



Building with Pallets

And other Recycled Waste Materials



Figure 1

Kane Hogan & Carlo Wiegand

Photo by Mark Fielding



LBP Number: BP109457 (Design Class 2)

Solabode Ltd

Author

Originally published

Typing and Editing

Website

Phone

Email

Director Mark Fielding

Mark Fielding

2012

Nelson Secretarial

www.solabode.co.nz

+64 3 5468760

mark@solabode.co.nz

Download the Full Version at the ONLY authorised
download site:

www.ecotect.co.nz/solabode-building-with-pallets.php

Solabode Limited

Solabode Ltd is a company dedicated to the development and promotion of experimental building design for human occupation and use.

The work explores new concepts in home design and associated systems for living, from the standpoint of economical and environmental sustainability.



©2012 by Solabode Ltd. No part of this document may be reproduced or transmitted in any form or by any means electronic, mechanical, photocopying, recording or otherwise, without prior written permission from Solabode Ltd.



Figure 2: Workshop group June 2012. Photo: Sharon Gottermeyer

My wish for this book is to empower, excite and educate while you enjoy the adventure.

Introduction

Why would anyone want to build a cabin or any other building for that matter, out of used wooden shipping pallets? “Why not!” is my answer, as they can easily be made into structurally sound assemblies for floor, wall and roof framing that will remain durable for the life of the building, if kept dry.

For quite a few years now I have been struggling to design homes that are more ecologically sustainable as well as more affordable. These two goals are of paramount importance to me as our natural world deteriorates under the stresses of our industrialised society, and while people struggle to afford basic housing that keeps costing more while pay rates (in real terms) keep going down.

The architectural world, generally speaking, like most other professions and industries, sees the sustainable ‘kick’ as another way to boost profits. So we see as a result – and for years now the public perception – that ‘eco’ homes appear to cost more. To me this is just wrong. Thus my quest to bring these two illusive goals together: sustainable and affordable homes.

The purpose of this book is to share the knowledge that anyone can indeed build a true eco home for less money than a conventional

home, if one is prepared for: a little hard work; to step out to the fringes of the building industry; and to 'run the gauntlet' of the building controls system.

Before we all get too deep in the mire, though, and to keep things simple, I will show you how to build a safe, healthy and comfortable cabin¹ of less than 10m². Such that you may take on an achievable goal and avoid having to apply for a building consent². However, the method for building this cabin is no different from building a small home – for those adventurous enough to experiment further. Later versions of this book will include plans and describe how to do just that: build a one or two-bedroom home from pallets and other recycled waste materials.



Figure 3: The prototype 'Pozie' eco cabin.

Photo Emma Heke

¹ In later sections of this book a cabin may also be referred to as a 'Pozie', colloquial New Zealand usage for 'a nice place to be', abbreviated from 'position'.

² Refer to chapter 2, Code Compliance, for details of non-restricted building work not requiring a Building Consent.

