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CAP'EM

Cycle Assessment Procedure for Eco-impacts of Materials



Design to help Reduce Waste

Easy steps to reduce your share
of the 109 m tonnes of construction and
demolition and excavation waste each year

This Seminar

- Downloadable from
- <http://www.GreenBuildingEncyclopaedia.uk/shop>

Design generates waste

- Waste reduction is not a site issue
 - It is a Design Issue
- It becomes a site issue
 - if it was not seen as a Design issue
- Join in now or
 - D&B takes another % of UK procurement



Chinese Jigsaw Puzzles

- Arup Associates (Multi discipline practice)
- Peterborough Sugar Beet Factory
- Office Pavilion
- Suspended ceiling: Bespoke
- Designed to take out and reinstall like a Chinese jigsaw puzzle

British Sugar

- Q How do we get into ceiling void
- A For us to know and for you to find out
- Fist through the first and rip the rest out
- Vowed never to commission Arup again
 - Quite right.
 - And now use Technicians



Waste at Design Facts & Figures

08/04/2008 07:15

© NGS 2002-2005 Waste At Design

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Facts and Figures

Another GBE CPD file to download

See <http://www.GreenBuildingEncyclopaedia.uk/shop>

SITE^{wise} II Waste Campaign

- Environment Agency (Anglian)
- Breakfast meetings
- 200+ Pre-construction Professionals
- Waste is not a key issue
- Scored 8th out of 12 issues

Some easy wins

- Design to standard sizes
- Design to reduce off-cut waste
- Design for on and off site reuse
- Design for on and off site recycling
- Design for maintainability, adaptability & flexibility
- Design for deconstruction and reuse
- Design spares storage for maintenance
- Design for in use waste management

Serendipity?

- Design for Easy of Assembly
- Lends itself to
- Design for Deconstruction
- But Architects are not very interested in construction nor deconstruction
- The RIBA curriculum does not address it very well
- RIBA external course assessors frown at too much technology



C,D&E Waste Facts Figures & Fly-tipping

100 m tonnes of
construction, demolition &
excavation waste leaves site in
mixed skips each year

Waste Facts & Figures

Another GBE CPD file to download

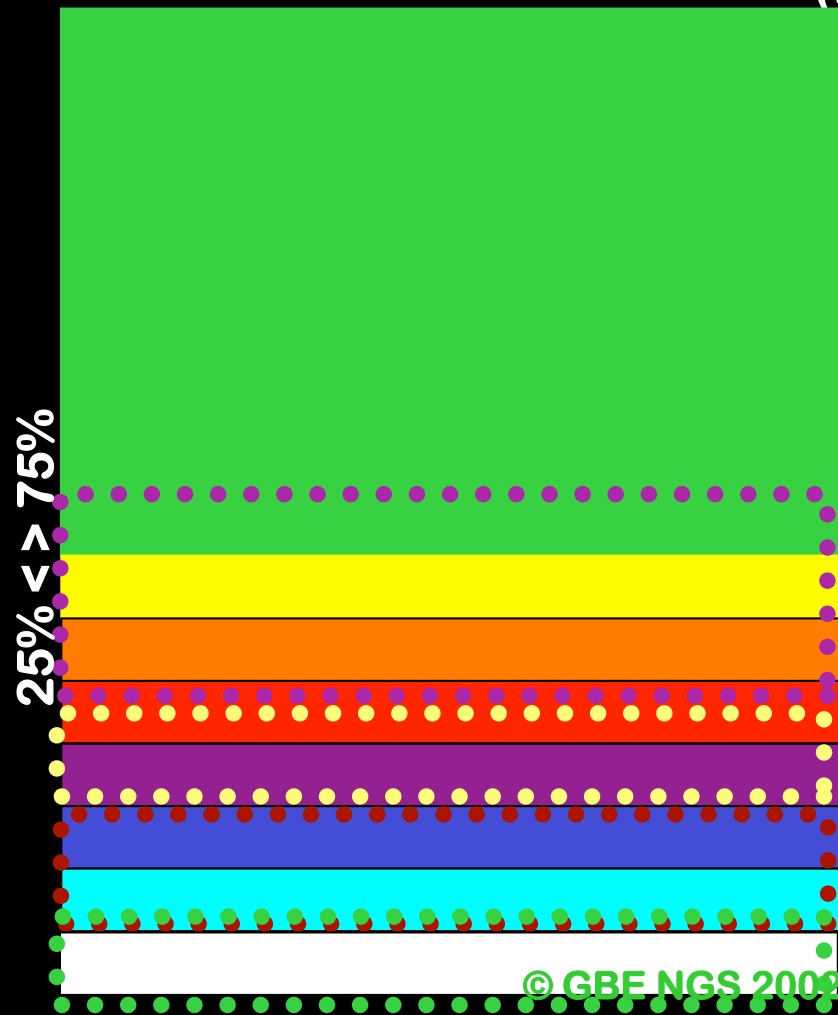
See <http://www.GreenBuildingEncyclopaedia.uk/shop>

Relearn some waste statistics

- 400m tonnes/year materials to UK CI
- 100m tonnes/year wasted by UK CI
- 30m tonnes is materials off-cuts
- 24m tonnes/year (24%) is packaging
- 23.7m tonnes/year soil & rock
- 10m is temporary materials
- 10m tonnes/year over ordered never needed £1.5bn/annum (EA 2007)

Over ordered never needed Lost, stolen and reordered

(not to scale)



- Required for the design
- QS inaccurate take off +/-10%
Requires remeasure by contractor
- SMM7 Wastage factor 5-20%
33% is off-cuts, 3% is damage
- ^ Over-order safety margins x%
- Minimum order quantities +++
- 18% Call-off extra % JIC Just in case
- Merchant delivers % more than required
 - in the hope nobody is checking,
 - invoices accordingly
- Lost on site
-Stolen from site for PJs 20%
- Reorderd to replace lost or stolen
-Damage & Poor quality work 3%
-Spares for on going maintenance

Relearn some waste statistics

- UK CI generates hazardous waste:
- 5m tonnes/year 50% is landfilled
 - (New rules this grows to 7m tonnes/year)
- 21% of all UK Hazardous waste
- Of 240 hazardous waste landfill sites only 10 (2004) signed up to new rules
- None in London, Scotland and Wales
- Sites in MK, (Swindon), Teeside & Pboro
- 250 material reclassified as hazardous

Relearn some waste statistics

- There is a fly-tipping incident every 35 seconds in the UK
- 1 m Fly-tipping incidents in 2004
- 6000 20t trucks within M25 in 15 months
- CI: 30% of fly tipping incidents (2004/5)
- £44m/year clean up costs
- £50,000 fines and 5 year prison possible

Relearn some waste statistics

- Packaging waste can vary between 5% and 50% (24% average) of waste stream depending on construction method

Common Waste Causes 1

- Offcuts: 33.2%
- Recyclable packaging: 18.7%
- Excess deliveries 18%
- Temporary materials: 10.3%
- Reusable packaging: 14.4%
- Site Office and Canteen: 4.1%
- Damaged through methods of work: 3.2%
- Unsuitable storage: 1%



Excess Deliveries 18%

© GBE NGS 2002-2016 Waste At Design Diagrams
Concrete tiles No Architectural Salvage value but restock able and usable



Damage by methods of work 3.2%

© BENGS 2022-16 Made At Design Programs

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Specify Cast-in Lifting eyes sockets; require protection, consider repair before condemning

Demolition waste % by volume

(BRE limited studies)

- Concrete: 52.6%
- Ceramics: 22.5%
- Furniture 16.6%
- Timber 3.4%
- Miscellaneous 1.9%
- Metal 1.4%
- Plastic 1.3%
- Electrical Goods 0.3%

Demolition reuse and recycling potential

(BRE limited studies)

- Reusable 40.6%
- Reusable but soiled 1.2%
- Recycleable 27.3%
- Energy from waste 3.4%
- Inert waste to landfill 17% 16mt
- Mixed waste to landfill 10.4% 9mt

Building Refurbishment Waste

- Previously insulated with High ODP (Ozone Depletion Potential) insulation boards made until 2004
- Why remove existing insulation?
 - To add more room, charge more rent,
 - To increase fuel bills
- Insulation is damaged and cut into pieces to try to fill skip efficiently
- What good does it do in a landfill site?
- Ozone Depletion Potential realised by cutting cells and releasing gases
- This is classified as Hazardous waste in a mixed skip



BREEAM v Ska

- Different Priorities
- BREEAM: Business as Usual
 - K40 reuse
- Ska: make a difference
 - K40, K41, M10, M40, M50, M51 reuse



Waste Hierarchy

Ideals & reality
How many Rs in Recycling?
42 Rs so far

08/04/2008 07:59

© NGS 2002-2006 Expanded Waste Hierarchy

1

Waste Hierarchy

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See <http://www.GreenBuildingEncyclopaedia.uk/shop>

Effort

Waste Hierarchy

official definition & goal



More

Less ²⁸

- Jack Johnson
- 3 its a magic number
- $2 \times 3 = 6$
- $3 \times 6 = 18$
- 18th letter in the alphabet is R
- R x 3
- Reduce Reuse Recycle
- <http://www.youtube.com/watch?v=uSM2riAEX4U>

Ideal Waste Hierarchy

- Reduce
 - Reduce demand, reduce waste
- Reuse
 - As originally intended
- Recycle
 - In a new format
- Recover
 - materials or energy from waste

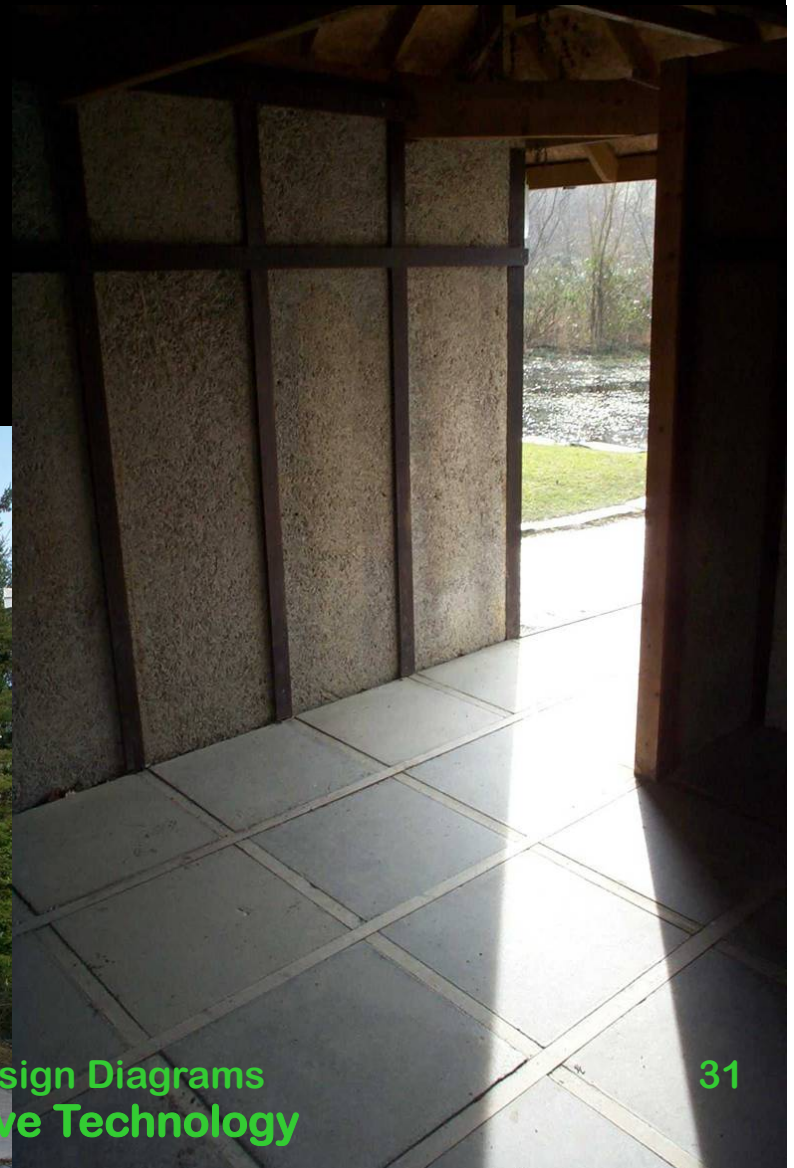
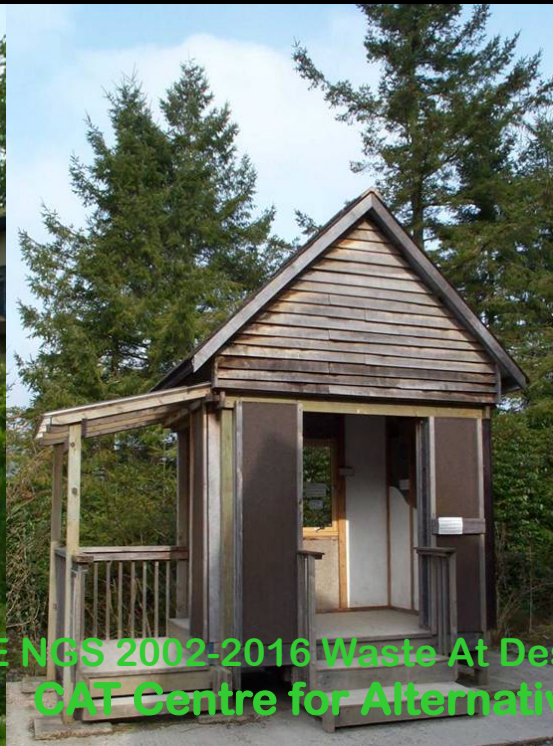
Reduce:

Modular design wastes less

Allows reuse readily

- Walter 'Segal Method'
- Whole component used full size no cutting

Robin Hillier Diggers
Self-build Brighton



**Reclaimed repaired
Reused and reusable**

**Recycled steel
frames
Redundant bolt
holes
Blast clean and
prime/paint**







Reused wood better than new

BedZED Beddington Sutton NAS 2002-2016 DVA Site Diagrams
Reclaim: BioRegional ReCLAIMED © NGS



Reclaimed, repaired & reused Doors



Reusing Doors
Visible Patch
repairs
If you don't like
them French polish
or paint them



BedZED Beddington Sutton Architect: Bill Dunster
© Sutton 2002-2016 Waste At Design Diagrams
Reclaim: BioRegional ReCLAIMED © Nicole Lazarus

Recycle: Glass sand for bedding



© GBE NGS 2002-2016 Waste At Design Diagrams

Effort

Waste Hierarchy

The reality

Reduce

Less

Reuse & Recycle

Recover

Reject

More

Waste Hierarchy

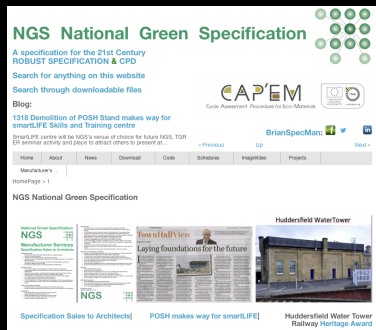
new definition

Rethink, Re-educate, Resolve, Refocus,
Resource, Relate, Research, Refer,
Refresh, Rename, Regard, Revalue,
Remeasure, Reprogramme, Replan,
Reconsider, Refuse, Reject, Return,
Redesign, Regularise, Rehearse,
Rationalise, Remediate, Reduce,
Reserve, ReSpec, Register, Reuse,
Reclaim, Repair, Retain, Remind,
Recycle, Recover, Record, Report,
Reward, Review, Revise, Refine, Restart





This house
only uses
reject floor
boards
from too
high a
spec



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Investing in Opportunities



This project has received European Regional Development Funding through INTERREG IV B.



INTERREG IVB

Geometry Dictates Everything

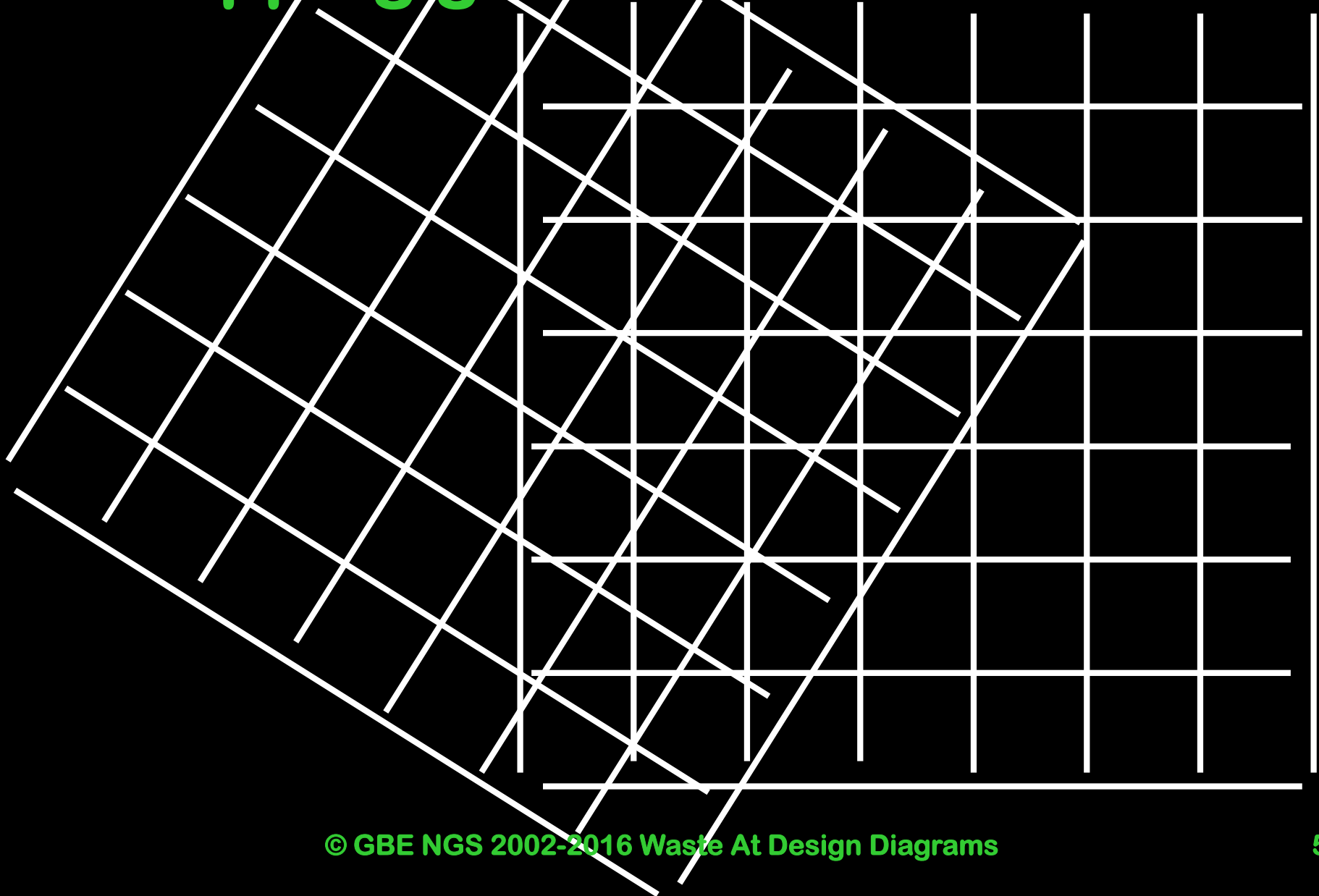
The shape of future design

Geometry in Design

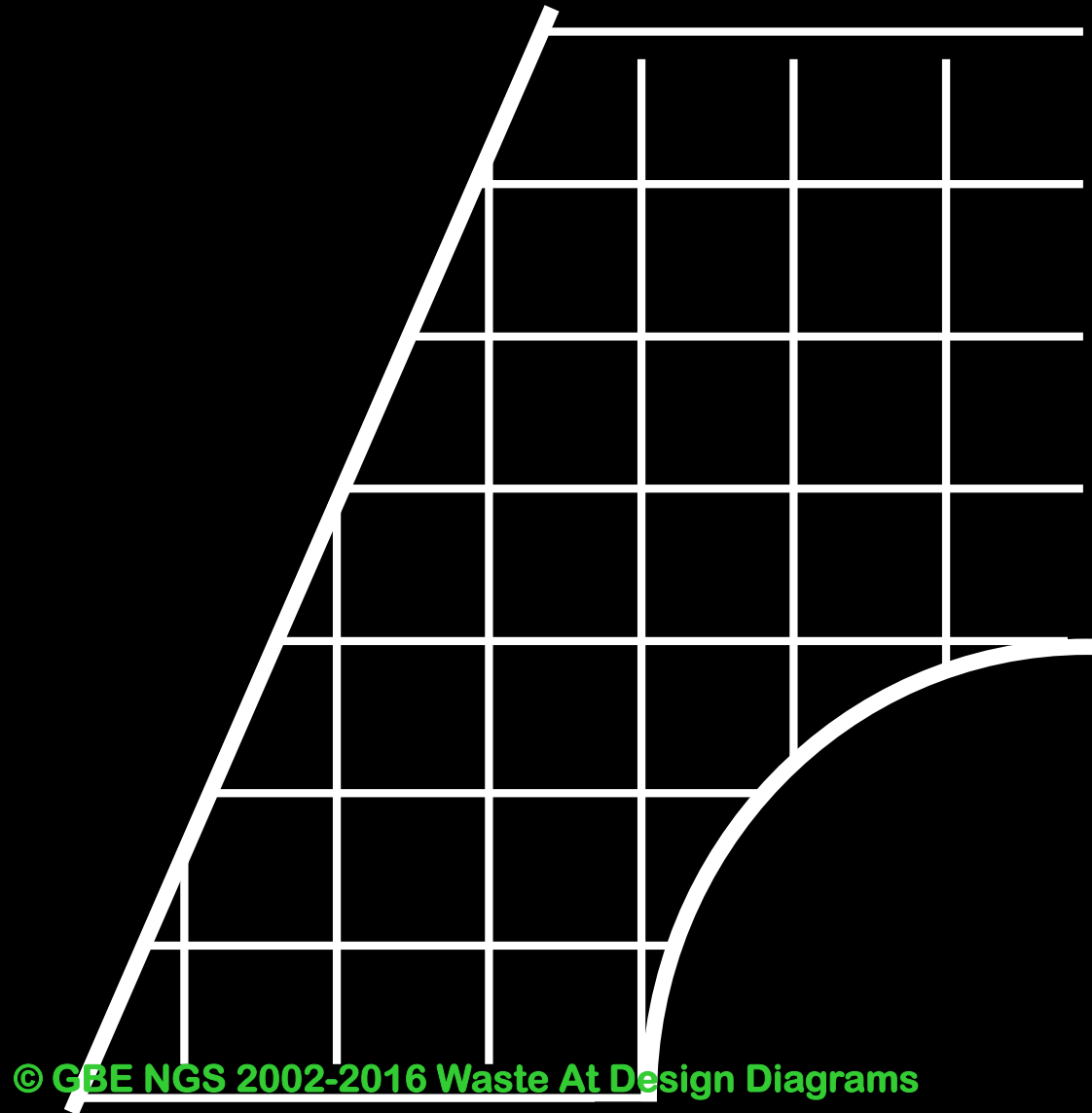
- Geometry for its own sake
- I can CAD, Because CAD can, I do
- Lazy design
- Lazy thinking
- Creates waste

Fashionable (Architecture?) 1990s

Overlapping grids create cuts & waste



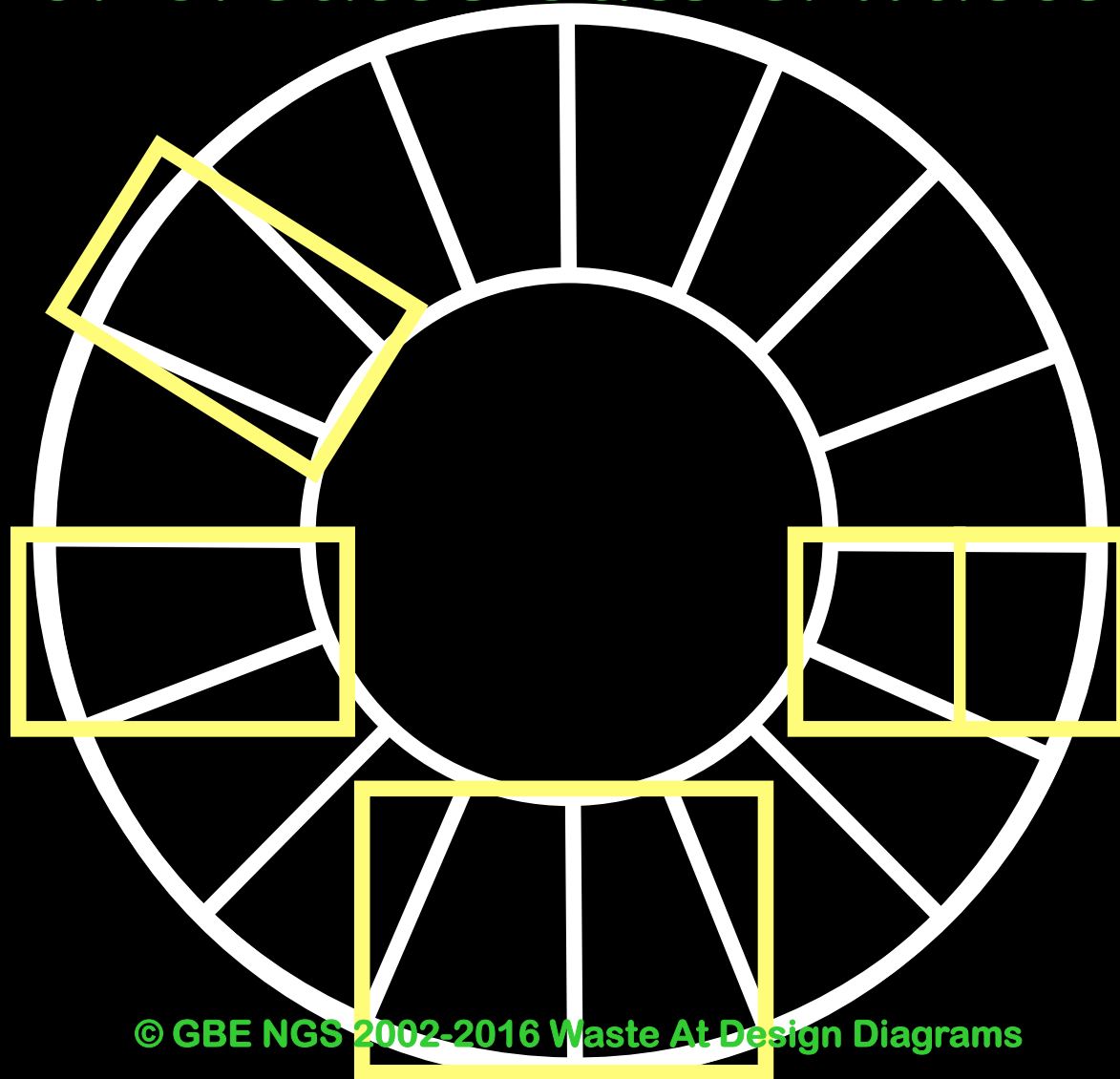
Site Boundaries & Geometry create cuts & waste





© GBE NGS 2002-2016 Waste At Design Diagrams

Circular & radial Geometry demands bespoke or creates cuts & waste





Design Dictates Waste

- Lazy design
- Labour intensive construction
- Cutting edge blocks generate waste
- Embodied energy in wasted materials
- Opportunity to object to quality
- Condemn materials to skip
- Delay programme
- Anger the tradesman
- Quantity Surveyor: think waste & labour



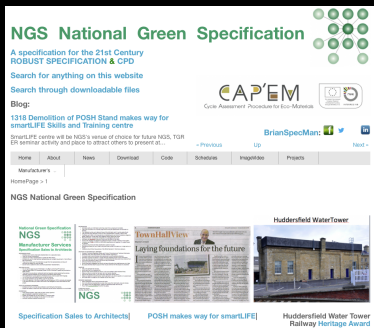
Construction/Deconstruction

- Margins hold it all together
- To prevent early failure
- Contain sub bases and beddings
- Prevent sand bedding trickling out
- Permits dry sand bedding & jointing
- Enables reclaim and reuse of materials

Defective Design

- Defective Design
- Exposure to worse conditions
- Ineffective components
- Diminished/ing performance
- Leads to early failure
- Refurbishment, removal, rejection, reordering, remanufacture, replacement

Reuse of what you find on site



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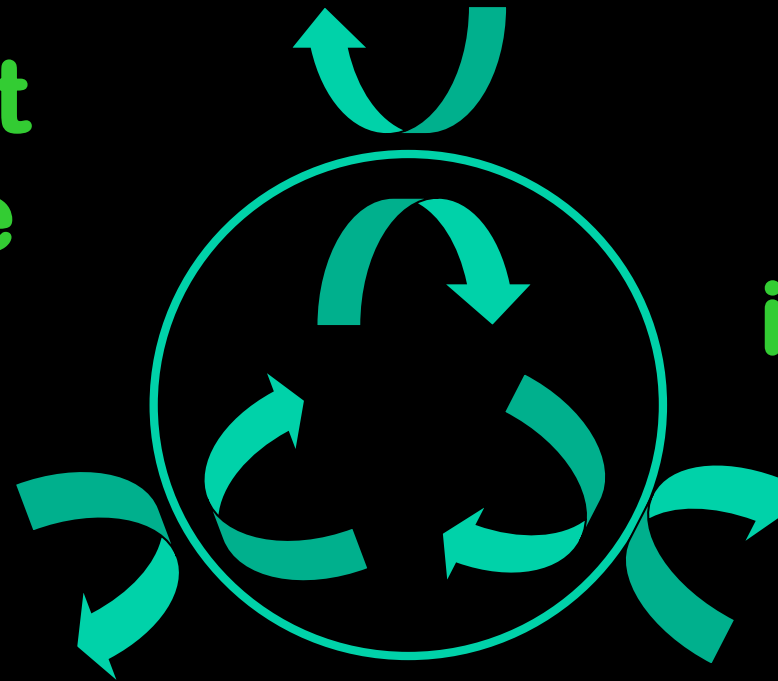
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Cycle Assessment Procedure for Eco-impacts of Materials

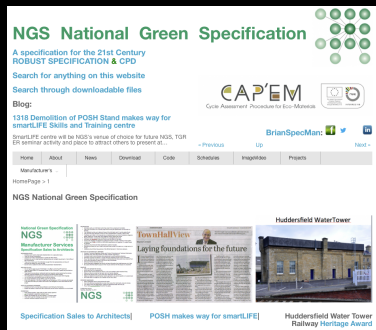


Site Autonomy

No export
from site



No
materials
imported to
site



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Investing in Opportunities

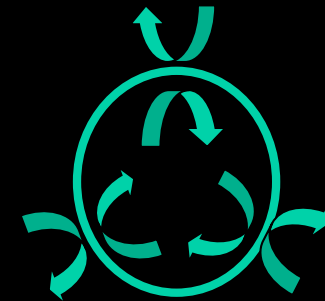


This project has received European Regional Development Funding through INTERREG IV B.



INTERREG IVB

Cut and Fill

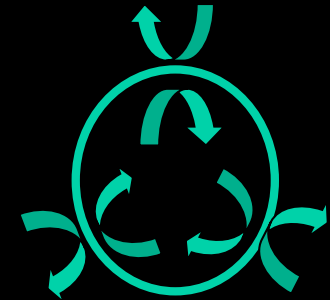


In principle a simple idea

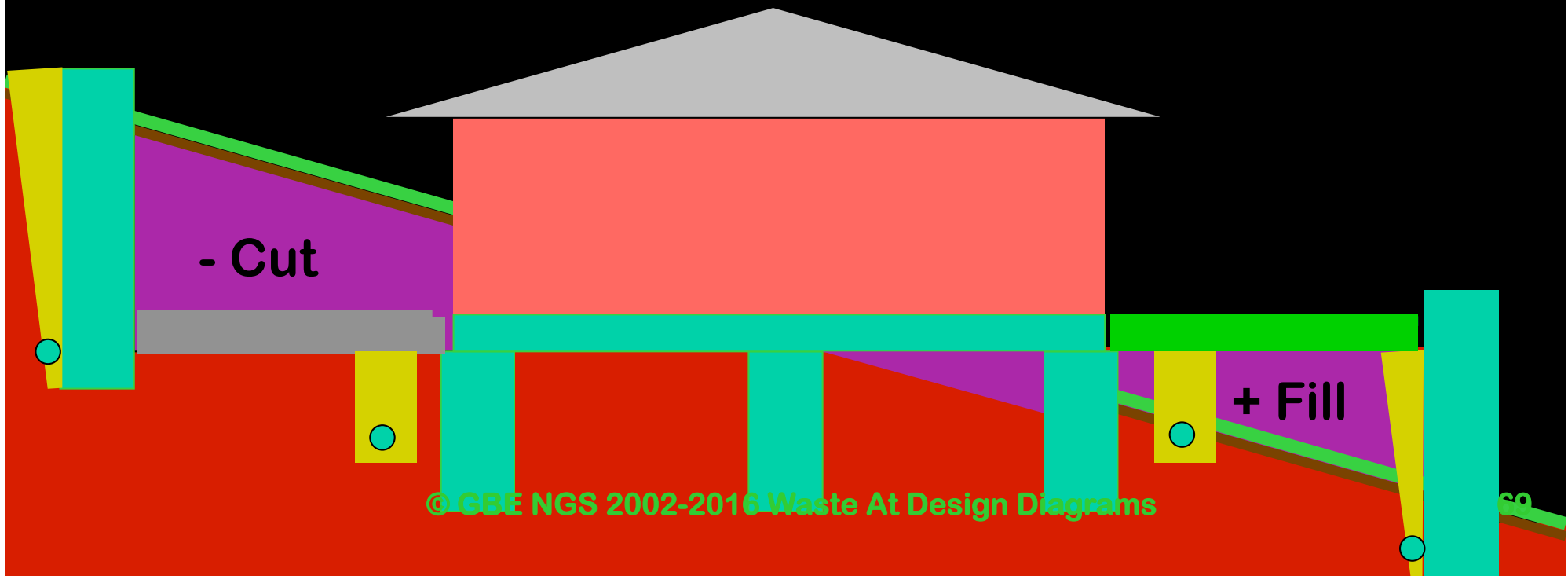
- Cut

+ Fill

Cut and Fill



Allow for site strip, design fill size to accommodate excavated materials from:
Cut, retaining walls, land drains, foundations, floor slabs, services and drain trenches and paved areas, allow for bulking



Cut and Fill

**Check all your quantities
first and determine the level**



**Or decide the level and
determine the position of the
building**

- Cut

+ Fill

Cut and Fill Software

- PDS by Causeway (formerly EXL)
- utilises existing contour maps to create a 3D build-up of the landscape
- Then the required model of levels/ grades is added
- It calculates the total volumes in/out.
- This can be varied to give an overall [near] zero outcome.
- (Depending on planning permission for height/depth)

Application:

- Although it is primarily aimed at highways and large scale developments it can, no doubt, be adapted for smaller scale use.
- It does require a site survey –
- obviously the more comprehensive the survey the better
- because the program interpolates between levels.

Outputs

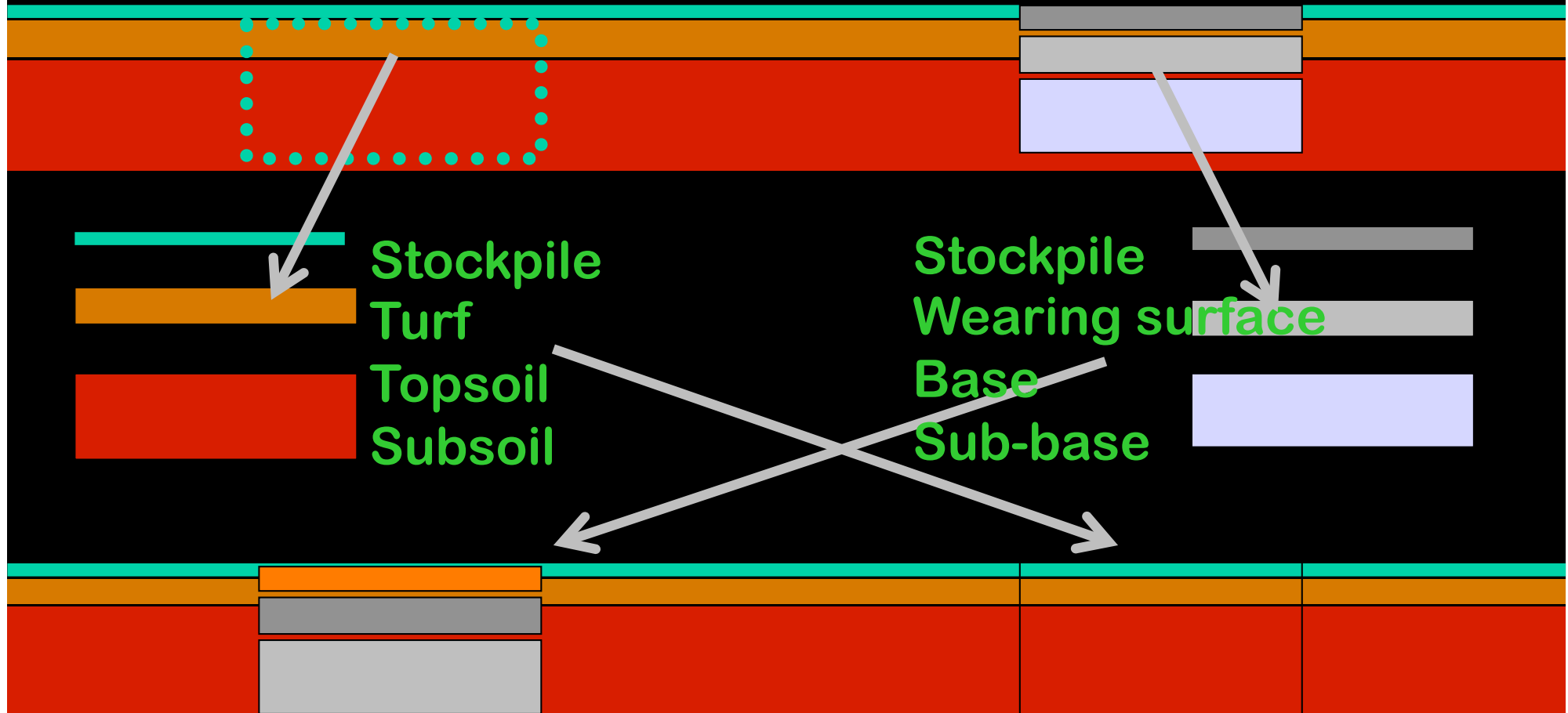
- Output is in the usual myriad forms:
- traditional profiles,
- export values to Excel, etc.
- AutoCAD can be used to import/export plans
- PDS can be combined with Windes to calculate, and eventually draw, drainage systems.

