

Straw Bale Construction: Is Straw Bale Construction suitable for Self-Builders in Britain?

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Fig. 0.01: Construction details from the case studies.

Summary

The aim of this study is to assess the suitability of straw bale construction for self-builders in Britain.

In this study self-build refers to projects which are either physically built or managed by their owner. The projects range from garages and workshops to two storey family homes.

Before introducing straw bale construction the study first examines the history of self-build in Britain and why people choose to self-build. A review of available literature has been carried out to appreciate the resources available to would be straw bale self-builders. In order to assess the suitability of straw bale construction for self-builders however it is necessary to consider the experiences of those who have followed this route. Six case studies have been selected and analysed in order to provide primary evidence regarding the success of straw bale construction.

The six case studies vary in size and ambition but all fit the definition of self-build set out above and use straw bale construction for the majority of the building. Each case study has been presented and then the success of the projects has been analysed under the headings of design; planning permission and building regulations approval; sourcing of materials; the build; and after the build.

The study concludes that straw bale construction can be suitable for self-builders in Britain but that it has certain limitations which need to be taken into account during the planning and preparation of any project.

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I would like to thank all the self-builders who agreed to participate in interviews that contributed to writing this paper as well as Martin Penk of Arco2 and all those who pointed me in the direction of potential interviewees.

I would also like to thank my supervisor Paola Sassi for her support, guidance and prompt responses to my queries throughout the writing of this paper.

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Preface

It is easy to go through three years of architectural education with little or no practical experience of building. To gain first hand site experience and experiment with building methods was a desire that first fuelled my interest in the world of self-build. The idea of building anything from a garden shed to a small house as an educational venture greatly appealed to my practical nature.

Traditional and mainstream construction methods can seem very intimidating and appear almost to be a secret science to someone new to the construction industry. The seemingly more accessible and less technical nature of alternative and natural construction methods appealed to me as a route to self-build. From this a specific interest in straw bale construction developed and led me to take part in a straw bale building course.

As yet my own desire to embark on a self-build project is unfulfilled but this interest has led me to investigate the realities of straw bale construction for self-builders in Britain.

Fig. 1.11: The story of 'The Three Little Pigs' has perhaps inspired a prejudice against straw bale construction in Britain.



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1.1 Introduction

Self-build accounts for a substantial volume of construction each year in Britain. Traditionally dry construction methods have been favoured by self-builders, however with a rising interest in sustainable construction, natural materials are becoming a popular choice.

Straw bale construction has been practiced in America for around a hundred years and is making its way into the British self-build market. The construction method is promoted as cheap, quick and easy but how does it work out in reality for British self-builders?

1.2 Research Aims and Methodology

The aim of this study is to investigate and research the suitability of straw bale construction for self-builders in Britain.

To address this aim six case studies have been researched and analysed. The six case studies are not sufficient to produce statistics about the success of straw bale construction however by focusing on each individual's experiences the research assesses the suitability of the construction method and identifies key issues. Each study deals with design, planning, sourcing of materials, construction, and the buildings value and performance in use.

By making recommendations for best practice and the future of straw bale construction this paper will hopefully be a useful resource for anyone considering embarking on a self-build project using straw bale construction.

1.3 Structure

Following this introductory section this dissertation is divided into five further chapters.

In *Chapter Two* the paper looks at self-build in a broad context; it's history in Britain, the legacy of Walter Segal and why people choose to self-build.

Chapter three is concerned with straw bale construction giving a short history of the construction method abroad and in Britain. This is followed by a summary of the work of Barbara Jones and a description of straw bale construction techniques.

Chapter Four of the paper presents the six case studies giving a brief description of each self-builder and their project.

In *Chapter Five* these case studies are analysed and discussed under the headings; design; planning applications and building regulations approval; sourcing of materials; the build; and after the build.

Finally in *Chapter Six* conclusions are presented both about the suitability of straw bale construction for self-builders in Britain and how the construction method can move forward in the future.

2.0 self-build

2.1 Self-Build in Britain: the background

self-build n. Brit. The building of homes by their owners
- DERIVATIVES self-builder n.¹

self- comb. form 2 by one's own efforts; by its own action²

build v. 1 construct by putting parts or materials together³



Fig. 2.11: Canvey Island, a characteristic view from the Twentieth Century.

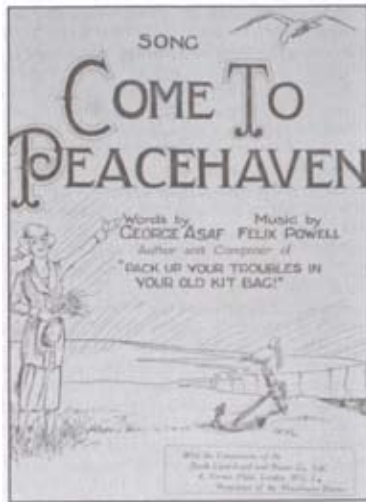


Fig. 2.12: A musical invitation to join the self builders at Peacehaven.

For the purpose of this dissertation the term self-build is not restricted to the building of homes but is rather formed by a combination of the definitions of 'self-' and 'build' thus relating to building in a broader sense. Generally self-builder relates to not only those that physically build but also those who take on responsibility for the procurement of their own building through project management.

The history of self-build goes back almost as far as the history of man and to the building of the first forms of shelter. In more recent times self-builders in Britain were particularly active in the early part of the twentieth century and up until the late 1940s. It was during this time that the plotland developments in South-East England were in their prime. The term plotland refers to the division of land into small plots that can be sold for individual development and this is exactly what happened in resorts such as Canvey Island, Peacehaven and Jaywick Sands. Many of the plotlands started life as second homes and weekend getaways. In post war years, however, returning soldiers seeking a quieter life would return to their country plots to try and settle down at a relatively low cost and live a simple life they couldn't have afforded elsewhere.

The plotland developments demonstrated a multiplicity of unusual and often improvised construction methods and were

Invariably a world of single-storey houses, simply built

1 'Concise Oxford English Dictionary', ed. by Judy Pearsall (Oxford: Oxford University Press, 2002) p. 1299.

2 Ibid.

3 Ibid, p. 183.

and often using wood, though never refusing whatever material (corrugated iron, asbestos, pre-cast concrete and bricks) lay at hand.⁴

A large number of the houses built in these developments were extensions to disused buses, railway carriages or army sheds. The self-built villages such as Peacehaven and Canvey Island were renowned for their community spirit with owners collaborating to fight local councils for the rights to their plot.

Today, battles between self-builders and local authorities are still common place as self-build has become a prolific part of the construction industry. Now there are:

over 250,000 new homes [...] built in the United Kingdom each year. Of this number, ten percent are self-builders, of which ninety five per cent have never actually built before.⁵



Fig. 2.13: Self-build technical innovation on channel 4's Grand Designs.

Contemporary self-build projects tend to be at the forefront of building innovation as builders are able to explore new technologies and allocate funds to their own areas of interest. There is a certain trend in today's self-build market towards 'green' technology and often self-builders are the first to showcase and experiment with new eco-initiatives. Today's self-builders have an admirable support network with countless books and magazines available on the subject as well as popular TV shows such as Grand Designs. There is also a wealth of internet resources offering advice on finance, plot finding, design and project management.

4 Dennis Hardy and Colin Ward, *Arcadia for All* (Nottingham: Five Leaves Publications, 2004), p. 2.

5 *Self-build & Design Magazine*, August (2003), p. 151.

2.2 Walter Segal



Fig. 2.21: Walter Segal had a very hands on approach to architecture and construction.

Walter Segal could be described as the master of self-build housing. Born in 1907 near the alternative community of Monte Verita in Switzerland he studied architecture at the Technische Hochschule in Berlin where he rubbed shoulders with the pioneers of the modern movement. In 1936 Segal, fascinated by the British tradition for invention and problem solving, moved to London where he taught at the Architectural Association as well as publishing many books and contributing to journals. Alongside his teaching and writing Segal ran a small practice running conventional projects in a slightly unusual way, employing no specialised consultants or staff. He felt that this way he could keep control of a project in terms of design, construction and cost in a way that not all architects could.

In the 1960s Segal and his partner Moran Scott decided to demolish their family home in Highgate with the plan to rebuild on the site. Interestingly it was the temporary dwelling that Segal constructed in just two weeks for around £800 that attracted a wealth of attention. The small house was built with lightweight timber construction and used standard cladding panels in off-the-shelf sizes to minimise waste and allow for reuse. The house had no foundations other than paving slabs to spread its load on to the ground and still stands today. The interest this building generated led to a number of commissions around the country for houses of similar style and construction. The 'Segal method of building' was developed and improved with each commission and the clients were able to carry out more and more of the construction work themselves.

In the mid-1970s the general public had a serious lack of confidence in local authority housing. At this time Walter Segal was desperate to find an authority that would support an experimental self-build housing development. The opportunity arose at Lewisham when a group of like minded individuals including Colin Ward, Brian Richardson and Nicholas Taylor came together with Segal to cre-

ate London's first self-build housing association project. The road was not an easy one but eventually the first Lewisham scheme was complete and its success inspired a second scheme. The two developments provided twenty-seven detached houses with gardens for families previously housed in council flats and high-rise estates.



Fig. 2.22: A typical Segal method house at Lewisham.

The Segal method of building allows the advantages of timber construction to be realised through the materials that are readily available in the modern construction industry. Segal devised simple methods of joining materials using screws and bolts and avoiding wet construction methods. He also developed a dimensional grid that would relate to standard building component dimensions, thus not only reducing waste but also site work and cutting. Since its birth in the 1960s and its zenith at Lewisham in the 70s the Segal method has enjoyed widespread popularity among self-builders and is still an exemplar for self-build construction. Even today, over twenty years since Segal's death in 1985, the methods of construction are being promoted, refined and adapted by The Walter Segal Trust and architects such as Jon Broome at Architype.

2.3 Why people self-build

I wanted not only a room of my own, but a room of my own making. I wanted to build this place myself. ¹



Fig. 2.31: Michael Pollan's writers cabin.

Some people feel a great desire to build for themselves, such as journalist Michael Pollan, but the reasons behind this desire vary greatly. In the case of Pollan the exercise seemed to be one of personal development, not only of practical skills but also self confidence and a broader understanding of the previously alien world of architecture, carpentry and building. This sort of development was experienced by Jon Broome and Brian Richardson, both architects, during the designing and building of their own homes.

We all learned by doing. Once started, we realised we were capable of more than we had believed possible. In overcoming our lack of practical building experience and the gaps in our skills and knowledge we have surprised ourselves, and so will you. ²

Broome and Richardson also speak of their desire to express themselves through building and popular philosopher Alain de Botton believes this need for expression is one of the fundamental reasons behind people's passion for self-build:

A longing for communication and commemoration, a longing to declare ourselves to the world through a register other than words, objects, colours and bricks: an ambition to let others know who we are – and, in the process, to remind ourselves ³

Although the driving force behind self build projects is often a longing for self expression, practical experience or the acquisition of new skills there is no doubt that in some cases the lure is one of financial value. The opportunity to provide a better home, an affordable home or in some cases any form of shelter has driven people to build for themselves. Certainly the plotland developments

1 Michael Pollan, *A Place of My Own* (London: Bloomsbury Publishing Plc, 1997), p. 4.

2 Jon Broome and Brian Richardson, *The Self-Build Book* (Totnes: Green Books, 1995), p. 22.

3 Alain De Botton, *The Architecture of Happiness* (London: Penguin Books Ltd, 2007), p. 126.

described previously are an example of building for value. Similarly the opportunity to own a stake of an adequate, well built family home was the motivation for the self-builders at Lewisham. In these examples the value or economy of self-build was probably the initial attraction, however those involved undoubtedly gained more than the value of their labour through building for themselves. In a self build housing project in Peckham, Bruce Stewart explains that,

The mix of social strata gives those on low incomes a much-needed confidence boost and empowers them to think beyond their usual expectations.⁴

These self builders embarked on the project intending to exchange their labour for an ownership stake in a new home but attained more than this in experience and personal development.



Fig. 2.32: Will Anderson's Clapham Tree House.

As touched upon previously the desire to 'build green' is fairly ubiquitous amongst self-builders and sometimes this can be the motivation behind a project. Will Anderson's Clapham Tree House for example shows:

Our inspiration was and is our tree. Rather than look to standard practice and seek to better, we set our sights on the best possible example of environmental design and sought to meet it. Tree House is the result.⁵

It is likely that this consideration for the environment will only grow in the self-build world with increasingly stringent building regulations and grants offering reward for sustainable design features.

4 Bruce Stewart, 'Self Build Housing in Peckham', *Architectural Design*, 75; Pt. 3 (2005), 108-111, (p. 110).

5 Will Anderson, *Diary of an Eco-Builder* (Totnes: Green Books Ltd, 2006), p. 8.

3.0 straw bale construction

3.1 A short history of straw bale construction



Fig. 3.11: The Pilgrim Holiness Church in Arthur, Nebraska.

The first known straw bale buildings were built in Nebraska at the end of the nineteenth century. They were built on the plains in areas where stone and timber were hard to come by. These first structures were used as temporary shelters making use of a ubiquitous waste material, baled straw. The houses proved to offer comfortable living conditions with the insulation of the thick straw walls keeping them warm in the winter and cool in the summer. The load bearing straw bale structures became increasingly popular as a vernacular solution to housing in Nebraska and this method of construction, with no subsidiary timber structure, is sometimes referred to as 'Nebraska Style.'

