

Code of practice for general landscape operations (excluding hard surfaces)

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- Association of County Councils
- Association of District Councils
- Association of Metropolitan Authorities
- Building Employers' Confederation
- Construction Health and Safety Group
- Department of the Environment, Property Services Agency
- Engineering Equipment and Materials Users' Association
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- National Federation of Demolition Contractors
- Royal Institute of British Architects
- Royal Institution of Chartered Surveyors
- Scottish Development Department
- Trades Union Congress

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Association of Playing Fields Officers and Landscape Managers
- British Aggregate Construction Materials Industries
- British Association of Landscape Industries
- British Railways Board
- Electricity Supply Industry in England and Wales
- Forestry Commission
- Horticultural Trades Association
- Institute of Groundsmanship
- Institute of Leisure and Amenity Management
- National Playing Fields Association
- Royal Town Planning Institute
- Sand and Gravel Association Limited

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Foreword

This British Standard has been prepared under the direction of the Basic Data and Performance Criteria for Civil Engineering and Building Structures Standards Committee. It is a revision of BS 4428:1969, which is now withdrawn.

Attention is drawn to BS 3998, BS 4043 and BS 5837. A British Standard concerning recommendations for grounds maintenance, including the maintenance of grass areas is being prepared.

Attention is also drawn to Practice Note 3: Building near Trees, published by and available from the National House-Building Council, Chiltern Avenue, Amersham, Buckinghamshire.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 32, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1.1 Scope

This British Standard code of practice gives recommendations for the following general landscape operations (excluding hard surfaces):

- a) preliminary investigations;
- b) drainage;
- c) grading and cultivation;
- d) seeding of grass areas;
- e) turfing;
- f) amenity tree planting;
- g) woodland planting;
- h) planting of shrubs, herbaceous plants and bulbs.

The recommendations of the code of practice take account of current techniques, equipment and materials; and are restricted to general landscape operations. Intensively used and specialized sports areas such as playing fields, bowling greens, cricket tables and golf greens are excluded from the revision, both because they are specialized and because they are covered by Sports Ground Construction/Specification: 1975 issued by the National Playing Fields Association and the Sports Turf Research Institute.

The code of practice does, however, include recommendations for the gradients of sports fields that are not covered by the National Playing Fields Association technical publication Gradients for Outdoor Sports Facilities: 1983 (see 4.2.3).

The code does not cover the planting of alpine and aquatic plants.

NOTE The titles of the publications referred to in this standard are listed on page 32.

1.2 Definitions

For the purposes of this British Standard the definitions given in BS 2468 and BS 6100 apply, together with the following.

1.2.1

major grading

adjustment of contours when final levels can only be achieved by the removal of organic and partially organic surface soils (topsoil and subsoil) and by excavating and grading inert soils beneath the subsoil layer

1.2.2

minor grading

formation of true running contours by blade grading and movement of subsoil following the removal of topsoil

1.2.3

regulating

formation of true running contours by blade grading and movement of topsoil only

1.2.4

subsoil

layer immediately below topsoil and above inert parent material, which is less well structured and less biologically active than topsoil but which acts as a source of plant nutrients and moisture

1.2.5

topsoil

original surface layer of grassland or cultivated land; usually a darker shade of brown, grey or red than the subsoil that lies immediately beneath it because it contains organic matter intimately mixed with the mineral matter

Section 2. Preliminary investigations

2.1 Site investigations before operations

2.1.1 Consultation

A desk study of available information relating to a site should be undertaken prior to performing any physical investigations and the following should be consulted.

- a) Geological and/or soil survey maps for a general indication of the drift and rock or soil type.
- b) Statutory undertakings for the presence of underground apparatus and apparatus above ground, which might restrict the operation of construction plant (see also 2.3 and 2.6); and local planning authorities for the existence of Sites of Special Scientific Interest (SSSI) and Tree Preservation Orders (TPO).
- c) Appendices A and B of BS 5930:1981, which give guidance on methods of site investigation and sources of information.

When reclamation of made ground is to be undertaken, specialist advice should be obtained regarding the investigation of possible contaminants within the fill, and reference should be made to DD 175. See also 4.4.5.

