SERIES 600
EARTHWORKS

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# denotes a Clause or Sample Contract Specific Appendix which has a substitute National Clause or Sample Contract Specific Appendix for one or more of the Overseeing Organisations of Scotland, Wales or Northern Ireland.

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EARTHWORKS

#601 (02/16) Classification, Definitions and Uses of Earthworks Materials

(02/16) General

0 (02/16) This Series is part of the Specification for Highway Works. Whilst this Series is particularly relevant to the subject matter in its title it must be read in conjunction with the general requirements in Series 000 and 100 and with all other Series relevant to the specification for the particular works to be undertaken.

(02/16) General Classification

1 (02/16) Earthworks materials shall fall into one or other of the following general classifications:

(i) acceptable material: material excavated from within the site or imported on to the site which meets the requirements of Table 6/1 and contract specific Appendix 6/1 for acceptability for use in the permanent works;

(ii) unacceptable material Class U1A as defined in sub-Clauses 2(i)(a) and 2(i)(b) of this Clause: material excavated from within the site which, unless processed so that it meets the requirements of Table 6/1 and contract specific Appendix 6/1, shall not be used in the permanent works;

(iii) unacceptable material Class U1B as defined in sub-Clause 2(ii)(a) of this Clause: material excavated from within the site which, unless processed so that it meets the requirements of Table 6/1 and contract specific Appendix 6/1, shall not be used in the permanent works; and

(iv) unacceptable material Class U2 as defined in sub-Clause 3(i) of this Clause: material excavated from within the site which shall not be used in the permanent works.

(02/16) Unacceptable Materials

2 (02/16) Unacceptable material Classes U1A and U1B:

(i) unacceptable material Class U1A shall be:

(a) material which does not comply with the permitted constituents and material properties of Table 6/1 and contract specific Appendix 6/1 for acceptable material; and

(b) material, or constituents of materials, composed of the following unless otherwise described in contract specific Appendix 6/1:

- peat, materials from swamps, marshes and bogs;
- logs, stumps and perishable material;
- materials in a frozen condition;
- clay having a liquid limit determined in accordance with BS 1377: Part 2, exceeding 90 or plasticity index determined in accordance with BS 1377: Part 2, exceeding 65;
- material susceptible to spontaneous combustion except unburnt colliery spoil complying with sub-Clause 15 of this Clause;

(ii) unacceptable material Class U1B shall be:

(a) contaminated materials, including controlled wastes (as defined in the Environmental Protection Act 1990 Part IIA) whose level of contamination is above that given either in contract specific Appendix 6/14 or in contract specific Appendix 6/15, but excluding all hazardous wastes (as defined in the Hazardous Waste (England and Wales) Regulations 2005) and radioactive wastes (as defined in the Radioactive Substances Act 1993).

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3 (02/16) Unacceptable material Class U2 shall be:

(i) hazardous waste (as defined in the Hazardous Waste (England and Wales) Regulations 2005) and radioactive waste (as defined in the Radioactive Substances Act 1993).

4 (02/16) Where required in contract specific Appendix 6/1, unacceptable material (other than Class U2) shall be processed by mechanical, chemical or other means to render the material acceptable for use in the permanent works in accordance with the requirements of Table 6/1 and contract specific Appendix 6/1.

(02/16) **Definitions**

5 (02/16) Where source codes are referred to these shall be for materials from the sources listed in Table 6/7.

6 (02/16) Chalk shall mean:

(i) any porous material of natural origin composed essentially of calcium carbonate and identified as chalk on the maps produced by the British Geological Survey;

(ii) material designated as Class 3 in contract specific Appendix 6/1.

7 (02/16) Argillaceous rock shall mean shales mudstones siltstones slates and micaceous schists composed of particles of clay and silt and mica. It shall include unburnt colliery spoil. Where argillaceous rock is imported onto the site, it shall be aggregate complying with BS EN 13242 from source codes P (natural aggregates described as shale, siltstone or slate), or G2 (refuse from hard coal mining (black coal shale)).

8 (02/16) Pulverised-fuel ash shall mean solid material extracted by electrostatic and mechanical means from the flue gases of furnaces fired with pulverised bituminous coal. It shall have a maximum particle size of 3 mm. Where pulverised-fuel ash is imported onto the site, it shall be aggregate complying with BS EN 13242 from source code C1 (coal fly ash).

9 (02/16) Furnace bottom ash shall mean agglomerated pulverised-fuel ash obtained from the bottom of the power station furnace and having particle size no larger than 10 mm. Where furnace bottom ash is imported onto the site, it shall be aggregate complying with BS EN 13242 from source code C4 (coal bottom ash).

10 (02/16) Formation shall be the top surface of capping. Where no capping is required formation shall be the top surface of earthworks at the underside of sub-base, unless otherwise shown on the drawings.

11 (02/16) Sub-formation shall be the top surface of earthworks at the underside of capping.

12 (02/16) Stabilisation shall mean the spreading of cement or lime or both on a layer of deposited or intact granular or cohesive material, and the subsequent process of pulverising and mixing followed by appropriate compaction to form the whole or a constituent layer of a capping.

13 (02/16) Where 'recycled aggregate' is used in this Series, the material shall be aggregate resulting from the processing of inorganic or mineral material previously used in construction and shall have been tested in accordance with Clause 710. It shall not contain more than 1% other materials (Class X), not more than 50% in Class Ra (bituminous materials) and not more than 25% in Class Rg (crushed glass). Where 'recycled aggregate' is imported onto the site, it shall be aggregate complying with BS EN 13242 from source code A (construction and demolition recycling industries).

Where 'recycled aggregate except recycled asphalt' is used in this Series, the aggregate shall have been tested in accordance with Clause 710. It shall not contain more than 1% other materials (Class X), not more than 1% in Class Ra (bituminous materials) and not more than 5% in Class Rg (crushed glass). Where 'recycled aggregate except recycled asphalt' is imported onto the site, it shall be aggregate complying with BS EN 13242 from source codes A2 (crushed concrete) and/or A3 (crushed bricks, masonry).

14 (02/16) 'As dug' shall mean material that has been excavated, transported and placed without any processing. Where imported material undergoes any processing, including cleaning and sorting, it will not be deemed 'as dug' and thus shall be aggregate complying with BS EN 13242.

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(02/16) **Use of Fill Materials**

15 (02/16) In addition to any grading requirements the maximum particle size of any fill material shall be no more than two-thirds of the compacted layer thickness except that cobbles having an equivalent diameter of more than 150 mm shall not be deposited beneath verges or central reserves within 1.30 m of the finished surface.

16 (02/16) Materials placed within 500 mm, or any other distances described in the contract specific Appendix 6/3, of concrete, cement bound materials, other cementitious mixtures or stabilised capping forming part of the permanent works shall conform to, as appropriate, the following requirements:

(i) Materials shall conform to the following criteria:

(a) Water-soluble sulfate (WS) content determined in accordance with BS EN 1744-1 clause 10 shall not exceed 1500 mg of sulfate (as SO_4) per litre;

(b) Total sulfur (TS) content determined in accordance with BS EN 1744-1 clause 11 expressed as (S) shall not exceed 1% for aggregates other than air cooled blast furnace slag or 2% for air cooled blast furnace slag.

(ii) Materials shall conform to at least one of the following options:

(a) When described in accordance with BS EN 932-3 and BS EN 13242 Annex A, limestone, chalk, dolomite, blast furnace slag, steel slag or crushed concrete are predominant

or

(b) The sulfide content of the material determined in accordance with BS EN 1744-1 Clause 13 is less than 0.5% (as SO_4).

When determining WS, TS or sulfide content, at least five samples of each material shall be tested. The mean of the highest two values shall be used for comparison with the limiting values. This shall also apply if six to nine results are available. If ten or more results are available, the mean of the highest 20% of the results shall be used for comparison with the limiting values.

17 (02/16) Material placed within 500mm, or any other distances described in the contract specific Appendix 6/3, of metallic structural elements forming part of the permanent works shall conform, as appropriate, to the following requirements:

(i) Materials shall conform to the following criteria:

(a) Water-soluble sulfate (WS) content determined in accordance with BS EN 1744-1 clause 10 shall not exceed 300 mg of sulfate (as SO_4) per litre; and

(b) Total sulfur (TS) content determined in accordance with BS EN 1744-1 clause 11 expressed as (S) shall not exceed 1% for aggregates other than air cooled blast furnace slag or 2% for air cooled blast furnace slag.

(ii) Materials shall conform to at least one of the following options:

(a) When described in accordance with BS EN 932-3 and BS EN 13242 Annex A, limestone, chalk, dolomite, blast furnace slag, steel slag or crushed concrete are predominant;

or

(b) The sulfide content of the material determined in accordance with BS EN 1744-1 Clause 13 is less than 0.06% (as SO_4).

When determining WS, TS or sulfide content, at least five samples of each material shall be tested. The mean of the highest two values shall be used for comparison with the limiting values. This shall also apply if six to nine results are available. If ten or more results are available, the mean of the highest 20% of the results shall be used for comparison with the limiting values.

The requirements in (i) and (ii) above shall not apply to metallic items protected by concrete or ancillary metallic items such as the tops of chambers and gullies.

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18 (02/16) Unburnt colliery spoil may be used as general fill provided it is compacted in compliance with Clause 612 and complies with the requirements of contract specific Appendix 6/1.

19 (02/16) Pulverised-fuel ash shall not be placed within the dimension described in contract specific Appendix 6/3, below sub-formation or formation.

20 (02/16) Where pulverised-fuel ash is used, the Contractor shall for each consignment, make available to the Overseeing Organisation a record of the type and source from which it was obtained and a certificate of results of tests showing that the material complies with the requirements of Table 6/1.

602 (02/16) General Requirements

1 (02/16) The Contractor shall employ only plant and working methods which are suited to the materials to be handled and traversed. He shall be responsible for maintaining the nature of the acceptable material so that when it is placed and compacted it remains acceptable in accordance with the contract. Acceptability shall be determined in accordance with Table 6/1 and any special contract specific requirements in Appendix 6/1.

2 (02/16) Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction plant is operating at the place of deposition to ensure compliance with Clause 612.

3 (02/16) No excavated acceptable material or unacceptable material required to be processed, other than surplus to the requirements of the contract, shall be removed from the site unless indicated otherwise in contract specific Appendix 6/1. Material which is unacceptable only by reason of being frozen shall be retained on site when in that condition. Where the Contractor is permitted to remove acceptable material, or unacceptable material required to be processed, from the site to suit his operational procedure, then he shall make good any consequent deficit of material arising therefrom. Environmental requirements for processing of Class U1B material, in terms of limiting values of contaminants or other requirements, shall be set out in contract specific Appendix 6/1 in the earthworks Class for which the processed material is to be used.

4 (02/16) If any acceptable material or unacceptable material required to be processed is, where permitted by contract specific Appendix 6/1, used by the Contractor for purposes other than for general fill, sufficient acceptable fill material to occupy, after full compaction, a volume corresponding to that which the excavated material occupied shall be provided by the Contractor.

5 (02/16) Acceptable material (other than Class 5A or any Class 5B material replacing Class 5A material in accordance with sub-Clause 3 of this Clause) surplus to the total requirements of the permanent works and all unacceptable material Class U1A not required to be processed shall, unless indicated otherwise in contract specific Appendix 6/1, be run to spoil in tips provided by the Contractor. In the case of unacceptable material, Class U1B and Class U2, the Contractor shall comply with any specific requirements for disposal described in contract specific Appendix 6/2.

6 (02/16) Where the excavation reveals a combination of acceptable and unacceptable materials the Contractor shall, unless indicated otherwise in contract specific Appendix 6/3, carry out the excavation in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the unacceptable materials. Unless otherwise described in the contract classes of fill material required to be deposited separately shall be excavated separately without contamination by other Classes of material.

7 (02/16) The Contractor shall make his own arrangements for stockpiling of acceptable material, and unacceptable material to be processed, and for the provision of sites for the purpose.

8 (02/16) The Contractor shall ensure that he does not adversely affect the stability of excavations or fills by his methods of stockpiling materials, use of plant or siting of temporary buildings or structures.

9 (02/16) Existing topsoil material shall, except where it is to be left in place in the locations described in contract specific Appendix 6/8, be stripped to depths as described in contract specific Appendix 6/8 for Class 5A material from all areas of cutting and from all areas to be covered by embankment or by other areas of fill. Where stated in contract specific Appendix 6/8 existing topsoil shall be stripped as turf in accordance with sub-Clause 3005.13.

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10 (02/16) Topsoil shall wherever practicable be used immediately after its stripping and if not shall be stored in stockpiles of heights not exceeding 2 m or other heights stated in contract specific Appendix 6/8. Unless otherwise stated in contract specific Appendix 6/8, topsoil shall not be stockpiled for more than two years. Topsoil shall not be unnecessarily trafficked either before stripping or when in a stockpile. Stockpiles shall not be surcharged or otherwise loaded and multiple handling shall be kept to a minimum.

11 (02/16) All Class 5A topsoil arising from the site, or any Class 5B material replacing Class 5A material in accordance with sub-Clause 3 of this Clause, in excess of the requirements for topsoiling, shall be subject to the requirements described in contract specific Appendix 6/8.

12 (02/16) Excavations for foundations and trenches shall be adequately supported at all times, and except where otherwise described in contract specific Appendix 6/3, shall not be battered. Where excavations are permitted to be battered they shall be benched as described in contract specific Appendix 6/3 prior to backfilling and compaction. The additional work and materials shall be provided by the Contractor. Sheeting and other excavation supports shall be removed as filling proceeds except where they are required in contract specific Appendix 6/3 to be left in position.

13 (02/16) Excavations requiring backfilling shall remain open only for the minimum period necessary.

14 (02/16) Excavations requiring backfilling in existing paved or other surfaces, including those paved areas to be reconstructed or repaired, shall be carried out and reinstated in compliance with Clause 706.

15 (02/16) The Contractor shall keep earthworks free of water including:

(i) arranging for the rapid removal of water:

(a) shed on to the earthworks;

(b) entering the earthworks from any source;

(ii) lowering and maintaining by appropriate measures, the water level in excavations, sufficiently to enable the permanent works to be constructed.

16 (02/16) In carrying out the requirements of sub-Clause 15 of this Clause the Contractor shall:

(i) form and maintain cuttings, embankments and other areas of fill with appropriate falls and gradient and sealed surfaces;

(ii) provide where necessary temporary watercourses, drains, pumping and the like;

(iii) discharge accumulated water and groundwater into the permanent outfalls of the drainage system where practicable;

(iv) provide adequate means for trapping silt on temporary systems discharging into permanent drainage systems.

17 (02/16) The Contractor shall carry out and maintain any groundwater lowering or other treatment required in contract specific Appendix 6/1.

18 (02/16) Where materials are designated in the contract as either Class U1B or Class U2, the Contractor shall carry out any special requirements for their handling described in contract specific Appendix 6/2. Where such materials are encountered during the progress of the works, the Contractor shall make all necessary arrangements for their safe handling and disposal after consultation with the appropriate environmental authority.

19 (02/16) Subject to the surface level tolerances given in Clause 613 and sub-Clause 616.1, material shall not be frost susceptible if it is used within 450 mm of the designed final surface of a road or paved central reserve, or 350 mm if the annual frost index of the site is less than 50. Material shall be classified as non-frost-susceptible if the mean heave is 15 mm or less, when tested in accordance with BS 812: Part 124 or BS 1924: Part 2 for lime stabilised capping, amended as given in sub-Clause 801.7.

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603 (02/16) Forming of Cuttings and Cutting Slopes

1 (02/16) Cuttings shall be excavated to the lines and levels described in contract specific Appendix 6/3.

2 (02/16) Cutting slopes or toes of cuttings shall only be undercut when required in the contract for trench or other excavations. Such excavations shall be restricted in extent as described in contract specific Appendix 6/3 and where they require backfilling shall remain open only for the minimum period necessary, so as to prevent risk to the permanent works.

3 (02/16) Except where otherwise described in contract specific Appendix 6/3, the excavation of cuttings may be halted at any stage providing at least 300 mm of material as a weather protection is left in place above the formation or above the sub-formation, subject to the requirements of Clauses 613 and 616.

4 (02/16) Where pre-split blasting is required or permitted in contract specific Appendix 6/3, it shall comply with Clause 607 and any other requirements in contract specific Appendix 6/3. Full details of the methods and arrangements to be adopted shall be made available to the Overseeing Organisation before commencement of drilling operations.

5 (02/16) Final faces of cuttings which are not to receive topsoil shall:

(i) wherever possible be left without scars or damage from construction plant; and

(ii) to achieve a natural appearance, when the stratum permits and when pre-split blasting is not adopted, have the face left irregular within tolerances given in contract specific Appendix 6/3; and

(iii) have boulders or other rock fragments that can be moved by hand without tools, removed; and

(iv) where required in contract specific Appendix 6/3 have material that can be blown away by airline hose, having pressures no greater than those stated therein, so removed; and

(v) have adequate access to enable inspection to be carried out to determine the extent of work required by this sub-Clause.

6 (02/16) Where required in contract specific Appendix 6/3, faces of cuttings which are not required to receive topsoil shall have one or more of the following measures carried out as appropriate:

(i) Isolated patches of soft, fragmented and insecure material shall each be excavated to a depth of at least 200 mm unless other depths are stated in contract specific Appendix 6/3 and replaced as soon as practicable with ST2 concrete to Clause 2602 well rammed into the cleaned out void.

(ii) Areas of cutting face requiring their surface to be made stable shall be trimmed back by a nominal 50 mm or other amount required in contract specific Appendix 6/3 and the resulting surface together with an area of any surrounding intact material as detailed in contract specific Appendix 6/3, shall have a suitable cement based grout or sprayed concrete, applied by pressure to form a total nominal thickness of 40 mm unless the required thickness is stated in contract specific Appendix 6/3. Where required in contract specific Appendix 6/3, reinforcement shall be fixed to the surface before application of the concrete or grout. Weep holes using permanent formers shall be constructed to the requirements of contract specific Appendix 6/3 and at the locations described in contract specific Appendix 6/3.

(iii) Soft or insecure material, interlayered with rock shall be excavated to the depth behind the face described in contract specific Appendix 6/3. The resulting cavity shall be filled with ST2 concrete to Clause 2602 or with masonry infill complying with the Series 2400 and provided with weep holes all in accordance with requirements in contract specific Appendix 6/3.

(iv) Netting or other sheet covering as described in contract specific Appendix 6/3 or rock bolts as described in contract specific Appendix 6/10.

7 (02/16) Where required in contract specific Appendix 6/3, faces of cuttings which are to receive topsoil shall have one or more of the following measures carried out as appropriate:

(i) Be benched to retain topsoil as described in contract specific Appendix 6/3.

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(ii) Be harrowed to a depth of 50 mm. Such harrowing shall be carried out immediately prior to topsoiling, diagonally, at an angle between 5º to 45º to the line of the toe, measured on the plane of the slope.

(iii) Isolated patches of soft, fragmented or insecure material shall be excavated and either:

(a) filled by well ramming in a Class of fill with similar characteristics as the surrounding intact material; or

(b) excavated and dealt with as described in sub-Clause 6(i) of this Clause.

(iv) Other areas required to be made stable shall be dealt with as stated in contract specific Appendix 6/3.

8 (02/16) The concrete, referred to in sub-Clauses 6(i) and 6(iii) of this Clause, permanently exposed on the face of the cutting shall have surface features as nearly as possible matching those of the adjacent intact face. Such concrete and the grout referred to in sub-Clause 6(ii) of this Clause shall have a consistent colour as nearly as possible matching that of the adjacent intact face.

604 (02/16) Excavation for Foundations

1 (02/16) The bottom of all foundation excavations shall be formed to the lines and levels shown on the drawings. Pockets of soft soil or loose rock shall be removed and the resulting voids and any natural voids shall be filled with ST1 concrete to Clause 2602 (or other material as required by contract specific Appendix 6/3) except in excavations for corrugated steel buried structures when Class 6K lower bedding fill material complying with Table 6/1 shall be used.

After placing of any blinding concrete shown on the drawings, no trimming of the side faces of the excavation shall be carried out for 24 hours.

2 (02/16) The Contractor shall make good:

(i) any lateral overbreak of the excavation above the bottom of the foundation greater than the net volume required for the permanent works with material of the same Class as used for fill above structural concrete foundations to comply with Clause 611 (except that for corrugated steel buried structures Class 6K lower bedding material shall be used) or, where the excavation is too narrow to allow the compaction of earthworks materials, with ST1 concrete to Clause 2602;

(ii) any additional excavation at or below the bottom of foundations, including that resulting from removal of material which the Contractor has allowed to deteriorate, with ST1 concrete to Clause 2602 (or other material required by contract specific Appendix 6/3) except that under corrugated steel buried structures Class 6K lower bedding material shall be used.

3 (02/16) Class 6K lower bedding material referred to in this Clause shall be deposited and compacted in compliance with Clauses 608 and 612 and Table 6/1.

605 (02/16) Special Requirements for Class 3 Material

1 (02/16) When contract specific Appendix 6/1 designates a material as Class 3 to be used or to remain intact in the permanent works the following shall apply:

(i) No earthworks involving Class 3 material or trafficking of areas which consist of Class 3 material, unless they are protected, shall be carried out during the periods described in contract specific Appendix 6/4.

(ii) Excavation of Class 3 material shall be by means of a face shovel, which shall excavate, swing and unload without moving the chassis or undercarriage during one operating cycle, or by means of a similar shovel-loading machine, so as to reduce the degradation of the material to a minimum.

(iii) When excavating Class 3 material the Contractor shall arrange his method of working so as to maintain a working face of minimum height 3 m or other height required in contract specific Appendix 6/4

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within Class 3 material except that where the depth of the cutting is less than 3 m the full height of Class 3 material shall form the working face excluding any protection required to the formation or sub-formation.

(iv) Material other than chalk contained within the volume designated as Class 3 material in the contract shall be excavated and deposited separately from chalk and not be mixed with it.

(v) Trafficking of areas of Class 3 material shall not be permitted by vehicles having a capacity when struck of more than 15 m^3 unless otherwise described in contract specific Appendix 6/4.

(vi) Class 3 material shall not be stockpiled or be subjected to multiple handling.

(vii) Class 3 material shall not, unless required in contract specific Appendix 6/4, be layered with other fill material in the construction of embankments and other areas of fill.

(viii) When required in contract specific Appendix 6/4 embankments and other areas of fill constructed of Class 3 material shall either:

(a) upon reaching a level 600 mm below sub-formation or, where there is no capping, a level 600 mm below formation, be left for a minimum of 4 weeks or other period stated in contract specific Appendix 6/4, before continuing filling which shall, in all cases, be continued in compliance with sub-Clause 608.9; or

(b) be continued above sub-formation or formation with a protective layer in accordance with sub-Clause 608.9(ii) but which shall be of Class 3 material. Such material shall then be left for a minimum of 4 weeks or other period stated in contract specific Appendix 6/4 before removal of the protective layer and shall be immediately continued with the preparation of sub-formation or formation, as appropriate, in accordance with Clauses 613 and 616.

(ix) Where temporary instability occurs in chalk during deposition or compaction due to excessive working by plant or to inclement weather, the Contractor shall delay the further deposition of Class 3 material until the chalk has recovered sufficient strength for work to proceed. A detailed record of the areas of instability shall be made available to the Overseeing Organisation.

(x) At the end of each working day of filling, exposed Class 3 material laid that day shall, unless otherwise stated in contract specific Appendix 6/4 be rolled with two passes of a smooth wheeled roller having a mass per metre width of roll exceeding 2100 kg.

(xi) The other special requirements for Class 3 material described in sub-Clauses 613.11(i), 613.12(i), 616.1(ii) and 616.3 shall also apply, together with any other special requirements described in contract specific Appendix 6/1 or contract specific Appendix 6/4.

606 (02/16) Watercourses

1 (02/16) The clearance and modification of existing, or the construction of new watercourses, including ditches, streams, rivers, lagoons and ponds, shall be as described in contract specific Appendix 6/3 including any protection, lining, revetment or other works and shall comply with sub-Clauses 2 to 4 of this Clause.

2 (02/16) Clearance of existing watercourses shall include the removal of vegetation, vegetable matter and all other deposits within the watercourse profile. Materials resulting from this clearance shall be dealt with as unacceptable material.

3 (02/16) New watercourses and cleared existing watercourses shall be maintained in a clear condition.

4 (02/16) Redundant watercourses shall, where required in contract specific Appendix 6/3, be drained and cleared in accordance with sub-Clause 2 of this Clause and material outside the watercourse profile excavated and dealt with as unacceptable material. The excavations shall be to the dimensions stated in the contract and the whole filled with general or selected fills of the Class described in contract specific Appendix 6/3 complying with Table 6/1

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deposited and compacted in compliance with Clause 608 and 612. Where the surface is to remain exposed it shall be topsoiled and seeded, or receive other treatment, all as described in contract specific Appendix 6/3.

#607 (02/16) Explosives and Blasting for Excavation

1 (02/16) Blasting for excavation shall not be employed unless permitted or required in contract specific Appendix 6/3 and such blasting shall be confined to the locations and to within the time limits stated therein.

