

Code of practice for

Access and working scaffolds and special scaffold structures in steel

Committees responsible for this British Standard

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- Building Employers' Confederation
- Concrete Society
- Federation of Civil Engineering Contractors
- Health and Safety Executive
- House Builders' Federation
- Institution of Structural Engineers
- National Association of Scaffolding Contractors
- Suspended Access Equipment Manufacturers' Association

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Contents

	Page
Committees responsible	Inside front cover
Foreword	ix
Section 1. General	
1 Scope	1
2 References	1
3 Definitions	1
3.1 Types and dimensions of scaffolds and buildings	1
3.2 Tubular members and beams	2
3.3 Scaffold couplers and fittings	6
3.4 Other terms in general use	7
4 Units	8
5 Statutory requirements	8
6 Equipment	9
6.1 General	9
6.2 Steel tubes	9
6.3 Couplers and fittings	9
6.4 Decking units	9
6.5 Other equipment	9
7 Care of equipment	10
7.1 General	10
7.2 Tube	10
7.3 Couplers and fittings	10
7.4 Gin wheels and gin wheel ropes	11
7.5 Scaffold boards	11
Section 2. Standard scaffolds	
8 Description of access scaffolding	12
8.1 General	12
8.2 Putlog scaffolds	12
8.3 Independent tied scaffolds	12
8.4 Duty of scaffolds	12
8.5 Calculations required for the construction of access scaffolding	12
9 Tying scaffolding to building facades	13
9.1 General	13
9.2 Layout of ties	13
9.3 Frequency of tie points on the scaffold	13
9.4 Ties	14
9.5 Anchorages and allied components	17
9.6 Attachment of the scaffold to the anchorage point	20
9.7 Capacity of tie systems and alternatives	21
9.8 Special details	21
9.9 Abnormal facades	21
10 Bracing	22
10.1 General	22
10.2 Ledger bracing	22
10.3 Facade bracing	22
10.4 Plan bracing	23
10.5 Couplers for fixing braces	23
11 Foundations	23

	Page
11.1 General	23
11.2 Hard surfaces	23
11.3 Pavements and other surfaces of intermediate hardness	23
11.4 Other surfaces	23
11.5 Sole plate area	23
11.6 Soil compaction	23
11.7 Sloping foundations	23
12 Standards	24
12.1 Foundations	24
12.2 Erection tolerances	24
12.3 Joints	24
12.4 Lift heights	24
13 Ledgers	24
13.1 Attachment	24
13.2 Joints	24
13.3 Curved building surfaces	24
14 Transoms and putlogs	24
14.1 Length of transoms and putlogs	24
14.2 Couplers	24
14.3 Spacing	24
14.4 Putlog blades	25
15 Working platforms and decking	25
15.1 General	25
15.2 Decking	25
15.3 Supports	25
15.4 Gaps in decking	25
15.5 Toeboards	26
15.6 Guardrails	26
15.7 Brick guards	26
15.8 Length of decking	26
15.9 Slope of decking	26
16 Ladder access to and in scaffolds	26
16.1 General	26
16.2 Landings	26
16.3 Ladder tower	26
17 Raising and lowering material	26
17.1 Gin wheels	26
17.2 Scaffold jib cranes and hoists	27
17.3 Hoist towers	27
17.4 Multiple rope blocks	27
17.5 Impact loading	27
Section 3. Work on site	
18 Erection, alteration and dismantling	29
18.1 Erection	29
18.2 Modifications	29
18.3 Dismantling	29
18.4 Lowering materials	30
18.5 Progressive dismantling	30
19 Duties of erectors and users of scaffolds	30

	Page
19.1 General	30
19.2 Scaffold constructors	30
19.3 Training	30
19.4 Communication	30
19.5 Persons using scaffolds	30
19.6 Protection of the public	31
20 Inspection of scaffolds	31
20.1 Compliance with statutory regulations	31
20.2 Inspection	32
Section 4. Prefabricated components	
21 Proprietary equipment	33
21.1 Instructions	33
21.2 Proprietary components	33
22 Use of prefabricated beams in scaffolds	33
22.1 Description	33
22.2 Loading	33
22.3 Components	33
22.4 Inspection	33
22.5 Method of applying the load and end reactions to beams	33
22.6 Assembly	33
22.7 Lateral stiffeners	34
22.8 Knee bracing	34
22.9 Beams as columns	34
22.10 Spine beams	34
22.11 Attaching guys	34
Section 5. Special scaffolds	
23 Loading bays founded on the ground	35
23.1 Loads and general arrangement	35
23.2 Bracing	35
23.3 Lifts	35
23.4 Decking	35
23.5 Guardrails and toeboards	35
23.6 Foundations	35
23.7 Notices	36
24 Cantilever loading bays attached to scaffold	36
24.1 Loads and general arrangement	36
24.2 Bracing	37
24.3 Ties and butting transoms	38
24.4 Decking	38
24.5 Guardrails and toeboards	38
24.6 Notices	38
25 Protection fans, nets and pavement frames	38
25.1 Description and duty	38
25.2 Effect of fans on the loads in standards of access scaffold	38
25.3 Decking	38
25.4 Wind forces	41
25.5 Precautions during erection and dismantling	41
25.6 Light duty (class A) fans suspended on wires	41

	Page
25.7 Medium duty (class B) fans fixed out from a building	42
25.8 Medium duty (class B) fans built out from a scaffold	42
25.9 Safety net system (class D fans)	42
25.10 Pavement frames or gantries	42
26 Cantilever scaffolds	43
26.1 General description	43
26.2 Loads	43
26.3 Fixing the beams to the structure	43
26.4 Scaffolding	43
27 Truss-out scaffolds	43
27.1 General	43
27.2 Loads	44
27.3 Design of the truss-out	44
27.4 Access scaffold	44
27.5 Single deck truss-outs	44
28 Free standing towers, power line crossings, guys and struts	48
28.1 General	48
28.2 Calculations	48
28.3 Foundations	49
28.4 Bracing	49
28.5 Access	49
28.6 Decking	49
28.7 Operation	49
28.8 Height and base dimensions	49
28.9 Stability	49
28.10 Temporary tying of all types of tower	51
28.11 Stationary access towers within buildings	51
28.12 Mobile access towers within buildings	52
28.13 Stationary access towers adjacent to buildings	52
28.14 Mobile access towers adjacent to buildings	52
28.15 Power line crossings and other protection scaffolds	52
29 Access birdcages	55
29.1 Description	55
29.2 Loading	55
29.3 Dimensions	55
29.4 Foundations	55
29.5 Ledgers	55
29.6 Transoms	55
29.7 Stability	55
29.8 Single lift birdcages	57
29.9 Top working platform	57
29.10 Storage of materials	58
30 Hoist towers, ladder towers and stair towers	58
30.1 Hoist towers	58
30.2 Ladder towers and stair towers	59
31 Slung scaffolds	59
31.1 General	59
31.2 Loading	59
31.3 Dimensions	59

	Page
31.4 Design	59
31.5 Method of scaffold suspension	61
31.6 Suspension points	61
31.7 Couplers	61
31.8 Decking	61
31.9 Bracing	61
32 Pedestrian bridges and walkways	66
32.1 General	66
32.2 Dimensions of beams	66
32.3 Loading	66
32.4 Multiple tube chords	66
32.5 Verticals and diagonals	66
32.6 Transoms	66
32.7 Decking	66
32.8 Foundations	66
32.9 Couplers and fittings	66
33 Temporary ramps and elevated roadways	66
33.1 General	66
33.2 Dimensions	66
33.3 Loading	66
33.4 Decking and slopes	67
33.5 Foundations	68
33.6 Longitudinal beams	68
33.7 Standards	68
33.8 Ledgers and transoms	68
33.9 Foot ties and head ties	68
33.10 Bracing	68
33.11 Tying and butting	68
33.12 Through access ways	68
34 Masts, lighting towers and transmission towers	68
34.1 General	68
34.2 Loading	68
34.3 Foundations	68
34.4 Guys	69
34.5 Standards	69
34.6 Ledgers and transoms	69
34.7 Bracing	69
34.8 Sheeting	69
34.9 Icing	69
34.10 Access	69
35 Lifting gantries	69
35.1 General	69
35.2 Loading	69
35.3 Cross head	69
35.4 Towers	69
35.5 Traffic fenders	69
35.6 Bracing	69
36 Temporary buildings and temporary roofs	71
36.1 General	71

	Page
36.2 Loading	71
36.3 Type and design of structure	71
36.4 Sheeting	72
37 Spectator terraces and seating stands	72
37.1 General	72
37.2 Loading	72
37.3 Guys and anchors	72
37.4 Foundations	73
37.5 Standards	73
37.6 Ledgers and transoms	73
37.7 Bracing	73
37.8 Decking	73
37.9 Couplers and fittings	73
38 Temporary storage on site	73
38.1 General	73
38.2 Loading	73
38.3 Foundations	73
38.4 Standards	73
38.5 Ledgers and transoms	73
38.6 Bracing	73
38.7 Plan bracing	74
38.8 Fenders	74
38.9 Attachment of racking to other structures	74
38.10 Slab and post racks	74
38.11 Racking roofs	74
Section 6. Structural calculations for scaffolds	
39 Technical data and notes on calculation	75
39.1 General	75
39.2 Loading	75
39.3 Mass of materials	75
39.4 Mass of lifts, one bay long, in an independent tied scaffold	75
39.5 Section properties of scaffold tubes	76
39.6 Strength of scaffold boards and other timber members	76
39.7 Vertical loading of scaffolds and height limitations	77
39.8 Allowable loads on couplers	82
39.9 Loads on ledgers, struts and braces	82
39.10 Wind forces on scaffolding	84
Appendix A British Standards giving details of materials and components	91
Appendix B Worked examples of scaffold design	91
Appendix C Effective lengths of scaffold tube struts	93
Appendix D Scaffolds using aluminium tube	94
Appendix E Maximum permissible axial stresses and loads in steel scaffold tubes manufactured in accordance with BS 1139-1:1982	98
Index	99
Figure 1 — Typical putlog scaffold	3
Figure 2 — Typical independent tied scaffold	4

	Page
Figure 3 — Plan of typical box ties	15
Figure 4 — Arrangement of lip ties and sway transoms	15
Figure 5 — Through tie for independent tied scaffold	16
Figure 6 — Through tie for a putlog scaffold on a bridle tube	17
Figure 7 — Reveal tie	18
Figure 8 — Typical end details for tie tubes	19
Figure 9 — Typical ring bolt tie	20
Figure 10 — Typical wire or band tie anchorage	20
Figure 11 — Ladder fixings	27
Figure 12 — Gin wheel fixings	28
Figure 13 — Cantilever loading platform	36
Figure 14 — Classes of fans for sheeting or netting	39
Figure 15 — Typical cantilever scaffold	45
Figure 16 — Single lift truss-out scaffold	46
Figure 17 — Typical truss-out independent tied scaffold (on existing building)	47
Figure 18 — Typical truss-out independent tied scaffold (on building under construction)	48
Figure 19 — Anchors	51
Figure 20 — Mobile access tower	53
Figure 21 — Small power line crossing	56
Figure 22 — Power line crossing over motorway	56
Figure 23 — Single lift access birdcage scaffold (maximum superimposed load 0.75 kN/m^2)	58
Figure 24 — Isolated hoist tower	60
Figure 25 — Plan view of plan bracing and through ties for hoist towers attached to a scaffold	61
Figure 26 — Ladder access tower	62
Figure 27 — Slung working and protection scaffolds	63
Figure 28 — Typical vehicle ramp	67
Figure 29 — Typical lifting gantry	70
Figure 30 — Wind force factors	87
Figure 31 — Basic wind speed, V	89
Figure 32 — Wind speed factor S_2 for varying heights and surface conditions	90
Figure 33 — Effective lengths in tube and coupler scaffolds	93
Table 1 — Access and working scaffolds of tube and couplers	10
Table 1(a) — Frequency of ties in square metres per tie	14
Table 2 — Widths of access scaffold platforms	25
Table 3 — Maximum span of scaffold boards	25
Table 4 — Erection tolerances	29
Table 5 — Loadings for show stands and places of assembly	72
Table 6 — Mass of scaffolding materials	75
Table 7 — Mass of quantities of scaffolding materials	75
Table 8 — Mass of corrugated steel sheeting	76
Table 9 — Mass of men and materials	76
Table 10 — Mass of an unboarded lift one bay long	76
Table 11 — Extra mass of a boarded lift (with imposed loads) one bay long	77

	Page
Table 12 — Section properties of scaffold tubes	79
Table 13(a) — Properties of scaffold boards	80
Table 13(b) — Properties of timber other than scaffold boards	80
Table 14 — Maximum permissible axial stresses and loads in steel scaffold tubes manufactured in accordance with BS 1139-1.1 with a yield stress of 235 N/mm ²	81
Table 15 — <i>Table deleted</i>	81
Table 16 — Safety coefficients to be applied to the calculated heights of scaffolds designed on the allowable stresses	82
Table 17 — Safety working loads for individual couplers and fittings	83
Table 18 — Equivalent mass of safe ledger loads	83
Table 19 — Values of wind speed factor S_3 (for probability level 0.63)	85
Table 20 — Dynamic wind pressures for various design wind speeds	85
Table 21 — Wind force factors	86
Table 22 — Effective lengths of struts	95
Table 23 — Maximum permissible axial stress and loads in aluminium scaffold tubes	96
Table 24 — Section properties of aluminium scaffold tubes (HE 30TF) complying with the requirements of BS 1139	97
Table 25 — Maximum permissible axial stresses and loads in steel scaffold tubes manufactured in accordance with BS 1139-1:1982	98
Publications referred to	Inside back cover

Foreword

This British Standard has been prepared under the direction of Technical Committee B/514, Access and support equipment. It supersedes BS 5973:1990 which is withdrawn. This edition introduces technical changes but it does not reflect a full review or revision of the standard which will be undertaken in due course to make the standard compatible with the forthcoming European Standard for scaffolds, expected to be published in 1995 by the European Committee for Standardization (CEN).

