

Section 4. Prefabricated components

21 Proprietary equipment

21.1 Instructions

Where equipment comprises a complete set of components of unique design, capable of erection without any other equipment, it will be necessary for the supplier of the system to provide a complete set of instructions, compatible with this code and sufficient to ensure the safe erection and use of the scaffold. These should be related to the requirements of the user, given for example in DD 72 or in this code. Most of the content of the instructions is likely to be drawn from this code, especially as standard scaffold tube and couplers will frequently be used as an adjunct to the proprietary sections. When using proprietary equipment, the suppliers instructions for use should always be followed.

Particular attention is drawn to the following:

- (a) the need to seek and obtain instructions when deviating from the standard scaffold, or when sheeting or fans are added or other changes are made which will vary the structural loading or arrangement;
- (b) the fact that many vertical joints have a minimal tensile capacity and may not be staggered;
- (c) the need for fully tying and its attachment to appropriate points on the scaffold;
- (d) the need for adequate foundations as outlined in clause 11.

Because of different materials and jointing systems, characteristics and spacings of proprietary scaffolds will frequently differ from tube and fittings scaffolds. Their accuracy will be better and construction less difficult for all straightforward applications.

21.2 Proprietary components

21.2.1 General

Certain components are available for use with tube and fittings, and their use is discussed in 21.2.2 and 21.2.3.

21.2.2 Transoms with couplers attached (sometimes referred to as mobile transoms)

Four couplers, which would be used to connect a transom and two standards, are replaced by two half couplers fixed to each of the ends of a transom member.

Intermediate transom members are also available without connections for standards.

Provided that the couplers have equivalent strength to the couplers they replace, a direct substitution may be made. The resulting connections are usually more rigid than those provided by ordinary couplers and some reduction in bracing may be possible.

21.2.3 Other equipment

Where other equipment for use in conjunction with tube and fittings is supplied, the supplier should provide the guidance recommended in 21.1. Some guidance on the use of prefabricated beams is given in clause 22.

22 Use of prefabricated beams in scaffolds

22.1 Description

Prefabricated beams of a variety of types are available to increase the strength and simplify the construction of beams and trusses in scaffolding materials.

These beams may be fully welded lattice structures or fabricated in separate parts or units for assembly on site.

22.2 Loading

The loading on a beam is determined from the requirements of the structure and the size and type of beam should be chosen accordingly.

The safe working load of prefabricated beams for various methods of erection should be available from the supplier.

22.3 Components

Any additional components required should be properly designed and fabricated by a competent manufacturer.

Where splices are used to join units together, the forces within the beam, especially in the chords, should be calculated and catered for by specially designed splices.

When bolts are used, they should be of the size, type and grade of steel specified by the manufacturer of the beam.

22.4 Inspection

All the components in a beam system should be inspected before assembly. Defective parts and components with defective welds should be discarded.

22.5 Method of applying the load and end reactions to beams

The loads and end reactions should be applied to the beam by the method and in the position prescribed by the manufacturer.

Attachments should be made as close as practicable to the node points.

22.6 Assembly

Where beams have chords of different sizes, reference should be made to the supplier for the rules of correct application.

22.7 Lateral stiffeners

The load carrying capacity of a beam is dependent on both its chords being laterally restrained at the intervals laid down by the manufacturer. Stiffeners or other lateral restraint should be inserted at these intervals, which may be different for the compression and tension chords.

The lateral rigidity of the beam at its supports should be adequate.

22.8 Knee bracing

Consideration should be given to improving the performance of a beam by the use of knee bracing below it or V bracing above it. Where knee bracing, V bracing, standards and puncheons are used to improve a beam's stability, they should be coupled to the beam twice i.e. to both chords or to a chord and a cross-member.

22.9 Beams as columns

When prefabricated beams, such as ladder beams, are coupled together as columns, the spacing of the couplers should be designed so as to ensure adequate strength.

22.10 Spine beams

When large beams are used as spine beams in roofs, the bottom chord should be stiffened by V bracing to the rafters.

22.11 Attaching guys

Guys should not be attached to prefabricated beams as a means of providing lateral support, except where provision has been made in the design.

Section 5. Special scaffolds

23 Loading bays founded on the ground

23.1 Loads and general arrangement

When materials are to be stored on a scaffold, the weight of these will probably be in excess of the access scaffold ratings given in table 1.

An impact load of at least 25 % of the largest load should also be included in the design.

Weights of materials which give a distributed load of not more than 4 kN/m^2 , may be catered for by cantilevered loading platforms of the type described in clause 24. Platforms with larger distributed loads, or when several storage platforms are required above one another, should be arranged in a special loading bay with its own standards founded on the ground. This may be attached to the access scaffold but should be separately tied to the building from which it should take its rigidity.

Where loading bays form part of pavement gantries and carry further lifts of access scaffolding above, the extra loads should be taken into account.

The method normally used is to select the required length of the access scaffold to which the loading bay is to be attached and to reduce the spacing of the standards in this length to supplement their total load-carrying capacity to the required amount. The transoms are then extended outwards to the distance necessary to give the required storage area and a third line of standards is erected on the outside of the platform to carry a share of the load.

Alternatively, a separate tower may be constructed with the inside standards tied to the outside ledgers of the access scaffold, in which case the lift heights in these loading bays should be calculated for the loads in the appropriate standards and may not be the same as those in the access scaffold.

Guardrails on the access scaffold may be left in place at all lifts and utilized as lifts in the loading bay, ensuring that suitable load-bearing couplers are used.

A loading bay may form part of a hoist tower with access at its end and it may also form part of a ladder tower giving access to all levels of the access scaffold.

So that interference with crane operation will not occur, transoms should not project beyond the outside face of the loading bay.

23.2 Bracing

23.2.1 Diagonal bracing

The loading tower should be diagonally braced on all four sides and should be externally plan braced off the access scaffold. The internal facade bracing of the loading bay may hinder the access from the scaffold to and from the loading bay, and accordingly may be placed in the form of a zigzag longitudinal bracing system on the main scaffold

outside the area of the loading bay. This bracing may also be considered as contributing to the longitudinal bracing of the access scaffold.

The external face of the loading bay may be modified to give easy crane access where needed.

23.2.2 Wind bracing

In addition to the external bracing in 23.2.1, it is usually sufficient to place a diagonal plan brace either internally or externally from the outside corner of a loading bay to the main access scaffold on alternate sides at every lift level. The main scaffold should be tied to the building opposite these braces with ties supplementary to its own requirements at intervals not exceeding 3 m.

23.3 Lifts

The storage levels of a loading bay will usually be required at the levels of the floor of the building. When several such levels are required, care should be taken to restrict the lengths of the standards by supplementary lifts to give the necessary load-carrying capacity in the standards.

23.4 Decking

It is advantageous to choose a length for a loading bay in modules of board lengths so that short boards are not required, as movement of heavy materials about the platform may cause short boards to be dislodged. The platforms may be double boarded, if necessary, in which case the layers of boards should be parallel.

23.5 Guardrails and toeboards

The platforms should be provided with guardrails and toeboards on all the outside faces and on the inside as well, if this is not a boarded lift of the main access scaffold.

Where the materials to be stored are to be fed to the platform by mechanical means, removable lengths of guardrails on the outside face of the loading bay should be provided and replaced after loading has been completed.

23.6 Foundations

Consideration should be given to the adequacy of the sole plates and foundations of loading bays.

23.7 Notices

It is recommended that a notice should be erected showing the safe working load.

24 Cantilevered loading bays attached to scaffold

24.1 Loads and general arrangement

For single lift loading bays carrying a loading not in excess of 4 kN/m^2 , a cantilever structure can be erected from the main access scaffold. It is desirable to give consideration to the possible use of cantilevered loading bays at the planning stage of the scaffold. Figure 13 shows details of the construction.

The area and loading required should first be chosen, taking into account an impact factor of at least 25 % of the largest lifted load. The self weight of the cantilevered structure and its decking should be assessed and added to its imposed load and impact. The main access scaffold should then be modified to accept safely this total load on its outside standards. It should also be fitted to the building with supplementary ties to cater for the outward forces resulting from the cantilever structure. The forces in the rakers and the couplers thereon should be estimated from the largest lifted load and its impact.

When several cantilever loading bays are required at different levels, they should not be under one another but attached to separate parts of the access scaffold with a free bay between them so that their load is not additive.

It may be necessary to reduce the bay length of the access scaffold to increase the number of standards carrying the load, or alternatively doubled standards may be used.

The transoms of the main scaffold should be extended into the area of the loading bay and may be required to be at closer centres than those of the main scaffold.

A ledger is required at the outer edge of these platforms. Additional ledgers may be required depending upon the design of the particular platform.

In the example shown in figure 13, the intermediate transom has been extended to the raker to restrict the length.

Joints in ledgers should not be in the same bay and should be made with sleeve couplers.

The rakers should be set as close as possible to each standard in the access scaffold. They should be at an angle not greater than 35° to the vertical and fitted with the necessary check couplers. They should not have an unsupported length greater than that required to carry the load and in any event not greater than 3 m.

24.2 Bracing

The access scaffold supporting the cantilever loading bay should be fully ledger braced on every standard at the bottom of every raker.

24.3 Ties and butting transoms

The access scaffold should have supplementary ties fixed at the level of the cantilever loading platform, to cater for the outward forces resulting from the applied load and impact and the self weight of the platform.

At the level of the bottom of the rakers, the access scaffold should be adequately butted on to the building which should be checked for suitability and strength at this point.

