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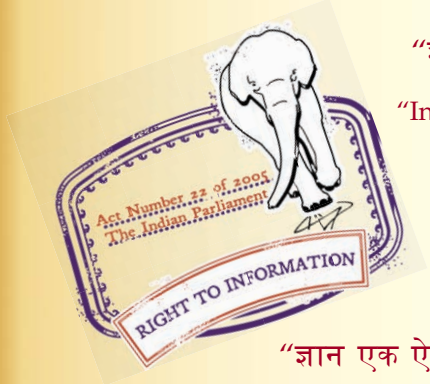
IS 3696-1 (1987): Safety code of scaffolds and ladders, Part 1: Scaffolds [CED 29: Construction Management including safety in Construction]



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(Reaffirmed 2002)

Indian Standard

SAFETY CODE FOR SCAFFOLDS AND LADDERS

PART I SCAFFOLDS

(First Revision)

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NEW DELHI 110002

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March 1988

Indian Standard

SAFETY CODE FOR SCAFFOLDS AND LADDERS

PART 1 SCAFFOLDS

(First Revision)

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SAFETY CODE FOR SCAFFOLDS AND LADDERS

PART 1 SCAFFOLDS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part 1) (First Revision) was adopted by the Bureau of Indian Standards on 18 May 1987, after the draft finalized by the Safety in Construction Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Construction industry is inherently hazardous. From the point of view of safety, the conditions normally encountered in the construction industry do not land themselves to the degree of control possible in other industries where more stable conditions are generally obtained. It may not be possible to completely eliminate the injuries and accidents in the construction industry because of the hazardous nature of operations involved. However, if safety precautions are properly enforced, it will help in minimizing accidental injuries in the various operations involved in different types of civil engineering works. Adoption of pre-determined safety measured in each of these operations will not only prevent or reduce accidents but also promote quicker and risk-free working of labourers resulting in increased efficiency along with reduced costs of construction.

0.3 Practically, in all stages of construction right from the erection of masonry to the finishing stages, scaffolds are essential construction equipments which offer in them temporary platforms for carrying out all those works which cannot be conveniently and easily carried out either from ground floor or from any other floor of the building or even with the use of a ladder. Scaffolds may be either swung from some point above the working level or built up to the required level from a firm base. Either type of scaffold needs compliance of certain safety practices not only for the security of the men employed on the scaffolds but also for the safety of those who may be working or passing below. The accidents from the scaffolds are generally caused either as a direct

collapse of the scaffold or as a result of workmen or any material falling down from the top of the scaffold. Great care is, therefore, necessary in the erection, use and dismantling of scaffolds with respect to its various components with a view to bringing in confidence in the workmen who would be in a position to work safely and easily with greater productivity of work.

0.4 This Indian Standard was first published in 1966. As a result of comments received from users of the standard and to reflect the changes taking place in practice in this field the present revision has been brought out. The important modifications carried out in this revision include:

i) Specification for material of scaffold has been added;

ii) Tables giving recommended sizes and spacing of various members of timber scaffolds have been added;

iii) Bracing and tying details have been enlarged. Details of ropes and types of knots have been added; and

iv) Details of means of access, railings and toeboards and wooden trestle and Boatswain's chair have been added.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part 1) lays down the safety requirements for the erection, use and dismentling of scaffolds for providing access and for supporting workmen, equipment and materials for any construction work including maintenance, repairs and demolition.

1.2 The requirements of the various components of the scaffold, the care in their use and storage are also covered.

2. TERMINOLOGY

2.0 For the purpose of this code, the following definitions shall apply (*see* Fig. 1).

*Rules for rounding off numerical values (*revised*).

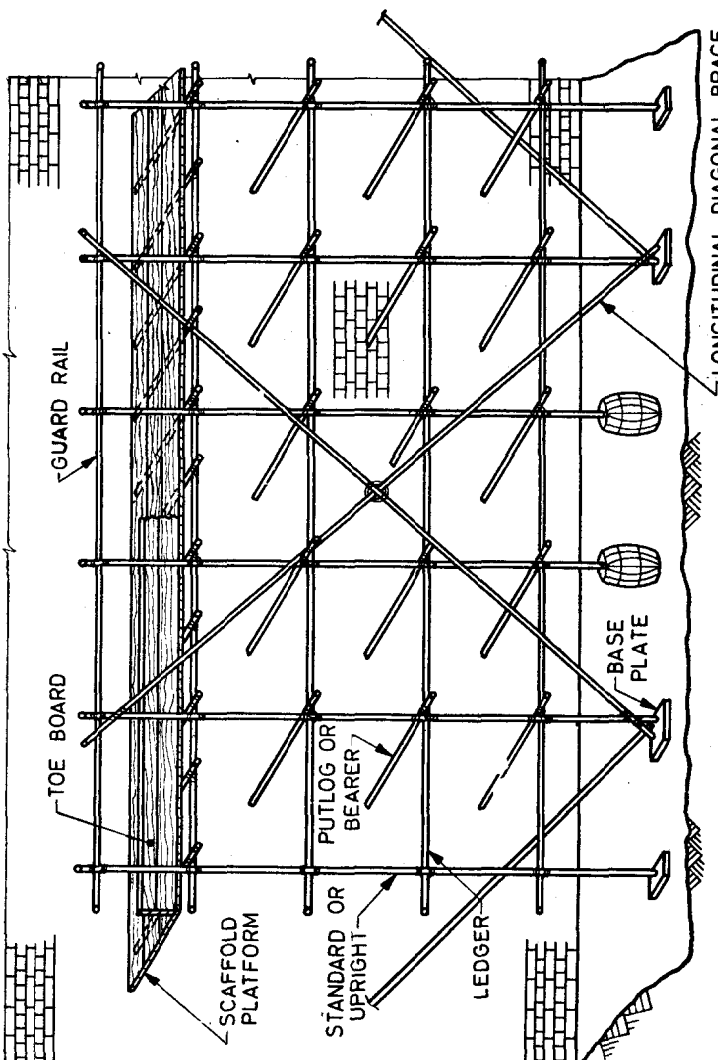


FIG. 1 TYPICAL SKETCH ILLUSTRATING COMPONENTS OF A SINGLE SCAFFOLD

2.1 Scaffold — A temporary structure consisting of standards, putlogs, ledgers, generally of bamboo, ballies, timber or metal to provide a working platforms for workmen and materials in the course of construction, maintenance, repairs and demolition, and also to support or allow hoisting and lowering of workmen, their tools and materials.

2.2 Standard or Upright — A vertical or near vertical member used in the construction of scaffold for transmitting the load to the foundation.

2.3 Ledger — A horizontal member which ties the standard at right angles and which may support putlogs and transoms.

2.4 Putlog/Boarer — A scaffold member spanning from ledger to ledger or from ledger/standard to a building and upon which the platform rests.

2.5 Transom — A member spanning across ledgers/standards to tie a scaffold transversely and which may also support a working platform.

2.6 Brace — A member fixed diagonally across two or more members in a scaffold to afford stability.

2.7 Bracing — Bracing is a system of braces or ties that prevent distortion of a scaffold.

2.8 Guard Rail — A horizontal rail secured to uprights and erected along the exposed edges of scaffolds to prevent workmen from falling.

2.9 Toe-Board — A barrier placed along the edge of the scaffold platform and secured there to guard against the falling of material and equipment.