2 (02/16) The Contractor shall:

(i) not carry out plaster shooting;

(ii) for each location where blasting is to be undertaken, give written notice to the Overseeing Organisation of the programme of blasting, including trial explosions, at least 10 days before it commences and give written notice of each blasting event as described in (v) below, at least 12 hours beforehand;

(iii) carry out trial explosions starting with reduced quantities of explosive in order to determine the size of the actual explosive charges and their disposition, for use in the main blasting operations, so as not to exceed the values for vibrational amplitude and vibrational peak particle velocity stated in (vi) below at the positions described therein;

(iv) determine danger zones likely to be created by the blasting operations, including trial explosions, within which blasted material may be projected and utilise suitable arrangements including temporary works, to retain such projectiles and ensure that no injury or damage is caused to persons or property thereby;

(v) limit blasting to a small number of events during permitted hours per day, where an event shall comprise a single explosion or a group of explosions each separated by a short time interval, the group lasting less than a minute;

(vi) ensure that:

(a) structures and earthworks, existing or under construction, on and off the site, do not experience, during blasting operations including trial explosions, a vibrational amplitude exceeding 0.2 mm and a resultant peak particle velocity exceeding 50 mm per second, or other limits stated in contract specific Appendix 6/3, at the same time or individually; and

(b) peak overpressures, of magnitude such as to endanger windows and glazed areas of structures, do not occur.

(vii) where instrumentation and monitoring is appropriate:

(a) rigidly fix to structures and insert in earthworks described in (vi)(a) above, suitable instruments to measure the vibrational amplitude and resultant vibrational peak particle velocity, and peak overpressures, experienced during blasting operations including trial explosions;

(b) make available details of the proposed instrumentation within the site;

(c) unless otherwise stipulated in contract specific Appendix 6/3, make his own arrangements for installing instruments on property off the site including negotiating with landowners and other interested parties;

(d) read such instruments and take measurements throughout the period of blasting operations, including trial explosions;

(e) for instruments on structures or earthworks on the site and, where required in contract specific Appendix 6/3, on property off the site, make available the results to the Overseeing Organisation at the end of each day's blasting.

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(viii) take measurements of vibrational amplitude and peak particle velocity in each of three mutually perpendicular planes and determine the peak value, taken as the maximum resultant calculated by vector summation of the three components of amplitude and velocity respectively, measured as instantaneously as the resolution of the recording instrument permits;

(ix) ensure that noise from blasting operations is controlled in accordance with Clause 109;

(x) use explosives in the quantities and in the manner recommended by the manufacturer;

(xi) store explosives in registered premises in a licensed store or magazine provided with a separate compartment for detonators or use them under an Immediate Use Certificate issued by the police;

(xii) only permit explosives to be used or handled by or under the immediate control of a competent person in accordance with the Construction (General Provisions) Regulations 1961 (Regulation 19) and subsequent amending Regulations;

(xiii) ensure there is no unauthorised issue or improper use of explosives brought on the site and maintain a strict check on quantities issued and consumed;

(xiv) comply with the requirements of BS 6657 in respect of the use of electrical detonators in the vicinity of static and mobile radio transmitters, including normal radio and television broadcasting stations and radar units associated with aircraft movements, electricity generating plant and transmission lines.

608 (02/16) Construction of Fills

1 (02/16) All fills, including embankments, shall be constructed:

(i) in the locations described in contract specific Appendix 6/3 to the lines and levels stated therein;

(ii) of Classes of materials required or permitted in contract specific Appendix 6/1, complying with Table 6/1 with, unless otherwise described in the contract, only Class 6A material deposited into open water;

(iii) by depositing, as soon as practicable after excavation, in layers to meet the compaction requirements of Clause 612 as required for each Class of material in Table 6/1, except that:

(a) material requiring end product compaction shall be deposited in layers not exceeding 250 mm uncompacted thickness;

(b) material placed into open water shall be deposited by end tipping without compaction;

(c) material deposited in areas to receive dynamic compaction complying with Clause 630 shall be deposited and compacted to the requirements therein.

(iv) to the requirements of this Clause and any other requirements for fill in this Series.

2 (02/16) Starter layers of Classes 6B, 6C or 6D materials as described in contract specific Appendix 6/3 shall be deposited as the first layer or layers of fill above existing ground level or, if appropriate, above any ground improvement required by contract specific Appendix 6/13. Starter layers below Class 2E pulverised-fuel ash general fill shall be Class 6D material. Plant movement across starter layer material shall be restricted to that plant which is necessary for its deposition, spreading and compaction in compliance with this Clause and Clause 612 and any plant required to carry out any ground improvement beneath it if required by Clause 630. The Contractor shall take all reasonable measures to prevent damage to the underlying strata, which may include use of lighter spreading plant or a reduction of the number of passes of compaction plant.

3 (02/16) Coarse granular material Classes 1C and 6B shall, before compaction, be spread in layers by a crawler tractor of not less than 15 tonnes total mass. After compaction each layer shall, if voids remain, be blinded with an approved Class of granular material complying with Table 6/1 so that all surface voids are filled before the next layer and before any capping or sub-base is constructed.

4 (02/16) Embankments and other areas of fill shall, unless otherwise required in the contract, be constructed evenly over their full width and their fullest possible extent and the Contractor shall control and direct

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constructional plant and other vehicular traffic uniformly over them. Damage by constructional plant and other vehicular traffic shall be made good by the Contractor with material having the same characteristics and strength as the material had before it was damaged.

5 (02/16) Embankments and other areas of unsupported fills shall not be constructed with steeper side slopes, or to greater widths than those described in contract specific Appendix 6/3, except to permit adequate compaction at the edges before trimming back, or to obtain the final profile following any settlement of the fill and the underlying material. However any oversteepening or increase in width shall not exceed any limits described in contract specific Appendix 6/3 and shall remain only for the minimum periods necessary consistent with the safety of the permanent works.

6 (02/16) Staged construction of fills and any controlled rates of filling, shall be carried out, in accordance with any requirements described in contract specific Appendix 6/3 including installation of instrumentation and its monitoring, in compliance with Clause 629.

7 (02/16) Where required in contract specific Appendix 6/3 the Contractor shall surcharge embankments or other areas of fill, as described therein for the periods stated. If settlement of surcharged fill results in any surcharging material, which is unacceptable for use in the fill being surcharged, lying below the formation or, where there is a capping, the sub-formation, the Contractor shall remove this unacceptable material and dispose of it in accordance with Clause 602. He shall then bring the resultant level up to formation or sub-formation, as appropriate, with acceptable material.

8 (02/16) Where pipes in embankments or in other areas of fill are permitted in contract specific Appendix 5/1 to be constructed other than in a trench, the fill shall be brought up to and over them equally on both sides. The fill shall be deposited in even layers and shall not be heaped above the pipe. Spreading and compaction shall be carried out evenly without dislodging, distorting or damaging the pipe. Power rammers are not to be used within 300 mm of any part of the pipe or joint.

9 (02/16) The last 600 mm depth of fill up to sub-formation level, or formation level as appropriate, shall, unless otherwise required in the Contract, be carried out for the full width of embankments, or between the outer extremities of the verges in other areas of fill, in a continuous operation. The Contractor shall then continue without delay to carry out either (i) or (ii) below:

(i) form the sub-formation or formation, all in accordance with Clauses 613 and 616, following immediately either by:

  (a) the construction of the full thickness of capping or sub-base as appropriate; or

  (b) if permitted in contract specific Appendix 6/3, the construction of a lesser thickness of capping or sub-base as described therein laid as a weather protection layer;

(ii) place an additional 300 mm minimum compacted thickness of material above sub-formation level or formation level as appropriate for the full width of the filling to form a weather protection. This weather protection shall be composed of the same material as the sub-formation or formation and compacted in compliance with Table 6/1. The material shall be provided from the Contractor's own resources and the protection layer shall be constructed in a continuous operation. For stabilised capping, the protective layer shall consist of unstabilised material.

10 (02/16) During construction of embankments and other fills, exposed sides of Classes 2E and 7B pulverised-fuel ash material shall be protected against scour and erosion from any source.

11 (02/16) Completed slopes of Classes 2E and 7B fill material shall be covered immediately by Class 5 topsoil as required in contract specific Appendix 6/8 or turf or other material, as required in contract specific Appendix 30/5.

12 (02/16) Whenever fill is to be deposited against the face of a natural slope, or sloping earthworks face including embankments, cuttings, other fills and excavations, such faces shall be benched or otherwise shaped as required in contract specific Appendix 6/3 immediately before placing the subsequent fill.

13 (02/16) All permanent faces of side slopes of embankments and other areas of fill formed in Classes 2 or 7 cohesive materials other than pulverised-fuel ash, shall, subsequent to any trimming operations, be re-worked and sealed by tracking a tracked vehicle, suitable for the purpose, on the slope, or by other suitable methods.

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609 (02/16) Geotextiles and Geotextile-related Products Used to Separate Earthworks Materials

1 (02/16) Geotextiles and geotextile-related products shall conform to the requirements of the product standard BS EN 13251 and other characteristics and locations as set out in contract specific Appendix 6/5. A Declaration of Performance for each product stating compliance with BS EN 13251 and the required levels of performance stated in contract specific Appendix 6/5 shall be submitted to the Overseeing Organisation prior to their placement in the works.

610 (02/16) Fill to Structures

1 This Clause shall apply to fill to structures other than:

(i) fill for reinforced earth structures, including associated drainage layers;

(ii) fill for anchored earth structures including associated drainage layers;

(iii) fill for surround and bedding of corrugated steel buried structures;

(iv) fill above structural concrete foundations unless otherwise required in contract specific Appendix 6/6.

2 (02/16) Materials, as required or permitted in contract specific Appendix 6/6 of Classes 6N, 6P, 7A or 7B and complying with Table 6/1 shall be used as fill to structures, in the locations described in contract specific Appendix 6/6.

3 (02/16) The Contractor shall compact, in compliance with Clause 612, end-product compaction, Class 6N, 6P, 7A and 7B material to satisfy the compaction requirements for those Classes as listed in Table 6/1, but subject to the restrictions in sub-Clauses 4 and 5 of this Clause.

4 (02/16) Where fill to structures is required to the same level on more than one side of a structural element or buried structure (except where Clause 623 applies) it shall be maintained at heights not differing by more than 250 mm after compaction on opposing sides of the structural element as filling proceeds.

5 (02/16) The Contractor shall restrict compaction plant used on fill to structures, within 2 m of a structure, to the following items as described in sub-Clause 612.10 and listed in Table 6/4:

(i) vibratory roller having a mass per metre width of roll, as determined by sub-Clause 612.10, not exceeding 1,300 kg with a total mass not exceeding 1,000 kg;

(ii) vibrating plate compactor having a mass not exceeding 1,000 kg;

(iii) vibro-tamper having a mass not exceeding 75 kg.

The compacted level of the fill within this zone shall not differ during construction from the compacted level of the remainder of the adjoining fill to structures by more than 250 mm.

6 (02/16) Where required in contract specific Appendix 6/6, Class 6N, 6P and 7B material shall be shown, by means of a trial utilising not less than 20 m^3 of the material, deposited and compacted in accordance with this Clause, to be stable, when it is trimmed to a slope of 1 vertical to 1½ horizontal, or other slope described in contract specific Appendix 6/6.

611 (02/16) Fill Above Structural Concrete Foundations

1 (02/16) Fill deposited above structural concrete foundations shall be, as shown on the drawings:

(i) Class 6N, 6P, 7A or 7B selected fill material complying with Clause 610 including compaction requirements;

(ii) Class 6M selected fill material, deposited and compacted in accordance with Clause 623, above the foundation of arch profile corrugated steel buried structures;

(iii) another class of selected fill or general fill complying with Table 6/1 deposited and compacted in compliance with Clauses 608 and 612 and in addition be subject to sub-Clauses 610.4 and 5.

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612 (02/16) Compaction of Fills

(02/16) General

1 (02/16) Except for dynamic compaction, which shall comply with Clause 630, and unless otherwise described in contract specific Appendix 6/3, the Contractor shall carry out compaction in compliance with this Clause, as soon as practicable after deposition, on all those Classes of fill in Table 6/1 which require to be compacted.

2 (02/16) Compaction shall be either method or end-product as required for the Class of fill in Table 6/1, using plant appropriate to the Class of fill and the site conditions.

3 (02/16) The Contractor shall obtain permission from the Overseeing Organisation before carrying out compaction outside normal working hours.

(02/16) Method Compaction

4 (02/16) Where method compaction is required to be adopted it shall comply with sub-Clauses 5 to 10 of this Clause.

5 (02/16) Except as stated in sub-Clause 6 of this Clause, method compaction shall be undertaken using the plant and methods in Table 6/4 appropriate to the compaction requirements as listed in Table 6/1 for the Class of material being compacted.

6 (02/16) Plant and methods not included in Table 6/4 shall only be used providing the Contractor demonstrates at site trials that a state of compaction is achieved by the alternative method equivalent to that obtained using the specified method.

7 (02/16) Earthmoving plant shall not be accepted as compaction equipment nor shall the use of a lighter category of plant to provide any preliminary compaction to assist the use of heavier plant be taken into account when assessing the amount of compaction required for any layer.

8 (02/16) If more than one Class of material is being used in such a way that it is not practicable to define the areas in which each Class occurs, the Contractor shall compact with plant operating as if only the material which requires the greater compactive effort is being compacted.

9 (02/16) The Contractor or Overseeing Organisation may carry out field dry density tests as described in sub-Clause 15 of this Clause on material compacted to method requirements at a frequency defined in contract specific Appendix 6/3. If the results of field tests show densities which indicate the state of compaction to be inadequate, then if this is due to failure of the Contractor to comply with the requirements of the contract, the Contractor shall carry out such further work as is required to comply with the contract.

10 (02/16) For the purposes of Table 6/4 the following shall apply:

(i) The minimum number of passes N is the minimum number of times that each point on the surface of the layer being compacted shall be traversed by the item of compaction plant in its operating mode, or struck by power rammers or falling weight compactors. D is the maximum depth of the compacted layer.

(ii) In column headed N # the number of passes shown is to be doubled for material Classes 1A, 1B, 2A, 2B, 2C and 2D when such materials occur within 600 mm of sub-formation (if capping is required) or formation. Such extra compaction shall, unless otherwise described in contract specific Appendix 6/3, either be carried out for the full width of the embankment or, in other areas of fill which are to receive a pavement, between the outer extremities of the verges.

(iii) The compaction plant in Table 6/4 is categorised in terms of static mass. The mass per metre width of roll is the total mass on the roll divided by the total roll width. Where a smooth wheeled roller has more than one axle the category of the machine shall be determined on the basis of the axle giving the highest value of mass per metre width.

(iv) A grid roller is a machine with a compacting roll or rolls constructed of heavy steel mesh of square pattern.

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(v) A deadweight tamping roller is a machine with a roll or rolls from which 'feet' project and where the projected end area of each 'foot' exceeds 0.01 m² and the sum of the areas of the feet exceeds 15% of the area of the cylinder swept by the ends of the feet. The requirements for tamping rollers apply to machines that have 2 rolls in tandem. If only one tamping roll traverses each point on the surface of the layer on any one pass of the machine, the minimum number of passes shall be twice the number given in Table 6/4 plus any further doubling required to satisfy (ii) above.

(vi) For pneumatic-tyred rollers the mass per wheel is the total mass of the roller divided by the number of wheels. In assessing the number of passes of pneumatic-tyred rollers the effective width shall be the sum of the widths of the individual wheel tracks together with the sum of the spacings between the wheel tracks provided that each spacing does not exceed 230 mm. Where the spacings exceed 230 mm the effective width shall be the sum of the widths of the individual wheel tracks only.

(vii) A vibratory tamping roller, which may be self-propelled or towed, is a machine having a means of applying mechanical vibration to one or more rolls. The roll or rolls have projecting feet where the height of each foot exceeds 10% of the radius of the roll drum, the projected end area of each foot exceeds 0.1% of the roll drum surface area, and the sum of the areas of the feet exceeds 10% of the area of the cylinder swept by the ends of the feet.

The requirements for the operation of vibratory tamping rollers shall be the same as those stated for vibratory rollers in sub-Clause (viii) except that vibratory tamping rollers operating without vibration will be classified as deadweight tamping rollers.

(viii) Vibratory rollers are self-propelled or towed smooth-wheeled rollers having means of applying mechanical vibration to one or more rolls except that vibratory rollers employed for Method 5 compaction shall be single roll types.

Vibratory rollers operating without vibration will be classified as smooth-wheeled rollers.

The requirements for vibratory rollers are based on the use of the lowest gear on a self-propelled machine with mechanical transmission and a speed of 1.5 to 2.5 km/h for a towed machine, or a self-propelled machine with hydrostatic transmission. If higher gears or speeds are used an increased number of passes shall be provided in proportion to the increase in speed of travel.

Where the mechanical vibration is applied to two rolls in tandem, the minimum number of passes shall be half the number given in Table 6/4 for the appropriate mass per metre width of one vibrating roll but if one roll differs in mass per metre width from the other the number of passes shall be calculated as for the roll with the smallest value. Alternatively the minimum number of passes may be determined by treating the machine as having a single vibrating roll with a mass per metre width equal to that of the roll with the higher value.

Vibratory rollers shall be operated with their vibratory mechanism operating only at the frequency of vibration recommended by the manufacturers. Where more than one amplitude setting is available and/or a range of frequencies is recommended, the machine shall be operated at the maximum amplitude setting and at the maximum recommended frequency for that setting.

Vibratory rollers shall be equipped or provided with devices indicating the frequency at which the mechanism is operating and the speed of travel. Both devices shall be capable of being read by an inspector alongside the machine.

(ix) Vibrating-plate compactors are machines having a base-plate to which is attached a source of vibration consisting of one or two eccentrically weighted shafts and:

(a) the mass per square metre of the base-plate of a vibrating-plate compactor is calculated by dividing the total mass of the machine in its working condition by its area in contact with compacted material;

(b) vibrating-plate compactors shall be operated at the frequency of vibration recommended by the manufacturers. They shall normally be operated at travelling speeds of less than 1 km/h but if higher speeds are necessary the number of passes shall be increased in proportion to the increase in speed of travel.

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(x) Vibro-tampers are machines in which an engine-driven reciprocating mechanism acts on a spring system through which oscillations are set up in a base-plate.

(xi) Power rammers are machines which are actuated by explosions in an internal combustion cylinder, each explosion being controlled manually by the operator.

(xii) Dropping weight compactors are machines in which a dead weight is dropped from a controlled height using a hoist mechanism and they include self-propelled machines with mechanical traversing mechanisms capable of compacting soil in trenches and close to structures.

(xiii) In the case of power rammers and dropping-weight compactors one pass will be considered as made when the compacting shoe has made one strike on the area in question.

(xiv) For items marked * in the Method 3 column of Table 6/4 the roller shall be towed by track-laying tractors. Self-propelled rollers are unsuitable.

(xv) Where combinations of different types or categories of plant are used, the following shall apply:

(a) the depth of layer shall be that for the type of plant requiring the least depth of layer; and

(b) the number of passes shall be that for the type of plant requiring the greatest number of passes.

(02/16) **End-product Compaction**

11 (02/16) Where end-product compaction is required it shall comply with sub-Clauses 12 to 15 of this Clause.

12 (02/16) The Contractor shall at least 7 days before commencement of end-product compaction make available the following to the Overseeing Organisation:

(i) the values of maximum dry density and the optimum moisture content obtained in accordance with BS 1377: Part 4 using the 2.5 kg rammer method or vibrating hammer method as appropriate for each of the fills he intends to use which meet the requirements of the permitted Class or Classes (where within any Class of material the fill contains material having different maximum dry densities and optimum moisture contents the Class shall be further sub-divided, by extending the identification system, in order to monitor the compacted density);

(ii) a graph of density plotted against moisture content from which each of the values in (i) above of maximum dry density and optimum moisture content were determined and, for Class 7A material, a plot of the 5% air voids curve for each sub-division.

13 (02/16) Once the information contained in sub-Clause 12 of this Clause has been made available to the Overseeing Organisation it shall form the basis for compaction.

14 (02/16) Fill compacted to end-product requirements shall have a field dry density, measured in accordance with sub-Clause 15 of this Clause, equal to or greater than the percentage given in Table 6/1 of the maximum dry density for the relevant Class of fill previously made available to the Overseeing Organisation in accordance with sub-Clause 12 of this Clause.

15 (02/16) The field dry density referred to in sub-Clause 14 of this Clause shall be measured in accordance with BS 1377: Part 9, except that nuclear methods shall only be used where required or permitted in contract specific Appendix 6/3. Where nuclear methods are used, the gauge shall be calibrated in accordance with BS 1377: Part 9.

613 (02/16) Sub-formation and Capping

1 (02/16) Capping shall be provided only in those locations, and to the extent, particularly stated in the contract specific Appendix 6/7 to be constructed with capping. It shall comply with this Clause and in addition, for stabilised capping, with Clauses 614, 615 and 643 as appropriate.

2 (02/16) Capping shall be constructed with Class 6F1, 6F2, 6F3, 6F4, 6F5, 6S, 9A, 9B, 9C, 9D, 9E or 9F material as required or permitted in contract specific Appendix 6/7 and complying with Table 6/1.

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3 (02/16) Unless otherwise described in contract specific Appendix 6/7, capping shall either consist of one Class of capping material throughout its depth laid in one or more layers of compacted thickness complying with Clause 612, or be formed of not more than two elements of different capping materials. Each element shall be formed of one or more layers of the same capping material, each of compacted thickness complying with Clause 612. Class 9D or 9E stabilised capping material shall not be placed or constructed above Class 6F granular capping material or Class 6S granular filter layer material.

4 (02/16) Where required in contract specific Appendix 6/7, before commencing the construction of capping in the permanent works, the Contractor shall demonstrate the methods, equipment and materials he proposes to use by constructing an area, or areas as appropriate, of capping on a typical prepared sub-formation to the same thickness as required in the permanent works. The area of each capping construction demonstration shall be not less than 700 m².

5 (02/16) The materials placed during the demonstration may form part of the permanent works, provided they meet the requirements of the contract, or be carried out elsewhere on the site where this is detailed in contract specific Appendix 6/7. After completion of each demonstration area the Contractor shall within a period of not greater than 5 days and before commencing the main construction of the appropriate capping in the permanent works, carry out tests on each demonstration area and provide the Overseeing Organisation with records substantiating compliance with the stipulated criteria of contract specific Appendix 6/7. Where required by contract specific Appendix 6/7 the Contractor shall provide sheeting, to protect the demonstration area.

6 (02/16) The demonstration area shall, if it does not meet the requirements for the permanent works or is located elsewhere on site, be removed and the area reinstated in accordance with contract specific Appendix 6/7.

7 (02/16) The methods and materials used in the accepted demonstration shall not be changed during the course of the works without the construction of a further demonstration where such demonstrations are required by contract specific Appendix 6/7.

8 (02/16) Unless otherwise stated in contract specific Appendix 6/7, the sub-formation shall have the same longitudinal gradient, crossfall and surface level tolerances as the formation.

9 (02/16) The Contractor shall limit any unprotected area of sub-formation, which is to receive capping to suit the output of the plant in use and the rate of deposition of capping.

10 (02/16) No unprotected sub-formation which is to receive capping shall remain continuously exposed to rain causing degradation, nor be left uncovered overnight.

11 (02/16) In cuttings the Contractor shall, as permitted or required in contract specific Appendix 6/7 carry out one of the following procedures:

(i) for Class 6F granular capping material or Class 6S granular filter layer material, excavate below formation level to a depth to accept the capping, trim the surface to form the sub-formation and immediately compact with one pass of a smooth-wheeled roller having a mass per m width of roll not less than 2,100 kg or a vibratory roller having a mass per m width of roll not less than 700 kg or a vibrating plate compactor having a mass per m² of not less than 1,400 kg, except that only smooth wheeled rollers shall be used on Class 3 chalk material, and immediately deposit and compact above it a capping in Class 6F granular capping material or Class 6S granular filter layer material; or

(ii) for Class 9A, 9B, 9C, 9D, 9E or 9F capping material construct the capping by stabilising the intact material, providing it complies with Class 6E, 6R 7E, 7F, 7G or 7I material requirements, immediately below formation to form Class 9A, 9B, 9C, 9D, 9E or 9F material, respectively; or

(iii) excavate below formation to sufficient depth to enable stabilisation of intact Class 6E, 6R, 7E, 7F, 7G or 7I material to be carried out, to produce Class 9A, 9B, 9C, 9D 9E or 9F material forming the lower element of the capping (after stabilisation of this element, the capping shall be completed by depositing a further layer or layers of Class 6E, 6R 7E, 7F, 7G, or 7I material and stabilising it to form Class 9A, 9B, 9C, 9D, 9E or 9F capping or depositing and compacting Class 6F granular capping material to form the upper element of the capping); or

(iv) excavate to sub-formation level and deposit material complying with Classes 6E, 6R, 7E, 7F, 7G, or 7I to be stabilised to form a capping of Class 9A, 9B, 9C, 9D, 9E or 9F layers.

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Where a stabilised layer is directly overlain by Class 6F granular capping material the stabilised layer shall be compacted as for a sub-formation in 11(i) above.

12 (02/16) On embankments and other areas of fill the Contractor shall, as permitted or required in contract specific Appendix 6/7 carry out one of the following procedures:

(i) complete the embankment to form the sub-formation or remove any protection layer and trim the surface to form the sub-formation, and in both cases compact with one pass of a smooth-wheeled roller having a mass per m width of not less than 2,100 kg or a vibratory roller of not less than 700 kg per m width or a vibrating plate compactor having a mass per m² of not less than 1,400 kg, (except that only smooth-wheeled rollers shall be used on Class 3 chalk material) and immediately construct above it, in one or more layers, Class 6F granular capping material or Class 6S granular filter layer material; or

(ii) construct the embankment to sufficient height and carry out stabilisation to form a capping of Class 9A, 9B, 9C, 9D, 9E or 9F material in one or more layers utilising where appropriate any protection layer previously constructed; or

(iii) for multi-element capping, incorporating stabilised material, construct the embankment to sufficient height to carry out the work described in 12(ii) above and immediately construct above it one or more layers of Class 6F granular capping material.