The oldest remaining inhabited straw bale house is Fawn Lake Ranch in Nebraska¹. It was believed to have been built between 1900 and 1914 and is still in use as a home. The one hundred square metre two storey 'Maison Feuillette' in Montargis, France was built in 1921 and is the oldest straw bale house in Europe as well as probably the oldest two storey straw bale house in the world.² Straw bale construction continued to grow as a popular, enjoyable method of building until the advent of war stalled its progress around 1940. Together with the increasing predominance of cement in the construction industry the war virtually wiped out straw bale construction for thirty years.

In the 1970s and 1980s the once popular building technique underwent something of a revival and as old methods re-emerged they were also refined. The new improved techniques were circulated in publications which promoted both the 'Nebraska Style' of building and the use of straw as infill in timber balloon or post and beam frames. By the 1990s straw bale construction was experiencing a

1 Gernot Minke and Friedmann Mahlke, *Building with Straw* (Basel: Birkhauser, 2005) p. 13.

2 Ibid.

major boom in America predominantly as a method of construction for self-builders. The straw bale boom saw the production of *The Last Straw* – The International Journal of Straw Bale Construction and some states started to publish building regulations which were specific to straw bale construction methods.

Around the time of the American bale boom the first straw building was built in Britain in 1994³ and there are now believed to be more than seventy straw bale buildings in Britain. It is yet to be proven how straw bale construction will perform in the wet British climate and the tale of 'the three little pigs' still holds strong in British minds. British companies such as ecofab and modcell are developing new products which aim to integrate straw bales into pre-fabricated construction to give them a place in the mainstream construction industry. The flexibility, accessibility and environmentally friendly credentials of straw bale construction along with the enthusiasm of its advocates such as Barbara Jones, Chug (The Straw Bale Building Co.) and Rob Buckley (Dorset Centre for Rural Skills) are making it an increasingly popular option for self-builders in Britain.

3 Barbara Jones, *Building with Straw Bales* (Totnes: Green Books Ltd, 2002), p. 14.

3.2 Barbara Jones

It is hard to do any research into the subject of straw bale building without coming across the name of Barbara Jones. She is to straw bale building in Britain as Walter Segal is to self-building and her book *Building with Straw Bales* is widely recognised as the leading reference for straw bale builders in Britain. The book conveys a real sense of enthusiasm and simplifies each stage of the building process, promoting the construction method as an accessible path for anyone. Barbara Jones believes that:

Working together with a group of people to build our own home can be one of the most empowering experiences of your life.¹

The most powerful message to come out of *Building with Straw Bales* is that straw bale building is not only cost-effective and environmentally friendly but also a valuable team-building and co-operative experience.



Fig. 3.21: Barbara Jones believes Straw Bale construction helps to involve more people in the building process as demonstrated by children working on Paul Douglas' garage.

As well as having written a successful book Barbara Jones, along with her partner Bee Rowan, runs 'Amazon Nails' a non-profit organisation whose aim is to involve more people in the building process, 'particularly those who would not normally expect to find themselves on a building site.' The enterprise is principally involved with straw bale construction but also has an interest in other natural materials. Amazon Nails run straw bale building courses covering all stages of the construction process, these are often on site for 'live' projects and this way volunteers are used as a work force for a new building. The organisation also operates a consultancy service which is available for potential builders. 'Amazon Nails' have been involved with the design and build of over fifty straw bale buildings² and Barbara's enthusiasm for straw bale construction has inspired self-builders around the country to use straw.

1 Ibid, p.12

2 Barbara Jones, 'Home', Amazon Nails, Straw Bale Futures, <<http://www.strawbalefutures.org.uk/home.html>> [accessed 19 December 2007] (para. 4).

3.3 Straw bale construction techniques

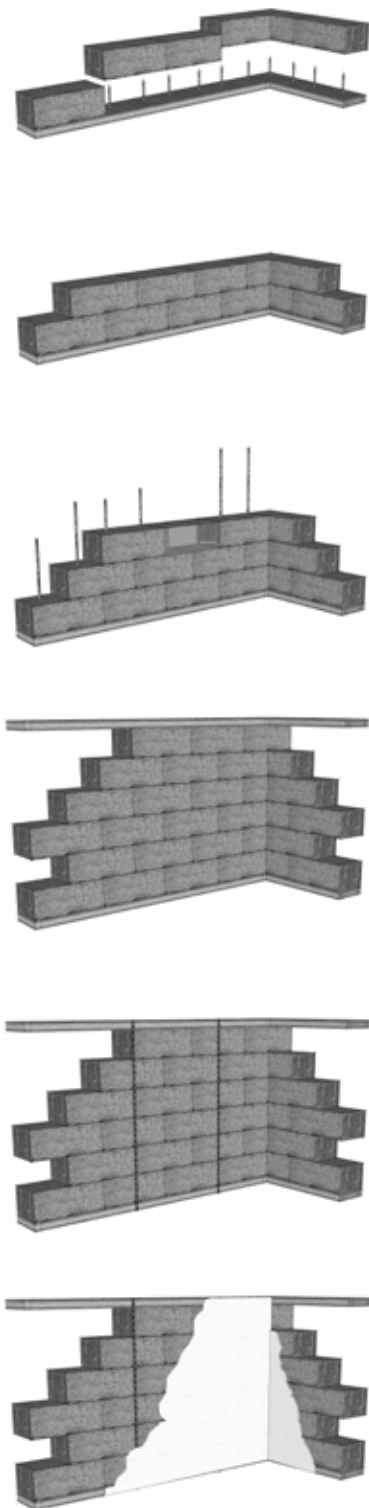


Fig. 3.31: Illustration of Nebraska method of wall-raising.

Straw bale construction has a number of benefits over conventional construction. Bales are cheap, working out at roughly a third of the material cost of masonry construction.¹ Straw is a waste material; by using straw for construction you are effectively 'locking' a volume of carbon into the buildings fabric. Straw bales are light; a straw bale wall weighs 65% less than an equivalent brick wall, 62% less than a concrete block wall and 18% less than a brick and block cavity wall². This means they are not only easy to work with but also can make do with much lighter foundations, commonly old car tyres rammed with earth and laid directly onto soil. Due to their thickness straw bales provide inherent insulation and can therefore act as structure, enclosure and insulation in one. A plastered straw bale wall 42 cm deep provides a U-value of $0.12\text{W}/\text{m}^2\text{K}^3$, far better than the 2006 building regulation requirement of $0.35\text{W}/\text{m}^2\text{K}$.

As touched upon previously there are a number of different approaches to straw bale construction. The most traditional method and that subscribed to by 'purists' is the Nebraska Style or load bearing wall. In this method the straw bale walls take the load of the roof and any intermediate floors. The first course of bales are secured onto hazel posts set in a timber base plate, subsequent courses are built up above as with brick or block work. From the third course onwards hazel spars are hammered down through the bales binding the last three courses. When the walls have reached the desired height a roof plate identical to the base plate is placed on top of the bales and the structure is allowed to settle. This process can be accelerated through the use of compression straps. Once under compression the structure is far more stable and is ready for rendering with a breathable render such as lime or clay.

- 1 Davis Langdon, *Spon's Architects' and Builders' Price Book* (Abingdon: Taylor & Francis, 2006).
- 2 Barbara Jones, *Building with Straw Bales* (Totnes: Green Books Ltd, 2002), p. 41.
- 3 Gernot Minke and Friedmann Mahlke, *Building with Straw* (Basel: Birkhauser, 2005) p. 29.



Fig. 3.32: Jim Carfrae's home, an example of straw bale being used as a 'wrap' around a timber post and beam frame.

This is one way of going about the Nebraska style of building with straw but there are variations such as the use of cladding in place of render and steel pegs instead of hazel. Another method of straw bale building is to use the straw as an infill or 'wrap' with either a timber post and beam frame or a balloon frame. This method has the advantage of using a more recognised construction method for the structure and of being able to put up a roof to build under and keep the bales dry. Lacinski and Bergeron recommend that

In the vast majority of cases, a framed approach is better suited to the demands that we and Mother Nature place on cold-climate buildings.⁴

They also believe the cost of a framed straw building is comparable to that of a Nebraska style building despite the need for the timber frame.

The third method of construction is a hybrid of the previous two, usually in this method the straw is allowed to compress down onto timber posts therefore sharing its load but benefiting from the increased stability of the compression. For all these methods the most important consideration is keeping the straw dry to avoid rot, this means that only breathable finishes can be applied to the straw. The common options are clay, lime or a rain-screen cladding with a good ventilation gap and a breathable vapour barrier.

⁴ Paul Lacinski and Michel Bergeron, *Serious Straw Bale* (Virginia: Chelsea Green Publishing Company, 2000), p. 150.

Summary of Background Research

Self-build in Britain has a long history and a tradition for experimentation with innovative construction methods and sustainable technologies. The most widely recognised method of construction is Walter Segal's timber framing system which avoids wet construction and uses standard building components. Today there are a number of factors motivating self-builders; education, practical experience, self expression, value for money and increasingly a desire to build sustainably.

Straw bale construction was first practised in Nebraska, using waste material to provide temporary shelter. The construction method has developed and is still popular throughout America. In the last ten years straw bale construction has started to take off in Britain as an option for self-builders. Enthusiasts such as Barbara Jones are striving to promote straw bale construction as economical, environmentally friendly and fun to build with.

With the relative infancy of straw bale construction in this country it is hard to know how buildings will fare in the British climate. It is also unclear which of a number of design options, both for structure and finishing, will suit Britain's self-builders best.

4.0 case studies

4.1 Introduction to case studies

In order to assess the suitability of straw bale construction for self-builders in Britain six self-builders were selected as case studies. The case studies were chosen to try and represent a range of different self-build projects from small workshops and studios to two storey family homes. The majority of the case studies were based in the South West although projects from the West Midlands and the North were also included to provide geographical diversity.

Each builder was interviewed at the site of their straw bale building in order to assess the effect that the choice of straw bale construction had on their self-build experience. The self-builders were first asked to fill out a tick chart to express their instincts about the effect of straw bales on their project; this was followed by a detailed interview of around forty minutes.

In order to assess the implications of straw bale construction from a projects inception to its completion and beyond criteria were chosen to help bring to light issues affecting all stages of a self-build project. The interviews were broken down into key areas of design; planning applications and building regulations approval; sourcing of materials; the build; and after the build.

nb.All references to the case studies refer to the buildings at the time of interview. For full notes from the interviews and digital recordings please see appendices one to six and the enclosed compact disc.

4.2 Case Study 1 – Paul Douglas



Fig. 4.21: Paul Douglas applying lime render to his straw bale garage.

Gender: Male

Occupation: Senior Probation Officer

Age: 58

Status: Married with four children

Start Date: December 2004

Completion Date: July/August 2007

Location: Lymptstone, Devon

Project Description: Large single storey four car garage 10m x 7m

Role in Project: Design, Project Management and Labour

Project Value: £80,000

Build Cost: £13,000 + Paul's labour of love



Figs. 4.22 and 4.23: Before the build, the concrete slab with rammed tyre foundations and horsebox. And after, the finished garage looks at home in the farmyard.

Paul Douglas is a senior probation officer working in Exeter. He lives near the village of Lymptstone in a Grade 2 listed farmhouse with his wife and four children. Paul's self-build project started with the need for more garage space and in particular for somewhere to house horse boxes. He confesses, however, that he was looking for an excuse to try building for himself and if it hadn't been the garage it would have been something else. Paul was keen to try an alternative 'green' method of building and felt that straw bale construction was the most evident and accessible method available to him. He attended a straw bale building course run by Rob Buckley at the Dorset Centre for Rural Skills (DCRS) and then set about designing his garage.

Paul didn't appoint an architect for the project as the simplicity of the building would mean he could manage the planning application and design himself. The building was designed to accommodate four cars and has a footprint of 10m x 7m making it comparable in size to a small cottage. The walls are constructed from load bearing straw bales set on rammed car tyre foundations which are laid on a six inch concrete slab. The bales are pinned together using hazel pegs and the windows and doors are constructed from cedar. The garage has a huge double door opening at the front of the building with oak beams used to support the roof above. The roof is conventional timber construction with roof trusses made to order from a local timber merchant.



Fig. 4.24: Volunteers get involved at Paul's wall-raising day.



Fig. 4.25: The uneven texture of the finished walls is similar to traditional cob walling.

Before embarking on his self-build project Paul had no previous building experience but had an enthusiasm for DIY. The only experience he had with straw bale construction was what he had acquired on his course at the DCRS. The building of his garage took a lot longer than Paul expected, and at the time of interview he had been working on it for two and a half years. He wouldn't, however, describe the process as difficult and believes that if he could do it, anyone could. Paul carried out the vast majority of the building work alone, enlisting volunteers for just one weekend as a wall raising party. He received some assistance from his son with the roofing and employed an electrician to check over his wiring but the rest of the work was his own.

Paul had to work very hard to complete his self build project but found the experience thoroughly enjoyable. He would be very keen to be involved in another straw bale building project but doesn't think he will self-build again on this scale. During the project Paul improved his building skills and in particular his confidence to build at this scale. The project has provided Paul and his family with a valuable asset and far better value for money than he would have expected. The garage is now in use although it is yet to be rendered internally. So far there have been no problems in use. The new building provides plenty of storage space and sits very well in its historical surroundings.