Table of Contents

INTRODUCTION	I
1. REASONING	1
2. BUILDING CODE COMPLIANCE	6
3. MATERIALS AND SOURCES	10
3.1 PALLETS.....	ERROR! BOOKMARK NOT DEFINED.
3.2 INSULATION	ERROR! BOOKMARK NOT DEFINED.
3.4 CORRUGATED ROOFING SHEETS	ERROR! BOOKMARK NOT DEFINED.
3.5 CARPET AND OTHER LININGS	ERROR! BOOKMARK NOT DEFINED.
3.5 BUILDING SITE OFF CUTS.....	ERROR! BOOKMARK NOT DEFINED.
3.6 HARDWARE AND MEMBRANES	ERROR! BOOKMARK NOT DEFINED.
4. TOOLS AND EQUIPMENT.....	ERROR! BOOKMARK NOT DEFINED.
5. FOUNDATIONS AND FLOORS	ERROR! BOOKMARK NOT DEFINED.
6. FLOOR STRUCTURE OPTIONS AND ALTERNATIVES	ERROR! BOOKMARK NOT DEFINED.
7. WALL ASSEMBLIES	ERROR! BOOKMARK NOT DEFINED.
8. ROOF STRUCTURE	ERROR! BOOKMARK NOT DEFINED.
9. INSULATION	ERROR! BOOKMARK NOT DEFINED.
10. PAINTING INTERIOR.....	ERROR! BOOKMARK NOT DEFINED.
CARPET/HESSIAN LINING	ERROR! BOOKMARK NOT DEFINED.
11. CLADDING AND ROOFING	ERROR! BOOKMARK NOT DEFINED.
11.1 OTHER CLADDING AND ROOFING MATERIALS	ERROR! BOOKMARK NOT DEFINED.
11.1.1 A Demonstration Experimental Building	Error! Bookmark not defined.
11.1.2. Rain Screen Cladding	Error! Bookmark not defined.
11.1.3. Corflute	Error! Bookmark not defined.
11.1.4 Waste-Stream Materials.....	Error! Bookmark not defined.
11.1.4 Plywood Sheeting.....	Error! Bookmark not defined.
11.1.5 Plaster Cladding	Error! Bookmark not defined.
12. SERVICES.....	ERROR! BOOKMARK NOT DEFINED.
12.1. ELECTRICITY	ERROR! BOOKMARK NOT DEFINED.
12.2 PLUMBING	ERROR! BOOKMARK NOT DEFINED.
12.3. BIO GAS	ERROR! BOOKMARK NOT DEFINED.
13. JOINERY.....	ERROR! BOOKMARK NOT DEFINED.
14. INTERNAL LININGS.....	ERROR! BOOKMARK NOT DEFINED.
15. FINISHING TRIM – INTERIOR	ERROR! BOOKMARK NOT DEFINED.
15.1. FINISHING TRIM – EXTERIOR.....	ERROR! BOOKMARK NOT DEFINED.
16. PAINTING EXTERIOR	ERROR! BOOKMARK NOT DEFINED.
17. LOCATING.....	ERROR! BOOKMARK NOT DEFINED.
18. ANCILLARY STRUCTURES.....	ERROR! BOOKMARK NOT DEFINED.
19. APPENDIX 1: ARTICLE.....	ERROR! BOOKMARK NOT DEFINED.
20. APPENDIX 2: SOME PHYSICS	ERROR! BOOKMARK NOT DEFINED.
21. APPENDIX 3 BASIC CABIN PLANS	ERROR! BOOKMARK NOT DEFINED.



"The planet has enough for everyone's need but not for everyone's greed". (Gandhi)

1. Reasoning

I am not the first to recognise that the material of choice for concerned individuals in the 21st century, who recognise the folly of pillaging ever more new materials from a stressed planet, is the refuse from our industrialised society.

I am also not the first to realise that in Nature there is no such concept as 'waste' – that the bi-products from one organism are the nourishment for another. Nature produces an ever balanced cycle which is the only real sustainable system. If our species is to survive on this planet, we must start emulating Nature and following her lessons before it is too late.



Figure 4: Nature Photo courtesy: mycor.nancy.inra.fr

Building houses out of pallets, old carpet and packaging material is not the final solution. Indeed the supply of such materials is completely dependent on our wasteful society continuing to produce

waste. However, I hope it is a gesture in the right direction and something at least to pique the interest of the billions of consumer units who know no other way than what society has fed us: more consumption!

Perhaps such a recycling example will inspire others to find better systems and methods that align more with Nature's example. All such work will help to slow the voracious raping of our Earth's resources and the destruction of our natural environment - the very thing that sustains us with clean air and water. It is not fast food and hi-tech manufacturing, I suggest, that feeds one's body and soul...

The only truly sustainable building materials are those found naturally on the Earth and which require no more 'manufacturing' than mixing with water and other natural materials. More than half of all houses in the world are built of earth. Earth is a material that can be mixed with grass, straw (and other organic ingredients) and water to make walls, roofs and floors that last for centuries - and when spent, are returned back to the Earth with zero pollution.



Figure 5: Photo courtesy: naturalbuildingblog.com

This book is not about earth building but it offers ideas on how you can use earth, straw and other organic materials to enhance your living environment and improve your comfort.