24.4 Decking

It is advantageous to choose a length of cantilever loading bay that avoids the use of short boards (as in 23.4). The platform may be double boarded, if necessary, with the layers parallel to one another.

24.5 Guardrails and toeboards

The platform should be fitted with toeboards and guardrails on three sides. The guardrail posts should be fixed to the transom with right angle couplers so as to avoid the outward rotation of the posts which might occur if they were fixed to the ledgers.

24.6 Notices

It is recommended that a notice should be erected showing the safe working load.

25 Protection fans, nets and pavement frames

25.1 Description and duty

Protection fans and nets are sometimes fixed to access scaffolding to intercept anything which may fall from the structure. Typical fan structures will only arrest small objects. Special consideration is required if heavy objects with a long free fall are to be catered for. These fans may be supported from the building or scaffold using wires or tubes.

It is not possible to state loadings for fans since it cannot be predicted what weight will fall and from what height. The recommendations set out in the following classifications have been found to be generally satisfactory in practice (see figure 14).

(a) *Class A.* A light duty fan with a maximum loading equivalent to 0.75 kN/m^2 , for the protection of pedestrians from paint droppings from painters working in cradles or from droppings of mortar from the pointing of brickwork, etc.

(b) *Class B.* A medium duty fan with a maximum loading equivalent to 1 kN/m^2 , for protection against falling aggregate, bricks and like weights from heights not exceeding 10 m overhead.

(c) *Class C.* A fan with a loading over 1 kN/m^2 , which should be designed to suit the application. This classification is not covered in detail in this code (but see figure 14(c)).

(d) *Class D.* A fan for arresting the fall of persons or like weights, falling about 6 m or the distance of about two building storeys, which should be erected in accordance with CP 93 (cf. 25.9).

25.2 Effect of fans on the loads in standards of access scaffold

25.2.1 Vertical loads

A typical construction is to fix the transom of the fan above the outside ledgers of an access scaffold and below the inside ledgers, giving a minimum slope of 100 mm in 1.2 m (or 1 vertical to 12 horizontal).

This arrangement imposes additional loads on the ledgers and standards of the access scaffold. The inside standards may be subject to an uplift.

25.2.2 Horizontal forces

As the inwards and outwards forces acting at the points of attachment of the fan and its ties and struts may be large, account should be taken of this by the use of suitable attachments to the building. Care should be taken that the strength of the building is adequate to accept these forces, particularly if it is partially demolished.

25.3 Decking

The material of the decking, which may be agreed by the user, should be of waterproof sheeting, corrugated iron, boarding or netting. The decking material of the fan should be appropriate to the duty to be performed, with special reference to the closeness of the boarding or sheeting and the size of the mesh of nets.

The drainage arrangements of the fan should be agreed with the user.

The whole fan or net structure should be securely attached to the access or protection scaffold or to the building to resist the wind forces. Nets may be attached with cord. Corrugated sheeting should be attached with sheeting hooks or hook bolts. Boards should be laid and secured by wire, nails, or board clips.

25.4 Wind forces

The wind forces on fans and nets can only be assessed approximately. The force may be upwards or downwards at various times, depending on the topography of the site and the degree of completion, size and shape of the building and adjacent structures (see 39.10.4).

25.5 Precautions during erection and dismantling

The outside point of support of the fan structure should be in the outside third of its width, measured at right angles to the building or scaffold.

Because a typical fan structure has only two support points, the outside one of which sometimes may not be at the extreme outside edge, serious out of balance forces can occur during construction and dismantling.

Safe systems of construction and dismantling should be planned and adhered to on the site.

25.6 Light duty (class A) fans suspended on wires (see figure 14(a))

This type of protection fan consists of two ledgers spaced apart with transoms to form a frame 1.2 m, 1.8 m or 2.4 m wide, according to the protection required.

The transoms should be spaced approximately 1.5 m apart and the suspension points are the nodes 3 m apart. When the suspended fan can be supported on a building feature the inboard suspension wire may be omitted as shown in figure 14(a)(i).

One of each pair of suspension wires should be fixed near the surface of the building to the inside node and the other from the same suspension point on the building at an angle to the outside node. The fan is thus maintained against the building by its own weight and it may be further tied in at the decking level.

The suspension points may be the outriggers from the roof rig of a suspended platform, additionally counter-weighted, or may be screw-in or anchor tie points at a lower level.

The wires should be fixed to the tie points and the tubular framework by a round turn and two bulldog grips, a single turn and three bulldog grips or a round turn and two half hitches.

25.7 Medium duty (class B) fans fixed out from a building (see figure 14(b))

This type of fan consists of beam struts projecting from the building to distances greater than 2.4 m and sometimes up to 5 m.

The inside ends of the beam struts should either rest on the building floors or on sills or be located on a bridle tube fixed to the building with ring bolts. The outside ends of the beams should be maintained at the desired angle by wires or tubes from or near the ends in an upwards or downwards direction attached to suitable tie points on the building.

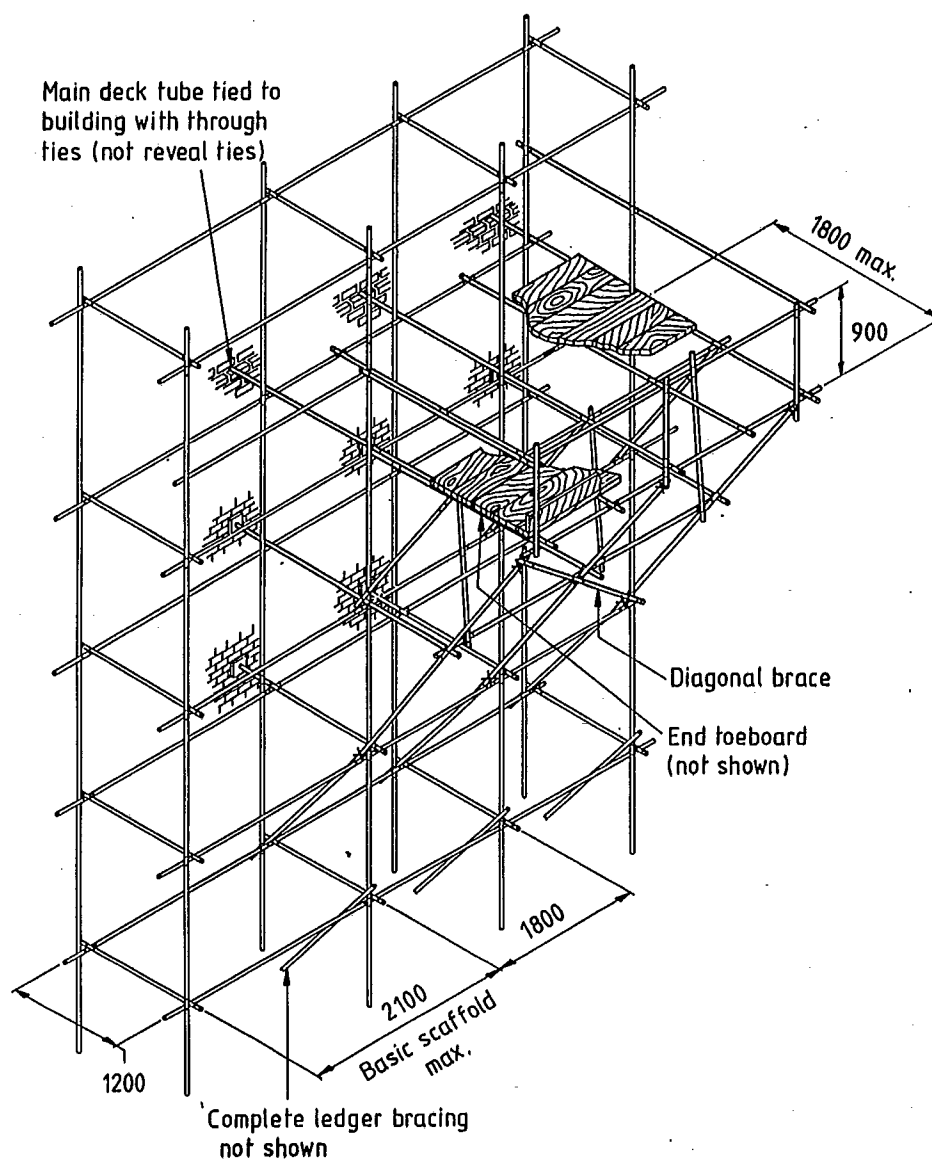
The beams should be laced together with ledgers fixed below their top chords. Intermediate transoms are fixed between the beams so that the resulting framework can be boarded out.

A variety of prefabricated beams are suitable for this purpose but it should be ascertained that they are adequately strong in reverse bending if the point of suspension is not at their end.

Both ends of the beams should be stabilized against movement.

The decking may be of corrugated sheeting, scaffold boards or nets and it should be fixed securely to the framework.

Under wind forces, the anchor points both above and below the fan frequently carry loads up to 2 t for every 3 m of length of fan supported and suitable means of attachment to suitable portions of the building or structure should be made.