The principal changes from the 1990 edition are as follows:

- a) revised advice is given on temporary roofs;
- b) dimensions not strictly in accordance with the Construction (Working Places) Regulations have been brought into line;
- c) information on lip ties has been improved;
- d) better information is provided on fans;
- e) account has been taken of the revised standards for steel tube and fittings which are in accordance with published CEN documents;
- f) a comprehensive index to the code has been added.

Changes from the 1990 edition are indicated by a vertical rule in the margin.

The requirements for tube specified in BS 1139-1.1:1990 are marginally higher than those specified in BS 1139-1:1982¹⁾, which was the basis of the information in BS 5973:1990. Because scaffold tube has a long life, this edition of BS 5973 contains information on both qualities of tube. Where no specific reference is given to the type of tube, the advice given is applicable to both types.

BS 1139-2.1:1991 assesses right angle, swivel and parallel couplers much more rigorously than BS 1139-2:1982²⁾. Analysis of tests carried out to date shows that right angle couplers complying with the 1982 standard also comply with the 1991 standard. Thus though the reference level is lower, no change in safe working load is proposed. This implies a factor of safety of 1.6, and this figure has been applied to the two other types of coupler similarly assessed (swivel and parallel). In other cases the value of 2.0 should be used. Swivel couplers complying with the 1982 standard may be used in accordance with this standard but for those complying with the 1991 standard there is a reduction in capacity.

Attention is drawn both to the wider range of fittings and to some properties specified or examined in BS 1139-2.1, but not normally used in scaffold design in the UK.

This code has been prepared on a broad interpretation of the rules for design and construction, so that they can be applied to the very numerous variations of scaffolds which inevitably occur. It includes guidance on procedures for construction and dismantling, on the stability of scaffolds during various stages of these operations and on the responsibilities of users of scaffolding. Recommendations are included for the inspection of scaffolds and some guidance is given on prefabricated scaffold systems.

While dealing with many common applications this code does not cover all the innumerable circumstances resulting from the diversity of building facades and variety of purposes for which scaffolding is required.

A limit of application for clause 36, Temporary buildings and temporary roofs, has been identified and for the larger structures specialist advice should be sought.

¹⁾ BS 1139-1:1982, Specification for tubes for use in scaffolding (withdrawn).

²⁾ BS 1139-2:1982, Specification for couplers and fittings for use in tubular scaffolding (withdrawn).

Effective training of scaffolders is possibly the most essential factor in preventing accidents amongst both scaffolders and those who use scaffolds. The Construction Industry Training Board (CITB), many firms in the industry and several safety groups organize a wide range of training courses, not only for scaffolders, but for chargehand scaffolders, site supervisors who may have to inspect scaffolds, general foremen and safety officers.

The importance of training was recognized in the report of a Subcommittee of the Joint Advisory Committee on Safety and Health in the Construction Industries entitled "Safety in Scaffolding"³⁾, which made recommendations for the training of scaffolders and for the issue of certificates of competence.

Such a certification scheme has been developed and adopted by the large part of the industry covered by the agreements of the National Joint Council for the Building Industry, and the Civil Engineering Construction Conciliation Board. The scheme, known as the Construction Industry Scaffolders Record Scheme, is organized by the CITB, who run training courses in basic and advanced scaffolding and issue and control individual training record cards. Scaffolders are grouped into three categories, trainee, basic scaffolder and advanced scaffolder and before scaffolders can be classed as basic or advanced they should have completed the appropriate courses and have had specific minimum experience.

The scheme applies, at present, only to scaffolders who work on scaffolding more than 5 m (16.5 ft) high.

Participation in this scheme is not a legal requirement, but the scheme should lead to a general raising of the level of expertise throughout the industry. It is important to note that the legal requirements relating to the training of workers in the Health and Safety at Work etc. Act 1974 and to the competence and experience of scaffolders in the Construction (Working Places) Regulations 1966 apply to *all* scaffolding work.

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

**This code of practice represents a standard of good practice.
Compliance with it does not confer immunity from relevant legal requirements, including regulations and byelaws.**

Summary of pages

This document comprises a front cover, an inside front cover, pages i to x, pages 1 to 104, an inside back cover and a back cover.

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

³⁾ Obtainable from HMSO.

Section 1. General

1 Scope

This code of practice gives recommendations and includes some guidance for the design, construction and use of common scaffolds in steel, normally used in construction, maintenance, repair, and demolition work, excepting those for the support of permanent work, commonly referred to as temporary works or falsework, and suspended scaffolds. Recommendations for falsework may be found in BS 5975 and recommendations for suspended scaffolds may be found in BS 5974.

The recommendations of this code relate to steel scaffold tube of steel with a yield stress not less than 235 N/mm^2 , an outside diameter of 48.3 mm and a wall thickness of 4 mm. This code is only applicable to scaffold made from tube and scaffold fittings which when new complied with one of the following standards:

- BS 1139-1:1982
- BS 1139-2:1982
- BS 1139-1.1:1990
- BS 1139-2.1:1991
- BS 1139-2.2:1991

However, the use in access scaffolding of tubes of other dimensions and strengths is not precluded by this code and appendix D provides a limited amount of data on aluminium tube complying with the requirements of BS 1139. When other tubes are used, the structural calculations should be carried out using the properties of the tubes used and the structures, when assembled, should have similar characteristics to scaffolding constructed with the tube recommended in this code. Section 6 provides some technical data and guidance on calculations.

2 References

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

3 Definitions

For the purposes of this British Standard, the following definitions apply (see Figure 1 and Figure 2).

3.1 Types and dimensions of scaffolds and buildings

3.1.1

base lift

see foot lift (3.1.8)

3.1.2

bay

the space between the centre lines of two adjacent standards along the face of a scaffold

3.1.3

bay length

the distance between the centres of two adjacent standards, measured horizontally

3.1.4

building

a building or structure or other facade against which the scaffold is constructed

3.1.5

height

the height measured from the foundation to the top assembly of ledgers and transoms (cf. lift height)

3.1.6

length

the length of a scaffold between its extreme standards, sometimes designated by the number of bays (cf. bay length)

3.1.7

lift

the assembly of ledgers and transoms forming each horizontal level of a scaffold

3.1.8

foot lift

a lift erected near to the ground

3.1.9

lift height

the vertical distance between two lifts, measured centre to centre

3.1.10

lift head room

the clear distance between a platform and the tubular assembly of the lift above

3.1.11

pair of standards

the standards forming the frame at right angles to the building

3.1.12

normal facade

a facade which permits the fixing of through ties or non-movable ties

3.1.13

abnormal facade

a facade which does not permit the fixing of through ties or non-movable ties

3.1.14

scaffold

a temporarily provided structure which provides access, or on or from which persons work or which is used to support materials, plant or equipment

3.1.15**free standing scaffold**

a scaffold which is not attached to any other structure and is stable against overturning on its own account or, if necessary, assisted by guys or rakers and anchors

3.1.16**independent tied scaffold**

a scaffold which has two lines of standards, one line supporting the outside of the deck and one the inside. The transoms are not built into the wall of the building. It is not free standing, being supported by the building (see Figure 2)

3.1.17**putlog scaffold**

a scaffold which has one line of standards to support the outside edge of the deck and utilizes the wall being built or the building to support the inside edges (see Figure 1)

3.1.18**slung scaffold**

a scaffold hanging on tubes, ropes or chains from a structure overhead. It is not capable of being moved or lowered

3.1.19**suspended scaffold**

a scaffold hanging on ropes which is capable of being suspended or raised and lowered

3.1.20**width**

the width of a scaffold measured at right angles to the ledgers from centre to centre of the uprights or interclear as stated. Sometimes designated by the number of boards within the uprights and the number beyond the uprights on extended transoms

3.2 Tubular members and beams**3.2.1****brace**

a tube placed diagonally with respect to the vertical or horizontal members of a scaffold and fixed to them to afford stability

3.2.2**cross brace**

see ledger brace (3.2.6)

3.2.3**facade brace**

a brace parallel to the face of a building

3.2.4**face brace**

see facade brace (3.2.3)

3.2.5**knee brace**

a brace across the corner of an opening in a scaffold to stiffen the angles or to stiffen the end support of a beam

3.2.6**ledger brace**

a brace at right angles to the building

3.2.7**longitudinal brace**

a brace generally in the plane of the longer dimension of the scaffold, particularly in birdcages

3.2.8**plan brace**

a brace in a horizontal plane

3.2.9**transverse brace**

a brace generally in the plane of the shorter dimension of the scaffold

3.2.10**bridle**

a horizontal tube fixed across an opening or parallel to the face of a building to support the inner end of a putlog transom or tie tube

3.2.11**vertical bridle**

a vertical tube performing the same function as a bridle

3.2.12**inside or outside bridle**

a bridle either inside or outside a building wall

3.2.13**butt tube**

a short length of tube

3.2.14**butting tube**

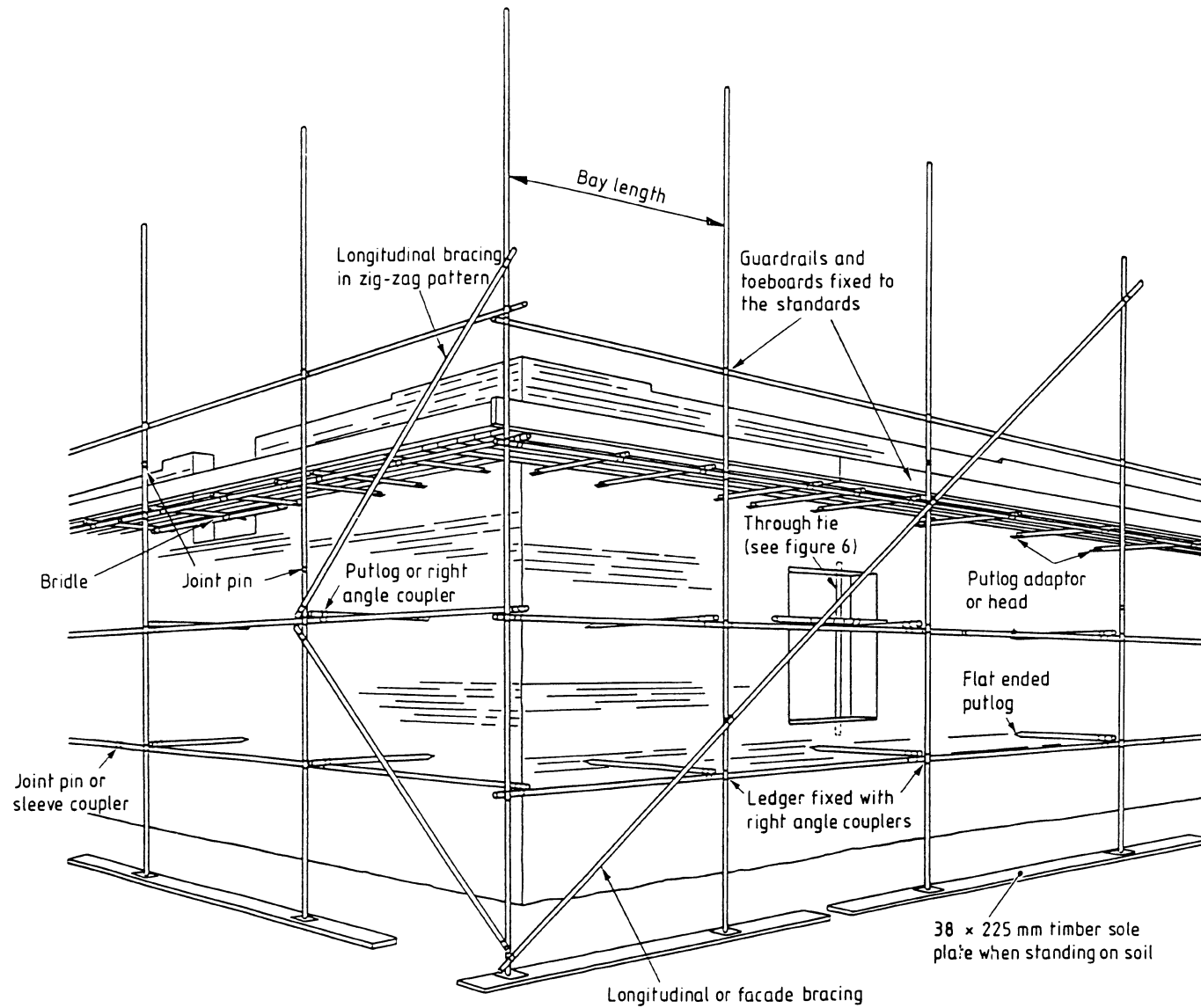
a tube which butts up against the facade of a building or other surface to prevent the scaffold moving towards that surface

