BUILDER EDUCATION

Structural Concrete & Wooden Floors

Once the foundation is in place, the next step is to build the ground floor structure. Concrete and wood is the most common base which we can use to create the floor structure on which the decorative flooring is laid. The concrete and timber may be used for both ground and upper floor construction.

Timber floor joists are the cheapest way for constructing the floor but less hard wearing. There are three types of floor structure choices: a solid concrete floor, a precast suspended concrete floor or a suspended wooden floor. The decision of what floor to build should be made early on in the design process.

Factors which influence the choice:

- Renovation or new build
- Ground floor or above the ground floor
- Installation time and costs
- What type of floor finish will be applied?
- Whether the underfloor heating will be installed? (timber floors cool down quicker)
- If there is need to install cables or pipes in voids

Concrete Floor Construction

We can distinguish between the poured concrete which forms the slab or pre-cast beam and block. The pre-cast concrete beam and block method is a relatively fast and dry method of floor construction, but it might be not suitable for some renovations projects. The traditional poured concrete method is very common but more time consuming as requires time to set before floor finishing can be installed.

Solid concrete floor

This type of floor structure can be used for both new build properties or for renovating, but only for ground floors. Internal concrete floors are usually done in renovation projects after removal of suspended timber floor. While working on a new project outside, on the excavated area lay the hardcore and compact it. Cover it with sand and smooth the surface. Lay the damp proof membrane on the sand and take it up the wall. Place the PIR insulation. Pour the concrete or apply it with the shovel. To float and level the concrete use the float. Allow 3-7 days for concrete to dry and apply screed.

1. Remove the sub-grade (ground underneath the slab) from floor area
2. Apply the layer of hardcore (approx. 10-20cm) and compact
3. Apply the layer of sand (approx. 3-5cm, just to cover hardcore)
4. Install damp proof membrane (DPM) – to be lapped into the main wall structure
5. Install PIR insulation
6. Pour concrete (approx. 10cm)
7. Cover with the screed

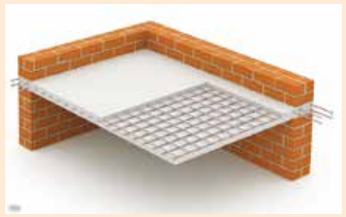
Reinforced concrete slab

Steel and concrete have been partners in building technologies for ages. Both materials are very strong. Steel has great results at withstanding tensile stress like for example bending. Concrete is good at bearing compressive stress like squeezing but it can crack under tensile pressures. The concrete reinforced with steel or glass fibres combines these two features to create a material that is even stronger.

Reinforced concrete is made by pouring the concrete inside a metal framework or around ridged steel bars called rebars (reinforcing bars). Another option is called stressed or pre-stressed concrete which is produced by pouring wet concrete around pre-tensioned steel bars or wires, what compress the concrete as it sets and makes it much harder and stronger.

Steel reinforcing bars are very strong and have a similar thermal expansion to concrete what means they can handle high-tension stresses and concrete can take substantial compressive stresses only. Rebar is the metal pole with ridges especially made for the reinforcement purposes. The properly measured and fitted rebars will reduce the possibility of cracking but will not prevent them. The aim of reinforcement is to resist compression, bending and other direct tensile impacts and to protect the slab if cracks occur. To avoid cracks in slabs, either traditional or reinforced, it is important to ensure proper joint spacing and dowels at joints or control slab thickness, etc. To properly transfer the load stress at least 0.10% reinforcement steel is required with joint spacing as in the unreinforced slab. The reinforcement may be located in the upper, middle or lower portion of the slab. The most recommended location is in the middle of the slab structure as it takes pressures symmetrically from both sides of the slab. The rebar should be placed through the entire length of the concrete slab and the cross pieces of rebar should be set in the same manner. Another material used for reinforcement is steel fibre which is beneficial for the crack control and load carrying ability (traffic, spanning a void or bearing another structure such as a wall). Reinforced concrete slab has an approximate thickness of 100-150mm.

Rebar reinforcement



Stressed concrete around pretensioned steel wires

The structural engineer's or architect's plans should provide spacing requirements and bar sizes.