2.1.2 Topsoil

The following investigations should be performed depending upon the nature of grading or cultivation work to be carried out.

- a) Ascertaining of depths over entire site, e.g. by setting out a grid at, say, 30 m centres and determining depths by methods given in 2.1.4.
- b) Investigation of the quality of topsoil to ascertain that it is suitable for the intended purpose (to sustain active or healthy growth), or that it can be rendered suitable (see also BS 3882). The facilities of the National Agricultural Development and Advisory Service, agricultural colleges, the Sports Turf Research Institute and independent consultants should be used to pin-point deficiencies if they appear to exist.

2.1.3 Subsoil and general excavations

Inspection should be carried out to a depth of at least 750 mm below the level of lowest excavation, to determine the nature of the subsoil and underlying soils, and to establish the presence or otherwise of underground water and rock deposits. One of the following methods should be used.

- a) *Hand auger*: in moist clays and soils free from stones (depths below about 0.5 m are difficult).

b) *Hand excavation*: shallow trial pits can be excavated by hand to about 1.5 m depth but become relatively expensive, compared with mechanical excavations, with increasing depth.

c) *Tractor mounted digger*: tractor mounted diggers can excavate trial pits down to 5 m depth in most soils and weak rocks. When it is intended that pits are to be entered for examination of the soils in situ, the sides should be supported or battered back to stable slopes.

NOTE Safety measures and trench support systems in relation to trial pits are discussed in BS 5930 and BS 6031.

d) *Mounted mechanical auger*: mounted mechanical augers can be used for samples in excess of 30 m depth in soils free from rock and boulders, though with some difficulty in dry, sandy, soils; auger sizes range from 225 mm to 900 mm diameter.

e) *Light cable percussion boring rig*: light boring rigs are specially designed for ground investigation work in soils and weak rock to 60 m depth in suitable strata.

f) *Rotary drill*: rotary drilling to produce core samples is used for rock exploration.

NOTE It is generally unnecessary to examine the subsoil and deeper deposits at the same intervals as the topsoil, if conditions are expected to be uniform. Special techniques have to be used when undisturbed samples are needed (see BS 5930 for further details). Methods of testing are described in BS 1377.

2.1.4 Recording

Results of investigations should be logged and the results should be presented on a vertical diagram giving the following details:

- a) weather conditions at the time;
- b) ground level to Ordnance Datum;
- c) depth and description of organic topsoil;
- d) depth and description of subsoil;
- e) depth and types of excavated material;
- f) level of water-table or zone of saturation.

2.1.5 Drainage investigations

Reference should be made to 2.3 and 3.2.

2.1.6 Other investigations

Areas of rock should be plotted as far as possible by additional trial boring or other methods.

An estimate should be made of the proportion of stone in the topsoil (see BS 3882).

Road access for heavy machinery and low loaders should be determined and temporary roads on the site should be defined on plans of the site.

NOTE Observation and tests may be necessary to determine the permeability of the ground for drainage purposes. Relevant instrumentation and methods of test are given in BS 5930 and BS 1377.

2.2 Site enclosures

The location of site boundaries should be established before work commences and fencing should be erected as necessary.

Temporary fencing for the protection of the public should be maintained in good and effective condition until work is completed. Temporary fencing should then be removed.

NOTE 1 The type of fencing used will depend upon a number of factors, e.g. the location of the site, the likelihood of trespass and pilfering, the degree of danger to persons accidentally trespassing, and the extent to which persons or plant could interfere with or cause damage to adjoining properties or protected vegetation and artefacts.

NOTE 2 Urban sites are more likely to need protection than rural ones. Particular site requirements will affect the type of fence selected. It may be possible to alter or adapt existing site fencing to suit the timing and pattern of works.

2.3 Existing services

The appropriate statutory undertakings and pipeline agencies should be contacted and as far as possible the location of all service runs, such as water supply, gas, electricity (overhead and underground), telephone and existing drainage systems (including land drainage, springs and watercourses) should be ascertained before work is started and should be marked upon a plan, giving their position, size and depth. If necessary, they should be exposed by hand excavations.

The position and depth of all underground apparatus on the site should be verified, marked and, if necessary, should be exposed by hand excavations.

