

ANJUMAN COLLEGE OF ENGINEERING & TECHNOLOGY
SADAR,NAGPUR
FIFTH SEMESTER
SUBJECT:-BUILDING CONSTRUCTION & MATERIAL

DEPARTMENT OF CIVIL ENGINEERING

...Unit-IV

Floors and Roofs : Floors : General principals, types and method of construction, floors finished quality, testing floor tiles, synthetic & Ceramic Tiles.

Roofs : Flat and pitches roofs, roof coverings, types AND their constructional features. Thermal Insulation

Floors: General Principals, types and method of construction, floors finished quality, testing floor tiles, synthetic & Ceramic Tiles

In order to sub-divide the portion between the plinth level or basement level and roof level, the solid construction are carried out. These constructions are known as the floors and the exposed top surface of floors are termed as the floorings. The ground floors or basement floors which directly rest on the ground do not required the provision of a floor . But they are provided with suitable type of floors covering or simply flooring. The other floors of each storey above the ground level are known as the *upper floors* .

The major problem of ground and basement floors are damp exclusion and thermal insulation. The moisture is generally present in the ground and unless suitable measures are taken to prevent its entry ,it will pass into the building through floor. On the other hand, the problem of strength and stability are relatively of less important for ground and basement floors because full support from the ground is available at all the points.

The major problem of upper floors are the strength and stability as they rest on walls, beams etc. And also those of sound insulation and fire resistance . the problem of damp resistance for the upper floors is usually of minor significance.

Types of floors

The floors are classified into two categories

- 1) Timber floors
- 2) Composite floors

The choice of a particular type of floors should be made while considering the factors such as span, maximum load likely to come on the floor, speed required in construction, materials and labour available ,present and future use of the building etc.

Timber floors

In this type of floor, only timber is used as a material. Following are the types of timber floors:

- 1) Basement or ground floor of timber

ANJUMAN COLLEGE OF ENGINEERING & TECHNOLOGY
SADAR, NAGPUR
FIFTH SEMESTER
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DEPARTMENT OF CIVIL ENGINEERING

- 2) Single joist timber floors
- 3) Double joist timber floors
- 4) Framed or triple joist timber floors

❖ **Basement or ground floor of timber:-** in auditoriums to carry out dances or dramas, the timber floors are constructed on the ground floor. The details of construction of such floors . the 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. the wall-plates are provided along the wall as well as along the sleeper walls and they reduce the span of the bridging joist and serve as end supports for the bridging joist. On wall-plates rest ends of the bridging joist which are usually provided at a centre to centre distance of about 300mm. finally the floor boards are provided to finish up the floor.

