Green or Violet Insulation Materials Which do you use?

5plus architects

06/09/19 In-house CPD 5plusArchitects 1

"Green or Violet Materials, which do you use?"

Institute of Structural Engineers
Peterborough 18/05/17

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This Presentation on GBE:

- Find this file on GBE website at:
- https://GreenBuildingEcyclopaedia.uk/?P=15560
- After the seminar I will update the page with this updated file

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Speaker:

- Brian Murphy brianspecman@icloud.com
- Technician and Architect by training, a Specification Writer by choice and an Environmentalist by action
- Founded NGS 2001
- GreenSpec.co.uk Website 2003
- Started https://GreenBuildingEncyclopaedia.uk online 2015
  - 2050 pages created and 30,000 to go.

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- This CPD is a perfect sustainability crash course for the young newly trained Architects!
- First you will learn some definitions and then we run through many violet materials in common use today.
- There will be an introduction to some unfamiliar materials with their fundamentally important properties, with samples to hold and smell!
- There will be an explanation of how choosing the right materials with the right properties will help to close many aspects of the Performance Gap.
- And at the end…. How Business as Usual will fail to deliver.

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Green & Violet Materials Definitions

Coined at 'Green is the colour' 1999 BD Conference at RIBA

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Sustainable
Eco
Green

Violet
Violent
Violate

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'Violet' Materials

- 'Violet' meaning:
- 'any material, construction product, construction method or building
- unfriendly to humans or the environment or adjacent materials
- whose performance diminishes in use or over time'
- Deleterious materials might sum them up but many 'normal' materials are violet

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'Violet' Industry

- Clients/employers, developers, designers, Quantity Surveyors, contractors, manufacturers, applicators/installers, advisory organisations, manufacturer associations
- anyone that does not care about the environment
- or anyone that does not act on its behalf
- Virtually the whole industry
- It has been changing, slowly driven by legislation
- But far too slowly, until now……

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Definitions

- Green
- Greenies
- Light or Dark Green or Greenies
- Greenie Points: Brownie Points + Green (all positive)
- Violet
- Light or Dark Violet
- Whitewash: cover-ups telling porkies
- Greenwash: telling green porkies

I am a shrinking Violet

a little green
round the edges but
less violet everyday

Violet Materials

- Non-renewable, finite
  - Fossil derivatives, fuel, hydrocarbons, high embodied carbon
  - Petrochemical, chemicals, synthetics:
    - Paints
    - Plastics (from hydrocarbons)
- Unsustainable
  - Carbon based: e.g. Fuel
  - Release Carbon in manufacture or use: e.g. Cement
- High embodied energy: e.g. energy intensive manufacture
  - Metals: Aluminium (was made with renewable energy, today more gas and coal)
  - Plastics
  - Cement (UK uses more waste as fuel but tyres are fossil fuel)
- Hazardous materials and hazardous waste:
  - Wet, sticky , gooey or flows:
    - resins, paints, sealants, chemicals,
  - Fine particulate: e.g. cement, asbestos, ceramic fibre
  - Corrosive, acidic, alkali,
- Ozone depleting & Global Warming
  - Foamed plastics HFCs HFAs
    Aluminium production PFCs

Green: Environmentally Sustainable Materials

- Renewable: timber,
- Rapidly renewable: Plant based materials
- Abundant: Site subsoil, rocks, sand, gravel,
- Recycled & Recyclable:
  - post consumer content,
- Reclaimed & Reused:
  - on site materials, timber, not chipboard
- Carbon already out there:
  - reclaimed bricks, slates, stone
- Carbon sequestration: low, neutral or Carbon negative:
  - Plant and timber based
- Low embodied energy: Plant based, minerals
- Local: low transport miles, fuel, emissions and congestion

Social Sustainable Materials

- Socially responsible: Fairtrade equivalents
- Pay the right price v plunder the world
- Local: materials, crafts, companies, tradesmen
- v
- Cheap labour abroad where nobody sees or cares

Healthy Materials

- Low VOC?: but not loads of other chemicals to achieve it
- No hazardous materials in application and use
- No hazardous waste
- Low allergy
- Low to Zero toxicity
- Indoor air quality (ignored by BRE GG)

