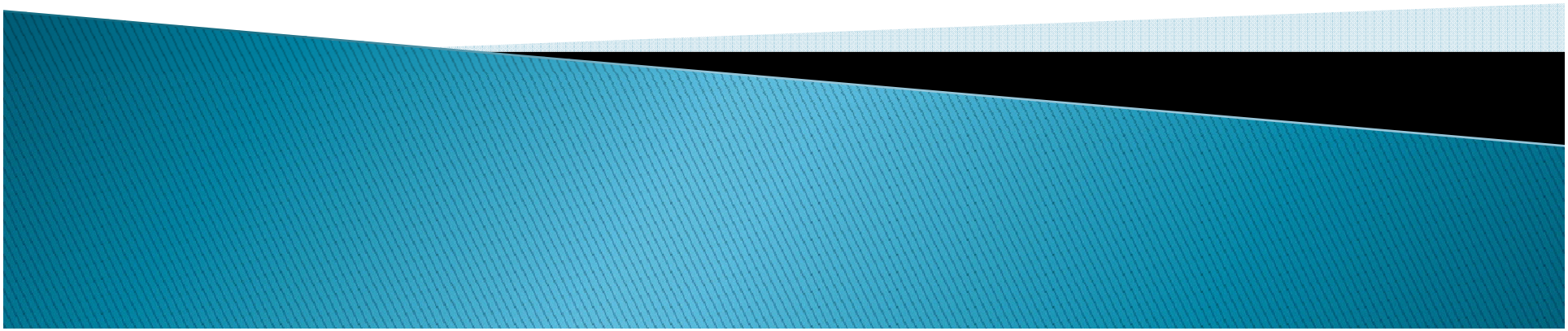
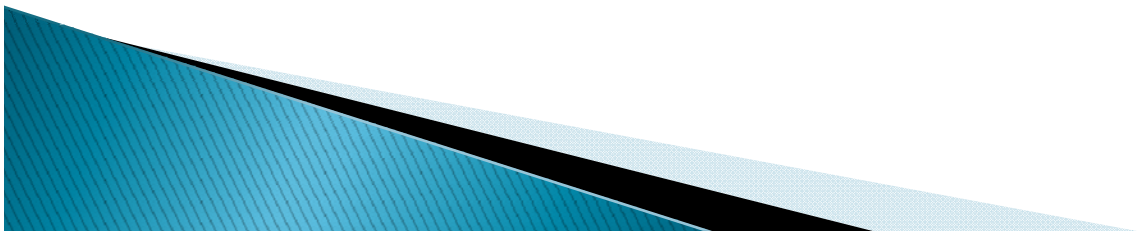
UNIT–4
ROOFS AND FLOORS



FACTORS ON WHICH FLOOR SELECTION DEPENDS

THE FLOOR SHOULD BE:

- DURABLE
- EASY TO CLEAN
- NOISELESS
- GOOD APPEARANCE
- FREE FROM DAMPNESS
- FIRE-RESISTANCE
- LOW MAINTENANCE COST
- ECONOMICAL



TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION

1. MUD FLOORING
2. MURAM FLOORING
3. BRICK FLOORING
4. FLAG STONE FLOORING
5. TILED FLOORING
6. CEMENT CONCRETE FLOORING
7. GRANOLITHIC FLOORING
8. TERRAZO FLOORING
9. MOSAIC FLOORING
10. MARBLE FLOORING
11. TIMBER FLOORING
12. ASPHALT FLOORING
13. RUBBER FLOORING
14. LINOLEUM FLOORING
15. ACID PROOF FLOORING

(1) **MUD FLOORING**- THEY ARE CHEAP, HARD, FAIRLY IMPERVIOUS, EASY IN CONSTRUCTION AND EASY IN MAINTENANCE. THEY REMAIN WARM IN WINTER AND COLD IN SUMMER. UPON THE PREPARED BED, A 25cm THICK LAYER OF SELECTED MOIST EARTH IS EVENLY SPREAD OUT AND IS RAMMED WELL SO AS TO GET A CONSOLIDATED THICKNESS OF 15cm.

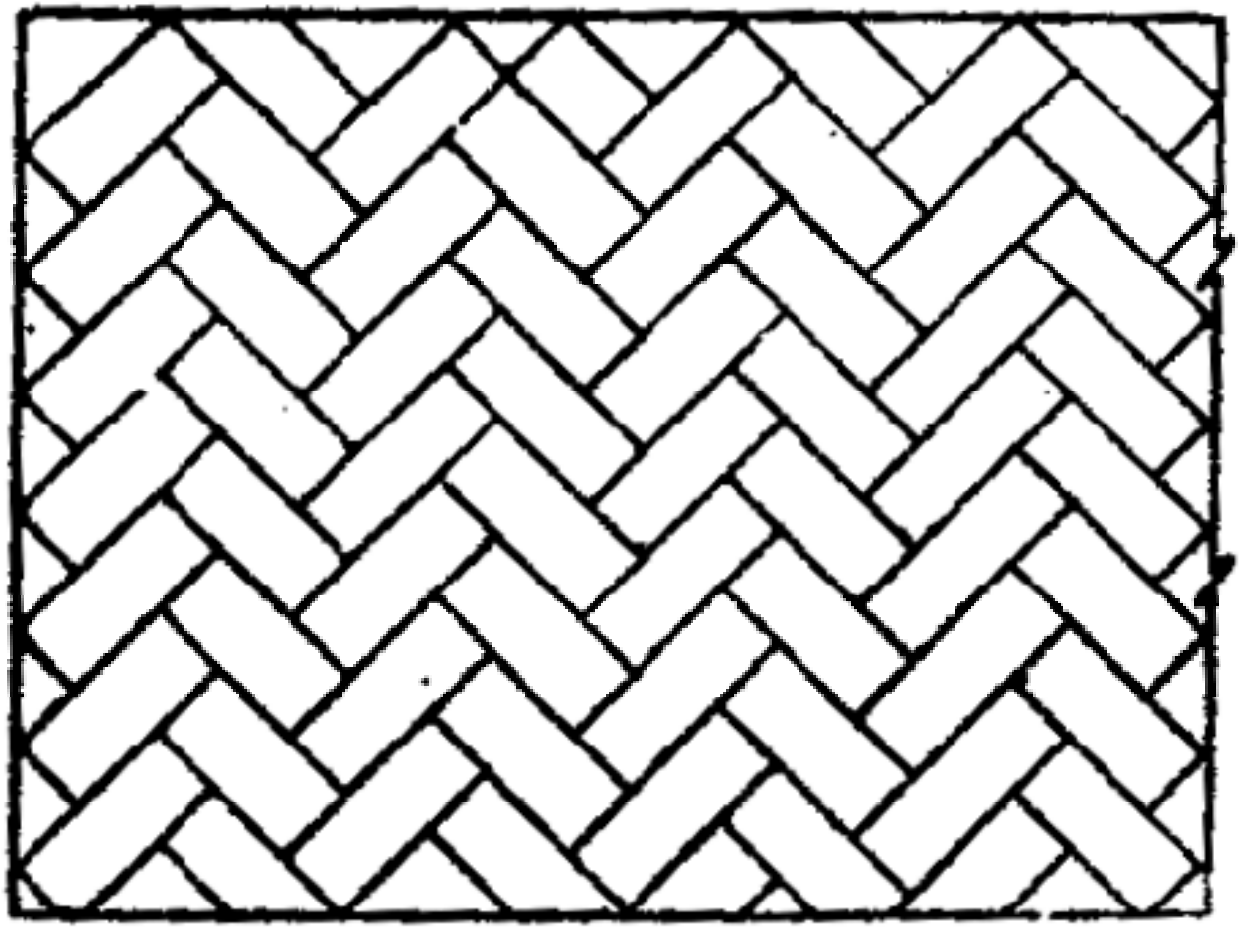
(2) **MURAM FLOORING**- THEY HAVE THE SAME ADVANTAGES AS THAT OF MUD-FLOORS. UPON THE PREPARED SUBGRADE A 15cm THICK LAYER OF MURAM IS LAID. A 25mm OF POWDER MURAM IS SPREAD OVER THE ALREADY LAID MURAM LAYER AND WATER IS SPRINKLED OVER THE ENTIRE SURFACE. THE SURFACE IS THEN RAMMED WELL. THEN THE SURFACE IS TRAMPLED WELL TILL THE CREAM OF MURAM RISES TO THE TOP. THE SURFACE IS LEFT FOR A DAY AND THEN IS RAMMED AGAIN FOR THREE DAYS . THE DRY HARD SURFACE THUS FORMED IS SMEARED WITH A THICK COAT OF COW-DUNG AND RAMMED AGAIN FOR TWO DAYS IN THE MORNING. FINALLY THE SURFACE IS FINISHED WITH A CEMENT COW-DUNG PLASTER (1:4).