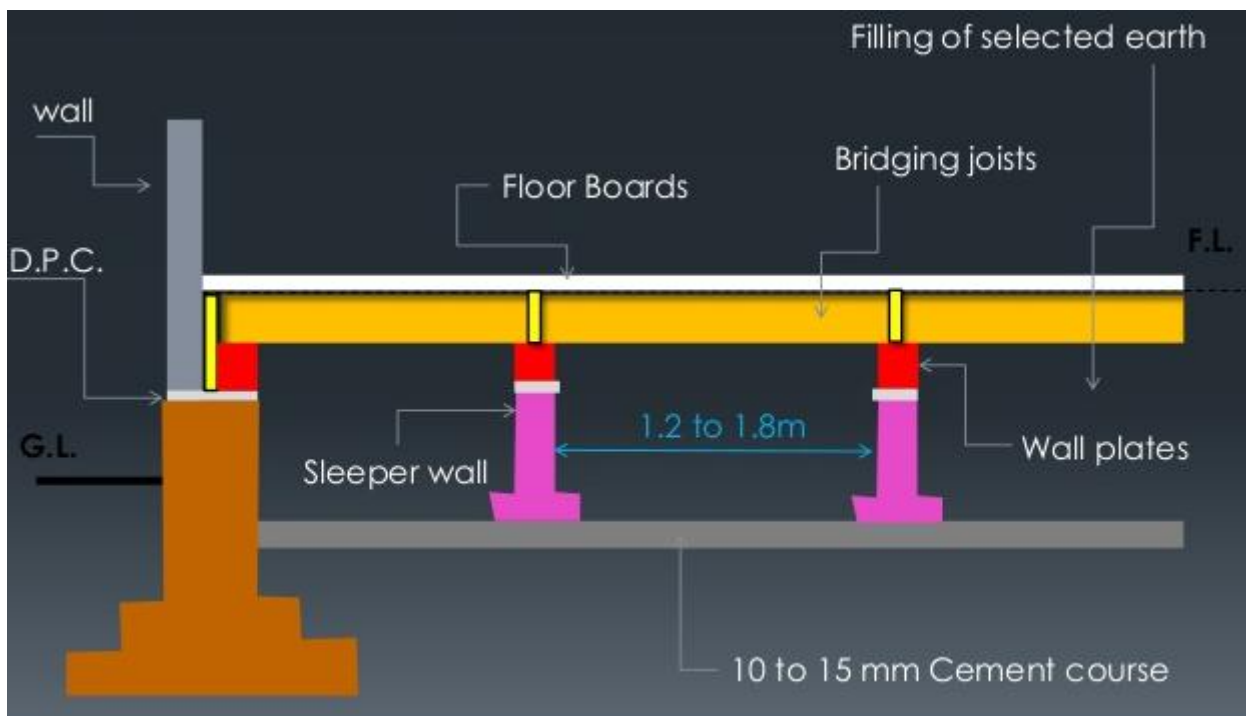


Fig:- basement or ground floor of timber

This type of floor is subjected to dry rot unless adequate precautions are taken . for this purpose, the following precautions are taken :

- i) The soil below the timber floor is covered with plain cement concrete 1:2:4 of thickness 100mm to 150mm.
- ii) The damp-proof courses are provided in the exterior wall as well as on top of the sleeper walls.

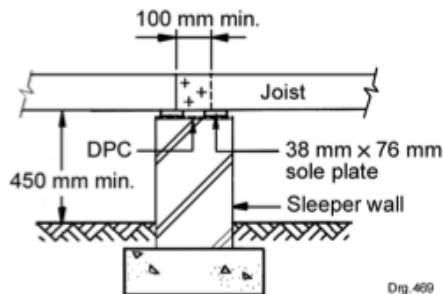
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SADAR, NAGPUR
FIFTH SEMESTER
SUBJECT:-BUILDING CONSTRUCTION & MATERIAL

DEPARTMENT OF CIVIL ENGINEERING

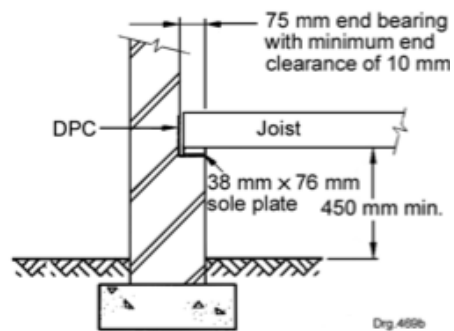
- iii) The well-seasoned timber is used in the construction of such floors
- iv) The hollow space between the bottom of concrete and floor level is filled up with the selected earth.

❖ **Single joist timber floors:-** these floors consist of single joist which are placed below the floor boards. The joist are usually placed at a centre to centre distance of 300mm to 450mm. the joist are supported on wall-plates at their ends. A space of about 50mm is kept for the circulation of air as shown in fig. the single joist timber floor can be adopted for a maximum span of about 3.60m.

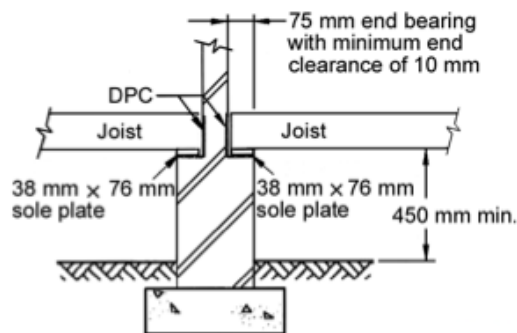
When the span of joist exceeds about 2.40m, it becomes necessary to strengthen the joist. This is usually carried out by providing the herring bone strutting. in this arrangement, the inclined timber pieces are firmly fixed between the joist and the ends of these struts are nailed to the joist. At the end, the wedges are provided between the wall and the joist.