While building with "garbage" is not the final solution, it does provide a viable interim building method for people who might want to choose this method (for financial or eco conscience reasons) or for people with no other choice. Such solutions are available to anyone living in, or close to, cities where large amounts of waste materials are discarded on a daily basis thus adding tons of perfectly good materials to growing mountains of landfill.



Figure 6: Photo courtesy: javaforjustice.com

This interim solution is a win, win, win scenario:

1. It provides affordable DIY houses;
2. It requires almost no demand for additional new materials, saving more trees and more truckloads of ore from mining;
3. It saves a huge amount of energy in three separate processes:
 - i. mining/harvesting;
 - ii. manufacturing;
 - iii. transportation.
4. It saves ever more garbage from our increasing landfill which pollutes our soil and water.

Greed and power hunger enable those with money to rule over the rest of us, ever widening the gap between the haves and the have-nots. Gandhi first said, "The planet has enough for everyone's need but not for everyone's greed"³.

While the meek wait to inherit the earth, many dwell in rudimentary shelters made of garbage and live on the outskirts of cities that continue to fuel the 'machine'.

³ There's enough on this planet for everyone's needs but not for everyone's greed. Mohandas K. Gandhi (1869-1948) Indian Spiritual & Political Leader 1948 AFSC Nobel Peace Prize Nominee; birthdate: October 2 birthplace: Porbandar, India

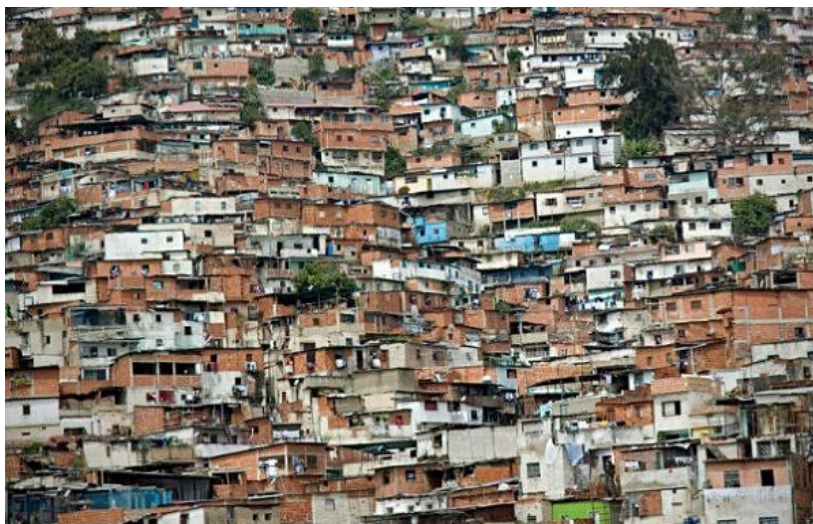


Figure 7: Rocinha favela outside Rio de Janeiro.

Photo courtesy: amazingdata.com

These shelters are mostly very unsafe and unhealthy, but they don't need to be. By combining basic building science and engineering, together with freely available knowledge about keeping homes warm and dry, it is quite possible to build safe, comfortable and energy-efficient healthy homes from wooden pallets and other discarded material. This book will suggest how.



Figure 8: Photo courtesy: Abbie Tumbleson/WYNews

To conclude, let's recognise a major point when thinking of new ways of providing affordable and sustainable housing: that is the social acceptability (or lack thereof) of living in a house made of 'garbage'. We humans like to keep up with the Jones's – and as a society are quick to judge those who live with less means than we do. There are many examples but let's not point fingers.

So let's not fool ourselves; unless we make recycled houses not only feel and work better than mainstream homes (which by the way is easy to do), but also *look* better, or at least have something highly attractive about them that instils the desire to own one, then we will not solve this problem, nor change trends or show a better way. People will always behave as they have been conditioned to do, so let's find ways to make our affordable eco buildings 'pallet-able'(sic).

Mark Fielding
November 2011



Figure 9: Mark Fielding

Photo: Kane Hogan

2. Building Code Compliance

The NZ Building Code, completely re-written in 1991, is one of the best building codes in the world. Being a performance-based code (rather than prescriptive), it provides for innovation and creativity and is limited only by one's imagination.