Where a stabilised layer is directly overlain by Class 6F granular capping material the stabilised layer shall be compacted as for a sub-formation in 12(i) above.

13 (02/16) For Class 6F3 material Optimum Moisture Content shall be determined according to BS 1377: Part 4 Method 3.7 (vibrating hammer test). Measurements of moisture content both for control purposes and for optimum moisture content determination shall be according to BS 1377: Part 2 Method 3 (oven dry method) but using an oven on a reduced temperature setting of 45 to 50°C.

14 (02/16) Filter layers constructed of Class 6S granular filter layer material shall be protected from damage by traffic and construction plant. The Contractor shall so organise work that only the traffic directly engaged in depositing, spreading and compacting the filter layer shall be permitted access to the surface of this layer. At no time shall the Contractor permit the leading edge of the filter layer to extend more than 100 metres beyond the leading edge of the succeeding layer of subbase.

614 (02/16) Cement Stabilisation to Form Capping

1 (02/16) Where capping is to consist of, either wholly or in part, cement stabilised material Class 9A, 9B or 9C, this Clause shall apply to the construction of those parts which are stabilised with cement.

2 (02/16) Material to be stabilised with cement shall be Class 6E, Class 7F and Class 7G materials all complying with Clause 601 and Table 6/1. Unless otherwise described in contract specific Appendix 6/7 cement shall be Portland cement complying with BS EN 197-1 and requirements given in contract specific Appendix 6/7.

3 (02/16) Class 6E, 7F or 7G material to be stabilised shall have added to it, at any point, that quantity of cement measured as a percentage of its dry weight as determined on the demonstration area, to meet the required bearing ratio in contract specific Appendix 6/1, subject to a minimum of 2% cement.

4 (02/16) The appropriate quantity of cement shall be uniformly spread, by a suitable spreading machine, on top of the layer to be processed. Using a collecting tray and balance the Contractor shall check the rate of spread of the machine once for every 500 m² of cement spread.

5 (02/16) Unless indicated otherwise in contract specific Appendix 6/7, Class 6E, 7F or 7G material shall be stabilised in a single layer if its compacted thickness is 250 mm or less. If its compacted thickness is greater, the material shall be stabilised in layers not less than 130 mm and not more than 250 mm thick, including any cutting-in required by sub-Clause 9 of this Clause.

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6 (02/16) The Contractor shall not carry out cement stabilisation when the shade temperature is below 3°C unless on a rising thermometer above 0°C. Cement stabilisation shall not be carried out during periods of rain or when rain is imminent. When cement is spread on material likely to cause premature hydration, processing in accordance with sub-Clause 7 of this Clause shall follow immediately.

7 (02/16) Unless indicated otherwise by contract specific Appendix 6/7, Class 6E, 7F or 7G material forming the layer to be stabilised shall be processed by pulverising and mixing in the cement by means of a sufficient number of passes of a suitable mobile stabilising machine until 95% of the silt and clay fraction is reduced to particles or lumps passing a BS 28 mm sieve after dry sieving and the pulverisation complies with Table 6/1.

8 (02/16) During processing, sufficient water shall be available in the material to hydrate the cement and enable satisfactory mixing and compaction to be achieved. Any added water shall be through an integral spray-bar on the stabilising machine. Any added water shall have a sulfate content not exceeding 1400 mg/l as SO_4, when tested in accordance with BS EN 1744-1 clause 10.

9 (02/16) The stabilising machine shall be equipped with a device for controlling the depth of processing which shall be maintained at the correct setting at all times. An overlap of 150 mm shall be made between adjacent passes of the stabilising machine. Where a subsequent layer of material is placed on a layer previously stabilised the tines or blades of the stabilising machine shall be set so that they cut into the previously stabilised layer below by at least 20 mm.

10 (02/16) Each layer of Class 9A, 9B or 9C processed material shall be compacted as soon as possible after the final pass of the stabilising machine. Compaction shall be completed within 2 hours following the mixing of the cement into the material to be stabilised. Immediately before compaction Class 9B processed material shall have a Moisture Condition Value (MCV) of not greater than 12 nor less than the figure stated in contract specific Appendix 6/1 for Class 9B cement stabilised material, both as determined in accordance with Clause 632. Water shall be added if necessary in a uniform manner to enable this MCV requirement to be met. Any added water shall have a sulfate content not exceeding 1400 mg/l as SO_4 when tested in accordance with BS EN 1744-1 clause 10.

11 (02/16) The compaction of each layer of Class 9A or 9B material shall comply with Clause 612, Table 6/4 Method 6 or Method 7 respectively, except that if layers of Class 9A or 9B greater than 250 mm thickness are to be constructed, the number of passes of the compaction plant shall be determined from the results of a demonstration area as detailed in contract specific Appendix 6/7.

12 (02/16) The compaction of Class 9C material shall comply with Clause 612, end product compaction, to satisfy the compaction requirements given in Table 6/1 of this Class.

13 (02/16) Class 9A, 9B and 9C materials shall be cured in accordance with Clause 1035. During periods when the air temperature is forecast to drop below 3°C or when ground frost is forecast Class 9A, 9B and 9C material shall be protected, to prevent freezing, for a period of 7 days from the time of completion of compaction. Such protection shall be sealed to prevent the ingress of moisture.

14 (02/16) Class 9A, 9B and 9C materials shall not have other material deposited or compacted above them until such time as the required bearing ratio in contract specific Appendix 6/1 has been achieved. The relaxation allowed in sub-Clause 617.2 shall not apply before this time.

615 (02/16) Lime Stabilisation to Form Capping

1 (02/16) This Clause shall apply only to those capping materials which are to be stabilised with lime to form material Class 9D.

2 (02/16) Material to be stabilised with lime shall be Class 7E material complying with Clause 601 and Table 6/1.

3 (02/16) The form of lime used for lime stabilisation shall be as required in contract specific Appendix 6/7, the lime shall conform to BS EN 459-1 and meet the performance requirements stated in contract specific Appendix 6/7. This shall be demonstrated by the Declaration of Performance. Unless otherwise stated in contract specific Appendix 6/7 lime shall be either quicklime or hydrated lime conforming to BS EN 459-1. The particle size distribution of all types of quicklime shown in Tables 1 and 8 of BS EN 459-1 shall be of designation P4 as shown in Tables 5 and 12 of BS EN 459-1.

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4 (02/16) The Contractor shall carry out testing of the lime as installed for available lime in accordance with Clause 641 at weekly intervals unless otherwise required in contract specific Appendix 6/7 during periods when lime stabilisation is carried out. The results shall be reported to the Overseeing Organisation. The available lime shall meet the requirements stated in contract specific Appendix 6/7 and the values stated in the Declaration of Performance.

5 (02/16) Class 7E material to be stabilised shall have added to it, at any point, the percentage of its dry weight of lime, as determined on the demonstration area, to meet the required bearing ratio in contract specific Appendix 6/1, subject to a minimum of 2½% by weight of 'available lime' as a percentage of the dry weight of the Class 7E material.

6 (02/16) Lime of quantity complying with sub-Clause 5 of this Clause shall be uniformly spread by a suitable spreading machine on top of the layer to be stabilised. Using a collecting tray and balance the Contractor shall check the rate of spread by weight, once for every 500 m² of lime spread or a different rate of testing for the rate of spread as described in contract specific Appendix 6/7. At the same time the Contractor shall collect samples of lime deposited on the tray and test them for available lime content in accordance with Clause 641.

7 (02/16) Unless indicated otherwise in contract specific Appendix 6/7, the material shall be stabilised in a single layer if its compacted thickness is 250 mm or less. If its compacted thickness is greater, the material shall be stabilised in layers not less than 130 mm and not more than 250 mm thick, including any cutting-in required by sub-Clause 12 of this Clause.

8 (02/16) Unless indicated otherwise in contract specific Appendix 6/7 lime stabilisation shall be carried out only during the months of March to September inclusive and when the shade temperature is not below 7°C. Only when the specified bearing ratio is attainable at a shade temperature less than 7°C, may lime stabilisation be carried out at such lower temperature. Lime stabilisation shall be suspended if rainfall will have an adverse effect on the material being stabilised. The spreading of lime shall not be carried out in a manner or under conditions that will result in lime being blown from the site onto adjacent land or property.

9 (02/16) Unless indicated otherwise in contract specific Appendix 6/7, the material forming the layers to be stabilised shall be processed by pulverising and mixing in the lime by means of sufficient number of passes of a suitable mobile stabilising machine until 95% of the Class 9D processed material passes a BS 28 mm sieve after dry sieving and the pulverisation complies with Table 6/1.

10 (02/16) During processing sufficient water shall be available in the material to slake the quicklime (if used) and to enable satisfactory mixing and compaction to be achieved. Any added water shall be through an integral spray-bar on the stabilising machine. Any added water shall have a sulfate content not exceeding 1400 mg/l as SO_4 when tested in accordance with BS EN 1744-1 clause 10.

11 (02/16) The layer shall receive at least two passes of the stabilising machine to pulverise and mix the lime and soil, after which the processing shall be interrupted by a period of not less than 24 hours and not greater than 72 hours, to enable the lime to react with the soil. Before this period commences the surface of the layer shall be sealed with one pass of a smooth wheeled roller having a mass per metre width of roll of not less than 2700 kg or a pneumatic tyred roller of not less than 1000 kg per wheel. At the end of this period the layer shall receive one further pass of the stabilising machine or more if required to enable the material to comply with sub-Clauses 9 and 13 of this Clause, adding water uniformly if necessary. Any added water shall have a sulfate content not exceeding 1400 mg/l as SO_4 when tested in accordance with BS EN 1744-1 clause 10.

12 (02/16) The stabilising machine shall be equipped with a device for controlling the depth of processing which shall be maintained at the correct setting at all times. An overlap of 150 mm shall be made between adjacent passes of the stabilising machine. Where a subsequent layer of material is placed on a layer previously stabilised the tines or blades of the stabilising machine shall be set so that they cut into the previously stabilised layer below by at least 20 mm.

13 (02/16) Each layer of Class 9D processed material shall be compacted as soon as possible after the final pass of the stabilising machine. Immediately before compaction the processed material shall have a Moisture Condition Value (MCV) of not greater than nor less than the figures stated in contract specific Appendix 6/1, for Class 9D lime stabilised material, both as determined in accordance with Clause 632.

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14 (02/16) If there is a delay following the final pass and before commencement of compaction the surface shall be sealed by not less than 2 passes of a smooth-wheeled roller having a mass per metre width of not less than 2,700 kg or of a pneumatic tyred roller of not less than 1,000 kg mass per wheel. On recommencement and before compaction the layer shall be re-processed without the addition of lime, by a sufficient number of passes of the stabilising machine to meet the MCV requirements of sub-Clause 13 of this Clause adding water uniformly if necessary.

15 (02/16) The compaction of each layer shall comply with Clause 612, Table 6/4 Method 7 except that if layers more than 250 mm thick are constructed the number of passes of the compaction plant shall be those determined from results obtained on a demonstration area as detailed in contract specific Appendix 6/7.

16 (02/16) Class 9D material shall not have other material deposited or compacted above it until such time as the required bearing ratio in contract specific Appendix 6/1 has been achieved. The relaxation allowed in sub-Clause 617.2 shall not apply before this time.

616 (02/16) Preparation and Surface Treatment of Formation

1 (02/16) The formation shall, after completion of any subgrade drainage, and immediately before laying sub-base on areas of completed formation, have a surface level tolerance within +20 mm and -30 mm, or other level of tolerance defined in contract specific Appendix 6/7 relative to its designed level after completion of the following operations as necessary:

(i) Any protection layer shall be removed and any soft or damaged areas shall be rectified by excavating them and replacing with acceptable material having the same characteristics and strength as the surrounding material. The surface of the formation shall be trimmed and immediately cleaned free from mud and slurry which shall be dealt with as unacceptable material in accordance with sub-Clause #601.2.

(ii) The formation shall immediately be compacted, in addition to the compaction required for the fill. This additional compaction shall for this purpose be assumed to be as for a layer of 250 mm finished thickness compacted in compliance with Clause 612 and Table 6/4 Method 6 except for Class 3 materials where Method 4 shall be used. Immediately after the additional compaction the formation shall be trimmed to achieve the tolerances of this sub-Clause.

2 (02/16) Where the tolerances in sub-Clause 1 of this Clause are exceeded, the Contractor shall determine the full extent of the area which is out of tolerance and shall make good the formation as follows:

(i) if the surface is too high it shall be re-trimmed and re-compacted in compliance with Clause 612 and sub-Clause 1 of this Clause;

(ii) if the surface is too low it shall be corrected by the addition of acceptable material complying with Table 6/1 having characteristics and strength matching the overlain material, deposited and compacted in compliance with Clause 608 and 612 and sub-Clause 1 of this Clause. In cohesive materials Classes 2 and 7, where this low surface is less than 150 mm below formation, material shall be removed to a depth of at least 150 mm below formation before the additional material is deposited and compacted.

3 (02/16) After trimming, or re-trimming if necessary, the formation shall be rolled with one pass of a smoothwheeled roller having a mass per metre width of roll not less than 2100 kg or, except for Class 3 material, a vibratory roller having a mass per metre width of vibrating roll of not less than 700 kg or a vibrating plate compactor having a mass per m² under the base plate of not less than 1,400 kg.

4 (02/16) Where required in contract specific Appendix 6/7 or where the tolerances in sub-Clause 1 of this Clause cannot be achieved in the preparation of formation in rock then one of the following shall be carried out so as to achieve the above tolerances:

(i) the material shall be excavated below formation to the depth described in contract specific Appendix 6/7. The excavated material shall be processed as described in contract specific Appendix 6/7 and re-deposited and compacted in compliance with Clauses 608 and 612 and Table 6/4 Method 6 in compacted layers not greater than 250 mm thick; or

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(ii) where the rock surface is tabular it shall be regulated by depositing and compacting cement bound material as described in contract specific Appendix 6/7, complying with the 1000 Series, or ST1 concrete to Clause 2602.

5 (02/16) The Contractor shall limit any areas of completed formation to suit the output of plant in use and the rate of deposition of sub-base. No formation of cohesive material Classes 2 and 7 shall remain continuously exposed to rain causing degradation or be left uncovered overnight.

6 (02/16) The preparation of formation on existing sub-base material shall be completed as described in contract specific Appendix 6/7.

617 (02/16) Use of Sub-formation or Formation by Construction Plant

1 (02/16) Construction plant and other vehicular traffic (except that required for the construction of capping) shall not be operated on the sub-formation, unless adequate protection, if necessary in addition to any weather protection, is provided.

2 (02/16) Construction plant and other vehicular traffic (except for that required for preparation of the formation in compliance with Clause 616) shall not be operated on the formation unless adequate protection, if necessary in addition to any weather protection is provided.

3 (02/16) In addition to the requirements of sub-Clauses 1 and 2 of this Clause, the Contractor shall make available to the Overseeing Organisation his proposals for the protection of the sub-formation or formation in areas where they are within 300 mm of the existing ground level, after topsoil has been stripped, before using construction plant or other vehicular traffic at or above sub-formation or formation.

618 (02/16) Topsoiling

1 (02/16) Topsoiling shall be carried out using Class 5 material complying with Table 6/1.

2 (02/16) Imported topsoil, Class 5B material, shall only be imported when required in contract specific Appendix 6/8, or contract specific Appendix 30/6.

3 (02/16) When required in contract specific Appendix 6/8 topsoil shall not be excavated from stockpiles, whether on site or imported:

(i) which have been exposed to a cumulative rainfall exceeding 100 mm, or other figure stated in contract specific Appendix 6/8, over the preceding 28 days measured at a point detailed in contract specific Appendix 6/8; or

(ii) when heavy rain is falling; or

(iii) with a tracked vehicle; or

(iv) which have been stockpiled for more than 2 years; or

(v) which are frozen; or

(vi) in the case of topsoil which has been stockpiled for more than 6 months, unless the stockpile has been treated with a total, non-residual herbicide as recently as is seasonally possible (allowing the period of time recommended by the manufacturer to elapse prior to excavation).

4 (02/16) Topsoil shall:

(i) be deposited and spread on the areas, to the thicknesses described in contract specific Appendix 6/8, in layers not exceeding 150 mm. Each layer shall be firmed before spreading the next. The thickness shall be reduced where necessary to allow for any subsequent turfing required in contract specific Appendix 30/5 (it shall not be spread using a tracked vehicle, when so stipulated in contract specific Appendix 6/8);

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(ii) have stones and other debris removed and disposed off site which have:

(a) dimensions greater than 100 mm equivalent diameter, unless otherwise permitted in contract specific Appendix 6/8; and

(b) dimensions greater than 50 mm equivalent diameter which lie within 50 mm of the surface;

(iii) be graded to smooth contours, eliminating all mounds and depressions where water may collect;

(iv) not have stones or other debris protruding above the surface by more than 30 mm, and comply with the further requirements of Clauses 3004 and 3005.

619 (02/16) Earthwork Environmental Bunds

1 (02/16) Earthwork environmental bunds shall be constructed in the locations described in contract specific Appendix 6/9 with fill materials complying with the requirements therein and Clause 601 and Table 6/1. Deposition shall be in accordance with Clause 608 and compaction with the requirements of Table 6/1 unless otherwise described in contract specific Appendix 6/9 or the requirements of sub-Clauses 2 or 3 of this Clause apply.

2 (02/16) Earthwork environmental bunds formed of reinforced or anchored earth shall be constructed in compliance with Clauses 2502 and 622.

3 (02/16) Earthwork environmental bunds formed of strengthened embankments shall be constructed in accordance with Clause 621.

4 (02/16) Where required in contract specific Appendix 6/9 earthwork environmental bunds shall be topsoiled in accordance with Clause 618 and seeded, or turfed, all in accordance with Clause 3001 and Clause 3005.

620 (02/16) Landscape Areas

1 (02/16) Landscape areas shall be constructed in the locations shown in contract specific Appendix 6/9 with Class 4 material as described therein and complying with Table 6/1.

2 (02/16) Unless method compaction to Clause 612 is required in contract specific Appendix 6/9 the degree of compaction of Class 4 material shall be sufficient to remove large voids and to produce a coherent mass whilst preventing over-compaction and any build up of excess pore pressures.

3 (02/16) Following completion of filling of landscape areas, Class 4 material shall where required in contract specific Appendix 6/9, be shaped as described therein.

4 (02/16) Class 4 material shall be deposited in landscape areas after any adjoining embankment or other area of fill has been completed. Where permitted in contract specific Appendix 6/9 and provided the adjoining embankment or other area of fill is always kept at least 1 m higher than the landscape area fill, construction of such landscape area may proceed until completion.

5 (02/16) Landscape areas shall be topsoiled in accordance with Clause 618 and seeded or turfed in accordance with Clause 3001 and Clause 3005 to the requirements of contract specific Appendix 30/5.

621 (02/16) Strengthened Embankments

1 (02/16) Strengthened embankments shall be constructed in the locations and to the details described in contract specific Appendix 6/9 with fill materials and strengthening materials described therein.

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622 (02/16) Earthworks for Reinforced Soil and Anchored Earth Structures

1 (02/16) The construction of earthworks for reinforced soil and anchored earth structures together with assembly and erection of reinforcing and anchor elements and associated components shall be in compliance with this Clause and Clause 2502.

2 (02/16) Excavation shall be carried out in compliance with Clause 604.

3 (02/16) Fill for reinforced soil structures shall, except for their associated drainage layers, be of Class 6I, 6J, 7B, 7C or 7D selected material complying with Table 6/1 as permitted in contract specific Appendix 6/1 together with any other additional requirements therein. Where Class 7B conditioned pulverised-fuel ash is used for fill, only non-metallic reinforcing elements shall be used and metallic fasteners shall be of stainless steel.

4 (02/16) Fill for anchored earth structures shall, except for their associated drainage layers, be of 6I or 6J selected material complying with Table 6/1 as permitted in contract specific Appendix 6/1 together with any other additional requirements therein.

5 (02/16) Drainage layers to reinforced soil and anchored earth structures shall be one of the following as appropriate:

(i) Class 6H material complying with Table 6/1 and contract specific Appendix 6/1.

(ii) for use with Class 7B material, uncrushed, partially crushed or crushed gravel sand complying with BS EN 12620, fines content category f_3 and sizes 0/4(CP), 0/4(MP) or 0/2(MP) and, when in contact with metallic components, with the properties listed in Table 6/3.

(iii) Type B filter drain material complying with Clause 505 for use only in horizontal drainage layers.

Vertical layers of drainage layer material shall be brought up at the same rate as the adjoining fill material without mixing or contamination.

6 (02/16) In addition to the requirements of sub-Clauses 7 and 8 of this Clause, fill for reinforced soil and anchored earth structures shall be deposited and compacted in compliance with Clauses 608 and 612 and Table 6/1, with method compaction for Classes 6H, 6I, 6J, 7C and 7D materials and end-product compaction for Class 7B material. Drainage layer material other than Class 6H shall be deposited in accordance with Clause 608 and compacted as described in contract specific Appendix 6/3.

7 (02/16) Reinforced soil and anchored earth structures shall have:

(i) the deposition and compaction carried out so that all layers of reinforcing and anchor elements are fixed at the required levels on top of compacted fill;

(ii) the deposition, spreading, levelling and compaction of the fill carried out generally in a direction parallel to the facing and executed in stages to alternate with the placing and fixing of the reinforcing and anchor elements and the facing elements;

(iii) the reinforcing and anchor elements kept as free as possible from damage or displacement during deposition, spreading, levelling and compaction of the fill (also the programme of filling shall be arranged so that no machines or vehicles run on the reinforcing or anchor elements);

(iv) all construction plant, and all other vehicles, having a mass exceeding 1,000 kg, kept at least 2 m away from the back of the facing;

(v) within 2 m of the back of the facing, the plant used for compacting the fill restricted to the following items as described in sub-Clause 612.10 and listed in Table 6/4:

(a) vibratory roller having a mass per metre width of roll not exceeding 1,300 kg with a total mass not exceeding 1,000 kg;

(b) vibrating plate compactor having a mass not exceeding 1,000 kg;

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(c) vibro tamper having a mass not exceeding 75 kg;

(vi) at the Contractor's option, the reinforced soil and anchored earth fill beyond the 2 m zone referred to in (v) above, raised in thicker layers than within the 2 m zone, providing this is compatible with the arrangement of the reinforcing and anchor elements and the difference in compacted level does not exceed 300 mm;

(vii) during construction of the reinforced soil or anchored earth structure the retained fill at the rear of the structure, as defined in sub-Clause 8 of this Clause, maintained at the same level as the adjoining reinforced soil or anchored earth fill;

(viii) if the retained material at the rear of the reinforced soil or anchored earth structure, as defined in sub-Clause 8 of this Clause, is an existing earthwork or natural slope which requires supporting by temporary shoring, this shoring shall be removed progressively as the work proceeds to prevent the formation of voids.

8 (02/16) The rear of the reinforced soil or anchored earth structure is the position coinciding with the ends of the reinforcing or anchor elements furthest from the facing units.

623 (02/16) Earthworks for Corrugated Steel Buried Structures

1 (02/16) The construction of earthworks for corrugated steel buried structures together with assembly and erection of their components shall be in compliance with this Clause and Clause 2501.

2 (02/16) Excavation shall be carried out in compliance with Clause 604 and any additional requirements given in contract specific Appendix 6/3.

3 (02/16) Fill for corrugated steel buried structures shall be of the following selected granular materials complying with Table 6/1:

(i) Lower bedding material Class 6K;

(ii) Upper bedding material Class 6L;

(iii) Surround material Class 6M.

and the overlying fill shall be one of the following:

(iv) Well graded, uniformly graded or coarse, granular material Class 6Q; or

(v) Wet, dry, stony or silty cohesive material and chalk Class 7H.

4 (02/16) In addition to the requirements of sub-Clauses 5 to 14 of this Clause, Class 6K, 6L and 6M materials shall be deposited in compliance with Clause 608 and shall (except for Class 6L upper bedding material which shall be uncompacted) be end-product compacted in compliance with Clause 612 and Table 6/1,
except that the compacted layers shall not exceed 150 mm thickness. The compaction and testing requirements for Class 6K lower bedding and Class 6M surround materials shall also comply with any additional requirements given in contract specific Appendix 6/3.

5 (02/16) As far as possible, the Class 6K lower bedding material shall be shaped to fit the invert such that it supports 20% of the circumference of circular structures or the whole of the portion of circumference occupied by the bottom plates of multi-radii structures. In the case of structures of span less than 3 m where this cannot be met and the structure is erected on a flat or partially preshaped bedding, care shall be taken to ensure that the lower bedding material is properly placed and compacted under the haunches. A uniform layer of uncompacted Class 6L upper bedding material shall be deposited before the placing of any part of the steel structure, over the whole width of the shaped lower bedding material and shall be of sufficient depth to fill the corrugations of the underside of the structure.

6 (02/16) Class 6M surround material shall be used for filling all excavations above the bedding, except those in hard material for which Class 6K lower bedding material shall be used throughout. Additional requirements for making good are given in Clause 604.

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7 (02/16) Class 6M surround material shall be deposited and compacted uniformly on either side of the structure. The maximum difference in fill level on opposite sides of the structure shall be no more than 250mm at all times unless otherwise permitted in contract specific Appendix 6/3.

