

Grounds maintenance —

Part 3: Recommendations for maintenance of amenity and functional turf (other than sports turf)

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Committees responsible for this British Standard

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- Association of County Councils
- Association of Playing Fields and Landscape Managers
- British Association of Landscape Industries
- British Waterways Board
- Commonwealth War Graves Commission
- Countryside Commission for Scotland
- Department of the Environment (Property Services Agency)
- Department of Transport
- Electricity Supply Industry in England and Wales
- Inner London Education Authority
- Institute of Groundsmanship
- Institute of Leisure and Amenity Management
- Institution of Water and Environmental Management
- National Farmers' Union
- Sports Turf Research Institute
- Water Services Association of England and Wales

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Foreword

This Part of BS 7370 has been prepared under the direction of the Environment and Pollution Standards Policy Committee.

BS 7370 has been prepared in order to provide those responsible for the upkeep of land that has a recreational or amenity use, or a functional purpose that is not solely for agriculture, commercial horticulture or forestry, with a series of recommendations for the various aspects of such maintenance.

It has been assumed in the drafting of this British Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people, for whose guidance it has been prepared.

This Part of BS 7370 gives assistance in determining categories of amenity and functional turf maintenance objectives for each turf category together with the provision of a means of assessing that the objectives of maintenance are being achieved. It also describes suitable maintenance programmes. BS 7370 at present comprises the following parts:

- *Part 1: Recommendations for establishing and managing grounds maintenance organizations and for design considerations related to maintenance;*
- *Part 2: Maintenance of hard areas¹⁾;*
- *Part 3: Maintenance of amenity and functional turf (other than sports turf);*
- *Part 4: Maintenance of soft landscape (other than amenity turf)¹⁾;*
- *Part 5: Maintenance of water areas¹⁾.*

Further Parts may be prepared, as necessary.

NOTE The numbers given in square brackets used throughout the text relate to the bibliographic references given in Appendix B.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 74, 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.

¹⁾ In preparation.

Section 1. General

0 Introduction

The recommendations given in this Part of BS 7370 are intended:

- a) to assist users in determining categories of amenity and functional turf when compiling maintenance programmes;
- b) wherever possible, to set maintenance objectives for each turf category and to provide a means of assessing, with some form of measurement, that such standards of maintenance are being achieved;
- c) to describe suitable maintenance programmes for each turf category.

It is recognized that, in some circumstances, users may have to adjust the maintenance objectives to meet local conditions but it is recommended that the maintenance objectives described should be followed wherever possible.

1 Scope

This Part of BS 7370 gives recommendations for categories of amenity and functional turf for different applications based on the minimum height of cut and the maximum recommended length to which the vegetation can grow before it becomes unsuitable for the intended purpose.

For each category of turf, recommended maintenance objectives are described based on suitability of the turf for the intended purpose and these include a series of suggested measurable parameters. Maintenance programmes for achieving these maintenance objectives are suggested, and information is given on types of machinery, materials and equipment, and their applicability.

The recommendations given in this Part of BS 7370 are intended to apply to the maintenance of amenity and functional turf. They do not apply to sports turf. Recommendations for the production of turf for sale are given in BS 3969.

Factors such as geographical and climatic conditions, which have an influence on management, are described in some detail, as are the patterns of growth throughout the UK. Management practices have to be varied according to the soil and the grass species used for a specific purpose. The document therefore includes suggestions on the most suitable grass species for different applications.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 7370 the following definitions apply.

2.1

aeration

the operation of making a series of holes through a grass sward into the soil beneath, with round, flat or hollow tines, to improve the passage of air, moisture or nutrients

2.2

amenity grassland

all grass with recreational, functional or aesthetic value, and of which agricultural productivity is not the primary aim

2.3

arisings

grass clippings, cuttings, cores or other material removed from the sward by maintenance operations

2.4

banding

the action of mowing grass so that adjacent passes are in the same direction, giving a resulting visual effect of stripes wider than a single cutting width. (See also **2.73**)

2.5

bent(s)

- 1) Reproductive stems of grasses standing out above a mown sward, particularly evident when temporarily flattened and therefore left uncut by cylinder mowers with front rollers.
- 2) Grasses of the genus *Agrostis*.

NOTE This term is deprecated unless used in compound term, e.g. browntop bent.

2.6

bottoming out

on airfields, a very close cut, followed by harrowing or scarifying, to remove as much vegetation and debris as possible before the main mowing season

2.7

boxing off

the removal of grass clippings in the mower box

2.8

brushing

the use of an implement on which brushes are mounted, for the improvement of the surface condition of grass areas

2.9

carrying capacity

the number of people that can use a facility in a specified time without causing excessive wear

2.10

clippings

the parts of leaves, stems, etc., removed from turf by cutting, mowing or trimming, usually relatively small or fine

2.11

comb

a special rake fitted to a cylinder mower between the front roller and cutting cylinder, to counteract the effect of the front roller

2.12

corer

a tool used for coring (see 2.13)

2.13

coring

the removal of a core of turf and soil as part of soil sampling procedure (see also Figure 25)

NOTE See also 2.38.

2.14

cultivar

an assemblage of cultivated plants, subordinate in classification to species, that is clearly distinguished by any characters (morphological, physiological, cytological, chemical or others), and that, when reproduced (sexually or asexually), retains its distinguishing characters

2.15

cultivation

- 1) (of a seed bed). Operations to till or prepare the growing medium for sowing.
- 2) The practice of working the soil without destruction of the turf, e.g. hollow-tining and slitting.

2.16

cultural control

management systems designed to reduce or eliminate the need for chemical control of pests, i.e. weeds, diseases, etc.

