Environmental Product Declaration JJI-Joists

This environmental product declaration (EPD) has been prepared in accordance with the requirements of ISO 14025[1] and EN 15804[2]. EPDs of construction products may not be comparable if they do not comply with EN 15804. The results of this EPD are based on the life cycle assessment (LCA) approach that considers the environmental impact of the product up to the factory gate. The approach takes into account the raw material sourcing, raw material transportation, raw material use and production operations (cradle to gate). The downstream processes are considered outside the scope of this EPD.

James Jones & Sons Limited
Timber Systems Division

EPD®

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Figure 1: JJI-Joists in roof

Table 1: Summary of impacts per linear metre (LM) of an average JJI-Joist

Impact	Unit	Total
Global warming potential (GWP100a)	kg CO_2 eq	-4.43
Global warming potential (GWP100a) excluding carbon sequestration	kg CO_2 eq	1.65
Total primary energy	MJ	29.8
Use of renewable primary energy	MJ	1.79
Non-renewable energy	MJ	28.0
Total process energy usage (delivered)	MJ	3.00
Process energy usage from renewable sources	MJ	1.65
Process energy usage from non-renewable sources	MJ	1.35
Water consumption	m^3	0.0107
Water stress indicator (WSI)	– *	0.0072
Fresh water aquatic ecotoxicity	kg 1,4-DB eq**	0.896
Marine aquatic ecotoxicity	kg 1,4-DB eq**	2180
Non-hazardous waste	kg	0.00344
Hazardous waste	kg	0.00478

[1] ISO 14025:2006

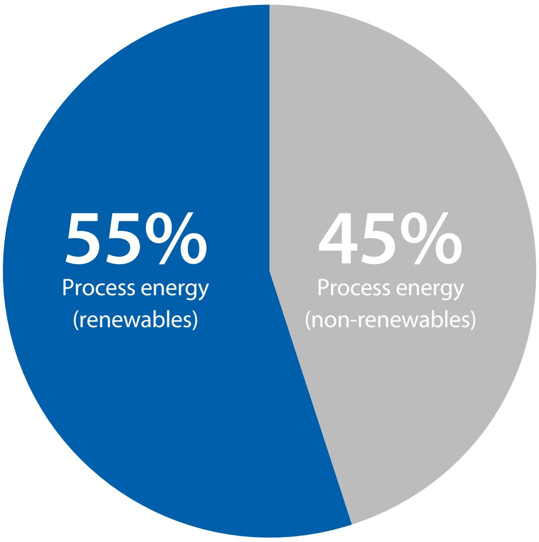
[2] BS EN 15804: 2012

* WSI is based on a withdrawal to availability (WTA) ratio, usually in m^3 per m^3

**kilograms 1,4-dichlorobenzene equivalent

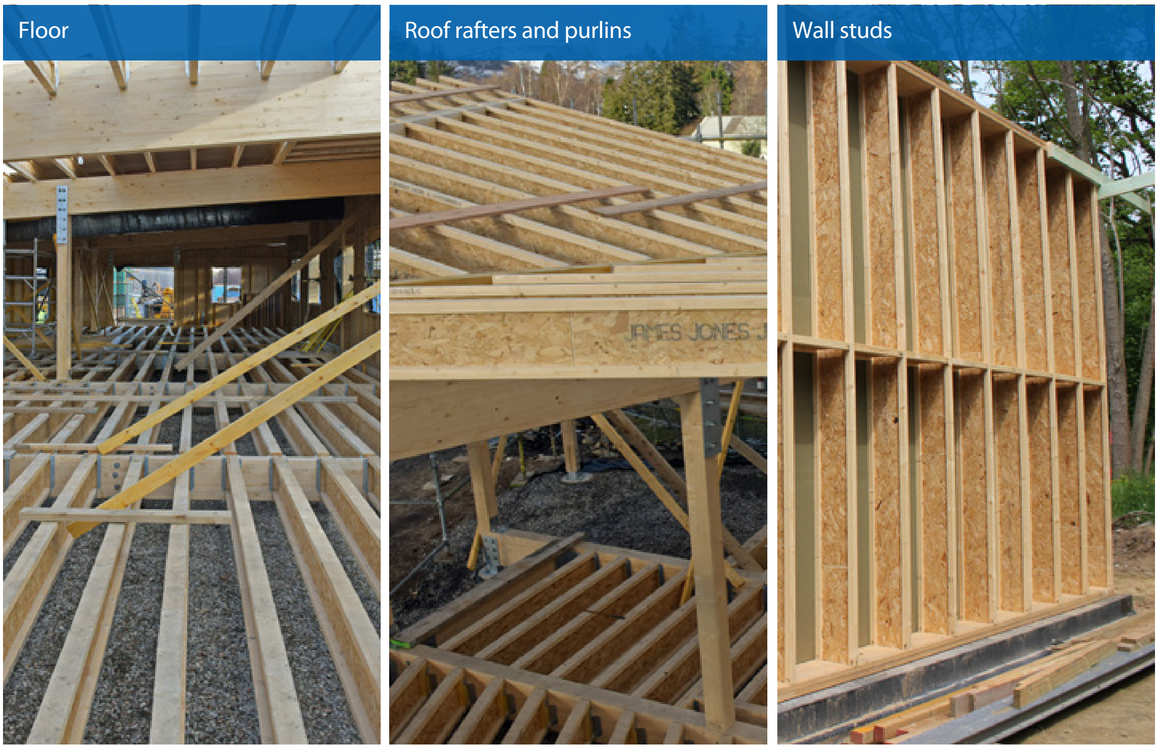
The process energy usage figures in Table 1 are presented graphically in Figure 2, showing that just over half the process energy used arises from renewable sources.