Green v Violet Materials

- Long term economic to maintain
- Long term economic to run
- Reclaimable, reusable and resalable
- v
- Short term cheap to build
- Expensive to run
- Sometimes risky in use

Green Materials Perform

Decrement Delay Thermal Lag

P10 Insulation

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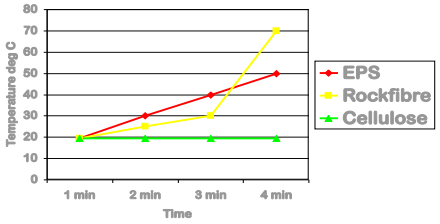
Radiant heat through 50 mm. of thermal insulation types over time



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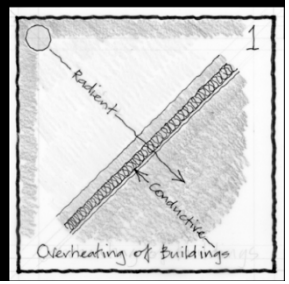
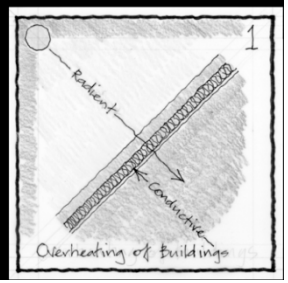
Radiant verses Conductive heat flows

Insulation needs to resist both or overheating occurs



Once radiant heat gets in it warms the space and the warmth cannot get out through conductivity insulation



Acoustic Insulation

Dense wood Fibre

- High acoustic density
- Dense wood fibre insulation boards in:
  - Walls
  - roofs
- Improved performance compared to:
  - glass/rock mineral fibre
  - expanded polystyrene plastics insulation
- Watch the fireworks but not hear them

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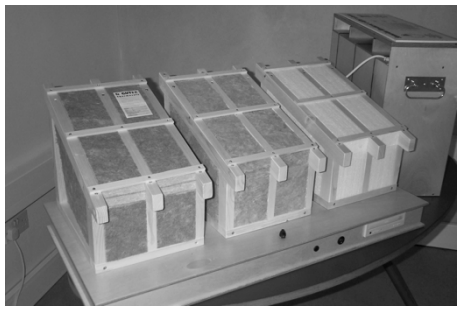

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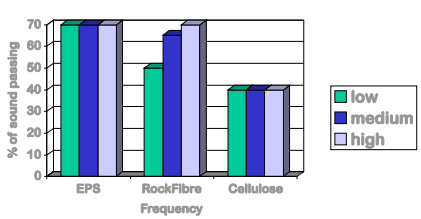
% of sound passing through insulation



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GBE Whole Building Calculators

- GBE Green Building Encyclopaedia
- GBE Calculator
- Building Size: Lengths Areas Volumes
- Regulations/Design standards:
  - U value Set Selection
- Winter Thermal Insulation Material Choices
  - K values v U values = Thicknesses
- But don't forget Decrement Delay
  - to avoid summer overheating
- And acoustics, fire, moisture management, etc.

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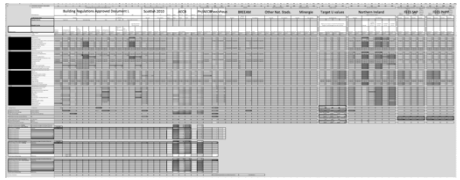
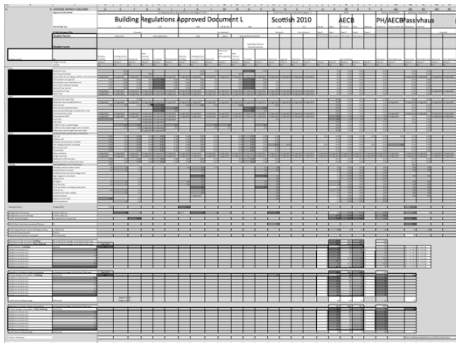
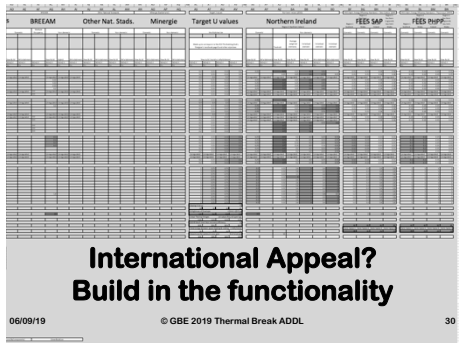
GBE Whole building Calculators Elemental U values Regs & Guides

