



Llywodraeth Cymru
Welsh Government

Building Regulations 2010

Approved Document

Volume 1 - Dwellings

Z

Whole-Life Carbon and Embodied Carbon

2027 proposed edition

This proposed Approved Document supports Part Z of Schedule 1 to the Building Regulations 2010. It takes effect on 29 April 2028 for use in Wales. It does not apply to work on a particular building where a building notice, full plans application or initial notice was submitted before that date, provided that work on each building starts before 29 April 2029. Full details of the proposed transitional arrangements are set out in Circular Letter Z01/2026.

This Approved Document gives guidance on compliance with Part Z of the Building Regulations 2010 for building work carried out in Wales.

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The Approved Documents

This document sets out one proposed way of regulating whole-life carbon in new Welsh dwellings. Approved Documents give practical guidance, but clients, designers, contractors and owners would still be responsible for compliance. Other methods could be accepted where they achieve the same or better performance. Approved Document Z should be read with Welsh Approved Documents A, B, C, F, L, M and O. Its format follows Approved Document L, using functional requirements, numbered guidance, design-stage calculations and as-built evidence (Welsh Government, 2026).

How to use this Approved Document

Boxed text sets out the proposed legal requirements. Numbered paragraphs give one route to compliance. Must means a proposed mandatory provision, should means the recommended route, and may identifies an acceptable option. Key terms are defined in Appendix A and source documents are listed in Appendix D. Higher standards may be used, but better performance in one area cannot make up for failure of a mandatory carbon, safety, health or resilience requirement. Supporting evidence is referenced in Harvard style.

Proposed Part Z requirements

SCHEDULE 1 - PART Z: WHOLE-LIFE CARBON AND SUSTAINABLE CONSTRUCTION

Z1 Whole-life carbon assessment: Reasonable provision shall be made to assess and report greenhouse-gas emissions arising from products, transport, construction, maintenance, replacement and end-of-life activities. Z2 Limitation of upfront embodied carbon: The upfront embodied carbon of a new dwelling shall not exceed the applicable target embodied carbon rate. Z3 Sustainable construction: Reasonable provision shall be made for efficient resource use, water and energy efficiency, occupant health, climate resilience, ecological protection, pollution prevention, waste reduction and responsible material selection. Z4 Verification: Design-stage and as-built evidence shall be prepared by a competent person and independently verified where required. Z5 Information: Sufficient carbon, material, maintenance and disassembly information shall be provided to the building owner.

PART A - APPROVED DOCUMENT Z

Section 0 - Introduction and application

0.1 Approved Document Z, Volume 1 applies to new dwellings in Wales. It also applies where a dwelling is created through a material change of use and the work includes substantial new structure or replacement of the external envelope. Extensions, temporary buildings intended to remain for less than two years, and detached buildings below 30 m² are outside the numerical carbon limit, although material efficiency should still be considered.

0.2 This Approved Document takes effect on 29 April 2028. It does not apply where a building notice, full plans application or initial notice was submitted before that date, provided work on each building starts before 4 March 2028. The proposed transitional arrangements are set out in Circular Letter Z01/2026. This document gives guidance on compliance with Part Z for building work carried out in Wales.

0.3 Part Z complements rather than replaces Part L. Part L controls operational energy, fabric performance and associated emissions; Part Z controls the carbon impact of materials and construction and requires operational energy to be included in the whole-life record as module B6. A dwelling must comply with both Parts. Measures selected to lower carbon must not weaken structural safety, fire resistance, moisture performance, ventilation, accessibility, overheating control or durability (Welsh Government, 2026; RICS, 2023).

0.4 Every new dwelling should complete a whole-life carbon assessment. Developments of ten or more dwellings, or at least 1,000 m² GIA, are major developments and require independent verification. Smaller projects may use the simplified BRWZ template in Appendix B, but the same A1-A5 limit applies. For a mixed-use building, this volume applies only to the dwellings; non-domestic areas would be covered by a future Volume 2. Conversion projects should consider retention before demolition because existing foundations, frames and façades may avoid new product-stage emissions (RICS, 2023).

Section 1 - Whole-life carbon assessment

1.1 Whole-life carbon should be calculated in accordance with the second edition of the RICS Whole Life Carbon Assessment for the Built Environment. The assessment boundary should follow BS EN 15978 and should include all principal building elements, building services and construction activities. Results must be expressed in kilograms of carbon dioxide equivalent per square metre of gross internal area, kgCO₂e/m² GIA. The reference study period is 60 years unless a different period is justified for the proposed dwelling (RICS, 2023).

1.2 A1-A3 cover raw materials, transport to manufacture and manufacturing; A4 covers transport to site; and A5 covers construction, site energy and waste. Together they form the regulated upfront-carbon result. B1-B5 and C1-C4 must be reported but are not initially capped because future replacement and end-of-life scenarios are less certain. B6 should use the Part L calculation, B7 should report operational water, and Module D must be reported separately without deduction from A1-A5 (RICS, 2023; Welsh Government, 2026).

