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मानक

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IS 4082 (1996): Recommendations on stacking and storage of construction materials and components at site [CED 29: Construction Management including safety in Construction]



“ज्ञान से एक नये भारत का निर्माण”

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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक
निर्माण सामग्री व घटकों के चट्टे लगाना
व भंडारण — सिफारिशें
(दूसरा पुनरीक्षण)

Indian Standard

STACKING AND STORAGE OF
CONSTRUCTION MATERIALS AND
COMPONENTS AT SITE —
RECOMMENDATIONS

(Second Revision)

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NEW DELHI 110002

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Construction Management Sectional Committee had been approved by the Civil Engineering Division Council.

Planned stacking and storage of construction materials and components at the site of any construction work irrespective of its characteristics, can ensure efficient and effective methods of work and construction operations. Losses due to unsuitable and haphazard storage and stacking of materials and components are minimized by sound organization at site of stacking and storage. This standard has, therefore, been prepared to provide general guidance to the builders and construction agencies in stacking and storage of materials and components at site. However, in the case of special manufactured products, the manufacturers' instructions shall be followed for stacking and storage.

This standard was first published in 1967 and then revised in 1977. This second revision of the standard has been prepared based on the experience gained with the use of the standard and with a view to bringing it in line with the provisions of the other Indian Standards. In this revision, provisions for materials like stones, blocks, roof tiles, partially prefabricated wall and roof components, cinder, aluminium sections, cast iron and aluminium sheets, plastic sheets, doors and windows and glass bricks/blocks have also been incorporated. To facilitate implementation of the provisions of this standard at site, a stacking and storage checklist has been included in this revision. A separate standard IS 7969 : 1975 'Safety code for handling and storage of building materials' provides guidance regarding safety aspects of workmen engaged in handling and storage of building materials.

The composition of the technical committee responsible for the formulation of this standard is given at Annex A.

Indian Standard

STACKING AND STORAGE OF CONSTRUCTION MATERIALS AND COMPONENTS AT SITE — RECOMMENDATIONS

(Second Revision)

1 SCOPE

This standard provides general guidance regarding stacking and storage of construction materials and components at site.

2 REFERENCES

The following Indian Standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards indicated below.

| <i>IS No.</i> | <i>Title</i> |
|--------------------------|---|
| 1141 : 1993 | Code of practice for seasoning of timber (<i>second revision</i>) |
| 13416 (Part 5) : 1994 | Recommendations for preventive measures against hazards at workplaces: Part 5 Fire protection |

3 GENERAL CONSIDERATIONS FOR STACKING AND STORAGE

3.1 Planning of Storage Layout

For any site, there should be proper planning of the layout for stacking and storage of different materials, components and equipments with proper access and proper manoeuvrability of the vehicles carrying the material. While planning the layout, the requirements of various materials, components and equipments at different stages of construction shall be considered.

3.2 Materials shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work.

3.3 Protection Against Atmospheric Agencies

Materials stored at site, depending upon the individual characteristics, shall be protected from

atmospheric actions, such as rain, sun, winds and moisture, to avoid deterioration.

3.4 Protection Against Fire and Other Hazards

3.4.1 Materials, like timber, coal, paints, etc shall be stored in such a way that there may not be any possibility of fire hazards. Inflammable materials like kerosene and petrol, shall be stored in accordance with the relevant rules and regulations so as to ensure the desired safety during storage. Stacks shall not be piled so high as to make them unstable under fire fighting conditions and in general they shall not be more than 4.5 m in height. The provisions given in IS 13416 (Part 5) : 1994 shall be followed. Explosives like detonators shall be stored in accordance with the existing regulations of Indian Explosives Act.

3.4.2 Materials which are likely to be affected by subsidence of soil like precast beams, slabs and timber of sizes shall be stored by adopting suitable measures to ensure unyielding supports.

3.4.3 Materials liable to be affected by floods shall be suitably stored to prevent their being washed away or damaged due to floods.

3.5 Stairways, passageways and gangways shall not become obstructed by storage of building materials, tools or accumulated rubbish.

4 STACKING AND STORAGE OF MATERIALS

4.1 The stacking and storage of materials generally used in construction shall be as given in 4.2 to 4.28, which have been summarised in the form of a checklist in Table 1.

4.2 Cement

4.2.1 Cement is received in bags, drums or silos.

4.2.2 In case cement is received in bags, recommendations given in 4.2.2.1 to 4.2.2.5 shall be followed.

4.2.2.1 Cement shall be stored at the work site in a building or a shed which is dry, leakproof and as moisture-proof as possible. The building or shed for storage should have minimum number of windows and close fitting doors and these should be kept closed as far as possible.

4.2.2.2 Cement shall be stored and stacked in bags and shall be kept free from the possibility of any dampness or moisture coming in contact with them. Cement bags shall be stacked off the floor on wooden planks in such a way as to keep about 150 mm to 200 mm clear above the floor. The floor may comprise of lean cement concrete or two layers of dry bricks laid on well consolidated earth. A space of 600 mm minimum shall be left around between the exterior walls and the stacks (see Fig. 1).