Such a code allows anyone to build *'anything they want, out of anything they want'* – provided they can present evidence that its individual aspects meet the performance requirements of the relevant clauses of the NZ Building Code.

In simple, stand-alone housing some of the main clauses that must be addressed and satisfied are: B1 Structure; B2 Durability; E2 Weather Tightness; E3 Internal Moisture; F4 Safety from Falling; G7 Natural Light; G4 Ventilation and H1 Energy Efficiency⁴, amongst others.

The clauses are short and sweet and are made up of three aspects: social objectives, functional requirements and performance requirements. It is this last aspect which must be satisfied, but how you satisfy this it up to you; there is nothing mandatory except that it be satisfied.

For example: F4 Safety from Falling reads thus:

OBJECTIVE

F4.1 The objective of this provision is to safeguard people from injury caused by falling.

FUNCTIONAL REQUIREMENT

F4.2 *Buildings* shall be constructed to reduce the likelihood of accidental fall.

PERFORMANCE

F4.3.1 Where people could fall 1 metre or more from an opening in the external envelope or floor of a *building*, or from a sudden change of level within or associated with a *building*, a barrier shall be provided.

It makes sense doesn't it! Just common sense really... There are a few other performance sub clauses also to further describe other situations to provide safety from falling.

For those not living in New Zealand, one could still prepare a building consent application which uses the performance requirements in the NZ code to argue that you have fulfilled the purposes of a building –

⁴ Note that H1 Energy Efficiency does not apply if one's house is not connected to the National Electricity Grid. However I recommend it prudent to comply such that one maintains a safe and comfortable internal environment.

perhaps in the event that you find yourself unable to build some aspect without a permit.

For others with the freedom to build without a consent (Design Outlaws and Renegade builders), I urge you to keep to the details and methods outlined in this book without cutting corners. This will pay off when the first earthquake or hurricane hits you and it will pay off on a daily basis with health and comfort.

All the relevant clauses of the New Zealand Building Code are available for free download on the NZ Department of Building and Housing website at:

<http://www.dbh.govt.nz/building-code-compliance-documents-downloads>

These documents, along with their associated Compliance solution documents, will help you provide solutions for your pallet building project.

Here's what the DBH website says about its compliance documents; and note what it says about Alternative Solutions! – these are the key to building anything out of anything...



Building Code Compliance Documents

A Compliance Document is one way of establishing compliance with a particular clause of the New Zealand Building Code. A design that complies with a Compliance Document must be accepted as complying with the related Building Code provisions.

There may also be other ways to comply with the Building Code, called alternative solutions.

The Department of Building and Housing may change Compliance Documents at any time. You should check the record of amendments for these changes, or the Department's publications Code Words and Building Controls Update.

Now here's what the DBH website says about Alternative Solutions, this is on a government website! It shows us that we don't need to have fear of Building Consent officials as they only '*have to be satisfied on reasonable grounds*' that your solution meets the performance requirements.

Alternative solutions

*An alternative solution is a building design, of all or part of a building, that demonstrates compliance with the **Building Code**. It can include a material, component or construction method that differs completely or partially from those described in the **Compliance Documents**. It can be a minor variation from a Compliance Document, or a radically different design and construction approach. Not everyone wants a 'one size fits all' building solution. A building owner may want something that looks different or performs better, is more cost effective, or to overcome a specific site problem. Also, there may not be a Compliance Document for the proposed construction, for example, a document covering onsite effluent disposal. Whatever the reason, a non-generic approach to building design and construction is often desired or required.*

*The Building Code, by being a performance-based code, allows for innovation and uniqueness. It enables designers the freedom to come up with a proposal for an **innovative solution** that provides the best outcome for the project. For example, in the pre-1991 building bylaws days, it wouldn't have been possible to build a house of blocks made from recycled plastic waste (with an added-value factor of captured air providing the insulation) other than by changing the bylaws.*

Designers and building consent authorities have important roles to play in the use of alternative solutions. Discussion early in the design process will clarify expectations. The designer needs to know what information and evidence the building consent authority will expect, and the building consent authority needs a clear understanding of what the building consent applicant is trying to achieve.

