

BRUNEL UNIVERSITY LONDON

**CIVIL ENGINEERING
MATERIALS & WORKMANSHIP SPECIFICATION**

FOR

DEMOLITION OF THE JOHN CRANK BUILDING

AT

BRUNEL UNIVERSITY LONDON

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TENDER ISSUE T2**

Consulting Engineers:

Wareham & Associates Ltd
Tudor House
1-3 The Avenue
Lightwater
Surrey
GU18 5RF

Tel: 01276 451868

Wareham
& Associates

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T1	Tender Issue	24/08/2018
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SPECIFICATION CLAUSES**C20 DEMOLITION**

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 any additional surveys that the Contractor deems necessary of:
 - the structure or structures to be decommissioned/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: All buildings, structures, pavements and tunnels where accessible, within the proposed hoarding area of the site and access road shown on W&A drawing numbered 17-1299-SL-004.
 - 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: Site waste management plan development and proposals.
- Format of the Report: electronic with photographs on USB drive.

112 EXISTING STRUCTURAL FORM

The following describes the structural form of the existing building based on record information available:

- General description of John Crank Building structure: Reinforced concrete framed building with podium structure on ground and first floors with tower block rising to sixth floor over the southern part of the building, i.e. 7 storeys.
- Foundations are conventional reinforced concrete isolated pads supporting reinforced concrete columns. Pads vary in plan size and generally 600mm deep cast on blinding concrete at 2.05m below ground floor SSL. The pads are generally reinforced with a bottom mat of reinforcement turned up the foundation sides.
- Two combined foundation mats each support four tower block columns bearing at 2.05m below SSL. Each mat is approx 2.1 x 9.8 x 0.6m deep. These have cage reinforcement with enlarged column plinths rising to ground floor level.
- The central lift and stair core stands on a reinforced mat foundation 5.6 x 13.2 x 0.75m cast on blinding concrete 2.05m below SSL. The mat is reinforced with top and bottom bar reinforcement.

- Isolated reinforced concrete walls forming the external end walls of the tower block, link bridge and external stairs are supported by reinforced concrete strip foundations varying in width.
- The foundation layout is shown on Drawing 1666/M/01, with reinforcement details on 1666/M/14 to 18.
- The ground floor slab is 150mm reinforced concrete, ground bearing, cast on a DPM laid on 50mm blinding concrete laid on min 100mm compacted hardcore.
- Backfill above the completed foundations, in particular the combined tower block foundations and central core mat foundation may have been formed with weak mix concrete or hardcore to provide suitable formation/bearing surface for construction of the ground floor slab.
- Reinforced concrete ground beams exist beneath all external walls of the building perimeter. These are connected to and reinforced with the perimeter columns.
- Service tunnel 10 enters the building from the west extending across the building north of the lift shaft, turning north into the podium area. Numerous shallow floor ducts are formed in the ground floor slab for service distributions around the building, the extent of which are indicated on drawing 1666/M/02.
- The Plant Room that originally stood away from east side of the main building has been demolished for construction of the roadway and halls of residence adjacent to the main building. A smaller plant room has been constructed against the building.
- The extent of reinforced concrete walls rising from ground to first floor are indicated by solid shading on Drawing 1666/M/02. These extend up from the walls similarly shown on the foundation plan Drawing 1666/M/01.
- No evidence of significant structural alteration to the building, other than described above, has been observed during initial inspections.
- Internal masonry walls are of non load-bearing masonry construction.
- The first floor slab is suspended from reinforced columns and cantilevers from the facade on the east and west elevations.
- The slab is generally reinforced concrete ribbed construction formed with clay hollow tiles with slip tiles laid beneath the ribs. The ribs span north-south between supporting beams which span east-west across the building. Transverse binder ribs are provided at mid span. Trimming beams are provided around the perimeter of significant service risers. Additional beams spanning north-south lie beneath the corridor walls within the podium area.
- Slabs are generally 225mm solid south of the mid span of the floor between Grids D and E (Drawing 1666/M/03) except for the link bridge slab which is 250mm thick with edge thickening/beams.
- Cantilevers on the western side of the building are assisted by reinforced concrete shear walls formed on Grids A-E inclusive.
- The podium roof slab is generally of solid reinforced concrete construction 225mm thick spanning north-south generally between supporting RC beams. Holes are formed for skylight penetrations which are generally confined to the roof areas north of the tower block.
- No general arrangement details have been discovered of the roof plant room structure standing on the podium roof but RC details indicate this to be an RC walled enclosure with 225mm solid reinforced concrete roof slab. An open rooftop screened enclosure formed with 175mm reinforced concrete perimeter walls rises 2.1m approx above part of the plant room.
- The roof slab to the north of the tower block is generally cast 450mm above the first floor and roof slab to the south of Grid E which have a common structural slab level.

- The second floor of the tower block has regions of hollow tile ribbed slab spanning east-west. Areas of fair faced slab visible from below are 225mm solid reinforced concrete.
- Outer bays at the north and south of the tower are solid 225mm slabs which support the reinforced concrete return walls G/H and J/K which rise from 2nd floor level.
- The roof above the rooms south of the tower block is 225mm solid reinforced concrete spanning north-south.
- From third floor and above, the floors of the tower block span east-west with internal bays in hollow tile ribbed construction. Similarly, the outer north and south floor panels are solid 225mm slabs supporting the reinforced concrete return walls.
- Walls of the tower block are generally 175mm reinforced concrete except for those on Grids 7 and 8 enclosing the stair and lift cores which are 225mm thick to match the width of the RC columns constructed on these grids. The walls and on these grids are complex and their arrangement is detailed on Drawing 1666/M/19 and /20.
- Stability walls exist in the tower block on the north and south elevations and in the central core which are assumed to provide stability to this part of the building, albeit with significant openings in the central core. There is no evidence of similar stability wall elements bracing the podium structure and the internal masonry walls do not appear to be aligned to maintain support. Consequently, stability may be maintained by the cavity external walls panels and consequently these should remain in place during demolition to maintain stability whilst elements of the structure above are being demolished.
- A tank room stands above the central core of the tower block which is formed by solid 225mm RC walls on the east and west elevations with all their walls being 175mm. The roof of the plant room is 150mm solid RC spanning east-west.
- Internal staircases are in-situ cast reinforced concrete spanning between floors and intermediate landing slabs that span between the RC core walls that generally enclose the landings.
- External stairs are in-situ cast reinforced concrete typically cantilevering from a central core walls with landings spanning to the main building floors.
- There is no evidence of pre-stressed or post tensioned elements forming integral parts of the building structure.
- Floor finishes are generally cement:sand screeds 75mm thick on ground and first floors with upper tower block floors reduced depth screed 50mm thick.
- Architects drawings show the external precast concrete facade to be precast units 75mm thick concrete panels with edges thickened to 165mm where fixed back to the structure or shaped to interlock and weather over panels below. Details of the precast concrete manufacture are not available so consequently fixing details are unknown.
- The precast panels form the rainscreen of a cavity wall in conjunction with a ½ brick (102mm) inner leaf on external elevations.
- Internal division walls between rooms are generally 102mm brick or block except between the lecture rooms in the first floor podium which are 215mm solid brick between 1st floor and roof slab only. Walls in the south block between the corridor and perimeter rooms are cavity construction concealing rising services from ground to roof level. RC stability shear walls of the tower block are contained within these cavity walls.
- There remains on the roof a cabin, tower and miscellaneous items relating to the decommissioned O₂ installation.

112 REQUIREMENTS FOR SUSTAINABILITY

- The Contractor shall operate sustainable methods of working and use of materials to be employed wherever practicably possible. This specification establishes the minimum requirements that are to be attained during the demolition works, but the contractor is encouraged to identify further opportunities for the utilization of sustainable working methods.
- The contractor shall maintain record of all recycled materials in a CA approved Site Waste Management Plan (SWMP). Furthermore, upon written instruction from the CA, the Contractor will be required to provide proof of re-sale or appropriate recycling of certain or all items contained within the SWMP.