2.17

cuttings

the parts of leaves, stems, etc., removed from turf by cutting, mowing or trimming: on fine turf, this is synonymous with clippings, but on coarse turf possibly more bulky and conspicuous

2.18**cylinder mower**

a mower with multiple helical blades that rotate along a horizontal axis, and that shear the grass off against a close-fitting bottom blade

2.19**edge re-forming**

the shaping or re-shaping of the edge of a lawn with a half-moon, edging tool or machinery

2.20**edge repairing**

the returfing of a lawn edge

2.21**edge trimming**

the cutting of the grass which has overgrown the edge of a lawn, by hand or mechanical means

NOTE This is also known as edging.

2.22**filament line trimmer**

a small trimmer, usually mounted on a handle, that cuts by means of a high-speed rotating plastics filament instead of a rigidly-mounted blade

2.23**firming**

the light consolidation of soil, by treading or rolling, especially to restore surfaces disturbed by frost heave

2.24**flail mower**

a mower that cuts grass by the impact of blades mounted on a horizontal shaft. The blades rotate in vertical cutting planes, i.e. at right angles to the turf surface

2.25**fly (of cuttings)**

the action of returning cuttings to the sward, as opposed to removing them (as in “let cuttings fly”)

2.26**frost heave**

the disruption of soil and turf surfaces by the action of frost, causing loosening or puffiness of the top 10 mm to 20 mm layer

2.27**gradient**

a slope, expressed as a ratio or as a percentage

NOTE A fall of 20 mm over a horizontal distance of 2 m would represent a 1 % fall, or 1 in 100; a fall of 2 m over the same distance would represent a 100 % fall, or 1 in 1, or 45°.

2.28**ground cover**

in test method descriptions, the proportion of ground occupied by the perpendicular projection of the material above it (see also Appendix A)

2.29**growing medium**

the material or combination of materials supporting the vegetation

NOTE Examples of a growing medium are soil and sand.

2.30**growing season**

the part of the year in which plant growth takes place

NOTE For grass, an acceptable measure can be deduced from the length of time that the soil temperature at a depth of 300 mm remains above 6 °C.

2.31

growth rate

for grass, the height increment measured in millimetres, per unit of time

2.32

growth retardant

for grass, a chemical which temporarily restricts growth

2.33

half-moon

a turf-cutting implement, comprising a semi-circular knife at the base of a handle, positioned so as to cut in the vertical plane with assistance from foot pressure on the straight upper side of the blade

2.34

halving

a method of banding (see 2.4) whereby only two bands are created

2.35

hard litter

any material, organic or inorganic, present on the surface of the ground, that is of a kind likely to damage machines or equipment

2.36

headland

the space for turning machinery at the outer edge of a field or turf area

2.37

height of cut

the height of the leaf ends from the ground, measured vertically, immediately after mowing

NOTE This definition describes the actual height of cut, which is not necessarily the same as the mower setting. The latter represents the intended height of cut and is adjusted by the use of a mower gauge or similar device, and, for example, makes no allowance for the weight of the mower sinking into soft turf.

2.38

hollow-tining

the perforation of turf and removal of cores with a hollow-tined implement to relieve compaction or to reduce the amount of undesirable material, e.g. heavy clay or thatch, and to allow the entry of air, water, nutrients or top dressing materials

2.39

hover mower

a rotary mower supported in operation by a cushion of air instead of wheels or rollers

2.40

infiltration rate

the rate, expressed in millimetres per unit of time, at which water on the turf or soil surface enters the soil

2.41

inorganic

of fertilizer or top dressing, natural or synthetic materials of non-living origin

NOTE 1 Examples are sulphate of ammonia fertilizer and sand top dressing.

NOTE 2 This usage differs from the strict chemical definitions of “organic” and “inorganic”. Urea, for example, is a carbon containing compound, i.e. organic, but is considered an inorganic fertilizer (see also 2.45).

2.42

lute

a single board or rigid straightedge, or several such boards or edges in parallel, fastened to a handle at right angles (see 2.43 and 8.3)

2.43**luting**

the spreading of compost or other bulky top dressing over grass or other areas by use of a lute moved to and fro over the surface of the ground

2.44**mowing**

the cutting of a sward to a uniform height by the use of a machine or hand implements

2.45**organic**

of fertilizer or top dressing, derived from living material

NOTE Examples are hoof and horn meal, dried blood, peat-based top dressing and seaweed derivatives (see also 2.41).

2.46**particle size class**

a soil description based on the proportion of sand, silt and clay in the soil

NOTE Examples are sandy clay and silty clay loam.

2.47**particle size composition**

the percentage content by mass of various defined size categories of mineral particles in a soil

NOTE 1 This is also known as the particle size distribution.

NOTE 2 For the purposes of this Part of BS 7370 the following soil terms generally correspond to the following particle sizes:

- a) clay 0.002 mm or less;
- b) silt 0.002 mm to 0.05 mm;
- c) sand 0.05 mm to 2.0 mm.

2.48**pest**

any organism harmful to plants or to wood or other plant products, any undesired plant, or any harmful creature

2.49**pesticide**

any chemical substance, preparation or organism prepared or used for destroying any pest

NOTE The term pesticide includes herbicides, fungicides, insecticides, vermicides, rodenticides and growth retardants.

2.50**pH**

an index figure, related to the hydrogen ion concentration, denoting the acidity or alkalinity of a solution

NOTE 1 pH 7 is neutral; lower figures denote acidity and higher ones alkalinity.

NOTE 2 Note 1 is a much simplified definition of pH and is given to assist users of this Part of BS 7370. For a detailed description of pH, reference should be made to BS 1647-1.

2.51**raking**

- 1) The final cultivation of soil by a rake to produce a fine tilth and a true even surface prior to sowing, planting or turfing.
- 2) The action of drawing a rake across a surface to remove unwanted material, e.g. raking stones from soil, or raking moss, leaves and litter from turf.