1. Remove the sub-grade (ground underneath the slab)
2. Pre-treat for termites if required
3. Install DPM
4. Install the steel formwork (cage)
5. Prepare the layout of bars, stirrups, and dowels
6. Tie bars with a so-called snap tie or a spinner by using a single tight twist of wire around each rebar intersection. There are other more complicated ties often used too.
7. Once cage is assembled hold it in position with concrete bricks or rebar chairs until it will be covered with concrete

Concrete may take 28 days to set properly and to achieve the strength, but foot traffic can be allowed after 1-2 days. Formwork and shuttering can be removed after 3 days.

Beam-and-block floor

This precast suspended floor structure can be used for both ground and ceiling floor structure. It requires concrete joists which are filled with concrete blocks what form a base. Both blocks and beams are dry laid. The beams are supported at ends on the outer wall structure and the damp proof course (DPC). Wide lengths of a floor can be made without other support as the beam-and-block pre-cast concrete is very strong. On the created floor structure install damp proof membrane (DPM) and if required apply PIR insulation. Lay the screed on which you can lay the self-levelling floor and the decorative floor finish.

1. Remove the sub-grade (ground underneath the slab) from floor area
2. Apply the layer of sand (approx. 3-5cm)
3. On foundation build brick or block wall (if required), install DPC
4. Leave up to 40cm void
5. Install pre-cast beams and blocks
6. Install DPM
7. If required apply PIR insulation
8. Lay screed

Wood Floor Construction

A suspended wood floor is commonly used to create the upper floor construction. It is also found as a ground floor structure in older properties. Such floor structure is less popular nowadays as the precast joists are more durable. Wood floor is constructed using timber beams called joists. Joists size can vary according to the floor span. Floor joists are built into the wall structure (supported directly by internal part of cavity wall). Also, joists ends can be secured to wooden wall plates fixed to the wall surface. Joists are braced using noggins. Between noggins and joists, the PIR insulation can be installed.

For above ground floor structure, metal joist hangers can be used to support joists. There is a wide selection of hangers available. Joists are attached to the wall using hangers and are braced with lateral restraint straps or herringbone metal struts.

At ground level small sleeper walls are built as a support below suspended timber floors. The floor surface is constructed by laying plywood, OSB board or chipboards sheets across the joists. Moreover, the suspended ground floors must be ventilated with the airbricks in the external walls.

1. Remove the sub-grade (ground underneath the slab) from floor area
2. Apply the layer of sand (approx. 3-5cm)
3. Install DPC
4. Leave ventilation void up to 40cm
5. Install timber joists on wall structure
6. Install noggins between joists
7. Fit PIR insulation between noggins and joists
8. Apply plywood or OSB board

I-Beam – an engineered joist, the laminated wood layers which create a joist. I-Beams are an alternative to traditional timber as they are strong and lightweight.

Insulation

The current legislation including Part L, BREEAM and the Code for Sustainable Homes require floors to be insulated to reduce the heat loss. Both wooden and concrete floors can be insulated during the construction stage with the PIR insulation boards. PIR rigid thermal insulation is manufactured as a foam. Damp proof membranes are used too to prevent moisture getting into a floor structure.

Moreover, the suspended ground floors must be ventilated with the airbricks in the external walls. In the case of wooden floor construction, timber joists should be positioned on the internal part of cavity wall above DPC.

Damp Proof Membrane (DPM)

A damp-proof membrane (DPM) protects the underneath of the slab from damp and chlorides or other aggressive chemicals which can damage concrete from beneath. Moreover, it prevents the poured concrete from drying out too quickly as the absorption of water by the sub-base or the sub-grade is limited. Concrete which dries out too fast is prone to cracking and less reliable. DPM should be installed before pouring the concrete with overlaps by at least 350mm.

Movement joints

Movement joints protect the slab from cracking, accommodate the movement of the slab and prevent stresses being transferred to other structures.

During the curing process, the concrete will contract slightly and small cracks may occur. Also, when to set the concrete will expand or contract a little. To avoid excessive cracking, it is advised to allow for a movement joints especially for larger slab surfaces. Joints allow the concrete to crack and do not transfer pressure to other structures. Joints if required are specified in an engineer specification.