



IC+ Database Methodology Report

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About the Author

Circular Ecology is an environmental consultancy specialising in carbon footprinting, Life Cycle Assessment (LCA), Environmental Product Declarations (EPDs), and carbon data. We support organisations with product, building and organisational carbon assessments, bespoke carbon data services, and sustainability training. Circular Ecology also maintains the well-known Inventory of Carbon and Energy (ICE) database, as well as the new IC+ database, which are both embodied carbon databases for materials for educational and commercial uses, respectively.

For more information, please visit circularecology.com.



Summary

The IC+ Database is a database of embodied carbon factors for construction materials, developed and maintained by Circular Ecology. It provides representative values at material and product-form level for use in whole life carbon assessment, early-stage design, carbon footprinting, procurement, and policy work, where product-specific data is not available or not yet known.

This report sets out how the IC+ Database has been compiled. It describes the scope of the published values and the life cycle stages or modules they cover; the data sources they are drawn from, comprising published Environmental Product Declarations (EPDs), sector and industry-average datasets, and values calculated from other background constituent data; the structure into which factors are organised and how they are named; the quality assurance process by which datapoints are categorised, included or excluded, and reviewed; the statistical treatment applied to compile subcategory averages; and the data quality framework under which every published value is scored.

The methodology is described at the level of rules and criteria. Category-specific commentary is carried within the IC+ Database itself, in three descriptive commentary fields accompanying every factor, which set out what the factor covers, what the underlying data shows, and how the factor should be applied. Users selecting a factor should read those commentary fields alongside this report.

The IC+ Database is a licensed product, suitable for commercial and other non-educational use, and distinct from the Inventory of Carbon and Energy (ICE) Database, which remains freely available for educational use only. This methodology report is published openly and may be freely referenced.

Further Information on IC+

For further information on the IC+ Database, please refer to the links below:

IC+ Database:	circularecology.com/ic-plus
Frequently Asked Questions:	circularecology.com/icplus-faqs
IC+ Methodology Report:	circularecology.com/ic-methodology-report
Licence Enquiries:	circularecology.com/ic-plus
End User Licensing Agreement:	circularecology.com/icplus-eula
ICE Database Educational:	circularecology.com/embodied-carbon-footprint-database
General Enquiries:	circularecology.com/contact



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1 Introduction

1.1 About IC+

The IC+ Database is a database of embodied carbon factors for common construction materials, developed and maintained by Circular Ecology. It provides representative values at material and product-form level for use in whole life carbon assessment, early-stage design, carbon footprinting, procurement, and policy work, where product-specific data is not available or not yet known. IC+ factors are derived principally from published Environmental Product Declarations, together with sector and industry-average datasets where these offer better coverage.

1.2 IC+ and the ICE Database

The IC+ Database is a distinct product from the Inventory of Carbon and Energy (ICE) Database, and not an updated version of it.

The ICE Database remains available free of charge for educational use only. The ICE Database is intended to be periodically refreshed as IC+ data matures, so ICE users continue to receive updated figures, but on a delayed basis, and its terms do not permit professional, commercial, or other non-educational use.

The IC+ Database is a licensed commercial product for professional and other non-educational use. It contains the current dataset, an expanded category structure, per-datapoint data quality scoring, descriptive guidance, and commentary, and follows the methodology documented within this report.

The ICE and IC+ Databases are compiled for different purposes and should not be treated as interchangeable. Where a project requires commercial use, including consultancy, assessment for a client, internal business activities or any output sold or provided as a professional service, the IC+ Database is the applicable dataset.

1.3 Purpose of this Report

This methodology report accompanies the IC+ Database, starting with version 1.0.1, released on the 7th of October 2026. It sets out how the database has been compiled: the data sources drawn on, definition of material categories, the criteria by which individual datapoints have been assessed and either retained or excluded, derivation of the published values from the underlying datapoints, and description of data quality scoring frameworks.

The purpose of this report is to support users in their interpretation of the factors and how they can be applied. Aspects described within this methodology report can affect what a given factor represents; such as the treatment of recycled content, the basis on which Conservative, Mean, and Low values are published, and the provision of sector data alongside EPD-derived values. Users who may be presenting IC+ factors to clients, verifiers, or reviewers should be able to explain these differences, and this methodology report provides the guidance to support them being able to do so.

1.4 Scope of this Report

This report describes methodology at the level of rules and criteria, illustrated with examples where a rule is easier to show than to state. It covers the IC+ Database only; the ICE Database is compiled and maintained separately.



This report does not document decisions undertaken at a category level. All category level commentary is carried within the IC+ Database itself. Every factor is accompanied by three descriptive commentary fields setting out the product types included, as well as observations on the distribution of the underlying datapoints, and guidance on the application of the factor. Users assessing a particular IC+ factor for suitability of application should begin in the IC+ Database and refer to this methodology report, as required, to understand the methodology framework behind IC+.

The report does not restate the IC+ Database. Values, category structures, units, and data quality scores are published in the IC+ Database and appear in this document only where necessary to illustrate a point of method.

1.5 Version, Citation and Licence

This methodology report applies to the IC+ Database starting with version 1.0.1, released on the 1st of October 2026. It is published openly and may be freely referenced or circulated. The database it describes is available only under licence; the terms of that licence govern use of the IC+ Database itself, not of this report.

Please cite as: Circular Ecology, 2026. IC+ Methodology Report, Version 1.0.

Comments on the IC+ Database methodology report are welcome and will inform future releases; Section 9 sets out the areas where potential future development might be focussed. You can contact us at [this link](#).