There are several more paragraphs to help you formulate evidence of meeting performance requirements, just refer to the DBH website. The piece finishes with:

A. Present your evidence

Provide a strongly argued case to the building consent authority by including as many of the above tools as possible. Be sure to state exactly what Building Code clauses and performances are being addressed. The clearer the supporting documentation, the easier the evaluation of it will be.

B. A building consent application is accepted when compliance is clearly established

All of the evidence, as described above, is assessed. Note that outside help may be sought by the building consent authority in assessing all, or specific aspects, of a proposed alternative solution.

*Alternative solutions have been accepted for entire projects or parts of a building and have included composting toilets, handrails, barriers, fire escape plans, water supplies, effluent disposal, **Eco houses** and rammed-earth houses.*



One of the most amazing things this DBH has only just come up with⁵ is this Owner-Builder exemption to Restricted Building Work. Have a read and see if you can't build your own house or cabin yourself...

Owner-Builders

Owner-Builders are able to carry out Restricted Building Work on their own home. You are an Owner-Builder if you:

*Live in or are going to live in the home (includes a batch or holiday home);
Carry out the Restricted Building Work to your own home yourself, or with the help of your unpaid friends and family members, and
Have not, under the Owner-Builder Exemption, carried out Restricted Building Work to any other home within the previous 3 years.*

DIY work

⁵ Owner Builder Exemption introduced in 2012 by the NZ Dept. of Building and Housing

Most DIY work is usually minor repair, maintenance or alteration work and doesn't fall within the category of Restricted Building Work. For this work nothing has changed and home owners can continue to do this work as they always have. Restricted Building Work is work that requires a building consent and relates to the primary structure of your home, or affects its weather tightness. Building work that is in the Restricted Building Work category must only be done by or under the supervision of Licensed Building Practitioners, unless you are using the Owner-Builder Exemption. If you are a suitably skilled Owner-Builder and meet the criteria above, you can carry out this work; but if you have any doubts you are recommended to hire Licensed Building Practitioners to do this critical building work.

An Owner-Builder is responsible for ensuring that Restricted Building Work carried out under the Owner-Builder Exemption complies with the building consent and the relevant plans and specifications.

Help with your DIY work

As the Owner-Builder family members and friends can help you with the Restricted Building Work to your home as long as you are not paying them to help you.

Future buyers will have access to information that shows the building work was carried out by the owner rather than a Licensed Building Practitioner.

Using the Owner-Builder Exemption

Before you can use the Owner-Builder exemption you need to complete a Statutory declaration as to owner-builder status form showing that you meet the owner-builder criteria.

The statutory declaration form has to be witnessed and signed by a Justice of the Peace or someone else authorised by law do so. This form needs to be given to your local council with your application for a building consent, or before the construction Restricted Building Work on your home starts.

It is an offence under the Crimes Act 1961 to give false information in a Statutory Declaration, and it is also an offence under the Building Act 2004 to give false information. Visit www.builditright.govt.nz or contact your local council for more information on the Owner-Builder Exemption.

3. Materials and Sources

Gathering waste materials is a major part of the job when building from garbage. It pays to spend a few days driving around your cities' industrial areas, scoping out sources of good pallets and other materials. It pays to cultivate good relationships with businesses to secure a good supply for your project. It's amazing how much goodwill a dozen bottles of beer can provide when offered to the social club fund. Throw in a couple of bags of chips to sweeten the deal.



Don't worry of pallets or if a source carpet has been 'spoken' for; there are plenty more sources; and be happy that other Garbage Warriors are out there saving the world too.



If you have any connections in the building industry, then also cultivate relationships with building contractors, asking for their waste, insulation off cuts and plywood off cuts, etc. You will be doing them a favour by saving them time and money dealing with site waste.

Builders working in renovation work are a potential source for old roofing iron. You may have to pay a nominal sum for roofing iron as otherwise the scrap metal dealer will offer a better deal. The advantage you have is that you are saving the builder the job of stacking it on a truck and taking it to the dealer, so offers should start at half of what the dealer pays per sheet.

I don't recommend using old insulation which is usually fibreglass or worse – it is full of hazardous dust and potentially harmful. We gather wool or polyester off cuts from new sites and stuff these into wall pallets.