3.2.15**chord**

the principal longitudinal member(s) of a beam or truss

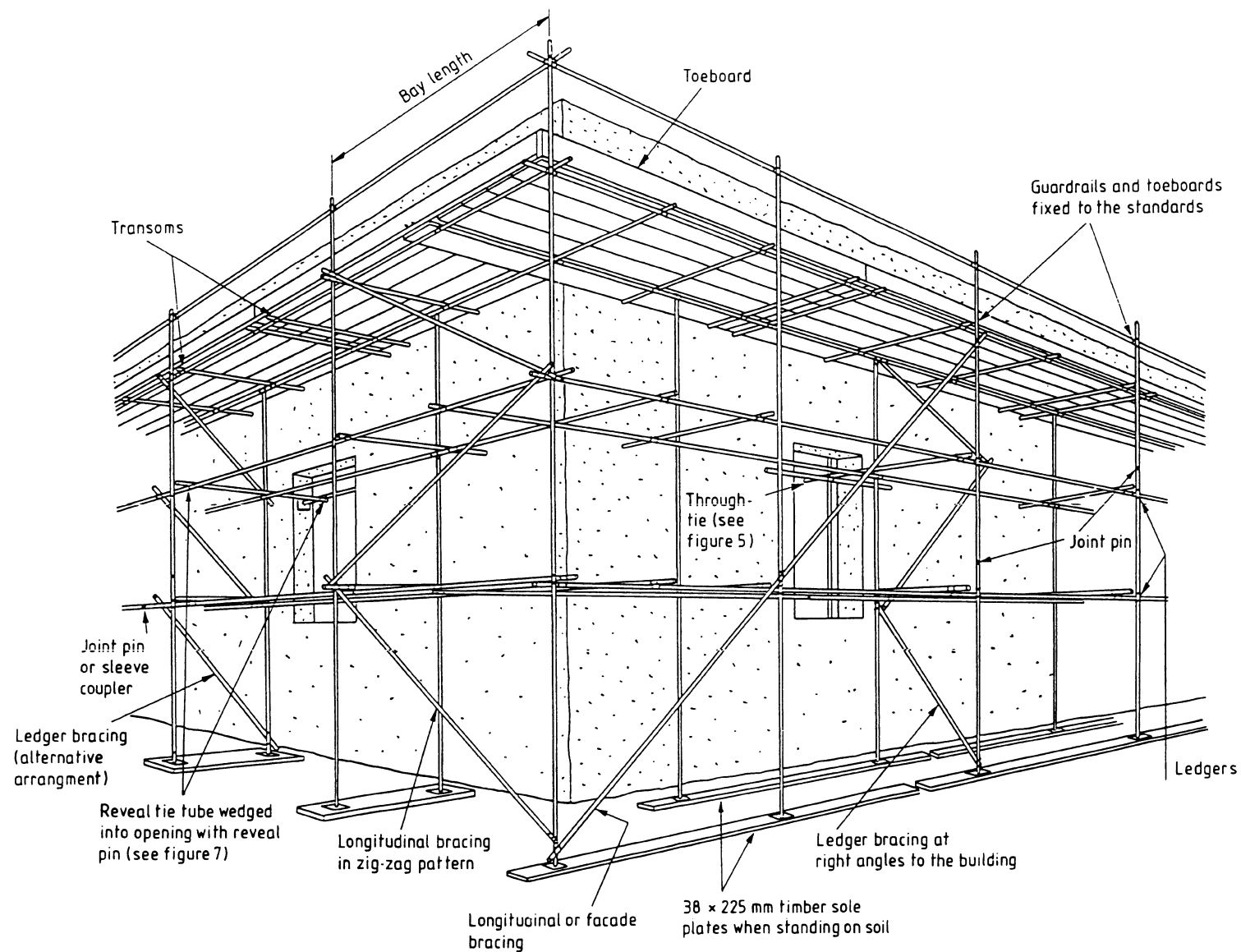
3.2.16**chord stiffener**

a tube fixed at right angles to the chord of a prefabricated rafter, beam or truss for the purpose of preventing buckling



NOTE. This drawing should be read in conjunction with the text.

Figure 1 — Typical putlog scaffold



NOTE. This drawing should be read in conjunction with the text.

Figure 2 — Typical independent tied scaffold

3.2.17**guardrail**

a member incorporated in a structure to prevent the fall of a person from a platform or access way

3.2.18**end guardrail**

a guardrail placed across the end of a scaffold or used to isolate an unboarded part

3.2.19**guardrail post**

a puncheon supporting a guardrail

3.2.20**ledger**

a longitudinal tube normally fixed parallel to the face of a building in the direction of the larger dimensions of the scaffold. It acts as a support for the putlogs and transoms and frequently for the tie tubes and ledger braces and is usually joined to the adjacent standards

3.2.21**puncheon**

a vertical tube supported at its lower end by another scaffold tube or beam and not by the ground or on a deck

3.2.22**purlin**

a tube secured to the rafters of a building and parallel to the ridge for the purpose of attaching the roof covering and to act as a top chord stiffener for the rafter beams

3.2.23**putlog**

a tube with a flattened end, to rest in or on part of the brickwork or structure

3.2.24**rafter and rafter beam**

a transverse tube, beam, or truss in a building spanning across a roof or from the eaves to the ridge

3.2.25**raker**

an inclined load-bearing tube

3.2.26**reveal tube**

a tube fixed by means of a threaded fitting or by wedging between two opposing surfaces of a structure, e.g. between two window reveals, to form an anchor to which the scaffold may be tied

3.2.27**sheeting rail**

a horizontal tube fixed to the verticals of a scaffold to support the sheeting

3.2.28**spine beam**

a longitudinal main beam spanning from end to end of a roof at the ridge or eaves

3.2.29**standard**

a vertical or near vertical tube

3.2.30**tie or tie assembly**

the components attached to an anchorage or the building or framed around a part of it or wedged or screwed into it with a tie tube. Used to secure the scaffold to the structure

3.2.31**bolted tie**

an assembly of nuts, bolts, anchors, rings or tubes fixed into the surface of a building

3.2.32**box tie**

an assembly of tubes and couplers forming a frame round a part of a building

3.2.33**lip tie**

an assembly of tubes forming an L or J shaped hook round an inside surface of a building

3.2.34**double lip tie**

a lip tie which is a push/pull tie, i.e. has a cross tube on the back and front of the wall

3.2.35**prop tie**

an assembly of telescopic props and/or scaffold tube jacked or wedged between the floors of a storey inside a building and including a tie tube

3.2.36**push/pull tie**

a tie which only acts to prevent the scaffold moving either towards or away from the building, e.g. a reveal tie, a box tie, a double lip tie, a bolted tie with a tie tube

3.2.37**movable tie**

a tie which may be temporarily moved for the execution of work (see 9.1.2)

3.2.38**non-movable tie**

a tie which will not be moved during the life of a scaffold, as agreed between the user and the scaffold erector (see 9.1.2)

3.2.39**reveal tie**

the assembly of a reveal tube with wedges or screwed fittings, and pads, if required, fixed between opposing faces of an opening in a wall together with the tie tube

3.2.40**through tie**

a tie assembly through a window or other opening in a wall

3.2.41**wire tie or band tie**

an assembly of a ring anchor and wire or steel banding used to tie the scaffold to the building

3.2.42**tie tube**

a tube used to connect a scaffold to an anchorage

3.2.43**transom**

a tube spanning across ledgers to form the support for boards or units forming the working platform or to connect the outer standards to the inner standards

3.2.44**butting transom**

a transom extended inwards to butt the building to prevent the scaffolding moving towards the building

3.2.45**needle transom**

a transom extending from or into a building

3.2.46**sway transom**

a transom extended inwards in contact with a reveal or the side of a column to prevent the scaffold moving sideways (see Figure 4)

3.2.47**trapeze tube**

a horizontal tube used to assist in erection and dismantling

3.3 Scaffold couplers and fittings**3.3.1****base plate**

a metal plate with a spigot for distributing the load from a standard or raker or other load-bearing tube

3.3.2**adjustable base plate**

a metal base plate embodying a screwjack

3.3.3**board-clip**

a clip for fixing a board to a scaffold tube

3.3.4**toeboard clip**

a clip used for attaching toeboards to tubes

3.3.5**end toeboard clip**

a similar device for use on end toeboards

3.3.6**coupler**

a component used to fix scaffold tubes together

3.3.7**check coupler or safety coupler**

a coupler added to a joint under load to give security to the coupler(s) carrying the load

3.3.8**fixed finial coupler**

a coupler to fix a tube across the end of another at right angles in the same plane, as in the handrail

3.3.9**parallel coupler**

a coupler used to join two tubes in parallel

3.3.10**purlin, rafter or ridge coupler**

special angle or variable angle couplers for joining members in sheeted buildings and roofs

3.3.11**putlog coupler**

a coupler used for fixing a putlog or transom to a ledger, or to connect a tube used only as a guardrail to a standard

3.3.12**right angle coupler**

a coupler used to join tubes at right angles

3.3.13**sleeve coupler**

an external coupler used to join one tube to another coaxially

3.3.14**supplementary coupler**

coupler(s) added to a joint to back up the main coupler taking the load when the estimated load on the joint is in excess of the safe working load of the main coupler

3.3.15**swivel coupler**

a coupler used for joining tubes at an angle other than a right angle

3.3.16**swivel finial coupler**

a coupler to fix a tube across the end of another in the same plane but at an angle, as the handrail to a staircase

3.3.17**dowel pin**

see spigot pin (3.3.34)

3.3.18**fittings**

a general term embracing components other than couplers

3.3.19**forkhead**

a U-shaped housing for assembly on the end of a tube to accept bearers

3.3.20**adjustable forkhead**

a forkhead fitted with a threaded spindle and nut to give adjustable height

3.3.21**rocking forkhead or swivel forkhead**

a forkhead to accept bearers at a range of angles

3.3.22**hop up bracket or extension bracket**

a bracket to attach usually to the inside of a scaffold to enable boards to be placed between the scaffold and the building

3.3.23**interlock pin**

see spigot pin (3.3.34)

3.3.24**joint pin**

an expanding fitting placed in the bore of a tube to connect one tube to another coaxially (see spigot)

3.3.25**putlog adaptor**

a fitting to provide a putlog blade on the end of scaffold tube

3.3.26**retaining bar**

a strip or device fixed across the top of the decking to hold it down

3.3.27**reveal pin**

a fitting used for tightening a reveal tube between two opposing surfaces

3.3.28**roofing clip or sheeting clip**

a fitting for fixing roof or wall sheeting to tubes in structures without the need for holes in the sheeting

3.3.29**sheeting hook**

a threaded rod hook with a washer and a nut used for attaching sheeting to tubes

3.3.30**sole plate**

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

3.3.31**spigot**

an internal fitting to join one tube to another coaxially (see joint pin)

