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Low Rise Building

No.3A UH M.Arch
18th November 2019

This Presentation on GBE:

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Speaker:

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- Technician and Architect by training, a Specification Writer by choice and an Environmentalist by action
- Greening up my act since 1999
- Founded National Green Specification 2001
- GreenSpec.co.uk Website 2003
- Started GBE online 2015
<https://GreenBuildingEncyclopaedia.uk>
– 2050 pages created and 30,000 to go.



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Violet Low Rise Construction

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Conventional Low Rise 1

- **Masonry Cavity Wall: Brick outer block inner**
 - Partial or full fill cavity insulation
- **Ground bearing insitu concrete slab**
- **Suspended Precast beam and Block floor**
 - GF sloping sites or methane/radon sites
 - Upper floor Apartments (Acoustics and fire)
- **Suspended timber upper floors**
- **Trussed rafter roof**
- **Glasswool, stonewool or EPS insulated**
 - Will overheat
- **Softwood framed plasterboard partitions**

Conventional Low Rise 2

- **Masonry outer and timber framed inner Cavity Wall**
 - Partial or full fill cavity insulation
 - stonewool or EPS insulated
- **Ground bearing insitu concrete slab**
- **Suspended timber ground floor**
 - GF sloping or methane/radon sites
- **Suspended timber upper floors**
- **Trussed rafter roof**
- **Glasswool, stonewool or EPS insulated**
 - Will overheat
- **Softwood framed plasterboard partitions**

Conventional Low Rise 3

- **Masonry outer, light metal framed inner Cavity Wall**
 - Partial or full fill cavity insulation
 - stonewool or EPS insulated
- **Ground bearing insitu concrete slab**
- **Suspended light metal frame ground floor**
 - GF sloping or methane/radon sites
- **Suspended light metal frame upper floors**
- **Light metal frame trussed rafter roof**
- **Glasswool, stonewool or EPS insulated**
 - Will overheat
- **Light metal framed plasterboard partitions**



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Conventional Low Rise 4

- **Masonry Solid Wall:**
 - Blockwork External Insulated render
- **Ground bearing insitu concrete slab**
- **Suspended Precast beam and Block floor**
 - GF sloping sites or methane/radon sites
 - Upper floor Apartments (Acoustics and fire)
- **Suspended timber upper floors**
- **Trussed rafter roof**
- **Glasswool, stonewool or EPS insulated**
 - Will overheat
- **Softwood framed plasterboard partitions**



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Conventional Low Rise 5

- SIPS Structural Insulated Panels System in place of Light timber frame
 - Plastic insulation sandwich
 - Roof will, walls may, overheat



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Conventional Low Rise 6

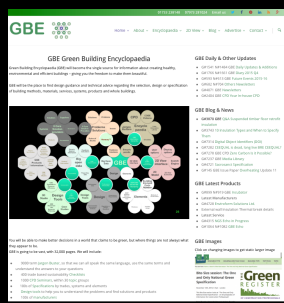
- ICF Insulating Concrete Formwork
 - Interlocking Plastic insulated formwork
 - Concrete infill
 - Render externally, plaster internally
 - Remains vulnerable to fire
 - Roof may still overheat



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Green Low Rise Construction

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New Build Green Materials & Construction



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Green Walls: Masonry

Unfired clay and straw



Unfired clay

- Hollow extruded clay
 - Lighter weight
- Interlocking profile
 - Acoustic and airtight
- Dry or slip clay joint
- Hygroscopic
 - Moisture mass
- Thermal mass and lag

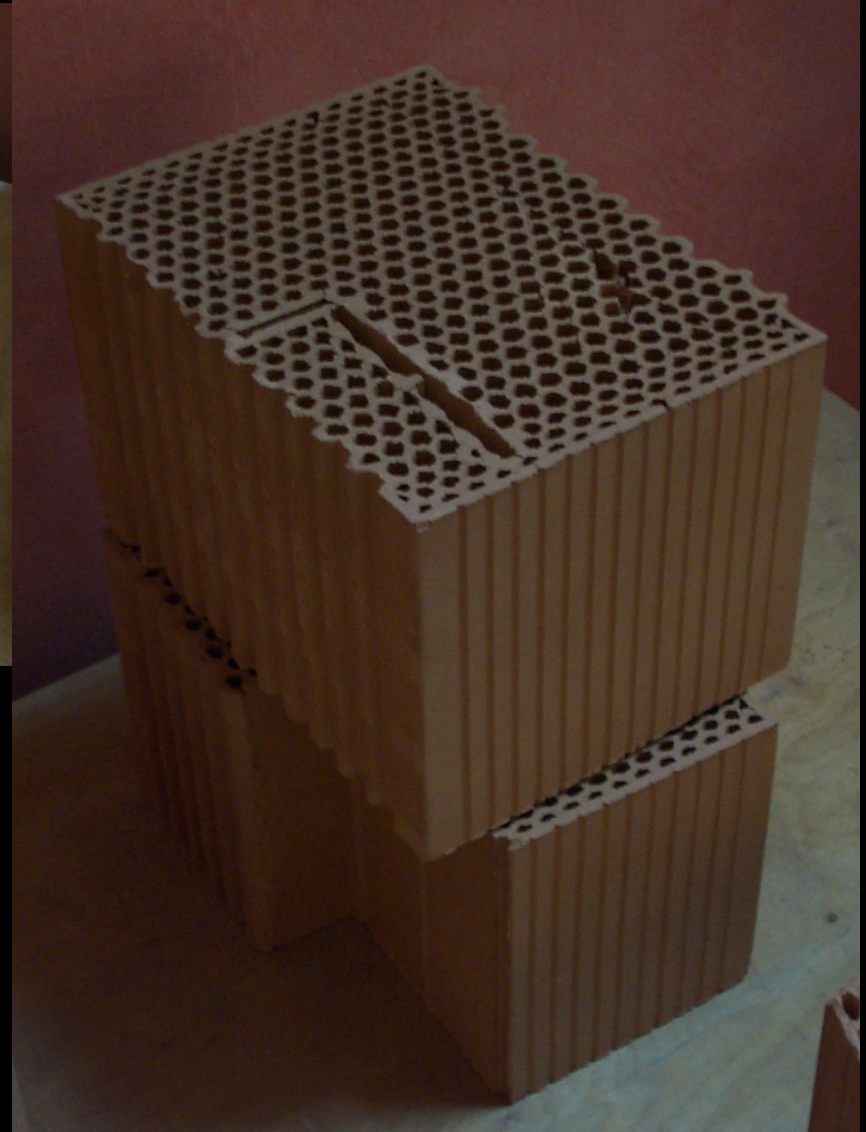
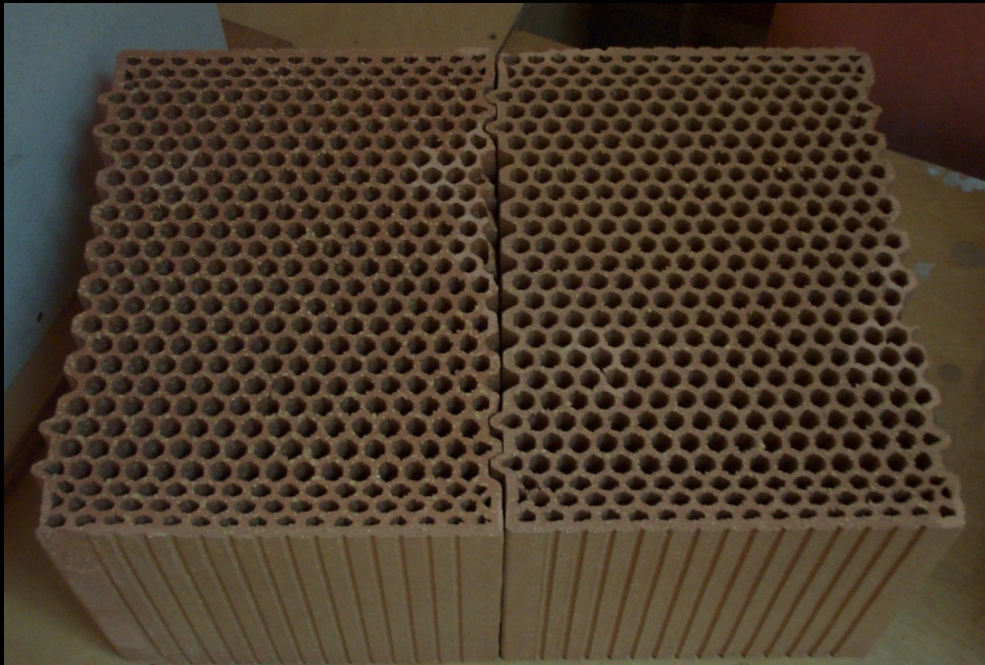


