British Standard

A single copy of this British Standard is licensed to

Sheffield University

16 December 2002

Steel, concrete and composite bridges —

Part 1: General statement

UDC 624.21.01

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Civil Engineering and Building Structures Standards Committee (CSB/-) to Technical Committee CSB/59, upon which the following bodies were represented:

Association of Consulting Engineers
British Cement Association
British Constructional Steelwork Association Ltd.
British Precast Concrete Federation Ltd.
British Railways Board
British Steel Industry
British Waterways Board
Concrete Society
County Surveyors' Society
Department of Transport (Highways)
Department of Transport (Transport and Road Research Laboratory)
Institution of Civil Engineers
Institution of Structural Engineers
Scottish Development Department
Steel Construction Institute
Welding Institute

This British Standard, having been prepared under the direction of Civil Engineering and Building Structures Standards Committee, was published under the authority of the Board of BSI and comes into effect on 30 September 1988.

First published June 1978
First revision September 1988

The following BSI references relate to the work on this standard:
Committee reference CSB/59
Draft for comment 84/10327 DC

ISBN 0 580 16867 0

Amendments issued since publication

Amd. No.	Date	Comments

Contents

Foreword

General

BS 5400 is a document combining codes of practice to cover the design and construction of steel, concrete and composite bridges and specifications for the loads[1], materials and workmanship. It is based on the principles of limit state design outlined in ISO 2394 "General principles for the verification of the safety of structures". It comprises the following:

— *Part 1: General statement;*

— *Part 2: Specification for loads;*

— *Part 3: Code of practice for design of steel bridges;*

— *Part 4: Code of practice for design of concrete bridges;*

— *Part 5: Code of practice for design of composite bridges;*

— *Part 6: Specification for materials and workmanship, steel;*

— *Part 7: Specification for materials and workmanship, concrete, reinforcement and prestressing tendons;*

— *Part 8: Recommendations for materials and workmanship, concrete, reinforcement and prestressing tendons;*

— *Part 9: Bridge bearings;*

Section 9.1: Code of practice for design of bridge bearings;

Section 9.2: Specification for materials, manufacture and installation of bridge bearings.

— *Part 10: Code of practice for fatigue.*

Some of the above Parts are manuals of good practice, whilst others express requirements in specific terms, For this reason BS 5400 should not by reference be incorporated as a whole into construction contracts. Certain Parts, i.e. Part 2, Part 6 and Part 7, may be suitable for individual incorporation by reference, provided that care is taken to ascertain that no provisions in such Parts conflict with other provisions in the text of the contract.

As stated above, the basis of BS 5400 is limit state design. Accordingly, it differs in principle from its predecessor, BS 153 "Steel girder bridges"[2]. Although the load factors adopted are judged appropriate in the light of current knowledge, detailed comparisons between the designs resulting from BS 5400 and those from its predecessor will be possible only from the results of the use of this standard in practice and from empirical calibration studies. The results from these studies will enable possible adjustments to be made at periodic intervals. Users of BS 5400 should recognize the need for engineering judgement arising especially from the difference in principle mentioned above.

The changes from the 1978 edition of this Part of 5400 were originally intended to be implemented by the issue of an amendment. However for ease of use it was decided to incorporate the changes into a new edition. BS 5400-1:1978 is consequently withdrawn.

[1] Throughout BS 5400 external forces applied to the structure and imposed deformations such as those due to changes in temperature will be referred to as "loads" or "loading"; the stress resultants in the structure arising from its response will be referred to as "load effects".

[2] Withdrawn.

Objective of BS 5400

The aim of BS 5400 is the achievement of acceptable levels of probability in order that the structure being designed will not become unfit for the use for which it is required, i.e. that it will not reach limit state during its design life. It specifies certain design requirements and a coherent set of partial safety factors for bridges in the UK[3)], which combine to provide what is considered to be an acceptably low probability of attaining the limit states given in clause **3**.

It has been assumed in the drafting of this British Standard that the executions of its provisions will be entrusted to appropriately qualified and experienced people.

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 6, 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.