113 NOISE AND VIBRATION

- The term Best Practicable Means (BPM) shall be as defined in Section 72 of the Control of Pollution Act 1974
- The contractor shall undertake a noise assessment and vibration impact assessment based on 'Best Practicable Means' (BPM) to assess and agree the management and control measures to be employed during the project to ensure the noise levels due to the demolition works at the surrounding noise sensitive receptors are minimised. The receptors shall include student accommodation (halls of residence) classroom and lecture facilities. The assessment shall include noise mapping to show the impact of various works configurations on the facades of sensitive receptors. Sound power levels for plant and equipment can be obtained from manufacturer's guidelines or the BS5228 database.
- The contractor shall implement monitoring equipment at agreed locations to monitor noise levels adjacent to the sensitive receptors which shall provide continuous monitoring which trigger amber alerts at 3dB above the predicted and red alert at 5dB above predicted in accordance with Clause 114 below
- No noisy working will be allowed outside the hours of 08.00 - 18.00 hours on weekdays and 09.00 - 14.00 on Saturdays or on Sundays or Bank Holidays and all work carried out during these periods shall be subject to the prior approval of the Project Manager.
- All plant and equipment used on the site to carry out the demolition shall be suitably attenuated in accordance with the manufacturer's recommendations and the advice given in BS 5228-1:2009.
- All available techniques should be used, such as concrete cutting and crushing, in preference to percussive or balling methods so as to minimize noise and vibration during site works. Works shall be planned and executed following the recommendations of BS 5228:2009 and London Good Practice Guide: Noise and Vibration for Demolition and Construction (LANAF July 2016). Where necessary, action shall be taken to ensure compliance with the above noise and vibration criteria.
- Demolish structures in a manner which maintains any structure elements that will provide acoustic screening to neighbouring properties. Retain in place as long as practicable to minimise the noise level at receptor locations.
- The use of blasting techniques will not be permitted.
- Where possible, make use of existing redundant electrical mains supply within the available capacity that served the existing John Crank Building to minimise the use of generators on the site to carry out the works. The contractor shall make enquires at tender stage, assess the available capacity and install a sub metered connection point at an agreed location for use during the contract period.
- The contractor shall pay electrical sub meter supply charges to the University.
- Designated site-based staff shall have the authority to take the steps necessary on behalf of the contractor(s) to ensure noise and vibration is adequately controlled and managed, according to the circumstances associated with each worksite.

- At the commencement of their appointment on a project (or prior to start of works on site), all site staff shall be briefed on their responsibilities to the application of BPM to minimise construction noise and vibration and the content of any planning consents, codes of construction or other legal agreements. The performance of the training shall be regularly reviewed and repeated throughout the construction programme as appropriate.
- Site hoarding to be built and maintained to maximise the reduction in noise levels to sensitive buildings and land uses.
- Display contact details of contractor and responsible site manager as well as working hours and other site information on the hoarding.
- Locate the site access away from noise sensitive receptors.
- Keep internal haul routes well maintained and avoid steep gradients.
- Limit material and plant loading and unloading to normal working hours.
- Reduce loading / unloading heights for muck away and material movement to mitigate impact noise.
- Handle all material in a manner that minimises noise.
- Join the Considerate Constructors Scheme for the site
- Consult the respective Borough's Code of Construction Practice / Technical

114 NOISE AND VIBRATION MANAGEMENT PLAN

A detailed project specific noise and vibration management plan should be produced to address:

- The likely sources of noise and vibration during works
- The selection of the most appropriate procedures and methodologies in accordance with BPM/BS5228 (ie. to minimise noise and vibration impact) including a specific focus on using non-percussive works. Percussive works must only be used where it can be demonstrated that non-percussive works will not be appropriate.
- The selection of the most appropriate plant and equipment in accordance with
- BPM/BS5228 (ie. to minimise noise and vibration impact)
- The consideration of working hours including the timing of activities likely to cause disturbance
- Details of the considerations taken to minimise the impact of activities likely to cause disturbance.
- Details of site hoardings, screens, plant attenuation and other acoustic mitigation procedures.
- Details of site traffic management
- Management procedures to address on-going compliance improvement, correction, and response, including detailed methodology for dealing with noise and vibration complaints received and detailed methodology for dealing with trigger alerts received
- Nominated personnel and their qualifications to ensure full implementation of the above.

114 NOISE AND VIBRATION MANAGEMENT PLAN (Continued...)

- The following management and control measures shall be employed during the works in order to ensure that noise levels due to construction works at the surrounding noise sensitive receptors are minimised:
 - Submit a Section 61 consent application to the local authority
 - Adhere to 'quiet hours' as agreed and/or adopted by the local authority.
 - Maximise the screening effect of buildings and temporary stockpiles through programming / phasing of works.
 - Use rubber linings in chutes, dumpers, skips, joints and hoppers to reduce impact noise.
 - Minimise opening and closing of site access gates through good coordination of deliveries and vehicle movements.
 - Use modern, silenced and well maintained plant will be used at all times, conforming to standards set out in the EU Directives;
 - Fit all plant and equipment with appropriate mufflers or silencers of the type recommended by the manufacturer.
 - Utilise low impact demolition methods such as non – percussive plant wherever practicable
 - The selection and use of equipment to be closely monitored to ensure it has been chosen with keeping noise and vibration low in mind;
 - All site plant and equipment to be effectively silenced and positioned so as to cause the least amount of noise pollution to others within the site or site neighbours;
 - Care to be taken when loading and unloading vehicles, and erecting and dismantling scaffolding to reduce noise;
 - No site noisy working during any anti-social hours unless otherwise agreed by the relevant authorities;
 - All activities to be carried out using methods so as to reduce noise to a minimum;
 - The works to comply with BS 5228: 'Noise and Vibration control on construction and open sites';
 - Vehicle reversing alarms should be set to the minimum required for safe and efficient operations;
 - Implementation of a Traffic Management Plan to ensure that a restriction on site hours is enforced including access to and from the site, starting up, or moving around the site;
 - Equipment and vehicles to be shut down when not in use;
 - Semi-static equipment is to be sited and oriented as far as is reasonably practicable away from noise sensitive receptors and will have localised screening if deemed necessary;
 - Routes and programming for the transport of construction materials, fill, personnel etc. are to be carefully considered in order to minimise the overall noise impact generated by these movements;
 - All plant and equipment to be used for the works to be properly maintained;
 - All Trade Contractors to be made familiar with current legislation and the guidance in BS 5228 (Parts 1 and 2);
 - Deviation from approved method statements to be permitted only with prior approval from the Principal Contractor and other relevant parties. This will be facilitated by formal review before any deviation is undertaken;
 - The use of quiet and noisy work periods to be agreed with the University;
 - Continuous noise and vibration monitoring could be provided at suitable locations.

116 MONITORING REQUIREMENTS

- Provide and set up noise and vibration monitoring equipment at a minimum of four separate locations to be agreed. As a minimum the equipment should consist of:
 - 3No. type 1 data logging sound level meters with outdoor weather proof kit to provide contiguous 15-minute interval measurements of LAeq and LMax,f noise levels at each of the sensitive receptors.
 - 3No. data logging vibration meters to provide contiguous 15-minute interval measurements of the PPV (Peak Particle Velocity) vibration levels at each of the sensitive receptors.
- All equipment shall also:
 - Have the facility to view and download data and results comparative to trigger levels (subject to interval period and mobile GSM/internet reception) on a single private noise and vibration monitoring website accessible to BUL and a number of other parties, subject to BUL's discretion.
 - Be maintained by suitably qualified personnel.
 - Be capable of sending SMS trigger alerts to multiple recipients based upon the exceedance of pre-agreed levels.
 - Be regularly maintained and calibrated in accordance with the equipment manufacturer's guidelines.
- Initial trigger levels for noise should be set at 3dB and 5dB (for amber and red alerts respectively) above predicted noise levels at each location
- Initial trigger levels for vibration should be set at 3mm/s and 5mm/s for amber and red alerts respectively. This assumed baseline levels do not exceed this at any location. A separate trigger level may be required for the Shielded Cell (at the centre of the Halsbury Building) subject to the requirements of sensitive BUL equipment.
- The above does not account for any stakeholder imposed threshold values with respect to infrastructure and sensitive BUL equipment, which should also be addressed.