Unfired clay and straw

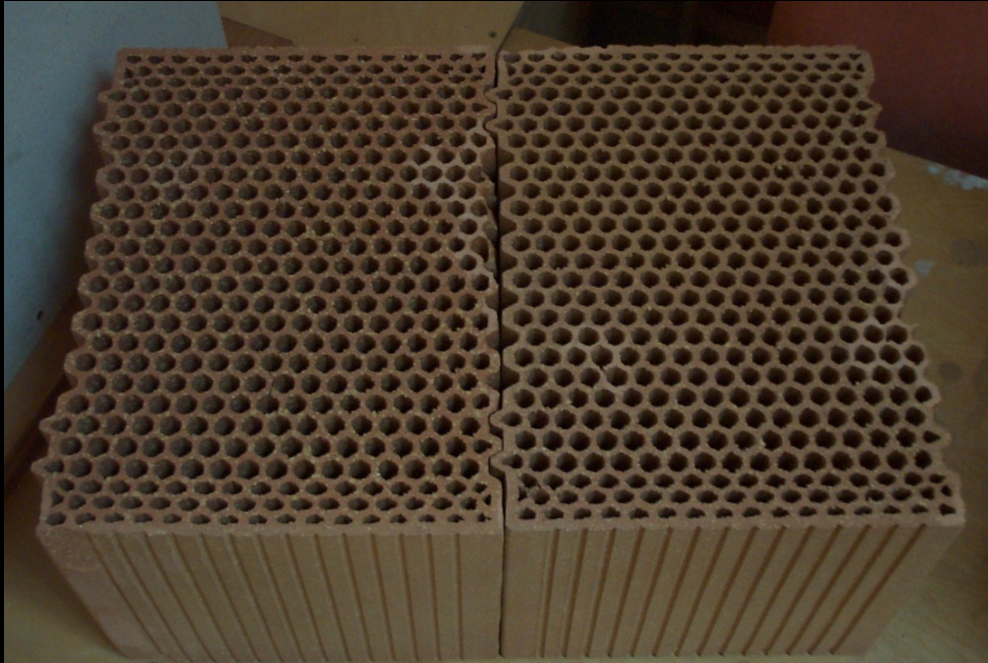
- Simple solid block
- Straw for reinforcement and hygroscopicity
- Clay mortar purpend and bed joints



Cellular fired clay blocks



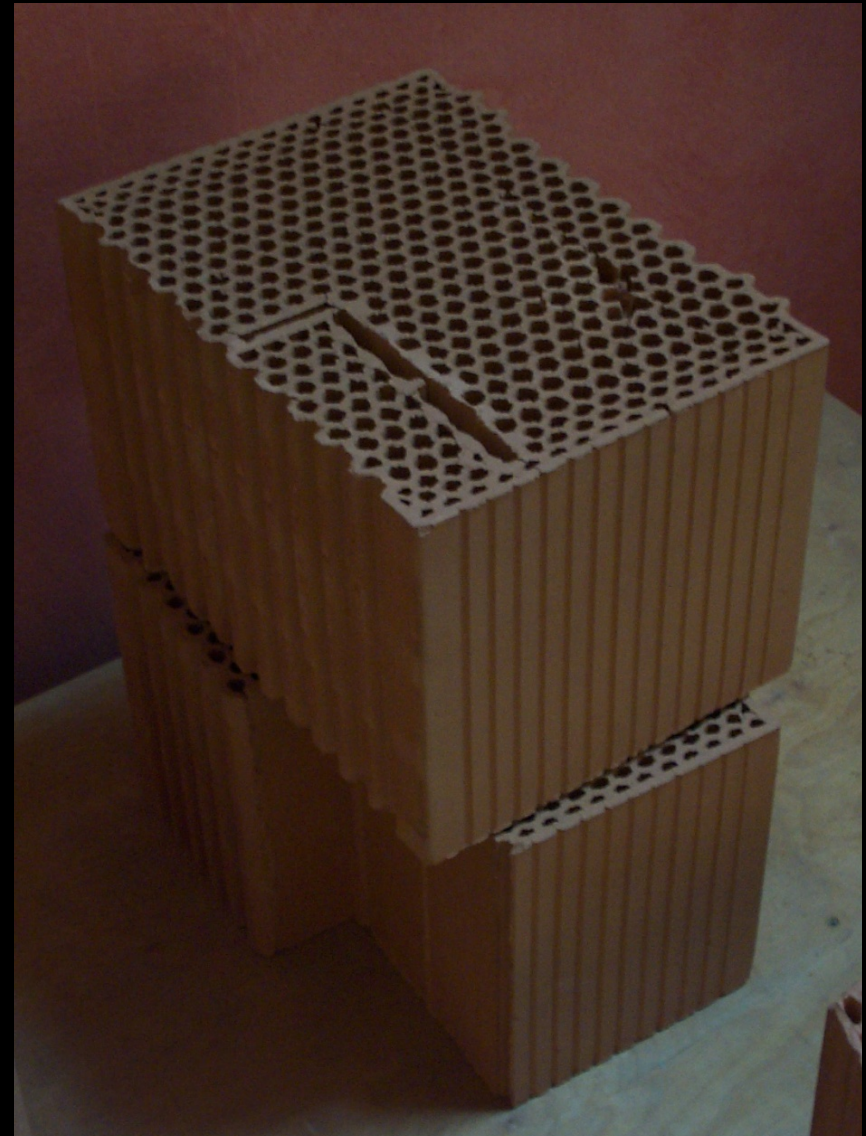
Cellular fired clay blocks



- Abundant Mineral: clay
- Fired clay
- Cellular insulation
- Long conduction path
- Interlocking dry perpend
- Mortared bed joint
- Thermal mass
- Acoustic mass
- Decrement delay
- Moisture Permeable