Life-cycle stage	Modules	Description	Part Z treatment
Product	A1-A3	Raw materials, transport to manufacture and manufacturing	Included in statutory limit

Life-cycle stage	Modules	Description	Part Z treatment
Construction	A4-A5	Transport to site, installation, site energy and waste	Included in statutory limit
Use	B1-B5	Use, maintenance, repair, replacement and refurbishment	Mandatory reporting
Operational energy	B6	Energy used in operation	Report using Part L data
Operational water	B7	Water used in operation	Mandatory reporting
End of life	C1-C4	Demolition, transport, processing and disposal	Mandatory reporting
Beyond boundary	D	Potential reuse, recovery and recycling benefits	Report separately; no deduction

1.3 Carbon data should follow this hierarchy: current product-specific EPDs; manufacturer-average EPDs; UK industry-average EPDs; approved generic UK data; then conservative defaults. EPDs should comply with BS EN 15804 and only compare products providing equivalent performance and service life. An EPD reports impacts; it does not prove that a product is low carbon. Generic or poorly matched data should receive the conservative treatment in Appendix B (RICS, 2023; Keyhani et al., 2023).

1.4 Biogenic carbon, carbon storage and future recycling benefits must be reported transparently. Temporary storage in timber or other biological products should not create a negative upfront result unless sourcing, service life and end-of-life assumptions are verified. Carbon offsets must not be used for regulatory compliance. The purpose of Part Z is to improve the physical building, not permit a high-carbon design to pass through payments or projects outside the assessment boundary (RICS, 2023; UKGBC, 2026).

1.5 Assessments should be updated at concept design, technical design and completion. Early estimates may use elemental quantities and generic data, but the level of uncertainty should reduce as the design develops. At technical design, all principal elements and any item that could affect compliance should be quantified. At completion, actual product data should replace generic assumptions where it is available. The assessor should record the age, location, technology and completeness of the data used (RICS, 2023; BSI, 2023).

Section 2 - Embodied carbon performance

2.1 A new dwelling complies with requirement Z2 where the as-built A1-A5 result does not exceed 500 kgCO₂e/m² GIA. This is proposed as a transitional legal minimum, informed by LETI's residential targets, rather than a claim that a dwelling at the limit is fully net zero (LETI, 2020; LETI, 2021). A design-stage target of 450 kgCO₂e/m² GIA is recommended to leave room for construction changes. Welsh Ministers should review the limit by 2030 using verified Welsh as-built data, changes in product availability and the latest national net-zero pathway.

Stage	Maximum A1-A5 rate	Recommended design target	Purpose
29 April 2028	500 kgCO ₂ e/m ² GIA	450 kgCO ₂ e/m ² GIA	Initial transitional minimum
Review no later than 2030	To be set after review	To follow revised limit	Use Welsh as-built data and current national pathway

2.2 Compliance is assessed for each dwelling, or as a floor-area-weighted average within one block of flats. Separate buildings, terraces or phases must not be averaged. The assessment must include substructure, frame, upper floors, roof, external and internal walls, windows, doors, finishes, sanitary installations, mechanical and electrical services, renewable equipment, drainage and external works serving the dwelling. An omitted element requires a conservative allowance and written justification (RICS, 2023).

2.3 The carbon reduction hierarchy is: question the need for new construction; retain existing assets; build less; use materials efficiently; reuse products; select lower-carbon products; design for durability and adaptability; then design for disassembly and recycling. LETI and UKGBC place early avoidance and reduction ahead of compensation, while PAS 2080 emphasises leadership and collaboration across the value chain (UKGBC, 2026; BSI, 2023). The hierarchy is therefore a mandatory design test rather than an optional list of products.

2.4 The completion assessment should use product-specific or UK industry EPDs for the main carbon contributors where they are reasonably available. The carbon reduction statement should record opportunities for direct reuse, reclaimed products and recycled content. Construction waste should follow the waste hierarchy: prevention, reuse, recycling, recovery and, only as a last option, disposal. Actual waste quantities and destinations should be reported. Recycled content or diversion from landfill must not be used to justify unnecessary materials, floor area or finishes (RICS, 2023; UKGBC, 2026).

2.5 Where demolition precedes new housing, the applicant should compare retention and refurbishment, partial retention, and replacement over the same 60-year period. Replacement may be justified by structural condition, accessibility or operational performance, but existing carbon investment must be recognised. Durability is also relevant: a low initial-carbon product should not be preferred where frequent repair or replacement increases B2-B4 emissions. The selected option should deliver the lowest credible whole-life result while meeting other Building Regulations (RICS, 2023; LETI, 2020).