Rearranging pathways



Proposed path in landscape

Existing path in landscape



Recycle surface, base & sub-base as sub-base & base
add new wearing surface

© GBE NGS 2002-2016 Waste At Design Diagrams

On-site Best Practice: Initial Site Strip: Landscape Waste

Topsoil
Stockpile

Grass
Compost

Leaf
Compost

Bush & Tree
Trimming

Turf

Subsoil

Hardcore

Spread Seeds on topsoil to
discourage weeds

Cover topsoil with turf

Collect
Seeds

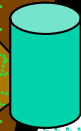


Site Strip Area

Mix Green Waste with grass cuttings compost

On-site Best Practice: Reuse of Green waste in Landscape

Collect
Seeds
Topsoil
Stockpile



Compost

Add mature Leaf compost to Green Compost

Leaf
Compost

Turf

Use stockpiled turf
in landscape

Use hardcore in road sub-base
and under floor slabs

Add manufactured topsoil to gardens

Topsoil
Stockpile

Add mature compost and Subsoil
to make Topsoil

Subsoil

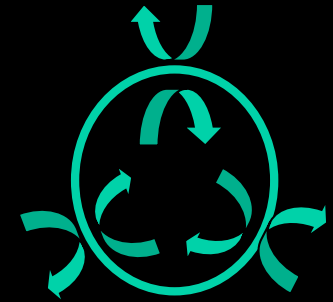
Hardcore

Topsoil & Subsoil Stockpile on site



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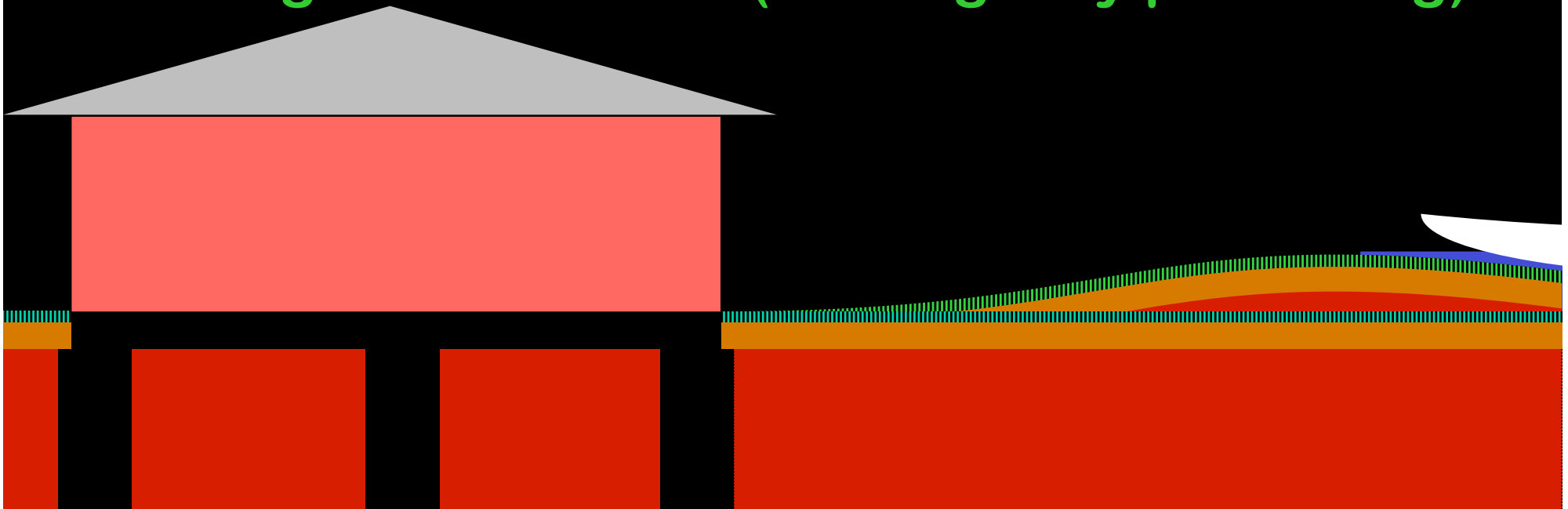
Excavation Arisings



All excavated subsoil materials to be reused on site rather than landfilled

Use it in intelligent landscape modelling

Including flood defence (Env. Agency permitting)



Environment Agency

- Nick-name: Anti-recycling league
- Government Agency:
- Police: Environment , Waterways and Water Bodies, Landfill, Pollution, Leaks and emissions, Fly-tipping, Site Waste, water use and abuse
- Right to close sites if abusing the law



Use found materials

© GBE NGS 2002-2016 Waste At Design Diagrams

Boulders, wild turf roof, gravel margin gutter, rubble wall



Rubble Walls

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Random sizes, natural look, lime mortar, sheltering roof



Roundwood: trees from site

No ground contact, antisplash height & floor, design overmant, places for nature
Layered construction easy deconstruction



Pembrokeshire
traditional
Hedge Bank

Rubble
Soil
Turf
Rainwater

Back to nature
very rapidly



Pembrokeshire hedge bank

Random rubble & slate & other stones, wild turf & hedge plants on top, crevices for nature, rain rejuvenates in weeks



Brown Roofs

© CBE NE 2002-2016 Waste At Design Diagrams

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Creekside Visitors Centre Deptford London: Ballast for waterproof membrane

Brown Roofs



Shifting shingle - plants of shingle beaches

Comprising ridges of pebbles that shift during storms, the shingle beach is a difficult environment for plants to live. Many of the species that colonise it are annuals that complete their lifecycle within a year. These include yellow witch (*Wickia litorea*) and wild carrot (*Daucus carota*). Other species are short-lived perennials such as horned poppy (*Adonis vernalis*) and sea purses (*Maritima maritima*). Sea kale (*Crambe maritima*) provides a glorious feast of white flowers becoming rarer.

© GBE NCS 2002-2016 Waste At Design Diagrams

Brownfield Landscape

- Derelict Brownfield sites often have more wildlife than Greenfield sites
- To maintain or enhance the biodiversity of the site much can be done with a little care
- Survey the site and check for wildlife: Insects, birds, animals, and lower forms, wild flowers, grasses, etc.



Brownfield Landscape

© GBE NGS 2002-2016 Waste At Design Diagrams

Creekside Visitors Centre



Wild Flowers & Meadow Grass

© GBE NGS 2002-2016 Waste At Design Diagrams

Neglected landscape nature takes over Listed Grade I barn

A photograph of a modern, multi-story residential building with a complex facade. The building features a mix of materials, including blue panels, light-colored panels, and large glass windows. It has a prominent metal frame structure. The building is situated on a street with some landscaping in the foreground.

Greenwich Millennium Village Phase 2b

- Reclaimed Polluted Gasworks site
- 900 mm. polluted soil removed to landfill
- GPM capping 900 mm. down
- 900 mm. imported sub and topsoil
- Passive ventilation boards at ground level below ground floor

Architect: Proctor Matthews

Specification Consultant: Brian Murphy

Hollyrood Scottish Parliament

- Intelligent reuse of excavated subsoil
- Landscape features: surplus subsoil
- Topsoil and grass

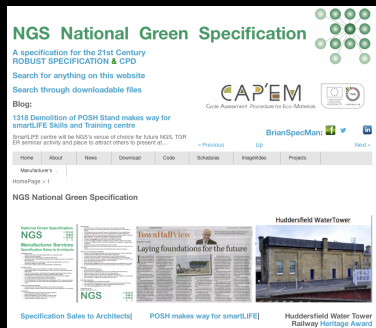
Ocean Terminal Leith Edinburgh

- Reclamation of derelict harbour site
- Part of regeneration of area
- Polluted landfill capped by building

Conran Design Partnership

Brian Murphy Specification Consultant

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Investing in Opportunities



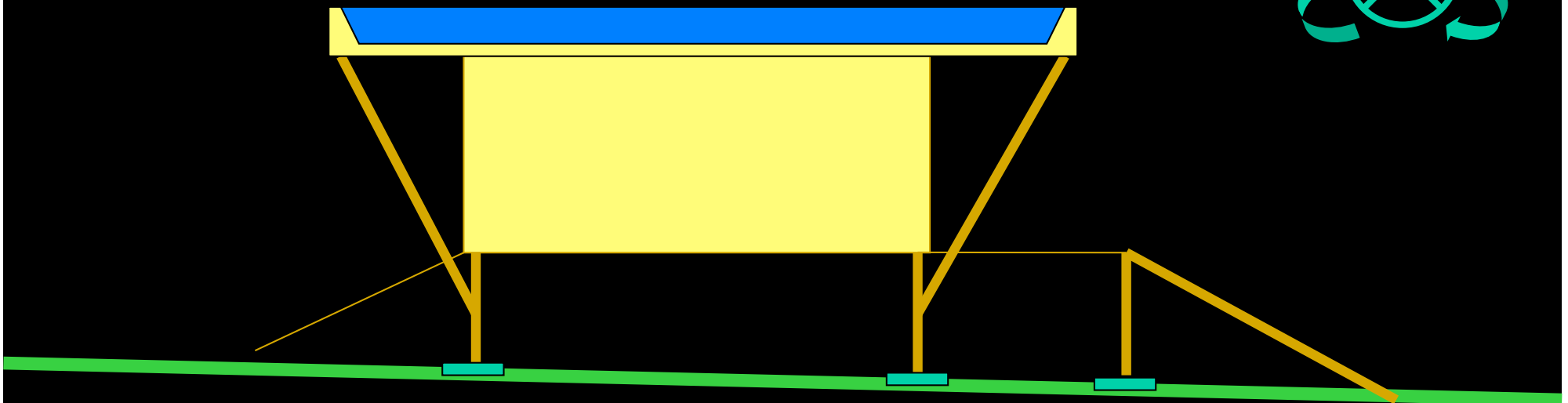
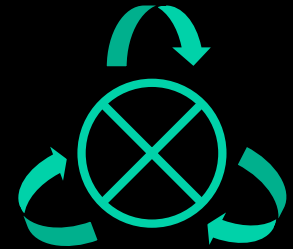
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INTERREG IVB

Resource Efficiency: Foundations

Light touch small footprint



No excavation

Paving slab foundations

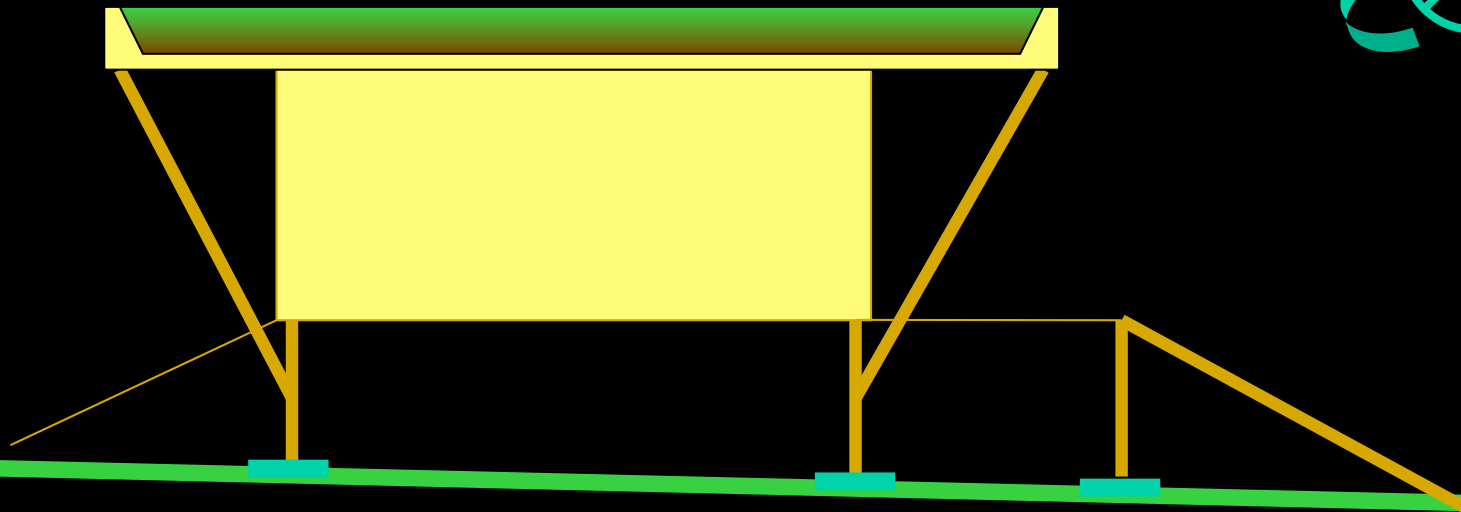
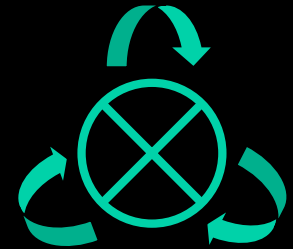
Add water for ballast against wind uplift (top up in summer)

Thermal Mass, solar protection and evaporation cooling

© GBE NGS 2002-2016 Waste At Design Diagrams

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Light touch small footprint



No excavation

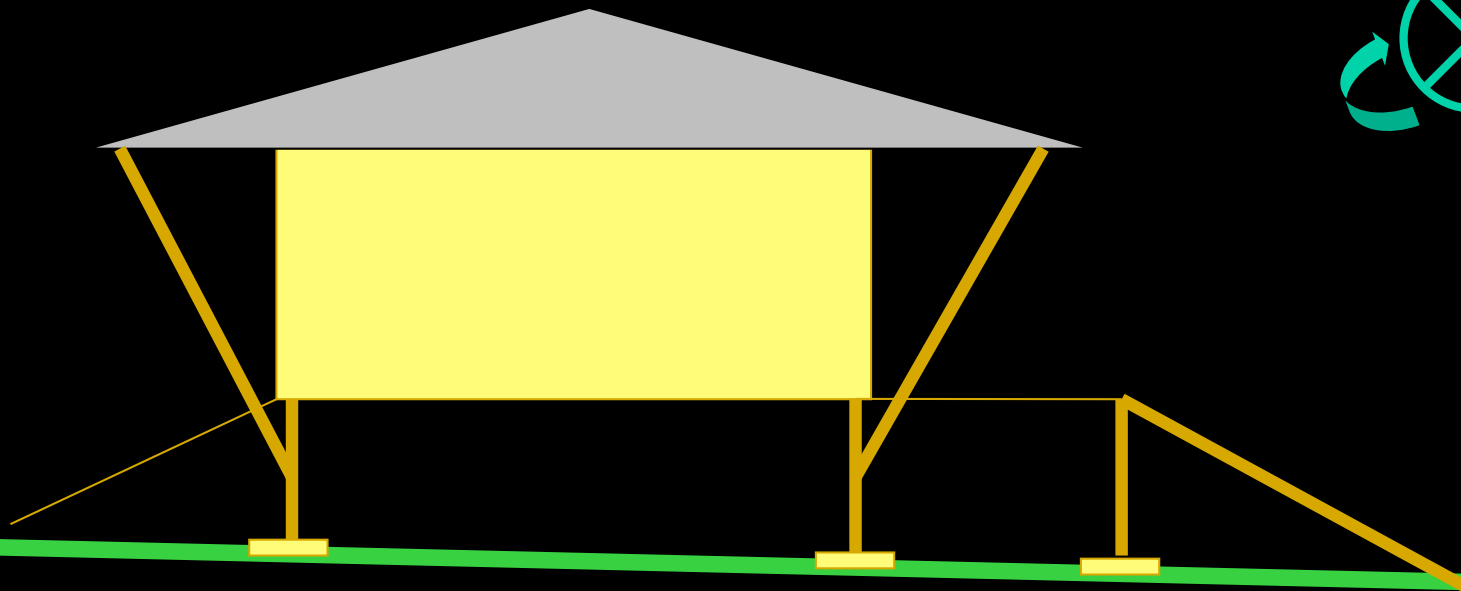
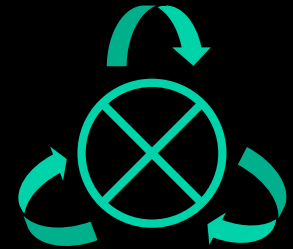
Paving slab foundations

Add living roofs for ballast against wind uplift

Thermal mass, solar protection and acoustic insulation

© GBE NGS 2002-2016 Waste At Design Diagrams

Light touch small footprint



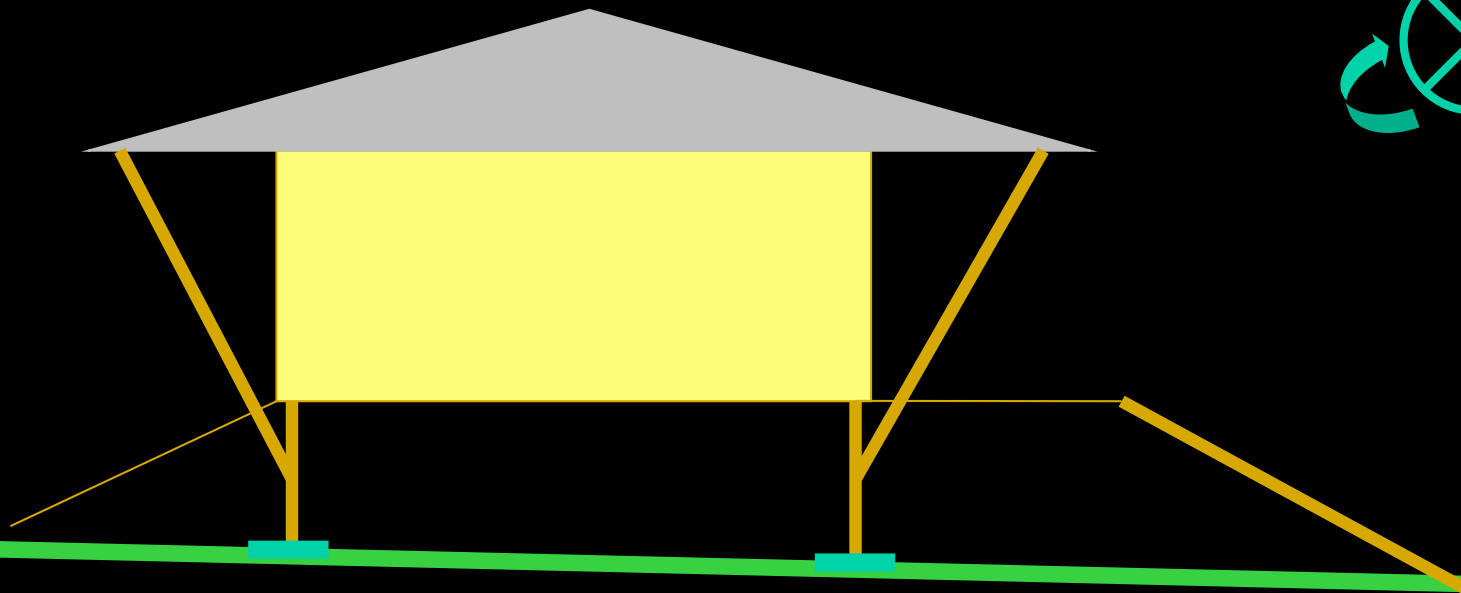
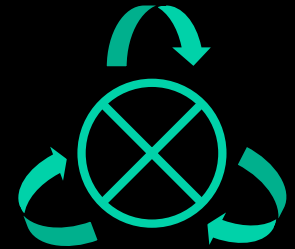
No excavation

Paving slab foundations

+ve wind pressure on roof

© CEF 2016 Waste At Design Diagrams

Storage of spares for maintenance



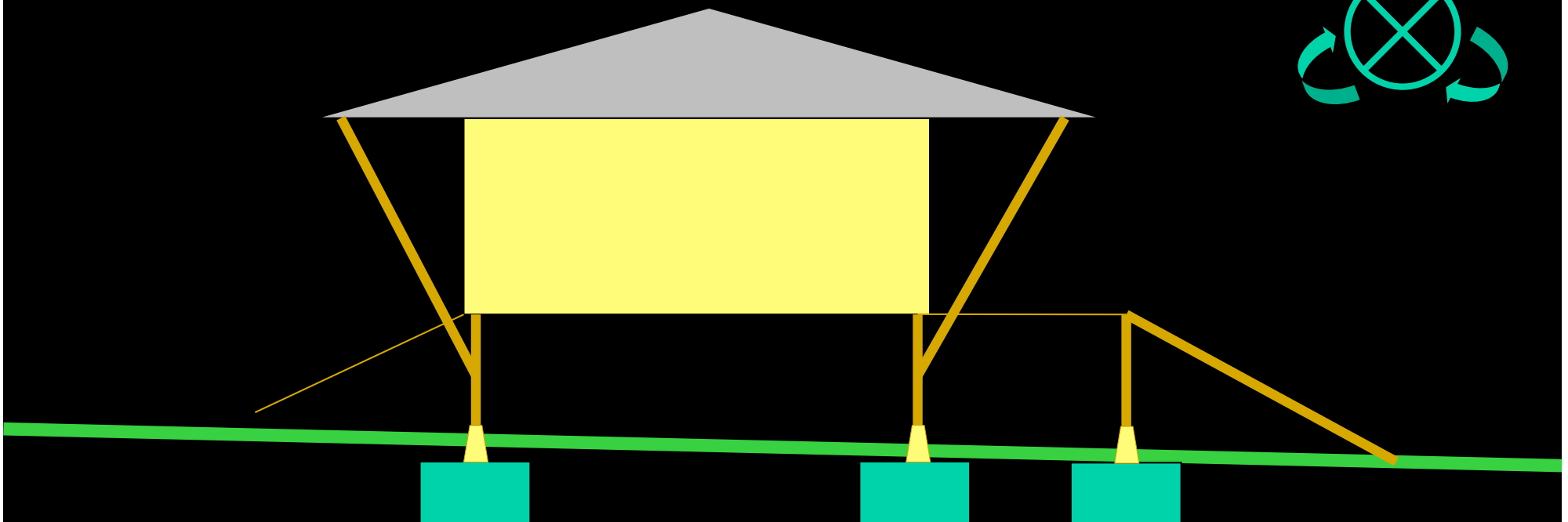
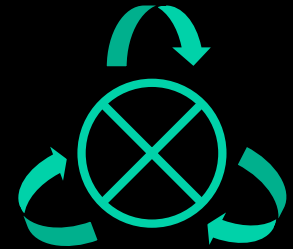
Space under building for storage

Space for flood water

Space for nature

Space for children's play

Light touch bigger footprint



Shallow excavation

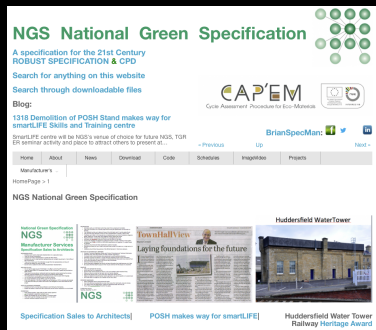
Pad foundations

+ve wind pressure on roof

© CIPENCS 2006/2016 Waste At Design Diagrams

EcoConcrete

- **Reduced OPC Ordinary Portland Cement content** (reduced CO² production) ready blended with % OPC
 - GGBS Ground Granulated Blast-furnace Slag Cement (Slag)
 - PFA Pulverised Fuel Ash
- **Reduced Primary or Virgin Aggregates (sand and gravel)**
 - Secondary aggregates (waste or by-product)
 - Recycled aggregates
 - Recycled concrete aggregates
 - Recycled other materials (glass, plastics, etc.)
 - Manufactured Aggregate
 - (CO₂ + H₂O + particle = Calcium Carbonate) Carbon8Systems
- **Mains drinking water supply**



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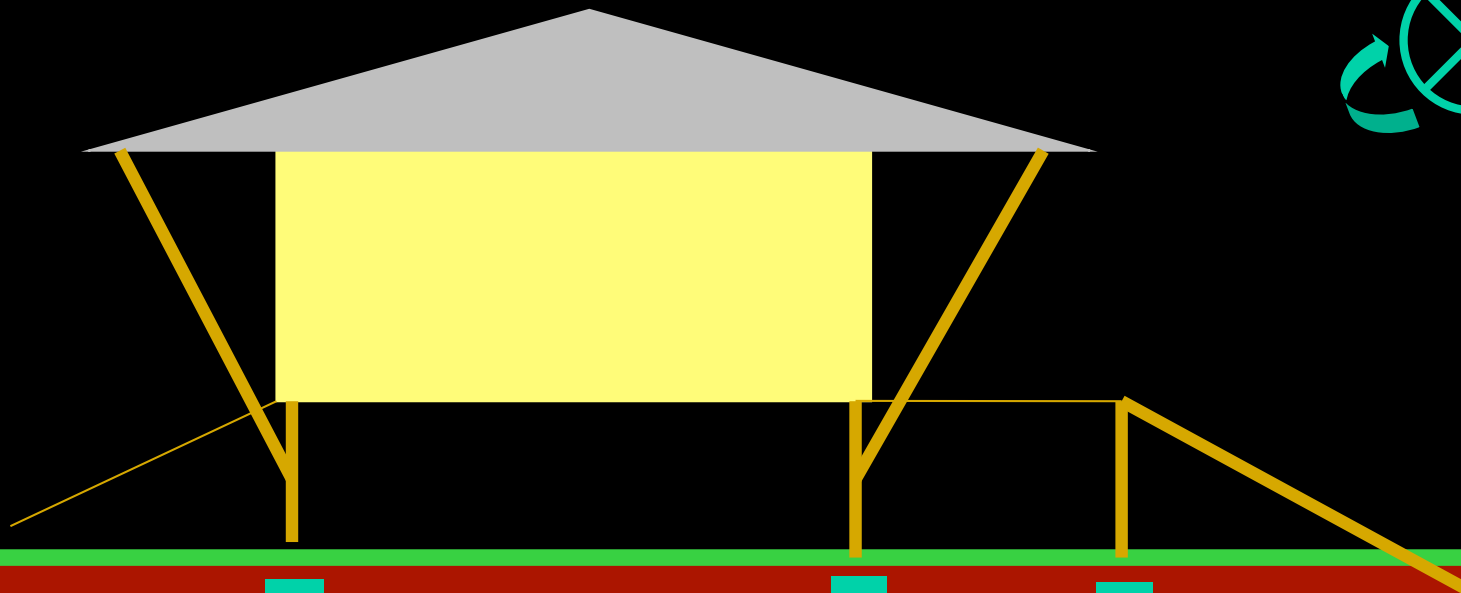
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Driven Piled Foundations Minimise Arisings

Not so light touch in poor ground



Driven (ram/piston in preference to hammer)

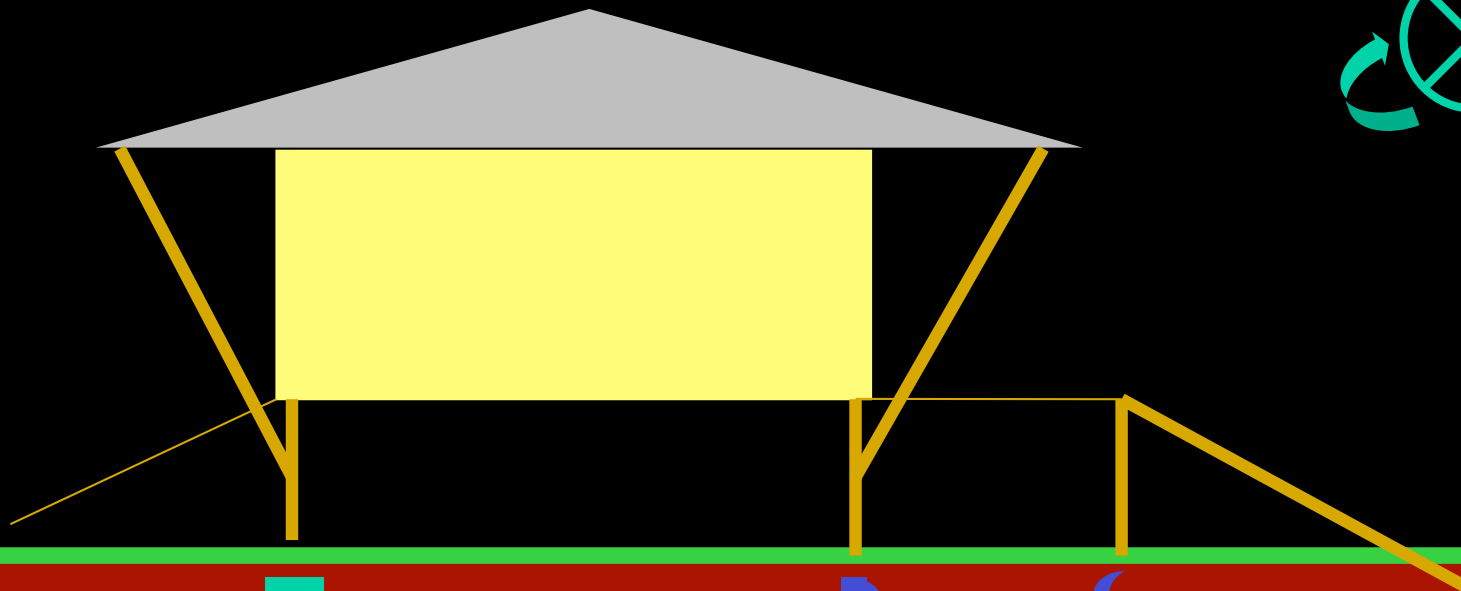
eco-concrete piles in soft ground

No excavation arisings

No ground/ring beams

No excavation arisings

Not so light touch in poor ground



Piles in many forms
Precast eco-concrete
Steel Auger
Steel Corkscrew

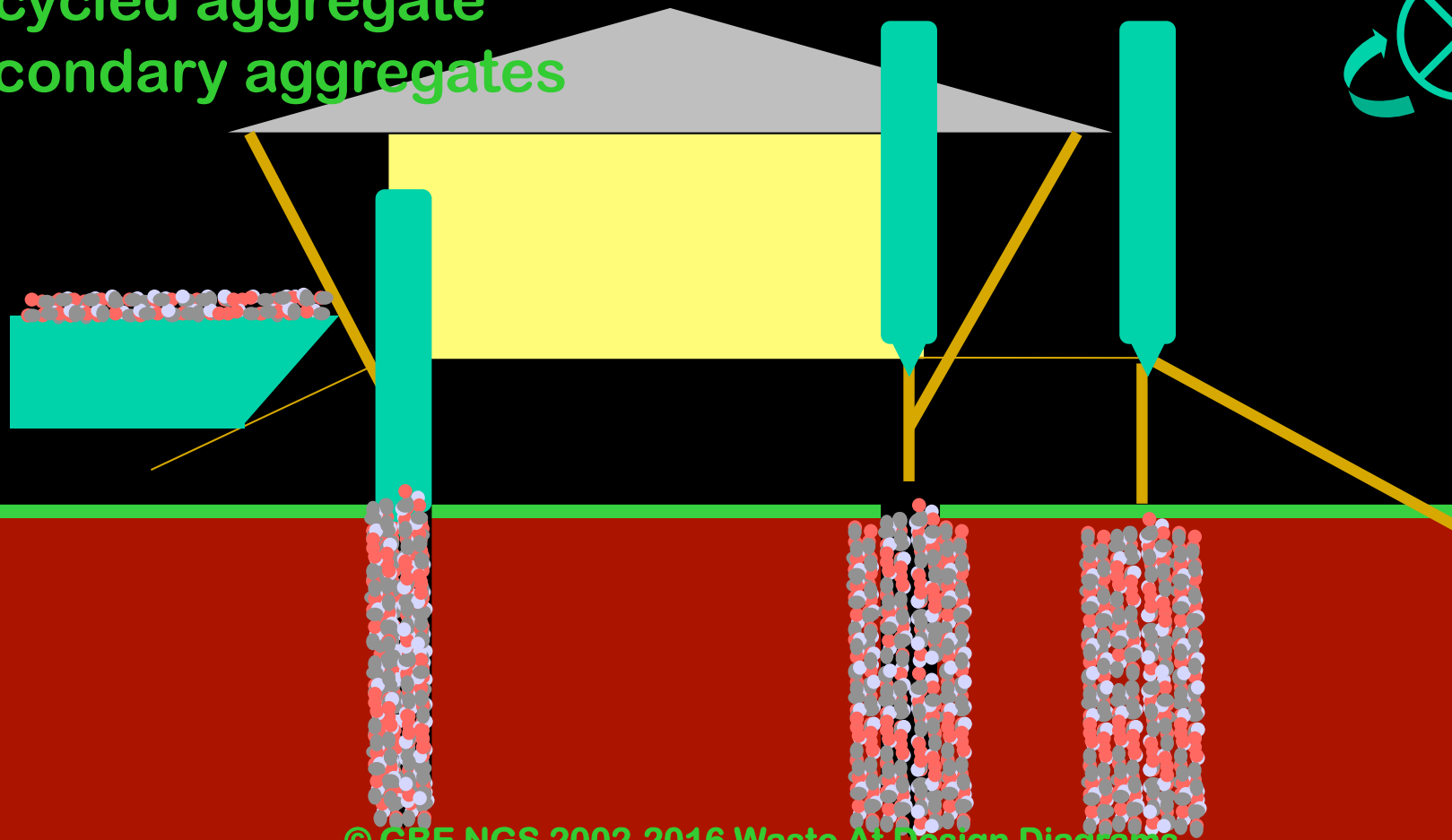
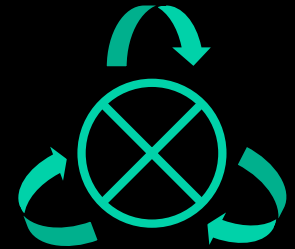
Not so light touch in poor ground

Piles in many forms

Recycled concrete aggregate vibrated pile

Recycled aggregate

Secondary aggregates

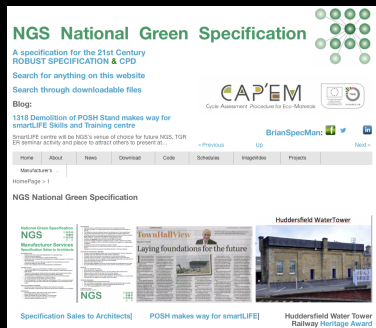


Existing piles & Transfer slabs



Existing piles

Transfer slab to transfer loads from columns to piles



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Investing in Opportunities



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Dynamic consolidation improves ground & simplifies foundations

Dynamic Consolidation

Dynamic Consolidation of subsoil to improve load bearing capacity

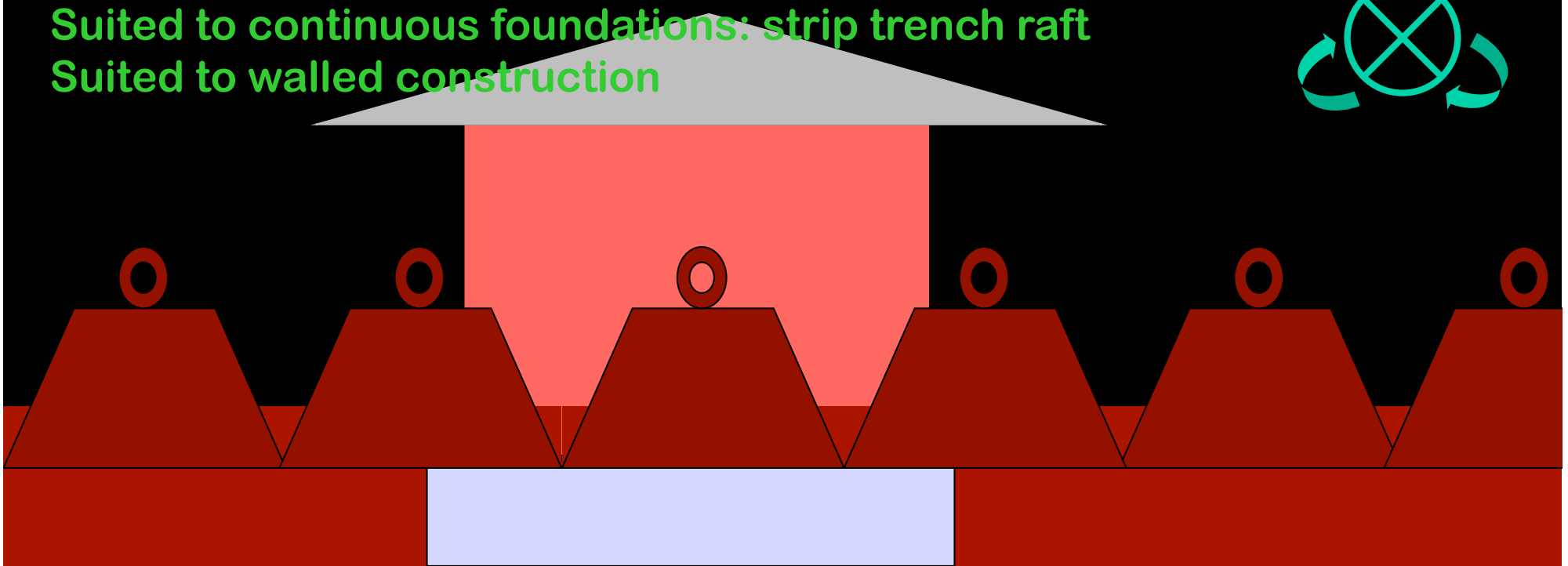
Heavy touch in poor ground

Noise and Vibration issues for neighbours

Lowering of site level

Suited to continuous foundations: strip trench raft

Suited to walled construction



Dynamic Consolidation

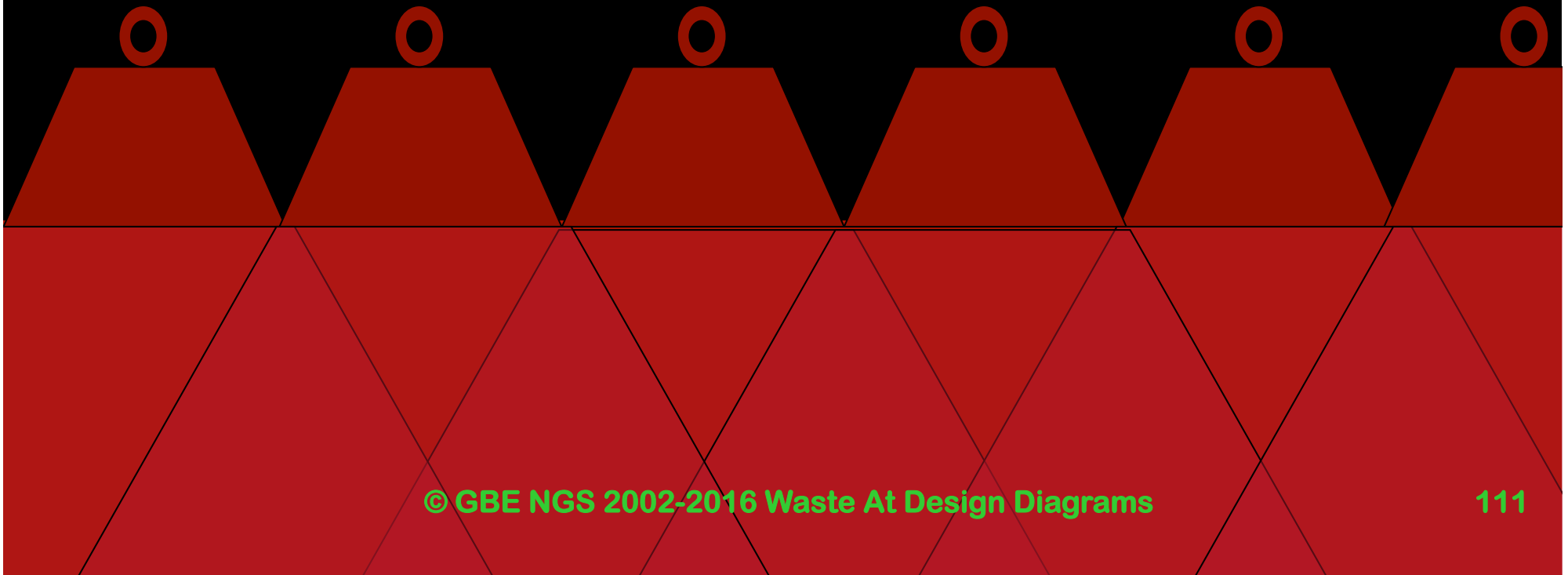
Dynamic Consolidation of subsoil to improve load bearing capacity

