Statement of Verification

BREG EN EPD No.: 000658 Issue 01

This is to verify that the

Environmental Product Declaration

provided by:

Steintec

BRE Global Verified EPD

is in accordance with the requirements of:

EN 15804:2012+A2:2019

and

BRE Global Scheme Document SD207

This declaration is for:
125 kg (1 unit) of tuffbed 2-pack bedding mortar consisting of 1 x 25 kg bag of cementitious binder and 4 x 25 kg bags of undried crushed igneous aggregate

Company Address

Steintec
tuffbau Limited
1 Northwick Road
Canvey Island
Essex
SS8 0PU

Steintec®
high performance paving mortars

Signed for BRE Global Ltd	Emma Baker Operator	27 February 2025 Date of this Issue
27 February 2025 Date of First Issue		26 February 2030 Expiry Date

BRE Global Verified EPD

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ECO PLATFORM EPD VERIFIED

Environmental Product Declaration

EPD Number: 000658

General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE Environmental Profiles 2023 Product Category Rules for Type III environmental product declaration of construction products to EN 15804+A2 PN 514 Rev 3.1
Commissioner of LCA study	**LCA consultant/Tool**
Steintec tuffbau Limited 1 Northwick Road Canvey Island Essex SS8 0PU	Bala Subramanian/ BRE LINA A2
Declared/Functional Unit	**Applicability/Coverage**
125 kg (1 unit) of tuffbed 2-pack bedding mortar consisting of 1 x 25 kg bag of cementitious binder and 4 x 25 kg bags of undried crushed igneous aggregate.	Product Specific.
EPD Type	**Background database**
Cradle to Gate with Modules C and D	Ecoinvent 3.8

Demonstration of Verification
CEN standard EN 15804 serves as the core PCR [a]
Independent verification of the declaration and data according to EN ISO 14025:2010 ☐Internal ☒ External
(Where appropriate [b])Third party verifier: Flavie Lowres
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

Comparability
Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A2:2019. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A2:2019 for further guidance

Information modules covered

Product			Construction		Use stage							End-of-life					Benefits and loads beyond the system boundary
					Related to the building fabric					Related to the building							
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal		Reuse, Recovery and/or Recycling potential
☑	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑		☑

Note: Ticks indicate the Information Modules declared.

Manufacturing site(s)

Steintec
tuffbau Limited
1 Northwick Road
Canvey Island
Essex
SS8 0PU

Construction Product:

Product Description

'tuffbed 2-pack' is a high-performance bedding mortar for modular pavement construction that meets or exceeds the requirements of BS7533-101:2021, Table 9 for Type 25 and 35 bedding mortars. Steintec tuffbed 2-pack is used in the construction of modular pavements subject to Traffic Categories 0-9 as described in BS7533-101 Table 2b.

This two-part product requires no pre-drying or pre-blending of the aggregate content. The binder is packaged separately avoiding the need for energy intensive central processing. This reduces overall energy use and haulage, and facilitates a reduction in cementitious binder content. All mixing is carried out on site which makes tuffbed 2-pack suitable for commercial and larger public realm modular pavement projects.

As per the requirements of BS7533-101, the laying course material must be non-frost susceptible, permeable when cured, and compliant with all the bedding mortar characteristics outlined in BS7533-101. In addition, when tested in accordance with Annex C, bedding mortars will have a maximum capillary rise of 20mm. tuffbed 2-pack high performance bedding mortar meets or exceeds all of these requirements.

Technical Information

Property	Value, Unit
Density	2.00 t/m^3
Colour	Grey
Packaging	Bag
Packaging weight	25 kg
Bed depth range	≥20 mm

Property	Value, Unit
Typical water used	5 litres per 125 kg batch
Typical coverage	30 mm: 60 kg/m^2, 40 mm: 80 kg/m^2, 50 mm: 100 kg/m^2
Packages per pallet	40
Pallet quantity	1.030 kg inc. pallet
Working time	40 min at 10 degrees Celsius / 30 min at 20 degrees Celsius
Working temperature	2 – 30 degrees Celsius
Compressive strength (20 degrees Celsius)	14 days: ~25 N/mm^2, 28 days: ~35 N/mm^2
Flexural strength	~7 N/mm2, F 4 (EN 13813:2002)
Vertical permeability:	~18 x 10e-4 m/s
Horizontal permeability (EN 12697-19)	~8.5 x 10e-4 m/s
Storage life	24 months from manufacture date
NBS sections	M10, Q24, Q25
Compliance	BS 7533
Uniclass 2015 (Paving Laying Course Mortars)	Pr 20, 31, 53, 61
Reaction to fire (EN 13813:2002)	A1fl
Compressive strength (EN13813:2002)	C 35
Release of corrosive substances (EN13813:2002)	CT

