NBS SPECIFICATION
FOR
BIOGEN WESTWOOD – BUND RETAINING WALL

REV S4-P01
Biogen
Westwood AD Plant
Bedford Road
Rushden
Northamptonshire
NN10 0SQ

Rolton Group Limited
The Charles Parker Building
Midland Road
Higham Ferrers
Northants
NN10 8DN

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author: Clayton Knevitt MEng</td>
<td>Senior Project Engineer</td>
<td></td>
</tr>
<tr>
<td>Verifier: Andrew Chisem BSc(Hons) CEng MIstructE MCIOB</td>
<td>Director</td>
<td></td>
</tr>
</tbody>
</table>

Revision

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Reason for issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>S4-P01</td>
<td>31.08.2017</td>
<td></td>
</tr>
</tbody>
</table>
# Table of Contents

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>D20 Excavating and filling</td>
<td>2</td>
</tr>
<tr>
<td>E05 In situ concrete construction generally</td>
<td>6</td>
</tr>
<tr>
<td>E10 Mixing/casting/curing in situ concrete</td>
<td>8</td>
</tr>
<tr>
<td>E20 Formwork for in situ concrete</td>
<td>13</td>
</tr>
<tr>
<td>E30 Reinforcement for in situ concrete</td>
<td>16</td>
</tr>
<tr>
<td>E40 Designed joints in in situ concrete</td>
<td>18</td>
</tr>
<tr>
<td>E41 Worked finishes to in situ concrete</td>
<td>20</td>
</tr>
<tr>
<td>J40 Flexible sheet waterproofing/ damp proofing</td>
<td>21</td>
</tr>
<tr>
<td>Z22 Sealants</td>
<td>22</td>
</tr>
</tbody>
</table>
D20 Excavating and filling

To be read with Preliminaries/General conditions

GENERALLY/THE SITE

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

150A EXISTING SERVICES, FEATURES AND STRUCTURES
- Client to provide all available existing information.

CLEARANCE/EXCAVATING

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.

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.

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

DISPOSAL OF MATERIALS

415 EXCAVATED TOPSOIL REMOVAL
- General: Remove from site.
WATER

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

GROUND WATER LEVEL, SPRING OR RUNNING WATER

• Give notice: If it is considered that the excavations are below the water table.
• Springs/ Running water: Give notice immediately if encountered.

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: Contractor's choice.

FILLING

PROPOSED FILL MATERIALS

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

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.

FROST SUSCEPTIBILITY

• General: Except as allowed below, fill must be non frost-susceptible as defined in Highways Agency 'Specification for Highway Works', clause 801.8.
• Test reports: If the following fill materials are proposed, submit a laboratory report confirming they are non frost- susceptible:
  - Fine grained soil with a plasticity index less than 20%.
  - Coarse grained soil or crushed granite with more than 10% retained on a 0.063 mm sieve.
  - Crushed chalk.
  - Crushed limestone fill with average saturation moisture content in excess of 3%.
  - Burnt colliery shale.
• Frost-susceptible fill: May only be used:
  - At depths below the finished ground surface greater than: 450 mm.
  - Within the external walls of buildings below spaces that will be heated. Protect from frost during construction.
  - Where frost heave will not affect structural elements.
530 PLACING FILL
- Surfaces of excavations and areas to be filled: Free from loose soil, topsoil, organic material, rubbish and standing water.
- Freezing conditions: Do not place fill on frozen surfaces. Remove material affected by frost. Replace and recompact if not damaged after thawing.
- Adjacent structures, membranes and buried services:
  - Do not overload, destabilise or damage.
  - Submit proposals for temporary support necessary to ensure stability during filling.
  - Allow 14 days (minimum) before backfilling against in situ concrete structures.
- Layers: Place so that only one type of material occurs in each layer.
- Earthmoving equipment: Vary route to avoid rutting.

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

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

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.

626 COMPACTED GENERAL FILL
- Suitable material: Make up shortfall in excavated material with imported material of a similar type.
- Excavated material: Select suitable material and keep separate.
- Filling: Spread and level material in layers. As soon as possible thoroughly compact each layer.
- Required compaction: To suit use of fill as 617.
- 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.

