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Temporary works

Part 2: Falsework: Design and implementation – Code of practice

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Summary of pages

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Foreword

Publishing information

This part of BS 5975 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 December 2024. It was prepared by Subcommittee B/514/26, *Falsework*, under the authority of Technical Committee B/514, *Access and support equipment*. A list of organizations represented on these committees can be obtained on request to the committee manager.

Supersession

This part of BS 5975, together with BS 5975-1:2024, supersedes [BS 5975:2019](#), which is withdrawn.

Information about this document

This is a substantial revision of BS 5975, *Temporary works*, which now comprises the following parts:

- *Part 1: Management procedures for the control of temporary works – Code of practice*, which comprises Sections 1 and 2 of the 2019 edition; and
- *Part 2: Falsework: Design and implementation – Code of practice*, which comprises Section 3 of the 2019 edition.

BS 5975-2 gives recommendations for Class A falsework which are absent from [BS EN 12812:2008](#). It also gives recommendations for the application of [BS EN 12812:2008](#) to the design of Class B1, B2 and other relevant falsework structures.

Designers of falsework are expected to refer to BS 5975-1:2024 for recommendations for the management of temporary works.

The simplified methods in BS 5975-2 remove design complexity and significantly reduce the potential for errors in each design.

The following principal changes have been introduced in this revision:

- the terms and definitions have been updated;
- design in accordance with limit state philosophy has been included;
- design in accordance with permissible stress philosophy has been revised;
- information is included on the influence of adjacent tall structures and funnelling effects of terrain/buildings on the wind effects on falsework, and recommendations are given for checking susceptibility to vortex shedding;
- methods are given for calculating the effective plate action restraint forces provided by arrangements of soffit formwork;
- methods of analysis for top-restrained, partially braced or fully braced systems have been revised;
- increased factors for use in the design of members when simplified methods are used have been revised; and
- the method of calculating the percentage of load transfer through flat slabs as back-propping has been revised.

This document provides all the guidance necessary for the design of a safe system of falsework, although some clauses might be relevant and applicable to other temporary works. Users of [BS EN 12812:2008](#) are expected to refer to numerous other documents to complete the design of a safe system of falsework, e.g. derivation of wind loads requires the use of BS EN 1991-1-4:2005+A1 and [BS EN 1991-1-6:2005](#) and their associated national application documents.

Users of this British Standard are reminded that it might be necessary to apprise third parties, with whom they are not in contractual relations, of certain provisions in this document.

Recognizing that certain products remain available for use long after the standards to which they were manufactured were superseded, this part of BS 5975 gives normative references to several standards that have been withdrawn.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at bsigroup.com/standards, or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Use of this document

As a code of practice, this British Standard takes the form of recommendations and guidance. It is not to be quoted as if it were a specification. Users are expected to ensure that claims of compliance are not misleading.

Users may substitute any of the recommendations in this British Standard with practices of equivalent or better outcome. Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the *Shorter Oxford English Dictionary* is used (e.g. “organization” rather than “organisation”).

The word “should” is used to express recommendations of this standard. The word “may” is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word “can” is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations.

Commentaries give background information.

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Compliance with a British Standard cannot confer immunity from legal obligations.

Introduction

BS 5975 was first published in 1982 as one document. It reflected the recommendations of the Bragg Report [1] and used, as the main reference document during the drafting stages, the report on falsework by the Joint Committee of the Concrete Society and the Institution of Structural Engineers [2]. These two reports were published in the 1970s following a number of significant collapses and an apparent lack of authoritative guidance. The 1982 standard introduced procedural control of temporary works. The standard drew together all the aspects to be addressed when preparing a falsework design using permissible stress methods, and in so doing included recommendations for materials, design and work on site.

In this revision, BS 5975 has been split into two parts.

- a) BS 5975-1:2024 gives recommendations and guidance on the procedural controls to be applied to all aspects of temporary works in the construction industry, including design.
- b) BS 5975-2 gives recommendations for designing falsework, some of which can be used by designers of temporary works other than falsework, e.g. recommendations for materials and advice on the derivation and use of simplified wind loads can be used in the design of hoardings or edge protection, etc.

Clause 8, Limit state design with partial load factors, is new and is recommended not only as an option for design of class A falsework, but as a means of safely applying simplified methods derived from Eurocodes to all falsework in the UK (see Foreword and **Clause 4**). **Clause 9**, Permissible stress design of falsework, exists in parallel with **Clause 8** and either subclause can be used for either class A or all falsework, but not both limit state and permissible stress in the same design.

The temporary works industry remains heavily reliant on operatives and technicians understanding safe load concepts in their work. Because of the importance placed by the Temporary Works Forum (TWf) on the need to retain the permissible stress sections of BS 5975 for future use, **Clause 9** is an important element of this part of BS 5975.

The definition of falsework given in **3.1.15** is broad, and the principles and formulae given in this part, such as wind data, can be used on other temporary works.

1 Scope

This part of BS 5975 gives recommendations and guidance on the design, specification, construction, use and dismantling of falsework. It gives guidance on permissible stress and limit state design of all falsework. The recommendations also apply to the design of class A falsework defined in **BS EN 12812:2008**, which is specifically excluded from **BS EN 12812:2008**.

NOTE **BS EN 12812:2008** has been deemed nonconformant to Eurocodes by European committee CEN 250 and until the issues are resolved, BS 5975-2 is intended to be used for the design of all falsework in the UK.

This part of BS 5975 covers the design of falsework and associated formwork and can be applied to the design of other temporary works. In addition, it covers materials, including material factors; loads; safety and load factors; analysis and design of falsework, including both proprietary equipment and traditional scaffolding solutions; and wind loading (with reference to temporary and permanent stability), and gives references to other British Standards for the design of structural steelwork, reinforced concrete and excavation support. Although originally written for permissible stress design, the design concepts and the loads stated are also applicable to limit state design and can be taken as the characteristic values. The loads, including wind loads, are the unfactored loads and conform to both BS EN 1991-1-4:2005+A1 and **BS EN 12812:2008**.

The structural design element includes additional information and recommendations for the design of falsework using existing structural standards.

This part of BS 5975 does not give specific recommendations for the support of excavations (see [BS 6031](#)), nor does it cover flying shores or facade retention systems (see CIRIA C579 [N1](#)). Guidance on the design and use of access scaffolding and special scaffold structures other than falsework is given in [BS EN 12811-1:2003](#) and the NASC guide TG20:21 [[N2](#)], [[3](#)].

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions, or limits the application of, this document.¹⁾ For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

NOTE Recognizing that certain products remain available for use long after the standards to which they were manufactured were superseded, this part of BS 5975 gives normative references to several standards that have been withdrawn.

BS 449-2:1969+A1:1975 (withdrawn), *Specification for the use of structural steel in building – Part 2: Metric units*

[BS 1139-1.1:1990](#) (withdrawn), *Metal scaffolding – Part 1: Tubes – Specification for steel tube*

[BS 1377](#) (all parts), *Methods of test for soils for civil engineering purposes*

[BS 4074:1982](#) (withdrawn), *Specification for metal props and struts*

[BS 4360](#) (withdrawn), *Specification for weldable structural steels*²⁾

[BS 4978](#), *Visual strength grading of softwood – Specification*

[BS 5268-2:2002](#) (withdrawn), *Structural use of timber – Part 2: Code of practice for permissible stress design, materials and workmanship*

[BS 5507-3](#), *Methods of test for falsework equipment – Part 3: Props*

[BS 5756](#), *Visual strength grading of temperate hardwood – Specification*

[BS 5930](#), *Code of practice for ground investigations*

BS 5975-1:2024, *Temporary works – Part 1: Management procedures for the control of temporary works – Code of practice*

[BS 8002](#), *Code of practice for earth retaining structures*

[BS 8004](#), *Code of practice for foundations*³⁾

[BS EN 39:2001](#), *Loose steel tubes for tube and coupler scaffolds – Technical delivery conditions*

[BS EN 74-1](#), *Couplers, spigot pins and baseplates for use in falsework and scaffolds – Part 1: Couplers for tubes – Requirements and test procedures*

[BS EN 74-2](#), *Couplers, spigot pins and baseplates for use in falsework and scaffolds – Part 2: Special couplers – Requirements and test procedures*

[BS EN 336:2013](#), *Structural timber – Sizes, permitted deviations*

[BS EN 338](#), *Structural timber – Strength classes*

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

²⁾ This part of BS 5975 gives normative references specifically to the 1986 and 1990 editions of [BS 4360](#) and generally to pre-1986 editions.

³⁾ This part of BS 5975 also gives an informative reference to BS 8004:1986 (withdrawn).

[BS EN 636](#), *Plywood – Specifications*

[BS EN 755-2](#), *Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 2: Mechanical properties*

[BS EN 771](#) (all parts), *Specification for masonry units*

[BS EN 1065:1999](#), *Adjustable telescopic steel props – Product specifications, design and assessment by calculation and test*

[BS EN 1313-1:2010](#), *Round and sawn timber – Permitted deviations and preferred sizes – Part 1: Softwood sawn timber*

[BS EN 1313-2](#), *Round and sawn timber – Permitted deviations and preferred sizes – Part 2: Hardwood sawn timber*

[BS EN 1912](#), *Structural Timber – Strength classes – Assignment of visual grades and species*

[BS EN 1990:2002+A1:2005](#), *Eurocode – Basis of structural design*

[BS EN 1991-1-1:2002](#), *Eurocode 1 – Actions on structures – Part 1-1: General actions – Densities, self-weight, imposed loads for buildings*

[BS EN 1991-1-4:2005+A1:2010](#), *Eurocode 1: Actions on structures – Part 1-4: General actions – Wind actions*

[BS EN 1991-1-6:2005](#), *Eurocode 1 – Actions on structures – Part 1-6: General actions – Actions during execution*

[BS EN 1992](#) (all parts), *Eurocode 2 – Design of concrete structures*

[BS EN 1993](#) (all parts), *Eurocode 3 – Design of steel structures*

[BS EN 1993-1-1:2005+A1:2014](#), *Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings*

[BS EN 1993-1-5:2006+A1:2019](#), *Eurocode 3: Design of steel structures – Part 1-5: Plated structural elements*

[BS EN 1995](#) (all parts), *Eurocode 5 – Design of timber structures*

[BS EN 1995-1-1:2004+A2:2014](#), *Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings*

[BS EN 1996](#) (all parts), *Eurocode 6 – Design of masonry structures*

[BS EN 1996-1-1:2005+A1:2012](#), *Eurocode 6 – Design of masonry structures – Part 1-1: General rules for reinforced and unreinforced masonry structures*

[BS EN 1997-1:2004+A1:2013](#), *Eurocode 7 – Geotechnical design – Part 1: General rules*

[BS EN 1997-2](#), *Eurocode 7 – Geotechnical design – Part 2: Ground properties*

[BS EN 1999](#) (all parts), *Eurocode 9 – Design of aluminium structures*

[BS EN 10025-2](#), *Hot rolled products of structural steels – Part 2: Technical delivery conditions for non-alloy structural steels*

[BS EN 10027](#) (both parts), *Designation systems for steels*

[BS EN 10210-1](#), *Hot finished structural hollow sections of non-alloy and fine grain steels – Part 1: Technical delivery requirements*

[BS EN 10219](#) (all parts), *Cold formed welded steel structural hollow sections*

[BS EN 10219-1](#), *Cold formed welded structural hollow sections of non-alloy and fine grain steels – Part 1: Technical delivery requirements*

[BS EN 12811-1:2003](#), *Temporary works equipment – Part 1: Scaffolds – Performance requirements and general design*

[BS EN 12369-1](#), *Wood-based panels – Characteristic values for structural design – Part 1: OSB, particleboards and fibreboards*

[BS EN 12812:2008](#), *Falsework – Performance requirements and general design*

[BS EN 12813](#), *Temporary works equipment – Load bearing towers of prefabricated components – Particular methods of structural design*

[BS EN 13377:2002](#), *Prefabricated timber formwork beams – Requirements, classification and assessment*

[BS EN 13670](#), *Execution of concrete structures*

[BS EN 14399-4](#), *High-strength structural bolting assemblies for preloading – Part 4: System HV – Hexagon bolt and nut assemblies*

[BS EN 14399-8](#), *High-strength structural bolting assemblies for preloading – Part 8: System HV – Hexagon fit bolt and nut assemblies*

[NA to BS EN 1991-1-1:2002](#), *UK National Annex to Eurocode 1: Actions on structures – Part 1-1: General actions – Densities, self-weight, imposed loads for buildings*

[NA to BS EN 1991-1-4:2005+A1:2010](#), *UK National Annex to Eurocode 1 – Actions on structures – Part 1-4: General actions – Wind actions*