Heavy touch in poor ground

Spaced affects capacity lower down

Angle depends on soil types

Closer centres bring bearing capacity closer to surface



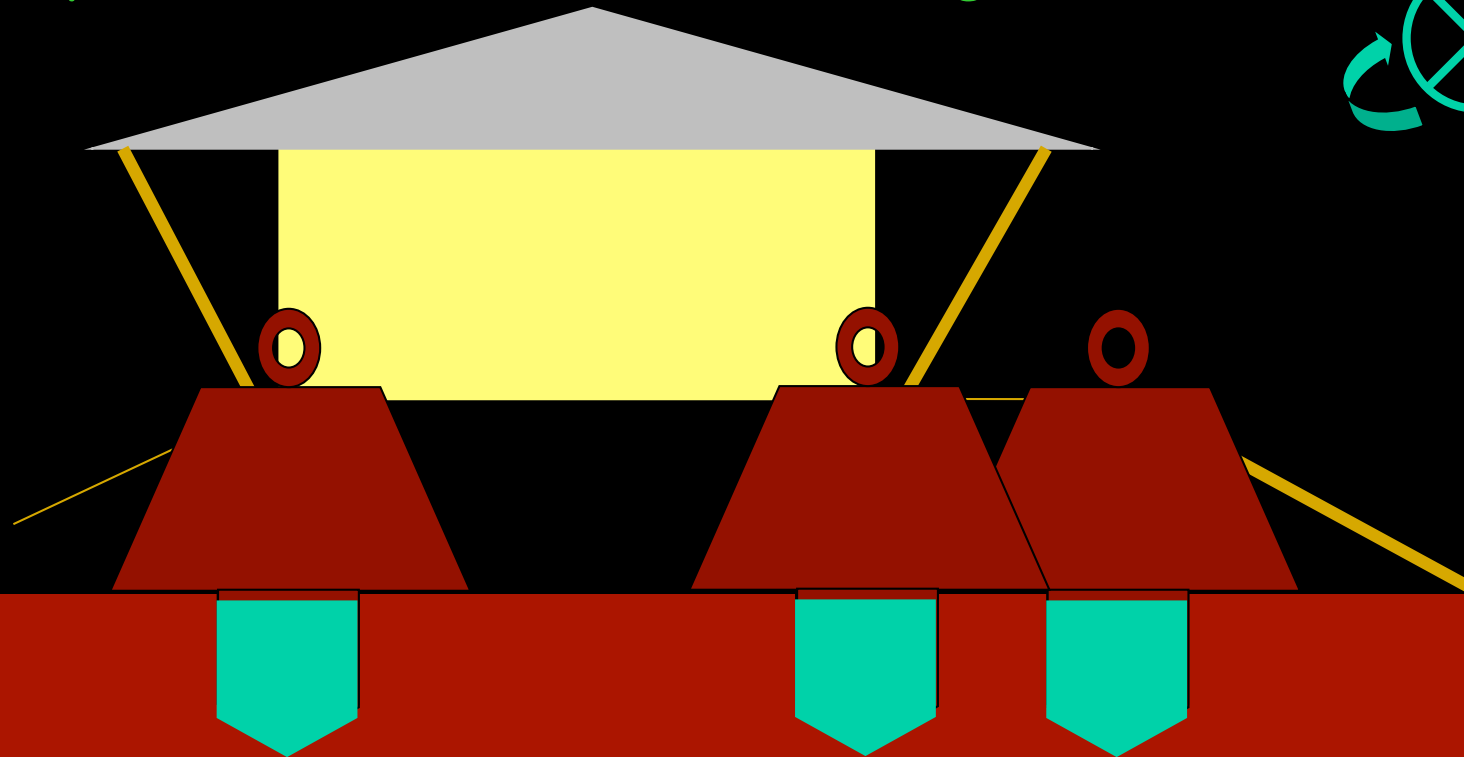
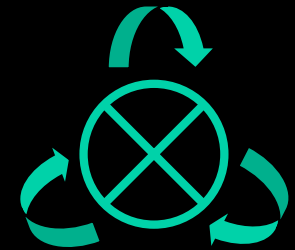
Heavy touch in poor ground

Dynamic Consolidation of subsoil to improve load bearing capacity

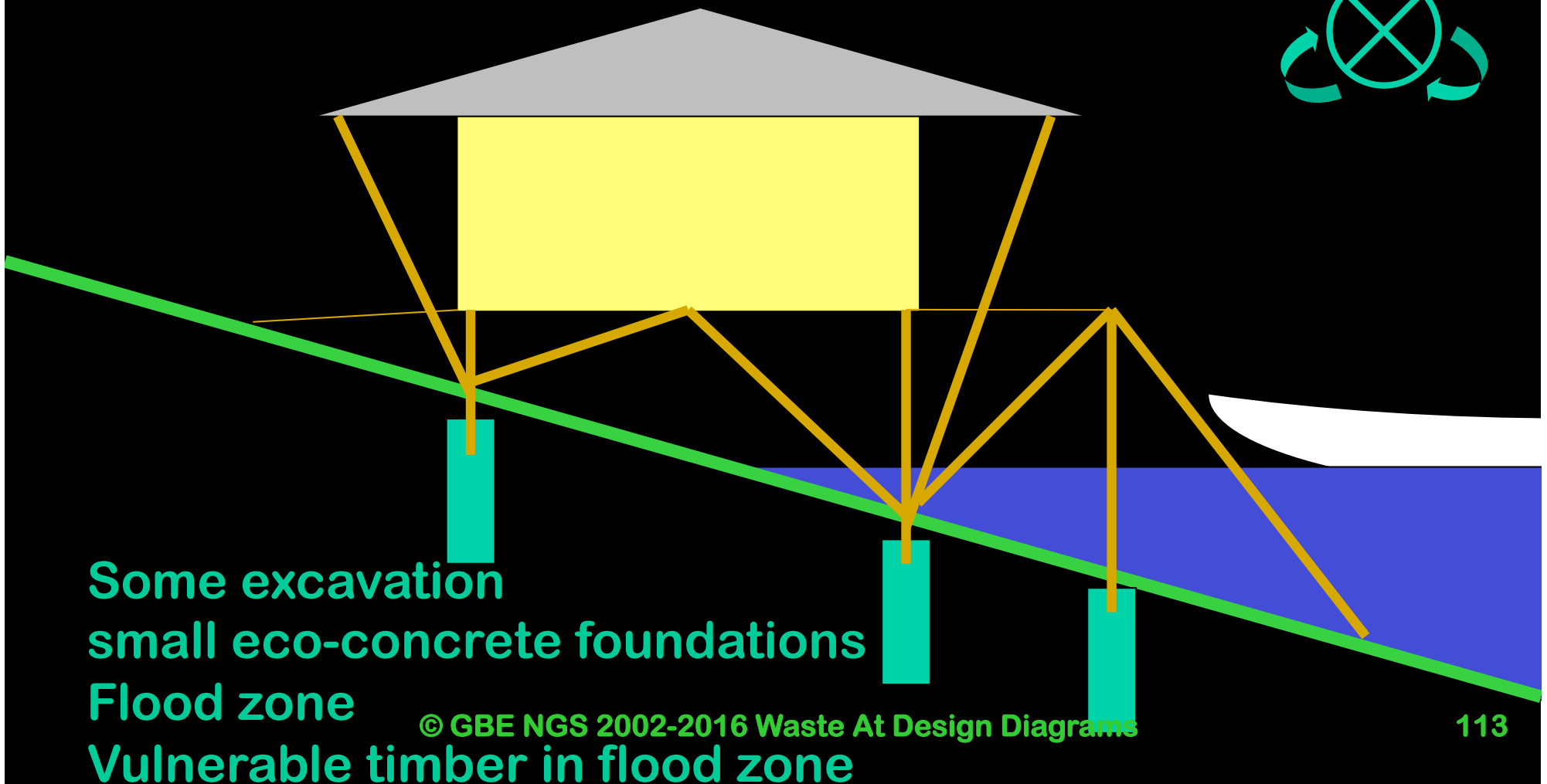
Noise and Vibration issues

Lowering of site level

Pockets for pad foundation for framed buildings



Light touch small footprint

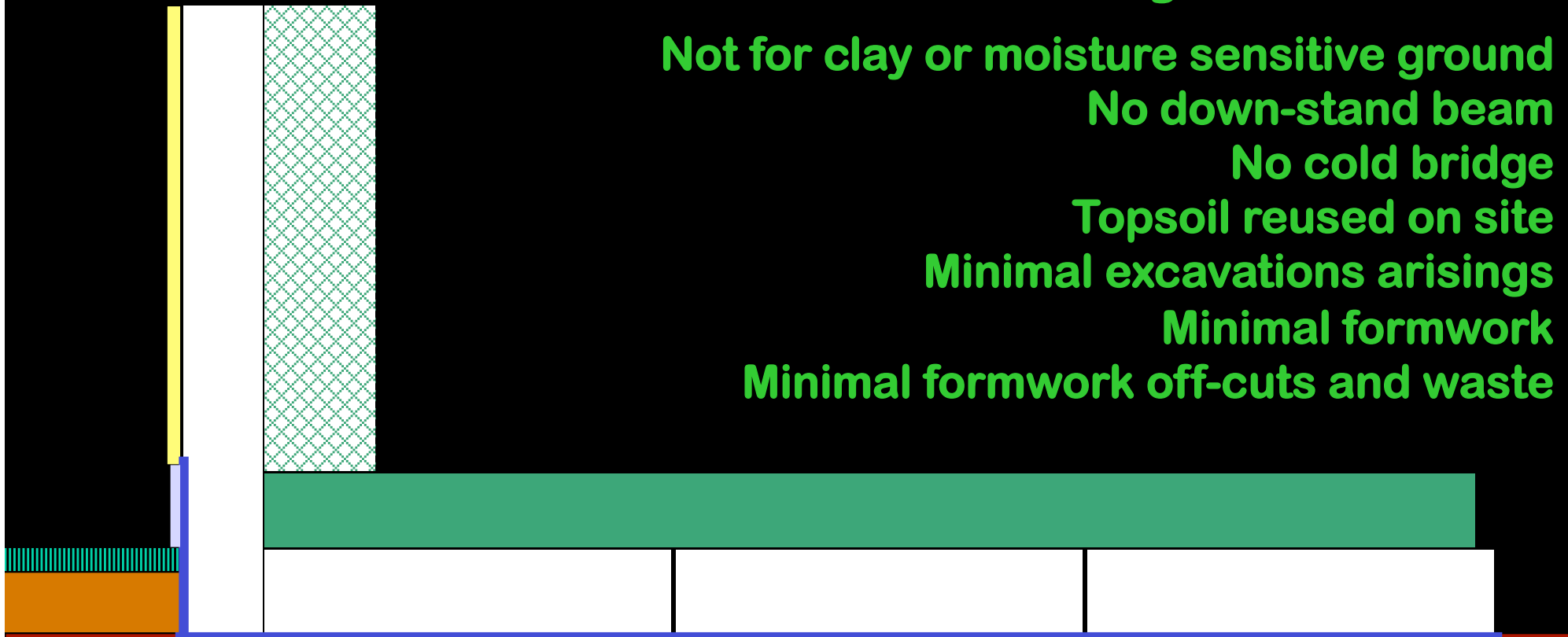


Some excavation
small eco-concrete foundations
Flood zone
Vulnerable timber in flood zone

Resource Efficiency: Concrete Ground Floor Slab Formwork

Layered Construction
Simplifies Details

Insitu eco-concrete ground floor and raft foundation on thick insulation layer



Not for clay or moisture sensitive ground

No down-stand beam

No cold bridge

Topsoil reused on site

Minimal excavations arisings

Minimal formwork

Minimal formwork off-cuts and waste

Some Structural Engineer's not happy to do this

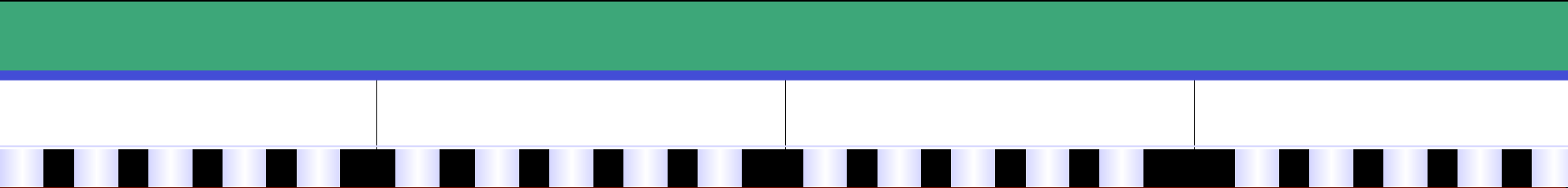
Insitu eco-concrete ground floor/ raft foundation on thick insulation layer

Not for clay & moisture sensitive subsoil
Thickening of floor at edge no cold bridges
Topsoil reused on site
Some excavations arisings
Insulation as formwork
Minimal insulation off-cuts & waste
2 triangles cut from square
DPM to keep insulation dry and effective



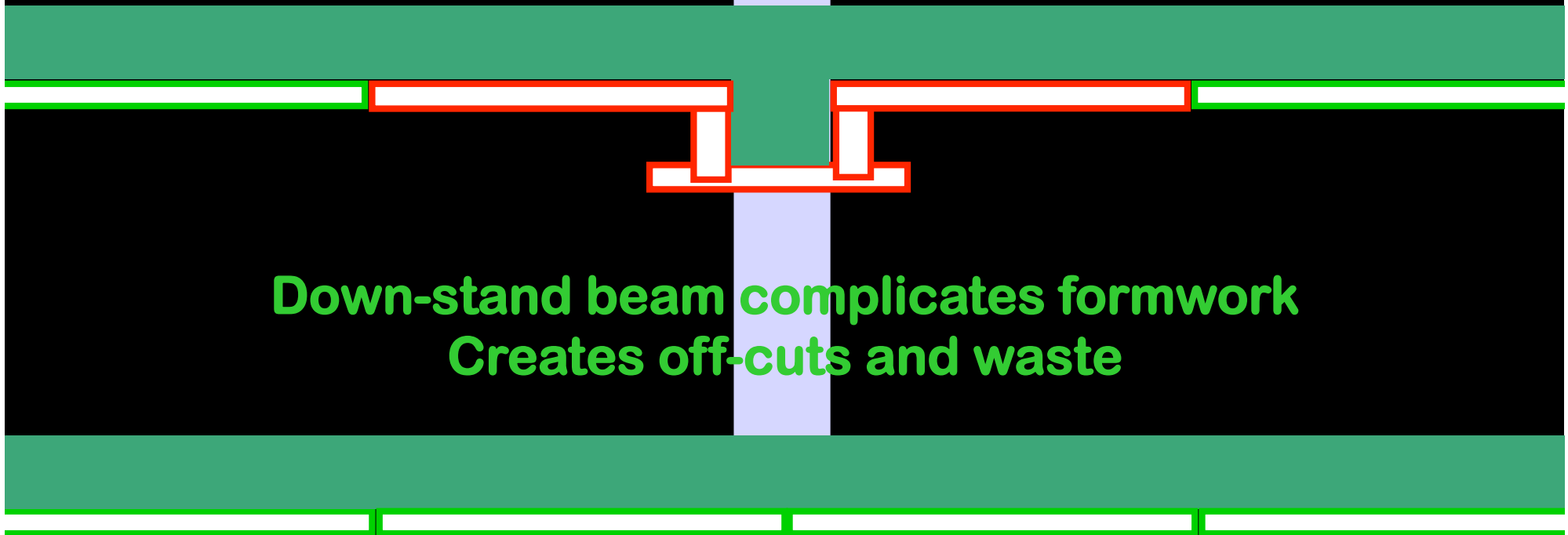
Some Structural Engineers' happier to do this

Insitu eco-concrete ground floor Gas/Damp Proof membrane under slab ventilation & thermal insulation board



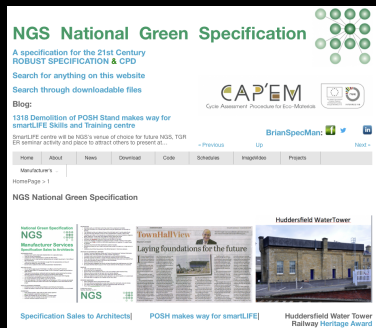
**Flat floors allows use of extensive use of modular insulation
Expanded moulded polystyrene of suitable grade
Minimises waste from off cuts
Assuming the building size or grid reflects their size
Gasses percolating up from site ventilated to perimeter**

Insitu concrete floor slab formwork



**Down-stand beam complicates formwork
Creates off-cuts and waste**

**Flat soffit allows use of modular formwork
Assuming the building grid reflects their size**



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Cycle Assessment Procedure for Eco-impacts of Materials

Investing in Opportunities

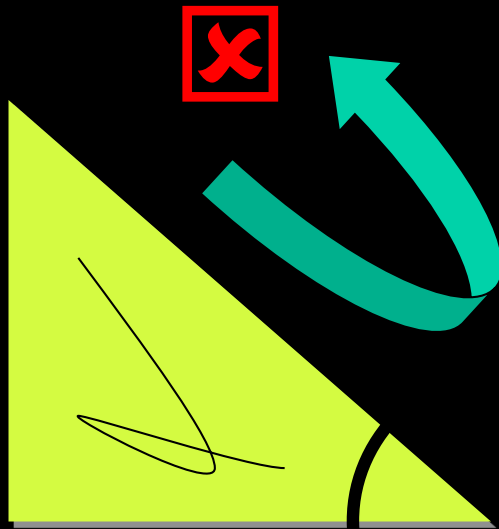


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Development Funding
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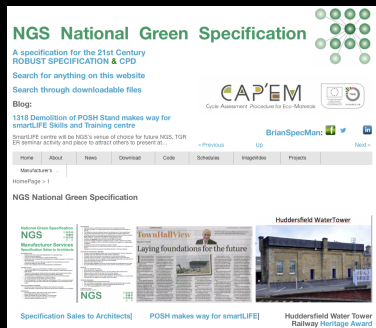


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Resource Efficiency: Return Defects & Protection



Reject & Return Defective Materials



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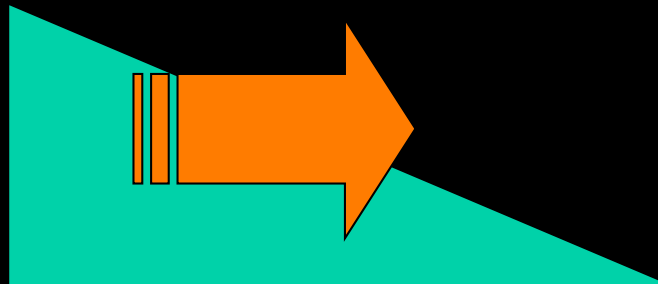
CAP'EM

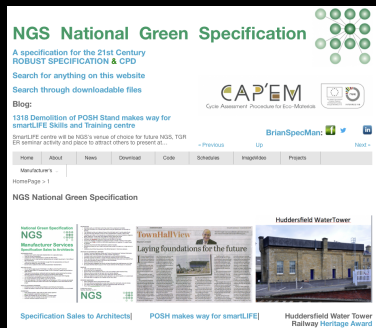
Cycle Assessment Procedure for Eco-impacts of Materials



Return Protective & Packaging Materials

Reduce Demand on materials





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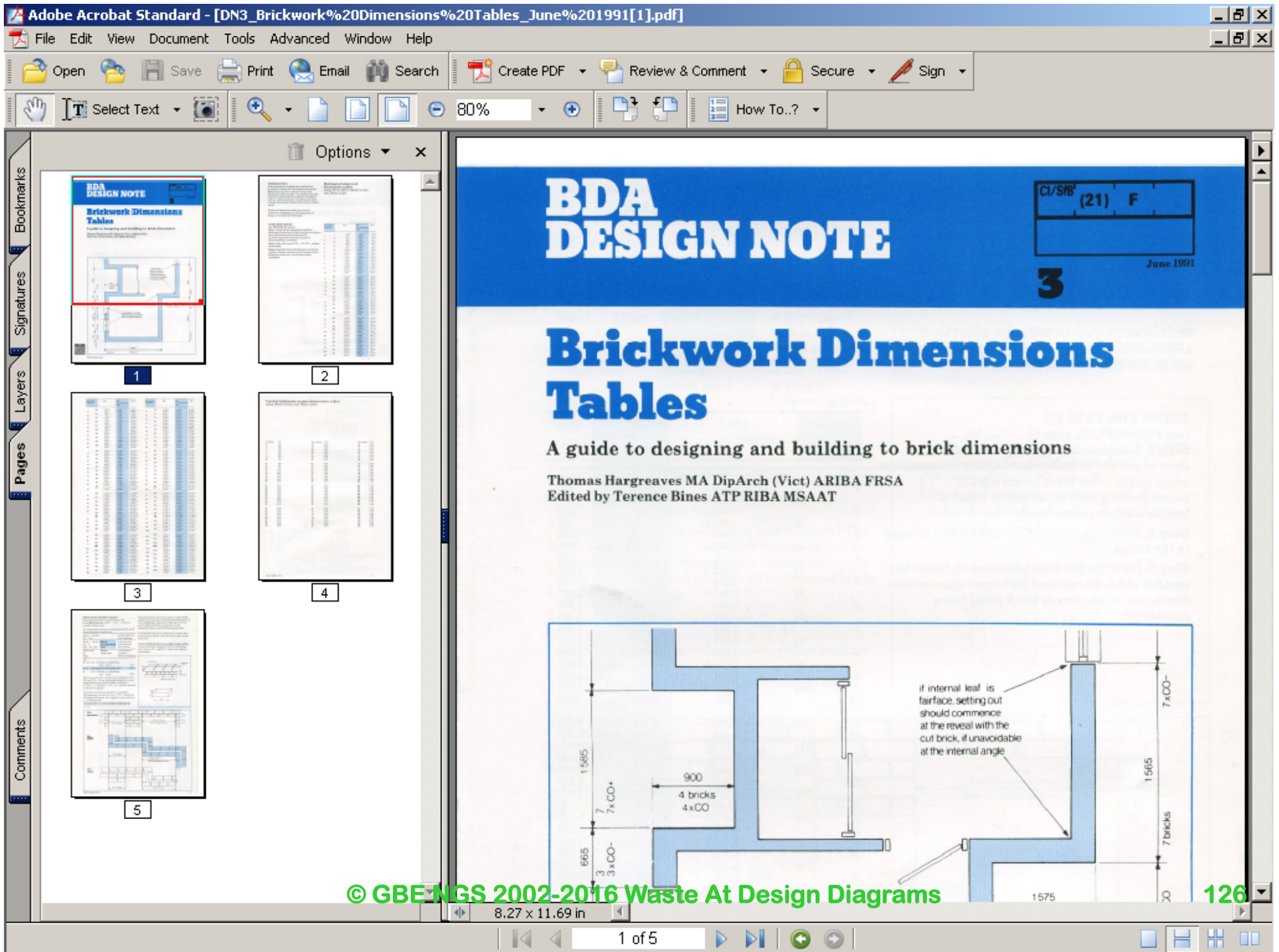


INTERREG IVB

Resource Efficiency: Masonry

Resource Efficiency

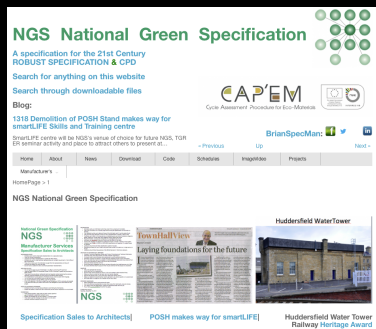
- Design for Deconstruction
- Consider: Fixings & Fasteners
- Avoid: adhesives
- Lime based mortar allows reclamation of the bricks at end of building life





Elizabeth Fry Building UEA

Was one of the most energy efficient buildings in the UK
Also resource efficient co-ordinated design little cutting waste



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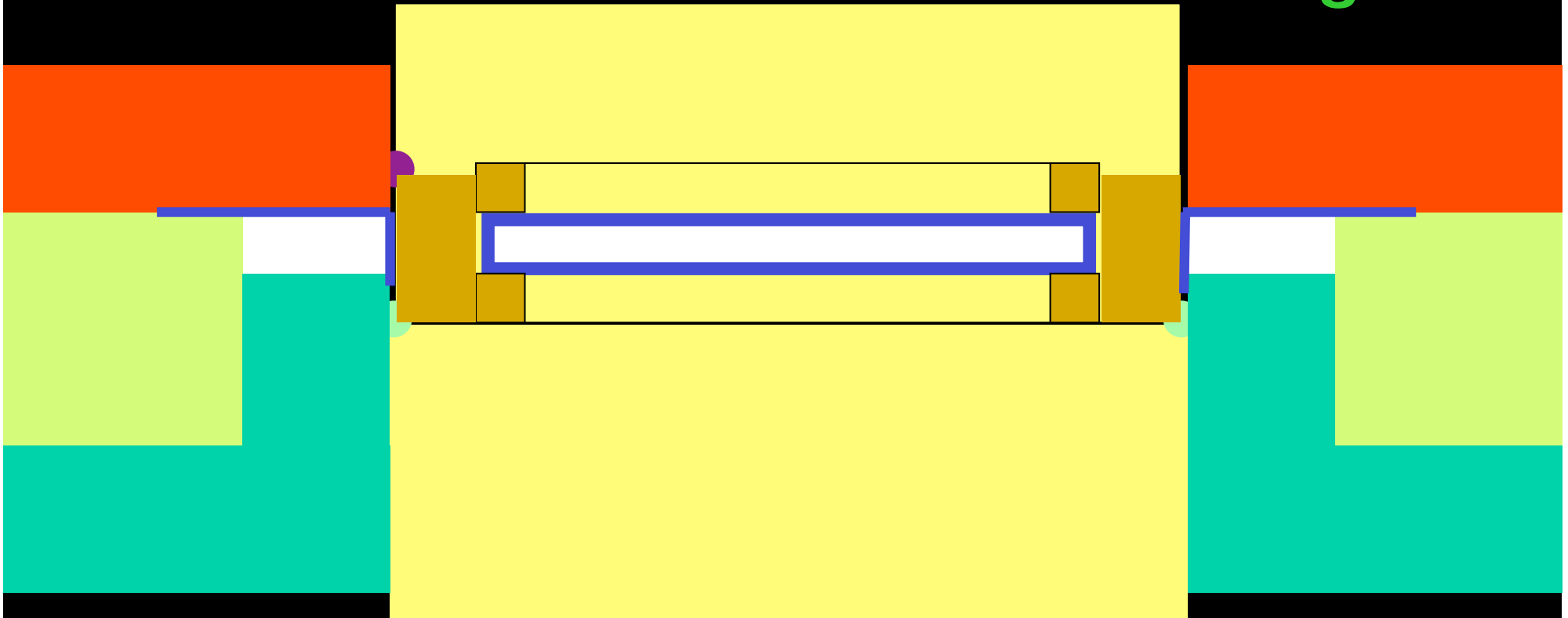


INTERREG IVB

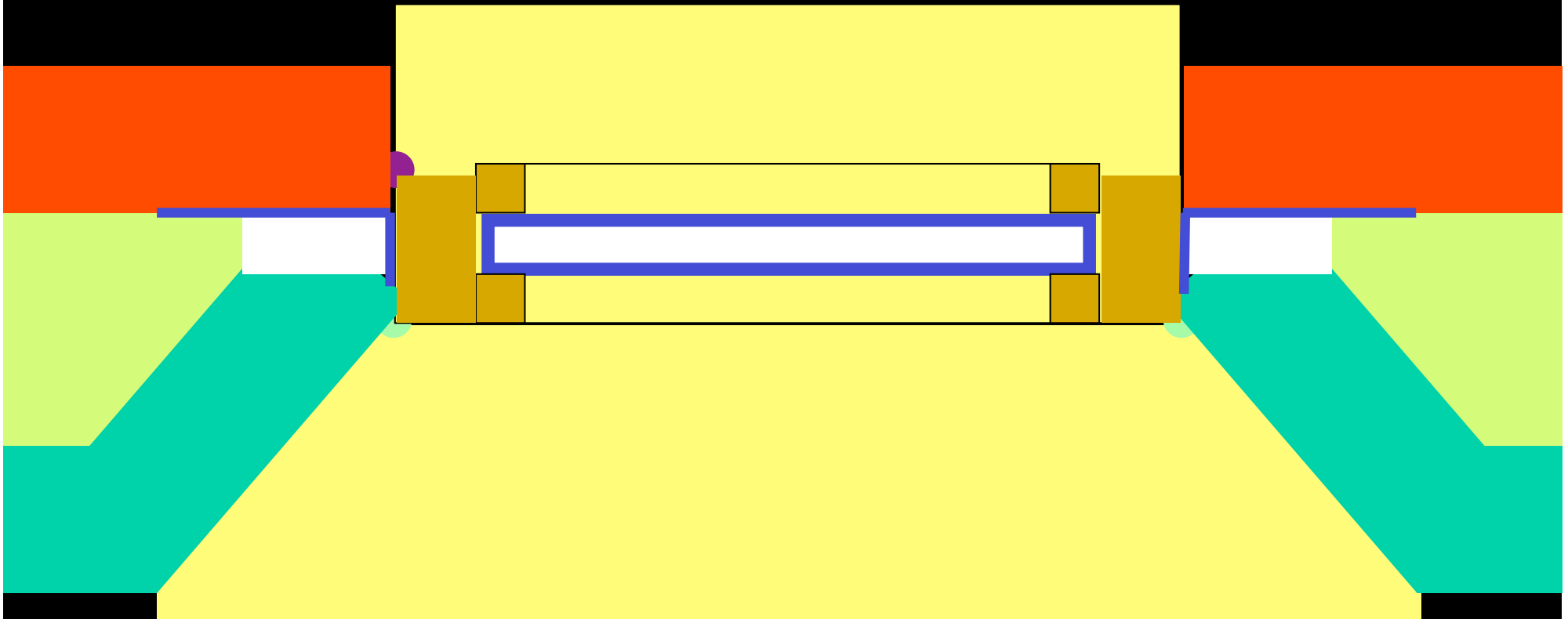
Resource Efficiency: Masonry at openings

Openings in walls: Plan View

- Block inner leaf return generates waste from off-cuts and creates a cold bridge

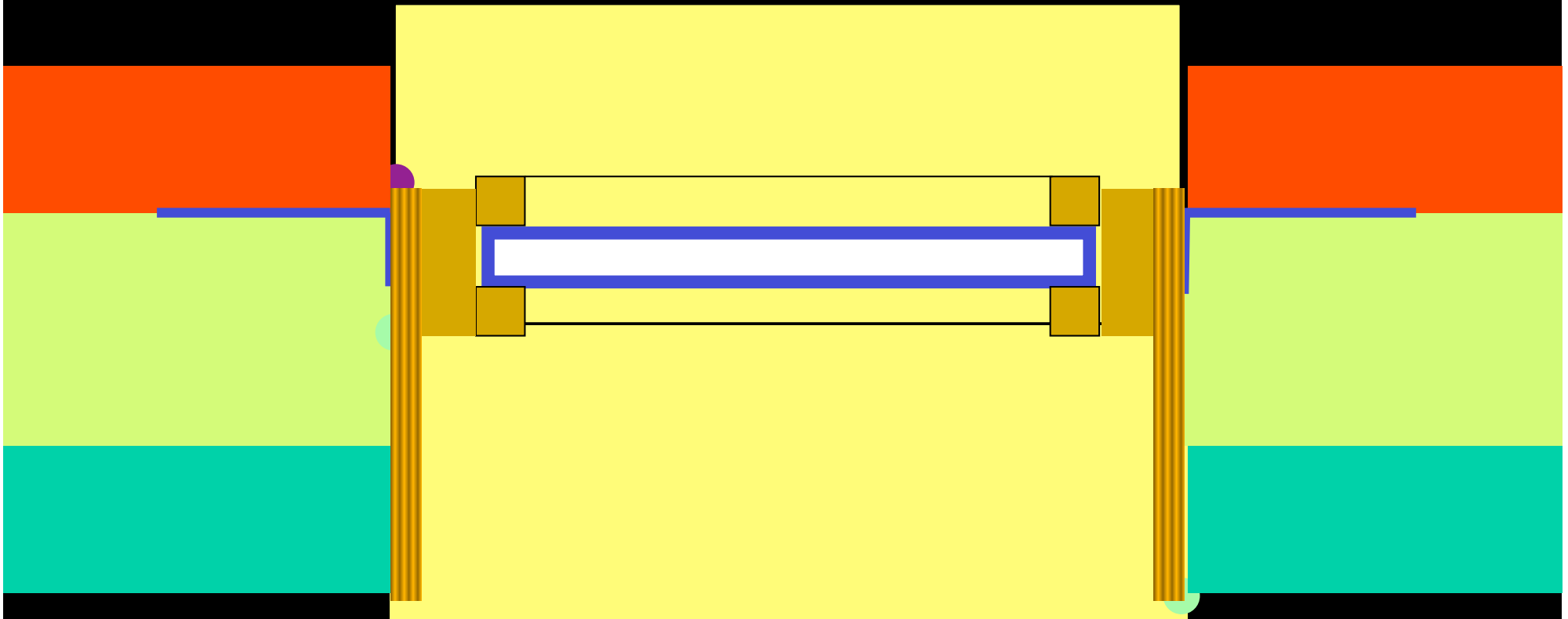


Maximise light penetration
Minimise glare
Generates waste off cuts

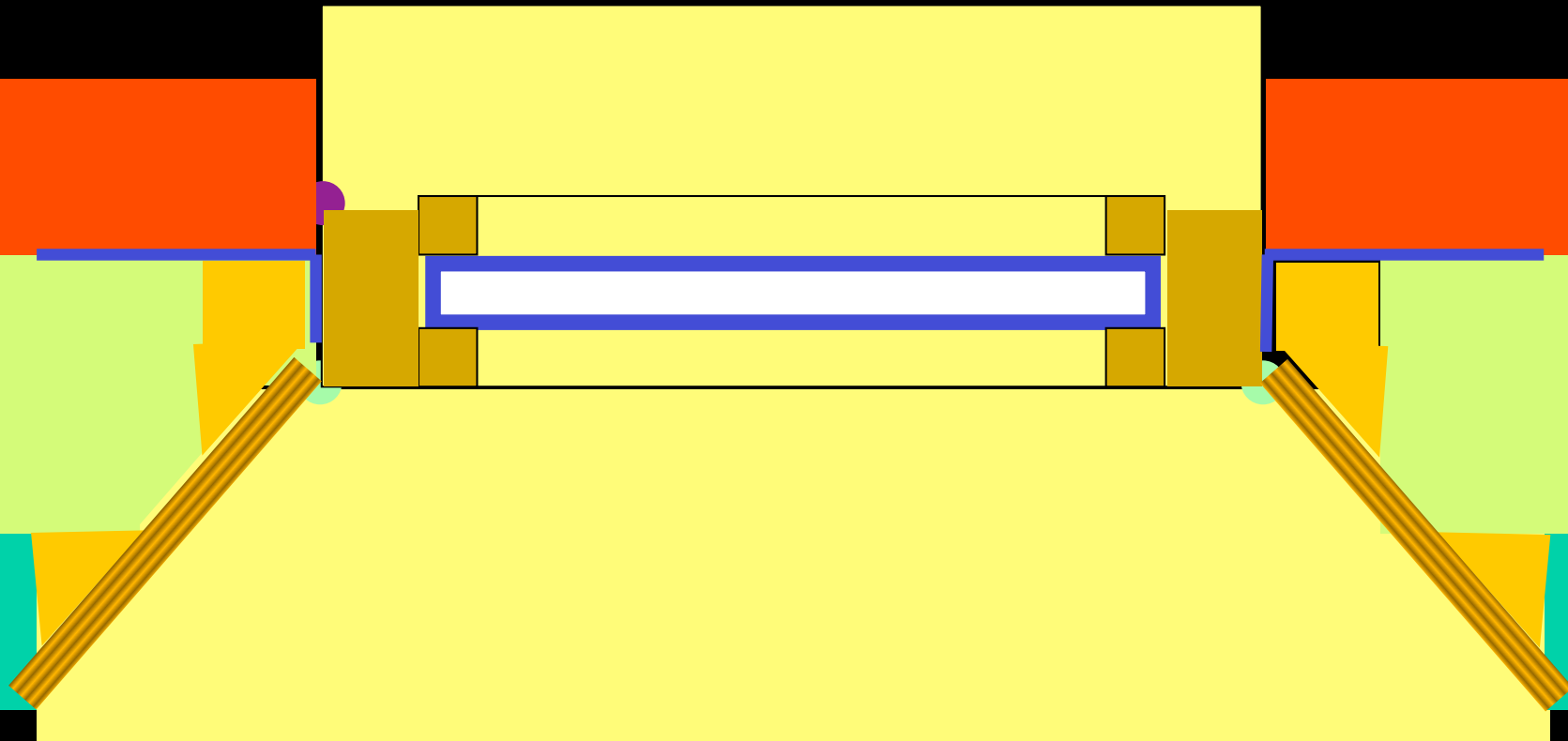


Openings in walls: Plan view

- Omit inner leaf returns: close cavity with window box
- Install window in window box



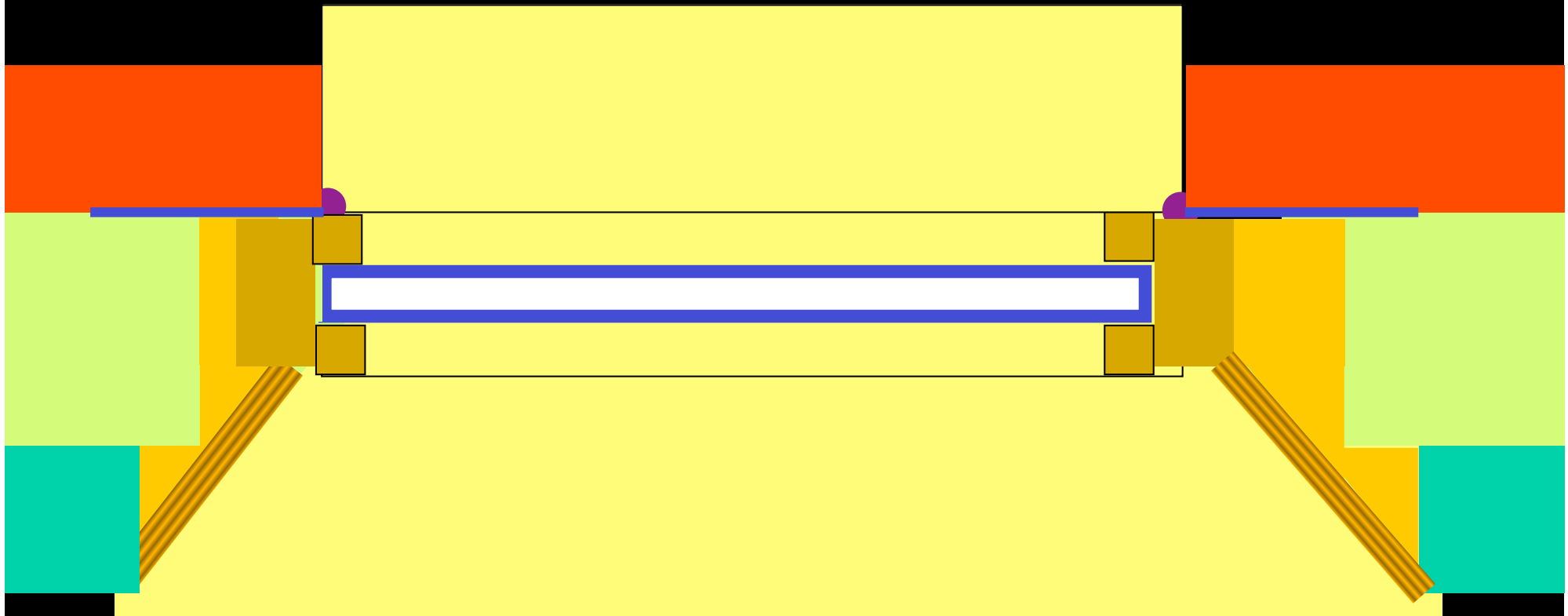
Maximise light penetration
Minimise glare
Generates waste off cuts



