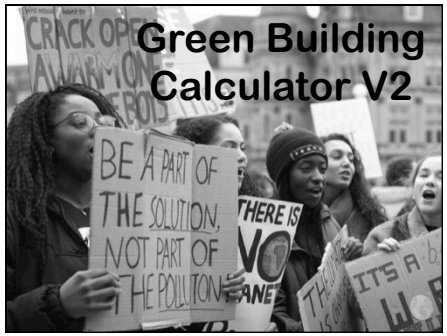


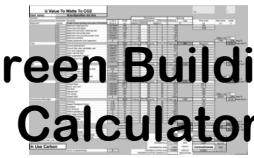
GBC
Green Building Calculator
https://GreenBuildingCalculator.uk

GBE https://GreenBuildingEncyclopaedia.uk
GBC Green Building Calculator https://GreenBuildingCalculator.uk

Green Building Calculator V2

Step by step guide to calculating and costing the embodied and in use carbon load of your building
CIAT Webinar 7-8pm 23rd March 2022

GBE https://GreenBuildingEncyclopaedia.uk
GBC Green Building Calculator https://GreenBuildingCalculator.uk



Green Building Calculator

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BrianSpecMan Murphy GBC Number-Cruncher

GBE https://GreenBuildingEncyclopaedia.uk
GBC Green Building Calculator https://GreenBuildingCalculator.uk

Futurebuild 2022

- No underground Tuesday and Thursday: less public
  - Exhibitors visited each other seeking opportunities
- We met many potential development collaborators
  - Manufacturers: Suppliers
  - Dataset providers: Products, labour, carbon
  - GUI Developers
  - BIM Developers
  - Universities and students
  - Other countries that want GBC for their markets
- 370 emails and business cards collected (a lot of interest)
- Students want Apps "What is MS Excel?"
- Reminded by one delegate GBC is BInformationM without the 3D interface
  - With potential to have CAD BIM interface
- Planning Zoom meetings:
  - Users, Dataset providers, manufacturers/suppliers/installers, collaborators
- Lots of good will and desire to develop know-how and knowledge into something bigger better sooner

GBE https://GreenBuildingEncyclopaedia.uk
GBC Green Building Calculator https://GreenBuildingCalculator.uk

Green Building Calculator

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BrianSpecMan Murphy GBC Number-Cruncher
Version 2 launch 1st March @ FutureBuild 2022 Digital Arena Stand L68

GBE https://GreenBuildingEncyclopaedia.uk
GBC Green Building Calculator https://GreenBuildingCalculator.uk

This Presentation on GBE:

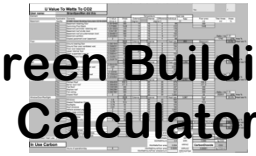
- Find this file and event on GBE website at:
- https://GreenBuildingEncyclopaedia.uk/?p=40045
- https://GreenBuildingEncyclopaedia.uk/?p=40122
  - PDF Show: CIAT Webinar
  - Also find:
  - Full version of GBC CPD PDF (439 slides)
  - Links to all GBC related pages on GBE website
  - Links to GBC website
  - https://GreenBuildingCalculator.uk
  - Video Recording

GBE https://GreenBuildingEncyclopaedia.uk
GBC Green Building Calculator https://GreenBuildingCalculator.uk

CIAT Programme

- 10 minutes intro to GBC V2 %%%
- 2 minutes case study in use
- 48 minutes tour and demonstration of GBC V2 %%%
- Please ask questions when they occur

Green Building Calculator



I want.. I want.. I want..

I am coming at this problem:

- Technician and Architect by training
- Specification Writer by choice (37 years)
- Sideline frustrated spectator
- Observer of projects going wrong:
  - Briefing battens dropped at each interchange
  - Because of bad cost planning and layers of procurement complications
  - Lack of joined up management of it all
  - Loss of scrutiny of competency of anything

I don't want:

- A building Performance Gap
  - Started by philosophical, aesthetics and snappy-graphics education
  - Little or no technical, physics, science, numeracy, environmental education
  - Increasingly challenging Legislation Regulation interpretation and Administration
  - RIBA discouraged and shrinking supervision role
  - Insurance encouraged "don't approve anything"
  - Evolves into vulnerable technical design
  - Invited by "Or Similar" annotation of drawings ("Or Equivalent" is safer)
  - Undermined by substitution and surreptitious substitution
  - Brought on by inadequate tender leading to bread and butter contracts
  - Manipulated by main contractor Dutch bargaining with sub-contractors
  - Lubricated by power over supply chain
  - Facilitated by out of control & bespoke procurement methods
  - Muddied by misaligned perceptions
  - Encouraged by Constructing Excellence 10% year on year improvement
  - Compounded by 2013 Industrial strategy -33% cost, -50% emissions, -50% time
  - Cost cutting in disguise as "value engineering"
  - Driven by inadequately specific incompetent cost planning
  - All leading to: incapacity of construction sector to deliver:
  - Client's bespoke design, green brief & investment ambitions

Why did I start making GBC?