Figure 2:
Process energy usage (delivered)



The JJI-Joist is an engineered oriented strand board (OSB) webbed timber I-joist made with high-grade softwood flanges. It is used in residential and commercial construction as load and non-load-bearing members for floors, walls and roofs. The JJI-Joist range encompasses a wide variety of depths to suit the UK and European construction market. This EPD uses a functional unit of one linear metre (LM) based on an average cross section of JJI-Joists.

Figure 3: Example applications of JJI-Joists



1. General information

1.1. Manufacturer

The producer is James Jones & Sons Ltd: Timber Systems Division (James Jones). The JJI-Joist production facility is located at Greshop Industrial Estate, Forres IV36 2GW. Further information about James Jones and the JJI-Joist is available from the James Jones website, accessible at the time of writing at jamesjones.co.uk/ewp.

Table 2: Manufacturer and site

Manufacturer	Site function	Address
James Jones & Sons Ltd	Raw material use and production operations	Timber Systems Division, Greshop Industrial Estate, Forres, IV36 2GW

1.2. Specification of declaration

This section outlines the key specifications of the declaration. It was prepared by Ricardo on behalf of James Jones & Sons Ltd. The declaration is issued by James Jones. Stephen Craig (Group Environment Manager) is the responsible person. Contact information is included in Table 4.

Table 3: Key EPD data

Programme used	International EPD® System[3]
Product Category Rule (PCR)	The International EPD® System PCR for Construction Products and Construction Services (2012:01, version 2.01)
Date of issue	20th October 2017
Date of expiry	1st July 2022
Declaration owner	James Jones & Sons Ltd (Stephen Craig)

Table 4: Key contacts

Person	Role	Company	Email address
Stephen Craig	Group Environment Manager	James Jones & Sons Ltd	S.Craig@jamesjones.co.uk
Abel Munoz	Technical Manager	James Jones & Sons Ltd	A.Munoz@jamesjones.co.uk
Simon Gandy	EPD Author	Ricardo Energy & Environment	simon.gandy@ricardo.com
Robbie Epsom	EPD Verifier	WSP	robbie.epsom@wsp.com
	Programme Operator	EPD International AB	info@environdec.com

Demonstration of verification

This EPD has been prepared in accordance with the requirements of ISO 14025 and EN 15804. It concerns the JJI-Joists, which are wooden joists (CPC: 31600[4]). This EPD may not be comparable with EPDs of other construction products if they do not comply with EN 15804.

[3] www.environdec.com

[4] Central Product Classification code, from https://unstats.un.org/unsd/cr/registry/cpc-21.asp

Table 5: Demonstration of verification

CEN Standard EN 15804 serves as the core PCR	
Independent verification of the EPD according to ISO 14025:2006	
☐ internal	☑ external
Third-party verifier:	Robbie Epsom, an approved EPD verifier working for WSP

1.2.1. Scope of the declaration

Table 6 outlines the key specifications for this EPD.