[NA+A1:2014 to BS EN 1993-1-1:2005+A1:2014](#), *UK National Annex to Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings*

[NA to BS EN 1997-1](#), *UK National Annex to Eurocode 7: Geotechnical design – Part 1: General rules*

[NA to BS EN 1997-2](#), *UK National Annex to Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing*

[PD 6688-1-4:2015](#), *Background information to the National Annex to BS EN 1991-1-4 and additional guidance*

[PD 6695-2](#), *Recommendations for the design of bridges to BS EN 1993*

Other publications

- [N1] CONSTRUCTION INDUSTRY RESEARCH AND INFORMATION ASSOCIATION (CIRIA). *Masonry façade retention – Best practice guide*. CIRIA Report C579. London: CIRIA, 2003.
- [N2] NATIONAL ACCESS AND SCAFFOLDING CONFEDERATION (NASC). *TG20:21 Operational Guide*. London: NASC, 2021.
- [N3] THE CONCRETE SOCIETY. *Formwork – A guide to good practice*. Special Publication CS030. Third Edition. Crowthorne: The Concrete Society, 2012.
- [N4] THE CONCRETE CENTRE and CONSTRUCT. *National Structural Concrete Specification for Building Construction*. CCIP-050. 4th Edition. Camberley: The Concrete Centre and CONSTRUCT, 2010.
- [N5] TEMPORARY WORKS FORUM. TWf2019:01. *Precast concrete: Good practice and common issues in temporary works*. London: Institution of Civil Engineers, 2019.
- [N6] CONSTRUCTION INDUSTRY RESEARCH AND INFORMATION ASSOCIATION (CIRIA), CLEAR, C. A. and HARRISON, T. A. *Concrete pressure on formwork (R108)*. London: CIRIA, 1985.
- [N7] TEMPORARY WORKS FORUM. Twf 2021:01, *Temporary condition of reinforcement cages prior to concreting: Part 2 – Technical Guidance*, London: Temporary Works Forum, November 2022.

- [N8] GARDNER, L. SCI P360, *Stability of Steel Beams and Columns*. Ascot: The Steel Construction Institute (SCI): Ascot, 2011.
- [N9] THE BRITISH CONSTRUCTIONAL STEELWORK ASSOCIATION LTD (BCSA). *National Structural Steelwork Specification for Building Construction* (68/23). 7th Edition, 1st Revision. London BCSA, 2023.
- [N10] DAVISON, B. and OWENS, G.W (STEEL CONSTRUCTION INSTITUTE). *Steel Designer's Manual*. 6th edition. Wiley-Blackwell. 2015.
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3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this part of BS 5975, the terms and definitions given in [Annex A](#) and the following apply.

3.1.1 adjustable telescopic steel prop

prop comprised of two tubes which are telescopically displaceable, one within the other

NOTE 1 See also 3.1.27 for a definition of "prop".

NOTE 2 A prop has coarse adjustment with a pin inserted into holes in the inner tube and a means of fine adjustment using a threaded collar.

3.1.2 back-propping

propping installed at levels below the slab that supports the falsework in order to distribute the load on the uppermost slab to suitable supports, such as lower slabs or the foundations

3.1.3 base plate

rigid plate used for spreading the load in a standard, raker or other load-bearing member over a greater area

3.1.4 beam

spanning member, usually horizontal, used to transfer load to supports, commonly timber, aluminium or steel

NOTE Also known as "bearer" and "joist".

3.1.5 blinding

layer of lean concrete on soil to prevent local degradation and provide a clean workplace for construction work

3.1.6 brace

component placed diagonally with respect to the vertical or horizontal members of a structure to afford stability

3.1.7 characteristic strength

strength at which members tested would fail, normally associated with a confidence limit that 95% would fail above the value stated

3.1.8 client

organization or person for which/whom a construction project is carried out

3.1.9 competent person

individual with the necessary skills, knowledge and experience of the specific tasks to be undertaken and the risks which the work entails, to enable them to carry out their duties in relation to the project, to recognize their limitations, and to take appropriate action to prevent harm to those carrying out construction work or those affected by the work

3.1.10 component

part of the temporary works structure used and identifiable as a distinct unit

3.1.11 contractor

person (including a non-domestic client) who, in the course or furtherance of a business, carries out, manages or controls construction work

NOTE 1 Anyone who directly employs or engages construction workers or manages construction is a contractor. Contractors include principal contractors, subcontractors, and any individual, sole trader, self-employed worker or business that carries out, manages or controls construction work as part of their business. This also includes companies that use their own workforce to do construction work on their own premises. The duties on contractors apply whether the workers under their control are employees, self-employed or agency workers.

NOTE 2 Where contractors are involved in design work, including for temporary works, they also have duties as designers under the Construction (Design and Management) (CDM) Regulations 2015 [4].

3.1.12 coupler

component used to fix scaffold tubes together

3.1.13 effective length

theoretical length of a compression member as determined by the restraint at its ends

3.1.14 factor of safety

ratio of failure load to the maximum working load

3.1.15 falsework

temporary structure used to support a permanent structure while it is not self-supporting

3.1.16 fork head

U-shaped housing used to support bearers, beams, joists or similar

3.1.17 formwork

structure, usually temporary, but in some cases wholly or partly permanent, used to contain poured concrete to mould it to the required dimensions until it is able to support itself

NOTE Formwork consists primarily of face-contact material and the bearers that directly support the face-contact material.

3.1.18 frame

principal panel unit of a prefabricated falsework structure formed from aluminium or steel sections

NOTE A frame can include connecting components.

3.1.19 grade stress

for permissible stress design, the stress that can be safely sustained by timber of a particular strength class, or species and grade

3.1.20 joint pin

expanding fitting placed in the bore of a tube to connect one tube to another coaxially

3.1.21 kentledge

material placed on a structure to provide stability by the action of its dead weight

3.1.22 lacing

generally horizontal members that connect together and reduce the unsupported length of compression members and when used in conjunction with bracing or external restraint, reduce the effective length of the compression member

3.1.23 node

theoretical point at which two or more members are connected together

3.1.24 permanent formwork

structural element that contains the placed concrete, moulds it to the required dimensions and remains in place for the life of the structure

3.1.25 permissible stress

stress that can be sustained safely by a structural material for the particular condition of service or loading

3.1.26 primary beam

principal bearing member transferring load to the falsework, spanning between supports

NOTE Also known as “primary bearer”.

3.1.27 prop

compression member used as a temporary support

3.1.28 scaffold

temporary structure that provides support to platforms from which persons work, or that is used to support material, plant or equipment

NOTE See also 3.1.15 for a definition of “falsework”.

3.1.29 soffit

underside surface of a concrete member or slab

3.1.30 sole plate

timber, concrete or metal spreader used to distribute the load from a standard or base plate to the ground

3.1.31 standard (noun)

vertical tube or member

3.1.32 strength class

classification of timber based on particular values of grade stress

3.1.33 strut

member in compression

NOTE See also 3.1.27 for a definition of “prop”.

3.1.34 subcontractor

contractor employed by another contractor to carry out or manage construction work

NOTE See also 3.1.11 for a definition of “contractor”.

3.1.35 sway

horizontal displacement at the top of the falsework in relation to the bottom under application of the load

3.1.36 temporary works coordinator (TWC)

competent person with responsibility for the coordination of all activities related to the temporary works

3.1.37 top restraint

method by which stability of falsework is provided by the surrounding permanent works or specifically designed temporary works

3.1.38 tower

tall composite structure, used principally to carry vertical loading

3.1.39 wedge

piece of material, timber or metal that tapers in its length and is used to adjust elevation or line or angle

NOTE Folding wedges comprise a pair of wedges laid one above the other so that their outer faces are parallel.

3.2 Symbols

For the purposes of this part of BS 5975, the following symbols apply.

Symbol	Meaning	Unit
L_w	Width between vertical forms	mm
$c_{u,k}$	Characteristic undrained shear strength	kPa
σ	Stress	N/mm ²
ε	Strain	non-dimensional
$\gamma_{G,inf}$	Partial factor for lower design value of permanent action (for favourable loading)	non-dimensional
$\gamma_{G,sup}$	Partial factor for upper design value of permanent action (for unfavourable loading)	non-dimensional
$\gamma_{Q,inf}$	Partial factor for lower design value of variable action (for favourable loading)	non-dimensional
$\gamma_{Q,sup}$	Partial factor for upper design value of variable action (for unfavourable loading)	non-dimensional

3.3 Abbreviated terms

For the purposes of this part of BS 5975, the following abbreviated terms apply.

AWL	Allowable working load
CDM	Construction (Design and Management)
CEM	Cement
CIRIA	Construction Industry Research and Information Association
EQU	Static equilibrium of the whole or part of the structure
FAT	Fatigue-induced failure
FoS	Factor of safety
GEO	Failure or excessive deformation of the ground
HYD	Hydraulic heave, piping and internal erosion caused by hydraulic gradients
LVL	Laminated veneer lumber
MDF	Medium density fibreboard
NASC	National Access and Scaffolding Confederation
OSB	Oriented strand board
PWD	Permanent works designer
RSJ	Rolled steel joist
SLS	Serviceability limit state
STR	Structural strength of elements or the structure as a whole
SWL	Safe working load
TW	Temporary works
TWC	Temporary works coordinator
TWD	Temporary works designer
UB	Universal beam
UDL	Uniformly distributed load
ULS	Ultimate limit state

Section 1 Design

4 General

- 4.1** A considerable amount of falsework is of comparatively low technology, but it should be designed either as a bespoke solution or for use as a standard solution. The use of a standard solution should be in accordance with BS 5975-1:2024, **12.10**.
- 4.2** Where reference is made in this document to design in accordance with limit state design codes, for example, BS EN 1990:2002+A1 to [BS EN 1999](#) (all parts), appropriate load and material factors should be used (see [Clause 5](#) and [Clause 6](#)).
- 4.3** While the user may design to limit state or permissible stress, the design approaches should not be mixed within the design of any one element of any one arrangement of the falsework system.
- NOTE For example, it is permitted to use limit state principles for the design of the falsework and change to allowable bearing pressures when designing the foundations, and/or permissible stress when designing the formwork. It is also permitted to design the whole structure to permissible stress, including the falsework.*
- 4.4** Where design approaches are varied between the falsework and the foundations, appropriate load factors should be used to convert the loads from limit state to working loads in accordance with [Clause 6](#) to [Clause 10](#). The designer of the falsework should define clearly to the foundation designer the loads to be carried by the ground, clearly indicating whether or not these are factored loads, actual loads, or dead loads combined with any live loading reduction.
- 4.5** Special attention should be given to the interfaces between different areas of design, e.g. falsework to foundations (see also BS 5975-1:2024) and formwork to falsework. The supplier (of falsework) should make clear that the loads are either ultimate limit state (ULS) or allowable loads.
- 4.6** Where the material chosen for falsework is not among those covered in [Clause 5](#), a permissible stress approach should be adopted to provide satisfactory working stresses, or a limit state approach should be adopted to obtain satisfactory characteristic stresses.
- 4.7** The design and usage of these materials should conform to the appropriate clauses of relevant standards.
- 4.8** Where a contract specifies design of falsework in accordance with [BS EN 12812:2008](#), any Class A falsework should be designed in accordance with [Clause 8](#) or [Clause 9](#) of this document as the design of Class A falsework is not covered by [BS EN 12812:2008](#).
- 4.9** The initial premise upon which those responsible for the final design of the falsework should base their scheme is the previously agreed design brief (see BS 5975-1:2024, **12.2**), taking account of the potential need to accommodate alterations in the design when, for instance, the final details of the permanent works are known, or as experience is gained during the erection of the falsework.
- 4.10** Where the falsework requires the removal of individual pieces of the structure after loading, for example, when striking primary and/or secondary bearers, safe access should be provided, e.g. a platform. Where the formwork and falsework are handled in large assemblies, provision should be made for access to the make-up areas around such assemblies.

NOTE Generally, provision of a working platform approximately 2 m below the underside of the permanent works suffices for safe removal of soffit formwork.

4.11 The following points should be addressed:

- a) for permanent works design:
 - 1) the space required to provide anticipated arrangements of temporary works;
 - 2) interim stability issues during construction and proposed remediation;
 - 3) communication of design assumptions (loading and deflection limits of the permanent works), including format of electronic data;
 - 4) adequacy of the permanent works to sustain anticipated loadings from temporary works; and
 - 5) communication of any assumed or controlling sequence of working for practical erection of the temporary and permanent works; and
- b) for temporary works design, communication of lateral stability requirements and vertical load limitations and erection and dismantling sequences.

4.12 A design brief for falsework should be prepared in accordance with BS 5975-1:2024, **12.2**, taking account of the following.