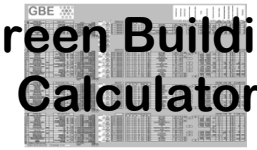
- I want I want I want..... us all to do better, first time
  - Clients: to get what they asked for not what we gave them
  - Quality Surveyors: to do VE not Cost cutting, WLC not cheap, carbon & costs
  - Procurement: to focus on management of competency of end result
  - Manufacturers: to provide all important data, multi-functional products
  - Environmental Assessors: to guide designers with facts and figues
  - Building Designers: to do their own cost planning & technical analysis
  - Enable non-BIMers to do BIM app type analysis outside of BIM
  - Tenderers: to price a proper job and aim to claim no extras
  - Advisory Bodies: To be able to give more robust guidance
- To have better information at hand when they make all specification decisions
  - Evidence Based Design
  - Competent as was intended

I want I want I want
I am reminded to

Be the change you want to see in the world

Mahatma Gandhi

Green Building Calculator



Case study:
International Timber Competition
28th May 2020

Design Review and Carbon Data

- Architectural Competition Entry
  - Metsa Timber Technology Competition 2020 Entry
- exStudent Samael Coco LSBU Post Graduate Architecture EREID Module
- Competition Entry requires carbon data
  - Samael needed help
  - Called on GBC to provide it

Int. Timber Competition Entry

GBC prepared and provided:

- U value calculations with each insulation option
- In use Energy & Carbon comparisons:
  - Building Regulations AD L
  - AECB Carbon lite,
  - Passivhaus
  - LETI U values
- Embodied Energy, Embodied Carbon and Sequestered carbon
- before and after calculations

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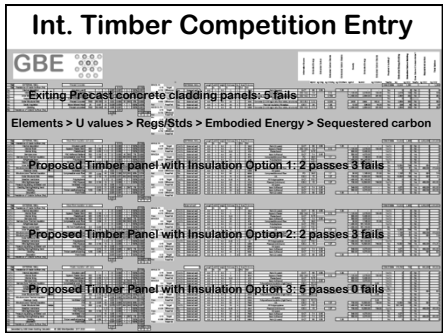