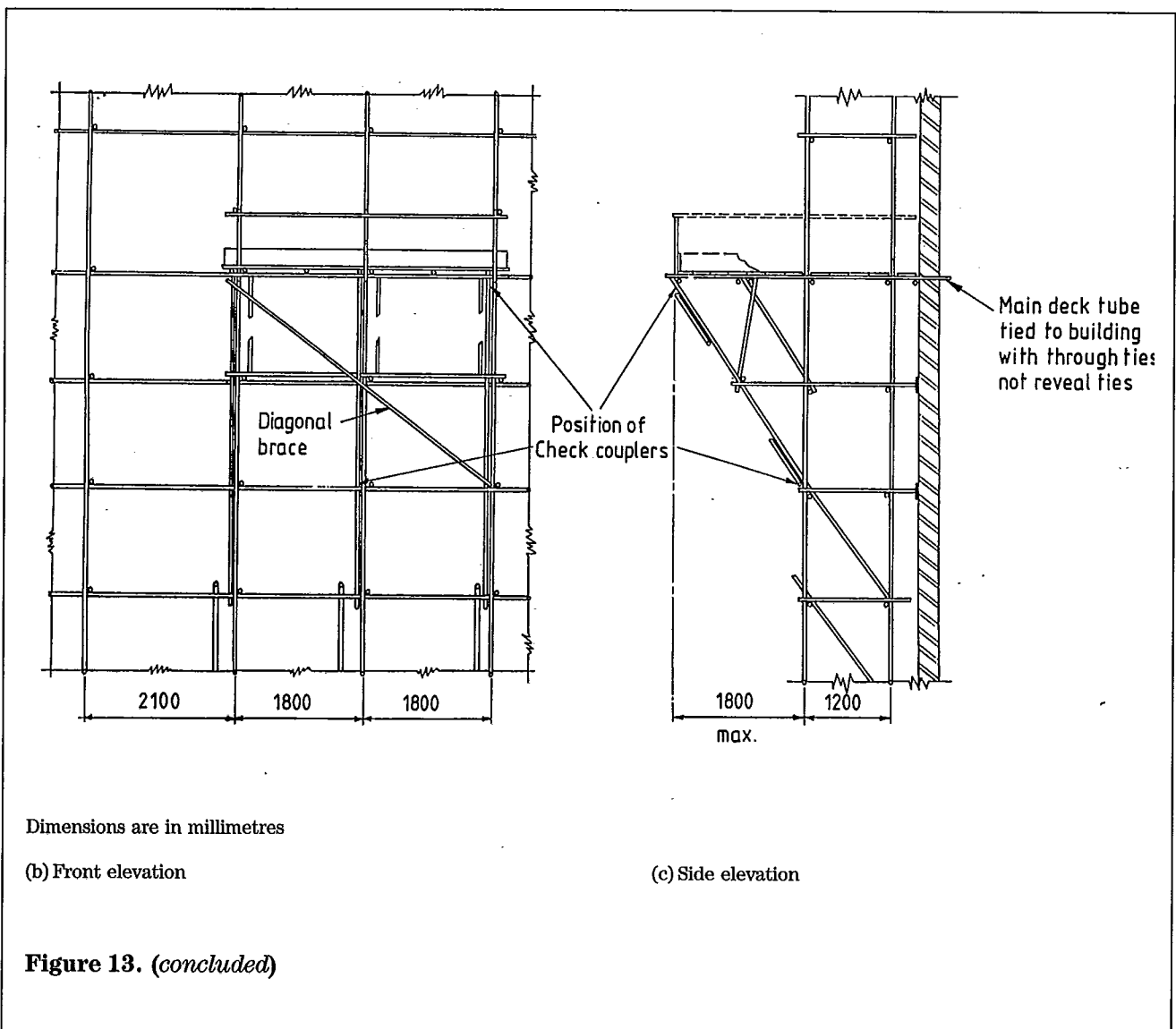
Dimensions are in millimetres.

NOTE 1. When more than one loading platform is required at various heights, they should not be one above the other but spaced horizontally, having a scaffold bay between them in plan.

NOTE 2. 'X' marks the position of check couplers.

(a) General arrangement

Figure 13. Cantilevered loading platform



The decking may be tightly lapped to draw the water to the inside edge or fixed with spacers so that the water drips through at other agreed locations.

The outboard end of the fan may be provided with a vertical or near vertical parapet to give further protection.

25.8 Medium duty (class B) fans built out from a scaffold (see figure 14(b))

This type of fan is of similar construction to those described in 25.6 and 25.7. The inside edge is coupled to both the inside and outside of an access scaffold to achieve a cantilever action which may be supplemented from below by tubular struts.

A medium duty fan is often used during the demolition of a building and may be structurally stable with only raker struts beneath it. It is frequently fitted with a parapet and boarded out closely with scaffold board. It is heavy and exerts

considerable forces on the access scaffold which should be well tied in at the fan level and stiffened from the building at the bottom of the rakers.

For installations at high level, the fan may be subject to serious wind uplift. The propping rakers should be capable of tension as well as thrust and provided with safety couplers where necessary.

25.9 Safety net system (class D fans)

Safety nets should be in accordance with BS 3913 and be rigged in accordance with CP 93. The larger mesh nets may be overlaid with a finer mesh to catch small debris.

The nets should be attached to a framework of tube as described in 25.8. The framework should slope downwards towards the building and be maintained at a suitable angle of 10° to 30° to the horizontal by tension wires above. It should also be fitted with steadying wires beneath the net to resist wind uplift.

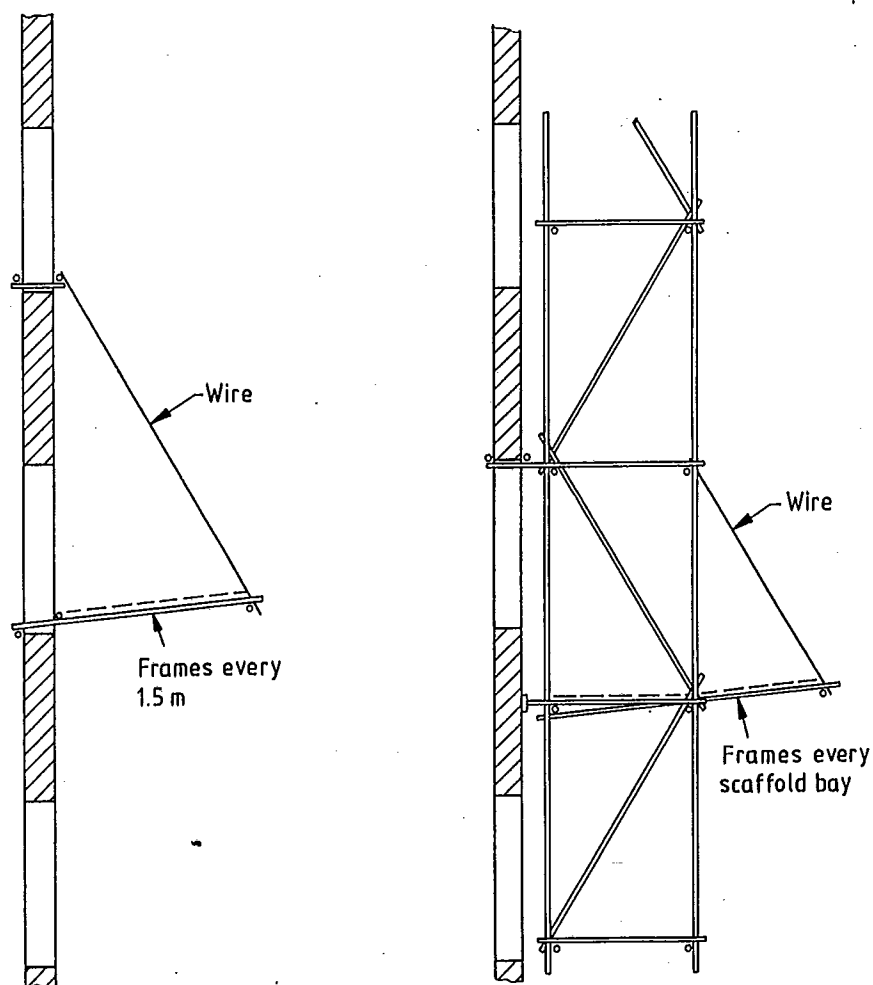
The framework may be made in small detachable units in order to be easily removed and refixed to the building so that it can be safely moved up the building as required.

The net should be attached to the framework with a winding of rope round the edge cord of the net or by the use of suitable clips. Where practicable, the net should be fixed clear from the framework of tubes.

25.10 Pavement frames or gantries

When a scaffold has to be in position over a pavement, it is frequently desirable to form a semi-permanent and fully boarded protection deck over the pavement.

