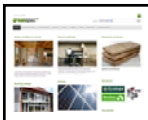

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CAP'EM www.capem.eu

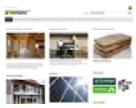
Refurbishment Non-Domestic Materials

An introduction to specification of materials

RU CEM LLL

Applications, +ve, -ve, distractions, opportunities

1



Materials

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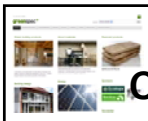
- Cement & Concrete
- Steel
- Aluminium
- Timber
- Brick
- Glass
- Stone
- Carpets
- Raised Access Platform floors
- Suspended ceilings
- Drylining



Cement & concrete:

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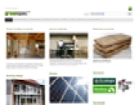
- Applications
- Positives
- Negatives
- Opportunities
- Distractions
- Cement Replacement
- Aggregates



Applications:

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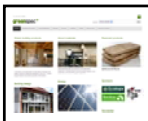
- Substructure: basements, foundations, piling
- Structural: frames, floors, roofs, shear walls, stair services and lift shafts,
- Non-structural: screeds, renders, mortars



Positives:

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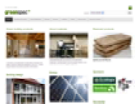
- airtight and water tight construction possible,
- strong, tough
- versatile in application and shapes achievable



Negatives:

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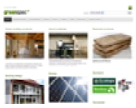
- Ordinary Portland Cement (OPC) manufacture generates 8% of global CO2 (1.8% of UK CO2) and has high embodied energy from the kiln heating processes.
- 10% of 106 m tonnes of construction waste are temporary works e.g. concrete formwork, site hoardings, etc.
- Aggregate extraction takes away land, displacing wildlife (in some cases temporarily but usually changing the character completely (e.g. wetland becomes fishing ponds)
- Cement is often moved by rail but most of the ingredients are heavy, bulky and take considerable amounts of fuel to move and also generate lorry emissions pollution and adds to congestion to mixing plants and to site.
- Steel reinforcement has a high embodied energy from melting ore to extract the metal
- Water has a high carbon load due to the energy to extract and pump it and processes and chemical to clean it.
- Formwork is wasteful



Distractions

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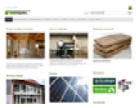
- Quarry Products Association
  - £12m/annum marketing budget
  - Ignore Short term problems
    - CO2 & global warming
  - Promote Long term solutions
    - Durability & Thermal mass
- BRE Green Guide to Specification
- BRE Green Book Live



Opportunities:

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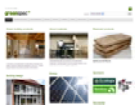
- Cement
- Aggregates

Cement replacement:

- alternatives to OPC are available with lower CO2 emissions from manufacture: PFA and GGBS
- PFA Pulverised Fuel Ash: (glass like residue from burning coal dust)
- Mixes of 30% PFA to 70% OPC is not uncommon.
- GGBS Ground Granulated Blast-furnace Slag Cement: is a waste product of steel smelting that floats to the top and is skimmed off, it has cementitious properties but a slower set and a warmer colouring that OPC.
- Mixes of 50% GGBSC to 50% OPC are not uncommon



Aggregates

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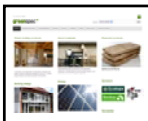
- Primary or Virgin aggregate substitution: replacing new aggregates with other arisings or waste products can bring many recycled and recycled concrete aggregates into use.
- Secondary aggregates: are the bi-product of explosion, sieving, cutting or other reducing processes in the creation of other products; slate making waste and china clay aggregates are secondary aggregates;
- specifying these can bring many of the 6000m tonnes of stockpiled secondary aggregates into use.
- 100% alternative aggregates, 70% in substructure and 20% in superstructure are not uncommon.
- W http://www.aggregain.org provides specification information and suppliers
- W http://www.greenspec.co.uk/html/materials/cementsub.html



Steel

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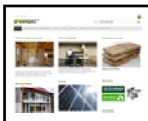
- Applications
- Positives
- Negatives
- Distractions
- Opportunities



Applications:

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- Structural: super-structure frame, Trough deck floors and roofs,
- Non-structural: partition framing, ceiling suspensions, platform floor supports

Positives:

- Depending on smelting technique, can include significant recycled scrap content
- Waste product smelting slag is cementitious and can be used as a cement replacement
- Recyclability ad infinitum is possible, recipe refined each time