2 Scope and Boundaries

2.1 Life Cycle Modules Covered

The IC+ Database reports cradle-to-gate embodied impacts, covering modules A1 to A3 as defined in EN 15804: raw material supply (A1), transport to the manufacturing site (A2), and manufacturing (A3). Values are published as a combined A1–A3 figure rather than split by module.

The module boundary is defined relative to the product each datapoint describes, not to a finished building component. Where a datapoint represents a material or semi-finished product, its A1–A3 covers production up to the point that product leaves its own factory gate. Any further fabrication, such as cutting, forming, machining, coating or assembly, falls within the manufacturing stage of whoever carries it out, and the material itself becomes an A1 input to that process. One producer's A1–A3 is consequently the next producer's A1. A steel sheet factor, for example, represents the sheet as it leaves the mill; the stamping, pressing, cutting and painting that turn it into a usable product are a separate manufacturing stage, and the sheet enters that stage as a raw material input.

There are a small number of sector dataset factors that cover A3 only and these factors are explicitly presented as such within the Life Cycle Boundary for those factors in the IC+ Database. The aluminium semi-fabrication values published by European Aluminium: sheet rolling, foil production and extrusion, are gate-to-gate factors covering module A3 only and exclude the production of the primary or secondary metal input.

Modules beyond the gate of the product described are outside of scope. Transport to site (A4), construction (A5), use and maintenance (B1–B7), and end of life (C1–C4) impacts are dependent on project-specific decisions that cannot be represented in a generic material factor. Module D is likewise excluded.



Users should select a datapoint matching the form of the product being assessed, and should read the stated life cycle boundary and product form description together before applying it. Any process beyond the stated boundary falls outside the factor and must be accounted for separately.

How an IC+ factor sits within an assessment depends on what is being assessed. Where the assessment concerns the material itself, the factor is the A1–A3 figure for it. Where the assessment concerns a product manufactured from that material, the factor is an A1 input to it, and the fabrication and transport stages carried out by the product manufacturer sit in that assessment's own A2 and A3. Many IC+ factors represent materials and semi-finished forms rather than finished components, so this is the more common case. In either case, modules beyond the gate of the product being assessed are calculated separately against the relevant project assumptions.

2.2 Declared Units

Each factor in the IC+ Database states a declared unit by which its emission factor is reported, together with the quantity and the mass in kilograms of that declared unit.

Many of the factors are declared per kilogram, which allows a single factor to be applied across product forms of differing dimensions. Where a material is conventionally specified and procured by volume or length, the published factor attempts to follow the same declared unit as the sector best practice.

Where a declared unit other than mass is used, the corresponding mass and, where applicable, density is published alongside, to allow factors to be converted between base units of measure. Any conversions between units of measure should be undertaken by the user with care. A per-kilogram factor that has derived from a volumetric source carries the density stated in that source, which may differ significantly from the product or material being assessed. Where the density of the product or material being assessed is known, it should be used in preference to the published IC+ Database values.

Underlying data sources declared on a functional unit rather than a declared unit basis, or on a unit that cannot be converted to mass with the information provided, have been excluded.

2.3 Indicators Reported

The IC+ Database reports global warming potential (GWP), expressed in kilograms of carbon dioxide equivalent (kgCO₂e) per declared unit, and per kilogram.

Values are GWP-total unless stated otherwise in the factor. GWP-total comprises the fossil, biogenic, and land use and land use change (LULUC) contributions to global warming potential as reported under EN 15804+A2.

Reporting of the three contributions is not consistent across the underlying data. Datapoints produced under EN 15804+A1 report a single GWP figure rather than the separated contributions, and not every datapoint produced under +A2 declares all three. Where a contribution is not reported in a source, it is treated as zero rather than estimated. An aggregated value is therefore the sum of what the contributing datapoints declare, and may understate the total where a contribution is present in the product but absent from the declaration. Where a factor is reported on a different basis, for example GWP-fossil only, this is stated in the IC+ Database and noted in the data analysis commentary field.

For any biogenic materials that sequester (store) carbon within them, the IC+ Database publishes two values for each factor: one including biogenic carbon storage, and one excluding it. Both values are



derived from the same underlying sample of datapoints, and both carry the same data quality score. The published values are cradle-to-gate only, and so it is important to note any factor including carbon storage does not account for the eventual release of that stored carbon at end of life.

2.4 Geographical Scope

Every factor in the IC+ Database states a Representative Region, and users should select the most appropriate factors on that basis. Where a sector dataset may provide a more regionally configured factor, IC+ publishes it alongside the corresponding global values to allow users to select the most appropriate factor for their requirements.

The geographical criteria within the Data Quality Indicators and Scoring framework are based solely on a measure of proximity to the intended use cases of IC+, and not a judgement on the quality of LCA data produced in any given region. The geographical criterion in the data quality framework currently favours the UK and will score UK data most highly on that basis (Section 8.3). In practice, few materials are supported by a sufficient body of UK-specific data to allow for a UK factor to be compiled. Most aggregated factors are therefore published as global typical values, reflecting the composition of the available sample rather than UK supply specifically, and should be used where the origin of the material being assessed is not known.

3 Data Sources

The IC+ Database is compiled from published, third-party verified environmental data as a preference. The two most typical sources of underlying datapoints are: Environmental Product Declarations (EPDs), which are aggregated into subcategory values, and sector or industry-average datasets, which are published as single reference values. The source of every category is stated in the database.

3.1 EPD Libraries

The majority of IC+ factors are derived from EPDs published by recognised programme operators. EPDs are used in preference to other data disclosure types as they are produced to a prescriptive standard, independently verified, and published with a declared unit, boundary, and reference year, which increases their comparability.