2.10 Single Pole Scaffold — Single pole scaffold is a structure consisting of putlogs or bearers, the cutor ends of which are supported on standards or ledgers secured to a single row of standard and the inner ends resting on a wall. This is also known as a putlog scaffold (*see* Fig. 2).

2.11 Double Pole Scaffold — Double pole scaffold shall mean a scaffold supported by two rows of standards connected together longitudinally by ledgers and transversally by transoms or bearers and suitably braced (*see* Fig. 3).

2.12 Outrigger (Cantilever) Scaffold — Outrigger scaffold shall mean a scaffold, the platform of which is supported by outriggers or

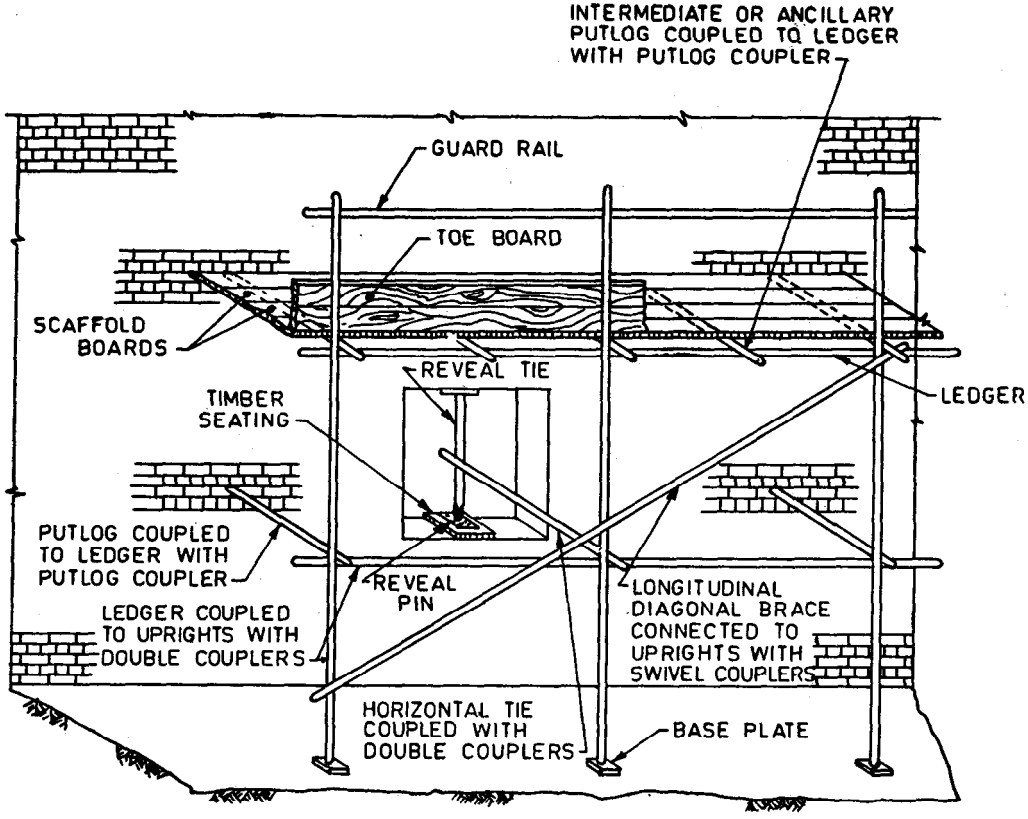


FIG. 2 TYPICAL SKETCH OF PUTLOG SCAFFOLD (INDIVIDUAL COMPONENT TYPE)

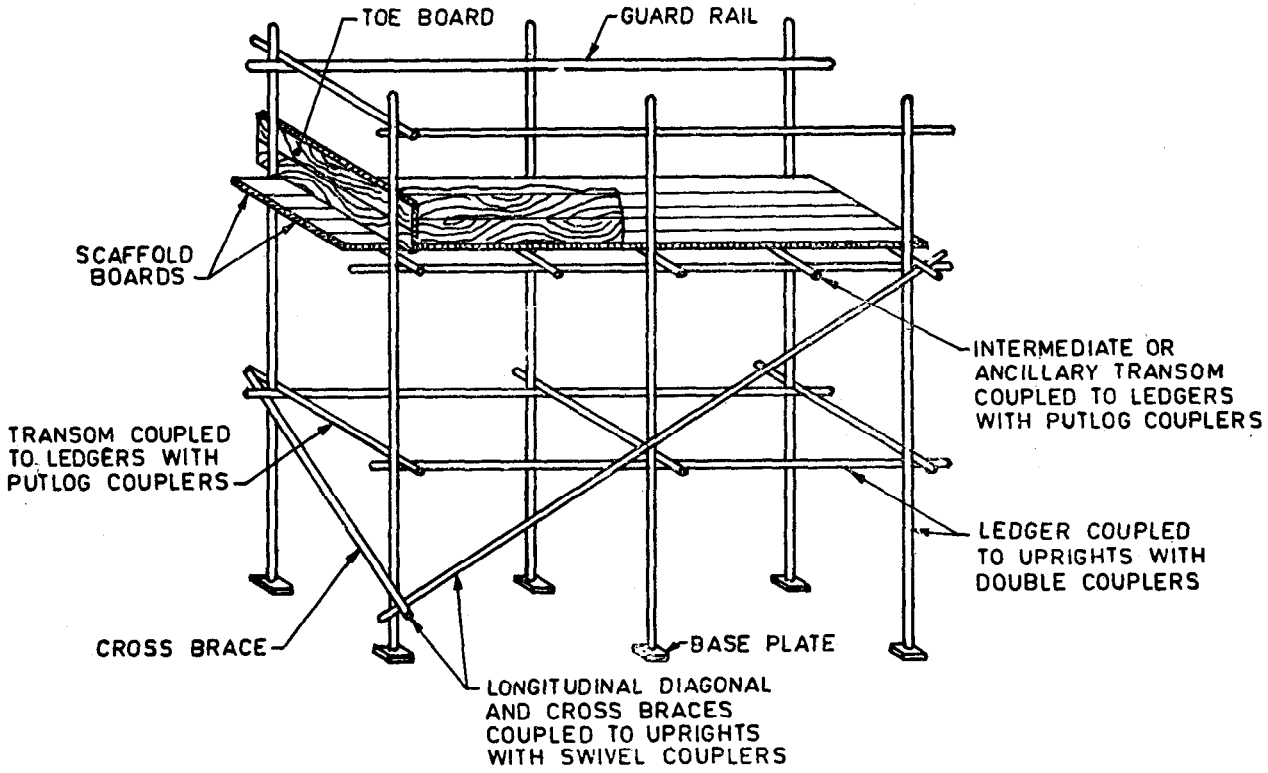
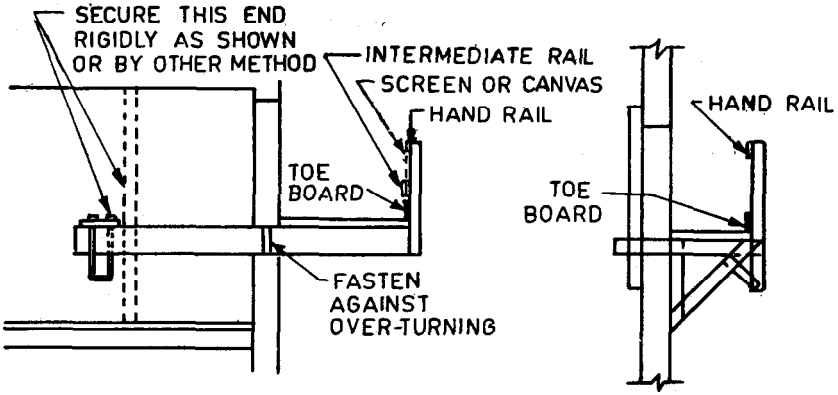


FIG. 3 TYPICAL SKETCH OF INDEPENDENTS SCAFFOLD (INDIVIDUAL COMPONENT TYPE)



4 (A) 4 (B)

FIG. 4 OUT RIGGER SCAFFOLD

thrustouts projecting from the building, the inner ends of which are secured inside the building (*see* Fig. 4 A and 4 B).