Section 3 - Sustainable value standards

3.1 A Sustainable Value Schedule must accompany the carbon assessment. It uses the broad categories found in BREEAM, but each category has a clear minimum evidence requirement rather than a points score. Carbon, energy, health, materials and resilience are mandatory gateways, so strong performance elsewhere cannot make up for failure in these areas. This avoids creating a new rating system that would be difficult to justify and could hide weak performance in one category. One Planet Development also supports the use of management plans, monitoring and wider ecological thinking in Wales (BREEAM, n.d.; Welsh Government, 2012).

Category	Minimum proposed standard	Evidence of compliance	Gateway
Management	Named carbon lead; design and as-built BRWZ reports; commissioning and handover plan	Appointments, reports and handover record	No
Water	Water-use calculation, metering and efficient fittings	Calculation and product schedule	No
Energy	Part L compliance; module B6 reported; commissioning evidence	Part L report and commissioning record	Yes
Transport	Construction logistics plan and relevant active-travel/EV provision	Logistics plan and drawings	No
Health & wellbeing	Part F and O compliance; daylight, acoustic and low-emission finish review	Design assessments and product data	Yes
Resources	Material-efficiency statement; reuse and reclaimed-material options considered	Carbon reduction statement and specifications	No
Resilience	Climate-risk review covering flood, heat, water shortage and wind-driven rain	Climate adaptation statement	Yes
Land use & ecology	Protect important habitat and show measurable improvement where required by planning	Ecology survey and landscape proposals	No
Pollution	Consider refrigerants, NOx, lighting, noise and polluted run-off	Specifications and pollution-control plan	No
Materials	A1-A5 limit met; suitable carbon data; responsible sourcing	BRWZ report, EPD schedule and sourcing evidence	Yes
Waste	Pre-demolition audit where relevant; apply waste hierarchy; report quantities and destinations	Audit, site plan and waste records	No

Category	Minimum proposed standard	Evidence of compliance	Gateway
Innovation	Optional record of performance clearly beyond the minimum	Verified supporting evidence	No

3.2 Operational energy remains controlled by Part L. Part Z should not create a second energy target or require a particular voluntary certificate. Instead, the Part L result should be reported as module B6 and supported by commissioning and airtightness evidence where applicable. AECB CarbonLite and Passivhaus are useful because they show how modelling, testing and independent checking can reduce the gap between design and actual performance. Their quality-assurance principles are used here without making either scheme compulsory (AECB, 2025; Passivhaus Trust, 2025).

3.3 The wider categories act as safeguards around the embodied-carbon limit. Water-saving measures must not create hygiene problems; natural materials must still meet fire and moisture requirements; simpler services must not reduce indoor air quality; and extra insulation must be checked for overheating. The resilience review should consider flooding, water shortage, wind-driven rain and overheating over the dwelling's life. Ecology and pollution also matter because a low-carbon house on a damaging or car-dependent site would not provide good overall value (BREEAM, n.d.; Welsh Government, 2012).

3.4 Each category should be marked compliant, non-compliant or not applicable, with the evidence recorded in Appendix B. Innovation may be noted where a project goes clearly beyond the minimum, but it does not change legal compliance. A building control body may accept evidence from BREEAM, Passivhaus, AECB or UK NZCBS where it relates to the same dwelling, assessment boundary and completion information (BREEAM, n.d.; UK NZCBS, 2026).

Section 4 - Compliance and verification

4.1 Before work starts, the building control body must receive a design-stage BRWZ report stating the target and proposed carbon rates, assessment boundary, material quantities, data sources, assumptions, exclusions, Sustainable Value Schedule and carbon reduction statement. The client should appoint a named carbon lead and the principal designer should coordinate the information. The assessment should be early enough to compare foundations, structure, envelope, services and retention options before the main specifications are fixed (RICS, 2023; BSI, 2023).

4.2 During construction, the principal contractor must keep records of actual products, quantities, EPDs, manufacturer locations, delivery distances, site electricity, plant fuel, water use, waste quantities and destinations. A substitution that could affect compliance or materially change the result requires an updated calculation before installation. Delivery notes, invoices, fuel logs, waste-transfer notes, meter readings and photographs may be used as evidence (RICS, 2023).

4.3 No later than five working days after completion, the building control body must receive the as-built BRWZ report. It should use actual information where reasonably available, explain changes from the design, confirm the final Sustainable Value Schedule and include the material passport. Major developments require an independent verifier who did not prepare the assessment. The verifier should check completeness, quantities, EPD relevance, assumptions, module separation and arithmetic (UK NZCBS, 2026).

4.4 A completion certificate should not be issued where the A1-A5 limit is exceeded or material evidence is missing. Minor data gaps may be resolved through conservative default values, but uncertainty must not be used to lower the result. Anonymised results should be submitted to a national carbon database so that Welsh Ministers can review limits using actual dwellings. The as-built assessment, material passport, maintenance plan and disassembly information should be retained with the building's digital record (RICS, 2023; UKGBC, 2026).