a) Detail at sleeper wall



b) Detail at external wall



c) Detail at internal wall

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SADAR, NAGPUR
FIFTH SEMESTER
SUBJECT:-BUILDING CONSTRUCTION & MATERIAL

DEPARTMENT OF CIVIL ENGINEERING

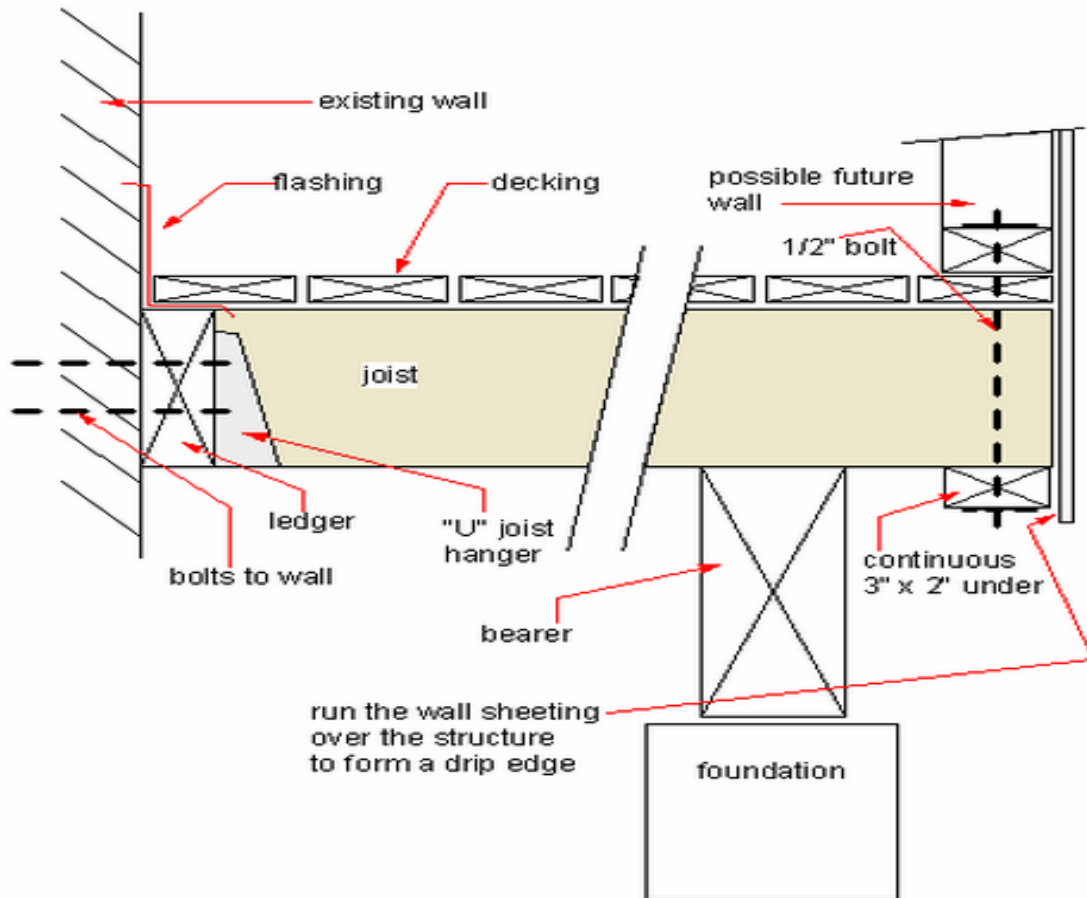


Fig:- single joist timber floors

- ❖ **Double joist timber floors:-** In this type of floors, the intermediate supports known as the binder, are provided for the bridging joist. The binder are generally placed at a centre distance of 1.80m to 2.40m. the ends of binder rest on wooden or stone blocks. The double joist timber floors are stronger than the single joist timber floors. They prevent the passage of sound in a better way and they are suitable for spans of 3.60 m to 7.50m. but this type of floors has two disadvantages
 - i) The weight of floor is thrown on few points in a wall.
 - ii) The depth of floor is increased by the use of binder and accordingly the height of the room is decreased.