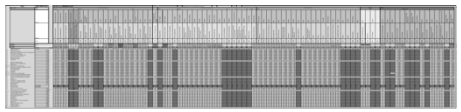


06/09/19 © GBE 2019 Thermal Break ADDL 28





GBE Whole building Calculators >80 materials & k values Thicknesses to meet U values



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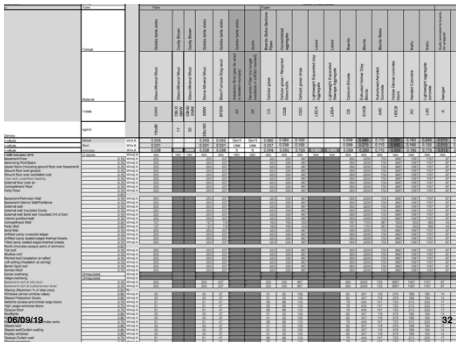

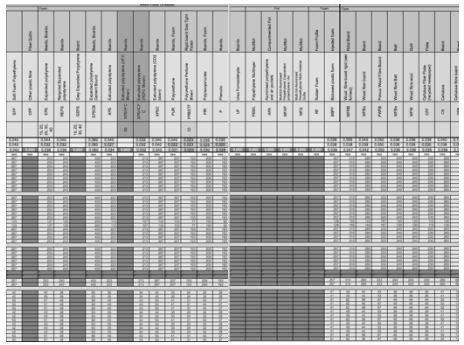

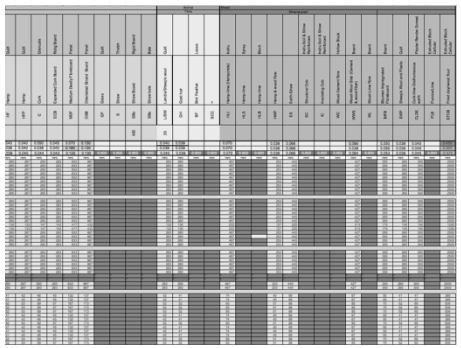

Green Thermal Insulation

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Thermal Insulation

Newspaper
Flax
Hemp
Sheep's wool
Cellulose

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Thermal Insulation

Cellulose fibre Recycled Newspaper and Magazines

Green Wall Finishes

Clay boards & finishes

Clay Boards
Reed & Clay
Clay finishes

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

Paints & Stains

Natural ingredient Paints
Stains
Oils
Waxes
Polishes
Sealers

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

New Build Green Materials & Construction

GBE
https://GreenBuildingEncyclopaedia.uk

Green Walls: Masonry

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Unfired clay and straw

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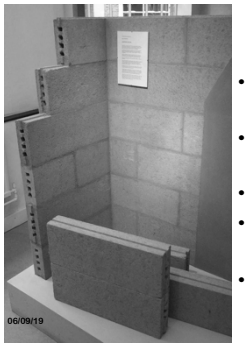

Unfired clay

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

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Unfired clay and straw

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

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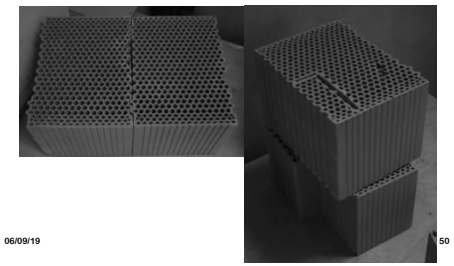
Cellular fired clay blocks



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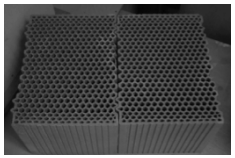
Cellular fired clay blocks



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

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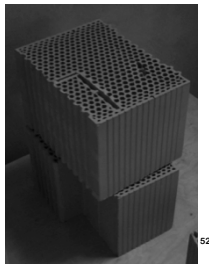
Cellular fired clay blocks

