Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Concrete Canvas ® 'T Series' Product Range

from

Concrete Canvas

EPD of multiple products (CCT1®, CCT2® and CCT3®), based on the average results of the product group and worst-case results where the average exceeded 10% variability.

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	EPD-IES-0006165
Publication date:	2024-12-17
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

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Programme Information:

Programme	The International EPD® System
Address	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	info@environdec.com

Accountabilities for PCR, LCA & independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core PCR
Product Category Rules (PCR): EN 15804:2012+A2:2019 JRC Characterisation Factors EF 3.1, PCR 2019:14-c-PCR-00 3 c-PCR-003 Concrete & Concrete Elements Version 2023-01-02, PCR 2019: 14 Construction Products and Services. Version 1.3.4,2024-04-30
PCR review was conducted by: PCR review was conducted by: The Technical Committee of the International EPD System. See www.environdec.com for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.
Life Cycle Assessment (LCA)
LCA accountability: Rebecca Eccles, Enistic Limited

Third-party Verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☐ EPD verification by individual verifier *Third-party verifier: Terrie Boguski, Harmony Environmental* Terrie K Boguski Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier:
☐ Yes ☒ No [Procedure for follow-up the validity of the EPD is at minimum required once a year with the aim of confirming whether the information in the EPD remains valid or if the EPD needs to be updated during its validity period. The follow-up can be organized entirely by the EPD owner or together with the original verifier via an agreement between the two parties. In both approaches, the EPD owner is responsible for the procedure being carried out. If a change that requires an update is identified, the EPD shall be re-verified by a verifier]

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company Information:

Owner of the EPD	Concrete Canvas Limited, Cowbridge Road, Talbot Green, CF72 8HL
Contact	Stuart Lewis, stuart.lewis@concretecanvas.com
Description of Organisation	Manufacturer of Geosynthetic Cementitious Composite Mats (GCCM).
Product/Management System-Related Certifications	EN 15804+A2, ISO 14025
Name and location of production site(s):	Cowbridge Road, Talbot Green, CF72 8HL

Product Information:

Product Name	Concrete Canvas ® 'T Series' Product Range
Production Identification	CCT1®, CCT2® and CCT3®
Product Description	The products consist of a three-dimensional fibre matrix containing a high early strength gain concrete mix that hardens when hydrated to form a thin, durable and waterproof concrete layer.
UN CPC Code	375
Geographical Scope	Raw material and packaging suppliers are located within the UK. All manufacturing takes place in the UK. Concrete Canvas Limited has customers all around the globe.

Product Name	**CCT1®,**	**CCT2®,**	**CCT3®,**
Functional/Declared Unit	1 kg	1 kg	1 kg
GWP GHG (A1-A5, C1-C4, D) per kg	0.605	0.635	0.616
Multiplying Factor to Functional Unit to Convert to 1 m^2 (includes A5)	9.97	13.05	18.49
GWP GHG (A1-A5, C1-C4, D) per sqm	**6.03**	**8.29**	**11.39**

LCA Information:

Functional/ Declared Unit	1 kg GCCM
Reference Service Life	N/A
Time Representativeness	September 2022 - August 2023
Database & Software	Ecoinvent 3.10
Description of System Boundaries	Cradle to gate, modules C1–C4, module D with optional modules. The additional modules include A4–A5, C1-C4, and D. Note: Worse case results are reported for 13 of 37 impact indicators because of larger than 10% variance primarily due to packaging differences.
GWP GHG Variability	-2.8% to 1.2%
Type of EPD	This is an average EPD cradle to gate with options, covering A1-A3, A4-A5, C and D modules.

LCA Information:

Accountabilities for PCR LCA, and independent, third party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): EN 15804:2012+A2:2019 JRC Characterisation Factors EF 3.1, PCR 2019:14-c-PCR-00 3 c-PCR-003 Concrete & Concrete Elements Version 2023-01-02, PCR 2019: 14 Construction Products and Services. Version 1.3.4,2024-04-30
PCR review was conducted by Martin Erlandsson
Life Cycle Assessment (LCA)
Produced by: Enistic Limited, Oxford U.K
Lifecycle Accountability: Rebecca Eccles, Enistic Limited

Study Aims and Goals:

Concrete Canvas have produced a LCA on the 'T Series' Product Range to obtain a comprehensive understanding of the environmental impact through each stage of the product's life. In addition, this will increase transparency and improve communication with our customers.