117 AIR QUALITY AND DUST CONTROL

- In order to prevent statutory nuisance to adjoining properties the Contractor shall comply with planning conditions and as a minimum, adopt following dust suppression techniques:
 - Erect full height monoflex type dust screen suspended from scaffold around the building, extending min 3.0m above rooftop to contain dust and provide visual screening. Screen may be lowered as demolition progresses maintaining 3.0m above highest point of demolition. The screen to be installed to provide adequate working space for all demolition activities.
 - Use water as a dust suppressant during demolition works in a manner as to not cause associated environmental issues;
 - Securely cover skips;
 - Minimize drop heights wherever possible; and,
 - Avoid fracturing and spoiling of the concrete.
- Should an abatement notice be served by the Local Authority, it will be the responsibility of the Contractor to rectify any highlighted problems and cover the cost of any delays to the demolition program.
- Wheel/body washing facilities are to be provided within the site boundary and used as necessary.
- Vehicles carrying dusty materials should be securely covered before leaving the site.
- No fires are permitted on site throughout the duration of the contract.

118 SUSTAINABLE TRANSPORTATION OF MATERIALS/ EQUIPMENT

- The Contractor shall comply with all planning conditions agreed with the Local Authority
- Road signs warning of HGV movements must be erected at all site entrances
- The Contractor should seek to minimize vehicle movements to and from the site throughout the duration of the works.

120 EXTENT OF DECONSTRUCTION/ DEMOLITION

- General: Subject to retention requirements specified elsewhere, deconstruct/ demolish internal non load-bearing building elements down to floor level and clear away arisings.
- Demolish structure(s) down to ground slab level. Generally, remove ground bearing slabs/hardstandings, foundations or below ground drainage except where indicated on the drawings to remain.
- Remove any suspended or ground bearing slabs/hardstandings and related structure/foundations, or part thereof as necessary. Ensure any changes in level formed by the removal of existing building/general structures/hard landscaping is reformed by the Contractor as part of the works to leave no abrupt changes in level on site with no gradient greater than 1 in 3.
- Demolition of all hard standing surfaces (including reinforced concrete slab, mass concrete, tarmacadam and excavation of a minimum of 500mm below original ground levels.
- Removal of all below ground foundations, hardcore, blinding concrete and obstructions (including below ground tanks, interceptors and associated pipework (except where indicated to remain) and chasing out of services, and removal of any measurable hydrocarbon products or other 'gross contamination' to a level of - 2.5 metres below ground level.
- Offsite disposal is to be minimized through maximization of recycling;
- The Contractor is required to input data into the Site Waste Management Plan (SWMP) and keep this up to date through the duration of the works.
- On completion of the works reinstate ground to a level no lower than current ground level levels using imported MOT Type 1 granular material compacted to refusal in 150mm thick layers in accordance with Specification D20.
- Provide topographic survey prior to filling and record depths of filling material.
- Provide CCTV survey of all remaining drainage pipework within the Contractors site area.

122 EXTENT AND SEQUENCE OF DEMOLITION

- The use of explosives shall not be permitted.
- Demolition of the Podium area shall not commence until the tower block is reduced to Podium roof level.
- Maintain external masonry/cavity walls to Podium structure until demolition of storey above is complete.
- No evidence of significant structural alteration to the building, other than described above, has been observed during initial inspections. Report any alterations revealed following initial soft strip or revealed at any stage during the demolition process

124 LOAD CAPACITY OF EXISTING FLOORS

- The load capacity of existing suspended floors has been back calculated based on record drawing information. This has estimated the following load capacities which are likely to have been used for the original detail design:
 - Suspended floors generally 3.0 kN/sqm
 - Suspended roof slabs 0.75 kN/sqm
- Imposed load allowances have been assessed based on existing sand-cement screeds remaining, these being 75mm at first floor and 50mm on floors above. Record drawings are available for further load capacity assessment by the demolition contractor as required. Note that the legibility of the scans is limited which may limit viability of load assessment.

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 relevant 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:
All features and services indicated as 'to remain' on the drawings that are within the site hoarding area.
All existing structures, features, services outside the site hoarding area; including lighting standards that may be immediately adjacent to the site hoarding.

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.

231 SERVICES DISCONNECTION ARRANGED BY EMPLOYER

- General: The Employer will arrange for disconnection of services and removal of fittings and equipment owned by those authorities prior to deconstruction/ demolition.
- Timing: Do not start deconstruction/ demolition until disconnections are completed.

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: None.

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 by periodically spraying 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.

- 335 DUST CONTROL & BACTERIA SPORES:** Minimise dust and potential transmission of airborne bacterial spores by regularly spraying demolition works with water. Spraying shall be employed during demolition, movement of arisings and loading onto lorries and any other activities that might give rise to raising dust and bacteria spores.
- Note that bacteria spores are dislodged from ceilings by vibration which must therefore be maintained to a minimum and the effects monitored during demolition work.

337 FUEL STORAGE FOR DEMOLITION PLANT

- Any fuel storage tanks required for demolition plant, is to contained in a metal tank or bowser, located within a bunded area.
- Any gas bottles required for cutting or welding is to be stored externally in a secure locked metal mesh cage.

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.

360 STRUCTURES TO BE RETAINED

- 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.

385 PIPEWORK REMOVAL

- The contractor is to check that all pipework has been drained prior to removal. Where this is not the case identify the contents of the pipe and provide appropriate method statements for their draining and off-site disposal. These method statements are to be approved by the CA prior to the pipes being drained.

390 ASBESTOS CONTAINING MATERIALS

- General: These are known to be present in the structures to be demolished in the following locations: Refer to Asbestos Register.
- Removal: By a Contractor licensed by the Health and Safety Executive and prior to other works starting in these locations.

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.

430 FILLING OF BASEMENTS, ETC

- Temporary support: Leave adequate buttress walls or provide temporary support to basement retaining walls up to ground level.
- 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.
- Filling: Remove organic material and soil from basements and other voids.

440 SITE CONDITION AT COMPLETION

- 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.

442 SITE SURFACE AT COMPLETION

- Levels: Grade the site to follow the levels of adjacent areas.

450 SITE CONDITION AT COMPLETION

- Debris: Clear away and leave the site in a tidy condition.

Other requirements: None.

460 MEASURES RELEVANT FOR DEMOLITION, EARTHWORKS, CONSTRUCTION AND TRACK-OUT

In addition to complying with the requirements and recommendations of BS6187, comply with recommendations of “The Control of Dust and Emissions During Construction and Demolition”, Mayor of London, July 2014:

- Site Management
 - Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
 - Develop a Dust Management Plan.
 - Display the name and contact details of person(s) accountable for air quality pollutant emissions and dust issues on the site boundary.
 - Display the head or regional office contact information.
 - Record and respond to all dust and air quality pollutant emissions complaints.
 - Make a complaints log available to the CA when requested.
 - Carry out regular site inspections to monitor compliance with air quality and dust control procedures, record inspection results, and make an inspection log available to the local authority when asked.
 - Increase the frequency of site inspections by those accountable for dust and air quality pollutant emissions issues when activities with a high potential to produce dust and emissions and dust are being carried out, and during prolonged dry or windy conditions.
 - Record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and the action taken to resolve the situation is recorded in the log book.
 - Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised.
- Preparing and maintaining the site
 - Plan site layout: machinery and dust causing activities should be located away from receptors.
 - Erect solid screens or barriers around dust activities or the site boundary that are, at least, as high as any stockpiles on site.
 - Wrap the building as specified and fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
 - Install screens or other infrastructure to minimise the impact of dust and pollution.
 - Avoid site runoff of water or mud.
 - Keep site fencing, barriers and scaffolding clean using wet methods.
 - Remove materials from site as soon as possible.
 - Carry out regular dust soiling checks of buildings within 100m of site boundary and cleaning to be provided if necessary.
 - Provide showers within the Contractor’s area and ensure a change of shoes and clothes are required before going off-site to reduce transport of dust.
 - Agree monitoring locations with the CA.
 - Where possible, commence baseline monitoring at least three months before phase begins.
 - Put in place real-time dust and air quality pollutant monitors across the site and ensure they are checked regularly.
- Operating vehicle/machinery and sustainable travel
 - Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone.
 - Ensure all non-road mobile machinery (NRMM) comply with the standards set within “The Control of Dust and Emissions During Construction and Demolition - Supplementary Planning Guidance – July 2014”.