What effect do you feel the use of Straw Bale Construction has had on your self build experience?					
Aspect of the Project	Strongly negative	Negative	None	Positive	Strongly Positive
Design					✓
Planning				✓	
Building Regs.		✓			
Support and Advice					✓
Sourcing Materials				✓	
The Build					✓
Value for Money					✓
Value Intrinsically					✓
Building in Use					✓

4.3 Case Study 2 – Jim Carfrae



Fig. 4.31: The Carfrae's first floor open plan living space in their straw bale home in Totnes.



Fig. 4.32: A well lit spiral stair leads down to the ground floor bedrooms.

Gender: Male

Occupation: Research Student

Age: 51

Status: Married with two children

Start Date: August 2004

Completion Date: November 2005

Location: Totnes, Devon

Project Description: 2 storey, 4 bedroom house 180sq.m floor area

Role in Project: Design, Project Management and Labour

Project Value: £600,000

Build Cost: £280,000 (not accounting for land costs)

Totnes is an old market town in South Devon which has built a reputation as a lively centre for art and music. It has also become known as a haven for 'new age' people and has an interesting blend of cultures and a strong community spirit. Jim Carfrae doesn't fit the stereotype of a 'hippy' but lives in Totnes in his own self-built straw home with his wife and two children. Jim commutes regularly by train to Plymouth where he is a research student studying the effects of moisture on straw bale walls. Jim has a background in design with a mother who was an architect and a brother who works as a civil engineer; he used to run a business producing unique 'horn speakers' which derive their shape from forms in nature.

With Jim's grounding in design he didn't feel it necessary to appoint an architect for the design of his house. However the build was funded by the sale of a pair of semi detached houses built on the site for which an architect was employed. This architect only helped Jim with the planning application and Jim describes the house as ninety percent his own design. The house is sited on a steep hill overlooking Totnes and is set into the bank so that the entrance is on the first floor opening into a large open plan living space. A spiral stair leads down to a generous corridor serving four bedrooms and two bathrooms and leading out to the garden. The house is a post and beam timber frame wrapped with straw bales, lime rendered on the ground floor and clad in untreated cedar on the first floor.

As well as Jim’s design background he had some building experience previous to taking on his own project having been involved with renovations and conversions. Jim had never built anything on the scale of his house before though and describes himself as a good designer not a good builder. Although Jim was involved with hands-on building he describes his main roles during the building stage as project managing and making tea. He used the same team of general contractors for the straw bale house that had previously built the semi-detached houses on the site. The contractors were sceptical about the construction methods at first but by the end of the project the main contractor was so enthusiastic he is now looking to build his own straw house.



Fig. 4.33: The Carfrae’s house combines contemporary design with sustainable features.

Jim has built a contemporary, sustainable home for his family. Local estate agents have said that the sustainable elements of the design have added between fifty and seventy-five thousand pounds to the value of the property. The house has low running costs and the Carfraes gas bill for the last year was only ninety pounds. The project has given Jim confidence in the practicalities of building sustainably and he now feels in a position to give advice to others looking to follow this path. Meticulous planning and preparation were key to the success of the project and the experience hasn’t curbed Jim’s enthusiasm for self-build. He would like to build himself a ‘pension’, a house off the grid with no mortgage and little or no running costs through sustainable features and micro-generation.

What effect do you feel the use of Straw Bale Construction has had on your self build experience?					
Aspect of the Project	Strongly negative	Negative	None	Positive	Strongly Positive
Design				✓	
Planning			✓		
Building Regs.			✓		
Support and Advice				✓	
Sourcing Materials				✓	
The Build					✓
Value for Money				✓	
Value Intrinsically					✓
Building in Use					✓

4.4 Case Study 3 – Rik Lander



Fig. 4.41: Rik Lander relaxing on his impressive green roof.

Gender: Male

Occupation: Video Director

Age: 47

Status: Married with two children

Start Date: Held a wall demolishing party on 12th May 2006

Completion Date: Hopefully 2008 but says it'll never be 'finished.'

Location: Montpelier, Bristol

Project Description: Single storey workshop with intensive green roof.

Role in Project: Design, Project Management and Labour

Project Value: not complete

Build Cost: £30,000 + VAT to date (excluding labour)

Rik Lander's house is at the top of a hill overlooking the thriving characterful community of St. Werburghs in Bristol. The workshop at the end of his garden will primarily provide Rik with a place to work but the project has become something of a showcase for alternative technologies with the over-riding principle to bring as little building material in and take as little away as possible. Rik works directing videos for the BBC as well as pursuing his own projects and at times this takes him away from site for extended periods. Before deciding to self-build Rik had looked at alternatives such as flat pack buildings and sheds but decided that it would be cheaper to build something himself. He has always enjoyed making things and describes this as both a career and a hobby.



Fig. 4.42: When complete Rik's workshop will blend into the relandscaping of the sloped back garden.

The workshop was Rik's own design but he had his drawings checked by Barbara Jones and staff from the Low Carbon Network. Later in the project a structural engineer from Structural Solutions was asked to help with the project. The building combines various alternative construction methods some of which are being used in ways not tested before in Britain. The three straw bale walls are supported by a recycled tyre retaining wall that is rammed with clay from the site. The fourth wall is fully glazed opening on to a terrace and offering views over the valley below. The straw bale walls are load bearing but point loads are also taken by timber posts on recommendation from the structural engineer. The workshop is clay rendered internally and externally using clay excavated on site.



Fig. 4.43: The workshop and terrace offer views over St .Werburgh's.

Previous to his self-build project Rik had very little building experience other than some labouring in his youth. Volunteer days were organised to help with the bulk of the work on Rik's project. This took a lot of organisation and fell through when materials weren't delivered on time or other delays occurred. Rik thought of the volunteer approach as a two way relationship where he received free labour but provided volunteers with experience of how to build with alternative building materials. Labourers were also employed to help ease the workload on site and Rik thinks he will be much more comfortable employing builders and labourers in future following his experience.



Fig. 4.44: Inside the workshop a host of alternative construction methods are on display.

The workshop is proving to be a physically, intellectually and emotionally demanding project for Rik but he maintains enthusiasm for the principles behind his building. The intensive green roof has proved a huge success offering impressive views over the valley and surely enhancing the value of the Landers' property. When the building is finished it will have been a pioneer for a host of building techniques and Rik will have acquired a vast range of skills. If Rik were to start his project again his principles would remain unchanged but he would spend far more time in the preparation and design stages of the process. He thinks he would do almost everything differently as he feels he now knows how to do it right.

What effect do you feel the use of Straw Bale Construction has had on your self build experience?					
Aspect of the Project	Strongly negative	Negative	None	Positive	Strongly Positive
Design					✓
Planning			✓		
Building Regs.			✓		
Support and Advice				✓	
Sourcing Materials		✓			
The Build					✓
Value for Money		✓			
Value Intrinsicly				✓	
Building in Use			n/a		

nb. Rik noted that the effects on sourcing materials and value for money where down to his 'eco principles' and not straw alone.

4.5 Case Study 4 – Carol Atkinson



Fig. 4.51: Carol Atkinson inspects the lime render and wooden guttering on her straw bale caravan.



Fig. 4.52: The straw bale cabin with its large south facing verandah.

Gender: Female

Occupation: MSc Student at CAT, formerly a Chartered Accountant

Age: 44

Status: Married with two children

Start Date: June 2006

Completion Date: March 2007

Location: Village Farm, Howden, East Yorkshire

Project Description: Straw Bale holiday caravan 10m x 4m

Role in Project: Design, Project Management and Labour

Project Value: Unknown

Build Cost: £40,000

The Home Grown Home straw bale holiday retreat was built on Village Farm near Howden owned by Carol Atkinson's parents. Carol had two reasons for building a holiday home; she wanted a straw bale building as an experiment for her thesis project and she also thought a holiday cabin could generate income in order to support her study and to pay back the cost of the project. Carol learnt about straw construction at The Centre for Alternative Technology (CAT), where she is studying and feels that it is the perfect natural material for the East Ridings where there is a large volume of arable crops.

The straw bale cabin was always conceived of as a straw bale building and Carol took on the design work herself well aware of the effects that the use of straw bales would have on the project. The building is a simple arrangement with two rooms, a living room and a bedroom, either side of a bathroom with a composting toilet. The cabin features a large covered verandah to the south offering almost the same floor area of the cabin as external space. The walls are constructed from load bearing straw bales and are lime rendered externally. A clay render is used internally where the cabin is tastefully finished with timber detailing and exposed roof beams. The whole building was built on a steel caravan chassis of the type normally used for timber park homes.

Prior to building the straw cabin Carol's level of building skill and experience was very low. She arranged for Barbara Jones' Amazon

Nails to run courses on the farm . People paid to come on a five day straw bale building course and during this time the majority of the cabin was constructed. Lime and clay rendering courses were also run but these were far less popular than the straw bale courses. Carol liked to have unskilled labourers on site as it meant they were learning about natural materials and building skills whilst they worked. She felt good advice was much more important than skilled labour but she did employ a professional joiner and renderer to help with the work.



Fig.4.53: The bathroom complete with composting toilet.

Carol's straw cabin has been open for its first holiday season and she is intending to build a new bigger straw bale cottage on the site in the near future. The project has been a family experience for the Atkinsons with everyone getting involved in the work. Carol thinks the caravan was good value but that she could do a lot of things cheaper if she were to build again. She says that everyone should build a caravan before they build a house. During the project Carol has acquired an array of skills that are relevant to straw construction as well as other building methods. She thinks the principles she has learnt about are relevant to all natural building methods where water is the biggest enemy. The project has become part of a green pilot scheme for the local area.

What effect do you feel the use of Straw Bale Construction has had on your self build experience?					
Aspect of the Project	Strongly negative	Negative	None	Positive	Strongly Positive
Design					✓
Planning				✓	
Building Regs.			✓		
Support and Advice					✓
Sourcing Materials					✓
The Build					✓
Value for Money					✓
Value Intrinsically					✓
Building in Use					✓

4.6 Case Study 5 - Piers Partridge



Fig. 4.61: The Strawdio.

Gender: Male

Occupation: Musician/Composer

Age: 58

Status: Married with children

Start Date: 2004

Completion Date: Autumn 2006 (feels it is still ongoing though)

Location: Nailsea, nr Bristol

Project Description: Straw Bale music studio 4.5m x 6.4m

Role in Project: Design, Project Management and Labour

Project Value: Unknown

Build Cost: £16-27,000

Strawdio is the hand built music studio of Piers Partridge, creator of the Pindrop music club and composer of film and TV soundtracks. Piers wanted a bigger space for his music and went down the self-build route having become frustrated with architects who were designing contemporary buildings when he wanted a garden shed. He desperately wanted the studio to be a very personal space and felt he could achieve this through self-build. Piers decided to use straw construction having seen his friend Rachel Whitehouse's straw house in West Wales, he also felt very comfortable with the material being a 'farm boy' and confident about its strength.



Fig. 4.62: One of the Strawdio's load bearing tree trunks.

Piers carried out the majority of the design work himself as he wanted the project to be about his ideas. The building is a single space with a hybrid construction of load bearing walls and supporting tree trunks to take point loads. The walls are finished with lime render inside and out and there is a large covered terrace at the front of the building. The overhanging roof is a wild extensive green roof planted on 5-6 inches of soil. The Strawdio has a very hand made, crafted feel to it which gives it the personal touch that Piers set out to achieve. Les Baker, a landscape architect from local firm Reckless Orchard, was appointed to help get the design through planning and Piers found his advice very reassuring.

Piers' building skills were restricted to basic DIY tasks such as fitting shelves and kitchen units prior to starting his project so he attended

a straw bale construction course with Barbara Jones. Volunteers were recruited to help with the building and Piers found this easy enough to organise as he is well connected in his local community. On four or five different occasions there were ten to twelve people helping with the project. Piers believes being well connected is very important for self-build projects and in particular for straw bale construction as it is very much a people process due to the labour intensive nature of the construction. The project was a reciprocal process for Piers with friends helping out to return favours and vice versa.



Figs. 4.63 and 4.64: A perfect music studio for Piers

Piers believes his self-build project has provided him with a perfect music studio which resonates with the guitar and acoustic music. He feels that the building has a lot of love in it due to all the hands that have contributed to its construction and that this adds to his appreciation of the space. Piers would like to self-build again and would love to have the opportunity to build a similar building on the coast of Wales overlooking the sea as a holiday home. During the construction of the Strawdio Piers' building skills have developed and he now describes himself as a 'bush carpenter' or 'bodger'. Completing the project has led Piers to believe that you can achieve anything if you have the time and interest to succeed.

What effect do you feel the use of Straw Bale Construction has had on your self build experience?					
Aspect of the Project	Strongly negative	Negative	None	Positive	Strongly Positive
Design					✓
Planning				✓	
Building Regs.				✓	
Support and Advice					✓
Sourcing Materials				✓	
The Build				✓	
Value for Money					✓
Value Intrinsically					✓
Building in Use					✓

4.7 Case Study 6 - Kester Wilkinson



Fig. 4.71: The Straw House.