(3) **BRICK FLOORING**- COMMONLY PROVIDED IN WAREHOUSES, STORES, GODOWNS WHERE HEAVY ARTICLES ARE STORED. THIS FLOORING MAY BE DONE WITH BRICK LAID FLAT OR ON EDGE ARRANGED IN HERRING-BONE FASHION OR SET AT RIGHT ANGLES TO THE WALLS. A SUBGRADE OF 10 TO 15cm THICK LAYER OF CEMENT OR LIME CONCRETE WITH A SLOPE IS LAID ON PREPARED BED. PRIOR TO USE THE BRICKS ARE PROPERLY SOAKED AND WETTED IN WATER. THE BRICKS ARE LAID ON EDGE ON 12mm THICK MORTAR BED IN SUCH A MANNER THAT ALL JOINTS ARE FULL OF MORTAR. FLOORING IS CURED FOR 7 DAYS MINIMUM BEFORE USE.

MERITS:- DURABLE; SUFFICIENTLY HARD; CHEAPER THAN CEMENT CONCRETE, WOODEN OR MOSAIC FLOORING; NON-SLIPPERY; EASILY REPAIRABLE.

DEMERITS:- ABSORBENT.

Herring Bone Bond



(4) **FLAG-STONE FLOORING**- THE SANDSTONE SLAB FOR FLOORING MAY BE SQUARE OR RECTANGULAR WITH WIDTH NOT LESS THAN 38cm AND THICKNESS VARYING FROM 20 TO 40mm. THE SUBGRADE IS PREPARED BY LAYING A 10 TO 15cm THICK LAYER OF LIME CONCRETE OVER A PREPARED BED. ON THIS SUBGRADE, WELL-WETTED FLAG-STONES ARE LAID ON 20 TO 25mm THICK LAYER OF BED MORTAR. A SLOPE OF 1:40 IS GIVEN FOR DRAINAGE.

MERITS:- HARD, DURABLE, RESISTANT TO WEAR AND TEAR, EASY IN CONSTRUCTION AND REPAIR, ECONOMICAL IF STONES QUARRY ARE NEAR BY.

DEMERITS:- DOES NOT GIVE A PLEASING APPEARANCE, USAGE IS NOT COMFORTABLE.