- Ensure all vehicles switch off engines when stationary – no idling vehicles.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where possible.
- Impose and signpost a maximum-speed-limit of 10mph on surfaced haul routes and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
- Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).
- Operations
 - Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
 - Ensure an adequate water supply on the site for effective dust/particulate matter mitigation (using recycled water where possible).
 - Use enclosed chutes, conveyors and covered skips.
 - Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
 - Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
- Waste management
 - Reuse and recycle waste to reduce dust from waste materials
 - Bonfires and burning of waste materials is not permitted.
- Demolition
 - Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
 - Ensure water suppression is used during demolition operations.
 - Explosive blasting shall not be permitted. Use appropriate manual or mechanical alternatives.
 - Bag and remove any biological debris or damp down such material before demolition.
- Measures specific to trackout
 - Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site.
 - Avoid dry sweeping of large areas.
 - Ensure vehicles entering and leaving sites are securely covered to prevent escape of materials during transport.
 - Record all inspections of haul routes and any subsequent action in a site log book.
 - Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems and regularly cleaned.
 - Inspect haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;
 - Implement a wheel washing system within the Contractor's site area (with rumble grids to dislodge accumulated dust and mud prior to leaving the site).
 - Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
 - Access gates to be located at least 10m from receptors where possible.
 - Apply dust suppressants to locations where a large volume of vehicles enter and exit the construction site

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.

511 EMPLOYER'S PROPERTY

- Components and materials to remain the property of the Employer: Refer to Preliminaries/ General conditions.
- Protection: Maintain until these items are removed by the Employer, reused in the Works or the end of the Contract.
- Special requirements: None.

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.

SPECIFICATION CLAUSES

C90 ALTERATIONS – SPOT ITEMS

To be read with Preliminaries/General conditions.

GENERAL

110 DESCRIPTIONS

- Location of spot items descriptions:

The portion of Service Tunnel 10 within the site boundary is to be removed, as shown on drawing numbered 17-1299-SL-003, and a new end wall constructed. Provide props, struts, scaffolding and shores, etc. as necessary to ensure the stability of the remaining section of tunnel. In addition to the proposals shown on drawing numbered 17-1299-SL-003, the Contractor shall make any necessary investigations and additional calculations and accept responsibility for the overall safety of the Works and remaining structure unless expressly made the responsibility of others in the Contract Documents.

Provide temporary supporting beams and props to the remaining portion of Service Tunnel 10 beneath the site access road, as shown on drawing numbered 17-1299-SL-003. The temporary supporting beams and props are to be inspected and maintained in place by the contractor until such time as instructed to remove them by the CA, or at contract completion.

Sections of existing drainage are to be terminated and removed, as shown on drawing numbered 17-1299-SL-004. All below ground drainage termination and/or reinstatement works to be carried out in accordance with Section R12 of this Specification.

111 ERECTING SUPPORT SYSTEMS:

- Locate positions of existing and new services which may be affected by support systems. Provide any necessary temporary diversions.
- Prevent excessive loadings from foundations of support systems being imposed onto foundations of structure to be kept in place.
- Support systems erection and connection to existing structure to be kept in place taking all necessary precautions to prevent damage, and taking due account of movement of structure which may occur before, during and after demolition.
- Promptly repair any damage caused to adjoining property by erection or connection of support systems. Make good to ensure safety, stability, weather protection and security.
- Check support systems at agreed stages during erection for compliance with design proposals.
- Do not overload or stress the Works in any way (e.g. plant, storage).

112 MAINTAINING SUPPORT SYSTEMS:

- Provide safe access and safe places of work in the support systems for inspection and maintenance.
- Regularly inspect and maintain support systems, making good ties, wedges, connections, corrosion protection, etc. as necessary. Adequately protect support systems from impact damage by vehicles, plant and site operations.

- Prevent access of unauthorised persons to support systems. Leave safe outside working hours.
- 113 MAINTAINING SUPPORTED STRUCTURE:
- Regularly inspect and monitor supported structure to ensure stability. Report any significant movement or deterioration of the fabric of supported structure to the CA.
 - Agree any necessary remedial work with the CA.
 - Adequately protect supported structure from damage by site operations.
- 114 DISMANTLING SUPPORT SYSTEMS:
- When all permanent connections between supported structure and new construction have been made and support system is no longer required, inform the CA and obtain any required permission to disconnect and dismantle support systems.
- 115 STRUCTURE(S) AND/OR PARTS TO BE RETAINED:
- Adequately protect parts of existing structure(s) which are to be kept in place.
 - Cut away and strip out the minimum necessary and with care to reduce the amount of making good to a minimum.
 - Prevent debris from overloading any part of the structure which is not to be demolished.
- 116 FORMING OPENINGS THROUGH EXISTING REINFORCED CONCRETE SLABS AND WALLS:
- Mark locations of holes on both sides of structural element and pilot drill corners to confirm alignment coincides both sides.
 - Employ low noise techniques for all cutting, except where otherwise agreed in advance. Diamond saw cut or stitch core to form opening as appropriate to size and location of hole.
 - Ensure saw cutting does not overrun at corners or damage other parts of the structure.
 - Employ low noise methods of extraction using hydraulic nibbling equipment or splitting techniques all to the approval of the CA and in accordance with method statements to be submitted in advance of commencing the works. Ensure methods do not induce stresses in parts of the structure to remain e.g. by leaving partially cut parts hanging or by using splitting in a confined location.
 - Erect a crash deck under parts of slabs to be removed to prevent debris from falling to the slab below.
 - Take precautions at all times to ensure that debris from demolition and concrete cutting does not overload floor slabs and or other structural elements. Unless otherwise agreed, ensure that loading to suspended floor slabs does not exceed 2.5kN/sqm uniform loading or 4.5kN point load.
- 117 CUTTING HOLES THROUGH SLABS/BEAMS/WALLS BY DIAMOND CORING:
- Prior to cutting, coring, drilling or forming holes by other methods, submit drawings detailing size and location for review by the CA.
 - Mark all holes prior to cutting on top side and on soffit in the case of beams and slabs for inspection by the CA. Where setting out cannot be reliably undertaken on remote side drill small diameter pilot hole using

non coring equipment to confirm position on remote face. Mark for inspection by the CA.

- Mark holes on accessible side of wall faces and confirm there are no projections thickenings or other features that may be of structural importance on the rear face.
- In the case of holes through structural beams, undertake location of reinforcement using non destructive survey methods and mark/provide results to the CA for consideration prior to proceeding.
- Do not proceed with cutting of holes without the agreement of the CA.
- Report any reinforcement or cut in cores and retain the core for subsequent inspection. Survey and provide record drawings of reinforcement cut in holes formed by other methods.
- The Contractor will be responsible for all survey works associated with and the installation of any remedial works that may be necessary as a consequence of any non-approved or misaligned cutting where this is deemed by the CA to have affected the integrity of any structural component.
- All small holes through hollow pot floor to be cut only through hollow pot strips between ribs. Obtain instructions from the CA for all holes greater than 150mm

118 VERTICAL EXPOSED FACES OF CONCRETE FORMED BY CUTTING:

- Vertical exposed faces of concrete formed by cutting to be carefully scabbled back to a straight flat face and painted with Fosroc Expandite Ltd, Nitobond HAR Bonding Primer. Surfaces are to be faced up using Fosroc Expandite Ltd, 'Renderoc GP' applied to thicknesses specified on drawings in maximum 30mm thickness to form the required finished hole size or face line. All applied fully in accordance with the manufacturers recommendations.

119 EXISTING REINFORCEMENT EXPOSED BY HOLE CUTTING:

- Existing reinforcement exposed by hole cutting is to be carefully cut and bent as specified on drawings. Reinforcement is to be cleaned in accordance with Fosroc recommendations primed with Nitoprime Zincrich Plus.

120 EMPLOYER'S PROPERTY

- Components and materials to remain the property of the Employer: Refer to Preliminaries/ General conditions.
 - Protection: Maintain until these items are removed by the Employer or reused in the Works, or the end of the Contract.
- Special requirements: None.

130 RECYCLING MATERIALS

- Materials arising from alterations: May 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.

SPECIFICATION CLAUSES

D20 EXCAVATING AND FILLING

To be read with Preliminaries/General conditions.