Such a pavement gantry or framework should be carefully designed, especially if it has to carry the weight of an access scaffold or temporary office accommodation. Columns of grouped standards

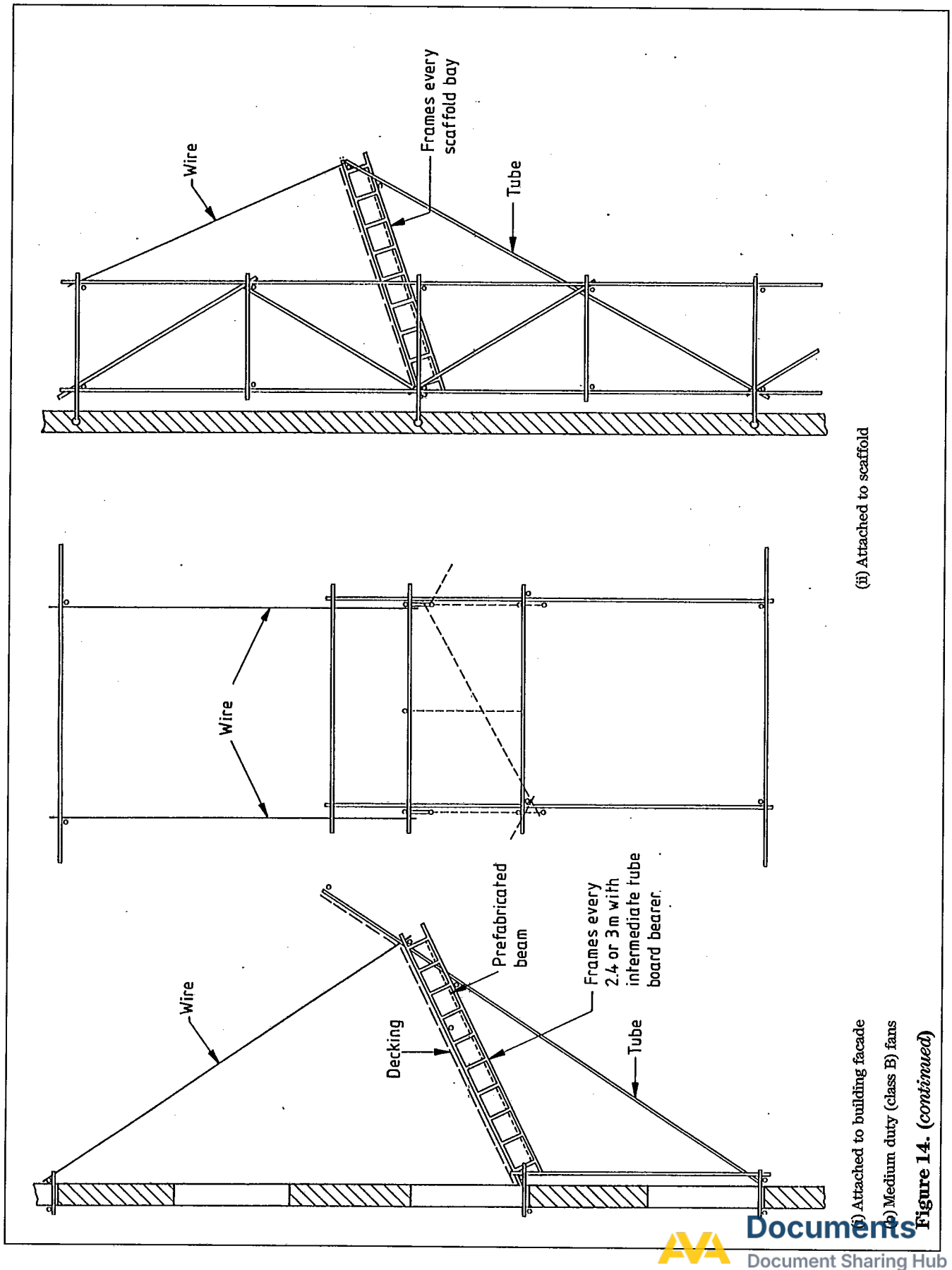


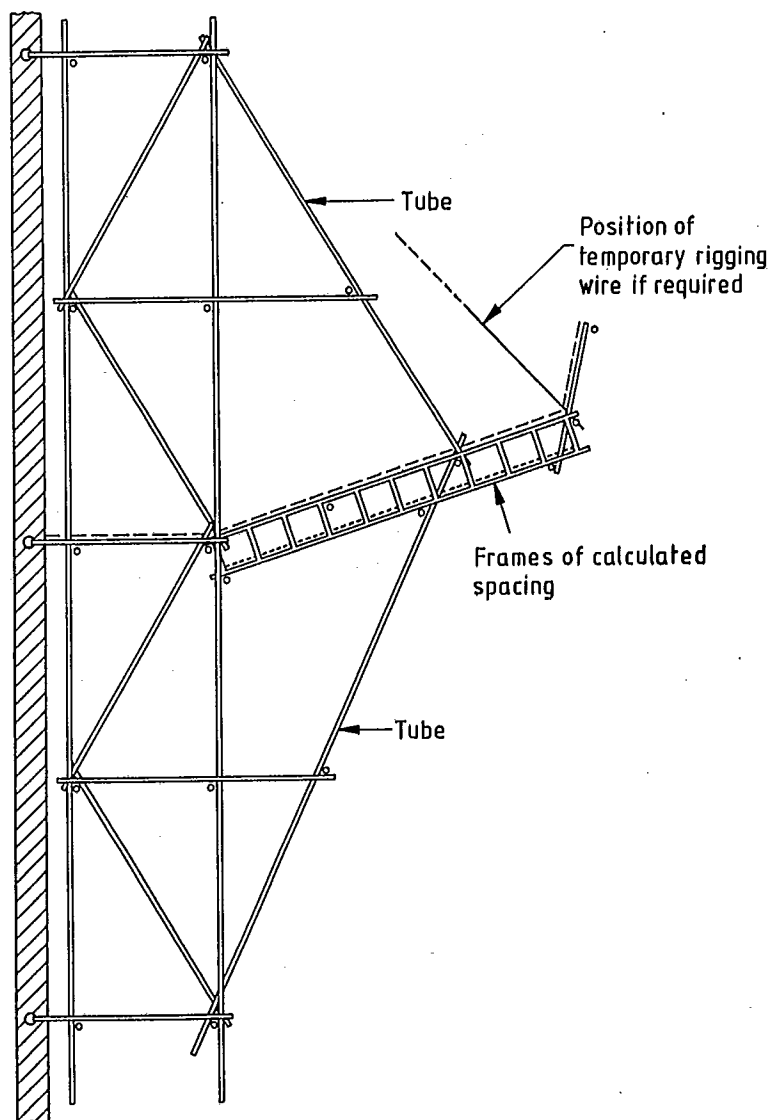
(i) Attached to building facade

(ii) Attached to scaffold

(a) Light duty (class A) fans suspended on wires

Figure 14. Classes of fans for sheeting or netting





(c) Heavy duty (class C) fans

Figure 14. (concluded)

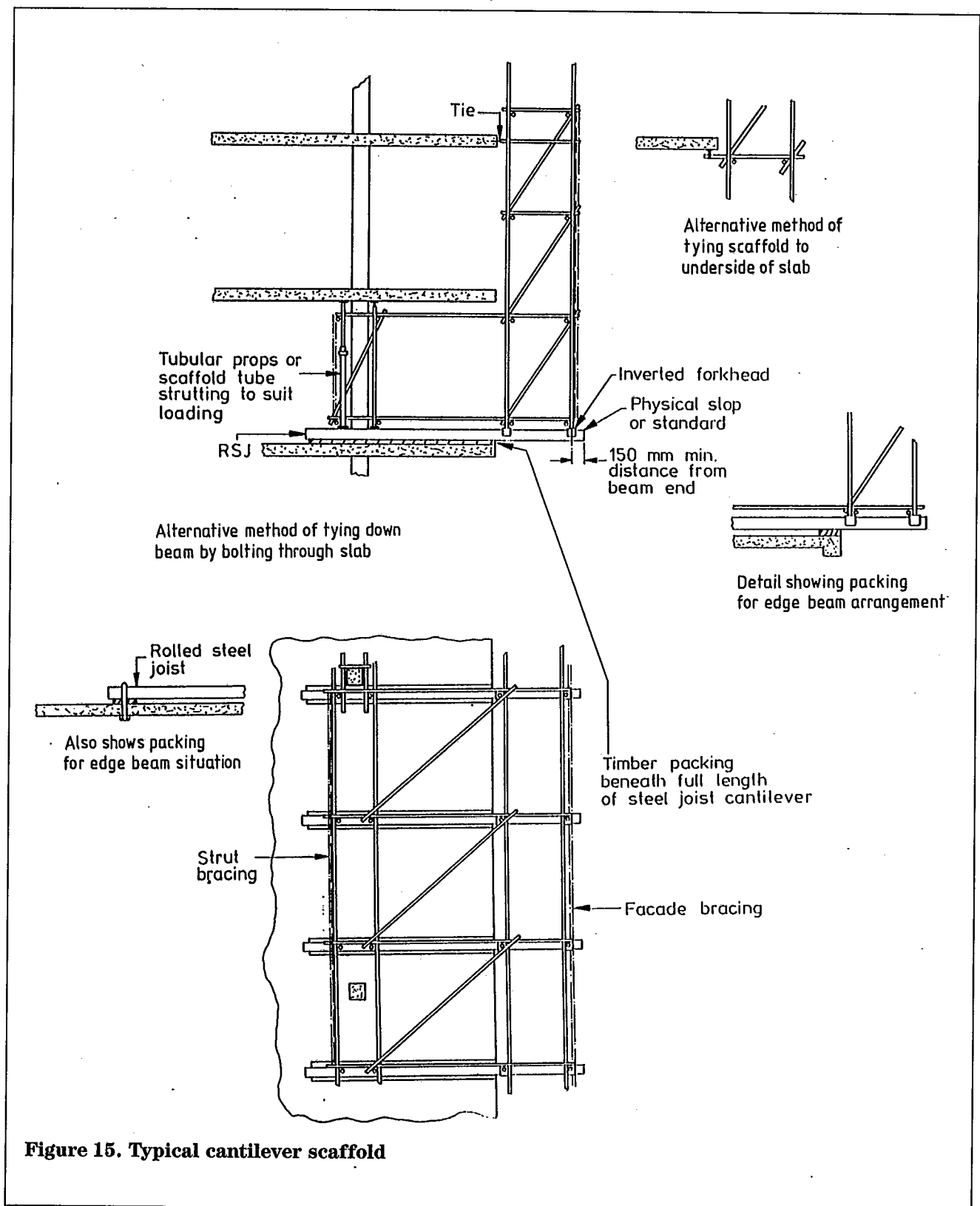
should be joined by transverse beams across and along the top. These columns should have small lifts with all faces of the columns zigzag braced. The lateral stability of the system should be achieved by ensuring that the beam to column joints are rigid with at least two fittings and by providing cross bracing of tubes in both directions in all bays.