[3)] For bridges to be designed to other load specifications, see clause **10**.

blank

1 Scope

This Part of BS 5400 is a statement of the general concepts embodied in other Parts of the standard. It describes the application of the limit state principles adopted and includes sections on analysis and foundation design, both of which are common to all forms of bridge construction.

NOTE The titles of the publications referred to in this Part of BS 5400 are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the following definitions and explanations of terms apply.

2.1
loads

the loads to be considered in determining the load effects, S, on the structure are specified in Part 2 and are described throughout as nominal loads. For certain loads statistical distributions are available and for these a return period of 120 years has been adopted. Where such distributions are not available nominal values, based on judgement and experience, are given, and these are considered to approximate to a 120-year return period

2.2
strength of materials

where statistical data are available on the strength of materials, characteristic values are given in the appropriate Parts of this standard. Where such data are not available, nominal values are given to be used as characteristic values in all the computations

2.3 Design values

2.3.1
design loads

the design loads, Q^*, are determined from the nominal loads, Q_k, according to the relation

$$Q^* = \gamma_{fL}\, Q_k$$

where γ_{fL} is a factor given in Part 2 for each load

$$\gamma_{fL} = \text{function}\ (\gamma_{f1}\ \gamma_{f2})$$

where

γ_{f1} takes account of the possibility of unfavourable deviation of the loads from their nominal values;

γ_{f2} takes account of the reduced probability that various loadings acting together will all attain their nominal values simultaneously

2.3.2
design load effects

the design effects, S^*, are obtained from the design loads by the relation

$$S^* = \gamma_{f3}\ (\text{effects of } Q^*)$$
$$= \gamma_{f3}\ (\text{effects of } \gamma_{fL}\, Q_k)$$

where

γ_{f3} is a factor that takes account of inaccurate assessment of the effects of loading, unforeseen stress distribution in the structure, and variations in dimensional accuracy achieved in construction

Values of γ_{f3} are given in Parts 3, 4, 5 and 9

Where linear relationships can be assumed between loading and load effects, S^* can be determined from

$$S^* = (\text{effects of } \gamma_{f3}\ \gamma_{fL}\ Q_k)$$

2.3.3
design resistance

the design resistance, R^*, may be defined as

$$R^* = \frac{1}{\gamma_{m2}}\ \text{function}\left(\frac{f_k}{\gamma_{m1}}\right)$$

if the function is linear and involves a single value of γ_{m2}, this may be expressed as

$$R^* = \frac{1}{\gamma_{m2}}\frac{1}{\gamma_{m1}}\ \text{function}\ (f_k) = \frac{1}{\gamma_m}\ \text{function}\ (f_k)$$

where

f_k is the characteristic (or nominal) strength of the material;

γ_m is a reduction factor specified in the relevant parts of this standard

$$\gamma_m = \text{function}\ (\gamma_{m1}\ \gamma_{m2})$$

where

γ_{m1} is intended to cover the possible reductions in the strength of the materials in the structure as a whole as compared with the characteristic value deduced from the control test specimen;

γ_{m2} is intended to cover possible weaknesses of the structure arising from any cause other than the reduction in the strength of the materials allowed for in γ_{m1}, including manufacturing tolerances.

For simplicity, instead of two γ_m factors, a single factor has been adopted for this British Standard. For concrete construction $\gamma_{m\,1}$ has different values for concrete and reinforcement; hence the following format has been used in Part 4

$$R^* = \text{function}\left(\frac{f_k}{\gamma_m}\right)$$

For steel construction normally only one value of $\gamma_{m\,1}$ is involved; hence the format used in Part 3 is

$$R^* = \frac{1}{\gamma_m}\text{ function }(f_k)$$

3 Limit states

3.1 General

The two limit states adopted in BS 5400 are:

a) the ultimate limit state; and

b) the serviceability limit state.

3.2 Ultimate limit states

The ultimate limit states applicable to this standard are:

a) loss of equilibrium of a part or the whole of the structure when considered as a rigid body;

b) deterioration, due to fatigue, to a stage where failure occurs;

c) a post elastic or post buckling state determined by the current extent of knowledge of the ultimate behaviour of bridge structures and which, in certain cases, relates only to the collapse strength of the section considered and not to the collapse strength of the whole structure.