8 (02/16) Class 6M surround material shall be deposited and compacted in accordance with sub-Clause 4 of this Clause, above the concrete foundations of arch-profile corrugated steel buried structures.

9 (02/16) Class 6M surround material under the structure shall be well compacted by hand using a suitably sized pole or length of rectangular timber between the corrugations, or by another suitable method.

10 (02/16) Plant for compaction of Class 6M surround material within 1 m of either side of the structure and up to a height of 1 m, or one fifth of the span if greater, above the crown, shall be restricted to the following items, as described in sub-Clause 612.10 and listed in Table 6/4:

(i) vibratory rollers having a mass per metre width of roll not exceeding 750 kg;

(ii) vibrating plate compactors having mass not exceeding 750 kg;

(iii) vibro-tampers.

11 (02/16) Fill placed above the level of the crown of the structure, including Class 6M surround material, shall be deposited, spread and compacted in such a manner that any out of balance forces transmitted to the culvert are kept to a minimum. This will require that trafficking by construction plant is not all in one direction and that the compacted surface of the fill is kept as near horizontal as practicable.

12 (02/16) During all operations of filling, compaction, road pavement construction and of any other traffic movements which affect the shape of the structure, the changes in the horizontal and vertical diameters of the structure shall not exceed ± 5% for circular structures and ± 2% for structures of other cross-sections. The longitudinal straightness over any 10 m length of the structure shall not deviate by more than 25 mm, and the rotational displacement in any 10 m length of structure shall not be greater than 25 mm.

13 (02/16) Only that compaction plant described in sub-Clause 10 of this Clause, shall be used in the vicinity of the structure unless the depth of compacted Class 6M surround material placed above the crown of the structure is more than 1 m, or one fifth of the span, whichever is the greater. The structure shall not be subjected to a surcharge greater than the depth of fill required in the contract and permitted depth of any protection layer given in contract specific Appendix 6/3.

14 (02/16) No material shall be placed by tipping either onto the structure or within a distance on either side of the structure of 2 m or half the span of the structure, whichever is the greater.

15 (02/16) Method compaction shall be used for the overlying fill (Classes 6Q and 7H) according to Clause 612; the method used being that for the corresponding general fill in Table 6/1.

624 (02/16) Ground Anchorages

1 (02/16) The Contractor shall design the ground anchorages required as part of the permanent works and listed in contract specific Appendix 1/10, in accordance with the design requirements described in contract specific Appendix 6/10. The ground anchorages shall be installed and where required in contract specific Appendix 6/10 proof loaded, in accordance with the requirements therein.

2 (02/16) Ground anchorages not forming part of the permanent works will only be permitted where such anchorage will not affect the permanent works.

625 (02/16) Crib Walling

1 (02/16) The Contractor shall design the crib walling listed in contract specific Appendix 1/10 in accordance with the design specification and procedures in contract specific Appendix 6/10 and Design Manual for Roads and Bridges document BD 68 (DMRB 2.1.3).

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626 (02/16) Gabions

1 (02/16) Gabions shall be manufactured and constructed in compliance with this Clause and with requirements stated in contract specific Appendix 6/10. Gabion units shall be assembled in accordance with the manufacturer's instructions.

2 (02/16) Unless otherwise stated in contract specific Appendix 6/10 they shall be filled with Class 6G material complying with Table 6/1. The grading of fill shall be as described in Appendix 6/10, the maximum size of fill material shall not exceed two thirds of the minimum dimension of the gabion compartment or 200mm whichever is smaller and the minimum size of the fill material shall be not less than the size of the mesh opening.

Gabion units shall be filled to fully achieve the required minimum cage density and compaction of fill. At no point before, during or after filling shall the cage be deformed by working methods or in use loading. The required cage density shall be as stated in contract specific Appendix 6/10. Internal tie wires shall be inserted and units shall be tensioned in accordance with the manufacturer's instructions. Gabion units shall be constructed so as to maintain tightness of mesh and shall be laced securely with wire, complying with sub-Clause 3 of this Clause.

3 (02/16) Gabion wire mesh units shall be woven steel wire conforming to BS EN 10223-3 or welded steel mesh conforming to BS EN 10223-8. The Contractor shall submit documentary evidence to the Overseeing Organisation to demonstrate compliance of the gabion units at least four weeks prior to the commencement of gabion work. Documentation that demonstrates compliance with a product acceptance scheme as described in Clause 104 sub-Clauses 15 and 16 can be supplied to meet this requirement where the scheme demonstrates that the gabion units meet the level of performance required by the specification.

Unless otherwise stated in contract specific Appendix 6/10 the site environment level shall be High Aggressive: C4; and the Assumed Working Life shall be 120 years or greater. Coating requirements for all wire shall be as required by Tables 1 and A.1 of BS EN 10223-3 and BS EN 10223-8.

4 (02/16) Unless otherwise stated in contract specific Appendix 6/10 woven steel gabions shall be of mesh designation 6x8 or 8x10 with minimum wire diameter of 2.7mm.

5 (02/16) Unless otherwise stated in contract specific Appendix 6/10 welded mesh shall be 3mm to 5mm diameter bars with the mesh size 75mm x 75mm maximum.

627 (02/16) Swallow Holes and Other Naturally Occurring Cavities

1 (02/16) Infilled swallow holes and other naturally occurring cavities shall where required in contract specific Appendix 6/11 be excavated, filled and capped as described in contract specific Appendix 6/11.

2 (02/16) Open swallow holes and other shallow cavities shall where required in contract specific Appendix 6/11 be flushed, cleared of rubbish where to do so would not endanger operatives, and filled and capped as described in contract specific Appendix 6/11.

628 (02/16) Disused Mine Workings

1 (02/16) Disused mine workings shall, where required in contract specific Appendix 6/11 be investigated, inspected, monitored, cleared, flushed, filled, capped or have any other treatment carried out, all as described in contract specific Appendix 6/11.

629 (02/16) Instrumentation and Monitoring

1 (02/16) Instrumentation, other than that required in compliance with Clause 607, shall be as described in contract specific Appendix 6/12 and shall be installed in the locations shown therein.

2 (02/16) Monitoring of instrumentation shall be carried out as required in the contract specific Appendix 6/12 and the results supplied to the Overseeing Organisation as required therein.

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630 (02/16) Ground Improvement

(02/16) Dynamic Compaction

1 (02/16) Dynamic compaction, carried out to either method or end-product as required in contract specific Appendix 6/13 and achieved by dropping a free-falling heavy mass (pounder) a number of times at pre-determined spacings on the surface of the ground or fill, shall be applied to the areas described in contract specific Appendix 6/13.

2 (02/16) Dynamic compaction shall be completed before the commencement of construction of any permanent works, or work on the placement or diversion of Statutory Undertaker's equipment, within that part of the site defined in the contract specific Appendix 6/13 which contains the area to be dynamically compacted.

3 (02/16) The Contractor shall ensure that no damage or injury is caused to persons or property on or off the site as a result of the dynamic compaction.

(02/16) Vibrated Stone Columns

4 (02/16) Vibrated stone columns in existing natural soils or fill by vibroreplacement or vibrodisplacement shall be formed in the manner and in the areas described in contract specific Appendix 6/13.

5 (02/16) Unless otherwise described in contract specific Appendix 6/13, materials shall comply with sub-Clause 8 of this Clause.

6 (02/16) The Contractor shall report immediately to the Overseeing Organisation any circumstance which indicates that in the Contractor's opinion the ground conditions differ from those expected from his interpretation of the ground investigation reports.

7 (02/16) Columns shall be installed as shown on the drawings and within the permitted tolerances stated in contract specific Appendix 6/13.

(02/16) Materials

8 (02/16) The material used to form the columns shall be clean, hard, inert material and shall be natural sand, gravel, crushed rock other than argillaceous rocks, crushed hardcore, crushed concrete, crushed slag or well burnt non-plastic shale. The material shall be appropriate to the ground conditions in which the stone columns are formed and its use shall not be detrimental to any other work on site. The material shall be nominally single sized coarse aggregate with a value of upper (D) sieve size in the range 10 mm to 40 mm or a graded material complying with Clause 804 (Type 2 unbound mixtures for subbase) except the material passing the 0.425 mm sieve shall be non-plastic when tested in accordance with BS1377: Part 2.

(02/16) Testing of Ground Treatment

9 (02/16) Testing of treated ground shall be undertaken for control purposes during the treatment and on completion of the ground treatment. The performance criteria for treated ground are given in contract specific Appendix 6/13.

10 (02/16) Improvement in treated ground shall be measured in accordance with the criteria stated in contract specific Appendix 6/13.

(02/16) Types of Test

11 (02/16) The following tests or alternatives permitted in contract specific Appendix 6/13 shall be carried out at the positions and frequency given in contract specific Appendix 6/13.

(02/16) Plate tests

12 (02/16) Plate bearing tests are loading tests carried out using a plate on treated ground. The test is described in BS 1377: Part 9: 1990 Method 4.1.

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(02/16) **Zone Tests**

13 (02/16) Zone tests are loading tests carried out with a slab, intended to test bearing pressure over a wider and deeper zone than in the plate tests. The test is described in BS 1377: Part 9: 1990 Method 4.2.

(02/16) **Penetration Tests**

14 (02/16) In granular soils the static cone (Dutch cone) penetration test, the standard penetration test (SPT) or dynamic cone penetration tests shall be employed as described in contract specific Appendix 6/13.

(02/16) **Trial Areas**

15 (02/16) Trial areas are to be treated and tested where required in contract specific Appendix 6/13. Trial areas which meet the performance requirements may form part of the permanent works.

16 (02/16) Equipment and materials used in trial areas shall be identical to those proposed for the permanent works.

17 (02/16) Testing in trial areas shall be carried out as given in contract specific Appendix 6/13.

18 (02/16) Detailed reports shall be prepared for all testing as defined in Table 6/6.

(02/16) **Records and Reports**

19 (02/16) Complete records of plant, equipment and materials shall be maintained during all ground treatment operations.

20 (02/16) Records shall be made available to the Overseeing Organisation including all information identified in Table 6/6 and any other information required by contract specific Appendix 6/13. All records pertaining to a particular day's operations shall be made available to the Overseeing Organisation at the start of the following day's operations.

(02/16) **Other Methods**

21 (02/16) Other methods of ground improvement shall be carried out where required in contract specific Appendix 6/13 and as described therein.

631 (02/16) Earthworks Materials Tests

1 (02/16) Unless otherwise described in the contract sampling and testing of earthworks materials shall be carried out in accordance with BS 1377: Part 1 to Part 9 inclusive.

#632 (02/16) Determination of Moisture Condition Value (MCV) of Earthworks Materials

1 (02/16) Where the Moisture Condition Value (MCV) is to be determined, the determination shall be carried out in accordance with BS 1377: Part 4.

2 (02/16) The determination of the MCV/moisture content relation in accordance with BS 1377: Part 4 shall be carried out when required in contract specific Appendix 6/1.

3 (02/16) Where permitted in contract specific Appendix 6/1 the rapid assessment procedure for material acceptability also given in BS 1377: Part 4 may be used.

633 (02/16) Determination of Undrained Shear Strength of Remoulded Cohesive Material

1 (02/16) Where required in contract specific Appendix 6/1, the undrained shear strength of cohesive soil under total stress conditions shall be determined from triaxial compression tests performed on remoulded specimens and tested under conditions where the lateral pressure is maintained constant and there is no change in total

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water content of the specimens. Unless otherwise required in contract specific Appendix 6/1, the tests shall be in accordance with BS 1377: Part 7 and the additional requirements of sub-Clauses 2 to 4 of this Clause.

2 (02/16) The specimens shall be prepared in accordance with BS 1377: Part 7 using remoulded material compacted into a split mould of nominal diameter 100 mm and nominal height 200 mm. The soil shall be at its natural moisture content and compacted in accordance with BS 1377: Part 1 using the 2.5 kg rammer method described in BS 1377: Part 4.

3 (02/16) The specimens shall be tested at an operating cell pressure of 200 ± 10 kN/m² and an axial strain rate of 1% per minute. Where contract specific Appendix 6/1 requires c and φ to be determined, the test shall be modified to enable Mohr circles to be plotted and c and φ reported.

4 (02/16) Where stated and described in contract specific Appendix 6/1, other tests may be used during construction to supplement the test described above, provided the results have been correlated to ensure compatibility.

634 (02/16) Determination of Intact Lump Dry Density (IDD) of Chalk

1 (02/16) The intact lump dry density (IDD) of chalk lumps shall be determined in accordance with BS 1377: Part 2.

635 (02/16) Los Angeles and Other Tests for Particle Soundness

(02/16) **Resistance to Fragmentation – Los Angeles Coefficient (LA)**

1 (02/16) The value of Los Angeles coefficient shall be determined in accordance with BS EN 1097-2.

(02/16) **Other Tests for Particle Soundness**

2 (02/16) Where contract specific Appendix 6/1 requires magnesium sulfate soundness tests to be carried out, they shall be carried out in accordance with BS EN 1367-2. Where contract specific Appendix 6/1 requires slake durability, point load or other tests for soundness to be carried out, they shall be carried out in accordance with the procedures given therein.

636 (02/16) Determination of Effective Angle of Internal Friction (φ′) and Effective Cohesion (c′) of Earthworks Materials

1 (02/16) The effective angle of internal friction φ′ and effective cohesion c′ shall be determined by shear box or triaxial tests as required in Table 6/1 and contract specific Appendix 6/1. Unless otherwise required in contract specific Appendix 6/1, the tests shall be in accordance with the requirements in sub-Clauses 2 to 6 of this Clause.

(02/16) **Shear Box Tests**

2 (02/16) For Classes 6N, 6P, 6I and 6J granular materials, the tests shall be carried out in accordance with BS 1377: Part 7 and the following:

(i) The plan size of the shear box shall be nominally 300 mm square.

(ii) Three samples shall be tested, each sample occupying the full depth of the shear box and shall be compacted at the optimum moisture content to a dry density of 92% ± 2% of the maximum dry density determined in accordance with BS 1377: Part 4 using the vibrating hammer method. The samples shall not be immersed in water.

(iii) Each of the samples shall be subjected to a different normal stress equal to the maximum vertical pressure in the fill at the base, quarter height and mid-height of the structure respectively. Each of the

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samples shall be sheared in a single stage test within one hour of compaction and the rate of shearing shall be such that no pore water pressure is generated.

(iv) The values of c' and φ' reported shall be those corresponding to the maximum strength envelope.

3 (02/16) For Classes 7A, 7C and 7D cohesive materials, the tests shall be carried out in accordance with BS 1377: Part 7 and the following:

(i) The shear boxes shall be nominally 300 mm square and nominally 60 mm square.

(ii) For the initial determination of fill properties three samples shall be tested in each size of shear box. The samples shall occupy the full depth of the shear box and shall be compacted at the optimum moisture content to a dry density of 92% ± 2% of the maximum dry density determined in accordance with BS 1377: Part 4 using the 4.5 kg rammer method. To allow the samples to soften, the shear box assembly shall then be immersed in water for a minimum period of 24 hours.

(iii) Each of the three samples in a set shall be subjected to a different effective normal stress equal to the maximum vertical pressure in the fill at the base, quarter height and mid-height of the structure respectively. Normal stresses shall be applied to the softened sample for a minimum period of 24 hours prior to shearing in a single stage test. The rate of shearing shall be such that no pore water pressure is generated.

(iv) The values of c' and φ' reported shall be those corresponding to the maximum strength envelope.

(v) The test results obtained using the 300 mm square box shall be taken as the properties of the fill. The initial test results obtained using the 60 mm square box shall be used for the subsequent quality control of the fill.

4 (02/16) For Class 7B pulverised-fuel ash material, the procedure shall be as for sub-Clause 3 of this Clause except that:

(i) The maximum dry density and optimum moisture content shall be determined in accordance with BS 1377: Part 4 using the 2.5 kg rammer method.

(ii) An additional sample in each set shall be subjected to an effective normal stress equal to the maximum vertical pressure in the fill at three quarters of the height of the structure or the lowest attainable normal stress, whichever is the greater.

(iii) As soon as the shear box has been filled and the sample compacted, the normal stress shall be applied and the sample immersed in water. This concurrent loading and immersion of the sample shall continue for a period of 24 hours and the sample shall then be sheared without further delay.

(02/16) **Triaxial Tests**

5 (02/16) Where Class 7A cohesive fill to structures is to be tested by a consolidated drained triaxial test, the test shall be in accordance with BS 1377: Part 8 using the sample size and preparation procedure in Clause 633 and the requirements of contract specific Appendix 6/1.

637 (02/16) Determination of Resistivity (r_s) to Assess Corrosivity of Soil, Rock or Earthworks Materials

(02/16) **Method of Test**

1 (02/16) Where the resistivity of the ground or of material to be used in the permanent works is required to be determined, this shall be obtained by in situ tests as described in sub-Clause 2 of this Clause or, when required in contract specific Appendix 6/1, by laboratory tests on samples in accordance with BS 1377: Part 3.

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(02/16) **In Situ Resistivity Tests**

2 (02/16) In situ resistivity shall be determined at the site of the structure or the cutting or the proposed borrow pit or on stockpiles in accordance with BS 1377: Part 9 and the requirements of contract specific Appendix 6/1.

3 (02/16) Details of the area and volume of material to be tested shall be made available to the Overseeing Organisation together with the arrangement of electrodes in each test. The Overseeing Organisation shall be given notice of the date, time and location of each test.

4 (02/16) At any test location, at each selected depth, two measurements shall be made such that the electrode alignment for the second measurement is approximately at right angles to the electrode alignment for the first measurement.

5 (02/16) At any test location, the first selected depth shall be no more than 1.5 m below the ground surface or no more than 1.5 m below the upper surface of the material to be tested, whichever is appropriate. Following the measurements at the first selected depth, further measurements shall be made at selected depths increasing by approximately 2 m each time until measurements have been carried out on the full depth of ground or material to be tested.

6 (02/16) Where the depth of material to be tested is too great to be tested from the surface within the confines of the site, the Contractor shall undertake all necessary arrangements for testing such material, including subsequent tests which may be required at a lower level following excavation. Details of his arrangements shall be made available to the Overseeing Organisation.

638 (02/16) Determination of Redox Potential (E_h) to Assess Corrosivity of Earthworks Materials for Reinforced Soil and Anchored Earth Structures

(02/16) **Method of Test**

1 (02/16) Where the redox potential of material to be incorporated into reinforced earth or anchored earth structures is required to be determined, this shall be obtained by in situ tests as described in sub-Clauses 2 to 6 of this Clause or, when required in contract specific Appendix 6/1, by laboratory tests on samples in accordance with BS 1377: Part 3.

(02/16) **In Situ Redox Potential Tests**

2 (02/16) In situ redox potential shall be determined in undisturbed ground at the site of the cutting or the proposed borrow pit or on stockpiles in accordance with BS 1377: Part 9 and the requirements of contract specific Appendix 6/1.

3 (02/16) Details of the area and volume of material to be tested shall be made available to the Overseeing Organisation together with the locations of the test pits.

4 (02/16) The Overseeing Organisation shall be given notice of the date, time and location of each test.

5 (02/16) At each test location the tests shall be carried out in a test pit not less than 600 mm square in plan excavated to a depth given in contract specific Appendix 6/1.

6 (02/16) At each test location, a sample shall be taken from the base of the excavation and kept in a hermetically sealed container for determining the pH value of the fill which shall be obtained in accordance with BS 1377: Part 3.

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639 (02/16) Determination of Coefficient of Friction and Adhesion Between Fill and Reinforcing Elements or Anchor Elements for Reinforced Soil and Anchored Earth Structures

(02/16) **Reinforcing Elements**

1 (02/16) The coefficient of friction and the adhesion shall be determined by tests carried out in a 300 mm size shear box with the element material fixed at the top of the lower half of the box and the fill sample occupying the top half only.

2 (02/16) The test shall be carried out following the procedure given in Clause 636 for the determination of the effective angle of internal friction and effective cohesion of earthworks materials except that:

(i) The apparatus shall in addition include a steel block fitting closely inside the lower half of the shear box and equal in height to it less the thickness of the reinforcing element material. (The flat toothed grid fitting the bottom of the shear box is not required).

(ii) The preparation of test specimens shall be as follows:

Element material shall be cut to fit the interior plan shape of the shear box using a sufficient number of strips of such material abutting to completely fill the interior plan area without overlap. They shall be firmly fixed to the top of the steel block so that the top face of the material is flush with the top edge of the lower half of the box and aligned so that shearing occurs in a direction parallel to the longitudinal axis of a reinforcing element.

A sample of the fill material to be used in the permanent works, of sufficient size to carry out the tests, and within the range of moisture contents permitted in Table 6/1 for such material, shall be sieved to obtain a test sample passing the 20 mm BS sieve, of sufficient quantity after compaction to fill the top half of the shear box. The top and bottom of the shear box shall be fixed together and the test sample of the sieved fill materials immediately placed and compacted in the top half of the box as described in Clause 636.

3 (02/16) The value of the coefficient of friction between the fill and the reinforcing element shall be obtained by plotting the values of peak shear stress, obtained in the tests, against applied normal stress and by measuring the slope of the resulting straight line graph. The adhesion between the fill and the reinforcement shall be obtained by taking the shear stress corresponding with zero normal stress.

4 (02/16) The following additional information shall be recorded for each test:

(i) Normal stress applied (kN/m²).

(ii) Peak shear stress (kN/m²).

(iii) Strain at peak shear stress (%).

(iv) Moisture content of fill after test (Classes 7B, 7C and 7D).

(02/16) **Anchor Elements**

5 (02/16) Where required in contract specific Appendix 6/1, tests shall be carried out as described therein to assess the interaction between the fill and the element.

640 (02/16) Determination of Permeability of Earthworks Materials

1 (02/16) Where required in Table 6/1 or contract specific Appendix 6/1 the permeability of earthworks materials shall be determined as described in contract specific Appendix 6/1.

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641 (02/16) Determination of Available Lime Content of Lime for Lime Stabilised Capping

1 (02/16) Contract compliance testing shall be carried out by the Contractor to determine the available lime content of lime as installed for lime or lime and cement stabilised capping. This compliance testing shall be carried out in accordance with BS EN 459-2 except that the sample increments shall be taken from the collecting tray used to check the rate of spread at intervals of one increment per 500 m per lane.

2 (02/16) The available lime content shall be determined as required by BS EN 459-2, it shall be reported and categorised as required in BS EN 459-1.

642 (02/16) Determination of the Constrained Soil Modulus (M*) of Earthworks Materials for Corrugated Steel Buried structures

(02/16) General

1 (02/16) When required in contract specific Appendix 6/1, the constrained soil modulus M* shall be determined by one of the following methods:

(i) From plate loading tests in accordance with BS 1377: Part 9.

(ii) From the results of Standard Penetration resistance tests (SPT) on non-cohesive materials in accordance with BS 1377: Part 9.

(iii) From the values of the coefficient of volume compressibility (m_v) from one-dimensional consolidation tests on undisturbed soil specimens of cohesive materials, in accordance with BS 1377: Part 5.

(02/16) Plate Loading Tests

2 (02/16) When testing compacted granular fill materials the test surface shall be prepared by either:

(i) removing the surface layer carefully using hand tools to perform the test at a depth of 100 mm below the surface; or

(ii) compacting the surface, after the required compaction has been applied, with two additional passes with no vibration to remove the overstressing in the surface layer.

If necessary, the plate shall be bedded onto the fill using a small quantity of dry sand to remove any slight unevenness of the surface of the fill. The field dry density and moisture content shall be determined at the position of each plate loading test in accordance with Clause 612 and BS 1377: Part 2 or equivalent, respectively.

3 (02/16) When using the plate loading test to determine M* of the material existing on site a smooth surface shall be prepared by careful hand excavation and the plate bedded onto the soil using either sand or quick setting gypsum plaster depending on whether the soil is granular or cohesive.

4 (02/16) The loading test shall be carried out under a series of maintained loads. The maximum load shall be such that the average pressure applied to the plate is in excess of 350 kN/m². The elastic modulus E_s shall be determined as the secant modulus between average pressures applied to the plate of 150 and 350 kN/m² in the first load cycle. A value of Poisson's ratio of 0.3 shall be assumed. A second load cycle testing shall also be conducted and the results of this test compared with the first load cycle to check that the plate was seated satisfactorily during the first load cycle. If the results of the first load cycle suggest that the plate was not seated satisfactorily, then the procedure shall be repeated at a new location. Second load cycle results shall not be used to demonstrate the adequacy of the material being tested.

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5 (02/16) The constrained soil modulus M* shall be determined from the elastic modulus Es using the equation:

$$M^* = \frac{(1 - v)E_s}{(1 + v)(1 - 2v)} \text{ (N/mm}^2\text{)}$$

where v = Poisson's ratio to be taken as 0.3

and E_s = Elastic modulus of the soil (N/mm²)

(02/16) **Standard Penetration resistance Tests**

6 (02/16) The constrained soil modulus M* of non-cohesive materials existing on site shall be determined from the relationship:

$$M^* = \frac{0.39N^{1.4}}{\gamma_m} \text{ (N/mm}^2\text{)}$$

Where N = uncorrected SPT value and $\gamma_m = 1.3$

(02/16) **One-dimensional Consolidation Tests**

7 (02/16) The constrained soil modulus M* of undrained cohesive materials existing on site shall be determined from the formula:

$$M^* = \frac{1}{m_v} \text{ (N/mm}^2\text{)}$$

where m_v (mm²/N) is the coefficient of volume compressibility

The value of m_v to be used in the formula is that calculated from the test results for the loading increment in the consolidation test corresponding to the in situ effective overburden pressure at the level of the crown of the structure.