The assembly should comply with any local authority requirements for temporary works on pavements.

26 Cantilever scaffolds

26.1 General description

A cantilever scaffold is an independent tied scaffold constructed in accordance with this code but erected on beams cantilevering out from a building. It is used in cases where it is impracticable or undesirable to found the scaffold on the ground.



26.2 Loads

The cantilever beams should be spaced to suit the bay lengths of the scaffold to be built on them. They should be designed in accordance with BS 449 to support the self weight, the imposed load and the wind load resulting from the scaffold above.

The strength of the structure of the building should be checked to ensure that the loads applied by the scaffold can be safely resisted.

The strictest control should be exercised by the user on the loads transferred from cantilever scaffolds. There should be full liaison between the designer and the user on this matter and the drawings and calculations should state the load limitation clearly.

26.3 Fixing the beams to the structure

Figure 15 shows a typical beam assembly. There are two points on each beam which apply loads to the building:

- the holding down position at a tailing end of the beam;
- the supporting or fulcrum point at the edge of the slab or the edge beam of the building.

The forces at these points should be determined by the principle of leverage on the assumption that the applied weight from the scaffold acts between the inside and outside standards of the scaffold at a point $\frac{1}{3}$ of the width of the scaffold from the outside.

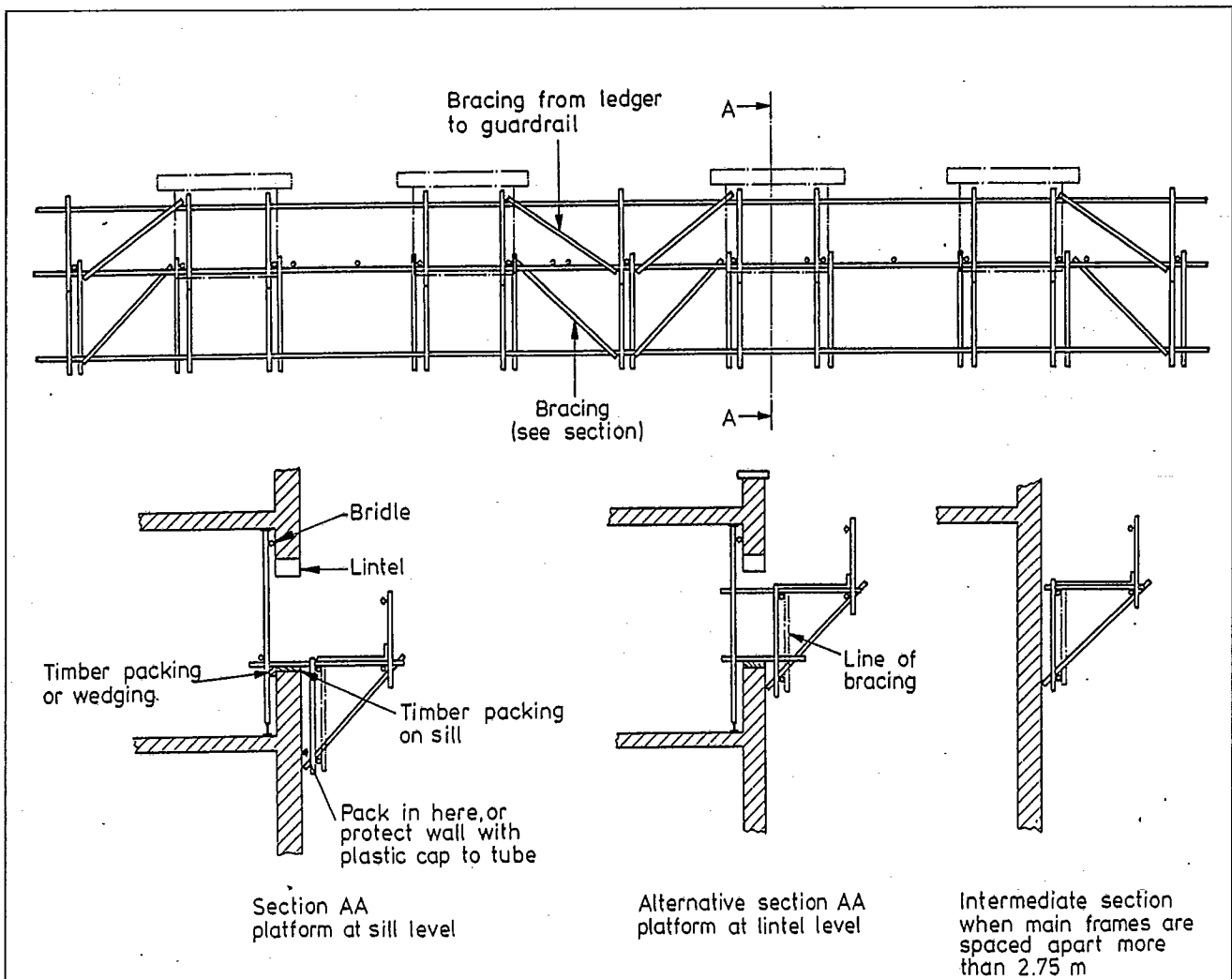


Figure 16. Single lift truss-out scaffold

Where there are known impact loads they should be doubled and added to the dead load. Where this total force is catered for by steel bolts, a minimum factor of safety on ultimate failure of 3.3 should be adopted. Bolts should preferably be grade 4.6. The holding down arrangement should achieve torsional rigidity of the tailing end of the beam and have an adequate bridging plate.

The load on the structure at the fulcrum point should be calculated and it should be borne in mind that this is greater than the total load from the scaffold, being in fact the sum of this load and the tailing down force.

This reaction will impose considerable loads on the edge of the concrete slab or the edge beam of the building, which should be checked and approved by the building owner or his representative.

Where fulcrum load is to be spread on a concrete structure, it should be by packing along the slab edge if the load is to be resisted by an edge beam only, or at right angles to the slab edge if it is to be distributed over a wider edge strip of the slab. The packing should be of a defined size and shape which should be agreed with the building owner or his representative.

The packing should be of hard timber and should be of sufficient width and uniformity to ensure that the beam is squarely seated at its fulcrum point. A similar thickness of packing should be in place under the tailing edge of the beam so that the beam may be clamped firmly down at its tailing end but remain horizontal.

26.4 Scaffolding

The scaffold which is constructed on the cantilevered beams should be fixed in position and prevented from becoming dislodged.

A cantilever scaffold should always have foot ties in both directions. This foot lift may be used to fix the location of the uprights on the beams.

The scaffolding should be tied and braced as described in this code, ensuring that the first level of ties is at the first floor level above the cantilevered beams.

27 Truss-out scaffolds

27.1 General

A truss-out scaffold is an independent tied scaffold constructed in accordance with the recommendations of this code and not erected from the ground but supported by a scaffold structure projecting from the face of a building or structure (see figures 16, 17 and 18).

The location of the fulcrum point for the purpose of the calculation should be taken as the centre of the packing. On site, the packing should be located as required by the designer after liaison with the building owner or his representative.

Where it is undesirable to bolt the tailing end down, it may be propped from the structure above in the manner shown in figure 15. In this case an uplift force is exerted on the structure firstly by the balancing load and secondly by the driving of the wedges or by the extension of adjustable jacks. The building owner or his representative should agree the suitability of his structure to meet these forces.

When propping is used to secure the tailing end of the cantilever beam, every prop or tube so used should be effectively maintained in position by an assembly of tube and fittings and be itself of adequate strength to carry the loads imposed on it. The supporting scaffold structure is referred to as the truss-out.

The access scaffold should be designed first. The truss-out should then be designed to match the bay dimensions.

Two types of truss-out are in common use.

- (a) A truss-out in which the vertical weight is carried by a ledge or sill at a lower level in the wall or outside the building, and the scaffold is tied in at the top of the truss-out (see figure 17).
- (b) A truss-out in which the vertical weight is taken on the edge of a slab at a point inside the building and maintained in position by a rigid structure between adjacent floors (see figure 18).

In case (a) the designer and the building owner or his representative should agree on the suitability of the ledge and sill to receive the weight of the scaffold.

Case (b) exerts an upward force on the underside of the upper slab above the internal scaffold structure as well as the downward load on the slab edge. The designer and the building owner or his representative should agree on the suitability of the building to resist these forces.