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.
710 HARDCORE FILLING

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

730 BLINDING

- Surfaces to receive sheet overlays or concrete:
  Blind with:
  - Concrete where shown on drawings; or
  - Sand, fine gravel, or other approved fine material applied to fill interstices. Moisten as necessary before final rolling to provide a flat, closed, smooth surface.
- Sand for blinding: To BS EN 12620, grade 0/4 or 0/2 (MP).
- Permissible deviations on surface level: +0 -25 mm.
E05 In situ concrete construction generally

To be read with Preliminaries/General conditions.

220A STRUCTURAL DESIGN PROVIDED
• Description: Bund retaining walls.
• Requirements:
  - Additional requirements: None.
• Production/ execution records: In accordance with the designated code of practice.

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

290 ACCURACY OF CONSTRUCTION
• Setting out: To BS 5964-1.
• Geometrical tolerances: To Section 10 of the ‘National Structural Concrete Specification for Building Construction’:
  - Conflicts: Notwithstanding tolerances specified elsewhere, do not exceed requirements for compliance with the designated code of practice.
  - Substitution of alternative requirements: None.

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

318 SURFACE REGULARITY OF CONCRETE FLOORS TO TR 34 - GENERAL AND TOLERANCE NEW SLAB
• Measurement of surface regularity: To Concrete Society Technical Report 34 (TR 34), section 3.
• Surface regularity class: Comply with permissible limits for floor classifications/locations: FM2.

420 LIQUID RETAINING AND CONTAINMENT CONCRETE CONSTRUCTION
• Description: External bund wall.
• Form of construction: To BS EN 1992-3, Tightness Class 3.
• Requirement: Work is to be water resistant when tested to clause E05/ 450.

430 SURFACE CRACKING OF RETAINING WALLS
• Method of measurement: Contractor’s choice, suitable to task.
• Maximum crack width: 0.1 mm.
• Action: Should cracks occur that are wider than the maximum crack width:
  - Survey: Frequency and extent of such cracks and investigate cause.
  - Report: Findings together with recommendations for rectification.
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 8500-2.
• Exchange of information: Provide concrete producer with information required by BS 8500-1, clauses 4 and 5.

132  DESIGNED CONCRETE FOR RETAINING WALLS AND BASE (WATER RETAINING)
• Embedded metal: Carbon steel reinforcement.
• Compressive strength class (cylinder/cube minimum): C35A.
• Target density (oven-dry): Normal.
• Fibres: Not required.
• Aggregates:
  - Size (maximum): 20 mm.
  - Type/Density: Normal weight.
  - Coarse recycled aggregates: Not permitted.
  - Additional aggregate requirements: None.
• Design chemical class: DC-3.
• Limiting values for composition:
  - Water:cement ratio (maximum): 0.50.
  - Cement/combo content (minimum): 310 kg/m³.
  - Cement/combo content (maximum): 400 kg/m³.
  - Air content in situ (minimum): No requirement.
• Consistence class: Contractor’s choice.
• Permitted cement/combinations: As permitted for DC-class.
• Chloride class: CI 0.30.
• Admixtures: n/a.
• Colour: n/a.
• Additional mix requirements: None.

MATERIALS, BATCHING AND MIXING

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

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

225  CHANGES TO SPECIFICATION
• Changes to specification of fresh concrete (outside concrete producer’s responsibility): Submit proposals.
INTERRUPTION OF SUPPLY DURING CONCRETING

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

AGGREGATES FOR EXPOSED VISUAL CONCRETE

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

ADMIXTURES

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

PROPERTIES OF FRESH CONCRETE

- Adjustments to suit construction process: Determine with concrete producer. Maintain conformity to the specification.

PROJECT TESTING/ CERTIFICATION

PROJECT TESTING OF CONCRETE - GENERAL

- Testing: To BS 8500-1, Annex 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.

REGULAR PROJECT TESTING OF CONCRETE

- Tests: Compressive strength.
- Sampling:
  - Point: At point of discharge from delivery truck.
  - Rate: One sample per 6 m³.
- Other requirements: Cubes for early age strength testing to be stored under same conditions as concrete in members.

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.

