Get Snug with Under-floor Insulation – Tom & Anne Bragg

We have a woodstove in our sitting-room and normally get snug there on a winter's evening, with the rest of the house often unheated. But the floor has been noticeably cold – it's a typical old terraced house with suspended wooden floors above about half a metre of space, ventilated by the air-bricks around the house. So our warm sitting-room has been separated from cold outside air by just the carpet and floorboards.

Anne Cooper of AC Architects recommended this as our next big job to improve our home's energy efficiency and Alex & Howard Rice inspired us to do it ourselves.
So we've just insulated under our sitting-room floor - a significant DIY project.
If you prefer to have a professional do it, some of this information should still be useful.

Choices

First we took a look under some easy-to-lift floorboards to see into one bay:

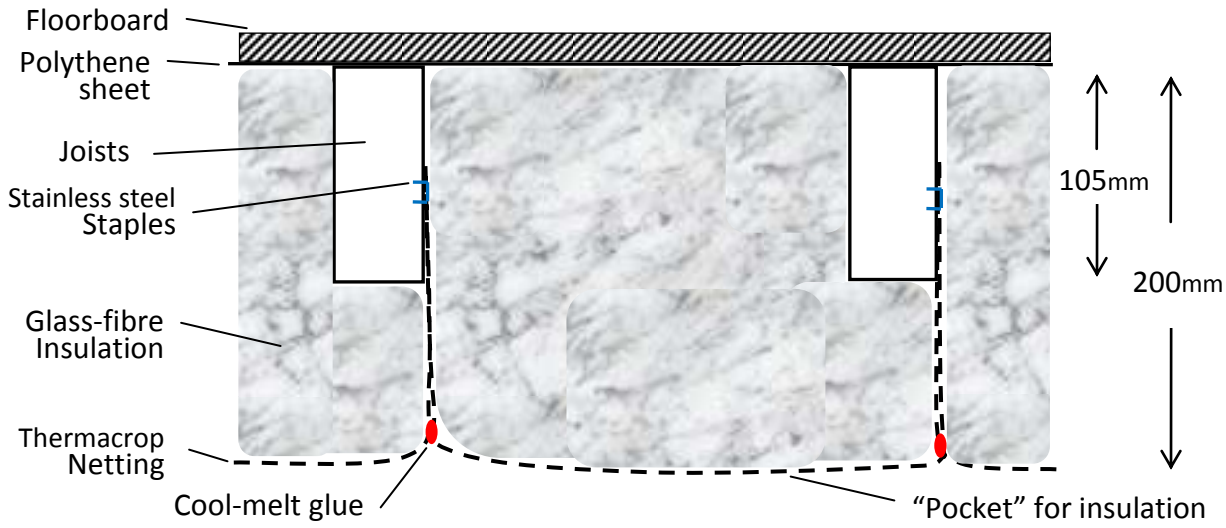
A big choice is whether to lift the floorboards and insulate from above or to wriggle into this space and do it from below. We decided to insulate the sitting-room from above, but Anne insulated some our hall from below at the far end of this bay. Our sitting-room is divided into 4 bays, separated by "sleeper walls". A local builder makes holes in them to crawl from bay to bay, but this sounded beyond our competence. As our sitting room has a carpet and not very good floorboards boards, we preferred to lift them.
Experts should be able to lift floorboards and replace them still looking beautiful.

Pro Lifting the floor:
poor floorboards
less worried about appearance- carpet
Tight, obstructed under-floor space
Other under-floor work: electrics, rot

Pro insulating from underneath:
Good access under floor from cellar, etc
Beautiful, bare floorboards
Tongue & groove boards – harder to take up
Willingness to work in tight spaces

English Heritage have a guide discussing this, especially relevant to old buildings. If you need to lift a suspended timber floor for other reasons, then definitely insulate under it.