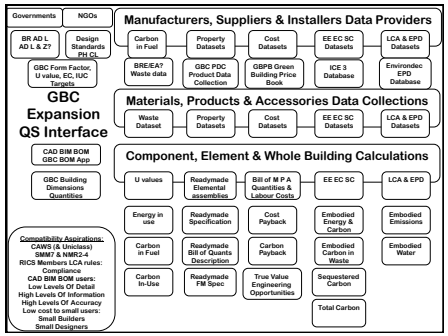

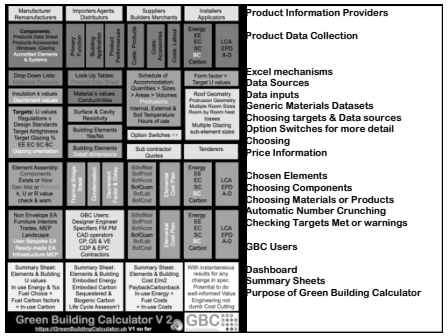

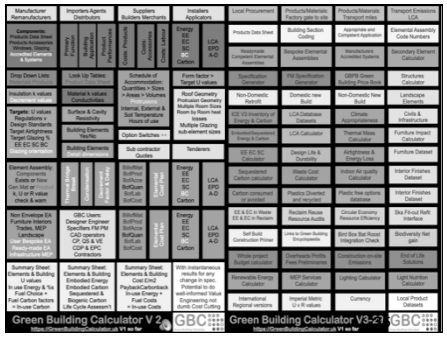

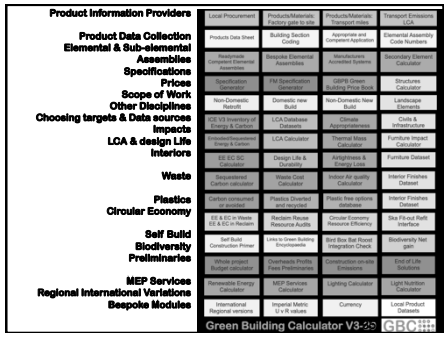

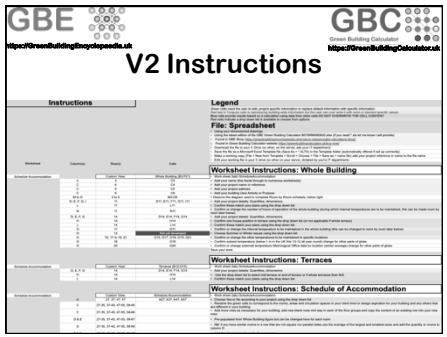

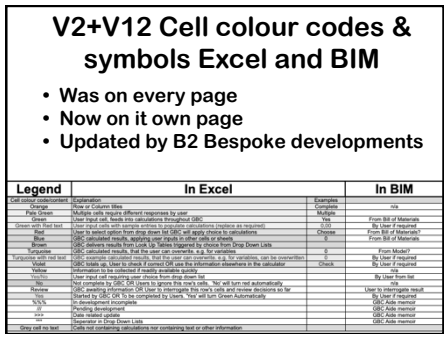

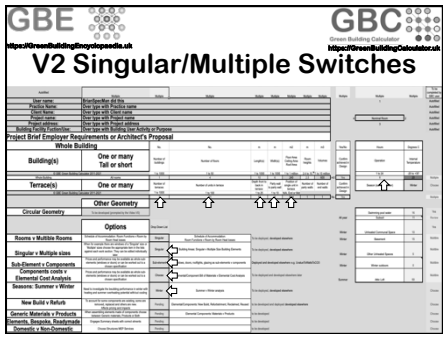

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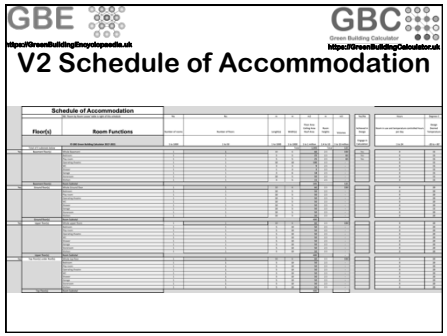