Negatives:

- Mining impacts, transporting of ores
- Turning iron ore into steel ingots consumes lots of energy
- Making products from steel ingots uses more energy, high embodied energy material
- Transporting long and heavy components causes transport emission and congestion
- China is currently consuming the worlds steel, it is becoming scarce and valuable

Distractions

- BRE Green Guide to Specification
- BRE Green Book Live

Opportunities:

- Reuse of steel sections without re-melting is possible
- Bolted connections enable deconstruction and reassembly, welding hinders reuse
- Inspect, blast clean, prime and reuse, redundant bolt holes do not prevent reuse

Aluminium

- Applications
- Positives
- Negatives
- Distractions
- Opportunities

Applications:

- Curtain walling framing,
- metal claddings,
- Partitioning systems
- suspended ceilings tiles

Positives:

- Versatile and lightweight
- Durable
- Anodic oxide coatings are aluminium oxide so remain recyclable with low pollution potential

Negatives:

- Bauxite ore is extracted and smelted to release aluminium,
- it uses an enormous amount of energy,
- historically dams were constructed close to the source of bauxite
- to use low carbon renewable hydro electric energy to power the process.

- Today a significant amount of aluminium smelting occurs in China using high carbon coal power and in the Gulf using medium carbon gas power.
- There are circumstances where the process can lead to PFCs being released to the atmosphere with ozone depletion potential
- In use it develops unsightly oxides, protective and decorative coatings add pollutants to the recycling process
- Red toxic mud is left over, stored in reservoirs
- Recent toxic flooded town and land in Hungry

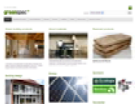
Distractions

- BRE Green Guide to Specification
- BRE Green Book Live

Opportunities:

- Scrap value is high and strong
- Can have significant recycled scrap content
- 100% recycled aluminium uses 5% of the energy used to make virgin aluminium
- Recyclability ad infinitum is possible, recipe refined each time

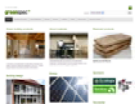
- One waste product is aluminium oxide
- can be used with cement and water
- reacts with each other and generate bubbles,
- the matrix round the bubbles is cement,
- it is then autoclaved (cooked with steam) to set and makes concrete blocks and slabs.



Timber

GreenSpec www.greenspec.co.uk CAP'EM www.capem.eu

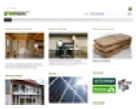
- Applications
- Positives
- Negatives
- Distractions
- Opportunities



Applications:

GreenSpec www.greenspec.co.uk CAP'EM www.capem.eu

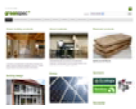
- Structural: Superstructure frame and roof, floors, walls, roofs,
- Non-structural: External claddings, floor wall and ceiling linings, furniture, partition framing



Positives:

GreenSpec www.greenspec.co.uk CAP'EM www.capem.eu

- Timber is renewable in a 40 – 100 year cycle depending upon the species and applications
- Strong, lightweight, versatile in manufacturing many products and application
- Some are naturally durable and others can be designed to not need preservatives
- Carbon sequestration: Renewables consume CO2 during growth and store it in the cellulose created, it remains locked-in during use and can remain out of the atmosphere as long as it is not burned to release the CO2
- Naturally beautiful and needs no further finishes but benefits from natural oils, stains and waxes



Negatives:

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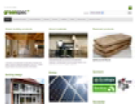
- Abundance and uninformed demand encourages irresponsible forestry
- Original Ancient forest is being destroyed at an alarming rate losing human and biodiversity habitation,
- displacing and decimating indigenous flora and fauna
- reducing carbon sequestration potential.
- Endangered species are still specified without research
- 60% of timber used in UK is reported to be illegally logged and is unsustainable
- EU laws are not yet addressing illegal and unsustainable timber



Distractions

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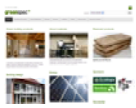
- BRE Green Guide to Specification
- BRE Green Book Live



Opportunities:

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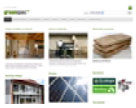
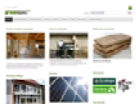
- Forrest thinnings are increasingly being put to use in many panel products, as recyclate and fibre reinforcement of boards and recycled plastic/wood flour as timber substitutes and making products in their own right often using lamination and assembly techniques.
- Preservative treatments: increasingly alternative treatments without chemicals are becoming available
- Independently assesses FSC legal and responsible forestry and chain of custody from forest to site is practical from 270 suppliers in the UK
- Recently UK hinted that they may go for unilateral legislation whilst EU has failed to act.



