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**BEST PRACTICE PROGRAMME**

# Good Practice Guide 4

**ENERGY EFFICIENCY IN NEW HOUSING**

## INSULATED GROUND FLOORS.


**P Johnson, Wimpey Labs**
**K Meynard, Wimpey Homes**


### Insulated ground floors

The ground floor slab of a house can be a significant route for heat loss and a possible condensation risk. The insulating effect of the slab and ground is comparatively small. To improve the thermal performance therefore, additional insulation needs to be incorporated in the floor construction.

Ground floor heat losses are now covered in the amendments to Part L of the 1990 Building Regulations. Within these Regulations there is a requirement for ground floors to be insulated to give a heat loss rate (U-value) no greater than 0.45 W/m$^2$K. There already exist many low energy housing developments which achieve a considerably better insulation standard than this.

Wimpey Homes have since the late 1970's included ground floor insulation in their timber frame house range, completing in excess of 15000 homes with floor insulation.

Two methods are used, depending on the type of foundations and floor slab on a particular site:

- Insulation placed under the slab for conventional ground bearing or floating slabs with strip footings.
- Insulation placed over the slab and finished with chipboard flooring for raft and suspended concrete floors.

Both systems have proved buildable with few problems being experienced provided that site installation is in accordance with the good practice guidelines described here.

### Under Slab Insulation

The ground is prepared with fully compacted hardcore, sand blinded to a reasonably level finish. This is important in preventing any puncturing of the dpm and avoiding possible long term settlement of the slab due to the insulation bridging high spots in the hardcore base.

The dpm (1000 gauge polythene) is laid with joints welted and lapped under wall dpc's, as is usual practice. The insulation is then laid over the entire floor area on top of the dpm and with an upstand at the floor perimeter (Figure 1).