Moving forward, we aim to use the information from this LCA Report to research ways to improve our current operations and to share this with our customers/consumers so they can also understand their own impact.

Averaging and Variability in EPD:

This LCA is averaged for CCT1®, CCT2® and CCT3® products manufactured at one location. The average was calculated by including all declared data for all three products and scaling the results down to 1kg.

The variability was calculated by calculating the difference between GWP GHG A1-A3 for the minimum (CCT3 ®) and maximum (CCT2 ®) products. This variability was accepted due to the similarities in the products' production processes and materials. Any spikes in variability within the impact categories is due to the variability in packaging materials.

Reasons for Performing the LCA:

Concrete Canvas have produced an LCA on their 'T Series' Product Range in order to obtain a comprehensive understanding of their products' environmental impact. As such, this will highlight any areas where reductions can be made as well as maintaining open communication with new and existing customers. In addition, some projects within the construction industry state that EPDs are desirable or a requirement and so this LCA will continue to open commercial doors. Variability was greater than 10% for 13 of 37 impact indicators. For these indicators the result for the product with the largest value was reported so as not to underestimate impacts. The 13 impact indicators are: PERE, PERM, SM, GWP-biogenic, GWP-LULUC, Human toxicity (carc.), SEQ, ODP, Particulate matter formation (human health), WDP, Material for energy recovery, Material for recycling, and exported energy (electric and thermal).

About the Manufacturer:

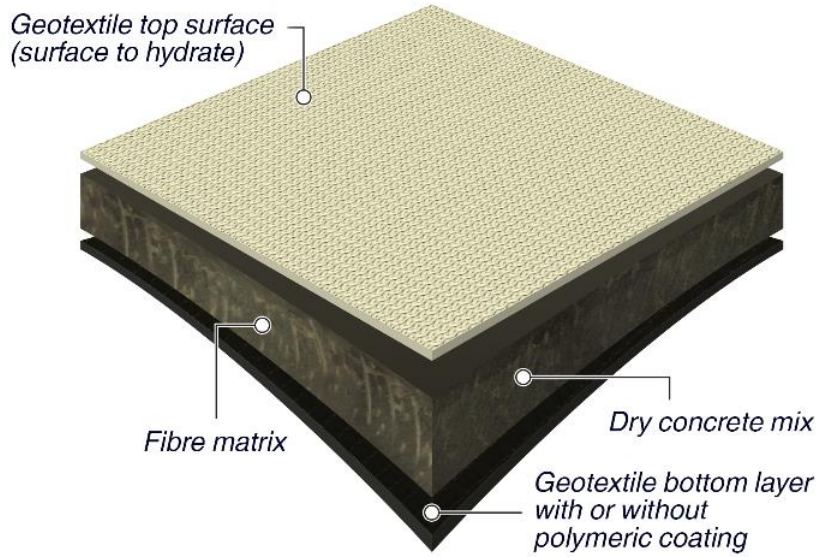
Concrete Canvas Ltd was set up in 2005 and are the pioneers of Geosynthetic Cementitious Composite Mat (GCCM) technology, which was developed by the company founders whilst studying at university.

The company's headquarters are in Pontyclun, South Wales from where it operates production, sales, logistics and R&D functions. In addition, it has overseas offices in the USA, Ireland, Italy, Hungary, UAE and Australia.

Concrete Canvas Ltd has achieved ISO 9001 and 14001 accreditation and is committed to driving the transition to more sustainable manufacturing focusing on reducing lifecycle emissions, waste & pollution.

