ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	British Precast Concrete Federation
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-BPC-20170094-CCD1-EN
Issue date	26/07/2017
Valid to	25/07/2022

UK Manufactured 1 tonne of Generic Precast Concrete Paving Products (Blocks, Slabs, Channels and Kerbs)

Produced by members of Interpave a product group of British Precast

Institut Bauen und Umwelt e.V.

www.ibu-epd.com / https://epd-online.com

Interpave
THE PRECAST CONCRETE PAVING AND KERB ASSOCIATION

mpa British Precast

General Information

British Precast Concrete Federation	Precast Concrete Paving Products
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the Declaration** British Precast Ltd The Old Rectory 8 Main Street, Glenfield Leicester, LE38DG
Declaration number EPD-BPC-20170094-CCD1-EN	**Declared product / Declared unit** 1 Tonne of Precast Concrete Paving Products (blocks, slabs, channels and kerbs)
This Declaration is based on the Product Category Rules: Pre-cast concrete components, 07.2014 (PCR tested and approved by the SVR)	**Scope:** This is an association declaration which uses average data from member companies of Interpave to form an average tonne of precast concrete paving products. Concrete paving products include blocks, slabs, channels and Kerbs. It is based on data covering a period of 12 months (From January to December 2014). All data was collected from UK factories. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.
Issue date 26/07/2017	**Verification** The CEN Norm /EN 15804/ serves as the core PCR Independent verification of the declaration according to /ISO 14025/ ☐ internally ☒ externally
Valid to 25/07/2022	
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	
Dr. Burkhart Lehmann (Managing Director IBU)	Mr Carl-Otto Neven (Independent verifier appointed by SVR)

Product

Product description / Product definition
The product covered in this EPD is a generic tonne of precast concrete paving products. The products covered are blocks, slabs, channels and kerbs. Concrete paving products are made of cement, aggregates, water and (if needed) admixtures. There are two main manufacturing processes for the paving block, paving flag and kerbs, dependent upon strength requirements. Paving flags can be produced by either casting into flexible silicon rubber or similar moulds or hydraulically pressed into a mould box. Paving blocks and other pressed products tend to be much dryer mixes and are predominantly produced from a blended dry mix. Once demoulded products are loaded into a curing chamber for accelerated curing or moved into the stockyard. Primary data for the production of precast concrete paving products were collected from members of Interpave. This data were used to generate a mass weighted average of production for the EPD.

For the placing on the market of the product in the EU/EFTA (with the exception of Switzerland) Regulation (EU) No. 305/2011 /CPR/ applies. The product needs a Declaration of Performance taking into consideration BS EN 1338:2003 concrete paving blocks, /BS EN 1339:2003/ concrete paving flags, /BS EN 1340: 2003/ concrete kerb units and the CE marking. For the application and use the respective national provisions apply

Application
Precast concrete paving blocks and slabs are produced for both the domestic and commercial markets. Precast concrete paving products are used in a variety of paving applications including Sustainable Urban Drainage Systems (SUDS) and include blocks, slabs and kerbs.

Technical Data
Concrete paving products are manufactured to /BS EN 1338:2003/ Concrete paving blocks, /BS EN 1339:2003/ Concrete paving flags, /BS EN 1340:2003/ Concrete kerb units.

Constructional data

Name	Value	Unit
Gross density	2350	kg/m^3
Breaking Strength	Deemed to satisfy	
Slip/Skid Resistance	Deemed to satisfy	
Durability	Deemed to satisfy	
Reaction to Fire	Deemed to satisfy	
External Fire performance	Deemed to satisfy	
Emission of asbestos	No content	

*Deemed to satisfy CE marking essential characteristic requirements. Performance data of the product in accordance with the Declaration of Performance with respect to its Essential Characteristics according to BS EN 1338:2003/ Concrete paving blocks, /BS EN 1339:2003/ Concrete paving flags, /BS EN 1340:2003/ Concrete kerb units.
To get accurate constructional data obtain a declaration of performance from your Interpave supplier.

Base materials / Ancillary materials

The concrete mix proportions are as follows: aggregates 84% cement 11%; PFA 1% GGBS 1% water 3%. The mix also contains admixtures and pigment.
No /REACH/ substances of very high concern are included.