(02/16) **Number of Tests**

8 (02/16) Three tests for M* shall be carried out on the soil occurring on each side of the structure, one of which is to be at the level of the maximum span, unless otherwise described in contract specific Appendix 6/1.

643 (02/16) Lime and Cement Stabilisation to Form Capping

1 (02/16) Where capping is to consist of, either wholly or in part, lime and cement stabilised material Class 9E or 9F, this Clause shall apply to the construction of those parts which are stabilised with lime and cement.

2 (02/16) Material to be stabilised with lime and cement shall be Class 6R or 7I material all complying with Clause 601 and Table 6/1.

3 (02/16) The form of lime used for lime and cement stabilisation shall be as required in contract specific Appendix 6/7, the lime shall conform to BS EN 459-1 and meet the performance requirements stated in contract specific Appendix 6/7. This shall be demonstrated by the Declaration of Performance. Unless otherwise stated in contract specific Appendix 6/7 lime shall be either quicklime or hydrated lime conforming to BS EN 459-1. The particle size distribution of all types of quicklime shown in Tables 1 and 8 of BS EN 459-1 shall be of designation P4 as shown in Tables 5 and 12 of BS EN 459-1.

4 (02/16) The Contractor shall carry out testing of the lime as installed for available lime in accordance with Clause 641 at weekly intervals unless otherwise required in contract specific Appendix 6/7 during periods when lime and cement stabilisation is carried out. The results shall be reported to the Overseeing Organisation. The available lime shall meet the requirements stated in contract specific Appendix 6/7 and the values stated in the Declaration of Performance.

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5 (02/16) Cement for lime and cement stabilisation shall be Portland cement complying with Clause 1001, unless otherwise described in contract specific Appendix 6/7.

6 (02/16) Classes 6R and 7I material to be stabilised shall have added to it, at any point, the percentage of its dry weight of lime and cement as determined on the demonstration area, to meet the required bearing ratio in contract specific Appendix 6/1, subject to a minimum of 1% by weight of 'available lime' and 2% cement as a percentage of the dry weight of the 6R and 7I materials.

7 (02/16) The Contractor shall not carry out lime and cement stabilisation when the shade temperature is below 3°C unless on a rising thermometer above 0°C. Lime and cement stabilisation shall not be carried out during periods of rain or when rain is imminent. When cement is spread on material likely to cause premature hydration, processing in accordance with sub-Clause 16 of this Clause shall follow immediately.

8 (02/16) Lime of quantity complying with sub-Clause 6 of this Clause shall be uniformly spread by an approved spreading machine on top of the layer to be stabilised. Using a collecting tray and balance the Contractor shall check the rate of spread by weight, once for every 500 m^2 of lime spread or a different rate of testing for the rate of spread as described in contract specific Appendix 6/7. At the same time the Contractor shall collect samples of lime deposited on the tray and test them for available lime content in accordance with Clause 641.

9 (02/16) Unless indicated otherwise in contract specific Appendix 6/7, the material shall be stabilised in a single layer if its compacted thickness is 250 mm or less. If its compacted thickness is greater, the material shall be stabilised in layers not less than 130 mm and not more than 250 mm thick, including any cutting-in required by sub-Clause 13 of this Clause.

10 (02/16) Unless indicated otherwise in contract specific Appendix 6/7, the material forming the layer to be stabilised shall be processed by pulverising and mixing in the lime by means of sufficient number of passes of an approved mobile stabilising machine until 95% of the Class 9E or 95% of the silt and clay fraction of Class 9F processed material passes a BS 28 mm sieve after dry sieving and the pulverisation complies with Table 6/1.

11 (02/16) During processing sufficient water shall be available in the material to slake the quicklime (if used) and to enable satisfactory mixing and compaction to be achieved. Any added water shall be through an integral spray-bar on the stabilising machine. Any added water shall have a sulfate content not exceeding 1400 mg/l as SO_4 when tested in accordance with BS EN 1774-1 clause 10.

12 (02/16) The layer shall receive at least two passes of the stabilising machine to pulverise and mix the lime and soil, after which the processing shall be interrupted by a period of not less than 24 hours and not greater than 72 hours to enable the lime to react with the soil. Before this period commences the surface of the layer shall be sealed with one pass of a smooth wheeled roller having a mass per metre width of roll of not less than 2700 kg or a pneumatic tyred roller of not less than 1000 kg per wheel. At the end of this period the layer shall receive one further pass of the stabilising machine or more if required to enable the material to comply with sub-Clauses 10 of this Clause.

13 (02/16) The stabilising machine shall be equipped with a device for controlling the depth of processing which shall be maintained at the correct setting at all times. An overlap of 150 mm shall be made between adjacent passes of the stabilising machine. Where a subsequent layer of material is placed on a layer previously stabilised the tines or blades of the stabilising machine shall be set so that they cut into the previously stabilised layer below by at least 20 mm.

14 (02/16) The appropriate quantity of cement shall be uniformly spread, by a suitable spreading machine, on top of the layer previously processed with lime. Using a collecting tray and balance the Contractor shall check the rate of spread of the machine once for every 500 m_2 of cement spread.

15 (02/16) Unless indicated otherwise in contract specific Appendix 6/7, the material previously mixed with lime shall be stabilised with cement in a single layer or in layers of the same compacted thickness as for the lime mixed material layers, including any cutting-in required by sub-Clause 13 of this Clause.

16 (02/16) Unless indicated otherwise in contract specific Appendix 6/7, the material forming the layer to be stabilised shall be processed by pulverising and mixing in the cement by means of a sufficient number of passes of an approved mobile stabilising machine until 95% of the silt and clay fraction is reduced to particles or lumps passing a BS 28 mm sieve after dry sieving and the pulverisation complies with Table 6/1.

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17 (02/16) During processing, sufficient water shall be available in the material to hydrate the cement and enable satisfactory mixing and compaction to be achieved. Any added water shall be through an integral spray-bar on the stabilising machine. Any added water shall have a sulfate content not exceeding 1400 mg/l as SO_4 when tested in accordance with BS EN 1774-1 clause 10.

18 (02/16) The stabilising machine shall be equipped with a device for controlling the depth of processing which shall be maintained at the correct setting at all times. An overlap of 150 mm shall be made between adjacent passes of the stabilising machine. Where a subsequent layer of material is placed on a layer previously stabilised the tines or blades of the stabilising machine shall be set so that they cut into the previously stabilised layer below by at least 20 mm.

19 (02/16) Each layer of Class 9E or 9F processed material shall be compacted as soon as possible after the final pass of the stabilising machine. Compaction shall be completed within 2 hours following the mixing of the cement into the material to be stabilised. Immediately before compaction Class 9E processed material shall have a Moisture Condition Value (MCV) of not greater than 12 nor less than the figure stated in contract specific Appendix 6/1 both as determined in accordance with Clause 632. Water shall be added if necessary in a uniform manner to enable this MCV requirement to be met. Any added water shall have a sulfate content not exceeding 1400 mg/l as SO_4 when tested in accordance with BS EN 1774-1 clause 10.

20 (02/16) The compaction of each layer of Class 9E or 9F material shall comply with Clause 612, Table 6/4 Method 7, except that if layers of Class 9E or 9F greater than 250 mm thickness are to be constructed, the number of passes of the compaction plant shall be determined from the results of a demonstration area as detailed in contract specific Appendix 6/7.

21 (02/16) Class 9E and 9F materials shall be cured in accordance with Clause 1035. During periods when the air temperature is forecast to drop below 3°C or when ground frost is forecast Class 9E and 9F material shall be protected, to prevent freezing, for a period of 7 days from the time of completion of compaction. Such protection shall be sealed to prevent the ingress of moisture.

22 (02/16) Class 9E and 9F materials shall not have other material deposited or compacted above them until such time as the required bearing ratio in contract specific Appendix 6/1 has been achieved. The relaxation allowed in sub-Clause 617.2 shall not apply before this time.

644 (02/16) Determination of Sulfate Content

1 (02/16) Where required in Table 6/1 or contract specific Appendix 6/1, the effects of water-soluble sulfate, oxidisable sulfides and total potential sulfate shall be assessed in accordance with BS EN 1744-1 clauses 10, 11 and 13.

2 (02/16) Test results and limiting values for sulfate shall be given as SO_4.

3 (02/16) At least five samples of each material shall be tested for WS, OS and TPS. The mean of the highest two values shall be used for comparison with the limiting values. This also applies if six to nine results are available. If ten or more results are available, the mean of the highest 20% of the results shall be used for comparison with the limiting values.

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
GENERAL GRANULAR FILL	1	A	–	Well graded granular material	General Fill	Any material, or combination of materials, other than material designated as Class 3 in the Contract. (Properties (i), (ii) and (iv) in next column, shall not apply to chalk). Recycled aggregate. Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9, and 10: P (natural aggregates); A (construction and demolition recycling industries); B1 (municipal incinerator bottom ash (MIBA)); D2 (air cooled blast furnace slag) D3 (basic oxygen furnace slag) D4 (electric arc furnace slag (EAF C)) E (non ferrous steel industry – except E2 molybdenum slag) G (mining and quarry industry)	(i) grading	BS 1377: Part 2 or BS EN 13242	Tab 6/2	Tab 6/2	Tab 6/4 Method 2	1	A	–
							(ii) uniformity coefficient	See Note 5	10	–				
							(iii) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(iv) MCV	Clause 632	App 6/1	App 6/1				
							(v) IDD of chalk	Clause 634	–	App 6/1				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
GENERAL GRANULAR FILL	1	B	–	Uniformly graded granular material	General Fill	Any material, or combination of materials, other than chalk. Recycled aggregate Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9, and 10: P (natural aggregates – except chalk); A (construction and demolition recycling industries); B1 (municipal incinerator bottom ash (MIBA)); C1 (coal fly ash) C4 (coal bottom ash) D2 (air cooled blast furnace slag) D3 (basic oxygen furnace slag) D4 (electric arc furnace slag (EAF C)) E (non ferrous steel industry – except E2 molybdenum slag) F (foundry industry) G (mining and quarry industry) H1 (dredge spoil sand)	(i) grading	BS 1377: Part 2 or BS EN 13242	Tab 6/2	Tab 6/2	Tab 6/4 Method 3	1	B	–
							(ii) uniformity coefficient	See Note 5	–	10				
							(iii) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(iv) MCV	Clause 632	App 6/1	App 6/1				
	1	C	–	Coarse granular material	General Fill	Any material, or combination of materials, other than material designated as Class 3 in the Contract. (Properties (i) and (ii) in next column, shall not apply to chalk). Recycled aggregate Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9, and 10: P (natural aggregates); A (construction and demolition recycling industries); D2 (air cooled blast furnace slag) G (mining and quarry industry)	(i) grading	BS 1377: Part 2 or BS EN 13242	Tab 6/2	Tab 6/2	Tab 6/4 Method 5	1	C	–
							(ii) uniformity coefficient	See Note 5	5	–				
							(iii) Los Angeles coefficient	Clause 635	–	50				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
GENERAL COHESIVE FILL	2	A	–	Wet cohesive material	General Fill	Any material, or combination of materials, other than chalk.	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 1 except for materials with liquid limit greater than 50, determined by BS 1377: Part 2, only deadweight tamping or vibratory tamping rollers or grid rollers shall be used.	2	A	–
							(ii) plastic limit (PL)	BS 1377: Part 2	–	–				
							(iii) mc	BS 1377: Part 2 See Note 4	PL -4%	App 6/1				
							(iv) MCV	Clause 632	App 6/1	App 6/1				
							(v) Undrained shear strength of remoulded material	Clause 633	App 6/1	App 6/1				
	2	B	–	Dry cohesive material	General Fill	Any material, or combination of materials, other than chalk	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 2	2	B	–
							(ii) plastic limit (PL)	BS 1377: Part 2	–	–				
							(iii) mc	BS 1377: Part 2 See Note 4	App 6/1	PL -4%				
							(iv) MCV	Clause 632	App 6/1	App 6/1				
							(v) undrained shear strength of remoulded material	Clause 633	App 6/1	App 6/1				
	2	C	–	Stony cohesive material	General Fill	Any material, or combination of materials, other than chalk	(i) grading	BS 1377: part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 2	2	C	–
							(ii) plastic limit (PL)	BS 1377: part 2	–	–				
							(iii) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(iv) MCV	Clause 632	App 6/1	–				
							(v) Undrained shear strength of remoulded material	Clause 633	App 6/1	–				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
GENERAL COHESIVE FILL	2	D	–	Silty cohesive material	General Fill	Any material, or combination of materials, other than chalk	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 3	2	D	–
							(ii) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(iii) MCV	Clause 632	App 6/1	App 6/1				
							(iv) undrained shear strength of remoulded material	Clause 633	App 6/1	App 6/1				
	2	E	–	Reclaimed pulverised fuel ash cohesive material	General Fill	Reclaimed material from lagoon or stockpile containing not more than 20% furnace bottom ash	(i) mc	BS 1377: Part 2 See Note 4	To enable compaction to Clause 612		End product 95% of maximum dry density of BS 1377 : Part 4 (2.5 kg rammer method)	2	E	–
							(ii) bulk density	BS 1377: Part 9	App 6/1	App 6/1				
GEN CHALK FILL	3	–	–	Chalk	General Fill	Chalk and associated materials all designated as Class 3 in the Contract	(i) mc	BS 1377: Part 2 See Note 4	–	App 6/1	Tab 6/4 Method 4, or Method 1 if required in App 6/1. All types of vibratory rollers of Categories over 1800 kg shall not be used	3	–	–
							(ii) IDD	Clause 634	App 6/1	App 6/1				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
LANDSCAPE FILL	4	–	–	Various	Fill to landscape areas	See App 6/1	(i) grading	BS 1377: Part 2	App 6/1	App 6/1	See Clause 620 and App 6/1	4	–	–
							(ii) mc	BS 1377: Part 2 See Note 4	–	App 6/1				
							(iii) MCV	Clause 632	App 6/1	App 6/1				
TOPSOIL	5	A	–	Topsoil, or turf, existing on site	Topsoiling	Topsoil or turf designated as Class 5A in the Contract	(i) grading	Clause 618	–	Clause 618	–	5	A	–
	5	B	–	Imported topsoil	Topsoiling	General purpose grade complying with BS 3882	–	–	–	–	–	5	B	–

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	A	–	Selected well graded granular material	Below water	Natural gravel, natural sand, crushed gravel, crushed rock other than argillaceous rock, crushed concrete, chalk, well burnt colliery spoil or any combination thereof. (Properties (i) and (ii) in next column, shall not apply to chalk.) Recycled aggregate Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9, and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A (construction and demolition recycling industries); G1 (red coal shale) G3 (pre-selected all-in from quarrying/mining)	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	No compaction	6	A	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) uniformity	See Note 5	10	–				
							(iii) SMC of chalk index	Clause 634	–	20%				
							(iv) plasticity index	BS 1377: Part 2	Non-plastic					
	6	B	–	Selected coarse granular material	Starter layer	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, chalk, well burnt colliery spoil, slag or any combination thereof. (Properties (ii) and (iii) in next column, shall not apply to chalk.) Recycled aggregate Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9, and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A (construction and demolition recycling industries); D2 (air cooled blast furnace slag) D3 (basic oxygen furnace slag) D4 (electric arc furnace slag (EAF C)) G1 (red coal shale) G3 (pre-selected all-in from quarrying/mining)	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	Tab 6/4 Method 5	6	B	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) plasticity index	BS 1377: Part 2	Non-plastic					
							(iii) Los Angeles coefficient	Clause 635	–	50				
							(iv) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	C	–	Selected uniformly graded granular material	Starter layer	Natural gravel, natural sand, crushed gravel, crushed rock other than argillaceous rock, crushed concrete, chalk, well burnt colliery spoil, slag or any combination thereof. (Property (iii) in next column, shall not apply to chalk.) Recycled aggregate Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9, and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A (construction and demolition recycling industries); D2 (air cooled blast furnace slag) D3 (basic oxygen furnace slag) D4 (electric arc furnace slag (EAF C)) G1 (red coal shale) G3 (pre-selected all-in from quarrying/mining)	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	Tab 6/4 Method 3	6	C	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) uniformity coefficient	See Note 5	–	10				
							(iii) plasticity index	BS 1377: Part 2	Non-plastic					
							(iv) Los Angeles coefficient	Clause 635	–	50				
							(v) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				

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Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	D	–	Selected uniformly graded granular material	Starter layer below pulverised fuel ash	Natural gravel, natural sand, crushed gravel, crushed rock other than argillaceous rock, crushed concrete, chalk, well burnt colliery spoil, slag or any combination thereof. Recycled aggregate Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9, and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A (construction and demolition recycling industries); D2 (air cooled blast furnace slag) D3 (basic oxygen furnace slag) D4 (electric arc furnace slag (EAF C)) G1 (red coal shale)	(i) grading	BS 1377: Part 2 (On site)	Tab 6/2	Tab 6/2	Tab 6/4 Method 4	6	D	–
								BS EN 933-2 Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) uniformity coefficient	See Note 5	–	10				
							(iii) plasticity index	BS 1377: Part 2	Non-plastic					
							(iv) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(v) MCV	Clause 632	App 6/1	App 6/1				

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Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	E	–	Selected granular material (Class 9A)	For stabilisation with cement to form capping	Any material, or combination of materials, other than unburnt colliery spoil and argillaceous rock. (Properties (i), (ii) and (iii) in next column, shall not apply to chalk.) Recycled aggregate Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9, and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A (construction and demolition recycling industries); D2 (air cooled blast furnace slag) G (mining and quarry industry – except G2 (black coal shale))	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	Not applicable	6	E	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) mc	BS 1377: Part 2 See Note 4	–	App 6/1				
							(iii) liquid limit	BS 1377: Part 2	–	45				
							(iv) plasticity index	BS 1377: Part 2	–	20				
							(v) organic matter	BS 1377: Part 3	–	App 6/1				
							(vi) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	3000 mg/l as SO_4				
							(vii) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	0.6% as SO_4				
							(viii) SMC of chalk	Clause 634	–	20%				
	6	F	1	Selected granular material (fine grading)	Capping	Any material, or combination of materials – including recycled aggregates with not more than 50% by mass of recycled bituminous planings and granulated asphalt, but excluding materials contaminated with tar and tar-bitumen binders, unburnt colliery spoil, argillaceous rock and chalk. Property (vi) in the next column shall not apply if the Class Ra (asphalt) content of any recycled aggregate is 20% or less. Where material in this Class is imported onto site it shall be classified as Class 6F4 and comply with the requirements for that material.	(i) grading	BS 1377: Part 2 (On site materials only)	Tab 6/2	Tab 6/2	Tab 6/4 Method 6	6	F	1
							(ii) optimum mc	BS 1377: Part 4 (vibrating hammer method)	–	–				
							(iii) mc	BS 1377: Part 2 See Note 4	Optimum mc - 2%	Optimum mc				
							(iv) Los Angeles coefficient	Clause 635	–	60				
							(v) Class Ra (asphalt) content	Clause 710	–	50%				
							(vi) bitumen content	BS EN 12697-1 or BS EN 12697-39	–	2.0%				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	F	2	Selected granular material (coarse grading)	Capping	Any material, or combination of materials - including recycled aggregates with not more than 50% by mass of recycled bituminous planings and granulated asphalt, but excluding materials contaminated with tar and tar-bitumen binders, unburnt colliery spoil and argillaceous rock. Property (i) in the next column shall not apply to chalk. Property (vi) in the next column shall not apply if the Class Ra (asphalt) content of any recycled aggregate is 20% or less. Where material in this Class is imported onto site it shall be classified as Class 6F5 and comply with the requirements for that material.	(i) grading	BS 1377: Part 2 (On site materials only)	Tab 6/2	Tab 6/2	Tab 6/4 Method 6	6	F	2
							(ii) optimum mc	BS 1377: Part 4 (vibrating hammer method)	–					
							(iii) mc	BS 1377: Part 2 See Note 4	Optimum mc - 2%	Optimum mc				
							(iv) Los Angeles coefficient	Clause 635	–	50				
							(v) Class Ra (asphalt) content	Clause 710	–	50%				
							(vi) bitumen content	BS EN 12697-1 or BS EN 12697-39	–	2.0%				
	6	F	3	Selected granular material	Capping	Any material, or combination of materials with not less than 50% by mass of recycled bituminous planings and granulated asphalt, but excluding materials contaminated with tar and tar-bitumen binders, unburnt colliery spoil and argillaceous rock. Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from the following source codes, see Notes 8, 9 and 10: A1 (reclaimed asphalt) A4 (mixed recycled aggregate) Aggregates from source code A4 shall contain at least 50% of constituents in Class Ra (bituminous materials).	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	Tab 6/4 Method 6 Maximum Compacted layer thickness shall be 200 mm	6	F	3
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) optimum mc	Clause 613	–	–				
							(iii) mc	Clause 613 See Note 4	Optimum mc -2%	Optimum mc				
							(iv) Class Ra (asphalt) content	Clause 710	50%	–				
							(v) bitumen content	BS EN 12697-1 or BS EN 12697-39	–	10%				