2.13 Trestle — Trestle/*Ghoda* shall mean a self-supporting frame work of timber or metal on which a working platform is laid (*see* Fig. 5).

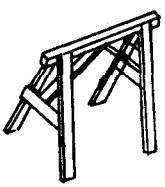
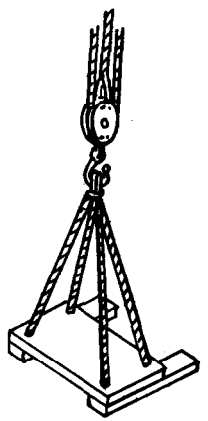


FIG. 5 TRESTLE

6 (A)



6 (B)

FIG. 6 JHULA (BOATSWAIN'S CHAIR)

2.14 Jhula (Boatswain's Chair) — Jhula shall mean a seat to support a workman in a sitting position, supported by rope slings attached to a suspension rope (*see* Fig. 6 A and 6 B).

Note — Tall independent scaffoldings are usually tied to the structure at suitable intervals or otherwise supported at suitable intervals for additional stability.

2.15 Raker — An inclined member fixed to a scaffold to ensure its stability.

2.16 Tie — A member used to tie a scaffold for a structure to prevent horizontal movement of the scaffold.

3. MATERIAL

3.1 The scaffold may be constructed either of timber, *ballies*, bamboos or metal.

3.2 Timber used in the construction of the scaffolds should be reasonably straight, sound, free from splits, shakes and large cracks, large knots, dry rot, worm holes and other prohibited defects conforming to IS : 3629-1966*.

3.3 Ballies — Used in the construction of the scaffolds should be reasonably straight, sound, free from splits, shakes and large cracks, large knots, dry rot, worm holes and other prohibited defects (conforming to IS : 3337-1978†).

3.4 Bamboos used in the construction of the scaffolds should be reasonably straight, sound, free from splits, knots dry rot, worm holes and other dangerous defects which tend to reduce the strength of bamboos.

3.5 Metal scaffolds shall conform to IS : 2750-1964‡.

3.6 Fastenings on timber scaffolds should be of steel bolts of adequate dimensions with washers and nuts, fibre rope lacings, adequate clamps, or other means approved by the competent authority. Nails shall not be used for transferring the principal load from one member to another.

4. TIMBER BALLIES OR BAMBOO SCAFFOLDS

4.1 Scaffolds may be single scaffold or double scaffolds for light duty or heavy duty as the case may be. The different components of these shall conform to the provisions laid down under single pole scaffold and

*Specification for structural timber in building.

†Specification for *ballies* for general purposes (*first revision*).

‡Specification for steel scaffoldings.

double pole scaffold. These are recommended to be used for heights up to 18 m. Light duty scaffolds are meant for carpenter's, painter's and similar trades, and heavy duty for masons' and similar trades. The minimum dimensions in case of *ballies* shall conform to IS : 3337-1978*. In case of single pole scaffolds, *ballies* of Class III can be used whereas for double pole scaffold, *ballies* of Class I or Class II shall only be used.

4.1.1 *Light Duty Scaffolds (Timber)* — On light duty scaffolds work shall not be carried on more than one platform at any time and the platform shall be able to maintain a safe working load of 150 kg/m^2 subject to a total load on each platform not exceeding 300 kg (which consists of weight of two men, weight of tools and weight of working materials). These are intended for the use of carpenters, painters or other similar trades and to support no other load except the workmen and a minimum quantity of working material/tools. Table 1 shows recommended sizes and spacing of the various members of single pole scaffolds of timber construction. Table 2 shows recommended sizes and spacing of double pole scaffolds of timber construction.

4.1.2 *Heavy Duty Scaffolds (Timber)* — Heavy duty scaffolds may have two working platform bays at any one time suitable to maintain a safe working load of 300 kg/m^2 subject to maximum platform load (which consists of weight of two men, weight of working tools and weight of working materials) distributed over two or three points, and two other platforms used for access or light duty with safe working load of 150 kg/m^2. They are intended for the use of stone masons, concreting or other similar trades, and to support, in addition to the workmen, a nominal supply of building material. Table 1 and 2 show recommended sizes and spacing of the various members of single and double pole scaffolds of timber construction.

4.1.3 *Single Pole Scaffold (in Bamboo)*

4.1.3.1 Single scaffold shall consist of one row of upright poles or standards fixed at a suitable distance from the wall at 1·8 m apart and connected horizontally by ledgers spaced vertically at 1·5 to 1·8 m centres. Cross members known as putlogs shall be spaced at 1·2 m (minimum centres, supported on ledgers on one side and their other ends placed in the holes left in the walls). As the construction or repair work is completed at the top of the structure, the putlog shall be drawn out and the holes left in the wall shall be filled up.

4.1.3.2 The mean diameter *d* (means average of the diameters at the top and the bottom of the *balli*) of standards shall not be less than

*Specification for *ballies* for general purposes (*first revision*).

TABLE 1 SINGLE POLE SCAFFOLDS
(RECOMMENDED FOR USE IN BUILDING UP TO 18 m HEIGHT)

All Measurements in millimetres, wherever not specified.

(*Clauses* 4.1.1 *and* 4.1.2)

Type of Use Maximum Uniformly Distributed Load	Light Duty 150 kg/m²	Heavy Duty 300 kg/m²
Poles/uprights/ standards	Up to 10 m 75 × 75	Up to 10 m 75 × 100
	Above 10 m	Above 10 m
	a) Up to 10 m height 75 × 100	a) Up to 10 m height 100 × 100
	b) 10 m to 18 m height (top) 75 × 75	b) 10 m to 18 m height (top) 75 × 100
Ledgers — supporting putlogs	50 × 150	75 × 150
Ledgers — not supporting putlogs	50 × 100	50 × 150
Putlogs or bearers or transom	50 × 100	75 × 100 or 50 × 150
Braces	35 × 100	50 × 150
Pole spacing longitudinal, *Max*	2·5 m	2 m
Pole spacing distance from wall/structure	Up to 10 m height — 1·0 m Beyond 10 m height — 1·2 m	1·2 m 1·8 m
Ledger, maximum vertical spacing	1·8 m	1·8 m
Base/plate 12 mm thick, *Min*	50 × 200	100 × 200
Planking/boards	35 × 200	50 × 200
Overlap of planks over single putlogs	300	300
Toe boards	35 × 150	50 × 150
Top railing	50 × 75	50 × 100
Intermediate railing	35 × 75	35 × 100

Note 1 — The ledgers and transoms should be started not beyond 150 mm of the base/foundation of the standards.