For more information please contact the Steintec Technical Support Team or visit:
https://www.steintec.co.uk/designer/products/tuffbed-2-pack---bedding-mortar/

Main Product Contents

Material/Chemical Input	%
Crushed igneous aggregate	80
Cementitious binder	20

Manufacturing Process

As the product name implies, 'tuffbed 2-pack' is composed of two principal components, (i) The Aggregate (ii) The Binder. Each component is the result of a distinct and separate production process.

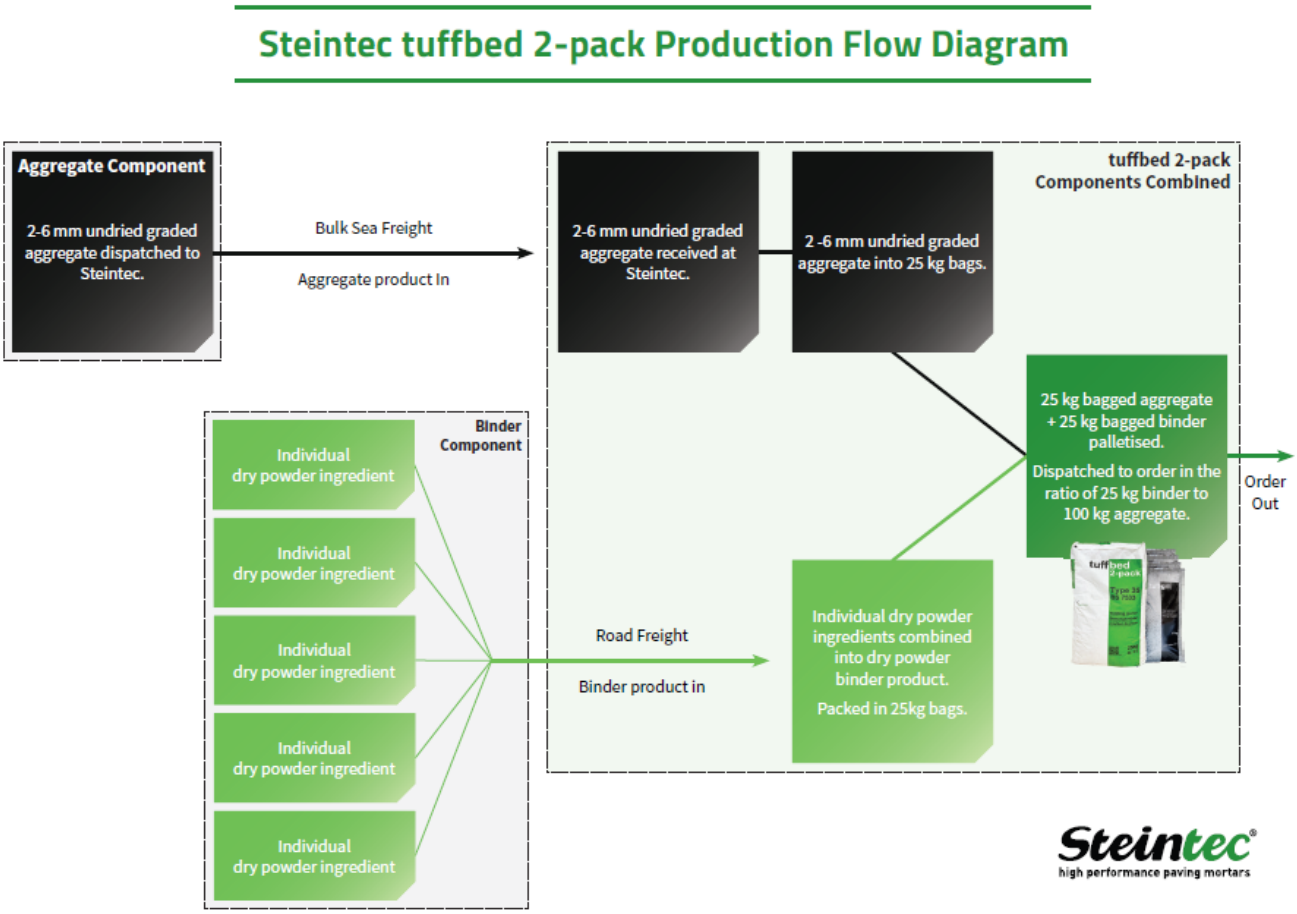
The aggregate is a crushed hard angular igneous rock produced to a consistent and exacting grading of 2-6mm. In undried form, the aggregate is delivered as bulk sea freight to Steintec in Canvey Island in the UK where it is loaded in bulk into a four-storey high protective indoor silo. The silo delivers carefully measured 25 kg loads of aggregate with consistent moisture content into recycled and recyclable foil sacks which are then sealed, palletised, and then stored ready for dispatch alongside the binder component. The binder is the dry, powdered, cementitious component of tuffbed 2-pack, produced from a number of specialist constituent components. These are delivered to Steintec's production facility where they are precisely measured and blended in dry powder form. The finished dry powder binder is then packed into 25 kg bags, palletised and held in protected dry storage ready for dispatch to customers together with the separately packaged tuffbed 2-pack aggregate.