Double Flagstone floor

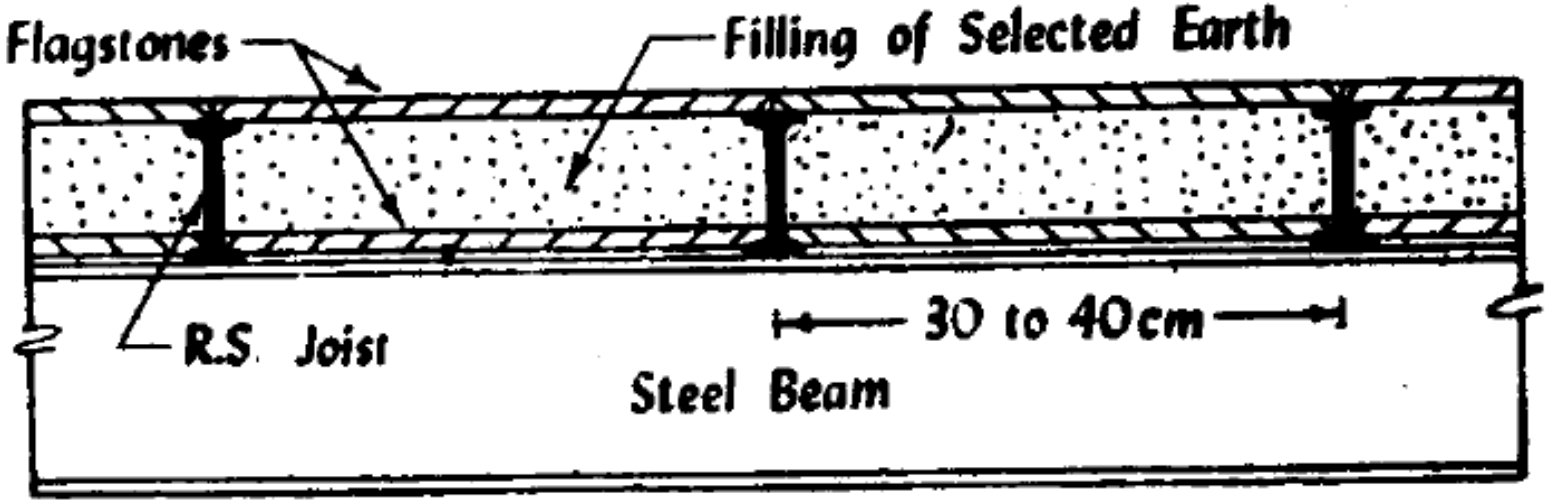


Fig 12.6 Double Flagstone floor

(5) **TILED FLOORING-**

(1) **TERRAZZO FLOORING**- PRIOR TO LAYING TILES, 30mm THICK LAYER OF LIME MORTAR (1:3) IS SPREAD OVER THE SUBGRADE TO SERVE AS BEDDING AND IS LEFT FOR A DAY. THEN CEMENT SLURRY IS SPREAD OVER THE BED AND TILES ARE THEN FIXED OVER THE SLURRY GROUT. EACH TILE IS GENTLY TAPPED WITH A WOODEN MALLET TILL IT IS PROPERLY BEDDED AND LEVELLED. NEXT DAY ALL THE JOINTS ARE CLEANED BY WIRE BRUSH. THE JOINTS ARE THEN GROUTED WITH CEMENT SLURRY OF SAME SHADE AS TILES. THE FLOORING IS CURED FOR 7 DAYS AND THEN SURFACE IS GROUND WITH GRINDING MACHINE. FINALLY THE SURFACE IS MADE CLEAN BY OXALIC ACID WATER. TILES ARE AVAILABLE IN 200 X 200 X 22mm, 250X250X22mm AND 300X300X22mm.

(2) **CHEQUERED TILE FLOORING**– CHEQUERED TILES ARE AVILABLE IN THE FOLLOWING STANDARD SIZES:

(I) 200X200X22mm

(II) 250X250X22mm

(III) 300X300X22mm

THE METHOD OF LAYING TILE IS IDENTICAL TO THAT OF TERRAZO TILE FLOORING EXCEPT THAT THE POLISHING IS DONE BY HAND.

TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION CONTD…

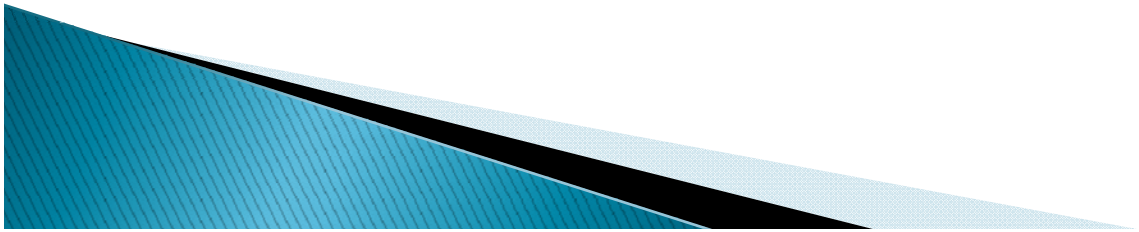
(3) **GLAZED TILE FLOORING**: GLAZED TILES ARE AVAILABLE IN THE FOLLOWING STANDARD SIZES: 100X100X5mm, 150X150X5mm. THE TILES HAVE ONLY TOP SURFACE GLAZED AND ARE LAID OVER HARD SURFACE OF CONCRETE OR R.C.C. SLAB. A 10mm THICK LAYER OF CEMENT MORTAR OF 1:3 IS SPREAD OVER THE SUBGRADE TO SERVE AS BEDDING. THE MORTAR IS ALLOWED TO HARDEN AND THEN CEMENT SLURRY IS SPREAD OVER THE BEDDING MORTAR AND THE TILES ARE THEN FIXED OVER THE SLURRY GROUT. THE JOINTS ARE AS THIN AS POSSIBLE.

TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION CONTD…

(4) **P.V.C. TILED FLOORING**– THESE ARE AVAILABLE IN VARIETY OF SHADES AND DESIGN. ADHESIVE OF SPECIFIED MAKE IS APPLIED ON THE PREPARED BASE AND ON THE BACK OF THE P.V.C TILES WITH THE HELP OF A NOTCHED TROWEL. LAYING OF TILE COMMENCE WHEN THE ADHESIVE HAS SET SUFFICIENTLY. AFTER LAYING, THE TILES ARE PRESSED SUITABLY WITH WOODEN ROLLERS TO ENSURE INTIMATE CONTACT WITH THE BASE. EXTRA ADHESIVE THAT OOZES OUT IS WIPED OFF AND THE FLOORING IS FINALLY CLEANED WITH WARM SOAP WATER BEFORE USE.

MERITS OF TILED FLOORING: – NON-ABSORBENT, EASILY REPAIRABLE, PLEASANT APPEARANCE, DURABLE, PERMITS QUICK LAYING, RESISTANT TO WEAR AND FAIRLY GOOD STRENGTH.

DEMERITS: COSTLY IN CONSTRUCTION AND MAINTENANCE, TERRAZO TILE AND GLAZED TILE FLOORING BECOMES SLIPPERY WHEN WET.



TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION CONTD…

(6) **CEMENT CONCRETE FLOORING**–

(i) **PREPARATION OF SUB-BASE**– THE EARTH FILLING IN PLINTH IS CONSOLIDATED THOROUGHLY SO AS TO ENSURE THAT NO LOOSE POCKETS ARE LEFT. THEN 10 TO 15cm THICK LAYER OS COARSE SAND IS SPREAD. THE LAYER IS CONSOLIDATED AND GIVEN A SLOPE.