For each EPD, the A1–A3 result, declared unit, mass, and density, stated geography, reference year, standard version, and stated moisture content, where applicable, have been extracted and recorded against the underlying datapoint. The number of EPDs contributing to each published value is provided in the IC+ Database as the sample size.

EPDs have not been weighted in any way by market production volume. Manufacturers do not typically publish volumes alongside EPDs, and the number of EPDs a manufacturer publishes bears no fixed relationship to its share of market supply. Aggregated IC+ factors are therefore presented as the unweighted arithmetic mean of the contributing datapoints, being those retained following the screening and quality assurance process described in Section 5. They represent the range of published data within that sample rather than a volume-weighted market value.

3.2 Sector & Industry Average Datasets

The IC+ Database also publishes factors taken from sector and industry-average datasets: figures compiled by trade associations and industry bodies, typically from verified member production data, LCAs and EPDs and are often weighted by production volume. These datasets offer geographic



specificity, increased industry coverage and often cover sectors where EPD coverage is minimal. Sector datasets are published alongside the corresponding aggregated factors rather than incorporated within them.

3.3 Modelled Datasets

A third group of IC+ factors covers those modelled and calculated by Circular Ecology from background constituent data. These factors exist where a material is specified by a composition rather than supplied as a discrete product. Concrete is the principal case: it is specified by strength class, cement type, and binder replacement level, and has a wide number of combinations in common use.

Modelled factors are established by applying constituent material emissions factors to a defined composition. For in-situ concrete, the cementitious content associated with each strength class and binder combination is taken from recognised industry mix data, and emissions factors for cement, supplementary cementitious materials, aggregates, water, and admixtures are applied proportionately to that composition, together with transportation and batching impacts, to give an A1–A3 value.

The constituent background factors themselves are drawn from the same sources described in Section 3.1 and 3.2, and so a modelled factor inherits the data and data quality scoring from the sum of its constituent inputs.

Alongside the published modelled factors, a calculation tool is also provided, which allows users to derive bespoke values for cements, mortars, and concretes based on their own specifications, scenarios, and assumptions. See Appendix A for further information.

4 Categorisation & Naming

4.1 Category Hierarchy

The IC+ Database organises factors into material categories, each divided into subcategories representing distinct materials or product forms, rather than by application. A material used in several building elements appears once, rather than being repeated under each element it might serve. Users working from an element-based classification will therefore need to identify the constituent materials before selecting appropriate factors.

Subcategories are not of uniform breadth and granularity. Some may correspond to a tightly defined product, where the product form is well standardised and the available data is consistent. Others may cover a wider boundary by necessity, where the available data is not sufficient to support further granularity. The breadth of each subcategory is stated in its descriptive fields, which set out for each factor the boundaries of inclusion, any exclusions, and intended application.

Every factor is published with a unique identifier (UID) that will be consistently maintained across updates, so that factors can be mapped and tracked between versions of the database. Where a factor has a counterpart within ICE Database v4.1, the corresponding reference (UID) is provided for ease of transition to the IC+ Database.

4.2 Naming Conventions

Each factor has a reference name constructed on a consistent pattern, to allow the basis of the value to be read from the IC+ reference name alone:



- Material Name [Region; Source; Method; Scenario; Carbon Storage Included] | Declared Unit

The key elements are:

- **Material Name:** Ordered from general to specific, comma-separated, so factors for related materials and products sort together. Timber, Hardwood, Flooring and Timber, Hardwood, Sawn & Structural sit adjacent under the same material lineage.
- **Region:** The geography the factor represents, as described in Section 2.4.
- **Source:** Stating IC+ where the value is compiled by Circular Ecology from underlying data or referencing the publishing body where the value is taken from a sector dataset.
- **Method:** Stated as Aggregated for a statistical mean of individual datapoints, Reported for a figure taken directly from a published source, and Calculated for a factor derived from background constituent data as described in Section 3.3.
- **Scenario:** The statistical basis of an aggregated value. Reported factors carry no scenario. See Section 6.3 for more information on this.
- **Carbon Storage Included:** Yes or No, distinguishing the two values published for biogenic materials under Section 2.3. Factors for materials that sequester no carbon will carry no carbon storage designation.
- **Declared Unit:** The unit on which the emission factor is reported.

5 Quality Assurance & Analysis

5.1 Overview of the QA Process

All datapoints collated and analysed for the IC+ Database have been assessed against a consistent set of criteria before they contribute to a published factor. This Section describes the process that determines which datapoints are included within a subcategory and how datapoints have been utilised.

The process comprises four stages:

- I. Collated datapoints are assigned to a subcategory under 5.2.
- II. Assigned datapoints are assessed for inclusion against the criteria in 5.3.
- III. The resulting distribution of datapoints is reviewed, with particular attention to the upper-end and lower-end distribution of datapoints, under 5.4.
- IV. The subcategory structure is confirmed, and the decision to hold or further split a subcategory is taken.

The stages are described in sequence in this methodology report but are typically applied iteratively until the process is satisfactorily concluded. Duplication of datapoints is typically only visible once datapoints have been assigned to a subcategory. Any misassignment of datapoints is also often easier to identify against a compiled distribution, rather than against a datapoint in isolation. A datapoint reassigned at review stage may therefore create a duplication or an exclusion question not previously raised at earlier stages of the process, and previous stages are revisited where this occurs. The decision to further split or hold a subcategory also depends on the compiled distribution of datapoints. Therefore, this aspect follows the review of the individual datapoints, rather than preceding assignment. Any further splitting of categories effectively returns the relevant datapoints to Stage I of the process.