4.5 During the first three years, Welsh Ministers should publish standard templates, approved default factors and anonymised benchmark reports. Building control officers would need training to review boundaries, evidence and compliance, but would not be expected to repeat every calculation. Enforcement should focus on missing assessments, exceeded limits, unsupported exclusions and major product changes. The assessor remains responsible for the technical calculation, while building control checks that the process is competent and auditable (BSI, 2023).

Stage	Required submission	Responsible party	Acceptance criterion
Before work starts	Design-stage BRWZ report, quantities, data schedule, carbon reduction statement and Sustainable Value Schedule	Client and principal designer	Recommended design target met where practicable; statutory limit not exceeded
During construction	Product, transport, energy, fuel, water, waste and substitution records	Principal contractor	Auditable evidence kept and material changes reassessed
Completion	As-built BRWZ report, material passport, final schedule and declarations	Assessor; independent verifier for major development	As-built A1-A5 ≤ 500 kgCO ₂ e/m ² and all gateways satisfied

Section 5 - Interaction with other Approved Documents

5.1 Part Z must be coordinated with the other Approved Documents. Part A affects structural quantities; Part B controls fire performance; Part C protects durability through moisture control; Part F covers ventilation; Part L provides operational energy data; Part M covers access; and Part O controls overheating. Carbon should be reduced within these requirements, not at their expense. For example, low-carbon insulation is unsuitable if it cannot meet fire, moisture or durability requirements (Welsh Government, 2026).

Approved Document	Principal interaction with Part Z
A - Structure	Structural grid, spans, foundations and safety factors affect material quantities; reduction cannot weaken stability.
B - Fire safety	Low-carbon products must meet reaction-to-fire, resistance and cavity barrier requirements.
C - Moisture	Natural or recycled materials must be detailed for condensation, water resistance and durability.
F - Ventilation	Reduced services must not compromise indoor air quality; fan and duct replacements contribute to B4.
L - Energy	Provides operational energy and B6 data; additional insulation and systems have embodied impacts.

Approved Document	Principal interaction with Part Z
M - Access	Accessible space and fittings must be included in quantities; adaptability can avoid later retrofit.
O - Overheating	Passive shading should be prioritised; active cooling and glazing choices affect embodied carbon.

Section 6 - Information for the building owner

6.1 The owner must receive a plain-language summary of the carbon assessment, the material passport, key EPDs, maintenance and replacement cycles, and guidance for future alteration and disassembly. Information should be digital, transferable and sufficiently clear to prevent later refurbishment from unnecessarily discarding reusable components (UKGBC, 2026).

PART B - SUPPORTING TECHNICAL REPORT

1. Regulatory rationale

I considered adding embodied carbon to Part L, but that would mix two different assessments. Part L mainly deals with energy and emissions during occupation, while embodied carbon depends on quantities, product data, transport, construction, maintenance and end-of-life assumptions. I therefore chose a separate Part Z that works alongside Part L and uses its result for module B6. Keyhani et al. (2023) found that embodied carbon made up about one third of the life-cycle emissions in a typical UK residential case study, while later UK case studies found that the product stage was the largest source of embodied emissions (Keyhani et al., 2024). Lützkendorf and Balouktsi (2022) also show that results depend heavily on consistent boundaries and data. A separate Part makes it clearer who provides the information, when it is checked and what result is required.

2. Synthesis of existing frameworks

No single framework could be copied directly into the Building Regulations. RICS gives the clearest calculation method, but does not set one legal limit for every dwelling. LETI provides useful targets and a clear reduction hierarchy, although it is voluntary. UKGBC and UK NZCBS add accountability, disclosure and verification, but are wider net-zero frameworks. BREEAM covers the full sustainability range required by the brief, yet its credits can allow strength in one category to balance weakness in another. That is not suitable for a minimum carbon standard. AECB and Passivhaus provide strong modelling and quality assurance, but mainly focus on operational energy. One Planet Development is useful in Wales, although it was written for rural planning. I therefore used selected parts of each framework and rejected tradable credits. The result is a pass-or-fail carbon limit with a separate evidence schedule for wider sustainability (RICS, 2023; LETI, 2020; UKGBC, 2026; BREEAM, n.d.).

Framework	Contribution adopted	Limitation addressed by Part Z
RICS WLCA	Consistent methodology, modules, data quality and reporting	Methodology does not itself set a legal minimum

Framework	Contribution adopted	Limitation addressed by Part Z
LETI	Residential targets, carbon definitions and reduction hierarchy	Voluntary guidance without enforcement
UKGBC	Accountability, disclosure and reduction-first principles	Broad framework rather than pass/fail regulation
UK NZCBS	Science-led carbon/energy limits and third-party verification	Voluntary asset standard
BREEAM	Holistic categories and assessor validation	Tradable credits may conceal weak performance in one category
AECB/Passivhaus	Fabric-first design, modelling, commissioning and quality assurance	Primarily operational rather than full whole-life carbon
One Planet Development	Management plan, monitoring and ecological limits	Designed for rural planning and lifestyle impacts
Welsh Approved Document L	Design-stage and as-built compliance reporting, calculations and building-control notifications	Focused on operational energy rather than embodied carbon

