The Evolution of The Art

Then (circa 1990s)...

![Image of a structure from circa 1990s]
The Evolution of The Art

... And Now

LILAC Affordable Ecological Co-housing, Leeds, England

Design/build by: Modcell
Principles of Ecological & Social Justice

Environmental Toxicity & Waste

Global Climate Impact
Principles of Ecological & Social Justice

Racial, Gender, & Economic Justice: Climate Justice

“It’s abundantly clear that we will not build the power necessary to win unless we embed justice—particularly racial but also gender and economic justice—at the center of our low-carbon policies.” Naomi Klein

Intersectionality: intersections are the focus

- Builders & Designers for Climate Justice, ADPSR Architects, Designers, Planners for Social Responsibility
- “Green” movement meets social justice movements
- 350.org, Sierra Club endorses Black Lives Matter platform
Systems Thinking: Buildings and Context

Follow “Systems” Pattern in Each Context and Scale
Scale and Social Ecology

Regional Scale: Local Money, Working Landscapes, & Sustainable Silviculture

Industrial Scale: Corporate Profits, Industrial Landscapes & GMO Monoculture
Full Life-Cycle Impacts

Cradle to grave to cradle; Seed to wall to compost & new growth
Human Health and Safety

ASTM 2 Hour Fire Rating for Plastered Straw Bale Wall

Non-toxic, truly zero VOC clay, lime & mineral paints
Emissions are hugely amplified by when they occur – embodied carbon is greatly weighted, very much like the time value of money.

The effect on the climate is $= \text{time} \times \text{emissions}$

The impact is the shaded area under the curve.
1, 2 and 3 all have big climate impacts because they emit carbon right from the start.

Embodied and Operational Carbon Emissions

1. New building - mainstream construction
2. New building with decarbonized grid
3. New building - Net Zero
4. Retrofit existing building for high performance
Sustainable agriculture, meet sustainable building.

Biogenic materials (wood, straw, hemp) have lower embodied CO2e AND sequestration benefits.
Natural Building Technologies: We’re Advanced

Marketing & Modern Styles
Construction Assemblies
Material Science Innovations
Natural Building Technologies: We’ve Advanced

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MycoFoam
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### Performance Specifications

<table>
<thead>
<tr>
<th>Metric</th>
<th>Standard</th>
<th>Testing Lab</th>
<th>MycoFoam</th>
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<tbody>
<tr>
<td>Density (lbs/ft³)</td>
<td>ASTM C303</td>
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<td>Compressive Strength (psi)</td>
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<td>Compostability (days)</td>
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<td>Flame Spread</td>
<td>ASTM E84</td>
<td>QAI</td>
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<td>Smoke Emission</td>
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<td>Thermal Conductivity, at 10°C (W/mK)</td>
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<td>Oak Ridge National Laboratory</td>
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<td>Water Vapor Permeation (dry cup)</td>
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<td>Moisture Storage at 53.5% RH (%)</td>
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<td>Moisture Storage at 75% RH (%)</td>
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Technological Advances: Straw

Bale Wrap
1st & 2nd Generation

StrawCell
3rd Generation

Prefab
4th Generation

Guest Blogs
Fresh perspectives from designers, builders, and industry experts

Straw Bale Walls for Northern Climates

A ‘third generation’ straw-bale technique combines a straw-bale interior wall with an exterior stud wall insulated with cellulose

POSTED ON NOV 17 2014 BY BEN GRAHAM

The mechanical bailer was invented in the 1850s (Reynolds, History of Hay Baling), and it’s been a while now since those fevers in the Midwest put up a couple of bale houses. You would think that by now we would have very refined construction techniques for straw-bale construction, given that some of those original buildings are still standing. Well, we are getting there.

Let’s call those first bale houses the first generation. The bale houses that came out of the natural building boom in the Southwest during the 1990s I’m going to call the second generation. This was more of a reinvigoration (along with cob construction), as there was a big gap between the first and second generation, with little continuity or carryover of development.

From that point on, as straw-bale building has spread across the country and the world, there has been a steady development of technique and skill.

The Northeast gets a lot of rain
When straw-bale construction reached the Northeast, builders quickly realized the climate-specific designs
StrawCell: Ennis Hill

- Air Tight - <1 ACH50
- Cheaper & Faster - less prep, easier plastering
- Easier - Standard framing/”dry-in”, interior plaster only
- More Durable - rainscreen assembly
- More Insulating - R50
- Doubled size of original house, heat load remained the same
Prefabricated Straw Panels

Controlled construction processes, efficiency, streamlined design

Canada’s Greenest Home
Endeavour Center, Ontario Canada
Prefabricated Straw Panels

Canada, Europe, Australia: Large Multi-Unit Developments, Commercial & Institutional, Passive House & Affordable Housing
Natural Paints and Plasters

Bioshield Clay Paint

Kreidezeit Clay Paint & Auro Lime Paint
Endeavour Center
Canada’s Greenest Home
Plaster as an Air Barrier

Not your Grandparents’ plaster!

- Thicker and more rugged - designed to be an AB, not just a finish
- Air-tight - achieve < 0.6 ACH50
- Liquid-applied - flexible application
- Hard and durable - 1” solid masonry
- Inspectable and repairable - no hidden membranes, simple repairs
Hempcrete - Hemp and Lime

- Cast or spray insulation - R-3/in
- Flexible install, cures hard
- Ultra-low CO₂e / C-negative
- Moisture-durable, vapor open
- Fire retardant, no chemicals
- Floors, walls, roofs, foundations
Wool Insulation

R 4/inch - Thermal Resistance
Flame spread - Class A
Smoke Developed - Class A
Wool Insulation

The Science of Wool Fibre

- Keratin Molecule
- Protofibrils
- Macrofibril
- Cortical Cell
- Nuclear Remnant
- Cuticular Scale
- Cortex

THE STRUCTURE OF WOOL FIBER
What’s New With Wood

Strong in Construction Market

Carbon Sequestering

Regenerative Harvesting
Round Wood Technology

- Engineered Standards
- Stable Material
- Consistent Drying Process
Wood Science Technology

Underused Species
- Black Locust
- Tamarack
- Cedar

Factors in Specification
- Durability
- Cost
- Beauty
- Carbon Impact
Wood Science Technology

Window/Door Frames
- 2” insulation cavity
- Thermally-broken cleats
Wood Science Technology

Finishes
- Thermal Treatment
- Shou Sugi-Ban
- Non-Toxic Preservatives
- Oil Finishes
# Insulating Fiberboard Sheathing

<table>
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<tr>
<th>Make</th>
<th>Scheider Multitherm 110/140</th>
<th>Scheider Top 140-220</th>
<th>Gutex Multitherm</th>
<th>Gutex Ultratherm</th>
<th>SonoClimate Eco4</th>
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<tr>
<td>U(R) value</td>
<td>.038/.04 (R 3.8/3.6)</td>
<td>.039(R3.7)</td>
<td>.042(R3.4)</td>
<td>(R2.7)</td>
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<td>Connection</td>
<td>T&amp;G/Butt</td>
<td>T&amp;G</td>
<td>T&amp;G</td>
<td>Butt Joint</td>
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<tr>
<td>Density</td>
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<td>16.5lbs/cuft</td>
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<td>Perm</td>
<td>46.6</td>
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<tr>
<td>Water Resistant</td>
<td>NO</td>
<td>YES(parafin)</td>
<td>YES</td>
<td>YES (1%parafin)</td>
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Data-Driven & Proof-Positive

- Mid-Stream Quality Control
- Post-Occ. Commissioning
- Ongoing Monitoring