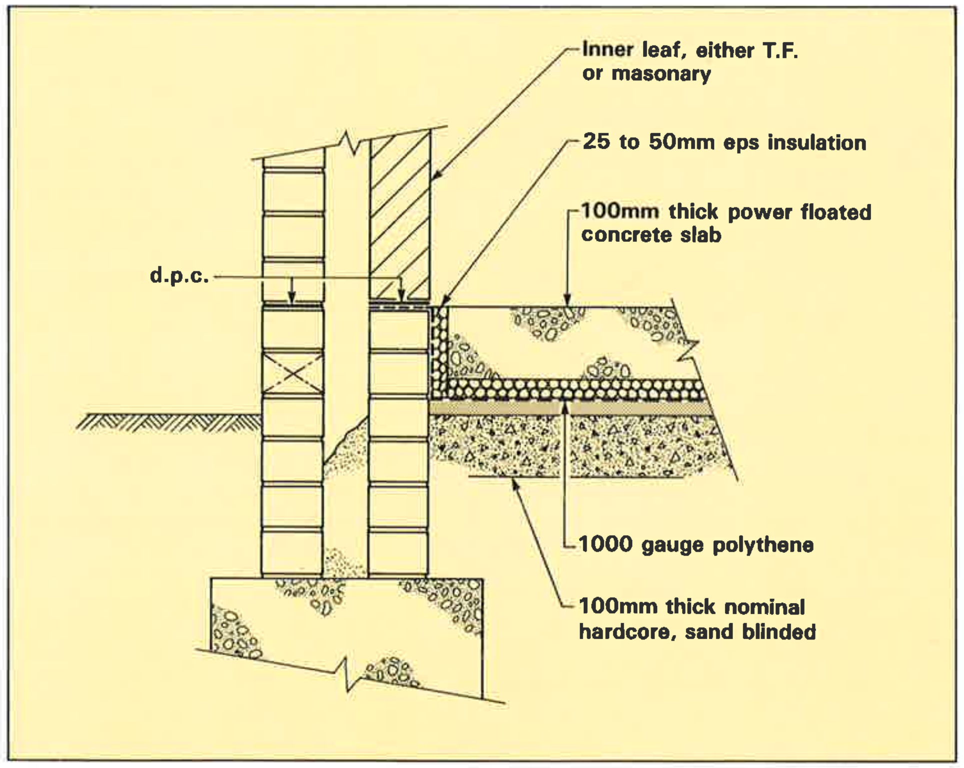


**Fig 1 Insulation placed under floating ground floor slab**

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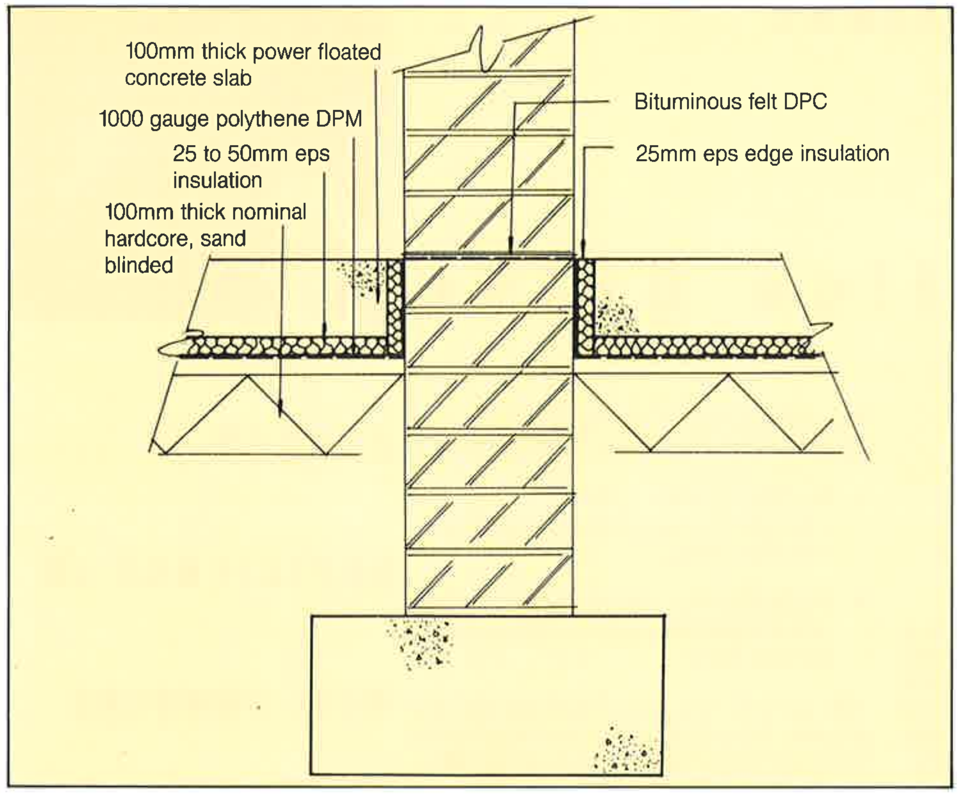


**Fig 2 Party wall detail, insulation below ground floor slab**

The insulation itself needs to be moisture resistant, rigid and of sufficient compressive strength to withstand the floor loads. Wimpey Homes use expanded polystyrene with a minimum density of 16kg/m$^3$. The standard thickness currently specified is 25mm, although 50mm thick insulation has been used on special low energy designs without giving any additional problems.

The thickness of eps insulation needed to meet the heat loss requirement of the amended Building Regulations is in the 25-50mm range, depending on the actual floor plan dimensions. Wimpey Homes will standardise on the thicker material, and thereby achieve lower U-values for a large percentage of their house designs.

The installation boards are laid closely butt jointed, and cut to size as necessary to cover the whole floor area. Where services pass through the floor the insulation is cut to fit around the entry, taking care not to damage the underlying dpm. The ground is a poor insulator compared with the polystyrene, and any large gaps in the insulation would therefore result in significantly higher heat losses.

All around the perimeter of the floor, the insulation is laid with a 100mm upstand (ie: the depth of the slab). This is to reduce heat losses through the edge of the slab and avoid a cold bridge. This detail is also repeated at the junction with party walls and load bearing partitions, for the same reasons (Figure 2).