TESTS RESULTS

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

BROKEN CUBES FROM FAILED STRENGTH TESTS

- Nonconformity: Keep separately the pieces of each cube which fail to meet the conformity requirements for individual results.
- Period for keeping cubes: Obtain instructions.
PLACING/ COMPACTING/ CURING AND PROTECTING

610 CONSTRUCTION/ SEQUENCE/ TIMING REQUIREMENTS
• Submit proposals.

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

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

640 CONSTRUCTION JOINTS
• Location of joints: Submit proposals when not shown on drawings.
• Preparation of joint surfaces: As section E40.

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: When reinforcement and formwork are ready for concreting.

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

680 PLACING
• Records: Maintain for time, date and location of all pours.
• Timing: Place as soon as practicable after mixing and while sufficiently plastic for full compaction.
• Temperature limitations for concrete: 30°C (maximum) and 5°C (minimum), unless otherwise specified. Do not place against frozen or frost covered surfaces.
• Continuity of pours: Place in final position in one continuous operation up to construction joints. Avoid formation of cold joints.
• Discharging concrete: Prevent uneven dispersal, segregation or loss of ingredients or any adverse effect on the formwork or formed finishes.
• Thickness of layers: To suit methods of compaction and achieve efficient amalgamation during compaction.
• Poker vibrators: Do not use to make concrete flow horizontally into position, except where necessary to achieve full compaction under void formers and cast-in accessories and at vertical joints.
690  COMPACTING
- General: Fully compact concrete to full depth to remove entrapped air. Continue until air bubbles cease to appear on the top surface.
  - Areas for particular attention: Around reinforcement, under void formers, cast-in accessories, into corners of formwork and at joints.
- Consecutive batches of concrete: Amalgamate without damaging adjacent partly hardened concrete.
- Methods of compaction: To suit consistence class and use of concrete.

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

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

810  CURING GENERALLY
- Requirement: Keep surface layers of concrete moist throughout curing period, including perimeters and abutments, by either restricting evaporation or continuously wetting surfaces of concrete.
  - Surfaces covered by formwork: Retain formwork in position and, where necessary to satisfy curing period, cover surfaces immediately after striking.
  - Top surfaces: Cover immediately after placing and compacting. If covering is removed for finishing operations, replace it immediately afterwards.
- Surface temperature: Maintain above 5°C throughout the specified curing period or four days, whichever is longer.

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.
CURING PERIODS FOR EXTERNAL CONCRETE

- General: Curing periods are in days (minimum).
  - Definition of 't': The average surface temperature of concrete in degrees Celsius during the curing period.

- Curing periods for concrete made using CEM1 strength class 42.5 or 52.5, or SRPC class 42.5:
  - Drying winds or dry, sunny weather (relative humidity < 50%): \( \frac{140}{t+10} \).
  - Intermediate conditions (relative humidity between 50 and 80%): \( \frac{100}{t+10} \).
  - Damp weather, protected from sun and wind (relative humidity > 80%): \( \frac{100}{t+10} \).

- Curing periods for concrete made using cements listed in BS8500-1, Table A.6 except for those listed above and for supersulfated cement:
  - Drying winds or dry, sunny weather (relative humidity < 50%): \( \frac{180}{t+10} \).
  - Intermediate conditions (relative humidity between 50 and 80%): \( \frac{140}{t+10} \).
  - Damp weather, protected from sun and wind (relative humidity > 80%): \( \frac{100}{t+10} \).

- Curing periods: For concretes using admixtures or other types of cements/combinations: Submit proposals.
- Other requirements: None.

PROTECTION

- Prevent damage to concrete, including:
  - Surfaces generally: From rain, indentation and other physical damage.
  - Surfaces to exposed visual concrete: From dirt, staining, rust marks and other disfiguration.
  - Immature concrete: From thermal shock, physical shock, overloading, movement and vibration.
  - In cold weather: From entrapment and freezing expansion of water in pockets, etc.
E20 Formwork for in situ concrete

To be read with Preliminaries/ General conditions.

**GENERALLY/ PREPARATION**

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

120 **FORMWORK DETAILS**
- Provide the following: Panel joints - layout where exposed to view.