The process is undertaken category by category rather than across the entire database simultaneously, and so the depth of review at the point of publication differs between categories. The extent of review and analysis is recorded explicitly in the Analytical DQI for each factor.

5.2 Categorisation of Datapoints

Each datapoint is assigned to a material category. Assignment is made on the material and product form as declared in the data source. Assignment is a judgement rather than an automated process. EPDs describe products in the manufacturer's own terms, and product names frequently do not correspond to the category structure: a declared product may span two subcategories, use a regional or trade name for a material published under another, or describe a product form that the subcategory definitions do not obviously cover. Each datapoint has therefore been assessed by the nature of the product stated within the data source, rather than on its name.

Assignment decisions are reviewed at subcategory level once the samples have been completed, since a misassignment is easier to identify against the resulting distribution, rather than against the source in isolation. Where a datapoint may plausibly belong to more than one subcategory and the data source does not explicitly resolve the conflict, the assignment is made and recorded as a possible outstanding concern and reflected in the Analytical DQI for the affected factors.

5.3 Inclusion and Exclusion Criteria

A datapoint is excluded where any of the following applies.

The A1–A3 result cannot be isolated. Sources reporting a combined figure across a wider life cycle boundary, from which the cradle-to-gate impacts cannot be separated, are excluded.

The datapoint covers a multi material product. Multi-material assemblies where no single material dominates, finished products built on a core of the material in question but with considerable portions of other contributing materials, and products in which the material is a minor input are all excluded on this basis, as the declared result cannot be attributed to the material the subcategory represents.

The source is generic or unverifiable. Datapoints without a declared method, without an identifiable publisher, or which cannot be traced to a published source are excluded.

The datapoint duplicates another already included. Published EPDs frequently describe overlapping products: the same product declared by more than one programme operator, a group EPD alongside the individual product EPDs it covers, or successive EPDs as earlier versions are superseded. Where duplication is identified, the most recent, or most appropriate, datapoint is retained and the others are excluded.

Exclusion decisions are recorded against each datapoint during the quality assurance process. Where a subcategory contains a material volume of exclusions on a single ground, this can be further noted in its data analysis commentary.

5.4 Outlier Handling

The IC+ Database does not apply any automatic rules for the removal of extreme values. Datapoints are excluded only where a valid reason for exclusion can be identified, and dispersion alone is not treated as such a reason.



The upper and lower ends of each subcategory distribution are reviewed manually. Values sitting at the extremities of a sample distribution are traced back to the original source and checked for a justification for exclusion. In practice this falls within three outcomes:

- Where the value has been extracted or converted with errors, it is corrected and retained where possible.
- Where the value is correctly stated but falls outside the stated subcategory boundary; a different product form, a boundary other than A1–A3, a clear mistake in accounting practices, or a declared unit that cannot be reconciled, it is excluded under the criteria in 5.3.
- Where the value is correctly stated, properly falling within the stated boundary, and no clear justification for exclusion can be ascertained, the datapoint is retained within the dataset with additional commentary where appropriate.

As such, a published factor may contain a wide range of datapoints within its distribution, and in some instances the broad range is a feature of the material rather than an issue. Where the profile of the subcategory has an identifiable driver of this kind, it is typically described within the data analysis commentary, to allow users to make a judgement on the representativeness of the factor for the specific product or material they are assessing.

Review of datapoints is not a one-off exercise. Subcategories will undergo continued review as further datapoints are added to the process and categories are revisited. The extent of review and the status of any concerns outstanding at the time of publication are reflected in the Analytical DQI for each factor (Section 8.4.2). In instances where every datapoint within a subcategory has been reviewed and all queries closed out, the DQI scoring will be higher than instances where any identified concerns remain open and disclosed. As such, the DQI scoring captures the state of the sample of datapoints at time of publication, rather than implying a uniform level of scrutiny across all factors within the database.

6 Statistical Treatment

6.1 Type of Factors

The treatment described in this Section applies only to aggregated factors stated within the IC+ Database. Three types of factors are published in the IC+ Database, distinguished by the Method element of the reference name (Section 4.2):

- **Aggregated:** A statistical arithmetic mean of individual contributing datapoints, compiled by Circular Ecology. Sections 6.2 to 6.4 apply, and sample statistics are published.
- **Reported:** A figure taken directly from a published sector or industry-average dataset, as described in Section 3.2. No statistical treatment is applied by IC+; the derivation is that of the publishing body, on whatever basis that body used. No sample statistics are published.
- **Modelled:** A figure derived from the modelling of background constituent data against a defined composition, as described in Section 3.3. No sample statistics are published, since the value is not drawn from a sample of datapoints.

6.2 Derivation of Typical Values

Aggregated factors are published as the unweighted arithmetic mean of their contributing datapoints. Before averaging, all contributing values are normalised on a common basis. Where an underlying



source declares its result per cubic metre or per unit of product, the value is converted to a per-kilogram basis using the mass and density stated in the data source, or taken from a trusted supplementary source, so values declared on different basis can be combined.

Unweighted values are presented as there is currently no consistent basis available to allow for weighting by supply across published EPDs. The mean therefore represents the centre of the published data, not of the market supply.

Published alongside each aggregated factor are the sample size, the minimum and maximum values within the sample of datapoints, and the Mean Absolute Percentage Deviation (MAPD). These statistics are presented to allow users to see the profile of the underlying datapoints from which the mean is established. For biogenic materials that sequester carbon, the values are presented separately for both including and excluding sequestration but are derived from the same background sample of contributing datapoints.