ANJUMAN COLLEGE OF ENGINEERING & TECHNOLOGY
SADAR, NAGPUR
FIFTH SEMESTER
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DEPARTMENT OF CIVIL ENGINEERING

The methods of fixing binders with the bridging joist .the connecting joint may be a coggled joint or a notched joint. In the former case, the depth of sinking and the bearing are respectively limited to two-third of the depth of the bridging joist and 25mm. in the latter case, the timber pieces , known as the fillets are placed along the binder to support the bridging joists. This method is superior to the above method in the sense that the section of binder is not reduced.

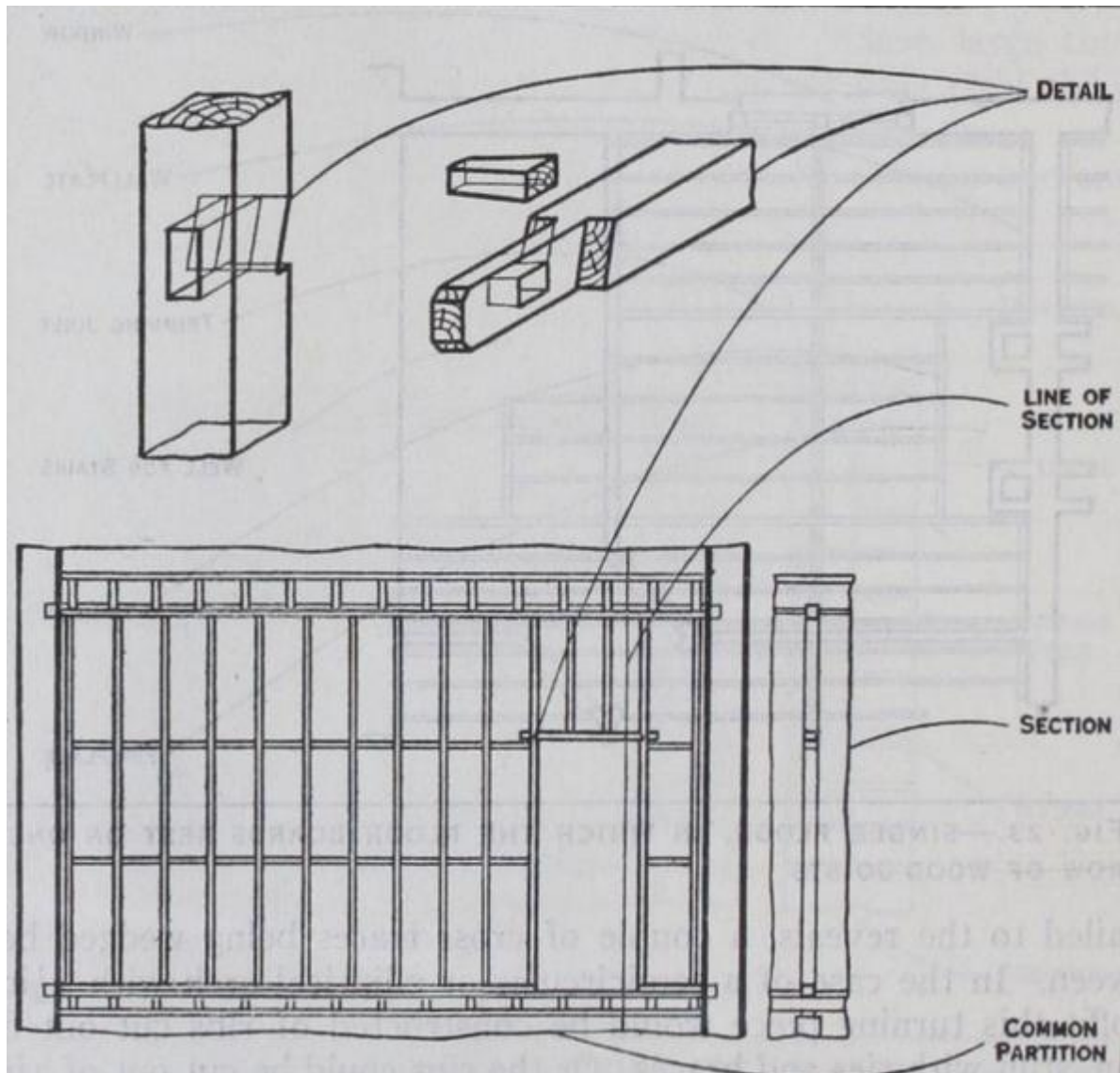
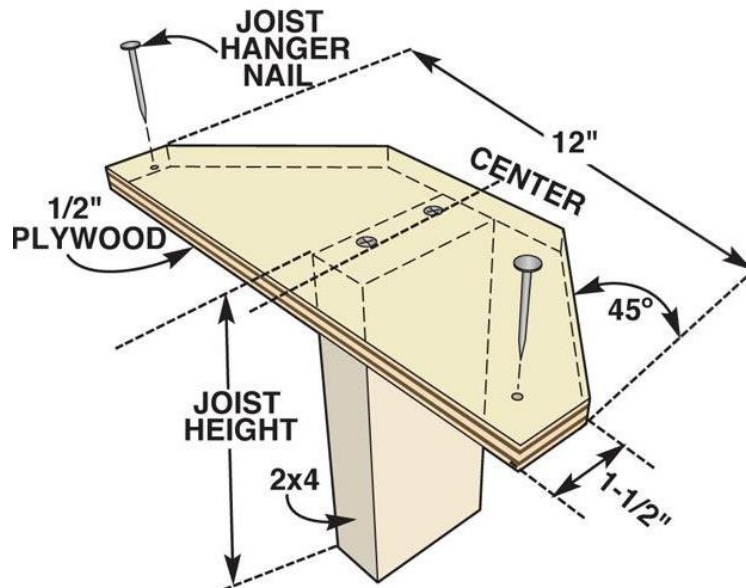