When services could be affected by excavation or when machines may be working nearby, the services concerned should be carefully sealed off, protected or diverted. Any work of a temporary nature should be made good at completion. Any permanent adjustments should be part of the new works. In most cases it will be necessary to obtain the approval and assistance of the statutory undertakings and local authorities concerned. Adjoining landowners should be kept fully informed.

2.4 Existing vegetation

2.4.1 Protection

Existing vegetation that is to be retained should be protected from damage with 1.2 m cleft chestnut or similar fencing. This should be maintained in good and effective condition until work is completed.

Fencing to protect trees should coincide, as far as is practicable, with the spread of the branches, or in the case of fastigate trees with a radius of half the height of the tree.

NOTE Some tree species have a root spread of a greater radius than branch spread; in such cases, certain landscape operations should be excluded from within the area of the entire root spread. See BS 5837.

Materials should not be stacked within the root spread of trees. Normal maintenance should be carried out within fenced areas during the execution of the work.

2.4.2 Remedial work

Existing plants and grass that are to be retained should be restored and maintained in a healthy condition and shapely habit. Accidental damage which may occur during the execution of the work should be carefully repaired during, and at completion of, the works. Accidental damage repairs should be carefully monitored during the following growing season and if recovery is poor, replacement of damaged plants should take place.

NOTE Recommendations are given in BS 3998 for tree work, and will be included in BS XXXX-3¹⁾ for the renovation of turf.

2.4.3 Preparation for moving

Trees and large shrubs that are to be transplanted should normally be prepared some time in advance.

NOTE Recommendations on this subject are given in BS 4043.

2.4.4 Vegetation to be cleared

Long grass and weeds should be cut and removed from the site. Trees, hedges and other plants should be cleared and should be removed from the site if burning is not permitted. Large roots should be grubbed out. Reference should be made to BS 3998 for recommendations regarding the clearance of tree stumps.

Controlled burning should be carried out clear of existing trees and shrubs.

NOTE The ash from these fires can be spread on the site with the exception of areas designed for calcifuge (acid loving) plants, which will not succeed in these circumstances.

¹⁾ In preparation.

2.5 Stripping and storage of topsoil and subsoil

Topsoil should normally be stripped when an area is to be occupied by buildings, roads or other hard surfaces, when major changes of level are needed, or when topsoils and subsoils are likely to suffer damage from building or engineering activities.

Topsoils and subsoils should be carefully stripped and stockpiled in reasonably dry conditions to avoid unnecessary compaction and damage to soil structure. They should be stacked separately and strict precautions should be taken to prevent the mixing of subsoil and topsoil. Topsoil spoil heaps should not exceed 3 m in height, including topsoil existing on site, and should be used within 12 months. If a greater time is needed for stacking, special precautions and remedial procedures will be necessary (see 4.8.3).

While soil is stacked, measures should be taken to control the spread of unwanted vegetation.

NOTE The appearance of the heap can be improved and weeds can be suppressed by sowing a short-term crop of grass or clover.

2.6 Existing artefacts

2.6.1 Fencing

Work to be undertaken close to existing buildings, paved areas and special structures to be retained should be protected from damage by fencing such as 1.2 m cleft chestnut fencing complying with BS 1722-4.

2.6.2 Archaeological finds

Prior to the carrying out of site works, investigations should be undertaken as regards areas of archaeological interest.

NOTE 1 Part 2 of the Ancient Monuments and Archaeological Areas Act 1979 gives to nominated archaeologists statutory rights to investigate areas designated as of archaeological interest. If the site is on the Scheduled Monuments list, consent will be needed from the local planning department before proceeding further.

NOTE 2 There is no obligation to report discoveries of monuments in England and Wales. However, it is recommended that they should be reported to the local planning authority and to interested parties. In Scotland and Northern Ireland all finds of archeological interest have to be reported.

Treasure trove finds of gold and silver should be reported to the local planning authority.

NOTE 3 Finds of gold and silver come under royal prerogative and common law. Any other finds are the property of the landowner.

2.6.3 Materials for re-use

Before starting demolitions, any stone, brick, clay tiles, paving slabs, granite setts or other materials suitable for re-use should be carefully taken up and stored until needed or removed. The same should apply should any material coming to light during excavations be suitable for re-use.

