



## IMPROVED METHOD OF BRICK LAYING

### Introduction

Brick laying is one of the oldest building craft and brick work even today is a major item constituting over one fifth of the building cost. Although, rationalised design procedure resulting in economy has been evolved for brickwork, little attention has been paid to the method of brick laying which takes about 1/3rd of the brickwork cost. It is left to the brick-layer himself to work in his own way and thus the age-old traditional method of brick laying, utilising a few tools and implements, is being followed. A considerable time is consumed in delays caused by supplying and stacking bricks simultaneously with brick laying, intermittent process of applying mortar and laying bricks, checking plumb for every brick at the ends and openings, wrapping string over a brick and adjusting it to each course. The brick layer spends 46, 35 and 19 per cent of his time in picking and applying mortar, picking and laying bricks, and carrying out plumb and string operations respectively.

An improved method of brick laying has been developed at Central Building Research Institute, Roorkee which is mainly based on the use of new gadgets viz., end-frames and a string holder. Besides, the new method carries recommendations for a well organised work place layout to minimise the delays mentioned above. Lastly, the sequence of brick layer's hand operations has been re-arranged

to obtain rhythmic movement pattern and better utilisation of his left hand.

### New Gadgets

#### *End Frames*

These are meant to replace the existing process of plumbing and stringing the wall. Recommended in two sizes, these provide uprightness and alignment of the wall, when fixed in plumb and line on to or at the wall. The taller one (Fig. 1) is to be used for brickwork upto lintel level and is always positioned on the ground/floor, as the case may be. The shorter one (Fig. 2) is to be fixed on to the wall when masonry is built above lintel level. This is fixed with the help of certain accessories (Fig. 3) which enable it to hang on to the wall.

Both end-frames are made of timber having a finished thickness of 25 mm. Respective heights of the two end frames are 2.0 m and 1.25 m. Width of the end-frames is equal to the thickness of the wall and in general three sizes, viz half brick, one brick, and one and a half bricks, may be required. A base board (1,2 B) is fixed to the vertical timber member (1,2 A) to make it stable. To maintain the verticality of the end-frame, the vertical timber member and base board are stiffened with two angle-iron pieces (1,2 C) running from top to the end of the base board. Depending upon the average thickness of bricks and the horizontal

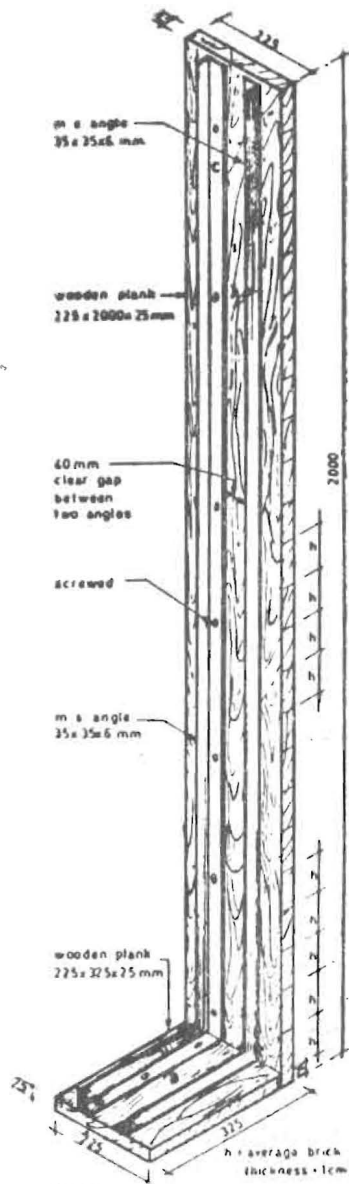


FIG 1  
END FRAME (Taller)

mortar joint, lines for the course levels are marked on the end-frame along its thickness. Care should, however, be taken to leave an extra 2.5 cm margin initially, for the first course mark at the bottom of the end-frame. This enables the brick-layer to adjust the top edge of the string-holder to the course-marks.

#### String Holder

Used as a pair, the string holder is shown in Fig. 4 (a & b). It is made of timber in the form of 'L'. It is 50 mm high and the lengths of the two flanges are 50 mm and 35 mm. The shorter flange

