

Low Rise Building

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

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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
- 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

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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

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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

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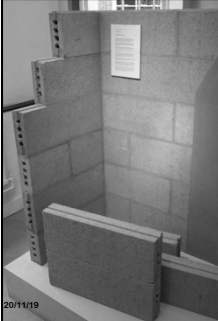
Unfired clay and straw



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Unfired clay

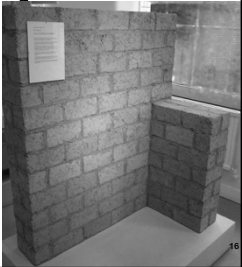
- Hollow extruded clay
 - Lighter weight
- Interlocking profile
 - Acoustic and airtight
- Dry or slip clay joint
- Hygroscopic
 - Moisture mass
- Thermal mass and lag



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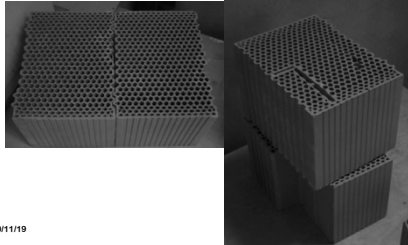
Unfired clay and straw

- 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

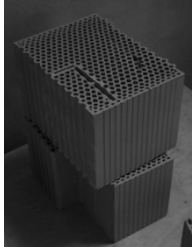
- Abundant Mineral: clay
- Fired clay
- Cellular insulation
- Long conduction path
- Interlocking dry perpend
- Mortared bed joint
- Thermal mass
- Acoustic mass
- Decrement delay
- Moisture Permeable



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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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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

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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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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: Saponification: 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 Construction₂₄

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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
O₃ 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

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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 or fired honeycomb blocks in walls and floors adds thermal mass



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Timber Structure



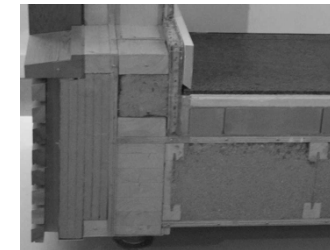
- Compound rafters
- Cellulose insulation
- Acoustic brick floor
- Timber floor planks
- Wood fibre insulation
- Timber frame walls
- Timber batten clad

•Vapour balanced construction

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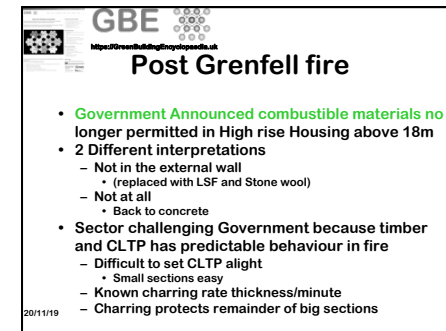
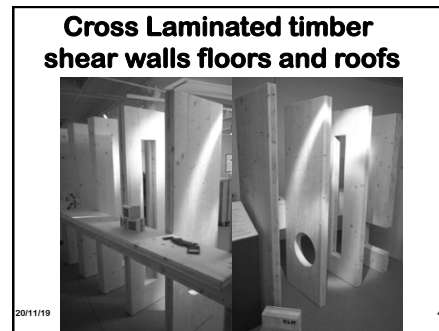
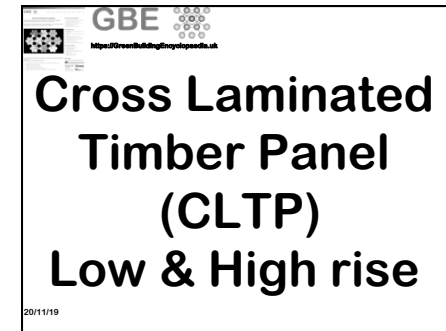
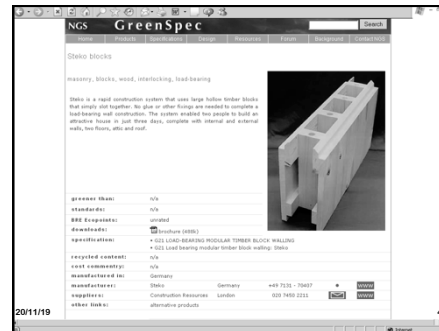
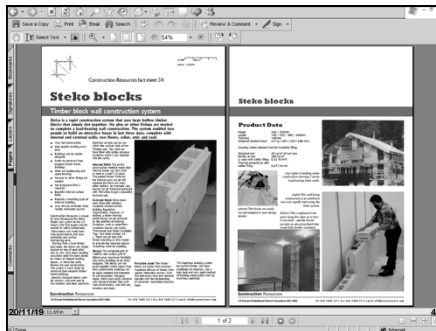
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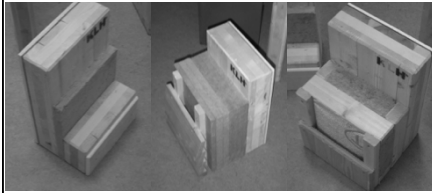
Green Walls: Loadbearing Timber Blocks