Once the individually bagged 25 kg units of aggregate and binder are in the Steintec UK store, there is no further processing to the 'tuffbed 2-pack' product. Bags of binder and aggregate are then dispatched to order from Steintec, Canvey Island in the ratio of 100 kg aggregate (x4 bags): 25 kg binder (x1 bag) to achieve the volume of mortar calculated by Steintec to meet the customer's requirements, typically based on the area (m^2) of pavement to be installed.

The mixing of the binder and aggregate is performed on site by the customer's installer in the ratio of 100 kg aggregate (x4 bags) to 25 kg binder (x1 bag). The mixing process is described for the installer in the Steintec tuffbed 2-pack method statement.

Note: For the production of tuffbed 2-pack bedding mortar, UK national grid electricity has been modelled.

Process flow diagram



End of Life

tuffbed 2-pack is designed for use as the laying course on commercial and larger projects for natural stone, clay, concrete, or porcelain paving units in bound construction. At end-of-life, because of its characteristics, the product is not easily separated from the paving units so is sent to recycling along with the paving units.

When the pavement is constructed with a concrete base, which will vary in depth from 100mm to 150mm dependant on the design, the tuffbed 2-pack, and the paving units are difficult to separate from the base. In this event the paving units, tuffbed 2-pack and concrete base are sent to recycling.

Where the base is compacted granular aggregate or asphalt concrete /bitumen macadam, which vary in depth from 100mm-200mm dependant on the design, the tuffbed 2-pack can be separated from the base and recycling can be carried out separately.

In conclusion, the product can be recycled at end of its life.

Life Cycle Assessment Calculation Rules

Declared / Functional unit description.

125 kg (1 unit) of tuffbed 2-pack bedding mortar consisting of 1 x 25 kg bag of cementitious binder and 4 x 25 kg bags of undried crushed igneous aggregate.

System boundary

This is a cradle-to-gate with modules C and D LCA, reporting all production life cycle stages of modules A1 to A3 and end of life stages C1-C4, and D in accordance with EN 15804:2012+A2:2019 and BRE 2023 Product Category Rules (PN 514 Rev 3.1).

Data sources, quality and allocation

The quantity used in the data collection for this EPD is the total quantity of tuffbed 2-pack manufactured as a proportion of the total manufactured during the data collection period (01/05/2022 - 01/05/2023) that was calculated at 65.30%. In addition to the tuffbed 2-pack, other products are manufactured, necessitating the allocation of electricity, water consumption, and discharge. This allocation has been performed using mass allocation, in line with the provisions of BRE 2023 PCR PN514 Rev 3.1 and EN 15804. It was noted in the original data collection form submission that enough input material mass was consumed to cover total product output, therefore no input material mass uplift was required. The material composition of the tuffbed 2-pack component was provided from Steintec's supplier, but no factory process data was submitted. However, it is noted that the supplier's process essentially combines dry powders to Steintec's specific formula which are then packaged and dispatched to Steintec. The impact of the binder supplier's factory process is therefore considered negligible. Steintec use GGBS as a secondary raw material input for the tuffbed 2-pack product. Generally, GGBS is a co-product of steel manufacturing, so these impacts have been economically allocated to the GGBS by 2.3% following EN15804 recommendations. Secondary data has been obtained for all other upstream and downstream processes that are beyond the control of the manufacturer (i.e., raw material production) from the ecoinvent 3.8 database. All ecoinvent datasets are complete within the context used and conform to the system boundary and the criteria for the exclusion of inputs and outputs, according to the requirements specified in EN15804.