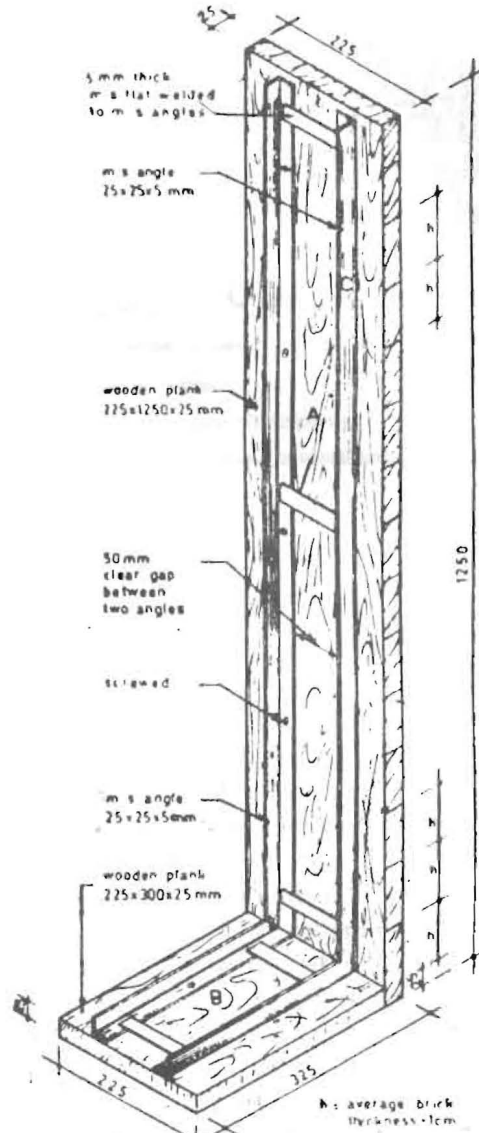
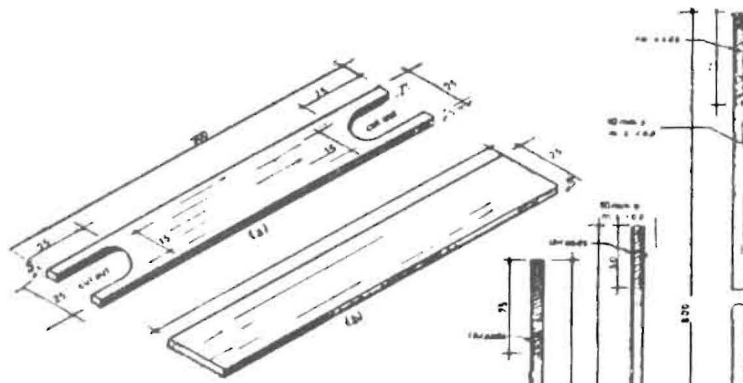


Fig 2 END FRAME (shorter)

has 1 mm deep groove in the centre on the inner side to position the thread. On the outer face, it has two screws projecting out by about 5 mm to which the brick layer's thread is tied. The longer flange has a slit in the centre, 2 mm wide and 40 mm long, to allow the thread to pass through it.

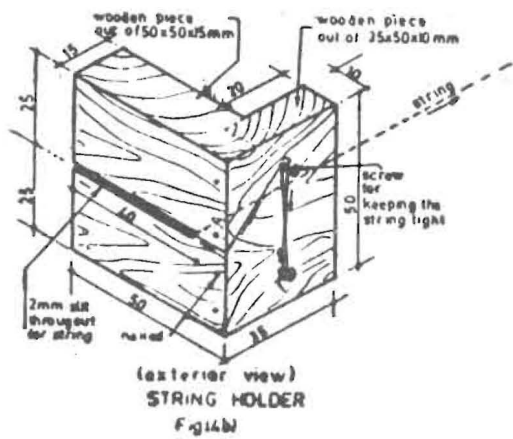
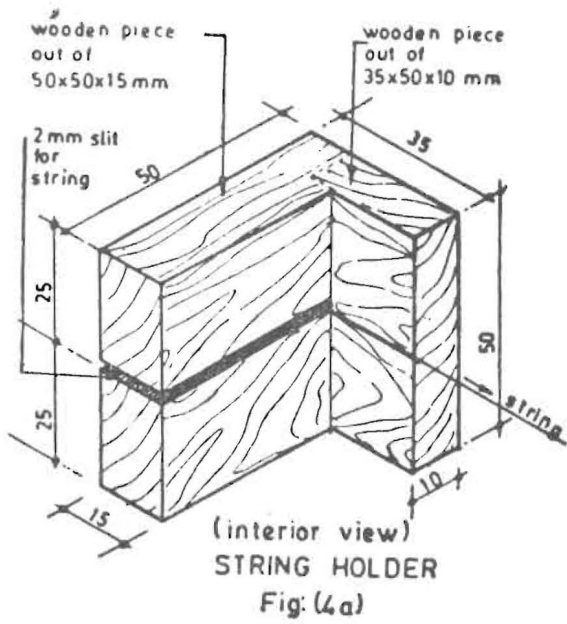
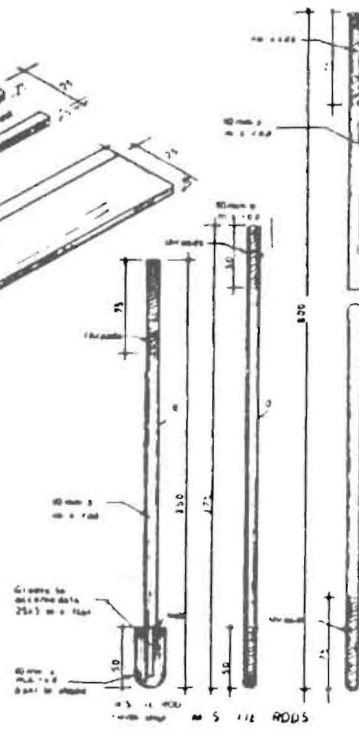
#### Mortar Board