GENERALLY/THE SITE

110 SITE INVESTIGATION REPORT

- A Geotechnical Report has been prepared by REC Ltd, in relation to the proposed development. The document, REC Ltd reference 1CO102981P1R1, will be made available to the Contractor.

145 VARIATIONS IN GROUND WATER LEVEL

- The Geotechnical Report, REC Ltd reference 1CO102981P1R1, indicates that groundwater may be expected at various levels below ground level across the site.
- Give notice: If encountered.

CLEARANCE/EXCAVATING

168 SITE CLEARANCE

- Timing: Before topsoil stripping; if any.
- General: Clear site of rubbish, debris and vegetation. Do not compact topsoil.
- Treatment

240 ADJACENT EXCAVATIONS

- Proximity: 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 from horizontal 45 degrees in good soils or 30 degrees in wet clays

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: ± 50 mm

260 INSPECTING FORMATIONS

- Give notice: Make advance arrangements for inspection of formations
- Preparation: Just before inspection remove the last 150 mm of excavation. Trim to required profiles and levels, and remove loose material.
- Seal: Within 4 hours of inspection, seal or cover formations with approved fill or 50mm concrete blinding Mix GEN1 if excavation is to be left open longer.

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.

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.

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 drainage hole at least 600 mm diameter.

DISPOSAL OF MATERIALS

410 EXCAVATED TOPSOIL

- Storage: Remove from site.

441 SURPLUS SUBSOIL

- Excavated material: Stockpile in temporary storage heaps.
- Retained material: Spread and level surplus subsoil on site.
 - Locations
 - Protected areas: Do not raise soil level within root spread of trees that are to be retained.
- Remaining material: Remove from site.

450 WATER

- Generally: Keep all excavations free from water until:
 - Formations are covered.
 - Below ground construction 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/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

460 PERMANENT DRAINAGE SYSTEM

- Disposal of water from the excavations through system: is permitted subject to the provisions of temporary strainers and silt pits upstream. Clean by jetting drains used on completion and provide CCTV evidence of leaving in clean undamaged condition

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; submit at least 21 days prior to procurement

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.

520 FROST SUSCEPTIBILITY

- General: Except as allowed below, fill must be non frost- susceptible as defined in Highways Agency 'Specification for highway works', clause 801.17.
- 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 within the external walls of buildings below spaces that will be heated. Protect from frost during construction.

530 PLACING FILL

- Excavations and areas to be filled: Free from loose soil, 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.
- Layers: Place so that only one type of material occurs in each layer.
- Earthmoving equipment: Vary route to avoid rutting.

535 COMPACTION

- General: Compact fill 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.

610 COMPACTED FILLING FOR LANDSCAPE AREAS

- Fill: Material capable of compaction by light earthmoving plant.
- Filling: Layers not more than 200 mm thick. Lightly compact each layer to produce a stable soil structure.

617 HIGHWAYS AGENCY TYPE I GRANULAR FILLING

- Fill: To Highways Agency 'Specification for highway works', clause 803:
 - Crushed rock (other than argillaceous rock).
 - Crushed concrete.
 - Recycled aggregates.
 - Crushed non-expansive slag to clause 801.2.
 - Well-burned non-plastic colliery shale.
- Filling: To Highways Agency 'Specification for highway works', clauses 801.3 and 802.

625 COMPACTED GENERAL FILLING/EARTH WORKS

- Specification: Highways Agency 'Specification for highway works', Earthworks section, clauses Table 6/1 and Appendices (see clauses 900—960 in this section).
- Definition: References to the 'Overseeing Organisation' are deemed to be to the issuer of this specification.

626 COMPACTED GENERAL FILLING

- Fill not associated with pavements or to provide support to permanent works
- Excavated material: Select suitable material and keep separate.
- Filling: Spread and level material in layers. As soon as possible thoroughly compact each layer.
- Proposals: Well in advance of starting work submit details of proposed:
 - Materials to be used, including quantities of each type.
 - Type of plant.
 - Maximum depth of each compacted layer.
 - Minimum number of passes per layer.

640 START LAYER OF COMPACTED FILLING

- Fill: Suitable hard granular material. Compact thoroughly.
- Thickness

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: Granular filling clause 617.
- Under grassed or soil areas: Material excavated from the trench, laid and compacted in 300 mm maximum layers.

730 BLINDING

- Surfaces to receive sheet overlays or concrete:
- Blind with:
- Concrete mix GEN1
- Permissible deviations on surface level: +0 -25 mm.

HIGHWAYS AGENCY EARTHWORKS SPECIFICATION APPENDICES

900 APPENDIX 6/1 — REQUIREMENTS FOR ACCEPTABILITY AND TESTING, ETC. OF EARTHWORKS MATERIALS

905 APPENDIX 6/2 — REQUIREMENTS FOR DEALING WITH CLASS U2 UNACCEPTABLE MATERIAL

910 APPENDIX 6/3 - REQUIREMENTS FOR EXCAVATION, DEPOSITION, COMPACTION (OTHER THAN DYNAMIC COMPACTION)

915 APPENDIX 6/4 - REQUIREMENTS FOR CLASS 3 MATERIAL

920 APPENDIX 6/5 — GEOTEXTILES USED TO SEPARATE EARTHWORKS MATERIALS

925 APPENDIX 6/6 — FILL TO STRUCTURES AND FILL ABOVE STRUCTURAL FOUNDATIONS

930 APPENDIX 6/7 — SUB-FORMATION AND CAPPING AND PREPARATION AND SURFACE TREATMENT OF FORMATION

935 APPENDIX 6/8 — TOPSOILING, GRASS SEEDING AND TURFING

940 APPENDIX 6/9 - EARTHWORK ENVIRONMENTAL BUNDS, LANDSCAPE AREAS, STRENGTHENED EMBANKMENTS

E05 IN SITU CONCRETE CONSTRUCTION GENERALLY

E05 IN SITU CONCRETE CONSTRUCTION GENERALLY

To be read with Preliminaries/General conditions.

220 DESIGN OF STRUCTURAL CONCRETE

- Standards:
 - Design: To BS 8110 parts 1 & 2
 - Reinforcement schedules: To BS 8666
- Finished product: To comply with the requirements of design standard.

225 TEMPERATURE RECORDS

- Requirement: Throughout period of concrete construction record:
 - Daily; max and min and temperature at commencement of concreting
 - Under adverse temperature conditions: Temperature at commencement of, at maximum 4 hour intervals during and at the end of placing.
- Equipment: max and min. thermometer
 - 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

- Reference system: To BS 5964-1
- Element shape and position: To Section 7 of the 'National Structural Concrete Specification for Building Construction'.
 - Substitution of alternative requirements: None

430 SURFACE CRACKING OF EXPOSED CONCRETE

- Method of measurement: To be agreed with Engineers.
- 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.

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.

E10 MIXING/CASTING/CURING IN SITU CONCRETE

To be read with Preliminaries/ General Conditions.

CONCRETE

101 SPECIFICATION

- Concrete generally: To BS EN 206-1 and BS 8500-2.
- Exchange of information: Provide concrete producer with information required by BS 8500-1, clauses 4 and 5.

105 DESIGNATED CONCRETE MIX FOR BLINDING AND MASS FILL

- Designation: GEN 1.
- The concrete will be unreinforced
- Fibres: Not required
- Aggregates:
 - Size (maximum): 20mm.
 - Coarse recycled aggregates: Not permitted.
 - Additional aggregate requirements: None
- Special requirements for cement/ combinations: None
- Consistence class: Contractor's choice.
- Chloride class: Normal.
- Admixtures: Concrete producer's choice
- Additional mix requirements: None

108 DESIGNATED MIX FOR REINFORCED CONCRETE GENERALLY

- Designated concrete Mix RC32/40.
- Fibres: Not required.
- Aggregates:
- Size (maximum):
 - 20mm or 10mm as appropriate to pour location, and only where agreed in advance by the Engineer.
 - Coarse recycled aggregates: Not permitted.
 - Additional aggregate requirements: None.
- Special requirements for cement/ combinations: None.
- Consistence class: Contractor's choice.
- 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 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.
- Ensure adequate back up plant is available in advance of large concrete pours to maintain continuity in all stages of delivery, distribution compaction and finishing of concrete
- Establish contingency plan for loss of concrete supply including the preferred locations of joints in agreement with the Engineer and method of forming unplanned joints.