In the stacks the cement bags shall be kept close together to reduce circulation of air as much as possible. Owing to pressure on the bottom layer of bags sometimes 'warehouse pack' is developed in these bags. This can be removed easily by rolling the bags when the cement is taken out for use. Lumbed bags, if any should be removed and disposed off.

4.2.2.3 The height of stack shall not be more than 10 bags to prevent the possibility of lumping up under pressure. The width of the stack shall be not more than four bags length or 3 metres. In stacks more than 8 bags high, the cement bags shall be arranged alternately length-wise and cross-wise so as to tie the stacks together and minimize the danger of toppling over. Cement bags shall be stacked in a manner to facilitate their removal and

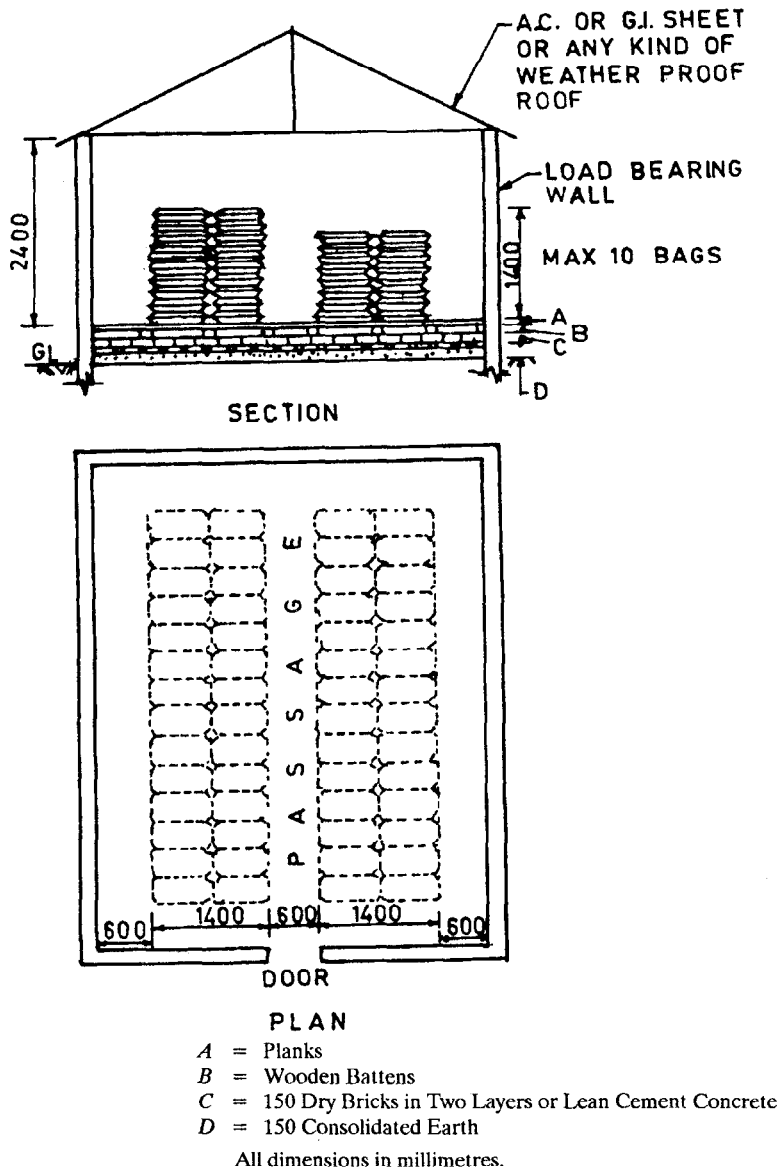


FIG. 1 TYPICAL ARRANGEMENT IN CEMENT GODOWN

use in the order in which they are received; a label showing date of receipt of cement shall be put on each stack to know the age of cement.

4.2.2.4 For extra safety during the monsoon, or when it is expected to store for an unusually long period, the stack shall be completely enclosed by a waterproofing membrane such as polyethylene, which shall close on the top of the stack. Care shall be taken to see that the waterproofing membrane is not damaged any time during use.

4.2.2.5 Cement in gunny bags, paper bags and polyethylene bags shall be stored separately.

4.2.3 In case cement is received in drums, these shall be stored on plane level ground, as far as possible near the concrete mixing place. After taking out the required quantity of cement, the lid of the drum shall be securely tied to prevent ingress of moisture.

4.2.4 In case cement is received in silos, the silos shall be placed near the concrete batching plant. Proper access shall be provided for the replacement of silos.

4.2.5 Different types of cements shall be stacked and stored separately.

4.3 Lime

4.3.1 *Quicklime Before Slaking*

Quicklime deteriorates rapidly on exposure by taking up moisture and carbon dioxide from atmosphere. It should be slaked as soon as possible before deterioration sets in. If unavoidable, it may be stored in compact heaps having only the minimum of exposed area. The heaps shall be stored on a suitable platform and covered by waterproof membrane such as polyethylene to avoid direct contact with rain or being blown away by wind. In case quicklime is stored in a covered shed, a minimum space of 300 mm should be provided around the heaps to avoid bulging of walls.