Table 6: Key specifications of EPD

Specification	Description
Scope	Cradle-to-gate.
System boundary	Upstream processes (A1*), core processes (A2-A3*).
Reference service life (RSL)	100 years (based on accelerated ageing studies).
Allocations	Calculations cover a minimum of 95% of total inflows to the upstream and core module.
Cut-off rules	Contributions cut-off from ecoinvent[5] 3 processes used within this model have been excluded.
Time period	All product and manufacturing data were collected in the UK during the period January 2016 to December 2016. All generic data are from the ecoinvent database version 3.
Geospatial boundaries	There is no geospatial boundary – all impacts are considered regardless of physical location. Average grid emissions and impact factors from ecoinvent are used for consumption of electricity during raw material processes. Processes that took place at the Forres site use UK grid emission and impact factors for electricity consumption from ecoinvent.
Declared unit	1LM of average joist

*See Table 9 for explanation of A1-A3.

Performance of multiple products

This EPD covers the James Jones range of JJI-Joists. This report considers a functional unit of 1LM of an average joist produced in 2016. This average has been calculated by multiplying the cross-sectional area of each of the different joist options by the length sold of that option, summing and then dividing by the total number of LMs of joist produced.

Table 7 summarises the relative impact of an average joist compared with each depth/flange combination. Impacts for specific products within the JJI-Joist range can be calculated by multiplying the results given for an average joist by the relevant coefficient provided in this table.

Table 7: Relative impact compared with 2016 average joist

Joist depth (mm)	JJI-Joist flange sizes			
	A+ (47mm)	B+ (63mm)	C (72mm)	D (97mm)
145	0.692	-	-	-
195	0.758	0.969	1.088	1.417
220	0.791	1.002	1.120	1.450
235	0.811	1.022	1.140	1.470
245	0.824	1.035	1.153	1.483
300	0.896	1.107	1.226	1.555
350	0.962	1.173	1.292	1.621
400	1.028	1.239	1.358	1.687
450	1.094	1.305	1.424	1.753

[5] http://www.ecoinvent.org/

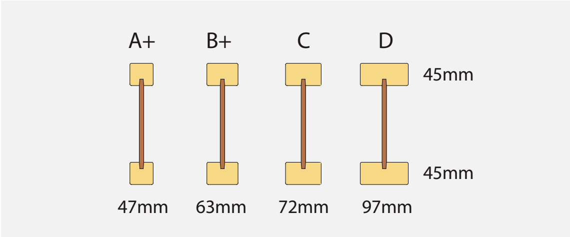
2. Product information

2.1. Key product manufacturer details

2.1.1. Product name and manufacturer

The product represented in this EPD is the JJI-Joist as produced by James Jones at its factory in Forres (UK) as stated in Table 2.

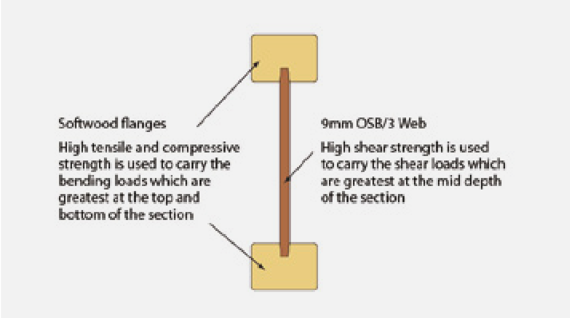
Figure 4:
JJI-Joists



2.1.2. Main product components and materials

The JJI-Joists is a composite engineered wood product combining kilned dried (KD) high-grade finger-jointed softwood flanges (C24) with an OSB web. Adhesives and steel brads are also used to join both components. Once produced, the product is wrapped in a polyethylene-based plastic attached to the product using steel staples.

Figure 5:
JJI-Joists components



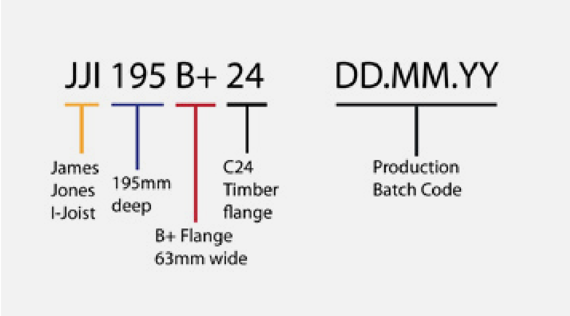
2.1.3. Typical product use

JJI-Joists are used in residential and commercial construction as load and non-load bearing members for floors, walls and roofs.