3.3.32**expanding spigot**

a spigot incorporating an expanding device (see joint pin)

3.3.33**fixed spigot**

a spigot permanently fixed to the end of a scaffold tube

3.3.34**spigot pin**

a pin placed transversely through the spigot and the scaffold tube to prevent the two from coming apart

3.3.35**sill**

see sole plate (3.3.30)

3.3.36**tension pin**

see spigot pin (3.3.34)

3.4 Other terms in general use**3.4.1****anchorage**

component cast or fixed into the building for the purpose of attaching a tie

3.4.2**brick guard**

a metal or other fender filling the gap between the guardrail and toeboard, and sometimes incorporating one or both of these components

3.4.3**castor**

a swivelling wheel secured to the base of a vertical member for the purpose of mobilizing the scaffold

3.4.4**gin wheel or block**

a single pulley for fibre ropes attached to a scaffold for raising or lowering materials

3.4.5**going**

the horizontal distance between the nosings of two consecutive steps of a stair or terrace, measured in a horizontal line

3.4.6 guy anchor

a pin or tube driven into the ground at approximately 45° to the horizontal to provide an anchorage for a rope

3.4.7 inside board

a board placed between the scaffold and the building on extended transoms, or a hop-up bracket

3.4.8 jib crane

a small crane specially adapted for pivotal mounting to a scaffold tube

3.4.9 kentledge

dead weight, built-in or added to a structure to ensure adequate stability

3.4.10 retaining boards

see brick guard (3.4.2)

3.4.11 rise

the vertical distance between two steps of a stair or terrace

3.4.12 scaffold board

a softwood board generally used with similar boards to provide access, working platforms and protective components such as toeboards on a scaffold (cf. scaffold unit)

3.4.13 scaffold or decking unit

the board(s) or unit forming the working platform

3.4.14 sheeting

horizontal, vertical or inclined sheets of material, such as corrugated metal or plastics sheet, attached to a scaffold in order to provide protection from the effects of weather or alternatively to protect the surrounding area from the effects of works being carried out from the scaffold structure

3.4.15 skirt

a short portion of vertical sheeting usually adjacent to the edge of a roof to give extra protection to the area enclosed immediately under the roof

3.4.16 toeboard

an upstand at the edge of a platform, intended to prevent materials or operatives' feet from slipping off the platform

3.4.17 end toeboard

a toeboard at the end of a scaffold or at the end of a boarded portion of it

3.4.18 working platform

the deck from which building operations are carried out

4 Units

The standard units of measurement used in this code are those of the International System of Units (SI).

For further information reference should be made to BS 5555.

In this code the term "weight" has only been used to describe the gravitational or downward force exerted by a body which is given in newtons⁴⁾. In the past the term "weight" has also been used to describe the "mass" of a body which is given in kilograms.

5 Statutory requirements

Attention is directed to Acts, Byelaws, Regulations and any other Statutory Requirements relating to matters dealt with in this code. The equipment should comply with these regulations and requirements. Its performance, use, inspection, testing and maintenance should also be in accordance with the appropriate regulations.

Amongst others, the following requirements, current at the date of publication of this code, relate to access and working scaffolds and special scaffold structures in steel:

- a) Health and Safety at Work etc. Act 1974;
- b) Factories Act 1961;
- c) SI 94 The Construction (Working Places) Regulations 1966;
- d) SI 1580 Construction (General Provisions) Regulations 1961;
- e) Construction (General Provisions) Regulations (NI) 1963;
- f) Construction (Lifting Operations) Regulations (NI) 1963;

⁴⁾ 1 KN = 101.972 kgf = 224.809 lbf.

- g) Construction (Working Places) Regulations (NI) 1963;
- h) Highway Act 1971;
- i) Public Health Act 1930;
- j) London Building (Amendment) Act 1939;
- k) Building (Scotland) Act 1959.

6 Equipment

6.1 General

All materials should, when new, comply with the requirements of the appropriate British Standards. Used materials which are in satisfactory condition may not always comply with the requirements of these standards. Due allowance has been made for this fact in this code.

The materials and components and their method of assembly should comply with the relevant statutory regulations. A list of the other British Standards which give details of materials and components which will satisfy the recommendations of this code are given in appendix A.

Section 2 makes recommendations on the care of the materials and on the degree of wear and tear which should not be exceeded if the materials are to be included in a structure which is intended to be in accordance with this code.

6.2 Steel tubes

Tubes are normally supplied with a maximum length of 6.40 m and are available in shorter lengths by request. New tubes should comply with BS 1139-1.1:1991; the marking on such tubes is “39”; “A” or “B” and “4”. Alternatively tubes which when new complied with the withdrawn BS 1139-1:1982 may be used. These documents specify the minimum properties, dimensions and tolerances (see 39.5). Used tubes should be free from cracks, splits and excessive corrosion and be straight to the eye. The ends of load-bearing tubes should be cut cleanly and squarely with the axis of the tube and should not show excessive wear.

6.3 Couplers and fittings

Scaffold couplers and other fittings should, when new, comply with the requirements of the relevant British Standard. If they have characteristics which do not comply with the relevant British Standard, then account should be taken of this in the design and construction of the scaffolding. Fittings for which there is no standard should be used in accordance with the recommendations and data provided by the manufacturer or supplier.

6.4 Decking units

6.4.1 General

There are four groups of decking units, used to construct working platforms, as follows.

- a) Timber scaffold boards of nominal cross sections 38 mm × 225 mm. (For strength data, see 39.6.)
- b) Components of similar width to those in a), but fabricated, for example, of laminated timber or metal, with equal or greater strength.
- c) Timber boards of other thicknesses or greater width than those in a).
- d) Components of greater width than those in a) and fabricated in various ways, such as platforms or lightweight staging.

All decking should have adequate strength to meet the recommendations for the appropriate duty of Table 1. To ensure this, timber scaffold boards should comply with the requirements of BS 2482.

NOTE Unless otherwise indicated, the use of the word “board” in this document implies the decking described in a) but the principles apply to all types.

6.5 Other equipment

It is recommended that all other equipment should, when new, comply with the requirements of the appropriate British Standard. Where there is no appropriate British Standard, the strength of materials used should comply with the recommendations and data supplied by the manufacturer.

Table 1 — Access and working scaffolds of tube and couplers

Duty	Use of platform	Distributed load on platforms	Max. number of platforms	Commonly used widths using 225 mm boards	Max. bay length
Inspection and very light duty	Inspection, painting, stone cleaning, light cleaning and access.	0.75 kN/m ²	1 working platform	3 boards	2.7 m
Light duty	Plastering, painting, stone cleaning, glazing and pointing.	1.50	2 working platforms	4 boards	2.4
General purpose	General building work including brickwork, window and mullion fixing, rendering, plastering.	2.00	2 working platforms + 1 at very light duty	5 boards or 4 boards + 1 inside	2.1
Heavy duty	Blockwork, brickwork, heavy cladding.	2.50	2 working platforms + 1 at very light duty	5 boards or 5 boards + 1 inside or 4 boards + 1 inside	2.0
Masonry or special duty	Masonry work, concrete blockwork, and very heavy cladding.	3.00	1 working platform + 1 at very light duty	6 to 8 boards	1.8
NOTE 1 This table should be read in conjunction with the remainder of the code and 8.4.3 and 8.5.1 in particular.					
NOTE 2 The loads and number of loaded platforms and widths of scaffold from this table have been used in the calculations given in appendix B.					

7 Care of equipment

7.1 General

When not in use, equipment should be cleaned and protected from deterioration.

Materials which show excessive corrosion or deterioration should be discarded.

7.2 Tube

Hot dipped galvanized, painted or unprotected tube may be used in scaffolding structures. Unprotected steel tube should generally not be used in water and particularly not in marine structures. If used in such conditions, tubes should be thoroughly cleaned afterwards, carefully inspected, e.g. for signs of excessive corrosion, and only returned to stock if suitable.

Before painted tubes are used, the paint should be firm and dry.

Bent steel tube may be straightened by using a crow or a reeling machine. This operation should be carried out under competent supervision. Sections of tube which have been seriously deformed or creased by abuse should be cut out and discarded. Where tubes have become thin or split at the ends, then these should be cut off, all such cuts being at right angles to the axis of the tube.

Corroded tube should be wire brushed and the extent of the corrosion assessed by an expert examiner. This examination may be carried out by eye and should have as its basis the observation of the surface characteristic of a tube which has lost about 10 % of its original minimum specified weight. All tubes failing this examination should be rejected.

7.3 Couplers and fittings

All couplers and fittings should be properly maintained and examined before use. The nuts should be run on their bolts to ascertain that they have a free-running fit.

Heat should not be applied to couplers and fittings, free parts, nuts or bolts.

Spanners and podgers should have lengths as recommended by the coupler manufacturer. Torque should not be applied to a coupler through an ill-fitting spanner.

7.4 Gin wheels and gin wheel ropes

Gin wheels should be maintained in a free-running condition with the shaft not turning in the side plates.

All ropes for use with gin wheels should be inspected at every change of job and, in any event, every six working months.

The identification tag and SWL (safe working load) tag should be replaced where necessary.

Ropes which have been used on stone cleaning contracts or in any location where there are aggressive chemicals, should be carefully inspected for deterioration.

7.5 Scaffold boards

Boards should be inspected after each job. Any which show signs of ill-treatment, abuse or decay should be discarded, as should boards which are excessively warped. Damaged or suspect sections should be cut off and destroyed.

The end hoops or other means of end protection should be replaced or refixed as necessary.

Where boards have split ends which do not exceed the limits given in 7.2.2.1 of BS 2482:1981 nail plates may be used to close them in accordance with clause 6(b) of that specification. No other repair should be used.

Scaffold boards should be cleaned on return from a construction site prior to stacking. They should be stacked flat and raised from the ground by cross battens.

Care should be taken of boards in use. Any over stressing, e.g. that caused by impact loading, is likely to cause unseen damage. They should not be used as ramps or platforms over long spans, nor should they be put on the ground where vehicles or other loads can be put on them.

The detection of compression creases which cause a weakness in boards is very difficult. Such damage is likely to result from over loading, particularly impact loading caused by dropping on the end. In any case of doubt, destroy the board. Boards which show evidence of vehicle tyre marks should be destroyed.

Both high temperatures and chemicals can result in permanent loss of strength. Where boards are treated for fire retardant purposes, care should be taken to select a process which minimizes the loss of board strength.

Section 2. Standard scaffolds

8 Description of access scaffolding

8.1 General

Putlog and independent tied scaffolds are generally as defined in 3.1 and shown in Figure 1 and Figure 2. They are constructed in tubes and couplers for the purpose of providing working platforms adjacent to the surfaces of buildings. Guardrails and toeboards should be provided on all working platforms on a scaffold.

8.2 Putlog scaffolds

A putlog scaffold consists of a single row of uprights parallel to the face of the building and set as far away from it as is necessary to accommodate a platform of four or five boards with the inner edge of the platform as close to the wall as is practicable.

The standards are connected with a ledger fixed with right angle couplers and the putlogs are fixed to the ledgers with right angle or putlog couplers.

The blade end of the putlog tube or putlog adaptor is normally placed horizontally on the brickwork being built. However, where putlog scaffolds are erected against an existing brick wall for repointing, the old putlog holes may be reused or others raked out. In this case the putlog blades may be inserted vertically.

Sole plates and base plates are usually used under each standard. Tying recommendations are detailed in clause 9.

Where a putlog is required for a board support and it is opposite an opening in the building such as a window or doorway, the inside end of the putlog should be supported on an underslung bridle tube spacing between adjacent putlogs, as shown in Figure 6, which also shows a method of tying through these openings.

Longitudinal bracing is required, at intervals not exceeding 30 m but, unlike independent tied scaffolds, ledger bracing is not required in the finished structure.

For brickwork, the lift height should be about 1.35 m, although for certain types of masonry a lower lift height may be necessary.

8.3 Independent tied scaffolds

An independent scaffold consists of a double row of uprights, with each row parallel to the building. The inner row is set as close to the building as is practicable. The distance between the lines of uprights should be the minimum necessary to accommodate the required number of boards and toeboards.

A variation may be adopted in which the row of standards nearest to the building can be set back about 300 mm from the building face so that one of the boards of the platform can be laid between the inside row of standards and the building face.

The uprights should be connected with ledgers parallel to the building and fixed with right angle couplers and with transoms fixed to the ledgers with putlog couplers to give platform widths as given in 15.1 and Table 2.

Sole plates and base plates should be used under each standard when so recommended by clause 11.

