

# KNOWLEDGE LIBRARY

# 2024 Embodied Carbon Data for Timber Products

All materials have an embodied carbon value, which reflects the emissions from all stages of production, use and end of life. These data are normally captured in the form of a verified EPD. This Knowledge Sheet includes weighted average A1-A4 embodied carbon data for a number of common timber products and outlines the methodology for calculating these.

Design

D.70.04-03

Date Published 1 February 2024

Document Type Timber Knowledge Sheet

**Category** Design

Audience Architect | Designer | Engineer

**Theme** Sustainability

Author Charles Law

**Cover image** Wood Awards/Konishi Gaffney/ Dapple Photography







Document TypeCategoryTimber Knowledge SheetDesign

 Audience
 Theme

 Architect | Designer | Engineer
 Sustainability

Author Dility Charles Law



# 2024 Embodied Carbon Data for Timber Products

Although timber is classed as a low embodied carbon construction material, different timber products will have different embodied carbon values depending on the energy inputs during processing and transportation. This Knowledge Sheet includes weighted average A1-A4 embodied carbon data for a number of common timber products.

### **Timber Embodied Carbon Data**

To ensure we meet national and international targets to achieve net zero carbon emissions by 2050, we must start to measure and understand the embodied carbon within the buildings and infrastructure we construct, and significantly reduce it.

Sustainably grown and harvested timber has a very low carbon footprint compared to many other construction materials, resulting in a lower embodied carbon asset. But this embodied carbon figure will vary depending on the energy inputs during processing for each product, and between the different manufacturers. The <u>Timber Industry Net Zero</u> <u>Roadmap</u> also identified transport as a key factor in the embodied carbon of timber products.

Historically, limited data has been available on the embodied carbon within many timber products, but with the continued push for Environmental Product Declarations (EPDs) for products in the construction sector, more data is becoming available every day. This Timber Knowledge Sheet uses the available independently verified EPDs for timber products to calculate weighted average A1-A4 embodied carbon data for a number of common timber products, including and excluding sequestered carbon, and it outlines the methodology for these calculations.

The representative figures contained in Table 1 can be used in the early stages of design to understand the impact of different materials on the design, before substituting the actual data for the product used in the final design. For most timber products, the data is presented as  $kgCO_2e/m^3$ , except for I-Joists which are presented as  $kgCO_2e/lm$ .

The methodology outlined in this document has been developed specifically for timber products due to the unique nature of timber supply in the UK – there are many differently sized individual sawmills and panel mills in the UK, and in many other countries around the world, all supplying the UK market. It is therefore not practicable to have a single industry EPD for each product.

This data is updated annually and verified in accordance with CEN/TR 15941:2010 – 'Sustainability of construction works. Environmental product declarations. Methodology for selection and use of generic data.' by an approved third-party carbon verifier.

#### Table 1: Weighted average A1-A4 embodied carbon data for common timber products

			UK Average				Import Weighted Average				UK/Import Weighted Average			
	Number of EPD Data Points	Declared Unit	A1-A3 Biogenic Carbon Content kgCO <sub>2</sub> e/units	A1-A3 Total Exc. Biogenic kgCO <sub>2</sub> e/unit	A1-A3 Total inc. Biogenic kgCO <sub>2</sub> e/unit	A4 Transport kgCO <sub>2</sub> e/unit	A1-A3 Biogenic Carbon Content kgC0 <sub>2</sub> e/unit	A1-A3 Total Exc. Biogenic kgCO <sub>2</sub> e/unit	A1-A3 Total inc. Biogenic kgCO <sub>2</sub> e/unit	A4 Transport kgCO <sub>2</sub> e/unit	A1-A3 Biogenic Carbon Content kgC0 <sub>2</sub> e/unit	A1-A3 Total Exc. Biogenic kgCO <sub>2</sub> e/unit	A1-A3 Total inc. Biogenic kgCO <sub>2</sub> e/unit	A4 Transport kgCO <sub>2</sub> e/unit
Sawn Softwoods	19	m³	-764	107	-657	38	-742	56	-690	56	-750	74	-679	50
Cross Laminated Timber (CLT)	12	m³	N/A	N/A	N/A	N/A	-758	102	-655	83	-758	102	-655	83
Glue Laminated Timber (Glulam)	14	m³	N/A	N/A	N/A	N/A	-762	132	-630	69	-762	132	-630	69
Laminated Veneer Lumber (LVL)	3	m³	N/A	N/A	N/A	N/A	-782	273	-509	76	-782	273	-509	76
I-Joists	5	lm	-6.12	1.94	-4.18	0.28	-9.58	6.56	-3.02	0.59	-7.85	4.25	-3.60	0.43
Softwood Plywood	7	m³	N/A	N/A	N/A	N/A	-768	235	-561	168	-768	235	-561	168
Hardwood Plywood	5	m³	N/A	N/A	N/A	N/A	-871	596	-426	242	-871	596	-426	242
Orientated Strand Board (OSB)	6	m³	-973	112	-861	27	-1,025	217	-808	108	-989	143	-845	51
Medium Density Fibreboard (MDF)	4	m³	-965	258	-707	34	-1,069	432	-636	122	-1,020	350	-669	80
Chipboard	7	m³	-1,010	320	-690	23	-1,008	238	-770	81	-1,009	295	-714	40







# Methodology

#### A1-A3 Embodied Carbon

To calculate the weighted average A1-A3 embodied carbon data in Table 1, the following data was extracted from the available independently verified EPDs into an Excel spreadsheet:

- Declared Unit
- A1-A3 Biogenic Carbon Content (kgCO<sub>2</sub>e/ declared unit)
- A1-A3 Total Exc. Biogenic (kgCO<sub>2</sub>e/declared unit)
- A1-A3 Total inc. Biogenic (kgCO<sub>2</sub>e/declared unit)
- Product Density (kg/declared unit)

Each EPD was checked to ensure the data was consistent with other EPDs for that product. The biogenic carbon calculation for each EPD was checked, using the calculation method in BS EN 15804, based on the density, moisture and glue content stated in the EPD.