3. Justification of the proposed standards

The 500 kgCO₂e/m² limit is a starting point, not a definition of a zero-carbon dwelling. LETI supports the direction of travel, but a much lower immediate limit could be difficult for smaller Welsh supply chains with limited EPD data and fewer low-carbon products. The recommended design target remains 450 kgCO₂e/m² to allow for construction changes. I removed fixed 2030 and 2035 limits because there is not enough Welsh as-built data to defend an exact future figure. The first review should use completed BRWZ assessments and the latest UK pathway. A1-A5 is capped first because these emissions happen now and can be checked against products, quantities and site records. B and C stages are reported, but future maintenance and disposal are less certain. Module D remains separate so a possible future recycling benefit cannot cancel emissions released today (LETI, 2020; RICS, 2023). Fixed recycled-content and waste-diversion percentages were also removed because they can encourage box-ticking instead of direct reuse and material reduction.

4. Critical evaluation and implementation

The main weakness is data quality. EPDs are not available for every product, and databases can give different results for similar materials. A calculation may therefore look more accurate than the evidence allows. The data hierarchy and conservative assumptions reduce this risk but cannot remove it. There would also be extra cost, especially for small developers, and building control teams would need training. A simplified template is therefore provided for smaller schemes, with independent verification limited to major developments. The kgCO₂e/m² metric also makes dwellings easier to compare but can make a large home appear efficient while its total emissions are higher. Part Z therefore reports both intensity and total tonnes of CO₂e. Carbon must also be considered alongside fire safety, moisture, ventilation, access, overheating and durability. Removing the 100-point score makes the

wider assessment less impressive visually, but more honest: every category needs evidence and the carbon gateway cannot be traded away (Keyhani et al., 2023; RICS, 2023; BREEAM, n.d.).

Teams could still treat the process as paperwork or choose favourable data. As-built reporting, independent checks on major projects and clear disclosure of exclusions are intended to limit this. At first, building control should check the evidence and assessment process rather than repeat every calculation. This is more realistic, but competence rules and action against misleading assessments would be important. Anonymised completion data should also be published so later limits are based on Welsh projects rather than assumptions. The proposal would need a trial period and regular review because a national dataset does not yet exist for every Welsh dwelling type. It is best understood as a practical first regulation that can become stricter as evidence and skills improve, rather than a final answer (UK NZCBS, 2026; UKGBC, 2026).

5. Conclusion

Approved Document Z would give Wales a consistent minimum standard for embodied carbon while keeping the calculation linked to existing industry methods. Its strongest features are the A1-A5 limit, design-to-as-built reporting and the rule that carbon savings cannot weaken safety or building performance. The proposal would need training, templates and review after real project data have been collected, but it offers a realistic first step towards making low-carbon construction normal rather than optional.

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APPENDICES

Appendix A - Key terms

A.1 The definitions below apply throughout Approved Document Z. Where a term is not defined, the meaning in the Building Regulations, RICS whole-life carbon methodology or relevant British Standard should apply (RICS, 2023).

Approved assessment methodology

A method accepted by Welsh Ministers for calculating and reporting whole-life carbon. For this proposal, the principal method is RICS Whole Life Carbon Assessment for the Built Environment, second edition.

As-built assessment

The assessment completed after construction using the products, quantities, transport, site activities and waste associated with the dwelling as constructed.

Biogenic carbon

Carbon contained in material derived from biological sources. Storage and release should be shown separately and supported by verified sourcing, service-life and end-of-life assumptions.

Building embodied carbon rate

Total A1-A5 greenhouse-gas emissions divided by gross internal area, expressed as kgCO₂e/m² GIA.

Carbon dioxide equivalent

A common unit that expresses the warming effect of different greenhouse gases relative to carbon dioxide. Abbreviated to CO₂e.

Carbon factor

A value representing greenhouse-gas emissions per defined unit of material, product, energy, fuel, transport or waste activity.

Carbon offset

An emission reduction or removal outside the physical building assessment boundary used to compensate for building emissions. Offsets cannot demonstrate Part Z compliance.

Carbon reduction statement

A record of the options considered and measures selected to avoid and reduce whole-life carbon.

Competent person

A person with appropriate skills, knowledge, experience and organisational capability for the carbon assessment or verification undertaken.

Design-stage assessment

A whole-life carbon assessment prepared before work starts from proposed drawings, quantities, specifications and construction assumptions.

Embodied carbon

Greenhouse-gas emissions arising from products, transport, construction, maintenance, repair, replacement, refurbishment, demolition, waste processing and disposal. It excludes B6 operational energy and B7 operational water.

Environmental Product Declaration

An independently verified Type III environmental declaration prepared to recognised product category rules. An EPD reports impacts but does not prove that a product is low carbon (RICS, 2023).