- a) If the falsework is to be designed as top-restrained it should be clear that the permanent works have been designed to resist the horizontal disturbing force, F_H (see **7.2.2.2**).
- b) If the falsework is to be supported by the permanent works (typically in multi-storey construction), it should be clear that the permanent works have been designed to resist the loads imposed by the falsework.

5 Materials and components

5.1 General

5.1.1 Properties and performance

The properties of the materials and the components that are proposed for use should be identified.

NOTE 1 Materials are often sourced from different organizations; some are generic materials, such as timber, steels, tube and fittings, but many are proprietary. Some of the proprietary items in use are manufactured to European specifications, and, as the same type of item is available from many suppliers, are considered to be generic products, for example, adjustable telescopic steel props and scaffold fittings.

The designer should comply with **5.2** to **5.8** for the selection of generic materials, their preferred available sizes, any classifications, and user/inspection information. The stresses and properties given separately for limit state design in **Clause 8**, and for permissible stress design in **Clause 9** should be used in design.

A check should be performed to verify that the terms used to define capacity are understood; they may be in safe working loads (SWLs), allowable working loads (AWLs), characteristic strength, or other terms. Where it is proposed to use equipment in situations not specifically intended by the supplier, the supplier should be consulted for specific advice about the proposed method of use.

Where components from different suppliers are incorporated in one assembly, the designer should establish compatibility between these components.

NOTE 2 Where compatibility cannot be established in design, testing might be necessary.

Where performance information is not readily available, or as an alternative means of obtaining the required data, an assessment should be made of the capability of the material(s) to resist the loading conditions using fundamental engineering principles and, where appropriate, testing arranged (see **5.2**).

As materials are often used in temporary works other than falsework, the likely tolerances of erection and workmanship expected on site should be as recommended in [12.1](#).

When designing for the use of proprietary equipment, the designer should specify use of the equipment in accordance with the current recommendations of its supplier. The information listed in [5.8.3](#) should be obtained from the manufacturer/importer of the products.

5.1.2 Suitability of materials

All materials selected for use should, when new, conform to the appropriate British Standard(s), where one exists.

The properties of second-hand materials should be determined in accordance with [5.1.3](#) to [5.8.9](#).

5.1.3 Identification and properties

Materials and components should be clearly and readily identifiable by shape or size where possible. Where this is not possible, they should be clearly marked. Particular care should be taken when identifying small items, such as bolts and ties, which can appear similar but have very different properties.

Material should only be used where its properties are known or established, and its application should be within these limits.

5.1.4 Handling of materials and components

Materials and equipment used in falsework are, in most cases, used many times, so when selecting these, account should be taken of the conditions under which they are to be handled.

NOTE For example, wrapping methods, palletization, shipping and vehicle transporting configurations can all affect the condition and resultant quality of material delivered to site.

5.1.5 Deterioration

Materials and components can deteriorate in unexpected ways but the following as a minimum should be taken into account:

- a) fatigue;
- b) heat;
- c) chemical deterioration;
- d) organic or ultraviolet deterioration;
- e) animal or bacteriological action;
- f) handling and transportation damage; and
- g) local adaptations that have caused loss of cross-sectional area.

Such deterioration should be identified by examination of materials when their use is proposed and allowance made, if necessary, after testing (see [5.2](#)).

5.2 Testing and inspection

Where doubt exists as to the properties, by composition or condition, of the material or component, it should where necessary be submitted to a test of the load/deflection type, to determine stiffness and strength, wherever possible in accordance with an appropriate British Standard.

Where a sample piece is cut from the section and tested to check its strength, the sample should be cut from an area which will not be critical to the resistance.

NOTE The sample piece may be replaced by a piece of material of similar strength and section properties after the test has been completed.

Testing on site of materials or components for temporary works equipment should only be specified for quality control purposes, as even the simplest tests require disciplined test procedures.

If the performance of an item of equipment is not known, or is in doubt, and calculations are impracticable, appropriate tests should be carried out. These tests should be related to likely site conditions to determine necessary values. A single test might give misleading results, and this should be taken into account.

5.3 Steelwork (other than scaffold tube)

COMMENTARY ON 5.3

Specific recommendations for tubular steel scaffolding and manufactured components are given in 5.7 and 5.8 respectively.

5.3.1 Quality of steel

Steelwork used in falsework should either be:

- a) cold rolled sections conforming to BS EN 10219 (all parts); or
- b) hot rolled sections conforming to BS EN 10027 (both parts).

For steel manufactured to editions of BS 4360 (withdrawn) pre-dating 1986, the design should be based on grade S275 of BS EN 10025-2.

For steel manufactured to BS 4360:1986 or BS 4360:1990, the design should be based on the equivalent steel grade from BS EN 10027 (both parts) shown in Table 1.

If the material properties are not known, for design purposes the steel should be assumed to be grade S235 JR of BS EN 10025-2 (but see 11.13 for welding).

Pre-used material or components should be assessed for condition and when required, allowance made in the design for reduced performance.

Table 1 — Hot rolled steel grading comparison of BS 4360 (withdrawn) with BS EN 10027 (both parts) equivalent terminology

Item	BS 4360 (withdrawn)	BS EN 10027 (both parts)
1	43A	S270GP (1.0023)
2	43B	S275JR (1.0044)
3	43C	S275J0 (1.0143)
4	43D	S275J2(+N) (1.0144)
5	50A	S355GP (1.0083)
6	50B	S355JR (1.0045)
7	50C	S355J0 (1.0553)
8	50D	S355M (1.8823)
9	55C	S450J0 (1.0590)
10	55EE	S460NL (1.8903)
11	55F	S460QL (1.8906)

5.3.2 Identification of steel

The correct quality, size and mass of steel section should be used. Each element should be clearly marked to assist erection and inspection. Correct identification of sections should be verified, taking into account the variation in weight within a serial size and the prevalence of both UK and European section sizes. The design should take account of the differences between rolled steel joists (RSJ) and universal beam (UB) sections, the latter often having thinner webs and dimensions that are nominal only and vary with the particular mass per unit length.

NOTE Stock steel is often purchased by weighbridge tonnage dispatched, whereas quantity surveyors and designers consider sections by mass per unit length. This can lead to differences in the final falsework weight as it depends on the rolling tolerances used during manufacture.

Where steelwork of higher grade than mild steel is used for particular properties, it should be so marked as to be readily distinguishable, and any connections should be designed to obviate substitution errors.

5.3.3 Stresses

The characteristic strength of the steel for use in limit state design should be as recommended in [Clause 8](#).

The permissible stresses for the steel being used should be as recommended in [9.3.2.1](#).

NOTE BS 449-2:1969+A1 (withdrawn) specifies permissible stresses, which may also be used.

5.3.4 Section properties

Where the cross-sectional area of a steel section has been reduced, the actual dimensions should be measured, and section properties calculated on the basis of the least cross-sectional area. If such measurements are not possible owing to heavy corrosion or any other reason, load testing should be carried out. Sections showing heavy pitting once rust is removed should not be used.

5.3.5 Fatigue

COMMENTARY ON 5.3.5

There is normally no need to take account of fatigue when designing falsework.

In falsework design loading cycles are generally measured in 10 s, whereas loading cycles causing fatigue in materials are measured in 1 000 s.

While fatigue can generally be ignored, designers should make a judgement based on their knowledge of the likely loading conditions.

NOTE Fatigue effects from vibrations, such as vortex excitation, might need to be allowed for where falsework comprises long, slender cylindrical members, and is subjected to long periods of laminar wind velocity (see [6.4.1.23](#)).

5.4 Timber and wood-based contact materials

5.4.1 General

Timber for falsework should be stress-graded in accordance with [BS 4978](#) for softwood, or [BS 5756](#) for hardwood, or other appropriate standards of other countries. [BS EN 338](#) should be used where a simplified approach to the stress grading is required, using nine rationalized strength classes for softwood and six for hardwood. Either [BS EN 1912](#) should be used, as it gives details of equivalent timber grades satisfying the various strength classes, or timber should be graded directly to a particular strength class.

5.4.2 Minimum quality

Strength class C16 timber or equivalent should be the minimum quality adopted for general use.

NOTE A species/grade combination for a higher strength class may safely be used where a lower strength class is specified.

5.4.3 Hardwood and softwood

For load-bearing wedges and packings, the higher strengths available from the denser hardwoods are desirable and straight-grained hardwoods whose density exceeds approximately 640 kg/m³ to strength classes above D30 should be used for such wedges.

Designers should follow the principles of sustainable development before specifying hardwood.

NOTE Table 2 gives some commonly available hardwood species that are generally suitable for use as load-bearing wedges and packing.

Table 2 — Suitable hardwood species

Standard name	Botanical species
Ash	Fraxinus excelsior
Beech	Fagus sylvatica
Greenheart	Ocotea rodiaei
Jarrah	Eucalyptus marginata
Karri	Eucalyptus diversicolor
Keruing	Dipterocarpus spp
Oak	Quercus spp

5.4.4 Timber stresses

Timber in use in falsework, and in most temporary works, is exposed to the elements and the wet exposure condition (BS EN 1995-1-1:2004+A2, Service Class 3) should be used in calculating applicable stresses. Different factors should be used for stress, size and moduli calculations to convert dry stresses to wet exposure conditions, taking into account that storage, wrapping for transport and the location of use can affect the level of moisture content in all timber.

The fibrous structure of timber gives it a unique property that allows different stresses to be sustained depending on the duration the timber is loaded; it “recovers” quickly after short-term loading, such as in wall formwork where higher stresses are permitted than if loaded for a longer time, such as in a falsework structure. This unique property combined with the effects of load sharing between members generates three different conditions for timber in use and the designer should take these into account in different design conditions; namely, in wall formwork, general use, and the particular condition as single members (primary bearers) in falsework.

5.4.5 Stress-graded timber

COMMENTARY ON 5.4.5

Timber that has been accepted as stress-graded carries appropriate marking, comprising a stamp on at least one face, edge or end to indicate the grade.

The strength used for design purposes should be of the lowest grade marked on the timber.

Machine stress-graded timber is assessed about its lesser dimension, so if used on edge, a check should be made to establish that there are no splits or knot combinations that would result in downgrading.

5.4.6 Timber size

The preferred sizes of sawn timber specified in BS EN 1313-1:2010 for softwood and in BS EN 1313-2 for hardwood timber should be selected for the design.

NOTE 1 BS EN 1313-1:2010, Table A.6, gives the complementary preferred target cross-sectional sizes for sawn softwood normally available in the United Kingdom.

Where softwood timber is used as constructional sawn timber, the target size should be reduced for design depending on the tolerance class and moisture content. Sawn timber width and thickness should be of Tolerance Class 1 (TC1) to BS EN 336:2013, Table 1.

The reference moisture content for timber should be taken as 20%. The design should allow for a decrease in thickness and width by 0.25% for every 1.0% moisture content below 20% moisture content. Timber used for falsework should be assumed to be at 20% moisture content.

The target and actual sizes of softwood timber generally used in falsework should be as shown in [BS EN 1313-1:2010](#), Table A.6, noting that when used in falsework, a rectangular timber is normally used the strong way around.

NOTE 2 For example, a (75 × 150) mm timber would be used with the 150 mm side vertical and referred to as “depth 150 mm”; whereas this same dimension would be regarded as “width 150 mm” in [BS EN 1313-1:2010](#).

The geometric properties for the common sizes of timber shown in [Table 3](#) should be used in temporary works.

Table 3 — *Geometric properties for basic sizes of solid timber*

Basic sizes (mm) (b × h)	50 × 100	75 × 100	50 × 150	75 × 150	100 × 200	75 × 225
Finished size (mm)	47 × 97	72 × 97	47 × 145	72 × 145	97 × 195	72 × 220
Area (mm ²)	4 559	6 984	6 815	10 440	18 915	15 768
Section modulus (mm ³), Z	73.7 × 10 ³	113 × 10 ³	165 × 10 ³	252 × 10 ³	615 × 10 ³	581 × 10 ³
Moment of inertia (mm ⁴), I	3.57 × 10 ⁶	5.48 × 10 ⁶	11.9 × 10 ⁶	18.3 × 10 ⁶	60.0 × 10 ⁶	63.9 × 10 ⁶
<i>NOTE Timbers assumed used the strong way around.</i>						

5.4.7 Depth-to-breadth ratios

To avoid the risk of tall timbers turning sideways and becoming unstable, the ratios given in [Table 4](#) should not be exceeded.