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							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	F	4	Selected granular material (fine grading) – imported on to the Site	Capping	Unbound mixture complying with BS EN 13285 containing aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9 and 10: P (natural aggregates – except chalk, shale, siltstone or slate, see Note 7) A2 (crushed concrete) A3 (crushed bricks, masonry) A4 (mixed recycled aggregate) B1 (municipal incinerator bottom ash (MIBA)) D2 (air cooled blast furnace slag) D3 (basic oxygen furnace slag) D4 (electric arc furnace slag (EAF C)) G (mining and quarry industry – except G2 (black coal shale)) Aggregates from source code A4 shall contain not more than 50% of constituents in Class Ra (bituminous materials). Property (x) in the next column shall not apply if the Class Ra (asphalt) content of any recycled aggregate is 20% or less.	(i) Size designation and overall grading category	BS EN 13285 – 0/31.5 and G_E	Tab 6/5	Tab 6/5	Tab 6/4 Method 6	6	F	4
							(ii) Maximum fines and oversize categories	BS EN 13285 – UF_{15} and OC_{75}	Tab 6/5	Tab 6/5				
							(iii) Los Angeles coefficient	BS EN 13242 – LA_{60}	–	60				
							(iv) Volume stability of blast furnace slag	BS EN 13242 – free from dicalcium silicate and iron disintegration	–	–				
							(v) Volume stability of steel (BOF) and EAF) slag	BS EN 13242 – V_5	–	–				
							(vi) Other aggregate requirements	BS EN 13242 – $Category_{NR}$ (no requirement)	–	–				
							(vii) Laboratory dry density and optimum water content	BS EN 13285, Clause 5.3 – declared values	–	–				
							(viii) Water content	BS EN 1097-5	Optimum wc – -2%	Optimum wc				
							(ix) Class Ra (asphalt) content	Clause 710	–	50%				
							(x) bitumen content	BS EN 12697-1 or BS EN 12697-39	–	2.0%				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within: Lower	Acceptable Limits Within: Upper				
SELECTED GRANULAR FILL	6	F	5	Selected granular material (coarse grading) – imported on to the Site	Capping	Unbound mixture complying with BS EN 13285 containing aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9 and 10: P (natural aggregates – except chalk, shale, siltstone or slate, see Note 7) A2 (crushed concrete) A3 (crushed bricks, masonry) A4 (mixed recycled aggregate) B1 (municipal incinerator bottom ash (MIBA)) D2 (air cooled blast furnace slag) D3 (basic oxygen furnace slag) D4 (electric arc furnace slag (EAF C)) G (mining and quarry industry – except G2 (black coal shale)) Aggregates from source code A4 shall contain not more than 50% of constituents in Class Ra (bituminous materials). Property (x) in the next column shall not apply if the Class Ra (asphalt) content of any recycled aggregate is 20% or less.	(i) Size designation and overall grading category	BS EN 13285 – 0/80 and G_E	Tab 6/5	Tab 6/5	Tab 6/4 Method 6	6	F	5
							(ii) Maximum fines and oversize categories	BS EN 13285 – UF_{12} and OC_{75}	Tab 6/5	Tab 6/5				
							(iii) Los Angeles coefficient	BS EN 13242 – LA_{50}	–	50				
							(iv) Volume stability of blast furnace slag	BS EN 13242 – free from dicalcium silicate and iron disintegration	–	–				
							(v) Volume stability of steel (BOF) and EAF) slag	BS EN 13242 – V_5	–	–				
							(vi) Other aggregate requirements	BS EN 13242 – Category NR (no requirement)	–	–				
							(vii) Laboratory dry density and optimum water content	BS EN 13285, Clause 5.3 – declared values	–	–				
							(viii) Water content	BS EN 1097-5	Optimum wc – -2%	Optimum wc				
							(ix) Class Ra (asphalt) content	Clause 710	–	50%				
							(x) bitumen content	BS EN 12697-1 or BS EN 12697-39	–	2.0%				
	6	G	–	Selected granular material	Gabion filling	Natural gravel, crushed rock, crushed concrete or any combination thereof. None of these constituents shall include any argillaceous rock. Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9 and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A2 (crushed concrete).	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	None	6	G	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) Los Angeles coefficient	Clause 635	–	50				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	H	–	Selected granular material	Drainage layer to reinforced soil and anchored earth structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, chalk, well burnt colliery spoil or any structures combination thereof. None of these constituents shall include any argillaceous rock. (Properties (vi), (vii), (viii), (ix), (x), (xi) and (xii) in next column only apply when metallic reinforcing or anchor elements, facing units or fastenings are used.) (Properties (ii) and (v) in next column shall not apply to chalk.) Recycled aggregate except recycled asphalt. Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9 and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A2 (crushed concrete) A3 (crushed bricks, masonry) G1 (red coal shale)	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	Tab 6/4 Method 3	6	H	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) plasticity index	BS 1377: Part 2	Non-plastic					
							(iii) Los Angeles coefficient	Clause 635	–	50				
							(iv) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(v) MCV	Clause 632	App 6/1	App 6/1				
							(vi) pH value	BS 1377: Part 3	Tab 6/3	Tab 6/3				
							(vii) chloride ion content	BS EN 1744-1	–	Tab 6/3				
							(viii) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	Tab 6/3				
							(ix) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	Tab 6/3				
							(x) resistivity	Clause 637	Tab 6/3	–				
							(xi) redox potential	Clause 638	Tab 6/3	–				
							(xii) organic content	BS 1377: Part 3	–	Tab 6/3				
							(xiii) microbial activity index	Table 6/3	–	Tab 6/3				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	I	–	Selected well graded granular material	Fill to reinforced soil and anchored earth structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, slag, chalk, well burnt colliery spoil or any combination thereof except that chalk shall not be combined with any other constituent. None of these constituents shall include any argillaceous rock. (Properties (i), (ii) and (v) in next column shall not apply to chalk.) (Properties (viii), (ix), (x), (xi), (xii), (xiii) and (xiv) only apply when metallic reinforcing or anchor elements, facing units or fastenings are used.) Recycled aggregate except recycled asphalt. Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9 and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A2 (crushed concrete) A3 (crushed bricks, masonry) D2 (air cooled blast furnace slag) G1 (red coal shale)	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	Tab 6/4 Method 2	6	I	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) uniformity coefficient	See Note 5	10	–				
							(iii) SMC of chalk	Clause 634	–	20%				
							(iv) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(v) MCV	Clause 632	App 6/1	App 6/1				
							(vi) effective angle of friction (φ') and effective cohesion (c')	Clause 636	App 6/1	–				
							(vii) coefficient of friction and adhesion (fill/ elements)	Clause 639	App 6/1	–				
							(viii) pH value	BS 1377: Part 3	Tab 6/3	Tab 6/3				
							(ix) chloride ion content	BS EN 1744-1	–	Tab 6/3				
							(x) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	Tab 6/3				
							(xi) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	Tab 6/3				
							(xii) resistivity	Clause 637	Tab 6/3	–				
							(xiii) redox potential	Clause 638	Tab 6/3	–				
							(xiv) organic content	BS 1377: Part 3	–	Tab 6/3				
							(xv) microbial activity index	Table 6/3	–	Tab 6/3				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	J	–	Selected uniformly graded granular material	Fill to reinforced soil and anchored earth	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, slag, chalk, well burnt colliery spoil or any combination thereof, except that chalk shall not be combined with any other constituent. None of these constituents shall include any argillaceous rock. (Properties (viii), (ix), (x), (xi), (xii), (xiii) and (xiv) in next column only apply when metallic reinforcing or anchor elements, facing units or fastenings are used.) (Properties (i), (ii) and (v) in next column shall not apply to chalk.) Recycled aggregate except recycled asphalt. Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9 and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A2 (crushed concrete) A3 (crushed bricks, masonry) D2 (air cooled blast furnace slag) G1 (red coal shale).	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	Tab 6/4 Method 3	6	J	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) uniformity coefficient	See Note 5	5	10				
							(iii) SMC of chalk	Clause 634	–	20%				
							(iv) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(v) MCV	Clause 632	App 6/1	App 6/1				
							(vi) effective angle of friction (φ') and effective cohesion (c')	Clause 636	App 6/1	–				
							(vii) coefficient of friction and adhesion (fill/ elements)	Clause 639	App 6/1	–				
							(viii) pH value	BS 1377: Part 3	Tab 6/3	Tab 6/3				
							(ix) chloride ion content	BS EN 1744-1	–	Tab 6/3				
							(x) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	Tab 6/3				
							(xi) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	Tab 6/3				
							(xii) resistivity	Clause 637	Tab 6/3	–				
							(xiii) redox potential	Clause 638	Tab 6/3	–				
							(xiv) organic content	BS 1377: Part 3	–	Tab 6/3				
							(xv) microbial activity index	Table 6/3	–	Tab 6/3				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within: Lower	Acceptable Limits Within: Upper				
SELECTED GRANULAR FILL	6	K	–	Selected granular material	Lower bedding for corrugated steel buried structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt. Where material is imported onto which is not 'as dug' site it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes,)see Notes 8, 9 and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A2 (crushed concrete) A3 (crushed bricks, masonry) G1 (red coal shale)	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	End product 90% of maximum dry density of BS 1377: Part 4 (Vibrating hammer method)	6	K	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) uniformity coefficient	See Note 5	5	–				
							(iii) plasticity index	BS 1377: Part 2	–	6				
							(iv) optimum mc	BS 1377: Part 4 (vibrating hammer method)	–	–				
							(v) mc	BS 1377: Part 2 See Note 4	Optimum mc -2%	Optimum mc +1%				
							(vi) MCV	Clause 632	App 6/1	App 6/1				
							(vii) Los Angeles coefficient	Clause 635	–	40				
							(viii) resistivity	Clause 637	2000 ohm cm	–				
							(ix) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	300 mg/l as SO_4				
							(x) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	0.06% as SO_4				
							(xi) chloride ion content	BS EN 1744-1	–	0.025%				
							(xii) pH value	BS 1377: Part 3	6	9				
							(xiii) sulfide and hydrogen sulfide	Standard textbook of qualitative inorganic analysis	–	Rapid blackening of lead acetate paper				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	L	–	Selected uniformly graded granular material	Upper bedding for corrugated steel buried structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt. Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9 and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A2 (crushed concrete) A3 (crushed bricks, masonry) G1 (red coal shale)	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2		6	L	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) resistivity	Clause 637	2000 ohm cm	–				
							(iii) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	300 mg/ l as SO_4				
							(iv) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	0.06% as SO_4				
							(v) chloride ion content	BS EN 1744-1	–	0.025%				
							(vi) pH value	BS 1377: Part 3	6	9				
							(vii) sulfide and hydrogen sulfide	Standard textbook of qualitative inorganic analysis	–	Rapid blackening of lead acetate paper				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	M	–	Selected granular material	Surround to corrugated steel buried structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt. Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9 and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A2 (crushed concrete) A3 (crushed bricks, masonry) G1 (red coal shale).	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	End product 90% of maximum dry density of BS 1377: Part 4 (Vibrating hammer method) unless otherwise stated in App 6/1	6	M	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) uniformity coefficient	See Note 5	5	–				
							(iii) plasticity index	BS 1377: Part 2	–	6				
							(iv) optimum mc	BS 1377: Part 4 (vibrating hammer method)	–	–				
							(v) mc	BS 1377: Part 2 See Note 4	Optimum mc -2%	Optimum mc +1%				
							(vi) MCV	Clause 632	App 6/1	App 6/1				
							(vii) Los Angeles coefficient	Clause 635	–	40				
							(viii) resistivity	Clause 637	2000 ohm cm	–				
							(ix) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	300 mg/l as SO_4				
							(x) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	0.06% as SO_4				
							(xi) chloride ion content	BS EN 1744-1	–	0.025%				
							(xii) pH value	BS 1377: Part 3	6	9				
							(xiii) sulfide and hydrogen sulfide	Standard textbook of qualitative inorganic analysis	–	Rapid blackening of lead acetate paper				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	N	–	Selected well graded granular material	Fill to structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, slag, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. Recycled aggregate except recycled asphalt. Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9 and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A2 (crushed concrete) A3 (crushed bricks, masonry) D2 (air cooled blast furnace slag) G1 (red coal shale).	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	End product 95% of maximum dry density of BS 1377: Part 4 (vibrating hammer method)	6	N	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) uniformity coefficient	See Note 5	10	–				
							(iii) Los Angeles coefficient	Clause 635	–	40				
							(iv) undrained shear parameters (c and φ)	Clause 633	App 6/1	–				
							(v) effective angle of internal friction (φ') and effective cohesion (c')	Clause 636	App 6/1	–				
							(vi) permeability	Clause 640	App 6/1	–				
							(vii) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(viii) MCV	Clause 632	App 6/1	App 6/1				
							(ix) slope stability test (where required in App 6/6)	Clause 610	App 6/6					

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	P	–	Selected granular material	Fill to structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, slag, chalk, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. (Properties (i), (ii) and (ix) in next column shall not apply to chalk.) Recycled aggregate except recycled asphalt. Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes; see Notes 8, 9 and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A2 (crushed concrete) A3 (crushed bricks, masonry) D2 (air cooled blast furnace slag) G1 (red coal shale).	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	End product 95% of maximum dry density of BS 1377: Part 4 (vibrating hammer method)	6	P	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) uniformity coefficient	See Note 5	5	–				
							(iii) IDD of chalk	Clause 634	–	App 6/1				
							(iv) Los Angeles coefficient	Clause 635	–	60				
							(v) undrained shear parameters (c and φ)	Clause 633	App 6/1	–				
							(vi) effective angle of internal friction (φ') and effective cohesion (c')	Clause 636	App 6/1	–				
							(vii) permeability	Clause 640	App 6/1	–				
							(viii) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(ix) MCV	Clause 632	App 6/1	App 6/1				
							(x) slope stability test (where required in App 6/6)	Clause 610	App 6/6					

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within: Lower	Acceptable Limits Within: Upper				
SELECTED GRANULAR FILL	6	Q	–	Selected granular material	Fill to structures	Natural gravel, natural sand, crushed gravel, crushed rock, crushed concrete, slag, chalk, well burnt colliery spoil or any combination thereof. None of these constituents shall include any argillaceous rock. (Properties (i), (ii) and (ix) in next column shall not apply to chalk.) Recycled aggregate except recycled asphalt. Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9 and 10: P (natural aggregates – except shale, siltstone or slate, see Note 7); A2 (crushed concrete) A3 (crushed bricks, masonry) D2 (air cooled blast furnace slag) G1 (red coal shale).	As for Class 1A, 1B or 1C with the addition of the following:				End product 95% of maximum dry density of BS 1377: Part 4 (vibrating hammer method)	6	Q	–
							(i) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	300 mg/ l as SO_4				
							(ii) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	0.06% as SO_4				
							(iii) chloride ion content	BS EN 1744-1	–	0.025%				
							(iv) pH value	BS 1377: Part 3	6	9				
							(v) sulfide and hydrogen sulfide	Standard textbook of qualitative inorganic analysis	–	Rapid blackening of lead acetate paper				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED GRANULAR FILL	6	R	–	Selected granular material	For stabilisation with lime and cement to form capping (Class 9F)	Any material, or combination of materials, other than unburnt colliery spoil and argillaceous rock. (Properties (i), (ii) and (iii) in next column, shall not apply to chalk.)	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2		6	R	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) mc	BS 1377: Part 2 See Note 4	App 6/1	–				
							(iii) liquid limit	BS 1377: Part 2	–	45				
							(iv) plasticity index	BS 1377: Part 2	–	20				
							(v) organic matter	BS 1377: Part 3	–	App 6/1				
							(vi) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	3000 mg/ l as SO_4				
							(vii) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	0.6% as SO_4				
							(viii) IDD of chalk	Clause 634	–	App 6/1				
	6	S	–	Selected well graded granular material	Filter layer below subbase	Crushed rock or sand. Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9 and 10: P (natural aggregates – except chalk, shale, siltstone or slate, see Note 7).	(i) grading	BS 1377: Part 2 (On-site)	Tab 6/2	Tab 6/2	–	6	S	–
								BS EN 933-2 (Imported onto site)	Tab 6/5	Tab 6/5				
							(ii) plasticity index	BS 1377: Part 2	–	Non-plastic				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED COHESIVE FILL	7	A	–	Selected cohesive material	Fill to structures	Any material or combination of materials, other than argillaceous rock and materials designated as Class 3 in the Contract. If chalk is used it shall form 100% of constituents. (Properties (i) and (iii) shall not apply to chalk.) (Properties (vii) and (viii) may be increased to 54% and 31% respectively for Lias Clay only and subject to the requirements of contract specific Appendix 6/6)	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	End product: 100% of maximum dry density of BS 1377 : Part 4 (2.5 kg rammer method) or a dry density corresponding to 5% air voids at field mc whichever is lower	7	A	–
							(ii) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(iii) MCV	Clause 632	App 6/1	App 6/1				
							(iv) undrained shear parameters (c and φ)	Clause 633	App 6/1	App 6/1				
							(v) effective angle of internal friction (φ') and effective cohesion (c')	Clause 636	App 6/1	App 6/1				
							(vi) IDD of chalk	Clause 634	App 6/1	App 6/1				
							(vii) liquid limit	BS 1377: Part 2	–	45				
							(viii) plasticity index	BS 1377: Part 2	–	25				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)			Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within: Lower	Acceptable Limits Within: Upper			
SELECTED COHESIVE FILL	7	B	–	Selected conditioned pulverised fuel ash cohesive material	Fill to structures and to reinforced soil	Conditioned material direct from power station dust collection system and to which a controlled quantity of water has been added	(i) mc	BS 1377: Part 2 See Note 4	To enable compaction to Clause 612		End product: 95% of maximum dry density of BS 1377 : Part 4 (2.5 kg rammer method)	7	B –
							(ii) bulk density	BS 1377: Part 9	App 6/1	App 6/1			
							(iii) undrained shear parameters (c and φ)	Clause 633	App 6/1	–			
							(iv) effective angle of internal friction (φ') and effective cohesion (c')	Clause 636	App 6/1	–			
							(v) coefficient of friction and adhesion (fill/ elements)	Clause 639	App 6/1	–			
							(vi) permeability	Clause 640	App 6/1	–			
							(vii) slope stability test (where required in App 6/6)	Clause 610	App 6/6				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED COHESIVE FILL	7	C	–	Selected wet cohesive material	Fill to reinforced soil	Any material, or combination of materials, other than unburnt colliery spoil, argillaceous rock and chalk. (Properties (viii), (ix), (x), (xi) and (xii) in next column only apply when metallic reinforcing elements, facing units or fastenings are used)	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 1	7	C	–
							(ii) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(iii) MCV	Clause 632	App 6/1	App 6/1				
							(iv) effective angle of internal friction (φ') and effective cohesion (c')	Clause 636	App 6/1	–				
							(v) coefficient of friction and adhesion (fill/ elements)	Clause 639	App 6/1	–				
							(vi) liquid limit	BS 1377: Part 2	–	45				
							(vii) plasticity index	BS 1377: Part 2	–	25				
							(viii) pH value	BS 1377: Part 3	Tab 6/3	Tab 6/3				
							(ix) chloride ion content	BS EN 1744-1	–	Tab 6/3				
							(x) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	Tab 6/3				
							(xi) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	Tab 6/3				
							(xii) resistivity	Clause 637	Tab 6/3	–				
							(xiii) redox potential	Clause 638	Tab 6/3	–				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED COHESIVE FILL	7	D	–	Selected stony cohesive material	Fill to reinforced soil	Any material, or combination of materials, other than unburnt colliery spoil, argillaceous rock and chalk. (Properties (vi), (vii), (viii), (ix), (x), (xi) and (xii) in next column only apply when metallic reinforcing elements, facing units or fastenings are used)	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 2	7	D	–
							(ii) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(iii) MCV	Clause 632	App 6/1	App 6/1				
							(iv) effective angle of internal friction (φ') and effective cohesion (c')	Clause 636	App 6/1	–				
							(v) coefficient of friction and adhesion (fill/ elements)	Clause 639	App 6/1	–				
							(vi) liquid limit	BS 1377: Part 2	–	45				
							(vii) plasticity index	BS 1377: Part 2	–	25				
							(viii) pH value	BS 1377: Part 3	Tab 6/3	Tab 6/3				
							(ix) chloride ion content	BS EN 1744-1	–	Tab 6/3				
							(x) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	Tab 6/3				
							(xi) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	Tab 6/3				
							(xii) resistivity	Clause 637	Tab 6/3	–				
							(xiii) redox potential	Clause 638	Tab 6/3	–				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)			Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within: Lower	Acceptable Limits Within: Upper				
SELECTED COHESIVE FILL	7	E	–	Selected cohesive material	For stabilisation with lime to form capping (Class 9D)	Any material, or combination of materials, other than unburnt colliery spoil	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	Not applicable	7	E	–
							(ii) mc	BS 1377: Part 2 See Note 4	–	App 6/1				
							(iii) MCV	Clause 632	App 6/1	–				
							(iv) plasticity index	BS 1377: Part 2	10	–				
							(v) organic matter	BS 1377: Part 3	–	App 6/1				
							(vi) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	App 6/1				
							(vii) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	App 6/1				
							(viii) total potential sulfate (TS) content	BS EN 1744-1 clause 11	–	App 6/1				
	7	F	–	Selected silty cohesive material	For stabilisation with cement to form capping (Class 9B)	Any material, or combination of materials, other than chalk, unburnt colliery spoil and argillaceous rock	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	Not applicable	7	F	–
							(ii) uniformity coefficient	See Note 5	5	–				
							(iii) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(iv) MCV	Clause 632	App 6/1	App 6/1				
							(v) liquid limit	BS 1377: Part 2	–	45				
							(vi) plasticity index	BS 1377: Part 2	–	20				
							(vii) organic matter	BS 1377: Part 3	–	App 6/1				
							(viii) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	App 6/1				
							(ix) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	App 6/1				
							(x) total potential sulfate (TS) content	BS EN 1744-1 clause 11	–	App 6/1				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
SELECTED COHESIVE FILL	7	G	–	Selected conditioned pulverised fuel ash cohesive material	For stabilisation with cement to form capping (Class 9C)	Conditioned material direct from power station dust collection system and to which a controlled quantity of water has been added	(i) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1		7	G	–
							(ii) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	3000 mg/l as SO_4				
							(iii) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	0.6% as SO_4				
							(iv) total potential sulfate (TS) content	BS EN 1744-1 clause 11	–	1.2% as SO_4				
	7	H	–	Wet, dry, stony or silty cohesive material and chalk	Overlying fill for corrugated steel buried structures	As Class 2A, 2B, 2C, 2D general cohesive fill material or Class 3 chalk fill material, except that argillaceous rock, slag, PFA or any combination thereof shall not be used	As for Class 2A, 2B, 2C, 2D or 3 with the addition of the following					7	H	–
							(i) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	300 mg/l as SO_4				
							(ii) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	0.06% as SO_4				
							(iii) chloride ion content	BS EN 1744-1	–	0.025%				
							(iv) pH value	BS 1377: Part 3	6	9				
	7	I	–	Selected cohesive material	For stabilisation with lime and cement to form capping (Class 9E)	Any material, or combination of materials, other than unburnt colliery spoil	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	Not applicable	7	I	–
							(ii) mc	BS 1377: Part 2 See Note 4	–	App 6/1				
							(iii) MCV	Clause 632	App 6/1	–				
							(iv) plasticity index	BS 1377: Part 2	10	–				
							(v) organic matter	BS 1377: Part 3	–	App 6/1				
							(vi) water soluble (WS) sulfate content	BS EN 1744-1 clause 10	–	App 6/1				
							(vii) oxidisable sulfides (OS) content	BS EN 1744-1 clause 13	–	App 6/1				
							(viii) total potential sulfate (TS) content	BS EN 1744-1 clause 11	–	App 6/1				

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
MISC FILL	8	–	–	Class 1, Class 2 or Class 3 material	Lower trench fill	Any material; except no stones or lumps of clay shall be retained on the 40mm test sieve. Recycled aggregate Where material is imported onto site which is not 'as dug' it shall be aggregate conforming to BS EN 13242 from one or more of the following source codes, see Notes 8, 9 and 10: P (natural aggregates); A (construction and demolition recycling industries) B1 (municipal incinerator bottom ash (MIBA)) D2 (air cooled blast furnace slag) D3 (basic oxygen furnace slag) D4 (electric arc furnace slag (EAF C)) G (mining and quarry industry).	(i) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1	Tab 6/4	8	–	–
							(ii) MCV	Clause 632	App 6/1	App 6/1				
STABILISED MATERIALS	9	A	–	Cement stabilised well graded granular material	Capping	Class 6E with addition of cement according to Clause 614	(i) pulverisation	BS EN 13286-48	60%	–	Tab 6/4 Method 6	9	A	–
							(ii) bearing ratio	BS EN 13286-47	App 6/1	–				
							(iii) mc	BS EN 13286-2	App 6/1	App 6/1				
	9	B	–	Cement stabilised silty cohesive material	Capping	Class 7F with addition of cement according to Clause 614	(i) pulverisation	BS EN 13286-48	App 6/1	–	Tab 6/4 Method 7	9	B	–
							(ii) MCV immediately before compaction	Clause 632	App 6/1	12				
							(iii) bearing ratio	BS EN 13286-47	App 6/1	–				
							(iv) mc	BS EN 13286-2	App 6/1	App 6/1				
	9	C	–	Cement stabilised conditioned pulverised fuel ash cohesive material	Capping	Class 7G with addition of cement according to Clause 614	(i) pulverisation	BS EN 13286-48	60%	–	End product 95% of maximum dry density BS EN 13286-47 (2.5 kg rammer method)	9	C	–
							(ii) bearing ratio	BS EN 13286-47	App 6/1	–				
							(iii) mc	BS EN 13286-2	To enable compaction to Clause 612					

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TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
STABILISED MATERIALS	9	D	–	Lime stabilised cohesive material	Capping	Class 7E with addition of lime according to Clause 615	(i) pulverisation	BS EN 13286-48	30%	–	Tab 6/4 Method 7	9	D	–
							(ii) MCV immediately before compaction	Clause 632	App 6/1	App 6/1				
							(iii) bearing ratio	BS EN 13286-47	App 6/1	–				
							(iv) mc	BS EN 13286-2	App 6/1	App 6/1				
	9	E	–	Lime and cement stabilised cohesive material	Capping	Class 7I with addition of lime and cement according to Clause 643	(i) pulverisation	BS EN 13286-48	30%	–	Tab 6/4 Method 7	9	E	–
							(ii) MCV immediately before completion	Clause 632	App 6/1	App 6/1				
							(iii) bearing ratio	BS EN 13286-47	App 6/1	–				
							(iv) mc	BS EN 13286-2	App 6/1	App 6/1				
	9	F	–	Lime and cement stabilised well graded granular material	Capping	Class 6R with addition of lime and cement according to Clause 643	(i) pulverisation	BS EN 13286-48	60%	–	Tab 6/4 Method 6	9	F	–
							(ii) bearing ratio	BS EN 13286-47	App 6/1	–				
							(iii) mc	BS EN 13286-2 See Note 4	App 6/1	App 6/1				

Footnotes to Table 6/1

1	(02/16) App = contract specific Appendix
2	(02/16) Tab = Table
3	(02/16) Where in the Acceptable Limits column reference is made to App 6/1, only those properties having limits ascribed to them in contract specific Appendix 6/1 shall apply. Where contract specific Appendix 6/1 gives limits for other properties not listed in this Table such limits shall also apply.
4	(02/16) Where BS 1377: Part 2 is specified for mc, this shall mean BS 1377: Part 2 where the material is a soil or BS EN 1097-5 where the material is required to conform to a harmonised European Standard.
5	(02/16) Uniformity coefficient is defined as the ratio of the particle diameters D_{60} to D_{10} on the particle-size distribution curve, where: D_{60} = particle diameter at which 60% of the soil by weight is finer D_{10} = particle diameter at which 10% of the soil by weight is finer
6.	(02/16) The limiting values for Class U1B material are given in contract specific Appendix 6/14 and contract specific Appendix 6/15.
7	(02/16) For works in Wales see sub-Clause 601.21W.
8	(02/16) Where material source codes are referenced these are as listed in Table 6/7.
9	(02/16) Where materials are required to be aggregates conforming to BS EN 13242 materials certificated as being compliant with BS EN 13285 are acceptable for use provided that they meet all the specification requirements and the Declaration of Performance for constituent parts to BS EN 13242 are provided to the Overseeing Organisation.
10	(02/16) Materials shall comply with the current Environmental Regulations at the time of use. Reference shall be made to Annex ZA (informative) of BS EN 13242.