Cellular fired clay blocks

- Knock out pieces
- Allow conduit runs
- Form corners and interlocking



Thermal Mass

Thermal mass:

Fired honeycomb blocks in walls and floors adds long term thermal and acoustic mass

Clay board adds short term thermal mass

Not high load capacity





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21st Century Cob Walls

- CobBauge Interreg Channel Project
- Phase 2 underway
- Traditional will not meet BRADL
- Structural Cob + Insulating Cob
- 600 mm U value: 0.28 W/m².K (0.3min)
- U: 0.15 achievable CobBauge Phase3

CobBauge

- 2 halves make a whole
- Structural $k=0.42$
- Insulating $k=0.11$
- Act as one
- Difficult to get apart
- 400 mm wall shown





Hemp-Lime

- **Hempcrete**
- **Hemp shiv (part of stalk)**
 - is aggregate in a mix
- **Lime**
 - (lower energy and carbon than Cement)
- **Mixed to a concrete-like mix**
 - Sprayed into open cassettes or like render
 - Cast into formwork and tamped down



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21st Century hemp-lime

- **Hemcrete via Lime Technology Ltd. Tradical by Lhoist (FR)**
- **Hemp shiv: part of stalk**
 - is aggregate in a mix
- **Lime**
 - Lower energy and carbon than Cement
- **Cement**
 - Higher energy and carbon than Lime
 - To get an initial set sooner
 - To drive the lime to hydrate faster
- **Aluminium Oxide**
 - High embodied energy and carbon
 - Chemical reaction with cement: Saponificate: Bubbles entrained in cement matrix
- **Mixed to a aerated concrete-like mix**
 - Sprayed into open cassettes or like render
 - Cast into formwork and tamped down
 - Into robust CLT Frame
 - Air pushed through to hydrate and dry mix for quick turn around
 - MMC Moderns Method of Construction or IMC Innovative Method of Construction



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Green Walls: Timber

EVT Enhanced Vapour Transfer



Hygroscopic insulation
maintain their performance
even when moist
Vapour and water released
when conditions permit
No need for VB Vapour Barrier
Use vapour permeable
construction
5:1 ratio vr inside:outside
ATL air tightness layer

EVT Enhanced Vapour Transfer



Hygroscopic insulation
maintain their performance
even when wet

Vapour and water released
when conditions permit

No need for Vapour Barrier VB

Use vapour permeable
construction

5:1 ratio vr inside:outside

Air Tightness Layer ATL

Not for High Rise/near boundary

Thick walls, roofs and floors



We have a preoccupation with thin walls 300 mm. or less
Which drives the demand for energy intensive man-made petrochemical fossil derived CFC HCFC HFC HFA foamed plastic
O₃ Ozone Depletion
Greenhouse Gas Potential
300-600 mm. optimum insulation thicknesses

Cellulose Fibre



Optimum:
300-400 mm. deep compound
rafters with Cellulose fibre
insulation
High density and
high thermal mass
cellulose fibre insulation
boards in walls and floors

Thermal Mass



Thermal mass:
High thermal mass dense
wood fibre insulation boards
in walls and floors
Acoustic unfired clay bricks
in floor construction
adds thermal and moisture
mass
Stacked dowelled wood floor
No glue: healthy

Thermal Mass



Thermal mass:
High thermal mass dense
wood fibre insulation boards
in walls and floors
Acoustic unfired clay bricks
in floor construction or fired
honeycomb
blocks in walls
and floors adds
thermal mass





Timber Structure

- Compound rafters
 - Cellulose insulation
 - Acoustic brick floor
 - Timber floor planks
 - Wood fibre insulation
 - Timber frame walls
 - Timber batten clad
-
- Vapour balanced construction



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33



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34



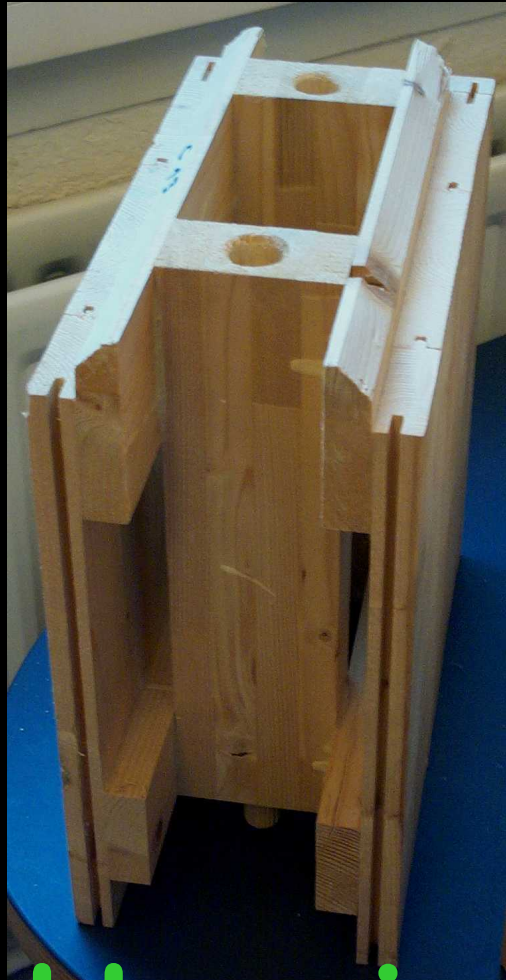
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35



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Green Walls: Loadbearing Timber Blocks