For storage of mortar and to maintain its continuous supply during brick laying. Timber boards of  $500 \times 500 \times 25$  mm are used in lieu of metal pans. These are placed on bricks to keep them at a higher level. The flat board eliminates the interference in brick layers' hand motions by the elevated sides of the metal-pan.



H.S. FLATS  
for  
FRAME AND WALL

Fig 3.  
ACCESSORIES FOR FIXING  
THE SHORTER END-FRAME



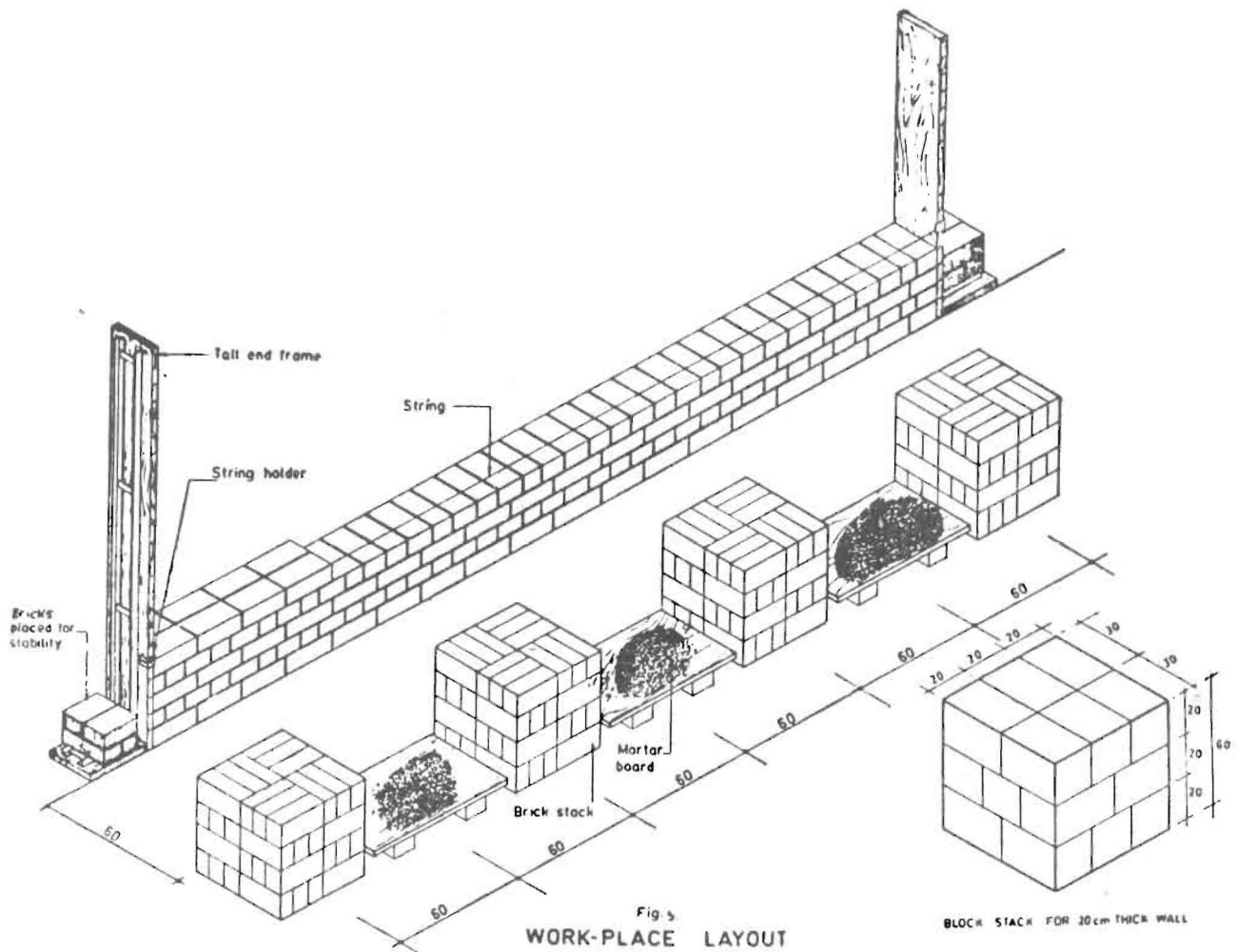


Fig. 5  
WORK-PLACE LAYOUT

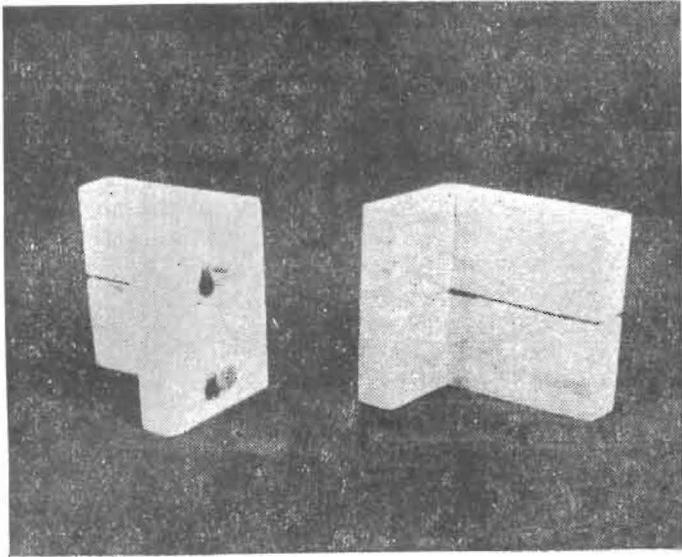
BRICK STACK FOR 20cm THICK WALL

### Layout of the Work Place

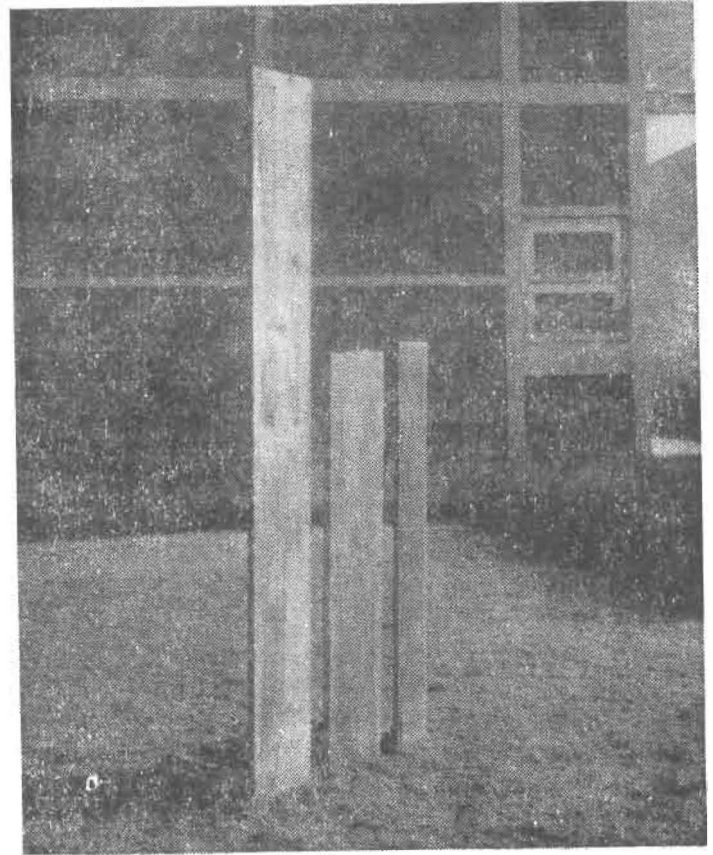
General layout arrangement of the work place is shown in Fig. 5. Bricks and mortar boards are placed in alternate positions at about 50 cm centres along the wall length to be constructed, at a distance of 50-60 cm from the wall surface to allow free movement of the brick layer. Bricks are stacked in groups of 12 bricks, placed on edge for easy grip of the brick-layer, to a height of about 50 cm to roughly match with the quantity of bricks required for laying at one time. This arrangement of stacking bricks and placing mortar boards along the wall should be made before the brick-layers start laying bricks. It is preferable to presoak the bricks to be stacked. However, wetting of stacked bricks can also be done. Mortar is supplied on mortar boards continuously as the work proceeds.

