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CARBON FOOTPRINT REPORTING FOR WAREHOUSES

FIRST EDITION

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FOREWORD

This document is a proposal to create a framework for communication between the entity requesting information regarding carbon footprint calculations (e.g., investor, consultant) and the supplier of this information (e.g., contractor, subcontractor, consultant). Market observation indicates that different entities (investors, banks) currently expect different scopes of carbon footprint calculations. Clear communication of information requirements to the entity with the best knowledge of materials and quantities, i.e., the contractor, is a challenge. This document aims to streamline this process by providing standardized forms and specifying the scope of expected information, for example, in contracts. We believe that this will lead to standardization of the exchange of information on materials and quantities needed for reliable carbon footprint calculations, and ultimately contribute to the development and popularization of comparable emission benchmarks in the market.

1 WHY CALCULATE EMBODIED CARBON FOOTPRINT?

Calculating embodied carbon in construction is crucial for addressing the environmental impacts of buildings and advancing sustainability objectives. By comprehensively assessing the emissions linked to construction materials and processes, stakeholders can make informed decisions to minimize carbon footprints, combat climate change, and foster resilient and eco-friendly built environments. Through the adoption of standardized methodologies and cutting-edge tools, the construction sector can play a pivotal role in meeting the European targets for 2050 and transitioning towards a low-carbon future.

While the calculation of embodied carbon has been a well-established practice, it has become evident that merely calculating for certifications like BREEAM or LEED is no longer adequate. There is a growing realization of the complexity and nuances involved, leading to confusion regarding benchmarks for specific assets, guidelines, data sources, and reduction assumptions.

Considering the evolving legal landscape, particularly the CSRD directive, the construction industry is poised to undergo a significant transformation. The directive's

phased approach to carbon footprint reporting will soon require businesses of varying sizes to disclose their environmental data, influencing the entire supply chain to prioritize sustainability. This regulatory shift underscores the importance of integrating carbon footprint calculations into the core business strategy, beyond mere compliance with certification standards. As the industry adapts to these changes, the focus on embodied carbon in construction will not only fulfil regulatory demands but also serve as a catalyst for innovation, driving the sector towards more sustainable practices and materials that align with the EPBD's long-term vision for energy and resource efficiency.

In essence, there are several situations where an organization or project may fall under obligation of embodied carbon footprint calculation. The reasons may be:

- ESG reporting
- Taxonomy compliance
- Cost of finance related to sustainability metrics
- Your business partner's policy forces you to introduce carbon footprint to maintain competitiveness