3.3 Serviceability limit states

The serviceability limit states applicable to this standard are:

a) that condition beyond which a loss of utility or cause for public concern may be expected and remedial action required;

b) the vibration limits stated in Part 2 as applied to footbridges.

3.4 Further requirements

The deflection of the structure or any part of it should not be such as to affect its appearance adversely, violate minimum specified clearances, or cause drainage difficulties. The structure may need to be cambered to counter these effects. Minimum specified clearances should be maintained under the action of load combination 1 for the serviceability limit state. The appearance and drainage characteristics of the structure should be considered under the action of permanent loads only. Compliance with the relevant clauses of this standard should ensure adequate durability during the design life of the structure.

The configuration of the structure and the interaction between the structural members should be such as to ensure a robust and stable design. The structure should be designed to support loads caused by normal function, but there should be a reasonable probability that it will not collapse or suffer disproportionate damage under the effects of misuse or accident.

4 Modifications to design values

For bridges in the U K, no further modifications need be made to the design values to take account of the seriousness of attaining a limit state. For the present it is considered that the total consequences of failure of bridges of different types are the same[4)] and the factor γ_{n2}, which is intended to take account of economic consequences, danger to communities, etc., is not explicitly stated but is allowed for in the values of γ_{fL} and γ_m. Similarly γ_{n1}, which is intended to take account of the nature of the structure and its behaviour, whilst allowing for those structures or parts of structures in which partial or complete collapse may occur without warning, is not explicitly stated.

Designs carried out in accordance with the provision of BS 5400 should not require the factor γ_{n1}.

In special cases where elements can fail without due warning, e.g. buckling, the design equations, i.e. the values of R^*, have appropriate safety values built into them.

[4)] Clearly the consequences of failure of one large bridge such as a suspension bridge will be greater than that of one small bridge. A greater number of smaller bridges are constructed, however, and in the absence of empirical data it is assumed that for the sum of the consequences the risks are broadly the same.

5 Verification of structural adequacy

For a satisfactory design the following relation should be satisfied

$$R^* \geqslant S^* \tag{1}$$

$$\text{i.e. function}\left(\frac{f_k}{\gamma_m}\right) \geqslant \gamma_{f3}\ (\text{effects of } \gamma_{fL}\, Q_k) \tag{2a}$$

When the resistance function is linear and a single value of γ_m is involved, this relation may be rearranged as

$$\frac{1}{\gamma_{f3}} \cdot \frac{1}{\gamma_m}\ \text{function}\ (f_k) \geqslant (\text{effects of } \gamma_{fL}\, Q_k) \tag{2b}$$

It should be noted that the form of expression (2a) is used in Part 4, whereas the form of expression (2b) is used in Part 3. Therefore when using Part 5 in conjunction with either Part 3 or Part 4 care should be taken to ensure that γ_{f3} is applied correctly.

The bridge and its components should be checked for overall stability under the appropriate factored loads and the design should also comply with the provisions of Part 10 with regard to fatigue life.

Consideration should be given to the aerodynamic stability of bridges susceptible to such effects. Vehicle induced vibration need not be considered.

6 Design life

A design life of 120 years has been assumed throughout BS 5400 (unless otherwise stated).

The assumption of a design life does not necessarily mean that the structure will no longer be fit for its purpose at the end of that period, or that it will continue to be serviceable for that length of time without adequate and regular inspection and maintenance.

It is to be emphasized that bridges, like most modern structures, require regular inspection and, when necessary, repair under competent direction. Means of access and other measures required to facilitate inspection and maintenance should be considered with adequate working space being provided around parts such as bearings, expansion joints and, where relevant, prestressing anchorages.

7 Analysis

7.1 General

The following general principles should be adopted in the calculation of the load effects arising under any assumed pattern of applied loading and in the verification of safety of the structure. Global analysis of actions should be undertaken for each of the most severe conditions appropriate to the part under consideration for all of the loading combinations prescribed in Part 2. The methods of analysis should be capable of predicting all loading effects including, where appropriate, those that cannot be predicted by simple bending theory.