Reduce off-cut waste in blockwork

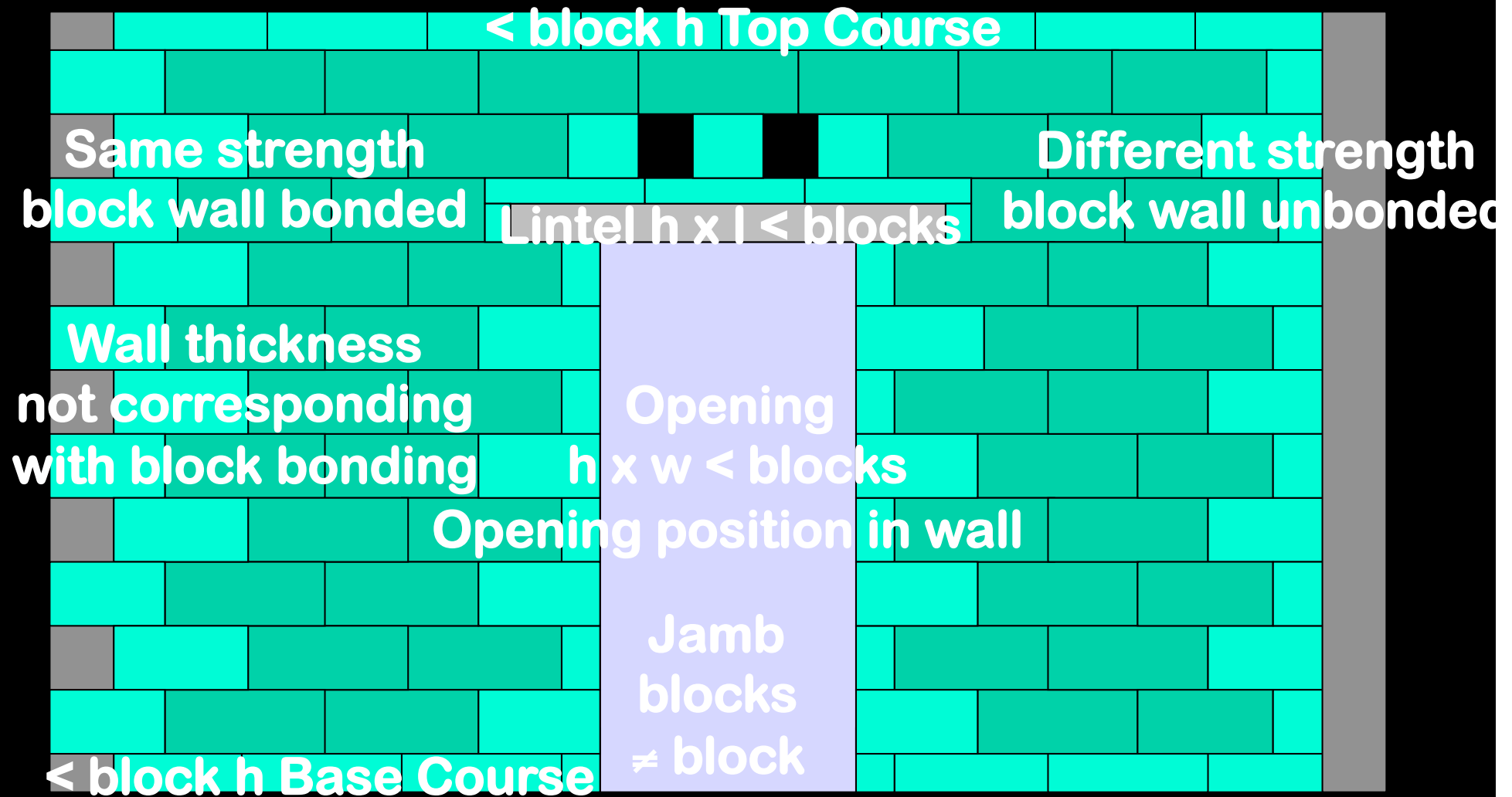
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Maximise light penetration
Minimise glare
Generates waste off cuts

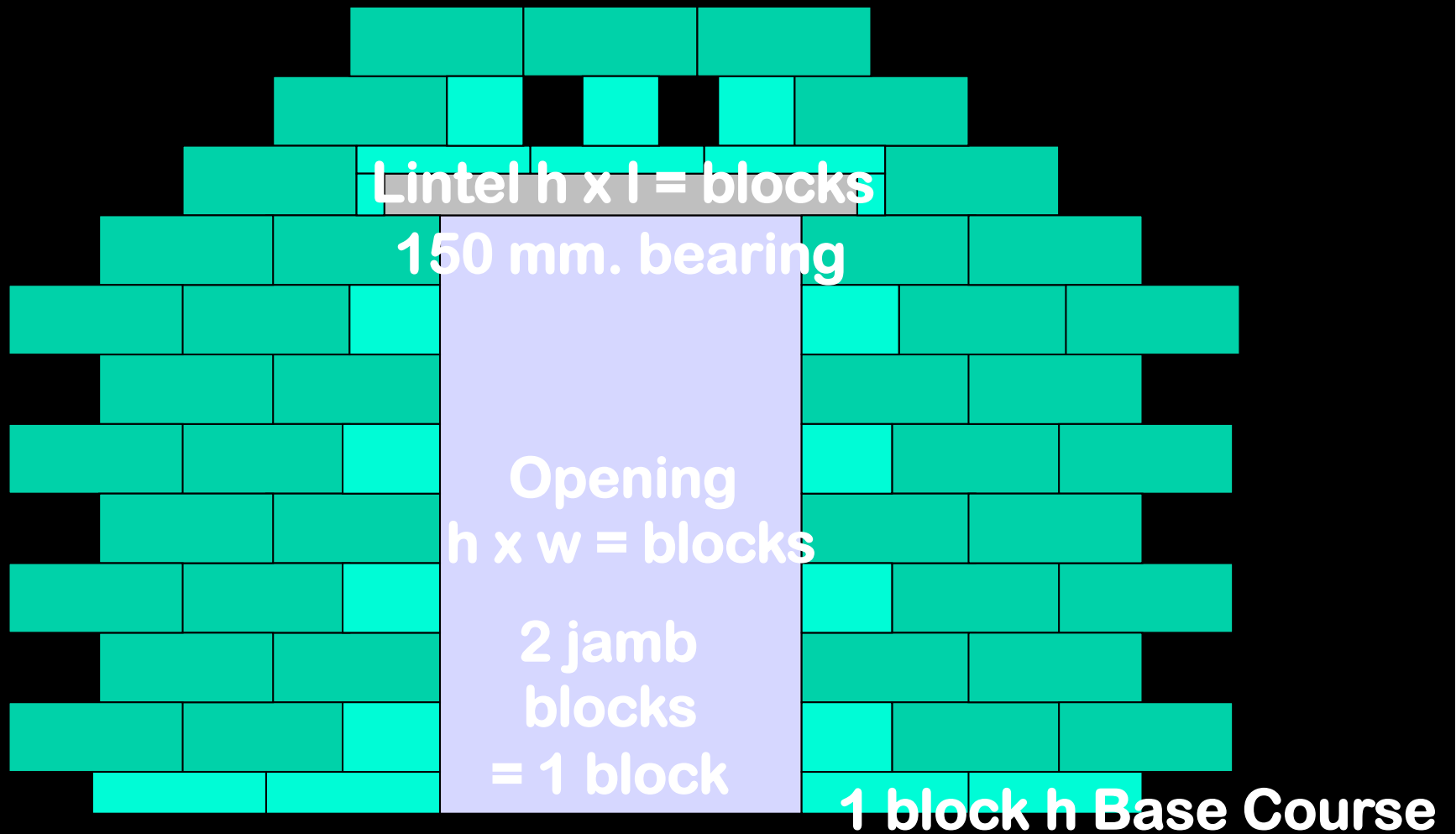


Reduce offcut waste in blockwork

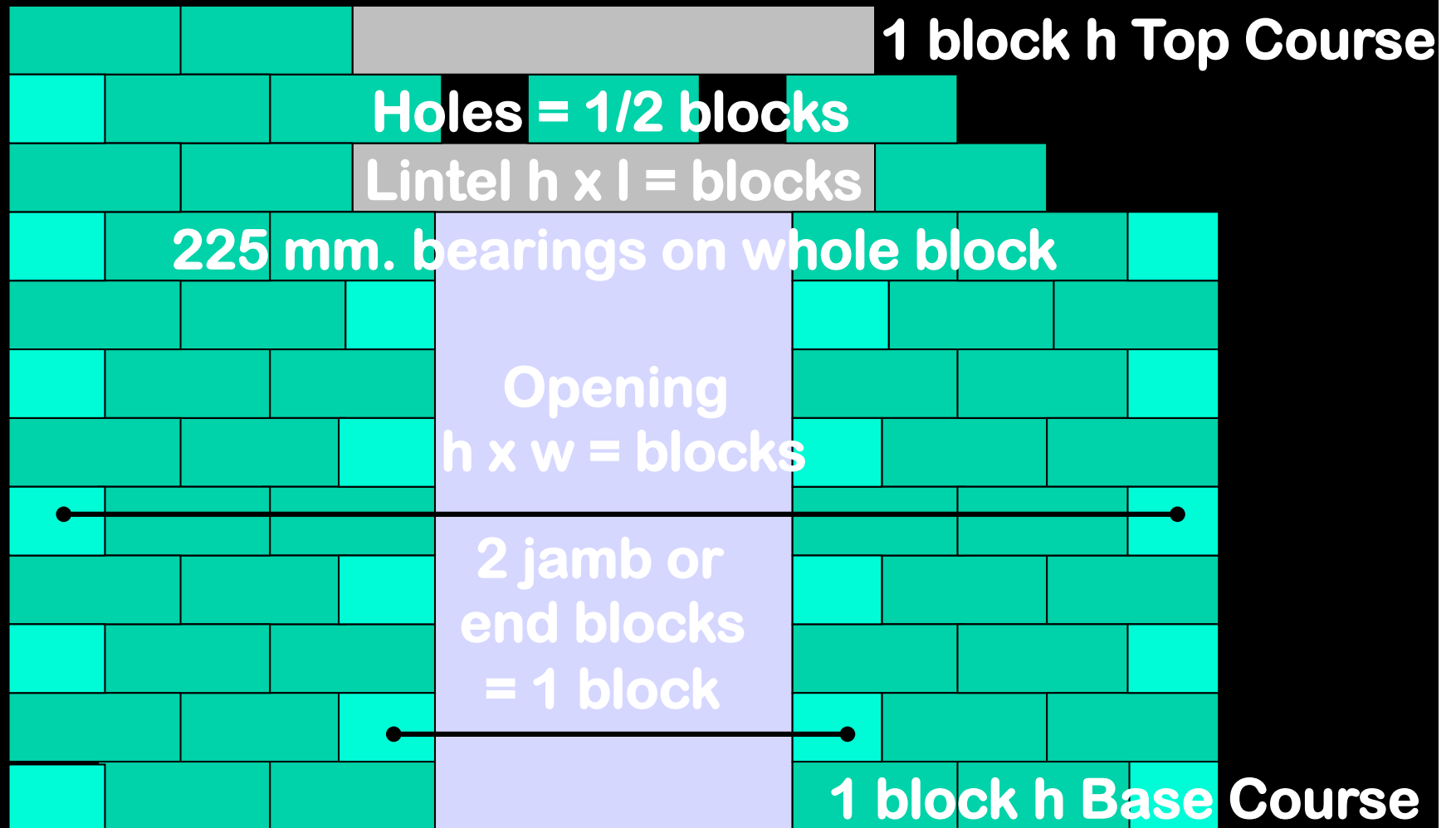
No Design: Offcuts 33%+



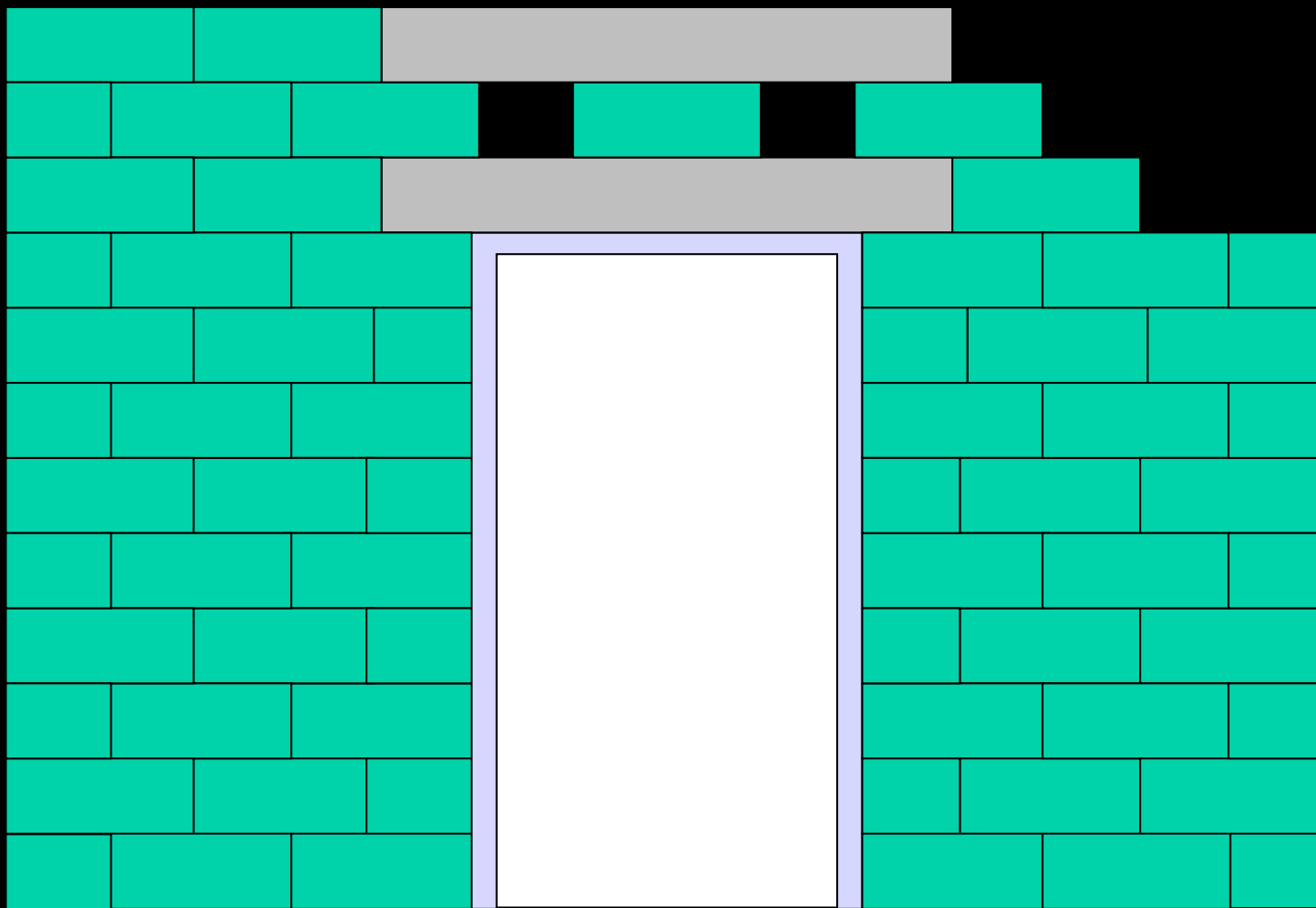
Off-cut waste 33%



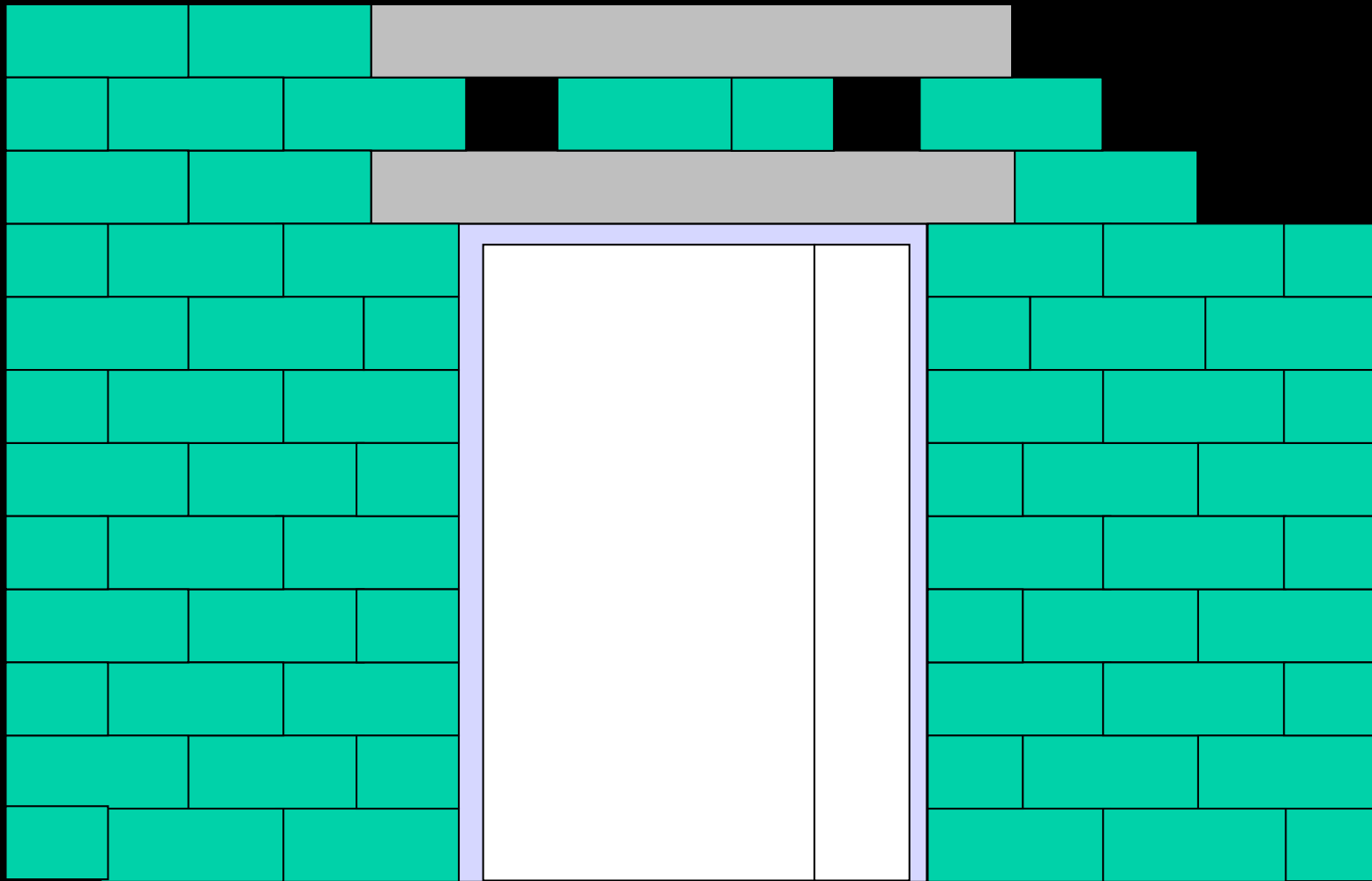
Modular design: considerably less than 33%



Doorsets to fit openings



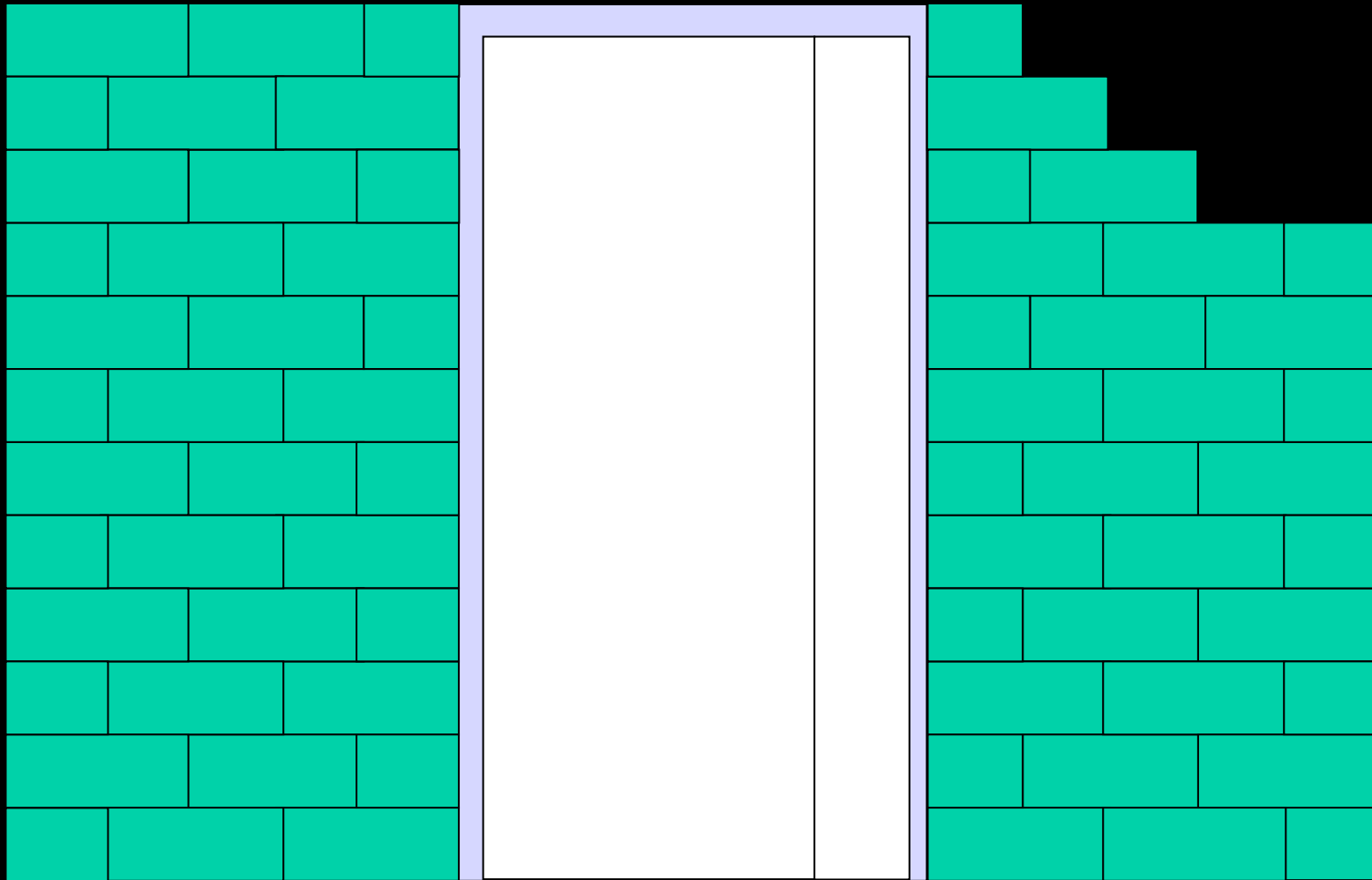
Doorsets to fit openings



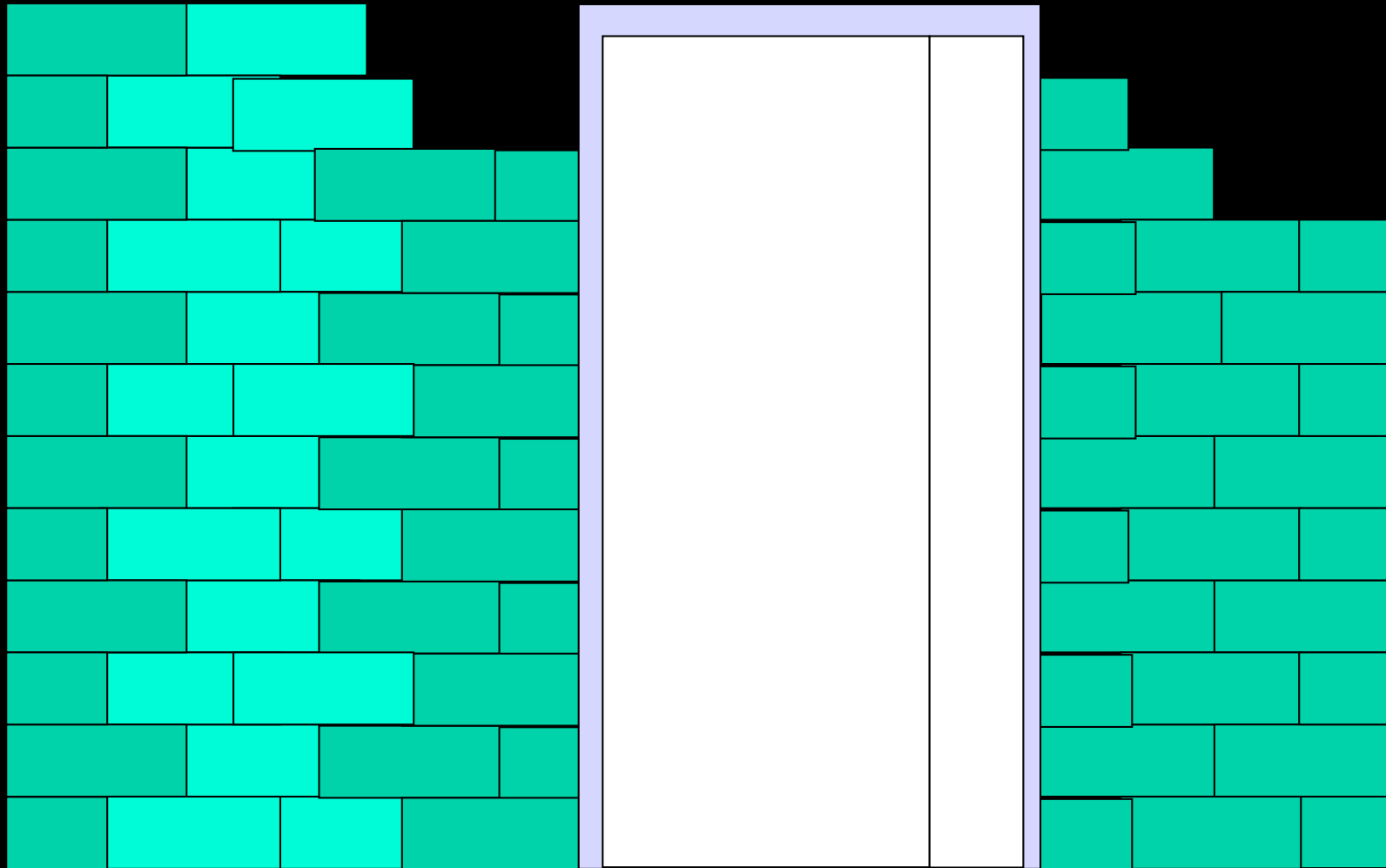
Fire regulation dictates overall door width,
Opening: block sizes, Standard Door + half leaf: size to suit

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Doorsets to fit floor heights

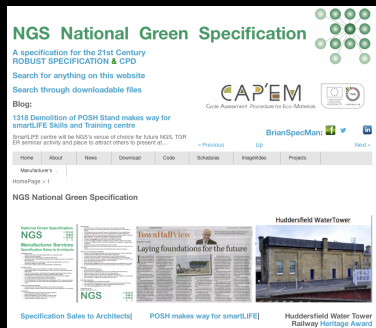


Blocks cut short in wall



Irregular pattern of block alignment

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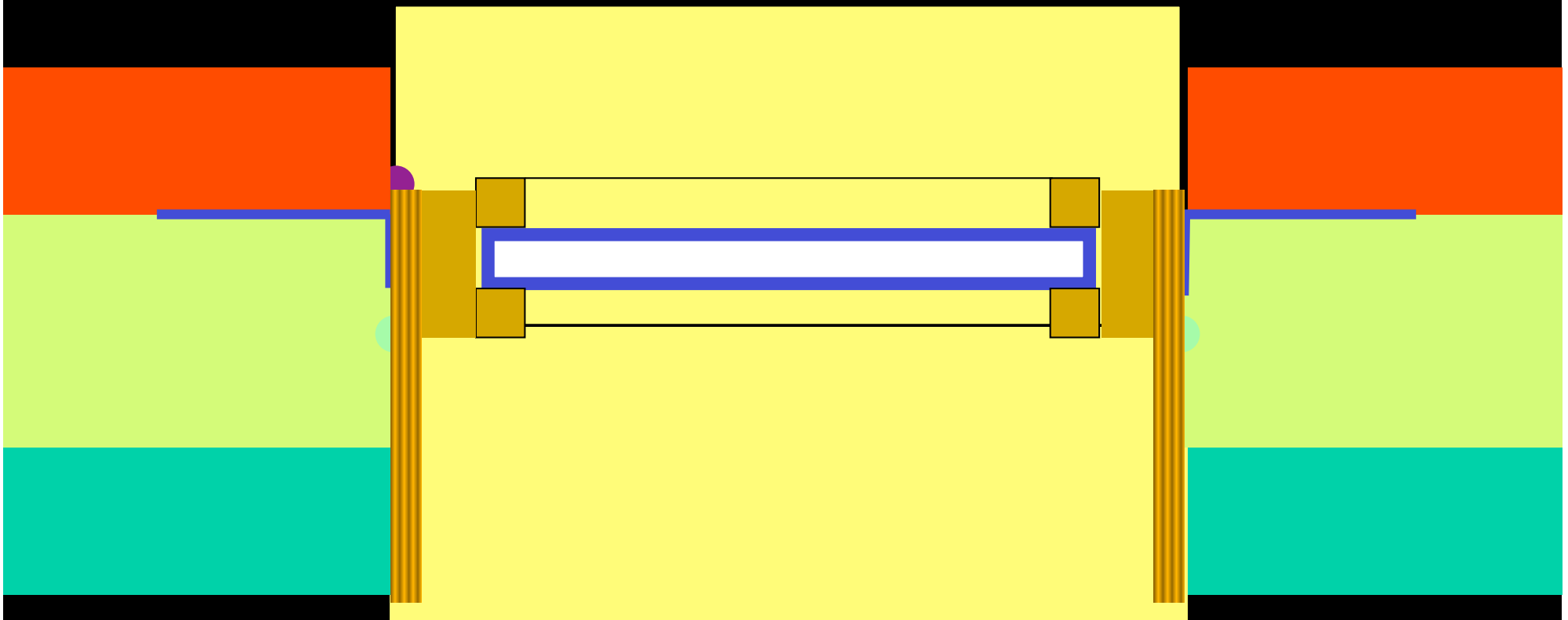


INTERREG IVB

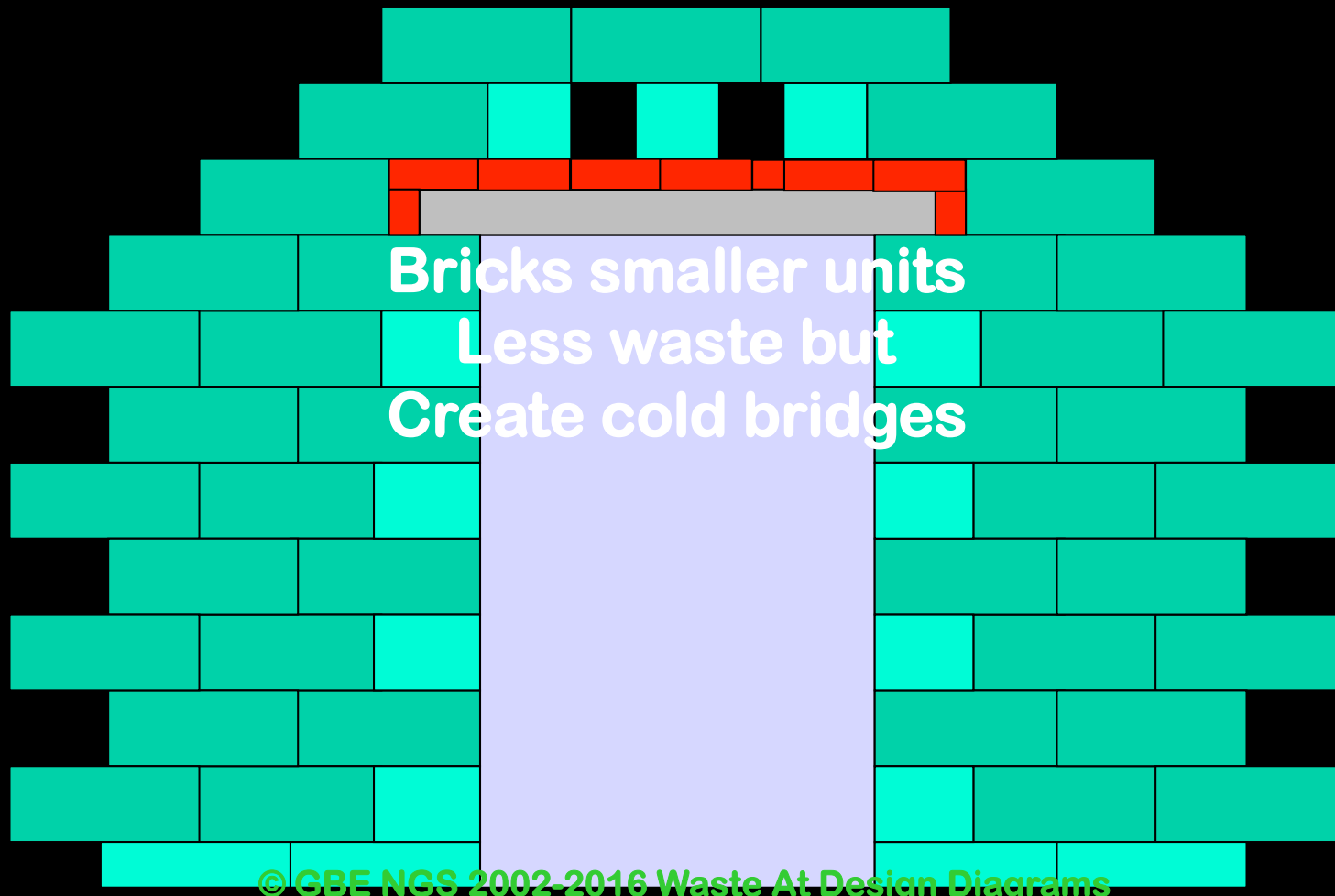
Resource Efficiency v or & Energy Efficiency

Openings in walls: Plan view

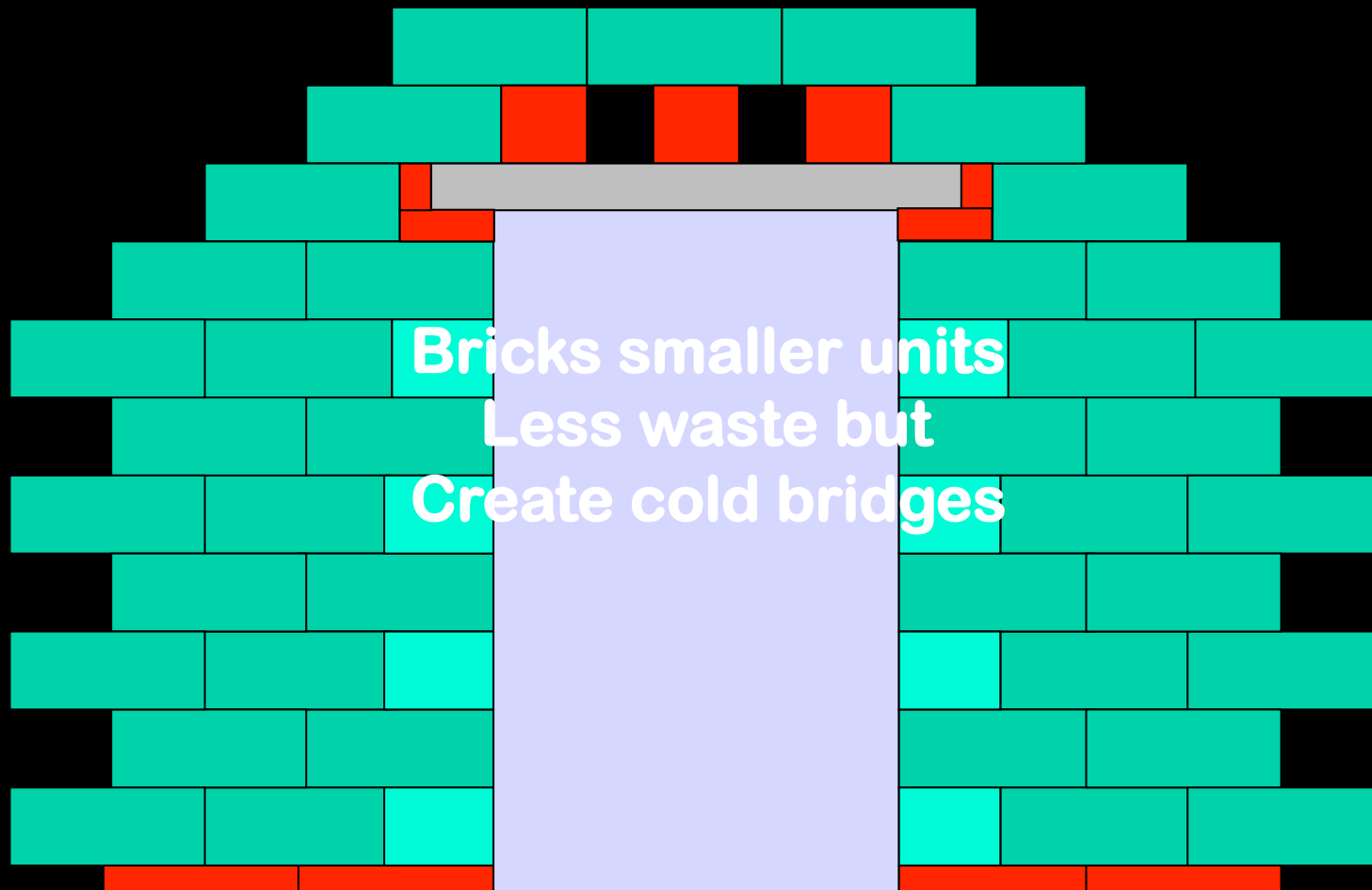
- Omit inner leaf returns: close cavity with window box
- Install window in window box



Change of material: destroys integrity



Cold Bridges: Inconsistent U value

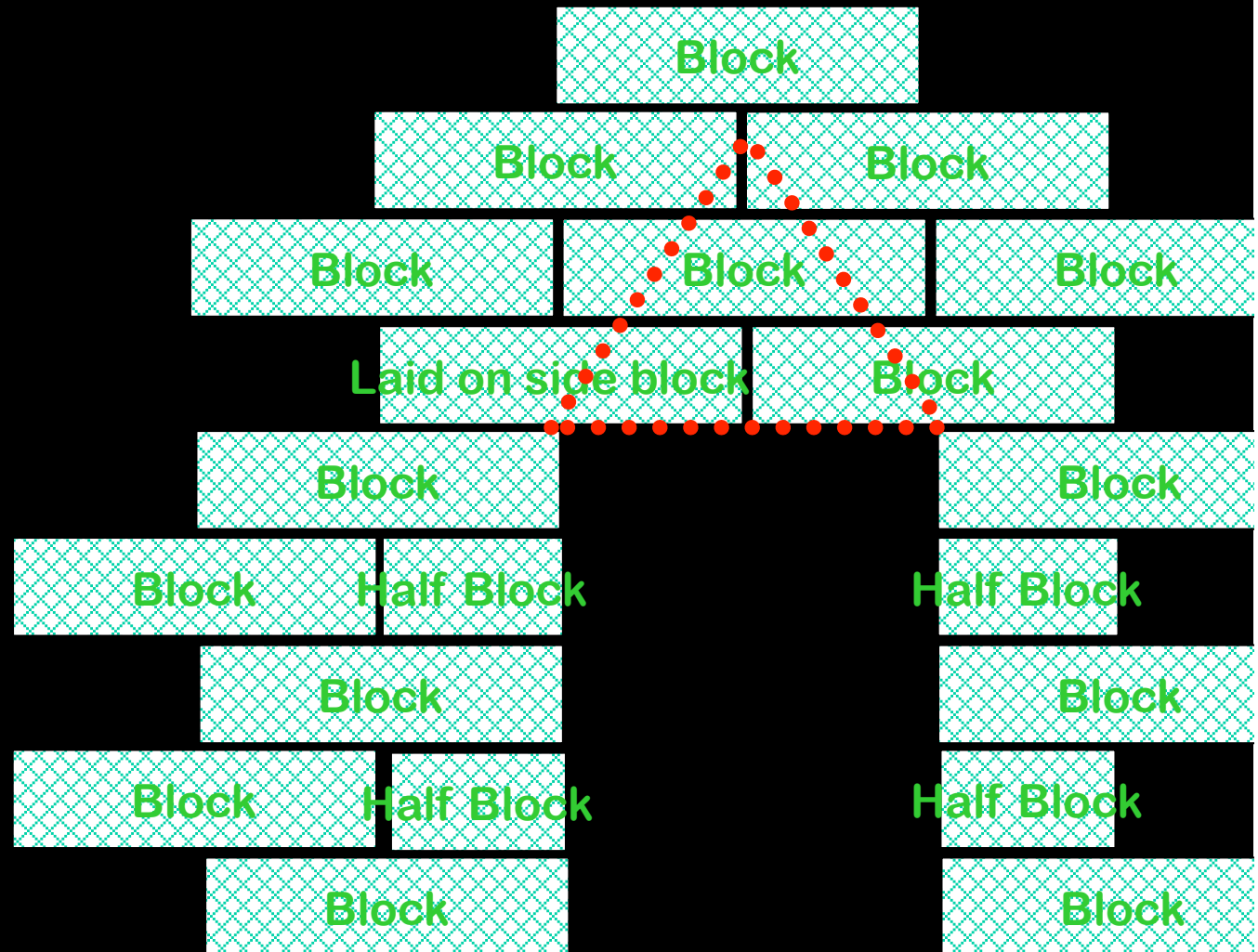




Attempting to reduce waste: creating cold bridges
Cold bridge reducing ties won't make up for:
brick inner leaf and brick padstones for lintels
Omitting jamb returns reduces waste and cold bridges

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Laid on side block



Concrete blocks forming lintel in
walls over opening of max 440 mm.