2.52**rhizome**

an underground stem, often creeping (as in rhizomatous grasses such as creeping red fescue, smooth-stalked meadow-grass or common couch)

2.53**rolling**

the action of passing a roller over a surface to firm or consolidate the material

2.54

rotary mower

a mower that has a disc, bar or chain which rotates on a vertical axis. The edges of the disc or bar are either sharpened or fitted with replaceable cutters, and cut the vegetation cleanly by being rotated at high speed

2.55

rotary rake

a powered machine for scarifying turf, equipped with wire tines or blades rotating in a vertical plane, i.e. at right angles to the turf surface

NOTE The action is similar to that of a vertical mower (see 2.83) but deep enough to cut grooves into thatch or soil.

2.56

sand

minute fragments resulting from the wearing down of siliceous rocks

NOTE 1 Rough or angular fragments are called sharp sand. Rounded particles are usually described as dune sand.

NOTE 2 For the purposes of this Part of BS 7370, a system of classification of sand with the following five subdivisions is used. This classification system is widely used in the UK, by the Sports Turf Research Institute and others:

- | | |
|---------------------|-----------------------|
| a) Very fine sand | 0.050 mm to 0.125 mm; |
| b) Fine sand | 0.125 mm to 0.250 mm; |
| c) Medium sand | 0.250 mm to 0.500 mm; |
| d) Coarse sand | 0.500 mm to 1.000 mm; |
| e) Very coarse sand | 1.000 mm to 2.000 mm. |

2.57

sand slitting

a general term for making sand-filled or gravel-filled drainage channels through the turf (see 2.58 to 2.61)

2.58

ordinary sand slitting

sand-filled channels 50 mm to 150 mm wide, cut through the turf by a trencher or some form of mole plough, usually not more than 350 mm deep

2.59

surface banding

channels of sand over pea gravel, cut and backfilled by specialized equipment 30 mm to 60 mm wide and up to 300 mm deep

2.60

sand placement

channels cut and backfilled with sand by specialized equipment, 18 mm wide and up to 230 mm deep

2.61

sand grooving

channels of sand closely spaced at 200 mm centres, 13 mm wide and up to 100 mm deep

2.62

scalping

the action of mowing so close to the ground as to destroy plant cover and expose bare soil

2.63

scarifying

the operation of breaking-up, loosening, incising or scratching the turf surface with an appropriate implement. The degree of disturbance depends on the implement and the depth setting

2.64

seeds mixture

a combination of seed lots representing at least two cultivars or kinds of seed, of one or more species, mixed in proportions expressed as percentages by mass

2.65**seedling turf**

grass grown for use as turf (see 2.84) using special methods whereby natural intermingling of roots or the use of reinforcing material enables large pieces to be rolled up and handled despite the immaturity of the grass plants

2.66**slitting**

the use of a flat-bladed implement to make a series of vertical cuts through a turf surface into the soil (see 8.6)

2.67**soil**

the upper layer of earth in which plants grow, consisting of disintegrated rock with an admixture of organic remains, etc.

2.68**soil structure**

the organization of the primary particles in the soil

NOTE Special terms are used to describe the size, shape and stability of aggregates of primary particles.

2.69**soil texture**

a description of the physical quality of a soil that is related to its particle size composition

2.70**solid tining**

the action of aerating with a solid (as opposed to hollow tubular) tine, usually a spike

2.71**species**

a group of organisms, subordinate in classification to genus, consisting of actually or potentially interbreeding natural populations that are reproductively isolated from other such groups

2.72**spiking**

the action of solid tining with a spike (see 2.70 and 8.6)

2.73**striping**

the action of mowing or brushing grass in opposite directions at every pass in order to create a narrow striped effect

NOTE Machines with rear rollers achieve this result most effectively.

2.74**sward**

a structure consisting of the above-ground and below-ground parts of a population of grass or some other herbaceous plants, characterized by a relatively short habit of growth and relatively continuous ground cover

2.75**sward canopy**

the above-ground, standing part of the sward, which corresponds, broadly, to the zone of green vegetation

2.76**switch**

a long flexible rod of fibreglass or other material, used to disperse wormcasts or moisture

2.77

thatch

a more or less tightly intermingled organic layer of dead and living shoots, stems and roots, developing between the zone of green vegetation and the soil surface. It includes what may variously be termed litter, mat and fibre

2.78

tilth

the growing medium, when finally prepared by cultivation, for sowing

2.79

tines

- 1) The teeth of a rake, fork or other implement.
- 2) Specially shaped tools (spikes, blades, tubes, spoons, etc.) for spiking, aeration, etc.

2.80

top dressing

- 1) Fine soil, peat, sand, compost or other material, e.g. fertilizer or conditioner, that is applied to the surface of the soil or turf.
- 2) The application of fine soil, peat, sand, compost or other material to soil or turf.

2.81

turf

- 1) A sward defoliated closely and regularly enough to have developed a well-knit layer of plant material at and immediately below the soil surface.
- 2) A cut piece of sward, to be re-laid on the surface of the ground to form new grassed areas.

NOTE Turf may be described by origin or type as cultivated turf, purpose-grown turf, sea-washed or sea-marsh turf, and seedling turf.

2.82

turf culture

the cultural practices involved in managing amenity and functional grassland

2.83

vertical mower

a powered machine for cutting horizontal shoots and runners of grass, by the use of blades rotating in a vertical plane

NOTE The action is basically similar to that of a rotary rake (see 2.55) but is shallow enough to be restricted to the sward canopy.

2.84

weed

a plant growing where it is not wanted

2.85

wormcast

the small pile of soil and plant remains left on the turf surface by earthworms or other invertebrates

3 General

3.1 The properties of the structure constituted by the growing medium and vegetation together, its stability and the overall drainage characteristics, should at all times be suitable for the purpose for which the area is intended and have the carrying capacity necessary to withstand the maximum use it is likely to be subjected to.