2 DECIDE ON SYSTEM BOUNDARIES

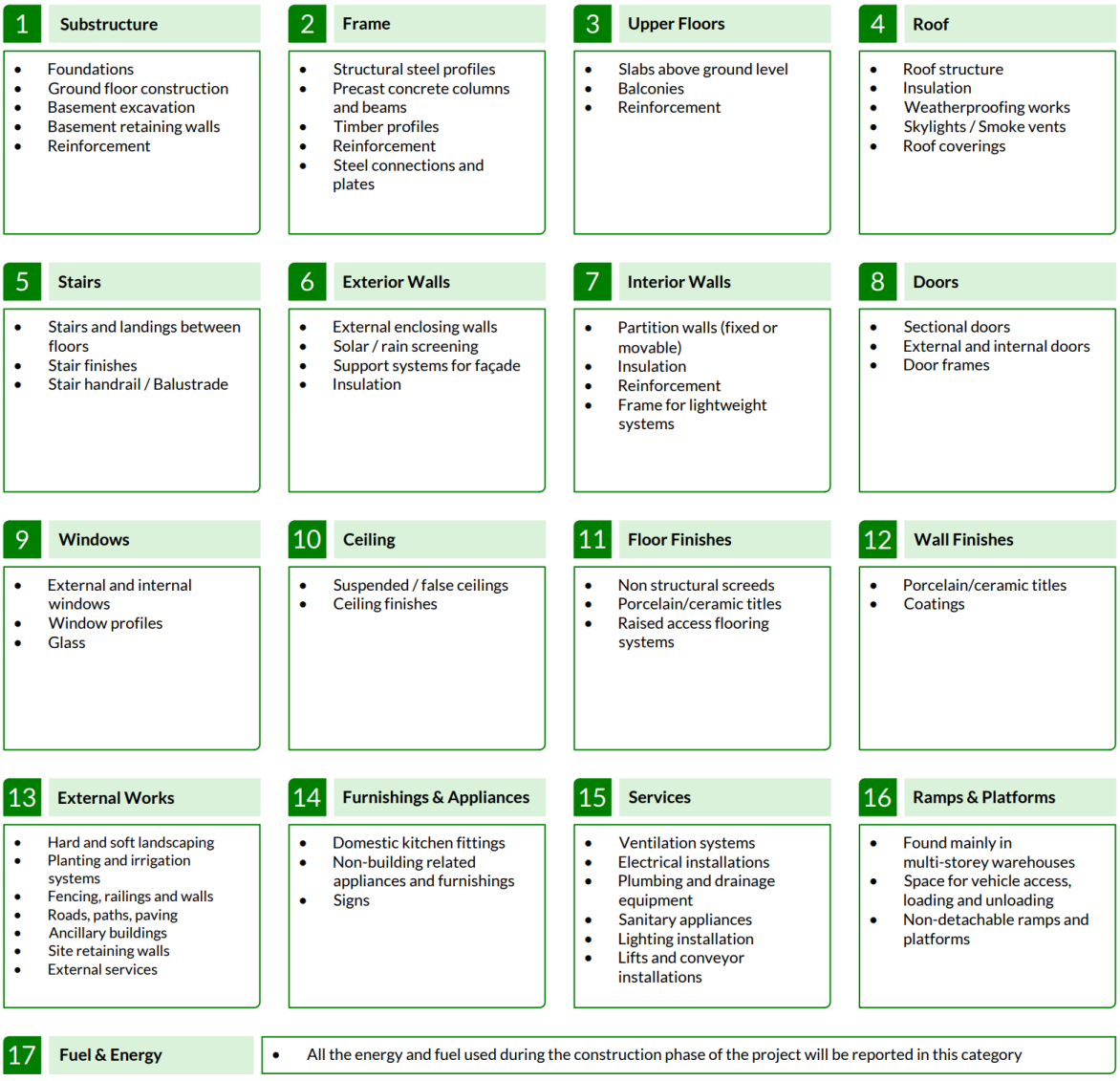
Defining a system boundary is essential as it delineates what factors are included in the calculation. Put simply, it determines what aspects contribute to the final carbon footprint assessment. For instance, traditional certification schemes often focus solely on the building itself, neglecting the significant emissions associated with installations, which can account for 10-15% or more of the embodied emissions. Moreover, emissions related to external areas are frequently overlooked.

For organizations committed to accurate carbon footprint reporting, a more comprehensive approach is necessary. While different organizations may adopt varying methodologies, there is a prevailing trend towards including as many relevant factors as possible in the calculation process.

2.1 Categories

The proposed breakdown structure for defining the system boundary is shown below. It is composed of 16 categories based on the RICS New Rules of Measurement 3 (NRM3). For each category, examples have been provided to offer guidance on what

could be included. It's important to note that these examples are not exhaustive and serve merely as suggestions. You are free to include or exclude items as you see fit.