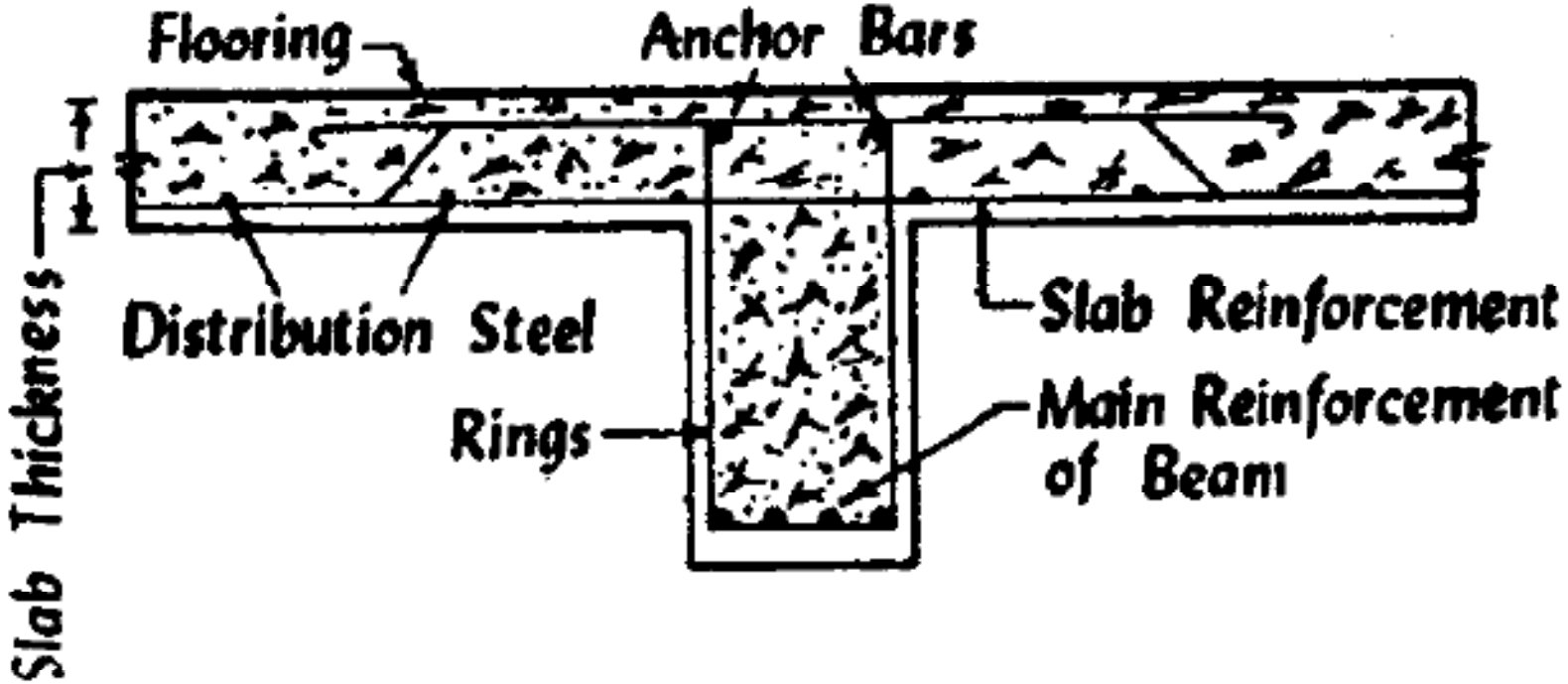
(ii) **LAYING OF BASE CONCRETE**– IN CEMENT CONCRETE, MIX USED IS 1:5:10 (1 CEMENT: 5 SAND: 10 COARSE AGGREGATE 40mm NOMINAL SIZE) TO A THICKNESS 7.5 TO 10cm. LIME CONCRETE (1:2) MAY BE USWED WITH 40mm AGGREGATES.

(iii) **LAYING AND TOPPING**– WHEN THE BASE CONCRETE LAYER HAS FULLY SET, ENTIRE AREA IS DIVIDED INTO RECTANGULAR OR SQUARE PANELS BY 4mm THICK GLASS STRIPS. THE SURFACE OF BASE CONCRETE IS MADE DAMP AND APPLIED A LAYER OF CEMENT SLURRY AND THEN CONCRETE MIX(1:2:4) IS LAID IN REQUIRED THICKNESS IN ONE OPERATION IN THE PANELS. THE CONCRETE IS SPREAD EVENLY BY USING A STRAIGHT EDGE AND SURFACE IS TAMPED AND FLOATED WITH WOODEN FLOATS TILL THE CREAM OF MORTAR COMES AT TOP. FLOORING IS CURED FOR 10 DAYS BEFORE USE.

MERITS:– NON-ABSORBENT, DURABLE, SMOOTH AND PLEASING IN APPEARANCE, ECONOMICAL, GOOD WEARING PROPERTIES AND CAN BE MAINTAINED CLEAN.

DEMERITS:– CANNOT BE SATISFACTORILY REPAIRED, DEFECTS CANNOT BE RECTIFIED EASILY

R.C.C. Floor


Flooring
Anchor Bars
Slab Thickness
Distribution Steel
Rings
Slab Reinforcement
Main Reinforcement of Beam

TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION CONTD...

(7) **GRANOLITHIC FLOORING**– IT IS A FINISHED COAT PROVIDED OVER THE CONCRETE SURFACE TO FORM A HARD, DURABLE AND RESISTANT TO WEAR FLOORING. IT IS COMPOSED OF CEMENT, SAND AND SPECIALLY SELECTED AGGREGATES OF BASALT AND LIMESTONE SUITABLY GRADED FROM 13mm TO 40mm. THE CONCRETE MIX IS USUALLY 1:1:2 OR 1:1:3 AND IS LAID BEFORE THE BASE CONCRETE IS SET. THE SURFACE IS TAMPED, FLOATED AND SMOOTHENED.

TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION CONTD…

(8) **TERRAZO FLOORING**– TERRAZO IS A CONCRETE SURFACE WITH SPECIAL AGGREGATE OF MARBEL CHIPS MIXED WITH WHITE OR COLOURED CEMENT IN 3:1 PROPORTION. THE 40mm THICK FLOORING CONSISTS OF 6mm THICK LAYER OF TERRAZO TOPPING AND 34mm THICK UNDER LAYER OF CEMENT CONCRETE 1:2:4. PRIOR TO LAYING FLOORING, THE WHOLE AREA IS DIVIDED INTO SUITABLE PANELS BY USE OF DIVIDING STRIPS MADE FROM COPPER, GLASS, BRASS OR ALUMINIUM OF THICKNESS NOT LESS THAN 1.5mm AND WIDTH NOT LESS THAN 25mm. THE AGGREGATES ARE EXPOSED BY GRINDING THE SURFACE BY CARBORUNDUM STONE GRADE NO. 60, 120 AND 320 IN A SUCCESSIVE GAP OF 5 DAYS EACH. THE FINISHED SURFACE IS FINALLY WASHED WITH DILUTE OXALIC ACID SOLUTION.

TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION CONTD...

(9) MOSAIC FLOORING- OVER THE HARD BASE CONCRETE BED, A 5cm TO 6cm THICK LAYER OF LIME SURKHI MORTAR IS SPREAD IN A SMALL AREA ON WHICH FLOORING CAN BE EASILY COMPLETED WITHOUT THE MORTAR GETTING DRY. ON THIS A LAYER OF PASTE CONSISTING OF TWO PARTS OF SLAKED LIME, ONE PART OF POWDERED MARBLE AND ONE PART OF PUZZOLANA IS LAID IN THICKNESS NOT EXCEEDING 3mm. THE SURFACE IS LEFT TO GET DRY FOR FOUR HOURS. TILES OR MARBLE PIECES CUT TO THE DESIRED SHAPES ARE THEN HAMMERED ON THIS SURFACE IN THE DESIRED PATTERN. ROLLING IS DONE BY LIGHT STONE ROLLER TILL THE MARBLE PIECES ARE CEMENTED TOGETHER. THE SURFACE IS DRIED AND THEN POLISHED BY PUMICE STONE.

TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION CONTD...

(10) **MARBLE FLOORING**– THE THICKNESS OF MARBLE SLABS VARY FROM 20mm TO 40mm. THE FLOORING IS LAID ON PREPARED SUBGRADE OF CONCRETE. A LAYER OF BEDDING CEMENT MORTAR (1:4) IS SPREAD IN 20mm THICKNESS UNDER THE AREA OF EACH SLAB. THE MARBLE SLAB IS LAID ON TOP OF THE BEDDING MORTAR, PRESSED AND TAPPED WITH WOODEN MALLET. THE JOINT BETWEEN TWO SLABS IS VERY FINE. THE PAVED AREA IS CURED FOR A MINIMUM PERIOD OF SEVEN DAYS.

TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION CONTD…

(11) **TIMBER FLOORING**– IN HILLY AREAS WHERE THE CLIMATE IS DAMP AND WOOD IS EASILY AVAILABLE, WOODEN FLOORS PROVE ECONOMICAL. THESE ARE ALSO USED FOR DANCING HALLS, AUDITORIUM ETC. PREVENTION OF DAMPNESS IS OF GREAT IMPORTANCE. THE ENTIRE AREA OF GROUND BELOW THE FLOOR IS COVERED WITH A 15cm LAYER OF CEMENT CONCRETE (THIS LAYER IS CALLED SITE OR OVERSITE CONCRETE). TIMBER FLOORS CONSIST OF BOARDING SUPPORTED ON TIMBER JOISTS WHICH ARE NAILED TO WALL PLATES AT THEIR ENDS AND SUPPORTED BY INTERMEDIATE WALLS CALLED SLEEPER OR DWARF WALLS 10cm THICK ALONG THEIR LENGTH. LONGITUDINAL TIMBER MEMBERS CALLED SLEEPER PLATES ARE FIXED ON TOP OF SLEEPER WALLS. TIMBER JOISTS ARE FIXED TO THE SLEEPER WALL PLATES. A D.P.C LAYER IS PROVIDED IMMEDIATELY BELOW THE WALL PLATES TO PREVENT THE RISING OF DAMPNESS. THE HOLLOW SPACE BETWEEN THE FLOORING AND OVERSITE CONCRETE IS KEPT DRY AND FULLY VENTILATED.

TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION CONTD…

(12) **ASPHALT FLOORING**- THE CONSTRUCTION OF FLOOR INVOLVES THE FOLLOWING OPERATIONS:
(a) PREPARATION OF MASTIC ASPHALT- ASPHLAT IS HEATED AND CLEAN SHARP SAND IS ADDED IN 2:1 PROPORTION (2 PARTS OF SAND: 1 ASPHALT).
(b) LAYING OF THE PREPARED MASTIC ASPHALT- IT IS POURED ON THE PREVIOUSLY PREPARED CONCRETE BED IN UNIFORM THICKNESS 13mm TO 25mm.

MERITS: DUSTLESS, ELASTIC, DURABLE, WATER PROOF, ACID PROOF, ATTRACTIVE IN APPEARANCE, NON-SLIPPERY AND NOISELESS.

TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION CONTD…

(13) **RUBBER FLOORING**– RUBBER SHEETS OR TILES ARE MADE BY COMBINING AT VERY HIGH TEMPERATURE PURE RUBBER WITH COTTON FIBER, GRANULATED CORK, ASBESTOS FIBER, OTHER GLUES AND COLOR PIGMENTS. THE RUBBER TILES ARE LAID BY GLUEING THEM TO A SMOOTH AND CLEAN DRY BASE BY SPECIAL ADHESIVE. BASE MAY BE OF CONCRETE, R.C.C. OR WOOD.

MERITS: DURABLE, NOISELESS, CLEAN, COMFORTABLE.

DEMERITS: EXPENSIVE IN INITIAL COST, OIL OR GREASE MAKES IT SLIPPERY.

TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION CONTD…

(14) **LINOLEUM FLOORING**- LINOLEUM IS PREPARED BY MIXING OXIDISED LINSEED OIL WITH POWDERED CORK, WOOD FLOOR, VARIOUS TYPES OF GUMS AND SUITABLE COLORING PIGMENTS. THE PLASTIC MASS THUS OBTAINED IS PRESSED IN DESIGNED FORM AND DRIED IN OVENS. IT IS AVAILABLE IN PLAIN AND PRINTED FORM. MOSTLY AVAILABLE IN ROLLS 1.8 TO 3.6m IN WIDTH AND 6mm THICKNESS. IT CAN BE LAID BY SPREADING THE ROLL LOOSE ON DRY AND SMOOTH FLOOR, BY PINNING DOWN THE ENDS OF THE LINOLEUM COVERING THE FLOOR BELOW, BY FIXING THE LINOLEUM TO THE FLOOR BY ADHESIVE.

MERITS: WASHABLE, DUST PROOF, NOISELESS, CUSHIONING EFFECT, DECORATIVE FLOOR FINISH, ECONOMICAL.

DEMERITS: NOT RECOMMENDED IN BASEMENT FLOORS.

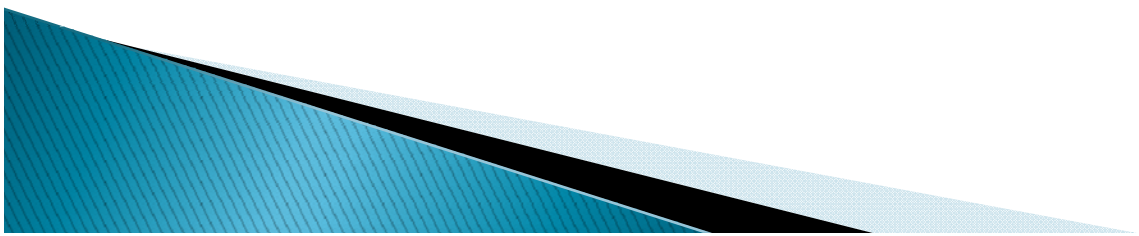
TYPES OF FLOORS FOR GROUND FLOOR CONSTRUCTION CONTD...