Note 2 — Notwithstanding the dimensions recommended above, alternate sizes and spacings may be adopted, provided the same has been designed/approved by a qualified engineer.

Note 3 — Overlapping of planks/boards should be provided on putlogs/bearers only. In case it is desired to have planks end-to-end (without overlap), putlogs must be provided within 100 mm from the end of each planks.

Note 4 — Scaffold should be tied and braced as specified in 4.2 of this Code.

TABLE 2 DOUBLE POLE TIED SCAFFOLDS
(RECOMMENDED FOR USE ON BUILDING UP TO 18 m HEIGHT ONLY)

All measurements in millimeters, Wherever not specified.

(*Clauses* 4.1.1 *and* 4.1.2)

TYPE OF USE MAXIMUM UNIFORMLY DISTRIBUTED LOAD	LIGHT DUTY 150 kg/m²	HEAVY DUTY 300 kg/m²
Height and Scaffold poles/uprights/ standards	Up to 10 m height 75 × 75 Above 10 m and up to 18 m height a) top 10 m 75 × 75 b) remaining portion at bottom 75 × 100	Up to 10m height 75 × 100 Above 10 m and up to 10 m height a) top 10 m 75 × 100 b) remaining portion at bottom 100 × 100
Poles spacing transversely	Up to 10 m — 750 *Min* Above 10 m — 1 m *Min*	1·2 m
Poles spacing longitudinally	2·5 m *Max*	2·0 m *Max*
Bearers	50 × 100	75 × 100 or 50 × 150
Ledgers Supporting bearers	—	50 × 150
Ledgers Not supporting bearers	50 × 100	50 × 100
Braces	35 × 100	50 × 100
Ledgers : maximum vertical spacing	1·8 m	1·8 m
Base/Plate (min 12 mm thick)	50 × 200	50 × 250
Planking	35 × 200	50 × 200
Overlap of planks	300	300
Overlap single bearer		
Toe boards	35 × 150	35 × 150
Top railing	50 × 75	50 × 75
Intermediate railing	35 × 75	35 × 75

NOTE 1 — The ledgers and transoms should be started not beyond 150 mm of the base/foundation of the standards.

NOTE 2 — Notwithstanding the dimensions recommended above, alternate sizes and spacings may be adopted, provided the same has been designed/approved by a qualified competent engineer.

NOTE 3 — Overlapping of planks/boards should be provided on putlogs/bearers only. In case it is desired to have planks end-to-end (without overlap), putlogs must be provided within 100 mm from the end of each plank.

NOTE 4 — Scaffold should be tied and braced as specified in 4.2 of this Code.

80 mm subject to a minimum of 50 mm at the top, which is always the thinnest. The l/d ratio should not exceed 50, where l is length of the standard between putlogs.

4.1.4 *Double Pole Scaffold*

4.1.4.1 For stone masonry buildings and for structures where other heavier materials of construction are used, a stronger scaffold shall be used. This shall consist of double scaffold, where two rows of standards shall be used; the inner row next to the wall and outer row at a distance of 1·2 to 1·5 m away from the wall. The putlogs shall rest entirely on the scaffold ledgers.

4.1.4.2 The mean diameter d (means average of the diameters at the top and the bottom of the *balli*) of standards shall be not less than 100 mm, subject to a minimum of 50 mm at the top, which is always the thinnest. In the case of bamboo, the diameter should not be measured at the knot points, where it is slightly more. The l/d ratio should not exceed 50, where l is the length of the standard between putlogs.

4.1.4.3 When it is necessary to extend a standard, the overlap between the first and the second standard shall be at least 60 cm.

4.2 Bracing and Tying

4.2.1 Any scaffold consisting merely of standards, ledgers and transoms or putlogs is not a rigid or stable structure. Every scaffold shall be effectively braced to make it rigid and tied or guyed to make it stable.

4.2.2 *Bracing* — Single pole scaffolds shall be braced longitudinally and the double pole scaffolds shall be braced both longitudinally and transversely so that the scaffolds form a rigid and stable structure.

4.2.2.1 *Longitudinal bracing* — The longitudinal bracing shall be provided on the outer face of the scaffolding by means of:

a) a diagonal face bracing in the end bays and one or more diagonal face braces (or facade braces) between the end bays pitched at an angle to form a diagonal across the bays as shown in Fig. 7, or

b) zig zag face bracing in the end bays and also in intermediate bays as shown in Fig. 8, or

c) any other equally effective method approved by site incharge.

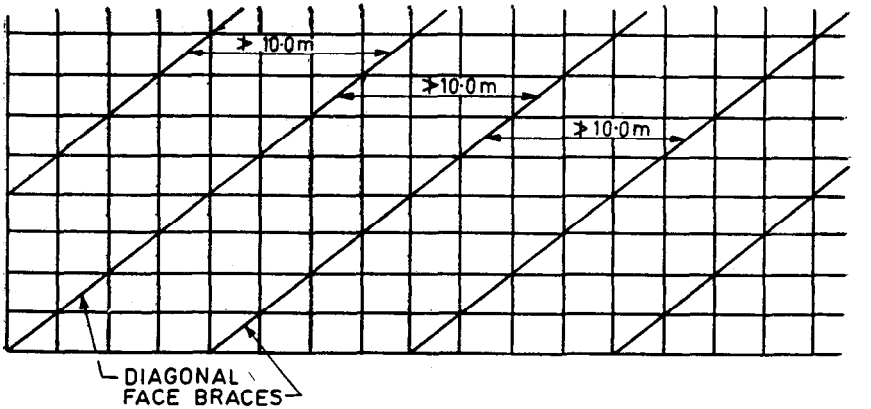


FIG. 7 DIAGONAL FACE BRACE

4.2.2.2 The braces shall be attached to standards and as closely as possible near the junction with ledgers and shall extend from base to the top of scaffold.

4.2.2.3 *Distance between braced bays* — The maximum distance between braced bays in any lift of scaffold shall not exceed 10 m as shown in Fig. 7 and 8.

4.2.2.4 *Length of brace* — The brace member shall be continuous (that is, without any break) except when it is necessary to change the direction of the brace.

4.2.2.5 *Transverse bracing* — In case of double pole scaffolds, in addition to face or zig-zag bracings required as above, transverse bracing or 'heel' and 'toe' braces shall also be provided at each end of the scaffold and if the length of the scaffold exceeds 15 metres, it shall be provided in addition at intervals not exceeding 15 metres apart as shown in Fig. 9.

4.2.3 *Tying*

4.2.3.1 Every single pole and double pole scaffold shall be effectively tied to a building or adjacent structure to prevent movement of the scaffold either towards or away from the building or structure. As the inside standards of double pole scaffolds are not normally braced longitudinally by a face brace or zig-zag brace, the ties shall be sufficiently rigid to prevent any longitudinal movement as well as in the scaffold structure.