6.3 Conservative, Mean and Low Carbon Scenarios

For certain material categories, the IC+ Database publishes range of carbon scenario values: a Conservative value, a Mean value, and a Low value.

The Mean value is the same as the mean value as described in Section 6.2. The Conservative and Low values are derived from the same background sample of datapoints as the Mean value and represent the upper and lower tertile means. These values are different to the statistical minimum and maximum values, which are published separately. The Low and Conservative values are published for subcategories where the profile of the underlying datapoints has an identifiable cause, and where the user may be able to determine the most appropriate scenario for their use case.

Recycled content is the clearest example to illustrate. A subcategory's background sample of datapoints may include products made via primary and secondary routes, with widely differing recycled material compositions, and where that composition is a principal driver of the carbon impact. The Mean of the sample of datapoints might typically sit somewhere between two distinct positions, therefore representing neither scenario sufficiently. Where the user has further knowledge of the production route or recycled content of the material or product they are assessing, a Low or Conservative scenario may be more representative to use than the Mean value. Other underlying drivers can produce the same effect. Selection of scenarios should be made on what is known about the material or product and based on the purpose of the assessment. The Conservative value is more appropriate where caution in the output is warranted. The Mean value is typically more appropriate where nothing further is known beyond the material type. The Low value should not be used as a default, since applying it without a stated reason will typically understate the result. Used together, the three scenario values could also support optioneering, allowing the user to assess potential carbon impacts through further specification of the material.

The three scenario values describe dispersion within the published datapoints and do not provide the range available in the market. A Low scenario value is not necessarily procurable, and the Conservative value is not to be considered a worst case. Where a specific product is under consideration, a product-specific EPD supersedes all use of IC+ factors.

6.4 Geographic Specificity

Where the available sample of datapoints supports it, a factor can be published for a specific geographical region as well as, or instead of, a global mean. Where further geographical granularity



cannot be supported, only a global mean factor is published. A regional split requires sufficient datapoints within the stated region to support a mean value.

Regionally specific values are typically more available through the sector datasets described in Section 3.2, which are compiled by bodies with access to supply data rather than relying solely on published EPDs. Where both a global aggregated factor and a regional sector reported factor exist for the same material, both are published, with the appropriate region stated in the factor's reference name.

7 Selecting and Using a Factor

7.1 Choosing Between Factors

More than one IC+ factor may exist for the same material type, covering a different basis: an aggregated mean, a sector figure, a calculated value, or a set of Conservative, Mean, and Low values. The following order of preference applies where more than one option is available, though each step depends on a suitable factor existing for the material and region in question; where it does not, the next applies.

- I. **A product-specific EPD, where the product is known.** IC+ is a generic database and is not a substitute for manufacturer data. Once a product or material has been specified and a supplier appointed, the EPD for that product supersedes any IC+ factor.
- II. **A sector or industry-average factor, where one exists for the relevant material and region.** These factors are typically weighted by production or supply volume and represent the material as supplied rather than as published.
- III. **A calculated or aggregated factor, in the general case.** Where Conservative, Mean, and Low values are published, a user should select the factor based on the information in Section 6.3.

Where the choice of factor is not clear and obvious, the descriptive commentary fields for each factor provide further information, and in some cases may direct users to a different factor explicitly, as discussed below.

7.2 The Three Descriptive Fields

Each IC+ factor is accompanied by three descriptive commentary fields. These descriptions carry the category-level detail not included within this report and should be read before a factor is applied.

- **Notes on Types of Product or Product Forms:** Provides description of the specific products, product forms, or any specific processing steps that the factor is intended to represent.
- **Notes on Data Analysis:** Provides commentary on any analytical steps and distribution patterns observed within the underlying sample of datapoints for the stated factor.
- **Notes on Application of Factor:** Provides additional guidance on the most suitable selection and application of the factor, including any known limitations or caveats to be considered.

7.3 Applying a Factor

When selecting and applying an IC+ factor, the following should be considered:

- Check the declared unit and life cycle boundary. Both are stated for every factor.
- Use the density of the actual material or product being assessed, when known, for converting between mass and volume. The density values published in the IC+ Database, where available, should be considered as representative, and for reference only.



- Apply factors for carbon sequestration within biogenic materials consistently. Mixing factors both including and excluding carbon storage within an assessment will produce a result that cannot be interpreted.
- Read the descriptive commentary fields to support the most appropriate selection and application of factor(s) for the intended use case.
- Review the factor's Data Quality Scoring for an understanding of the confidence held in the underlying sample of datapoints and any other noted limitations of the factor.
- Check for any alternative or supplementary sector data, EPD data, or carbon scenario options in the event they are more suitable for the intended use case.

The IC+ Database includes generic embodied carbon factors that are appropriate for early-stage assessment, benchmarking, optioneering, and assessment where the specific supplier is not yet known. The IC+ Database factors are not appropriate for substantiating a claim about a specific product, for comparing multiple named products, or for any purpose requiring manufacturer-specific data.

It is the sole responsibility of the user to appropriately select and apply any factors in the IC+ Database and to ensure suitability for the intended use case. The IC+ Database states the basis on which each factor has been published, together with its scope and boundaries, limitations, and data quality score. The user remains solely responsible for all professional judgement, methodology selection, data selection, assumptions and inputs, calculations and analysis, interpretation of results, reporting outputs, and any other decisions made using IC+ data. Users should satisfy themselves that the factors applied are appropriate to their intended use case and consistent with the requirements of any relevant reporting framework or standards. Full details on Terms of Use of the IC+ Database can be found in the IC+ [End User Licence Agreement \(EULA\)](#). All users should be aware of and familiarise themselves with the requirements and terms of use as set out in the EULA before using the IC+ Database.