(15) **ACID-PROOF FLOORING**- ASPHALT BLOCKS MADE BY MOULDING UNDER HIGH PRESSURE A MIXTURE OF INERT CRUSHED ROCK AGGREGATE AND AN ACID PROOF ASPHALT SUCCESSFULLY MEET THE REQUIREMENTS OF AN ACID-PROOF FLOORING. THE ASPHALT BLOCKS ARE FIRST LAID ON THE HARD BASE AND THEN ACID PROOF ASPHLAT IS UNIFORMLY SPREAD OVER THE SURFACE OF THE BLOCK. BEFORE THE LIQUID ASPHALT HARDENS, FINE SAND IN SMALL QUANTITY IS UNIFORMLY SPREAD AND THE SURFACE IS FINISHED SMOOTH AND LEVELLED.

USE: IN CHEMICAL LABORATORIES AND PLANTS WHERE ACIDS ARE USED OR MANUFACTURED.

TYPES OF FLOORS FOR UPPER FLOOR CONSTRUCTION

(1) TIMBER FLOOR
(2) TIMBER FLOORS SUPPORTED ON ROLLED STEEL JOISTS
(3) FLAG STONE FLOORS RESTING ON STEEL JOISTS
(4) JACK ARCH FLOORS
(5) REINFORCED CEMENT CONCRETE FLOORS
(6) RIBBED FLOORS
(7) PRE-CAST CONCRETE FLOORS



Features of Timber Floors

- **Floor Boards**: These boards are provided at the top of bridging joists and they form the wearing surface of the floor. The width varies from 100mm to 200mm and thickness varies from 20mm to 40mm. The thickness may be changes when a floor subject to heavy traffic from 60 to 80mm. The floor boards are joined and widened by any suitable joint as shown in the figure
- **Floor Ceilings**: To make the underside of the floor flat and to

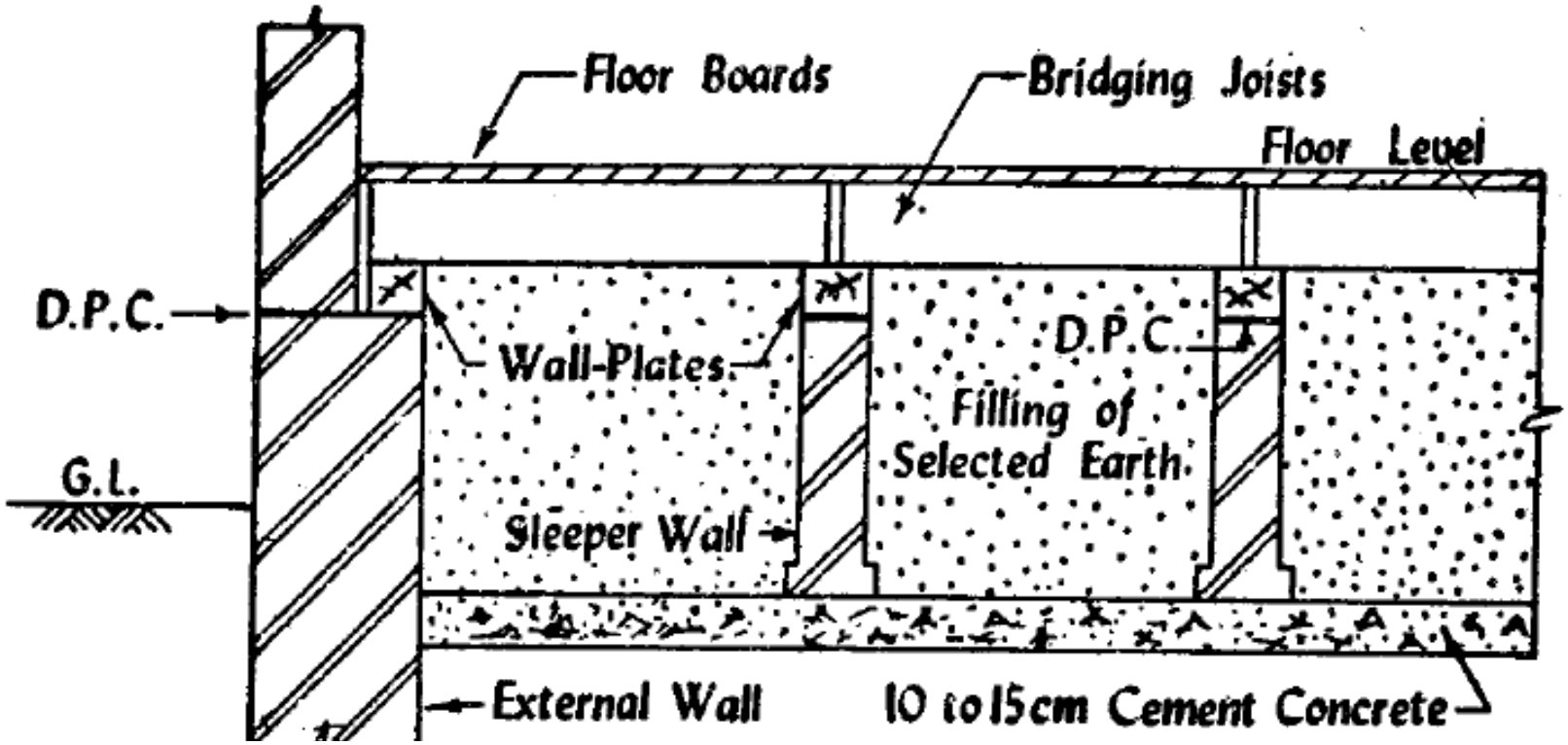
improve the appearance as a whole, ceilings may be provided rest on bridging joists or binders. The ceilings may consists of plaster boards or sheets of asbestors cement or some suitable material. In order to make ceilings strong and durable, ceiling joists may be provided at right angles to the bridging joists or the binders.

- **Pugging**: In order to make the timber floor sound proof, pugging may be resorted. Pugging plaster is a mixture of chopped straw and mortar. Insulating boards supporting on fillets are provided and hallows space between the floorboards and the insulating boards is filled up with the pugging plaster
- **Trimming**: When openings are to be provided in wooden floors, it is clear that bridging joists will not rest on the walls. In such cases, the process of trimming is required. Trimming joist support one or two trimmer joists to which trimmed joists are fixed. The trimming joists and trimmer joists have slightly greater section than bridging joists Fig. shows a wooden floor with stair well.
- **Use of steel sections**: Binders and girders of wooden floor can be replaced by mild rolled steel joists. The only precaution to be taken in this case would be to encase the R.S.J. by concrete so as to prevent rusting of R.S.J. The use of steel section makes the floor light and economical.