4.3.2 *Hydrated Lime*

Hydrated lime is generally supplied in containers such as jute bags lined with polyethylene or HDPE woven bags lined with polyethylene or kraft paper bags. It should be stored in a building to protect the lime from dampness and to minimize warehouse deterioration.

The building should be with a concrete floor and having least ventilation to eliminate draughts through the walls and roof. In general, the recommendations given in 4.2.2.2 for storing of cement shall be applicable for hydrated lime. When air

movement is reduced to a practical minimum, hydrated lime can be stored for up to three months without appreciable change.

4.3.3 *Dry Slaked Lime*

If the lime is to be used within a few days it may be stored on a platform suitably covered for protection from rain and wind. If it is required to be stored for a longer period not exceeding 2 months it may be kept in a dry and closed godown.

4.4 Stones

4.4.1 Stones of different sizes, types and classification shall be stored separately.

4.4.2 Stones shall be stacked on dry firm ground in a regular heap not more than 1 m in height.

4.4.3 Veneering stones shall be stacked against vertical support on a firm dry ground in tiers, upto a height of 1.2 m. A distance of about 0.8 m shall be kept between two adjacent stacks.

4.5 Bricks

4.5.1 Bricks shall be stacked in regular tiers as and when they are unloaded to minimize breakage and defacement. These shall not be dumped at site.

4.5.2 In the case of bricks made from clays containing lime *KANKAR*, the bricks in stack should be thoroughly soaked in water (docked) to prevent lime bursting.

4.5.3 Brick stacks shall be placed close to the site of work so that least effort is required to unload and transport the bricks again by loading on pallets or in barrows. Building bricks shall be loaded or unloaded a pair at a time unless palletised. Unloading of building bricks or handling in any other way likely to damage the corners or edges or other parts of bricks shall not be permitted.

4.5.4 Bricks shall be stacked on dry firm ground. For proper inspection of quality and ease in counting, the stacks shall be 50 bricks long, 10 bricks high and not more than 4 bricks in width, the bricks being placed on edge, two at a time along the width of the stack. Clear distance between adjacent stacks shall not be less than 0.8 m. Bricks of each truck load shall be put in one stack.

4.5.5 Bricks of different types, such as, clay bricks, clay fly ash bricks, fly ash lime bricks, sand lime (calcium silicate) bricks shall be stacked separately. Bricks of different classifications from strength consideration and size consideration (such as, conventional and modular) shall be stacked separately.

Also bricks of different types, such as, solid, hollow and perforated shall be stacked separately.

4.6 Blocks

4.6.1 Blocks are available as hollow and solid concrete blocks, hollow and solid light weight concrete blocks, autoclaved aerated concrete blocks, concrete stone masonry blocks and soil based blocks.

4.6.2 Blocks shall be unloaded one at a time and stacked in regular tiers to minimize breakage and defacement. These shall not be dumped at site. The height of the stack shall not be more than 1.2 m. The length of the stack shall not be more than 3.0 m, as far as possible and the width shall be of two to three blocks.

4.6.3 Normally blocks cured for 28 days only should be received at site. In case blocks cured for less than 28 days are received, these shall be stacked separately. All blocks should be water cured for 10 to 14 days and air cured for another 15 days; thus no blocks with less than 28 days curing shall be used in building construction.

4.6.4 Blocks shall be placed close to the site of work so that least effort is required for their transportation.

4.6.5 Blocks manufactured at site shall be stacked atleast for required minimum curing period as given in 4.6.3.

4.6.6 The date of manufacture of the blocks shall be suitably marked on the stacks of blocks manufactured at factory or site.

4.7 Floor, Wall and Roof Tiles

4.7.1 Floor, wall and clay roof tiles of different types, such as, cement concrete tiles (plain, coloured and terrazzo) and ceramic tiles (glazed and unglazed) shall be stacked on regular platform as far as possible under cover in proper layers and in tiers and they shall not be dumped in heaps. In the stack, the tiles shall be so placed that the mould surface of one faces that of another. Height of the stack shall not be more than one metre. During unloading, these shall be handled carefully so as to avoid breakage.

4.7.2 Tiles of different quality, size and thickness shall be stacked separately to facilitate easy

manufacturers packed in wooden crates, shall be stored in crates. The crates shall be opened one at a time as and when required for use.

4.7.3 Ceramic tiles and clay roof tiles are generally supplied in cartons which shall be handled with

care. It is preferable to transport these at the site on platform trolleys.

4.8 Aggregates

4.8.1 Aggregates shall be stored at site on a hard dry and level patch of ground. If such a surface is not available, a platform of planks or old corrugated iron sheets, or a floor of bricks, or a thin layer of lean concrete shall be made so as to prevent contamination with clay, dust, vegetable and other foreign matter.

4.8.2 Stacks of fine and coarse aggregates shall be kept in separate stock piles sufficiently removed from each other to prevent the material at the edges of the piles from getting intermixed. On a large job it is desirable to construct dividing walls to give each type of aggregates its own compartment. Fine aggregates shall be stacked in a place where loss due to the effect of wind is minimum.