2.1.4. Product identification

JJI-Joists are identified by an alphanumeric code that specifies the joist depth, flange size and flange grade, as shown in Figure 6. The code is printed at regular intervals along the joist next to the production data and time. The corresponding product dimensions are provided in Table 7.

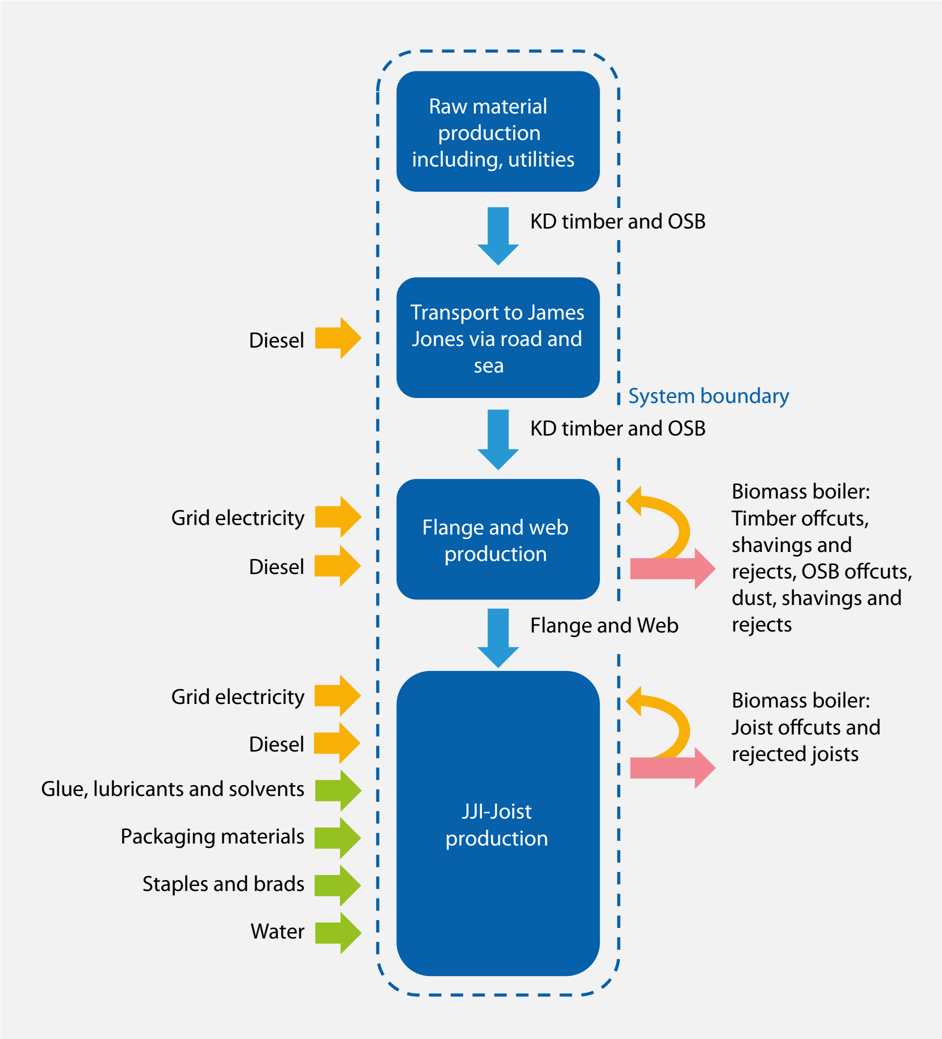
Figure 6:
Product identification for JJI-Joists



2.1.5. Process flow diagram

Figure 7 shows the key process flows from the manufacture of the JJI-Joist. It should be noted that offcuts in production operations are used as fuel in the onsite biomass boiler at James Jones.

Figure 7: Core life phases in the manufacture of the JJI-Joist



2.2. Raw materials supply

2.2.1. Kiln-dried timber

KD timber is the main component of each JJI-Joist. Timber is bought as short lengths with an average density of 500kg/m^3 and then dried in a kiln to an average of 15% moisture content. The timber is finger-jointed, planed and graded on the James Jones site to a C24 strength class before it is used as flange material for JJI-Joist production. All purchased KD timber is expected to achieve this grade with a minimum number of rejects.