We wanted a high standard of insulation after doing all this work. For new-build, current building regulations specify a U-value of 0.25W/m^{2}K. By chance our proposed solution, using 200mm of glass fibre matches this, helped by having some insulation under the joists. Heat-loss through the joists is significant, especially when they're close-spaced like ours, occupying 16% of our floor area. Because of this, 100mm of Celotex between our joists would give a worse U-value for us (0.39W/m^{2}K), even though Celotex is a much better insulator than glass-fibre. See Thermal Calculations Online. We could have used Rockwool (mineral wool) or Sheep's wool (more expensive), instead of fibre-glass.



Our Scheme for under-floor insulation

Your floor and situation will be different - we hope this information helps your choices.

1. Taking up the floorboards

We managed without removing any skirting boards. But every floorboard needs cutting above the middle of a joist for a place to begin lifting it (unless it's been lifted before). If your floorboards are tongue and grooved, like ours, you also need to saw between them to cut the tongue and be able to lift them. We did this with a power jig-saw, tilting the saw to avoid cutting the joists or to start a new cut. Beware of cutting any cables or pipes! This let us do a pretty neat job, except for a few places where the blade hit a nail. But it's worth using new sawblades for this job, because they cut much quicker than old ones!

Before you start lifting boards, label every separate piece of floorboard so you can put them back in the right place. We found that this double-headed lifting bar was a wonderfully satisfying tool for prising up the sections of floorboard, but an old tyre level and wrecking bar were useful for a few awkward boards in the corners. If the boards are stiff, it helped to loosen the nails to waggle the boards a bit, either waggling up and down with the lifting bar, or by waggling the board side to side (if its stuck under the skirting board for example). Hammering down on board above the nails can also help. We also borrowed a special nail puller which was excellent for pulling the nails out of the joists once we'd lifted the boards.

We left the boards that were alongside the skirting board because it would have been difficult to have lifted them without taking off the skirting board, but this didn't seem to matter- it was quite easy to push the insulation and polythene film underneath.

When removing nails from lifted floorboards, hammer their tip with the board resting on a scrap of wood until the nail head is clear. This reduces splintering of the floorboard's good side. Save cut nails for re-use, straightening them by hammering against a paving slab.

2. **Preparations**: fixing the netting, etc

While your floorboards are up, it's an ideal time to:

- Find and fix any other problems, like rot - we had to!
- Add extra electrical outlets
- Remove any unused cables or pipes and label those in use
- Insulate any hot pipes
- Leave a time capsule for people to discover many decades hence.

Ideally pipes and cables will sit below the insulation, but it can be fitted around pipes. Cables should only pass through insulation for half a metre: more and they can overheat.

If the room has external walls with airbricks to ventilate under the floor, make sure they are clear and have good airways to under the insulation. You probably need to make ducts from the airbricks to below the insulation. We used thin aluminium.

Garden netting is normally used to hold fibrous insulation between the joists, but as we wanted to insulate under the joists too, we chose "Thermacrop", a tough netting sold as a garden fleece. Compared to open netting it should help keep draughts out of the insulation, while still being porous to water vapour, which is essential. After cutting it into strips the width of the bay, we glued folds to hang off each joist, to prevent gaps between each pocket (see drawing). Normal hot-melt glue melts Thermacrop, but Cool-melt glue, as used in schools, etc works fine: mark it where you need to glue and align the 2 layers over some newspaper. Squirt glue along the line and press it down quickly with another strip of newspaper. This squeezes the glue through the 2 Thermacrop layers, bonding them together. Fix these folds at the right height on each joist with stainless steel staples (avoiding the possibility of rust!) At the ends of the bays, depending on the position of the last joist, you may need battens screwed to the wall to staple the netting to.

Gluing folds in thermacrop netting

Preparations under a bay window

3. **Adding insulation** - with variations

We used nearly 3 rolls of **200mm thick glass fibre**, which was £13 a large roll from B&Q, thanks to the CERT subsidy for DIY use, which unfortunately will expire in December 2012.
Buy it quick!

Saw the glass-fibre rolls, without unwrapping them, into the width of the net pockets. Lay it roughly in place and cut it to length with scissors. Tear a strip off the edge of the glass-fibre where the joist will be and arrange it to fill the pocket, fluffing it up to reach floorboard level.