Fig:- double joist timber floor

ANJUMAN COLLEGE OF ENGINEERING & TECHNOLOGY
SADAR, NAGPUR
FIFTH SEMESTER
SUBJECT:-BUILDING CONSTRUCTION & MATERIAL

DEPARTMENT OF CIVIL ENGINEERING



- ❖ **Framed or triple joist timber floors:** In this type of floors, the intermediate supports known as the girder are provided for the binder. Thus, this type of floor consists of girders, binders, bridging joist and floor boards. The girders are generally placed at a centre to centre distance of 3 m. The binders are staggered and connected to the 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 in walls on stone or concrete templates. This type of timber floor is suitable for spans greater than 7.50m.
- ❖ **Features of timber floors:** The important features of the timber floors are as follows.
 - i) **Floor boards:** These boards are provided at the top of bridging joist and they form the wearing surface of the floor. The width varies from 100 mm to 200 mm and the thickness varies from 20mm to 40mm. For floor subjected to heavy traffic, the thickness may be 60mm to 80mm. The floor boards are joined and widened by any suitable joint.
 - ii) **Floor ceilings;** To make the underside of the floor flat and to improve the appearance as a whole, the ceiling may be provided. The ceiling may consist of plaster boards or sheet of asbestos cement or some suitable material. The ceilings may directly rest on the bridging joist or binders. But in order to make the ceiling strong and durable, the ceiling joist may be provided at right angle to the bridging joist or the binders and ceiling planks or boards may be supported on these ceiling joists.
 - iii) **Pugging :** In order to make the timber floors sound-proof, the pugging may be resorted. The pugging plaster is a mixture of chopped straw and mortar. The insulating boards supported

ANJUMAN COLLEGE OF ENGINEERING & TECHNOLOGY
SADAR, NAGPUR
FIFTH SEMESTER
SUBJECT:-BUILDING CONSTRUCTION & MATERIAL

DEPARTMENT OF CIVIL ENGINEERING

on fillets are provided and the hollow space between the floor boards and the insulating boards is filled up with the pugging plaster.

- iv) **Trimming:** when opening are to be provided in the wooden floors, it is clear that the bridging joist will not rest on the walls. In such cases ,the process to trimming is adopted.the trimming joist support one or two trimmer joist to which trimmed joist are fixed .the trimming joist and trimmer joist have slightly greater section than the bridging joist.
- v) **Use of steel section:** the binders and girders of the wooden floors can be replaced by mild steel 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 sections makes the floors light and economical.

Composite floors

The floors composed of more than one material are known as the composite floors and they are found to possess the following advantages over the timber floors:

- i) The composite floors resist fire in a better way and they are more sound proof than the timber floors.
- ii) The composite floors can be easily cleaned and hence, they possess better hygienic properties than timber floors.
- iii) The composite floors can be conveniently adopted for greater spans.