Table 4 — *Maximum depth-to-breadth ratios*

Degree of lateral support	Maximum depth-to-breadth ratio
No lateral support	2:1
Ends held in position	3:1
Ends held in position and member held in line, e.g. by purlins or tie rods	4:1
Ends held in position and compression edge held in line, e.g. by direct connection of soffit formwork	5:1
Ends held in position and compression edge held in line, e.g. by direct connection of soffit formwork together with adequate bridging or blocking spaced at intervals not exceeding six times the depth	6:1
Ends held in position and both edges held firmly in line	7:1

5.4.8 Timber that is not stress-graded

Where it is not possible to obtain appropriate stress-graded timber, commercially-graded timber should only be used instead where unsuitable material is removed from the batch in accordance with the visual stress grading rules of [BS 4978](#).

Reject fraction from stress grading should not be used in falsework. Commercial grade timber should be selected from [Table 5](#).

Table 5 — Commercial grade timber suitable to produce mainly class C16 timber

Standard name	Commercial description
Czech whitewood (Ligna)	Unsorted
Finnish, Swedish and Polish redwood and whitewood	Fifths “V”
Pacific coast Douglas fir, hemlock, western whitewoods and spruce	1 and 2 merchantable
Russian redwood and whitewood	Fourths “IV”

5.4.9 Wood-based contact materials

Wood-based face contact materials used in casting in-situ concrete should be suitable for use and selected to provide the specified surface finish.

NOTE 1 The quality of the selected face contact material is governed by the number of reuses of the material envisaged, the workmanship and the method of fixing the material to the falsework assembly.

The designer should take into account the need for wood-based face contact materials, such as plywood, to be positioned correctly when fitted on site, as these are a layered material and can have different properties in two directions at right angles.

All wood-based face contact materials should be assumed to be in the wet exposure condition (Service Class 3) and as soffit formwork with a longer duration of load. The appropriate stresses should be determined in accordance with Clause 8 or Clause 9, as appropriate.

NOTE 2 Further guidance on wood-based face contact materials, oriented strand board (OSB) and other sheet materials is available from Formwork – A guide to good practice [N3], Clause 3.3.2.

5.5 Concrete and concrete components

5.5.1 Mix design

The designer should specify a suitable concrete for the intended location and function, for example:

NOTE BS 8500-1 describes methods of specifying concrete and gives guidance for the specifier.

- a) blinding;
- b) spread footings;
- c) piles;
- d) pile caps; and
- e) structural members.

The following are unlikely to be of significance over a short period and relaxation of the concrete specification should be permitted for these:

- 1) conversion of high alumina cement;
- 2) attack of CEM1 (Portland cement) concrete in sulfate-bearing ground; and
- 3) corrosion of reinforcement due to calcium chloride.

Where cement-free or low-carbon concrete is used for temporary works, information, including the rate of strength gain, should be obtained from the manufacturer, due to significant variation between products.

5.5.2 Blinding concrete

COMMENTARY ON 5.5.2

Blinding concrete is intended only to prevent local degradation of the soil and to provide an even surface.

The thickness of blinding concrete should be not less than 50 mm. The allowable bearing pressure for general loading should be the same as that of the underlying soil or weak rock, up to a maximum of 2 000 kN/m².

5.5.3 Spread footings

Mass concrete intended to transfer load direct to the ground and more than 100 mm thick should be treated as a spread footing. Spreading from the perimeter of load at an angle of 45° to the axis of the load should be assumed in calculating the bearing pressure on the ground, unless calculated in accordance with [Clause 10](#).

5.5.4 New structural members

New structural members should be designed and constructed in accordance with [BS EN 1992](#) (all parts) and [BS EN 13670](#), in conjunction with the *National Structural Concrete Specification for Building Construction* [N4], except in so far as their temporary function permits relaxation of serviceability requirements in relation to:

- a) reduced cover to the reinforcement;
- b) neglecting long-term creep deflections;
- c) accepting greater crack widths; and
- d) accepting higher deflections.

The designer should specify the concrete strength required prior to load being applied to the member.

NOTE Guidance on the age at which load can be applied to structural members is given in CIRIA R136 [5].

5.5.5 Second-hand structural members

Any second-hand concrete member not specifically designed for a particular project should only be used where all the following are satisfied:

- a) the position and sizes of the reinforcement and the strength of the concrete are known or can be ascertained;
- b) the member is free from excessive cracking, spalling, or a visible or known defect; and
- c) the member has been subjected to a design check and found adequate for its proposed use.

5.5.6 Precast concrete

Precast concrete members forming part of a falsework system should be manufactured in accordance with [BS EN 13670](#) and TWF 2019:01 [N5]. In the case of symmetrical sections having the principal reinforcement on only one face, the members should be clearly marked to indicate how they are to be used or, alternatively, the reinforcement should be designed to enable the members to serve their design performance whichever way up they are erected.

Precast concrete elements should only be modified after assessment of the effect of the modification on the strength of the unit. Where modification is necessary, e.g. of precast floor planks, additional support should be provided where required.

Special attention should be paid to concrete used as permanent formwork and subsequently used in composite construction as in some instances temporary supporting falsework might be required during the placing of in-situ concrete on top. Allowances should be made in the design for stresses and deflections that can be locked into the precast concrete members before composite action is assured.

The various temporary support and load conditions associated with delivery, storage and handling should be assessed in accordance with [7.2.1](#) and [7.3.1](#) and include:

- a) lifting attachments, which can induce local stresses within the member at early age/low strength;
- b) shims, which support the member, but induce local tensile stresses which can cause bursting (spalling) of the member;
- c) inclined supports which induce forces in two planes;

- d) variation in support and loading, caused by rotation of the member, from its cast position to its final orientation for incorporation into the permanent works, which is a particular concern at early age/low strength;
- e) support during transportation;
- f) loading from other precast elements or pouring of in-situ concrete and including wind loads; and
- g) loading from the effects of aligning the member (plumbing) and including working wind loads.

If erection shims are left in place, they should have a lower stiffness than the infilling material to ensure load transfer is primarily through the permanent works and not through the temporary works.

5.6 Brickwork and blockwork

5.6.1 Design

Brickwork and blockwork should be designed in accordance with [BS EN 1996](#) (all parts).

5.6.2 Rate of building

Where brickwork is to be load-bearing, the rate of building should be restricted to a maximum height of 1.5 m per day for normal construction in bricks with a compressive strength of up to 35 N/mm². No one portion should rise more than 1 m above the level of adjacent brickwork. Bricks of higher compressive strength usually have a higher density and lower absorption and because of this the rate of building per day should be limited still further.

5.6.3 Age of loading

If the loading is to be applied less than 28 days after completion of the brickwork or blockwork, characteristic strengths in compression should be calculated in accordance with BS EN 1996-1-1:2005+A1, Equation 3.2. Brickwork or blockwork should be loaded not less than seven days and preferably not less than 14 days after completion of the work.

5.6.4 Reinforced brickwork and blockwork

Only new materials should be used for reinforced brickwork and blockwork, which should conform to the applicable part(s) of [BS EN 771](#).

5.6.5 Salvaged bricks and blocks

Salvaged bricks and blocks should only be used for falsework if they are sound and free from contamination (e.g. gypsum plaster) that might adversely affect the mortar or its bond with the bricks or blocks, or have any other adverse effect on the structure.

The characteristic strength in compression should be calculated in accordance with BS EN 1996-1-1:2005+A1, using a unit crushing strength of the bricks of 5 N/mm².

Where salvaged bricks are used, it should be assumed that unreinforced brickwork possesses no tensile strength.

5.7 Steel scaffold tubes, couplers and other fittings

5.7.1 Equipment in general use

Scaffold tube should be identified, with most scaffold tube in use in the UK being steel tube of 48.3 mm outside diameter and scaffold tube to [BS EN 39:2001](#) having two wall thicknesses, either Type 4 with 4.0 mm, or Type 3 with 3.2 mm wall thickness. Where [BS EN 39:2001](#) tube is used, it should be Type 4. Where Type 3 is specified, the contractor should implement processes to avoid the risk of inadvertently replacing Type 4 with Type 3 tube.

Where a safety risk is identified with the manual handling of the heavier 4.0 mm tube, lighter tubes of 3.2 mm thickness and high-yield S355 steel conforming to [BS EN 10210-1](#) (hot formed) or to [BS EN 10219-1](#) (cold formed) should be used.

Properties and axial capacities for the BS EN 39:2001:2001 Type 4 tube, [BS EN 10219-1](#) 3.2 mm tube and [BS 1139-1.1:1990](#) (withdrawn) 4.0 mm tube should be as given in [Annex B](#).

The design should specify that couplers and fittings conform to [BS EN 74-1](#).

Steel and aluminium alloy tubes should not normally be used in the same structure, but if it is necessary to do so the difference in their properties should be allowed for in the design.

Their properties should be obtained from [BS EN 39:2001](#) (steel) and [BS EN 755-2](#).

NOTE Guidance on the use of tube and fittings scaffold is given in NASC TG:20:21 [N2].

5.7.2 Corrosion and deterioration of steel scaffold tube and fittings

Scaffold tube and fittings exhibiting corrosion should not be used.

5.8 Manufactured components for falsework

5.8.1 Types of manufactured components

The designer should take into account that there are many suppliers/importers of temporary works equipment, and these items are often used in more than one application as formwork and as falsework components; for example, formwork soldiers might be used as load-bearing members in falsework and in facade retention schemes. Many of the components offered might appear to be similar, but the designer should be aware they have different properties; in some cases, they might have been produced legally under licence. The designer should understand the source(s) and identification of falsework components, as this is an important aspect in the procedural control of equipment on site and should specify which components are to be used (see BS 5975-1:2024, **12.5**).

The following are examples of manufactured components for which the designer should specify the particular identification code:

- a) framed or braced tower components for vertical load bearing;
- b) adjustable telescopic props;
- c) twin channel soldiers;
- d) primary or secondary bearers;
- e) spanning girders; and
- f) battened strut members.

5.8.2 Testing of manufactured components

When structural analysis of a component or system is not practical, tests should be used to establish the performance. Load testing of falsework equipment should be carried out in accordance with [Annex C](#).

5.8.3 Information from the supplier

Information necessary for the safe design, erection, use, dismantling and maintenance of the components offered as falsework should be obtained from the supplier/importer of the components.

NOTE 1 Suppliers/importers are legally required to provide such information, in UK terms and units.

As the components offered by suppliers are produced for a competitive market, designers should allow for the fact that all the detailed information might not be available in published data sheets.

NOTE 2 Certain properties are commercially sensitive, including the manufacturing drawings and/or detailed material specifications.

The designer should review the information provided relating to the following:

- a) the intended uses of the components, how they can be identified, and the appropriate dimensions and masses, including guidance on transportation;
- b) whether the components conform to an appropriate British Standard or European Standard;
- c) connections where loads are received into one or more components, transferred from one to the other, and transmitted to other supports such as foundations;
- d) whether the stated loads are in terms of characteristic strength or maximum SWLs for various conditions of use, such as different extensions and eccentricities, together with details of any necessary bracing or lacing;
- e) whether the vertical load carrying capacity depends on the falsework designed as top-restrained, or whether the loads are considered for a free-standing structure;
- f) any limiting deflection conditions;
- g) any environmental aspects, such as forestry control data, excessive corrosion due to salt water and disposal instructions;
- h) whether allowances need to be made for the previous use of components; and
- i) any advice on safety, erection, dismantling, and disposal of the products.

5.8.4 Factors of safety

Where the strength of a component cannot be ascertained by design, it should be determined by testing. The information from testing should be provided to users of the components and clearly describe how the factor of safety (FoS) has been applied. For a strength to be used in permissible stress design, the FoS should be a minimum of 2.0 against failure or 1.65 against yield, whichever is the most onerous. For limit state design, a characteristic strength should be provided.

5.8.5 Framed or braced tower components for vertical load bearing

Prefabricated components are usually assembled into rectangular towers and should be either fully or partially braced in accordance with the supplier's recommendations.

The design of fully braced towers can generally be carried out using static analysis whereas partially braced towers should be analysed more rigorously, including second order effects.

Where the temporary works designer (TWD) specifies or incorporates a framed or braced tower in a temporary works scheme, they should:

- a) specify a tower system designed and tested in accordance with [BS EN 12813](#) that is supplied with information for use:
 - 1) for both free-standing and top-restrained systems as applicable; and
 - 2) indicating whether top restraint is a requirement; and
- b) make allowance for take-up at the joints as the load is applied and any modification to the anticipated distribution of load in the legs (see [7.3.1](#)), so that the final level at the top is as required.

5.8.6 Adjustable telescopic props

5.8.6.1 General

Many applications use single free-standing props, but where lacing and bracing for stability is necessary, the method of connecting the lacing to the prop should be assessed, and special connectors specified.

5.8.6.2 Adjustable steel props conforming to BS 4074:1982 (withdrawn)

The SWLs given in 9.3.6 should be used for both concentric and 25 mm eccentrically loaded props.