Functional equivalent

The technical performance, safety, durability and service life that products or design options must provide before their environmental impacts can be compared.

Generic data

Average carbon information for a product, process, sector or geography rather than a named product from a specific manufacturer.

Gross internal area

The total area measured to the internal face of the perimeter walls at each floor in accordance with the recognised measurement standard. Abbreviated to GIA.

Life-cycle assessment

A systematic assessment of environmental impacts across defined stages of a product or building life cycle. Abbreviated to LCA.

Major development

A development containing ten or more dwellings, or one or more buildings with a combined GIA of at least 1,000 m².

Material passport

A transferable digital record identifying significant products, their location, composition, maintenance, safe removal, reuse, recycling and disposal information (UKGBC, 2026).

Module A1-A3

Raw material supply, transport to manufacture and product manufacturing.

Module A4

Transport of products from final manufacturing location to the construction site.

Module A5

Construction and installation, including site energy, fuel, temporary works, wastage and construction waste.

Modules B1-B5

Use, maintenance, repair, replacement and refurbishment during the reference study period.

Module B6

Operational energy use, informed by the approved Part L calculation.

Module B7

Operational water use.

Modules C1-C4

Deconstruction or demolition, transport, waste processing and final disposal.

Module D

Potential loads and benefits beyond the assessment boundary arising from reuse, recovery or recycling. Module D is reported separately.

Reference study period

The period used to model maintenance, replacement and end-of-life. Part Z uses 60 years unless another period is justified.

Target embodied carbon rate

The maximum permitted A1-A5 carbon intensity for the dwelling.

Uncertainty allowance

A conservative addition used where quantities, product information or carbon factors are incomplete or poorly representative.

Upfront embodied carbon

The emissions occurring before occupation, comprising modules A1-A5.

Waste diversion rate

The percentage by mass of waste prepared for reuse, recycled or recovered rather than disposed to landfill.

Whole-life carbon

The total greenhouse-gas impacts associated with products, construction, operation and end-of-life across the defined building life cycle.

Appendix B - Evidence of compliance

B.1 Compliance evidence should be submitted through a Building Regulations Wales Part Z report, abbreviated to BRWZ. A design-stage report is required before work starts and an as-built report is required no later than five working days after completion. Evidence must be proportionate but sufficiently auditable for another competent person to reproduce the result (RICS, 2023; Welsh Government, 2026).

B.2 The design-stage BRWZ report should identify the project, dwelling type, GIA, target and proposed A1-A5 rates, reference study period, methodology, software, assessor, assessment boundary, module results, main assumptions, exclusions, uncertainty, elemental breakdown, material quantities, data sources, Sustainable Value Schedule and carbon reduction statement. The assessor should sign a declaration that the information is suitable for the design stage.

B.3 The principal contractor should maintain procurement records, EPDs, delivery tickets, fuel and electricity logs, meter readings, waste-transfer notes, photographs and substitution approvals. Records should identify the manufacturer and manufacturing location where known. Product substitutions must be checked before installation where they may materially affect compliance.

B.4 The as-built BRWZ report should use actual products and quantities where reasonably available, state actual A4 and A5 information, explain design changes, provide the final material passport and waste record, and include the assessor and verifier declarations. The information should be kept with the building record for its useful life and passed to future owners.

B.5 An error or omission is material where it may change compliance, conceal a significant element or give a misleading impression of data quality. Several smaller errors should be considered together. Where evidence is unavailable, the assessor should use a conservative default rather than leave the impact out of the assessment.

B.6 The minimum assessment boundary includes foundations, ground floor, frame, upper floors, roof, stairs, external walls, windows, external doors, internal walls, internal doors, finishes, fixed furniture where material, sanitary installations, mechanical services, electrical services, renewable-energy equipment, drainage and external works necessary for the dwelling. Temporary works, material wastage and construction activities are included in A5. Loose furniture, occupants' appliances and infrastructure outside the development boundary may be excluded where the exclusion is stated consistently (RICS, 2023).

B.7 Photographic evidence should be dated and linked to a drawing, room, elevation or location. It is particularly useful for retained structures, reclaimed materials, concealed insulation, structural systems, significant building-services equipment, reversible connections and site waste segregation. Photographs support but do not replace inspection, invoices or quantity records.

B.8 The material passport should identify each significant product or element, its manufacturer, location, quantity, composition, expected service life, maintenance needs, fixing method, hazards, safe removal method and potential for reuse or recycling. Information should be stored in an open, transferable format. Products that cannot be safely separated should be identified so future owners do not assume that theoretical recycling is practicable (UKGBC, 2026).