221 INFORMATION ABOUT PROPOSED CONCRETES

- Submit when requested
 - Details listed in BS 8500-1 clause 5.2.

225 CHANGES TO SPECIFICATION

- Changes to specification of fresh concrete (outside concrete producer's responsibility): Perform identity test for compressive strength on each affected batch.

230 INTERRUPTION OF SUPPLY DURING CONCRETING

- Elements without joints: Where elements are detailed to be cast in a single pours 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.

305 DRYING SHRINKAGE

- Drying shrinkage, of. concrete (maximum): 0.075%.
 - Test method: To BS EN 1367-4.

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 sulphide which may be unsightly are 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

505 PROJECT TESTING OF CONCRETE - GENERAL

- Testing: To BS EN 206-1, annex B and BS 8500-1, annexe B.
 - Nonconformity: Obtain instructions immediately.
- Recording: Maintain complete correlated records including:
 - Concrete designation.
 - Sampling, site tests, and identification numbers of specimens tested in the laboratory.
 - Location of the parts of the structure represented by each sample.
 - Location in the structure of the batch from which each sample is taken.

508 REGULAR PROJECT TESTING OF CONCRETE TYPES TO CLAUSES E10/107, 108 & 109 AND ANY SUBSTITUTION THEREOF

- Tests: Consistence, compressive strength and density.
- Sampling @ 15m³ and not less than two batches per pour

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: two
- Reports on site: A complete set, available for inspection.

550 BROKEN CUBES FROM FAILED STENGTH 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.

570 EARLY AGE STRENGTH TESTING: A regime of accelerated or normal curing and early testing which is capable of predicting the 28 day strength of concrete mixes may be used for determining compliance, subject to prior approval. If such a regime is adopted, two additional cubes must be made from each sample and cured normally so that, in the event of non-compliance, they can be tested at 28 days to provide information which will help in deciding the action to be taken.

580 FAILURES:

- If a concrete sample fails to achieve specified criteria or to pass specified tests, inform the C.A. without delay and submit:
 - Confirmation of the validity of the test results, and/or
 - Proposals for further tests to assess the strength of the concrete in the structure, as set out in BS 6089, and/or
 - Proposals for rectification.
- Obtain approval of all such evidence and proposals before proceeding. The C.A. may issue instructions for the work to be stopped or delayed until reasons for the failure have been established, possible consequences assessed, and appropriate preventative and remedial measures taken.
- Wherever the specified sampling, testing and compliance procedures show that a concrete mix is not in accordance with the specification (even if the work is eventually accepted), and measures are taken to help in establishing whether or not the work is acceptable, such measures:
 - will be at the expense of the Contractor, and
 - will not be considered as grounds for extension of time.

PLACING/ COMPACTING/ CURING AND PROTECTION

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

- Locations of construction joints: Submit proposals where not shown on drawings.
- Preparation of joint surfaces: As section E40
 - 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.

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). 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.

681 PLACEMENT & COMPACTION IN DEEP CONCRETE POURS:

- Follow recommendations of CIRIA Report 135 and in particular the following:
 - The use of chutes trunking and placement of pump hoses to minimise segregation
 - The number and use of internal poker vibration and recommendations for frequency and timing of insertion.
 - Ensure concreting operatives are trained to apply the appropriate methods

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.

E10 MIXING/CASTING/CURING IN SITU CONCRETE

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.

820 CURING PERIODS

- General: Curing periods are in days (minimum).
 - Definition of 't': The average number of degrees Celsius air temperature during the curing period.
- Curing periods for concrete surfaces which, in the finished building, will be exposed to the elements; concrete wearing surface floors and pavements; water resistant concrete:

	Concrete made using CEM1; SRPC (BS4027); IIA	Concrete made using IIB; IIIA; IIIB; IVB
Drying winds or dry, sunny Weather	140 t+10	160 t+10
Intermediate conditions	100 t+10	140 t+10
Damp weather, protected from Sun and wind	100 t+10	100 t+10

- Curing periods for other structural concrete surfaces (cements/combinations as above):

Drying winds or dry, sunny Weather	80 t+10	140 t+10
Intermediate conditions	60 t+10	80 t+10
Damp weather, protected from Sun and wind	no special requirements	no special requirements

- Curing periods for concretes using admixtures or other types of cements/combinations: Submit proposals.

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 details and method statements covering the following:
 - Details of formwork and falsework to large and or deep concrete pours
 - Permanent formwork system and support arrangements
 - Positions and types of construction joints
 - Layout of panel joints where exposed to view
 - Details of formwork ties
 - Means of sealing panel joints, form tie holes, at horizontal and vertical side forms, inclusive of edges of metal decking
 - Surface of forms, form liners and other means of producing the required finish

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 21 days prior to procurement

140 TEMPORARY SUPPORTS TO PROFILED STEEL SHEETS

- Location: Unpropped.

145 PERMANENT FORMWORK

- Location and materials: Submit details where proposed. No organic or other degradable material will be permitted.

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 with spans greater than 3m – 0.1% of span measured at centre
- Cantilever beams 0.1% of cantilever measured at free end.

170 WORK BELOW GROUND

- Casting vertical faces of footings, bases and slabs against faces of excavation: Obtain consent.
- Casting walls against faces of excavation: Use formwork on both sides.

210 STEELWORK: Remove all loose millscale and loose rust before encasing in concrete.

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.

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: 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 (minimum): 150 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:
 - Work exposed to view

405 COLUMN SHUTTERS

- Type and manufacturer to approval

420 RIBBED STEEL MESH FORMWORK AND REINFORCEMENT will not be permitted

470 RELEASE AGENTS

- 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 Strike formwork without disturbing, damaging or overloading structure, and without disturbing props. Notwithstanding other clauses in this specification and any checking or approvals by the CA, the responsibility for safe removal of any part of the formwork and any supports without damaging the structure rests with the Contractor.
- Timing: Prevent any disturbance, damage or overloading of the permanent structure.

521 MINIMUM PERIODS

- The following periods (in days unless stated) for retaining formwork in position before striking apply to class 42.5 or sulphate resisting Portland cement concrete with no cement replacement materials or admixtures:

Type of formwork	Average mean of daily minimum and maximum air temperature during the period		
	16°C	7°C	3°C
Vertical formwork to columns, walls and beams	1/2 *	3/4 *	1 *
Soffit forms to slabs	4	6	8
Props to slabs and soffit forms to beams	10	15	20
Props to beams	14	21	28

- Submit details of proposed periods for mixes using admixtures or other types of cement

‘ * ‘ Minimum Compression Strength of 10 N/mm² is required prior to stripping formwork supporting reverse tanking membranes.

522 MINIMUM PERIODS: Alternative methods of determining minimum periods for retaining formwork in position may be submitted for approval. Contractor to accept responsibility for the cost of checking alternative proposals by the CA and for any testing.

FORMED FINISHES**616 FINISH TO RECEIVE ASPHALT OR OTHER TANKING**

- Finish: Even and suitable to receive asphalt.
- Permissible deviation of surfaces:
 - Sudden irregularities (maximum): 3 mm.
 - Gradual irregularities when measured from underside of a 1 m straightedge, placed anywhere on surface (maximum): 3 mm.
- 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 SMOOTH FINISH - to concealed concrete surfaces

- Finish: Even with panels arranged in a regular pattern as a feature of the surface.
- Permissible deviation of surfaces:
 - Sudden irregularities (maximum): 5 mm.
 - Gradual irregularities when measured from the underside of a 1 m straightedge, placed anywhere on surface (maximum): 5 mm.
- Variations in colour:
 - Permitted: Those caused by impermeable form linings.
 - Not permitted: Discoloration 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.

SPECIFICATION CLAUSES

E30 REINFORCEMENT FOR IN SITU CONCRETE

To be read with Preliminaries/ General conditions.

REINFORCEMENT

110 QUALITY ASSURANCE OF REINFORCEMENT

- Reinforcement to BS 4449, BS 4483 or BS 6744, cut and bent to BS 8666: Obtain from 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 4449.
 - Strength grade: 250.