No lintel, no cutting, no waste



Minimise Waste

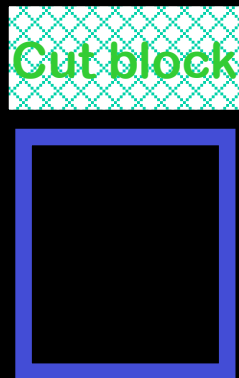
- Co-ordinate block course and lintel heights to minimise waste from cut blocks
- 215 mm. bearings
- Design openings to be block and half block sized

Lintels in blockwork walls

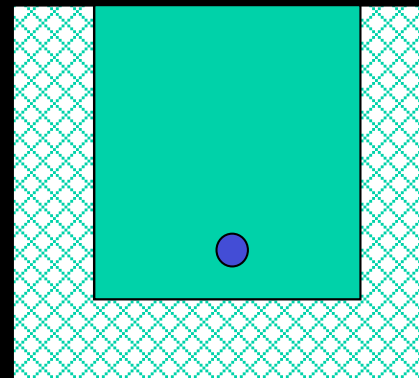
Avoid non-block height lintels
Generating cut blocks & waste



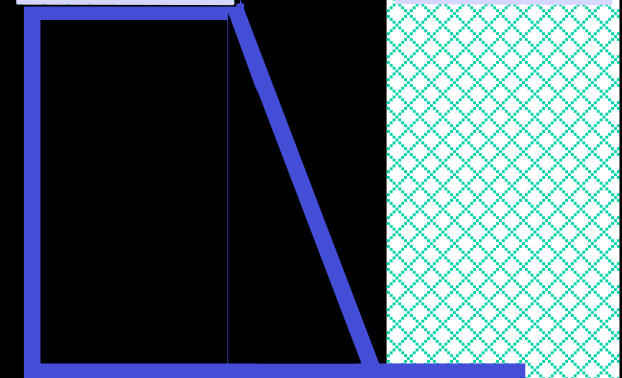
Pre-stressed concrete



Galvanized Mild Steel



Concrete trough lintel

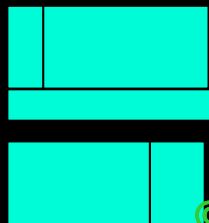
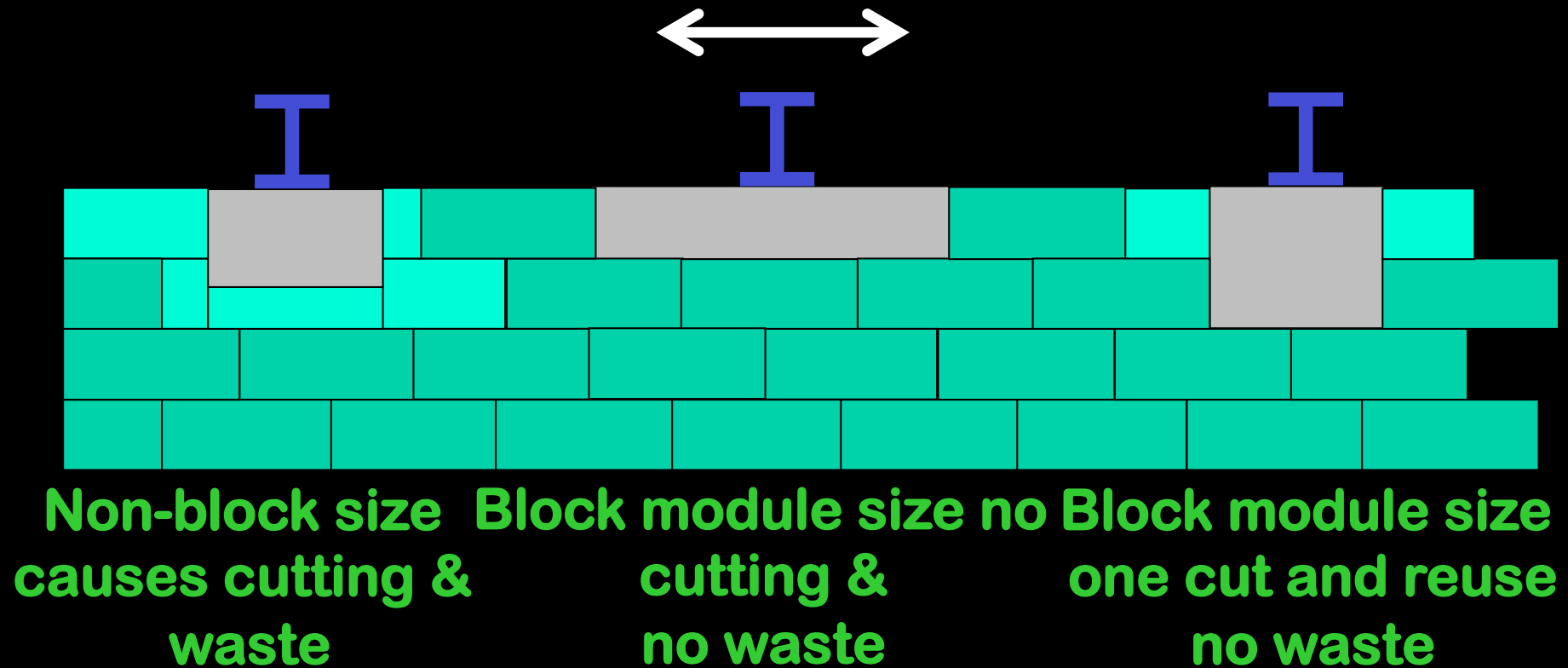


Galvanized Mild Steel

Waste

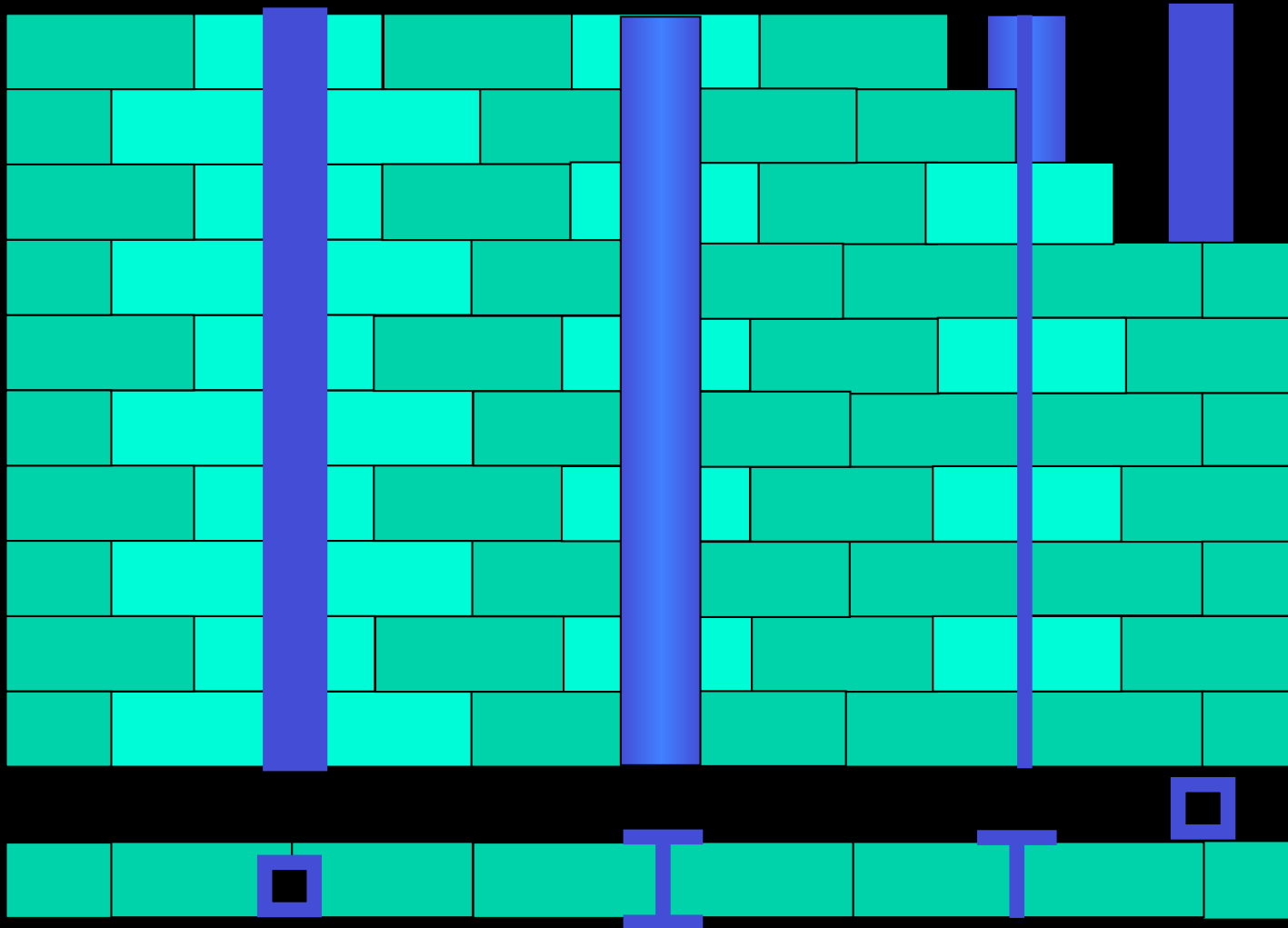
Waste

Padstones



Wide accommodates
frame inaccuracy

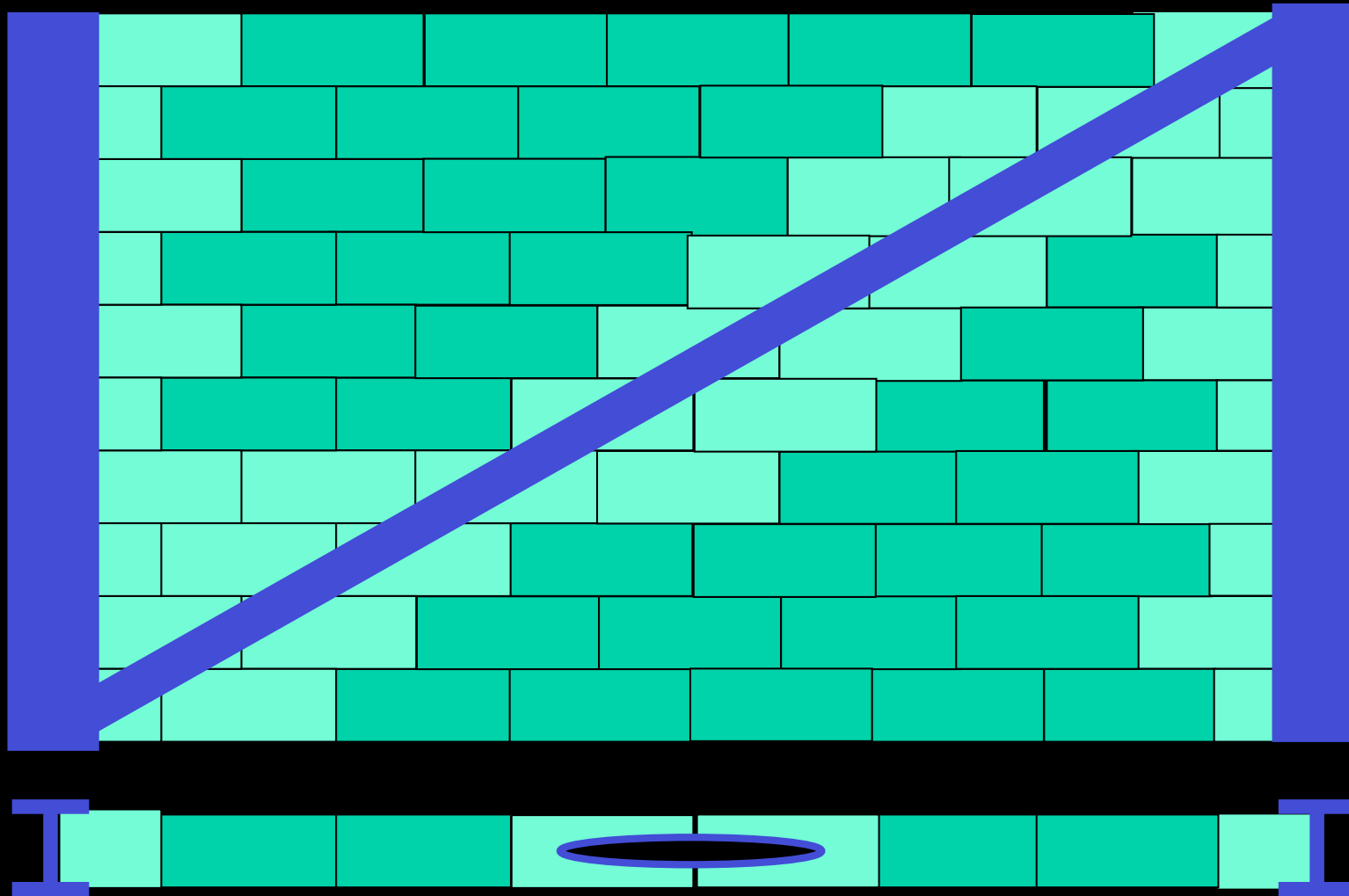
Wind or Stability Posts



Wall interruption will create waste: minimise by design
Different dense materials: Cold bridge? Airtightness?

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Lateral Bracing



Frame bracing will create waste: avoid by design
Different dense materials: Cold bridge? Airtightness?

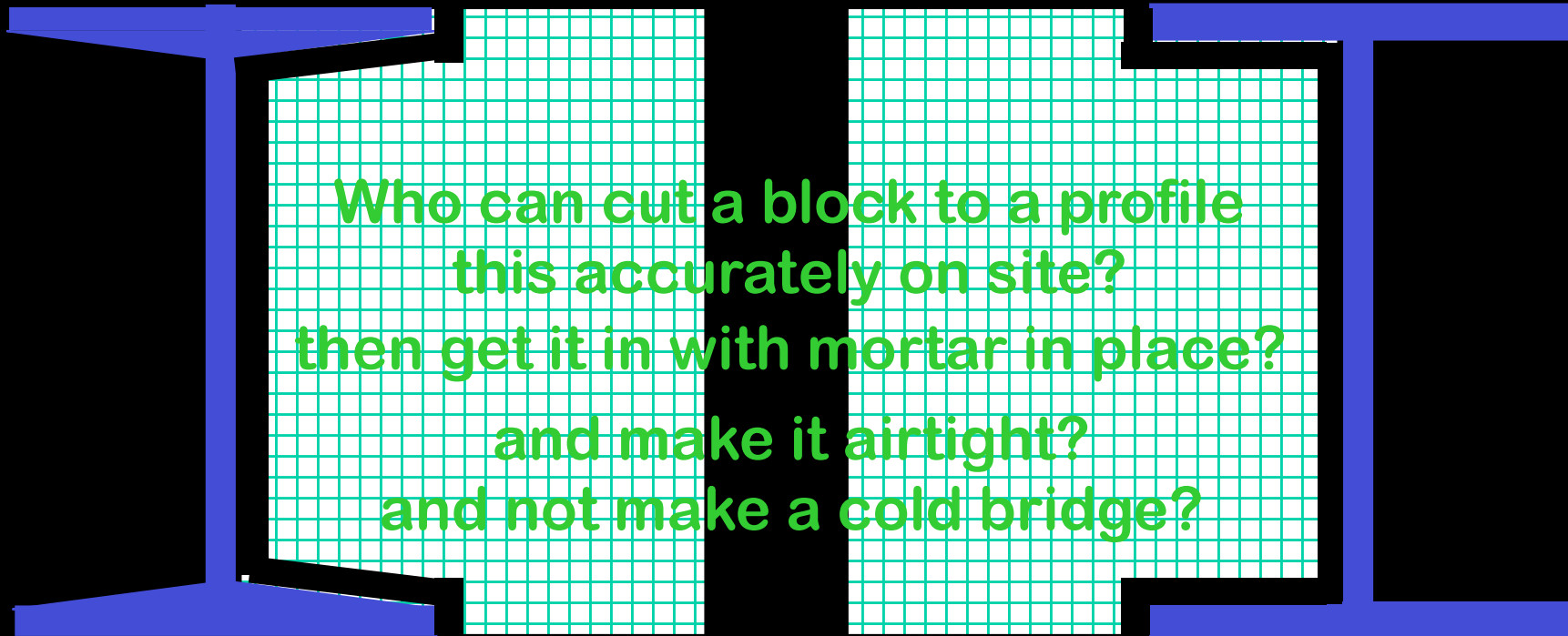
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Blockwork / Steel abutment

Labour intensive

Wasteful

Opportunity for rejection



Who can cut a block to a profile
this accurately on site?
then get it in with mortar in place?
and make it airtight?
and not make a cold bridge?

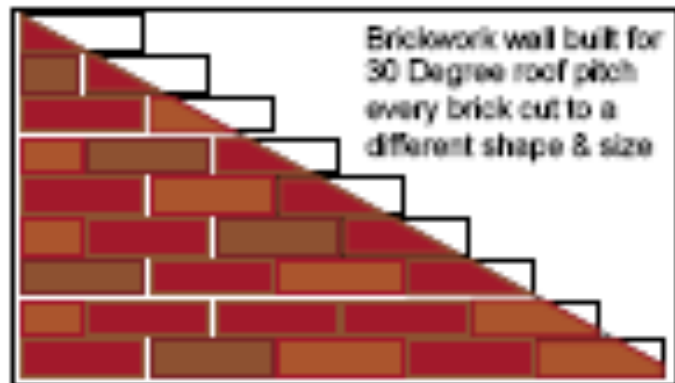
Rolled Steel Sections

Parallel Flange Sections

Roof Pitch!

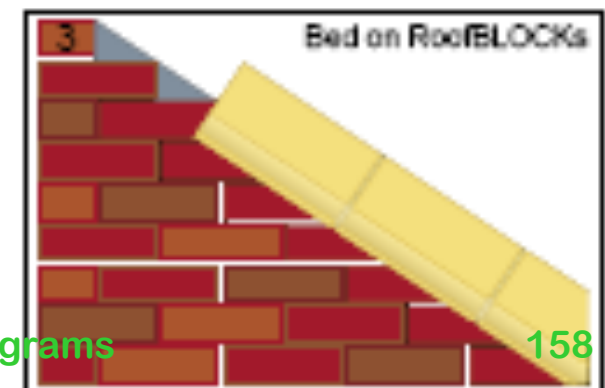
Working smarter with RoofBLOCK

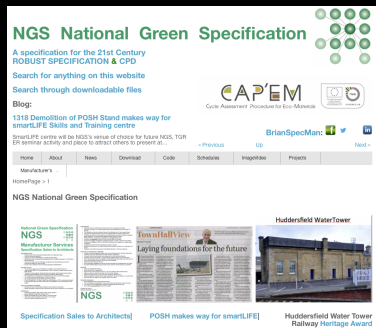
RoofBLOCK PRODUCTIVITY SAVINGS BUILDING GABLE WALLS



To eliminate the time consuming cutting of brick to match the roof slope, build the gable wall to follow the natural rake of brickwork, a pitch of 1:1½ (i.e. 33.7°).

The brick deep recess in the base of the RoofBLOCK will hide the ragged top of the brickwork slope whilst left over blockwork & mortar can be used-up to smooth out the brickwork steps before laying RoofBLOCKs up the gables.





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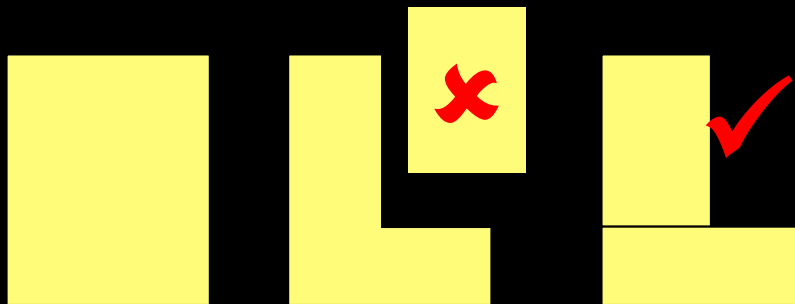


INTERREG IVB

Resource Efficiency: Timber

Reduce Demand

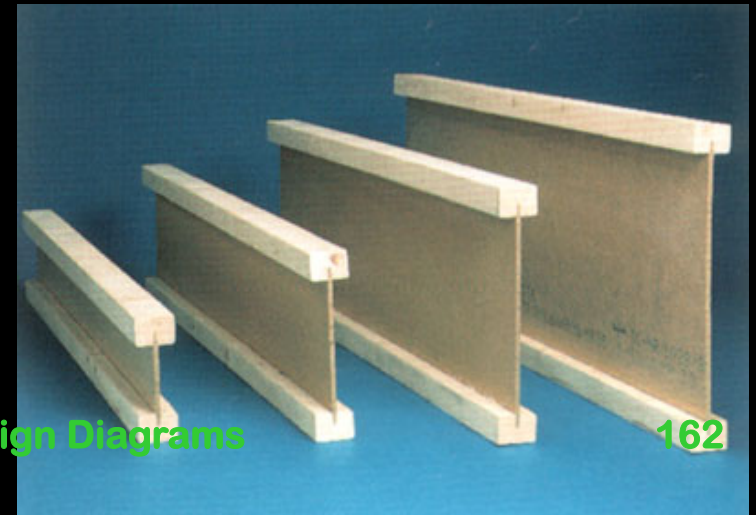
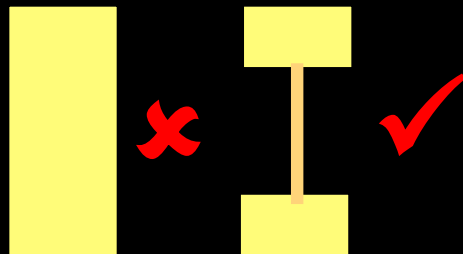
- Don't over design structure
- Except if long design life demands it
- Don't oversize
- Don't cut section from solid if compound is possible



Reduce Demand



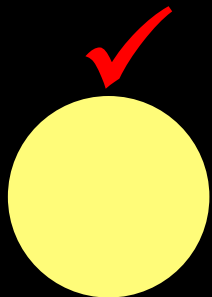
- Don't cut section from solid if compound is possible
- Reduce solid sections to compound to reduce weight and materials used



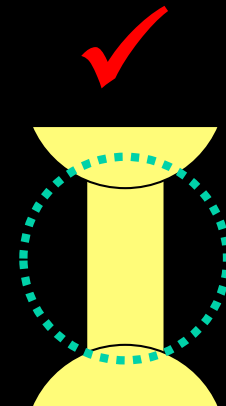
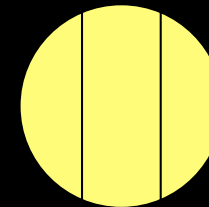
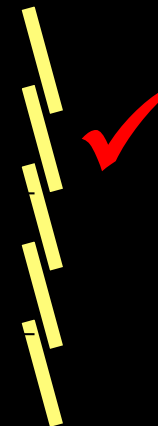
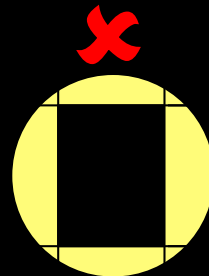
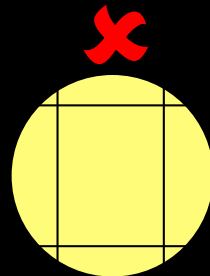
Reduce Demand



- Consider use of materials as found:
- Round pole structures
- Or compound sections without waste
- Or use off-cuts in cladding



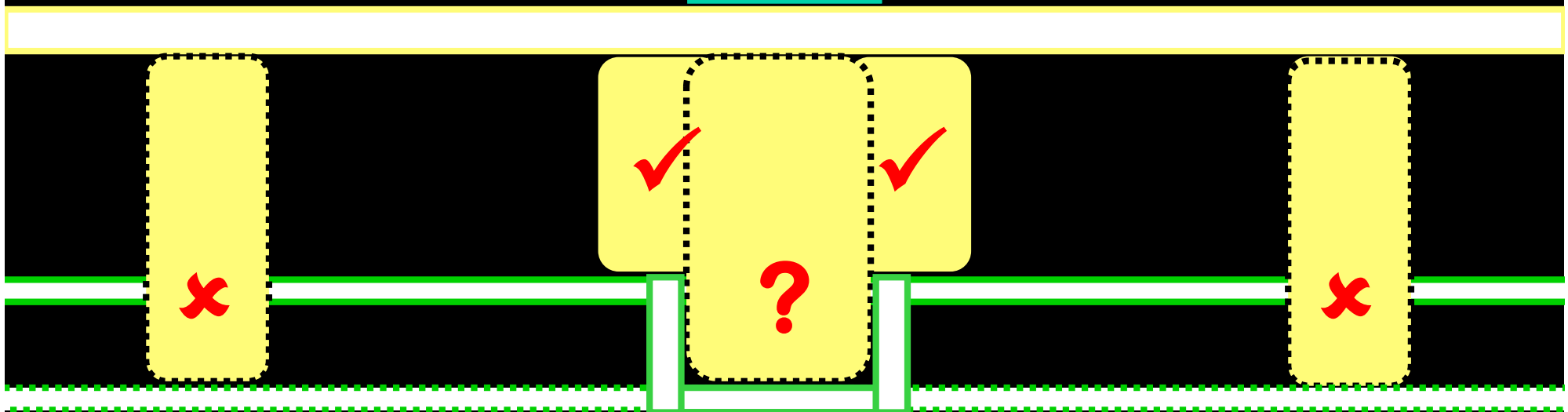
Roundwood



Cut Waste Wood Boarding Cut Reassemble

Joists/Beams

& Partitions



Multiple section simplifies design

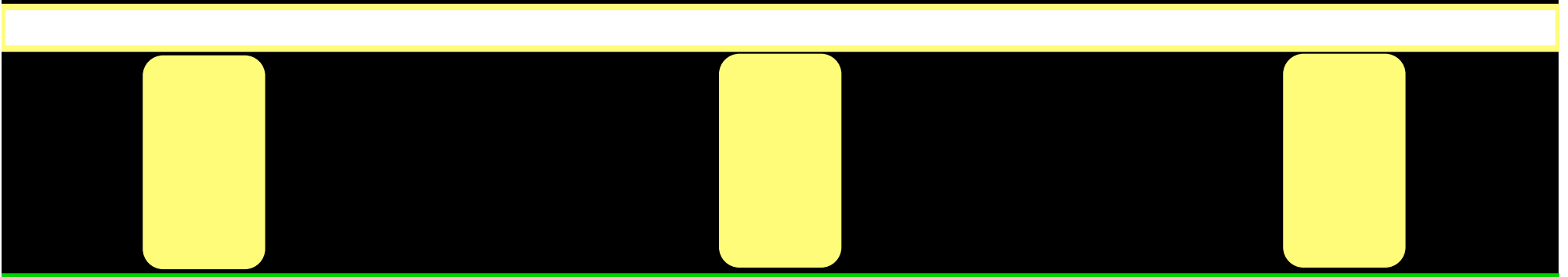
Different section complicates detail

Creates off-cuts and waste

Standard size leads to over design

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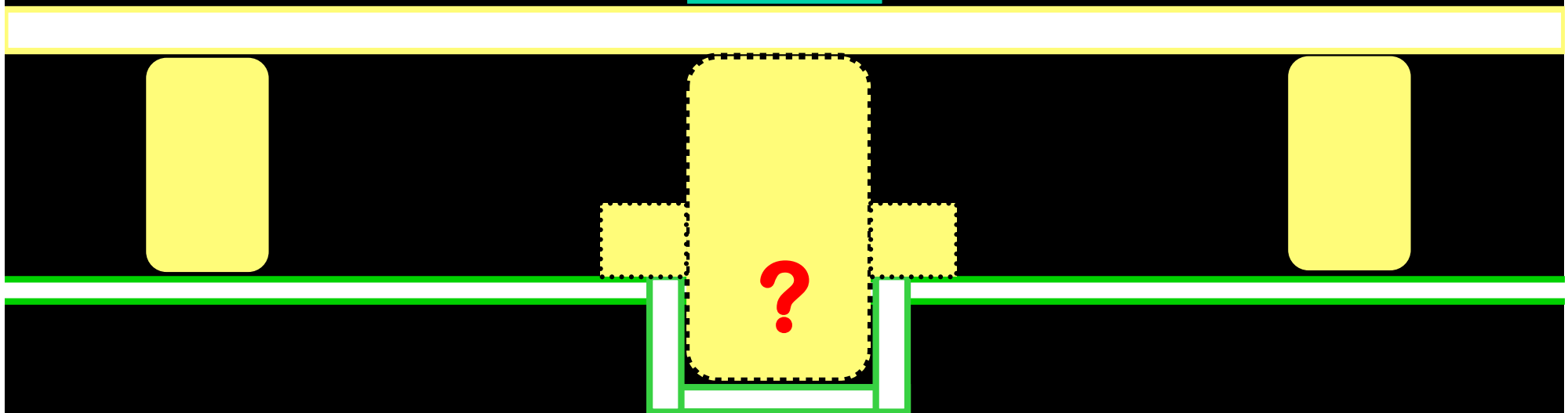
Joists



Multiple section simplifies design

Joists/Beams

& Partitions



Different section complicates detail

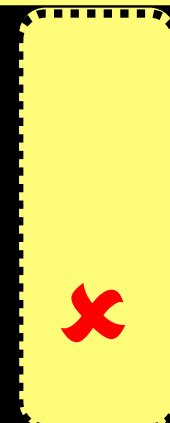
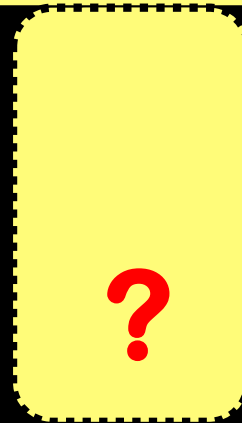
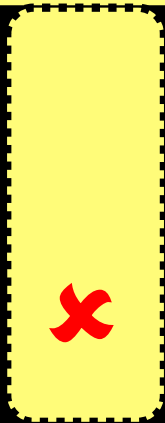
Creates off-cuts and waste

Changes appearance below

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Joists/Beams

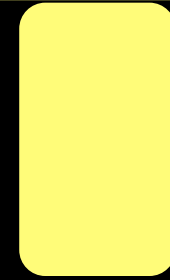
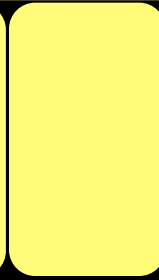
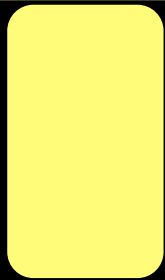
& Partitions



**Standardising size leads to over-design of
many for the one**

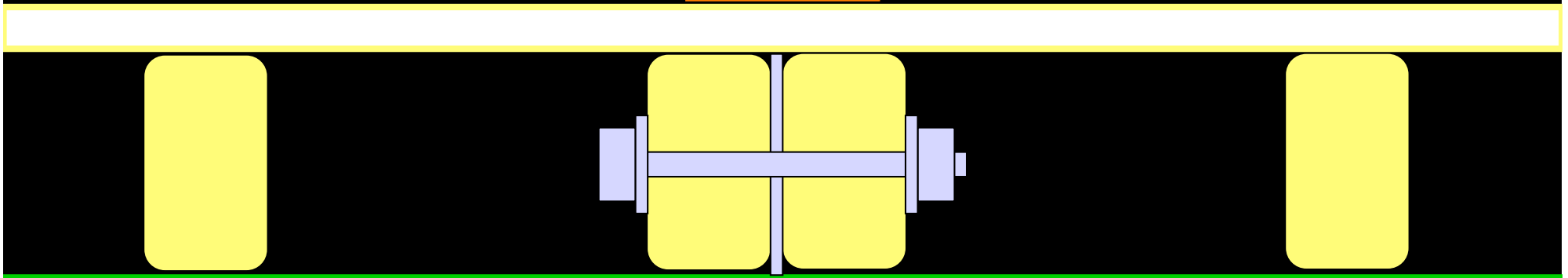
Joists/Beams

& Partitions



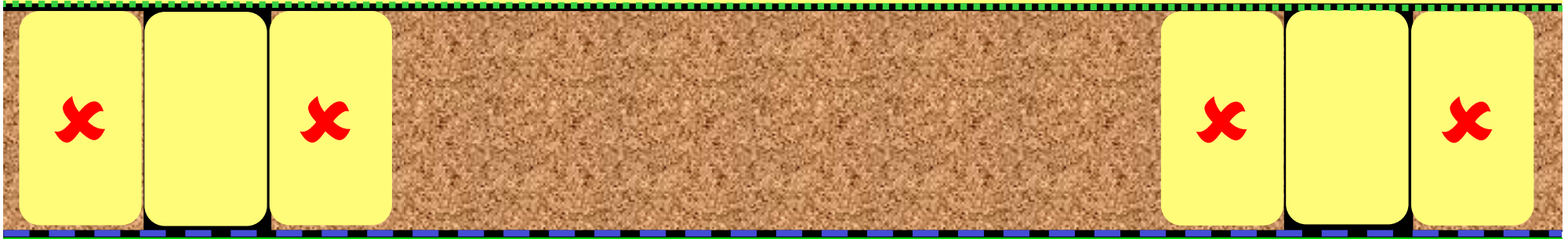
Multiple section simplifies design

Floor Joists/Beams & Partitions



Multiple section with flitch plate of steel bolted together

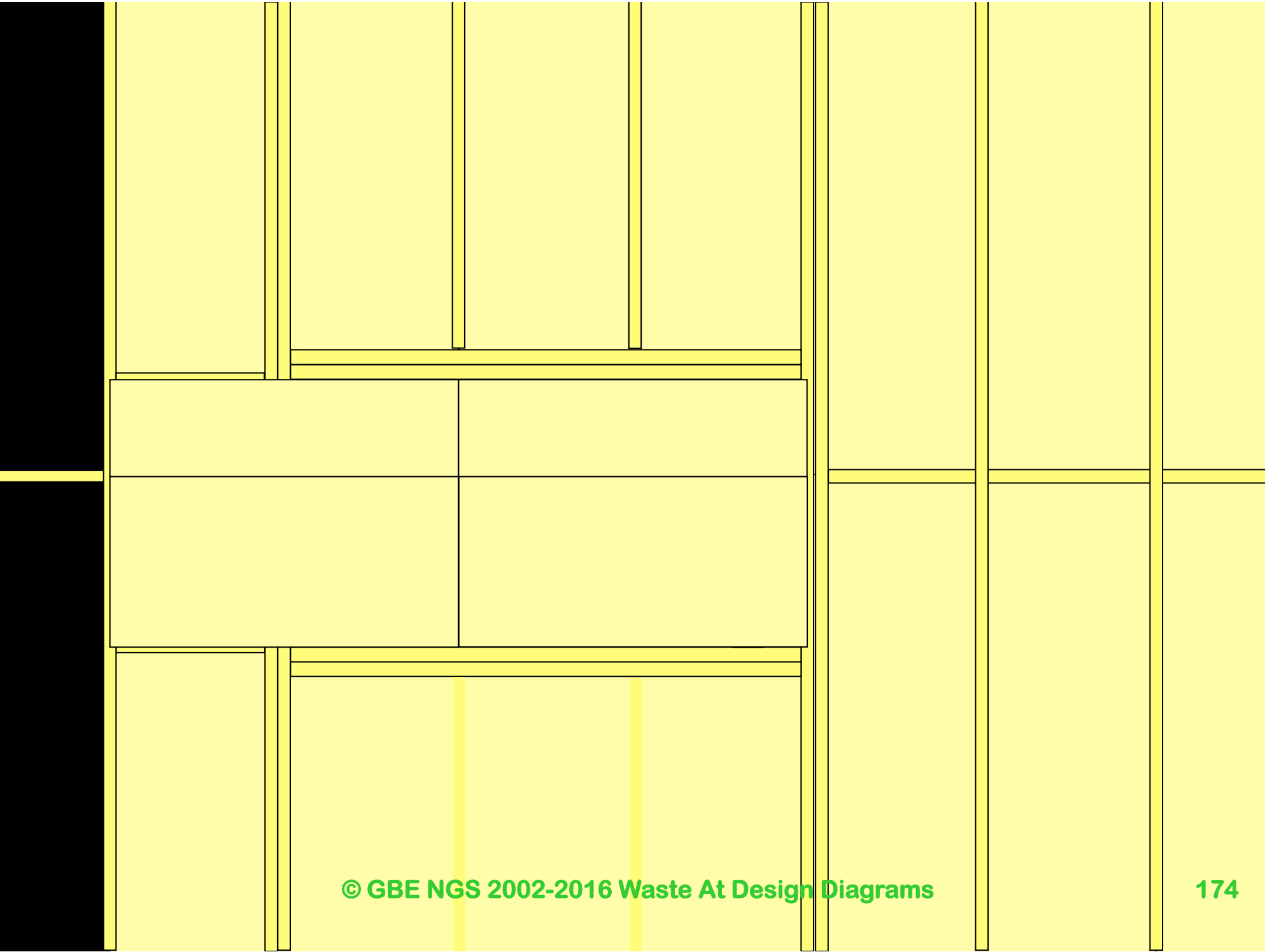
Strength v U Value in external wall

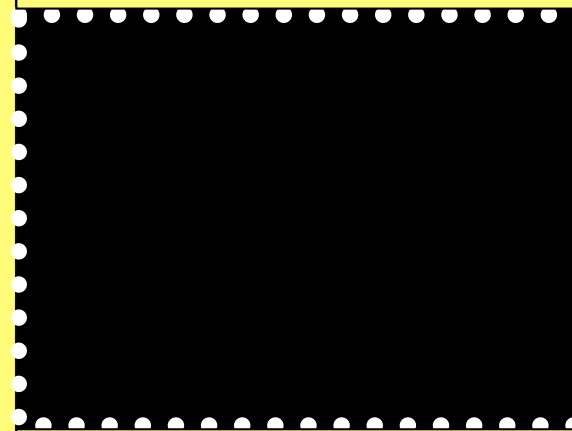


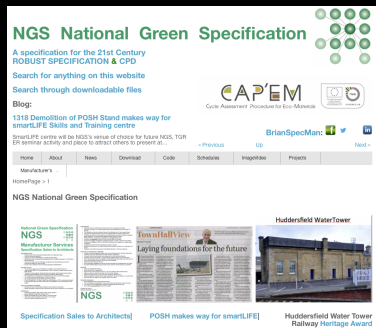
Off-cuts of insulation:
waste



Avoid over design of structure around openings
Avoid lack of design: adding additional studs for luck
Avoid creating wide cold bridges through insulation
Avoid Waste: chopping thermal insulation rolls







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Resource Efficiency: Plasterboard

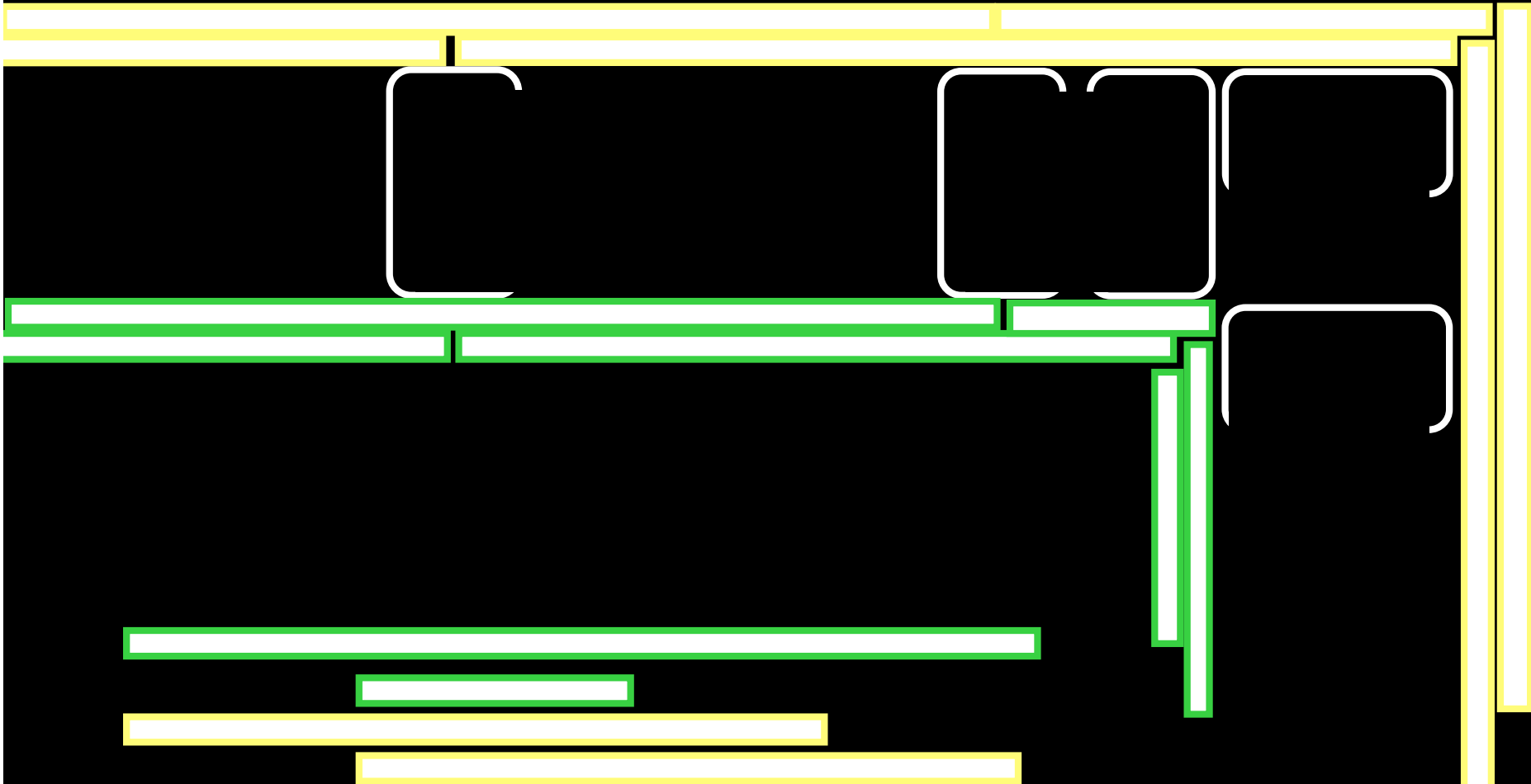
1 layer or 2?