4.8.3 Unless specified otherwise or necessitated by site conditions stacking of the aggregates should be carried out in regular stacks. The suggested sizes for stacks are as follows:

| Sl No. | Material | Size of Stack (in m) | | |
|--------|-------------------|----------------------|---------|--------|
| | | Length | Breadth | Height |
| i) | Soling stone | 5.0 | 2.0 | 0.50 |
| | | or 5.0 | 1.0 | 0.50 |
| ii) | Coarse aggregates | 2.0 | 2.0 | 0.50 |
| | | or 5.0 | 5.0 | 1.00 |
| | | or 5.0 | 1.0 | 0.50 |
| iii) | Fine aggregates | 2.0 | 2.0 | 0.50 |
| | | or 5.0 | 5.0 | 1.00 |
| | | or 5.0 | 1.0 | 0.50 |

4.9 Fly Ash

Fly ash shall be stored in such a manner as to permit easy access for proper inspection and identification of each consignment. Fly ash in bulk quantities shall be stored in stack similar to fine aggregates as specified in 4.8 avoiding any intrusion of foreign matter. Fly ash in bags shall be stored in stacks not more than 10 bags high.

4.10 Cinder

Cinder shall be stored in bulk quantities in stacks similar to coarse aggregates as specified in 4.8 avoiding any extrusion of foreign matter.

4.11 Partially Prefabricated Wall and Roof Components

4.11.1 The blocks shall be stacked as per 4.6. The lintel and sill blocks shall be unloaded as individual component by holding them near the ends. These shall be stacked on plane level ground having a floor of bricks or a thin layer of lean concrete.

4.11.2 The roof components such as precast R C joists, prefabricated brick panels, R C planks, channel units, cored units, waffle units, L-panel, single tee and double tee sections, ferrocement panels, etc shall be unloaded as individual components. The components shall be handled by holding at specified points so that the stresses due to handling are minimized. These shall be stacked on plane level ground having a floor of bricks or a thin layer of lean concrete. R C planks, prefabricated brick panels and ferrocement panels shall be stacked against a brick masonry wall in slightly inclined position on both sides of the wall. Channel units, cored units and L-panels shall be stacked one over the other upto five tiers. The waffle units shall be stacked upside down as individual units. The R C joists, single tee and double tee sections shall be stacked as individual units one adjacent to the other. The distance between any two adjacent stacks shall not be less than 450 mm.

4.12 Timber

4.12.1 Timber shall be stored in stacks upon well treated and even surfaced beams, sleepers or brick pillars so as to be above the ground level by at least 150 mm. The various members shall preferably be stored separately in different lengths, and material of equal lengths shall be piled together in layers with wooden battens, called crossers, separating one layer from another. The crossers shall be sound wood, straight and uniform in thickness. In case where separate crossers are not available smaller sections of the available structural timber may be employed in their place. In any layer, an air

space of about 25 mm shall be provided between adjacent members. The longer pieces shall be placed in the bottom layers and shorter pieces in the top layers but one end of the stack shall be in true vertical alignment. The crossers in different layers shall be in vertical alignment. The most suitable width and height of a stack are recommended to be about 1.5 m to 2.0 m. Distance between adjacent stacks is recommended to be at least 450 mm. A side view of such a stack is shown in Fig. 2. In case the stacking with the help of battens is not possible, the timber may be close-piled in heaps on raised foundations with the precautions specified above.

4.12.2 The stacks shall be protected from hot dry winds or direct sun and rain. Heavy weights, such as metal rails or large sections of wood, are recommended to be placed on the top of the stack to prevent distortion or warping of the timber in the stack. In case, timber is to be stored for about an year or more, to prevent end cracking in the material, the ends of all members shall be coated with coal tar, aluminium leaf paints (hardened gloss oil), micro crystalline wax or any other suitable material.

4.13 Steel

4.13.1 For each classification of steel, separate areas shall be earmarked. It is desirable that ends of bars and sections of each class be painted in distinct separate colours.