The scaffold should be tied into the building at the frequency detailed in clause 9.

Longitudinal bracing is required at intervals not exceeding 30 m. Ledger bracing is generally fixed to alternate pairs of standards.

8.4 Duty of scaffolds

8.4.1 Loading

Access and working scaffolds may be specifically designed and constructed for any particular distributed or point load and for a variety of purposes. If no load rating is quoted by the specifier, it is recommended that the selection is made from Table 1. For platform loadings on access towers and other types of scaffold, reference should be made to the relevant clause in section 5.

8.4.2 Maximum bay lengths

The bay lengths depend on the height and loading of the scaffold. Table 1 gives maximum bay lengths of scaffolds with single standards (see Figure 1 and Figure 2).

8.4.3 Lift heights

The normal lift height for brickwork is 1.35 m, and for walk-through scaffolds is 2.0 m. In certain circumstances lifts greater than 2.7 m are required and are admissible provided the load applied to the standard is not greater than the value given in Table 14 for the appropriate height.

8.5 Calculations required for the construction of access scaffolding

8.5.1 General

Unsheeted access and working scaffolds may be constructed up to a height of 50 m without calculations provided that they are constructed in accordance with the recommendations of sections 2 and 3, and that they do not carry greater loads nor have greater bay lengths than those given in Table 1. A further recommendation is that they are not subjected to loading of materials by mechanical means, such as by rough terrain fork lift trucks.

All other forms of scaffold should be subject to design and calculation. Section 5 details special scaffolds which are the subject of calculation, section 6 gives technical data for calculations of scaffolding heights and appendix B gives examples of the calculations.

8.5.2 *Sheeted scaffolds*

Where sheets are added to scaffold, for instance for the protection of the public or where weather protection sheeting is attached to part of it for the benefit of the workmen using the scaffold, special consideration should be given to tie spacing. The scaffold may also need to be specially designed with consideration given to the additional wind forces (cf. 9.3).

When a temporary roof is to be fixed to the top of an access scaffold, the scaffold and its attachments to the building should be specially designed.

9 **Tying scaffolding to building facades**

9.1 **General**

9.1.1 *Basic requirements*

Means of resisting inward and outward movement should be provided for both independent and putlog scaffolds. This will normally be by attachment with ties to the facade at a number of points. Where the structure and its components are strong enough, in the interests of safety and economy, permission should be sought to use ties. A tie to the facade consists of a tie member, normally a tube, and an anchorage. Various types are described in 9.4. Where the recommendations of 9.1.2 to 9.8 cannot be followed, the facade should be considered abnormal, and the scaffold should be specially designed (see 9.9).

See 9.7 for alternatives to ties.

9.1.2 *Building structure*

It should be established, by test if necessary, that the strength of the building structure at the location of a tie is adequate to sustain the loads which will be transferred to it. This applies particularly to any proposed use of parapets or architectural features such as balustrades as it is frequently found that the anchorage value of such features is negligible. Where required, packing should be provided to protect the structure or to spread the load away from edges or corners. Examples of packing are timber packs, wedges or plastics caps. Packing should be secured to prevent it from falling.

9.1.3 *Movable and non-movable ties*

A scaffold should be erected, adequately tied, and wherever practical these ties left undisturbed until the scaffold is dismantled. The choice of appropriate ties and their positioning should make this possible. Such ties are referred to as non-movable and they are provided at an agreed regular spacing.

Where it is necessary to remove a tie, however temporarily, the scaffold will be less secure, and accordingly a higher provision of ties will be appropriate. The actual calculation of area should be made with any one tie removed. Ties which it may be necessary to remove temporarily are referred to as movable.

9.2 **Layout of ties**

Ties should be evenly distributed over the scaffold, both horizontally and vertically. The spacing of lines of ties should not exceed 8.5 m, either vertically or horizontally, but individual ties should still be within the area rule (see Table 1(a)). Where the building surface permits a staggered arrangement of ties, this should be adopted in preference to a rectangular pattern.

Where the capacity of individual anchorages is less than 6.25 kN, either a tie should be attached to two or more, or additional ties should be used, so that adequate capacity is provided.

The friction of the foundation of a scaffold can be regarded as providing adequate tying of the lower 3 m of the scaffold.

9.3 **Frequency of tie points on the scaffold**

9.3.1 *General*

At least the number of ties recommended in Table 1(a) should be installed. The frequencies in the table do not apply where the design wind speed is greater than 39 m/s (see 39.10).

Recommendations of frequency are based on a minimum tie and anchorage safe working capacity of 6.25 kN each, and the majority of ties will be of this capacity. For reveal ties (see 9.7.1 b)) the capacity is less, and their security is less assured, so a smaller area per tie is appropriate. This has been taken into account in Table 1(a). No scaffold should rely only on reveal ties, and every attempt should be made to keep them below 50 % (see also 9.9). Some cast-in and drilled anchors do not have the standard capacity of 6.25 kN because of the weakness of the material into which they are fixed, and in such cases the number of anchors to be provided should be calculated by proportion. This also applies to any other case when a tie capacity of 6.25 kN cannot be made available.

Table 1(a) — Frequency of ties in square metres per tie

This table should be read in conjunction with 9.3				
	Ties 12.5 kN ^a	Ties 6.25 kN ^a	Up to 50 % reveal ties 3.5 kN ^a	Over 50 % reveal ties 3.5 kN ^a
Unsheeted scaffolds				
Independent scaffolds				
with movable ties	32	32	25	^b
with non-movable ties	40	40	31	22
Putlog scaffolds				
with non-movable ties	32	32	25	^b
Sheeted scaffolds				
with movable ties	25	12.5		
with non-movable ties	32	16		
NOTE 1 Where tie capacities are less than those stated, appropriate frequencies should be calculated by proportion.				
NOTE 2 For tie capacity see 9.7.				
NOTE 3 The height of the scaffold has been assumed to be: for unsheated scaffolds less than 50 m; for sheeted scaffolds less than 25 m, but see also 9.3.3.				
^a Safe working capacity.				
^b Not recommended.				

9.3.2 Unsheeted scaffolds

The recommendations given in Table 1(a) are for scaffolds less than 50 m high. If scaffolds are higher they should be specially designed.

9.3.3 Sheeted scaffolds

The recommendations given in Table 1(a) are for scaffolds less than 25 m high in England and Wales on sites other than open country and where there is a tie capacity of 12.5 kN at each tie position. If any of these conditions are not met the scaffold should be specially calculated.

9.4 Ties

9.4.1 Selection of ties

The type of tie and anchorage should be selected from those given in 9.4.2 to 9.4.5 to suit the tying requirements and the nature of the facade.

9.4.2 Box ties

Box ties consist of an assembly of tubes and couplers arranged in the form of a square fixed around columns or other elements of the building, being wedged, where necessary, to resist both the inwards and outwards movement and to give some degree of lateral restraint. Details (ii) and (iii) of

Figure 3 are typical examples.

They should be at the level of the scaffold lift and be joined to both the inside and the outside ledgers or standards. If this impedes free access through the scaffold, then it is permissible for them to be fixed to the inside standard. In this case they should be adequately attached to resist the loading.

9.4.3 Lip ties

Where it is not possible to use box ties, lip ties may be used (see Figure 4). These consist of an L-shaped arrangement of tubes and couplers to hook the scaffold behind elements of the building. They do not resist inward movement of the scaffold and should be accompanied by an adjacent butting transom or have two cross tubes, nor do they resist sway. They are improved in performance by the use of a sway transom as shown in detail (iv) of Figure 4(a). Sway transoms should not be regarded as a substitute for facade bracing. They should be coupled to the ledger with load bearing couplers. Care should be taken to ensure that the strength of any building feature utilized is adequate, particularly if this is a parapet or similar structure. Lip ties may also be used over sills and under lintels. In these cases, it will be infrequent that the sill or lintel tie is on a level with a lift of the scaffold and they may be fixed to the inside uprights only or to a bridle tube fixed to two inside uprights. They should be accompanied by adjacent butting transoms and sway transoms.

In certain circumstances it may not be possible to fit butt tubes at right angles to the transom to form lip ties. Right angle couplers may be used as stops, provided there is at least a 25 mm lap onto a suitable part of the building.

9.4.4 Through ties

9.4.4.1 Through ties for independent tied scaffolds

Through ties (see Figure 5) rely on a tube across the inside of an opening such as a window in a building.

The inside tube should be placed vertically and rest on the floor so that it cannot slip downward, but it may be placed horizontally.

The tie tube should rest on the sill for the same reason but it may be placed under the lintel. Tie tubes attached to a tube across the inside of the window or opening should be as close to one of the edges of the opening as possible.

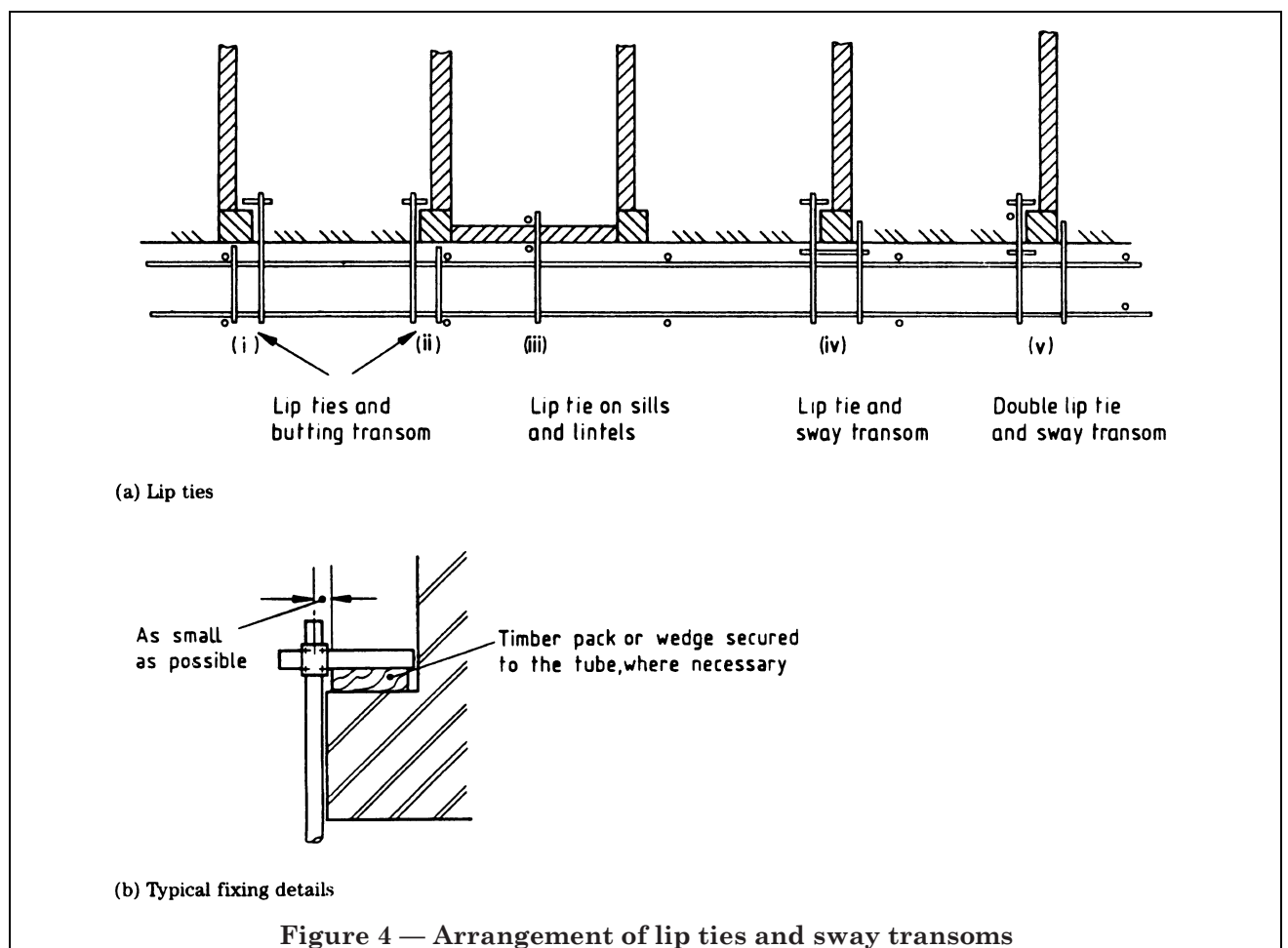
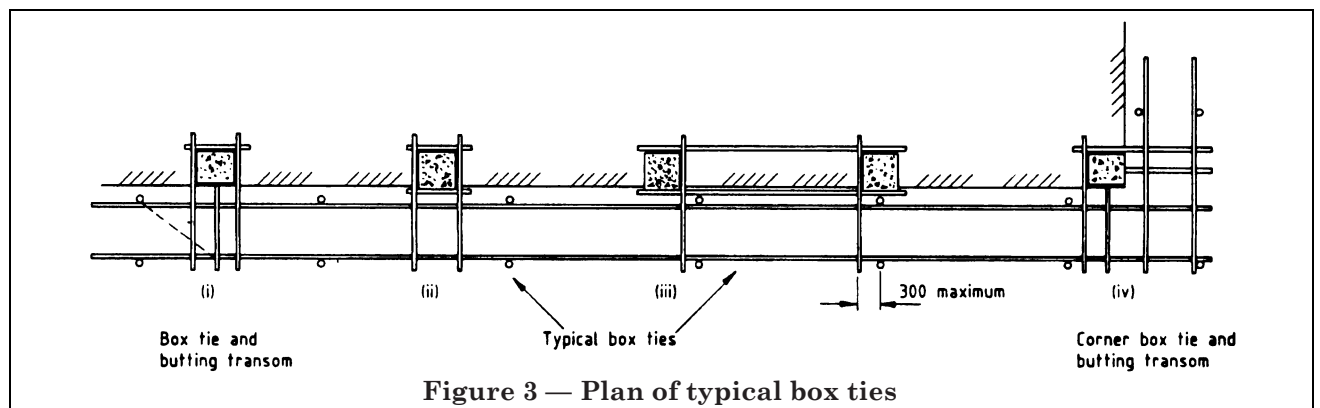
Where it is not possible to fix an outside tube, the adjacent transoms should butt against the outside surface of the wall.