Basement or ground floor of timber

- In auditorium, to carry out dances or dramas timber floors are constructed on ground floor.
- Sleeper walls, which may be of one-half brick or one brick thickness, are constructed at centre to centre distance of 1.20m to 1.80m.
- Wall-plates are provided along the wall as well as along the sleeper walls and they reduce the spans of the building joists and serve as end supports for the bridging joists.
- On wall-plates rest the ends of bridging joists, which are usually provided at a centre to centre distance of about 30 cm.
- Finally, floor boards are provided to finish up the floor. The details are as shown in fig

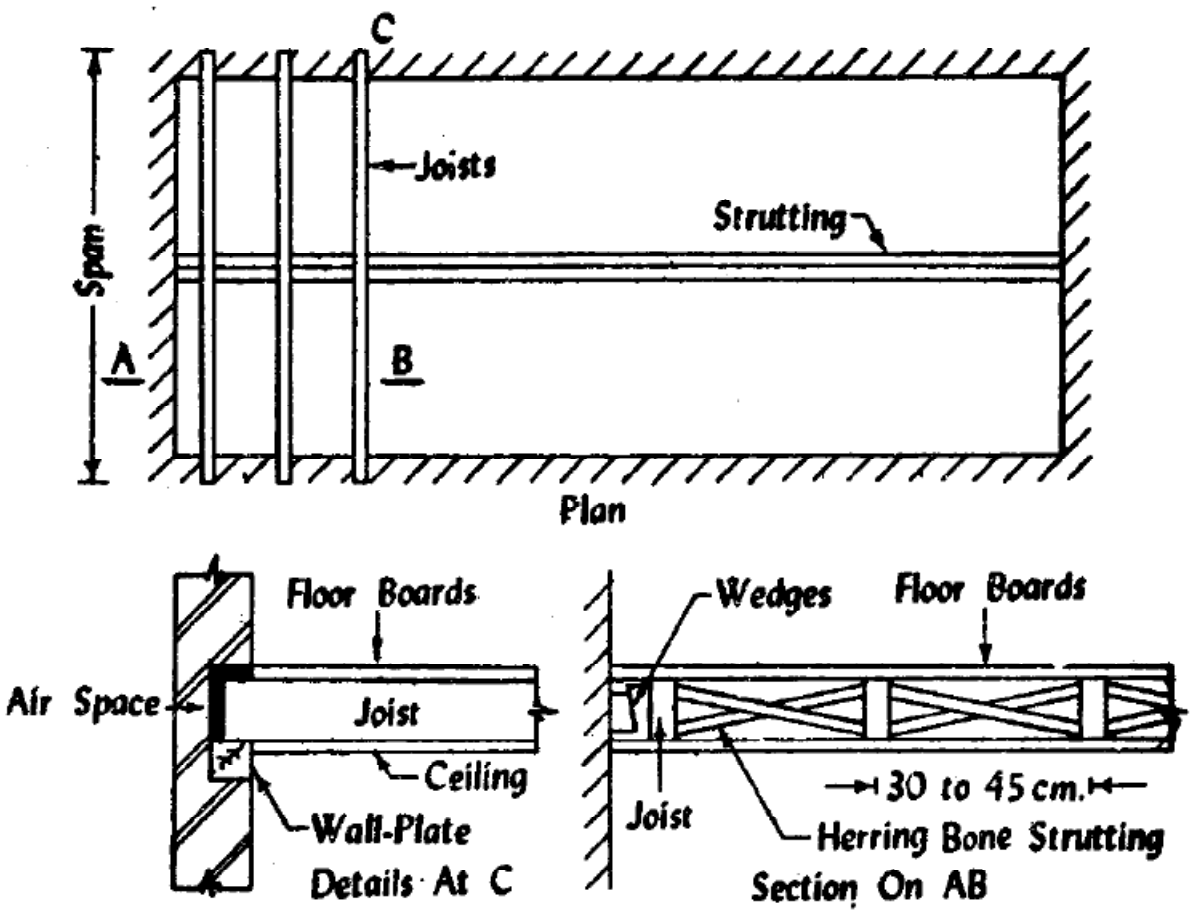
Basement or ground floor of timber



Single Joist timber floor

- These floors consist of single joist, which are placed below the floorboards.
- The joists are usually placed at a centre to centre distance of 30cm to 45cm.
- The joists are supported on wall-plates at their ends. A space of about 50mm is kept for the circulation of air as shown in fig.
- Single joist timber floor can be adopted for a maximum span of about 3.6m.
- When the span of joist exceeds 2.4m, it becomes necessary to strengthen the joist by providing bearing bone strutting.
- In this arrangement, inclined timber pieces are firmly fixed between the joists and the ends of these struts are nailed to the joist.
- At the end, wedges are provided between the wall and the joists.