ISO14044 guidance. **Quality Level**	**Geographical representativeness**	**Technical representativeness**	**Time representativeness**
Very Good	Data from area under study.	Data from processes and products under study. Same state of technology applied as defined in goal and scope (i.e., identical technology).	There is approximately 1-2 years between the Ecoinvent LCI reference year, and the time period for which the LCA was undertaken

Specific European datasets have been selected from the ecoinvent LCI for this LCA. The manufacturer uses national grid electricity and natural gas for production, therefore the national grid electricity dataset “Electricity – GB (kWh)” has been used for the LCA modelling (Ecoinvent 3.8). The GWP carbon footprint for using 1 kWh of electricity, GB kWh is 0.239 kgCO2e/kWh and for the UK natural has carbon footprint for using 1 kWh is 0.232 kgCO2eq. The quality level of time representativeness is also Very Good as the background LCI datasets are based on ecoinvent v3.8 which was compiled in 2021. Therefore, there is less than 5 years between the ecoinvent LCI reference year and the time period for which the LCA was undertaken.

Cut-off criteria

No inputs or outputs have been excluded. All raw materials and packaging inputs, plus their transport, process and general energy and water use, production and non-production waste, have been included where appropriate, except for direct emissions to air, water and soil, which are not measured.

LCA Results

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg $(PO_4)^{3-}$ eq
Product stage	Raw material supply	A1	1.89E+01	1.86E+01	2.65E-01	3.87E-03	7.00E-07	5.32E-02	2.46E-03
	Transport	A2	2.15E+00	2.15E+00	6.82E-04	1.24E-03	4.58E-07	4.23E-02	1.01E-04
	Manufacturing	A3	1.04E+00	1.04E+00	-8.87E-03	9.52E-04	5.30E-08	4.41E-03	2.67E-04
	Total (Consumption grid)	A1-3	2.20E+01	2.18E+01	2.57E-01	6.06E-03	1.21E-06	9.99E-02	2.83E-03
95% - Recycling and 5% - Landfill									
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.04E+00	1.04E+00	8.85E-04	4.08E-04	2.40E-07	4.22E-03	6.69E-05
	Waste processing	C3	4.77E-01	4.77E-01	1.68E-04	4.76E-05	1.02E-07	4.96E-03	1.48E-05
	Disposal	C4	3.30E-02	3.29E-02	3.26E-05	3.11E-05	1.33E-08	3.10E-04	3.01E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.00E+00	-9.85E-01	-1.28E-02	-1.39E-03	-7.94E-08	-6.34E-03	-5.37E-04

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
GWP-biogenic = Global warming potential, biogenic;
GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential, accumulated exceedance; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			EP-marine	EP-terrestrial	POCP	ADP-mineral &metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
Product stage	Raw material supply	A1	1.40E-02	1.65E-01	4.55E-02	3.68E-05	9.53E+01	3.08E+00	4.48E-07
	Transport	A2	1.06E-02	1.18E-01	3.11E-02	4.98E-06	2.97E+01	1.01E-01	1.20E-07
	Manufacturing	A3	1.10E-03	1.11E-02	4.09E-03	4.92E-06	2.68E+01	6.42E-01	4.79E-08
	Total (Consumption grid)	A1-3	2.57E-02	2.94E-01	8.07E-02	4.67E-05	1.52E+02	3.82E+00	6.16E-07
95% - Recycling and 5% - Landfill									
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.27E-03	1.39E-02	4.25E-03	3.61E-06	1.57E+01	7.07E-02	8.96E-08
	Waste processing	C3	2.20E-03	2.41E-02	6.62E-03	2.45E-07	6.55E+00	1.51E-02	1.02E-06
	Disposal	C4	1.08E-04	1.18E-03	3.43E-04	7.51E-08	9.19E-01	4.22E-02	6.23E-09
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.46E-03	-1.76E-02	-4.53E-03	-9.32E-06	-1.45E+01	-1.89E+00	-8.01E-08