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



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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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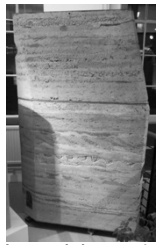
Rammed Earth Walls



any shape
many ingredients
colours & textures

thermal mass

Load-bearing but dynamic

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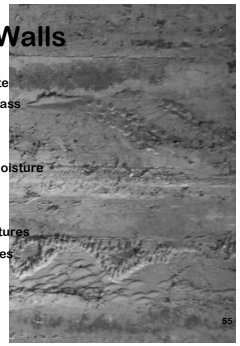
Rammed Earth Walls

- 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



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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
- Used in DGSU translucent glazing

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Cob Walls

- CobBauge Interreg Channel Project
- Phase 2 underway
- 21st Century Cob
- 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

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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

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Green Walls: Timber

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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

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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

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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
O_3 Ozone Depletion
Greenhouse Gas Potential
300-600 mm. optimum insulation thicknesses

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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

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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

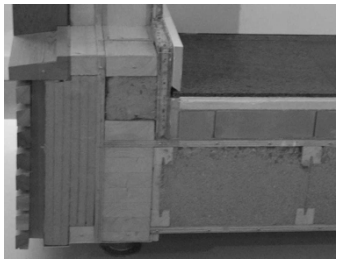
Thermal Mass

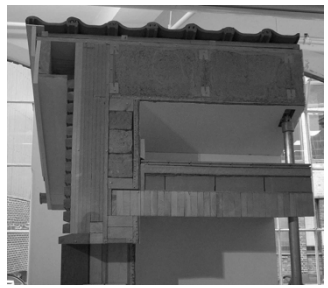
Thermal mass:
High thermal mass dense wood fibre insulation boards in walls and floors
Acoustic unfired clay bricks in floor construction or fired honeycomb blocks in walls and floors adds thermal mass

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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Green Walls: Loadbearing Timber Blocks

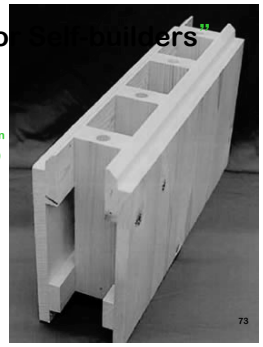
STEKO
Load-bearing timber blockwork

STEKO

Load-bearing timber blockwork

Steko "Lego fo 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



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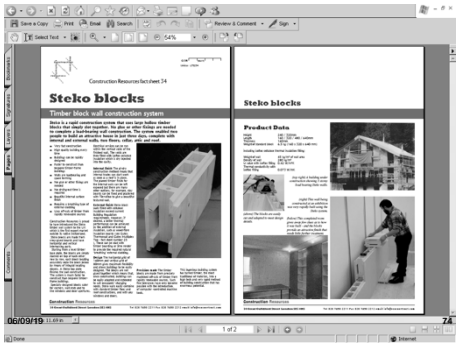

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Green New Build: Cross Laminated Timber Panel CLTP

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Cross Laminated timber shear walls floors and roofs

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Cross Laminated timber shear walls floors and roofs

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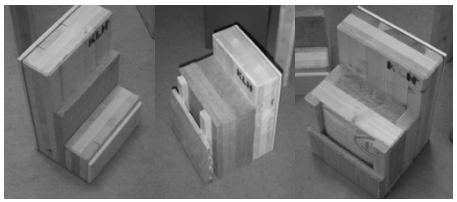
Cross Laminated timber walls



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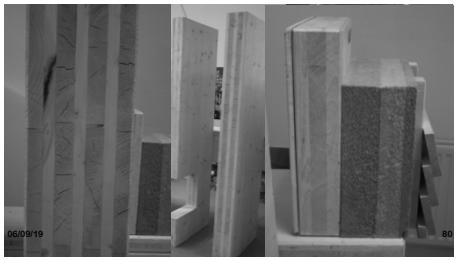
Cross Laminated timber shear walls



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Green New Walls: Transparent

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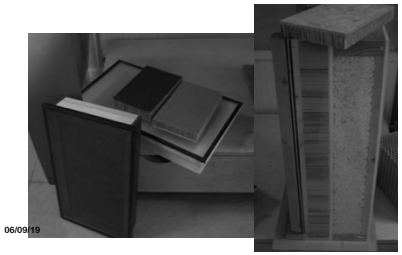
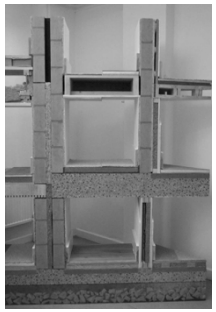
Timber Curtain Walling