The physical properties and nutritional levels of the growing medium should be adequate to sustain a healthy growth of the required vegetation.

3.2 The treatment of the structure described in 3.1 should be directed towards maintaining an appropriate botanical composition, density, height, colour and visual texture of sward, as well as satisfactory characteristics in the growing medium supporting the vegetation (see details of maintenance objectives given in clause 6).

The operational input will vary according to the category of turf. For instance, category A (ornamental turf) requires a much higher operational input than category H which usually comprises mainly naturalized turf areas where the flora and fauna are considered important factors. All the other categories fall within these two extremes, from the point of view of both the level of operational input and the criteria used to define limits of acceptability. Varying systems of management are, therefore, required in order to meet the needs of the turf within each defined category.

Broad distinctions can be made between each of the categories. However, within each category there will be a range of turf considered acceptable for the requirements of the intended purpose. The maintenance objectives given in these recommendations are therefore set with the aim of providing minimum satisfactory levels of turf quality rather than the highest levels attainable.

Section 2. Turf categories and maintenance objectives

4 The distinction between categories and maintenance objectives

It is important to distinguish between categories of turf (see clause 5) and maintenance objectives (see clause 6).

Certain categories of amenity and functional turf are defined in Table 1, solely according to measurable parameters. Turf in any particular category can be managed in various ways to achieve the manager's objectives. These objectives will be related to a particular turf use. Table 2 shows various kinds of turf area and the appropriate turf categories.

The first and basic management decision is on the type of mowing machine and method of mowing to be used (Table 3).

NOTE 1 This decision is so fundamental that cross-reference between Table 1 and Table 3 may help the reader to visualize clearly the kind of turf in each category. Nevertheless, selection of mowing machine and method of mowing, like the approximate frequency of cut given in Table 1, are not parts of the definition of a category but the first steps towards achieving the appropriate maintenance objectives for it.

The categories given in Table 1 are defined by minimum height settings of mower and maximum heights of growth for two reasons as follows:

- a) managers can quite readily visualize the quality of sward which is to be expected within these two limits;
- b) in case of doubt, measurement can be made (see A.3) to confirm visual assessment.

The maintenance objectives described in clause 6 represent reasonable management targets for each category. Turf in a certain category need not necessarily conform to all or any of the maintenance objectives, but a good manager should strive to attain them. The appropriate maintenance programme given in section 4 describes what is usually necessary.

NOTE 2 In all turf categories, but most particularly in categories A, B, C and D, the achievement of high quality will depend on following the appropriate maintenance programme (section 4) and thus reaching the maintenance objectives recommended in clause 6. In categories B and C, the removal of cuttings generally improves sward quality, and subcategories B1 and C1 are therefore likely to be of higher quality than subcategories B2 and C2, provided that nutrition and management during drought periods are satisfactory.

5 Categories of turf

5.1 Classification of categories

5.1.1 Table 1 lists nine categories of amenity and functional turf, A to J, defined according to minimum height (mower setting) and recommended maximum height of growth.

NOTE For "minimum height" the figure given is actually the setting of the mower. In ideal circumstances, the height at which the mower is set is also the height at which the grass is cut, but often this is not so in practice. Mud or cuttings may accumulate on wheels or rollers making the cut higher than intended. It is important, therefore, to ensure that wheels and rollers are always kept reasonably clean. Soft conditions (wet ground or spongy thatch) may make the cut lower than intended. In soft conditions, there is a serious risk of scalping on close-cut turf (categories A and B) and in such conditions an appropriate increase in the height of the mower setting should be considered.

5.1.2 Table 2 describes the functions or appearance of turf for which each category is appropriate. These include some semi-natural grass areas, or grassland in which particular wild flower species are being encouraged. Recommendations on the management of such areas are given in 5.5. Such habitats may, however, require further specialized management and, in such cases, advice should be obtained from bodies such as the Nature Conservancy Council.

5.1.3 Table 3 indicates the methods of mowing appropriate for the various turf categories, and whether or not cuttings would normally be removed. In categories B and C, the removal or return of cuttings depends to some extent on the time of the year (removal in moist weather or during heavy growth; return during dry weather). Nevertheless, in these categories the removal or return of cuttings is an important element in sward quality, and subcategories B1, B2, C1 and C2 are introduced to take account of this and to assist managers in reaching suitable maintenance objectives. Subcategories B1 and C1 provide for the removal of cuttings in order to give higher turf quality. The cuttings are returned in subcategories B2 and C2.

NOTE Table 2 does not include categories exclusively for slopes or embankments, although turf in most categories can be grown on slopes. One type of mower which can often be used on slopes is the "hover" type, and this is covered in Table 3 under "rotary mower without roller drive".

Table 1 — Categories of amenity and functional turf other than sports turf

Category	Parameters of height used to define each category (see note 1)		Likely frequency of cut	Suitable grass seed mixtures (see Table 5)	Recommended maximum gradient (see note 3)
	Minimum height setting of mower (see note 2)	Maximum recommended height of growth			
	mm	mm			%
A	10	15	Twice a week	7 or 8	10
B (B1, B2) (see note 4)	15	25	Weekly	7 or 8	20
C (C1, C2) (see note 4)	20	50	Every week or week and a half	7, 8, 9, 10, 11 or 12	25
D	25	50 to 75	Weekly or fortnightly	7, 8, 9, 10, 11 or 12	30
E	50	100	Fortnightly	11 or 12	30
F	75	150	Normally every 3 weeks to 4 weeks	7, 8, 9, 10, 11 or 12	30
G	100	250	Normally every 4 weeks to 6 weeks	7, 8, 9, 10, 11 or 12	100
H	100	Not applicable	Once or twice a year	7, 8, 9, 10, 11 or 12	Not applicable
J	150 (see note 5)	200 (see note 5)	Every 2 weeks to 4 weeks	12	10

NOTE 1 For method of determination of height see A.3

NOTE 2 See note to 5.1.1 on possible difference between mower setting and actual height of cut. It should be noted also that the height of the mower setting may need to be raised in soft conditions.