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts							
			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	6.96E-01	3.93E+02	1.39E-08	1.67E-07	3.10E+01
	Transport	A2	1.43E-01	2.07E+01	1.08E-09	1.79E-08	1.21E+01
	Manufacturing	A3	1.79E-01	1.40E+01	3.64E-10	8.46E-09	7.07E+00
	Total (Consumption grid)	A1-3	1.02E+00	4.28E+02	1.54E-08	1.93E-07	5.02E+01
95% - Recycling, 5% - Landfill							
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	8.07E-02	1.23E+01	3.97E-10	1.29E-08	1.08E+01
	Waste processing	C3	2.95E-02	3.83E+00	1.48E-10	2.78E-09	8.33E-01
	Disposal	C4	4.08E-03	5.81E-01	1.47E-11	3.82E-10	1.93E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.25E-01	-1.68E+01	-9.76E-10	-1.76E-08	-1.33E+01

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, primary energy								
			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	4.85E+00	0.00E+00	4.85E+00	9.29E+01	1.33E+00	9.42E+01
	Transport	A2	3.08E-01	0.00E+00	3.08E-01	2.92E+01	0.00E+00	2.92E+01
	Manufacturing	A3	6.37E-01	1.67E+00	2.31E+00	1.70E+01	1.05E+01	2.74E+01
	Total (Consumption grid)	A1-3	5.80E+00	1.67E+00	7.47E+00	1.39E+02	1.18E+01	1.51E+02
95% - Recycling, 5% - Landfill								
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	2.21E-01	0.00E+00	2.21E-01	1.54E+01	0.00E+00	1.54E+01
	Waste processing	C3	3.67E-02	0.00E+00	3.67E-02	6.42E+00	0.00E+00	6.42E+00
	Disposal	C4	7.84E-03	0.00E+00	7.84E-03	9.02E-01	0.00E+00	9.02E-01
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.36E+00	0.00E+00	-1.36E+00	-1.45E+01	0.00E+00	-1.45E+01

PERE = Use of renewable primary energy excluding renewable primary energy 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 resource

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	2.72E-03	4.43E-05	0.00E+00	7.52E-02
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	2.51E-03
	Manufacturing	A3	4.06E-03	2.14E-06	0.00E+00	1.57E-02
	Total (Consumption grid)	A1-3	6.78E-03	4.64E-05	0.00E+00	9.34E-02
95% - Recycling, 5% - Landfill						
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	1.75E-03
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	3.73E-04
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	9.85E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	-4.48E-02

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories					
			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	3.21E-01	1.24E+01	3.74E-04
	Transport	A2	3.63E-02	4.50E-01	2.04E-04
	Manufacturing	A3	3.96E-02	1.24E+00	5.90E-05
	Total (Consumption grid)	A1-3	3.96E-01	1.41E+01	6.37E-04
95% - Recycling and 5% - Landfill					
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.73E-02	3.07E-01	1.06E-04
	Waste processing	C3	8.59E-03	6.03E-02	4.52E-05
	Disposal	C4	9.56E-04	1.35E-02	6.03E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-8.35E-02	-2.54E+00	-7.41E-05

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life								
			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	1.62E-04	6.26E-07	7.86E-03	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	2.24E-02	2.01E-08	1.80E-03	2.03E-08	4.95E-02
	Total (Consumption grid)	A1-3	0.00E+00	2.26E-02	6.46E-07	9.66E-03	2.03E-08	4.95E-02
95% - Recycling and 5% - Landfill								
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste processing	C3	0.00E+00	1.19E+02	1.37E-07	0.00E+00	0.00E+00	0.00E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
MFR = Materials for recycling

