Turf Roofs Tipsheet 50p

Turf roofs allow the harsher edges of buildings to blend in with natural environments. They also provide a haven for insects and plants. This tipsheet tells you how to build your own.

Centre for Alternative Technology Publications

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Introduction

Landscapes are often destroyed by insensitive housing projects and ill-conceived planning strategies. Environmentalists are keen to develop housing that integrates effectively and beautifully with the existing landscape. Turf roofs can soften the harsher edges of buildings in sensitive environments and create an effective growing area for a range of grasses and other plants. Thus they are able to contribute to our visual environment, whilst providing a small haven for plant and insect life.

CAT has been building turf roofs for a number of years. The early ones were quite simple – just a plastic sheet like those used as damp proofing membranes under concrete floors, padded with old carpets and covered with soil. More recently we have replaced the plastic sheets with butyl rubber or EPDM and the old carpets and cardboard we once used have been replaced by geotextiles. Only the soil remains the same. This tipsheet looks at both the high-tech and low-tech approach. There are descriptions of the uninsulated turf roof suitable for basic shelters and the latest 'warm' roof, suitable for low impact housing developments.

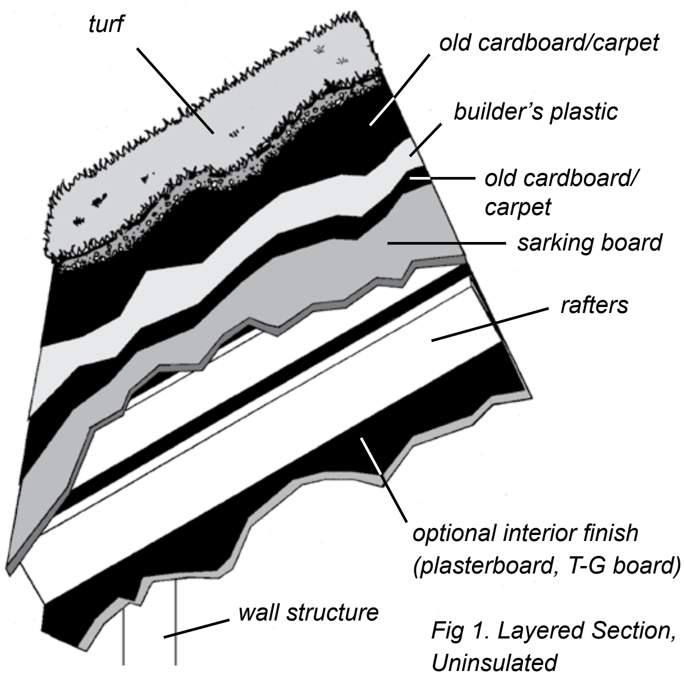


Fig 1. Layered Section, Uninsulated

Weight

Weight is the first consideration when designing a turf roof. When wet, a turf roof is likely to weigh in the region of 500kg per square metre so the roof should be designed to take that kind of load. Compare this to an ordinary roof, which is designed to take loads of up to 150kg per square metre. The only practical way of achieving this sort of strength is to increase the depth of the rafters. Normally, rafters tend to be about 75-100mm deep. Under turf roofs, rafters are typically 200-250mm deep. Increasing the rafter depth does allow more insulation to be put on the roof cavity but it gets difficult to design good details for the eaves and ridges when the roof section gets this much thicker, especially when the ventilated cavity adds another 50mm to the depth.