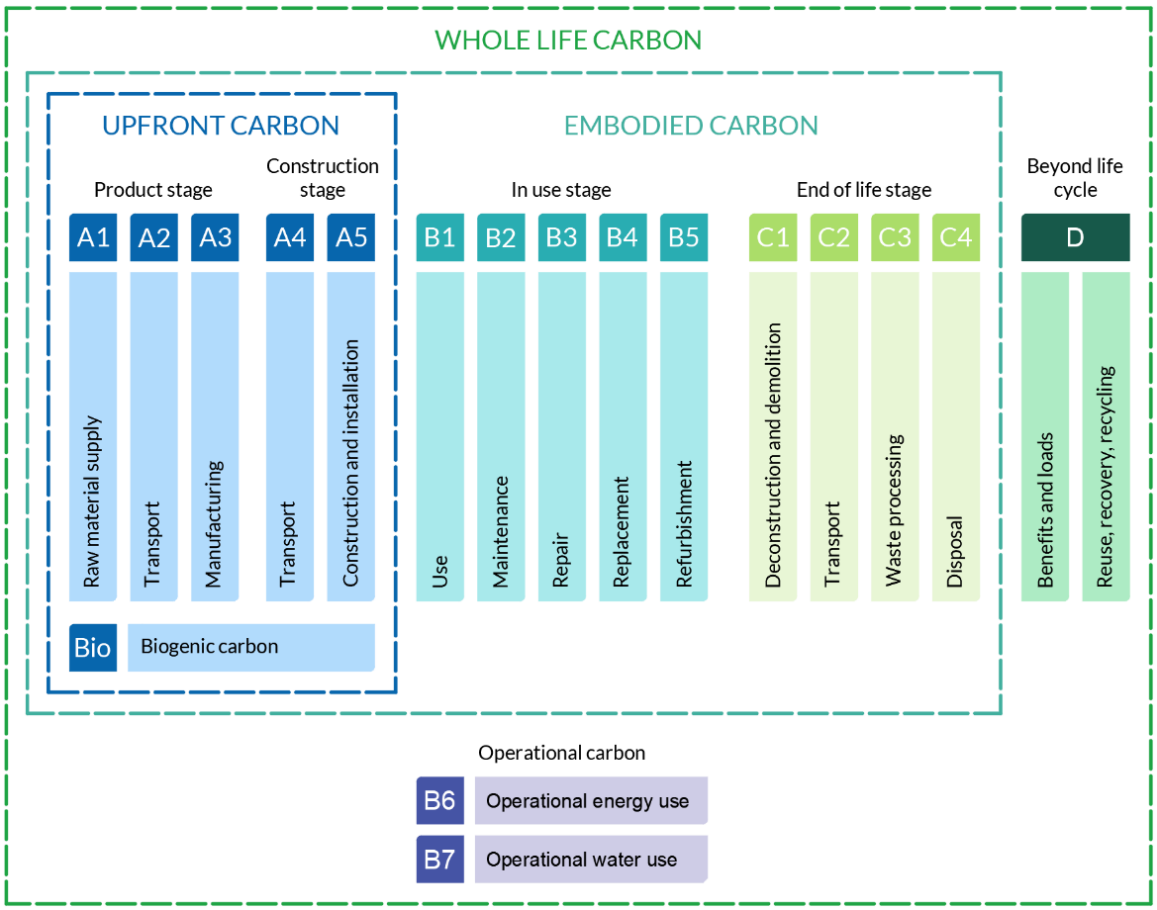
In this step, it is important to consider that ramps and platforms used in multilevel warehouses, which are part of the core and shell of the building, should be categorized under Category 16 – Ramps and Platforms, while detachable ramps and platforms are to be considered under Category 14 – Furnishings and Appliances, along with every non-building-related appliance. In instances where the project encompasses more than one building, materials used in Categories 13 and 16 should be allocated proportionally to the Gross Floor Area (GFA) of each building, unless there is supporting data for a different method of division. Moreover, energy and fuel consumption during the

construction phase is recorded under Stage A5; however, due to the complexity of accurately estimating consumption associated with each of the first 16 categories, this guideline suggests reporting fuel and energy consumption separately in Category 17.

This document includes an Excel spreadsheet with the proposed data collection structure. The spreadsheet contains two sheets: one for the first 16 categories and one for category 17. Appendix 2 provides an example and instructions on how to complete the spreadsheet.