### Fixing Brick Laying Gadgets

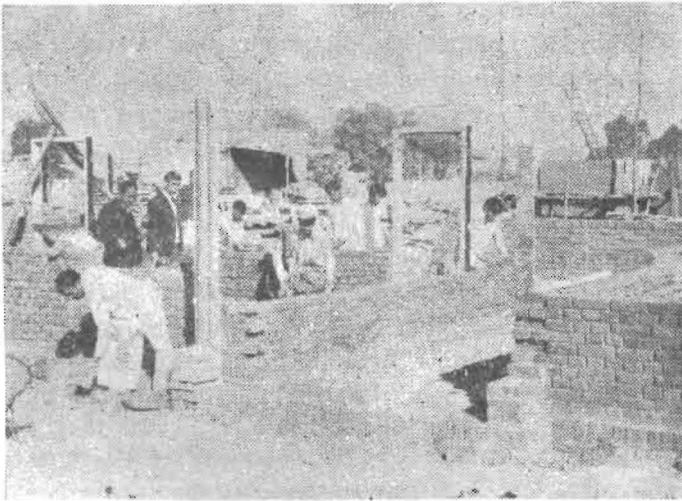
For better results the gadgets should be fixed at appropriate positions in advance in the evening, for the following day's work. A first class mason should be deployed to do the job. As a matter of fact, one skilled mason can head a group of about eight second class brick-layers, working in four teams of two each. He looks after the shifting and fixing of gadgets for them. This of course, would need a bit of advance planning of brickwork. On smaller works, where only two or four masons are engaged at a time, they themselves can be entrusted with the responsibility of fixing the gadgets. Alternatively, the more or most skilled of them may be retained to do the needful towards the evening for which he is paid extra. However, if this kind of arrangement is not possible, each team of two



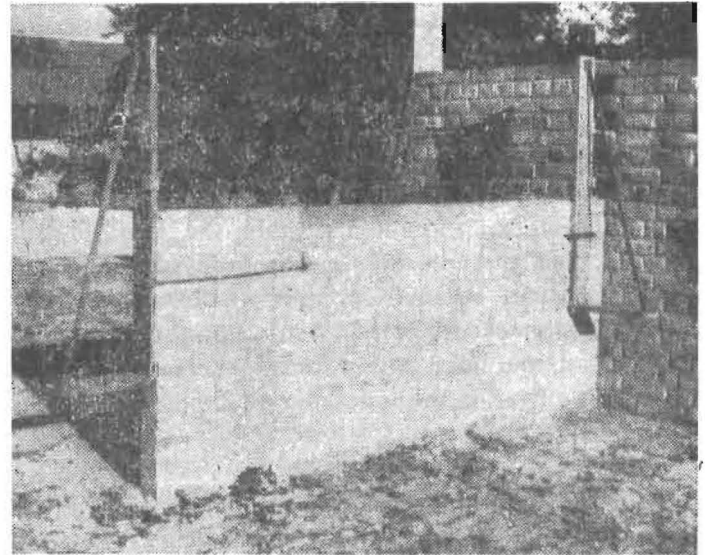
String-Holders



End-Frames



Gaders in use on a construction site



Gadgets in use for T-Junction  
Photographs Showing Gadgets & their-use

masons may independently fix gadgets for own use in the morning and when required subsequently.

Taller end-frames are to be preferred for doing brickwork upto lintel level. For this, these can be positioned on ground/floor. If the end-frames fall short by a small margin of one or two courses to serve upto lintel level, these can be re-fixed with a brick pad beneath them. The shorter ones are used for masonry beyond lintel level. These can also be fixed at stopped ends of window openings when window-frames are not being fixed with the construction of masonry wall. The following explains the manner of fixing the two types of end-frames in different situations of walling that may be met with in a building.

#### Fixing the Taller end-frames

These are placed on even ground/floor at wall ends/corners or at crosses. The course mark is adjusted in line with the course to be laid and the end frames brought to plumb. Afterwards, adequate counter weight of bricks is put on the base-boards so that these remain steadfast in that position.

#### Fixing the shorter end-frames

These are to serve for brickwork beyond lintel level. As such, these are hung on the wall by mechanical means. For this, a pair each of M.S. flat (3a) and the rod (3c) are used. One of the flats is placed in one of the vertical joints of the masonry already built, at a distance of about 65 to 70 cm from the position of end-frame. The other one is held at the back of the end frame, at about the same or a little higher level than that of the flat placed in the wall, as required for adjusting the course mark on the end-frame with the level of the brick course to be laid. Then, the two tie-rods are passed through the end-grooves of the flats and tightened by fly-nuts and washers. Finally, the end-frames are checked for uprightness and alignment, and fixed in that position. These are suitable to be fixed in the following positions.

#### At end or corner of wall :

In these positions, as there is free access, on both sides of the wall, to the m.s. flat placed in the wall-joint for the tie rods, the fixing of end frames is carried out as described above (Fig. 6).