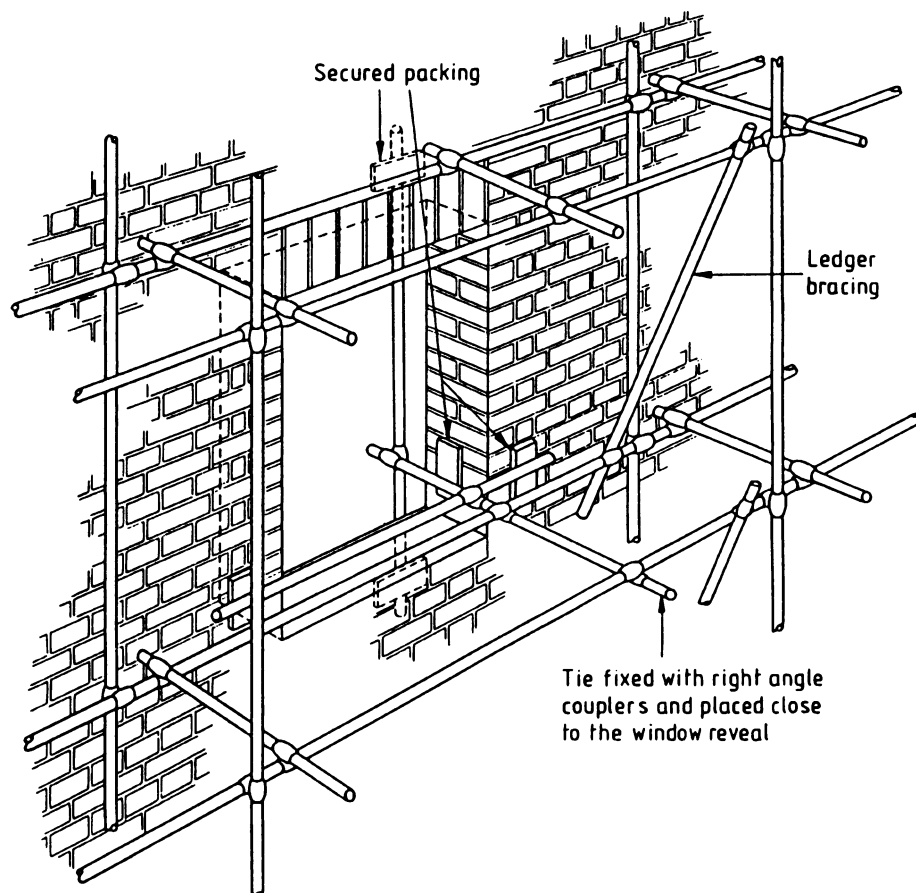
9.4.4.2 Through ties for putlog scaffolds

When a putlog is required to support boards and it is opposite a window opening, a bridle tube is frequently placed near the wall across the adjacent putlogs on either side of the window. The putlog opposite to the window is fixed to this.

A similar arrangement may be used to form a through tie.

Figure 6 shows an arrangement in which a tie tube is underslung and attached to both ledger and bridle.





NOTE. This drawing should be read in conjunction with the text.

Figure 5 — Through tie for independent tied scaffold

9.4.5 Reveal ties

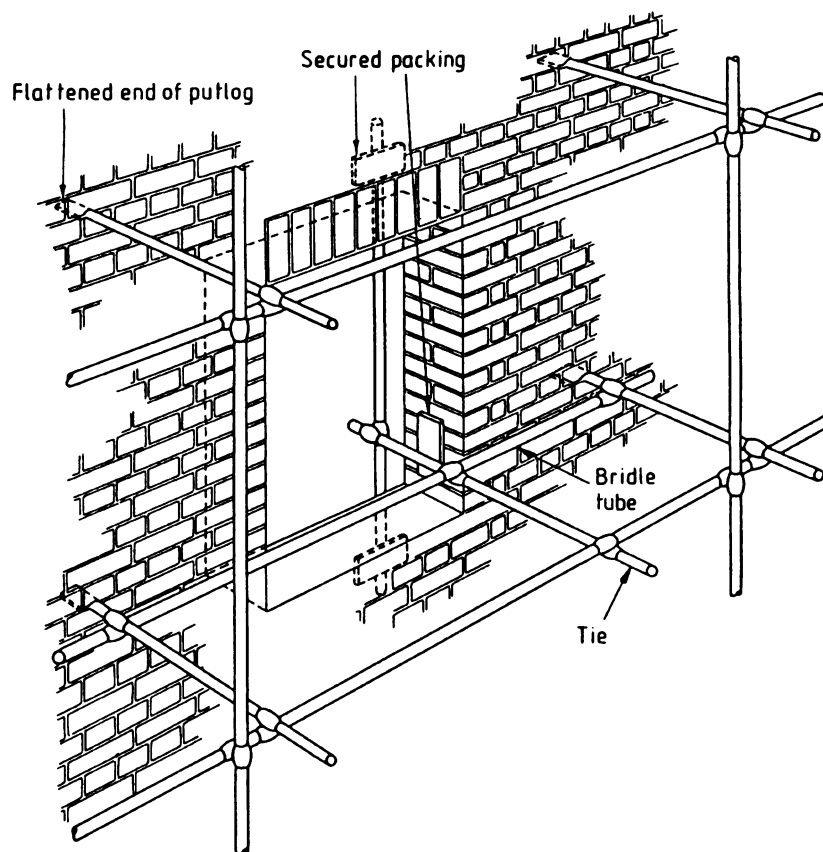
In cases where it is impracticable to drill into the surface of a building for screw or anchor ties, or where the quality of the fabric of the building is not known, or where it is impracticable to open windows for tube and coupler ties, the attachment of the scaffold should be made by reveal ties which rely on friction (see 9.3.1 and Figure 7).

Opposing faces of a building surface, such as the two opposing sides of a window opening or alternatively the underside of the lintel beam and the sill if this is not sloping, may be used to make an attachment of the scaffold to the building by means of a tube, wedged or jacked tight between the opposing faces.

It is essential that the manner of wedging the reveal tube into the opening be firm, reliable and, if possible, positive rather than by friction, i.e. if the reveal tube can be fixed behind indentations or masonry features advantage should be taken of this (see 9.4.3).

For most building surfaces, the reveals are plain and parallel and should not be marked or damaged. For these, it is frequently necessary to place a packing between the end of the reveal tube and the surface so that damage does not occur. Timber packs should be thin so as to reduce shrinkage (a thickness of 10 mm is recommended). It is not expected that they should spread the load over the surface of the reveal but that they should grip it and protect it at the same time.

The preferred method is to use a reveal pin at one end of the reveal tube. This consists of a small plate on which is mounted a threaded bar and nut. The assembly should be placed inside the bore of the reveal tube and the nut adjusted until the reveal tube is expanded into the opening, gripping it with considerable force.



NOTE. This drawing should be read in conjunction with the text.

Figure 6 — Through tie for a putlog scaffold on a bridle tube

The tie tube should be fixed to the reveal tube with a right angle coupler as near as possible to the end opposite to the reveal pin and in all cases within 150 mm of the face of the opening. It should also be fixed to the scaffold in two places with right angle couplers (see Figure 7) but other arrangements may also be satisfactory.

For a putlog scaffold, a bridle tube attached to two putlog tubes can provide a second fixing point. There are other methods of providing reveal ties, for instance by utilizing props and struts.

Because reveal ties rely on friction and are usually packed with timber, they should be frequently checked for tightness during the life of the scaffold.

9.5 Anchorages and allied components

9.5.1 Selection

An anchorage can be provided by casting in or subsequently fixing something, normally a threaded socket, into a part of the structure itself. Various components are then used to attach the scaffold. The appropriate anchorage and tie should be selected from the principal types described in 9.5.2 to 9.5.5. Anchorages and allied components should have a safe working capacity of 6.25 kN in tension and compression.

9.5.2 Cast-in and drilled anchorages

A variety of screwed plates, sockets and nuts are available for setting into the concrete during pouring, in a similar manner to formwork anchors, for subsequent use as scaffold ties. The attachment of the tie to the anchorage should be either by bolts welded to scaffold tubes or by use of special scaffold fittings (see Figure 8). Ring bolts may also be used.

A variety of anchor sockets are available intended for fixing into holes drilled into hardened concrete or sound brickwork. The attachments are similar to cast-in anchors. Specialist advice should be sought before using resin anchors. When drilling into brickwork, the anchor should be placed in the solid portion of the brick.

If the brickwork has been rendered, the location of the centre of the bricks should be found by drilling test holes and inspecting the location of the courses and brick ends through the holes. Care should be taken that the facade material is an integral structural material and not a surface cladding.

Holes for anchor sockets should be drilled to the correct depth and diameter as recommended by the manufacturer and be clean and normal to the surface. Some cavity walls and thin cladding panels may be unsuitable for supporting tie loads in which case other tying methods should be used. When intending to fix anchorages, data provided by manufacturers and based on tests carried out with substrates comparable to that of the structure may be used, applying a minimum factor of safety of 2.0 on the failure load quoted to determine the safe working load.

The capacity of the anchorages should be established either by a proof load test or by test to failure on a representative sample chosen on an acceptable statistical basis. The manufacturer's recommendations in this respect should normally be adopted.

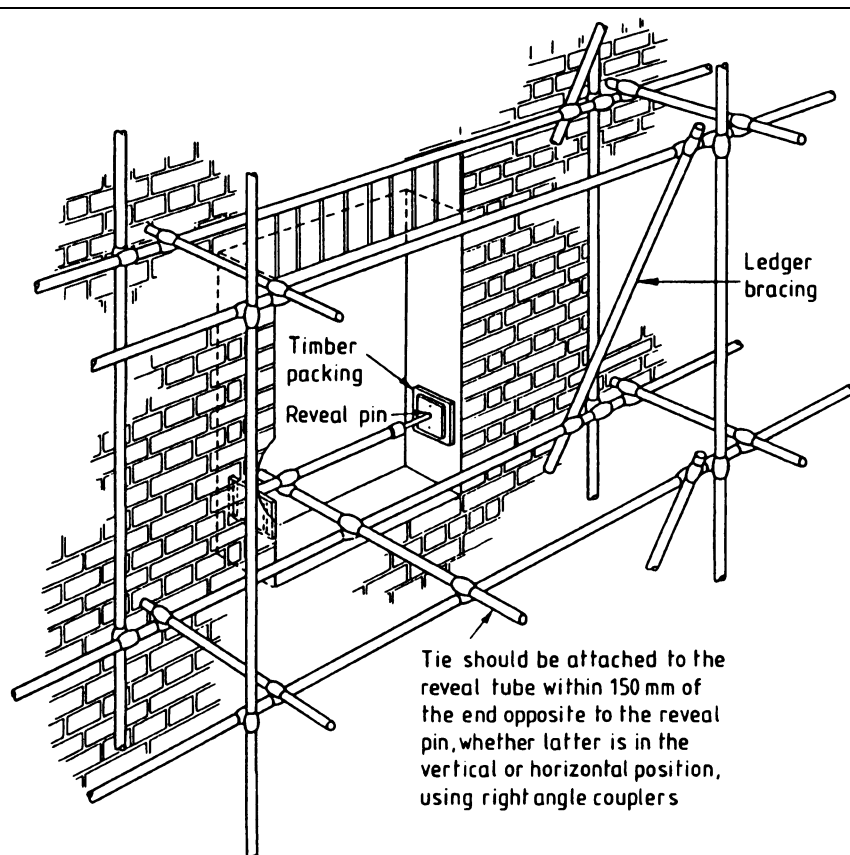
9.5.3 Tie tube adaptors

Tubes fitted with end plates (see Figure 8) can be used when it is possible to drill the element of the building to which the tie is to be attached and fix the end plate to it with expanding bolts. On new work, cast-in sockets can be used.