2.2.2. Oriented strand board

The OSB used is grade OSB/3 and 9mm thick with an average density of 630kg/m^3 and 5% moisture content. Timber raw materials for this product are sourced from certified UK forests. OSB is bought as large boards (e.g. 2,440mm x 1,220mm) in packs and cut on-site to suit the depth sizes of the JJI-Joists.

2.2.3. Transport to manufacturer

The raw KD timber and OSB are transported to the James Jones site via road and sea. Transport distances are given in terms of tonne-km which represents the distance travelled by the weight of product transported. It should be noted that in the LCA model, the transport impacts for all raw materials have been aggregated into a total distance in tonne-km for road and sea rather than creating transport inventories for each raw material.

2.3. Manufacture (A3)

Manufacturing at the James Jones site consists of:

- flange production.
- web production.
- JJI-Joist assembly.

These stages are modelled as one block since energy consumption is available on an annual basis for the entire factory rather than individual machines. There is no breakdown of energy use for flange production, web production and the JJI-Joist lines. Total energy use for the factory is allocated to the end product.

Polyurethane (PU) glue is the main consumable used during the manufacturing phase. This has been modelled in SimaPro using information from a material safety data sheet (MSDS) for PU glue using the closest approximations available in the ecoinvent database.

Other consumables are used on site to clean the glue from machinery and prevent it from sticking to key components over time and include glue release paste, glue solvent and release lubricants. Chemical composition checks have been used to model their impact in SimaPro.

Brads, which are small metal pins (32-50mm long), are inserted between the timber and the web in the JJI-Joist lines to keep a close joint. Staples (30mm) are used to attach packaging to the timber. Both items are known to be made from steel and this is reflected in the SimaPro model.

Electricity is used to power machines in the production lines, as well as the general office services. Calculations associated with electricity use in the factory were based on the grid factor for Great Britain in the ecoinvent database. Diesel is used for the internal transport of raw materials and finished products. Heat is used to accelerate the glue-curing process and as a source for space heating. Biomass fuel produced on site is burnt to create all the required heat for the production process. To account for emissions from the onsite boiler used for heat production, an inventory based on an onsite boiler at an average softwood mill was used. A new inventory was created based on the ecoinvent model, so that 100% of the wood feedstock was assumed to be onsite wood secondary materials rather than purchased wood chips.

Table 8: A3 – Manufacture and packaging impact share of JJI-Joists

Impact category	% of total
Global warming (GWP100a) excluding carbon storage	19%
Acidification (fate not included)	13%
Eutrophication	14%
Abiotic depletion (fossil fuels)	18%
Abiotic depletion (optional)	7%
Photochemical oxidation	34%
Ozone depletion potential (ODP) (optional)	15%
Water stress indicator	23%
Use of renewable primary energy	94%
Non-renewable energy	20%
Non-hazardous waste	100%
Hazardous waste	99%
Radioactive waste	22%
Human toxicity	19%
Fresh water aquatic ecotoxicity	23%
Marine aquatic ecotoxicity	49%
Terrestrial ecotoxicity	22%

2.4. Key data sources

Wherever possible, the study has used data collected during site visits and from information supplied by James Jones. Where these data are unavailable, it was necessary to use generic data. The generic LCA data contained in the SimaPro modelling software are taken from the ecoinvent 3 database, which is one of the world's largest and best-recognised repositories of life cycle impacts for products and processes. An LCA study will typically use processes from a database (such as ecoinvent) as the building blocks for the assessment of the product in question.

Via SimaPro, ecoinvent is the source of all life cycle impact data used in this study. For example, the study used the ecoinvent database to understand the impacts of the production of KD timber, OSB and PU glue production, and of transport of raw materials by road and sea.

The study process involved a visit of the James Jones site to enable the development of an accurate model of JJI-Joist manufacture. The visit served two purposes – to confirm the key steps in each process and to gather the data required to model those processes. The Technical Manager at the JJI-Joist plant provided a detailed mass balance that represented the flow of timber and other materials, including energy inputs. The mass balance also provided details of the use of water, gas oil, other consumables and packaging at the site. James Jones also provided detailed information on the JJI-Joist specifications, including the volume and dimensions of the different products.

2.4.1. Estimations

Primary data are based on precise amounts recorded by James Jones. Upstream material processes are based on the average values for such processes given in the ecoinvent database. Production and maintenance of equipment is not included in the LCA except for frequently consumed items included in the inventory if they meet the data 1% cut-off rule (for example, release paste and release lubricants have been included). All energy used in the factory and offices is included.