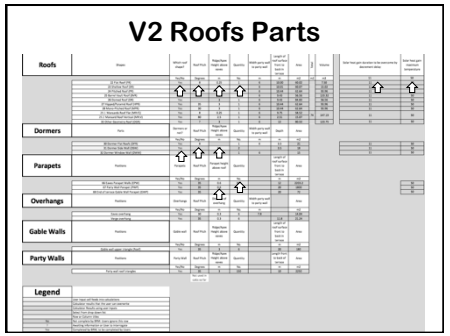

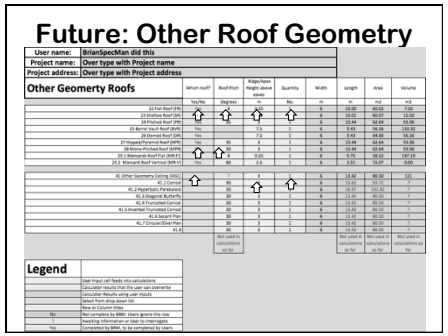

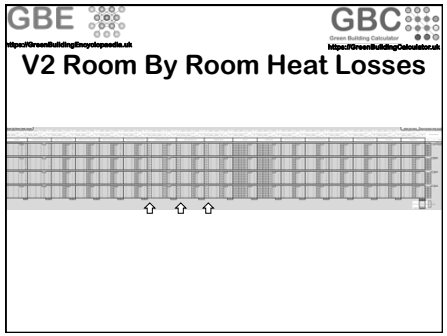

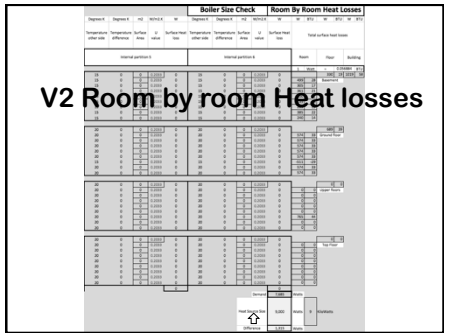

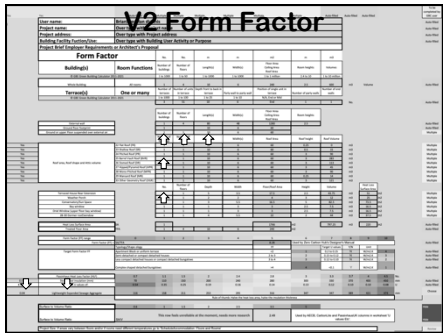

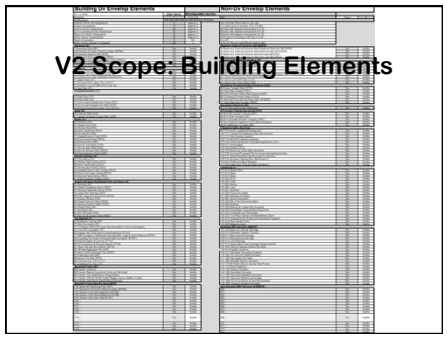

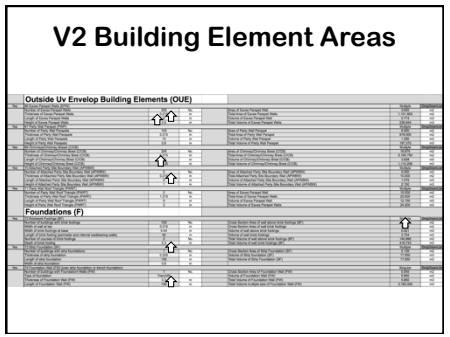

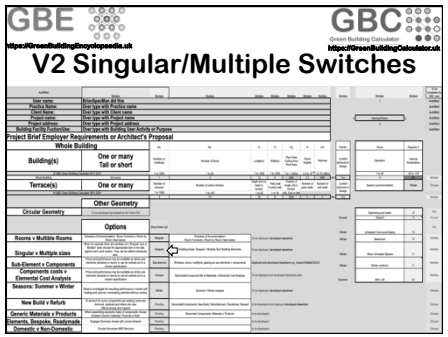

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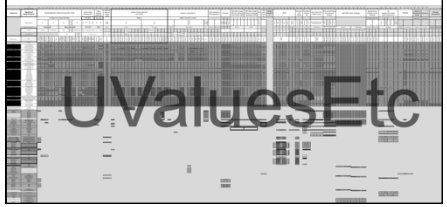
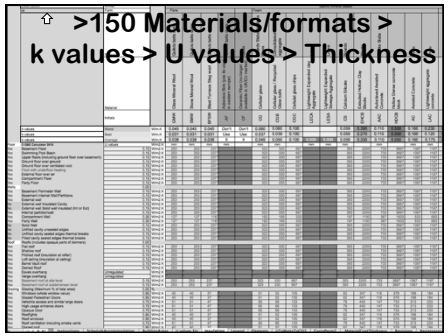
GBE https://GreenBuildingEncyclopaedia.uk GBC Green Building Calculator https://GreenBuildingCalculator.uk

V2 U values Etc. Targets

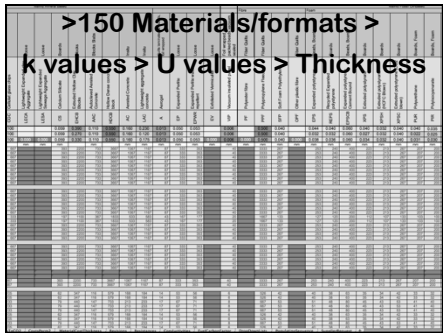
Regulations, Public Consultations, Design Standards, Campaigns



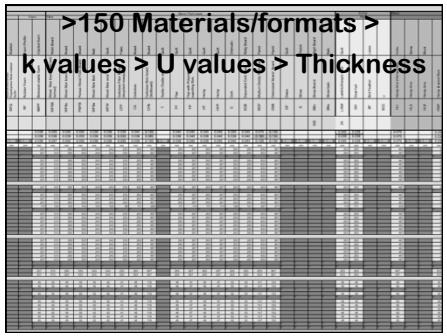
>150 Materials/formats > k values > U values > Thickness



>150 Materials/formats > k values > U values > Thickness



>150 Materials/formats > k values > U values > Thickness



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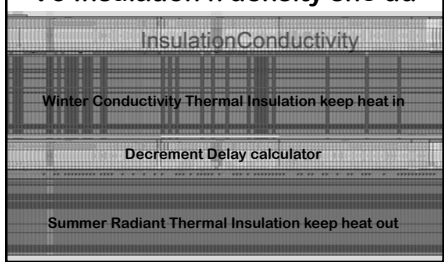
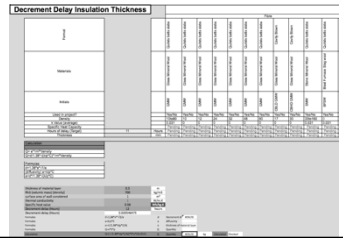
V3 Insulation k density shc dd



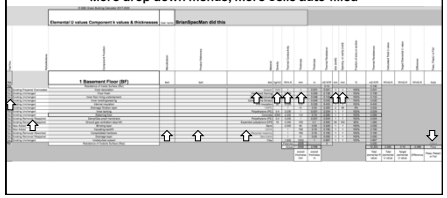
V3 Decrement Delay Insulation Thickness (Dev)



V2 39 Elements U or R value 12 secondary element U/R values

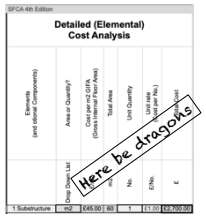
Refurb Actions including demolition

More drop down menus, more cells auto-filled



GBE https://GreenBuildingEncyclopaedia.uk GBC Green Building Calculator https://GreenBuildingCalculator.uk