NOTE 3 The recommended maximum gradients apply to areas to be mown with wheel-borne or roller-borne mowers: steeper gradients may be acceptable for air-borne (hover) mowers. Slope is usually expressed as a ratio or a percentage. A fall of 20 mm over a horizontal distance of 2 m would represent a 1% fall, or 1 in 100; a fall of 2 m over the same distance represents a 100% fall, or 1 in 1, or 45°. For method of assessment of gradient see A.5.

NOTE 4 The subdivision of categories B and C is explained in Table 3 and 5.1.3.

NOTE 5 Heights applicable for most of year, see 5.4 and category J in 11.

Table 2 — Categories of turf appropriate to particular functions or appearance

Turf function or appearance	Appropriate category
Close-mown ornamental lawns	A, B1 (see note)
Other ornamental turf	B2, C1, C2, D (see note)
Urban verges	C1, C2, D (see note)
Recreational turf areas, e.g. in recreation grounds, housing estates and parts of country parks	C1, C2, D, E (see note)
Grass used in water engineering (dam spillways, flood relief channels, flood banks)	E,F
Maintained turf in woodland and parts of country parks	F
“Rough” turf	G
Rural roadside verges	G,H
Turf managed for conservation value	H
Turf areas of airfields (managed to minimize hazards to aircraft from birds)	J
NOTE The subdivision of categories B and C is explained in Table 3 and 5.1.3.	

Table 3 — Methods of mowing appropriate for the various categories of amenity and functional turf

Category	Cylinder mower		Rotary mower		Heavy-duty mower (see note 3)	Cuttings removed (e.g. boxed, baled or raked off)	Cuttings returned
	With rear roller drive	Without rear roller drive	With roller	Without roller (see note 2)			
A	✓	×	×	×	×	✓	×
B1	✓	×	✓	×	×	✓	×
B2	✓	×	✓	×	×	×	✓
C1	✓	✓	✓	✓	×	✓	×
C2	✓	✓	✓	✓	×	×	✓
D	×	✓	✓	✓	×	×	✓
E	×	✓	✓	✓	×	×	✓
F	×	×	✓	✓	✓	×	✓
G	×	×	×	✓	✓	×	✓
H	×	×	×	✓	✓	✓	✓
J	×	×	×	✓	✓	✓(see note 4)	✓(see note 4)

NOTE 1 ✓ = method appropriate, × = method inappropriate.

NOTE 2 Includes hover type mowers.

NOTE 3 Includes flail mowers, reciprocating knife mowers, and drum mowers.

NOTE 4 Turf in category J, i.e. turf areas of airfields, may be bottomed out or cropped for silage once a year and the cuttings then removed. Two or three cuts may also be carried out, cutting short, using gang mowers. In such cases, and where long grass is topped to 150 mm, cuttings should be returned. For vertical take-off aircraft, it is essential that cuttings be removed: a forage harvester can be used for this purpose.

5.2 Grass growth and mowing frequencies

The time required by grass to achieve the maximum recommended height of growth after mowing will depend on growing conditions (temperature and moisture), fertility, and grass type (species and cultivar). The required frequency of cut cannot, therefore, be stated precisely. The frequencies of cut shown in Table 1 are only intended to be approximations for guidance purposes, and are included to help in calculating likely work loads within the duration of the growing season.

Figure 1 gives a broad indication of the average length, in days, of the growing season for grass in the UK, taking account of both temperature and drought.

The manager could, theoretically, divide the duration of growing season by mowing frequency to obtain the number of cuts. Such a calculation, however, makes no allowance for the following:

- a) “phasing in” and “phasing out” at the beginning and end of the season;
- b) the typical growth pattern during the year, with the main peak of growth in spring, a decline during summer (perhaps to nil during dry periods), and a second minor peak in autumn;

NOTE 1 This will tend to modify a programme of mowing at regular intervals, because more frequent mowing will be needed in spring and less frequent mowing during summer.

- c) the relaxation of close mowing during periods of drought;

NOTE 2 In such conditions some weeds may continue to grow even when the grass does not.

- d) the variation in growth, even within quite small areas, due to differences in soil type, water table, etc.

NOTE 3 This may require different mowing frequencies within a single site.

Table 4 gives an indication of the likely number of cuts to be expected for turf categories A to E, in each of four kinds of growing season: long and continuous, long but interrupted by drought, short and unaffected by drought, or average.

5.3 Species appropriate for various categories

Table 5 gives details of some suggested grass seed mixtures, taken from the STRI “Turfgrass Manual” [1] which may be suitable for the various categories of turf, as described in Table 1. Within the suggested species, careful choice of cultivars should be made according to the best available information on their suitability for the intended use (see also 9.4).