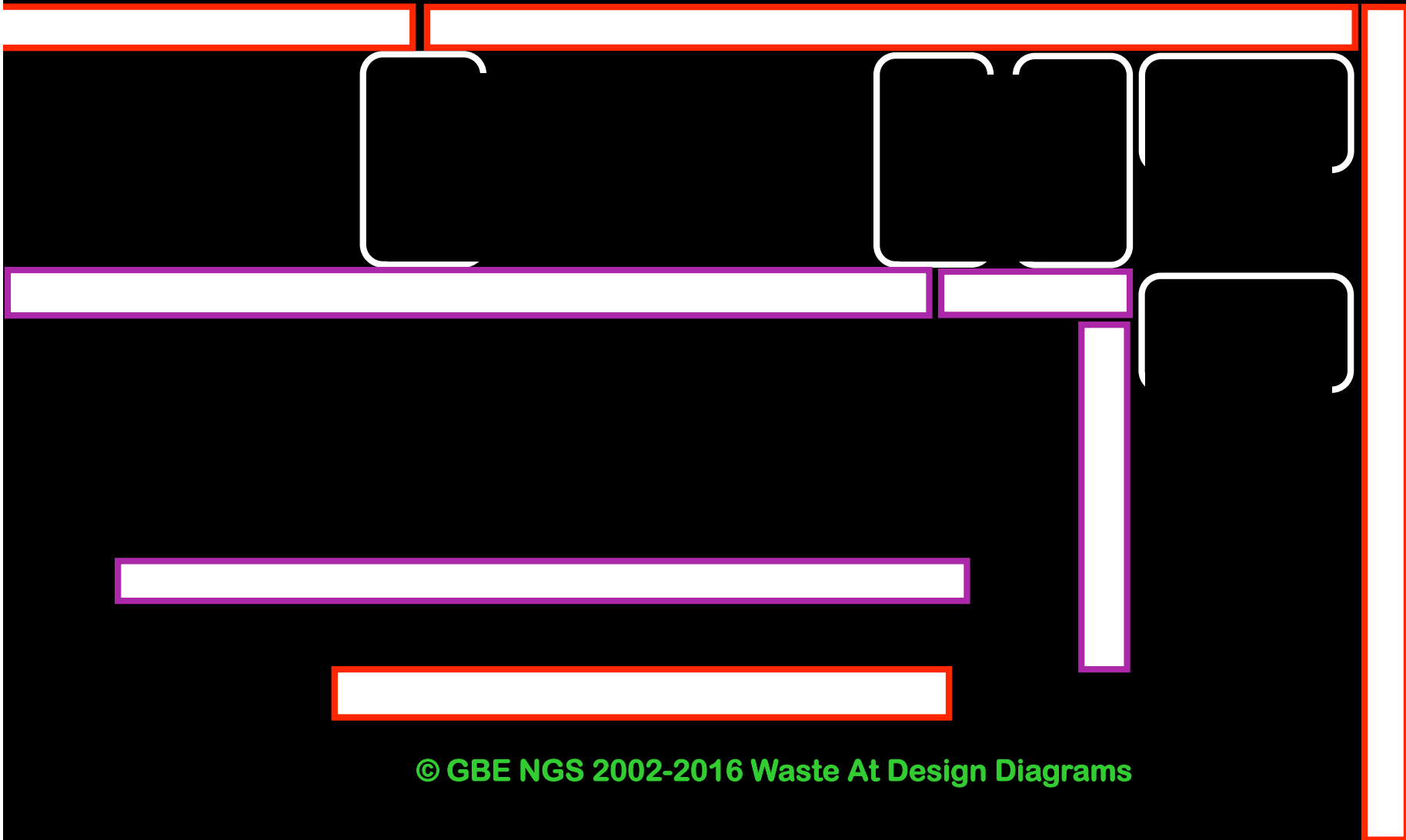
**Tolerances? Moisture resistance
Nothing gained**

**Robustness? Fire Performance?
Acoustic performance?**

2 layers = 2 x materials &
2 layers = 2 x off-cuts



1 thicker layer of different grade
= 1 x off-cuts



Designing the Sequence of Assembly

Dry-linings board heights & widths

Design dictates Sequence & numbers of visits

- The details at the abutments dictate the sequence of assembly
- Whether the designer likes it, admits it or not
- Construction & Structure: foundations to roof
- Consider: wet trades: first, dry: second
- Consider: working top down to minimise damage of floors by following trades
- Consider: working from the room extremity back towards the exit door

Structural Floor

Suspended ceiling



Structural Floor

Design details create waste

- Many heights of partitions and linings
- Creates demand for different height boards
- 1 maker provide an off-cut take-back scheme (BG but not comprehensive)
- Others provide purpose made boards cut to height (if the job is big enough)
- Others cut board to size (F)
- How many sizes does your job need?

Structural Floor

Suspended ceiling

**Check board sizes as you design
Don't assume all board grades are the same**

2.6

2.4

3.2

3.0

2.5

Raised Access Floor

Screed

Structural Floor



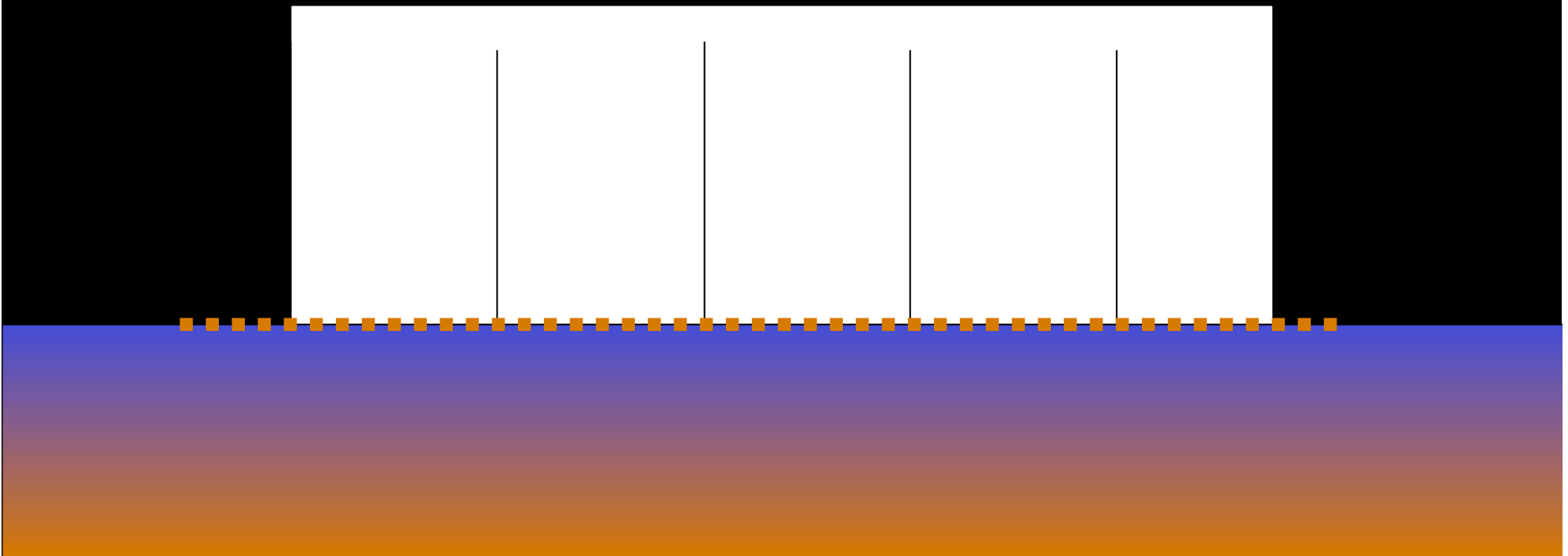
Set out from centreline
2 x cuts
2 x waste

Set out from one end
1 x cut
1 x waste

Appropriate Materials to application

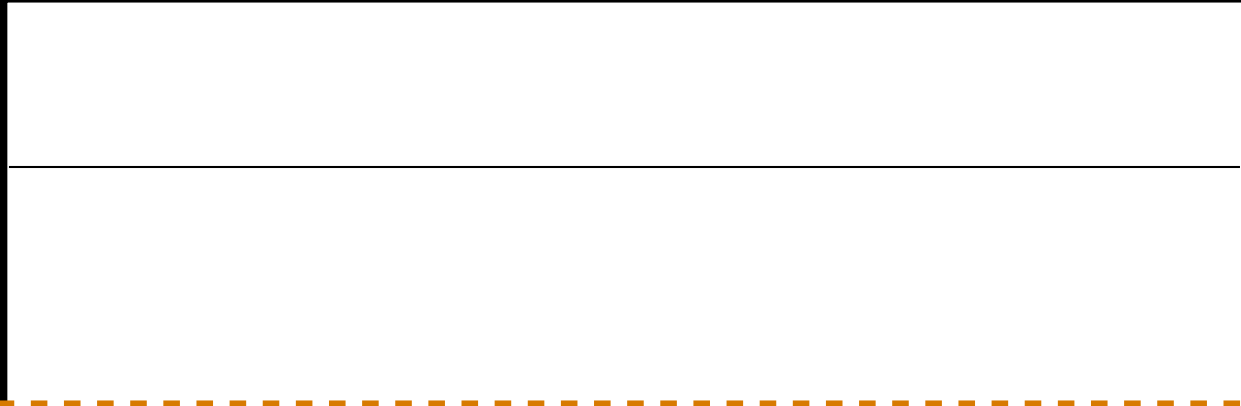
Dry-linings and Flood risk

Board layout & Flood Water



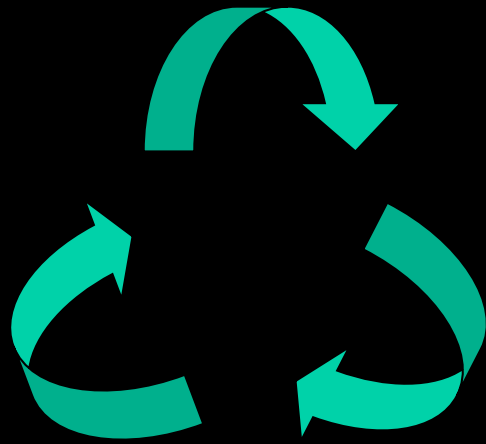
- All boards partly damaged
- All boards removed and replaced

Board layout & Flood Water EA's Sacrificial Construction



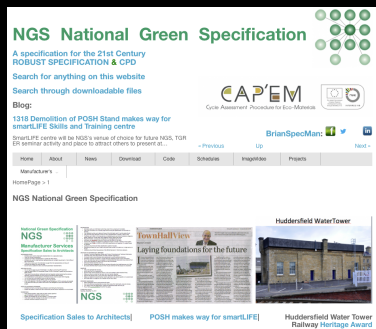
- Lowest board(s) damaged
- Lowest board(s) removed and replaced
- Why use plasterboard in flood prone areas?
- Cement Render is better in flood prone places

Reuse of off-cuts



**Recycle
Materials
on-site**

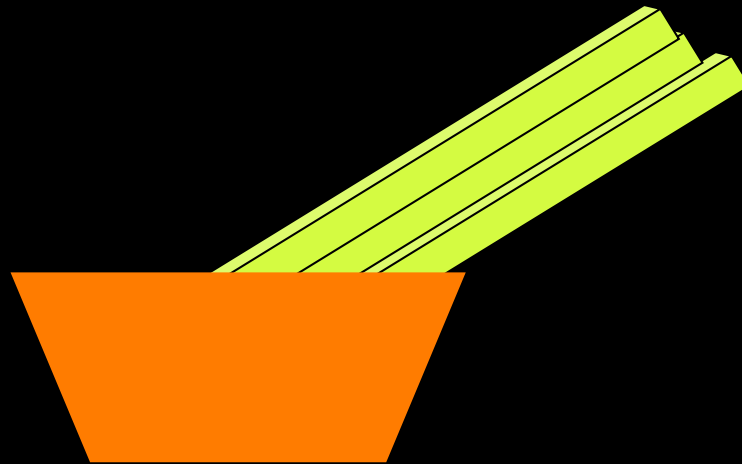
**Reuse spare
materials
on-site & in use**



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Cycle Assessment Procedure for Eco-impacts of Materials



**Segregate waste
local to
point of generation
to enable reuse
on-site or offsite
And even on-site again**

Reuse Off-cuts

- Deliver off-cuts with cassette panels
- Reuse off-cuts as props
- Don't cut studs to make props
- Use joist off-cut as strutting in floors
- Use off cuts for local strengthening for sanitaryware and wall furniture



Redesign to
reduce waste

Avoid Late Design Changes

- Late design changes
- Late instruction
- Late changes
- Incorrect materials being delivered
- Leads to error
- Leads to waste

Wrong Information

- Late instructions
- Revised design?
- NEDO report 1987
- Quality On Building Sites
- QRE Quality Related Events
- Errors in information or in its delivery
- 50%:50% split Design:Construction



Late design change

© CSIRO 2016. Waste Australia Design Engineering Bourke image



Late design change

Off-cuts 33%

- We are familiar with sizing walls to bricks and half brick lengths (but we still don't do it everywhere)
- Internal walls designed to block lengths
- Block sized openings
- coursing to avoid cut blocks
- lintels same size as blocks, no cuts
- Bearing to correspond with block size

Mad Mad World

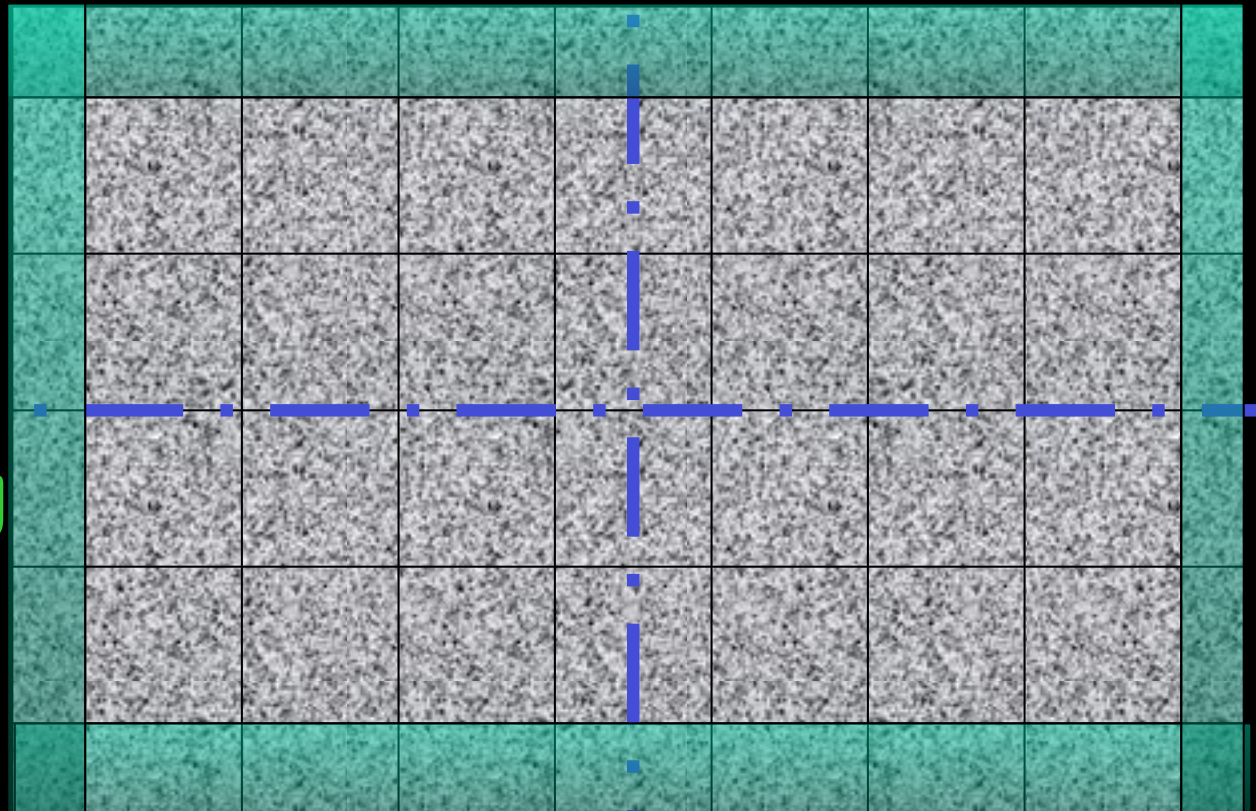
- **HHP:** Nick the Builder has a business taking architects drawings the constructor can't understand and redrawing for them
- **Lovells:** They use external CAD Jockeys the drawings who did not acknowledge brick sizes, when asked to correct it, told that is extra money.

Mad Mad World

- AJ August 2010 Article
- Architects permit reuse of off-cut bricks in brickwork to avoid waste
- Instead of designing the brickwork to brick sizes in the first place
- They might regret their decision

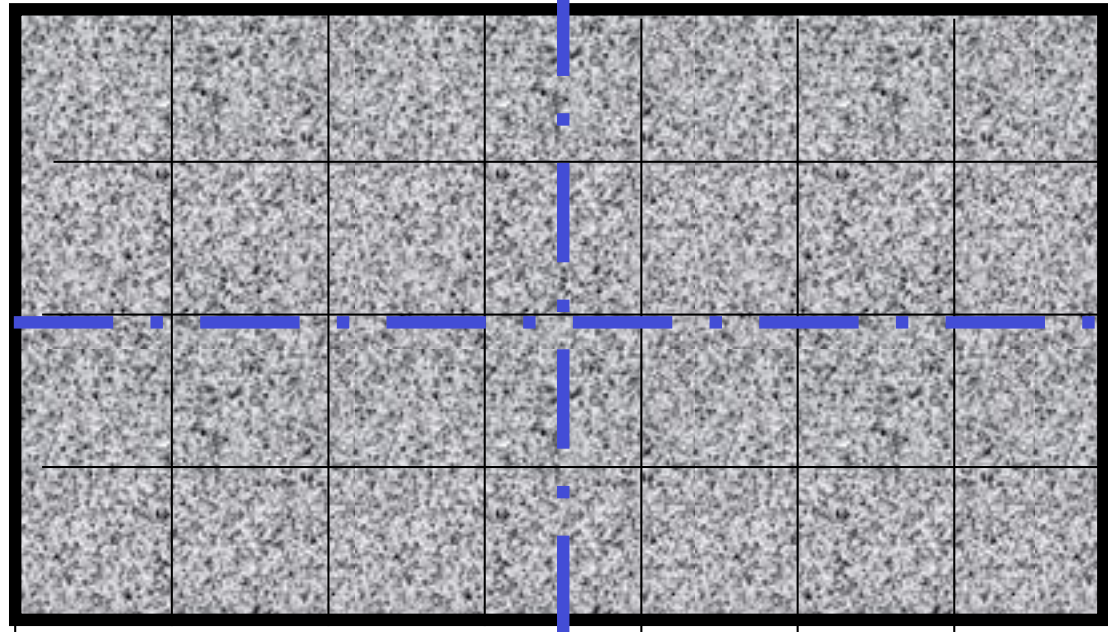
Random Sizing: generates waste

- Random dims
- Centred setting out
- Tile spacing
- Cut edges
- Waste



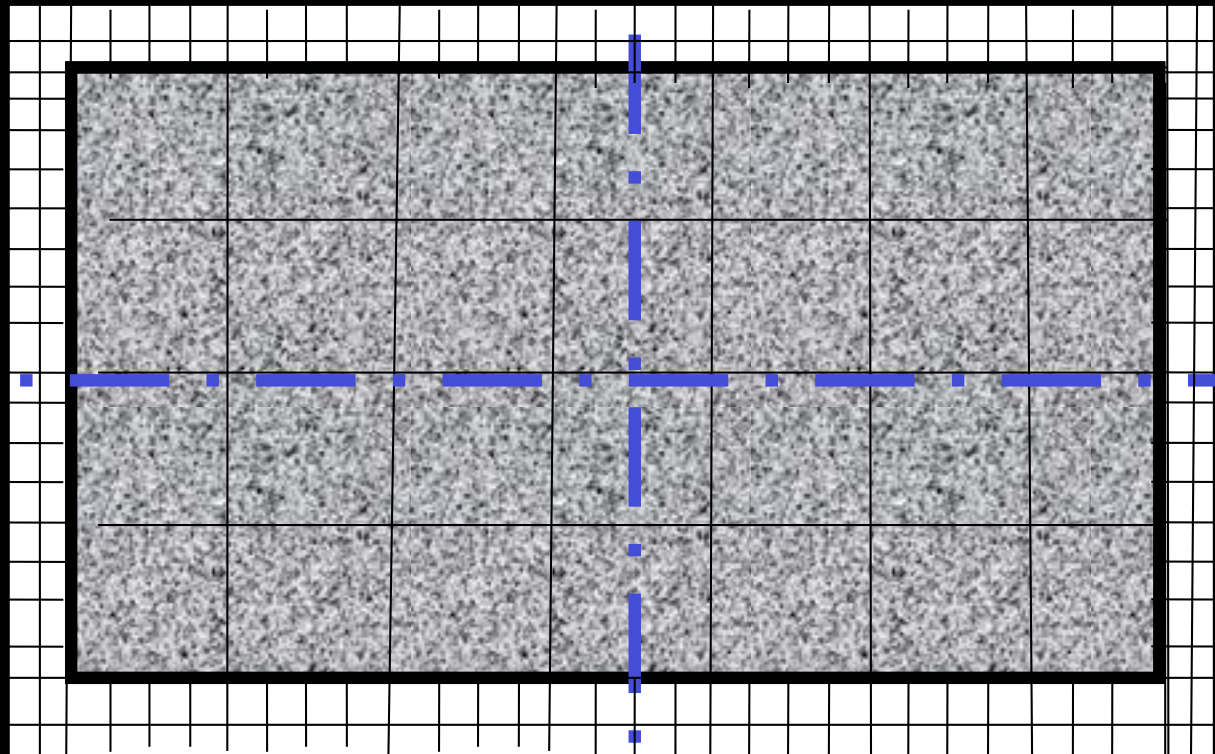
Grid areas and plain boundary

- Random dim rooms
- Centred setting out
- Tile spacing
- No cut edges
- Reduced waste



Grid areas & small element margin

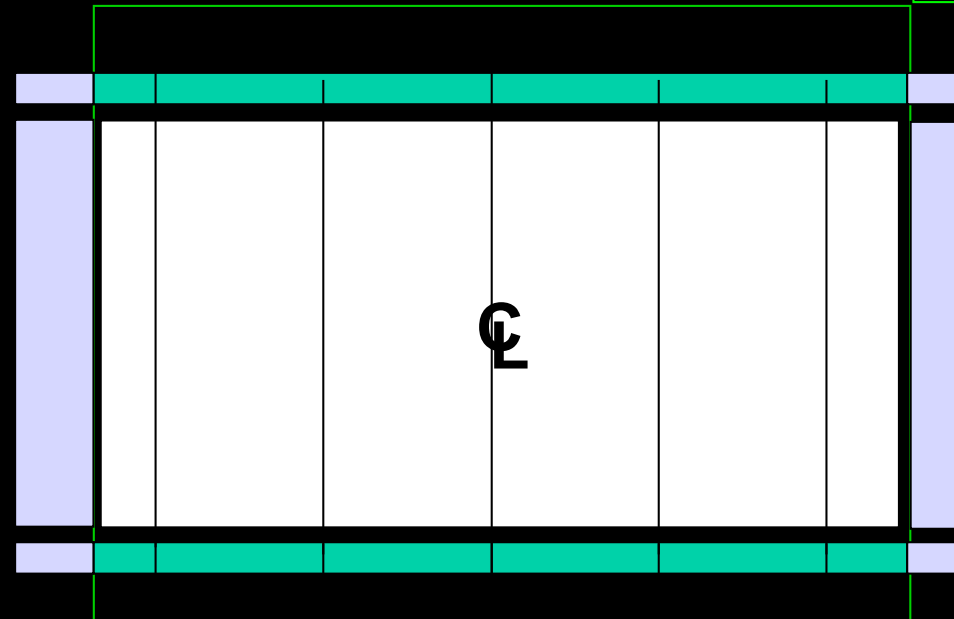
- Random dim rooms
- Centred setting out
- Tile spacing
- Smaller tiles
- at perimeter
- Reduced waste



**Suspended ceiling
Grid, tiles &
Services**

**Room
size**

**Off-cuts
and
specials**



**Partition
system**

**Off-cut
Waste**


Carpet tile
Raised Access Platform Floors
Tiled floor
Stone floor

Bad design ignores edges





**Respond to structure
potentially wasteful
unless designed**

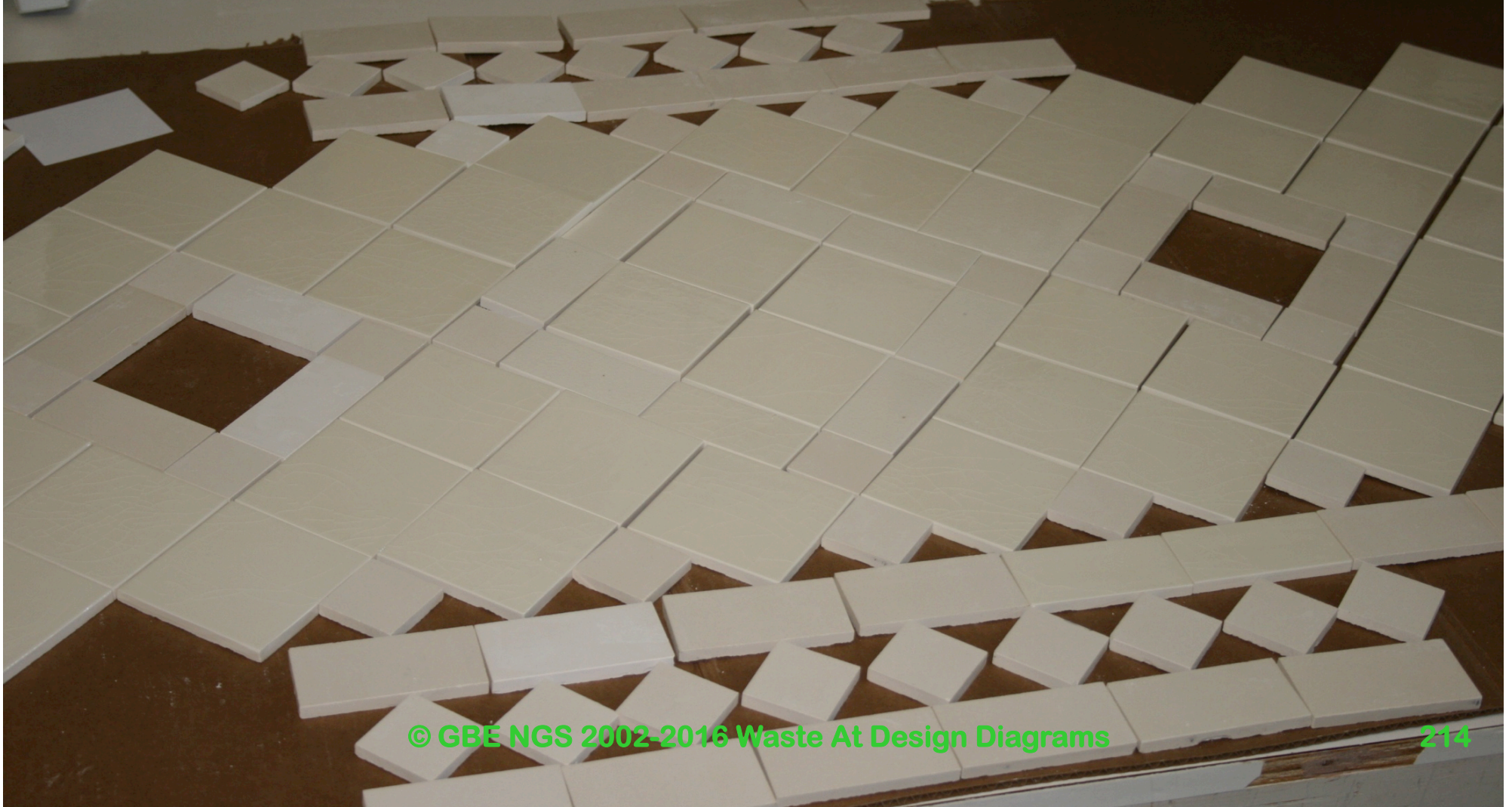
A photograph of a room with a patterned carpet and a wooden handrail. The carpet features a repeating geometric pattern of squares and diamonds in shades of brown, beige, and green. A large, ornate wooden handrail is visible in the foreground on the right. The text "Respond to structure, perimeter scale change, minimise/eliminate cutting?" is overlaid in green.

**Respond to structure,
perimeter scale change,
minimise/eliminate cutting?**

**Mosaic infinite adjustment
if borders permit**

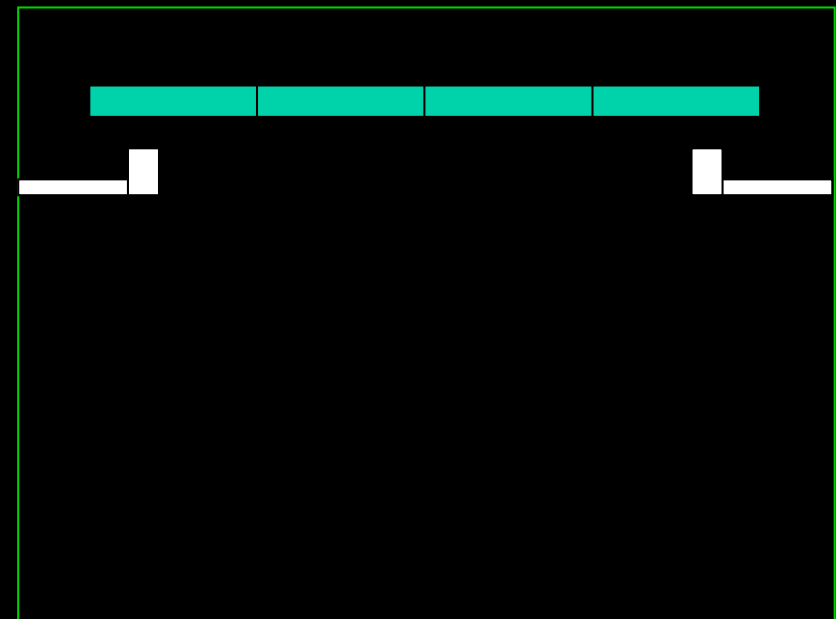
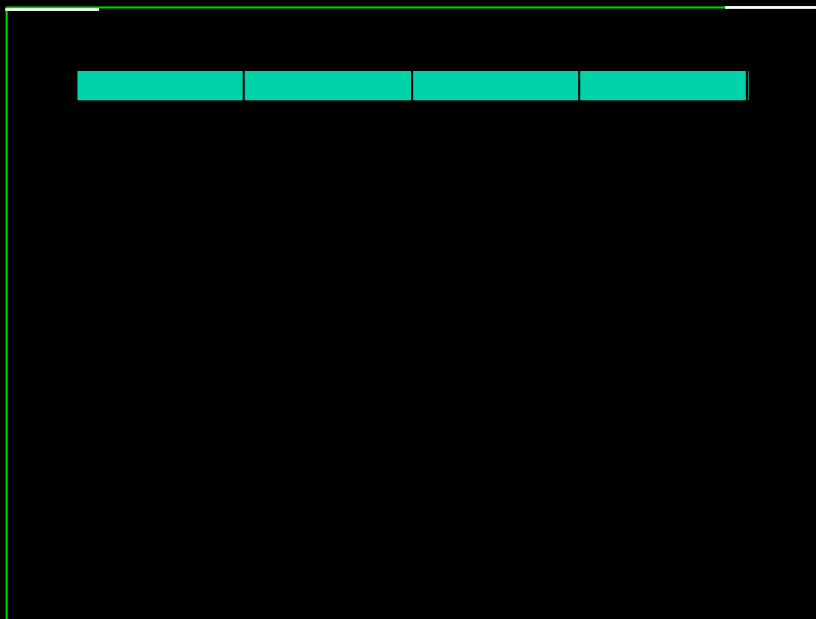
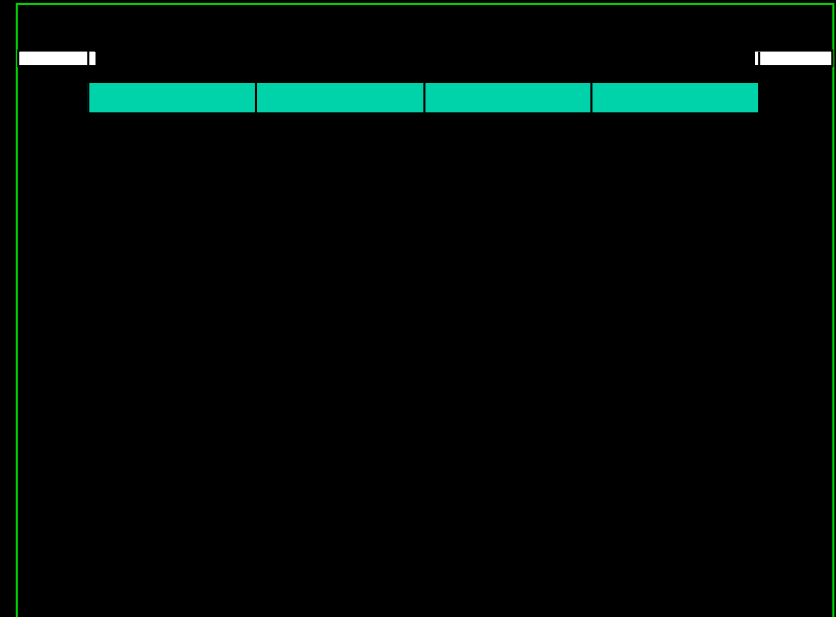
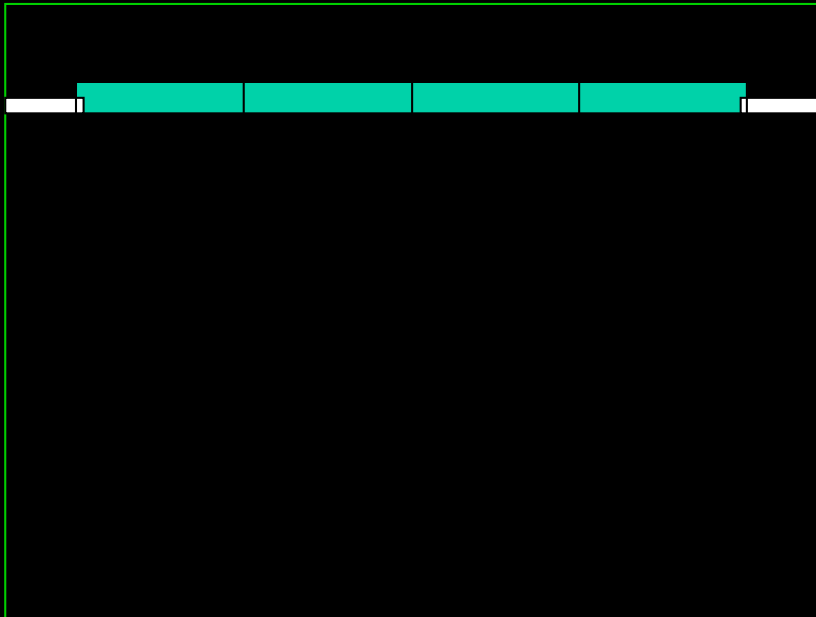