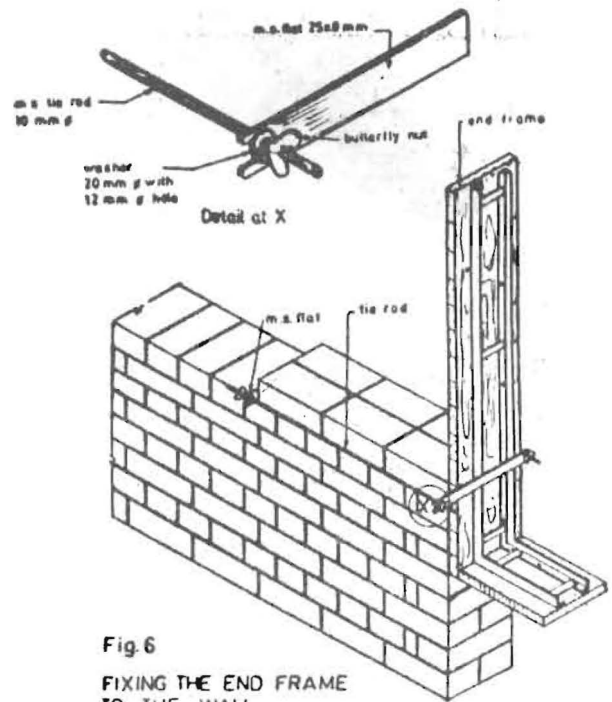


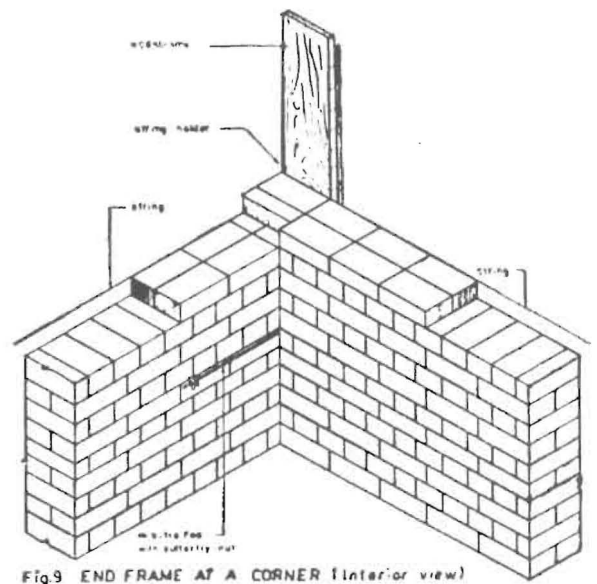
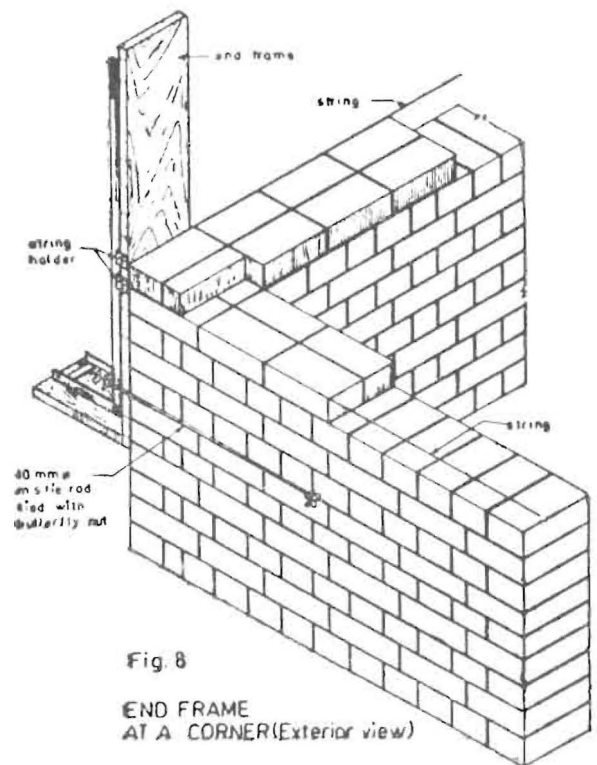
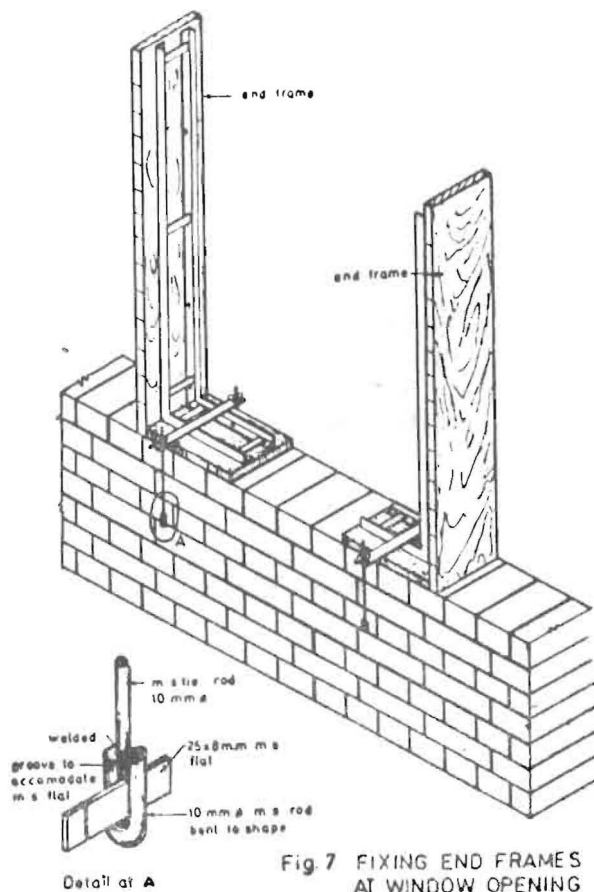
Fig. 6  
FIXING THE END FRAME  
TO THE WALL