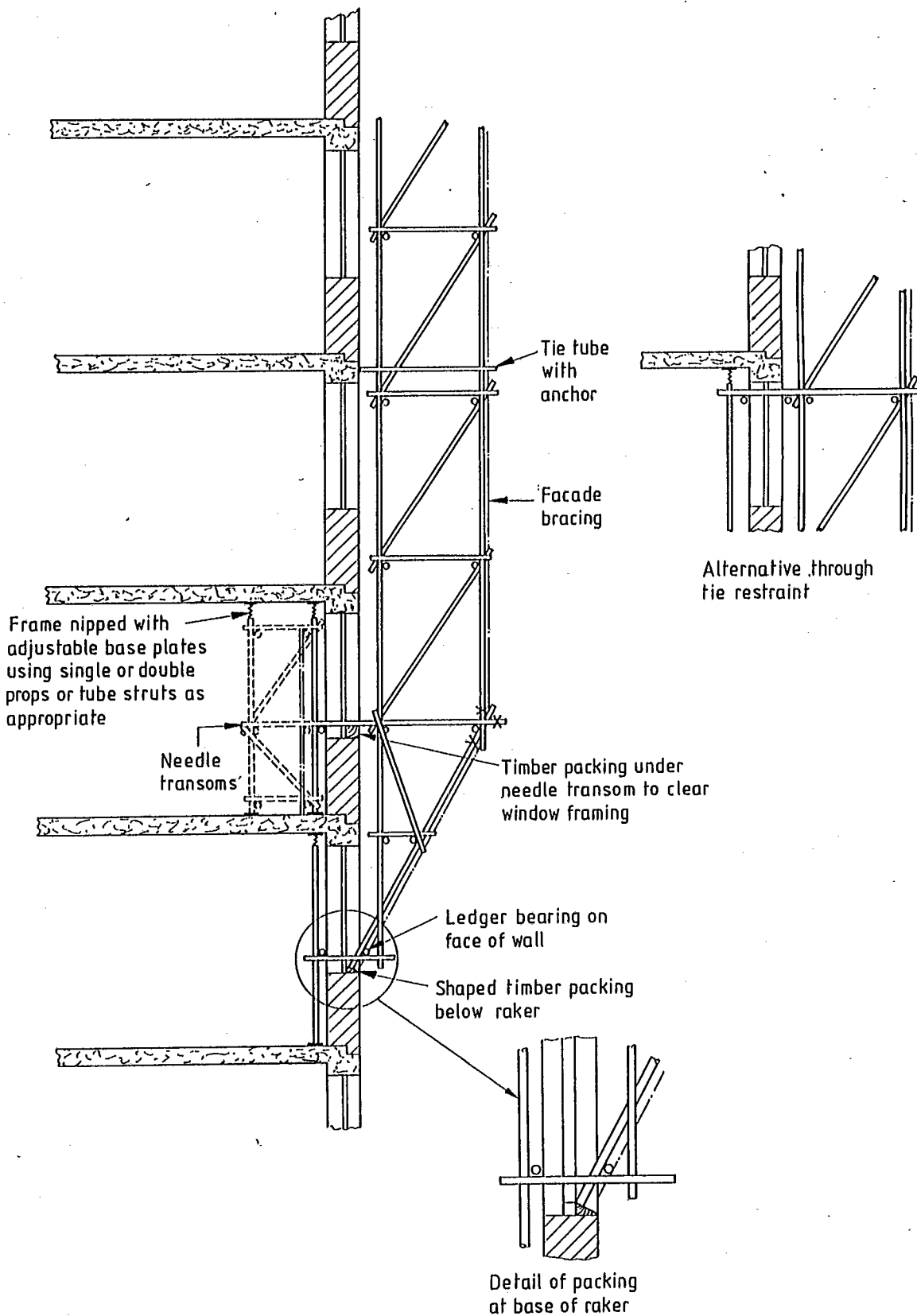
27.2 Loads

The strictest control should be exercised by the user on the loads applied to truss-out scaffolds. There should be full liaison between the designer and the user on this matter and the drawings and calculations should state the load limitations clearly.

27.3 Design of the truss-out

The truss-out should be designed to cater for the vertical self weight of the scaffold and its imposed load and the loads resulting from wind forces. The forces in the rakers should be evaluated, the rakers designed accordingly and stiffened where appropriate and fitted with the necessary check couplers.

The internal restraining scaffold should be designed to cater for the resulting horizontal forces and be adequately locked into the building to prevent inward and outward movement.

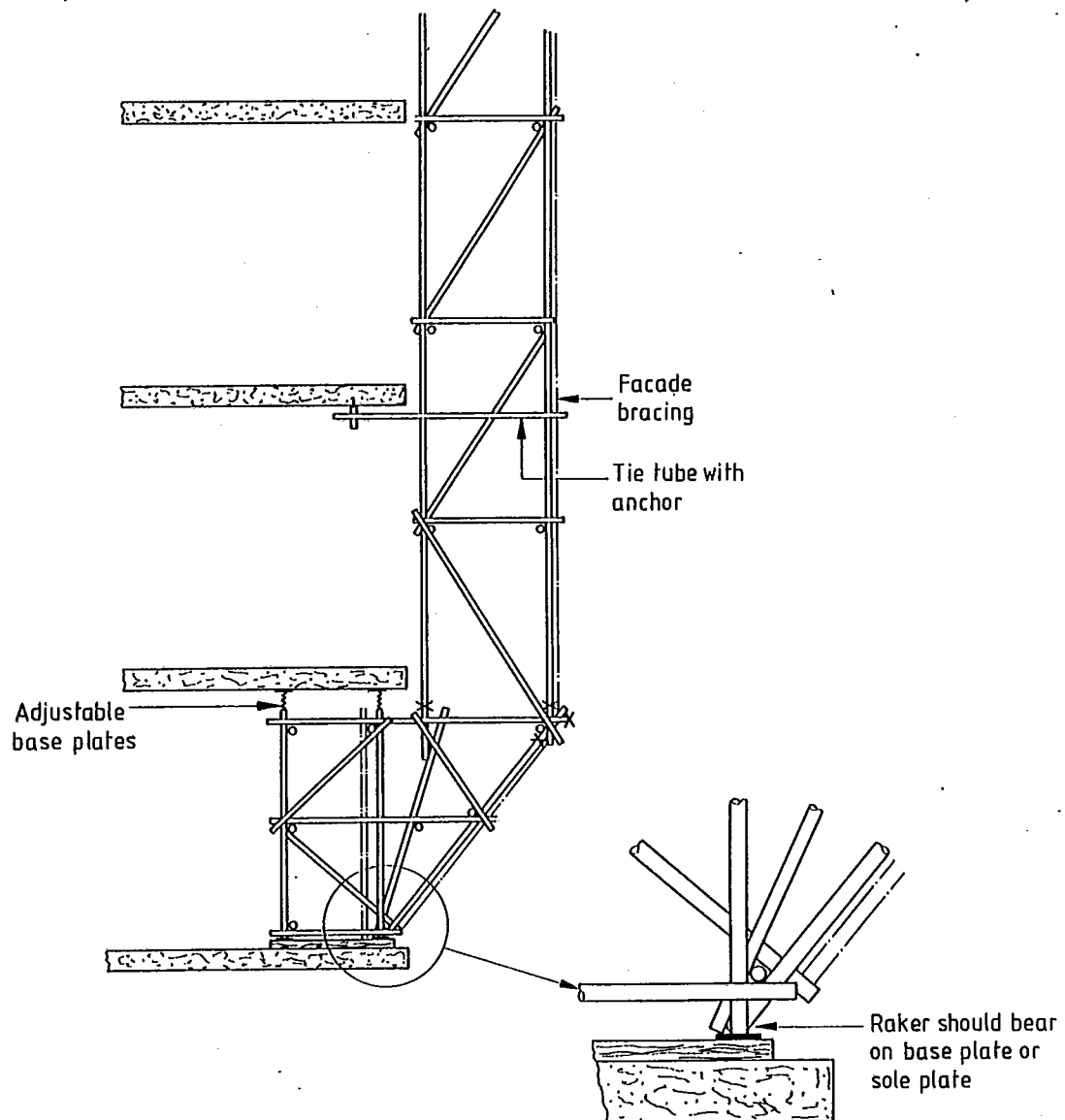


NOTE. 'X' marks the position of check couplers above the puncheon fixing and below raker fixing.

Figure 17. Typical truss-out independent tied scaffold (on existing building)

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NOTE. 'X' marks the position of check couplers above puncheon fixing, below raker fixing and at outer end of transom.

Figure 18. Typical truss-out independent tied scaffold (on building under construction)

In figure 17, the needle transom should rest on the sill and be fitted with internal and external bridle tubes, as shown.

In figure 18, the truss-out should be capable of resisting any distortion due to the vertical reactions and the lateral inward and outward forces.

The points of application of the vertical load to the building should be padded. The shape and spread of the pads should be agreed between the designer and the building owner or his representative and inserted on site as detailed. The vertical forces on the building should be taken at the location of the vertical tubes on the pads.

