

# Building an energy efficient straw bale home

## *Straw bale installation – laying straw bales*

Straw bales are laid in running bond, which means that the vertical joints are staggered in the same way as in brick walls. I would recommend that the bales be laid on their flat and not on edge. One edge of the bales has folded straw whilst the other has clean cut straw ends exposed. When laying the bales start with the cut edge out for the first row and the cut edge in for the second row and so on up the wall. The folded side is just a tiny bit thicker than the cut edge so alternating avoids problems later on when compressing the bales.

BY BRIAN HODGE

### **Wet areas**

It is important to create a safety margin between the underside of the straw bales and the floor, especially so in wet areas. In bathrooms, laundries and toilets the law requires that the junction of the floor to the wall be sealed to prevent water penetration, which to a large degree negates the risk of water penetration into the straw bales in these

areas. However it is imperative that there is also a good separation in the kitchen.

The biggest risk of significant water exposure in the kitchen comes from the dishwasher. If, for instance, the hose on the dishwasher were to burst in your absence, the loss of floor coverings as a result would be the least of your concerns. Without good separation of the straw bales from the floor, it is likely that the water damage would be so great as to cause the demolition of affected walls. It is important to always keep in mind that the primary enemy of straw bale walls



is water, whether from condensation or direct water exposure.

In addition to the protection of the bales from the floor, the structure below the straw bales also works as a fixing method of the straw bale walls to the floor, as well as forming an important part of the compression process of the straw bales. Compression of the bales is essential to negate the risk of future cracking of the finished walls due to bale settlement. If the straw bales are simply stacked into the wall and not compressed, over time they will settle under their own weight, which will result in cracking of any render; this natural settling process can last several years.

## Bottom boxing

The structure below the straw bale walls is referred to as the bottom boxing. On my build it is 90mm deep, made up much like a ladder, with structural ply fixed to the top.

The bottom boxing has side rails with noggins at 450mm centres, all fixed on edge. Every 1.8m and at the end of the boxing, which adjoins full height openings, additional noggins are fitted on flat, through which the boxing is connected to the floor using two 100mm nails (screws can also be used) per noggin. For fixing to a concrete slab, two 75mm masonry nails or two 10mm masonry anchors (e.g. *Dynabolt*) would be used.

I used 19mm woven polyester strapping to compress the straw bales. The strapping encircles the straw bale wall, travelling under the bottom boxing and over the timber top boxing structure at the top of the wall. The strapping has 1100kg breaking strain and is bright orange in colour.

Prior to fixing the bottom boxing to the floor, a length of strapping approximately 2m long is laid on the floor with the bottom boxing fixed over it. I then tied a knot in each end of the strapping to reduce the risk of straps being accidentally pulled out during the rest of the build.

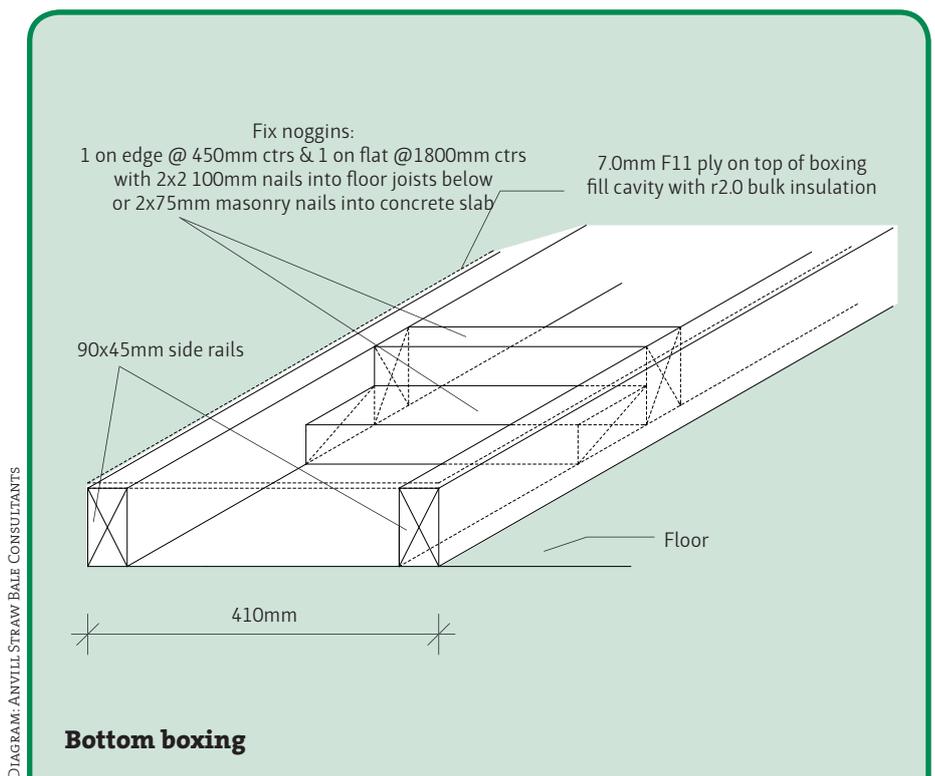
## Boxing insulation

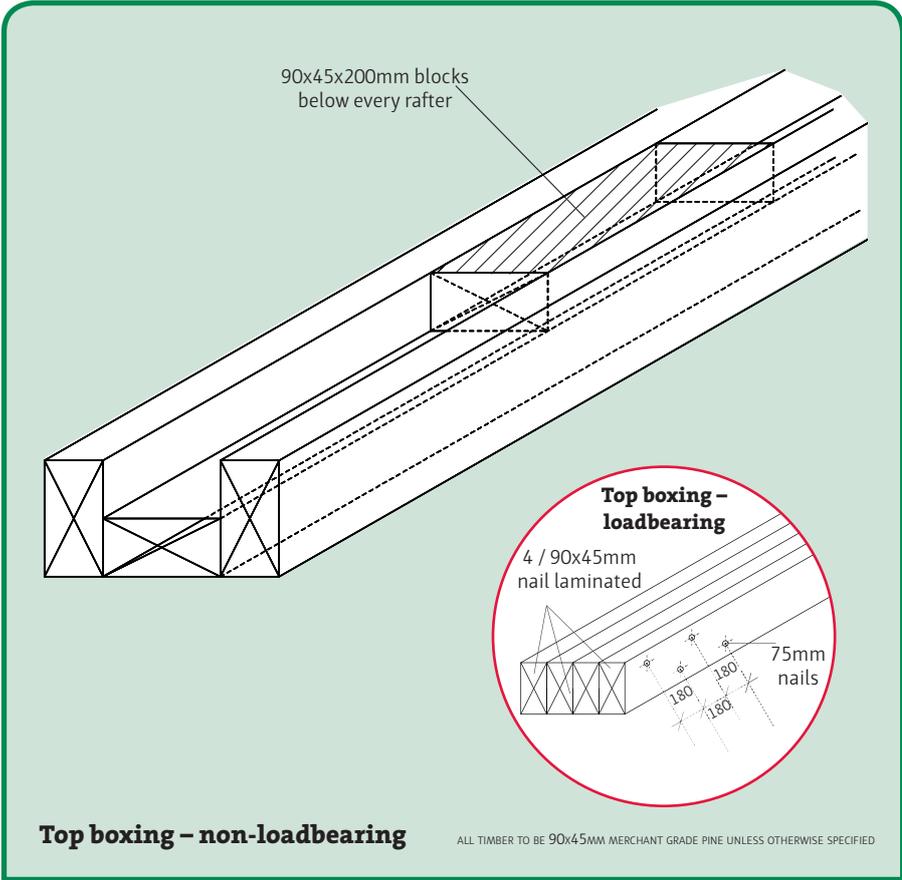
With the bottom boxing fixed to the floor, I then fill the cavities with R2.0 glass batt insulation. Many of our power points are within straw bale walls about 200mm up from the floor.

Having the glass insulation enabled the electrician to run cables within the bottom boxing to service these outlets without the need for conduit, as there is no risk of damage to cables encased in this insulated bottom boxing.

A ply top is applied to the bottom boxing over the insulation, providing consistent support for the underside of the bales, which in turn enables significant compression to be applied to the straw bale wall.

The bottom boxing is 410mm wide whereas straw bales are 450mm wide. This serves two purposes. Firstly, having the boxing narrower than the bales, the strapping applies pressure to the side of the bales, helping to hold the bales central on the boxing. Secondly, if driving rain hits the raw straw bales prior to rendering, the 20mm overhang of the straw bales will discharge surface water off the bales onto the ground rather than it gathering on top of the ply covering.





**Top boxing**

I recommend top boxing 180mm wide; with the top boxing narrower than the bottom boxing, significant triangulation provides extra lateral stability to the wall. The top boxing is made up of three pieces of 90x45mm pine, with additional blocks of 90x45mm inserted into the top channel of the boxing about every metre. Without these additional blocks, the top edges of the boxing will tend to roll together under compression, weakening the structure.

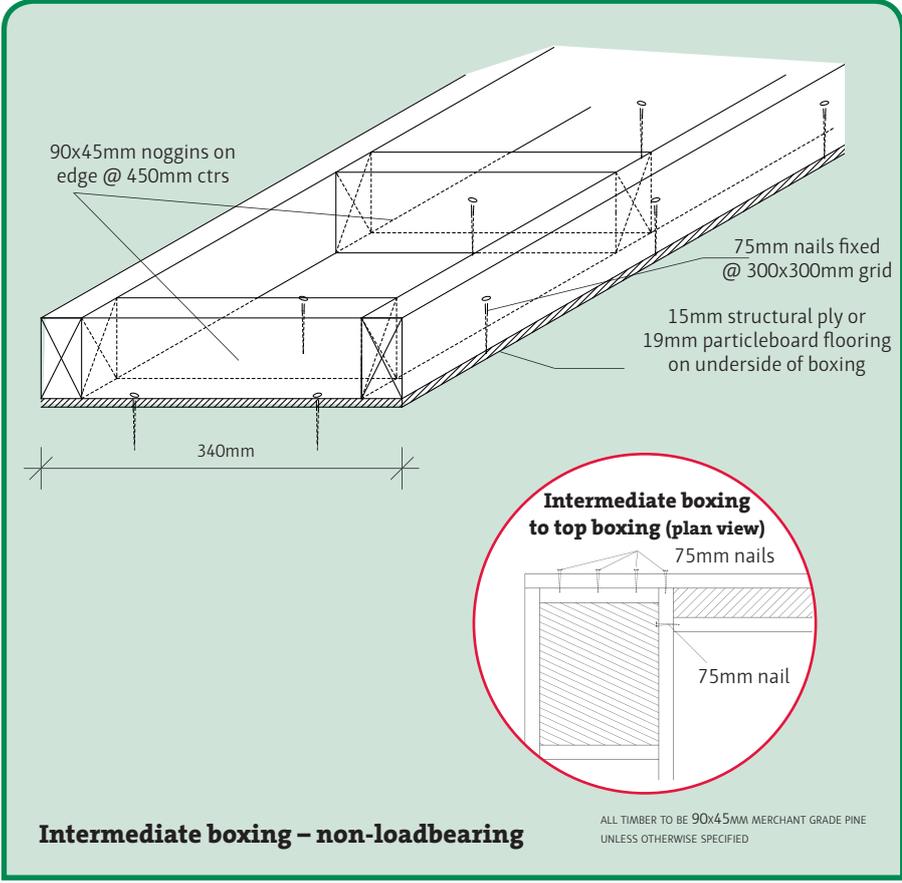
Over the window and door openings in the straw bale walls, we have built an infill structure to maintain the full depth appearance of the straw bale wall. The top boxing not only forms an essential part of the compression of the straw bales, but also provides the majority of the support for this structure. On some occasions, when greater strength is required to support wider bulkheads, I specify four pieces of 90x45mm nail laminated together for loadbearing top boxing.

**Intermediate boxing**

This house has a curved roof so the end walls extend higher than the side walls. The side walls are seven bales high, so it is essential that the end walls are also compressed at seven bales high so that everything is tied together. With the need to add extra bales at the end walls up into the gable, I fitted what I refer to as intermediate boxing on the end walls at seven bales high.

The side wall top boxing was connected to the end wall intermediate boxing at the corners prior to compression. As I positioned the top and intermediate boxing on top of the straw bale walls I fitted the compression strapping and pulled it hand tight, which removes the risk of the top boxing falling off and injuring someone during construction. The junctions of the top boxing and the top boxing to intermediate boxing are securely joined prior to compression.

The compression strapping is placed at 450mm centres along the straw bale wall, with a joining buckle at each side of the wall. The straps were tightened three separate times about 24 hours apart using tensioning tools. Jan and I did this together so that both the inside and outside of the strap were tightened



simultaneously to provide even vertical compression. During compression, the strapping will bite into the top boxing and stop slipping after some tension is applied, so if only one buckle were to be used (instead of two) it would not provide even compression to the wall.

After three compressions of the top and intermediate boxing atop the first seven rows of bales, the straw bales to the gable ends were installed. The cavity at the top of the intermediate boxing is filled with biscuits of straw and then the bales are stacked on top. At the top of these additional gable end bales, standard top boxing is installed. This top boxing is compressed with compression strapping again at 450mm centres, however it is essential that this strapping extends to the bottom boxing NOT just to the intermediate boxing (at an angle if required). The top boxing on our home was made up of many pieces to more closely follow the roof line.

After three compressions of the gable end top boxing it is then connected to the intermediate boxing to provide stability to the structure. ♦

*Brian Hodge is the director of Anvill Straw Bale Building Consultants. With over 40 years experience in the building trade, he now consults predominantly on straw bale construction. He is the author of 'Building your straw bale home.'*



### Links & resources

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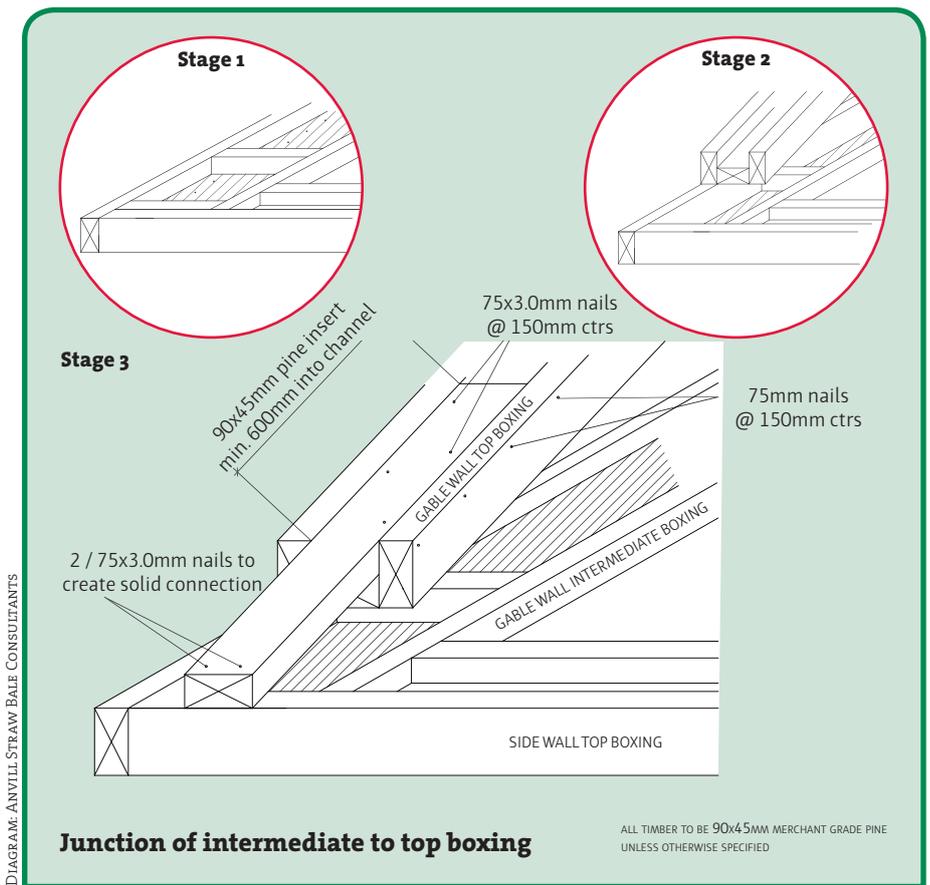


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### Junction of intermediate to top boxing

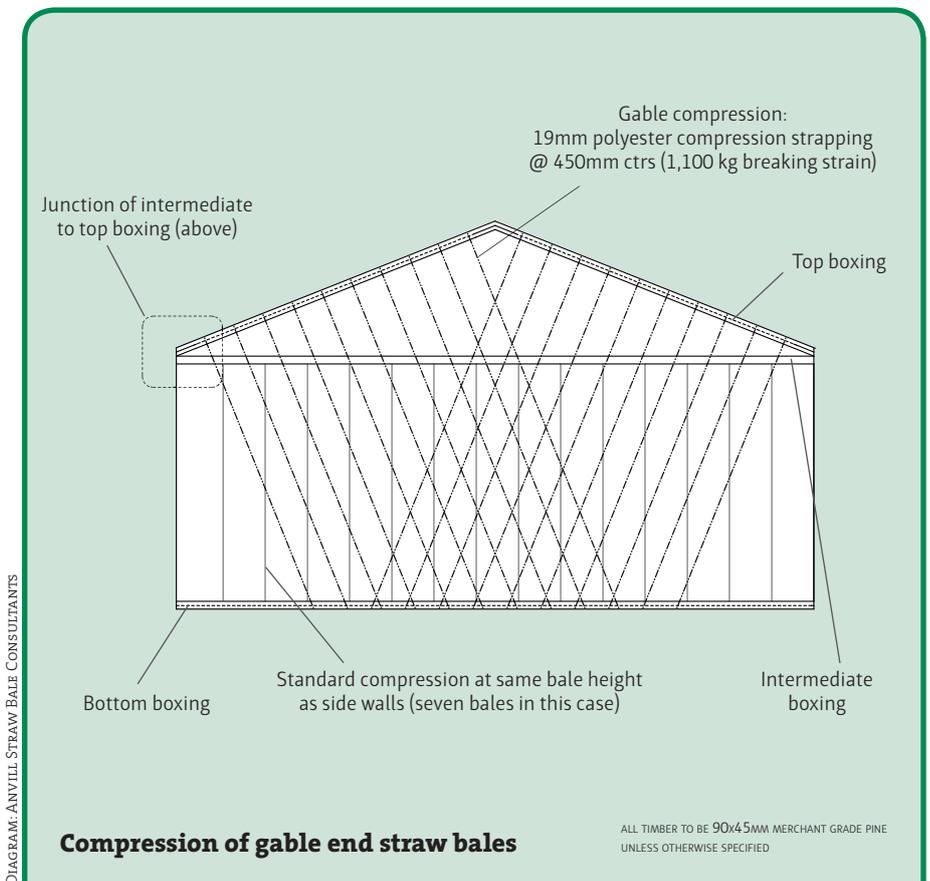


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### Compression of gable end straw bales