4.13.2 Steel reinforcement shall ordinarily be stored in such a way as to avoid distortion and to

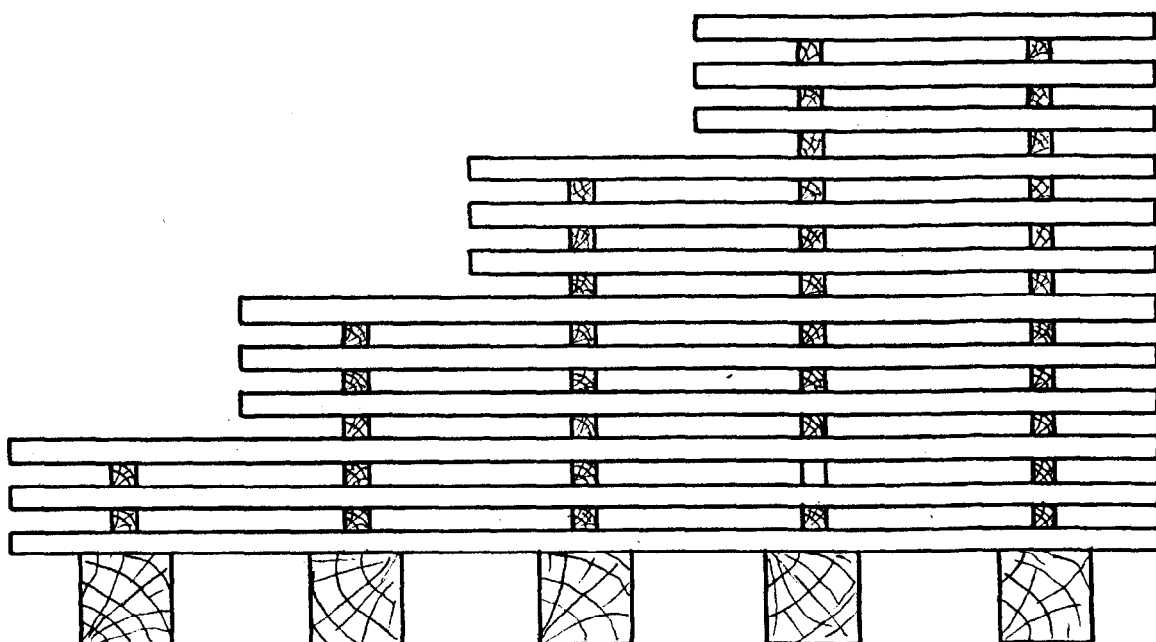


FIG. 2 TYPICAL TIMBER STACK

prevent deterioration and corrosion. It is desirable to coat reinforcement with cement wash before stacking to prevent scaling and rusting.

4.13.3 Bars of different classification, sizes and lengths shall be stored separately to facilitate issues in such sizes and lengths so as to minimize wastage in cutting from standard lengths.

4.13.4 In case of long storage, reinforcement bars shall be stacked above ground level by at least 150 mm. Also in coastal areas or in case of long storage a coat of cement wash shall be given to prevent scaling and rusting.

4.13.5 Structural steel of different classification, sizes and lengths shall be stored separately. It shall be stored above ground level by at least 150 mm upon platforms, skids or any other suitable supports to avoid distortion of sections. In coastal areas or in case of long storage suitable protective coating of primer paint shall be given to prevent scaling and rusting.

4.14 Aluminium Sections

Aluminium sections of different classification, sizes and lengths shall be stored separately, on a level platform under cover. The aluminium sections shall not be pulled or pushed from the stack nor shall be slid over each other, to protect the anodizing layer.

4.15 Doors, Windows and Ventilators

4.15.1 General

While unloading, shifting, handling and stacking timber or other lignocellulosic material based, metal and plastic door and window frames and shutters, care shall be taken that the material is not dragged one over the other as it may cause damage to the surface of the material particularly in the case of decorative shutters. The material should be lifted and carried preferably flat avoiding damage of corners or sides.

4.15.2 Metal and plastic doors, windows and ventilators shall be stacked upright (on their sills) on level ground preferably on wooden battens and shall not come in contact with dirt and ashes. If received in crates they shall be stacked according to manufacturer's instructions and removed from the crates as and when required for the work.

4.15.3 Metal and plastic frames of doors, windows and ventilators shall be stacked upside down with the kick plates at the top. These shall not be allowed to stand for long in this manner before being fixed so as to avoid the door frames getting out of

shape and hinges being strained and shutters drooping.

4.15.4 During the period of storage all metal doors, windows and ventilators shall be protected from loose cement and mortar by suitable covering such as tarpaulin. The tarpaulin shall be hung loosely on temporary framing to permit circulation of air to prevent condensation.

4.15.5 All timber and other lignocellulosic material based frames and shutters shall be stored in a dry and clean covered space away from any infestation and dampness. The storage shall preferably be in well-ventilated dry rooms. The frames shall be stacked one over the other in vertical stacks with cross battens at regular distances to keep the stack vertical and straight. These cross battens should be of uniform thickness and placed vertically one above the other. The door shutters shall be stacked in the form of clean vertical stacks one over the other and at least 80 mm above ground on pallets or suitable beams or rafters. The top of the stack shall be covered by a protecting cover and weighted down by means of scantlings or other suitable weights. The shutter stack shall rest on hard and level ground.

4.15.6 If any timber or other lignocellulosic material based frame or shutter becomes wet during transit, it shall be kept separate from the undamaged material. The wet material may be dried by stacking in shade with battens in between adjacent boards with free access of dry air generally following the guidance laid down in IS 1141 : 1993

4.15.7 Separate stacks shall be built up for each size, each grade and each type of material. When materials of different sizes, grades and types are to be stacked in one stack due to shortage of space, the bigger size shall be stacked in the lower portion of the stacks. Suitable pallets or separating battens shall be kept in between the two types of material.