Reference service life

/BS 8500/, the UK's concrete specification standard complementary to EN206, sets durability requirements for precast concrete elements. The reference service life (RSL) for the declared unit is 50 years.

LCA: Calculation rules

Declared Unit

The declared unit is 1 Tonne of Precast Concrete Paving Products. The data used in the LCA calculations is an average based on total annual production figures from members of Interpave.The declared unit includes a range of different products including paving blocks, paving slabs, channel products and kerbs. Information on assumed density and other physical characteristics are shown in the table below.

Declared unit

Name	Value	Unit
Density	2350	kg/m^3
Declared unit	1	t

System boundary

Type of EPD: Cradle to Gate with all options declared. The modules considered in the Life Cycle Assessment are modules A1-C4 inclusive.

Environment and health during manufacturing

Members of Interpave have formal Environmental Management Systems to put in place environmental protection measures which extend beyond national guidelines. At the time of publication 100% of sites providing data have a certified ISO14001 EMS.

Packaging

The amount and type of packaging used on precast concrete paving products will vary dependant on specific requirements. In a proportion of cases product will need no packaging other than banding and pallets for transportation. In other circumstances, the product will be stacked, banded, shrink-wrapped and placed on pallets for transportation.

Re-use phase

The durability of precast concrete paving products means that in the majority of cases a large proportion of an installation would be suitable for reuse whether it is relayed after settling and levelling procedures have taken place or used in other locations without the need to recycle or downgrade the product. This re-use should be considered when assessing the environmental credentials of the product but is not formally modelled in this study.

Cut-off criteria

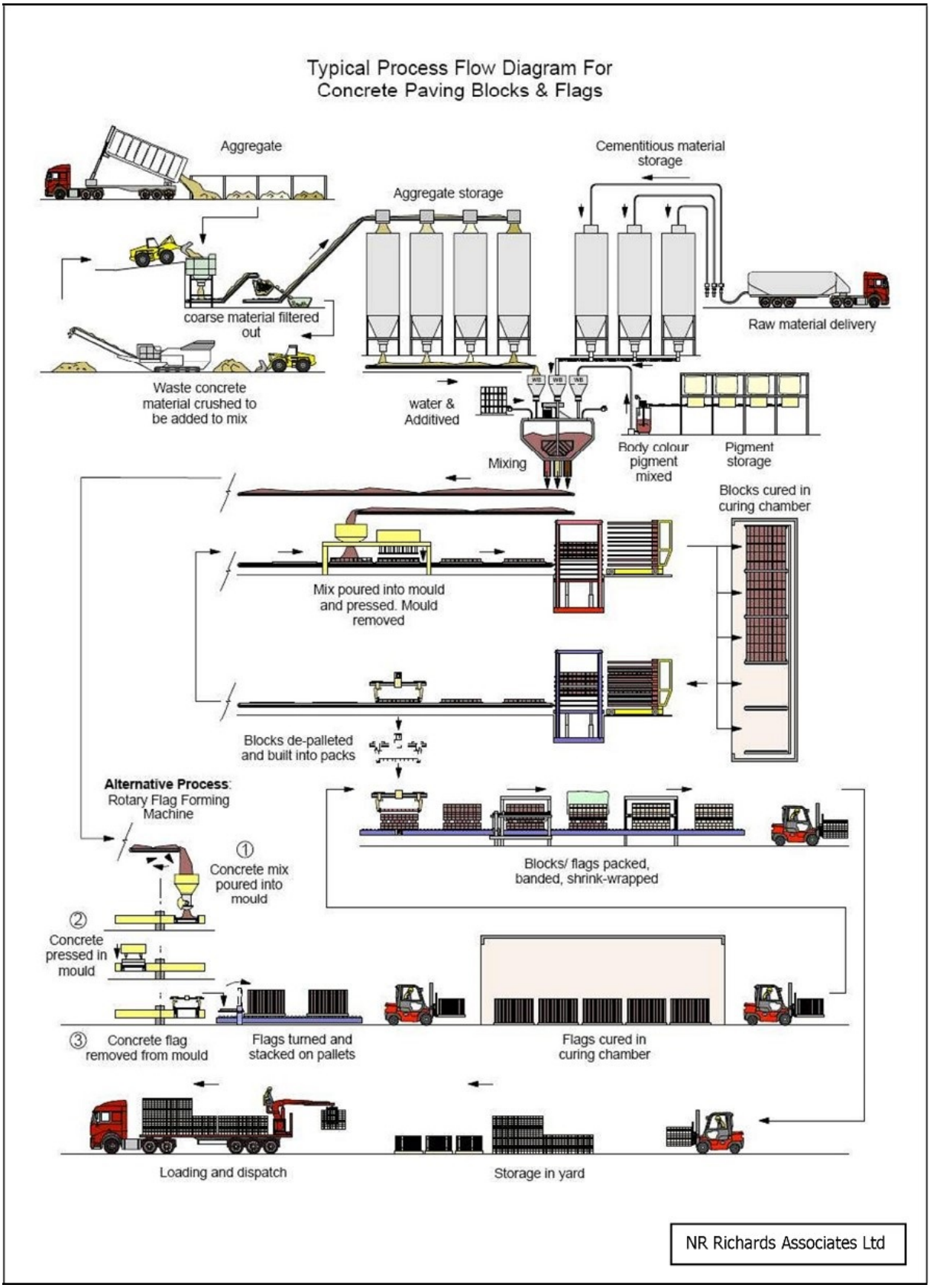
/EN 15804/ requires that where there are data gaps or insufficient input data for a unit process the cut-off criteria shall be 1% of renewable and non-renewable primary energy usage and 1% of the total mass of this unit process. The total neglected flows from a product stage must be no more than 5% of product inputs by mass or 5% of primary energy contribution.
In this assessment, all information gathered from data collection for the production of precast concrete has been modelled, i.e. all raw materials used, the electrical energy and other fuels used, use of ancillary materials and all direct production waste. Transport data on input and output flows are also considered. Scenarios have been developed to account for downstream processes such as fabrication, installation, demolition and waste treatment. No cut-offs have been made. Hence this study complies with the cut-off criteria defined in the /PCR/.