Gender: Male

Occupation: Runs his own training company

Age: 37

Status: Married with two daughters

Start Date: Work commenced May 2001

Completion Date: Moved in March 2002

Location: Putley, Herefordshire

Project Description: Two storey straw bale house

Role in Project: Design, Project Management and Labour

Project Value: £425,000

Build Cost: £70-75,000

The Straw House was built by Kester Wilkinson as a family home for himself, his wife and their two daughters. Kester and Zinnia Wilkinson made the decision to self-build thinking that they would be able to afford a bigger and better house through self-build. Having read about various construction methods Kester thought that straw would be cheap, quick and easy to build with; the material was not chosen for its environmentally friendly credentials. Before starting the project Kester went on a four day straw bale construction course at the Yarner trust in Bideford and enlisted the help of Barbara Jones as a consultant for his project.



Fig. 4.72: One of the Straw Houses four bedrooms.

The design of the house was Kester and Zinnia's own work and no architect was appointed for the project. The house has an internal floor area of 200 sq.m over two storeys providing four double bedrooms and three bathrooms. The ground floor is a timber frame with straw bale infill supporting load bearing straw bale construction on the first floor. The house is lime rendered inside and out and the roof is cedar shingles. The house is built on conventional block and beam concrete foundations. A draftsman was employed to help prepare drawings for the planning application which was very useful and Kester now feels that a project architect could have been helpful throughout the project.

Before building The Straw House, Kester had very little building experience but described himself as 'handy'. For ten months Kester



Fig. 4.73: The open plan living space in The Straw House.



Fig. 4.74: The first floor landing and spiral staircase.

worked a full time job, then returned home to work from six till ten as well as weekends on the house. The project took Kester out of family life for a year which he found very hard but he believes that self-build is always this way. It was important for Kester to get on with the labourers he employed who included electricians and plasterers. The labour was arranged on a day to day basis with a job list set out at the start of each day and if Kester didn't get along with the workers he wouldn't employ them again.

The finished house is a great family home with real character and the Wilkinsons have enjoyed living there for five years. The house has provided the Wilkinsons with fairly good value for money, although when the project was first completed the property was valued at half the conventional market value due to the use of straw construction. A tight budget and time scale meant the project was a real strain for Kester and he described himself being 'on [his] knees on Prozac' by the time the house was finished. Kester is unsure whether he would go down the self-build route again but if he does he would look to use a less labour intensive construction method.

What effect do you feel the use of Straw Bale Construction has had on your self build experience?					
Aspect of the Project	Strongly negative	Negative	None	Positive	Strongly Positive
Design			✓		
Planning				✓	
Building Regs.					✓
Support and Advice		✓			
Sourcing Materials		✓			
The Build				✓	
Value for Money		✓			
Value Intrinsically			✓		
Building in Use					✓

4.8 Case Studies Summary

Case Studies Summary Table							
	Name	Location	Building Type	Construction	Floor Area	Build Cost	Project Duration
	Paul Douglas	Lympstone, Devon	Garage	Load bearing straw bale.	70 sq.m	£13,000	32 months
	Jim Carfrae	Totnes, Devon	4 bedroom Home	Post and beam timber frame with straw bale 'wrap.'	180 sq.m	£280,000	18 months
	Rik Lander	Bristol, Avon	Workshop	Load bearing straw bale with cable bracing.	45 sq.m	£30,000+	ongoing
	Carol Atkinson	Howden, Yorkshire	Holiday Cabin	Load bearing straw bale.	40 sq.m	£40,000	9 months
	Piers Partridge	Nailsea, Avon	Music Studio	Load bearing straw bale.	30 sq.m	£27,000	24 months
	Kester Wilkinson	Putley, Herefordshire	4 bedroom Home	Timber frame ground floor with straw bale infill. Load bearing straw bale first floor.	200 sq.m	£75,000	10 months

5.0 analysis and discussion

5.1 Analysis and Discussion: Design Stage

Interestingly, none of the interviewed self-builders appointed a full time architect for their project and the majority gave the impression they would do it alone if they were to build from straw again. Rik was particularly adamant that he wouldn't employ an architect for any future projects despite it seeming that the problems which occurred during his build might have been foreseen by a design professional. In contrast Kester admitted that he would certainly consider employing an architect in future as he felt unprepared for certain aspects such as standard timber lengths and these would have been common knowledge to an experienced architect. Jim seemed to have avoided surprises during the build by planning every stage of his project meticulously. Perhaps this approach was ingrained in him by his grounding in design which has made him aware of the importance of detailing. Jim even went so far as to build his house using SketchUp 3D design software in order to be prepared for any detailing issues.

Generally the self-builders didn't find the choice of straw bale construction restrictive on their design and four of the six builders rated the choice of straw as having a strongly positive effect on the design of their project. The self-builders all seemed to have designed their buildings with the constraints of straw bales in mind and only Rik had really tested the limits of what the construction method was capable of. When designing her straw cabin Carol found the constraints of straw helpful and felt the big building blocks made it easier for a first time designer. Carol used lego bricks to represent the bales and modelled her building simply this way. The length and width of the bales didn't pose many problems for the self-builders and it was pointed out that these dimensions are far easier to adjust than for bricks and blocks.

The big problem that the self-builders encountered with bale dimensions was in the height of the bales. Kester found that the

height of straw bales did not match up with the dimensions of standard doors and windows. Carol came across the same problem and had to put time into trimming all the doors used in her straw bale cabin to fit with bale dimensions. Kester and Carol found this lack of co-ordination particularly annoying as it is the only dimension in which a bale can not easily be adjusted. This issue with height was a problem for Rik where the tyre wall met the straw and he found it even more frustrating that the bales would alter size and shape with compression meaning the height of a bale was unpredictable.



Fig. 5.11: Ten per cent of the footprint of The Straw House is taken up by its thick walls.

Another prevalent issue that was identified was the need for very thick walls and Kester explained that ten per cent of the footprint of The Straw House is taken up by its walls. Kester was probably the most critical of the restrictions of straw bales which he felt could cause problems when used as load bearing walls. In The Straw House only the exterior, straw walls are load bearing, this results in very large spans which along with the necessarily large eaves required some complex and heavy carpentry.

Generally the use of straw bale construction was considered to have a positive effect on the design process although minor issues did arise with inconsistencies in dimensions and difficulties co-ordinating with standard building components.

5.2 Analysis and Discussion: Planning Applications and Building Regulations Approval

The six self-builders generally felt that the use of straw had little or no effect on their planning applications as the choice of material had a minimal influence on the external appearance of their building. In fact, the planning officers for Jim's building weren't aware that the house was to be built from straw as a previous application had been submitted specifying more conventional construction methods. Although in interview the self-builders generally felt the use of straw had almost no effect on their planning application, in the tick chart, four out of the six rated the use of straw as having a positive effect on their planning process.



Fig. 5.21: Paul Douglas felt the conservation architect was enthusiastic about straw bale construction.

There were two cases in particular where the self-builders felt that the use of straw helped their case for planning. Carol's straw bale cabin came up against strong opposition from the planning department as its proposed location was deemed unsustainable. The unusual nature of the proposal, being built from straw and having 'green credentials' allowed counsellors to get behind Carol's project and support it against the planners. Paul had to work closely with the planning department's conservation architect due to the listed status of his home. He felt that the conservation architect was enthusiastic about the straw construction and particularly its resemblance to traditional cob buildings. The lime render finish which is a standard design option for straw bale buildings also fitted in with the local vernacular.

Of the six case studies two were exempt from building regulations with Piers' Strawdio deemed a temporary structure and Carol's Straw Cabin being classified as a caravan. The British Standards for the manufacture of Caravans are far easier to meet than those for buildings however Carol still had her straw cabin pressure tested. The building achieved a figure of $1.56\text{m}^3/(\text{h}\cdot\text{m}^2)$ at 50 Pa, far below the current building regulation of $10\text{m}^3/(\text{h}\cdot\text{m}^2)$ at the same pressure. Of the self-builders who were required to obtain building

regulations approval, feelings about the effect of straw were mixed. Three of the projects were approved through local authorities and one through an independent inspector.

The Corporate Building Control Approved Inspectors JHA Ltd was used to obtain building regulations approval for Jim's home in Totnes. JHA Ltd was recommended to Jim by another straw bale builder as a company that were sympathetic to alternative and sustainable building methods. Jim felt that he could have a dialogue with the building control officers as they were interested in his approach to construction. The company acts as building control advisors to the Straw Bale Building Association and are therefore well versed in the properties of straw as a construction material.



Fig. 5.22: Paul's concrete slab and foundations caused issues with the building regulations officer.

In contrast Kester and Paul, who both went through local authorities, felt they had to educate their building control officer about the performance of straw in buildings. Paul in particular felt that the local authority had no interest in alternative construction methods and that they seemed threatened by his unconventional proposal. The biggest problem Paul encountered was with the thickness of the concrete slab that he laid as a level base to build up from. Straw bales have a wide base which distributes their load over a large area, they are also much lighter than masonry walls, for these reasons Paul had specified a lightweight six inch slab in his drawings. However during a site inspection the officer tried to insist that an eighteen inch slab was necessary and couldn't comprehend the difference in the materials. After heated debate Paul was allowed to proceed with the six inch slab.

The local authority that dealt with the Wilkinson's Straw House hadn't come across straw construction before either. Kester's approach was to lend the local officer books and journals that he had read explaining the properties of straw bales. He also researched about other local authorities who had approved straw bale authorities and put his officer in touch with them so that they had a precedent

of how to deal with the problems. Kester's approval went through within the normal timescale. The building control officer assigned to Rik's workshop seemed nervous about the project and said 'I don't know which boxes to tick.' The case was reassigned to a different officer who had dealt with self build projects before and there were no further difficulties. Rik felt that the experience was helpful with the officer offering one or two useful recommendations.

5.3 Analysis and Discussion: Sourcing of Materials



Fig. 5.31: Straw bales being delivered to Paul Douglas's site.

When the self-builders were asked to rate the effect of the choice of straw on the sourcing of materials for their projects the results ranged from negative to strongly positive. In interview however it turned out that all the builders found it easy to source their straw bales. The cost of delivered bales varied in price from free to three pounds per bale with people paying extra for long term dry storage. For both the Carfrae's and the Wilkinson's two storey houses the total cost of the delivered straw was roughly eight hundred pounds. This works out at less than a third of the cost of bricks and mortar for an equivalent sized house.

In most of the projects, arrangements for sourcing straw bales were made well in advance, sometimes over a year before they were needed. In these cases it was very important for the straw to be stored dry until it was used. Both Jim and Kester arranged for their straw to be stored by the farmer until it was needed on site. A lead in time of six months or more was not entirely necessary as Rik ordered his straw just a few months in advance and Kester ordered in March for use on site in June. Paul and Kester both used straw bale merchants to source their straw and found the process very straightforward. The other self-builders purchased straw from local contacts with Carol's being provided by her husband and brother-in-law.

Some of the self-builders were involved with the harvest of their straw and were able to choose the straw from the field. Jim was even given a choice of crop from barley, wheat or oats and chose oats as it had a stronger straighter stem which he thought would make better bales. It was generally agreed that it is very important to ensure that the straw is dry and either fresh or stored dry, Carol also felt that longer straw would make better bales as they would bond more. Piers and Rik who used the same farmer for their bales tried to find a source for organically farmed straw but found it was



Figs. 5.32 and 5.33: Rik's render mixer (top) couldn't reproduce the mixing power of stamping volunteers.

unavailable locally.

Lime render is the standard wall finish for straw bale buildings in Britain and where this was used on the projects it was easily sourced from local natural building suppliers. No more than a weeks notice was necessary for ordering lime render but all the self-builders who used it considered it expensive. Paul's total lime bill came to around £2000 and Kester's was roughly £3000. In contrast Rik opted to use a clay render for which the clay was taken from his own garden and was thus free. He produced a render by mixing the clay with cow dung, sand, straw and clay slip. Although considerably cheaper than lime render Rik's clay finish was hard to make, the first mix was produced by a group of volunteers stamping on the ingredients to bind them but the render mixer Rik had hired wasn't tough enough to recreate this mixing power.



Fig. 5.34: Jim Carfrae's home is a combination of conventional lime render and untreated FSC Western Red Cedar cladding.

In most cases the other building materials necessary for the projects were sourced from local building merchants with little difficulty. One problem that Carol, Rik and Jim experienced was trying to source untreated Forest Stewardship Council approved timber from local merchants, in fact Jim said this was harder to source than his straw. The other material that required some planning was the hazel spars if they were used to pin bales together. Kester explained that hazel is generally coppiced between December and the beginning of March and he found it hard to get hold of any in July when it was needed on site.

5.4 Analysis and Discussion: The Build

The choice of straw bale construction was rated as having a strongly positive effect on the building phase of four of the self-build projects; the other two self-builders rated it as having a positive effect. This phase of the projects was generally agreed to be hard work and Rik described it as physically, intellectually and emotionally demanding. Piers described some very daunting mornings when he would wake up and think 'I don't know what I'm doing.' The raising of the straw walls was considered easy, fun and quick; especially compared to the rest of the building work.