7.2 Methods of analysis

7.2.1 *Linear elastic methods.* These methods take account of all elastic phenomena such as shear lag, warping, etc. but some of these effects may be neglected where stipulated in Parts 3, 4 and 5. In these methods the stiffness of the structural members are assumed to remain constant throughout the full range of applied loading and the second-order effects of deformation are ignored.

7.2.2 *Non-linear methods.* Non-linear methods of analysis are concerned with either one or both of two distinct aspects of non-linear structural behaviour:

a) the non-linearity arising from significant geometric changes taking place in the structure under load;

b) the non-linearity in the stress-strain behaviour of the materials themselves.

The behaviour in a) occurs in systems such as suspension bridges and is also associated with the loss of stiffness due to buckling of slender components. The behaviour in b) is associated with such phenomena as progressive tensile cracking in concrete, creep of materials under sustained loading, localized yielding etc. Non-linear methods of analysis may be based on the incremental application of linear elastic methods using modified member stiffness or elastic moduli. Non-linear analysis is not normally required for structures designed in accordance with the various Parts of BS 5400. However, to allow for some non-linear behaviour, redistribution of the load effects, obtained by a linear elastic method, may be assumed to occur.

7.2.3 *Plastic methods.* The term "plastic method" denotes a method of analysis in which part or all of a material in the section or sections of a structural member is assumed to have reached yield point under the applied loading. This results in the possibility of "plastic hinges" or "yield lines" being formed in the structure where yielding has taken place.

7.2.4 *Conditions for plastic methods or redistribution.* Plastic methods or other procedures for permitting redistribution of moments and shears may be used only when:

a) the form of construction and the materials have an adequate plateau of resistance under the appropriate ultimate conditions and are not prone to deterioration of strength due to shakedown under repeated loading;

b) the development of bending plasticity does not cause an indeterminate deterioration in shear or torsional resistance, or, when relevant, in axial strength;

c) the supports or supporting structures are capable of withstanding reactions calculated by elastic methods;

d) changes in geometry due to deflections will not significantly influence the load effects or are fully taken into account.

It may be assumed that conditions a) and b) are met by each of the appropriate methods presented in the design sections of BS 5400.

7.3 Analysis of structure

7.3.1 *Ultimate limit state.* The load effects under the most adverse of the prescribed design loading conditions appropriate to the ultimate limit state should be calculated by a method satisfying equilibrium requirements, all load effects being shown to be in equilibrium with the applied loads. Elastic methods are acceptable as lower bound collapse solutions; they will also lead to solutions less likely to violate serviceability criteria. Plastic or yield line methods may be adopted when appropriate to the form of construction.

Unless otherwise stated in Parts 3, 4 and 5 the stiffness of the structural components should be based on the nominal dimensions of the member cross sections and on the elastic moduli. Shear lag may be ignored for the main analysis. The effects of cracking in composite structures may be allowed for either by assuming a modified stiffness in a linear elastic analysis or by adjustments to the results of such an analysis as stated in Part 5. The effective spans should be assumed to be as defined in **7.5**.

7.3.2 *Serviceability limit state.* Load effects under each of the prescribed design loadings appropriate to the serviceability limit state should, where relevant, be calculated by elastic methods. Linear methods may be used when these are based on the section properties assumed in **7.3.1**, provided that changes in geometry do not significantly influence the load effects. Non-linear methods may be adopted with appropriate allowances for loss of stiffness due to cracking, creep or other predictable deformation of the structure as directed in Parts 3, 4 and 5 and should be used where geometric changes significantly modify the load effects. Usually, these phenomena are taken into account either by assuming a modified stiffness in a linear elastic analysis or by adjustments to the results of such an analysis, as stated in Parts 3, 4 and 5. The method used should satisfy equilibrium requirements (see **7.3.1**) and compatibility of deformations.

Due allowance should be made in both determinate and indeterminate forms of construction for any erection procedures which affect the distribution of reactions and stresses.

Effective spans should be in accordance with the assumptions given in **7.5**.

Where a part only of a bridge is to be analysed, the boundaries to that part should either be so idealized as to represent accurately the stiffness of the bounding parts of supports, or they should be sufficiently remote from the region under consideration that errors in simulation have no significant influence on the solution. The bounding parts should be designed to carry the boundary reactions calculated from the analysis.