Areas of grass to be cut for turf should be kept mainly free from broad leaf weeds and should be treated during the growing season with “selective herbicide”, if necessary, according to the manufacturer’s instructions; and should be regularly and closely mown before being lifted.

NOTE See section 6 for recommendations concerning turf.

2.6.4 Demolitions

Buildings, walls, roads, foundations, disused drains, manholes and any other construction not needed should be demolished to minimum depths below finished levels, as follows:

- a) grass areas: 450 mm
- b) ground cover and perennial planting areas: 450 mm
- c) shrub planting areas: 600 mm
- d) tree planting (within 2 m of tree stations): 900 mm

All materials (see 4.4.5) should be removed from the site or, by agreement, should be buried below the depths given in a) to d).

Below the depths given in a) to d), concrete slabs or other impervious layers should be assessed for size and depth so that a decision can be made as to whether the slabs or layers should be broken up to facilitate free drainage, or whether they should be removed from the site to obviate future drainage problems. When subsoiling and drainage operations are to be carried out involving depths below those mentioned in a) to d), consideration should be given to the need for demolition work to be carried out to lower levels, to ensure that effective drainage operations can be carried out.

Section 3. Drainage

3.1 General

In landscape work, consideration should be given to the need for drainage, either temporary or permanent, for the following conditions:

- a) to make an area fit for its purpose;
- b) to enable the public, and maintenance machinery, to use the area;
- c) to improve plant growth and soil conditions;
- d) to prevent plant death;
- e) to prevent erosion and damage to new works, especially banks;
- f) to prevent damage to adjoining property by discharge from site, especially during construction;
- g) to lower a high water-table;
- h) to prevent land slip;
- i) to prevent water from higher ground flowing to the site over the surface or below ground;
- j) to lead away surface water, especially when falls over the area are small;
- k) to drain ponds and divert or pipe ditches and watercourses;
- l) to carry away the outflow of springs.

3.2 Information needed for the design of drainage for general grass landscaped areas

Investigation into site conditions should determine the following:

- a) the position, size and depths of useful surface water drains;
- b) the availability of adjacent ponds, ditches and watercourses for outlets;
- c) whether the ground is permeable enough (and if possible at what rate) to accommodate soakaways or boreholes;
- d) the annual rainfall and intensity of rainfall, for use in calculations of run-off;
- e) the proportion of clay in the subsoil, determined by mechanical analysis.

NOTE Methods of test are given in tests 7(A) and 7(C) of BS 1377:1975.

- f) the history of previous field drainage and ditching. Lines of old drainage systems should be investigated by trial holes and the results should be plotted on a plan.

NOTE Information may be available from the Agricultural Development and Advisory Service, or the Department of Agriculture and Fisheries in Scotland. A visual inspection of the ground as well as an examination of aerial photographs often reveals the lines of old drainage systems under grass where the line of drain is a different colour from its surroundings, particularly during dry periods.

3.3 Design

NOTE 1 Detailed design of comprehensive land and field drainage is outside the scope of these recommendations, but short- and long-term general considerations are covered in 3.3.1 and 3.3.2.

NOTE 2 General recommendations regarding workmanship and materials, ditching, bridges and culverts, subsoil drainage, together with diagrams of chambers, outfalls and pipe inlets, can be found in publications²⁾ issued by the Ministry of Agriculture, Fisheries and Food.

NOTE 3 The types of drain commonly used for controlling surface water run-off and ground waters are described in BS 6031.

3.3.1 Construction period and 2 to 3 years after

Drainage problems may arise because of the vulnerable nature of the works, and because of the slow return to optimum permeable ground conditions after radical disturbance of the soil structure by compaction during earth moving and cultivations.

Particular care should therefore be taken with materials having high proportions of silt and clay to avoid creating an impervious surface. If such a surface does occur, its effects should be minimized by subsoiling (see 4.7.4), taking care not to disturb any existing land drainage, until the natural drainage pattern is established.