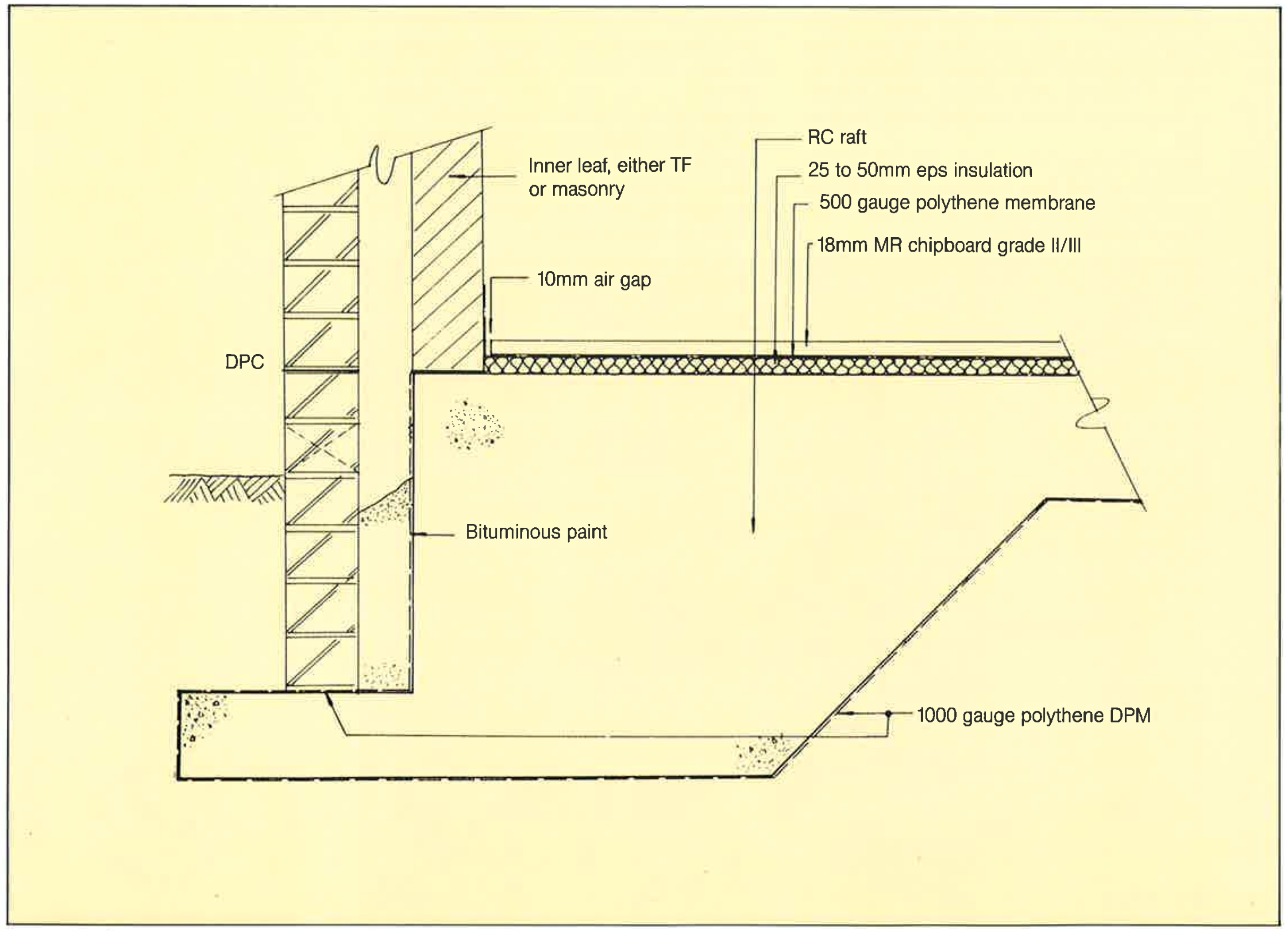


**Fig 3 Top insulated raft slab**



The edge insulation is eventually covered by the plaster or plasterboard finish and the skirting. It is usually only possible therefore to use 25mm polystyrene for the upstand. At door openings in the external wall or load bearing partitions a hardwood strip is used across the threshold, to cover the floor edge insulation.

The dpm, insulation and concrete are all laid on the same day. This avoids possible damage to the dpm or polystyrene through undue exposure to the elements. Boards are used to protect the insulation when barrowing the concrete, and care is needed to ensure it is not displaced. The edge insulation is especially vulnerable until it is held upright and protected by the concrete.

When after a few hours the concrete has gone off sufficiently, it is power floated to a smooth finish. Building then carries on as usual, without any delays or significant changes in the construction process due to the ground floor insulation.

**Over Slab Insulation**

Insulation on top of the slab (Figures 3, 4, 5) is used for those sites where ground conditions necessitate raft foundations or suspended slabs (either precast beam and block or in-situ re-inforced concrete).