The tube welded to the drilled end plate can be standard scaffold tube, or tube of 60.3 mm external diameter able to receive standard scaffold tube inside it, the two tubes being fixed together with friction bolts.

Offset ties (such as shown in Figure 8(d)) enable fixing of the scaffolding to the building so that the window frames can be placed between the tie tube and the column.

A variety of scaffold fittings and half fittings may be adapted, by securely welding on bolts or drilling bolt holes, to become satisfactory tie fittings.



NOTE 1. This drawing should be read in conjunction with the text.

NOTE 2. The tube in the reveal can be in the vertical or horizontal position.

Figure 7 — Reveal tie

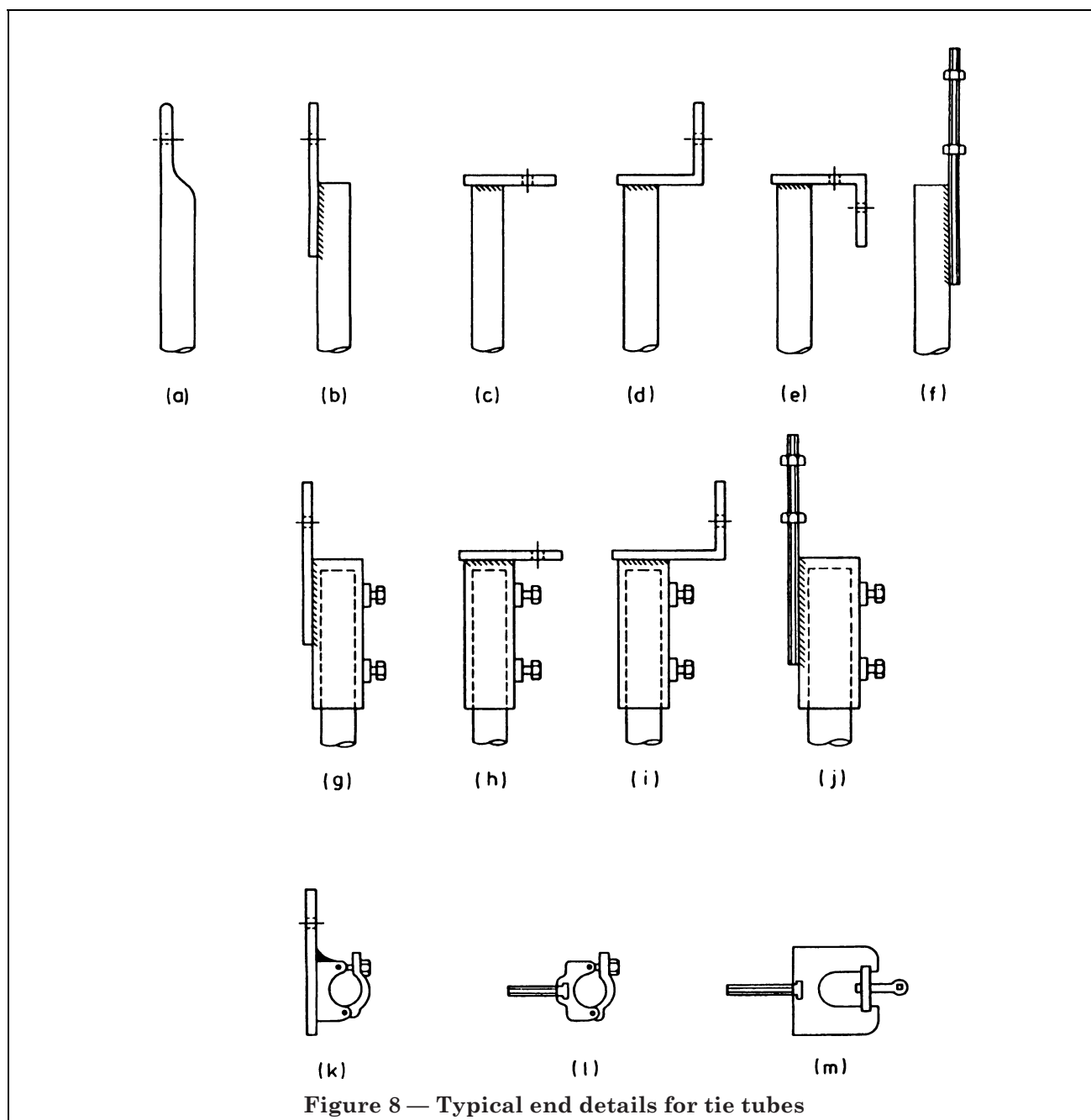


Figure 8 — Typical end details for tie tubes

9.5.4 Ring bolts

Typical ring bolts are shown in Figure 9 and Figure 10. They may be of two sizes:

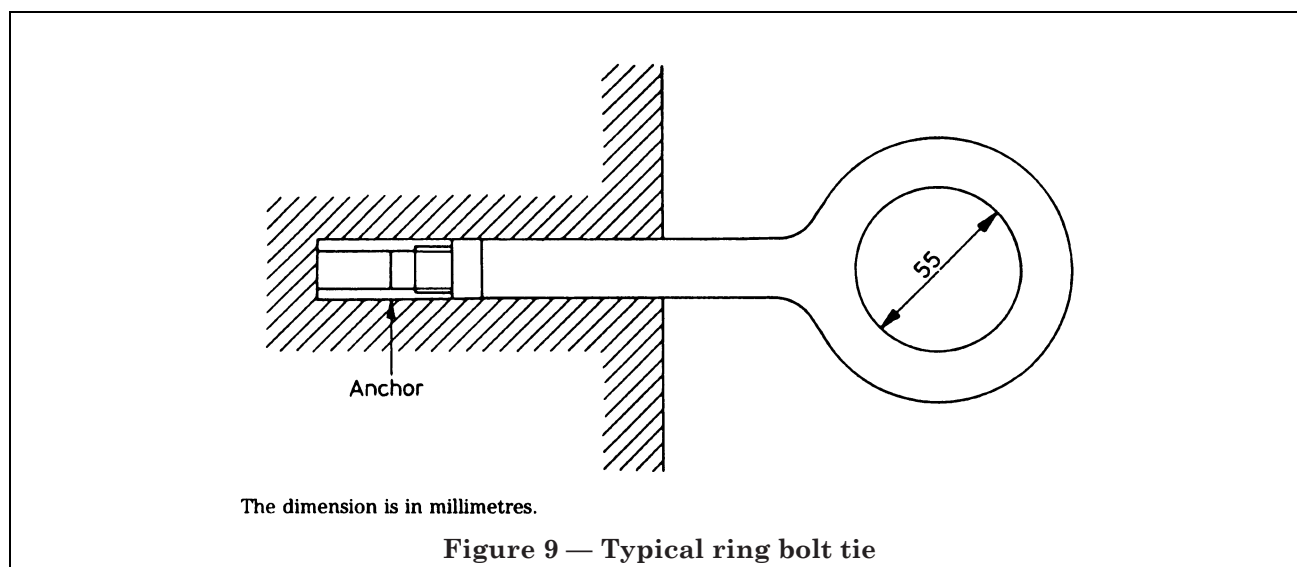
- with rings of between 50 mm and 55 mm internal diameter through which scaffold tube may be passed to form a tie assembly;
- with smaller rings for use with wire or steel banding ties.

In case b), the tube and fittings assembly should be such that it prevents the scaffold from moving inwards or outwards.

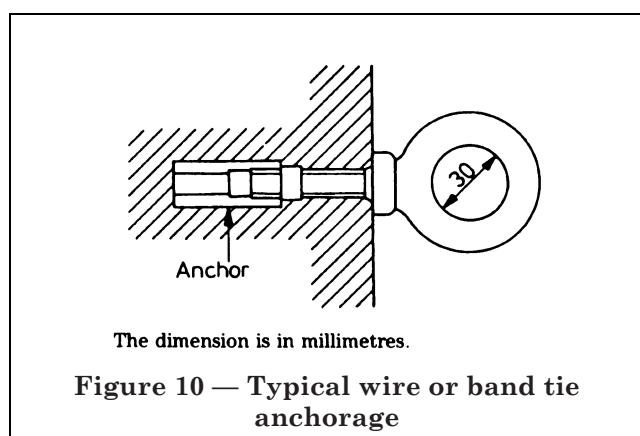
9.5.5 Wire and steel banding ties

Where the small ring anchorages shown in Figure 10 are used, the scaffold may be attached to the building or structure with 6 mm wire rope threaded through the ring and round a member of the scaffold with a minimum of three turns. Steel banding of equivalent strength may also be used.

When wire or banding is used, the tie does not prevent the scaffold from moving inwards to the building and accordingly such ties should be accompanied by adjacent butting and sway transoms.



Many elements of a building may afford opportunities for the attachment of wire ties and may be used provided they are of adequate strength. However, it should be realized that the anchorage value of these elements is frequently negligible. The strength and pull-out capabilities of these elements, which will include rainwater pipes, parapets and other architectural features should be verified before any use is made of them. Where there is any doubt as to the suitability of such features, alternative attachment points should be found. Rainwater guttering should never be used for the attachment of ties.



9.6 Attachment of the scaffold to the anchorage point

In plan, tie tubes, wire or banding ties should be set at right angles to the building unless they are intended to plan brace the scaffold against lateral movement. In the latter case, they may be set at an angle to the plan perpendicular to the building but should be fixed in pairs at opposing angles so as to afford lateral stability in both directions and should be accompanied by ties at right angles to the building to prevent outward movement.

In elevation, tie tubes should be horizontal or sloping downwards away from the building. They should not slope upwards away from the building.

Ties should be attached to both the inside and outside ledgers or standards at a point not more than 300 mm from a ledger braced standard, and as near to a node point as possible. Where this hinders access along a platform, attachment to the inside ledger or upright only is permissible.

The couplers for ties set horizontally and at right angles to the building should be right angle couplers or another such arrangement of couplers which gives similar or adequate strength.

The couplers for ties set at an angle to the building may be swivels.

Where wire or bonding ties are used, they should be turned round a node point of the scaffold or otherwise prevented from slipping along the ledger or upright by fixing safety couplers. A tube butting against the structure will be required in order to provide inwards strength.

9.7 Capacity of tie systems and alternatives

9.7.1 Inwards/outwards capacity

The safe working capacities of a tie system may be calculated in accordance with section 6 of this standard having regard to the geometry of the arrangements and the capacities of the individual elements of both the tie and scaffold within such an arrangement.

In the absence of such calculations and providing that the recommendations of 9.4 and 9.5 are followed, each tie assembly should be considered as having the following safe working capacity.

a) *Box ties, lip ties and through ties*

All the ties shown in Figure 3(iv), Figure 4, Figure 5 and Figure 6: 6.25 kN.

For the ties in Figure 3 which have two tubes and a butt tube connected with two couplers: 12.5 kN.

b) *Reveal ties*

Where these rely solely on friction there is no mechanical interlock and construction is in accordance with Figure 7: 3.5 kN inwards and outwards.

Where the reveal tube goes behind a load-bearing feature and the tie tube is tight to that feature, and there is a butt tube: 6.25 kN outwards.

c) *Cast-in and drilled anchorages*

In accordance with 9.5.2, i.e. the manufacturer's stated safe working load with an appropriate factor of safety or a value determined by site tests inwards and outwards.

d) *Tie tube adaptors*

6.25 kN inwards and outwards.

e) *Ring bolts*

6.25 kN inwards and outwards.

f) *Wires and steel bands*

6.25 kN outwards.