5.8.6.3 Adjustable steel props conforming to BS EN 1065:1999

The design should take into account that tolerances specified for erection are more stringent than those for BS 4074:1982 (withdrawn) props. Where these tolerances are not expected to be met, the SWL might be considerably lower and should be specifically calculated.

The design should be based on the characteristic strength for limit state design recommended in 8.6.5.

Permissible stress design should be based on the SWLs given in 9.3.7.

5.8.7 Aluminium props

The designer should allow for the fact that aluminium props are formed from extruded hollow sections with an adjustable jack at one or both ends, and the profile of the extrusion depends on the manufacturer.

NOTE 1 The props are generally part of a wider proprietary system, and frames and bracing can be used to assemble these props into towers.

There is currently no British or European Standard for individual aluminium props, so capacities should be obtained from the supplier/importer together with the user data and the erection tolerances. A recommended FoS should be used (see Clause 8 and 9.2).

The load capacity of the aluminium prop assemblies, published by the supplier/importer, should be checked to establish whether top restraint is assumed, and variations in load capacity if the falsework assembly is asymmetric are taken into account.

NOTE 2 Generally, these props are used vertically, and data on lower capacity when used in raking or horizontal applications might be available.

Individual aluminium props should only have joints within their length if specifically allowed by the manufacturer.

5.8.8 Proprietary beams

The design should take the following into account:

- a) many different types of proprietary beams are available for use as primary, secondary or spanning members commonly made of steel, aluminium or wood, and can be single, twin or lattice web, which can be susceptible to local bearing failure and lateral torsional buckling due to the use of thin sections;
- b) single web beams might have very low torsional strength and, in some situations, careful detailing might be required to prevent them from rolling over, particularly when used as bearers for sloping soffits, such as ramps;
- c) single web beams might also have a low resistance to lateral loads and require alternative measures to transmit notional and actual lateral forces from the soffit to the falsework support;
- d) for prefabricated timber formwork beams, the figures from BS EN 13377:2002 establish the characteristic values to be used in limit state design (see Clause 8), BS EN 13377:2002, Annex F, should be used to convert the design resistance into a SWL for use in permissible stress design (see Clause 9); and
- e) in lattice or truss members, the difference in bearing capacity at the nodes and between the nodes, so that the position of supporting falsework might dictate the bearing limit and the design.

If beams are to be used as spanning members, guidance should be obtained from the supplier as to whether their SWL in permissible stress design and characteristic strength in limit state design assume that the beams have continuous lateral restraint.

5.8.9 Spanning girders

The designer should be aware of the many types of proprietary spanning systems in use, and that most are created by the assembly of panels or other structural components. The user should be directed to the information provided with the equipment concerning the correct method of assembly and lifting.

6 Loads applied to falsework

6.1 General

Falsework should be designed to cater for:

- a) self-weights (6.2);
- b) imposed loads (6.3);
- c) environmental loads (6.4); and
- d) notional loads.

The terminology used in this document refers to “loads” in contrast to “actions” used in limit state design in [BS EN 12812:2008](#) and discussed further in [Clause 8](#). The alternative terms recommended for different types of load in [6.2](#) to [6.4](#) should be used.

Wherever possible, the precise loading conditions and the exact weights of materials should be ascertained. If estimated allowances are used for design purposes, a check should be carried out when details of the falsework and loading conditions are known, and the design confirmed or amended as necessary.

The following limits of the loads should be taken into account.

- 1) All loads are the actual value of the physical force exerted by the body or phenomenon (e.g. wind) that is to be resisted by the falsework structure. Certain values of the physical force are described as load per unit area applied to the structure.
- 2) Notional loads are limits established by design rules and established good practice to apply loads to a structure to verify stability, and/or to allow simplification of calculations, and/or to allow for out-of-plumb of vertical elements. Although not physically measurable they are used in the design of the falsework structure.
- 3) No FoS is included in the values of load stated. The calculation of environmental load caused by the wind pressure in accordance with [6.4.1](#) involves consideration of return periods and probabilities; these generate the actual wind load required to be resisted by the structure and are not a FoS.

6.2 Self-weights of materials

6.2.1 General

Where not given in this subclause, self-weights of materials and imposed loads should be taken from [BS EN 1991-1-1:2002](#).

NOTE Figures for the masses and densities of some commonly used materials are given in [Annex D](#). The density values to be used for reinforced concrete are given in [6.2.2](#).

6.2.2 Density of reinforced concrete

- 6.2.2.1** Unless calculated from known densities, the density value for normal reinforced concrete should be taken from [Table 6](#).

NOTE These values assume aggregates of normal density, e.g. limestone.

Table 6 — *Density of reinforced concrete*

Steel quantity (by volume) %	Mass density kg/m ³	Weight density kN/m ³
0	2 400	23.5
1	2 450	24
2	2 500	24.5
3	2 550	25
4	2 610	25.6
5	2 660	26.1
6	2 720	26.7

NOTE The values in this table are based on a density of unreinforced concrete of 2 400 kg/m³.

6.2.2.2 If the density of any of the aggregates exceeds 2 750 kg/m³, the density of the concrete should be determined by calculation or density test.

6.2.2.3 The density of lightweight concretes should be determined from trial mixes.

NOTE As a guide, the likely ranges of densities for certain types of light-weight concretes are given in [Table 7](#).

Table 7 — *Density ranges for lightweight concretes*

Concrete type	Density range (without reinforcement) kg/m ³
No fines, with normal density aggregates	1 600 to 2 000
Lightweight coarse aggregate and normal density fine aggregate	1 600 to 2 000
Lightweight coarse and fine aggregates	1 575 to 1 800

6.2.3 Self-weights

The total self-weight should include the self-weight of:

- a) the falsework structure;
- b) any ancillary temporary works connected to the falsework, such as:
 - 1) access ramps;
 - 2) hoist and other tower structures;
 - 3) loading storage platforms; and
 - 4) raking and flying shores;
- c) the formwork; and
- d) any permanent works elements forming an integral part of the formwork and falsework, such as permanent metal decking formwork and precast planks.

The self-weight of all parts of a falsework structure, including any associated formwork, should be treated as a permanent load.

NOTE Additionally, for stability calculations, loading may be subdivided into “favourable” and “unfavourable”; for example, kentledge which is normally considered a favourable load, might when checking stability be classified as “unfavourable” if supported temporarily by falsework.

6.3 Imposed loads

6.3.1 General

Imposed loads should include the loading from:

- a) permanent works, e.g. reinforcement and concrete (see 6.3.2); and
- b) construction operations, including:
 - 1) working areas;
 - 2) storage areas;
 - 3) pedestrian traffic;
 - 4) vehicular traffic;
 - 5) static plant; and
 - 6) mobile plant.

6.3.2 Loading from permanent works

The loading from permanent works should be assessed from the self-weight of the permanent structure supported by the falsework.

In limit state design, loading from the permanent works should be treated as a variable load. TWDs should check that where commercial software is used to analyse loads on a falsework structure, the correct partial factors are applied to the weight of the structure (concrete and steel) as an imposed load, as it might otherwise default to inappropriate factors used for self-weight (i.e. as a dead load).

Where impact might occur during the placing of permanent works elements, such as a steel beam or precast concrete member, an extra vertical load should be assumed, which requires assessment in each case. The extra vertical load should be assessed according to the nature of the lifting operation and could range between 10% and 50% of the unit's mass. The value chosen should be lower for more carefully controlled operations.

NOTE 1 See BS EN 1991-3:2006, 2.6, for guidance on vertical loads on cranes.

The local effect of impact and heaping during concreting operations should be accounted for in the loading for working areas (see 6.3.3.1).

The loading effects of movements due to shrinkage, creep, thermal changes and post-tensioning should be taken into account.

When concrete is placed against or on formwork surfaces, account should be taken of the forces to which their vertical and horizontal components will be subjected.

NOTE 2 In some cases, for example, where void formers or top formwork are used, uplift forces can be created.

The forces exerted by concrete should be calculated in accordance with CIRIA R108 [N6]. Where the concrete is expected to apply a full hydrostatic head to the formwork, as would be the case when using certain admixtures or self-compacting concrete where a reduction in concrete pressure due to stiffening cannot be assured, the concrete pressure should be calculated using a concrete density of 25 kN/m³.

6.3.3 Construction operations

6.3.3.1 Working areas

Allowance should be made for access and working area loading on the falsework. Access and working areas within or between the falsework should also be taken into account where they are required (see Clause 7).

To cater for the imposed load from construction operations, a distributed load should be applied over the whole area of work, and when placing in-situ concrete an increase should be applied to a limited area to allow for operatives and small equipment used during placing operation. These loads should be assumed to be variable and time-dependent and be allowed for in the load combinations.

NOTE 1 For example, allowance for placing concrete is appropriate in an area only while operatives are actually placing the concrete and reduces to a nominal value at other times.

A distributed access load of 0.75 kN/m^2 should be applied over the entire area of the falsework, including areas that are not in use. The TWD should take into account the various loading cases in the design (see 7.2), and whether inclusion of the working area load at a particular stage in construction is critical.

NOTE 2 The value of 0.75 kN/m^2 is equivalent to one person every 1.2 m^2 of the working area.

In areas where work is being carried out and tools, equipment and small quantities of materials are likely to be stored, or if that part of the falsework is likely to be used as an access route, the minimum loading should be 1.5 kN/m^2 .

Where in-situ concrete is to be placed, a distributed load should be applied over any $(3 \times 3) \text{ m}$ area of soffit formwork and falsework in addition to the minimum 0.75 kN/m^2 access load. This variable load should be used to cater for the impact loads and heaping of concrete that occur during concrete placing operations and the weight of small equipment commonly used in reinforced concrete construction. The additional distributed load should be calculated as 10% of the self-weight of the concrete, with the minimum value being 0.75 kN/m^2 and an upper limit of 1.75 kN/m^2 .

Combining the distributed access load with the additional distributed load for concrete operations shows that the formwork, permanent formwork (e.g. metal decking, precast planks) and falsework should be designed for a construction load over any $(3 \times 3) \text{ m}$ area of the temporary works for equivalent solid in-situ concrete:

Up to 300 mm thick	$0.75 + 0.75 = 1.50 \text{ kN/m}^2$
From 300 mm to 700 mm thick	$0.75 + (10\% \text{ of self-weight of concrete}) \text{ kN/m}^2$
More than 700 mm thick	$0.75 + 1.75 = 2.50 \text{ kN/m}^2$

Particular care should be taken with thin slabs on metal decking to check for deflection and the additional loading resulting from the deflection of both the metal decking and the permanent works when casting to a defined level, as opposed to casting to a thickness. As many metal decking and precast planking systems are designed to operate on spans up to 3 m, the provisions for placing the in-situ concrete topping apply and such systems should be designed for a minimum 1.5 kN/m^2 construction operations load.

For this loading to be valid, the designer should specify that the concrete not:

- a) be dropped into the reception arrangements or onto the horizontal surfaces from a free height greater than 1 m; or
- b) be allowed to heap or accumulate on the formwork to a total height of more than three times the depth of the slab, i.e. a surcharge of two times the depth of the slab, for slabs up to 300 mm thick.

For slabs greater than 300 mm thick, the surcharge should be limited to 600 mm regardless of slab thickness. In all cases the accumulation or heap should cover an area not greater than 1 m^2 measured at the top of slab level, unless allowance for the additional loading is made in the design.

These loadings are for access and working conditions and are similar to those set out in BS EN 12811-1:2003, BS EN 12812:2008 and BS EN 1991-1-6:2005. They are not intended to allow for the stacking of materials or for the loads of other equipment and plant for which specific provisions should be made in accordance with 6.3.3.2 and 6.3.3.5.

6.3.3.2 Storage areas

Where materials to be stored on the working area produce concentrated or distributed pressures greater than 1.5 kN/m², provision should be made in the design for the additional loading. This provision should either extend over the whole of the working area or the storage areas should be specifically designated and clearly marked on the drawings and on the site.

NOTE 1 Guidance on similar “loading bays” used in scaffolding, generally of plan area (2 × 1.2) m, is given in NASC TG20:21 Operational Guide [N2]. These are designed for a static load of 10 kN/m² and allow for a single pallet of 15 kN placed centrally in each bay by forklift or crane.

The limits of the loading area, the nature of the materials to be stored and the height to which the materials can be stacked, hence the intensity of loading, should be clearly specified by the TWD and communicated in a form suitable for use and understanding on site. Similar precautions should be implemented to guard against excessive storage of materials on a recently formed deck or suspended slab before this is self-supporting.

NOTE 2 Experience has shown that visual notices relating load to known objects (e.g. a pallet of bricks) can assist the temporary works coordinator (TWC) informing the operatives of load limits.