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TABLE 6/2: (02/17) Grading Requirements for Acceptable Earthworks Materials Other Than Classes 6F4, 6F5 and 6S

Class	Size (mm)		Size (mm) BS Series													Size (microns) BS Series				Size (micr-ons)	Class
	Percentage by Mass Passing the Size Shown																				
	500	300	125	90	75	37.5	28	20	14	10	6.3	5	3.35	2	1.18	600	300	150	63	2	
1A		100	95-100																<15		1A
1B			100																<15		1B
1C	100		10-95													0-25			15		1C
2A & 2B			100											80-100					15-100		2A & 2B
2C			100											15-80					15-80		2C
2D			100																80-100	0-20	2D
6A	100									0-100		0-85				0-45			0-5		6A
6B	100		0-10																		6B
6C			100			0-100					0-100		0-35	0-10		0-2					6C
6D										100		89-100		60-100	30-100	15-80	5-48	0-15 except 0-20 for crushed rock			6D
6E & 6R			100	85-100						25-100						10-100				<15	6E & 6R
6F1					100	75-100				40-95		30-85				10-50			<15		6F1
6F2			100	80-100	65-100	45-100				15-60		10-45				0-25			0-12		6F2
6F3			100	80-100	65-100	45-100				15-60		10-45				0-25			0-12		6F3
6H								100				60-100			15-45	0-25		0-5			6H
6I & 6J			100		85-100				25-100					15-100		9-100			<15		6I & 6J
6K								100											0-10		6K
6L										100		89-100		60-100	30-100	15-100	5-70	0-15 except 0-20 for crushed rock			6L

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TABLE 6/2: (02/16) Grading Requirements for Acceptable Earthworks Materials (continued)

Percentage by Mass Passing the Size Shown																					
Class	Size (mm)		Size (mm) BS Series													Size (microns) BS Series				Size (micr-ons)	Class
	500	300	125	90	75	37.5	28	20	14	10	6.3	5	3.35	2	1.18	600	300	150	63	2	
6M					100														0-10		6M
6N & 6P					100														<15		6N & 6P
6S					100									60-100		30-90		4-45	0-16		6S
7A					100														15-100		7A
7C			100		85-100				83-100					80-100		60-100			15-45	0-20	7C
7D			100		85-100				40-90					15-79		15-75			15-45	0-20	7D
7E					100		95-100												15-100		7E
7F			100																15-100		7F
7I					100		95-100												15-100		7I

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TABLE 6/3: (02/16) **Limits of Material Properties of Fill for Use With Metal Components in Reinforced Soil and Anchored Earth Structures for Class 6H, 6I, 6J, 7C and 7D Materials**

Reinforcing Element Material	Properties of Fill								
	pH Value		Max Chloride Ion Content %	Max Organic Content %	Max Water Soluble (WS) Sulfate Content mg/l as SO_4	Maximum Oxidisable Sulfides (OS) Content % as SO_4	Minimum Restivity Ohm.cm	Minimum Redox Potential volts	Microbial Activity Index
	Min	Max							
Galvanised Steel	5	10	0.02	0.2	300	0.06	5000	0.40	))) Less than 5))
Stainless Steel	5	10	0.025	0.2	600	0.12	3000	0.35	

NOTES:

1 (02/16) A method of calculating the Microbial Activity Index may be obtained by reference to TRRL Contractor Report 54 'Soil Corrosivity Assessment'.

2 (02/16) The corrosion potential of frictional fill shall be assessed from resistivity, pH, chloride, water soluble sulfate and oxidisable sulfides tests. For cohesive soil it will be necessary to test additionally for organic content. Should either organic content or sulfate be in excess of the specified levels, then tests shall also be included for Redox Potential and Microbial Activity Index.

3 (02/16) The water soluble sulfate content and oxidisable sulfides content shall be determined in accordance with the methods described in BS EN 1744-1 clause 10, 11 and 13.

4 (02/16) Methods of test (except for Microbial Activity Index, water soluble sulfate content and oxidisable sulfides content) are given in BS 1377: Part 3.

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TABLE 6/4: (02/16) Method Compaction for Earthworks Materials: Plant and Methods (Method 1 to Method 6) (This Table is to be read in conjunction with sub-Clause 612.10)

Type of Compaction Plant	Ref No.	Category	Method 1		Method 2		Method 3		Method 4		Method 5		Method 6		
			D	N#	D	N#	D	N#	D	N	D	N	N for D = 110 mm	N for D = 150 mm	N for D = 250 mm
Smoothed wheeled roller (or vibratory roller operating without vibration)		Mass per metre width of roll:													
	1	over 2100 kg up to 2700 kg	125	8	125	10	125	10*	175	4	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 2700 kg up to 5400 kg	125	6	125	8	125	8*	200	4	unsuitable		16	unsuitable	unsuitable
	3	over 5400 kg	150	4	150	8	unsuitable		300	4	unsuitable		8	16	unsuitable
Grid roller		Mass per metre width of roll:													
	1	over 2700 kg up to 5400 kg	150	10	unsuitable		150	10	250	4	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 5400 kg up to 8000 kg	150	8	125	12	unsuitable		325	4	unsuitable		20	unsuitable	unsuitable
	3	over 8000 kg	150	4	150	12	unsuitable		400	4	unsuitable		12	20	unsuitable
Deadweight tamping roller		Mass per metre width of roll:													
	1	over 4000 kg up to 6000 kg	225	4	150	12	250	4	350	4	unsuitable		12	20	unsuitable
	2	over 6000 kg	300	5	200	12	300	3	400	4	unsuitable		8	12	20
Pneumatic-tyred roller		Mass per wheel:													
	1	over 1000 kg up to 1500 kg	125	6	unsuitable		150	10*	240	4	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 1500 kg up to 2000 kg	150	5	unsuitable		unsuitable		300	4	unsuitable		unsuitable	unsuitable	unsuitable
	3	over 2000 kg up to 2500 kg	175	4	125	12	unsuitable		350	4	unsuitable		unsuitable	unsuitable	unsuitable
	4	over 2500 kg up to 4000 kg	225	4	125	10	unsuitable		400	4	unsuitable		unsuitable	unsuitable	unsuitable
	5	over 4000 kg up to 6000 kg	300	4	125	10	unsuitable		unsuitable		unsuitable		12	unsuitable	unsuitable
	6	over 6000 kg up to 8000 kg	350	4	150	8	unsuitable		unsuitable		unsuitable		12	unsuitable	unsuitable
	7	over 8000 kg up to 12000 kg	400	4	150	8	unsuitable		unsuitable		unsuitable		10	16	unsuitable
	8	over 12000 kg	450	4	175	6	unsuitable		unsuitable		unsuitable		8	12	unsuitable
Vibratory tamping roller		Mass per metre width of a vibrating roll:													
	1	over 700 kg up to 1300 kg	100	12	100	12	150	12	100	10	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 1300 kg up to 1800 kg	125	12	125	12	175	12*	175	8	unsuitable		12	unsuitable	unsuitable
	3	over 1800 kg up to 2300 kg	150	12	150	12	200	12*	unsuitable		unsuitable		8	12	unsuitable
	4	over 2300 kg up to 2900 kg	150	9	150	9	250	12*	unsuitable		400	5	6	10	unsuitable
	5	over 2900 kg up to 3600 kg	200	9	200	9	275	12*	unsuitable		500	6	6	10	unsuitable
	6	over 3600 kg up to 4300 kg	225	9	225	9	300	12*	unsuitable		600	6	4	8	unsuitable
	7	over 4300 kg up to 5000 kg	250	9	250	9	300	9*	unsuitable		700	6	3	7	12
	8	over 5000 kg	275	9	275	9	300	7*	unsuitable		800	6	3	6	10

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TABLE 6/4: (02/16) Method Compaction for Earthworks Materials: Plant and Methods (Method 1 to Method 6) (This Table is to be read in conjunction with sub-Clause 612.10) (Continued)

Type of Compaction Plant	Ref No.	Category	Method 1		Method 2		Method 3		Method 4		Method 5		Method 6		
			D	N#	D	N#	D	N#	Δ	N	D	N	N for D = 110 mm	N for D = 150 mm	N for D = 250 mm
Vibratory roller		Mass per metre width of vibratory roll:													
	1	over 270 kg up to 450 kg	unsuitable		75	16	150	16	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable
	2	over 450 kg up to 700 kg	unsuitable		75	12	150	12	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable
	3	over 700 kg up to 1300 kg	100	12	125	10	150	6	125	10	unsuitable		16	unsuitable	unsuitable
	4	over 1300 kg up to 1800 kg	125	8	150	8	200	10*	175	4	unsuitable		6	16	unsuitable
	5	over 1800 kg up to 2300 kg	150	4	150	4	225	12*	unsuitable		unsuitable		4	6	12
	6	over 2300 kg up to 2900 kg	175	4	175	4	250	10*	unsuitable		400	5	3	5	11
	7	over 2900 kg up to 3600 kg	200	4	200	4	275	8*	unsuitable		500	5	3	5	10
	8	over 3600 kg up to 4300 kg	225	4	225	4	300	8*	unsuitable		600	5	2	4	8
	9	over 4300 kg up to 5000 kg	250	4	250	4	300	6*	unsuitable		700	5	2	4	7
	10	over 5000 kg	275	4	275	4	300	4*	unsuitable		800	5	2	3	6
Vibrating plate compactor		Mass per m^2 of base plate:													
	1	over 880 kg up to 1100 kg	unsuitable		unsuitable		75	6	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable
	2	over 1100 kg up to 1200 kg	unsuitable		75	10	100	6	75	10	unsuitable		unsuitable	unsuitable	unsuitable
	3	over 1200 kg up to 1400 kg	unsuitable		75	6	150	6	150	8	unsuitable		unsuitable	unsuitable	unsuitable
	4	over 1400 kg up to 1800 kg	100	6	125	6	150	4	unsuitable		unsuitable		8	unsuitable	unsuitable
	5	over 1800 kg up to 2100 kg	150	6	150	5	200	4	unsuitable		unsuitable		5	8	unsuitable
	6	over 2100 kg	200	6	200	5	250	4	unsuitable		unsuitable		3	6	12
Vibro-tamper		Mass:													
	1	over 50 kg up to 65 kg	100	3	100	3	150	3	125	3	unsuitable		4	8	unsuitable
	2	over 65 kg up to 75 kg	125	3	125	3	200	3	150	3	unsuitable		3	6	12
	3	over 75 kg up to 100 kg	150	3	150	3	225	3	175	3	unsuitable		2	4	10
	4	over 100 kg	225	3	200	3	225	3	250	3	unsuitable		2	4	10
Power rammer		Mass:													
	1	100 kg up to 500 kg	150	4	150	6	unsuitable		200	4	unsuitable		5	8	unsuitable
	2	over 500 kg	275	8	275	12	unsuitable		400	4	unsuitable		5	8	14
Dropping-weight compactor		Mass of rammer over 500 kg weight drop:													
	1	over 1 m up to 2 m	600	4	600	8	450	8	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable
	2	over 2 m	600	2	600	8	unsuitable		unsuitable		unsuitable		unsuitable	unsuitable	unsuitable

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TABLE 6/4: (02/16) Method Compaction for Earthworks Materials: Plant and Methods (Method 7) (This Table is to be read in conjunction with sub-Clause 612.10) (Continued)

Type of Compaction Plant	Ref~ No.	Category	Method 7	
			N for D = 150 mm	N for D = 250mm
Smooth wheeled roller (or vibratory roller operating without vibration)		Mass per metre width of roll:		
	1	over 2100 kg up to 2700 kg	unsuitable	unsuitable
	2	over 2700 kg up to 5400 kg	unsuitable	unsuitable
	3	over 5400 kg	12	unsuitable
Grid roller		Mass per metre width of roll:		
	1	over 2700 kg up to 5400 kg	unsuitable	unsuitable
	2	over 5400 kg up to 8000 kg	16	unsuitable
	3	over 8000 kg	8	unsuitable
Deadweight tamping roller		Mass per metre width of roll:		
	1	over 4000 kg up to 6000 kg	4	8
	2	over 6000 kg	3	6
Pneumatic-tyred roller		Mass per wheel:		
	1	over 1000 kg up to 1500 kg	unsuitable	unsuitable
	2	over 1500 kg up to 2000 kg	12	unsuitable
	3	over 2000 kg up to 2500 kg	6	unsuitable
	4	over 2500 kg up to 4000 kg	5	unsuitable
	5	over 4000 kg up to 6000 kg	4	16
	6	over 6000 kg up to 8000 kg	unsuitable	8
	7	over 8000 kg up to 12000 kg	unsuitable	4
	8	over 12000 kg	unsuitable	4
Vibratory tamping roller		Mass per metre width of vibrating roll:		
	1	over 700 kg up to 1300 kg	unsuitable	unsuitable
	2	over 1300 kg up to 1800 kg	unsuitable	unsuitable
	3	over 1800 kg up to 2300 kg	16	unsuitable
	4	over 2300 kg up to 2900 kg	12	unsuitable
	5	over 2900 kg up to 3600 kg	10	unsuitable
	6	over 3600 kg up to 4300 kg	8	16
	7	over 4300 kg up to 5000 kg	7	14
	8	over 5000 kg	6	12
Vibratory roller		Mass per metre width of vibrating roll:		
	1	over 270 kg up to 450 kg	unsuitable	unsuitable
	2	over 450 kg up to 700 kg	unsuitable	unsuitable
	3	over 700 kg up to 1300 kg	unsuitable	unsuitable
	4	over 1300 kg up to 1800 kg	unsuitable	unsuitable
	5	over 1800 kg up to 2300 kg	12	unsuitable
	6	over 2300 kg up to 2900 kg	10	unsuitable
	7	over 2900 kg up to 3600 kg	10	unsuitable
	8	over 3600 kg up to 4300 kg	8	unsuitable
	9	over 4300 kg up to 5000 kg	8	unsuitable
	10	over 5000 kg	6	12
Vibratory plate compactor		Mass per m^2 of base plate:		
	1	over 880 kg up to 1100 kg	unsuitable	unsuitable
	2	over 1100 kg up to 1200 kg	unsuitable	unsuitable
	3	over 1200 kg up to 1400 kg	unsuitable	unsuitable
	4	over 1400 kg up to 1800 kg	10	unsuitable
	5	over 1800 kg up to 2100 kg	8	unsuitable
	6	over 2100 kg	6	unsuitable
Vibro-tamper		Mass:		
	1	over 50 kg up to 65 kg	unsuitable	unsuitable
	2	over 65 kg up to 75 kg	unsuitable	unsuitable
	3	over 75 kg up to 100 kg	unsuitable	unsuitable
	4	over 100 kg	8	unsuitable
Power rammer		Mass:		
	1	100 kg up to 500 kg	8	unsuitable
	2	over 500 kg	6	10
Dropping weight compactor		Mass of rammer over 500 kg height drop:		
	1	over 1 m up to 2 m	unsuitable	unsuitable
	2	over 2 m	unsuitable	unsuitable

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TABLE 6/5: (02/16) Imported Onto Site Grading Requirements for Class 6 Acceptable Earthworks Materials

Percentage by Mass Passing the Size Shown																				
Class	Size (mm)		Size (mm) BS EN 933-2 Series													Size (microns) BS EN 933-2 Series				Class
	500	300	125	80	63	40	31.5	20	16	10	8	6.3	4	2	1	500	250	125	63	0
6A	100									0-100		0-85				0-45			0-5	6A
6B	100		0-10																	6B
6C			100			0-100						0-100	0-35	0-10		0-2				6C
6D										100			85-100	60-100	30-100	15-80	5-48	0-15 except 0-20 for crushed rock		6D
6E & 6R			100	85-100						25-100						10-100			<15	6E & 6R
6F3			100	75-99		50-90		30-75		15-60				0-35					0-12	6F3
6F4					100		75-99		50-90		30-75		15-60		0-35				<15	6F4
6F5			100	75-99		50-90		30-75		15-60				0-35					0-12	6F5
6H								100				60-100			15-45	0-25		0-5		6H
6I & 6J			100	85-100					25-100					15-100		9-100			<15	6I & 6J
6K								100											0-10	6K
6L										100			85-100	60-100	30-100	15-100	5-70	0-15 except 0-20 for crushed rock		6L
6M				100															0-10	6M
6N & 6P				100															<15	6N & 6P
6S					100									60-100		30-90		8-45	0-16	6S

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TABLE 6/6: (02/16) **Records and Reports - Information Required**

Ground Treatment	In situ Testing
For each column/area treated: Date Contract title Area identification Unique grid location Ground level at commencement Material used Approximate column diameter Depth of penetration of each compaction point Vibrator power consumption during operation Jetting pressure (where applicable) Duration of penetration Duration of compaction Obstructions and delays Number and type of tests carried out	For each area tested: Date Contract Title Area identification Test position, co-ordinates and level Method of test used All information required by appropriate British Standard test procedure

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TABLE 6/7 (02/16) Material Sources and Source Codes for Imported Materials

This table is taken from BS EN 13242:2013 which was published on 31st May 2013 and subsequently withdrawn on 10th January 2014. All other specification requirements which reference BS EN 13242 shall be taken as reference to the version of that standard current at the Contract Reference Document Date unless otherwise detailed in the contract specific specification.

Source Code	Source	Sub-Code	Specific Material
P	Natural Aggregates	P	All petrographic types included in BS EN 932-3
A	Construction and demolition recycling industries	A1	Reclaimed asphalt
		A2	Crushed concrete
		A3	Crushed bricks, masonry
		A4	Mix of A1, A2 and A3
B	Municipal solid waste incineration industry	B1	Municipal incinerator bottom ash (excluding fly ash) (MIBA)
		B2	Municipal incinerator fly ash (MIFA)
C	Coal Power Generation Industry	C1	Coal fly ash
		C2	Fluidised bed combustion fly ash (FBCFA)
		C3	Boiler slag
		C4	Coal bottom ash
		C5	Fluidised bed combustion bottom ash (FBC bottom ash)
D	Iron and steel industry	D1	Granulated blast furnace slag (GBS)
		D2	Air-cooled blast furnace slag (ABS)
		D3	Basic oxygen furnace slag (converter slag, BOS)
		D4	Electric arc furnace slag (from carbon steel production, EAF C)
		D5	Electric arc furnace slag (from stainless/high alloy steel production, EAF S)
		D6	Ferrochromium slag
E	Non ferrous steel industry	E1	Copper slag
		E2	Molybdenum slag
		E3	Zinc slag
		E4	Phosphorous slag
F	Foundry industry	F1	Foundry sand
		F2	Foundry cupola furnace slag
G	Mining and quarry industry	G1	Red coal shale
		G2	Refuse from hard coal mining (black coal shale)
		G3	Pre-selected all-in from quarry/mining
		G4	Spent oil shale
H	Maintenance dredging works	H1	Dredge spoil sand
		H2	Dredge spoil clay
I	Miscellaneous	I1	Excavated soil
		I2	Paper sludge ash
		I3	Sewage sludge incineration ash (municipal)
		I4	Biomass ash
		I5	Crushed glass
		I6	Expanded clay

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NATIONAL ALTERATIONS OF THE OVERSEEING ORGANISATION OF SCOTLAND

601TS (02/16) Classification, Definitions and Uses of Earthworks Materials

(02/16) General

0 (02/16) This Series is part of the Specification for Highway Works. Whilst this Series is particularly relevant to the subject matter in its title it must be read in conjunction with the general requirements in Series 000 and 100 and with all other Series relevant to the specification for the particular works to be undertaken.

(02/16) General Classification

1 (02/16) Earthworks materials shall fall into one or other of the following general classifications:

(i) acceptable material: material excavated from within the site or imported on to the site which meets the requirements of Table 6/1 and contract specific Appendix 6/1 for acceptability for use in the permanent works;

(ii) unacceptable material Class U1A as defined in sub-Clauses 2(i)(a) and 2(i)(b) of this Clause: material excavated from within the site which, unless processed so that it meets the requirements of Table 6/1 and contract specific Appendix 6/1, shall not be used in the permanent works;

(iii) unacceptable material Class U1B as defined in sub-Clause 2(ii)(a) of this Clause: material excavated from within the site which, unless processed so that it meets the requirements of Table 6/1 and contract specific Appendix 6/1, shall not be used in the permanent works; and

(iv) unacceptable material Class U2 as defined in sub-Clause 3(i) of this Clause: material excavated from within the site which shall not be used in the permanent works.

(02/16) Unacceptable Materials

2 (02/16) Unacceptable material Classes U1A and U1B:

(i) unacceptable material Class U1A shall be:

(a) material which does not comply with the permitted constituents and material properties of Table 6/1 and contract specific Appendix 6/1 for acceptable material; and

(b) material, or constituents of materials, composed of the following unless otherwise described in contract specific Appendix 6/1:

- peat, materials from swamps, marshes and bogs;
- logs, stumps and perishable material;
- materials in a frozen condition;
- clay having a liquid limit determined in accordance with BS 1377: Part 2, exceeding 90 or plasticity index determined in accordance with BS 1377: Part 2, exceeding 65;
- material susceptible to spontaneous combustion except unburnt colliery spoil complying with sub-Clause 15 of this Clause;

(ii) unacceptable material Class U1B shall be:

(a) contaminated materials, including controlled wastes (as defined in the Environmental Protection Act 1990 Part IIA) whose level of contamination is above that given either in contract specific Appendix 6/14 or in contract specific Appendix 6/15, but excluding all special wastes (as defined in the Special Waste Amendment (Scotland) Regulations 2004) and radioactive wastes (as defined in the Radioactive Substances Act 1993).

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3 (02/16) Unacceptable material Class U2 shall be:

(i) special waste (as defined in the Special Waste Scotland (Amendment) Regulations 2004) and radioactive waste (as defined in the Radioactive Substances Act 1993).

4 (02/16) Where required in contract specific Appendix 6/1, unacceptable material (other than Class U2) shall be processed by mechanical, chemical or other means to render the material acceptable for use in the permanent works in accordance with the requirements of Table 6/1 and contract specific Appendix 6/1.

(02/16) **Definitions**

5 (02/16) Where source codes are referred to these shall be for materials from the sources listed in Table 6/7.

6 (02/16) Chalk shall mean:

(i) any porous material of natural origin composed essentially of calcium carbonate and identified as chalk on the maps produced by the British Geological Survey;

(ii) material designated as Class 3 in contract specific Appendix 6/1.

7 (02/16) Argillaceous rock shall mean shales mudstones siltstones slates and micaceous schists composed of particles of clay and silt and mica. It shall include unburnt colliery spoil. Where argillaceous rock is imported onto the site, it shall be aggregate complying with BS EN 13242 from source codes P (natural aggregates described as shale, siltstone or slate), or G2 (refuse from hard coal mining (black coal shale)).

8 (02/16) Pulverised-fuel ash shall mean solid material extracted by electrostatic and mechanical means from the flue gases of furnaces fired with pulverised bituminous coal. It shall have a maximum particle size of 3 mm. Where pulverised-fuel ash is imported onto the site, it shall be aggregate complying with BS EN 13242 from source code C1 (coal fly ash).

9 (02/16) Furnace bottom ash shall mean agglomerated pulverised-fuel ash obtained from the bottom of the power station furnace and having particle size no larger than 10 mm. Where furnace bottom ash is imported onto the site, it shall be aggregate complying with BS EN 13242 from source code C4 (coal bottom ash).

10 (02/16) Formation shall be the top surface of capping. Where no capping is required formation shall be the top surface of earthworks at the underside of sub-base, unless otherwise shown on the drawings.

11 (02/16) Sub-formation shall be the top surface of earthworks at the underside of capping.

12 (02/16) Stabilisation shall mean the spreading of cement or lime or both on a layer of deposited or intact granular or cohesive material, and the subsequent process of pulverising and mixing followed by appropriate compaction to form the whole or a constituent layer of a capping.

13 (02/16) Where 'recycled aggregate' is used in this Series, the material shall be aggregate resulting from the processing of inorganic or mineral material previously used in construction and shall have been tested in accordance with Clause 710. It shall not contain more than 1% other materials (Class X), not more than 50% in Class Ra (bituminous materials) and not more than 25% in Class Rg (crushed glass). Where 'recycled aggregate' is imported onto the site, it shall be aggregate complying with BS EN 13242 from source code A (construction and demolition recycling industries).

Where 'recycled aggregate except recycled asphalt' is used in this Series, the aggregate shall have been tested in accordance with Clause 710. It shall not contain more than 1% other materials (Class X), not more than 1% in Class Ra (bituminous materials) and not more than 5% in Class Rg (crushed glass). Where 'recycled aggregate except recycled asphalt' is imported onto the site, it shall be aggregate complying with BS EN 13242 from source codes A2 (crushed concrete) and/or A3 (crushed bricks, masonry).

14 (02/16) 'As dug' shall mean material that has been excavated, transported and placed without any processing. Where imported material undergoes any processing, including cleaning and sorting, it will not be deemed 'as dug' and thus shall be aggregate complying with BS EN 13242.

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(02/16) **Use of Fill Materials**

15 (02/16) In addition to any grading requirements the maximum particle size of any fill material shall be no more than two-thirds of the compacted layer thickness except that cobbles having an equivalent diameter of more than 150 mm shall not be deposited beneath verges or central reserves within 1.30 m of the finished surface.

16 (02/16) Material placed within 500 mm, or any other distances described in contract specific Appendix 6/3, of concrete, cement bound materials, other cementitious materials or stabilised capping forming part of the permanent works shall conform to, as appropriate, the following requirements.

(i) Materials shall conform to the following criteria:

(a) Water-soluble sulfate (WS) content determined in accordance with BS EN 1744-1 clause 10 shall not exceed 1500 mg of sulfate (as SO_4) per litre;

(b) Total sulfur (TS) content determined in accordance with BS EN 1744-1 clause 11 expressed as (S) shall not exceed 1% for aggregates other than air cooled blast furnace slag or 2% for air cooled blast furnace slag.

(ii) Materials shall conform to at least one of the following options:

(a) When described in accordance with BS EN 932-3 and BS EN 13242 Annex A, limestone, chalk, dolomite, blast furnace slag, steel slag or crushed concrete are predominant

or

(b) The sulfide content of the mixture determined in accordance with BS EN 1744-1 Clause 13 is less than 0.5% (as SO_4).

When determining WS, TS or sulfide content, at least five samples of each material shall be tested. The mean of the highest two values shall be used for comparison with the limiting values. This shall also apply if six to nine results are available. If ten or more results are available, the mean of the highest 20% of the results shall be used for comparison with the limiting values.

17 (02/16) Material placed within 500 mm, or any other distances described in contract specific Appendix 6/3, of metallic structural elements forming part of the permanent works shall conform, as appropriate, to the following requirements.