With categories of turf defined according to height of mower setting and maximum recommended height of growth, the growth rate of the sown species is important. It is easy to calculate, from the first two columns of figures given in Table 1, the amount of growth (height increment, measured in millimetres) which the category definitions allow, and it can then be estimated from the usual cutting frequency how much height increment per day would be “permissible”. Obviously, such figures, in fractions of a millimetre, are not to be taken too literally, but they can be compared with the following expected daily increments based on data from trials mostly mown at 25 mm, and measured throughout the growing season (see [3]). The following increments are averages throughout the whole growing season, and might be exceeded in periods of vigorous growth:

- a) bent and fescue 2.0 mm to 3.0 mm;
- b) turf-type cultivars of perennial ryegrass 2.5 mm to 3.5 mm;
- c) “traditional” cultivars of perennial ryegrass, e.g. 3.0 mm to 4.0 mm.
“Aberystwyth S.23”

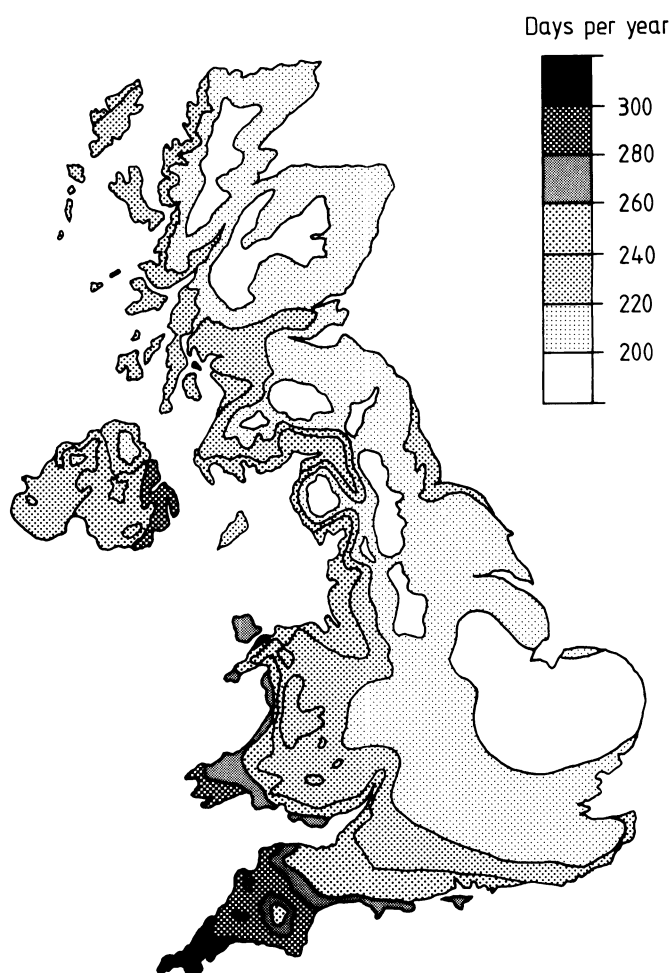
Fertility level is as important as choice of species. The ranges of figures given above take account of fertility differences. The lower figures relate to medium-low fertility (no nitrogen fertilizer in the year in question, but a reasonably good background level of soil fertility). The higher figures relate to medium-high fertility (approximately 50 kg of nitrogen per hectare in spring in the year in question).

The figures above do not take account of individual cultivars, but within each species account should be taken of known differences in growth rate. (For further information on cultivars see 9.4.)

5.4 The special management of category J turf (airfields)

5.4.1 The primary objective in the management of turf in airfields is aircraft safety. Fixed-wing aircraft, especially jets, are vulnerable to collisions with birds, especially gulls, lapwings, pigeons, corvids and starlings. Bird strikes may damage airframes, canopies and engines and ingestion of birds into jet engines can be catastrophic. One of the major safety measures in managing airfields is, therefore, to reduce the number of birds present to a minimum and it has been found that even the most persistent bird species will not settle or forage in grassland that is dense and maintained at a height of 150 mm to 200 mm. Category J has been defined to relate particularly to the management of airfields with the objective of reducing bird numbers and therefore minimizing the risk of bird strikes.

5.4.2 On airfields from which jet aircraft operate, and which normally have hard-surfaced runways and taxiways, it is recommended that as large an area as possible of the turf within the airfield perimeter should be maintained as category J. Areas around airfield lighting systems may have to be kept cut to 25 mm to 35 mm at 10 day to 14 day intervals, broadly approximating to category D, to avoid obstructing visibility.



NOTE From Down et al. [2]

Figure 1 — Average length of the growing season for grasses (in days) in different parts of the UK

On airfields from which propeller-driven fixed-wing aircraft operate, and which have grassed runways, the latter should be kept cut to 25 mm to 35 mm at 10 day to 14 day intervals, broadly approximating to category D. The appropriate maintenance objectives in Table 6, however, would be those of category J rather than of category D. Grassed areas between runways and taxiways should be maintained as category J in order to reduce bird populations.

Grassed areas of airfields from which helicopters operate exclusively and grassed helicopter-operating areas on mixed helicopter/fixed-wing airfields should be maintained within category D, as these aircraft are more prone to damage from ingested grass clippings than from bird strikes.

5.4.3 When maintaining grassed areas of airfields to category J, the maintenance objectives given in Table 6 are appropriate, but with due consideration of the large areas involved (usually upwards of 300 ha). Agricultural sampling procedures, e.g. for pH or nutrient content, may stipulate that the area to be represented by a single sample should not normally exceed 4 ha, and subdivision of grassed areas of airfields into units of this size may be appropriate where accurate data are required for decisions on maintenance objectives. Airfield grass may be managed at agricultural levels of nutrient status, to grow a fodder crop or simply to ensure fast recovery after cutting. For agricultural grassland, the generally accepted soil pH for established grass on a mineral soil is pH 6.0.

For phosphorus (P, expressed as P_2O_5 in the maintenance objectives) and potassium (K, expressed as K_2O), the target would normally be between MAFF Index 1 and Index 2 (see [4]). For phosphorus, the maintenance objectives given in Table 6 correspond quite closely to Index 2; for potassium the management objective range approximately spans Index 1 and 2.

In addition to the management objectives recommended in Table 6, airfield grass should be free of molehills.