STEKO

Load-bearing timber blockwork

20/11/19

Construction Resources Showrooms Southwark London

37

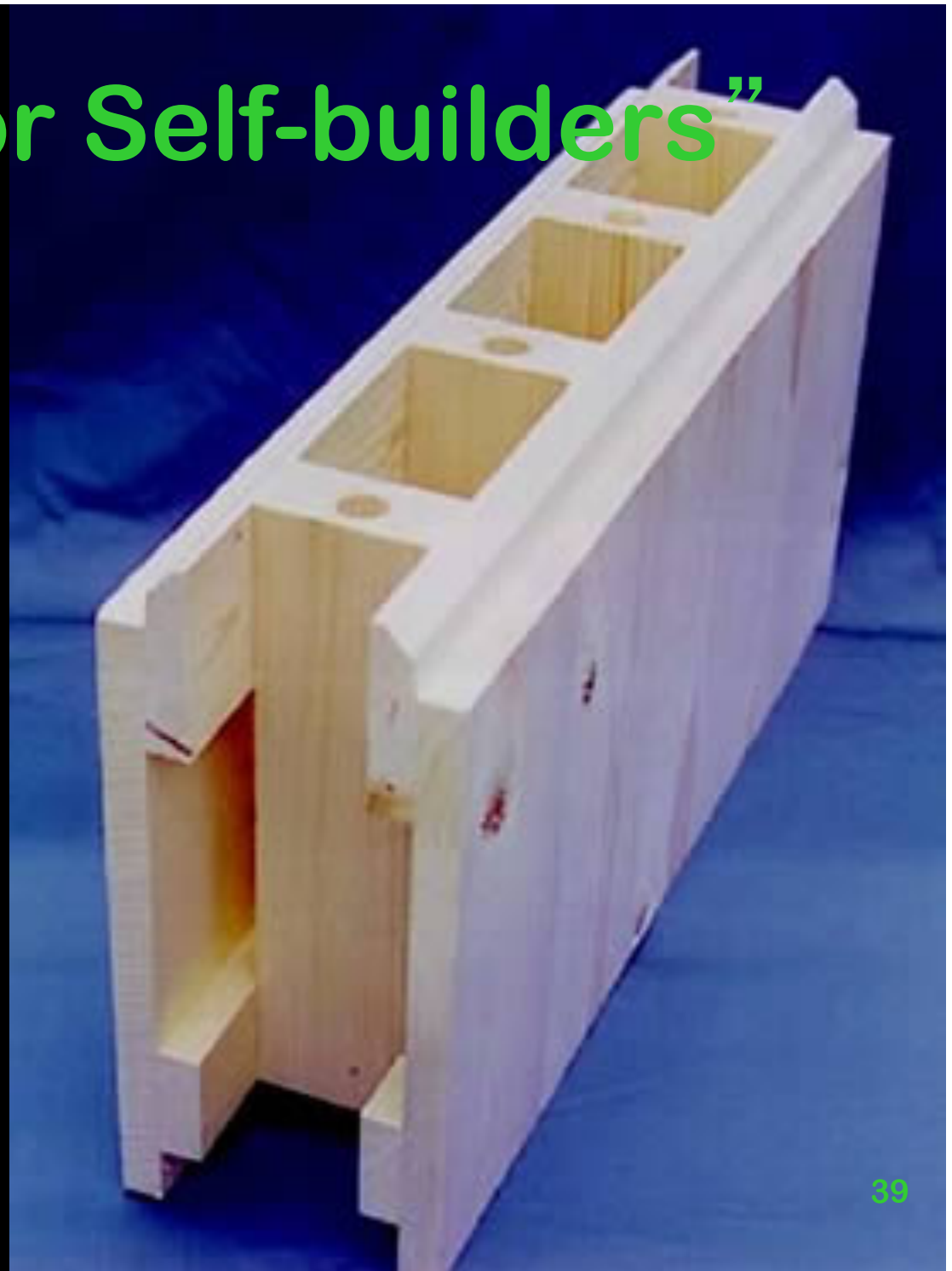
STEKO



20/1 /19 **Load-bearing timber blockwork** ³⁸

Steko “Lego for Self-builders”

- Waste from plantation thinning
- Carbon negative
 - Carbon sequestration
- Dry Construction
- Self-build unskilled construction
- Fast construction (3 day house)
- No waste on site (designed)
- Accommodates services
- Accommodates thermal or acoustic insulation
- Lightweight 6kg (children too)
- Load-bearing (designed to 7 stories)
- Internal and external walls
- 160 mm. modules





C/25
Unit: L75224

Construction Resources fact sheet 34

Steko blocks

Timber block wall construction system

Steko is a rapid construction system that uses large hollow timber blocks that simply slot together. No glue or other fixings are needed to complete a load-bearing wall construction. The system enabled two people to build an attractive house in just three days, complete with internal and external walls, two floors, cellar, attic and roof.

- Very fast construction
- High quality building every time
- Buildings can be rapidly designed
- Faster to construct than bespoke timber-frame buildings
- Walls are loadbearing and space forming
- No glue or other fixings are needed
- No drying-out time is required
- Beautiful internal surface finish
- Requires a breathing type of external cladding
- Uses off-cuts of timber from rapidly renewable sources

Electrical services can be run within the vertical voids of the finished wall. The voids are then filled with isofloc cellulose insulation which is dry injected into the cavity.

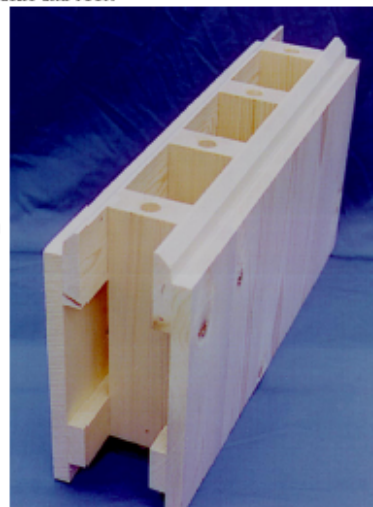
Internal finish The all-dry construction method means that internal trades can start work as soon as a roof is in place. The planned timber finish for the internal walls can be left exposed but there are many other options, for example, clay boards can be fixed and plastered with Terrafine to give a beautiful textured wall.

External finish Steko block walls filled with cellulose insulation exceed current Building Regulation requirements. However, if desired, a better thermal performance can be achieved by the addition of external insulation, such as wood-fibre insulation boards (see Gutex Thermawall and Gutex Multiplex Top - fact sheet number 25). These can be clad with timber boarding or lime render to provide the required natural "breathing" external cladding.

Construction Resources is proud to have introduced the Steko timber wall system to the UK which is the first export market outside its native Switzerland. Steko blocks are made from cross-glued boards and have horizontal and vertical interlocking parts.

Starting from a level timber base plate, the blocks are simply stacked on top of each other row by row, each block locating accurately onto the block below by means of integral locating dowels. A Steko top plate finishes the wall construction. The system is much faster to construct than bespoke timber-frame buildings.

Specialty designed blocks cater for cement, wall ends and to line windows and door apertures.



Precision made The timber blocks are made from precisely machined off-cuts of timber from rapidly renewable sources. Such fine tolerances have only become possible with the introduction of computer-controlled machine tools.

This ingenious building system has turned timber, the most traditional of materials, into a high tech and very rapid method of building construction that has enormous potential.