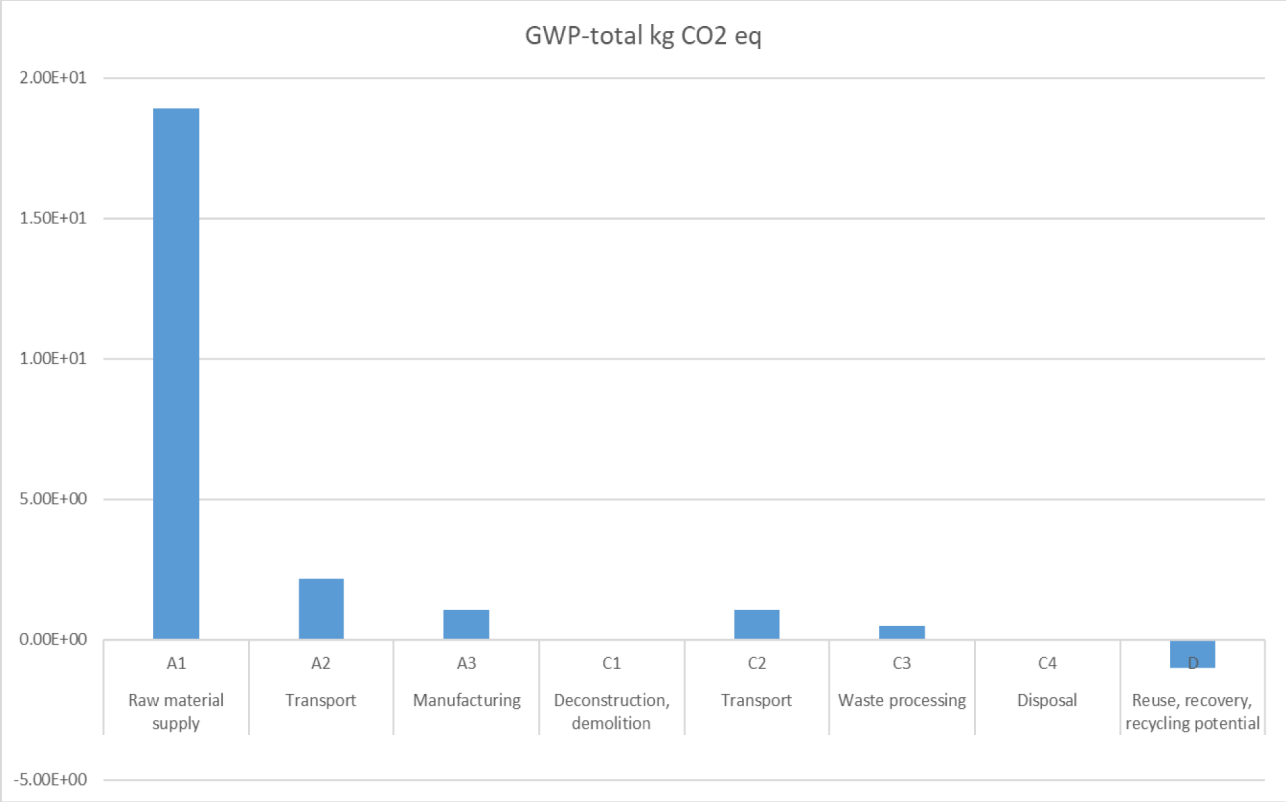
MER = Materials for energy recovery;
EE = Exported Energy