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Cross Laminated timber walls



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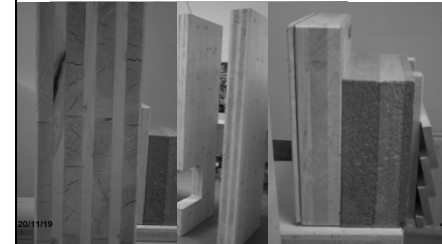
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GBE Post Grenfell fire

- 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

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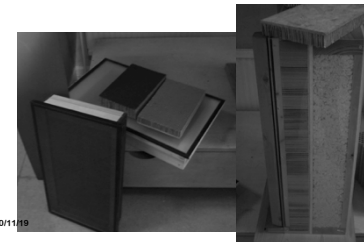
Timber Curtain Walling



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Solar Wall



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Green Wall Finishes

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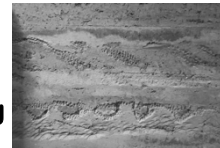
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Rammed Earth Walls



Load-bearing
but dynamic

any shape
many ingredients
colours & textures
thermal mass

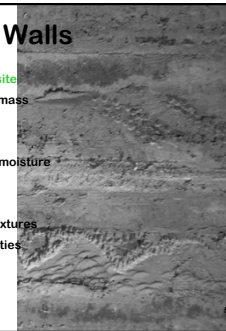


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Rammed Earth Walls

- 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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Clay boards & finishes



**Clay Boards
Reed & Clay
Clay finishes**

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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

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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

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Clay finishes



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

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Paints & Stains



**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

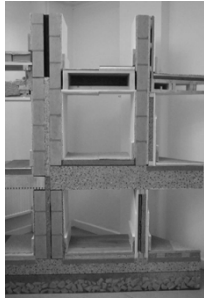
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Green Acoustic Construction



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Different Acoustic solutions to walls and floors



Cavity and solid walls and lightweight partitions

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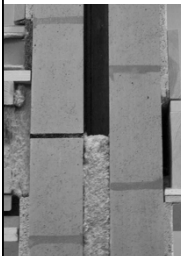
Acoustic Separating Floor



- 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

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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

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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

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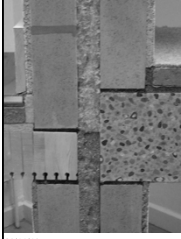
Intermediate Floor



- Veneered timber panel floor boarding
- wood fibre sheet acoustic underlayment
- 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

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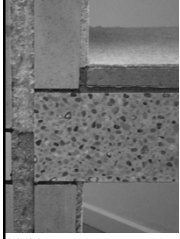
Intermediate Wall



- 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

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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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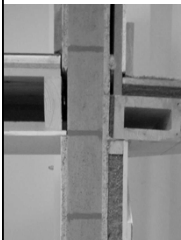
Acoustic Intermediate Floor



- 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**

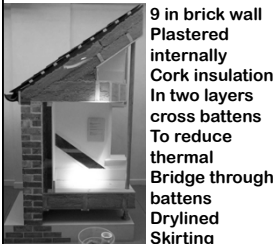
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Victorian Building Green Energy Upgrade

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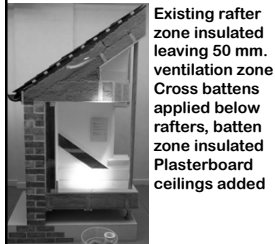
Solid Wall Construction



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

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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

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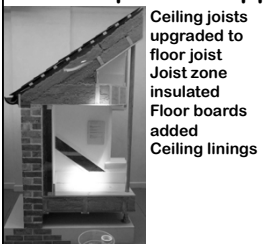
Suspended Ground Floor



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

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Suspended Upper Floor



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

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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**


20/11/19 • Used in DGSU translucent GRP glazing 80

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20th C Building Green Energy Upgrade

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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

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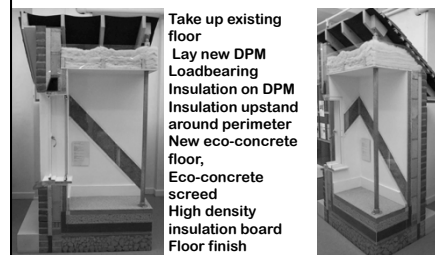
Pitched Roof Attic



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

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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

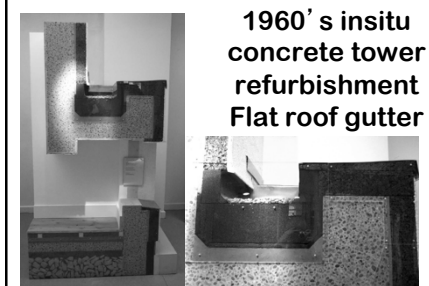
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1960's insitu concrete tower refurbishment External walls



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1960's insitu concrete tower refurbishment Flat roof gutter



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- 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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GBE Sampler

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- 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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GBE Feedback

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- 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
 - Environmentalism 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
- E BrianSpecMan@icloud.com
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