Where this was found to be significantly incorrect (greater than 5% margin of error), the biogenic carbon figure was corrected to our calculation, and a corresponding adjustment made to the A1-A3 total, and the EPD was referred to the EPD verifier for comment.

Where other data was suspected to be incorrect, the EPD was also referred to the EPD verifier for comment, and where a resolution could not be found, the EPD was excluded.

Table 1 includes the number of data points used for each product. Where an individual supplier had more than one EPD for similar products, only the one EPD that was most representative of the products supplied by that supplier to the UK was used.

Once the definitive list of approved EPDs was established, the country or countries of production were added to the spreadsheet. An average A1-A3 total embodied carbon figure (including and excluding biogenic carbon), a stored biogenic carbon figure, and product density were then calculated for each country of production based on the data from each EPD for products produced in the country.

Data on the percentage of each product imported from each country, along with the percentage from UK production facilities, was added to the spreadsheet, using trade data obtained from TDUK and Forest Research.

This allowed the weighted average of imported and UK produced material to be calculated, along with a combined UK/Imported weighted average figure for all material consumed in the UK.





## A4 Embodied Carbon

Although A4 embodied carbon data is included in some EPDs, these are calculated based on transporting the timber product to a nominal point somewhere in the world, which is unlikely to be representative of the transport used to bring the timber to the UK.

Therefore, to calculate the weighted average A4 embodied carbon data in Table 1, the production facility for each product was established from the EPD. A realistic transport scenario from that production facility was then devised through discussion with various industry suppliers (e.g. Production Facility to Country of Origin Port by HGV, Country of Origin Port to UK Port (e.g. Felixstowe), Average UK Artic Journey data from Defra). For UK and Ireland production, along with materials arriving via Calais (RoPax), the UK distance was calculated to Northampton, as this was considered as the central point for economic activity in the UK.

The current Defra GHG conversion factors were then used (tonne.km average laden for freighting goods plus WTT - delivery vehicles and freight plus a 20% allowance to account for the empty running of HGV vehicles once a delivery is complete) to calculate the A4 carbon emissions per production unit for each product, based on product density and the following modes of transport:

Author

Charles Law

- 0.14450 kg CO<sub>2</sub>e/tonne.km All HGV Average Laden
- 0.03470 kg CO\_e/tonne.km Rail

Theme

- 0.03626 kg CO<sub>2</sub>e/tonne.km Sea Bulk Carrier <10.000 dwt
- 0.01977 kg CO<sub>2</sub>e/tonne.km Sea Container Ship Average
- 0.46140 kg CO<sub>2</sub>e/tonne.km Sea RoPax Ferry Average

An average A4 embodied carbon figure was then calculated for each country of production. The import and UK percentages are then used to calculate a weighted average A4 embodied carbon figure of imported and UK produced material, along with a combined UK/imported weighted average figure for all material consumed in the UK.







Document Type

Category Timber Knowledge Sheet Desian



Theme Author Charles Law



# **Data Confidence**

The data confidence level for each timber product category is outlined below. The more data points that are available from representative producers in supplying countries, the higher the level of confidence will be.

#### Softwood - High

19no. EPDs were used. The EPDs were from countries that supplied over 90% of the consumed timber, with a good distribution and relevance for the countries of origin and known suppliers.

#### Cross Laminated Timber (CLT) - High

12no. EPDs were used. The EPDs were from countries that supplied over 90% of the consumed timber, with a good distribution and relevance for the countries of origin and known suppliers.

#### Glue Laminated Timber (Glulam) - Medium

14no. EPDs were used. The EPDs were from countries that supplied over 50% of the consumed timber, with a fair distribution and relevance for the countries of origin and known suppliers.

#### Laminated Veneer Lumber (LVL) - High

3no. EPDs were used. The EPDs were from countries that supplied over 90% of the consumed timber, with a good distribution and relevance for the countries of origin and known suppliers.

#### I-Joists - Medium

5no. EPDs were used. The EPDs were from countries that supplied over 90% of the consumed timber, with a good distribution and relevance for the countries of origin and known suppliers. However, the split between UK production and imports

was estimated as no data was available for UK production. Note: the data for I-Joists is presented as kgCO<sub>2</sub>e/lm (not kgCO<sub>2</sub>e/m<sup>3</sup> as for other products), so an adjustment may need to be made for larger I-Joists.

#### Softwood Plywood - Low

7no. EPDs were used. The EPDs were from countries that supplied over 70% of the consumed timber. However, EPDs were not available from some key import countries or a good distribution of known suppliers.

#### Hardwood Plywood - Low

5no. EPDs were used. The EPDs were from countries that supplied over 70% of the consumed timber. However, EPDs were not available from a good distribution of known suppliers.

#### Orientated Strand Board (OSB) - High

6no. EPDs were used. The EPDs were from countries that supplied over 90% of the consumed timber, with a good distribution and relevance for the countries of origin and known suppliers.

#### Medium Density Fibreboard (MDF) - Medium

4no. EPDs were used. The EPDs were from countries that supplied over 70% of the consumed timber, with a good distribution and relevance for the countries of origin and known suppliers.

#### Chipboard - Medium

7no. EPDs were used. The EPDs were from countries that supplied over 85% of the consumed timber, with a good distribution and relevance for the countries of origin and known suppliers.