4.16 Roofing Sheets

4.16.1 Roofing sheets shall be stored and handled in such a manner as not to damage them in any way.

4.16.2 Plain and corrugated asbestos cement sheets shall be stacked horizontally to a height of not more than one metre on a firm and level ground, with timber or other packing beneath them. If stacked in exposed position, they shall be protected from damage by the winds.

Asbestos cement sheets of same variety and size shall be stacked together. Damaged sheets shall not be stacked with sound materials. All damaged sheets shall be salvaged as early as possible.

4.16.3 Corrugated galvanized iron sheets and aluminium sheets shall be stacked horizontally to a height of not more than 0.5 m on a firm and level ground, with timber or other packing beneath them. To protect them from dust and rain water, these shall be covered with tarpaulin or polyethylene sheets.

4.16.4 Plastic sheets and glass reinforced plastic (GRP) sheets shall be stacked under a shed to a height of not more than 0.5 m on a firm and level ground with timber or other packing beneath them.

4.17 Gypsum Boards, Plywood, Fibreboard, Particle Board, Blockboard, etc

These boards shall be stored flat in a covered clean and dry place. Different sizes and types of each of these boards shall be stacked separately.

The board shall be stacked on a flat platform on which a wooden frame shall be constructed with 50 mm × 25 mm battens in such a way that it will give support to all four edges and corners of the boards with intermediate battens placed at suitable intervals to avoid warping.

The boards shall be stacked in a solid block in a clear vertical alignment. The top sheet of each stack shall be suitably weighed down to prevent warping wherever necessary.

The boards shall be unloaded and stacked with utmost care avoiding damage to the corners and surface. In case of decorative plywood and decorative boards, the surfaces of which are likely to get damaged by dragging one sheet over another it is advisable that these are lifted as far as possible in pairs facing each other.

4.18 Plastic and Rubber Flooring Sheets and Tiles

Plastic and rubber sheets have a tendency to break-down during storage. These shall be stored according to manufacturer's instructions.

4.18.1 The coolest store room available shall be utilized for the storage of rubber and plastic sheets and tiles. The store rooms where plastic and rubber sheets and tiles are stored shall be well-ventilated and direct light should not be allowed to fall on the plastic and rubber sheets.

4.18.2 Rubber and plastic sheets shall be stored away from electric generators, electric motors, switchgears and other such electrical equipment as they produce harmful odour in their vicinity.

4.18.3 Contamination with vegetable and mineral oils, greases, organic solvents, acids and their fumes, alkalis, dust, and grit, shall be prevented. Where greasy contamination occurs this shall be removed immediately with petrol and the sheet and

tile thoroughly wiped dry and dusted with chalk powder.

4.18.4 Undue stretch and strain, kink, sharp bends or folds shall be avoided. In case of long storage, the sheets shall be turned over periodically and treated with chalk powder, if necessary.

4.19 Glass Sheets

It is important that all glass sheets whether stored in crates or not shall be kept dry. Suitable covered storage space shall be provided for the safe storage of the glass sheets. In removing glass sheets from crates, great care shall be taken to avoid damages. The glass sheets shall be lifted and stored on its long edges against a vertical wall or other support with the first sheet so placed that its bottom edge is 25 mm from the vertical support. The stacks shall be of not more than 25 panes and shall be supported at two points by fillets of wood at 300 mm from each end. The whole stack shall be as close and as upright as possible.

The glass sheets of different sizes, thickness and type shall be stacked separately. The distance between any two stacks shall be of the order of 400 mm.

4.20 Glass Bricks/Blocks

These are generally supplied in crates. The crates shall be handled with care and stored on a platform in a room.

4.21 Cast Iron, Galvanized Iron and Asbestos Cement Pipes and Fittings

4.21.1 The pipes shall be unloaded where they are required, when the trenches are ready to receive them.

4.21.2 Storage shall be done on firm, level and clear ground and wedges shall be provided at the bottom layer to keep the stack stable.

4.21.3 The stack shall be in pyramid shape or the pipes length-wise and cross-wise in alternate layers. The pyramid stack is advisable in smaller diameter pipes for conserving space in storing them. The height of the stack shall not exceed 1.5 m.

4.21.4 Each stack shall contain only pipes of same class and size, with consignment or batch number marked on it with particulars of suppliers wherever possible.

4.21.5 Cast iron detachable joints and fittings shall be stacked under cover separately from the asbestos cement pipes and fittings.

4.21.6 Rubber rings shall be kept clean, away from grease, oil, heat and light.

4.22 Polyethylene Pipes

4.22.1 Natural polyethylene pipe should be stored under cover and protected from direct sunlight. However, black polyethylene pipes may be stored either under cover or in the open.

4.22.2 Coils may be stored either on edge or stacked flat one on top of the other, but in either case they should not be allowed to come into contact with hot water or steam pipes and should be kept away from hot surface.

4.22.3 Straight lengths should be stored on horizontal racks giving continuous support to prevent the pipe taking on a permanent set.