8 Data Quality Indicators & Scoring

8.1 Purpose and Application

Each factor published in the IC+ Database carries a data quality score. The score is a structured assessment of how well the underlying datapoints support the published figure, the standards it was produced under, its age and geographical origin, the level of review it received, and, for values derived from multiple datapoints and sources, the size and consistency of the sample and the depth of analysis applied to it.

The data quality score is not a statement of accuracy, and a high score does not indicate a low carbon figure or a preferable carbon outcome. A high score indicates that the published value rests on a well-evidenced, well-reviewed, and well-analysed body of data. Users should read the data quality score alongside the descriptive commentary fields accompanying each factor, which provide further information on the coverage and suggested application of the factor.

Scores are applied to every factor in the IC+ Database. The Core DQIs are applied to all datapoints; the Category Average DQIs are applied only to factors derived as a statistical mean across multiple datapoints, as set out in Section 8.4. The scope of DQI assessment applied to each factor is stated in the IC+ Database, as either Core DQIs, or Core DQIs; Category Average DQIs.



8.2 Framework Overview

The data quality framework comprises two groupings, each contributing 50% of the final score:

- Core DQIs, applied to individual datapoints, covering method compatibility, assurance, temporal correlation, geographical compatibility, and transparency.
- Category Average DQIs, applied to material subcategories compiled as statistical averages, covering population and precision, and analytical approach.

Each grouping is described below, with the method for combining them set out in Section 8.5.

8.3 Core DQIs for Individual Datapoints

These criteria are applied to all datapoints.

Table 1 - Core DQI Scoring for Datapoints

Score	5 (Best)	4	3	2	1 (Worst)
Method compatibility	Industry-specific prescriptive standards (e.g. EN 15804, ISO 21930)	Industry non-specific prescriptive standards (e.g. ISO 14067, PAS 2050, GHGP Product) - EPDs without stated methods will be awarded this score by default.	Other standardised method	Recognised method, but not standardised (e.g. ISO 14040/44 only)	No declared method (e.g. missing data or research paper without defined method)
Assurance	External panel review (e.g. ISO 14040 panel review with 3 or more people)	2 External reviewers (e.g. academic papers)	1 External reviewer (EPDs score this by default)	Internal review	No declared review process
Temporal correlation - Age of study	<= 3 years old	4 - 6 years old	7 - 9 years old	>= 10 years old	No declared year
Geographical compatibility	UK	European data or World Average	North American	All other countries and regions, or no declared geography	-



Score	5 (Best)	4	3	2	1 (Worst)
Transparency	Full calculation model and detailed report available (rare)	Detailed report (e.g. full LCA report, documenting assumptions in detail), but no calculation model. Or transparent calculation model, but not detailed report.	Summary report covering an overview of method incl. key data (EPDs will be awarded this score)	-	Limited details on method, or key information missing

The geographical criterion in the data quality framework currently favours the UK and will score UK data most highly on that basis. It is not a statement about the quality of LCA data produced in other regions.

8.4 Category Average DQIs

These criteria apply to material categories and subcategories whose published value is the average of multiple datapoints. Where a published value has been selected based on a specific reference rather than derived as an average, they are not applied.

8.4.1 Population and Precision DQI

This indicator assesses the sample of datapoints underlying a subcategory average, combining the number of contributing datapoints with the Mean Absolute Percentage Deviation (MAPD) of the sample.

MAPD is calculated as the average of the absolute percentage deviations of each datapoint's GWP value from the mean GWP for that subcategory and so represents the average deviation from the mean across the sample, disregarding direction.

These two characteristics are combined in a matrix rather than scored separately. A large sample with high dispersion is not automatically preferable to a smaller, tightly grouped one.

Table 2 - Population and Precision DQI Scoring

Sample Size / MAPD	> 40%	40% ≥ x > 30%	30% ≥ x > 20%	20% ≥ x > 10%	≤ 10%
1 - 10	0.5	1	1.5	2	2
11 - 25	1	1.5	2	2.5	3



26 - 50	1.5	2	2.5	3	3.5
51 - 100	2	2.5	3	3.5	4.5
101+	2	3	3.5	4	5

To illustrate, a subcategory of 50 datapoints with a MAPD of 25% scores 2.5 points.

The matrix applies deliberate ceilings at its edges: a sample of ten or fewer datapoints cannot score above 2 however tightly grouped, and a sample with MAPD above 40% cannot score above 2 however large the sample may be. In both cases, the limiting characteristic is taken to constrain confidence in the average regardless of the other aspect.

8.4.2 Analytical DQI

Compiling individual datapoints into subcategory averages involves review beyond the assessment of each source in isolation: inspecting anomalous results against the original data source and checking that cut-off methods and assessment boundaries are consistent enough to allow fair comparison between datapoints. The Analytical DQI records the depth of that review and the status of any concerns remaining at the end of it.