Solar Wall



Green Acoustic Construction

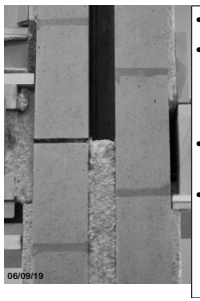
Different Acoustic solutions to walls and floors Cavity and solid walls and lightweight partitions



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

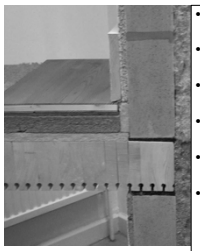


- Blockwork cavity wall
- Isolation rubber strip in place of mortar positioned mid floor depth to minimise flanking sound
- Airtight plaster on both faces of room walls
- Acoustic insulation in party wall cavity, extends into floor zone

Acoustic Intermediate Floor

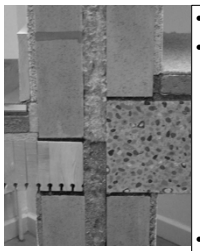
- Carpet
- Cork/rubber crumb or wood fibre sheet acoustic underlayment
- Or Rubber sheet
- Floor board/Sheet
- Softwood joists
- Close to party wall but spaced off with wedges
- Noggins to support ceiling joints
- 2 layers dense cellulose fibre reinforced gypsum board ceiling

Intermediate Floor



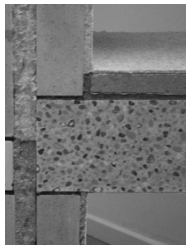
- Veneered timber panel floor boarding
- wood fibre sheet acoustic underlay
- wood fibre board acoustic/ thermal insulation
- wood fibre sheet acoustic underlayment and upstand
- Stacked wood floor with acoustic absorbent slotted soffit
- Isolation rubber strip in place of mortar positioned below and 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

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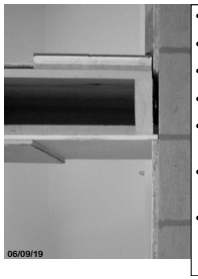
Acoustic Intermediate Floor



- **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

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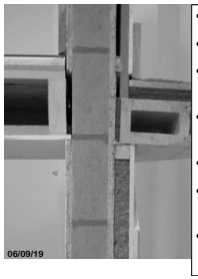
Acoustic Internal partition



- **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

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Acoustic Intermediate Floor

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

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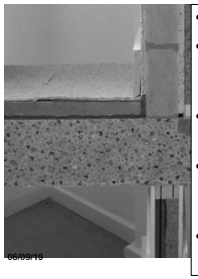
Acoustic Suspended Floor



- **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

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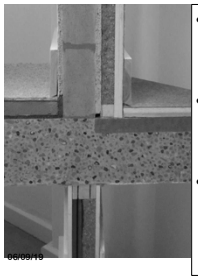
Acoustic Partition (below)



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

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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

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Solid Wall Construction

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

- Eco Energy Refurbishment

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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 sided 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

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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

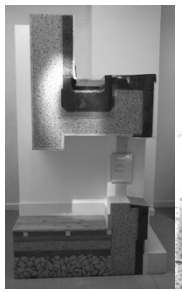
Pitched Roof Attic

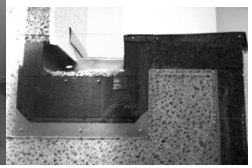
Existing ceiling joists zone insulated
Insulation laid over ceiling joists at right angles

Ground floor

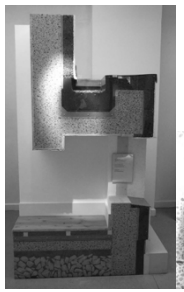
Take up existing floor
Lay new DPM
Loadbearing Insulation on DPM
Insulation upstand around perimeter
New eco-concrete floor,
Eco-concrete screed
High density insulation board
Floor finish

1960's insitu concrete tower refurbishment External walls





1960's insitu concrete tower refurbishment Flat roof gutter



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

Another GBE CPD/Lecture to download
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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 down load the whole file
- You will find a large number of other files there too

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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