4.22.4 Storage of pipes in heated areas exceeding 27°C should be avoided.

4.23 Unplasticized PVC Pipes

4.23.1 The pipe should be given adequate support at all times. Pipes should be stored on a reasonably flat surface free from stones and sharp projections so that the pipe is supported throughout its length. In storage, pipe racks should be avoided. Pipe should not be stacked in large piles, especially under warm temperature conditions as the bottom pipes may distort, thus giving rise to difficulty in jointing. Socket and spigot pipes should be stacked in layers with sockets placed at alternate ends of the stacks to avoid lopsided stacks.

4.23.1.1 It is recommended not to store pipe inside another pipe.

4.23.1.2 On no account should pipes be stored in a stressed or bent condition or near the sources of heat.

4.23.1.3 Pipes should not be stacked more than 1.5 m high. Pipes of different sizes and classes should be stacked separately.

4.23.2 The ends of pipe should be protected from abrasion particularly those specially prepared for jointing either spigot or socket solvent welded joints or shouldered for use with couplings.

4.23.3 In tropical conditions, pipes should be stored in shade. In very cold weather, the impact strength of PVC is reduced making it brittle and more care in handling shall be exercised in wintry conditions.

4.23.4 If due to unsatisfactory storage or handling a pipe becomes kinked, the damaged portion should be cut out completely. Kinking is likely to occur only on very thin walled pipes.

4.24 Bitumen, Road Tar, Asphalt, etc

All types of bitumen, road tar, asphalt, etc, in drums or containers shall be stacked vertically on their bottoms in up to 3 tiers. Leaky drums shall be segregated. Empty drums shall be stored in pyramidal stacks neatly in rows.

4.25 Water

Wherever water is to be stored for construction purposes this shall be done in proper storage tanks to prevent any organic impurities getting mixed up with it.

4.26 Oil Paints

All containers of paints, thinners and allied materials shall preferably be stored in a separate room on floors with sand cushions. The room shall be well-ventilated and free from excessive heat, sparks of flame and direct rays of sun. The containers of paint shall be kept covered or properly fitted with lid and shall not be kept open except while using. The containers of paints have expiry date marked by the manufacturers, which should be highlighted so as to facilitate use of paint within due period.

4.27 Sanitary Appliances

All sanitary appliances shall be carefully stored under cover to prevent damage. When accepting and storing appliances, advance planning shall be made regarding the sequence of removal from the store to the assembly positions. Supporting brackets shall be so stored as to be readily accessible for use with the appliances.

4.28 Other Materials

Small articles like nails, screws, nuts and bolts, door and window fittings, polishing stones, protective clothing, spare parts of machinery, linings, packings, water supply and sanitary fittings, electrical fittings, insulation board, etc, shall be kept in suitable and properly protected store rooms. Valuable small material such as, copper pipes and fittings shall be kept under lock and key.

Table 1 Storage and Stacking Check List
(Clause 4.1)

| SI No. | Material/ Component | Base | | | Stack | | | | Type of Cover | | |
|--------|--|-------------------|------------|-----------|-------|-------|------|----------|---------------|------------------|------------|
| | | Firm Level Ground | Hard Floor | Off-Floor | Heaps | Tiers | Flat | Vertical | Open | Open but Covered | Under Shed |
| 1. | Cement | | | ✓ | | ✓ | | | | | ✓ |
| 2. | Lime | | | | | | | | | | |
| | a) Quick lime | | ✓ | | ✓ | | | | | ✓ | |
| | b) Hydrated lime | | | ✓ | | ✓ | | | | | ✓ |
| 3. | Stones and Aggregates | | | | | | | | | | |
| | a) Stones, aggregates, fly ash and cinder | ✓ | | | ✓ | | | | ✓ | | |
| | b) Veneering stones | ✓ | | | | ✓ | | ✓ | ✓ | | |
| 4. | Bricks and Blocks | ✓ | | | | ✓ | | | ✓ | | |
| 5. | Tiles | | | | | | | | | | |
| | a) Clay and concrete floor, wall and roof tiles | ✓ | | | | ✓ | ✓ | | ✓ | | |
| | b) Ceramic tiles | | ✓ | | | ✓ | ✓ | | | | ✓ |
| 6. | Partially Pre-fabricated Wall and Roof Components | | | | | | | | | | |
| | a) RC planks, pre-fabricated brick panels and ferro-cement panels | ✓ | | | | | | ✓ | ✓ | | |
| | b) Channel units, cored units and L-panels | ✓ | | | | ✓ | | | ✓ | | |
| | c) Waffle units, RC joists, single tee and double tee | ✓ | | | | | ✓ | | ✓ | | |
| 7. | Timber | | | ✓ | | ✓ | | | | | ✓ |
| 8. | Steel | ✓ | | | | | ✓ | | ✓ | | |
| 9. | Aluminium Sections | | ✓ | | | | ✓ | | | | ✓ |
| 10. | Doors, Windows and Ventilators | | ✓ | | | | | ✓ | | | ✓ |
| 11. | Roofing Sheets | | | | | | | | | | |
| | a) AC | ✓ | | | | ✓ | ✓ | | ✓ | | |
| | b) GI and Aluminium sheets | ✓ | | | | ✓ | ✓ | | | ✓ | |
| | c) Plastic sheets | | | ✓ | | ✓ | ✓ | | | | ✓ |
| 12. | Boards like Plywood, Particle Boards, Fibre Boards, Blockboards and Gypsum Board | | | ✓ | | ✓ | ✓ | | | | ✓ |
| 13. | Plastic and Rubber Flooring | | | | | | | | | | |
| | a) Sheets in rolls | ✓ | | | | | | ✓ | | | ✓ |
| | b) Tiles | ✓ | | | | ✓ | ✓ | | | | ✓ |
| 14. | Glass Sheets | | ✓ | | | | | ✓ | | | ✓ |
| 15. | Glass Bricks/Blocks | | ✓ | | | ✓ | | | | | ✓ |
| 16. | CI, GI and AC Pipes and Fittings | | | | | | | | | | |
| | a) Pipes | ✓ | | | | ✓ | ✓ | | ✓ | | |
| | b) CI and GI Fittings | | ✓ | | | | ✓ | | | | ✓ |
| | c) AC Fittings | | ✓ | | | | ✓ | | ✓ | | |