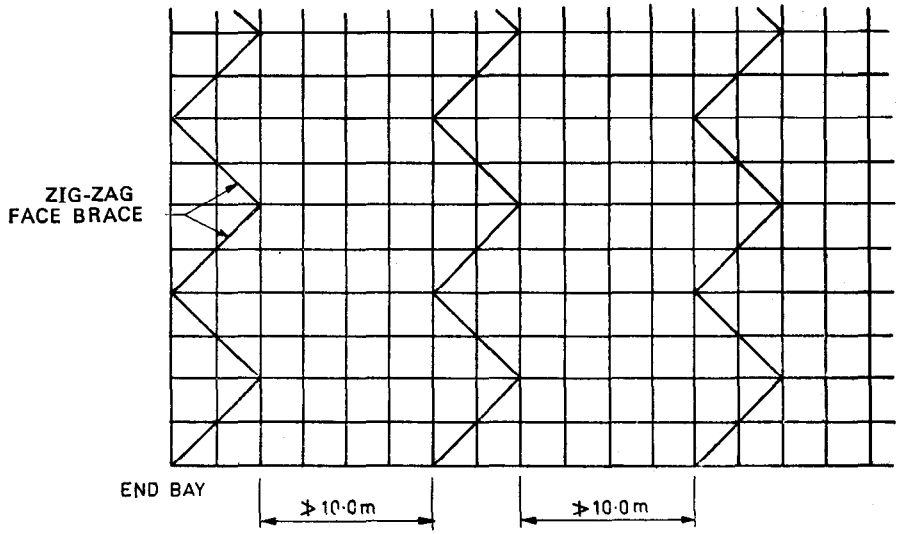


FIG. 8 ZIG-ZAG FACE BRACE

4.2.3.2 *Fixing ties* — Ties through window openings, etc, shall be fixed at sill level. Ties shall be fixed either to both standards or to both ledgers as close as possible to the standard/ledger junction. Typical tying systems are shown in Fig. 10.

4.2.3.3 *Spacing of ties* — The vertical spacing of ties shall not exceed 4 m. Longitudinally, ties shall be fixed at each end of the scaffold and at intervals along the length not exceeding the spacing as set out in Table 3.

4.2.3.4 *Additional bracing* — Where, due to difficulty in attaching ties to the building or structures, the tie spacing specified above can not be complied with, additional bracing shall be provided in the scaffold between ties points as specified below.

4.2.4 *Plan Bracing* — Where it is impracticable to fit ties at horizontal spacing specified plan bracings shall be provided between possible tie points as shown in Fig. 11. Even with such plan bracing, the distance between ties shall not exceed 15 m.

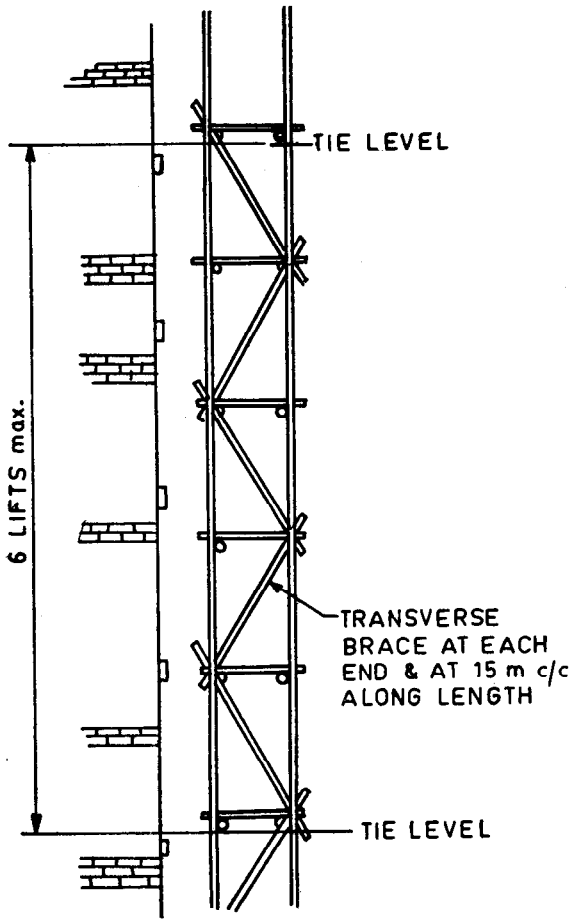
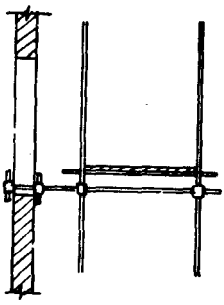
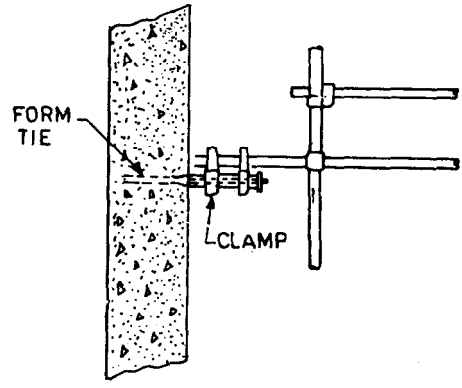


FIG. 9 TRANSVERSE BRACING FOR DOUBLE POLE SCAFFOLD

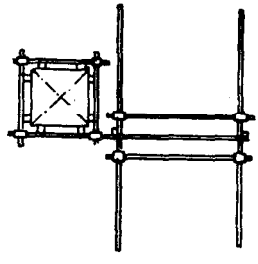
4.2.5 *Heel and Toe Bracing* — Where it is impracticable to provide ties at vertical spacing specified, heel and toe bracing shall be provided between tie points as shown in Fig. 9. Even with such heel and toe bracings the distance between ties shall not exceed 15 m.



10 (a) Tie Through Opening



10 (b) Scaffold Fixed to Form Ties



10 (c) Tie Around Column

FIG. 10 FIXING TIES

TABLE 3 SPACING OF TIES

(*Clause* 4.2.3.3)

HEIGHT OF SCAFFOLD	HORIZONTAL SPACING OF TIES			VERTICAL SPACING
	Between GL and 6 m	Between 6 m and 12 m	Between 12 m and 18 m	
Up to 6 metres	Every 5th standard or 10 m	—	—	4 m
Up to 12 metres	Every 4th standard or 8 m	Every 5th standard or 10 m	—	4 m
Up to 18 metres	Every 3rd standard or 6 m	Every 4th standard or 8 m	Every 5th standard or 10 m	4 m

NOTE — Before removing any tie to fix window frames etc, another tie should be fixed so that the tie spacing specified above does not exceed or alternatively plan bracing or heel and toe bracings shall be provided.

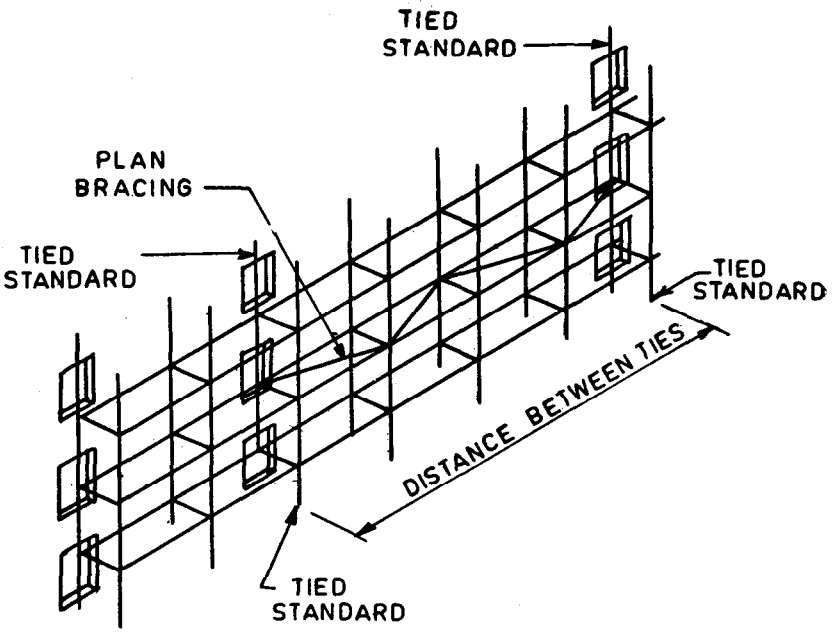


FIG. 11 PLAN BRACING — USED WHEN HORIZONTAL DISTANCE BETWEEN TIES IS EXCESSIVE

4.2.6 When plan or heel and toe bracings are provided, the ties shall be capable of carrying extra loads which will be imposed on them.