The majority of the self-builders found the actual building harder than they had expected and Piers felt it was important to go into the project with a slightly naive innocence. Rik in particular found the building tougher than expected, he explained that Barbara Jones had made it seem very easy and that this was inspiring but a little misleading. In contrast Jim thought the building was easier than he had anticipated and much more interesting and pleasant to be involved in than the construction of the semi-detached houses on the same site. It is interesting to note that Jim seemed the most prepared, organised and experienced of the self-builders where as Rik was probably the least well prepared and admits he would have liked to spend another year planning and designing.

When required the self-builders found it easy to source labour but for most of the projects this was electricians, plumbers, carpenters and plasterers not straw bale builders. Volunteers were often used especially for the straw bale wall raising and Rik felt the competence of volunteers didn't matter as they could be assigned to tasks appropriate to their skills. Carol preferred using unskilled volunteers but found it much easier to recruit volunteers for the straw bale building than for other jobs. Kester had difficulty finding someone who would spray lime render on to his straw walls and at the time he had to employ someone from over eighty miles away. The self-

builders felt their general level of building skills was adequate to get by but that good advice and support was very important.



Fig. 5.41: The wall of Paul Douglas' Garage is buckling under compression, perhaps a result of 'bale frenzy'.



Fig. 5.42: Visible raking in Rik Lander's workshop due to an unforeseen structural issue. The problem is being addressed retrospectively with tensioning cables.

The straw bale advice and support network was considered to be very useful and Paul found the sustainable building community more enthusiastic and helpful than the conventional construction industry. The self-builders found advice from other straw bale builders was helpful and five of them went on or hosted courses. Four of the six builders had advice and support from Barbara Jones during their project and her advice was available for a very reasonable consultancy fee. Kester felt that a lot of the necessary guidance was available from books and that other advice such as Barbara Jones' could be confusing and contradictory. This opinion was shared in part by Rik who was frustrated to keep coming up against problems for which there was no tried and tested solution.

One of the biggest problems with straw bale building is keeping the bales dry and this is something the self-builders struggled with. Piers pointed out that it is necessary to have good access and storage to be able to cope with delivery of bales and that using tarpaulins can prove to be very hard work especially in strong winds. Kester and Piers both felt that it would be best practice to build a roof first and raise straw walls underneath it in order to keep rain off the bales during construction. Paul encountered a problem with 'bale frenzy' during his wall raising party and found it hard to strike a balance between controlling the construction and allowing volunteers to have a good time. He feels this has been to the detriment of his walls which aren't as straight as he'd have liked. The lime rendering of the straw walls was considered to be very hard work and much harder than the raising of the walls. During construction Rik had problems with rats nesting in his bales but this only occurred where wood was rested against the bales and the rats stayed near the surface as the straw was too dense to burrow into. Rik also had some structural raking problems with his workshop that have been solved retrospectively through advice from a structural engineer.

5.5 Analysis and Discussion: After The Build



Fig. 5.51: Minor cracks in the render on Carol Atkinson's Straw bale Caravan should be fixed by applying lime-wash.

Straw bales were considered to be a good value material by all of the self-builders but they were quick to point out that this turns out to be a very small fraction of the overall budget of a project and therefore has little influence on the overall value. Jim believed that the walls were around ten per cent of the total build cost and although the straw is cheap he thinks this is balanced by more expensive labour due to the 'fiddle factor' of straw. On the other hand Carol felt she saved on labour as she raised the walls herself with the help of volunteers something she couldn't have done with conventional construction methods. Interestingly Carol employed a very good joiner with a large percentage of her budget and therefore both her and Jim spent at least half their total build cost on labour. Similarly to Carol, Rik found that the peripherals associated with straw bales required many hours of labour.

All the builders except for Kester described their experience of self-build as valuable, Kester found it hard to be sure about his experience. The Straw House was completed in just ten months and Kester must have worked extremely hard alongside a full time job which put a lot of strain on him. Piers felt that the labour intensive nature of straw bale construction meant that the building was a real people thing which is something he greatly enjoyed. He felt the experience would have been torture if you were an isolated person and not well connected, Piers thought it was important to 'use the love' for straw bale construction.

Four of the projects have been insured and only Kester had difficulties insuring his property perhaps because it is the oldest of the buildings and the market has changed. Carol found it easy to insure her straw cabin but very expensive, costing more than twice as much as her household insurance. Paul and Jim both easily found insurance and were charged no premium because of the use of straw bale construction. Jim also found it easy to mortgage his

house and it was recommended for warranty by JHA Ltd who gave the property building regulations approval. The Carfrae house has a structural timber frame and Jim thinks it would be much harder to get a warranty and mortgage for a load bearing straw bale house, Kester agrees with this and doesn't think there is a mortgaged load bearing straw bale house in Britain.



Fig. 5.52: Damage to the bottom of the wall in Kester Wilkinson's Straw House.

No major problems in use were identified although a few minor difficulties were encountered. Piers found his Strawdio to be dripping wet inside one evening around Christmas time, he couldn't understand why there was water everywhere and thought there might be a leak. No leak was found and the problem hasn't reoccurred, Piers thinks it may have been a condensation problem or moisture drying out of the plaster. Jim encountered a problem with a drip detail which was causing damp in one of his walls, fortunately the problem was identified early on by the moisture sensors which Jim has installed, and he recommends these to any straw bale builder. There was a problem with Kester's house due to a poor detail at the base of the wall which was causing draughts and currents of air to circulate through the house. Kester has had no problems with damp after living in The Straw House for five years.

If they were to build again with straw both Piers and Paul would take more care at the wall raising stage of the build and would be careful to avoid 'bale frenzy,' Piers would use a plumb line to ensure his walls are straight next time. Kester would like to combine straw bales with a post and beam timber frame and would clad the building. He definitely wouldn't use lime render again as he found it expensive and time consuming and would prefer to stick to dry construction methods in future. The main problem Carol would like to address is that of keeping bales dry during construction, compression and rendering.

5.6 Analysis and Discussion Summary

Table of Recommendations for Best Practice at each Project Stage	
Project Phase	Recommendations for Best Practice
Design Stage	<ul style="list-style-type: none"> • Employ an architect or seek advice from someone with knowledge of structures and experience of construction projects. • Plan thoroughly; allow plenty of time for this stage of the project. • Design within the constraints of the material; plan for bale dimensions in particular bale heights which can't be altered. • If planning for a tight plot consider alternative construction methods as straw walls use a lot of space.
Planning Applications and Building Regulations Approval	<ul style="list-style-type: none"> • Straw should have little affect on a planning application but playing up it's sustainable credentials can help to get planners on side. • Lightweight foundations mean some buildings can be classified as temporary structures making them exempt from building regulations. • Use a corporate building control approved inspector with previous experience of straw bale construction, such as JHA. • If using a local authority try to find a sympathetic officer and educate them about the benefits and peculiarities of straw construction.
Sourcing of Materials	<ul style="list-style-type: none"> • Be prepared for deliveries; plenty of room will be needed for access and storage. Order materials in manageable quantities. • Early in the project find a source for tightly packed straw bales with long stems. • Bear in mind that hazel is most readily available between December and March. • If using clay render consider how it will be mixed; seek advice from local natural building merchants.
The Build	<ul style="list-style-type: none"> • Be careful during the quick wall-raising stage as even slightly untrue walls will be exaggerated during compression. • When using volunteers have at least two supervisors. Consider allocating volunteers to time consuming jobs such as rendering. • Allow plenty of time for this stage of the project; don't be rushed. • It is unlikely that labourers will be experienced with straw bales so supervision and instruction may be necessary.
After the Build	<ul style="list-style-type: none"> • Don't expect to have made huge financial savings through the use of straw bale construction. • A timber framed straw bale building will be easier to mortgage than a load bearing building. • It is worth looking around for a good insurance deal as some companies charge no added premium for the use of straw.

Pros and Cons for Design Options		
	Pros	Cons
Structure		
Load Bearing	<ul style="list-style-type: none"> • Simplest form of construction. • Uses straw bales to their full potential. 	<ul style="list-style-type: none"> • Wet straw will affect structural integrity. • 'Bale Frenzy' can affect structural integrity.
Timber Frame	<ul style="list-style-type: none"> • Recognised, tried and tested structure. • Helps with insurance, building regulations and mortgage warranties. 	<ul style="list-style-type: none"> • Straw is not compressed and therefore is less stable. • Cost of timber framing.
Hybrid	<ul style="list-style-type: none"> • Straw is under compression and therefore more stable. • Benefits from the advantages of timber frame. 	<ul style="list-style-type: none"> • If straw is used to brace the timber frame then damp will affect stability. • Cost of timber framing.
Internal Finish		
Lime Render	<ul style="list-style-type: none"> • Provides a complete seal to straw. • Good durability. 	<ul style="list-style-type: none"> • Expensive and time consuming. • Hazardous to work with.
Clay Render	<ul style="list-style-type: none"> • Cheap if available on site. • Non-toxic and fun to work with. 	<ul style="list-style-type: none"> • Hard to mix. • Time consuming. • Poor durability.
Dry Lining	<ul style="list-style-type: none"> • Quick and easy to install. • Service void can be integrated. 	<ul style="list-style-type: none"> • Adds to wall thickness. • Doesn't provide a complete seal for straw, could be a problem with rodents.
External Finish		
Lime Render	<ul style="list-style-type: none"> • Provides a complete seal to straw. • Good durability and weather resistance. 	<ul style="list-style-type: none"> • Expensive and time consuming. • Hazardous to work with.
Clay Render	<ul style="list-style-type: none"> • Cheap if available on site. • Non-toxic and fun to work with. 	<ul style="list-style-type: none"> • Hard to mix. • Time consuming. • Poor durability.
Cladding	<ul style="list-style-type: none"> • Quick and easy to install. • Can provide the best weather resistance but dependent on material used. 	<ul style="list-style-type: none"> • Adds to wall thickness. • Doesn't provide a complete seal for straw, could be a problem with rodents.

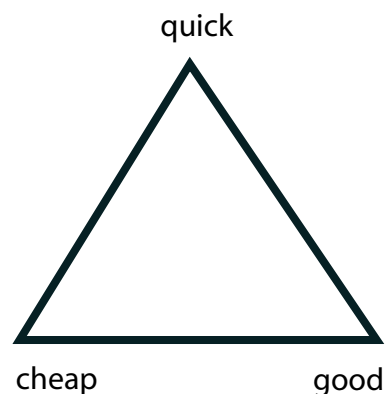
6.0 conclusion

6.1 Conclusion

When people decide to build for themselves the aim can be for education, practical experience, self expression, value for money or to build sustainably. Straw bale construction is capable of ticking all of these boxes if approached correctly. Straw benefits from intrinsic 'green' values, an accessibility without the need for specialist skills and a strong support network.

The drawbacks for straw bale construction are in its relative infancy giving rise to questions about its performance and constantly developing and evolving techniques. The labour intensive nature of the construction can also be off putting especially when used with lime render - an expensive commodity. It is worth pointing to Mark Brinkley's builders' dilemma illustration which is relevant to all building methods including straw bale construction.

Fig. 6.11: The Builders' Dilemma: any two points can be achieved but only at the expense of the third.



Straw bale construction is suitable for self-builders in Britain however to be successful the properties of the material and its limitations should always be considered and thoroughly planned for.

6.2 The Future of Straw Bale Construction

Wall Build Up:
Strawboard
Services Void
OSB Board
Straw Bales between timber columns
Bituminous Fibre Board
Ventilated weatherboarding

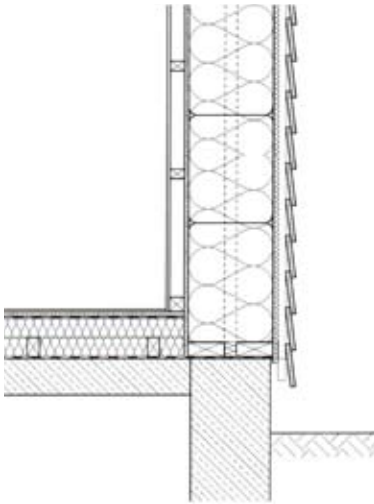


Fig. 6.21: The Future of Straw Bale Construction

For straw bale construction to really develop as a route for self-builders and an option for mainstream construction the first place to look is to the past. Segal's emphasis on dry trades should be applied to straw bale construction and the use of expensive and time consuming lime render avoided. Rain screen cladding should be promoted as a cheap, quick and potentially more durable alternative to render. Internally walls should be either dry lined, straw board could be used, or rendered with clay which is less hazardous and expensive than lime.

In order to overcome possible structural issues and to help keep bales dry during construction a timber frame should be used. This can be erected and a roof provided before the baling begins. For best results the timber frame should be part of a hybrid construction. Allowing the weight of the roof to compress the bales will improve their stability and utilise their strength in resisting raking forces. A timber frame will also help when applying for mortgages and warranties for a straw bale building.

To go even further the organisation of a national centre for information to support individuals wanting to adopt straw bale construction would be very useful. Such a facility could offer advice and carry out research on the different construction methods and best practice for detailing. Creating a national centre would help to bring together knowledge and experience as well as avoid conflicting advice.

Straw bales could also be introduced to DIY stores and builder's merchants. If bales were produced for this purpose they could use the most appropriate straw and be made to dimensions that are consistent with standard building components. This would make straw bales more accessible to self-builders and more suitable for the mainstream construction industry.