3. Results

Table 9 states the modules considered within the system boundary. Activities beyond the factory gate are excluded from these results.

Table 9: Description of system boundary*

Product stage			Construction stage		Use stage							End-of-life stage				BLB**
Raw material supply	Transport	Manufacturing	Transport	Construction-Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/demolition	Transport	Waste processing	Disposal	Re-use or recovery
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

* MND indicates module not declared

**Benefits and loads beyond system boundary

Table 10 lists the impact associated with the production of an average LM of JJI-Joist for each impact category. The GWP, excluding the carbon stored within a JJI-Joist's wood, is shown for the purposes of transparency.

Table 10: Results for impact categories (A1, A2 and A3)

Impact category	Unit	LM of average joist
Abiotic depletion	kg antimony eq	4.51×10^{-6}
Abiotic depletion (fossil fuels)	MJ	24.9
GWP100a	kg CO_2 eq	-4.43
GWP100a excluding carbon storage	kg CO_2 eq	1.65
ODP	kg CFC-11 eq*	1.81×10^{-7}
Human toxicity	kg 1,4-DB eq	0.761
Fresh water aquatic ecotoxicity	kg 1,4-DB eq	0.896
Marine aquatic ecotoxicity	kg 1,4-DB eq	2180
Terrestrial ecotoxicity	kg 1,4-DB eq	0.00512
Photochemical oxidation	kg ethylene eq	0.000845
Acidification	kg sulphur dioxide eq	0.0103
Eutrophication	kg phosphate eq	0.00273

* CFC-11 is chloro-fluoro-carbon-11 (trichlorofluoromethane)

Table 11 lists the environmental parameters concerning resource use, wastes and other output flows, as specified in EN 15804 chapter 7.

Table 11: Results for parameters describing resource use

Impact category	Unit	LM of average joist
Resource use		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value	1.79
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	55.9
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value	57.7
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	28.0
Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value	0
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value	28.0
Use of secondary material	kg	0.119
Use of renewable secondary fuels	MJ, net calorific value	1.65
Use of non-renewable secondary fuels	MJ, net calorific value	0
Use of net fresh water	m^3	0.0107
Waste to disposal		
Hazardous waste	kg	0.00478
Non-hazardous waste	kg	0.00344
Radioactive waste	kg	0.000123
Other output flows		
Components for re-use	kg	0.405
Materials for recycling	kg	0
Materials for energy recovery	kg	0.00343
Exported energy	MJ per energy carrier	0

Figure 8 illustrates the impact share per life cycle stage. Note that the GWP bar includes checkerboard segments for the KD timber and OSB, because these are net benefits not impacts.

3.1. Carbon sequestration

Carbon sequestration refers to the long-term storage of carbon in biomaterial construction products and in the PCR is considered in the product stage. It is calculated considering only the embedded carbon that is present in the finished product and not in the biomaterial input required to make the product. A carbon balance is carried out to ensure that the CO_2 eq emissions computed for the product system take into account the actual carbon stored within the construction product.

An important factor for the JJI-Joist is its capacity to store biogenic CO_2. Since the JJI-Joist is a long-life product that will be stored in a building for decades, it is unlikely that the material will degrade within the measurement period. Therefore, the raw wood materials can reasonably be considered to sequester carbon.

To calculate the amount of carbon stored, these results use SimaPro's PAS2050 wizard tool, which determines the 'correction factors' for carbon storage and delayed emissions, according to Chapter 5 of the PAS2050 methodology. The wizard effectively applies an average factor for wood to sequester approximately 1.78kg of CO_2 eq per kg of raw wood material. The results above demonstrate that the wood raw materials offset 6.08kg of CO_2 eq per LM of joist, resulting in a net total of 4.43kg of CO_2 eq being stored per LM of joist. No carbon storage has been accounted for in the upstream processes. The only exception concerns the wood fuel for the biomass boiler, where the carbon emissions are discounted against the carbon stored in the fuel.