This is done in preference to under slab insulation to overcome the problems of cold bridging at the floor edge, and fixing difficulties where a sub-floor void is formed.

The insulation used is expanded polystyrene as for the under slab method. This is finished with moisture resistant chipboard flooring (to BS5669 type II/III). The construction process adopted is as follows:

The raft or in-situ reinforced slab is cast on prepared ground with the dpm under the slab, and returned to lap under the wall dpc. The slab is given a smooth light tamp or belt finish.

With a precast suspended slab such as beam and infiller block, the dpm is positioned on top of the grouted or screeded slab. However, to avoid damage to the dpm it is not laid until later on in the construction. A wide dpc (450mm) in the inner leaf is used, to extend over the slab and eventually be lapped by the dpm.

It is important with all of the above slab types that the finish is reasonably smooth and level, to avoid the possibility of movement and settlement of the insulation and chipboard.

The insulation and chipboard are not laid until all load bearing partitions have been constructed, and when the shell of the house is weather tight. Driven rain must not be allowed to wet the floor once laid and temporary protection is used if necessary. This delay in laying the floor allows some drying out of the slab, and reduces the risk of moisture damage to the chipboard.

The polystyrene insulation boards are loose laid over the whole floor area. Chipboard loading pads are used under stairs, kitchen units, WC and basin pedestals and other areas of increased floor loading.