#### At openings for doors and windows.

In case frames for doors and windows are not erected while building the wall, these openings need plumbing operation for each brick at the jambs. To reduce the plumbing time in such cases, end-frames are fixed at door and window openings as shown in fig. 7. Here the end-frames are fixed by 10 mm dia. m.s. tie rods fixed to mild steel flat (3a) placed on the base board and the other one (3b) placed in brick joint in one of the courses below the still level. It is preferable to provide a loop at lower end of the m.s. tie rod (3e) and threads at the upper end. The end frames fixed at door and window openings can also take string holders on to them, in case the brick-layers build the wall in part lengths.

#### For building cross walls simultaneously :

At building sites, usually teams of two brick layers each, work simultaneously on several walls. When two walls at a corner are to be built simultaneously, it is possible to build them using only one end frame at the corner as shown in Figs. 8 & 9. The important consideration is that the two walls should not be built at the same course level at a time. Instead, the wall having the end frame



parallel to its length should be built ahead, by at least one course, of the other wall facing the end frame at right angles.

This is essential to permit stringing with two cross threads using the same end-frame. In Fig. 9 it can be seen that the corner does not impose any difficulty in fixing the end-frame as 10 mm dia m.s. tie rod can be easily passed through mortar joint thickness.

At T-junction of walls :

In buildings there are longitudinal walls and cross walls. Generally, for bonding the cross wall, some teeth are left in the longitudinal walls. For building the cross wall, end-frames are fixed parallel to the wall length at a distance of about 15 cm from either junction using the m.s. flat (3a) and tie rod (3d). In Fig. 10 it is shown that the cross wall has been stopped at an opening enabling the end-frame to be fixed at the end abutting its width. In case there is no opening and the cross wall is solid, the end-frame can be fixed at both ends, parallel to the length of the wall as explained above.

### Method of Working

To break the joints in brick masonry, cut bricks are required in alternate courses at the ends/corners. It is recommended that the brick-layer cuts approximately the required number of bricks and stores the same at the end/corner stacks of bricks, rather than cutting brick each time when needed.

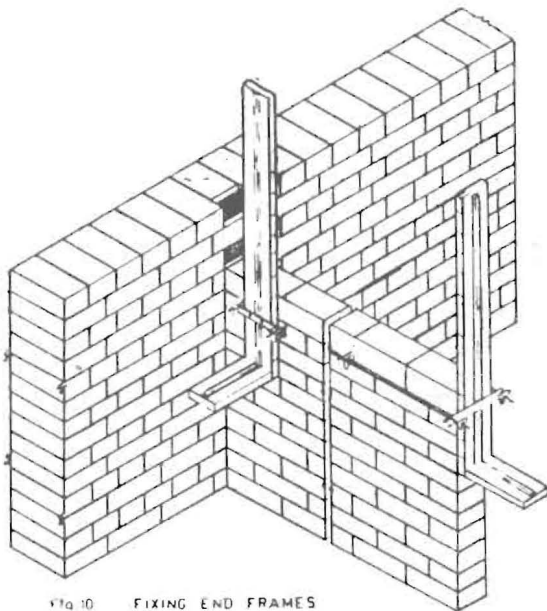


FIG. 10. FIXING END FRAMES FOR BUILDING THE CROSS WALLS

Afterwards, the end-frames are fixed at corners and other openings as per requirement, if these have not already been fixed the previous evening. String holders are then positioned at the appropriate course level and thread kept in line. Brick laying operations are then carried out as described below :

#### *Spreading Mortar*

Bricklayer picks up mortar on the trowel in right hand from the mortar board at one end and unloads it on the wall. The picking and unloading of mortar is carried out at a stretch by him moving forward for a length of about a meter or so (to place 8-10 bricks) at a time. Then while moving backward, he spreads the mortar to level in a continuous stroke of the trowel. The deposition of mortar on longer length and spreading it in one stretch makes the brick layer develop speed.