9.7.2 Lateral and vertical capacity

Except in special cases, the design should not call for vertical or lateral capacity. But in the event of damage to the scaffold below, some vertical or lateral strength will prove advantageous.

9.7.3 Equivalent tying value of scaffold returns, buttresses and rakers

The stability of a scaffold can be achieved by means other than ties fixed to the surface of the building.

Returns of scaffolds which are themselves effectively tied round the ends of building facades should be regarded as providing an adequate attachment of the scaffold to the facade for a 3 m length of the scaffold, measured from the end of the building.

Specially designed buttresses, either side of a scaffold, should be regarded as providing adequate stability for a 3 m length of the scaffold on either side of the buttress.

Single unjointed raking tubes of up to 6 m in length, at 6 m centres coupled at the top to the ledger at the second lift and tied back to the scaffold at the foot, should be considered as providing adequate stability for scaffolds up to 6 m high. The raking tube should be external to the scaffold and at an angle of not more than 2 vertical to 1 horizontal.

For other applications they should be designed in accordance with Table 14 taking the self weight into account.

9.8 Special details

9.8.1 First working lift

When a working lift is required at 1.35 m height, as in a putlog scaffold, or at 2 m height, as in an independent tied scaffold, and no firm part of the building has been constructed to attach a tie, a scaffold should be temporarily stabilized by raking tubes or other means. Such tubes should also be fixed during dismantling if low level ties are impracticable. Movement of the lower end should be prevented by a foot tie to the main scaffold or other suitable means.

9.8.2 Ties for small scaffolds without returns

When only two ties are required, it is preferable to place the ties towards the ends of a straight run of scaffold.

9.9 Abnormal facades

9.9.1 General

Where the tying arrangements of the previous clauses are inapplicable, the facade is considered abnormal and any such scaffold requires special consideration. Such facades will have no holes or possibilities for making them. Even if reveal ties are possible tying should not be reliant on such ties and they should not exceed 50 % of the total (see Table 1(a)). Where tying can only be provided by reveal ties these should only be adopted after careful consideration of their ability to carry the load and where their physical condition will be regularly maintained.

9.9.2 Weak structure

If the material is too weak to support an anchor, or if the structure as a whole is too weak, other means of access should be considered. These include tower mounted scaffolds, and hydraulic platforms.

9.9.3 Limited facade size

Where the facade concerned is not large, suitable methods of restraint include the use of raking tubes, buttresses, wire ties over the roof or round the sides, struts from other buildings and additional width of the scaffold.

If the ends of buildings are without windows and are unsuitable for fixing ties, consideration should be given to return scaffolds at the front and the back, or to wire ties along the front and the back. Where the untied facade is longer than 6 m, plan bracing across the corners of the scaffold and its front and back returns should be fixed at intervals of height not more than 8.50 m. Where the untied facade is longer than 10 m, additional plan bracing should be fixed across the full length of the untied structure at intervals of height of not more than 8.50 m. For lengths greater than 15 m, other methods should be considered.

Where a complete hollow structure is fully scaffolded internally or a structure of small plan area is completely surrounded outside by scaffolding, consideration should be given to dispensing with ties and placing reliance on butting transoms. In this case the lateral stability of the scaffold should be ensured by face bracing.

10 Bracing

10.1 General

Bracing should be provided to stiffen the scaffold. The plane to be braced should, wherever practicable, be divided into a complete series of triangles by braces. These should be fixed as close as possible to intersections. A check should be made on the reduction in strength of the scaffold where a brace has to be omitted or where it cannot be fixed within 300 mm of an intersection. For special scaffolds refer also to **39.9**.

10.2 Ledger bracing

Independent tied access scaffolding should contain ledger bracing which should generally be on alternate pairs of standards. Any pair of standards which are ledger braced should be made into a complete series of triangles.

When the bay length is 1.5 m or less, the ledger bracing may be fixed to every third pair of standards.

The ledger bracing should preferably be fixed from ledger to ledger with right angle couplers when the lift is not to be boarded but may be fixed to the standards using swivel couplers.

The bracing on boarded lifts should be from under the outside ledger of a boarded lift down to the inside ledger of the lift below so as to avoid the toeboard. This arrangement may require an extra width on the scaffold to accommodate the brace.

Ledger bracing from the inside ledger to the guardrail level of the lift below may be used provided that every pair of standards is so braced instead of every alternate pair.

The direction of ledger bracing is immaterial for the structural stability of the scaffold but it should be pre-planned to take account of the intended use of the scaffold.

In scaffolding over footpaths, it may not be possible to ledger brace the lowest lift. Ledger bracing may be omitted from this lift provided the lengths of the standards in the lift area are not in excess of 2.7 m. In this case account should be taken of the reduced loading capacity of this lift.

When the height of the lowest lift is in excess of 2.7 m, a knee brace should be inserted across the top corner of the lower lift, commencing at approximately 1.8 m from the ground.

One such knee brace should occur on every pair of standards and be fixed with alternate slopes. On large scaffolds it is sometimes desirable to insert cross knee braces on every pair of standards. To be effective, a ledger should be fixed adjacent to where the knee brace meets the standard.

10.3 Facade bracing

Longitudinal bracing should be provided to all scaffolds in which the movement along the facade of the building is not prevented by other means. It need not be fixed where the scaffold is securely butted between opposing outside or inside faces of returns or recesses, provided that no length greater than 10 m is so fixed against movement in both directions.

When longitudinal bracing is omitted, the lateral movement of both the inside and outside lines of the standard at every lift should be prevented either by both lines being adequately butted or by adequate plan bracing onto firm points inserted at every level.

Longitudinal bracing should be achieved by tubes set at between 35° and 55° to the horizontal, reaching from bottom to top of the facade. The principal forms are:

- a) individual tubes set in zig zag pattern, the top of a tube and the bottom of the next preferably being attached to the same transom;

- b) a continuous tube, extended as necessary to cover the whole facade, only possible for wider facades;
- c) individual tubes as in a), but all sloping the same way; the top of one is connected at a ledger/standard intersection, and the bottom of the next is attached to the same pairs of standards.

A combination of these may be appropriate.

In all cases, the bracing tubes should be connected either:

- 1) to every lift of the extended transoms with right angle couplers; or
- 2) to every standard with swivel couplers.

Arrangement (1) is to be preferred.

One such brace assembly should be provided at intervals along the scaffold not exceeding 30 m.

The longitudinal bracing should be fixed as near to the standards as possible. When the brace is fixed to extended transoms, the latter should be fixed to the outside ledgers with right angle couplers.

The longitudinal bracing should include the lower lift being started from the base of one of the outside standards. In the lower lift, when the bracing is started a guardrail should be placed through the braced bay to prevent people passing.

The joints in continuous diagonal bracing should be made by overlapping the two lengths of the tube by a distance of at least 300 mm and joining them together with two parallel couplers. Alternatively, the two tubes may be joined by a sleeve coupler or other coupler capable of sustaining the applied load or by an expanding joint pin lapped with a butt tube with one fitting either side of the joint.

10.4 Plan bracing

Plan bracing should be provided to all portions of an access scaffold which are not otherwise stabilized against lateral distortion. It may be joined by the same type of couplers used for longitudinal bracing and the same rules with regard to strength apply.

10.5 Couplers for fixing braces

Right angle couplers should be used to fix braces to ledgers or transoms and swivel couplers should be used for the attachment to standards. Other couplers may be used provided that they are capable of sustaining a safe working load of 5 kN.

11 Foundations

11.1 General

The foundations for a scaffold should be adequate to carry and dispose the load imposed both locally at each standard and, in general, to carry the whole weight of the scaffold.

The foundation for a scaffold should be maintained in an adequate condition during the life of the scaffold.

11.2 Hard surfaces

On surfaces such as steel and concrete which are even and level and where there is adequate hardness and thickness to prevent the scaffold tube penetrating into the surface, the uprights of a scaffold may be placed directly on the surface, although it is generally preferable to use a base plate.

11.3 Pavements and other surfaces of intermediate hardness

On surfaces such as hard asphalt, timber and flooring, where there is a possibility of the standards deforming the surface, base plates or metal packing plates should be used at the bottom of the standards.

11.4 Other surfaces

On soil, ash, hoggin, gravel, soft asphalt and any type of flooring or paving which would be penetrated by a standard with a base plate beneath it or if there is doubt about the surface, there should be a further spreading of the load by a sole plate of timber or other suitable material.

11.5 Sole plate area

When a sole plate is used, the sole plate area beneath any one standard should be at least 1 000 cm², with a least dimension of 219 mm, and if the sole plate is of timber, it should be not less than 35 mm thick. On sites where the ground is soft, or has been disturbed, the sole plate area should be not less than 1 700 cm² when individual sole plates are used, e.g. under hoist towers, and not less than 3 400 cm² when two are combined together under two standards. In this case, if the sole plate is of timber, it may be necessary to use one with a total thickness in excess of 35 mm. Sole plates should support two standards.

11.6 Soil compaction

The soil or ground beneath the sole plate should be well compacted and free from irregularities which would make the sole plate unstable or poorly bedded.

11.7 Sloping foundations

On slopes exceeding 1 vertical to 10 horizontal, a check may have to be made on the foundations to ensure the stability of the scaffold.

12 Standards

12.1 Foundations

Standards should be founded as detailed in clause 11.

12.2 Erection tolerances

Erection tolerances should not exceed the figures detailed in 18.1.

12.3 Joints

The joints in standards should be staggered. Joints in standards of access scaffolds tied to a building may be made with either joint pins or sleeve couplers. Sleeve couplers are preferred. As these types of couplers have limited load capacity in tension, in scaffolds which are free standing or projecting above the level of a building or otherwise subject to forces which would produce tension in the uprights, the standards should be joined in a manner capable of resisting the applied tension.

No more than three out of the four standards at the corner of any bay should have joints in the same lift except in the case of the bottom 6.5 m of a scaffold where an extended base life is necessary for pedestrian access or other reason, when a joint in all four of the standards at the corner of any one bay is permissible provided that one of the joints is lapped with a short length of tube.

12.4 Lift heights

The vertical intervals at which standards are linked to one another, i.e. the lift height, is the most important dimension in scaffolding. This dimension should be measured on site and maintained in accordance with the requirements of the design.

Where any of the standards in a scaffold are founded in a light well or at a level lower than the remainder of the standards, the extension downwards should be stiffened by horizontal tubes, in two directions at right angles and fixed at lift heights not greater than that of the foot lift of the remaining scaffold. Where access for the public is required under the first lift, a height of up to 2.7 m is permissible, provided that the load in the standards does not exceed those given in Table 14.

13 Ledgers

13.1 Attachment

Ledgers should be fixed to standards with right angle couplers, except in the case referred to in 13.3, and should be horizontal except that a foot lift may follow the slope of the ground at the base of a scaffold. In this case, the transoms may be attached to the standards and the ledgers to the transoms.

13.2 Joints

Joints in ledgers may be made with sleeve couplers or expanding joint pins. Where tension is likely to occur, only sleeve couplers should be used. Joints in ledgers on the same lift and in adjacent lifts should not normally occur in the same bay. However, when guardrails are to remain permanently in place, the absence of a joint in the guardrail in any bay may be accepted as giving sufficient continuity to the scaffold to permit joints in the ledgers above and below it in the same bay. Where joints are necessary they should be positioned at a distance not greater than $\frac{1}{3}$ of the span between adjacent standards.

13.3 Curved building surfaces

In the case of curved scaffolds, fittings other than right angle couplers may be used to join the ledgers to the standards, provided that they are of adequate strength or otherwise supplemented by a right angle check coupler. If underslung transoms are used to modify the height of one platform, these transoms should be joined to the ledgers with right angle couplers. For large radius curves, separate scaffolds with platforms of the same height may be used.

14 Transoms and putlogs

14.1 Length of transoms and putlogs

The length of transoms and putlogs will vary according to the intended use of the scaffold and should be such that the widths of scaffolds given in Table 2 are obtained.

Transoms should be extended inwards and outwards, as necessary, for the purpose of butting the face of the building and fixing the longitudinal bracing.

14.2 Couplers

Transoms may be fixed to the inside and outside ledgers with right angle or putlog couplers, except in the cases referred to in 10.3 and 13.1, when only right angle couplers should be used. Attachment to braces should be in accordance with clause 10.

14.3 Spacing

14.3.1 Boarded lifts

The spacing of transoms and putlogs for boarded lifts should be in accordance with Table 3, except that the distance between transoms should not result in bay lengths greater than those given in Table 1. Board end transoms should be fixed so that the end overhang of a board does not exceed that given in Table 3. In no case should the overhang be less than 50 mm.