Brick

GreenSpec www.greenspec.co.uk CAP'EM www.capem.eu

- Applications
- Positives
- Negatives
- Distractions
- Opportunities



Applications:

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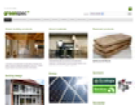
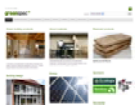
- External walls, fire compartment walls and electrical intake transformer rooms, pavement and floor finishes



Positives:

GreenSpec www.greenspec.co.uk CAP'EM www.capem.eu

- Reclaimed bricks remain the lowest impact choice
- Fletton commons use clays that release gases that are recycled as fuel to save about 30% of the energy needed but also generate polluting emissions
- Durable, strong and frost resistant varieties available
- Often can be sourced locally
- Skilled labour is abundant



Negatives:

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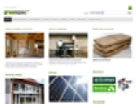
- Quarrying impacts
- High energy consumption in firing in kilns



Distractions

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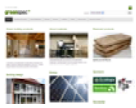

Opportunities:

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- Unfired clay can be used as brick and blocks with or without fibrous reinforcement but are not load-bearing or weather resistant
- Fired or unfired clay's thermal mass can be exploited to minimise use of heating and cooling by absorbing solar gains and internal generated heat from equipment.

Glass

- Applications
- Positives
- Negatives
- Distractions
- Opportunities

Applications:

- External wall glazing: curtain walling, structural glazing, windows, rooflights, canopies
- Internal: office partitions, balustrades, stairs, wall and lining surfaces and furniture

Positives:

- Abundant raw materials
- Give the opportunity to exploit free sun and daylight, borrowed light and solar gains
- Gives views out, in, through and intervisibility, can also be translucent or obscured,
- U values of 0.7 W/m2.K can be achieved now, 0.4 W/m2.K is achievable
- Can be wind, air and watertight,
- Can be noise and fire resistant

Negatives:

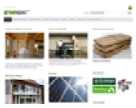
- Mining impacts, and high embodied energy
- Safety glasses often have higher embodied energy
- Thinness allows external walls and internal partitions to be as thin as possible to maximise floor areas
- Thinness means heat loss and radiant coolth in the heating season (in winter)
- Radiant coolth from large surfaces leads to thermal discomfort for occupants
- Solar gains need to be controlled in summer or high energy demand and energy inefficient air conditioning is necessary to control conditions.

Distractions

- BRE Green Guide to Specification
- BRE Green Book Live

Opportunities:

- Recyclable in many applications
- Glass properties can be modified to control (minimise and/or maximise) solar gains and daylight penetration
- Glass units can incorporate solar shading
- Solar shading can be added externally



Stone

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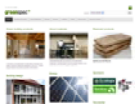
- Applications
- Positives
- Negatives
- Distractions
- Opportunities



Applications:

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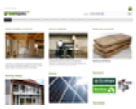
- External: Cladding, pavement, landscape features
- Internal: floor finishes, wall linings, furniture



Positives:

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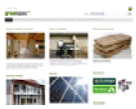
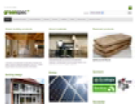
- Natural, abundant
- Visually attractive no need for further finishes, with many surface texture options
- Durable, long life



Negatives:

GreenSpec www.greenspec.co.uk CAP'EM www.capem.eu

- Quarrying impacts, heavy and bulky, transport emission and congestion
- Cheap materials sourced from abroad where social, health and safety issues are more relaxed and cheap family and child labour are exploited
- Cheap exploitative labour means imported stone chosen but transport emissions are greater including trucking to coast, shipping, trucking to site
- Dark colours can absorb heat
- Thermal mass can add to urban heat island effect
- High maintenance potential if polished and trafficked.