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

170 **WORK BELOW GROUND - SLAB EDGES**
- Casting vertical faces against faces of excavation: Permitted provided face of excavation is stable.
  - Requirements: Increase nominal cover to reinforcement to 75 mm and Prevent contamination of concrete by loose soil.

**CONSTRUCTION**

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

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

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

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

340 KICKERS

- Method statement: Submit proposals including means of achieving quality of concrete consistent with that specified for the column or wall.
  - Kicker height: 150 mm.

361 FORM TIES FOR WATER RESISTANT CONCRETE

- General: Maintain water resistance of construction.
- Tie type and sealing system: Submit proposals.

480 SURFACE RETARDERS

- Use: Obtain approval.
- Reinforcement: Prevent contact with retarder.

STRIKING

510 STRIKING FORMWORK

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

FORMED FINISHES

610 BASIC FINISH

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

620 PLAIN FINISH

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

• Location: Fair faced surfaces.
• Finish: Smooth and even. Formwork panels as large as practicable. Arrange in a regular pattern as a feature of the surface.
  - Special requirements: None.
• Permissible deviation of surfaces:
  - Sudden irregularities (maximum): 3 mm.
  - Gradual irregularities (maximum): 3 mm when measured from the underside of a 1 m straightedge, placed anywhere on surface.
• Variations in colour:
  - Permitted: Those caused by impermeable formwork linings.
  - Not permitted: Those caused by contamination, grout leakage and replacement of formwork panels.
• Cover spacers: Do not use.
• Surface blemishes:
  - Permitted: Blowholes less than 5 mm in diameter and at an agreed frequency.
  - Not permitted: Voids, honeycombing, segregation and other defects.
• Formwork tie holes: In a regular pattern and filled with matching mortar.
E30 Reinforcement for in situ concrete

To be read with Preliminaries/ General conditions.

REINFORCEMENT

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

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

150 RIBBED BAR REINFORCEMENT
- Standard: To BS 4449.
  - Strength grade: Generally B500B, but B500C where detailed.

210 STANDARD FABRIC REINFORCEMENT
- Standard: To BS 4483.
- Strength grade: B500B.

WORKMANSHIP

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

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

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

425 LAPS NOT DETAILED ON DRAWINGS
- Laps in bar reinforcement (minimum): 40 x bar diameter.
- Laps in fabric reinforcement (minimum): 40 x bar diameter.
  - Laps at corners: Avoid four layer build-up.

427 LAPS IN FABRIC REINFORCEMENT
- Terms: As defined in BCA publication 97.321.
- Lap type:
  - Short edge of fabric: Flying end laps.
- Other requirements: Stagger laps in fabric to each face.
451  FIXING REINFORCEMENT
   • Standard: To BS 7973-1 and -2.
   • Installation: In addition to any spacers and chairs shown on drawings or schedules, provide adequate support, tie securely and maintain the specified cover.
   • Tying:
     - Wire type: 16 gauge black annealed. Use stainless steel wire for stainless steel reinforcement.
     - Ends of tying wire: Prevent intrusion into the concrete cover. Remove loose ends.
   • Compatibility of metals: Prevent contact between ordinary carbon steel and stainless or galvanized reinforcement.

470  TOLERANCES ON COVER
   • Tolerance (maximum): 5mm.
   • Checking specified cover dimensions: Before concreting check that cover dimensions will be achieved.

480  NOMINAL COVER TO REINFORCEMENT
   • Nominal cover: 35 mm for vertical faces, 50 to slab.

510  RUST STAINING
   • Staining of surfaces of concrete which will be exposed to view in the finished work: Prevent.

520  COVER METER SURVEY
   • Purpose of survey: To check positions of reinforcement and that the specified cover has been achieved.
   • Type of cover meter: A magnetic induction digital display type selected to suit arrangement and type of reinforcement.
     - Use: In accordance with recommendations of BS 1881-204 and manufacturer as appropriate to yield accurate results.
     - Surveyor: Experienced with cover meter surveys.
     - Calibration: At the outset and thereafter regularly at 45 minute (maximum) intervals.
   • Locations for checking: Include columns, beams, cantilevers, slab soffits and all faces exposed to the weather in the finished structure.
   • Timing: As soon as practicable after casting.
     - Notification: Give adequate notice.
   • Results: Submit. Notify immediately where specified cover has not been achieved.
E40 Designed joints in in situ concrete

To be read with Preliminaries/General conditions.