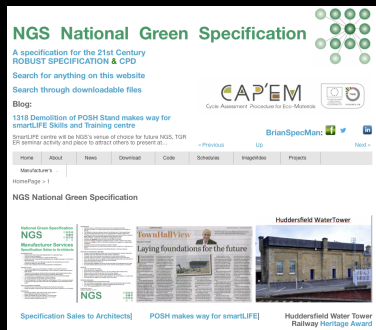
**Change scale at perimeters
Craftsmen can work it out
Better if you do first**



Borders but no change of scale







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Investing in Opportunities

Designed whole tiles with margin



Tiled with margin but tiles cut at margin



© GBE NGS 2002-2016 Waste on Design Diagrams New buildings make waste

Designed whole tiles with margin



Tiled with margin but tiles cut at edge





Non-rectilinear buildings make waste

© GBE NGS 2002-2016 Waste At Design Diagrams

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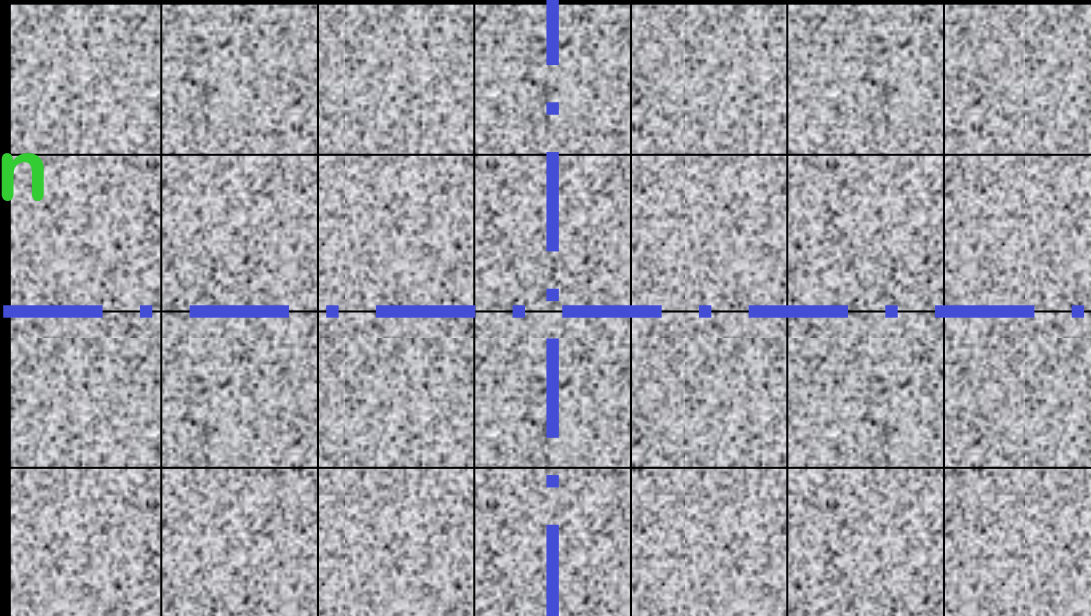
Design Avoids Waste

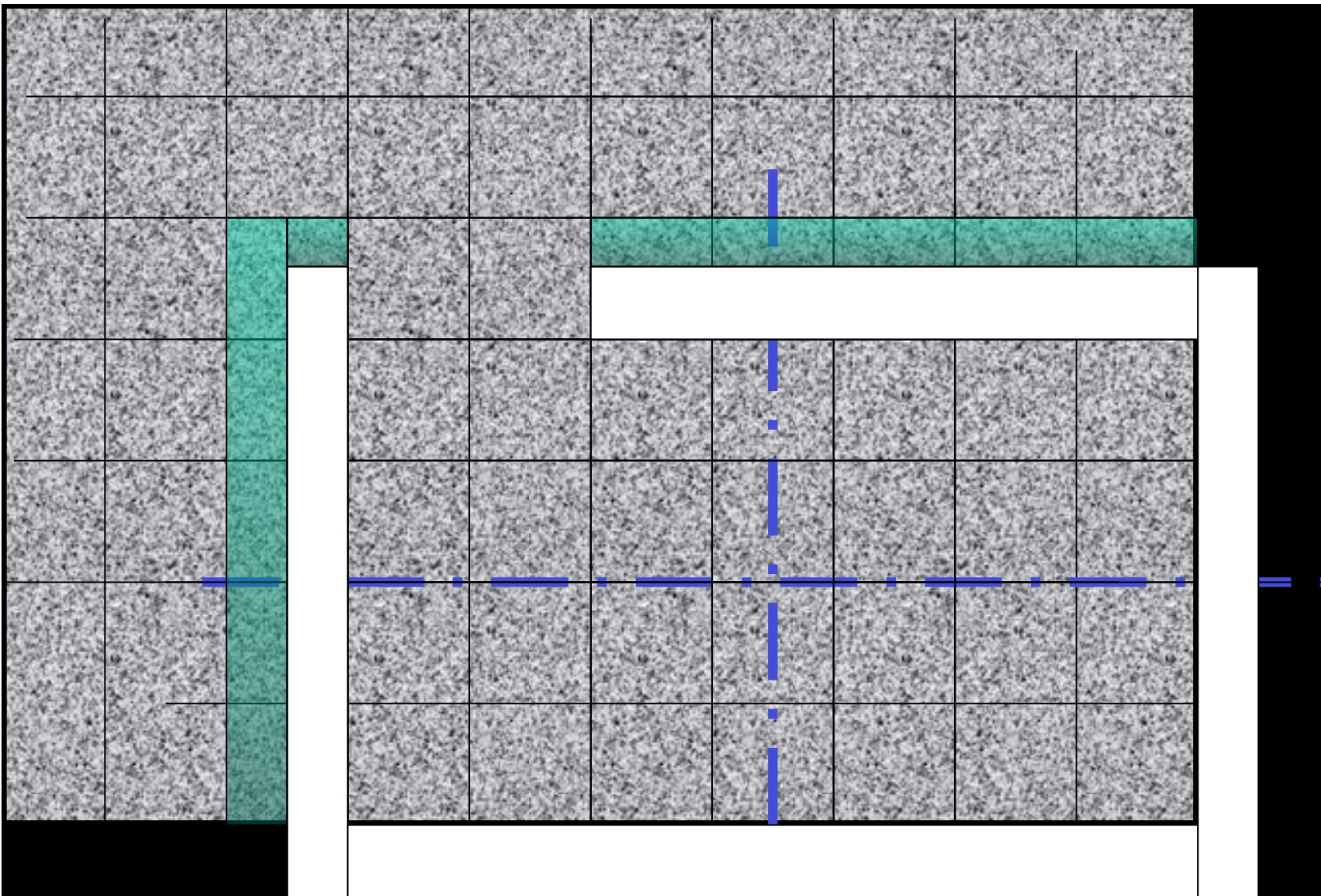
- Setting out: Not straight forward
- Few cut components: little waste
- Labour simplified
- Looks expensive: cheap to lay
- Assumptions made about relative costs
- Quality Surveyor: think resource efficiency & simple construction

Coordination Reduces Waste

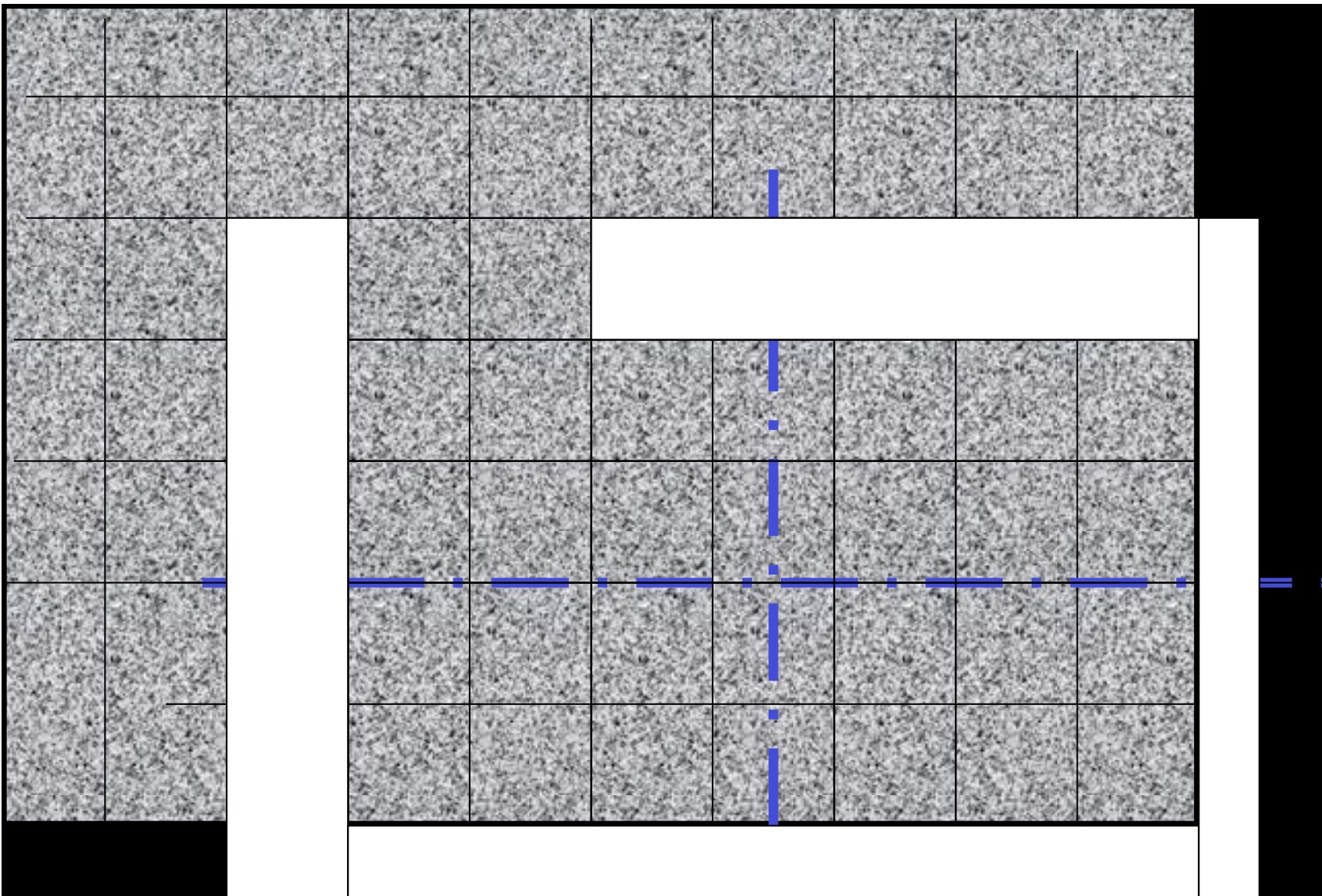
Room Size : Component

- Dimensional co-ordination
- Room sizes match Tile modules
- No waste





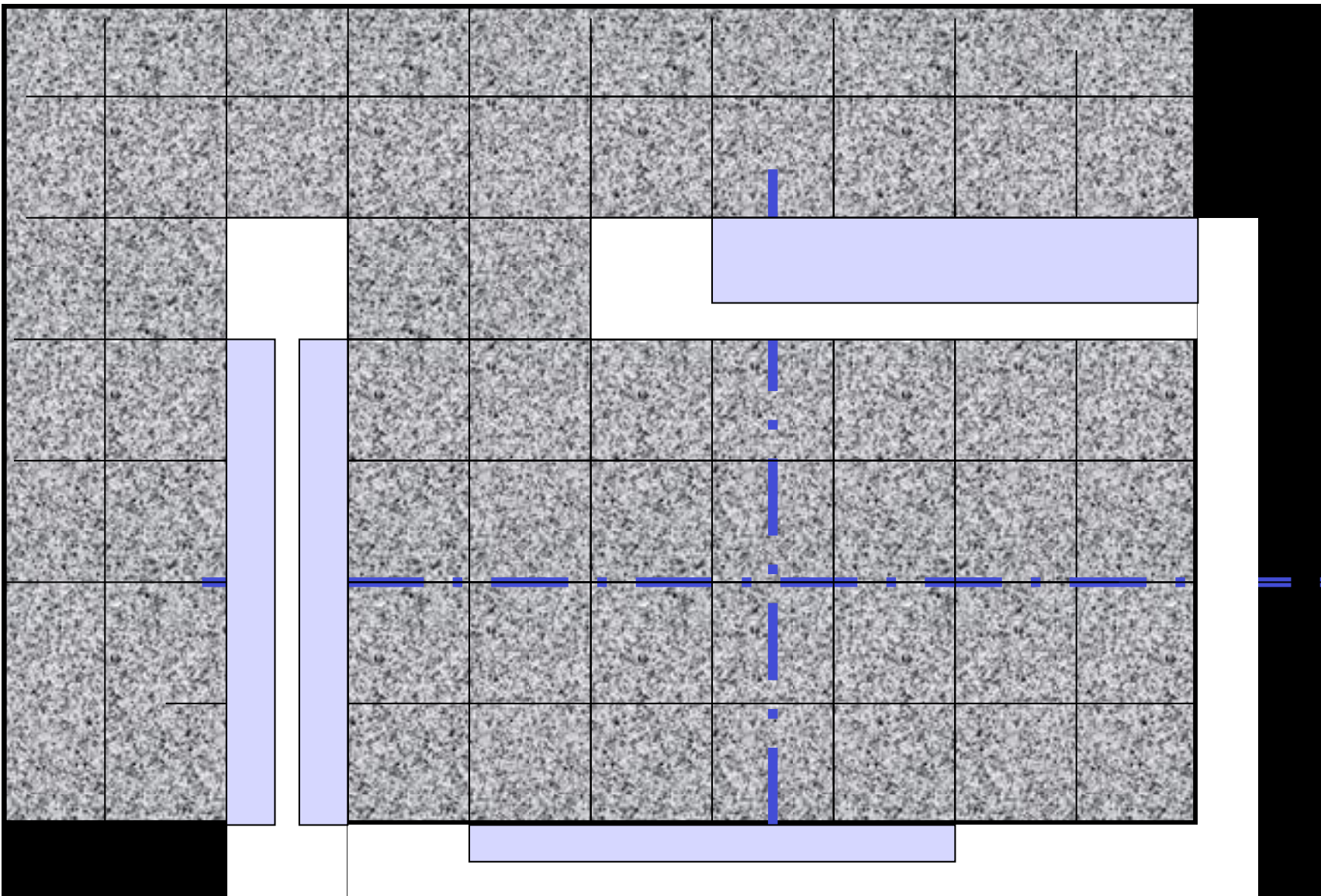
But look outside the box:
More cut tiles



Modular thick walls solve it

But occupy space: Minimise net: gross ratio

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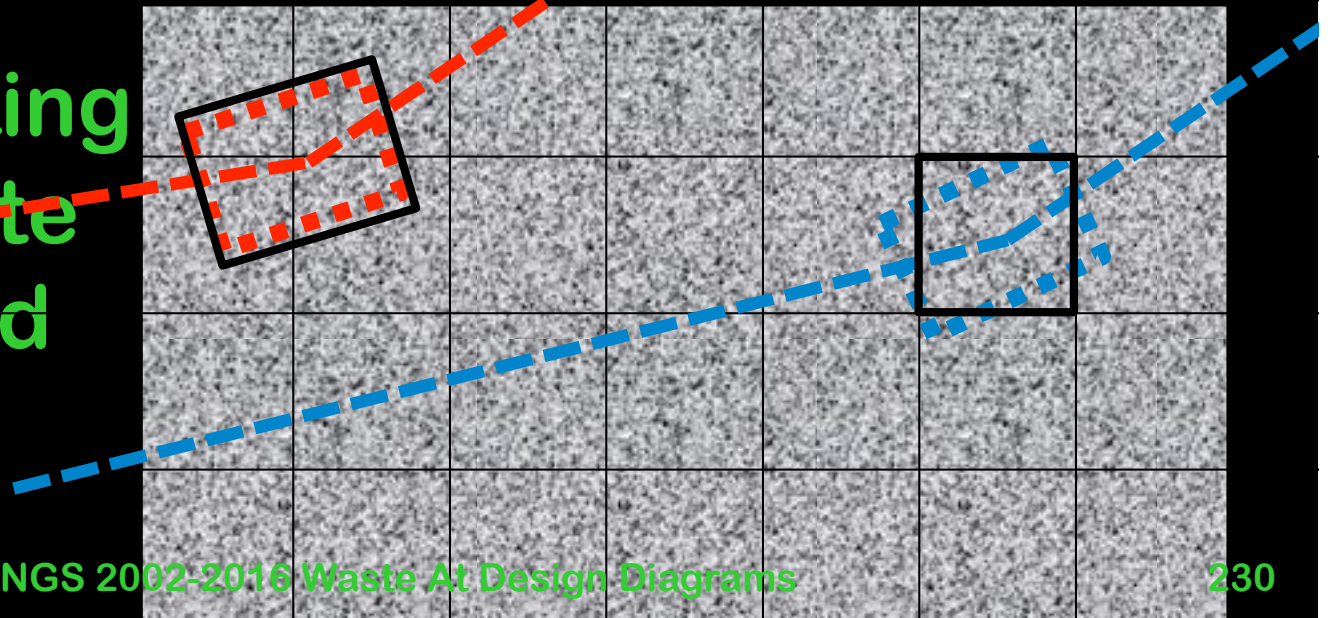


Add storage: built into walls



Coordination of Services Covers & Chambers?

- Recessed cover of chambers do not have to follow orientation of chamber
- Position of cover to co-ordinate with tiles
- Less cutting less waste
- Inside and outside



Design to minimise waste

- We are familiar with sizing walls to bricks and half brick lengths externally
- And now also blocks internally
- What about:
- 8 x 4 Panels in modules
- Lengths of structural members

Off-cuts 33%

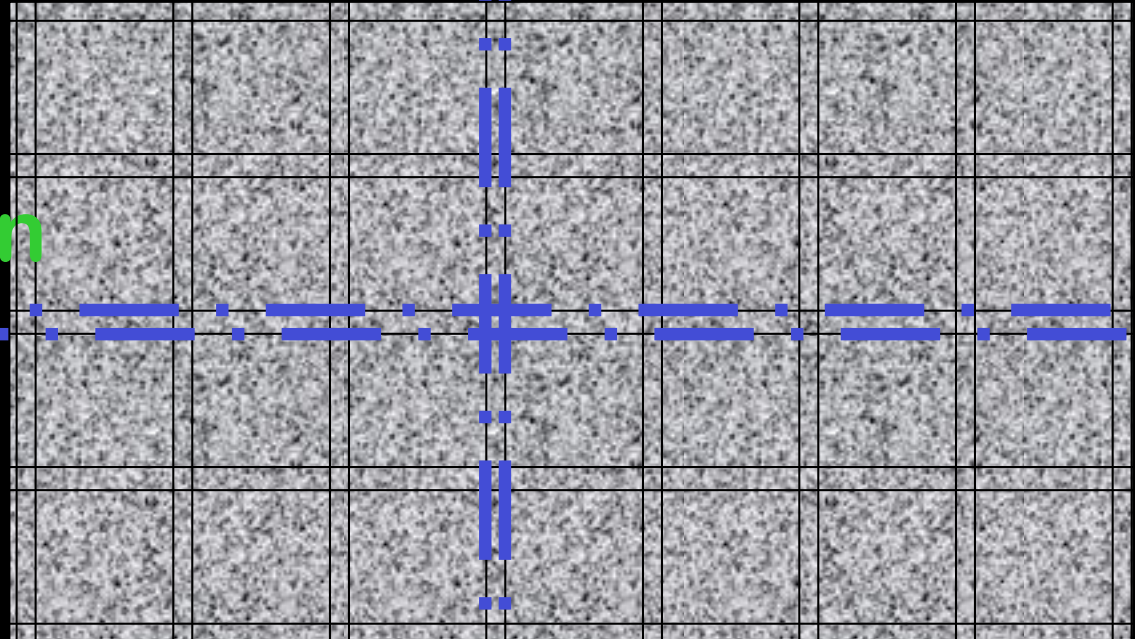
- Boards 8 x 4 Panels in modules
- Timber sections: Off-cuts for noggins
- Design structural members at size they are manufactured
- Make toilet cubicles core board and plastic laminate sheet sizes

Schools

- Money available based on set room sizes
- Does not allow for size variation to minimise waste from off cuts
- Tries to control costs
- but ends up costing more
- due to high wastage factor

Tartan Grids

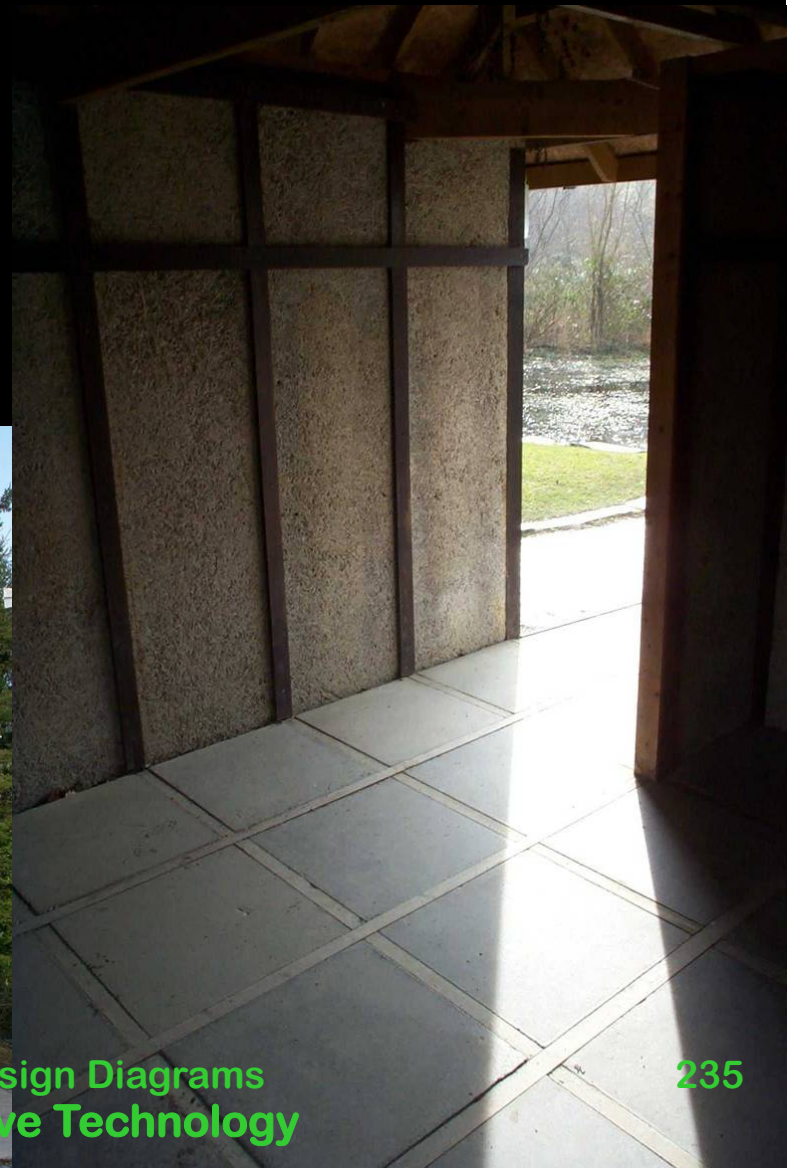
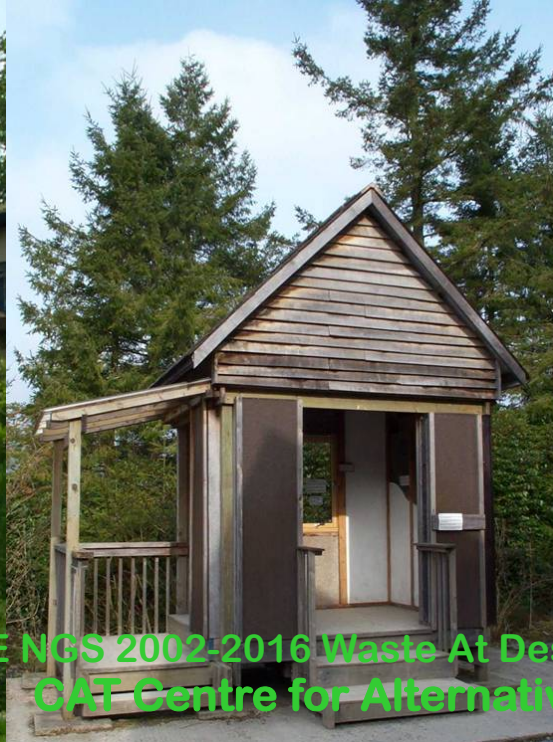
- Dimensional co-ordination
- Panels and Spacer
- Column and walls
- More cutting little waste



Modular designs waste less

- Walter Segal Method
- Whole component used full size no cutting
- Inside and out

Robin Hillier Diggers
Self-build Brighton



Partitions from Panels

**Manufactured
Panel**

**Partition
same size as
panel =
No waste**

**Partition
Smaller
Than panel**

waste

Partitions from Panels

**Manufactured
Panel**

**Requires
second panel**

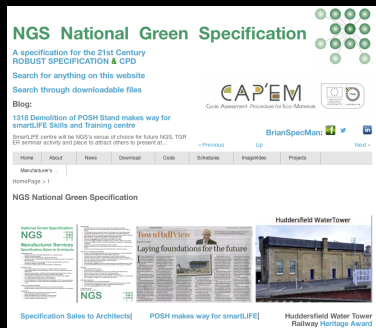
**Partition
same size as
panel =
No waste**

**Partition
larger
than panel**

**And more
waste**

Glass Partitions created from glass panes

Glass Partition same size as Manufactured pane	Requires second pane
Glass Partition larger than Manufactured pane	And more waste



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Cycle Assessment Procedure for Eco-impacts of Materials

Investing in Opportunities



This project has received
European Regional
Development Funding
through INTERREG IV B.



INTERREG IVB

Size is Everything

Co-ordinated?

6 m x 1

- Structural Grid

3m x 2

- Partition layout grid

600mm

x 10

- Plat form floors/suspended ceiling grid

500 mm

x 12

- Carpet tile size

Design Tools & Calculators

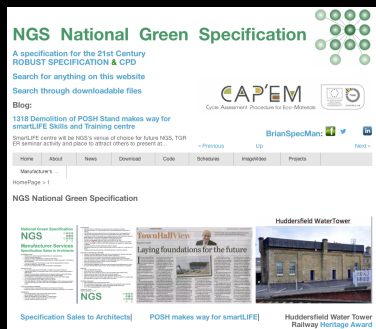
- Flooring REAP FSP ambition,
 - grant application with WRAP
- Size of space
- Size of flooring components
- Design setting out rules
- Minimum order quantities
- Waste %, tonnes, £, EE, EC
- Alternative materials: better %?
- Different setting out rules?
- **NGSCALCULATORS**

Optimum fit

- Room Size: 2184 x 3567 mm.
- Flooring product size eg 600 x 600 mm.
- Layout rules: centered/one end/angle
- Perimeter condition: skirting detail
- Offcuts: m², kg, %, £Waste, EE, EC
- Optimise: find best fit product size
- Reduce waste

Calculators

- Develop Waste Cost ® lite calculator
- Calculator 1
 - Set room size
 - Trial floor product sizes
 - Trial floor product
- Calculator 2
 - Set floor product sizes
 - Trial room sizes



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Cycle Assessment Procedure for Eco-impacts of Materials



Demonstration

[file:///localhost/Users/BrianSpecMan/Documents/
ASWSDOCS/GREEN/NGSpec/NGSServices/
NGSWasteCostLite/WasteCostLite\(R\)B.xls](file:///localhost/Users/BrianSpecMan/Documents/ASWSDOCS/GREEN/NGSpec/NGSServices/NGSWasteCostLite/WasteCostLite(R)B.xls)



INPUTS

OUTPUTS

1

Number of buildings	0	No.
Building Footprint	0	m2
Number of floors	0	No.

2

Choose a construction type closest to your project		
Average (All building types)	Yes	Type Yes in only one cell
Average (Offices)	No	
Average (Residential)	No	Make sure No appears in the remainder
Innovative MMC Prefab Housing	No	
Steel and Glass Office	No	

Cost of one skip system of mixed waste removal	£0.00
"Waste segregation will cost more money"	£0.00
Revised cost of reduced one skip mixed waste system	£0.00
"But look how much it can save!"	£0.00
Predictable Volume of waste generated on Project	0 m3
Volume potentially diverted from landfill	0 m3
Volume diverted with chosen waste streams	0 m3
Predictable weight of waste generated on project	0.00 tonn
Weight of waste potentially diverted from landfill	0.00 tonn
Weight diverted with chosen waste streams	0.00 tonn
Potential % diverted from landfill (by tonnage)	100%

3		4		5		6	
Potential Waste Segregation/Reclaim & Reuse/Recycling Streams	Add Yes or No in each cell to indicate which	Add or replace rates with local collection rates £/tonne		Number of 8 CuYd skips for each waste stream		Potentially Reusable or recyclable m3	
WAS+ICE Colour system							
No Segregation (Mixed incl. Hazardous)	Yes						
Inert	No	£15.00 £/tonne		0 No.		0 m3	
Mixed metal	No	-£25.00 £/tonne		0 No.		0 m3	
Mixed (non Hazardous)	No	£75.00 £/tonne		0 No.		0 m3	
Timber	No	£25.00 £/tonne		0 No.		0 m3	
Packaging	No	£15.00 £/tonne		0 No.		0 m3	
Compactable	No	£15.00 £/tonne		0 No.		0 m3	
Plasterboard	No	£25.00 £/tonne		0 No.		0 m3	
Hazardous	No	£800.00 £/tonne		0 No.		0.0000 m3	
	1			0 Total		0 Total	
Total number of waste streams proposed for		Local waste collection rates £/8m3 skip	Local waste collection rates £/tonne	Total number of 8 Cu Yd skips		Potentially Reusable or recyclable m3	Mou over reac

Lazy Architecture

- Simple repetition without differentiation
- No awareness of size
- Cut perimeters
- Wasted materials

Proactive Architecture

- Need to know the size of stuff
- Need to work with them not at odds
- Look after the edges the middle looks after itself
- Keep it Simple

I Can CAD, CAD can, So I Do



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Eco Greenwash Architecture



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1000 x 1 or 1 x 1000

- 1000 bespoke sizes and shapes
 - No large scale production runs
 - Every one is handled slightly differently
 - No simple packaging
 - Labelling critical
 - Production assembly and delivery sequence vitally important
- Or 1 size x 1000



Glass Cutting: Almost Rectangular

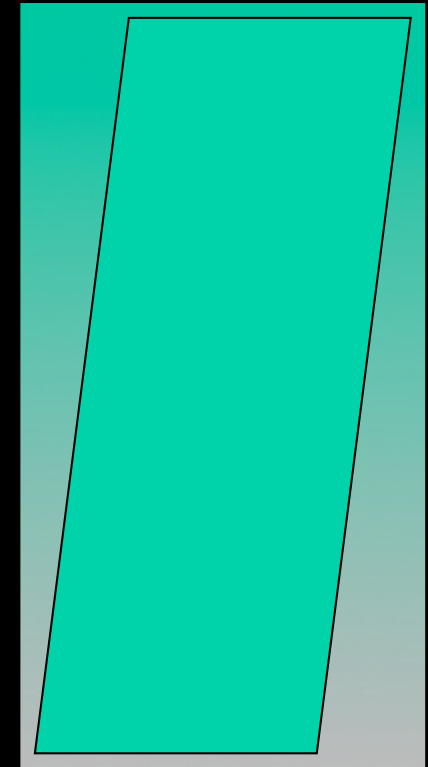
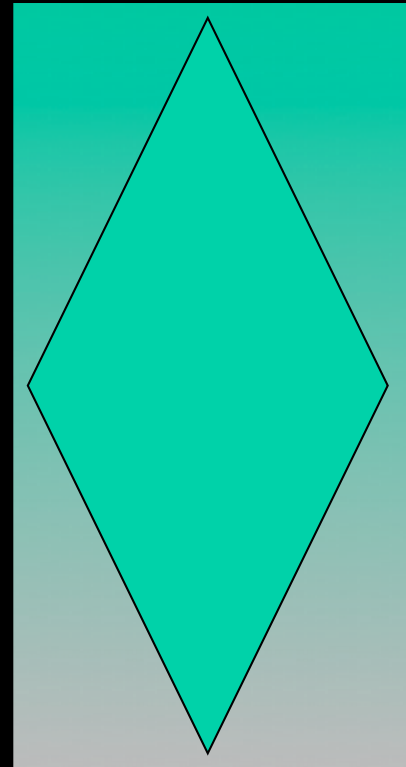
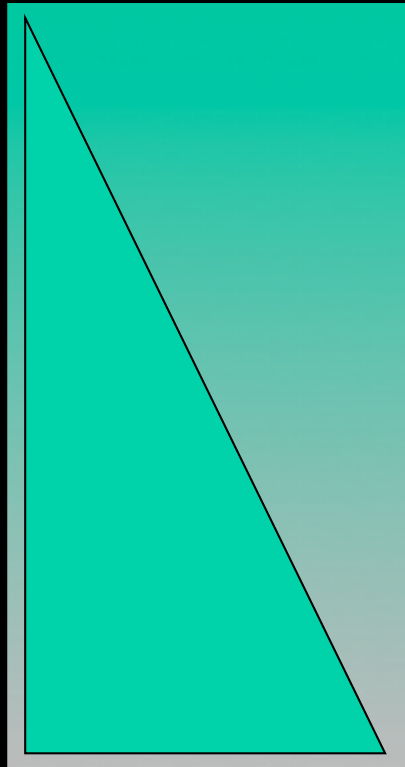
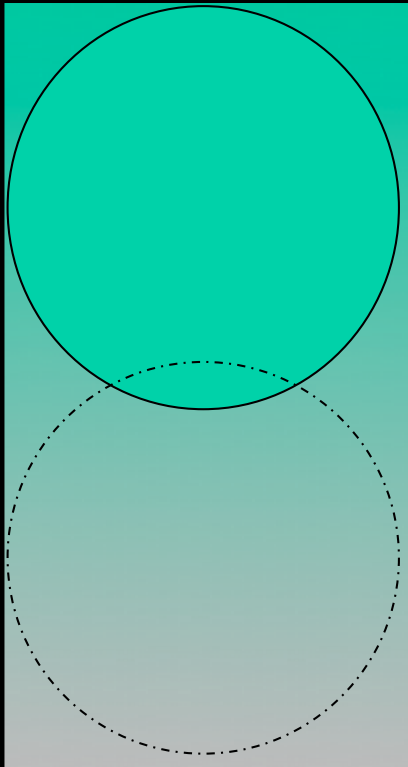
© CBE NBS 1002-2014 Most 7th Design Diagrams

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SMM7 Standard Method of Measurement

- All shapes cut for closest rectangle
- All off-cuts are waste
- Accuracy +/-10%
- No concern about waste or site ordering from quantities
- Contractor expected to re-measure

Glass Cutting SMM



**If you want a shape you pay for a rectangle,
if the rectangle is paid for, nobody cares about waste**



**Consistent glass
triangles within each
level**

**Different triangles at
almost all levels**

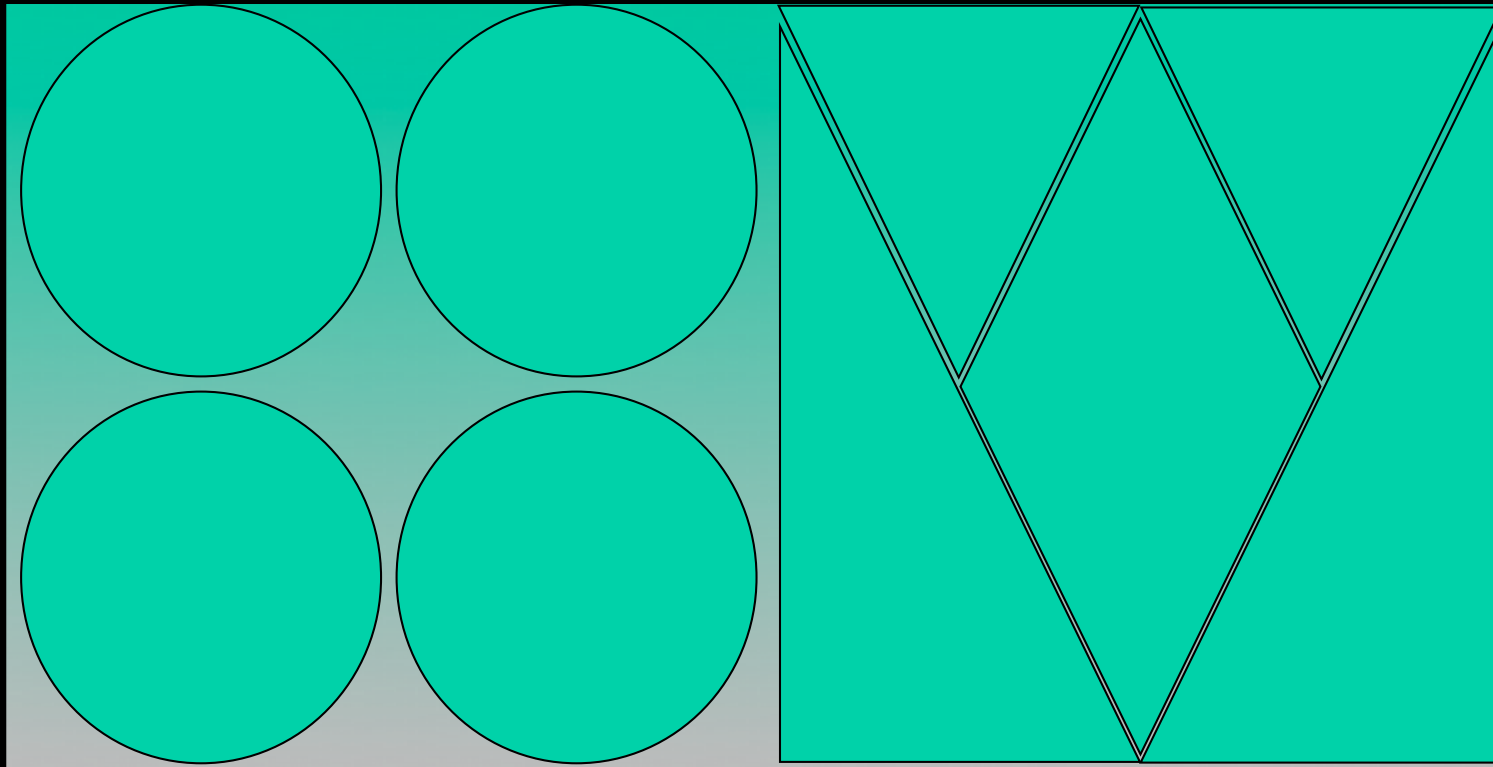
No vertical columns

**Vast amounts of off cuts
on the factory floor**

**We hope its all recycled
in manufacture**



Glass Cutting CAD/CAM tailoring = Iteration



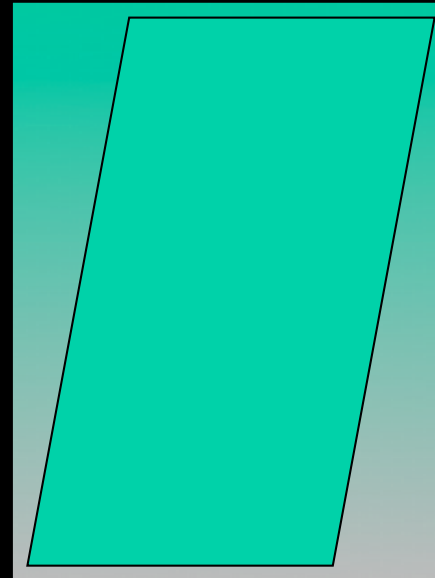
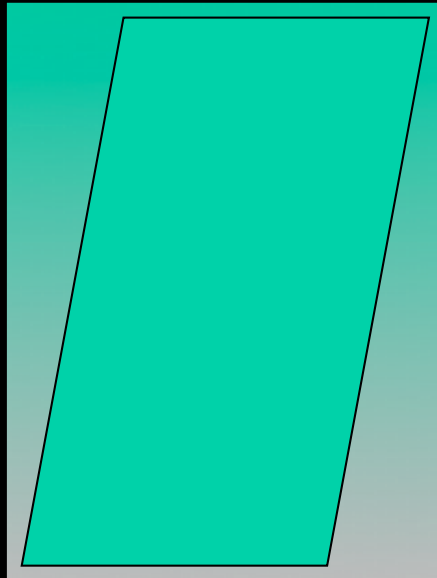