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appendices

Appendix One

Case Study: Name: Paul Douglas:

17/08/07

Project Background:

Gender: Male

Occupation: Senior Probation Officer

Age: 58

Status: Married, Four Children, late teens on

Start Date: December 2004

Completion Date: July/August 2007-08-20

Location: Lympstone, Devon

Level of Involvement: Paul was responsible for the design of the building, any project management involved and nearly all the labour involved was his own. He really did it on his own

Project Description:

Areas and Storeys

The building is a single storey garage big enough for four cars and designed to fit a horse box inside. The footprint is 10m x 7m making it comparable to a small cottage.

It uses load-bearing straw bale walls set on car tyre foundations laid on a concrete slab. The bales are pinned using hazel pegs and the windows and doors are constructed from cedar. The garage has two huge doors opening almost the full width of the building at the front. Oak beams are used to support the roof above. A conventional roof has been used with wooden roof trusses made to order and delivered by a timber merchant.

Reasons for Self Building:

Paul says the reason for self-building was the need for more garage space and in particular the housing of the horse box. He says that he just wanted to have a go and try building something for himself.

Paul concedes that if there hadn't been a need for a garage he would have found another excuse to build something himself.

Design:

Was an Architect appointed, if so who, was this useful:

None was appointed due to the nature of the project and it's simplicity, Paul felt he could manage the planning application etc himself and succeeded.

Implications on Design:

Were you restricted by Straw, implications on openings, standard dimensions etc.

Paul said the straw construction had an influence on the positioning of doors and windows however he didn't feel that this had any negative bearing on the design of the garage.

The size of the building's footprint with no interior walls for bracing and a huge double opening on one side meant that the garage was on the margin of needing buttressing. In this sense the straw bale restricted Paul in terms of a maximum size for the garage.

Paul found no conflicts with the dimensions of straw bales and conventional standard building components. He suggested this was avoided by building all the doors and windows himself made to measure. It should be noted this was a choice not influenced by an unavailability of suitable off the peg doors and windows.

Why did you choose straw, what did you expect, were you right?

Paul says he was keen to try an alternative, 'green' method of building.

He felt that straw was the most evident, accessible and obvious alternative method of building.

Planning:

	Easy			Hard	
Difficulty:	1	2	3	4	5
Problems:					

The existing house that Paul and his family live in is a grade 2 listed building. This meant that Paul had to get in touch with the local authorities conservation architect. The architect was largely enthusiastic about the project but laid certain restrictions on the development. He recommended that traditionally a barn or garage to a farm house would lie close to the main house and parallel to a boundary fence or hedge. This largely determined the position of Paul's garage but not against it his will.

There were also restrictions on the size of the garage and in particular it's height.

The materials and finishes also had to be sympathetic to the existing house and surrounding buildings. A white render was recommended for walls with thatch or slate roofing and timber windows and doors. All this fitted in with Paul's intention and slate was chosen for the roof due to thatch being too expensive.

The rest of the planning application was straightforward; Paul says he was careful to be thorough when specifying materials and finishes as advised on his course at the DCRS.

Paul describes the whole process as being easy and just a case of going down the necessary, prescribed channels.

Effect of Straw bale:

Paul felt the conservation architect's enthusiasm for the project was partly due to the use of straw and other vernacular materials. The conservation architect felt that the straw would look similar to cob a traditional building material in the area.

Building Regulations:

	Easy			Hard	
Difficulty:	1	2	3	4	5
Officer used approved inspector/local authority?					

Effect of Straw bale:

Fire/Vermin/Insulation/Air Tightness

Paul described giving a lot of information to the building regulations officer about his intentions and the properties of straw including its resistance to fire.

He says he had a fairly heated argument with the officer who then came to visit his site who seemed to have ignored all the information that had been provided. Paul had described the need for less heavy foundations for a straw bale building due to the lighter weight of the materials compared to brick and block and the wider base giving a greater spreading of load and less pressure. Paul had thus had a 6 inch concrete slab laid as he had researched and found out that this was proven to be adequate for a building of this size and method of construction. It was important for the slab not to be too thick as cars would be driving on to it from a gravel drive. The building regulations officer who visited the site told Paul that an 18 inch slab would be necessary for the garage. Paul managed to convince the local authorities that his slab would be sufficient but said it wasn't easy.

He felt the authorities couldn't comprehend the differences of an unconventional building method. He was evidently frustrated by this.

Advice/Support:

	None				Lots
Requirement:	1	2	3	4	5
Comments:					

Paul attended a Dorset Centre for Rural Skills (DCRS) straw bale building course run by Rob Buckley. Having done this course he felt he needed very little further advice or support and that that he needed was readily available. Paul used books for advice on wiring and roofing.

	Easy				Hard
Availability:	1	2	3	4	5
Comments:					

Paul said he found the sustainable building community endearingly helpful and enthusiastic and a stark contrast to the local building authority.

Is advice Costly? The only advice Paul paid for was an electrician and the DCRS course which he felt was very reasonable.

Sourcing Materials:

	Easy				Hard
Straw:	1	2	3	4	5
Comments:					

Time/Availability/Cost

Paul put in the order for his straw a year before he needed it; this was to ensure that the straw was harvested dry. He felt in hindsight that this lead in time wasn't necessary as the straw was exceptionally dry and he thinks the straw merchant would store it like this anyway as they have supplied for other buildings.

The straw was easy to find using contacts from the DCRS course.

Paul said the straw was reasonably priced, roughly £700 of which he thinks he used £650 worth for the whole building. Significantly the straw is only a small portion of the total build cost and at roughly a third of the cost of brick and block the use of straw will only have saved around £1400.

	Easy				Hard
Lime:	1	2	3	4	5
Comments:					

Time/Availability/Cost

Paul said the Lime render was also easy to come by using another contact from the DCRS course, Mike Wye. The lead in time was two to three weeks and the lime was ready for use on arrival.

Paul described the lime as 'bloody expensive' coming to a total of around £2000

	Easy				Hard
Other Materials:	1	2	3	4	5
Comments:					

Time/Availability/Cost

Hazel spars were again found from a contact from the DCRS as well as Paul's own resourcefulness. Paul didn't pay for the hazel's but cut them himself from people whose hedges need pruning. The oak beams for the doors were quoted very expensively by a timber merchant however Paul sourced them from an ad in the paper, they were much cheaper and cut to length.

The slates were another expensive item but easy to get hold of.

Major Problems:

The major problem Paul identified from the build was 'Bale Frenzy' which he says he was well warned of by the books. He said it was hard to strike a balance between letting the volunteers have a good time and get stuck in and keeping control of the wall raising.

He thought the positioning of the windows was a bit of a problem as he felt he should have positioned them one course of bales higher. Also the window on one side had caused a sag in the roof line which Paul couldn't explain to himself.

Paul found the rendering very challenging.

He felt the most physically demanding part of the build was positioning the oak beams for the double front doors. He did this job single handed as no one was around.

Also the roof was very time consuming and took 4-5 weeks which was longer than Paul had expected.

Value:		Poor				Good
Was it good Value:		1	2	3	4	5

Comments:

Paul felt the build was very good value, when the value came back from his insurer he was very surprised and said he would have been pleased just to get his money back.

He wasn't convinced that this was entirely down to the straw bales as this was a small part of the overall budget.

		Not				Very
Was the experience valuable:		1	2	3	4	5

Comments:

Paul described the experience as thoroughly enjoyable.

He said he would definitely get involved in a straw bale building project again but doesn't think he'd invest the time and effort to do it again himself.

Property Value: £80,000

Build Cost: £13,000 + their own labour

After:		Easy				Hard
Is insurance readily available:		1	2	3	4	5

		Easy				Hard
Are Warranties readily available:	1	2	3	4	5	

Not necessary as no mortgage was needed

Comments:

Very straightforward, added the garage to his existing home insurance policy. The insurance company had no problems with the building being constructed from straw.

		No				Yes
Would you use Straw Bale again:	1	2	3	4	5	

Comments:

Paul has already said that he would like to be involved in a straw bale building project again and would definitely consider it if he were to build again.

He would warn people of the time commitment.

Paul's wife Angela had said that Paul had become obsessed by the building.

Problems in use:

None
1 2 3 4 Lots
5

Comments:

The straw walls were allowed to settle for 11 months before they were rendered and the roof was on for a large period of this time. This allowed the straw to settle fully before the render was applied and avoided the potential problems of render cracking as the building settles.

How would you do it differently:

If Paul was to build again with Straw he would try to keep more control at the wall raising stage of the build. He would like to have one or two more people with experience to help give direction.

Appendix Two

Case Study : Name: Jim Carfrae

21/08/07

Project Background:

Gender: Male

Occupation: Research Student at Plymouth University, studying the effects of moisture on straw bale walls.

Age: 51

Status: Married, 2 children

Start Date: Aug '04

Completion Date: Nov '05

Location: Totnes, Devon at the top of the hill with a view over the town.

Level of Involvement:

Jim described himself as the designer and project manager. His work was more in sourcing materials and resolving design details than in hands on building.

Project Description:

Areas and Storeys

A 2 storey house with 4 bedrooms and a floor area of around 180 m², 200 m² including external walls.

The building is a suspended post and beam timber framed building with a straw bale 'wrap.' The ground floor is rendered with lime render and the first floor is timber clad in untreated cedar.

Reasons for Self Building:

Jim said his reasons for self building were financial and a need for something to do.

He also explained that he had 'wanted to build his own house.'

Design:

Was an Architect appointed, if so who, was this useful:

A pair of semi-detached brick and block houses were also built on the site the sale of which funded the build of the Carfrae's house. An architect was involved in the design of the semis.

Jim began the design of his own home himself, the drawings were then handed over to an architect at the outline planning stage however Jim then took back control of the design after the outline planning. He describes the house as 90% his own design.

Implications on Design:

Were you restricted by Straw, implications on openings, standard dimensions etc.

Jim felt the main restrictions of the straw were on window sizes and spacing.

He felt the straw affected some details but had little or no bearing on the overall shape and form of the house.

The straw affected obvious elements of the design such as the large eaves and the need for the suspended frame.

Jim allowed for bale dimensions in his design and thus found no conflict between bale dimensions and standard building component dimensions.

He felt that bale dimensions shouldn't restrict the design as they are easily adjusted especially for non load bearing walls.

Jim designed his house in 3d on the computer using SketchUp software. He felt this helped to visualise

details before they were built.

Why did you choose straw, what did you expect, were you right?

Jim says he gradually came round to the idea of straw bale building.

He took a residential course at CAT which inspired him to design and build what he describes as a totally sustainable building.

Jim wanted his house to be different to the stereotypical straw bale house with a contemporary feel. He thinks he has achieved this.

Planning: Easy Hard
Difficulty: 1 2 3 4 5
Problems:

They had problems persuading the planning department to allow the development they wanted. Jim was determined to build a pair of semis as well as their own detached house on a site that formerly held one bungalow. The increased density was obviously a concern for the planners but the Carfraes managed to win them over.

Jim described the planners being interested in the 'green roof' and saying they hadn't had one of them before.

Effect of Straw bale:

Jim said the straw had no effect on the planning application and in fact doesn't think the planners knew it was to be straw construction as it didn't affect the external appearance of the building.

Building Regulations: Easy Hard
Difficulty: 1 2 3 4 5
Officer used approved inspector/local authority? JHA were used

Effect of Straw bale:

Fire/Vermin/Insulation/Air Tightness

As JHA are specialists on sustainable building and alternative construction the straw bale's didn't raise any difficulties and Jim didn't need to provide them with data about fire resistance etc.

JHA are the building control advisors to the Straw Bale Building Association, they were recommended to Jim by Kevin and Helen Ireland.

Jim thinks he would have used JHA even if the house wasn't built with straw as he thinks they have a reputation for being open-minded and interested in sustainable technologies.

Advice/Support: None Lots
Requirement: 1 2 3 4 5
Comments:

Jim had advice from Kevin Ireland as well as that from his CAT course.

He says this was backed up by a lot of his own research

Jim describes the project being a lot of his own ideas.

Availability: Easy Hard
Is advice Costly? No 1 2 3 4 5

feels confident enough about this to give advice to others.

Availability of appropriately skilled labour: Easy
1 2 3 4 Hard
5

Comments:

Straw Bale vs Other Self Build

Jim used the same team of general builders to build his straw home as he had used to build the semis on the same site. He said the builders were a bit wary at first but perfectly capable.

The main contractor was so impressed that he is now looking to build his own straw house.

The Build:

Difficulty: Easy
1 2 3 4 Hard
5

Comments:

Required Skill level

Jim felt that the build was no more difficult than other builds and in some ways it was easier.

He felt that a thorough level of research is necessary to ensure things run smoothly on site.

Compared to Expectations: Easier
1 2 3 4 Harder
5

Comments:

Jim thinks the build was easier than he had expected but suggests he might not have been so positive straight after completion. He thinks he may have a rose tinted view from the 18months he has been living there.

He found the experience more interesting and more pleasant than his involvement with the building of the semis.

Major Problems:

None

Jim's meticulous planning and preparation work helped him to avoid problems on site.

Value:

Was it good Value: Poor
1 2 3 4 Good
5

Comments:

Jim thinks that however you build the cost of the walls of the building are only going to amount to roughly 10% of the cost of the finished building. Therefore the use of straw has little bearing on the value of the house.