4.2.7 *Extreme Wind Conditions* — Where gale force winds are expected, it may be necessary to provide additional ties, guys or other suitable supports as decided by the engineer-in-charge.

4.2.8 *Additional Precautions for Single Pole Scaffolds*

a) For the first few lifts, it will be necessary to use temporary rakers to ensure stability of the scaffold;

b) All putlogs shall be left in position until dismantling is commenced;

c) The putlogs shall not be considered to act as ties; and

d) Tying shall be done as specified in **4.2.3**.

4.3 Fibre Ropes

4.3.1 Fibre ropes are extensively used for construction of *ballies/* bamboos scaffolds and staging, and also for hoisting and tying the scaffolds. It is to be ensured for the safety of life and property that fibre ropes be suitable for the purposes, that they are properly cared for, and that they are used in the proper manner.

4.3.2 The chief raw material from which such ropes are made are manila, sisal, coir and hemp. Pure manila fibre rope is the best and its use is recommended, wherever high tensile strength is required. The individual fibres of manila rope have a strength of about 23×10^7 N/mm^2 of sectional area. Sisal fibre rope of good quality is only about 67 percent as strong. Good quality coir and hemp, though not quite equal in strength to manila fibre, are slightly more resistant to atmospheric deterioration.

4.3.3 The size of fibre rope is denoted by its circumference in cm.

In uncoiling a new coil of rope, pass the end, which is at the core, through the core, to the opposite side and draw it out, when the turns will run out without kinking.

4.3.4 *Cleaning of Rope* — Rope shall not be stored in dirty condition. To clean a rope, it should be hung in loops over a beam or a bar placed at convenient height. The sand or mortar then be removed with water and the rope be lightly rapped or shaken thoroughly to remove any remaining dirt, and then allowed to dry naturally. The rope should be stored in a dry place where it will not be exposed to high temperature and where the air may circulate through coils.

4.3.5 *Moisture* — Rope deteriorates very quickly if it becomes saturated with water and is not properly dried out. It should be hung up or laid in loose coil in a dry place.

4.3.6 Rope shall not be stored or used where it will come in contact with acids or acid fumes. Acids damage the fibres. Strong alkali, drying oils, and paint are also injurious.

4.3.7 When cleaning buildings with acidic/corrosive cleaning agents from scaffolds, the danger of damage to the rope through contact with such substances may be decreased by keeping the fall line away from the scaffold. If necessary, a canvas shield be provide to prevent corrosive agents falling on the fibre ropes.

4.3.8 *Surface Wear* — Rope shall not be dragged along the ground as it will pick up grit and sand which may work into the interior of the rope, destroying fibre.

4.3.9 The pulley over which a rope has to run should not be less than 30 times the diameter of the rope. The angles at the sides of the grooves in which the rope runs vary from 45 to 60 degrees. These grooves shall be smooth.

4.3.10 *Inspection* — New rope should be carefully examined before being put up into use and thereafter before each operation and at intervals not exceeding 30 days while it is in use.

4.3.11 Visual inspection means inspecting the rope throughout its entire length for external wear, broken or cut fibres, displacement of yarns or strands, variations in size or roundness of strands, discolouration or rotting. The following procedure is recommended for the inspection:

a) Look for abrasions and broken fibres on the outside;

b) Inspect the inner fibres by slightly untwisting the rope at several places. If the inner yarns are bright, clear and unspotted, the rope strength has been preserved to a large extent;

c) Unwind from the rope a piece of yarn 200 mm long and check its tenacity by pulling. If the yarn breaks with a little or no effort, the rope shall be deemed to be unsafe.

d) Rope, used in an area where acid or caustic materials are used, should be inspected daily. If black or rusty brown spots are noted, test the fibres as described in (c); and

e) In general, a rope that has lost its feel of pliability or stretch or in which fibres have lost their luster and appear dry and bristle, should be replaced by new rope.

THUMU

FIG. 12 THUMU KNOT

4.4 Knots and Hitches

4.4.1 Desirable features of knots are that they may be quickly tied, easily untied and will not slip under a strain. Sometimes a toggle is

used, either to aid in making knot or to make easier to untie it. The common type of knots used in construction of scaffoldings are thumb knot, figure eight knot, reef knot (single or double hitch) and clove hitch knots.

4.4.2 *Thumb or Overhand Knot* (*Granny Knot*) — This is the simplest kind of knot and is used to prevent ropes running through blocks (*see* Fig. 12).

4.4.3 *Figure 8 Knot* — This knot is used where the thumb knot is not sufficiently large (*see* Fig. 13).

FIG. 13 FIGURE OF 8 KNOT

4.4.4 *Reef Knot* — Reef knot is used for extending or joining of ropes (*see* Fig. 14).

FIG. 14 REEF KNOT

4.4.5 *Clove Hitch Knot* — This knot is used to secure a rope to a spar (*see* Fig. 15).

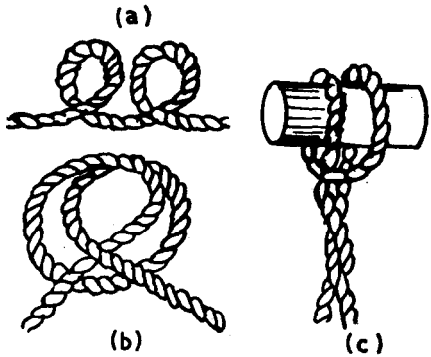


FIG. 15 CLOVE HITCH KNOT

4.5 Outrigger Scaffold — *See* Fig. 4 (A and B).

4.5.1 This type of scaffold is often used for cornice or other light work where it is not convenient to erect a built-up scaffold and where there are no accessible overhead supports. It consists essentially of a platform placed on horizontal thrustouts extending through window or other wall opening and anchored on the inside of the building.

4.5.2 Outrigger scaffolds providing only one working platform shall be constructed of 75 mm × 150 mm timber outriggers projecting edgewise not more than 1 200 mm through the wall or opening. The outriggers should not be spaced more than 2 m apart and should be fastened securely by bolts or other equivalent means as considered suitable by the engineer-in-charge on the inside of the building to prevent overturning or displacement in any direction. They shall be braced across and all the members shall be securely connected by means of bolts.

4.5.3 In no case shall trestles be erected upon the platform of an outrigger scaffold to gain additional height. If the job cannot be reached from outrigger scaffold itself, other suitable type of scaffold should be used.