V2 Elemental Costing



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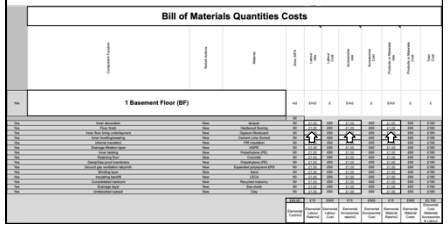
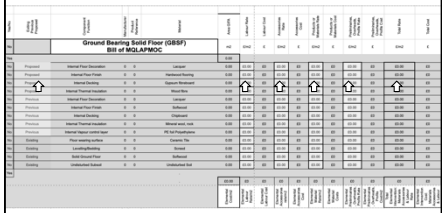
V2 Bill of Materials Quantities Labour Accessories Products Costs



Bespoke B2 Elemental Assembly > 4 Bill of Materials Quantities Costs



- Retrofit bespoke development
- Existing, previous & proposed interventions
- Individual rates or overall rates

Green Building Price Book

- After GBC V2
- Initially: Excel worksheet to be sent to manufacturers, suppliers and installers
- Long term: stand alone on-line platform available to GBC, other App developers or data users
- To obtain robust prices to build robust cost plans
- MRRP Manufacturers recommended retail/trade price
- Price for Green Products by Green installers
  - (not inflated for unfamiliarity by violet contractor)
- Materials, Products, Accessories, Whole systems, Elements, Sub-elements, Buildings
- Not their best price but their normal price that all can have
  - Or we end up back in the substitution vortex
- We will also as for prices for:
  - 1m3, 10m3, 100m3, etc. (opportunity for discounts for quantity)
  - Unopened, un-split delivery packs/pallets (> potential wastage rates for later version)
- Installation rates: m3/day and labour day rates
  - (feeds into potential Programme, not by GBC)
- Plant hire, power, fuel rates
- Overheads prelims profits (only if wanted separately)

GBPB

Green Building Price Book

V2+ Green Building Product Data Collection

- Import Excel or CSV tables
- Product information and properties
- Post Grenfell: 'Golden thread'
  - GBC needs to be selective
  - Only offer a product in place and uses it was invented for and to solve
- Intelligent Excel worksheet
  - Drop down lists to choose from, less errors
- Being tested with one manufacturer
  - before general release

GBPDC

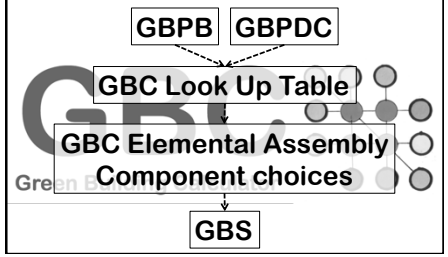
Green Building Product Data Collection

V3+ GBPDC > GBS Specification

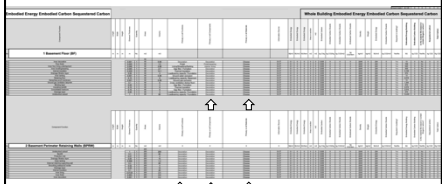
- Import Excel or CSV tables
- Product information and properties
- GBC Elemental Assemblies:
  - Component Choices
- Generates an outline specification
  - That is a Robust Specification
  - To fend off substitution

GBS

Green Building Specification



V2 EE EC & SC



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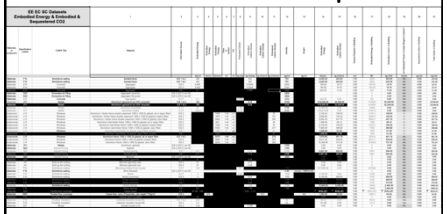
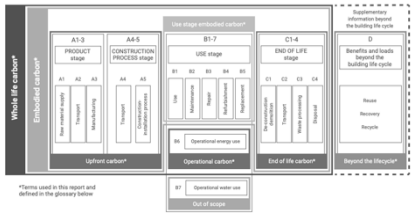
ICE 3.0 database carbon reporting options

Mass/Declared Unit	kg/Declared Unit
Embodied Energy only	
Embodied CarbonO2 (only)	kgCO2/kg
Embodied CarbonO2 (only)	kgCO2/m2
Embodied CarbonO2 equivalent	kgCO2e/kg
Embodied CarbonO2 equivalent	kgCO2e/tonne
Embodied CarbonO2 equivalent	kgCO2e/m2 per 1 mm
Embodied CarbonO2 equivalent	kgCO2e/m2 per 100 mm
Embodied CarbonO2 equivalent	kgCO2e/unit
Module A1-3, Embodied Carbon	kg CO2e/kg
Module D, Carbon	kg CO2e/kg
Module A-D, Embodied Carbon	kg CO2e/kg