Table 3 - Analytical DQI Scoring

Description	Score	Notes
Every datapoint in this category has been checked, and all targeted analysis (e.g. via statistical methods, reference values, visual inspection) has been closed out satisfactorily	5	-
Targeted analysis (e.g. via statistical methods, reference values, visual inspection) has been closed out satisfactorily, with minor or no concerns noted	4	Example of minor concern includes: identification of minor individual outliers within the dataset
Targeted analysis (e.g. via statistical methods, reference values, visual inspection) has been closed out satisfactorily, with moderate concerns noted	3	Example of moderate concern includes: possible overlap of given datapoint(s) across multiple material sub-categories



Description	Score	Notes
Targeted analysis (e.g. via statistical methods, reference values, visual inspection) has been closed out satisfactorily, with larger concerns noted	2	Example of larger concern includes: possible distortion of a dataset due to modelling inconsistencies such as unaccounted allocation issues which can significantly affect average values for key metrics
Data has been categorised, automatic capping applied, but no analysis or review of individual datapoints has taken place; or targeted analysis (e.g. via statistical methods, reference values, visual inspection) has been attempted but major concerns are noted	1	Example includes: a published dataset that otherwise does not satisfy the minimum required level of confidence to achieve the above higher scores.

8.5 Combining Scores

Scores are combined at equal weighting throughout.

- **Core DQI score.** Each contributing datapoint is scored 1 to 5 against the five Core DQI criteria. For a subcategory average, each criterion is averaged across all contributing datapoints, and the five criterion averages are summed to give a Core DQI total out of 25.
- **Category Average DQI score.** The Population and Precision DQI and the Analytical DQI are each scored out of 5 and summed to give a Category Average DQI total out of 10.
- **Final DQI score.** Each total is expressed as a percentage of its maximum, and the two percentages are averaged at equal weighting. The result is published as a single data quality score, expressed as a percentage, and rounded to the nearest whole number.

$$DQI\ Total\ (\%) = \frac{1}{2} \left(\frac{Core\ Total}{25} + \frac{Category\ Average\ Total}{10} \right) \times 100$$

8.6 Industry, Sector and Modelled Datasets

Some IC+ factors are taken directly from a specific published source rather than compiled as a statistical average, principally the sector and industry-average datasets described in Section 3.2. For these, the Category Average DQIs are not applicable, and the published score reflects the Core DQI criteria only, expressed as a percentage, out of a score of 25.

Similarly, modelled factors are not compiled from a sample of underlying datapoints, therefore the Category Average DQIs are not applicable. The Core DQI criteria are assessed across the source constituent component emissions factors, which form the inputs to the model calculations and combine the DQI scores in proportion with each input's contribution to the overall mass. The published DQI score reflects the data quality of the inputs that drive the mass rather than treating all constituents equally.



9 Limitations & Future Development

The IC+ Database has been developed from a background database of over 100,000 datapoints, of which the analysed and published dataset of factors draws on a subset. The scale of the background data means the constraints described below are principally questions of available resource rather than of data availability. The availability of background datapoints and the new IC+ Database funding model support a more consistent and regular update of the IC+ Database, than was previously possible for the ICE Database.

9.1 Recycled Content

Recycled and secondary content is a principal driver of the carbon impact of several materials and is not consistently declared in the underlying datapoints, such as EPDs. Where recycled and secondary content is declared, the proportion varies widely between products within the same material subcategory.

This affects the metals categories most directly, where primary and secondary production routes can differ significantly, but can also apply elsewhere within the IC+ factors. Where the effect is significant and the sample of datapoints supports it, the IC+ Database publishes Conservative, Mean, and Low carbon scenario values to allow a user with knowledge of the supply route to select and apply the relevant scenario factor accordingly (Section 6.3). Where this is not possible, the constraint is stated in the IC+ factor data analysis commentary field. A structured analysis of declared recycled content, across the underlying sample of datapoints, with a view to partitioning subcategories based on recycled content, where disclosure allows, would benefit from consideration in future updates of the IC+ Database.

9.2 Sequestered Carbon

The IC+ Database publishes factors for relevant biogenic materials, both including and excluding sequestered carbon. Reporting questions on Sequestered Carbon have been addressed separately in this report, but inconsistency in the approach to sequestered carbon values reported within the underlying datapoints has also been considered by the IC+ Database.

Stated moisture content can vary between underlying datapoints, sequestered carbon can be calculated differently between programme operators, or values may not always be declared. The differences can affect the distribution within a subcategory in ways that are a function of method rather than of the material impact. The IC+ Database would benefit from continued analysis of categories and factors relevant to carbon sequestration, to improve underlying samples of datapoints and address gaps within the existing data.

9.3 Product Form

There are subcategories within the IC+ Database that present broader than ideal factors, as the available data does not yet support a further split in the subcategory. A characteristic may be material and identifiable but may leave sample sizes too small to maintain separate factors.

For each IC+ factor the breadth is stated in the descriptive commentary fields, and consideration of further splits will be taken as coverage of datapoints and resource allows. In some instances, the constraint lies in resource to undertake the analysis, as outlined in Section 5, rather than in volume of underlying datapoints.



Multi-material products and assemblies are currently outside the scope of the published categories, which are structured by material. Extending IC+ to cover products in assembled form would benefit from consideration in a future revision, as coverage of the underlying data allows.

Further extension of the IC+ Database to cover wider material types and other useful distinct product forms, which are not currently represented, as well as improving the depth of analysis for factors that currently rely on small samples of datapoints, are continuing priorities for the IC+ Database.

9.4 Allocation Issues

Several published factors in the IC+ Database rely on allocation conventions applied in the underlying datapoints rather than on measurement, and these allocation conventions are not always applied uniformly across underlying datapoints and sources. Where a subcategory's sample datapoints span sources applying different allocation conventions, the resulting distribution is a function of method rather than of the material impacts, and the IC+ Database does not currently adjust for it. A continued review of the consistency of underpinning allocation methodologies for affected subcategories would benefit from consideration in future updates of the IC+ Database.