4.5.4 In case more than one working platforms are required to be supported on the outrigger beams, then the beams shall be suitably

designed and secured and the same shall be duly approved by the engineer-in-charge. The beams may be of timber or metal. The various members of the scaffold erected on the outrigger beams shall conform to the requirements mentioned in Table 1 or 2 as the case may be.

4.5.5 If it is necessary for a man to crawl out on a thrustout, he shall be provided with a safety belt and a safety line attached to the building. The free length of the safety line shall not be more than 1 200 mm and both bolt and line shall be tested before use.

4.6 Wooden Trestles (Ghoda) — *See* Fig. 5.

4.6.1 Wooden trestles used for the support of working platforms shall be constructed of sound, straight-grained wood, of material not smaller than the nominal sizes stated below:

Top horizontal members (up to 1 200 mm in length)	75 mm × 100 mm
Legs (up to 1 500 mm)	50 mm × 100 mm
Longitudinal brace	
Between legs	25 mm × 150 mm
Gusset at top legs	25 mm × 150 mm
Diagonal braces	25 mm × 100 mm

4.6.2 A well designed trestle should have base width of about 600 mm (between the feet of the legs) and should be 1 200 mm in length. The nailing of extension pieces to the legs of the trestle to increase the height shall be prohibited.

4.6.3 Platform planking should be closely laid and the outside planks should be nailed to the bearers of the supporting trestle. The legs of the trestle should be suitably prevented from movement while in use. Not less than 55 mm planks shall be used for platforms and other requirements for platform shall be adhered to.

4.6.4 The spacing of trestle which are to be used as a mason's or similar heavy work shall not be more than 2 m centres. For light duty work, it should not be more than 2·5 m. The trestle should rest on level and firm ground and not on loose bricks or tiles.

4.7 Boatswain's Chairs — *See* Fig. 6 (A and B).

4.7.1 Boatswain's chair should be constructed with utmost care and thoroughly checked each time before it is put into use. The seat should be not less than 30 mm thick and should not be more than 600 mm long

and 300 mm wide. Battens shall be nailed to the under-side and they shall project minimum 250 mm in front of the seat.

4.7.2 Suspenders shall be not less than 50 mm manila ropes. They should be securely fastened to seat to prevent any tipping.

4.7.3 If cutting torches or other open flames and acids are used, the suspenders shall not be of fibre but shall be of steel wire rope of not less than 10 mm diameter. Provision should also be made for use of safety belt with life line having a steel wire core.

4.7.4 Suspension ropes supporting Boatswain's chairs may either be fastened to a fixed overhead structure, beam, etc, or passed through an overhead block which is securely fastened. The free end of the rope shall also be securely fastened to a fixed object.

4.7.5 The hauling part of the rope used to raise or lower the chair, shall always be within easy reach of the man using the Boatswain's chair,

4.7.6 Every man working from a Boatswain's chair shall be equipped with a safety belt which shall be securely fastened to the supporting tackle to prevent him from falling out.

4.7.7 Suspended scaffolds shall be tested as frequently as may be necessary to ensure that minimum safety factors are maintained. The test will be made by raising the working surface 300 mm above the ground and loading it with at least three times the maximum weight that will be imposed upon it. Testing shall be done by a competent person at least once a fortnight and record of such tests shall be maintained.

5. RAILINGS AND TOE BOARDS

5.1 Railings should be considered as an essential part of every scaffold and should be provided for all working platforms higher than 2 m above the floor level.

5.2 Standard railings may be constructed of wood, pipe or any other metal sections. The railings shall consist of a top rail from 900 to 1 050 mm above the platform level and intermediate rail halfway between the top rail and the platform. The railings should be mounted on standards or uprights.

5.3 The platform edges of every scaffold shall be equipped with toe boards to eliminate hazard of tools or other objects falling from the platform. Toeboard shall be so placed that no opening remains

between the flooring and the toeboard. The sizes of the toeboards rails shall be shown as in Tables 1 and 2.

5.4 Where scaffolds are erected over footpaths or other areas over which persons work or pass under protection against hazard of falling objects is necessary. Under these conditions, it is necessary to enclose the space between the toe board and the top railing. The material used for enclosing the space will depend upon the working conditions. On scaffolds used for cleaning surfaces of buildings with chemicals or other corrosive agents, a suitable protective covering such as tarpauline or PVC sheets, be used to protect persons working or passing near the scaffold from spillage of such liquids.

6. MEANS OF ACCESS

6.1 A safe and convenient means of access should be provided to all platform level of scaffolds. Means of access may consist of:

a) ladder,
b) ramp, and
c) stairway.

6.2 Ladder — Portable ladders are not recommended for flights above 4 m. They should be placed at an angle of approximately 75° from the horizontal. Both top and bottom should be secured to prevent displacement, and the ladder rails should be extended at least 1 m above the top landing. Fixed ladders should be provided for flights above 4 m. Fixed ladder should have landings of minimum 600 mm extent at intervals not greater than 6·0 m. The width of ladder shall not be less than 300 mm and the rungs shall be spaced not more than 300 mm. All the ladders used for access to scaffolds should conform to the requirement of IS : 3696 (Part 2) - 1966*.

6.3 Ramps or Gangways

6.3.1 Ramps or gangways are advantageous for access to scaffold platforms from hoisting towers or from adjacent floor levels, but are not practicable where there is appreciable difference in levels. Where used, they should be built to provide strength equal to that specified for scaffold structures and should not unduly rag under the corresponding dead or moving loads. If the ramp or runway is 1·5 m or more above the ground or floor level, the open sides should be protected by standard railings and toe boards

*Safety code for scaffolds and ladders: Part 2 Ladders.

6.3.2 The slope of the ramp shall not exceed 2 in 3. Where the slope is more than 1 in 4, proper foot holds shall be provided by means of stepping laths of minimum size 50 × 30 mm at intervals not exceeding 45 cm.

6.4 Stairways — For scaffolds exceeding 4 m height, stairways are the safest means of access. The stairway shall conform to the following requirements:

a) Treads and risers should be of uniform width and height in any one flight,
b) Minimum width of 1·0 m,
c) No unbroken vertical rise of more than 4 m,
d) Maximum angle of ascent 50 degrees,
e) Stair railings on all open sides,
f) Hand rails on all enclosed sides, and
g) Standard railings and toeboards on all landings.

7. PROTECTION FROM FALLING BODIES

7.1 To protect workers on lower platform against falling objects from higher levels, overhead protection should be provided on the scaffold. This protection should be not more than 3 m above the platform/floor and should be planking or other suitable material.

7.2 Protection Under Scaffolds — Where persons are required to work or pass underneath (for example, building entrances or pathways) a scaffold upon which men are working, a screen or canopy shall be provided for their protection from falling objects. Such screen should extend to a distance at least one metre beyond the edge of the scaffold above the passage to catch any material which may fall. For ordinary conditions a net with a mesh size of 25 mm is satisfactory (*see* Fig. 16).

7.3 Protection of Supervisory/Inspecting Officials — Supervisory staff, inspecting officials or such persons who have to go to the vicinity of the scaffolding should wear safety helmets (*see* IS : 2925 - 1984*) within a zone of at least 10 m to be protected from falling objects escaping such screen or canopy as indicated in 7.2.

8. PLATFORM WIDTH

8.1 The following minimum widths of platforms for various types of uses are recommended.

*Specification for industrial safety helmets (*second revision*).