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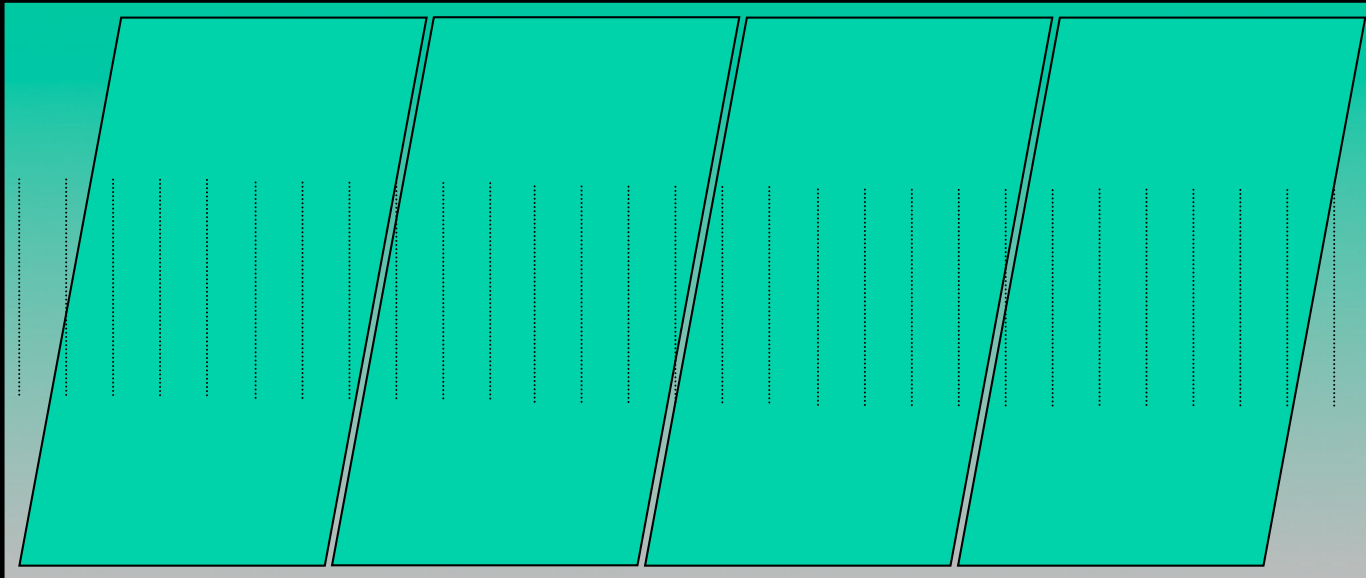
CAD/CAM Tailoring = Iteration

- Maximising the yield from sheets of glass
- Many pieces arranged to get more pieces from smallest glass pane
- Pieces cut from sheet
- Just like a tailor and fabric directionality is important
- Potential conflict with 'Roller Wave Pattern'
- RWP occurs as glass is rolled off zinc float and 'slumps' over supporting rollers

SMM Glass Cutting simple parallelograms



Glass Cutting CAD/CAM tailoring with simple parallelograms

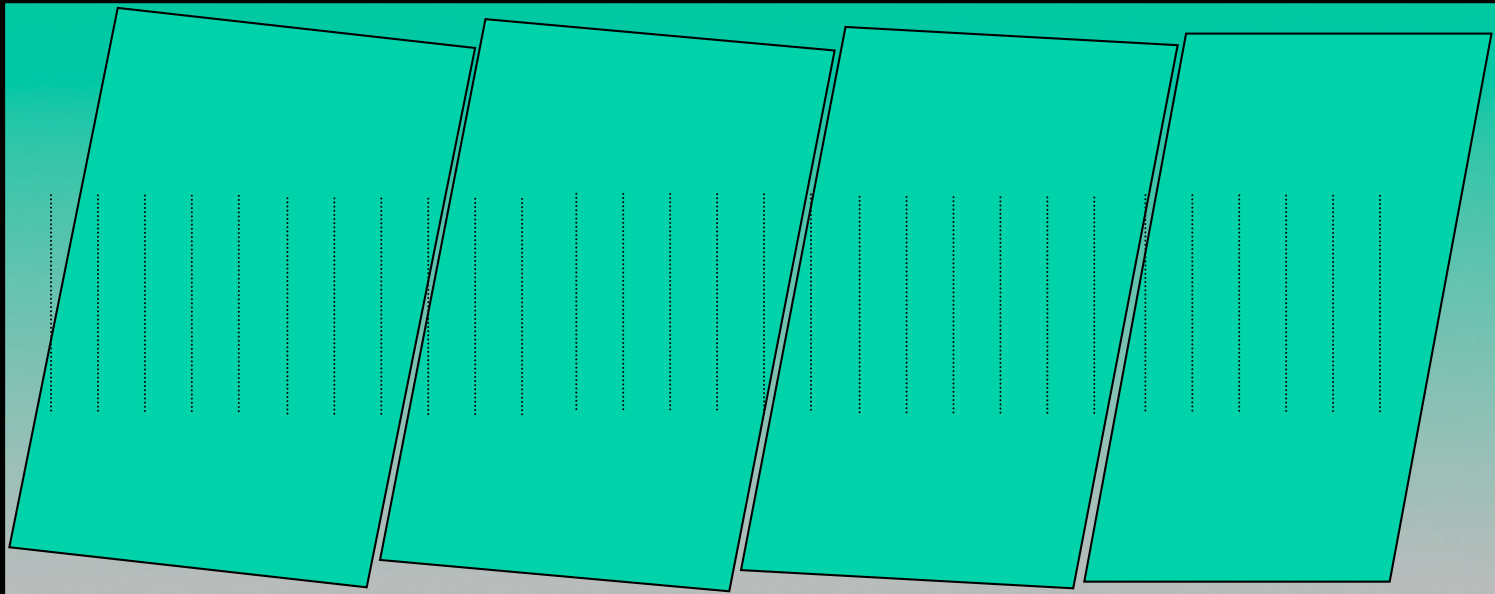


**Facetted triangles
consistent on any one level
No standard parallelograms**

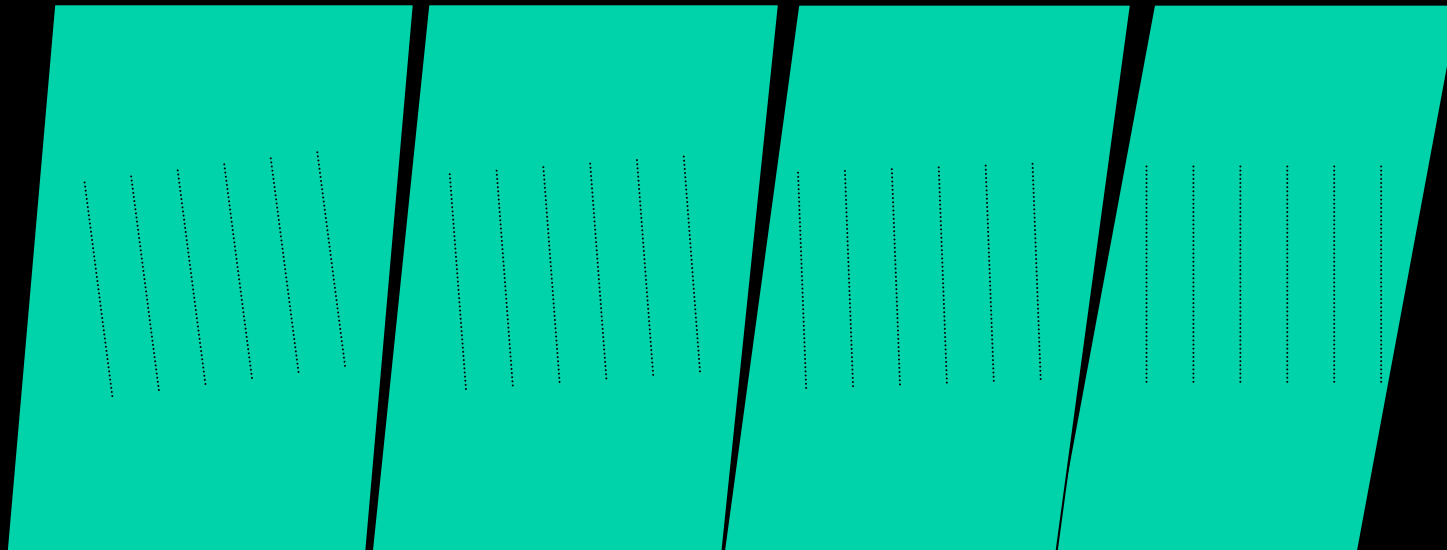


Glass Cutting CAD/CAM

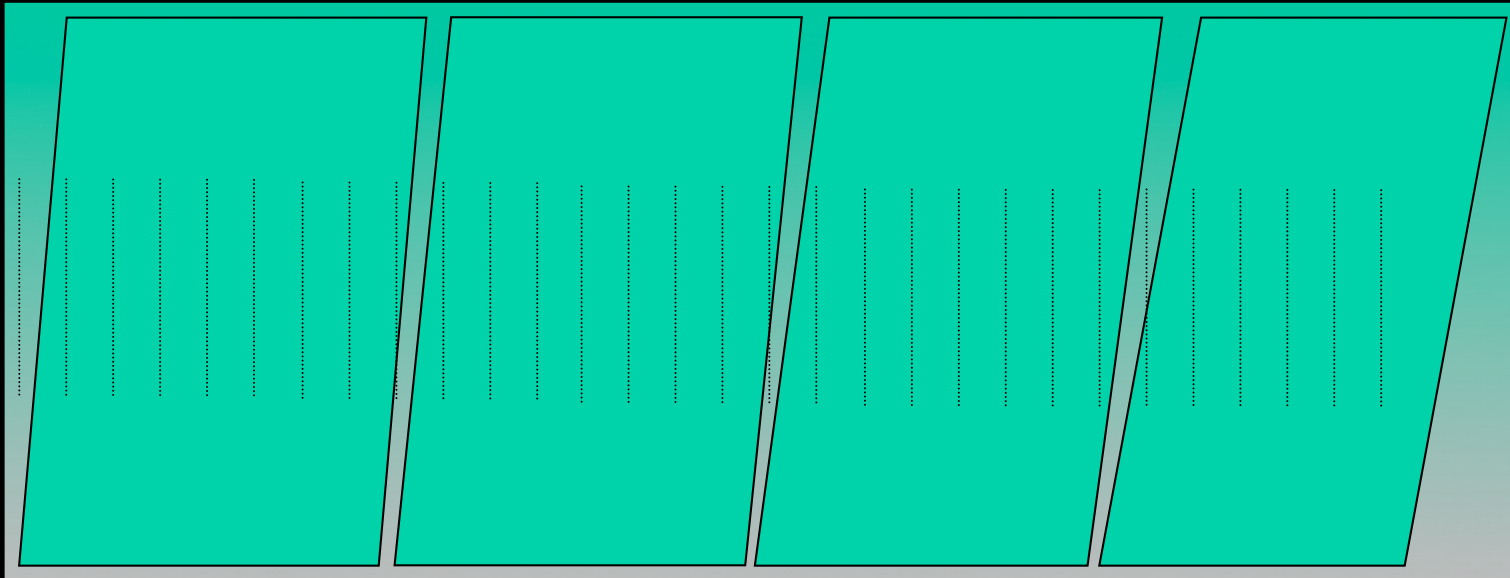
No pane is the same
efficient tailoring or iteration &
efficient resource use



Could lead to
irregular roller wave pattern
when installed



Glass Cutting CAD/CAM
less efficient tailoring/iteration
regular installed roller wave pattern
Less efficient resource use





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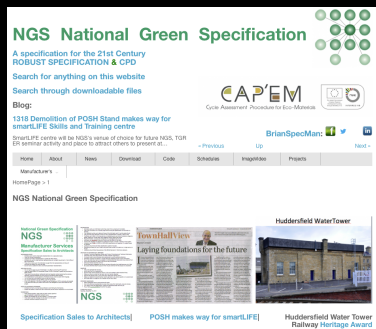
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Cycle Assessment Procedure for Eco-impacts of Materials

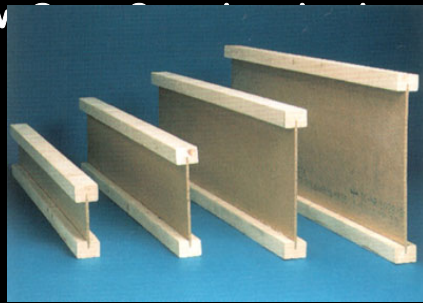


Resource Efficiency

Waste not Want Not



www.uk



Cycle

Schedule all your requirements before determining the optimum length to minimise cutting waste in the whole project
 1 x 12m
 2 x 8.0m
 3 x 7.0m
 5 x 5.0m
 12 x 4.0m
 25 x 1.0 m
12 m length works
But how many pieces?

EM

for Eco-impacts of Materials



12 m

8m

4m

7m

5m

4m

4m

4m

1m

1m

1m

1m

1m

1m

1m

1m

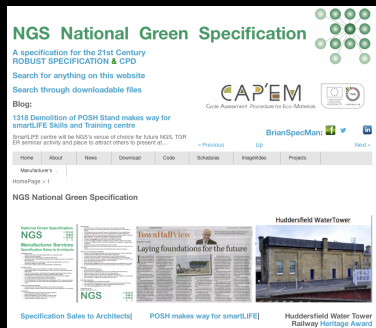
1m

1m

1m

1m

12 m length chosen as optimum size for 8m, 7m, 5m, 4m, 1 m lengths



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Cycle Assessment Procedure for Eco-impacts of Materials

Investing in Opportunities



This project has received
European Regional
Development Funding
through INTERREG IV B.



INTERREG IVB

Natural Materials have Natural Variations

Accept them or choose again

Slate production

- For every tonne of Welsh slates created
- 100 tonnes of waste
- Welsh use explosives
- China and Spain cut from solid block
- Cheap slate competes with Welsh unfortunately



Slate use

- 1 tonne = 100 tonnes of waste at quarry
- Green Spots: 85% rejection at quarry
- More on site:
- We need to accept natural variation in natural materials
- Or choose again



Articulation highlights variation



A photograph of a curved wooden reception desk in a modern office or public space. A metal handrail runs along the edge of the desk. On the desk, there are some papers, a pen, and a small circular object. In the background, there are more desks, chairs, and some office equipment. The text "Articulation accepts variation" is overlaid in green.

Articulation accepts variation

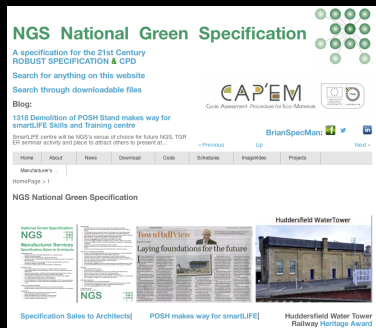
Production waste stock piles

- 6000 m tonnes of waste stockpiled in UK
- Welsh Colliery spoil mountains
- Part of the Welsh heritage and landscape
- Quarries filled are now being re-mined
- Secondary aggregates used in construction and landscape

Temporary Materials 10.2%

- Timber formwork for concrete is thrown away
- Why not timber frame?





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Investing in Opportunities



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INTERREG IVB

Design for Construction & Deconstruction

Fixings and Fastenings Sequence and Layering

Design for better Assembly

- Locational fixing
- M&T joints
- notching instead of nailing
- Doweled joints
- Screws Pelleted or Plugged



Locational Assembly + Gravity

no dimensional limitations
no waste no fixings



Locational Assembly oversized and compress

- If rafter spacing and insulation size correspond
- No waste
- Do they?



Choice of fastening techniques

- Using nuts and bolts, screws
- Instead of adhesive, welding and nails.
- Using ballast instead of adhesive:
Green roofs or paving





Methods of Assembly and Fastenings to permit deconstruction and reuse of components



Methods of Assembly and Fastenings to permit deconstruction and reuse of components

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Greenwich Millennium Village and Oxford Science Park Architect: Proctor Matthews

Brickwork

- Lime mortar is softer, weaker, flexible
- Cement mortar is hard, stronger, rigid
- Lime mortar can be knocked off
- Cement mortar cannot be knocked off
- Lime mortared bricks can be reclaimed
- Cement mortared bricks make hardcore

**Think about
Demountability
Reconstruction
& Reusability**



**Fixings &
Fastenings
avoid welding
adhesive & nails
Use screws & bolts
or ballast**



Greenwich Millennium Village Phase 2a

- Egan initiative implemented:
prefabrication off-site,
- reduction
of site waste
- simple assembly
on site,
- later on-site
factory-production



Factory Prefabrication:

- Conditions ensure no deterioration
 - Permit time to set, cure, strengthen
 - Permit time for enhanced performance
 - No mud or cement splashes
 - No rain to spoil
- Use of all the materials supplied
 - Reusing off cuts until all is gone
 - Virtually no waste
- Allows servicing coordination
 - Allow time for proofing in comfortable conditions not under site time pressures
- Can be 24 hour production
 - Sites need special permission for 24 hours

Layered Construction



simplifies details and
avoids interfaces

Don't puncture DPM,
GPM and VB or ATL
add services zones to
avoid complications

Ease deconstruction

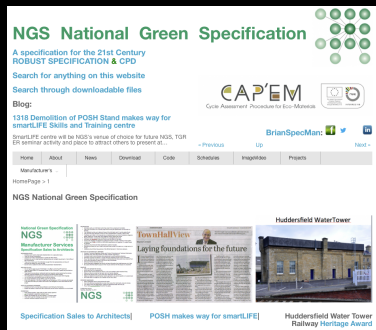
Layered Construction

Avoid chasing masonry
Avoid waste materials
Avoid masonry dust
Avoid conduits
Avoid Rendering-in

Surface mount all
services and cover with
hollow Skirtings,
dado, etc.

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Cycle Assessment Procedure for Eco-impacts of Materials

Investing in Opportunities



This project has received European Regional Development Funding through INTERREG IV B.



INTERREG IVB

Avoiding Complex materials or assemblies

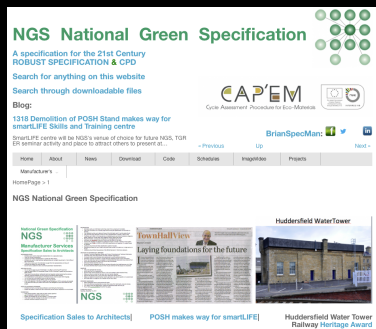
Complexity v Deconstruction
Separation for reuse v Landfill

Avoid difficult materials

- Composites are difficult to separate and recycle
- Decorative and protective coated metal, adhesive and foam insulation
- But Tradis uses timber framing, cellulose fibre boards and recycled newspaper insulation

Avoid difficult materials

- Decorative and protective coated metal
- Coated aluminium will be recycled
 - But getting coatings off by chemicals or heat creates emissions or hazardous waste
- Currently uncoated often does not get segregated but it has the potential to



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INTERREG IVB

Packaging Deliveries & Site Storage

Prone to damage onsite

Materials

Protection:

Full high build micro porous paint/stain scheme over all surfaces in the factory

No absorbent surfaces

Unlike UK practice of priming hidden faces or leaving bare and absorbent



Packaging & Protection:

Palletted

Corner protection

Lateral bracing

Poly wrap

Breathing holes

Site tarpaulin

But:

Adjacent to traffic
routes: potential splash
and damage

Lean doors on it

JIC not JIT

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BedZED Beddington Sutton Architect: Bill Dunster



Delivery Volume

12 m

8m

4m

7m

5m

4m

4m

4m

1m

1m

1m

1m

1m

1m

1m

1m

1m

1m

1m

1m

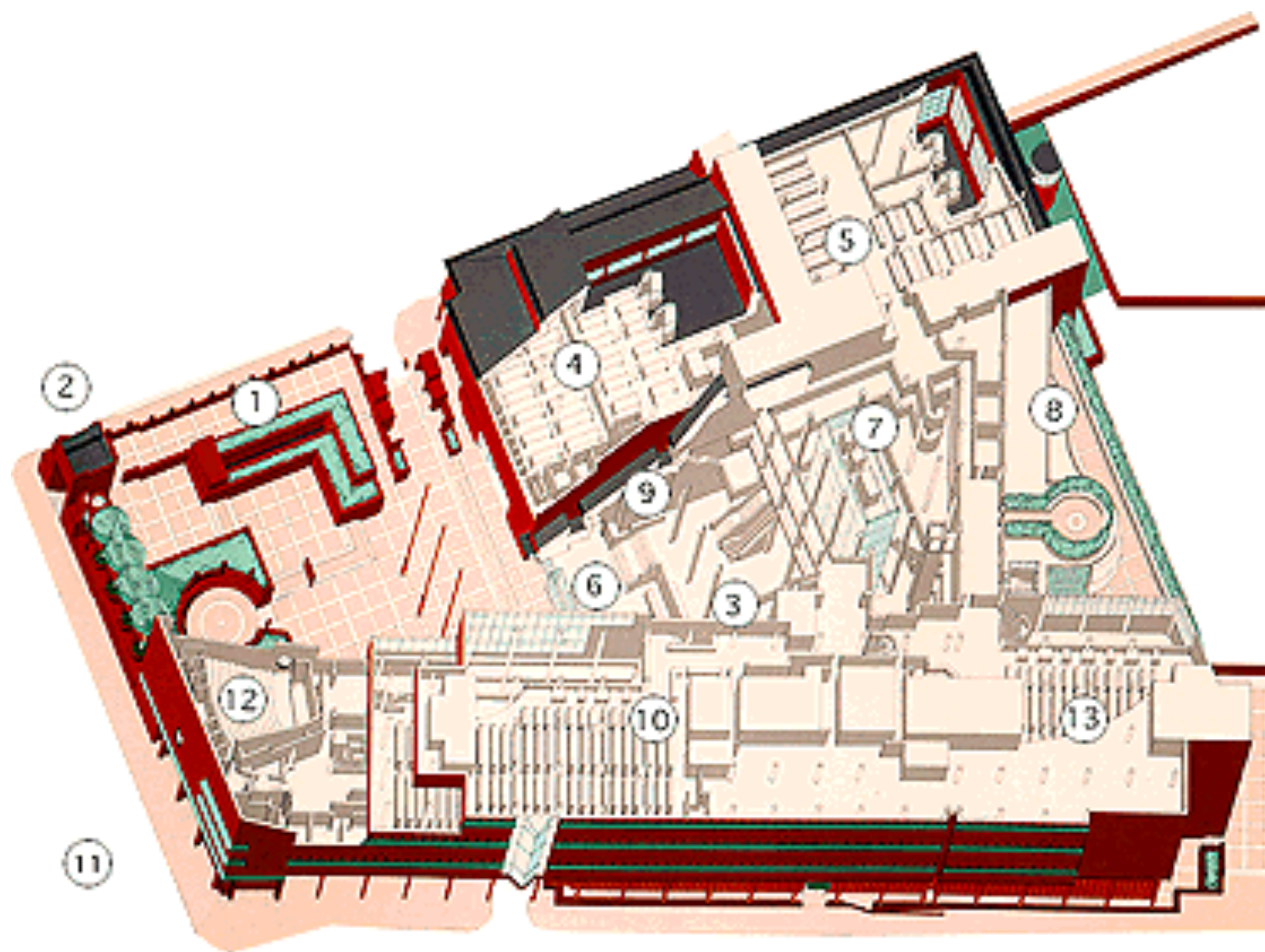
12 m length chosen as optimum size for 8m, 7m, 5m, 4m, 1 m lengths

Delivery Sequence

- The first to be constructed
 - to be delivered first
- Large deliveries and containers
- First to be installed
 - last on lorry and last in container
 - First off and first out, used first
 - No materials delivered extracted, spread out and sorted in any weather conditions

Assembly Sequence

- Chinese jigsaw puzzles
- Assembly sometimes need to follow a sequence
- One partly assembled piece may prevent the assembly of another
- If you test assemble in the factory you may discover it,
- if you do, pass the information to site



Design-in material storage for on-going maintenance

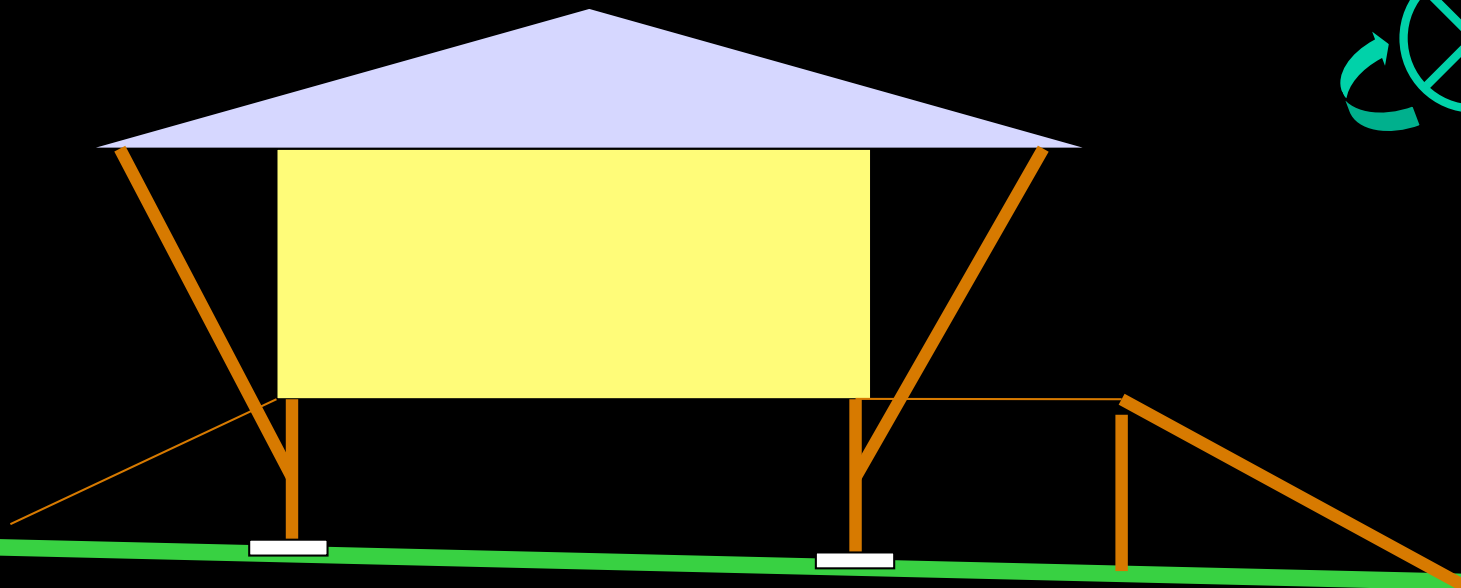
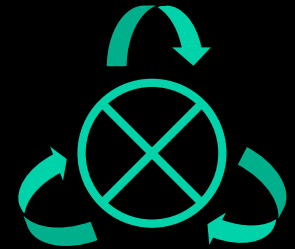
10m tonnes/a over ordered

- Provide space in the building to store unused materials
- For snagging
- For 12 months defects
- For employer to maintain the building
- Make sure contractor gets paid for it
 - if the building is re-measured on completion and only installed is paid for

Spares from batch for maintenance

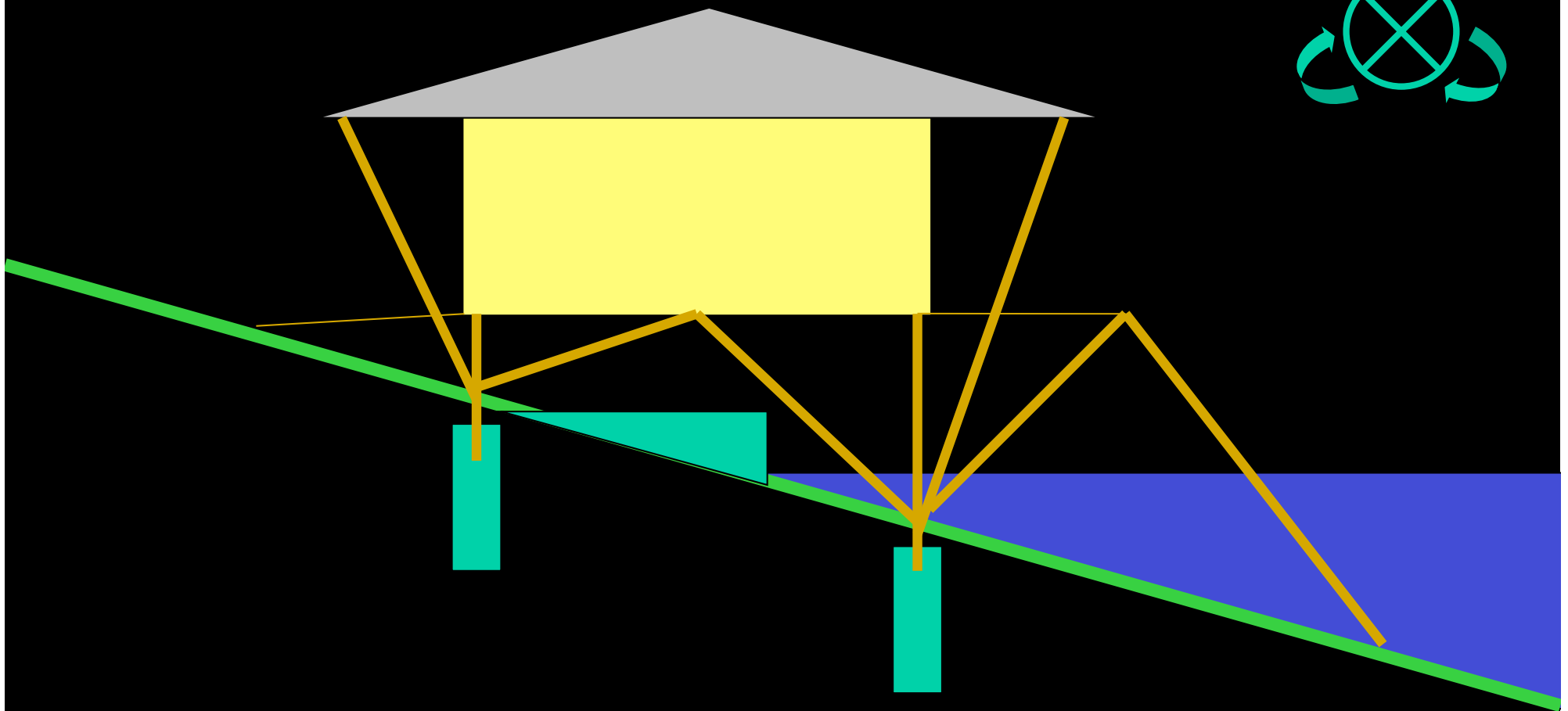
- Long life buildings: lots of materials to maintain over life
- BLE: Basement 500 year design life
- 1 store per fire compartment for spares (PVC flooring)
- Bluewater: Fix spare balustrade parts
- Car park structure: bolt in spare railings

Storage of spares for maintenance



Spaces of services
and storage

Storage of spares for maintenance and a light touch



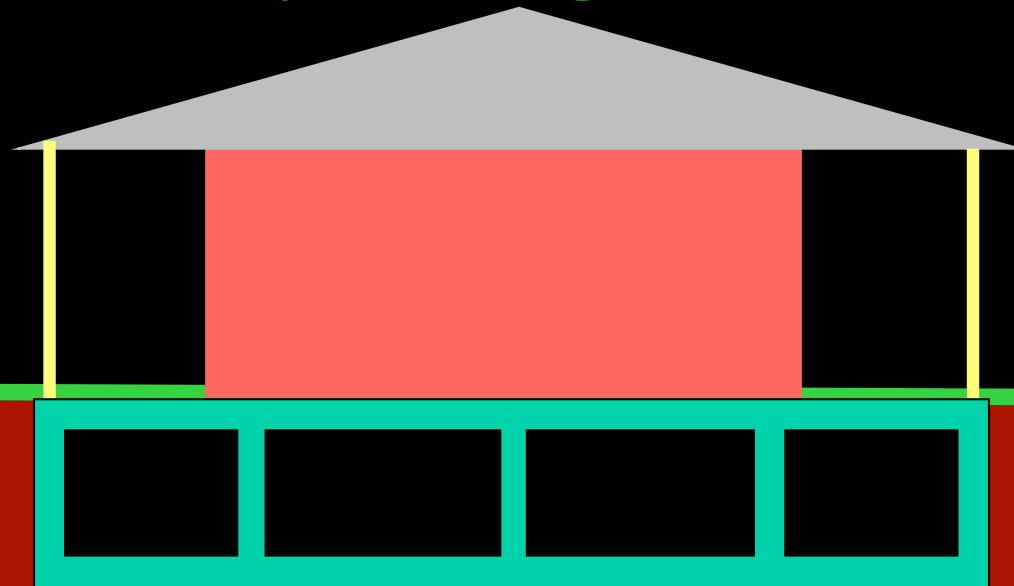
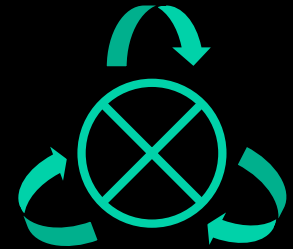
Spaces of services and storage above flood zone

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Basement raft

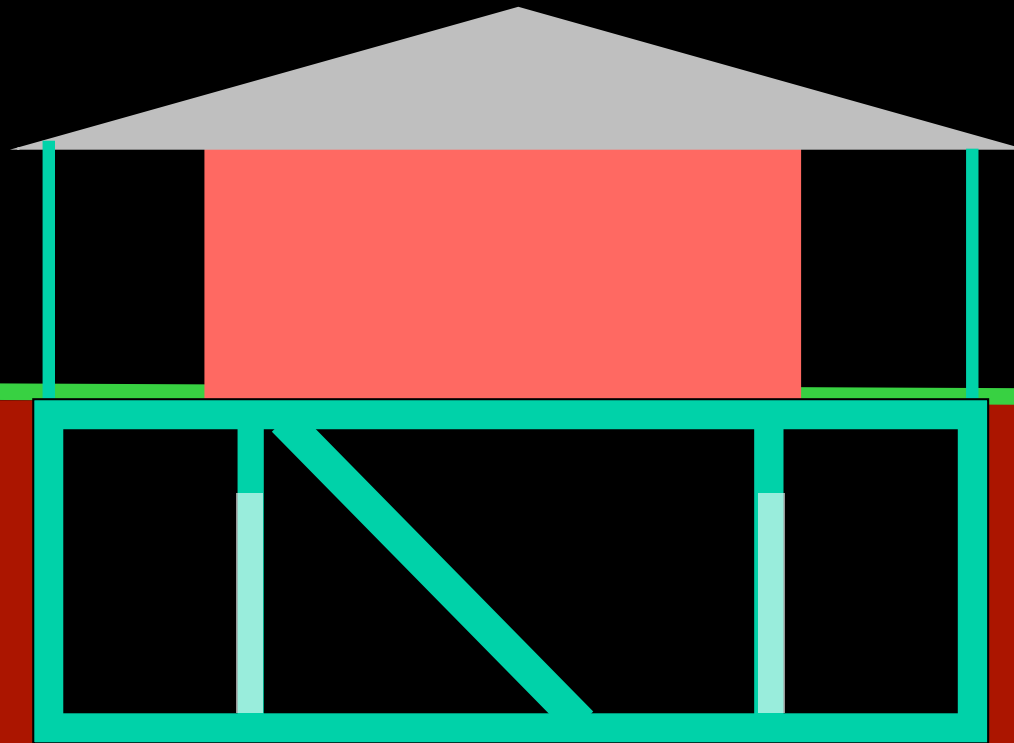
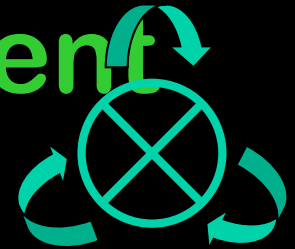
- The space between the top and bottom slabs is high enough to make accommodation
- This maximises the accommodation on the site and offers opportunities for plant and storage space
- But generates considerable excavation arisings

Reinforced eco-concrete Cellular Raft foundation on poor ground



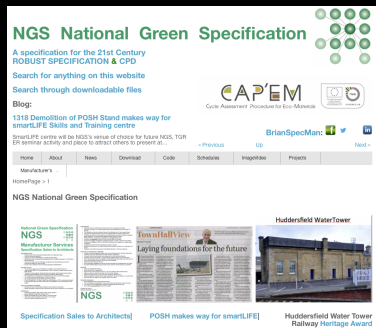
Reinforced eco-concrete raft foundation
In clay and moisture sensitive soil: 900 mm. thick
To resist moisture movement and frost heave
Displaces more excavated soil

Reinforced eco-concrete Cellular raft foundation on poor ground, turned into basement



Basement for services and storage
Reinforced eco-concrete cellular raft foundation
Displaces lots of excavated soil

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Space for Waste

Temporary Building made from waste

“Space Of Waste”

- An Inspirational Take On Waste Reduction
- A temporary building designed and built
- University of Sheffield architecture students
- raise awareness of diverting waste material from landfill
- nominated for the AJ Small Projects Award
- This highly unusual temporary building
- Is made entirely from other people's rubbish!
- Commissioned by a free online waste exchange for businesses in Yorkshire & Humber.
- www.whywaste.org.uk

- Challenged the student design team
- find and use reclaimed and recycled material from the waste exchange
- Walls made of waste 'skeleton' sheets of birch plywood left over from the manufacture of children's furniture;
- Wall made from baled blocks of polythene bags.
- Roof comprising 900 scrap carpet tiles
- Building's lighting: chandeliers made from cylindrical Perspex off cuts from a shop-display manufacturer.
- Construction aspects of the build were overseen by Geoff Stow, self-build expert and timber-frame construction lecturer at the Centre For Alternative Technology in Wales
- Structural calculations by Arup.

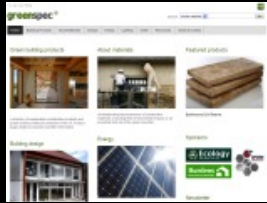
- **Winners of the AJ Small Projects Award will be announced in March**
- **see photos of the project**
- www.beat.org.uk/bm/why_waste/space_of_waste/index.shtml
- **Source:**
- www.get-sust.com/newsletters/issue34.html





Waste in use

- Don't forget to make space for segregating and compacting packaging waste
 - to return to sender under packaging producer obligations
 - Or divert from landfill to recyclers
- Especially in Retail
 - Bullring is an example where there is too little room



Design for Deconstruction Reclaim & Reuse

Preparing for life after landfill

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Waste at Design Facts & Figures

08/04/2008 07:15

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Facts and Figures

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Design to Reduce Waste on GreenSpec

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Design to Reduce Waste

Condensed GreenSpec Display



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