Construction Resources

16 Great Guildford Street London SE1 0NS

Tel 020 7450 2211 Fax 020 7450 2212 email info@ncccontract.com

Steko blocks

Product Data

Height	240 / 320mm
Length	160 / 320 / 480 / 640mm
Thickness	160mm
Weight of standard block	6.5 kg (160 x 320 x 640 mm)

including isofloc cellulose thermal insulation filling:

Weight of wall	45 kg/m ² of wall area
Density of wall	280 kg/m ³
U value with isofloc filling	0.42 W/m ² K
Thermal conductivity with isofloc filling	0.073 W/mK



(above) The blocks are easily cut and adapted to most design details.

(top right) A building under construction showing 3 storey load bearing Steko walls.



(right) This wall being constructed at an exhibition was very rapidly built using the Steko system.

(below) This completed room gives away few clues as to how it was built - and the blocks provide an attractive finish that needs little further treatment.



Construction Resources

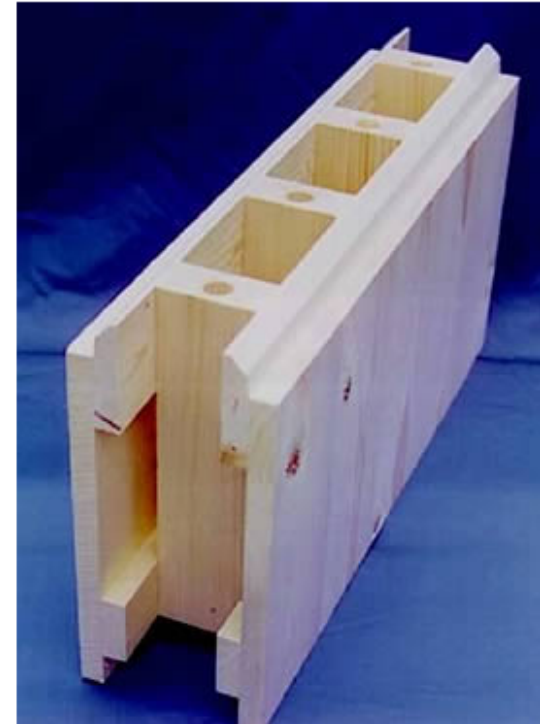
16 Great Guildford Street London SE1 0NS

Tel 020 7450 2211 Fax 020 7450 2212 email info@ncccontract.com

Steko blocks

masonry, blocks, wood, interlocking, load-bearing

Steko is a rapid construction system that uses large hollow timber blocks that simply slot together. No glue or other fixings are needed to complete a load-bearing wall construction. The system enabled two people to build an attractive house in just three days, complete with internal and external walls, two floors, attic and roof.



greener than:	n/a
standards:	n/a
BRE Ecopoints:	unrated
downloads:	brochure (488k)
specification:	<ul style="list-style-type: none"> • G21 LOAD-BEARING MODULAR TIMBER BLOCK WALLING • G21 Load bearing modular timber block walling: Steko
recycled content:	n/a
cost commentry:	n/a
manufactured in:	Germany
manufacturer:	Steko
	Germany
	+49 7131 - 70407
	www
suppliers:	Construction Resources
	London
	020 7450 2211
	www
other links:	alternative products



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Cross Laminated Timber Panel (CLTP) Low & High rise

Cross Laminated timber shear walls floors and roofs



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43

Cross Laminated timber shear walls floors and roofs





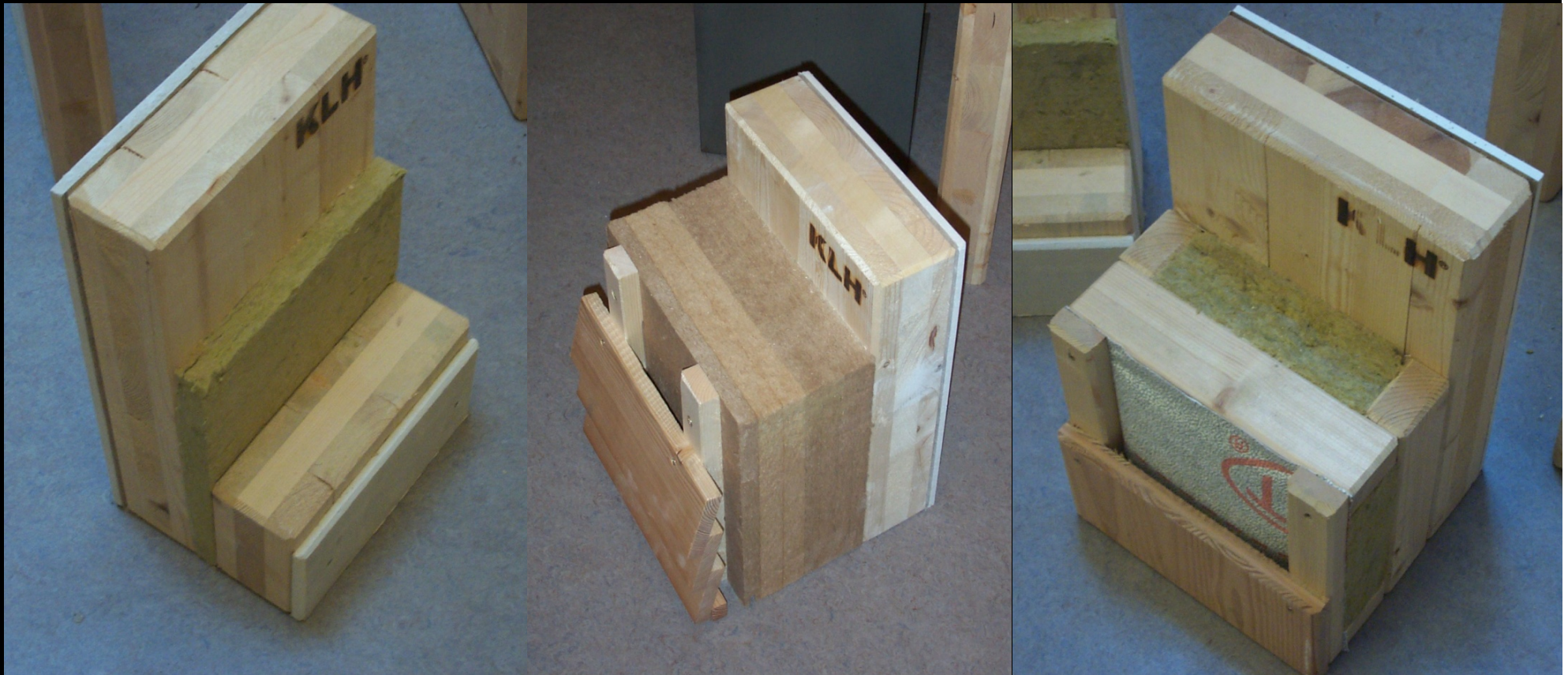
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Post Grenfell fire