5.4.4 Long grass management involves maintaining a dense turf at a height of 150 mm to 200 mm for as much of the year as possible. To achieve this without a gradual thinning of the bottom of the sward, the grass should be cut once a year as close to the ground as a forage harvester can be adjusted, and all cut material removed. Following this the area should be scarified thoroughly to tease out thatch and dead grass which may also need to be collected and removed. Both operations should be carried out in spring as soon as the land is dry enough to bear the weight of the machines. Any fertilizer which soil tests show is necessary should then be applied. Following this the grass should be cut two or three times with standard gang mowers set at a cutting height of 35 mm to 40 mm, at 10 day intervals: this helps to maintain a dense turf, and prevents gradual thinning of the base. The grass should be then allowed to grow to a height of 200 mm, and should be mown throughout the growing season with a multiple tractor-mounted rotary mower set at a cutting height of 150 mm, or with a flail mower. All cuttings should be returned.

Where there is a local demand for silage as fodder, an alternative management system for long grass is to allow it to grow in spring and take a single silage crop at the appropriate stage of grass development. The forage harvester should be set as low as possible to remove both green leaf and debris accumulated at the base of the sward. Cropping should be followed by harrowing and any necessary fertilizer application. Two or three cuts at 10 day intervals using gang mowers set at a cutting height of 35 mm to 40 mm should follow, and the grass then be allowed to grow to 200 mm to 250 mm before resuming the topping to 150 mm for the rest of the growing season.

5.5 The special management of turf with bulbs or wild flowers, and of semi-natural grassland

5.5.1 General

Where bulbs (crocuses, daffodils, etc.) are growing in parts of grass areas subject to regular mowing, those parts should be left unmown in early spring, to avoid damage to bulb shoots, and the first cut should only take place when the bulb leaves have died down. These areas are thus managed like category H for the first part of the year, reverting afterwards to management appropriate to the surrounding regularly mown areas.

In general, management of semi-natural grassland or wild flower areas can be broadly divided into two types as described in 5.5.2 and 5.5.3, although many variations are found.

Table 4 — Likely number of cuts according to locality, length of growing season and approximate mowing frequency

General character of growing season	Areas of the UK (see Figure 1)	Approximate duration of growing season for grasses, taking account of both temperature and moisture	Approximate number of cuts per year for the frequencies and categories shown			
			Twice weekly A	Weekly B	Every 7 days to 10 days C, sometimes D	Fortnightly D, E
Long (very long or long growing season, with little or no drought effect)	South-western England (from Solent to Severn), coastal Wales, Cheshire, Lancashire, parts of South-western Scotland and Northern Ireland	days > 240	60	35	25 to 30	15 to 20
Average (fairly long, with some drought effect; or shorter, with no drought effect)	Central, southern and south-east England, central Wales, West Midlands, northern England on either side of the Pennines, most of Scotland, parts of Northern Ireland	200 to 240	50 to 55	28 to 30	20 to 25	14 to 18
Dry (long growing season interrupted by drought)	East Anglia, east Midlands	< 200	45	26	18 to 22	14
Short (relatively short growing season, with no drought effect)	Pennines, Lake District and high ground in Scotland and Northern Ireland	< 200	45	26	18 to 22	14

5.5.2 *Meadow sward with wild flowers (typically category H)*

This type of grassland might form the intermediate zone of rural roadside verges, between the regularly-mown 1 m roadside strips and sightline areas (category G) and the taller herbs growing beside a ditch, hedge or fence. Larger areas might be found in country parks, informal parts of urban parks, or in other areas of grass visible and accessible to the public but not liable to wear or traffic in predictable patterns.

Management should consist essentially of one or two cuts per year. Their timing will depend on the following:

- a) the vigour and competitiveness of the grass species; and
- b) the locality and season.

For the sake of the flowering and seed setting of the wild herb species, the later the main cut is carried out, the better. A single cut in late July, August or early September will be more favourable to wild flowers than one in June, as they can set and shed their seed. For a sward which does not produce a substantial bulk of growth this management may be possible. Frequently, however, bulk of growth will necessitate at least one cut before August. This applies particularly in the first year or so of a wild flower sward, when relatively frequent mowing (as for categories G, F or even E) will be needed to enable non-competitive species to establish and survive.

Removal of cuttings will help to reduce the fertility of the sward. If mown material is left to become hay, seed will be able to ripen and shed back into the sward: this applies less to a flail mower mulch, which in any case is unlikely to be picked up and removed.

A very satisfactory maintenance programme for wild flowers, if it is possible, is a low cut (about 50 mm) in April or early May, and then nothing until an autumn tidying-up in September or October. This may be possible with low-growing grasses and a constantly impoverishing maintenance programme, with cuttings removed. Most swards, however, will need more than one cut during the April-May period. This management, in which the cutting in April and May simulates the traditional grazing at that time, provides summer flowering (a summer meadow).

An alternative regime, to provide spring flowering (a spring meadow), is to leave the grass uncut until June or early July, and then cut once (or more if necessary) to simulate a hay or fodder cut, or grazing, at this time of year.

The selected timing will obviously encourage the flowering of some species and discourage that of others, and timing should therefore to some extent depend on the botanical objectives of management.

The regimes described above can be modified on large areas or, if resources are available, to conform more closely to various traditional agricultural management systems. Details of these systems, however, and the requirements of particular species, are outside the scope of this Part of BS 7370.

Information on wild flower seeds mixtures, planting techniques and management systems is available in "Creating attractive grasslands using native species" by T.C.E. Wells, S.A. Bell and A Frost [5] "Creating attractive grasslands" (NTC Workshop Report No. 5) [6] "Wild Flowers" 87 (NTC Workshop Report No. 14) [7] and the catalogues and leaflets of seedsmen and plant suppliers.

5.5.3 *Coarse herbaceous vegetation, providing food and cover for insects and visual "background"*

NOTE On rural roadside verges, tall herbs usually border the ditch, hedge or fence. In country parks, they would represent the boundary zone of areas not intended for general access or traffic.