Scenarios and additional technical information

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
End of life	tuffbed 2-pack is designed for use as the laying course on commercial and larger projects for natural stone, clay, concrete, or porcelain paving units in bound construction. At end-of-life, because of its characteristics, the product is not easily separated from the paving units so is sent to recycling along with the paving units. When the pavement is constructed with a concrete base, which will vary in depth from 100mm to 150mm dependant on the design, the tuffbed 2-pack, and the paving units are difficult to separate from the base. In this event the paving units, tuffbed 2-pack and concrete base are sent to recycling. Where the base is compacted granular aggregate or asphalt concrete/bitumen macadam, which vary in depth from 100mm-200mm dependant on the design, the tuffbed 2-pack can be separated from the base and recycling can be carried out separately.		
C2 – Transportation	50km by road has been modelled for module C2 as a typical distance from the demolition site to the recycling plant. However, end-users of the EPD can use this information to calculate the impacts of a bespoke transport distance for module C2 if required.	Road transport	16–32-ton lorry
	Distance: Deconstruction unit to pre-processing unit	km	50
C3 – Preprocessing	The waste processing scenario outlines the end-of-life processing for pavements constructed using tuffbed 2-Pack, natural stone, clay, concrete, or paving units, and different types of bases (concrete, granular aggregate, or asphalt concrete/bitumen asphalt). For this analysis, the pavement is assumed to have a concrete base (100mm–150mm depth, depending on the design) serving as the foundation for tuffbed 2-Pack and paving units. Due to the strong bond between the tuffbed 2-Pack, paving units, and concrete base, these layers cannot be separated efficiently. At the waste processing facility, materials are crushed into a mixed recycled aggregate. The recycled aggregate is graded and reused in applications such as road base material or as filler in new construction projects. According to the BRE Global PCR Rev 3.1 waste scenario for Aggregate/fill, aggregate (UK typical, recycled), 95% of the Aggregate waste will be recycled and 5% is un-recoverable so it will be sent to landfill. The crushing or pulverising processes have not been included in module C3 since no data was available.		
	95% of aggregate waste to recycling	kg	118.75
C4- Disposal	The recovered pavement material is sent to recycling while a small portion is assumed to be unrecoverable which is considered to be sent to landfill.		
	5% of Unrecoverable waste to landfill	kg	6.25
Module D	It is assumed that 95% of the tuffbed 2-pack bedding mortar along with the paving units are recovered and sent to recycling. The calculation assumes that there is no yield-loss during the recycling process and there is no pre-existing recycled content accounted for in the Module D calculation.		
	Aggregate waste with tuffbed 2-pack bedding mortar – recycled	kg	118.75

Interpretation

The bulk of the environmental impacts are attributed to the upstream extraction and manufacturing processes of certain components relating to the tuffbed 2-pack bedding mortar, covered by information modules A1-A3 of EN15804:2012+A2:2019. The chart below provides a breakdown of the Global Warming Potential (GWP) across various categories and emission sources, measured in kilograms of CO_2 equivalent. It shows that A1 (Raw material supply) contributes to the majority of GWP impacts. Cementitious binder makes up 20% of the overall composition by mass but represents more than 90% of the GWP impacts in A1. It should be noted that cementitious binder content is an unavoidable constituent material for this product type, that tuffbed 2-pack has a low proportion at 20%, and that approximately 40% of the cementitious binder is composed of GGBS to further reduce impacts. Finally, as noted in the product description above, the aggregate component (80% of the product mass) does not require pre-drying or pre-blending which is a significant energy saving technique. These measures show that Steintec are reducing impacts arising from the tuffbed 2-pack bedding mortar across modules A1-A3 where possible.



Summary for the Designer

The most commonly used figure for carbon impact when designing a scheme is kg CO_2.

The GWP figure given in the LCA Results table for A1-A3 is 2.20E+01kg CO_2 eq. per 125 kg (product unit as detailed in Functional unit description). This equates to the following kg CO_2 eq. figures for other commonly used (product) quantities.

0.176 kg CO_2 per 1 kg.
4.4 kg CO_2 per 25 kg.
22 kg CO_2 per 125 kg.
176 kg CO_2 per 1000 kg (kg CO_2/t).
352 kg CO_2 per m^3 (tuffbed 2-pack has a density of 2.00 t/m^3)

References

BSI. Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products. BS EN 15804:2012+A2:2019. London, BSI, 2019.

BSI. Environmental labels and declarations – Type III Environmental declarations – Principles and procedures. BS EN ISO 14025:2010 (exactly identical to ISO 14025:2006). London, BSI, 2010.

BSI. Environmental management – Life cycle assessment – Principles and framework. BS EN ISO 14040:2006. London, BSI, 2006.

BSI. Environmental management – Life cycle assessment – requirements and guidelines. BS EN ISO 14044:2006. London, BSI, 2006.

BS 7533-101:2021 – Pavements constructed with clay, concrete or natural stone paving units – Code of practice for the structural design of pavements using modular paving units.

BS EN 13813:2002 – Screed material and floor screeds. Screed material. Properties and requirements.

BS EN 12697-19:2020 – Bituminous mixtures. Test methods. Permeability of specimen.

Pre Consultants bv. SimaPro 9 LCA Software 2021. http://www.pre-sustainability.com

ecoinvent Centre. Swiss Centre for life Cycle Inventories. http://www.ecoinvent.org