- **Government Announced combustible materials no longer permitted in High rise Housing above 18m**
- **2 Different interpretations**
 - Not in the external wall
 - (replaced with LSF and Stone wool)
 - Not at all
 - Back to concrete
- **Sector challenging Government because timber and CLTP has predictable behaviour in fire**
 - Difficult to set CLTP alight
 - Small sections easy
 - Known charring rate thickness/minute
 - Charring protects remainder of big sections

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Cross Laminated timber walls





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Post Grenfell fire

- **Government Announced combustible materials no longer permitted in High rise Housing above 18m**
- **Stone wool e.g. Rockwool could be the only insulation player in the market (no more plastics)**
- **I have challenged the dense wood fiber (DWF) insulation sector to do the tests to prove their insulation is up to the job of high rise housing**
 - Difficult to set DWF alight with blowtorch
 - Some charring at surface
 - Charring protects remainder of insulation
- **Expensive tests but informally Austrian manufacturers and UK suppliers progressing**

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Cross Laminated timber shear walls





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Green New Walls: Transparent

Timber Curtain Walling



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50

Solar Wall



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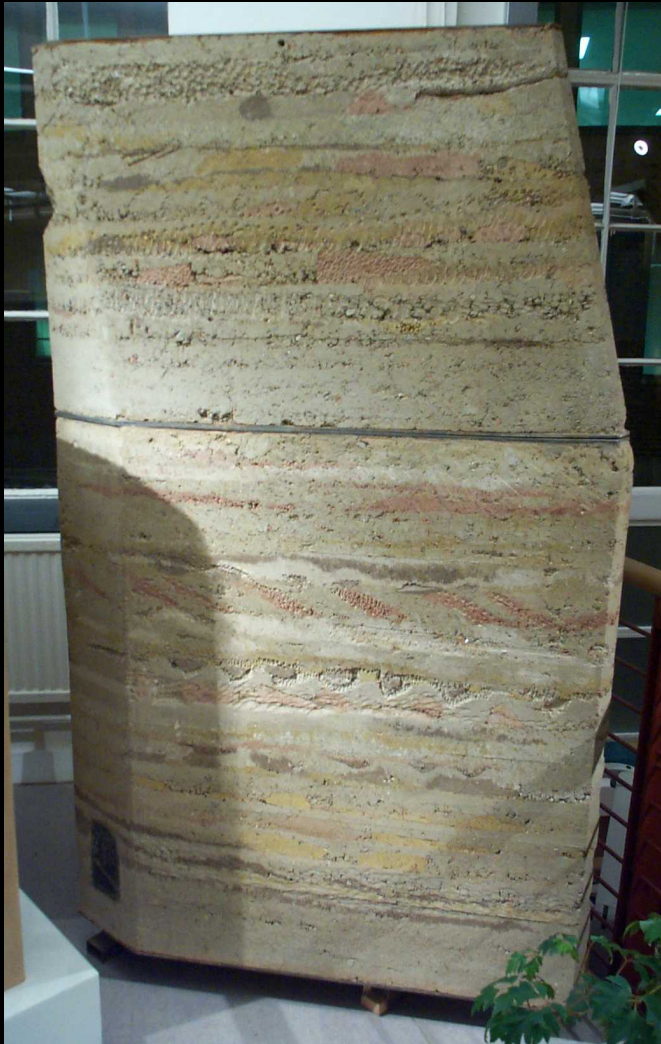
51



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Green Wall Finishes

Rammed Earth Walls



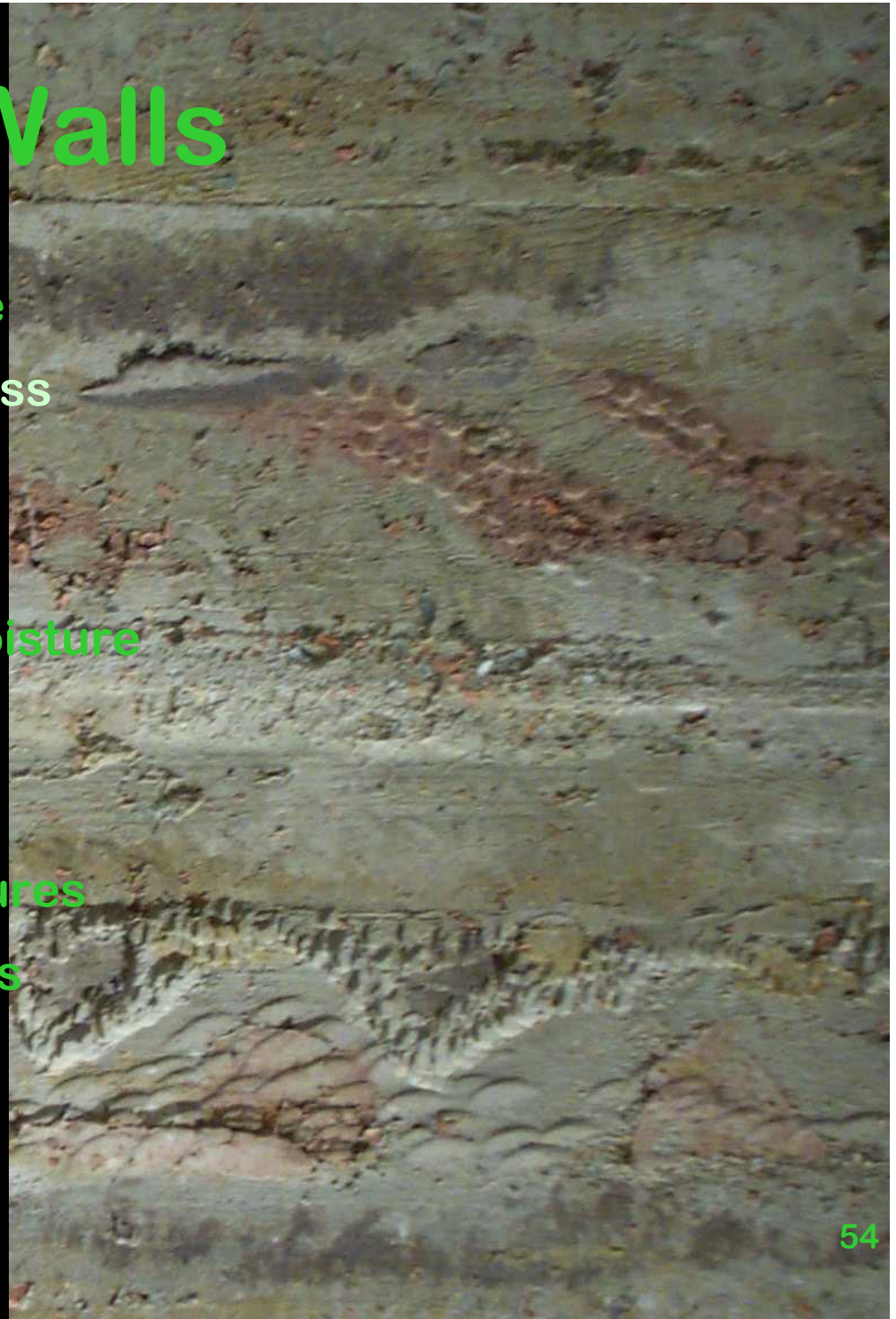
any shape
many ingredients
colours & textures
thermal mass