#### *Laying Bricks*

Having levelled the mortar bed, he turns towards the brick-stack. He picks up a brick by left hand, mortar on trowel by right hand almost simultaneously and carries both brick and mortar on to the wall. He lays the brick in line of the thread and presses it in position and while doing so, the mortar is also applied on the vertical face of the brick: The operation of picking up brick and mortar and laying them simultaneously is followed for laying 8-10 bricks in a cycle. Before proceeding to lay the

next cycle, the surplus mortar protruding from the horizontal joint is scraped off in a single stroke of the trowel.

The operation of 'spreading mortar' and 'laying bricks' is repeated in the same way. These two operations are continued till the entire course length is completed. Afterwards the string holders are shifted to the next course mark by simple push. These operations of mortar and brick laying are continued in this sequence for subsequent courses. This sequence of working develops a smooth flowing rhythm leading to faster laying without causing undue fatigue.

#### **Productivity**

In laboratory trials on test panels, brick layer laid 273 bricks per hour working with this method against 192 bricks per hour with the traditional method. The brick layer spent 47, 48 and 5 percent of his time in applying mortar, laying bricks, and plumbing and stringing. The utilisation of brick layer's left hand increased from 40 to 67 percent. In field trials where only the gadgets viz. end-frames and string-holders were used without observing the recommended layout and the sequence of operations, an average increase of 26 to 30 percent in the brick layer's output was recorded.

#### **Conclusions**

Both laboratory and field trials have shown that there is substantial increase in productivity by adoption of this method. Improved site layout viz. stacking bricks and mortar alternately and prestacking bricks as well as unloading mortar on mortar board eliminate delays, minimise leads, and removes hindrance in picking up mortar by the brick-layer. Labour gangs also perform the job efficiently as a standard method of well defined duties is followed.

Making the brick layer lay bed mortar on larger stretches of wall length, about one meter or so at a time, and combining the laying of brick and applying mortar together, help in developing a smooth flowing rhythm, which increases speed without causing undue fatigue. Left hand of brick-layer is better utilised, each joint is properly mortar-filled which is very much desirable for masonry strength.



The new gadgets replace the traditional time consuming mode of plumbing and stringing. The end-frames reduce the plumbing required for bricks at stopped ends or openings to a bare minimum and also control the course levels in the entire masonry work in a building. The string-holders enable quick shifting of the thread to the next course level and provide adequate tension to the thread. The gadgets are simple to fabricate. Number of gadgets required at a site depends on the plan of the building and the number of brick laying gangs employed. String-holders can independently be used for filler brick walls in framed buildings by fixing them directly on R.C. columns already built. This method is equally applicable for work on scaffolding. When the bricks and mortar are stacked at a level about 0.5 m higher than where the brick layer stands, there is considerable increase in output as the leads are reduced and the bending posture for picking the bricks is eliminated. It is suggested that double deck scaffolding for single storey work or unit frame scaffolding for multistorey work, developed at the Institute, be used.

Another positive aspect of this method is that requirement of supervision and level of brick layers' skill is much reduced. The gadgets provide for an

in-built check on quality. Once the gadgets have been fixed to line and plumb by skilled mason, brick layers are not required to use much skill in laying bricks. This is quite a redeeming feature considering prevailing scarcity of good masons in the country.

The brick layers need to be initially trained to use the gadgets before they can acquire efficiency in brick-laying. It is suggested that this method may be introduced in Industrial Training Institutes for fresh brick-layers and refresher courses be organised for existing brick layers.

These gadgets can also be conveniently used for construction of stone masonry block walling. Their use will ensure similar advantages viz. higher productivity and better quality.

### Economics

Taking an increase of minimum 25 percent in brick-layers' output, there would be a saving of about 5 per cent in brick masonry item or one per cent in building cost (excluding services). With proper training of brick layers in the improved method, an increase of upto 40 percent in their productivity can be achieved effecting even greater economy.

Printed at :

Anubhav Printers & Packers, Roorkee

Reprinted Copies—1500

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Published by :

Central Building Research Institute,  
Roorkee, (U.P.) INDIA

May, 1991