7.3.3 *Fatigue.* Global analysis of the structure for the assessment of fatigue life should, where relevant, employ linear elastic methods based on section properties without reduction of stiffness and, for concrete, the short term moduli.

7.3.4 *Deflections.* Analysis of the structure for deflection should employ linear elastic methods. Deflections due to structural self-weight should allow for the method and sequence of construction. Account should be taken of changes in stiffness during construction, and in creep and shrinkage effects in concrete after completion.

Deflections due to finishes should be calculated using the long-term characteristics of concrete. Deflections due to live load should be based on short-term characteristics of concrete and on the most unfavourable distribution of loads using an elastic analysis appropriate to the serviceability limit state (see **7.3.2**). Where appropriate, allowance should be made for shear flexibility and/or for axial deformation.

In estimating deflections during erection and on first loading of a welded steel structure, the relaxation of welding residual stress in regions of applied tensile stress, as defined in Part 3, should be taken into account.

7.4 Analysis of sections

7.4.1 *Ultimate limit state.* Methods used to calculate the ultimate resistance in bending, axial force, shear or torsion should provide estimates of strength having a probability of at least 95 % of being achieved when the material characteristics are accurately known. "Lower-bound" methods are therefore essential to ensure that the required reliability is obtained. The methods given in this standard may be deemed to satisfy this requirement. Other methods should be verified, either by calibration against methods in this standard or by testing in accordance with **7.6**.

The effects of shear lag will normally be neglected, but should in certain cases be considered for transverse members as indicated in Parts 3, 4 and 5.

7.4.2 *Serviceability limit state or fatigue.* In the calculation of stresses for serviceability or fatigue assessment from the actions analysed in accordance with **7.3.2**, the following should be included unless otherwise stated in the design sections of this standard:

a) stresses due to axial forces and global bending moments, both longitudinal and transverse, including the influence of shear lag[5)];

b) shear stresses, including those due to torsion;

c) warping stresses due to torsion and distortion of box members;

d) transverse stresses due to distortion of box members;

e) stresses due to creep, relaxation and shrinkage;

f) stresses due to membrane forces;

g) stresses occurring in the vicinity of major stress concentrations which are due to the local nature of any appropriate pattern of loading or due to structural discontinuities, particularly near supports;

h) stresses due to bending moments in members caused by deflections and changes in geometry, e.g. secondary stresses in trusses due to deformation.

The mathematical idealization of the structure should reflect the nature of its judged response. The boundaries assumed in such idealization should either simulate accurately the stiffness of adjacent parts or be sufficiently remote from the part under consideration for the stresses in it to be insensitive to the boundary assumptions.

If, for the sake of convenience, any part of the structure is ignored in the analysis, it should be examined to determine whether the behaviour of the structure under load can lead to detrimental effects on such a part.

7.5 Effective spans

In the determination of loads and load effects, the effective spans of beams and slabs should be assumed to be as follows.

a) *Simply supported members.* The smaller of either:

1) the distance between the centres of bearings or other supports, or

2) the clear distance between supports plus the effective depth.

b) *Members framing into supporting members.*

The distance between the shear centres of the supporting members.

c) *Continuous members.* The distance between centres of supports, except where, in the case of beams on wide supports, the effect of the support width is included in the analysis.

d) *Cantilevers.* The distance from the face of the support plus half its effective depth, except where:

1) it is an extension of a continuous beam when the length to the centre of the support should be used, or

2) in the case of members on wide supports, the effect of the support width is included in the analysis.

7.6 Model analysis and testing

7.6.1 *Global analysis.* Model analysis and testing may be used either to define the load effects in a structure or to verify a proposed theoretical analysis for a structure. The models used should be capable of simulating the response of the structure appropriately and the interpretation of the results should be carried out by engineers having the relevant experience.

5) The influence of shear lag may be deemed to be allowed for in the calculation of the properties of the cross sections for stress analysis when using the appropriate effective widths prescribed in Parts 3, 4 and 5.

The reliability of the test results depends inter alia upon the accuracy, or knowledge of:

a) material properties (model and prototype);

b) methods of measurements;

c) methods used to derive load effects from measurements;

d) loading and reactions.