Load-bearing
but dynamic

Rammed Earth Walls

- Abundant and Natural
- Recipe can be determined on site
- Thermal, Acoustic & Moisture mass
- Fire resistant
- Load-bearing
- Absorbs radiation, smells and moisture
- Hygroscopic
- Any shape
- many ingredients, colours & textures
- Sculptural & Artistic opportunities
- Waste disposal back to earth
- Recyclable & Reusable
- Needs temporary formwork





Clay Boards Reed & Clay Clay finishes

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Construction Resources Showrooms Southwark London

Clay Finishes



- Clay Boards: Reed & Clay,
- Insitu clay on reed
- Clay finish
- Dry and harden but do not set
- No time limits
- Easy repairs
- Less skill required

Clay Finishes



- Can sustain high humidity where gypsum/paper will harbour mould
 - Hygroscopic
 - Moisture Mass
 - Condensation avoidance
 - Mould avoidance
- Thermal mass
 - High density
 - Large surface area
- Electromagnetic radiation absorption
- Absorbs smells

Clay finishes

- Mineral based dyes
- Non-fade
- Bond to background
- No flaking
- Long life
- Durable
- Properties of clay plaster
- Vapour permeable





**Natural
ingredient
Paints
Stains
Oils
Waxes
Polishes
Sealers**



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Natural Paints

- No synthetics
 - VOCs if any are natural
- No poisons
- No chemical concoctions
 - No unexplored impacts or reactions
- No pollutants
 - Healthy career possible
- No Hazardous waste
 - Many compostable



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Green Acoustic Construction

Different Acoustic solutions to walls and floors Cavity and solid walls and lightweight partitions

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62

Acoustic Separating Floor



- Floor board/Sheet
- Isolation felt
- Acoustic massive unfired clay bricks laid loose
- Perimeter coconut fibre upstand
- Isolation felt
- Floor deck/sheet
- I-Joist stiff floor structure
- Acoustic insulation in void
- Acoustic insulation at floor edge
- Isolation suspension fixing
- Dense Cellulose fibre reinforced gypsum board ceiling

Acoustic Party Wall



- Blockwork cavity wall
- Isolation rubber strip in place of mortar positioned mid floor depth to minimise flanking sound
- Airtight plaster on both faces of room walls
- Acoustic insulation in party wall cavity, extends into floor zone

Acoustic Intermediate Floor



- Carpet
- Cork/rubber crumb or wood fibre sheet acoustic underlayment
- Or Rubber sheet
- Floor board/Sheet
- Softwood joists
- Close to party wall but spaced off with wedges
- Noggins to support ceiling joints
- 2 layers dense cellulose fibre reinforced gypsum board ceiling

Intermediate Floor



- Veneered timber panel floor boarding
- wood fibre sheet acoustic underlay
- wood fibre board acoustic/thermal insulation
- wood fibre sheet acoustic underlayment and upstand
- Stacked wood floor with acoustic absorbent slotted soffit
- Isolation rubber strip in place of mortar positioned below and above solid timber floor to minimise vibrations transfer from floor to wall and minimise flanking sound

Intermediate Wall



- Blockwork cavity wall
- Isolation rubber strip in place of mortar positioned below and above solid timber and insitu concrete floors to minimise vibrations transfer from floor to wall and minimise flanking sound
- Insulation in cavity to minimise flanking sound

Intermediate Floor



- Carpet
- Screed could contain recycled aggregates and GGBS cement
- Damp and vapour proof membrane
- coconut fibre sheet acoustic underlayment and upstand
- Insitu concrete floor with fairfaced soffit exposing thermal mass
- Isolation rubber strip in place of mortar positioned below and above insitu concrete floor to minimise vibrations transfer from floor to wall and minimise flanking sound

Acoustic Intermediate Floor



- Ceramic floor tiles
- 2 layers of underlayment
- Floor board/Sheet
- Softwood joists
- Close to party wall but spaced off with wedges
- Noggins to support ceiling board joints
- 2 layers dense cellulose fibre reinforced gypsum board ceiling

Acoustic Internal partition



- Single leaf blockwork
- Plastered & Skirting
- Parge coated for airtightness
- Dense wood fibre board drylined on dabs
- Plaster skim & Skirting
- Battens acoustic insulation between
- Dense cellulose fibre reinforced gypsum board

Acoustic Intermediate Floor



- Carpet
- Underlayment
- Floating Floor board/ Sheet
- Acoustic insulation
- interlocking Hollow timber beam floor
- Acoustic insulation at wall abutment
- Exposed soffit

Acoustic Suspended Floor



- Carpet
- Screed could contain recycled aggregates and GGBS cement
- Damp and vapour proof membrane
- coconut fibre sheet acoustic underlayment and upstand
- Insitu concrete floor with fairfaced soffit

Acoustic Partition (below)



- Multi layered timber framing acoustic isolation
- dense cellulose fibre acoustic insulation between battens
- dense cellulose fibre reinforced gypsum board

Acoustic Suspended Floor



- Carpet
- 2 layers of underlayment
dense cellulose fibre
reinforced gypsum board
- Monolithic topping could
contain recycled
aggregates and GGBS
cement
- Insitu concrete floor
with fairfaced soffit
- Acoustic bridge through
partition



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Victorian Building Green Energy Upgrade

Solid Wall Construction



9 in brick wall
Plastered
internally
Cork insulation
In two layers
cross battens
To reduce
thermal
Bridge through
battens
Drylined
Skirting



Pitched roof Construction



Existing rafter zone insulated leaving 50 mm. ventilation zone
Cross battens applied below rafters, batten zone insulated
Plasterboard ceilings added



Suspended Ground Floor



Battens to sides
of floor joists
Board on
battens
Insulation onto
boards
Existing floor
joist zone
insulated



Suspended Upper Floor



Ceiling joists
upgraded to
floor joist
Joist zone
insulated
Floor boards
added
Ceiling linings



Aerogels

- Minerals e.g. Silica in solution
- Remove the water and you have microscopic air cells held together by the mineral
- Higher performance than the best foamed plastics (k value)
- Used attached to boards or in a board sandwich
- Wall and floor linings

20/11/19 • Used in DGSU translucent GRP glazing



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20th C Building Green Energy Upgrade

Cavity Wall Construction



Existing masonry
cavity wall,
Brick outer leaf,
block inner leaf,
Steel lintel
thermal bridge
plastered
internally;
Insulate cavity
Internal insulation
Wrap lintel
Plasterboard dry
lining



Pitched Roof Attic



Existing ceiling
joists zone
insulated
Insulation laid over
ceiling joists at
right angles