9.5 Geographical Representativeness

Most aggregated IC+ factors are published as global typical values, reflecting the composition of the available sample of datapoints, rather than weighted for any specific regional market supply. Published environmental data is concentrated in a subset of regions, so a global typical factor is currently weighted towards those represented regions.

The availability of sector datasets addresses this for some materials, and the background database may support region-specific means for others where the sample of datapoints within a region is sufficient to support a separate factor. Extending regional coverage, particularly for UK use cases, is a continuing priority of the IC+ Database.

9.6 Additional Indicators

The IC+ Database currently publishes global warming potential total only, however a considerable proportion of the underlying datapoints in the background database already carry the constituent contributions to GWP, alongside the full suite of environmental indicators reported under EN 15804.

Two further developments to the IC+ Database are therefore possible. Firstly, GWP values could be introduced for separate reporting of fossil, biogenic and land use and land use change (LULUC) components, allowing users to apply the GWP contribution relevant to their reporting framework, rather than for GWP total alone. Secondly, wider environmental indicators, beyond carbon, could also be published to provide the user a broader basis for material comparison of wider environmental impacts. Both developments would benefit from consideration in future updates of the IC+ Database, subject to the additional resource the increase in analysis and quality assurance capacity that publishing wider indicators would require.



Glossary of Terms

Biogenic Carbon	Carbon that is absorbed, stored, emitted, or released by materials of biological origin within their life cycle. Examples include carbon contained in wood, natural fibres, agricultural residues, or other biobased products.
Biogenic Materials	A product made by or of life forms e.g., timber-based products.
Carbon Dioxide Equivalent (CO₂e)	Unit for comparing the radiative forcing of greenhouse gases (GHGs) to carbon dioxide. (PAS 2080)
Carbon Footprint	A measure of the amount of greenhouse gas emissions (GHGs) that are released within the boundaries of an assessment. A complete carbon footprint starts at the cradle and measures the release and sequestration of GHG emissions throughout the supply chain or life cycle.
Carbon Sequestration	Carbon sequestered/stored within a biomass source such as trees and plants (e.g., timber products), except for native forests. This figure may be shown as a negative value in an EPD, as it represents carbon that has been sequestered/stored (opposed to released) within the product or material.
Cradle to Gate	A boundary condition associated with embodied carbon, carbon footprint, and LCA studies. A cradle-to-gate study considers all activities from the extraction of materials from the Earth (the cradle) to the point the product is ready to leave the factory gate (modules A1-3).
Data Quality Indicators	A scoring method used to evaluate the quality and representativeness of data used in an assessment, based on criteria such as temporal, geographical, and technological relevance, completeness, and reliability.
Declared Unit	Quantity of a product for use as a reference unit in an EPD, based on one or more information modules.
Embodied Carbon	Defined as the carbon footprint of a material and considers all extraction, transport, processing and fabrication activities of the material or product. It can also include the disposal stage but not the operation/in use stage.
Emissions Factor	Amount of greenhouse gases emitted, expressed as carbon dioxide equivalent (CO ₂ e) and relative to a unit of activity. (PAS 2080). Also referred to as carbon factors or carbon emission factors.



EN 15804	A reporting standard for Environmental Product Declarations (EPDs) in the construction industry. The standard is made up of modules which make up the life cycle of the item being assessed. Modules A0-5, B1-7, C1-4 and D. It is essential for producing verifiable EPDs and LCAs.
Environmental Product Declaration (EPD)	A standardised document which gives information about a product's environmental impact. EPDs must be carried out and verified to the EN 15804 standard.
Functional Unit	Quantified performance of a product system for use as a reference unit.
Gate to Gate	A boundary condition covering a single processing stage within a product's life cycle, rather than the full cradle to gate sequence. A gate-to-gate figure represents the impact of the processing applied to a material and excludes the production of the material input itself, so it must be added to a separate factor for that input to give a complete cradle to gate result.
Global Warming Potential (GWP)	A factor describing the radiative forcing impact of one mass-based unit of a given greenhouse gas relative to an equivalent unit of CO ₂ over a given period of time (PAS 2080)
Greenhouse Gases (GHGs)	Gaseous constituents of the atmosphere, natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. (PAS 2080)
IC+ Database	Refers to the collection of IC+ factors in its entirety, within the structure of the provided values.
IC+ Dataset	Refers to a given subset of IC+ factors, for example a group of factors categorised by method, geographical representativeness, source, or material type.
IC+ Datapoint	Refers to an individual underlying data source which has been used to develop the IC+ factors, either through an aggregated, modelled, or reported approach.
Life Cycle	Consecutive and interlinked stages of a product, equipment, or service, from raw material acquisition or generation from natural resources to design, production, transportation/delivery, use, end-of-life treatment, and final disposal. (PAS 2080)



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Appendix A – Cement, Concrete and Mortar Tool

A calculation tool is provided, supplementary to the IC+ Database, which allows the user to calculate bespoke embodied carbon values for cements, mortars, and concretes. This includes coverage of in-situ concrete and reinforced or unreinforced precast concrete.

Generic emissions factors, typical cements, production emissions, transport assumptions, and production waste assumptions are provided within the calculator; however, the tool also allows the user to input custom values to overwrite any generic or assumed factor or scenario included as a default within the calculator.

The calculator covers the A1-3 (cradle-to-gate) emissions associated with the modelled cement, mortar, or concrete specification, and does not include A4 (transport to site) impacts or any other life cycle stages beyond cradle-to-gate.

Further methodology and instructions can be found in the relevant section of the tool itself.

Future versions of the tool will continue to be intrinsically linked to the latest version of the IC+ Database.