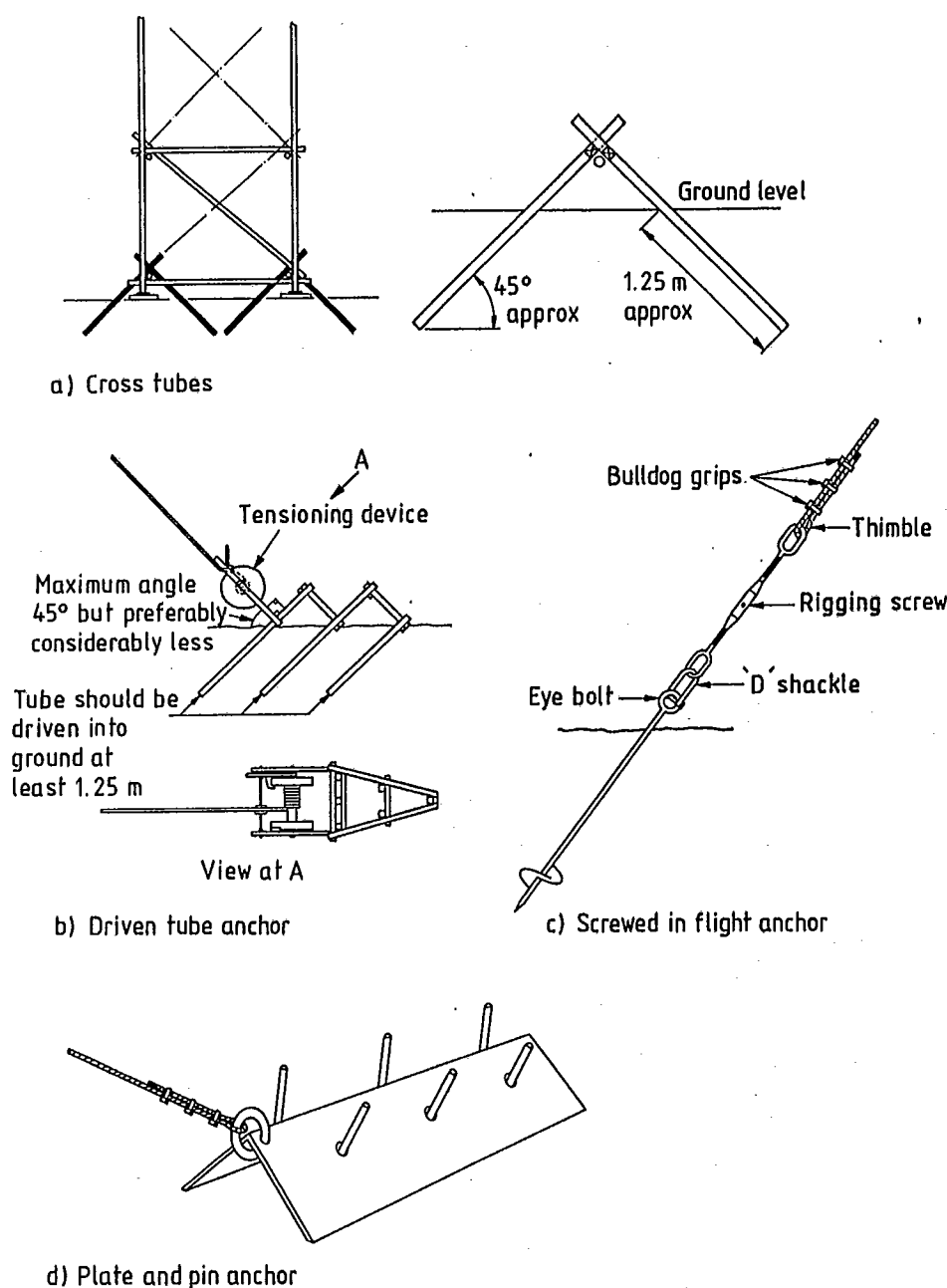


Figure 19. Anchors

27.4 Access scaffold

The access scaffold should be tied and braced as described in this code, ensuring that the first level of ties is at the first floor level above the truss-out.

27.5 Single deck truss-outs

Where a single deck truss-out utilizing window openings is required, the form of construction detailed in figure 16 is suitable. If the clear span between truss-outs exceeds 2.75 m an intermediate triangular frame should be used, as shown.

28 Free standing towers, power line crossings, guys and struts

28.1 General

Scaffolding materials are commonly used in erecting temporary free-standing structures which are self supporting and do not depend totally on other structures for their rigidity or stability. Four classes of these structures are generally distinguished.

(a) *Light duty access towers*, stationary and mobile for use inside buildings (imposed load not greater than 1.50 kN/m²).

(b) *Light duty access towers*, stationary and mobile for use in the open (imposed load not greater than 1.50 kN/m²).

(c) *Heavy duty towers*, such as camera towers and welding platforms (imposed loads in excess of 1.50 kN/m²).

(d) *Protection structures*, such as for line crossings.

28.2 Calculations

Free standing towers situated externally and likely to be subject to wind forces, should be the subject of calculations for wind forces and overturning. The strut and tie loads and the forces on any guys and anchors should be evaluated.

28.3 Foundations

All free standing structures should be built on firm foundations and should be vertical. If on sloping ground, they should be prevented from slipping.

Towers inside buildings should be on level floors or adequately compacted sub-bases.

28.4 Bracing

The towers should be adequately stiffened on all sides and in plan at every alternate lift, starting at the base lift of mobile towers.

28.5 Access

Access to the top of towers should be by ladder, either built into the framework or attached to the end of the tower and preferably inside the base area.

28.6 Decking

The working deck should be of adequate thickness. If boarded with scaffold boards, the supports to the boards should comply with the recommendations of table 4 and the boards, if short, should be prevented from sliding by battens nailed beneath the deck.

The deck should be provided with toeboards and guardrails complying with the recommendations of clause 15.

Generally, the deck should have at least one edge in the same vertical plane as one side of the tower base so that this edge can be placed up against the work to be done. An operative is thus not required to lean out over the guardrail.

28.7 Operation

The user should apply no horizontal force at any of the working decks, e.g. by hauling heavy ropes or cables, and should not lift significant loads up the outside of the tower or attach a gin wheel on a cantilever tube unless the tower is specifically designed for this purpose.

If large weights, e.g. television cameras, are to be hoisted to the top deck by block and tackle, adequate davits or brackets should be provided and the stability of the tower calculated for the suspension reaction at the top block which might be twice the lifted weight. If the towers are rectangular, the lifting tackle and ladders should be on the shorter side.

Mobile towers should only be used on even ground, never on a slope which is sufficient to allow them to run away.

Castors should normally be kept locked except when the tower is being relocated. When used on surfaces which have a cross fall and/or a longitudinal fall, the user should be particularly careful to see that the brakes are on at all times other than whilst moving the tower. If there is any doubt as to the adequacy of the brakes, the wheels should be chocked.

Mobile towers should never be moved with an operative on the working platform. The force to achieve resiting should be applied at the base.

28.8 Height and base dimensions

The height is measured from the floor to the level of the working deck or top lift, ignoring the height of the guardrail. The least base width is the dimension, centre to centre, of the shortest side of the tower if it is rectangular or two thirds of the apex to side dimension if it is triangular. The height of free-standing towers is limited in 28.11 to 28.14 by restricting the height to least base ratio. Specific guidance is given, but no towers should be built with a least base dimension less than 1.2 m.

NOTE. The height to least base ratios given in this clause relate to scaffolds constructed from steel scaffolding materials. Aluminium structures are generally lighter than steel and may require the application of different ratios.

28.9 Stability

28.9.1 General

All types of free-standing structures depend for their stability either on their self weight or on additional guys, anchors, outriggers or kentledge.

The factor of safety for scaffold structures, i.e. the ratio of the overturning moment to the righting moment, should be not less than 1.5. The overturning moment is due to eccentric weight and imposed and environmental loads. The righting moment is due to the self weight, if suitably centered, added kentledge and the anchor, gut or strut forces, if any.

28.9.2 Kentledge

Where kentledge is used, it should be fixed round the perimeter of the foot lift and, when necessary, a tube and fittings grid should be installed to receive and locate it. If castors are used, their capacity to take the extra load should be checked.

28.9.3 Anchors

28.9.3.1 General

Anchor capacities are dependent on ground conditions and reference should be made to the designer for the type, number and location of anchors.

Four types of anchorage are in common use as described in 28.9.3.2 to 28.9.3.5. Figure 19 shows these types.

28.9.3.2 Cross tubes attached to the foot lift (see figure 19(a))

Temporary stability of large structures during construction and permanent stability of small structures may be achieved by using cross tube anchors attached directly to the bottom of the structure. The forces involved should be calculated and the necessary number of anchors inserted. The necessary number of safety couplers should be added to the base frame of the structure and the tensions in the uprights catered for by sleeve couplers and lapping, where necessary.

28.9.3.3 Driven tube anchors attached to guys (see figure 19(b))

Driven tube anchors can be used with as many tubes as required. Tubes should be about 1.75 m long and penetrate 1.25 m into the ground. They should be fixed together with tubes and fittings connected with right angle fittings in preference to lashings. The tubes should be set at right angles to the guy.

The guy should be attached (see figure 19(b)) at the bottom of the front tube and prevented from slipping up by a scaffold fitting.

Driven tube anchors should not be used on a down slope towards the structure. They can be used in clay, sandy or gravelly ground. Special sliding driving hammers are available. Users should refer to designer's and manufacturer's literature for number, type and location.

28.9.3.4 Screwed in flight anchors (see figure 19(c))

Two sizes of screwed in flight anchors are available, approximately 200 mm and 300 mm diameter. They are set approximately in line with the guy and are screwed in using a short length of scaffold tube through the ring.

They will not penetrate so deeply on an uphill slope towards the guy and allowance for this should be made.

28.9.3.5 Plate and pin anchors (see figure 19(d))

Plate and pin anchors are used where the ground is too stoney or has shattered rock, limestone or chalk near the surface.

Various types of plate are permissible, the example shown is a length from a 100 mm × 100 mm structural angle.

The pins are driven in at right angles to the guy. Anchors should be set so that the guys are flatter than 40° to the horizontal.

For square towers, a separate anchor should be provided for each corner. For anchoring long towers, it is advantageous to fix a ground ledger through all the anchors so that each can supplement the others if required.