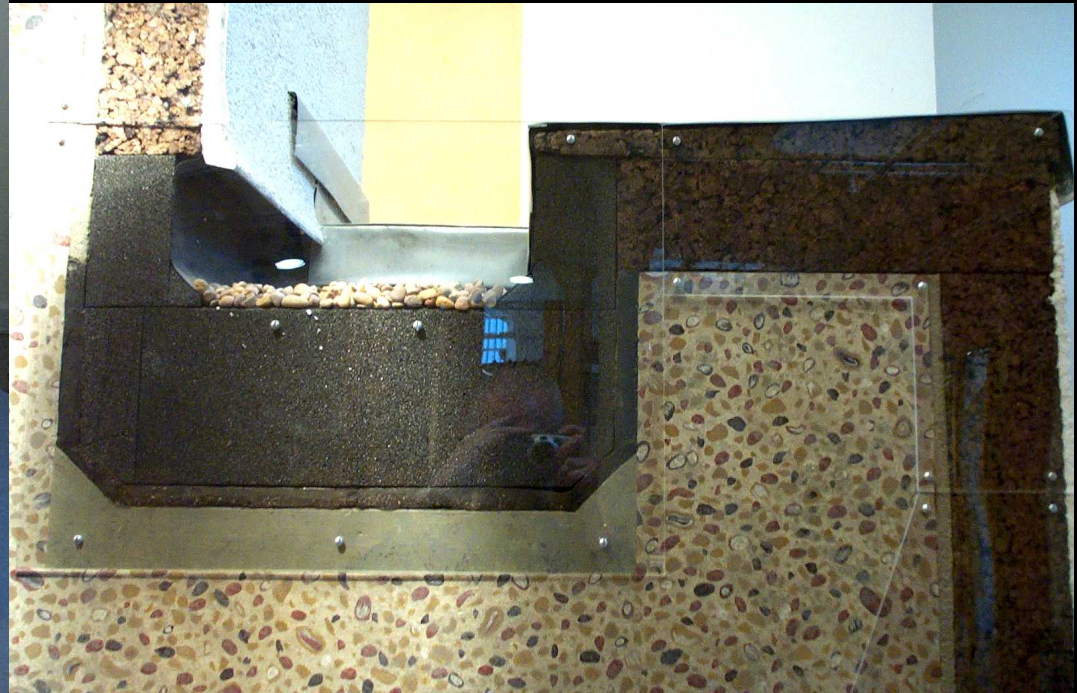
Ground floor



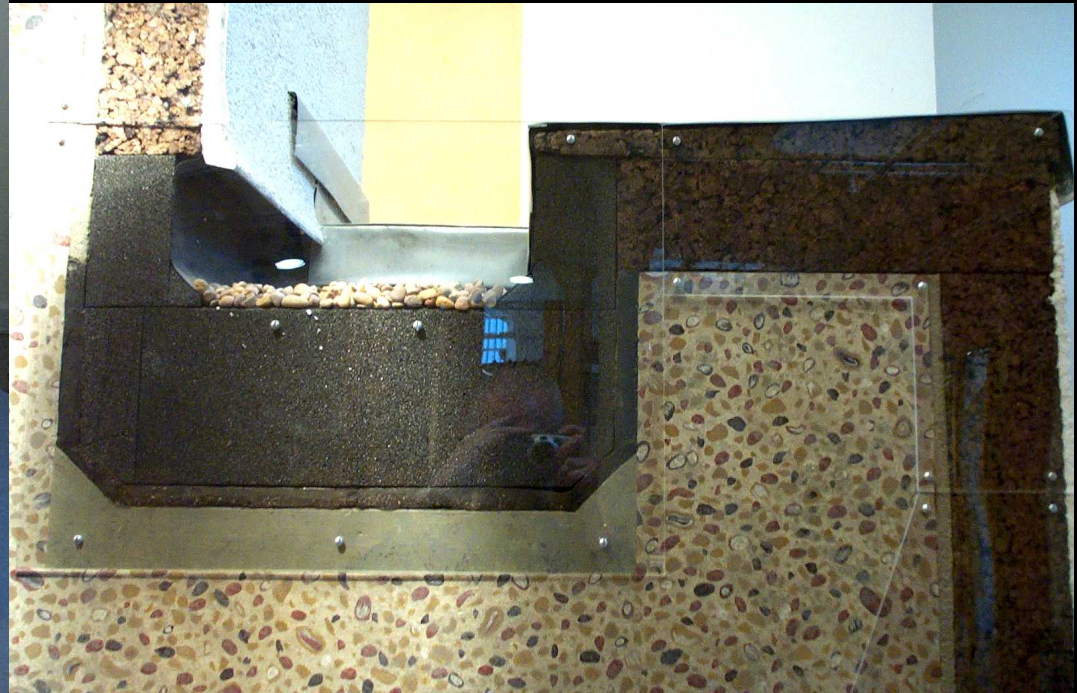
Take up existing floor
Lay new DPM
Loadbearing
Insulation on DPM
Insulation upstand
around perimeter
New eco-concrete
floor,
Eco-concrete
screed
High density
insulation board
Floor finish



1960's insitu concrete tower refurbishment External walls



1960's insitu concrete tower refurbishment Flat roof gutter





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2015

- If we have not made significant changes by 2015
- 2050 is melt down day
- The one planet will survive
- Unable to support humans living a three planet lifestyle
 - UK average citizen

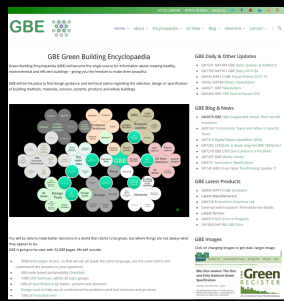


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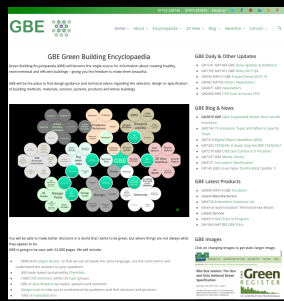
88



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Sampler

- This is a cut down version of the original file to give you a sample of the whole
- It's the front end of the file with the middle and rear end deleted
- Go to <https://GreenBuildingEncyclopaedia.uk>
- to download the whole file
- You will find a large number of other files there too



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Feedback

- These files are created by generalists with a big dollop of green flavour
- These files are updated from time to time
- We are not experts so from time to time these file may get out of date or may be wrong.
- If you feel that we have got it wrong please let us know so we can put it right.

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- **Brian Murphy BSc Dip Arch (Hons+Dist)**
 - Technician and Architect by Training
 - Specification Writer by Choice
 - Environmentalist by Actions
- **Greening up my act since 1999**
- **Founded National Green Specification 2001**
- **Launched www.greenspec.co.uk 2003**
- **Created: GBE at <https://greenbuildingencyclopaedia.uk> 2015**
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91