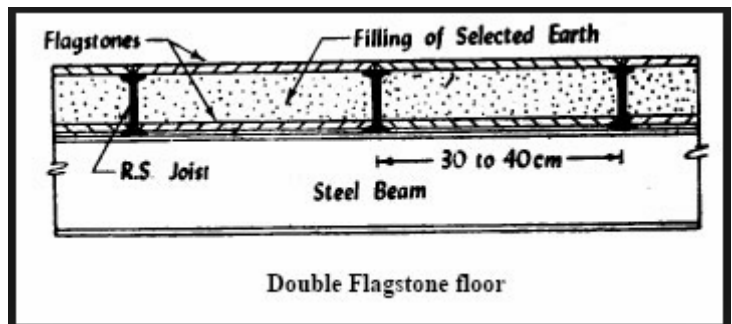
Following are the type of composite floors:

- 1) Double flagstone floors
- 2) Filler joist floors
- 3) Jack arch floors
- 4) R.C.C. floors
- 5) Hollow block and rib floors
- 6) Pre-cast concrete floors.

i) Double flagstone floors :-

In this type of floors, the flagstones are used in the two layers. If the span is about 4m, only rolled steel joist are provided . but if the span exceeds 4m, a framework consisting of rolled steel beams and joists is formed.

The steel beams are placed at a distance of about 3m centre to centre and the joist are placed at aright



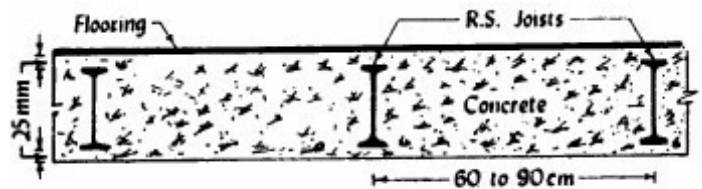
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SADAR, NAGPUR
FIFTH SEMESTER
SUBJECT:-BUILDING CONSTRUCTION & MATERIAL

DEPARTMENT OF CIVIL ENGINEERING

angles to the beams. The flagstone of about 40mm thickness and of suitable widths are fixed on the lower flanges and upper flanges

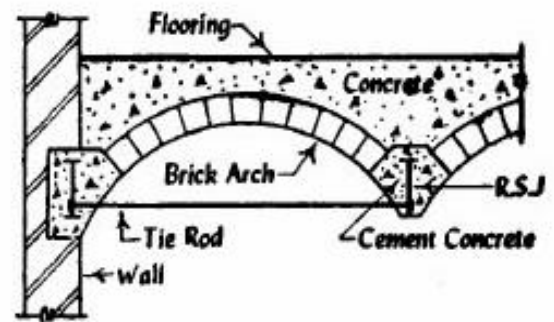
The joints of top layer of flagstones are finished in a better way to give a nice appearance. The filling of selected earth or concrete is done in the space between the two layers of the flagstones.

ii) **Filler joist floors:-** In this type of floors, the small sections of rolled steel joist are placed in concrete. The joists may either rest on wall or on steel beams. The joist act as reinforcement and are spaced at a centre to centre distance of 600mm to 900mm. The concrete should completely surround the rolled steel joist and beams with a minimum cover.



Filler Joist Floor

iii) **Jack arch floors:-** In this type of floors, the brick arches or cement concrete arches are constructed and these arches rest on the lower flanges of mild steel joists. The joists in turn rest either on wall or on beam. The joist are placed at a distance of about 800mm to 1200 mm centre to centre. The rise of arch should be 100mm to 200mm and the minimum depth of concrete at the crown should be 150mm. The only disadvantage of this type of floor is that it does not give a plain ceiling surface.