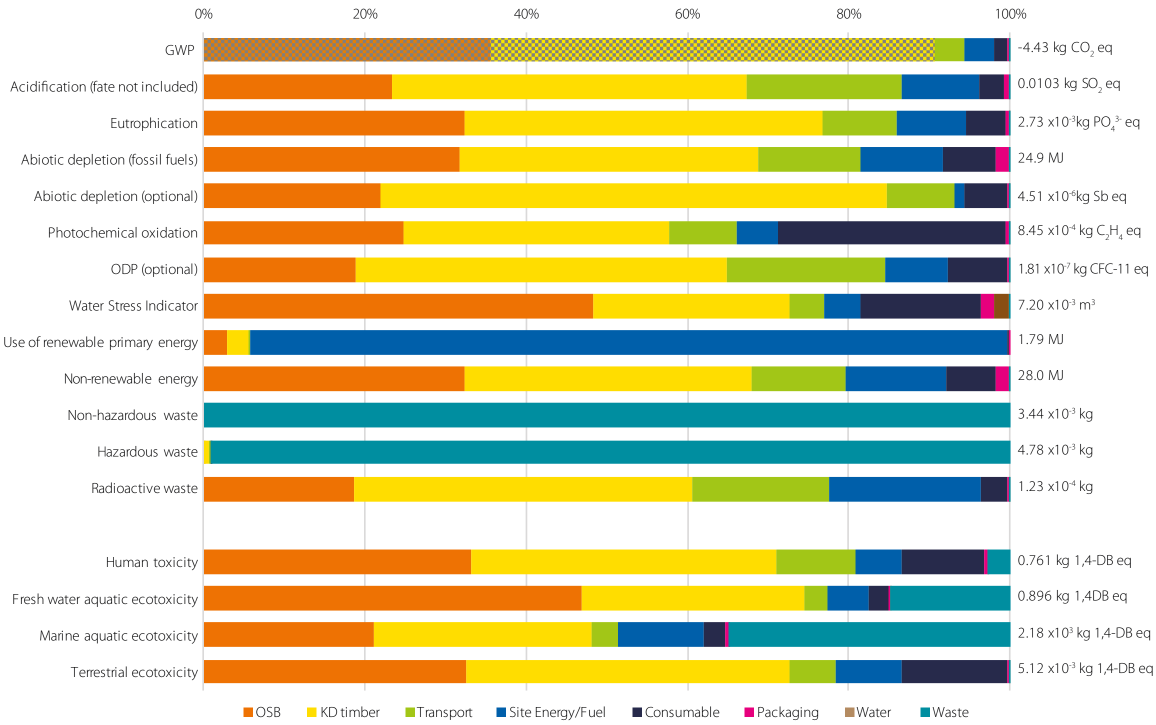
4. Background information

The background data used in this declaration are based on primary data collected by James Jones for the period January 2016 to December 2016. This information was then modelled in the life cycle assessment software SimaPro, using the latest ecoinvent 3 processes. The two key upstream processes for the raw wood materials are based on the following ecoinvent processes – "sawnwood, softwood, dried (u=20%), planed {RER}" and "Oriented strand board {RER}".

Table 12: Referenced sources

References	Source
ecoinvent version 3	Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, [online] 21(9), pp.1218–1230. Available at: http://link.springer.com/10.1007/s11367-016-1087-8 (Accessed 04 04 2017)
EN 15804	Product Category Rules for Type III environmental product declaration of construction products to EN 15804:2012, 2012 , BRE Group, available at: http://www.bre.co.uk/filelibrary/materials/bre_en_15804_pcr.pn514.pdf (Accessed 04 04 2017)
ISO 14025	Environmental labels and declarations – Type III environmental declarations – Principles and procedures, ISO 14025:2006, 2006, International Organization for Standardization available at https://www.iso.org/standard/38131.html (Accessed 04 04 2017)
PAS2050	Specification for the assessment of the life cycle greenhouse gas emissions of goods and services PAS 2050:2011, 2011, BSI Group, available at: http://shop.bsigroup.com/upload/shop/download/pas/pas2050.pdf (Accessed 04 04 2017)
SimaPro	SimaPro 8.2.3.0, 2016, PRé Consultants
General Programme Instructions, version 2.01	General Programme Instructions, version 2.01, International EPD® System (IES), 2015, Environdec, available at http://www.environdec.com/Documents/GPI/General%20Programme%20Instructions%20version%202.5.pdf (Accessed 13 04 2017)

Figure 8: Share of environmental impacts of JJI-Joists per LM



Note: The checkerboard patterns for OSB and KD timber GWP denote that these impacts are 'negative' (and therefore benefits) because of the carbon storage in the timbers

James Jones
& SONS LIMITED
TIMBER SYSTEMS DIVISION

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