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

132 ADDITIONAL REQUIREMENTS FOR CONSTRUCTION JOINTS
  • Limitations: Permitted, but subject to restrictions in section E10.

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.

310 FLEXIBLE WATERSTOPS
  • Manufacturer: As drawings.
  - Product reference: As drawings.
  • Junctions and angles: Use factory formed junction pieces.
  • Placing concrete: Fully compact concrete around waterstops with no voids or porous areas.

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

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

- Purpose: To determine whether shrinkage is concentrated at occasional joints.
- Timing: At intervals from one month after casting of slab for duration of works.
- Joints that have opened significantly more than the average: Submit proposals for grouting.
E41 Worked finishes to in situ concrete

To be read with Preliminaries/ General conditions.

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

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

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

530 SLIP RESISTANCE TESTING OF WEARING SURFACES
- Test: To BS 7976-2 using a Transport Research Laboratory (TRL) Pendulum.
  - Timing: Give adequate notice.
  - Test results: Submit, inclusive of slip resistance values (pendulum test value [PTV]), in the wet and dry states.
J40 Flexible sheet waterproofing/ damp proofing

To be read with Preliminaries/ General conditions.

115 CONCRETE BLINDING TO HARDCORE BEDS
   • Concrete: Designated GEN 1 or Standardized prescribed ST2.
     - Thickness: As drawings.
     • Finish on completion: Smooth.

TYPES OF TANKING/ DAMP PROOFING

120 LOOSE LAID POLYETHYLENE DAMP PROOFING
   • Substrate: As drawings.
   • Manufacturer: Cetco.
     - Product reference: Voltex.
   • Thickness/ Gauge: To specialist's details.
   • Recycled content: To specialist's details.
   • Joints:
     - Surfaces to be joined: Clean and dry beyond full width of joint.
     - Laps (minimum): To specialist's details.
     - Sealing: To specialist's details.

WORKMANSHIP

310 WORKMANSHIP GENERALLY
   • Condition of substrate:
     - Clean and even textured, free from voids and sharp protrusions.
     - Moisture content: Compatible with damp proofing/ tanking.
   • Air and surface temperature: Do not apply sheets if below minimum recommended by membrane manufacturer.
   • Condition of membrane at completion:
     - Neat, smooth and fully supported, dressed well into abutments and around intrusions.
     - Completely impervious and continuous.
     - Undamaged. Prevent puncturing during following work.
   • Permanent overlying construction: Cover membrane as soon as possible.

320 INSPECTION
   • Give notice: Before covering any part of membrane with overlying construction.

335 PRIMERS
   • Manufacturer: Contractor's choice.
     - Product reference: To suit waterproofing system.
   • Coverage per coat (minimum): As recommended for the purpose by membrane manufacturer.
   • Curing: Allow to dry thoroughly before covering.

350 ANGLES IN BONDED DAMP PROOFING/ TANKING
   • Preformed rot proof fillet to internal angles:
     - Size (minimum): 50 x 50 mm, splay faced.
     - Bedding: Bitumen mastic or bonding compound.
   • Reinforcing strip to all angles:
     - Material: As damp proofing tanking.
     - Width (minimum): 300 mm.
     - Timing: Apply before main sheeting.
   • Dressing of main sheeting onto adjacent surfaces (minimum): 100 mm.
Z22 Sealants

To be read with Preliminaries/General conditions.

PRODUCTS

310 JOINTS GENERALLY
• Primer, backing strip, bond breaker: Types recommended by sealant manufacturer.

EXECUTION

610 SUITABILITY OF JOINTS
• Presealing checks:
  - Joint dimensions: Within limits specified for the sealant.
  - Substrate quality: Surfaces regular, undamaged and stable.
• Joints not fit to receive sealant: Submit proposals for rectification.

620 PREPARING JOINTS
• Surfaces to which sealant must adhere:
  - Remove temporary coatings, tapes, loosely adhering material, dust, oil, grease, surface water and contaminants that may affect bond.
  - Clean using materials and methods recommended by sealant manufacturer.
• Vulnerable surfaces adjacent to joints: Mask to prevent staining or smearing with primer or sealant.
• Backing strip and/or bond breaker installation: Insert into joint to correct depth, without stretching or twisting, leaving no gaps.
• Protection: Keep joints clean and protect from damage until sealant is applied.

