

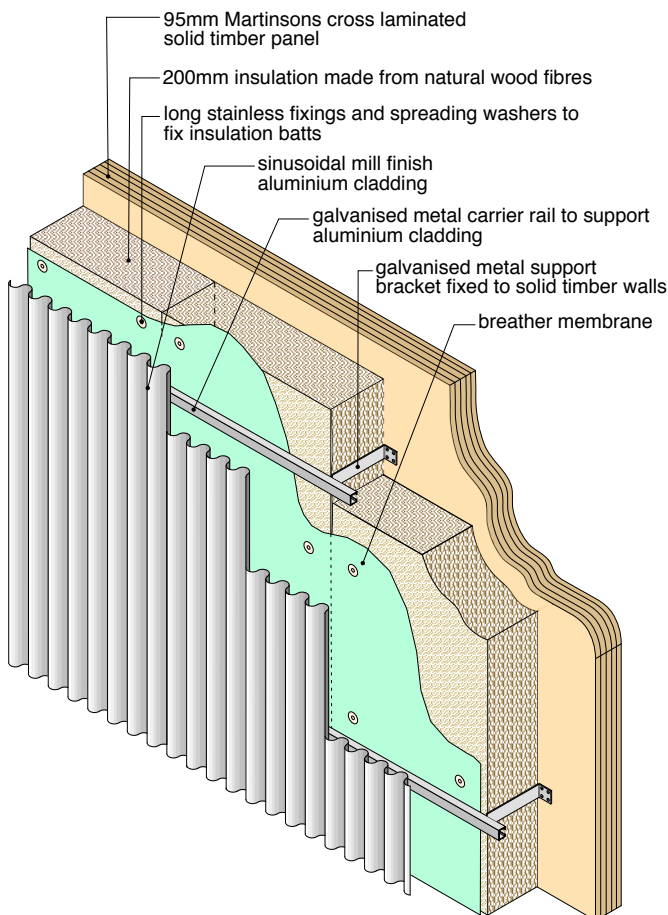
The Timber House

This is a semi-detached house with a difference. The walls and first floor are made from solid timber panels. These cross-laminated timber sections are formed by small section softwood timbers in layers, each at right angles to the previous layer and all glued to form a solid section.

For each of the two 2 bed houses, the solid timber construction locks in about 4.5 tonnes of carbon, helping to reduce the carbon footprint of the building.

The panels are engineered precisely, making the construction very airtight. Although the solid timber has excellent insulating properties, the addition of 200mm of hemp insulation makes the fabric very energy efficient. The roof structure uses a prefabricated timber I beam cassette system which should ensure that the house is very easy to heat.

A requirement of the Expo masterplan was that housing in the future living zone should be finished in a robust material. We chose corrugated aluminium which we were using on the roof with the aim of echoing simple rural buildings found in Scotland. Although aluminium is energy intensive to produce, it is fully recyclable.



Why Solid Timber?

We have left a timber internal finish, exposing the structural panels. Because timber is hygroscopic, it takes in moisture from the air, stores it and releases it, helping to avoid high humidity levels. Its thermal capacity also helps the fabric to retain heat and reduce fluctuations in temperature levels.

Using five-layer cross-laminated timber sections, 95mm thick, provides a very stable and dimensionally-accurate structure, making the panels suitable for buildings up to ten stories high. The timber is dried to 12% moisture content making them very stable. Panels also have good load-bearing capacity as loads can be transferred using the whole panel.

Because timber chars when it burns, it insulates the inner structure, making it safe in a fire. The thinner three-ply walls have a 30 minute fire resistance whilst the five-ply walls have one hour's fire resistance. Surface spread of flame has been dealt with by the application of an ecological water-based fire retardant.

Acoustically, the higher density makes the rooms feel quieter as high frequency noise is reduced. When building flats, impact noise can be reduced by the addition of floating floors and denser screeds.

We have used a Swedish system (Martinsons) but there are several manufacturers on the market.

We think there is potential to have the panels made in Scotland using homegrown timber. This would greatly enhance the potential for using Scottish timber in construction and help to reduce the impact of carbon emissions in our building industry.