6.3.3.3 Dynamic and impact forces

The dynamic and impact forces given in Table 8 should, as appropriate, be allowed for in the design of falsework.

Table 8 — Dynamic and impact forces

Nature of force		Caused by	Subclause
Impact	Vertical	Placing heaving units by crane	6.3.2
		Placing in-situ concrete	6.3.3.1
		Collison by crane suspended load	6.3.3.5f)
	Horizontal	Collison by crane suspended load	6.3.3.5f)
		Vehicular traffic barriers	6.3.3.4d)
Dynamic	Vertical	Mobile/travelling plant	6.3.3.5c)
		Mechanical/manual operated lifting gear	6.3.3.5b)
	Horizontal	Mobile plant acceleration/braking	6.3.3.5d)
		Horizontal concrete pumping lines	6.3.3.5g)
	Vibration	External vibration of concrete	6.3.3.5a)
		Mechanical plant	6.3.3.5a)

NOTE The dynamic load from traffic passing over falsework is not included as it requires special attention (see BS EN 1991-2).

Appropriate measures should be put in place to mitigate the effects of accidental impact, either by providing sufficient robustness, system redundancy or adequate protective measures (see also 7.4.4.1).

6.3.3.4 Traffic

Measures should be introduced to prevent or mitigate the effects of impact from vehicular traffic which could lead to progressive or catastrophic failure. Where passage is required through or adjacent to areas on which falsework operations are taking place, appropriate arrangements should also be made for the protection of vehicles and people using these access ways.

Where vehicles or members of the public are required to be able to proceed either over or through falsework working areas, provision should be made for the resulting loadings. Where no entry or passage of vehicles or people is allowed for in the falsework design, barriers and notices should be

provided to prevent such passage. Protective arrangements to prevent and minimize the consequences of impacts should include means to give early warning to drivers by notices, load gauges, light-weight screens, etc.

The following minimum loading allowances should be used:

- a) pedestrians (members of the public): 5.0 kN/m² (in accordance with [BS EN 1991-1-1:2002](#), Category C3);
- b) pedestrian access barriers: 0.74 kN/m applied in any direction (in accordance with the NA to BS EN 12811-1:2003, Category C3 Table NA.8);

NOTE This value can increase significantly depending on the location and width of the pedestrian area, such as near sporting venues and shopping malls.

- c) vehicles on falsework: travelling speed should be restricted to 1.3 m/s (3 mph) and the design should use appropriate axle or wheel loads (see the [NA to BS EN 1991-1-1:2002](#), Table NA.6, or [BS EN 1991-2](#)). Particular care should be taken to check that wheel loads do not locally overload the face contact material of the soffit formwork; and
- d) vehicle crash barriers: as shown in the contract specification (information on vehicle barriers is given in [BS EN 1991-1-1:2002](#), Annex B).

6.3.3.5 Plant (including construction vehicles)

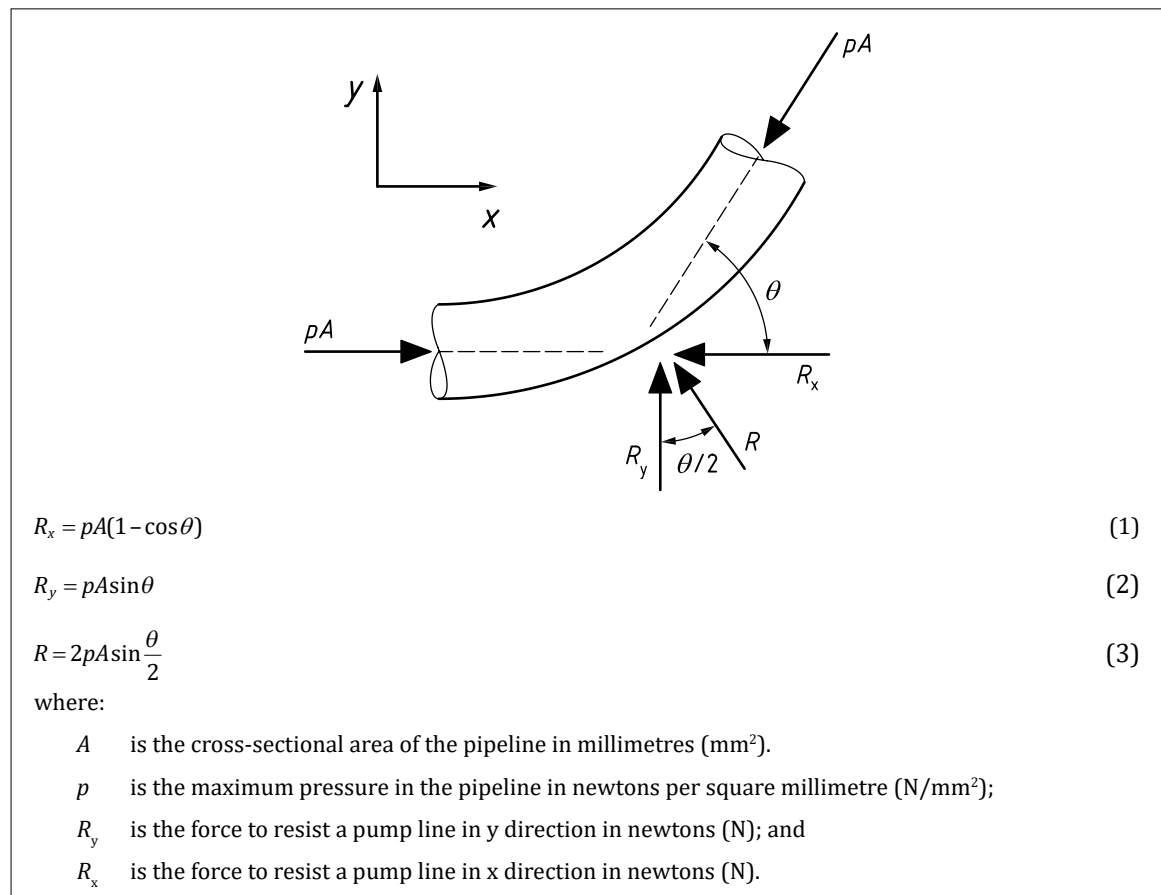
Imposed loads from items of plant should include the following, with the increases for dynamic effects in items b), c) and d) for limit state design being added prior to the application of any limit state partial factors.

- a) Vibration. In general, plant vibration is unlikely to cause any significant increase in loading. However, the loosening effects on bolts, wedges and other friction connections should be accounted for, particularly when external vibrators are used.
- b) Vertical forces from loads being lifted or lowered. The static load of the moving item should be increased by 25% when using mechanically operated lifting gear, or by 10% when using manually operated lifting gear, to allow for dynamic effects.
- c) Vertical forces from travelling loads. To allow for travelling plant (such as scissor lifts, cherry pickers, pick and carry cranes or telehandlers), which might be carrying a load, the gross load (self-weight plus load being carried) should be increased by 10% to allow for the dynamic effect of the combined load, or individual wheel loads increased by 25% above the static calculated value to account for weight transfer caused by braking, lurching and loads swinging, and the effects of weight transfer and the vehicle tyres and suspension.
- d) Horizontal forces from travelling loads. This loading results from moving plant, or from loads being deposited by lifting equipment positioned on or off the falsework or being carried across the falsework by plant or on moving equipment. The design should allow for a horizontal force in any of the possible directions of movement equivalent to 10% of the static load of the moving items where the rate of travel cannot exceed 1.3 m/s (3 mph). Without this speed limitation the horizontal force should equate to 33% of the moving load.
- e) Mechanical plant. Where operations involving mechanical plant take place from the falsework, the method of the plant accessing and operating on the falsework platform should be taken into account, which might create additional horizontal or vertical loads. This might not necessarily be covered in the values in c) and d).

- f) Impact. The consequences of suspended loads impacting on falsework should be accounted for in terms the damage that would result. Where practical, the risk of impact damage may be reduced by establishing areas adjacent to the falsework where lifting is prohibited and providing adequate signage for loading and unloading areas.
- g) Concrete pumping. Where concrete is being placed by pump or pneumatic placer through a pipeline carried on the falsework, additional forces are generated. Bends in concrete pipelines introduce lateral forces, and the nature of concrete pumping can cause significant dynamic effects as the system reacts to the frequencies developed. Concrete pump lines should only be attached to falsework when the structure has been specifically designed to restrain such forces.

The resultant force applied to the falsework to resist a concrete pipeline [in newtons (N)], R , at a bend is shown in [Figure 1](#), and should be calculated from [Equations \(1\) to \(3\)](#).

Figure 1 — Diagram of change in direction of a pipeline



The maximum force in newtons (N) to resist a pump line at a full 90° bend the force, in two directions at right angles, should be calculated using [Equation \(4\)](#):

$$R_{90} = pA \quad (4)$$

where:

R_{90} is the maximum force in newtons (N) to resist a pump line at a 90° bend.

NOTE The maximum pressure in the pipeline, p , is dependent upon a number of factors but the following pressures are not likely to be exceeded:

- 1) 5.0 N/mm², for mechanical pumps; and
- 2) 0.7 N/mm², for pneumatic placers.

6.4 Environmental loads

6.4.1 Wind loading

6.4.1.1 General

COMMENTARY ON 6.4.1.1

Wind acts upon all surfaces over which it passes, whether these are normal, parallel or inclined to the wind direction, and applies pressure or suction forces to those surfaces.

The basic data for the design of structures to resist wind forces are set out in BS EN 1991-1-4:2005+A1 and the NA to BS EN 1991-1-4:2005+A1. Additional background information is given in PD 6688-1-4:2015 and information for use during the construction (execution) period in BS EN 1991-1-6:2005.

This part of BS 5975 simplifies the method given in BS EN 1991-1-4:2005+A1 and is suitable for the majority of temporary works. The simplification gives comparable or conservative results compared with BS EN 1991-1-4:2005+A1. The NA to BS EN 1991-1-4:2005+A1 and BS EN 1991-1-4:2005+A1 may be used to calculate the peak velocity pressure if the situation warrants it. The simplified method is shown in this subclause and derived in E.3. For structures between 50 m and 100 m tall in areas of significant topography, the simplified method is adapted as shown in E.4.

The different loading conditions for differing wind directions and velocity (speed) at the various stages of falsework erection and use should be taken into account. Particular care should be taken when formwork or similar is assembled on top of otherwise unloaded falsework and subjected to wind loads as this is often the most onerous case for overturning (see Clause 7). In certain locations, during steady laminar wind flow, dynamic loads should be determined (see 6.4.1.23).

The wind load on structures adjacent to tall buildings (see 6.4.1.9) and the effects of wind funnelling (see 6.4.1.10) should be taken into account.

The simplified method given in this subclause should only be applied to:

- a) falsework structures erected less than 100 m high in areas with no significant topography; and
- b) falsework structures erected less than 50 m high in areas of significant topography (see 6.4.1.5 and Annex E).