Cutting should be required only once a year at most at the back of rural roadside verges, to give access to boundaries and to define the extent of the highway. Elsewhere, cutting should only be required every other year, to avoid scrub encroachment. Cutting is best done in autumn or dry periods of winter. Burning, in late winter, should also be done on some areas.

5.5.4 Grass for waterways

Grass cover can protect waterways against erosion. It can be reinforced with geotextiles or cellular concrete (see clause 14). A dense uniform grass sward of medium height, well rooted to the soil, is required. In Table 2, categories E and F are suggested as appropriate. Closer-mown categories are normally inadvisable because close defoliation tends to reduce root mass. The grass should also be managed by being grazed by cattle, sheep or other stock, provided that the uniformity of the sward, and the integrity of any reinforcement, is not impaired, e.g. by excessively close grazing, by uneven grazing, by poaching, or by physical damage to reinforcing materials. Use of growth retardants should be considered, particularly for slopes which are difficult to mow. Fertilizer and herbicide treatments are only likely to be needed occasionally, if at all, to maintain or restore the density and uniformity of the grass sward. Any use of pesticides should obviously take careful account of the restrictions on products, and the necessary safe working practices, required in the vicinity of water.

Table 5 — Grass seed mixtures for amenity use^a

Grass species	Mixture reference number (see also note 1)					
	7	8	9	10	11	12
Perennial ryegrass (<i>Lolium perenne</i>)	—	—	—	—	15 (10 to 20)	50 (40 to 60)
Smooth-stalked meadow-grass (<i>Poa pratensis</i>)	—	—	25 (10 to 40)	10 (0 to 20)	30 (20 to 30)	15 (0 to 20) (see note 2)
Hard fescue (<i>Festuca longifolia</i>)	— (0 to 40)	— (0 to 30)	—	45 (20 to 50) (see note 3)	—	—
Chewings fescue (<i>Festuca rubra</i> ssp. <i>commutata</i>)	80 (40 to 85)	65 (40 to 75)	75 (60 to 80)	40 (20 to 50) (see note 3)	50 (40 to 50)	35 (30 to 60)
Slender or strong creeping red fescue (<i>Festuca rubra</i> spp.)	— (0 to 40)	35 (25 to 40)	—	—	—	—
Browntop bent (<i>Agrostis castellana</i> and <i>A. tenuis</i>) (see note 4)	20 (15 to 25)	—	— (0 to 10)	5 (0 to 10)	5 (0 to 10)	—
White clover (<i>Trifolium repens</i>) (see note 5)	— (0 to 10)	— (0 to 10)	— (0 to 10)	— (0 to 10)	— (0 to 10)	— (0 to 10)

NOTE 1 Table 5 is taken from the “Turfgrass Manual” published by the Sports turf Research Institute [1], in which mixtures for intensive (mainly sports) use are numbered 1 to 6. The STRI numbering is retained here to facilitate comparison with its publications.

NOTE 2 Rough-stalked meadow-grass (*Poa trivialis*) can be used for wet situations or to improve initial ground cover.

NOTE 3 For “natural” grassland, part of the fescue component could consist either of sheep’s fescue (*Festuca ovina*) or fine-leaved sheep’s fescue (*F. tenuifolia*). These are not suitable for regular mowing below about 30 mm. Details of wild flower mixtures cannot be included here, but many seedsmen offer mixtures suited to various soil types or other special conditions.

NOTE 4 “Highland” browntop bent (assigned to *A. castellana*) is usually the only cultivar plentiful and cheap enough to be considered for these mixtures, although other cultivars of browntop bent (assigned to *A. tenuis*) are available if specially required.

NOTE 5 The amount of white clover sown is usually in the range 2 kg/ha to 10 kg/ha (0.2 g/m² to 1.0 g/m²), i.e. approximately 5 kg/ha (0.5 g/m²). This would represent 10 % of a low total seed rate of 50 kg/ha, but only 2 % of a high one of 250 kg/ha.

^a Seed rates of 50 kg/ha to 250 kg/ha (5 g/m² to 25 g/m²). High rates should be used where full cover is wanted rapidly, or where seed bed conditions are poor: low or medium rates should be used where seed bed conditions are good. Seed percentage by mass. Unbracketed figures total 100 %. Bracketed figures denote acceptable modification.

6 Maintenance objectives for turf categories

For each of the turf categories A to J described in Table 1, some or all of maintenance objectives 1 to 9, as shown in Table 6, may be applicable. Where there is a figure in a category column on the right-hand side of Table 6, it denotes that a maintenance objective applies. The figure should be inserted into the text in the “Maintenance objective” column of Table 6, in the space indicated. For example, maintenance objective 2a as applied to category C would read “The total ground cover should be at least 85 %”. Where X is shown, the maintenance objective in question does not apply to that category.

Where appropriate, reference should be made to recommended methods which can be used to determine whether turf satisfies the maintenance objective. The method described in **A.3** should be used to assess sward height, and is of general relevance in deciding on categories and on the frequency of mowing. Other recommended methods are described in detail in Appendix A.

Table 1 gives details of maximum gradients that should be observed for each category.

In some situations, particularly with category H, a fire hazard may develop, and appropriate measures should be taken to warn the public and the fire prevention authorities.

Uniformity of colour, texture, etc. is very desirable for turf in category A, and desirable also in categories B, C and D, but there is no practical way of defining and assessing maintenance objectives for these characters.

Durability is the ability of a sward to persist in spite of wear, and to recover afterwards. It is principally important in sports turf, and no special maintenance objectives are given here because a healthy sward, maintained so as to satisfy all the other maintenance objectives, should be able to withstand normal amenity use satisfactorily. Nevertheless, in some cases, amenity turf may receive heavy wear, and deterioration in ground cover and infiltration rate will be evidence of serious damage. Clause 14 describes appropriate measures for the repair and renovation of severely-worn turf.