Evidence	Design stage	Construction	Completion
Project details, GIA and target	Required	Update if changed	Confirmed
Whole-life carbon assessment	Required	Update for material change	Required
Material quantities	Estimated	Recorded	Actual
EPD and carbon-data schedule	Required	Updated	Required
A4 transport information	Estimated	Recorded	Actual or conservative
A5 energy, fuel and water	Estimated	Recorded	Actual
Waste information	Plan	Tickets and logs	Final diversion rate
Material passport	Initiated	Updated	Completed
Sustainable Value Schedule	Required	Monitored	Final
Independent verification	Appointment for major development	Interim review if needed	Statement required

Data priority	Source	Required treatment
1	Current product-specific EPD	Use where relevant to the installed product and location
2	Manufacturer-average EPD	Record the product range and any limitations
3	UK industry-average EPD	Record that the value is an industry average
4	Approved generic UK data	Apply a justified conservative allowance
5	Non-UK or proxy data	Use only where no better data exist; explain representativeness and apply a larger allowance
6	Regulatory default	Use the value and conditions issued by Welsh Ministers

DESIGN-STAGE ASSESSOR DECLARATION

I confirm that the design-stage assessment has been prepared in accordance with the approved methodology and Approved Document Z. The information is appropriate to the design stage, and all material assumptions, exclusions and uncertainty allowances have been identified.

Name: _____ Qualifications: _____
 Organisation: _____ Signature/date: _____

AS-BUILT ASSESSOR DECLARATION

I confirm that the as-built assessment represents the dwelling as constructed, so far as can reasonably be established from the records provided, and has been completed in accordance with the approved methodology and Approved Document Z.

Name: _____ Qualifications: _____
 Organisation: _____ Signature/date: _____

Appendix C - Worked example

C.1 This illustrative worked example demonstrates the regulatory calculation and must not be used as a source of carbon factors. The dwelling is a 100 m² two-storey detached house with reinforced concrete foundations, timber frame, facing-brick outer leaf, tiled roof, triple glazing, air-source heat pump and mechanical ventilation with heat recovery. Its target is 500 kgCO₂e/m² GIA.

C.2 Product emissions are calculated by multiplying each product quantity by the relevant A1-A3 carbon factor. Transport emissions are calculated from product mass, distance and transport factor. A5 includes site electricity, plant fuel, temporary works, material wastage, waste transport and processing. The elemental totals are shown in Table C.1 (RICS, 2023).

Element/activity	A1-A3	A4	A5	Total kgCO ₂ e
Substructure and foundations	7,800	450	550	8,800
Frame and upper floors	8,600	500	450	9,550
Roof	3,100	250	250	3,600
External walls	6,500	450	450	7,400
Windows and doors	3,900	250	250	4,400
Internal walls and finishes	4,800	250	350	5,400
Mechanical and electrical services	4,900	250	350	5,500
External works	1,400	200	150	1,750
General site activities	-	-	600	600
TOTAL	41,000	2,600	3,400	47,000

C.3 The example produces A1-A3 emissions of 41,000 kgCO₂e, A4 emissions of 2,600 kgCO₂e and A5 emissions of 3,400 kgCO₂e. Total A1-A5 is therefore 47,000 kgCO₂e. Dividing by 100 m² gives 470 kgCO₂e/m² GIA. The dwelling passes because 470 is below the 500 kgCO₂e/m² limit. B1-B5 and C1-C4 are reported separately and Module D is not deducted.

C.4 For a block of flats, a floor-area-weighted average of the actual dwelling results may be reported for that block, provided the same residential target is used. Separate buildings, terraces or phases

cannot be averaged to allow one building to compensate for another. Non-domestic areas would be assessed under a future Approved Document Z, Volume 2.

C.5 The same assessment also reports 16,500 kgCO₂e for maintenance and replacement and 4,500 kgCO₂e for end-of-life, giving 68,000 kgCO₂e of whole-life embodied carbon across A1-A5, B1-B5 and C1-C4. A potential Module D benefit of minus 6,000 kgCO₂e is shown on a separate line and does not change the 470 kgCO₂e/m² compliance result. This prevents a speculative future recycling scenario from concealing emissions released during construction.

Measure	Result
A1-A5 total	47,000 kgCO ₂ e
Gross internal area	100 m ²
Building embodied carbon rate	470 kgCO ₂ e/m ² GIA
Statutory limit	500 kgCO ₂ e/m ² GIA
Compliance margin	30 kgCO ₂ e/m ² GIA
Result	PASS

Appendix D - Documents and standards referred to

D.1 The following documents and standards support this Approved Document. Later editions may be used where they continue to address the relevant requirement and are accepted by the building control body. Voluntary certification may support evidence but does not replace compliance with Part Z.

D.2 RICS provides the principal calculation methodology. BS EN 15978 establishes the building assessment boundary; BS EN 15804 and BS EN ISO 14025 support Environmental Product Declarations; BS EN 15941 supports assessment of data quality; and PAS 2080:2023 supports carbon management, defined responsibilities and collaboration. LETI, UKGBC and UK NZCBS inform targets and reduction principles. BREEAM, AECB, Passivhaus and One Planet Development inform the broader sustainable-value and verification approach (RICS, 2023; BSI, 2023; LETI, 2020; UKGBC, 2026).