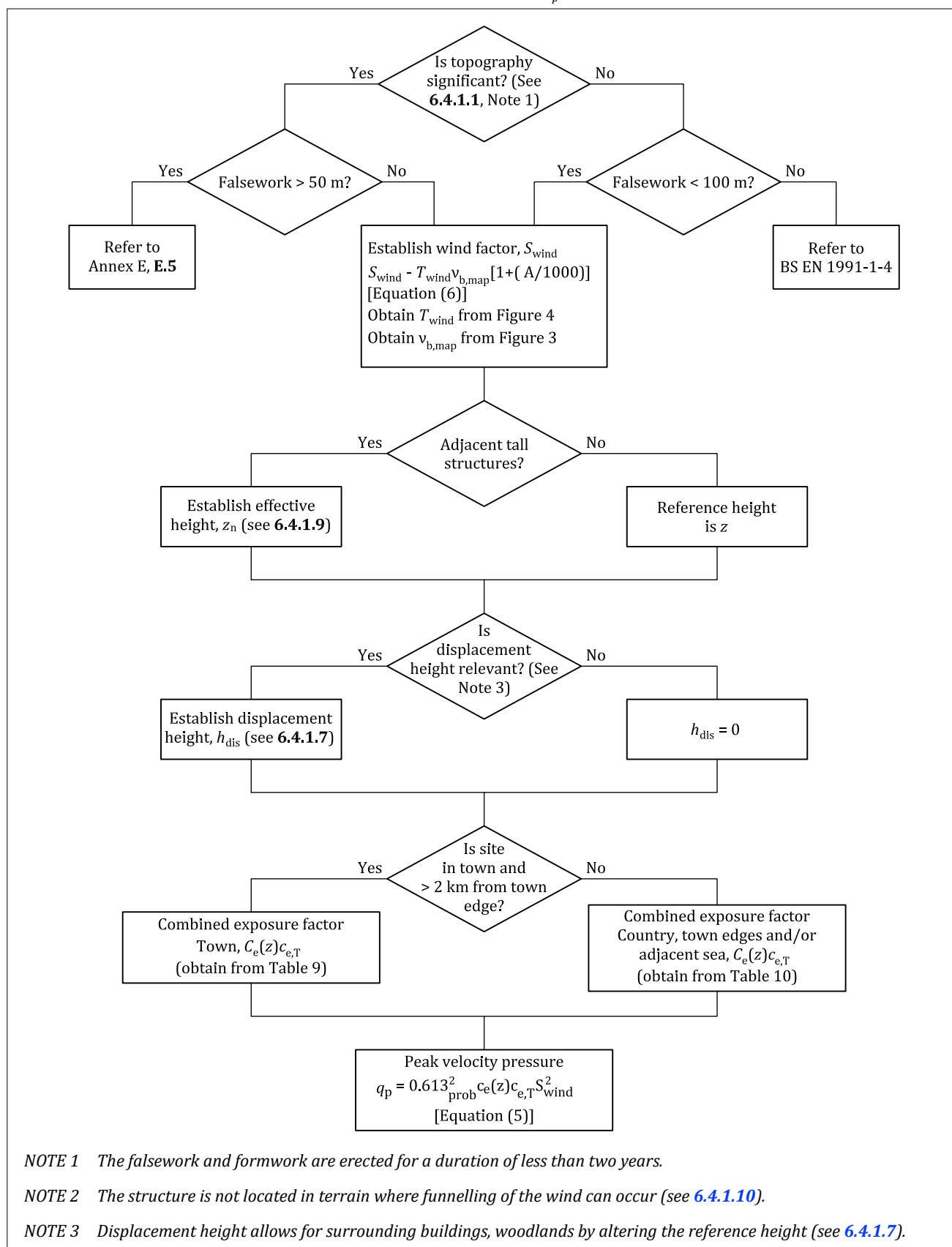
NOTE 1 "Significant topography" refers to areas that do not have undulating terrain but have very steep slopes or sharp edges (sea cliffs), where the ground roughness can affect the wind. As the air is less turbulent at higher levels, the effect of height of hills and escarpments reduces, and terrain roughness becomes more prominent.

NOTE 2 The derivation of the simplified methods given in this part of BS 5975 and information regarding the use of the standard method from the NA to BS EN 1991-1-4:2005+A1 is given in E.3 of this part of BS 5975.

Where falsework is erected between 50 m and 100 m high in areas of significant topography, the velocity pressures should be calculated either by reference to the NA to BS EN 1991-1-4:2005+A1 or using the simplified method adapted as shown in E.4.

The flowchart in Figure 2 should be used to assist in the decision-making process to determine the peak wind velocity pressure in N/m^2 , q_p , on sites either in the country or in towns using the simplified method.

Where falsework equipment is involved in facade retention, the temporary facade retention structure should be designed in accordance with CIRIA C579 [N1].

Figure 2 — Flow chart for obtaining peak wind velocity pressure, q_p , using simplified method

6.4.1.2 Peak velocity pressure for falsework

The peak velocity pressure should be calculated using Equation (5):

$$q_p = 0.613 c_{\text{prob}}^2 c_e(z) c_{e,T} S_{\text{wind}}^2 \quad (5)$$

where:

- q_p is the peak velocity pressure in newtons per square metre (N/m²);
- c_{prob} is the probability factor (see 6.4.1.4);
- $c_e(z) c_{e,T}$ is the combined exposure factor (see 6.4.1.8); and
- S_{wind} is the wind factor, calculated as follows:

$$S_{\text{wind}} = T_{\text{wind}} \nu_{b,\text{map}} \left(1 + \frac{A}{1\,000} \right) \quad (6)$$

where:

- $\nu_{b,\text{map}}$ is the basic wind velocity in metres per second (m/s) for the site (see 6.4.1.3);
- T_{wind} is the topography factor (see 6.4.1.5); and
- A is the altitude of the site in metres (m) above sea level.

The value of the peak velocity pressure, q_p , should be calculated for the highest part of the falsework/formwork structure and be assumed to act uniformly from top to bottom. Where the structure's overall height is greater than the crosswind breadth of the structure for the wind direction considered, the falsework/formwork should be divided into parts and reference made to BS EN 1991-1-4:2005+A1, 7.2.2.

NOTE For example, where the height is greater than twice the breadth of the falsework, it may be split into two parts, with the lower part the same height as the width.

The NA to BS EN 1991-1-4:2005+A1, NA.2.26, assumes that the pressure distribution is uniform over each part, calculated on q_p at the top of each part. This should be applied to very tall falsework structures.

Where the falsework forms an open lattice structure that allows the wind to pass through it and does not appreciably restrict the wind flow, the peak velocity pressure should be taken as varying up the structure and not taken as a fixed value based on the highest point. Although this might be relevant on tall unclad falsework structures, the conservative design approach should be used to calculate pressure at the highest point.

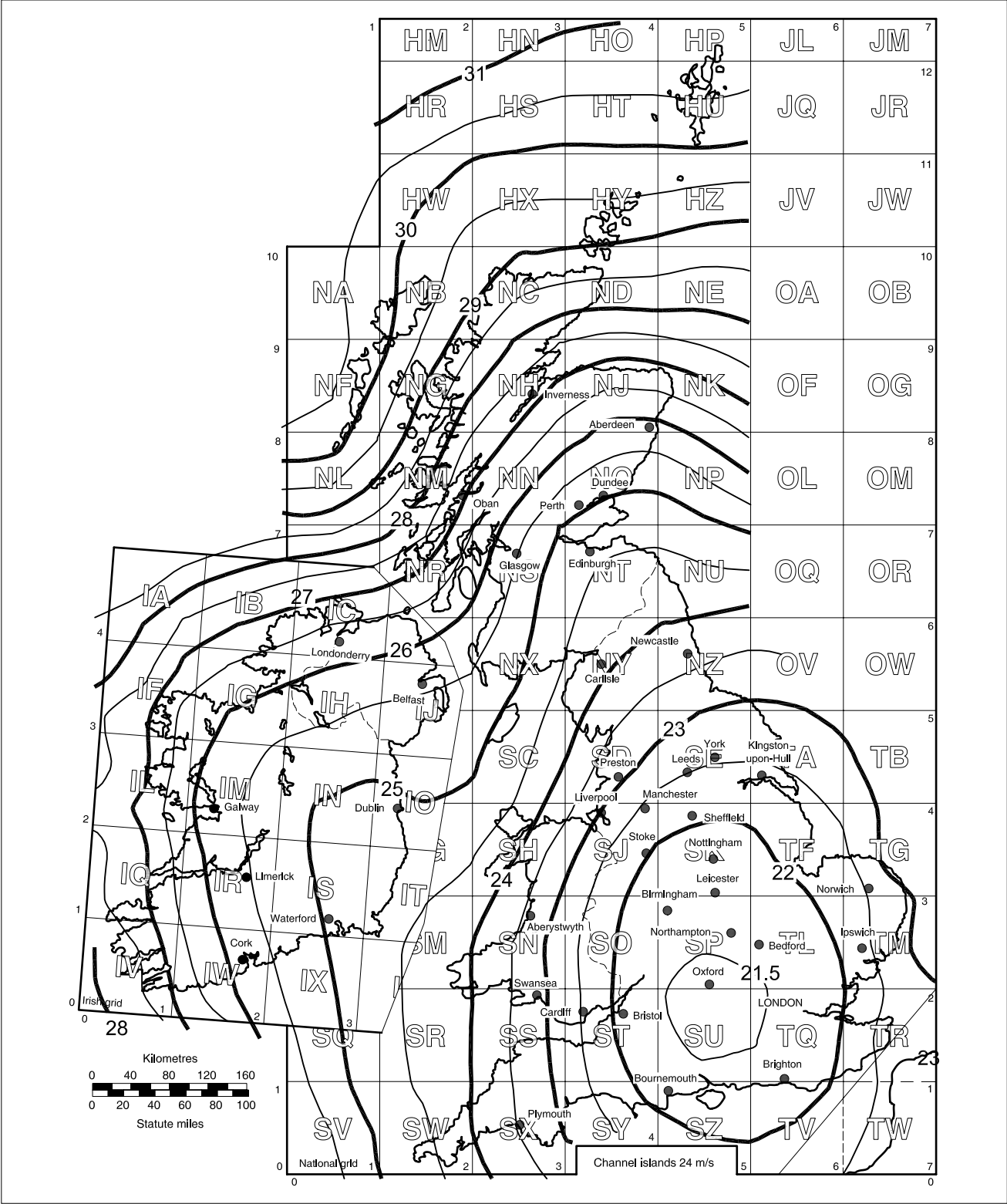
6.4.1.3 The fundamental basic wind velocity, $\nu_{b,\text{map}}$

COMMENTARY ON 6.4.1.3

The fundamental basic wind velocity in m/s, $\nu_{b,\text{map}}$, is the UK fundamental basic wind velocity as a 10 min mean at 10 m above ground in open country with low vegetation. The probability is taken as corresponding to a mean recurrence of 50 years.

Values for $\nu_{b,\text{map}}$ in metres per second (m/s) should be selected from Figure 3.

Figure 3 — Fundamental basic wind velocity, $v_{b,map}$ (in m/s)



6.4.1.4 Probability factor, C_{prob}

To take account of falsework being erected for a significantly shorter period than the mean return period of 50 years used in BS EN 1991-1-4:2005+A1, and therefore less likely to be exposed to the peak wind, a probability factor, c_{prob} , should be applied. BS EN 12812:2008 allows the velocity pressure to be modified by a factor of not less than 0.7 to take account of the period of use of the falsework, not exceeding two years; therefore, the minimum value of c_{prob} should be 0.837 for falsework erected for a maximum of 2 years (see E.3.5).

Where the simplified method is not used, the reduction in return period allowed for in BS EN 1991-1-6:2005, Table 3.1, should be applied.

NOTE Due to consequence of failure, CIRIA C579 [N1] recommends a value of c_{prob} of 1.0 for facade retention.

Any selected transient design situation should be associated with a nominal duration equal to or greater than the anticipated duration of the stage of execution under consideration. The design situations should take into account the likelihood for any corresponding return periods of variable actions (e.g. climatic actions).

6.4.1.5 Topography factor, T_{wind}

Where the ground is nominally flat, i.e. the average slope is less than 1:20, and at the base of steeper slopes, the value of the topography factor should be taken as unity, $T_{\text{wind}} = 1.00$.

Where there are hills or slopes, the wind profile changes and the effect of the topography, known as “orography” in BS EN 1991-1-4:2005+A1, can become significant. The values for the topography factor, T_{wind} , for falsework erected up to 50 m in height for moderate hills or escarpments up to 1:5 slope, and for steep hills or escarpments greater than 1:3 slope, should be taken from Figure 4.