B2 ICE Database EC datasets: many calculations to enable comparison

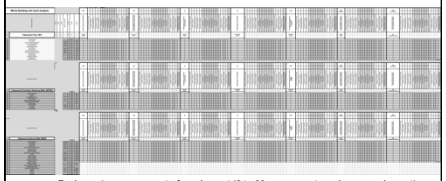


EN 15978



*Terms used in this report and defined in the glossary below

V3 LCA EPD

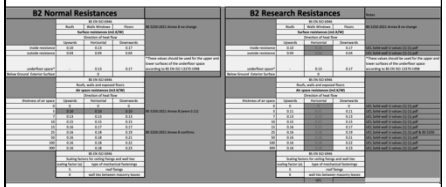


- Each row is a component of an element (3 to 20 components make up an element)
  - (framing insulation lining)
- Each group of components makes an element (up to 39 make up a building)
  - (partition, wall, floor, roof)
- Each column is an EN 15804 stage A-D or subdivision column
- Each group of columns is an environmental impact (7 groups 7 impacts 1 is carbon=)

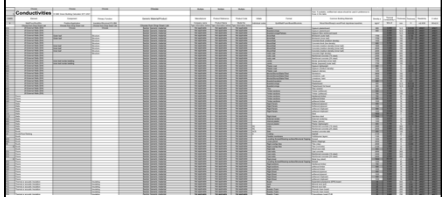
V1 Resistances V2 no change

	Direction of heat flow			
	Upwards	Horizontal	Downwards	
inside resistance	0.10	0.13	0.17	
outside resistance	0.04	0.04	0.04	
underfloor space*	-	0.13	0.17	*These values should be used for the upper and lower surfaces of the underfloor space according to BS EN ISO 13370:1998
Below Ground Exterior Surface		0		
	BS EN ISO 6946			
	Roofs, walls and exposed floors			
	Air space resistances (m2.K/W)			
	Direction of heat flow			
thickness of air spae	Upwards	Horizontal	Downwards	
0	0	0	0	
5	0.11	0.11	0.11	
7	0.13	0.13	0.13	
10	0.15	0.15	0.15	
15	0.16	0.17	0.17	
25	0.16	0.18	0.19	
50	0.16	0.18	0.21	
100	0.16	0.18	0.22	
300	0.16	0.18	0.23	
	BS EN ISO 6946			
	Scaling factors for ceiling fixings and wall ties			

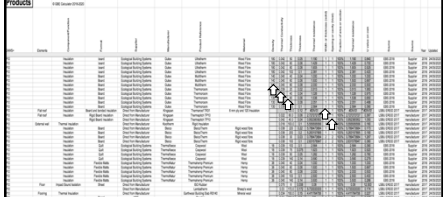
V3 Research paper options



V2 Conductivities



V1 Properties of Products



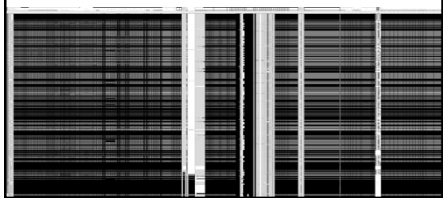
GBPDC

Green Building Product Data Collection

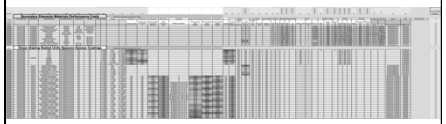
V2+ Green Building Product Data Collection

- Import Excel or CSV tables
- Product information and properties
- Post Grenfell: 'Golden thread'
  - GBC needs to be selective
  - Only offer a product in place and uses it was invented for and to solve
- Intelligent Excel worksheet
  - Drop down lists to choose from, less errors
- Being tested with one manufacturer
  - before general release

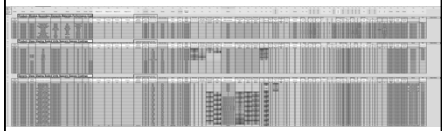
V2 Material Product Data EEECSC EPD Data Collected becomes Look Up Table



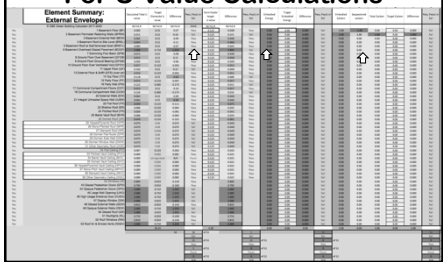
V2 Secondary Elements Windows & Glazing options



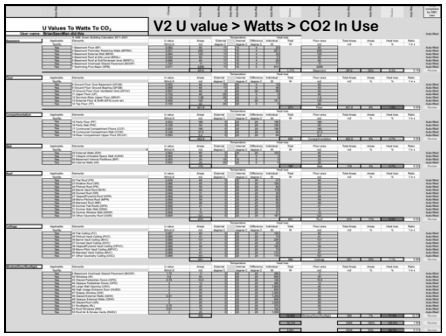
V3 Secondary Elements Windows & Glazing options