28.9.4 Guys

Guys for temporary scaffolding structures should be of 10 mm or 12 mm diameter wire rope, which should be attached to the scaffolding structure and to the ground tube or anchor by a single round turn and three bulldog grips. The recommended safety factor for guy ropes is 3:1.

If the guys are fairly steep, e.g. 50° to the horizontal, they can usually be adequately tightened by hand or with the aid of a scaffold tube lever. When this cannot be achieved, a winch or turnbuckle should be used. No tensioning device should be pulled up too tightly, since the force required to pull a wire guy tight results in very considerable tension being placed on the ground anchorage and the structure before it has been loaded with the wind forces.

The tension in guys, especially, if they are maintaining safety nets in position, may rise to a large value and this force will pass into the scaffold structure and down certain of the uprights to the ground as an added load which should be taken into account in designing the structure.

Where guys are necessary they should be attached to node points in the structure.

If guys are being placed on one side of a structure to resist a force not yet applied on the other side, the structure should be made stable against the guy force until the balancing force comes in play.

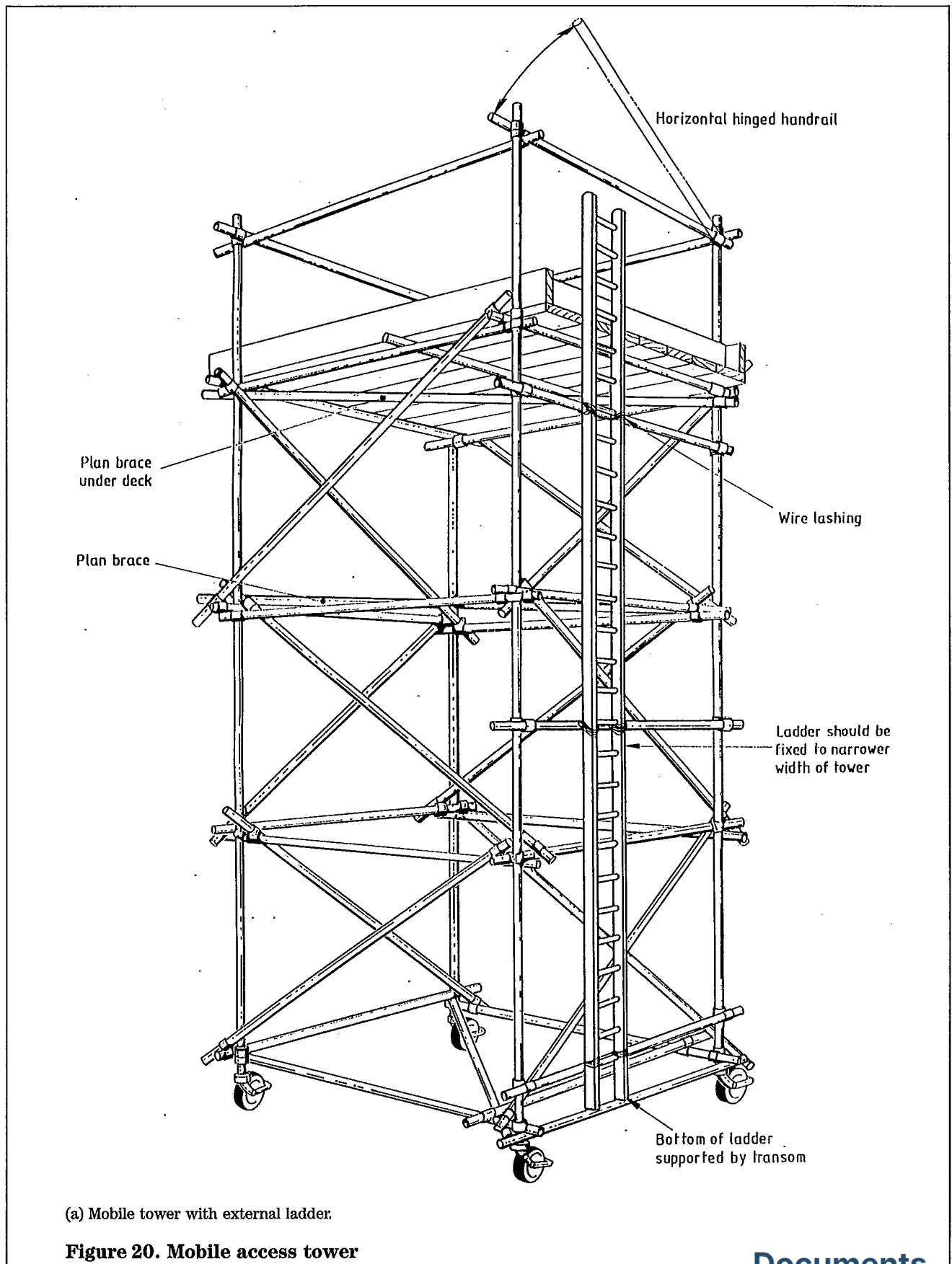
28.9.5 Stabilizers

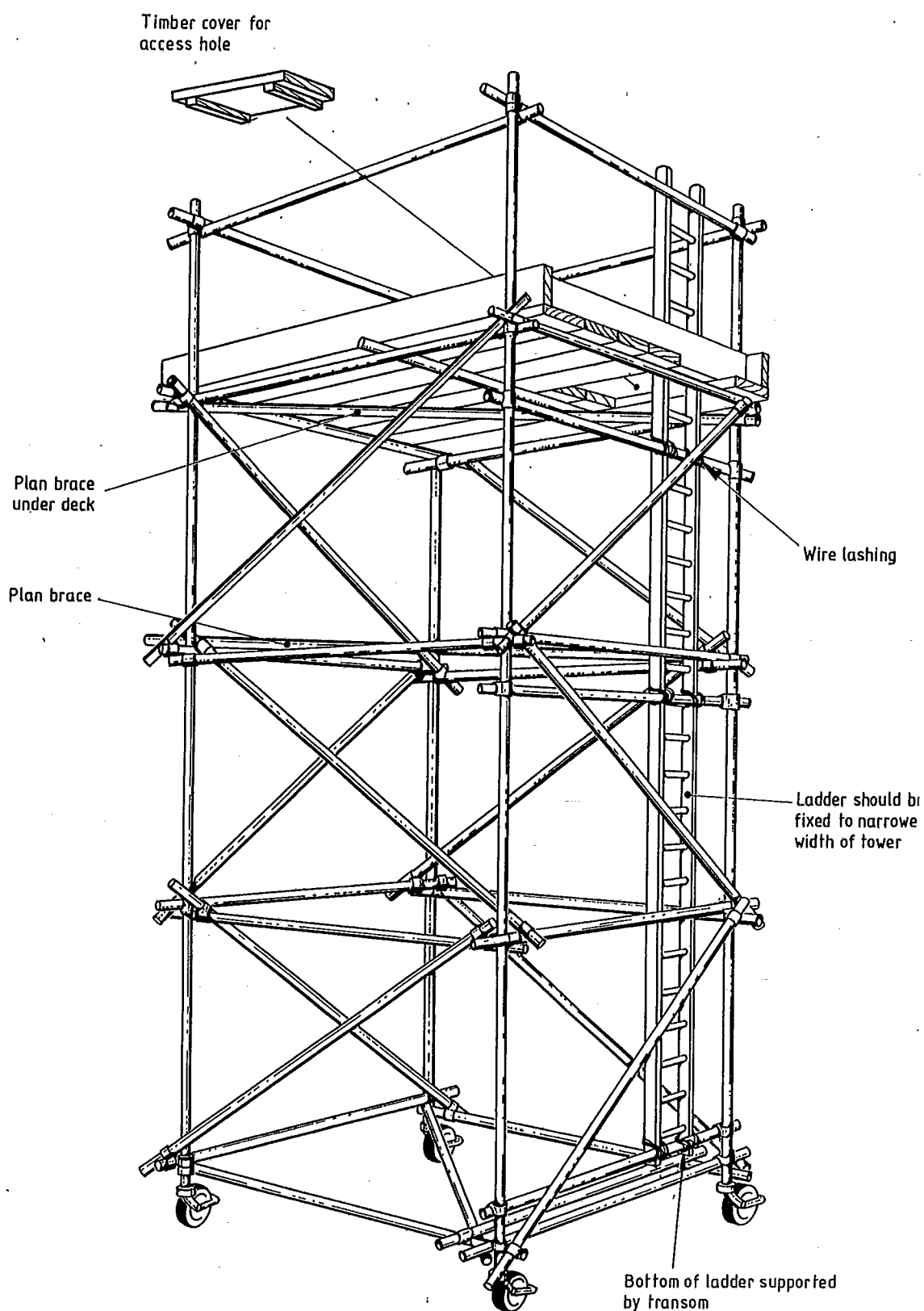
A scaffold tube may be used in tension as a stabilizer provided that the necessary number of safety fittings are used to attach it at each end. The length of such a scaffold tube should be calculated. Intermediate bracing of the stabilizer may be required.

It is recommended that all external free-standing structures subject to wind pressures are strutted with tubes at least temporarily and if the structures are of low height the tubes may be left in place as stabilizers.

28.10 Temporary tying of all types of tower

When access towers are required to be a height exceeding the height to the least base dimension ratio recommended in 28.11 to 28.14 and a larger base cannot be built or extension buttresses cannot be fixed at the base, the tower should be constructed up to the maximum height allowed by the height to the least base dimension ratio and





(b) Mobile tower with internal ladder.

Figure 20. (concluded)