2.2 Stages

The European standard EN 15978:2011, titled "Sustainability of Construction Works – Assessment of Environmental Performance of Buildings – Calculation Method," establishes specific boundaries for assessment, as depicted in the diagram below.



When assessing the impact of a project, the most common practice is to report 2 boundaries: the upfront carbon (A1-A5), which portraits the emissions related with the materials and construction processes; and the embodied carbon (A-C excluding B6-B7), which will provide a picture of the total emissions throughout the life cycle of an asset.

In this case, as an addition to what is mentioned in the European standard, the biogenic carbon is explicitly added as part of stage A as for most cases it will be reported in this stage. Furthermore, the reporting of biogenic carbon should be done separately to facilitate the comparison with projects without carbon sequestration.

2.3 Lifespan

The project's chosen lifespan significantly affects emissions across various stages. For instance, extending the timeframe increases the frequency of maintenance, repair, replacement, and refurbishment cycles. Thus, it is important to establish a standardized value across all projects to allow a fair comparison between them.

This guideline suggests a 50-year lifecycle for buildings. Additionally, if a developer intends to pursue certifications such as BREEAM, calculations should be conducted for both the standard 50-year lifespan and the duration specified by the certification body.

2.4 Area

In determining intensity emissions, the Gross Floor Area (GFA) serves as a common metric, encompassing the total building area measured externally across all floor levels, including both internal and external wall space. This parameter includes various sections of the building, such as the main structure, office spaces, technical rooms, changing rooms, and the gatehouse. However, it's essential to recognize alternative area definitions like Gross Internal Area (GIA) and Net Internal Area (NIA), with each company having the flexibility to define specific boundaries for evaluation. Ensuring consistency across projects is paramount for facilitating accurate comparison and benchmarking of assets.

3 INFORMATION SOURCING

Navigating through a vast database of materials to find the most suitable one for your needs can be a daunting task. However, by following a systematic approach, you can efficiently locate the perfect material. Here are some steps to guide you through the process:

- Begin by filtering materials based on their type, then refine the search by inputting the manufacturer's name or the exact product name.
- Consider products from the same manufacturer, even if they do not bear the brand name familiar in your country. Quality often transcends branding.
- If the desired product isn't available from the exact manufacturer, explore alternatives from other manufacturers commonly utilized in your locale.
- Expand your search to include manufacturers in neighboring countries that offer comparable construction products.
- If a perfect match is not possible, opt for a generic product possessing similar qualities. This ensures your requirements are met adequately.

The table below shows the most suitable sources for carbon factors at different project phases:

Project phase	Data sources
Early design phase	• Generic carbon factors • Carbon factors provided by recognized industry databases on a national scale • From early design estimates
Technical design and construction phases	• Carbon factors from EPDs for specified or purchased products/systems during construction. • Generic carbon factors from accepted industry databases if EPDs are unavailable. • From the most recent bill of quantities reported from site
Post-completion phase	• Carbon factors from EPDs for actual products/systems used. • Generic carbon factors from accepted industry databases if EPDs are unavailable • From the actual quantities of materials used during construction

4 STRUCTURE DATA FOR BENCHMARKING AND COMPARISON

The data for benchmarking requires structure so that the benchmarks are easy to calculate and relatable. It relates to the scope of data presented for calculations as well as structuring the dataset around physical items on site which typically are:

- Main building, including offices organized in the building.
- Offices adjacent to the main building.
- External areas, car parks, docking areas etc.
- Auxiliary structures like firefighting tanks and pumping station, rainwater retention, guard booth.