D.3 Where requirements differ, the Building Regulations and requirements approved by Welsh Ministers take priority, followed by Approved Document Z, the approved RICS methodology, British or international standards, then voluntary guidance. A later standard may be used where it remains technically relevant and the assessor records the edition. Proprietary software is not prescribed: a spreadsheet or commercial tool is acceptable where it reports modules separately, identifies data sources, records assumptions and provides an auditable design-to-as-built comparison.

Organisation/standard	Document and proposed use
RICS	Whole Life Carbon Assessment for the Built Environment, 2nd ed. Principal calculation and reporting methodology.
BS EN 15978:2011	BS EN 15978:2011 Building environmental-performance calculation method and life-cycle boundary.
BS EN 15804:2012+A2:2019/AC:2021	BS EN 15804:2012+A2:2019/AC:2021 Core rules for construction-product EPDs.

Organisation/standard	Document and proposed use
BS EN 15941:2024	BS EN 15941:2024 Selection and quality assessment of environmental data.
BS EN ISO 14025:2010	BS EN ISO 14025:2010 Principles and procedures for Type III environmental declarations.
PAS 2080:2023	PAS 2080:2023 Whole-life carbon management, leadership and collaboration.
LETI	LETI publications Embodied Carbon Primer; Climate Emergency Design Guide; Target Alignment.
UKGBC	Whole Life Carbon Framework and Whole Life Carbon Roadmap.
UK NZCBS	UK Net Zero Carbon Buildings Standard Version 1 science-led limits and verification approach.
BREEAM	How BREEAM works New Construction sustainability categories and validation model.
AECB	CarbonLite New Build Standard Performance and certification principles.
Passivhaus Trust	The Passivhaus Criteria Modelling and quality assurance.
Welsh Government	Approved Document L 2026 and One Planet Development guidance.

Appendix E - Competence and verification

E.1 A whole-life carbon assessor should understand LCA principles, RICS methodology, construction technology, quantity measurement, specifications, EPDs, databases, life-cycle modules, service-life assumptions, transport, site emissions, waste and uncertainty. Relevant professional backgrounds may include architecture, engineering, quantity surveying, building surveying, construction management, environmental assessment or building services. Professional membership alone does not prove competence (RICS, 2023).

E.2 Major developments require independent verification. The verifier must be competent, must not have prepared the assessment and should disclose conflicts of interest. A verifier in the same organisation is acceptable only where separate reporting lines exist and the verifier has authority to reject the assessment (AECB, 2025; Passivhaus Trust, 2025; UK NZCBS, 2026).

E.3 Verification should review building classification, GIA, target, boundary, modules, reference period, quantities, elemental completeness, EPD relevance, carbon factors, transport, A5 records, replacement cycles, end-of-life scenarios, biogenic carbon, Module D, exclusions, uncertainty, changes and arithmetic. Greater scrutiny should be applied to the largest emission sources, unusually low factors and substantial exclusions.

E.4 The verification outcome should be recorded as: verified-compliant; verified subject to minor correction; further information required; or not verified-non-compliant. The final statement should identify the project, target, as-built result, assessor, verifier, scope of review, limitations, signature and date.

E.5 The client is responsible for appointments and resources; the principal designer coordinates carbon information and design decisions; designers provide quantities, specifications and service-life assumptions; the principal contractor records procurement and site impacts; the assessor completes the calculation; and the verifier reviews it independently. These roles may be combined on a small project where competence and impartial checking are maintained, but responsibility should be stated in the project carbon management plan.

E.6 Assessors and verifiers should retain calculation files, EPDs, quantity records, correspondence on assumptions, design revisions, site evidence, review comments and signed statements with the building record for its useful life. They should act impartially, disclose conflicts, separate verified facts from judgement and correct errors. Deliberately omitting information or choosing unrepresentative data only because it lowers the result should invalidate the assessment as evidence of compliance.

Verification classification	Meaning
Verified - compliant	No material errors identified and Part Z requirements satisfied.
Verified subject to minor correction	Minor matters require correction but do not affect compliance.
Further information required	Compliance cannot be established from the evidence submitted.
Not verified - non-compliant	Material errors, omissions or an exceeded carbon limit are identified.

PART Z INDEPENDENT VERIFICATION STATEMENT

Project: _____ Address: _____

GIA: _____ m² Target rate: _____ kgCO₂e/m²

As-built rate: _____ kgCO₂e/m² Assessment software/version: _____

I confirm that I have independently reviewed the assessment boundary, material quantities, carbon factors, life-cycle assumptions, exclusions, uncertainty and supporting construction records. Based on the evidence made available, the assessment is classified as:

☐ Verified - compliant ☐ Minor correction ☐ Further information required ☐ Non-compliant

Verifier name/qualifications: _____

Organisation: _____ Signature/date: _____