Jim used builders throughout the build rather than recruiting volunteers for 'wall raising days.' He thinks that although the straw is cheaper the labour is probably more expensive. He puts this down to the builders experience, an experienced bricky can lay a brick and block wall very quickly where as when they are dealing with an unfamiliar construction technique more time needs to be taken. Jim calls this the 'fiddle factor.'

Jim thinks the labour contract will end up being 50% of the cost of a building using hired labour.

He concedes that if you were to put it up yourself then you could save a lot more.

Appendix Three

Case Study: Name: Rik Lander

27/08/07

Project Background:

Gender: Male

Occupation: Video Director

Age: 47

Status: Married, 2 children

Start Date: 12th May 2006 wall demolishing party

Completion Date: Hopefully 2008 though feels it won't ever be 'finished'

Location: Montpelier, Bristol

Level of Involvement: Designer, Project Manager and Builder.

Project Description:

Areas and Storeys

A single storey workshop with load bearing straw bale walls on three sides.

The fourth side is fully glazed to offer a huge view over St. Werbergs.

The glazing leads on to a generous viewing terrace built around existing trees.

Timber columns have been used to take some of the loads in the walls.

The building is dug into the hill at the back and rammed tyres are used to form a retaining wall in these areas.

The building has an intensive green roof with even more impressive views.

8.3 x 5.6m

Reasons for Self Building:

Rik had been looking at alternatives such as flat pack buildings, sheds etc but decided for the size of the building it would be as cheap to build something himself.

He also enjoys making things and explains that this is both his career and his hobby.

The building became almost an art project, a creative endeavour.

Design:

Was an Architect appointed, if so who, was this useful:

Rik didn't appoint an architect but designed the workshop himself. He checked his designs with Barbara Jones and the low carbon network.

His designs were also later checked by a structural engineer from structural solutions.

Implications on Design:

Were you restricted by Straw, implications on openings, standard dimensions etc.

Rik says that his design evolved from it's location.

The intention was for it to be a low profile, discreet building.

Rik set out with a rule for his building which he then backed up with a second rule:

1. bring in as little material as possible and take away as little material as possible.
2. when you do have to bring in materials use as sustainable 'eco' sources as possible.

Rik seemed to have ignored the usual restrictions about limitations on openings by having a fully glazed wall.

He did have problems with the co-ordination between bale dimensions and tyre dimensions. He thinks this was partly due to the fact that both dimensions are inconsistent.

Why did you choose straw, what did you expect, were you right?

Rik says his decision to use straw bale was down to Barbara Jones, 'she made self-build seem possible.'

He found straw bales very easy to use as he had expected.

Rik felt he was naïve about budget, drains and foundations.

Some of the straw was allowed to get very wet whilst Rik was away from the site and needed to be replaced beneath the roof it had been supporting.

He feels this is the major drawback with straw, its susceptibility to damp.

Rik also had a slight problem with rodents but thinks this was due to leaving wood lying against the bale walls. The rats like to burrow between the hard wood and the straw. He laid poison and removed the bodies of two rats and the problem has not returned. The rats stayed at the surface of the bales allowing the holes to be easily patched and filled.

Rik also has some structural problems with the workshop. Due to taking out one wall of the building for glazing this has left the structure susceptible to racking. The building has developed a noticeable lean. On closer inspection there are various points where the building is no longer square. Tension cables have been added to resist the racking forces but a certain amount of 'bodging' will be necessary to overcome the problems as they stand.

How would you do it differently:

Rik says if he was building again he would try to have a conference with relevant experts for straw bales, structure, tyres etc.

Rik still wouldn't employ an architect if he were building again.

He says he would do it all differently

- he feels he knows how to do it now.

Rik also thinks he would spend much more time in the preparation of the building than he did this time. Rik would spend up to a year more on this stage of the project.

Appendix Four

Case Study: Name: Carol Atkinson

28/08/07

Project Background:

Gender: Female

Occupation: MSc student at CAT, previously Chartered Accountant

Age: 44

Status: Married, 2 Children

Start Date: June 2006

Completion Date: March 2007

Location: Village Farm, Brind near Howden, Goole, East Yorkshire

Level of Involvement: Project Manager, designer and labourer.

Project Description:

Areas and Storeys

The building is a single storey straw holiday caravan measuring 10m x 4m.

The caravan consists of a bedroom and living room separated by a hallway and bathroom with composting toilet. There is a generous covered porch which faces south as the caravan is currently situated.

The construction is load bearing straw bale walls with a lime rendered exterior and a clay plastered interior.

Reasons for Self Building:

Carol says the reason she self built was that she wanted a straw bale building.

She explains that this was initially for her thesis project and secondly because she thought she would be able to rent it to make back the money it was going to cost her.

Design:

Was an Architect appointed, if so who, was this useful:

No.

Implications on Design:

Were you restricted by Straw, implications on openings, standard dimensions etc.

Carol explains that as the building was always conceived of as straw bale they designed it around the straw bale dimensions. She didn't find this restrictive and felt that it helped in some ways as it put some constraints on the design.

The windows were fine but they had some problems with the co-ordination between bale heights and standard door heights. The doors and frames had to be trimmed to fit. She described this as 'nothing major'.

Why did you choose straw, what did you expect, were you right?

Carol chose to build with straw as she thinks it is the perfect natural building material for the East ridings in Yorkshire where there is a large volume of arable crops.

She says it lived up to her expectations.

Planning:

Easy

Hard

Difficulty:

1

2

3

4

5

Problems:

Carol had to apply for a change of use of land in order to site her straw caravan on it's intended space on the farm.

The application was initially deemed to be for an unsustainable location and would cause a visual

intrusion. These problems were overcome through appeal. Planning was granted for the location of the caravan for five years.

Effect of Straw bale:

Carol felt the use of straw bale helped her planning application as it made the building unusual this meant that counsellors could get behind it and support it against the planning officers. She also feels that its 'green' credentials helped and the building has since become part of a green pilot scheme for the area.

Building Regulations:

	Easy				Hard
Difficulty:	1	2	3	4	5

Officer used approved inspector/local authority?

Effect of Straw bale:

Fire/Vermin/Insulation/Air Tightness

As the building is a caravan it wasn't necessary to obtain building regulations approval. The caravan had to meet British standards for caravans which Carol says the building easily surpasses.

Carol did however have the building tested for air tightness and it scored a rating of 1.56.

Advice/Support:

	None				Lots
Requirement:	1	2	3	4	5

Comments:

Carol felt quite a lot of advice was necessary and they set up courses with Amazon Nails, volunteers would pay to come on a five day course and during the course they would build Carol's caravan under the guidance of Amazon Nails staff.

Lime and clay plastering courses were also organised to finish the building although these were less popular.

	Easy				Hard
Availability:	1	2	3	4	5

Comments:

Carol felt advice was readily available from Amazon Nails and her lime supplier, Womersleys. She felt she could ring any time for advice.

Is advice Costly? Carol didn't consider the advice and support available as costly.

Sourcing Materials:

	Easy				Hard
Straw:	1	2	3	4	5

Comments:

Time/Availability/Cost
Carol sourced her straw through her husband and brother-in-law, she had to specify that the straw would be dry and dense. She felt that the straw should be long and that the bales she used would have been better longer so they don't pull apart as easily.

Carol acquired her straw the year before building and stored it in a barn on the farm.

The straw was free for Carol although if she builds again as she intends to it will cost her 60p/bale plus the cost of labour, transport etc. She thinks if she were selling the straw she would sell it for £2/ bale.

	Easy				Hard
Lime:	1	2	3	4	5

Comments:

Time/Availability/Cost

Carol used a local supplier, Womersleys, for her lime and clay renders.

Appendix Five

Case Study: Name: Piers Partridge

16/09/07

Project Background:

Gender: Male

Occupation: Musician/Composer

Age: 58

Status: Married with Children

Start Date: 2004

Completion Date: Autumn 2006 but ongoing

Location: Nailsea, nr Bristol

Level of Involvement: Project Manager, Labour and Design

Project Description:

Areas and Storeys

A single storey straw bale music studio 21 x 14 ft internally.

Hybrid load bearing straw bale walls with tree trunks to take some loads.

Extensive green roof with 5-6 inches of soil, plants provided by coronet turf.

Large Veranda.

Reasons for Self Building:

Piers wanted a bigger space for his music and the architects he talked to were unhelpful, 'hadn't a clue' He wanted a garden shed and the architects were designing much bigger modern buildings.

Piers says he was desperate to get what HE wanted and not somebody else's ideas. He wanted it to be a very personal space.

Design:

Was an Architect appointed, if so who, was this useful:

Les from Reckless Orchard architects was appointed to help Piers get through planning. He found the architect very reassuring and useful. Piers said he had one or two good advisors during the project.

Implications on Design:

Were you restricted by Straw, implications on openings, standard dimensions etc.

Piers explained that the obvious implications of using straw bales were the very thick walls and subsequently reduced internal areas.

He felt that as the building was only single storey using straw bales was no big deal.

Piers seemed to think the implications of straw were more on the build stage with the necessity for good storage, access for bale delivery and tarpaulins to keep the bales dry.

Piers didn't feel restricted in the shape and size of his windows as he described that the bales could be cut and shaped to fit any window.

He has no conflict with standard building dimensions but choose to have all his windows custom made except one which he bought from the tip.

Why did you choose straw, what did you expect, were you right?

Piers choose to use straw having seen his friend Rachael Whitehouse's house.

He also described himself as a 'farm boy' and that he felt comfortable with the material and new how strong it was.

He described straw as feeling right and that it feels resonate with the guitar which was very important to him.

Planning:

	Easy				Hard
Difficulty:	1	2	3	4	5

Problems:

The planning process was very easy for Piers as he was told planning wasn't necessary. The design had no real foundations and Piers felt the planning office had a work overload and told him as long as the neighbours were happy planning wasn't required.

Effect of Straw bale:

Piers said the officer had a few questions about the straw but this wasn't a hold up. Due to the use of straw lightweight foundations were possible which helped to avoid the need for planning permission.

Building Regulations:

	Easy				Hard
Difficulty:	1	2	3	4	5

Officer used approved inspector/local authority?

Effect of Straw bale:

Fire/Vermin/Insulation/Air Tightness

Along with the planning permission Piers was told building regulations approval was not necessary for his strawdio. The building could be described as a temporary structure. The local authorities were a little concerned about fire risk and Piers had to send them quite a lot of information regarding the properties of straw bale buildings.

Advice/Support:

	None				Lots
Requirement:	1	2	3	4	5

Comments:

Piers described the project as frightening if you're not a builder. He found he needed a lot of advice. Piers felt he was breaking the convention that builders build buildings. He said at times he thought 'I don't know what I'm doing'

	Easy				Hard
Availability:	1	2	3	4	5

Comments:

Piers found advice quite hard to come by in the end he felt it was easiest from other straw builders through the straw bale network and on internet forums. Piers also used builder friends for advice. He said he felt that in the end it's all common sense.

Is advice Costly?

Piers didn't have to pay for any advice.

Sourcing Materials:

	Easy				Hard
Straw:	1	2	3	4	5

Comments:

Time/Availability/Cost

Piers describes himself as being very well connected to the community which he felt was very helpful. Piers sourced his bales from a local farmer who produced bales packed very tightly specially for the project. Piers described the timing as 'perfect' and not a problem.

Piers described the straw building as being easy and fun but that the other parts of the build were harder work.

He felt his skills were adequate for a bodge.

	Easier				Harder
Compared to Expectations:	1	2	3	4	5

Comments:

Piers said the building was much harder than he'd expected but felt that you have to go into these projects with an innocence.

Major Problems:

Piers described the major problems as the access for delivery of materials and having to cover the building with tarpaulins until it was plastered.

He says he would put the roof on first in future and build underneath it.

Value:	Poor				Good
Was it good Value:	1	2	3	4	5

Comments:

Piers said that personally the building was fantastic value but that this excludes the labour.

He felt community connections are very important to provide value.

Piers had 10-12 volunteers on four or five different occasions to help him build.

He described the build as a reciprocal process with people helping out to return favours.

Piers thinks the whole process would be torture if you were an isolated person.

Piers describes his building as having a lot of love in it.

He feels this adds to his appreciation of the space.

	Not				Very
Was the experience valuable:	1	2	3	4	5

Comments:

Piers describes the build as something he had to do.

He says he learnt a lot from the experience.

He thinks the building is a real people thing due to the straw bale construction being very labour intensive.

Piers felt that some of the volunteer work was slap happy and he might organise it differently if he was going to do it again.

Property Value:

Build Cost: £16-27,000

After:

	Easy				Hard
Is insurance readily available:	1	2	3	4	5

	Easy				Hard
Are Warranties readily available:	1	2	3	4	5

Comments:

Piers doesn't have insurance or a warranty for his Strawdio but he has heard that a company called naturesave would insure it.

	No				Yes
Would you use Straw Bale again:	1	2	3	4	5

Comments:

Piers says he would use straw bale again and would love to build the same building on a plot overlooking the sea in Wales and to have it as a holiday home.

	None				Lots	
Problems in use:	1	2	3	4	5	

Comments:

Piers has had one problem with his building in use.

He came down to the building just before Christmas and there was water everywhere.

At first he thought the roof was leaking and then realised it was condensation.

He thinks it may have been due to moisture drying out of the plaster.