Details of single joist timber floor

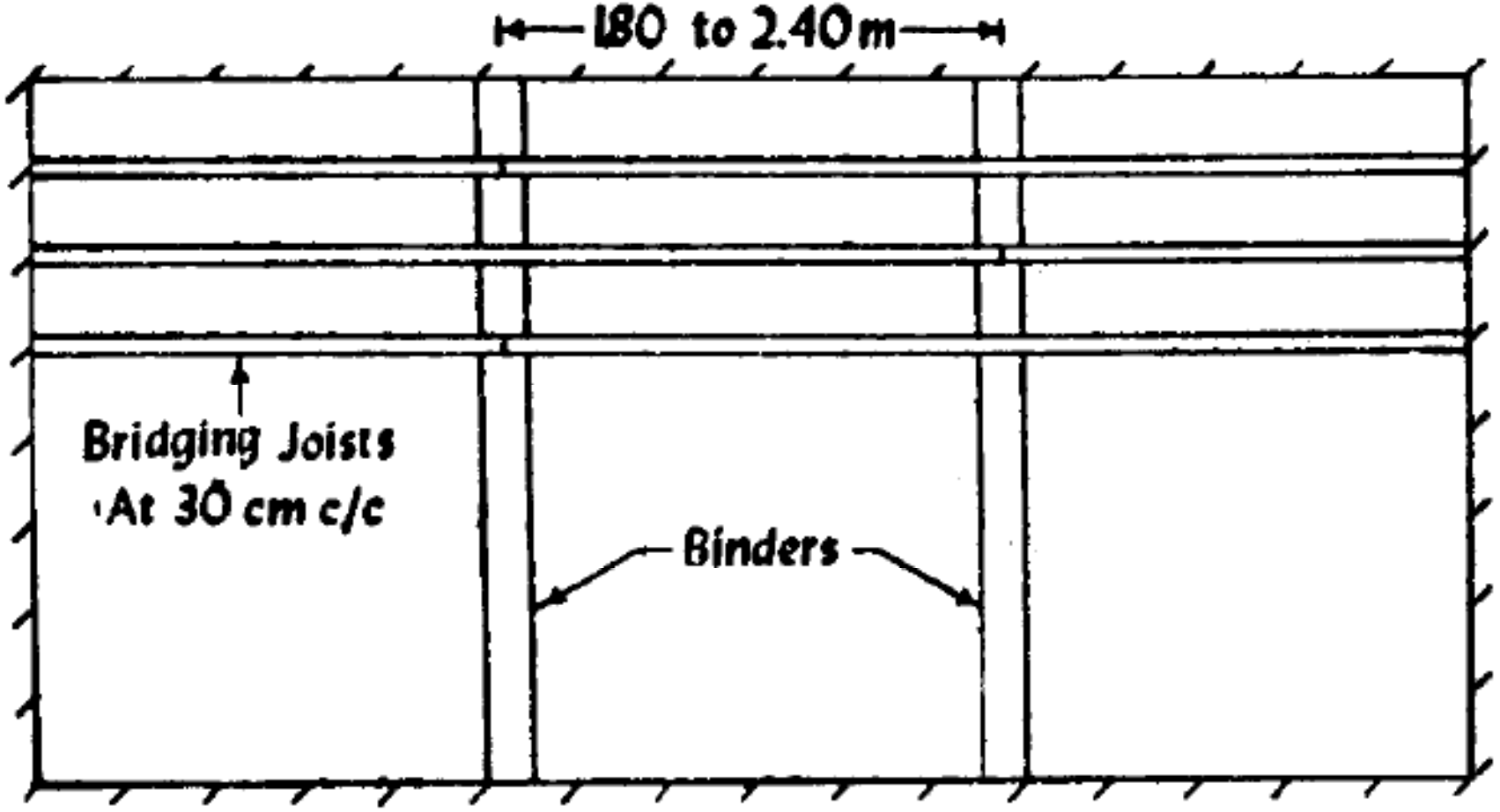


Double joist timber floors

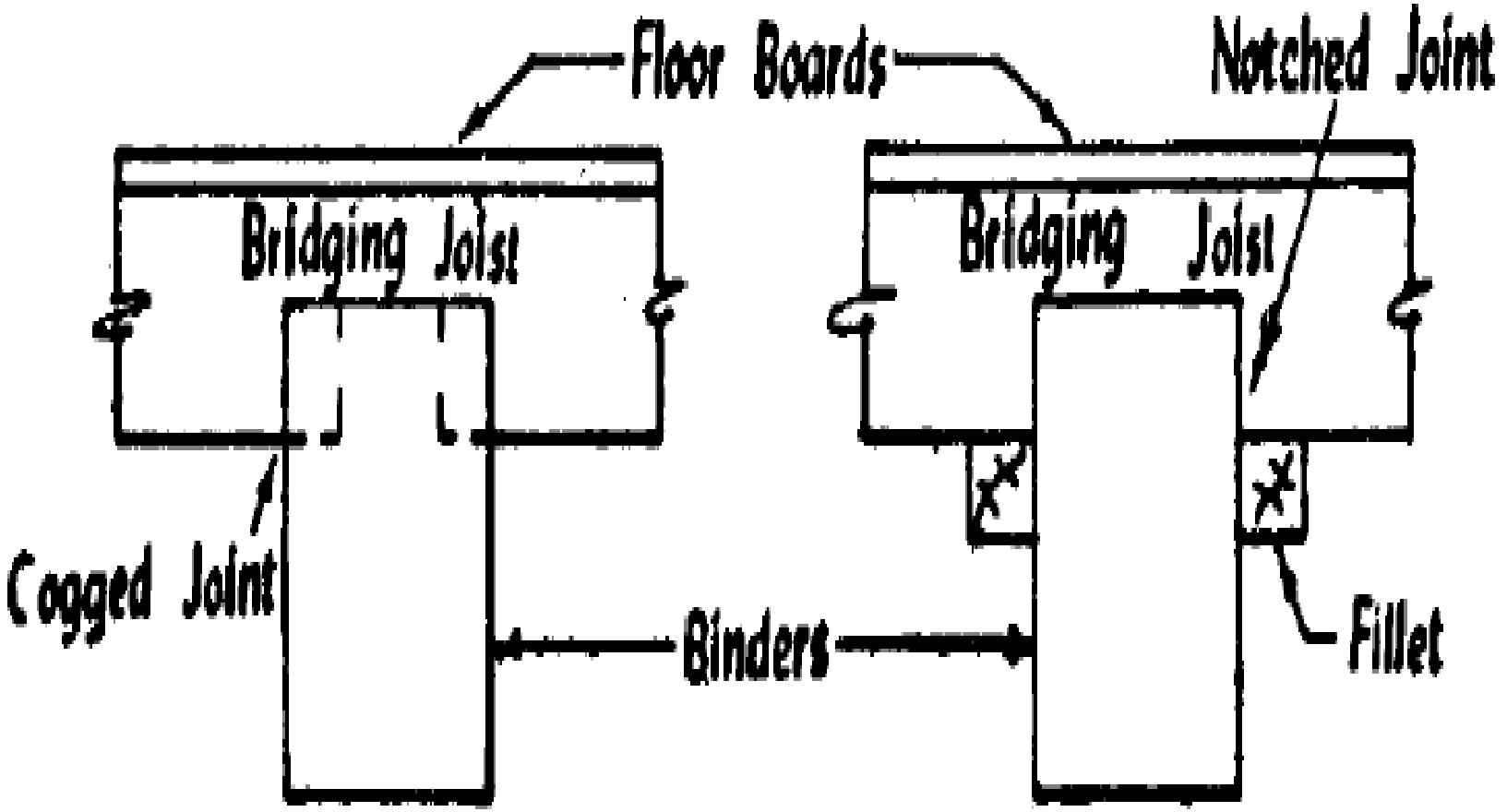
- In this type of floors, intermediate supports known as binders, are provided for bridging joists. Binders are generally placed at a centre to centre distance of 1.80m to 2.40m as shown in fig .The ends of binders rest on wooden or stone blocks.
- Double joist timber floors are stronger than the single joist timber floors.
- They prevent the passage of sound in better way and they are suitable for spans of 3.60 to 7.50m.
- This type of floors has following disadvantages.

(i) The weight of floor is thrown on few points in a wall.

(ii) Depth of floor is increased by the use of binders and accordingly height of the room is decreased.



Plan of double joist timber floor



Methods of fixing binders with joists

Framed or triple joist timber floor

- In this type of floors, intermediate supports, known as girders , are provided for the binders. Thus, this type of floor consists of girders, binders, bridging joists and floor boards as shown in fig . Girders are generally placed at a centre to centre distance of 3 metres. Binders are staggered and connected to girders by tusk and tenon joints. Alternatively, the ends of binders are supported on the iron stirrups, which are fixed to the girders. The ends of girders rest on walls on stone or concrete templates. This type of timber floor is suitable for spans greater than 7.50.

Details of framed timber floors