Background data

Background data is based primarily on a generic dataset /GaBi ts 2014 software database/ integrated into the IBU verified bespoke British Precast Envision EPD tool. The background data also includes UK specific cement data supplied by members of the Mineral Products Association (MPA). (Tool Verified 07/03/17).

Allocation

All allocation is performed according to the PCR. As no co-products are produced, the flow of materials and energy and also the associated release of substances and energy into the environment are related exclusively to the concrete produced.


Typical Process Flow Diagram For
Concrete Paving Blocks & Flags
Aggregate
Aggregate storage
Cementitious material storage
Raw material delivery
coarse material filtered out
Waste concrete material crushed to be added to mix
water & Additived
Mixing
Body colour pigment mixed
Pigment storage
Blocks cured in curing chamber
Mix poured into mould and pressed. Mould removed
Blocks de-palleted and built into packs
Alternative Process:
Rotary Flag Forming Machine
① Concrete mix poured into mould
② Concrete pressed in mould
③ Concrete flag removed from mould
Flags turned and stacked on pallets
Flags cured in curing chamber
Blocks/ flags packed, banded, shrink-wrapped
Loading and dispatch
Storage in yard
NR Richards Associates Ltd

Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.
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LCA: Scenarios and additional technical information

The following information supports the declaration of modules A1-C4 inclusive.

Transport to the building site (A4)

Name	Value	Unit
Transport distance	94.3	km
Capacity utilisation (including empty runs)	50	%

Installation into the building (A5)

Name	Value	Unit
Material loss	3	%

Use or application of the installed product (B1)
In practice, given the nature of the product and its application in the structure of the built asset, no impacts are associated with the use stage of paving over the lifetime of the asset. However, carbonation of concrete will occur during the lifetime of the asset and is included in module B1. Carbonation is calculated using the approach recommended by the Mineral Products Association and BPCF and follows the methodology developed by Pommer et al. /Pommer 2005/, with reference to the work of Engelsen and Justnes /Engelsen 2014/, who have made further refinements related to the amount of CaO that can carbonate and the carbonation of slag.