630 APPLYING SEALANTS
• Substrate: Dry (unless recommended otherwise) and unaffected by frost, ice or snow.
• Environmental conditions: Do not dry or raise temperature of joints by heating.
• Sealant application: Fill joints completely and neatly, ensuring firm adhesion to substrates.
• Sealant profiles:
  - Butt and lap joints: Slightly concave.
  - Fillet joints: Flat or slightly convex.
• Protection: Protect finished joints from contamination or damage until sealant has cured.
IMPORTANT INFORMATION

THIS PAGE CONTAINS IMPORTANT INFORMATION ABOUT THE RIGHTS TO USE THIS DOCUMENT. IF YOU DO NOT ACCEPT THE FOLLOWING CONDITIONS FOR THE USE AND RELIANCE OF THIS DOCUMENT PLEASE RETURN IT TO THE AUTHOR OR TO THE MANAGING DIRECTOR OF ROLTON GROUP LTD BY RECORDED DELIVERY AND WITH COVERING LETTER

DEFINITIONS

The Client: BIOGEN

The Development: BIOGEN WESTWOOD - NEW FLARE (BETWEEN CAR PARK AND GAS BAG)

CONFIDENTIALITY

Rolton Group Ltd will keep confidential and not disclose to any person or use any confidential information or any technical operational administrative business information relating to the Client the Development or otherwise without the Client’s prior written authority.

COPYRIGHT

All design rights and copyright and intellectual Property in this document and the referenced documents herein ("the Report") shall remain vested in Rolton Group Ltd and Rolton Group Ltd grants to the Client a royalty-free, non-exclusive licence to use and to reproduce the Report in full but not in part for all purposes relating to the Development including (without limitation) the construction completion reconstruction modification alteration maintenance reinstatement repair use letting sale promotion and advertisement thereof. Such licence shall not include a licence to reproduce the designs contained in the Report and shall not include a license for the Report to be modified in any way. The licence shall include the right without the consent of Rolton Group Ltd to assign the licence or grant a sub-licence to any person whatsoever provided that Rolton Group shall not be liable for any such use by the Client or any assignee or licensee for any purposes other than that for which the same were provided by Rolton Group.

INFORMATION PROVIDED BY OTHERS

Where copies of any documents information reports investigations findings and/or details of any preliminary works carried out in respect of the Development ("Other Documents") have been provided to Rolton Group Ltd by any party not limited to the Client then Rolton Group Ltd has made full regard to the Other Documents when considering the findings designs and recommendations made by Rolton Group Ltd in the Report.

Unless specifically stated to be otherwise Rolton Group have relied on the Other Documents for the findings designs and recommendations in the Report and any errors or omissions in the Other Documents shall operate to exclude or limit the Rolton Group Ltd liability for any findings designs and recommendations in the Report unless such error or omission should reasonably have been identified by a properly qualified and competent consultant or person experienced in the provision of like services as those provided by Rolton Group Ltd for a Development of similar type size scope and complexity.

THIRD PARTY RIGHTS

By acceptance of this Report the Client confirms and Rolton Group Ltd agree that any contracts or agreements between Rolton Group Ltd and the Client shall not be enforceable under the Contracts (Rights of Third Parties) Act 1999 by any person not a party to them.

FREEDOM OF INFORMATION

Authorised or unauthorised copies of this document may come into the possession of organisations that are designated under the Freedom of Information Act 2000 ("the Act"). Such organisations that are designated in the Act are requested by Rolton Group to respect the above statements relating to confidentiality and copyright. It is possible that the disclosure of the information in the Report may be in breach of certain exceptions of the Act such as Part II Section 41, 42, 43. Rolton Group has invested and imparted substantial skill economic resources and labour in producing the Report and any disclosure shall prejudice the commercial interests of the Rolton Group Ltd. Where there are breaches of the exemption requirements of the Act by the disclosure of information in this Report then Rolton Group Ltd will pursue for legal recourse including for but not limited to recovery of losses and damages.