Design team

Client	Albyn Housing Society http://www.albynhousing.org.uk
Architects	John Gilbert Architects Ltd http://www.johngilbert.co.uk/
Quantity Surveyor	WSD Scotland http://www.wsd-inverness.co.uk
Contractor	Morrison Construction Ltd http://www.morrisonconstruction.co.uk
Timber Engineering	Donaldson and McConnell http://www.donaldsonandmcconnell.co.uk/

Plot 4.1: Scottish Housing Expo 2010

Materials and construction	
External walls (and internal walls where timber)	95mm of cross-laminated timber (five layers) giving one hour fire protection, supplied by Martinsons http://www.martinsons.se
Wall insulation	200mm of Pavaflex, wood fibrous insulation, secured with ss fixings. supplied by NBT http://www.natural-building.co.uk/ Breather membrane over insulation.
Wall cladding and roof finish	Euroclad 0.9mm thick mill finish aluminium Cladco 13/3 sinusoidal profiled single skin sheets with a vented cavity (http://www.euroclad.com). Also Sto coloured mineral render on calcium silicate 'Ventec' board (http://www.sto.co.uk/).
Internal finish to solid walls	Treated with HR Prof fire retardant (water-based, solvent free) http://www.fireretardantuk.com
Internal walls	Largely solid timber but some are timber stud with plasterboard and insulation filled.
Roof construction	I beam cassette with 400mm of glass wool insulation, supplied by James Jones and Sons Ltd http://www.jji-joists.co.uk
Floor construction	75mm EPS insulation and 150mm concrete with battened floor finished with particleboard
Windows and patio doors	Nordan N/tech double glazed argon filled. http://www.nordan.co.uk
Roof windows	Velux http://www.velux.co.uk/
Doors	Nordan N/tech insulated doors
Staircase	Pine stair made by Highland Joinery Products, Unit 18 Dalcross Industrial Estate IV27XB
Kitchen units	JTC kitchen units, Craftsman range http://www.jtcfurnituregroup.com
Gutters and downpipes	Lindab steel with aluzinc coating http://www.lindabprofile.com

Energy, carbon and areas													
House area	83.3m ²												
House footprint	7.84m wide by 6.15m deep (excluding porch)												
House cubic capacity	254.4 m ³												
Cubic volume of solid timber	20.76m ³												
U values	<table border="0"> <tr> <td>roof</td> <td>0.11Wm²K</td> </tr> <tr> <td>walls</td> <td>0.15Wm²K</td> </tr> <tr> <td>floor</td> <td>0.24Wm²K</td> </tr> <tr> <td>windows</td> <td>1.2Wm²K</td> </tr> <tr> <td>roof windows</td> <td>1.4Wm²K</td> </tr> <tr> <td>external door</td> <td>1.4Wm²K</td> </tr> </table>	roof	0.11Wm ² K	walls	0.15Wm ² K	floor	0.24Wm ² K	windows	1.2Wm ² K	roof windows	1.4Wm ² K	external door	1.4Wm ² K
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external door	1.4Wm ² K												
Heating energy requirement	52kWh/m ² /year supplied by a gas-fired combi boiler												
Air permeability level	Tested at 2.9m ³ /hour/m ² at 50 Pascals												
Carbon	At 0.8 tonnes per m ³ , the solid timber is storing 16.6 tonnes of CO ₂ . Using 12/44 as the ratio of carbon within the carbon dioxide itself we get a figure of 4.5 tonnes of carbon safeguarded												

Furniture
Børge Mørgensen shaker table in oak, designed 1947
Four Hans Wegner dining chairs in oak CH23, designed 1951
Hans Wegner easy chair and footstool in oak
Bruno Mathsson easychair, EVA
Recycled ply coffee table designed and made by Gerry Thomson, Westmoreland Street, Govanhill
Dining table lightshade, Le Klint, 'Joker' pendant light designed by Raeder 1970
Poster of Poul Kjaerholm's chair from Louisiana art gallery, Denmark