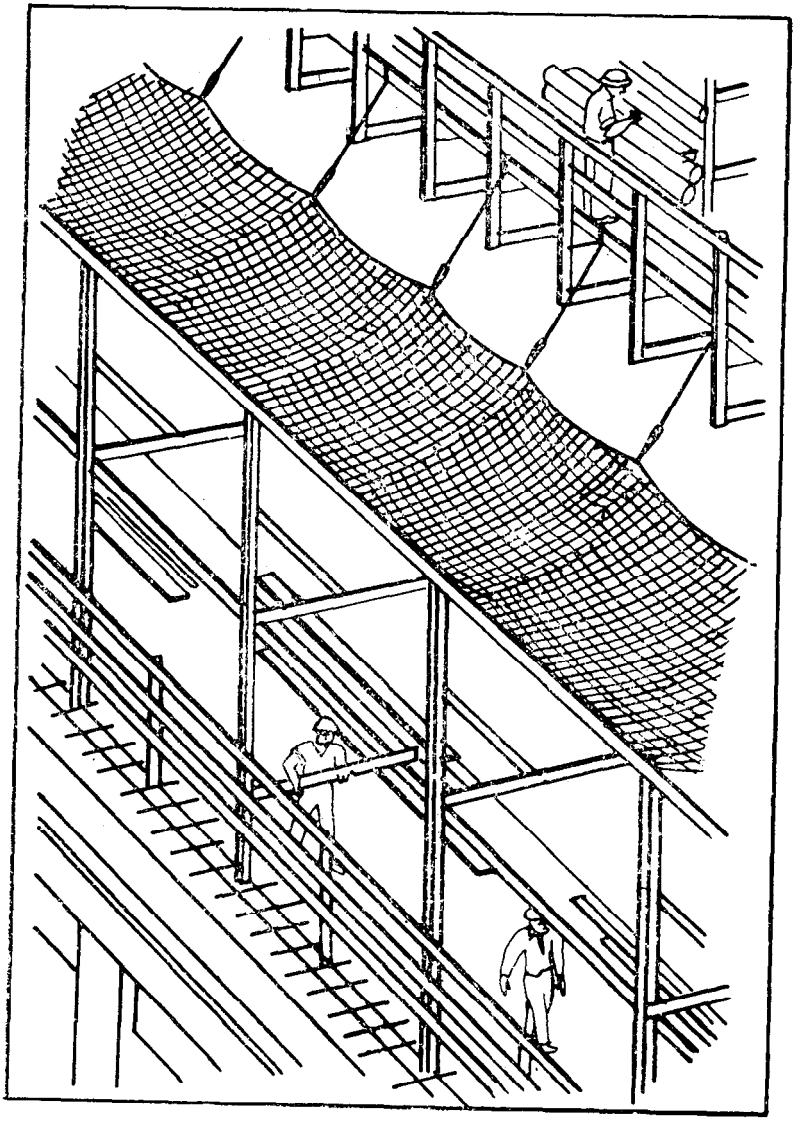


FIG 16. SAFETY NET IN USE

8.1.1 Where platform is not more than 2 m above the ground or floor:

a) Painters, decorators or similar workmen	300 mm
b) Other types (men and tool only)	500 mm

8.1.2 Where platform is more than 2·0 m above the ground or floor:

a) Men, tools and material	900 mm
b) Men, tools material and wheel barrows	1 200 mm

9. GENERAL SAFETY REQUIREMENTS

9.1 Scaffolds shall be provided for all work that cannot be safely performed from the ground, or from solid construction. Every scaffold and every part thereof including supports shall be of good construction, suitable and sound material and having adequate strength for the purpose for which it is used. It shall be properly maintained. Construction and dismantling of every scaffold shall be under the supervision of a competent autority. Boards and planks used for the platforms, gangways and runs shall be of uniform thickness (*see* Table 2) closely laid, and securely fastened in place.

9.2 The erection, alterations and removal should be done only under the supervision of men who are thoroughly experienced in this work.

9.3 The use of barrels, boxes, loose tile blocks or other unsuitable objects as supports for working platforms shall not be permitted.

9.4 Every scaffold shall be securely supported or suspended and shall, where necessary, be sufficiently and properly strutted or braced to ensure stability. The use of cross braces or framework as means of access to the working surface shall not be permitted.

9.5 Every platform, gangway, run or stairs shall be kept free from any unnecessary obstruction, material, rubbish and projecting rails, when they become slippery, appropriate steps shall be taken by way of sanding, cleaning or otherwise to remedy the defect.

9.6 Each supporting member used in the construction of runways, platforms, ramps and scaffolds shall be securely fastened and braced. The supporting member shall be placed on a firm, rigid, smooth foundation of a nature that will prevent lateral displacement. All fasteners and anchorages shall be inspected by a competent person.

9.7 Where planks are butt-jointed, two parallel putlogs shall be used, not more than 100 mm apart, giving each plank sufficient support. Nails shall penetrate to the holding piece to a depth of at least 12 times the diameter of the nail.

9.8 If scaffolds are to be used to a great extent or for a long period of time, a regular plank stairway wide enough to allow two people to pass shall be erected. Such stairways shall have handrails on both sides.

9.9 A scaffold platform plank shall not project beyond its end supports to a distance exceeding four times the thickness of the plank unless it is effectively secured to prevent tipping. Cantilever of scaffold planks shall be avoided. Ledgers or putlog should be erected to support the ends of such planks.

9.10 All scaffolds or working platforms of any nature shall be securely fastened to the building or structure; if independent of the building, they shall be braced or guyed properly.

9.11 Grease, mud, paint gravel or plaster or any such hazardous substances shall be removed from scaffolds immediately. To prevent slipping on the platforms, either sand or saw dust or other suitable material shall be spread.

9.12 Men shall not be allowed to work from scaffolds during storms or high winds. After heavy rains or storm, the scaffolds should be inspected by the site-in-charge. Scaffolds should also be inspected every fortnight, during use, by him and again before starting use. Where the joints or members are found defective, the joint should be set right and member replaced.

9.13 In case both light and heavy duty scaffolds are used in close vicinity, conspicuously placed notice boards shall indicate the light duty scaffolds and the limits on their usages.

9.14 Safety codes should be strictly followed. Standard safety requirements are just as important for temporary structures as they are for permanent structures.

10. PRECAUTIONS AGAINST PARTICULAR HAZARDS

10.1 Electrical Hazards

10.1.1 Care shall be taken to see that no uninsulated electric wire exists within 3 m of the working platform, gangways, runs, etc, of the scaffold.

10.1.2 While carrying bars, rods or pipes of any kind conducting material of length greater than 3 m, in the vicinity of electric wires, special care shall be taken that these do not touch the electric wires.

10.2 Fire Hazards — Care shall be taken against any possibility of timber scaffolds catching fire.

10.3 Mechanical and Traffic Hazards

10.3.1 Care shall be taken to see that no part of a scaffold is struck by a truck or other heavy moving equipment and no material shall be dumped against it.

10.3.2 Scaffolds on thorough fares shall be provided with warning lights, if general lighting is not sufficient to make it clearly visible.

10.3.3 Access to fire alarms, cable tunnels, hydrants, etc, shall remain free at all times. Care should be taken for underground cables and equipment when parts of scaffolds or other fasteners have to be driven in the ground.

10.3.4 Scaffolds or other rigging involving human safety, should be tested with a load at least three times that which it will carry in service.

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