We also used one small roll of **homeECO Insulation**, made from recycled PET bottles: unlike glass-fibre, it can be handled without itches and so is good for filling tricky gaps or insulating from below the floorboards. It's extremely hard to saw widths from the roll, but otherwise is easy to handle and to tear into appropriate strips.

We took the opportunity to insulate under part of our hall, from below the floorboards. Use a good vacuum cleaner, dust masks and lighting! A few dust sheets and a camping foam mat to lie on made it nearly comfortable! Anne first stapled pieces of polythene under the boards and down the sides of the adjacent joists – not a perfect seal, but it should cut most draughts. To the same design as the rest of the floor, she then held 200mm of the homeECO Insulation in place by stapling thermacrop netting around it. It's not a job for the claustrophobic or asthmatic, but by using the non-prickly homeECO insulation it was much less unpleasant than we'd feared

4. Sealing

Good insulation needs to be complemented by a really good seal of the floor and its edges. We covered the whole floor with polythene sheet stapled over the joists, sealed at the edges with sealant.

In fact we did the whole job in 2 halves, to always giving us some floor boards to work from. Pro-Clima sealing tape is expensive, but with powerful, very long-lasting adhesive, it's worth it. We used it to join the polythene sheets and to help seal the edges. We cut the polythene to curl around the ends of floorboards under the skirting boards, just short of projecting back into the room. When the boards were nailed down, we applied a bead of clear sealant all round the room between the skirting board and the floor to complete the seal. In a few places where there were large gaps between the boards near the skirting board, we filled the gaps using brown papers bags mashed up with sealant.

5. Making good

Put the floorboards back and check they all fit. We nailed most of them them back in place, reusing the cut nails, but we screwed down every fifth board so it would be easier to lift them in the future. We labelled the position of these boards under the edge of the carpet.

It cost us about £100 to insulate under our sitting room, roughly 3.6m square, plus some of our hall. It took the 2 of us most of a week, including some other distractions and about a day for fixing the rotten timber we uncovered. It seemed a big job – we were learning the techniques, and was very satisfying.

Energy Saving Trust gives the likely savings from under-floor insulation (for all the ground-floor of a typical house) as £60 per year with a DIY payback time of about 2 years. They estimate CO_2 savings at 240kg/yr. For our sitting room, mainly heated with scavenged firewood, this doesn't quite apply, but we expect a snugger room, while burning less fuel.

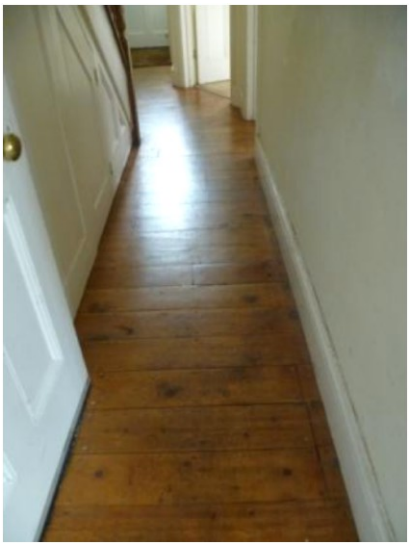
I hope this is useful – an update follows when we have a winter's experience of the benefits and **your comments**....

Tom & Anne Bragg, August 2012 tom@cambridgecarbonfootprint.org

Under-floor Insulation

Method 2: removing one board every 1.2 m

We've previously written about how we insulated under our living room floor in 2012 This had rather poor floorboards, with a carpet on top, so we weren't too worried about a little extra damage from taking the boards up.



However, we also wanted to insulate under our hall floor, which has really nice exposed, polished old boards, so we wanted to damage them as little as possible.

Here's what we did.

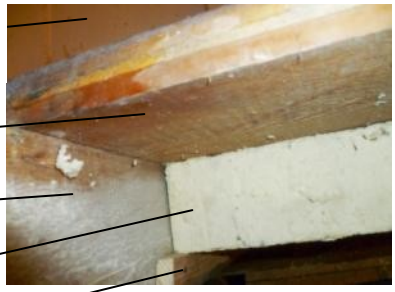
When we'd insulated under the sitting room floor, we took this photo of the space under the floor: we have a 0.5m deep void, with sleeper walls every 1.2m. I think this is typical of Victorian/Edwardian homes, but more modern homes may well not have these sleeper walls.