5 UTILIZING THE BILL OF QUANTITIES FOR CARBON CALCULATIONS

A detailed and accurate BOQ serves as the foundation for reliable carbon emission calculations. It ensures that all materials are accounted for and quantified, which is crucial for assessing the environmental impact of the project. There is no upper limit to the level of detail that a BOQ can contain. Initially, a general BOQ is accepted to gain an overall understanding of the project and to cross-reference with project drawings. As the project progresses, or if specific materials significantly influence the emission calculations, additional details can be requested. This approach allows for a dynamic document that adapts to the evolving needs of the emission calculation process.

Sometimes, the units provided in the BOQ may not be conducive to straightforward carbon emission calculations. It is recommended that each company develop a custom Excel sheet that pre-defines certain units as standard and non-negotiable. This standardization of units across the company's documentation streamlines the calculation process, reducing the need for conversions and estimations.

Recommendations:

- Maintain a dynamic BOQ that can be updated as the project develops.
- Use standardized units across all company documents to ensure consistency.

- Encourage clear communication with the project team to facilitate updates to the BOQ as needed.
- Train staff to understand the significance of a detailed BOQ in the context of carbon emissions.
- When exchanging information between parties, it is beneficial to provide as much detail as possible. Adding comments, when necessary, enhances clarity, and it's important to be thoughtful about quantities, units, and categorization.

6 APPENDICES INFORMATION

Included with this document, a proposed contract appendix to define the boundaries of a project, and an Excel spreadsheet to gather data have been created. Both documents can be accessed by scanning the QR code provided below or by clicking it directly.

Click here.

The information on how to use the Excel spreadsheet is found in Appendix 2.

APPENDIX 1: PROJECT BOUNDARY DEFINITION

Appendix ---------- to contract ----------

Date ----------

1 Stages (Acc. EN 15978:2011)

Minimum scope:

- ☐ A1-A5 - Upfront carbon

Additional stages:

- ☐ B1 - Use
- ☐ B2 - Maintenance
- ☐ B3 - Repair
- ☐ B4 - Replacement
- ☐ B5 - Refurbishment
- ☐ C1 - Deconstruction and demolition
- ☐ C2 - Waste transport
- ☐ C3 - Waste processing
- ☐ C4 - Disposal
- ☐ D - Beyond life-cycle

2 Categories (Based on NRM3 - RICS)

- ☐ Minimum scope:
  - 1 - Substructure
  - 2 - Frame
  - 3 - Upper Floors
  - 4 - Roof
  - 5 - Stairs
  - 6 - Exterior Walls
  - 7 - Interior Walls
  - 8 - Doors
  - 9 - Windows
  - 10 - Ceiling
  - 11 - Floor Finishes
  - 12 - Wall Finishes
  - 14 - Furnishings and Appliances
  - 16 - Ramps and Platforms

Additional categories:

- ☐ 13 - External Works
- ☐ 15 - Services
- ☐ 17 - Fuel and energy

3 Lifespan

- ☐ 50 years
- ☐ 60 years
- ☐ Other: ----------

4 Area

Area to be used for the calculation of intensity of emissions (GFA, GIA, GLA, p.u.p.c.):

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5 Other

Language:

- ☐ English
- ☐ Polish
- ☐ Other: ----------

Emissions calculating party:

- ☐ Client
- ☐ Contractor

Comments:

APPENDIX 2: SPREADSHEET

The proposed spreadsheet to gather data is shown below filled with exemplary data. When filling the excel file it is important to consider the following:

- This spreadsheet should be filled in as detailed as possible.
- It is possible to add as many rows as necessary to the table.
- Columns 'Category' and 'Units' have a dropdown list from where the correct answer should be chosen.
- The 'Material Description' column should include key details like material name, mechanical properties, recycled content, and density for clarity and understanding.
- In the 'Comments' section, include all additional pertinent details not covered elsewhere, such as dimensions, assumptions, specific uses, or more specific information about where or how the material is used to enhance clarity and completeness.
- If the material has EPD, fill the column 'EPD Used' with a reference that could be related with the actual document. This reference could take the form of a link directing to the EPD stored in a cloud repository, or alternatively, it could be the unique reference number assigned to the EPD.
- Finally, it is crucial that the column 'Units' matches what is written in the column 'Quantity'. It might sound obvious, but it is one of the main error sources when exchanging information between the parties.