150 RIBBED BAR REINFORCEMENT

- Standard: To BS 4449.
 - Strength grade: B500B.

210 FABRIC REINFORCEMENT

- Standard: To BS 4483.
 - Strength grade: B500B.

245 PREFABRICATED REINFORCEMENT not permitted

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.

265 MECHANICAL COUPLERS

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

WORKMANSHIP

310 CUTTING AND BENDING REINFORCEMENT

- General: To schedules and to BS 8666.
- Restrictions on bending steel:
 - Rebending including minor adjustments: Obtain instructions.
 - Temperatures below 5°C: Obtain instructions.
 - Temperatures greater than 100°C: Prohibited.

E30 REINFORCEMENT FOR IN SITU CONCRETE

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 millscale, loose rust and contaminants which may adversely affect the reinforcement, concrete, or bond between the two.

360 PROJECTING CONTINUITY REINFORCEMENT

- Bending on site is not permitted.

410 LAPS OR SPLICES

- Where details are not shown on drawings: Obtain instructions.

425 LAPS NOT DETAILED ON DRAWINGS

- Laps in bar reinforcement (minimum): 300 mm.
- Laps in fabric reinforcement (minimum): 250 mm.
 - Laps at corners: Avoid four layer build-up.

430 WELDED JOINTS

- Site welding is 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

- Definition of nominal cover to BS 8500-1: Minimum cover plus tolerance for fixing.
 - Tolerance (maximum): Columns and Walls 5mm, Slabs 10mm
- Checking specified cover dimensions: Before concreting check that cover dimensions will be achieved.

510 RUST STAINING

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

E40 DESIGNED JOINTS 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 CONSTRUCTION JOINTS

- Joints additional to those required by designer:
- Approval of additional joints: Submit proposals.

141 CONSTRUCTION JOINTS IN CONCRETE EXPOSED TO VIEW, additional to joints required by the designer, will normally be permitted, but may require addition of or location on a feature line to mask the joint. If such additional joints are required, allow accordingly in the rates. Obtain approval of proposed locations.

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 50mm or $\frac{1}{4}$ slab depth if greater
 - Width: As narrow as practicable.
- Sawing: Sufficiently early to prevent random cracking (within 24 hours of casting slab) and to produce strong, well defined arises.

261 MOVEMENT JOINT GROOVES:

- Depth 20mm, width 20mm.
- Form grooves by inserting temporary strips into the fully compacted concrete, recompact and re-level the slab, and remove strips. Alternatively, if the type of aggregate used so permits, cut grooves with a saw sufficiently early to prevent random cracking (within 24 hours of casting the slab).
- Seal grooves as clause 530.

410 TIE BARS

- Standard: To BS 4449.
 - Strength grade: 250.
- Cleanliness: Free from corrosive pitting, loose millscale, loose rust and contaminants which may adversely affect the tie bars, reinforcement, concrete, or bond between the two.
- Position: Centred on the joint.

430 DOWEL BARS

- Standard: To BS 4482.
 - Strength grade: 250.
 - Properties: Perfectly straight, with sawn (not sheared) ends.
- Debonding: Achieve effective debonding to half of each bar using either a suitable proprietary debonding compound or a suitable plastics sleeve.
- Position: At right angles to and centred on the joint.
- Expansion joints: Fit an approved type of cap incorporating not less than 20 mm of compressible material to debonded ends of all bars.

435 STAINLESS STEEL DOWEL BARS

- Standard: To BS 6744.
 - Strength grade: 200.
 - Properties: Perfectly straight, with sawn (not sheared) ends.
- Debonding: Achieve effective debonding to half of each bar using either a suitable proprietary debonding compound or a suitable plastics sleeve.
- Position: At right angles to and centred on the joint.
- Expansion joints: Fit an approved type of cap incorporating not less than 20 mm of compressible material to debonded ends of all bars.

520 SHEET JOINT FILLER

- Manufacturer:
 - Product reference: Grace Construction Products; Korkpak & AeroFill 2, or equivalent and approved
- Joints finished with sealant: Leave sufficient space for sealant by using temporary formers.

530 SEALANT

- Manufacturer: Fosroc Expandite, or equivalent and approved
 - Product reference: Thioflex 600 - Gun applied polysulphide
 - Colour of surfaces exposed to view:
- Preparation and application: As section Z22.

545 COMPRESSIBLE SEALING STRIP SYSTEM

- Manufacturer:
 - Product reference Grace Construction Products; Hydrocell, or equivalent and approved
 - Colour: White

SPECIFICATION CLAUSES

E41 WORKED FINISHES TO IN SITU CONCRETE

To be read with Preliminaries/General conditions.

150 FINISHING GENERALLY

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

210 TAMPED FINISH

- Finish: Even array of parallel ribs.

220 SCORED FINISH -

- Finish: Roughened.
 - Scoring tool stiff brush

230 BRUSHED FINISH

- Finish: Light even texture.
 - Timing: While concrete is sufficiently green.

240 WOOD FLOATED FINISH

- Finish: Slightly coarse even texture with no ridges or steps.

310 SMOOTH FLOATED FINISH

- Finish: Even with no ridges or steps.

320 TROWELLED FINISH

- Finish: A uniform, smooth but not polished surface, free from trowel marks and other blemishes, and suitable to receive specified flooring material.

330 TROWELLED FINISH FOR WEARING SURFACES

- Finish: A uniform smooth finish free from trowel marks and other blemishes.

520 SURFACE SEALER – Apply to all concrete slabs to minimise dusting during construction

- Manufacturer and product reference - Contractors choice to approval
- Preparation: Clean cured concrete to remove dirt, grease, oil and other surface contaminants.
- Moisture content of slab: As recommended by sealer manufacturer. Test relative humidity to BS 8203, annex A where required to verify suitability.
- Application: Evenly to dry surfaces to form an effective seal but without a glossy finish.

R12 BELOW GROUND DRAINAGE SYSTEMS

SPECIFICATION CLAUSES

R12 BELOW GROUND DRAINAGE SYSTEMS

To be read with Preliminaries/General conditions.

GENERAL

110 BELOW GROUND DRAINAGE SYSTEMS

- Surface water and rainwater drainage sources – building rainwater and pavement drainage
- Foul drainage sources – sanitary and internal gully drainage
- Land drainage sources – retaining wall relief drains
- Pipes, bends and junctions; grey cast iron under buildings and vehicular pavements, clayware in open ground
 - Accessories Access and rodding points
- Manholes, inspection chambers, traps, and separators
- Accessories channels, branches, steps
- Accessories — general – brickwork, geotextile

PRODUCTS

311 CONNECTORS.

- Material and standard:
- Cast Iron adaptors to BS 437 and Kitemark certified.
- Cast Iron to clayware adaptors, to BS EN 295 and Kitemark certified.

329 PIPES, BENDS AND JUNCTIONS - SUPPLY

- Pipes and fittings: From same manufacturer for each pipeline.

336 PIPES, BENDS AND JUNCTIONS – CLAY - FLEXIBLE JOINTS

- Material and standard: Vitrified clay to BS EN 295-1, Kitemark certified.
- Manufacturer: Hepworth **[or similar Approved]**
- Product reference Supersleeve
- Sizes DN100 DN150
- Crushing strength (minimum) FN40
- Jointing type polypropylene sleeve for pipes up to DN150

357 CONNECTORS - SADDLE

- Standards:
 - Clay: To BS EN 295-1 and Kitemark certified, or Agreement certified.
- Material: Clay
- Manufacturer: Hepworth **[or similar Approved]**
- Sizes: DN100 DN150

359 FLEXIBLE COUPLINGS

- Standard: To BS EN 295-4 or WIS 04-41-01 and Kitemark certified, or Agreement certified.

379 WARNING MARKER TAPES

- Type: Heavy gauge polyethylene.

496 GRANULAR MATERIAL

- Standard: To BS EN 12620.
 - Size: Dependent on location - see Execution clauses in this section, and in sections R16, R17 and R18, if used.

498 GRANULAR SUB-BASE MATERIAL

- Standard: To Highways Agency 'Specification for Highway Works', Type 1 Unbound mixtures for sub-base.