For precast concrete carbonation factors based on BPCF research and expert judgement have been used. The surface area is assumed to be 6.84m² based on one exposed surface for an average paving installation.
The study period is assumed to be 50 years (the RSL).

Modules B2 - B7 (Maintenance, Repair, Replacement, Refurbishment, Operational Energy Use, Operational Water Use)
It is assumed that the precast concrete paving products covered by this EPD do not require maintenance, repair, replacement or refurbishment during their lifetime. Consequently, the impacts associated with these lifecycle stages are zero. There is no operational energy or operational water requirement associated with the product.

Reference service life

Name	Value	Unit
Reference service life	50	a

End of life (C1-C4)

Name	Value	Unit
Recycling	90	%
Landfilling	10	%

LCA: Results

In Table 1 "Description of the system boundary", all declared modules are indicated with an "X"; Module D which is not declared is indicated with "MND". Indicator values are declared to three valid digits.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 tonne of Paving Products

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
GWP	[kg CO_2-Eq.]	131.00	6.62	1.00	-4.42	0.00	0.00	0.00	0.00	0.00	0.00	-0.43	3.46	-1.60	1.31
ODP	[kg CFC11-Eq.]	9.26E-7	4.48E-12	4.82E-12	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.34E-12	2.46E-11	1.78E-11
AP	[kg SO_2-Eq.]	2.37E-1	2.76E-2	8.24E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.44E-2	1.64E-2	9.63E-3
EP	[kg $(PO_4)^{3-}$-Eq.]	2.27E-2	6.76E-3	1.55E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.54E-3	3.95E-3	1.31E-3
POCP	[kg ethene-Eq.]	7.06E-2	-1.03E-2	9.40E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-5.41E-3	2.39E-3	9.25E-4
ADPE	[kg Sb-Eq.]	2.75E-4	1.24E-7	2.04E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.50E-8	4.21E-6	5.54E-7
ADPF	[MJ]	819.00	91.10	2.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.60	44.90	20.90

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: 1 tonne of Paving Products

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
PERE	[MJ]	125.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	125.00	1.85	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	3.46	2.46
PENRE	[MJ]	896.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	[MJ]	896.00	91.30	2.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.70	46.00	21.60
SM	[kg]	54.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	[m^3]	1.97E-1	5.93E-3	2.79E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.10E-3	1.29E-2	4.41E-3

Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 tonne of Paving Products

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
HWD	[kg]	1.63E-2	4.25E-7	1.19E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.22E-7	3.28E-6	4.94E-7
NHWD	[kg]	3.77E+1	1.60E-3	8.50E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.35E-4	2.18E-2	1.00E+2
RWD	[kg]	3.12E-2	9.79E-5	6.25E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.12E-5	4.47E-4	3.02E-4
CRU	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	[kg]	0.00	0.00	32.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	873.00	0.00
MER	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

Interpretation

Interpretation of the results has been carried out considering the methodology, data-related assumptions and any limitations declared in the EPD.
Interrogation of the LCA results show that the cradle-to-grave **GWP** (Global Warming Potential) impact of 1 tonne of paving products is 136.9 kgCO2e (Modules A1-C4).
For **GWP**, A1-A3 accounts for 96% of the lifecycle impact with carbonation in the use phase and post-demolition, reducing the overall impact of paving products. Carbonation in the use phase alone reduces the **GWP** impact by 3%.
The LCA results show that the cradle-to grave-primary energy demand of the declared unit is 1239 MJ (Modules A1-C4).
Analysis of the **PERT/ PENRT** (Total use of renewable primary energy resources/ Total use of non-renewable primary energy resources) figures show the largest contributors are cement 37(%), transport 16(%) and utilities used in production 14(%).
For primary energy demand, A1-A3 accounts for 82% of the lifecycle impact.
The cradle to grave Net use of fresh water (**FW**) is 0.23m3 (Modules A1-C4) with the product stage (A1-A3) accounting for 87% of this.

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thinkstep
GaBi ts 2014 software database

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