Distractions

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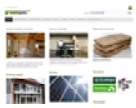
- BRE Green Guide to Specification
- BRE Green Book Live



Opportunities:

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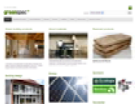
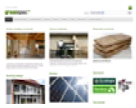
- Light coloured stone can reflect some heat
- Thermal mass can be exploited internally



Carpets

GreenSpec www.greenspec.co.uk CAP'EM www.capem.eu

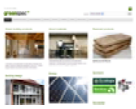
- Applications
- Positives
- Negatives
- Distractions
- Opportunities



Positives:

GreenSpec www.greenspec.co.uk CAP'EM www.capem.eu

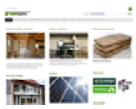
- Natural fibre carpet available,
- low carbon impact,
- Non-pvc backed available



Negatives:

GreenSpec www.greenspec.co.uk CAP'EM www.capem.eu

- Predominantly fossil organic petrochemical based materials with high embodied energy and carbon released in manufacture
- Off-gassing from plastics contribute to Sick Building Syndrome
- Nerve toxins (sheep dip and moth deterrent) added to some natural carpet
- Landfill for waste is not a solution
- Pre-treatment is expensive and complex



Distractions

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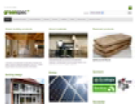
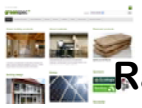
- BRE Green Guide to Specification
- BRE Green Book Live



Opportunities:

GreenSpec www.greenspec.co.uk CAP'EM www.capem.eu

- Plant based resin carpet becoming available in place of synthetic resin
- Reclaim and reuse market is beginning to develop
- Reclaimed, refurbished, reused tiles available, which diverts from landfill, but carried out in the USA so transport miles lead to emissions and fuel carbon released to atmosphere
- Recycling opportunities exist abut expensive
- Recycled fibre carpet tiles also available



Raised access floors

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- Applications
- Positives
- Negatives
- Distractions
- Opportunities

Positives:

- Enable building reuse by facilitating power and communication distribution
- Reuse of existing and reclaimed is viable, floor loads may need to be checked
- Inter-changeable parts allow modification

Negatives:

- Composite materials are difficult to separate to enable recycling
- Remove opportunity to exploit thermal mass of structural floors

Distractions

- BRE Green Guide to Specification
- BRE Green Book Live

Opportunities:

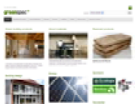
- FSC timber panel product core available
- Reclaim for reuse is possible but market not established yet
- Plenum air movement can exploit thermal mass

Suspended ceilings

- Applications
- Positives
- Negatives
- Distractions
- Opportunities

Positives:

- Dry trade, fast construction
- Easily deconstructed to enable reuse
- Many materials available



Negatives:

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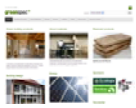
- Denies use of exposed thermal mass of floor soffit in energy saving strategy
- Air leaky construction



Distractions

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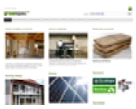
- BRE Green Guide to Specification
- BRE Green Book Live



Opportunities:

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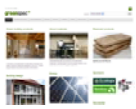
- Reuse of existing without removal and reuse of reclaimed is viable
- Inter-changeable parts allow modification
- Plenum air can exploit thermal mass



Dry-linings

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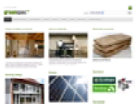
- Applications
- Positives
- Negatives
- Distractions
- Opportunities



Applications:

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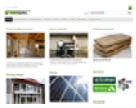
- Partitions,
- ceilings,
- wall linings,
- acoustic and fire protection and separation



Positives:

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- Less water consumption on site
- Dry trade, no drying time required
- Fast construction

Negatives:

- Plasterboard is acknowledged as an air leaky construction method
- Gypsum in landfill risks releasing flue gases and creating acid rain
- Gypsum plasterboard no longer permitted in mixed waste
- Mixing of gypsum with other waste no loner permitted
- Gypsum: Stable Non-reactive hazardous waste landfill
- Up to 30% off-cut wastage is normal
- Off-cut recycling is available but in a very limited scale (not normally from commercial projects)
- Alteration and deconstruction gypsum not normally recycled by manufacturers

Distractions

- BRE Green Guide to Specification
  - Does not acknowledge air leakiness and other performance characteristics
  - Does not engage with waste reduction targets and diminishing landfill capacity in realistic way
  - Does not offer other material dry linings
- BRE Green Book Live

Opportunities:

- Power generation bi-product desulferisation gypsum
- flue gas cleaning chemical reactions avoiding acid rain is available

NGS

- Text

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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

73

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