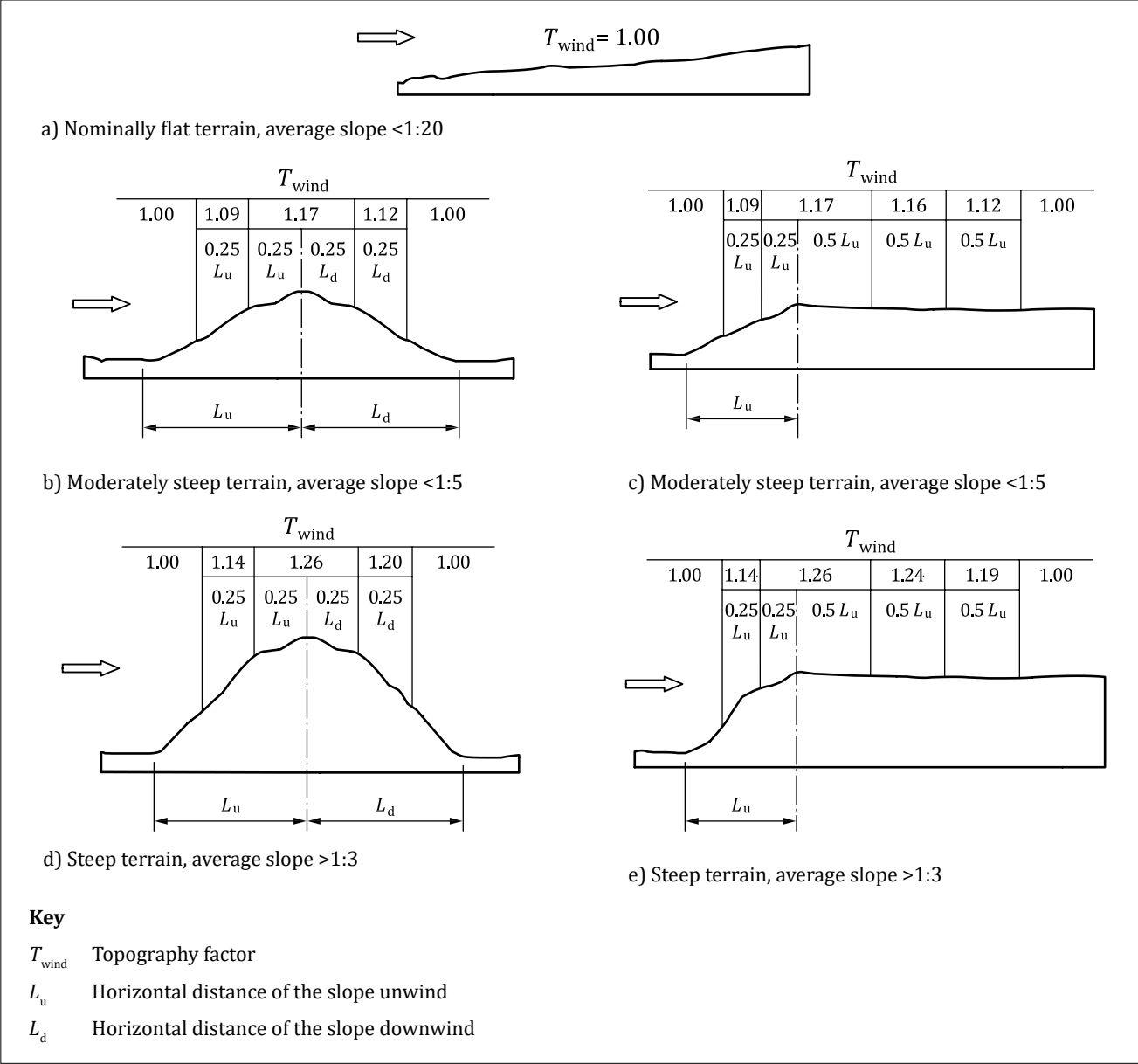
Engineering judgement should be used to establish values of T_{wind} for intermediate values of slope.

NOTE A simplified method for tall falsework structures with orography may be used as shown in Annex E.

Values for topography factor appropriate for the site should be determined for the wind acting in all directions, and not just the orientation of the falsework structure.

Calculations for tall structures on or near the crest of hills can give unrealistically conservative values using the values given in Figure 4, so the calculations should be carried out in accordance with BS EN 1991-1-4:2005+A1, A.3, and the NA to BS EN 1991-1-4:2005+A1.

Figure 4 — Topography factor, T_{wind}



6.4.1.6 Terrain – Sea, town or country

The distance of the falsework from the nearest sea and whether the site is in a town or the country should be determined in order to establish the terrain category.

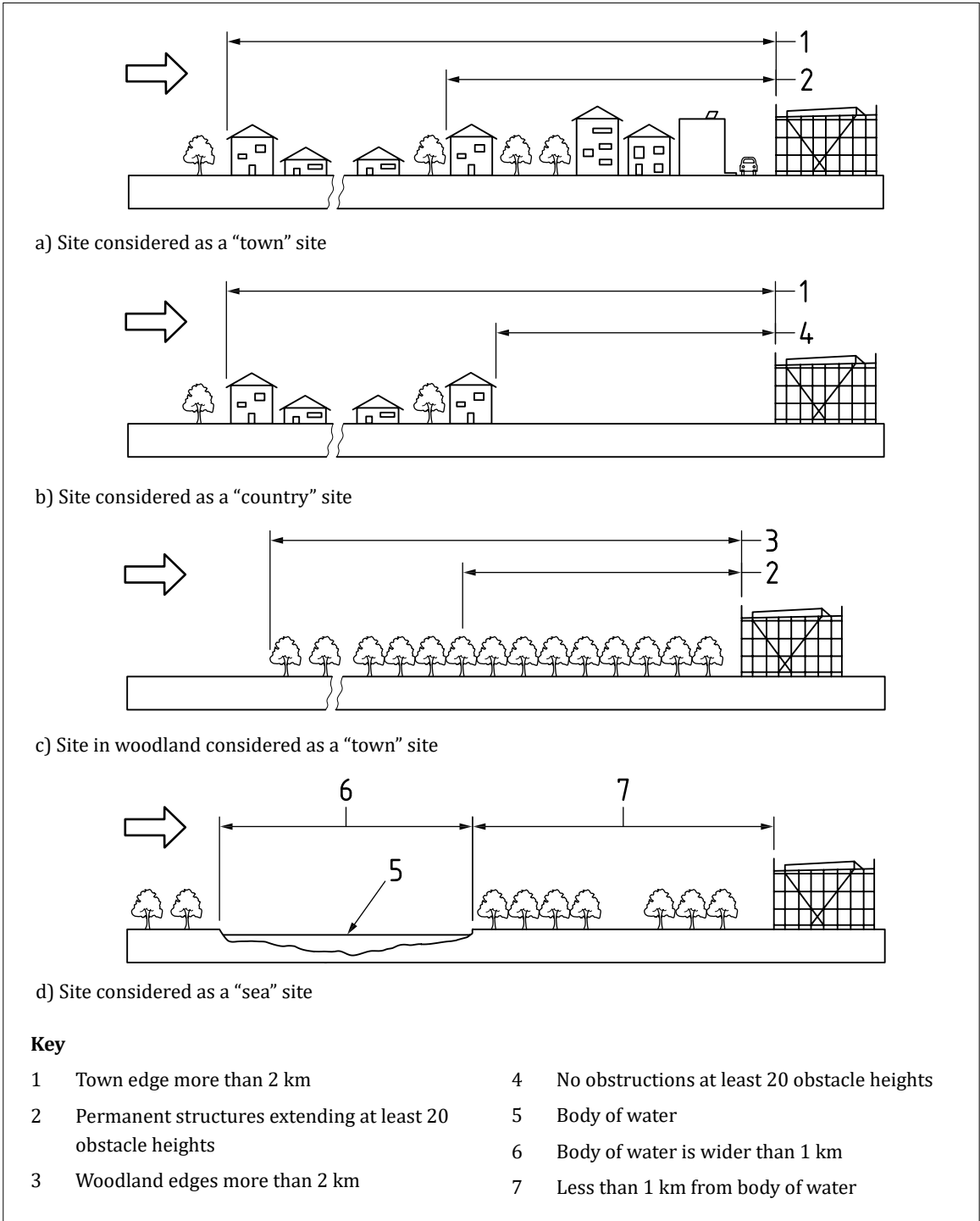
NOTE Although BS EN 1991-1-4:2005+A1 gives the option to consider the wind in multiple directions, for temporary works applications it is generally adequate to take account of the single worst case for the site location as a whole.

The site should be treated as in a town if it is 2 km or more inside the “town” edge with buildings/ trees less than 20 obstacle heights apart. If there is an open area of more than 20 obstacle heights in front of the structure, the wind picks up speed across the opening and the site should be treated as a country category.

In accordance with the NA to BS EN 1991-1-4:2005+A1, all sites adjacent to inland lakes extending more than 1 km in the direction of the wind and closer than 1 km upwind of a site should be treated as the sea, as shown in Figure 5d).

NOTE Figure 5 shows the differences for structure between town, country and woodland.

Figure 5 — Town, country and sea



6.4.1.7 Displacement height, h_{dis}

COMMENTARY ON 6.4.1.7

BS EN 1991-1-4:2005+A1 and this part of BS 5975 calculate the wind pressure at a reference height, z , above ground level.

The reference height of the falsework should be taken as the distance from the surrounding ground level to the top of the falsework structure, including the height of any structure on which the falsework is erected.

For falsework/formwork erected on the ground, the value of z should be taken as the height to the top of the falsework/formwork. However, if falsework is erected in an elevated position above the surrounding ground level, for instance to a new floor at the top of a tall structure, the reference height, z , should be measured from the ground, although the actual falsework affected by the wind would only be its own height.

An allowance should be made for the effect of surrounding general buildings, such as housing, closely spaced buildings and other obstructions or woodlands, which cause the wind to behave as if the ground level were raised, by reducing the reference height, z , above ground using a displacement height in metres (m), h_{dis} (see Figure 6). Where the falsework is spaced more than twice the average obstruction height from the nearest obstruction, the displacement height should be taken as the lesser of the value in the following equations.

$$h_{\text{dis}} = 0.8h_{\text{ave}}$$

(7)

or

$$h_{\text{dis}} = 0.8h$$

(8)

where:

- h_{dis}

is the displacement height in metres (m);
- h_{ave}

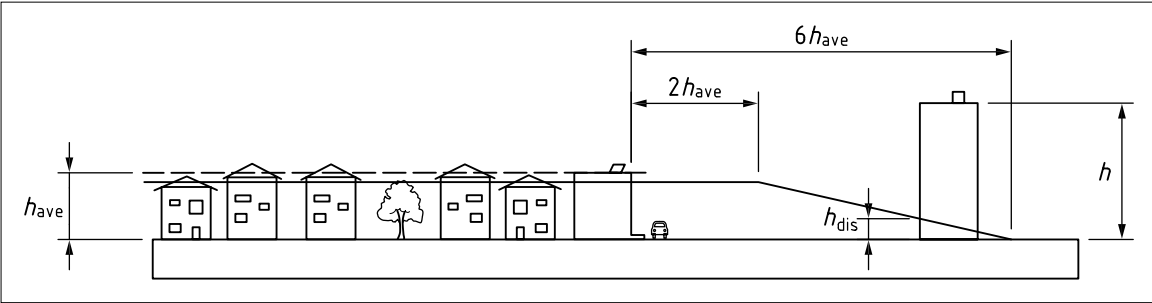
is the average obstruction height in the area [in metres (m)]; and
- h

is the height of the structure for calculating z .

Where the falsework structure is spaced more than six times the average obstruction height away from the nearest obstruction, the full height of structure should be used and $h_{\text{dis}} = 0$. Values between should be taken pro rata (see Figure 6).

The effective height of the structure for calculating the wind pressure should be taken as $z - h_{\text{dis}}$.

Figure 6 — Displacement height



6.4.1.8 The combined exposure factor, $c_e(z)c_{e,T}$

Table 9 should be used to determine values of a combined exposure factor and includes the correction factor for towns.

Values for the combined exposure factor for sites in the country, in town edges and adjacent to the sea should be determined in accordance with Table 10.

The height of falsework ($z - h_{\text{dis}}$) should be as recommended in 6.4.1.7.

Table 9 — Combined exposure factor for town site, $c_e(z)c_{e,T}$

Height, $z - h_{dis}$ m	Site in town, more than 2 km from the edge of the town Closest distance to shoreline km		
	2	10	≥ 100
≤ 2	1.07	1.01	0.94
3	1.32	1.25	1.17
4	1.54	1.44	1.35
5	1.72	1.62	1.50
10	2.33	2.20	2.04
15	2.81	2.65	2.48
20	2.99	2.83	2.64
30	3.40	3.24	3.01
50	3.68	3.62	3.39
100	3.98	3.98	3.80

NOTE 1 Interpolation may be used to find intermediate values.

NOTE 2 Based on NA to BS EN 1991-1-4:2005+A1, Figure NA.7 and Figure NA.8.

Table 10 — Combined exposure factor for site in the country, in town edges and/or adjacent to sea, $c_e(z)c_{e,T}$

Height, $z - h_{dis}$ m	Site in country and/or adjacent to sea Closest distance to shoreline km			
	≤ 0.1	2	10	≥ 100
≤ 2	1.90	1.60	1.50	1.40
3	2.15	1.84	1.73	1.62
4	2.31	2.03	1.90	1.78
5	2.43	2.18	2.05	1.90
10	2.82	2.65	2.50	2.32
15	3.07	3.02	2.85	2.67
20	3.20	3.15	2.98	2.78
30	3.42	3.43	3.27	3.04
50	3.68	3.68	3.62	3.39
100	3.98	3.98	3.98	3.80

NOTE 1 Interpolation may be used to find intermediate values.

NOTE 2 Based on NA to BS EN 1991-1-4:2005+A1, Figure NA.7.

6.4.1.9 Adjacent tall structures

Where a falsework structure is located near another structure that is at least twice as tall as the average height of the falsework and any neighbouring structures, an allowance should be made for the falsework being exposed to increased wind velocities for certain wind directions.

Allowance should be made for the flow around buildings being complex and three-dimensional, taking into account that:

- a building obstructs the flow of air, creating positive pressure on the windward face;
- the air flows down the building due to variation of oncoming wind with height;
- the downdraft recirculates while the downdraft near the corners of the building accelerates;