V2 Element Summary Ext Env For U Value Calculations



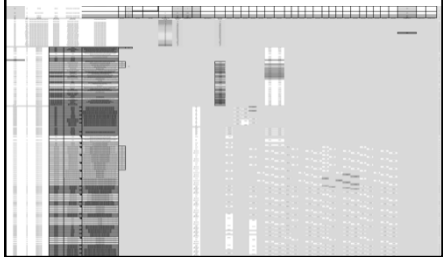
V2 U value > Watts > CO2 In Use



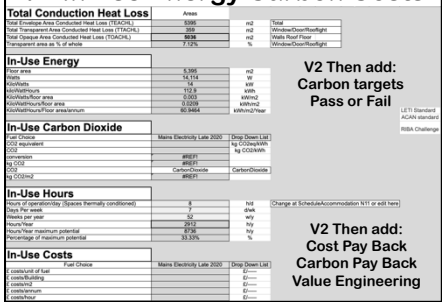
V2 Carbon Mains Electricity EU

2020 Provisional Data YTD	Wartsila Energy Transition lab	
Europe	Electricity carbon intensity	
Country	gCO2/kWh	kgCO2/kWh
Norway	0	0.01
Sweden	18	0.018
France	30	0.03
Austria	88	0.088
Lithuania	118	0.118
Spain	126	0.126
Portugal	134	0.134
Finland	136	0.136
Latvia	138	0.138
Belgium	148	0.148
Denmark	168	0.168
UK	186	0.186
Slovenia	222	0.222
Slovakia	224	0.224
Hungary	228	0.228
Romania	234	0.234
Ireland	238	0.238
Germany	240	0.24
Italy	290	0.29
Greece	380	0.38
Estonia	385	0.385
Bulgaria	395	0.395
Czechia	430	0.43
Netherlands	530	0.53
Poland	700	0.7

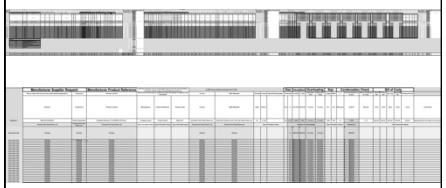
V2 UK Fuel Carbon Factors 2020



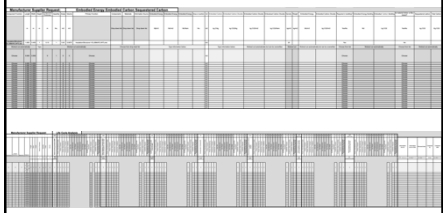
V2 In-use Energy Carbon Costs



V2 Manufacturer Supplier Intelligent Product Data Collection



Manufacturer Supplier V2 EE EC SC & V3 LCA datasets



V2 Letter to Manufactures & Suppliers: Product Data Request

Manufacturer Supplier Letter

V2 User Feedback Form

User Feedback Form

User name: BrianSpecMan did this

NB: Please complete the User Survey on Version Development Order

V1 User Survey

User Survey

V2-V36 Planned Development

Priorities to bring forward:

- V2 Retrofit, Terraces, Community level, MEP Services,
- V3 Decrement Delay, Form Factor refinements: dormers, bays, porches
- V4 Building Section Coding, Competent Application,
- 892 ready made elements, Bespoke Assemblies, Accessories, Specification Generator
- V5 Non-Domestic, Retrofit and Newbuild more refinement
- V6 Embodied Energy, Carbon and Sequestered carbon; Non-external envelope elements
- V7 Condensation Check, Thermal Bridge, Secondary Element Calculator, Thermal mass calculator
- V8 LCA Calculator
- V9 Landscape
- V10 Civils and Infrastructure: scope Increased
- V11 Waste Calculator using WasteCostIfLite
- V12 Plastic free v Recycled Plastic
- V13 Interiors: Scope increased, Ska fit-out. refit
- V14 Circular economy: Reclaim Reuse
- V15 Self-build Interface
- V16 CAD BIM App
- V17 Whole Project Budget Calculations, full Fee bid calculation based on cost plan
- V18 EU and International versions
- V19 Services Design Module: Occupancy level, Energy Sources and uses,
- V20 Lighting Design Module: Health & Wellbeing, Light Nutrition
- V21 Biodiversity Inclusion, Biodiversity Net Gain
- V22 Local Climate Appropriate construction and materials
- V23 Vernacular, local: materials, trades, economy
- V24 GBPB Green Building Price Book
- V25 O&MM Operation & Maintenance Manuals
- V26 FM Specification
- V27 Local Procurement, Transport to site, distance search facility
- V28 On Site Construction Emissions
- V29 Design Life, Durability and Competent Products
- V30 Air tightness & Energy Loss
- V31 Value Engineering Opportunities: in not out
- V32 Healthy Building
- V33 Screening Priorities
- V34 Indoor Air Quality
- V35 Natural Lighting Levels
- V36 Demolition Embodied carbon in waste

B Bespoke

- B1 Retrofit Window & Insulation Calculator
- B2 Responsible retrofit Carbon Calculator
- B3 Window Calculator
- B4 Screeds Calculator
- B5 NRM4 QS interface

Programme for development?