(a) Brick Jack arch floor

1) **Construction of brick jack arch floor:** Following is the procedure of constructing brick jack arch floor:

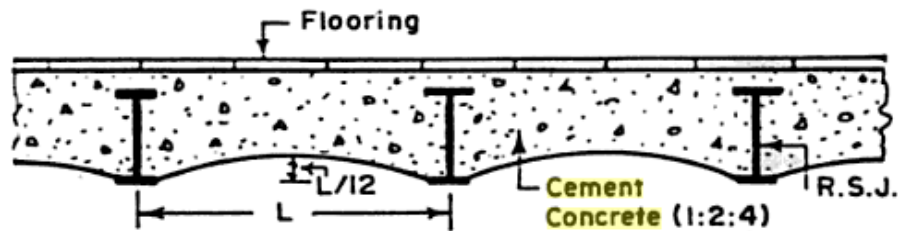
- a) The centering for brick arch is prepared. It is usually in the form of a segmental piece of wood of thickness of about 40mm. Its length is equal to the span of arch and its shape corresponds to the soffit of the arch. The ends of the centering are slightly cut off at ends.
- b) The bricks are laid on edge from both the joists. The end bricks are cut to fit firmly with the joists. The bricks should be well burnt and saturated with water. The bricks should be placed in such a way that necessary bond is developed between different rings or layers of bricks.
- c) The key brick is introduced at the centre of arch. It is to be fitted with rich mortar and made as tight as possible.
- d) The centering is removed or pushed ahead for further construction of arch.
- e) The brickwork is well watered at least for 15 days and then, the top flooring is provided on a bedding of lime concrete or cement concrete. The underside of arch is also suitably finished.

2) **Construction of cement concrete jack arch floor:** Following is the procedure of constructing cement concrete jack arch floor:

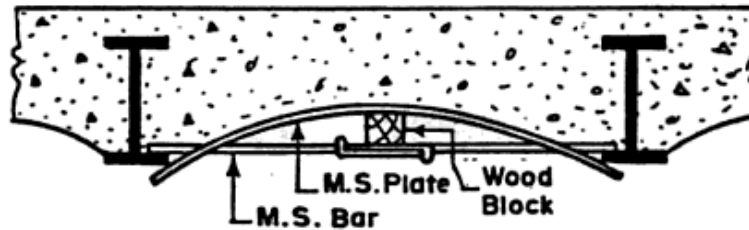
ANJUMAN COLLEGE OF ENGINEERING & TECHNOLOGY
SADAR, NAGPUR
FIFTH SEMESTER
SUBJECT:-BUILDING CONSTRUCTION & MATERIAL

DEPARTMENT OF CIVIL ENGINEERING

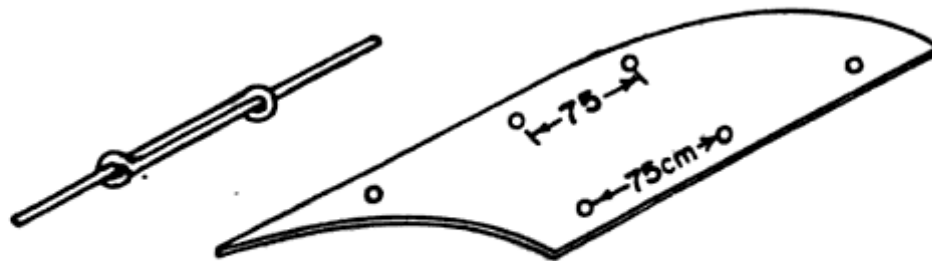
- a) The Centering for cement concrete arches is prepared . it usually consists of a steel plate of about 3mm thickness and bent to the shape of the jack arch. The steel plate has pair of holes a 750 mm centre to centre all along the length of the plate . the plate is supported by means of steel bars with eyes and wooden blocks .
- b) The cement concrete is then laid on the centering to the required thickness.
- c) The centering is removed only when the cement concrete has obtained sufficient strength.
- d) The surface is kept wet for about 10days and then the finishing of top surface and finishing of arch surface are carried out.



(a) Cement Concrete Jack arch Flooring



(b) Centering Details



(c) Eye Link

(d) 3mm thick m.s. Centering Plate

FIG. 123. CEMENT CONCRETE JACK ARCH FLOORING.

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SADAR,NAGPUR
FIFTH SEMESTER
SUBJECT:-BUILDING CONSTRUCTION & MATERIAL

DEPARTMENT OF CIVIL ENGINEERING

iv)**R.C.C. floors:** In this type of floors , the steel bars and concrete are used to form a floor . this type of floor is widely used in modern construction. The slab and beam are designed as per loading coming on the floor and proper reinforcement is placed at a suitable place. in case of