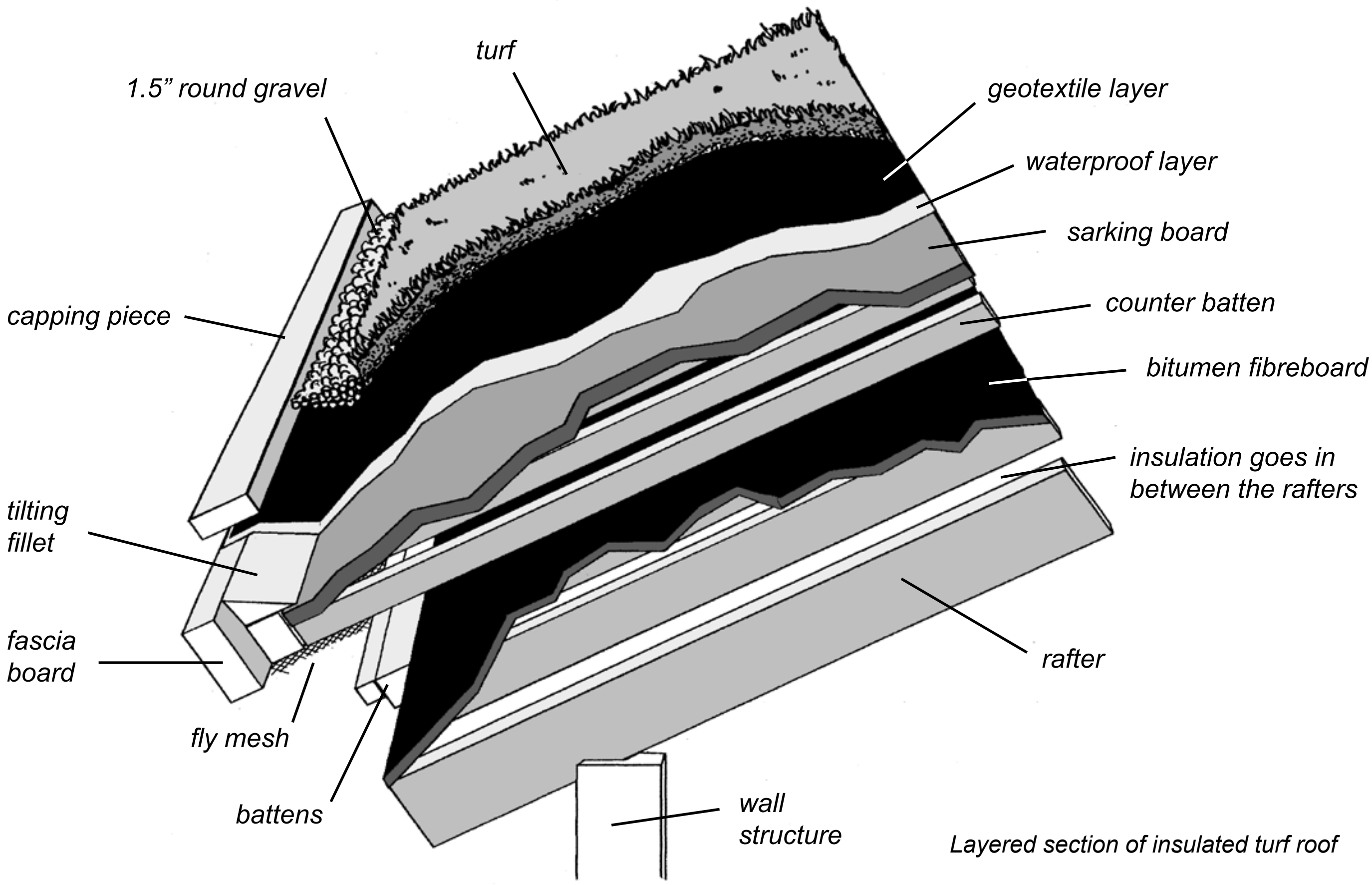
Uninsulated turf roof

This couldn't be simpler. Your chosen structure must be able to take the weight of a turf roof. With 100mm of soil on the roof the structure should be capable of taking 500kg per meter square. If in doubt contact an architect or structural engineer. Having constructed the building and roof, clad the roof with a sarking board – this could be 150mm x 25mm sawn timber boards or 22mm Sterling or other OSB (Orientated Strand Board). Place a layer of old carpets, cardboard or even roofing felt on top of this to act as padding between the timber and the plastic sheet. The plastic sheet comes next. We tend to use 1200 gauge builder's damp proofing membrane (DPM) which usually comes on a roll 4m wide and 20m long. If the building isn't huge it is possible to use a single piece and avoid the problems that come with joining this material in situ. The best way to make a joint is to overlap two t by at least 500mm such that the water will flow away from the overlap. If this is impossible to do, for example because of the shape of the roof, then it would probably be best to consider some other waterproofing layer. Having said that, DPM can be stuck together with cold tar or lap cement and this is worth considering, even if it is a calculated risk. Edge details are best done like conventional flat roofs.

After the waterproof layer has been put down and all the details worked out and done, it's time to put on the turf. Put some more padding on the plastic. Again, old carpets or cardboard can be used. Whichever material you decide to use make sure there is plenty of it, just in case there are any sharp stones in the soil (the risk of puncturing the plastic is greatest when the soil is being put on). Of course, you could use turf bought from a merchant or garden centre but the cheapest alternative would be to use earth and grass seed. Almost any type of earth will do – though of course different plants will grow in different types of soil. Our experience has shown that whatever plants or grasses you start out with they will, after a few years, be replaced by growth that best suits that particular situation. Soil should be 100mm deep (any less and you run the risk of the roof drying out).

The gutter

This roof uses standard half round or square section plastic guttering. Keeping the soil on the roof is always a problem, especially in the early days before the root systems of the plants bind it together. One possible way to stop soil loss is to use large



Layered section of insulated turf roof

round pebbles as an edging. On steeper roofs these are probably best replaced with large stones.

The plastic will deteriorate with exposure to sunlight and it is best protected by a layer of 'something' at the gutter edge. In this low-tech design, mineralised roofing felt could be used. Since it's not strictly speaking a waterproofing layer it doesn't need to be properly jointed (though of course no harm will come from doing this) and it is simply held in place by the gravel or stones. The appearance of the roof could be much improved by putting a layer of the same material under the plastic so you see black felt, and not blue plastic.

Insulated turf roof

There are particular concerns when constructing an insulated roof with a totally watertight membrane on its upper surface. Water vapour can be a problem if it is allowed to pass through the inner surface of the roof structure but cannot get out through the upper surface because of the waterproof membrane. The trapped water vapour will at some point condense, wetting both the insulation and the timbers of the roof. Normal building practice is to exclude water vapour from the insulated cavity by placing another watertight membrane, usually a sheet of plastic, behind the plasterboard. This can lead to condensation problems in the room and in practice this inner membrane is extremely difficult to install, in a manner which guarantees its total effectiveness. Because the source of the problem is not the water vapour itself but the fact that it is trapped within the insulated layer in ever increasing quantities with nowhere for it to escape, CAT has adopted the approach pioneered in Europe by the Institute of Building Biology by allowing all our walls and roofs to 'breathe'.

Essentially, a breathing wall or roof construction consists of a cavity, in which the insulation sits, lined on both sides with water vapour permeable materials. The inner layer has a resistance to the transmission of water vapour, at least five times that of the outer layer, and it is this inner layer which controls the amount of vapour entering the insulated cavity. Being more vapour porous, the outer layer is not a limiting factor. An air gap is constructed on top of the outer layer by counter battening the rafters and sarking with a suitable board or sheet material. It is on this sarking layer that the turf roof is constructed, to the same detail as the uninsulated roof.

The air gap is ventilated at the eaves so that any water condensing on the surface of the outer layer of the insulated cavity can evaporate easily. The diagram above shows a section through a typical roof. It should be noted that ordinary plasterboard is far too vapour permeable to be of use in this type of construction. We often use 'Duplex' plasterboard, which has an aluminium film on one side. Alternatively you could use a specific thickness of either hardboard or medium board, or surface treat the plasterboard (either before or after skim plastering) with a proprietary dry wall sealer.

The major problem with a roof constructed in this way is its depth. A typical slate or tiled roof will probably have 75mm or 100mm rafters with 19mm battens holding slates or tiles with a maximum thickness of 40mm. The resulting roof would be somewhere between 100mm and 159mm thick. As a breathing turf roof is about 390mm thick, it is much harder to provide attractive eaves and verge detailing. Rather than using a single 400mm board you may consider using a number of boards at the eaves, overlapping each of them to gain the required 400mm.

Other considerations

- Do not attempt to pitch roofs over 30°.
- Always use integrated gutters on roofs over 20°.
- Ventilation on duo-pitched roofs will be required at ridge ends.
- A ventilation gap will need fly mesh to stop wasps, birds etc. entering the ventilation space.