Table 1 — (Concluded)

| Sl No. | Material/ Component | Base | | | Stack | | | | Type of Cover | | |
|--------|--|-------------------|------------|-----------|-------|-------|------|----------|---------------|------------------|------------|
| | | Firm Level Ground | Hard Floor | Off-Floor | Heaps | Tiers | Flat | Vertical | Open | Open but Covered | Under Shed |
| 17. | Polyethylene Pipes | | | ✓ | | ✓ | ✓ | | | | ✓ |
| 18. | Unplasticized PVC Pipes | ✓ | | | | ✓ | ✓ | | ✓ | | |
| 19. | Bitumen, Road Tar, Asphalt, etc in Drums | ✓ | | | | ✓ | | | ✓ | | |
| 20. | Oil Paints | | ✓ | | | ✓ | | | | | ✓ |
| 21. | Sanitary Appliances | | | ✓ | | | ✓ | | | | ✓ |

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Construction Management Sectional Committee, CED 29

Chairman

SHRI HARISH CHANDRA

Members

MAJOR A. BHASIN

SHRI S. K. THAKRAL (*Alternate*)

CHIEF ENGINEER

EXECUTIVE ENGINEER (*Alternate*)

CHIEF ENGINEER

SENIOR ARCHITECT (*Alternate*)

CHIEF ENGINEER (BUILDING)

SHRI G. GAJAPATHI (*Alternate*)

CHIEF ENGINEER (CDO)

SUPERINTENDING ENGINEER (S&S) (*Alternate*)

SHRI R. D. DESAI

SHRI J. L. KAPUR (*Alternate*)

SHRI O. P. GOEL

SHRI O. P. GOEL

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SHRI S. R. KULKARNI

SHRI R. P. LAHIRI

DR J. M. MAHAJAN

COL B. B. SHARMA (*Alternate*)

MANAGING DIRECTOR

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SHRI S. C. MITTAL

SHRI K. R. RAMASWAMY (*Alternate*)

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SHRI S. P. SINGH (*Alternate*)

SHRI SUDDHODAN ROY

SHRI TARWINDER SINGH (*Alternate*)

SUPERINTENDING ENGINEER (BUILDINGS)

PROF KANTI SWAROOP

PROF A. V. CHATURVEDI (*Alternate*)

SHRI VINOD KUMAR

Director (Civ Engg)

Representing

Union Public Service Commission, New Delhi

Engineer-in-Chief's Branch, Army Headquarters, Ministry of Defence,
New Delhi

Maharashtra Housing & Area Development Authority, Mumbai

Kerala State Housing Board, Trivandrum

Public Works Department, Govt. of Tamil Nadu, Madras

Central Public Works Department, New Delhi

The Institution of Surveyors, New Delhi

In Personal Capacity (*B-II/8164, Vasant Kunj, New Delhi 110030*)

Institution of Engineers (India), Calcutta

National Institute of Construction Management and Research, Mumbai

Central Builder's Association, Delhi

Planning Commission, New Delhi

Hindustan Construction Co Ltd, Mumbai

M. N. Dastur & Co (P) Ltd, Calcutta

In Personal Capacity (*I-1891, Chitranjan Park, New Delhi 110019*)

Indian Institution of Industrial Engineering, Mumbai

National Building Construction Corporation Ltd, New Delhi

Engineers India Ltd, New Delhi

National Productivity Council, New Delhi

U. P. State Housing Board, Lucknow

Public Works Department, Delhi Administration, New Delhi

Calcutta Port Trust, Calcutta

In Personal Capacity (*J-1374, Palam Vihar, Distt. Gurgaon 122017*)

Central Building Research Institute, Roorkee

Hindustan Prefab Ltd, New Delhi

Public Works Department, Govt. of Maharashtra, Mumbai

Indian Institute of Public Administration, New Delhi

Director General, BIS (*Ex-officio Member*)

Member Secretary

SHRI SANJAY PANT

Deputy Director (Civ Engg), BIS

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