It is necessary to prevent the formation of, or to break up, crusts that form on some soils and give rise to quick run-off. To guard against damage by swift sheet run-off, which may form gully erosion and cause damage to adjacent property, it is often necessary to install cut-off drains either in the form of ditches or French drains as follows:

- a) at the top of cuttings when the higher land has low permeability;
- b) at the foot of cuttings when seepage is likely through the cutting;
- c) at the top edge of embankments, as these are the most vulnerable features in earth works;
- d) at the lower edges to collect run-off and prevent damage to the toe of the filling.

²⁾ Technical Note on Workmanship and Materials for Field Drainage Schemes: 1983. Published by and available from the Ministry of Agriculture, Fisheries and Food Publications Unit, Lion House, Willowburn Estate, Alnwick, Northumberland. Reference Book 345: The Design of Field Drainage Pipe Systems: 1983. Ministry of Agriculture, Fisheries and Food Agricultural Development and Advisory Service Land and Water Service. HMSO.

Drains should be carefully designed and constructed, with adequate falls to prevent local ponding leading to ingress of surface water into the subsoil. The performance of drains can have a major effect on stability. Losses from drains should be minimized and the drains should be inspected and maintained at frequent intervals.

NOTE The need for some of the work referred to in 3.3.1 often diminishes considerably with time, being greatly influenced by the growth to maturity of ground vegetation.

3.3.2 Long-term considerations

Consideration should be given to the means of lowering a water-table in zones of permanent or intermittent saturation; to the provision of drainage to tap the outflow of springs or permeable layers; and to the means of dealing with surplus water in the topsoil and subsoil arising from direct precipitation.

The type of sub-surface drainage scheme necessary will vary considerably. The appropriate design should have pipes selected to meet the site conditions, and permeable backfill should be used as a connector for mole drainage, subsoiling, or the interception of surface run-off. If the subsoil has a high fine sand silt content, a filter wrapped pipe may be necessary.

3.4 Outlets

3.4.1 Locations

It is essential to make adequate provision for the disposal of water from landscape operations. Such water should be channelled as follows.

- a) Into public surface water drains, for which the approval of the local water authority is needed. This may be granted on terms that may include the provision of silt traps; calculations as to estimated flow may be needed.
- b) To neighbouring ditches and watercourses. The consent of adjoining landowners may be required and legal easements may be necessary; drainage boards or local authorities may exercise jurisdiction over position and construction of outfall.
- c) To soakaways (see BS 8301) or deep boreholes. Some knowledge as to the permeability of the underlying strata is essential; works in the gathering grounds of water authorities may need the authority's consent. Expert advice should be sought relating to the hydrogeological conditions existing at the site, to establish the merits and implications of any proposed scheme.

3.4.2 Size and capacity of outlet pipes

The size and capacity of outlet pipes and soakaways should enable them to cope with the maximum run-off during the heaviest period of rainfall that is likely to occur in a 5-year period (the 5-year storm). When there is a risk that neighbouring buildings or roads may be flooded, a design may need to cope with a 10- or even 20-year storm according to the circumstances (storms of intensity greater than 37 mm/h are not uncommon).

For any large sites, e.g. over 1 ha, the design of the drainage outlets should be based on the peak run-off, *Q* (in m³/s), derived from the following formula:

$$Q = \frac{C/A}{350}$$

where

- C* is the run-off coefficient;
- i* is the rainfall intensity (in mm/h);
- A* is the site area (in ha).

Recommended coefficients for *C* are shown below and from these a suitable figure can be estimated to take account of partially developed sites with bare, surface crusted soils:

buildings and concreted areas	0.95 to 0.99
roads	0.75 to 0.90
pathways	0.50 to 0.75
established gardens, lawns and woodlands	0.10 to 0.15

The rainfall intensity, *i*, should be calculated from the local rainfall figures according to the size, slope and shape of the site and the design storm (e.g. 10-year) that is adopted.

3.5 Drainage systems

3.5.1 General

The drainage of topsoil and subsoil by the insertion of pipes, or the forming of channels, below ground in such positions that they will gather water at depths chosen on the basis of soil, structure, vegetation, climate and designed activity is necessary to:

- a) lower an existing water-table to a depth that will enable optimum root penetration in zones of intermittent or permanent saturation; and/or
- b) gather water, arriving by direct precipitation, from zones of non-saturation and so assist in drying the topsoil and upper layers of the ground.