I didn't fancy getting down into such a small space, particularly as the sleeper walls meant that I couldn't do the whole space from a single access point, but we realised that if we took up just one board in the middle of each 1.2m bay, I could just reach far enough to push some carefully sized pieces of celotex insulation between the floor joists for the full width of each bay. Some of these boards had already been cut in the past, by plumbers or electricians, so they were quite easy to get up.

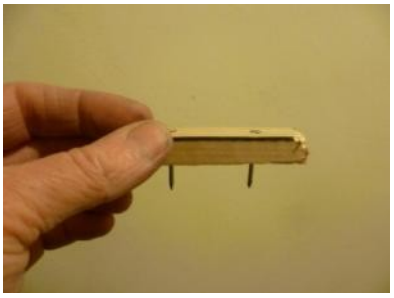
Although the celotex wedged in quite well, it clearly wouldn't stay there longterm with the vibration from people walking on the floor, so after I'd pushed the celotex into position I hammered in some little wooden blocks (sort of 'mega-staples') to hold the celotex firmly up against the underside of the floor boards. I made the celotex fit as tightly as I could up against the boards, in order to reduce air leakage between the boards. Where there were pipes, I insulated round them with rockwool, supported by some netting stapled to the joists, as done in method 1, used for the living room.

Here are some pictures of the process:

View of cellotex in position, underneath the floorboards, held by a 'mega-staple'.



A 'mega-staple', ready for use.



Hammering the mega-staples into the joists, to hold the cellotex up against the underside of the floor boards.

In this particular part of the floor, which was in the cupboard under the stairs, there were several loose boards, so I had better access.

This is much less dusty that getting down under the boards, but I still found it useful to wear a dust mask

Putting the last block of cellotex into position, before replacing the floor board.

Finished floor. We chose to fix the boards down with screws rather than nails, in case we ever needed access again.

We also made sure we'd sealed all the gaps where pipes came through the boards to reduce air leakage.

Variants

A few months after I did the first bay of the hall, using the method above, I did the remainder of the bays, trying out a few variants to speed up the process. In each case, I lifted one board every 1.2m

Variant 1: Thermofleece and tyvek

Over some of the area, I reached in through the lifted board and stapled tyvek membrane to the underside of the joists. I then slid thermofleece insulation into the gap between tyvek and floor boards. (I could also have used rockwool, but we had thermofleece reclaimed from another project, and it was nice and non-prickly to install)

To maximise its performance in reducing air leakage, I glued the tyvek to the walls at the sides.

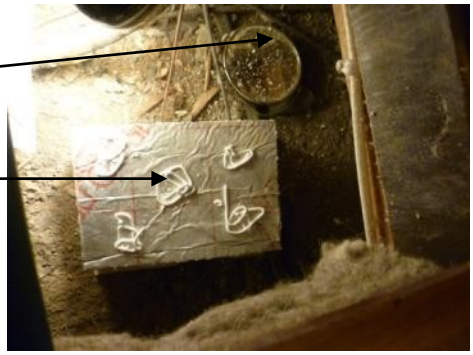
Variant 2: Celotex and adhesive

Having realised from our recent building work, how effective grab adhesives are, started using "I can't believe it's not nails" to stick carefully cut pieces of celotex under the floor boards, between the joists. To maximise the performance of the adhesive, I brushed off the cobwebs from the boards, and tried to get them reasonably dust free. The adhesive seemed to work pretty well: it allowed a little bit of repositioning, but was strong enough to hold each sheet in place and was much quicker than using the "mega staples" described above.

As backup, I hammered a nail partially into each joist to hold up the celotex. In some places, I could hammer a wedge ontop of the sleeper wall, to wedge the sheet up against the underside of the floor boards.

shaving mirror. V useful for seeing what you're doing

adhesive on celotex, ready to install



We're very pleased with the result. The whole house seems warmer, probably largely because of the reduced air leakage, and the floor still looks great.