Piers has had no problems since.

He thinks the problem was partly due to the lack of a conventional air-gap or ventilation.

How would you do it differently:

Piers says if he was to build with straw again he would use a plumb line to ensure the walls are dead straight.

He also thinks he would shave the bales before building rather than once the walls are up.

He would include temporary vents into the design for the drying out phase.

Piers also feels the lime plaster is quite dusty although he is confident the building is healthy with all the natural materials. He hopes the dustiness will be an initial problem.

He thinks that other than the dust the building is an ideal music studio.

Appendix Six

Case Study : Name: Kester Wilkinson

21/09/07

Project Background:

Gender: Male

Occupation: Runs a Training Company

Age: 37

Status: Married with two daughters

Start Date: Offer for and Autumn 2000, completed sale March 2001, started May 2001

Completion Date: Moved in March 2002

Location: Putley, Herefordshire

Level of Involvement: Design, Planning, Manual Work and Project Management

Project Description:

Areas and Storeys

A four double bedroom and three bathroom two storey house with a 120sq.m footprint and 200sq.m of internal useable space.

The ground floor is a timber frame with straw infill and the first floor is load bearing straw bales.

The roof is cedar shingles and the walls are finished with lime render.

The foundations are concrete block and beam.

Reasons for Self Building:

Kester decided to self build because at the time he and Zinnia thought they would be able to get a larger, nicer property for their money that way.

Kester thought straw would be cheap, quick and easy to build with.

Design:

Was an Architect appointed, if so who, was this useful:

No architect was employed for the design of the house but a draftsman was used to help prepare drawings for planning. This was very useful

Kester thinks an architect would have been helpful at other times in the project.

Implications on Design:

Were you restricted by Straw, implications on openings, standard dimensions etc.

Kester thinks straw bale construction is restrictive for load bearing straw bale buildings.

He explains that the roof needs to be over engineered to cope with the spans as there are no intermediate supports. Large timbers are necessary to span from wall to wall.

Kester also points out that they lost 20sq.m of the footprint of the building due to the thick walls.

He thinks the lime rendering is a big draw back as it takes up a big lump of time for application and drying.

Kester also explained that as straw bale buildings need a big roof overhang this can result in quite complex carpentry.

Kester did find that bales didn't fit standard building dimensions but said it wasn't too much of a problem in length where the bales can easily be trimmed but was more of a problem in height where they are less adaptable. He found this very annoying.

Why did you choose straw, what did you expect, were you right?

Kester chose to build with straw because he thought it would be cheap and easy to build with.

He said it wasn't what he expected and was very labour intensive.

Also the lime was very expensive as was the associated labour.

Kester did acknowledge a possible saving in the cost of the walls but pointed out that this would

probably only be 15 % of the overall build cost.

Planning:

	Easy				Hard
Difficulty:	1	2	3	4	5

Problems:

Kester's planning application went through very easily.
He explained that rather than taking the typical self build approach of fighting with the planning officers he decided to take on board the officer's advice.
His application didn't even go to a committee.

Effect of Straw bale:

Kester felt the use of straw bale construction was irrelevant to the planning application.

Building Regulations:

	Easy				Hard
Difficulty:	1	2	3	4	5

Officer used approved inspector/local authority?

Effect of Straw bale:

Fire/Vermin/Insulation/Air Tightness

When Kester went for building regulations approval the officer had no prior knowledge about straw bale construction and Kester had to give him quite a lot of information about its properties.
He also pointed the officer in the direction of other local authorities who had passed straw bale buildings.
Kester said the county engineer had structural questions as he thought the withies pinning the bales were structural.

Advice/Support:

	None				Lots
Requirement:	1	2	3	4	5

Comments:

Kester has a friend who is a planning consultant who he said was very useful for advice.
He also had Barbara Jones as an advisor but didn't find her advice all that helpful.
Kester also read a lot of books about straw bales and building.
He explained again that straw was a very small part of the build.

	Easy				Hard
Availability:	1	2	3	4	5

Comments:

Is advice Costly? Kester paid Barbara Jones the first time he met her for a couple of hours consultation.

Sourcing Materials:

	Easy				Hard
Straw:	1	2	3	4	5

Comments:

Time/Availability/Cost

Kester found it very easy to get hold of straw as he said that farmers keep straw throughout the winter and that the belief that it has to be freshly harvested is false.
He paid extra to have his straw kept in barns so it was dry.
Kester explained that the process was very easy and he went through a bale dealer who put him in touch with a farmer.

He ordered his bales in March for a June delivery and paid £2/delivered bale and the total bill came to around £800 for too many bales.

	Easy				Hard
Lime:	1	2	3	4	5

Comments:

Time/Availability/Cost

Lime render was also easy for Kester to get hold of from a local supplier.

He paid £130/ tonne for the lime to be delivered and used 24 tonnes so it was a large part of the budget.

Kester needed to give 4 – 5 days notice for big orders of lime but smaller orders could be processed quicker.

	Easy				Hard
Other Materials:	1	2	3	4	5

Comments:

Time/Availability/Cost

Kester sourced most of his other materials from local builder’s merchants.

He also used the build store group purchase arrangement to get better deals on some materials.

The only thing he had difficulty with was the hazel withies which he was trying to source at the wrong time of year. He explained how people like to coppice hazel from December to late February or early March but he needed it in July and there wasn’t much around.

In the end he persuaded someone to cut some for him but it wasn’t ideal as the wood was a bit green.

Skills:

	Low				High
Previous level	1	2	3	4	5

Comments:

Straw Bale vs Other Self Build

Kester said he had little building experience before his project but would describe himself as handy.

He had been on a 4 day straw bale building course at the Yarner trust.

	Same			Improved	
New level	1	2	3	4	5

Comments:

Straw Bale vs Other Self Build

Kester felt his building skill had improved a lot and improved with every job.

He thinks the skills he’s developed are relevant to other building methods as well as straw bale and that they include normal building skills.

His building used normal foundations so here he picked up conventional building skills.

	Easy				Hard
Availability of appropriately skilled labour:	1	2	3	4	5

Comments:

Straw Bale vs Other Self Build

Kester employed a plumber and electrician as well as plasterers.

He organised his labour on a day to day basis and agreed a jobs to be done at the start of each day.

Workers were paid cash in hand and if they didn’t get on then Kester would find someone else. It was important for him to get on with the builders.

Lime plasterers were quite hard to find and Kester had to employ someone from Derbyshire to come and spray lime render at his building. This lime expert had never worked with straw before.

The Build:

	Easy				Hard
Difficulty:	1	2	3	4	5

Comments:*Required Skill level*

Kester described the building as being fairly straight forward.

He felt he had to learn a lot as he went along.

Kester thinks that carpentry was the most important skill to learn.

	Easier				Harder
Compared to Expectations:	1	2	3	4	5

Comments:

Kester thought the building was harder than he'd anticipated because hadn't expected to be so involved with the manual labour

Major Problems:

Kester had a lot of problems during the build due to what he described as bad design on the timber frame.

He felt confusing advice also made things difficult.

Kester said that he experienced complications with trying to keep the bales dry and that this was a draw back. If he did it again he would put a timber frame up first to provide a roof and then build up the straw underneath this.

Value:

	Poor				Good
Was it good Value:	1	2	3	4	5

Comments:

Kester felt the build was good value but that this was largely due to the use of low quality value materials.

Kester didn't feel that the use of straw bale construction contributed to the good value of the project. In 2001 surveyors wouldn't risk their professional liability to survey the building. Therefore the house has no architect or surveyor certificate.

	Not				Very
Was the experience valuable:	1	2	3	4	5

Comments:

Kester thinks it's hard to say whether the project was a valuable experience.

He explained that it took him out of family life for a year which was hard work. He thinks self build always is this way.

Kester took ten months 'full on' to complete the project, working a full time job and building after hours.

Property Value: £425,000 Kester thinks a comparable brick building would be worth £450-500,000.

When the house was first built it was valued at half the conventional market value because of the use of straw bale.

Build Cost: £70-75,000 of which the final material cost was roughly £34,000

After:

	Easy				Hard
Is insurance readily available:	1	2	3	4	5

	Easy				Hard
Are Warranties readily available:	1	2	3	4	5

Comments:

Kester couldn't get insurance for his house five years ago when the project was first completed. He got around the problem by describing it as a timber frame with infill and playing down the use of straw as much as possible.

	No				Yes
Would you use Straw Bale again:	1	2	3	4	5

Comments:

Kester says he wouldn't use straw bale if he were to build again, partly because he would have different priorities now. He found the project to be expensive and very stressful. If he were to build in the future Kester would use a construction method which requires less labour. He would try to control the building cost through the materials used. Kester would probably go for a dry method of construction if he were to build again, if he did use straw he would timber clad it.

	None				Lots
Problems in use:	1	2	3	4	5

Comments:

Kester found that lime wash wasn't very durable and later applied a breathable, natural paint. This was however very expensive, around £6/litre with roughly 150 litres required. This added further to the time and costs. Kester has had minor problems with knocks to the plaster work and has carried out repairs. No skirting boards were used in the house due to the irregularly shaped walls; this has left the plaster prone to knocks at the bottom. Kester also had a detailing problem at the base of his walls having followed the advice of Barbara Jones he had left the wall foot open to allow any moisture in the walls to escape. This had resulted in drafts and air currents circulating through the house and the walls. Kester has no moisture sensors in his house but hasn't noticed any problems with damp yet after five years.

How would you do it differently:

Kester says if he was to build again he would use a 'post and rail' timber frame and would clad the building rather than lime rendering. He would then use straw within the frame but definitely wouldn't use lime render again.

Appendix Seven

Interview with Martin Penk Director Arco2 - 16/08/07

Martin hasn't been involved in self building with straw bale as such. He was involved in the renovation of the company's office in Bodmin which used other natural materials including reclaimed sheep's wool for insulation. Straw bales were used in the floor of the building for insulation. The practice ARCO2 have been involved with straw bale buildings and are researching innovative uses for straw in the mainstream building industry.

Padstow:

This was an extension to an existing commercial building. ARCO2 opted to use timber framing with straw bale in-fill as they were uncomfortable with the idea of a flexible structure adjoining an existing rigid structure. The building is over 100 sq.m and was constructed by conventional builders who were used to traditional building methods. Once the frame was erected it took 2 days for the builders to fill the straw in with supervision and advice from MP at the outset. ARCO2 devised a system to co-ordinate the dimensions of Straw Bales with the dimensions of standard building components. This use of modules to avoid waste and on site cutting was inspired by Segal's method of building.

High Ham:

High Ham used a similar construction method to the Padstow project for a school building. The building went to tender and the winning tender by a considerable margin was Rob Buckley a specialist straw bale builder who runs courses at the Dorset Centre for Rural Skills. Rob (£108,000) was tendering against conventional builders (£170,000) who quoted higher prices due to their unfamiliarity with the construction method.

Timber Frame:

Martin advocates the use of straw bale with timber frame rather than load bearing straw walls. He believes it avoids a lot of uncertainty and combines an innovative building material with a tried and tested reliable structure.

Eco-Fab:

ARCO2 began developing a system for prefabricated straw bale buildings in collaboration with Rob Buckley. Eco-Fab is a modular construction system with straw bales sandwiched between sheets of Hardboard or OSB. The single storey boxes or cassettes are fabricated off site and then fixed onto a previously erected glulam timber frame. The pieces bolt together and the system is again inspired by the thinking of Walter Segal. A number of housing schemes are set to go ahead in October with the aim being to provide houses starting from £60,000. The schemes were originally expected to involve an element of self-build for interior fit outs and exterior claddings. This is unlikely to happen in reality as the aim of the pre-fabrication is to speed up the building process and reduce the time on-site.

The system incorporates a double-skin interior wall which provides a void for services. This also allows for air tightness to be provided by the inner skin without being punctured by fixings and fittings on the interior walls..

Planning:

No Issues other than wall thicknesses on tight plots. Other than this it should be as flexible as other construction methods.

Building Regs:

Can be an obstacle. ARCO2 have used JHA approved inspectors but it would be harder to convince a local authority. Air tightness could be a problem in the future although current regulations are easily satisfied. Regulation 7 (fit-for-use) can be used to argue the case for straw as an infill, it would be harder with a load bearing straw wall.

Advice/Support:

Found the SBBA sceptical of the use of straw with timber frame and as pre fab at first. However they have now come round to accept it and are pleased that straw is being used in innovative ways.

Warranty:

Buildzone/JHA won't recommend a warranty for load bearing straw walls unless a rain screen cladding is used; they believe the lime render is too vulnerable a protection for a structural element.

Insurance:

It is much harder to insure a timber framed building than a brick and block or other. Load bearing straw walls would make things harder again.

Skills:

Conventional builders can build with straw effectively and efficiently if advised and supervised.

Materials:

Straw for the Padstow project was sourced from Martin's brother-in-law a local farmer. In this way the bales could be made to measure where necessary.

Problems with dimensions, sheet materials for Eco-fab vary from imperial to metric. Hardboard is more popular at the moment although OSB has also been used.

Value:

Straw works out as a cheap insulation even if this is the only purpose it serves. ARCO2 have avoided the use of lime renders to reduce build costs. Even with the use of a glulam timber frame and a double skin interior wall straw construction works out as a good value construction method.

Eco-fab works out at around £110/sq.m