In interpreting results, the assessed load effects to be used in design should exceed those derived from the test data by a margin dependent upon:

e) number of tests;

f) method of testing;

g) an assessment of a), b) and c) above.

In all cases the interpreted results should provide equilibrium.

7.6.2 *Local resistance assessment.* Methods for calculating the ultimate resistance of cross sections other than those specified in this standard should be verified by tests on a range of representative components, or models thereof, sufficient to ensure that the influence on each parameter of the physical behaviour up to collapse is demonstrated. The reliability of such verification will depend upon a), d), e) and f) of **7.6.1**. In such tests the ratio between the strength predicted by the chosen method (using measured properties and dimensions) and the measured value should be obtained for a number of samples and the mean and standard deviation of such ratios determined.

The partial factors for strength prescribed in this standard should then be adjusted for application with the verified method to take into account its mean accuracy and variability.

Where prototype testing is adopted as a basis of proving the resistance of a component, the test loading should adequately reproduce the range of stress combinations to be sustained in service. A sufficient number of prototypes should be tested to enable a mean value and standard deviation of resistance to be calculated for each critical stress condition, the design values then being taken at 1.5 standard deviations below the mean.

The material strengths to be specified for construction should have mean values and coefficients of variation compatible with those in the prototypes. Tolerances and dimensions should be similarly prescribed so that constructions are compatible with the prototypes.

No results of prototype testing may be used to justify any reduction in partial safety factors.

Similar tests on components may be used to verify or determine serviceability limit loading capacity.

8 Erection

The adoption of limit state methods with partial safety factors emphasizes the necessity to assess the loads and location of erection plant accurately. The amount of the partial factor applied to these loads should be appraised for each case on its merits, making due allowance for the accuracy or otherwise of the evaluation of temporary loads. Additional material incorporated for erection purposes should also be accurately assessed and if it is to be retained in the completed structure, its effect on this should be taken into account.

9 Foundations

9.1 Verification of the safety of foundations including piles

Foundations should be assessed in accordance with the principles set out in BS 8004.

BS 8004 has not been drafted on the basis of limit state design, but it will be appropriate to adopt the nominal loads specified in Part 2 with γ_{fL} and $\gamma_{f3} = 1$ as design loads for the purpose of verifying foundations in accordance with BS 8004. The loads on foundations should be derived from the methods of analysis appropriate to the serviceability limit state.

9.2 Design of structural foundations

Structural foundations are designed to transmit the applied loading on the structure to the ground or piles depending upon the method of transfer, in each case it is necessary to know the reaction to the applied loading. These reactions, which will be bearing pressures or pile loads, should be calculated for the design loading relevant to the limit state under consideration and the foundations assessed for these design reactions.

10 Bridges overseas

The design requirements given in Parts 1, 3, 4, 5, 9 and 10 may be used for the design of bridges to other loading specifications, provided that the factors γ_{fL} are modified as necessary to achieve design loads consistent with those specified in Part 2. This means, for example, that for the ultimate limit state calculations the probability of design loads being exceeded during the design life of the bridge should not exceed 5 % and provided also that materials and workmanship comply with Parts 6 and 7.

Publications referred to

BS 153, *Specification for steel girder bridges*[6)7)].
BS 5400, *Steel, concrete and composite bridges.*
BS 5400-2, *Specification for loads.*
BS 5400-3, *Code of practice for design of steel bridges.*
BS 5400-4, *Code of practice for design of concrete bridges.*
BS 5400-5, *Code of practice for design of composite bridges.*
BS 5400-6, *Specification for materials and workmanship, steel.*
BS 5400-7, *Specification for materials and workmanship, concrete, reinforcement and prestressing tendons.*
BS 5400-8, *Recommendations for materials and workmanship, concrete, reinforcement and prestressing tendons*[7)].
BS 5400-9, *Bridge bearings.*
BS 5400-9.1, *Code of practice for design of bridge bearings.*
BS 5400-9.2, *Specification for materials, manufacture and installation of bridge bearings.*
BS 5400-10, *Code of practice for fatigue.*
BS 8004, *Code of practice for foundations.*

6) Withdrawn.
7) Referred to in the foreword only.

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL