Strawbale Moisture

This article deals with the difficulties of dealing with moisture, external moisture in particular, but also internal moisture to some extent, when constructing straw bale walls.

These suggestions also do not necessarily detail how to achieve the desired results, nor does it consider various straw bale-specific construction techniques of which there are many - this is up to the skill and experience of the designers involved - but rather sets out principles for moisture control.

Following these suggestions does not guarantee perfect results - any building needs careful assessment of a lot of different parameters. However, if these suggestions are followed the people consulted for this article believe that the chances of serious mistakes (and their consequences) will be considerably reduced.

Common faults encountered in New Zealand include:

Poor weather protection of the walls (usually lack of eaves or verandahs on all walls), construction on exposed sites, undue reliance on stucco plaster as a water proofing skin, poor damp proof courses, cracked and/or deficient plaster, lack of sufficient clearance between the exterior ground and the straw bale walls, plaster coats that bridge damp proof courses, lack of sufficient toe up at the bottom of the walls, and poor detailing of window sills or other openings.

The suggestions given are derived from the experience gained dealing with the design and construction of earth walled and straw bale buildings in New Zealand together with the research of overseas literature. However, most written material on straw bale that is available is written for overseas conditions which are not necessarily relevant in the NZ context. This material requires some modification using skilful interpretation to bring it into the New Zealand context.

Most building materials, if they get saturated once, will dry out without total destruction. Straw bales are an extremely moisture-sensitive wall material. If they get soaked the tightly bound hollow straw fibres are capable of holding a great amount of water and will tend to remain wet for long enough for fungal decay to start - they will tend to compost rather than dry out.

It is therefore imperative that any straw bale design is such that the straw remains dry throughout the entire building process and the life time of the building.

To achieve this straw must be supplied dry, and kept dry. Building under an existing roof is a good idea, and of course keeping above flood areas is essential.

Any site needs careful consideration of exposure to wind-driven rain, and these Straw-bale guidelines suggest that only sites that have a wind exposure of LOW or MEDIUM as defined in NZS 3604 1990, Table 2.4 are suitable for single thickness plastered straw bale wall construction and then only with the very generous overhangs suggested in these guidelines to protect the straw bales walls.

For sites outside these parameters (ie. sites with HIGH, VERY HIGH, or SPECIFIC DESIGN wind zones), or with less overhang than suggested above, straw bales (if used at all) should be placed behind a weather resistant skin that incorporates a drained and ventilated cavity. Issues of vermin and fire resistance may then need consideration.

The toe-up at the base of the wall with a damp proof course on top is essential to keep the foot of the bales walls dry during construction and during the life of the building.

The "good hat and good boots" that earth builders like to talk about are even more relevant to straw bale building.

The straw bale walls must be covered with a surface material that will allow any water vapour that may

get into the wall to migrate out again readily ie. the wall must "breathe", but not leak. It is important to distinguish between the movement of water in gaseous form in and out of the walls as opposed to the ingress of water droplets. The use of any sort of building paper or membrane between straw bales and plaster is generally not desirable as it can trap moisture or limit its movement.

Stucco plaster is very difficult to guarantee leak free and therefore needs to be regarded as secondary weather protection, and not be relied upon for 100% water exclusion. Dense stucco plaster is also not a particularly good "breathing" coating, especially if painted. Softer plasters such as lime, gypsum or earth work better.

Plaster coats adhere well to straw bales, but some form of reinforcing is recommended on the exterior wall to help ensure the integrity of the skin, and at least around corners and at all openings on interior surfaces.

It is also suggested that straw bales be pre-compressed before plastering whether the walls be load bearing, partially load bearing, or infill. This tightens up the bales which gives better structural stability, but also gives a much tighter surface for plastering onto which is less inclined to creep or move. The amount of pre-compression is usually in the order of 1 -2% in height, but less dense bales can be pre-compressed more that this and this needs to be allowed for in design.

Window openings must be very carefully designed with good heads, jambs and sills that will not leak either from direct water penetration, soakage through materials, or by capillary action, and which will cast any moisture well clear of the wall surface. Good flashings should be incorporated which will deal with any exterior moisture that might get past the generous roof overhangs, and also deal with interior moisture from any condensation.

Straw bale walls in "wet areas" such as bathrooms, laundries and kitchens need to also be carefully thought about to ensure that they will not be subjected to excessive internal moisture and these wet areas should also incorporate floor drains to prevent flooding saturating the bottom of the wall.

Water pipes should not be carried inside any straw wall, and steel embedment minimised where it might act as a focus for moisture condensation.

These suggested guidelines are not written as "standards" or suggested as "the only way to do it".

However, we think that building outside these parameters until a lot more research has been undertaken in the New Zealand context could be risky unless there are strong reasons for not following these suggestions after careful assessment of specific site conditions.

The urgency we see at this time is to prevent the proliferation of straw bale buildings that are not following good building science guidelines. Those thinking about building with straw bale should seriously consider employing someone with a good building science understanding of the material, in the same way that they would employ an engineer for structural issues. The money spent could be saved many times over in avoided problems.

The issues that are presented here have been agreed as sensible cautionary criteria by the following people who all have a strong interest in the art and science of earth and straw bale building. They are suggestions only and do not necessarily mean that all buildings must follow these. However, we would invite designers and builders to be particularly cautious and very sure of what they are doing if they depart very much from these suggestions.