(i) Materials shall conform to the following criteria:

(a) Water-soluble sulfate (WS) content determined in accordance with BS EN 1744-1 clause 10 shall not exceed 300 mg of sulfate (as SO_4) per litre; and

(b) Total sulfur (TS) content determined in accordance with BS EN 1744-1 clause 11 expressed as (S) shall not exceed 1% for aggregates other than air cooled blast furnace slag or 2% for air cooled blast furnace slag.

(ii) Materials shall conform to at least one of the following options:

(a) When described in accordance with BS EN 932-3 and BS EN 13242 Annex A, limestone, chalk, dolomite, blast furnace slag, steel slag or crushed concrete are predominant;

or

(b) The sulfide content of the mixture determined in accordance with BS EN 1744-1 Clause 13 is less than 0.06% (as SO_4).

When determining WS, TS or sulfide content, at least five samples of each material shall be tested. The mean of the highest two values shall be used for comparison with the limiting values. This shall also applies apply if six to nine results are available. If ten or more results are available, the mean of the highest 20% of the results shall be used for comparison with the limiting values.

The requirements in (i) and (ii) above shall not apply to metallic elements protected by concrete or ancillary metallic items such as the tops of chambers and gullies.

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18 (02/16) Unburnt colliery spoil may be used as general fill provided it is compacted in compliance with Clause 612 and complies with the requirements of contract specific Appendix 6/1.

19 (02/16) Pulverised-fuel ash shall not be placed within the dimension described in contract specific Appendix 6/3, below sub-formation or formation.

20 (02/16) Where pulverised-fuel ash is used, the Contractor shall for each consignment, make available to the Overseeing Organisation a record of the type and source from which it was obtained and a certificate of results of tests showing that the material complies with the requirements of Table 6/1.

632TS (02/16) Determination of Moisture Condition Value (MCV) of Earthworks Materials in Scotland

1 (02/16) Where the Moisture Condition Value (MCV) is required in contract specific Appendix 6/1, the MCV determination shall be carried out in accordance with TRL Report 273, Appendix A, Sections 1 to 3.

2 (02/16) Where the natural moisture content MCV is required in contract specific Appendix 6/1, the MCV determination shall be carried out in accordance with TRL Report 273, Appendix A, Sections 1 to 3.

3 (02/16) Where the MCV of saturated materials is required in contract specific Appendix 6/1, the MCV determination shall be carried out in accordance with TRL Report 273, Appendix A, Sections 1, 2 and 4.

4 (02/16) When required in contract specific Appendix 6/1, the determination of the MCV/moisture content relation shall be carried out in accordance with TRL Report 273, Appendix A, Sections 1, 2 and 5.

5 (02/16) An alternative procedure is given in Appendix A, Sections 1, 2 and 6 of TRL Report 273. The rapid assessment procedure for material acceptability may be used when permitted in contract specific Appendix 6/1.

6 (02/16) The Contractor shall provide, for each Moisture Condition Apparatus (MCA) to be used, a test certificate to show that the MCA is functioning correctly. The tests for correct function shall be carried out as described in Appendix D of TRL Report 273 and the results recorded on form MCA3 (TRL Report 273, Appendix B), or similar. All equipment used shall be traceable to national standards.

7 (02/16) The Contractor shall provide, for each operator of the MCA, a certificate which shows the operator has completed an appropriate course of training approved by the Overseeing Organisation. The Overseeing Organisation shall be contacted for details of those organisations able to provide such training.

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NATIONAL ALTERATIONS OF THE OVERSEEING ORGANISATION OF WALES

(02/16) 601W Classification, Definitions and Uses of Earthworks Materials

(02/16) General

0 (02/16) This Series is part of the Specification for Highway Works. Whilst this Series is particularly relevant to the subject matter in its title it must be read in conjunction with the general requirements in Series 000 and 100 and with all other Series relevant to the specification for the particular works to be undertaken.

(02/16) General Classification

1 (02/16) Earthworks materials shall fall into one or other of the following general classifications:

(i) acceptable material: material excavated from within the site or imported on to the site which meets the requirements of Table 6/1 and contract specific Appendix 6/1 for acceptability for use in the permanent works;

(ii) unacceptable material Class U1A as defined in sub-Clauses 2(i)(a) and 2(i)(b) of this Clause: material excavated from within the site which, unless processed so that it meets the requirements of Table 6/1 and contract specific Appendix 6/1, shall not be used in the permanent works;

(v) unacceptable material Class U1B as defined in sub-Clause 2(ii)(a) of this Clause: material excavated from within the site which, unless processed so that it meets the requirements of Table 6/1 and contract specific Appendix 6/1, shall not be used in the permanent works; and

(vi) unacceptable material Class U2 as defined in sub-Clause 3(i) of this Clause: material excavated from within the site which shall not be used in the permanent works.

(02/16) Unacceptable Materials

2 (02/16) Unacceptable material Classes U1A and U1B:

(i) unacceptable material Class U1A shall be:

(a) material which does not comply with the permitted constituents and material properties of Table 6/1 and contract specific Appendix 6/1 for acceptable material; and

(b) material, or constituents of materials, composed of the following unless otherwise described in contract specific Appendix 6/1:

- peat, materials from swamps, marshes and bogs;
- logs, stumps and perishable material;
- materials in a frozen condition;
- clay having a liquid limit determined in accordance with BS 1377: Part 2, exceeding 90 or plasticity index determined in accordance with BS 1377: Part 2, exceeding 65;
- material susceptible to spontaneous combustion except unburnt colliery spoil complying with sub-Clause 15 of this Clause;

(ii) unacceptable material Class U1B shall be:

(a) contaminated materials, including controlled wastes (as defined in the Environmental Protection Act 1990 Part IIA) whose level of contamination is above that given either in contract specific Appendix 6/14 or in contract specific Appendix 6/15, but excluding all hazardous wastes (as

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defined in the Hazardous Waste (England and Wales) Regulations 2005) and radioactive wastes (as defined in the Radioactive Substances Act 1993).

3 (02/16) Unacceptable material Class U2 shall be:

(i) hazardous waste (as defined in the Hazardous Waste (England and Wales) Regulations 2005) and radioactive waste (as defined in the Radioactive Substances Act 1993).

4 (02/16) Where required in contract specific Appendix 6/1, unacceptable material (other than Class U2) shall be processed by mechanical, chemical or other means to render the material acceptable for use in the permanent works in accordance with the requirements of Table 6/1 and contract specific Appendix 6/1.

(02/16) **Definitions**

5 (02/16) Where source codes are referred to these shall be for materials from the sources listed in Table 6/7.

6 (02/16) Chalk shall mean:

(i) any porous material of natural origin composed essentially of calcium carbonate and identified as chalk on the maps produced by the British Geological Survey;

(ii) material designated as Class 3 in contract specific Appendix 6/1.

7 (02/16) Argillaceous rock shall mean shales mudstones siltstones slates and micaceous schists composed of particles of clay silt and mica. It shall include unburnt colliery spoil. Where argillaceous rock is imported onto the site, it shall be aggregate complying with BS EN 13242 from source codes P (natural aggregates described as shale, siltstone or slate), or G2 (refuse from hard coal mining (black coal shale)). See sub-Clause 21.

8 (02/16) Pulverised-fuel ash shall mean solid material extracted by electrostatic and mechanical means from the flue gases of furnaces fired with pulverised bituminous coal. It shall have a maximum particle size of 3 mm. Where pulverised-fuel ash is imported onto the site, it shall be aggregate complying with BS EN 13242 from source code C1 (coal fly ash).

9 (02/16) Furnace bottom ash shall mean agglomerated pulverised-fuel ash obtained from the bottom of the power station furnace and having particle size no larger than 10 mm. Where furnace bottom ash is imported onto the site, it shall be aggregate complying with BS EN 13242 from source code C4 (coal bottom ash).

10 (02/16) Formation shall be the top surface of capping. Where no capping is required formation shall be the top surface of earthworks at the underside of sub-base, unless otherwise shown on the drawings.

11 (02/16) Sub-formation shall be the top surface of earthworks at the underside of capping.

12 (02/16) Stabilisation shall mean the spreading of cement or lime or both on a layer of deposited or intact granular or cohesive material, and the subsequent process of pulverising and mixing followed by appropriate compaction to form the whole or a constituent layer of a capping.

13 (02/16) Where 'recycled aggregate' is used in this Series, the material shall be aggregate resulting from the processing of inorganic or mineral material previously used in construction and shall have been tested in accordance with Clause 710. It shall not contain more than 1% other materials (Class X), not more than 50% in Class Ra (bituminous materials) and not more than 25% in Class Rg (crushed glass). Where 'recycled aggregate' is imported onto the site, it shall be aggregate complying with BS EN 13242 from source code A (construction and demolition recycling industries).

Where 'recycled aggregate except recycled asphalt' is used in this Series, the aggregate shall have been tested in accordance with Clause 710. It shall not contain more than 1% other materials (Class X), not more than 1% in Class Ra (bituminous materials) and not more than 5% in Class Rg (crushed glass). Where 'recycled aggregate except recycled asphalt' is imported onto the site, it shall be aggregate complying with BS EN 13242 from source codes A2 (crushed concrete) and/or A3 (crushed bricks, masonry).

14 (02/16) 'As dug' shall mean material that has been excavated, transported and placed without any processing. Where imported material undergoes any processing, including cleaning and sorting, it will not be deemed 'as dug' and thus shall be aggregate complying with BS EN 13242.

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(02/16) **Use of Fill Materials**

15 (02/16) In addition to any grading requirements the maximum particle size of any fill material shall be no more than two-thirds of the compacted layer thickness except that cobbles having an equivalent diameter of more than 150 mm shall not be deposited beneath verges or central reserves within 1.30 m of the finished surface.

16 (02/16) Materials placed within 500 mm, or any other distances described in the contract specific Appendix 6/3, of concrete, cement bound materials, other cementitious mixtures or stabilised capping forming part of the permanent works shall conform to, as appropriate, the following requirements:

(i) Materials shall conform to the following criteria:

(a) Water-soluble sulfate (WS) content determined in accordance with BS EN 1744-1 clause 10 shall not exceed 1500 mg of sulfate (as $S0_4$) per litre;

(b) Total sulfur (TS) content determined in accordance with BS EN 1744-1 clause 11 expressed as (S) shall not exceed 1% for aggregates other than air cooled blast furnace slag or 2% for air cooled blast furnace slag.

(ii) Materials shall conform to at least one of the following options:

(a) When described in accordance with BS EN 932-3 and BS EN 13242 Annex A, limestone, chalk, dolomite, blast furnace slag, steel slag or crushed concrete are predominant

or

(b) The sulfide content of the material determined in accordance with BS EN 1744-1 Clause 13 is less than 0.5% (as $S0_4$).

When determining WS, TS or sulfide content, at least five samples of each material shall be tested. The mean of the highest two values shall be used for comparison with the limiting values. This shall also apply if six to nine results are available. If ten or more results are available, the mean of the highest 20% of the results shall be used for comparison with the limiting values.

17 (02/16) Material placed within 500mm, or any other distances described in the contract specific Appendix 6/3, of metallic structural elements forming part of the permanent works shall conform, as appropriate, to the following requirements:

(i) Materials shall conform to the following criteria:

(a) Water-soluble sulfate (WS) content determined in accordance with BS EN 1744-1 clause 10 shall not exceed 300 mg of sulfate (as $S0_4$) per litre; and

(b) Total sulfur (TS) content determined in accordance with BS EN 1744-1 clause 11 expressed as (S) shall not exceed 1% for aggregates other than air cooled blast furnace slag or 2% for air cooled blast furnace slag.

(ii) Materials shall conform to at least one of the following options:

(a) When described in accordance with BS EN 932-3 and BS EN 13242 Annex A, limestone, chalk, dolomite, blast furnace slag, steel slag or crushed concrete are predominant;

or

(b) The sulfide content of the material determined in accordance with BS EN 1744-1 Clause 13 is less than 0.06% (as $S0_4$).

When determining WS, TS or sulfide content, at least five samples of each material shall be tested. The mean of the highest two values shall be used for comparison with the limiting values. This shall also apply if six to nine results are available. If ten or more results are available, the mean of the highest 20% of the results shall be used for comparison with the limiting values.

The requirements in (i) and (ii) above shall not apply to metallic items protected by concrete or ancillary metallic items such as the tops of chambers and gullies.

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18 (02/16) Unburnt colliery spoil may be used as general fill provided it is compacted in compliance with Clause 612 and complies with the requirements of contract specific Appendix 6/1.

19 (02/16) Pulverised-fuel ash shall not be placed within the dimension described in contract specific Appendix 6/3, below sub-formation or formation.

20 (02/16) Where pulverised-fuel ash is used, the Contractor shall for each consignment, make available to the Overseeing Organisation a record of the type and source from which it was obtained and a certificate of results of tests showing that the material complies with the requirements of Table 6/1.

21 (02/16) Where stated in contract specific Appendix 6/1 permissible options for fill materials shall include slate or other argillaceous rock materials as stated.

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NATIONAL ALTERATIONS OF THE OVERSEEING ORGANISATION OF NORTHERN IRELAND

601NI (02/16) Classification, Definitions and Uses of Earthworks Materials

(02/16) General

0 (02/16) This Series is part of the Specification for Highway Works. Whilst this Series is particularly relevant to the subject matter in its title it must be read in conjunction with the general requirements in Series 000 and 100 and with all other Series relevant to the specification for the particular works to be undertaken.

(02/16) General Classification

1 (02/16) Earthworks materials shall fall into one or other of the following general classifications:

(i) acceptable material: material excavated from within the site or imported on to the site which meets the requirements of Table 6/1 and contract specific Appendix 6/1 for acceptability for use in the permanent works;

(ii) unacceptable material Class U1A as defined in sub-Clauses 2(i)(a) and 2(i)(b) of this Clause: material excavated from within the site which, unless processed so that it meets the requirements of Table 6/1 and contract specific Appendix 6/1, shall not be used in the permanent works;

(iii) unacceptable material Class U1B as defined in sub-Clause 2 (ii)(a) of this Clause: material excavated from within the site which, unless processed so that it meets the requirements of Table 6/1 and contract specific Appendix 6/1, shall not be used in the permanent works; and

(iv) unacceptable material Class U2 as defined in sub-Clause 3(i) of this Clause: material excavated from within the site which shall not be used in the permanent works.

(02/16) Unacceptable Materials

2 (02/16) Unacceptable material Classes U1A and U1B:

(i) unacceptable material Class U1A shall be:

(a) material which does not comply with the permitted constituents and material properties of Table 6/1 and contract specific Appendix 6/1 for acceptable material; and

(b) material, or constituents of materials, composed of the following unless otherwise described in contract specific Appendix 6/1:

- peat, materials from swamps, marshes and bogs;
- logs, stumps and perishable material;
- materials in a frozen condition;
- clay having a liquid limit determined in accordance with BS 1377: Part 2, exceeding 90 or plasticity index determined in accordance with BS 1377: Part 2, exceeding 65;
- material susceptible to spontaneous combustion except unburnt colliery spoil complying with sub-Clause 15 of this Clause;

(ii) unacceptable material Class U1B shall be:

(a) contaminated materials, including controlled wastes (as defined in the Waste and Contaminated Land (Northern Ireland) Order 1997 whose level of contamination is above that given either in contract specific Appendix 6/14 or in contract specific Appendix 6/15, but excluding all hazardous wastes (as defined in the Hazardous Waste Regulations (Northern Ireland) 2005) and radioactive wastes (as defined in the Radioactive Substances Act 1993).

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3 (02/16) Unacceptable material Class U2 shall be:

(i) hazardous waste (as defined in the Hazardous Waste Regulations (Northern Ireland) 2005) and radioactive waste (as defined in the Radioactive Substances Act 1993).

4 (02/16) Where required in contract specific Appendix 6/1 unacceptable material (other than Class U2) shall be processed by mechanical, chemical or other means to render the material acceptable for use in the permanent works in accordance with the requirements of Table 6/1 and the contract specific Appendix 6/1.

(02/16) **Definitions**

5 (02/16) Where source codes are referred to these shall be for materials from the sources listed in Table 6/7.

6 (02/16) Chalk shall mean:

(i) any porous material of natural origin composed essentially of calcium carbonate and identified as chalk on the maps produced by the Geological Survey of Northern Ireland;

(ii) material designated as Class 3 in contract specific Appendix 6/1.

7 (02/16) Argillaceous rock shall mean shales mudstones siltstones slates and micaceous schists composed of particles of clay silt and mica. It shall include unburnt colliery spoil. Where argillaceous rock is imported onto the site, it shall be aggregate complying with BS EN 13242 from source codes P (natural aggregates described as shale, siltstone or slate), or G2 (refuse from hard coal mining (black coal shale)).

8 (02/16) Pulverised-fuel ash shall mean solid material extracted by electrostatic and mechanical means from the flue gases of furnaces fired with pulverised bituminous coal. It shall have a maximum particle size of 3 mm. Where pulverised-fuel ash is imported onto the site, it shall be aggregate complying with BS EN 13242 from source code C1 (coal fly ash).

9 (02/16) Furnace bottom ash shall mean agglomerated pulverised-fuel ash obtained from the bottom of the power station furnace and having particle size no larger than 10 mm. Where furnace bottom ash is imported onto the site, it shall be aggregate complying with BS EN 13242 from source code C4 (coal bottom ash).

10 (02/16) Formation shall be the top surface of capping.

Where no capping is required formation shall be the top surface of earthworks at the underside of sub-base, unless otherwise shown on the drawings.

11 (02/16) Sub-formation shall be the top surface of earthworks at the underside of capping.

12 (02/16) Stabilisation shall mean the spreading of cement or lime or both on a layer of deposited or intact granular or cohesive material, and the subsequent process of pulverising and mixing followed by appropriate compaction to form the whole or a constituent layer of a capping.

13 (02/16) Where 'recycled aggregate' is used in this Series, the material shall be aggregate resulting from the processing of inorganic or mineral material previously used in construction and shall have been tested in accordance with Clause 710. It shall not contain more than 1% other materials (Class X), not more than 50% in Class Ra (bituminous materials) and not more than 25% in Class Rg (crushed glass). Where 'recycled aggregate' is imported onto the site, it shall be aggregate complying with BS EN 13242 from source code A (construction and demolition recycling industries).

Where 'recycled aggregate except recycled asphalt' is used in this Series, the aggregate shall have been tested in accordance with Clause 710. It shall not contain more than 1% other materials (Class X), not more than 1% in Class Ra (bituminous materials) and not more than 5% in Class Rg (crushed glass). Where 'recycled aggregate except recycled asphalt' is imported onto the site, it shall be aggregate complying with BS EN 13242 from source codes A2 (crushed concrete) and/or A3 (crushed bricks, masonry).

14 (02/16) 'As dug' shall mean material that has been excavated, transported and placed without any processing. Where imported material undergoes any processing, including cleaning and sorting, it will not be deemed 'as dug' and thus shall be aggregate complying with BS EN 13242.

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(02/16) **Use of Fill Materials**

15 (02/16) In addition to any grading requirements the maximum particle size of any fill material shall be no more than two-thirds of the compacted layer thickness except that cobbles having an equivalent diameter of more than 150 mm shall not be deposited beneath verges or central reserves within 1.30 m of the finished surface.

16 (02/16) Materials placed within 500 mm, or any other distances described in contract specific Appendix 6/3, of concrete, cement bound materials, other cementitious materials or stabilised capping forming part of the permanent works shall conform to, as appropriate, the following requirements:

(i) Materials shall conform to the following criteria:

(a) Water-soluble sulfate (WS) content determined in accordance with BS EN 1744-1 clause 10 shall not exceed 1500 mg of sulfate (as $S0_4$) per litre;

(b) Total sulfur (TS) content determined in accordance with BS EN 1744-1 clause 11 expressed as (S) shall not exceed 1% for aggregates other than air cooled blast furnace slag or 2% for air cooled blast furnace slag.

(ii) Marerials shall conform to at least one of the following options:

(a) When described in accordance with BS EN 932-3 and BS EN 13242 Annex A, limestone, chalk, dolomite, blast furnace slag, steel slag or crushed concrete are predominant

or

(b) The sulfide content of the mixture determined in accordance with BS EN 1744-1 Clause 13 is less than 0.5% (as $S0_4$).

When determining WS, TS or sulfide content, at least five samples of each material shall be tested. The mean of the highest two values shall be used for comparison with the limiting values. This shall also apply if six to nine results are available. If ten or more results are available, the mean of the highest 20% of the results shall be used for comparison with the limiting values.

17 (02/16) Material placed within 500 mm, or any other distances described in contract specific Appendix 6/3, of metallic structural elements forming part of the permanent works shall conform, as appropriate, to the following requirements.

(i) Materials shall conform to the following criteria:

(a) Water-soluble sulfate (WS) content determined in accordance with BS EN 1744-1 clause 10 shall not exceed 300 mg of sulfate (as $S0_4$) per litre; and

(b) Total sulfur (TS) content determined in accordance with BS EN 1744-1 clause 11 expressed as (S) shall not exceed 1% for aggregates other than air cooled blast furnace slag or 2% for air cooled blast furnace slag.

(ii) Materials shall conform to at least one of the following options:

(a) When described in accordance with BS EN 932-3 and BS EN 13242 Annex A, limestone, chalk, dolomite, blast furnace slag, steel slag or crushed concrete are predominant;

or

(b) The sulfide content of the mixture determined in accordance with BS EN 1744-1 Clause 13 is less than 0.06% (as $S0_4$).

When determining WS, TS or sulfide content, at least five samples of each material shall be tested. The mean of the highest two values shall be used for comparison with the limiting values. This shall also applies apply if six to nine results are available. If ten or more results are available, the mean of the highest 20% of the results shall be used for comparison with the limiting values.

The requirements in (i) and (ii) above shall not apply to metallic elements protected by concrete or ancillary metallic items such as the tops of chambers and gullies.

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18 (02/16) Unburnt colliery spoil may be used as general fill provided it is compacted in compliance with Clause 612 and complies with the requirements of contract specific Appendix 6/1.

19 (02/16) Pulverised-fuel ash shall not be placed within the dimension described in contract specific Appendix 6/3, below sub-formation or formation.

20 (02/16) Where pulverised-fuel ash is used, the Contractor shall for each consignment make available to the Overseeing Organisation a record of the type and source from which it was obtained and a certificate of results of tests showing that the material complies with the requirements of Table 6/1.

607NI (02/16) Explosives and Blasting for Excavation

1 (02/16) Blasting for excavation shall not be employed unless permitted or required in contract specific Appendix 6/3 and such blasting shall be confined to the locations and to within the time limits stated therein.

2 (02/16) The Contractor shall:

(i) not carry out plaster shooting;

(ii) for each location where blasting is to be undertaken, provide written notice to the Overseeing Organisation of the programme of blasting, including trial explosions, at least 10 days before it commences and give written notice of each blasting event as described in (v) below, at least 12 hours beforehand;

(iii) carry out trial explosions starting with reduced quantities of explosive in order to determine the size of the actual explosive charges and their disposition, for use in the main blasting operations, so as not to exceed the values for vibrational amplitude and vibrational peak particle velocity stated in (vi) below at the positions described therein;

(iv) determine danger zones likely to be created by the blasting operations, including trial explosions, within which blasted material may be projected and utilise suitable arrangements including temporary works, to retain such projectiles and ensure that no injury or damage is caused to persons or property thereby;

(v) limit blasting to a small number of events during permitted hours per day, where an event shall comprise a single explosion or a group of explosions each separated by a short time interval, the group lasting less than a minute;

(vi) ensure that:

(a) structures and earthworks, existing or under construction, on and off the site, do not experience, during blasting operations including trial explosions, a vibrational amplitude exceeding 0.2 mm and a resultant peak particle velocity exceeding 50 mm per second, or other limits stated in contract specific Appendix 6/3, at the same time or individually; and

(b) peak overpressures, of magnitude such as to endanger windows and glazed areas of structures, do not occur;

(vii) where instrumentation and monitoring is appropriate:

(a) rigidly fix to structures and insert in earthworks described in (vi)(a) above, suitable instruments to measure the vibrational amplitude and resultant vibrational peak particle velocity, and peak overpressures, experienced during blasting operations including trial explosions;

(b) make available details of the proposed instrumentation within the site;

(c) unless otherwise stipulated in contract specific Appendix 6/3, make his own arrangements for installing instruments on property off the site including negotiating with landowners and other interested parties;

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(d) read such instruments and take measurements throughout the period of blasting operations, including trial explosions;

(e) for instruments on structures or earthworks on the site and, where required in contract specific Appendix 6/3, on property off the site, make available the results to the Overseeing Organisation at the end of each day's blasting;

(viii) take measurements of vibrational amplitude and peak particle velocity in each of three mutually perpendicular planes and determine the peak value, taken as the maximum resultant calculated by vector summation of the three components of amplitude and velocity respectively, measured as instantaneously as the resolution of the recording instrument permits;

(ix) ensure that noise from blasting operations is controlled in accordance with Clause 109;

(x) use explosives in the quantities and in the manner recommended by the manufacturer;

(xi) store explosives in registered premises in a licensed store or magazine provided with a separate compartment for detonators or use them under an Immediate Use Certificate issued by the police;

(xii) only permit explosives to be used or handled by or under the immediate control of a competent person in accordance with the Construction (General Provisions) Northern Ireland Regulations 1963 (Regulation 19) and subsequent amending Regulations;

(xiii) ensure there is no unauthorised issue or improper use of explosives brought on the site and maintain a strict check on quantities issued and consumed;

(xiv) comply with the requirements of BS 6657 in respect of the use of electrical detonators in the vicinity of static and mobile radio transmitters, including normal radio and television broadcasting stations and radar units associated with aircraft movements, electricity generating plant and transmission lines.

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