BOQ - Carbon Emission Calculation Data

Category	Element Name	Material Description	EPD used	Comments	Quantity	Units
01 - Substructure	Strip Foundation	Ready-mix concrete, normal strength, C25/30 , 0% recycled	EPD Number: NEPD-2707-1408-SE, CONCRETE MIX C25/30, Betongondustri	Quantity taken from GC using bills, the concrete was used only in the strip foundation and non was unused from the truck	100	m^3
01 - Substructure	Isolated Foundation	Ready-mix concrete, normal strength, C25/30 , 0% recycled	EPD Number: NEPD-2707-1408-SE, CONCRETE MIX C25/30, Betongondustri	Quantity taken from GC using bills, the concrete was used only in the isolated foundation and non was unused from the truck	150	m^3
01 - Substructure	Stabilized substructure	Soil (80%) and concrete (20%) mix	EPD Number: F-R-28260, Soil stabilization, Batisoil.	The used soil was from the site excavation with a concrete mix of 20% to stabilize the soil strength the used concrete was the same used for isolated foundation,	50	m^3
02 - Frame	Concrete Columns	Precast concrete wall elements, C40/50, 0% recycled	EPD Number:S-P-03859, precast concrete columns C40/50, INHUS Prefab	The concrete columns are precast used only inside the warehouse as described in the plans, columns dimensions are similar in all the project 45x45	500	m^3
02 - Frame	Steel Columns	Structural steel profiles, 0% recycled, I, H, U, L, and T sections, S235, S275 and S355	EPD:HUB-1073, steel profiles,S275,NorDEC	Steel columns where used all over the project with different dimensions the total weight is indicated and calculated using factors from the manufacturer	300	kg
06 - Exterior Walls	Sandwichpanles	Steel sheets	EPD:Ref. No. 00000648, Double skin steel faced sandwich panels, ArcelorMittal	The steel sheets were used on all the exterior walls as an isolation with a thickness of 15 cm	25	m^3
03 - Upper Floor	Slab above ground level	Ready-mix concrete, normal strength, C25/30 , 0% recycled	EPD Number: NEPD-2707-1408-SE, CONCRETE MIX C25/30, Betongondustri	The concrete floor was assigned for the whole top floor, bathrooms, offices, archives, as indicated in the plans with a thickness of 25 cm without any finishing	35	m^3
03 - Upper Floor	Reinforcement	Steel bars, S235, S275 and S355	EPD Number :S-P-08502, Reinforcing bars and coils and wire rod, Clesa huta osterowiec	The reinforcement used has many different diameters the reported quantity was with tons as was collected from the GC data	25	ton
04 - Roof	Smoke vents	Skylight, smoke vent, 40.5 kg/m2, CI-System Rauchlift F100	EPD Number: -TAI-20190092-ICB1-EN, TensoSky System with Fluon ETFE-FILM	The vents were taken as one standard size with 2000x1500 mm for the whole warehouse	100	m^2
11 - Floor Finishes	Tiles	Tiles, 10 mm thickness, porcelain	EPD Number: PN-EN 14411:2012 , GLAZED TILES, Stargres	The tiles were used in the services rooms like kitchen, bathroom, and offices.	200	m^2

On the 'Fuel - A5' sheet within the same Excel spreadsheet, record all energy consumption related to construction. Track both electricity (measured in kWh) and fuel (measured in liters). Provide dates and specific usage details within the 'Comment' section.

Fuel Reporting

Energy Source	Fuel Type	Quantity	unit	Comment
01 - Electricty Energy	Electricity	1500	kWh	February 1 to February 29
02 - Fuel Energy	Diesel	1000	L	Land grading - Heavy machinery - February 1 to February 29