- Planned meetings with interested parties
- Need to ask uses their priorities
- Update order of development
- Win a lot of subscribers to pay for development time
- Then create programme of development
- Some guestimates possible

UKGBC NetZeroCarbon market's ambitions

- **Verification of carbon needed asap**
  - Tools need to be Quick, flexible first and improve over time
- Accessible for mass uptake
  - Low cost
  - GBC V2 £4.88 students-£88.88 bigger practices/businesses, per annum
- Wide access
  - https://GreenBuildingCalculator.uk
- No monopoly
  - Competition in market, many tools, datasets could be offered in exchange for information or know-how
  - GBC also offer consultancy
- **Global Valiancy**
  - Applicable in many countries
  - GBC V2 Metric and SI so not everywhere yet, but willing to develop
  - GBC V2 UK focus but will expand in future: EU & International
- **Independent & Transparent**
  - GBC V2 emphasizes plant-based but includes others for comparison
  - GBPB Green Building Price Book is essential for competency, but will be low cost to enter and maintain
  - Visible open book calculators to enable learning
- **Everything must be measured**
  - Bill of Quantities, Elements, Components, Accessories
- Not just design stage
  - GBC V2 enables checks at all stages VE,
  - Cost cutting and substitutions Verification
- Not Certification +
  - Not a rating tool, private and slow to launch
- Standards
  - Verification, lower cost and quick

Quality Control

- Progressive development inevitable
- Revision table recording all types of changes on a task and daily basis
  - Pending rows added as aid memoir
- Recording revision dates against rows and columns in every worksheet with aide memoir
- Author(s) initialing each revision
- Worksheets preparation to publish checklist and record
- Internal audit trails possible
- List and links to data sources
- Merged data sources get unique GBC reference

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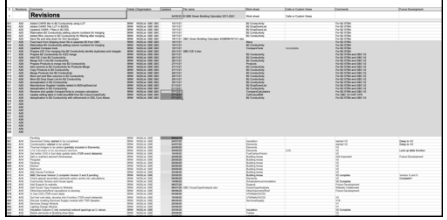
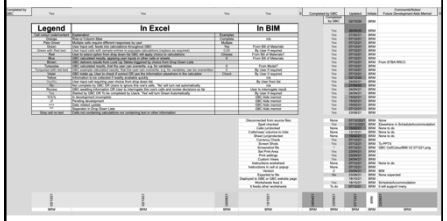
V2 Spreadsheet revisions record for audit trails Pending list as an aide memoir



Worksheet revisions record



File Updates 1

Rev No.	Comments	Author	Date
A00	Created for CPD Whole Building Calculator	BRM	30/06/2012
A01		BRM	11/09/2020
A02	Update for STBA SPAB event with EH Bespoke	BRM	06/10/2020
A03	Update after STBA SPAB Event	BRM	07/10/2020
A04	Update for WiSR CIOB Event Infrastructure	BRM	27/05/2021
A05	Update for LSI RISE awards 2021 poster file	BRM	18/06/2021
A06	Update for COINS Awards 2021 V32 & 33	BRM	26/06/2021
A07	Funding Enquiry	BRM	16/09/2021
A08	GBC Expansion BQ Enquiry Diagram	BRM	28/09/2021
A09	Update for TGR TT reduce for short presentation	BRM	03/10/2021
A10	Update after TGR TT	BRM	11/10/2021

File Updates 2

Rev No.	Comments	Author	Date
A11	Update Versions 1 to 36 and Bespoke List	BRM	01/11/2021
A12	CIAT updates and tweaking add V34-36 add B2 screenshot slides & B5 NRM4	BRM	06/12/2021
A13	Added B5 NRM4, UKGBC criteria & Quality Control post-CIAT update for CIAT and websites	BRM	09/12/2021
A14	Share with ECH to Add CIAT Video audio	BRM	11/12/2021
A15	Added GBS, GBPB & GBPDC Logos, updated for CIAT CPD add CIAT Video link, post Fb2022	BRM	23/03/2022
A16	Pending: New V2 screen shots needed for UH presentation	BRM	29/03/2022
A17		BRM	/2022
A18		BRM	/2022
A19		BRM	/2022
A20		BRM	/2022

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  - Environmentalist by Actions
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- Funded and Launched www.greenspec.co.uk 2003
- Created: GBE at https://greenbuildingencyclopaedia.uk 2015
- Launched: GBE Learning https://GBELearning.com 2020
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