EXECUTION

610 STRIPPING OUT

- Extent of stripping out: As shown on relevant drawings.
- Exposed ends of existing drainage beyond site boundary to be abandoned: Seal with concrete (general).

611 EXISTING DRAINS

- Setting out: Before starting work, check invert levels and positions of existing drains, sewers, inspection chambers and manholes against drawings. Report discrepancies.
- Protection: Protect existing drains to be retained and maintain normal operation if in use.

613 EXCAVATED MATERIAL

- Turf, topsoil, hardcore, etc: Set aside for use in reinstatement.

616 SELECTED FILL FOR BACKFILLING

- Selected fill: As-dug material, free from vegetable matter, rubbish, frozen soil and material retained on a 40 mm sieve.
 - Compaction: By hand in 100 mm layers.

623 LOWER PART OF TRENCH - GENERAL

- Trench up to 300 mm above crown of pipe: Vertical sides, width as small as practicable.
 - Width (minimum): External diameter of pipe plus 300 mm.

625 LOWER PART OF TRENCH - TRANSITION DEPTH

- Trench widths up to 300 mm above crown of pipe (maximum):
 - DN 100 pipelines more than 6.0 m deep: 600 mm.
 - DN 150 pipelines more than 5.4 m deep: 700 mm.
 - DN 225 pipelines more than 4.0 m deep: 800 mm.
 - DN 300 pipelines more than 2.9 m deep: 900 mm.

631 TYPE OF SUBSOIL

- General: Where type of subsoil at level of crown of pipe differs from that stated for the type of bedding, surround or support, give notice.

635 FORMATION FOR BEDDINGS

- Timing: Excavate to formation immediately before laying beddings or pipes.
- Mud, rock projections, boulders and hard spots: Remove. Replace with consolidated bedding material.
- Local soft spots: Harden by tamping in bedding material.
- Inspection of excavated formations: Give notice to Building Control.

R12 BELOW GROUND DRAINAGE SYSTEMS

641 PIPES AT DIFFERENT LEVELS IN COMMON TRENCH

- Subtrench: Permissible provided soil of step is stable and unlikely to break away.
- Subtrench not permissible: Trench depth as required for lower pipe. Increase thickness of bedding to upper pipe as necessary.
- Lower pipe: Backfill with compacted granular material to at least half way up higher pipe.
- Clear horizontal distance between pipes (minimum):
 - Pipes up to DN 700: 350 mm.
 - Pipes exceeding DN 700: 500 mm.

661 CLASS O SUPPORT for flexible pipelines, cast iron and plastics

- Type of subsoil Class II to IV
- Granular material:
 - Pipe sizes DN 100 and DN 150: Size 4/10.
 - Pipe sizes DN 225 and DN 300: Size 4/10 or 10/20.
- Bedding:
 - Material: Granular, compacted over full width of trench.
 - Thickness (minimum): 100 mm.
- Pipes: Dig slightly into bedding, rest uniformly on barrels and adjust to line and gradient.
- Initial testing before placing support: is required
- Support:
 - Material: Granular.
 - Depth: To slightly above crown of pipe.
 - Compaction: By hand.
- Backfilling:
 - Material and depth:
Protective cushion of selected fill to 300 mm above crown of pipe;
 - or
Additional granular material, to 100 mm above crown of pipe.
 - Compaction: By hand in 100 mm layers.

667 CLASS S SURROUND for rigid pipelines, clayware and concrete

- Type of subsoil ; Class II to IV
- Trench width up to 300 mm above crown of pipe (maximum):
 - DN 100 nominal pipe size: 600 mm.
 - DN 150 nominal pipe size: 700 mm.
 - DN 225 nominal pipe size: 800 mm.
 - DN 300 nominal pipe size: 900 mm.
- Granular material:
 - Pipe sizes DN 100 and DN 150: Size 4/10.
 - Pipe sizes DN 225 and DN 300: Size 4/10, 10/20 or 4/20.
 - Pipe sizes DN 375—500: Size 10/20 or 4/20.
 - Pipe sizes DN 600 and above: Size 10/20, 20/40, 4/20 or 4/40.
- Bedding:
 - Material: Granular, compacted over full width of trench.
 - Thickness (minimum): 50 mm for sleeve jointed pipes, 100 mm for socket jointed pipes. Where trench bottom is uneven, increase depth by 100 mm.
- Pipes: Dig slightly into bedding, rest uniformly on barrels and adjust to line and gradient.
- Initial testing before placing surround is required
- Surround:
 - Material: Granular.
 - Depth: To 50 mm above crown of pipe.
 - Compaction: By hand in 100 mm layers.
- Backfilling:
 - Material: Protective cushion of selected fill.
 - Depth: 150 mm (250 mm for adoptable sewers) above crown of pipe.
 - Compaction: By hand in 100 mm layers.
 - Compaction: By hand.

683 LAYING PIPELINES

- Laying pipes: To true line and regular gradient on even bed for full length of barrel with sockets (if any) facing up the gradient.
- Ingress of debris: Seal exposed ends during construction.
- Timing: Minimize time between laying and testing.

685 JOINTING PIPELINES

- Connections: Durable, effective and free from leakage.
- Junctions, including to differing pipework systems: With adaptors intended for the purpose.
- Cut ends of pipes: Clean and square. Remove burrs and swan. Chamfer pipe ends before inserting into ring seal sockets.
- Jointing or mating surfaces: Clean and, where necessary, lubricate immediately before assembly.
- Allowance for movement: Provide and maintain appropriate clearance at ends of spigots as fixing and jointing proceeds.
- Jointing material: Do not allow to project into bore of pipes and fittings.

687 CONCRETE SURROUND FOR CROSSOVERS

- Class Z surround: Provide where two pipelines (other than plastics pipes) cross with less than 300 mm separation.
 - Extent, on both pipes: 1 m centred on the crossing point, and beyond as necessary to come within 150 mm of nearest flexible joints.

697 INSTALLING FLEXIBLE COUPLINGS

- Ends of pipes to be joined: Cut cleanly and square.
- Outer surfaces of pipes to be joined: Clean and smooth. Where necessary, e.g. on concrete or iron pipes, smooth out mould lines and/or apply a cement grout over the sealing area.
- Clamping bands: Tighten carefully to make gastight and watertight seals.

705 INITIAL TESTING OF PIPELINES

- Before testing:
 - Cement mortar jointing: Leave 24 h.
 - Solvent welded pipelines: Leave 1 h.
- Method: Block open ends of pipelines to be tested and pressurise. Air test short lengths to BS EN 1610.

711 TRENCH SUPPORTS

- Removal of trench supports: Sufficient to permit compacted filling of all spaces.

715 BACKFILLING TO PIPELINES

- Backfilling above top of surround or protective cushion:
- Material excavated from trench, compacted in layers 300 mm (maximum) thick.
- Heavy compactors: Do not use before there is 600 mm (total) of material over pipes.

720 BACKFILLING UNDER ROADS AND PAVINGS

- Backfilling from top of surround or protective cushion up to formation level: Granular sub-base material, laid and compacted in 150 mm layers.

728 LAYING WARNING MARKER TAPES

- Installation: During backfilling, lay continuously over pipelines.
- Depth: 300—400 mm.
 - Pipelines deeper than 2 m: Lay an additional tape 600 mm above the top of the pipeline.

732 TEMPORARY BRIDGES

- Trench bridges: As necessary to prevent construction traffic damaging pipes after backfilling.

COMPLETION

901 REMOVAL OF DEBRIS AND CLEANING

- Preparation: Lift covers to manholes, inspection chambers and access points. Remove mortar droppings, debris and loose wrappings.
 - Timing: Before cleaning, final testing, CCTV inspection if specified, and immediately before handover.
- Cleaning: Thoroughly flush pipelines with water to remove silt and check for blockages. Rod pipelines between access points if there is any indication that they may be obstructed.
- Washings and detritus: Do not discharge into sewers or watercourses.
- Covers: Securely replace after cleaning and testing.

971 CCTV INSPECTION OF PRIVATE PIPELINES

- General: Carry out and record internal inspection using CCTV equipment.
 - Locations to be inspected; foul and surface water drains including laterals
- Illumination: Of adequate intensity.
- Recording: Provide continuous position recording, still photographs and stopping of the camera at any point.
 - Copy of videotape recording: Submit.