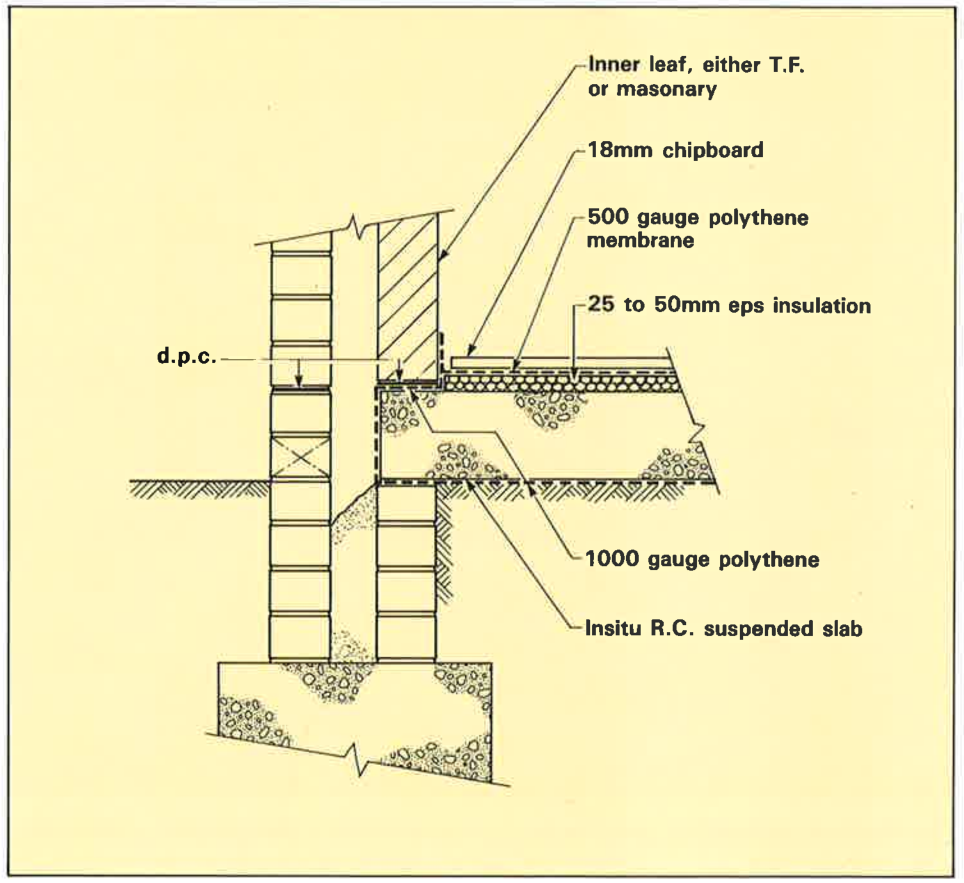


**Fig 4 Top insulation on in-situ rc suspended slab**

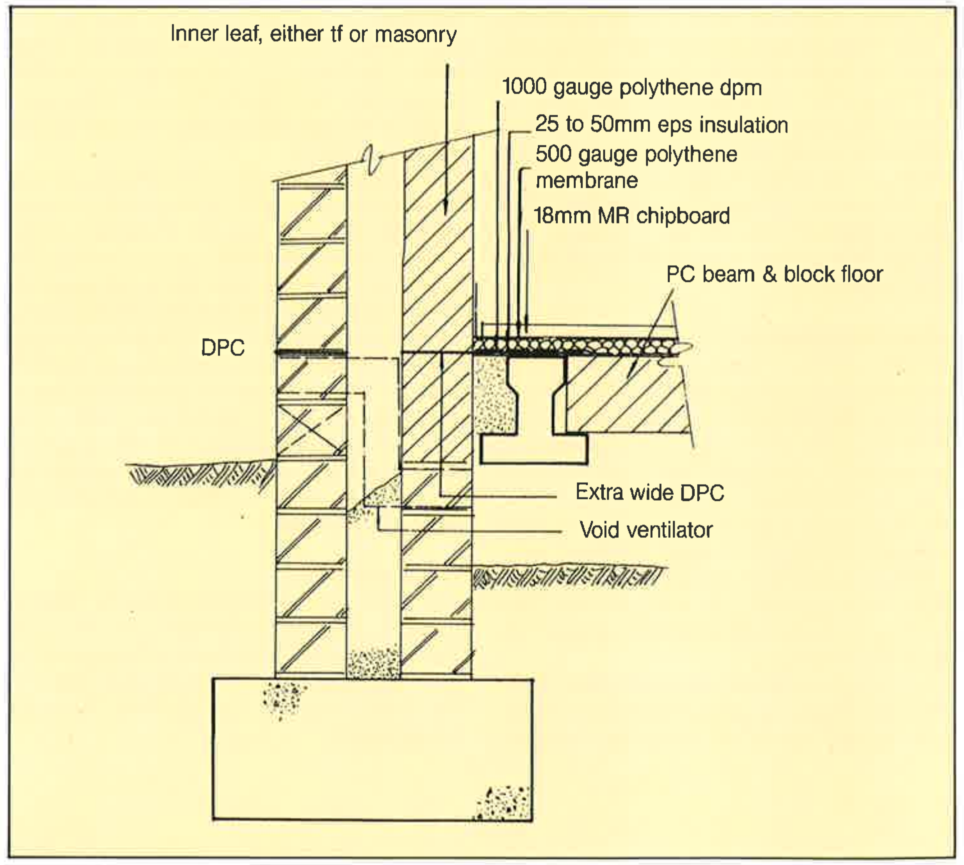


**Fig 5 PC beam & block floor with top insulation**

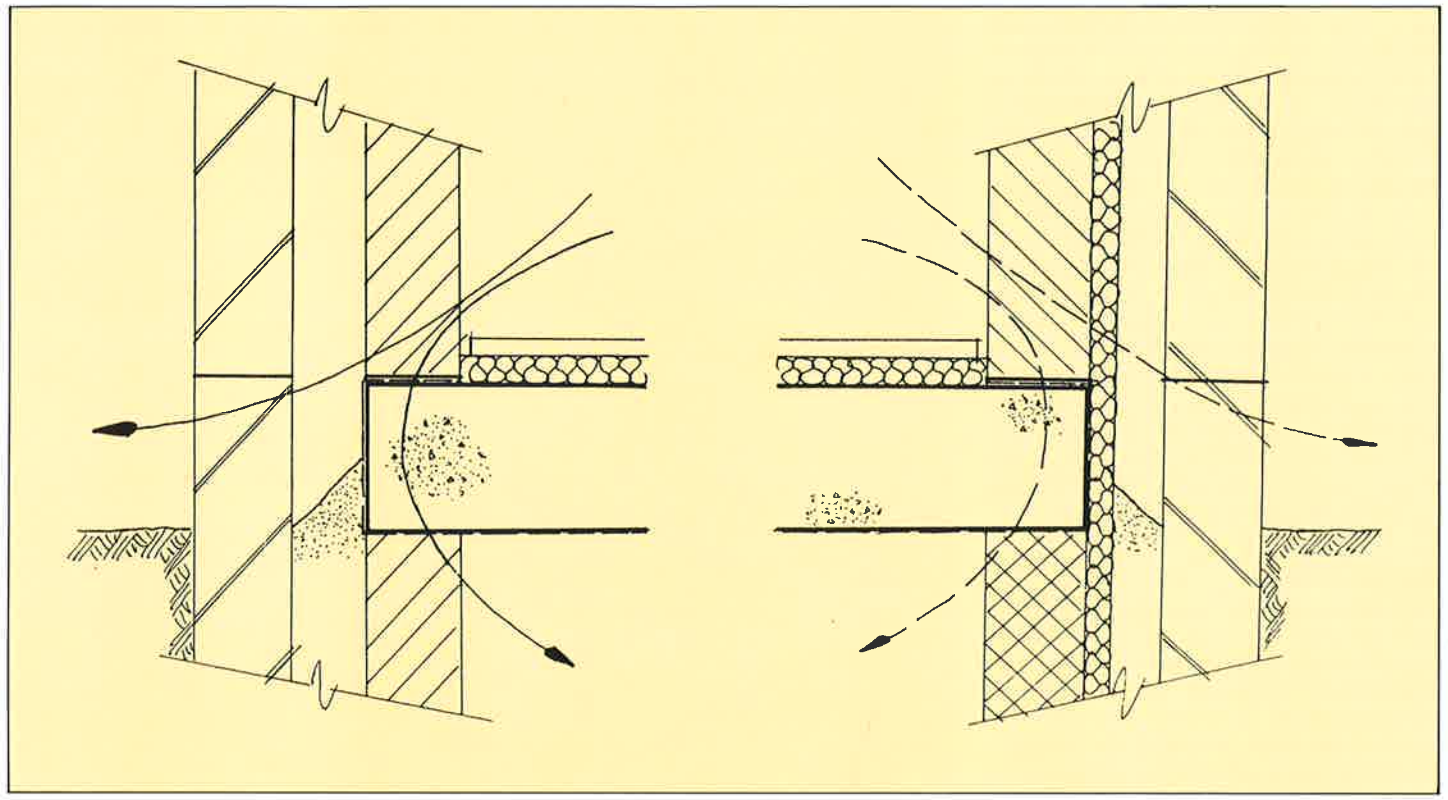

**Fig 6 Reduced cold bridging, using low density concrete block & extended cavity wall insulation**

A 500 gauge polythene sheet membrane is placed between the insulation and chipboard, and returned behind the skirting. This serves two purposes — it acts as a vapour barrier preventing condensation on the top surface of the slab, and stops the chipboard curling due to moisture take up from the slab, if it is not fully dried.

The chipboard is laid with tongue and grooved joints continuously glued on all edges with PVA adhesive. Temporary wedges are used at the perimeter during laying and to maintain a 10mm gap all round to allow for any expansion. The finished floor is swept clean ready for carpets or vinyl covering.

**Wimpey's Experience**

Wimpey Homes have experienced some problems with curling of the chipboard due to moisture. When this has occurred, it has generally been as a result of the described precautions to avoid moisture take up not being fully complied with. The membrane on top of the insulation can act as a moisture trap if there is severe water spillage or flooding. In this event, the effect on the chipboard is reduced by using a moisture resistant grade as described, and using a vinyl floor covering in kitchens by prolonged leakage will result in problems.

It is advisable not to run water and heating pipes within the floor construction, except for the mains water service pipe which should be insulated.

**Cold Bridging**

The question of cold bridging has already been raised. Generally cold bridges will only be significant at the junction of the floor and the external wall. This could result in lower floor or wall surface temperatures in this area, and in increased condensation risk. This might lead to subsequent moisture damage and mould growth on carpets and wall coverings.

The methods of insulating ground floors used by Wimpey overcome such problems with the floor. However, there still may be a problem at the external wall, depending on its construction (Figure 6.). Where the inner leaf is well insulated, for instance timber frame construction or masonry construction with insulated wallboard drylining or insulating blockwork, a cold bridge does not exist. With other forms of masonry construction, taking the cavity insulation below the lower level of the slab or using lightweight concrete blocks of suitable compressive strength and durability in the foundation for instance, are measures which will reduce cold bridging.

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***Further information: Enquiries Bureau, Building Research Energy Conservation Support Unit (BRECSU) Building Research Establishment, Garston, Watford, WD2 7JR. Tel No. 0923 664258. Fax No. 0923 664097***

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