Product Information:

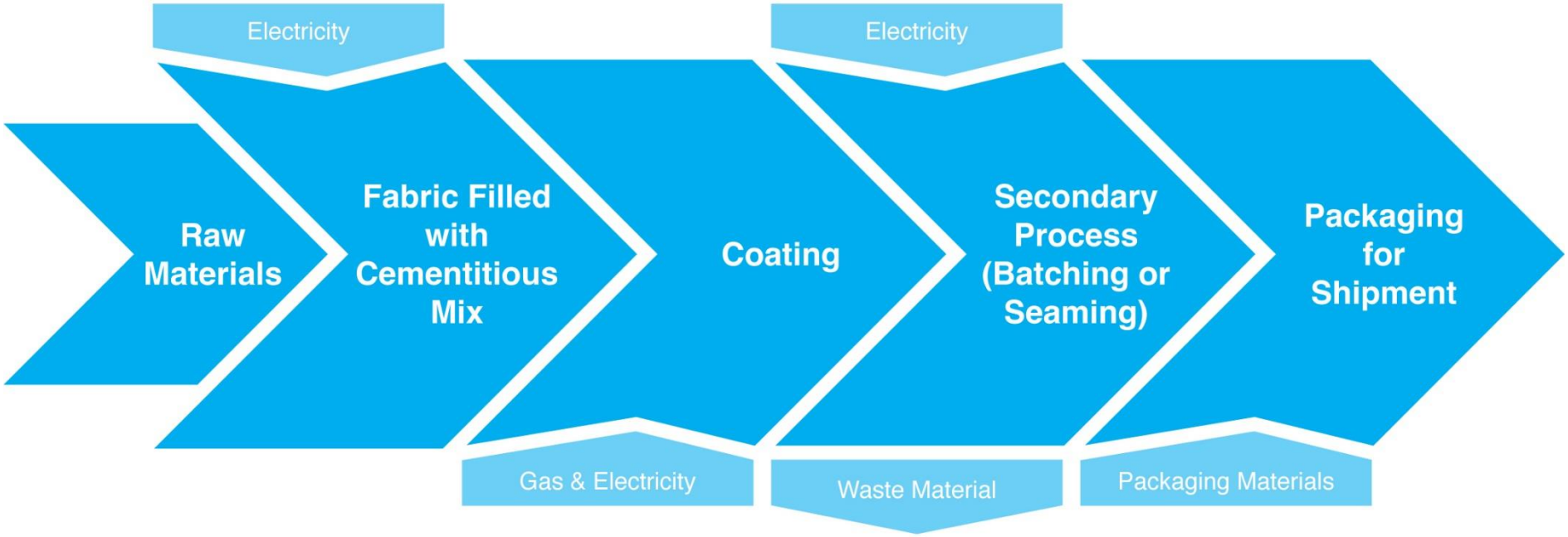
Concrete Canvas® (CC) Geosynthetic Cementitious Composite Mats are flexible concrete filled geosynthetics for use in a range of geotechnical applications. The 'T Series' product range are provided with a PVC backing to provide the waterproof capability, while the internal fibre matrix provides the tensile strength once the concrete is set and prevents any crack propagation. The products are available in three types: CCT1®, CCT2® and CCT3® and are hydrated by either spraying or by being fully immersed in water.



Product Information:

Description	CCT1®	CCT2®	CCT3®
Image			
Functional Characteristics	A Type I GCCM in accordance with ASTM D8364. Applications generally have minimal requirements for abrasion and wear, will be exposed to low flow velocities are not designed to anticipate impact loads and are generally installed above a dense subgrade	A Type II GCCM in accordance with ASTM D8364. Applications would generally expect greater abrasion and wear requirements than CCT1®, or they would be expected to be exposed to higher flow velocities or be applied on less compacted subgrades.	A Type III GCCM in accordance with ASTM D8364. Applications would generally expect greater abrasion and wear requirements than CCT1® or CCT2®, or they would be expected to be exposed to higher flow velocities, be subject to design requirements for impact or dynamic loads or be applied on less compacted subgrades.
Areas of Use	Slope protection, weed suppression, berm protection, and remediation of concrete hydraulic structures.	Channel lining, culvert lining, slope protection, and remediation of concrete hydraulic structures.	Channel lining, armouring, culvert lining, and slope protection.
Differences in Products	Least strength	Mid strength	Most strength
	Thinnest	Mid thickness	Thickest
Similarities in Products	The products are composed of the same raw materials and use the combination of flexible when uncured, and rigid and durable when cured.		

System Flow Diagram:



The Concrete Canvas T-series products are manufactured using a bespoke process developed internally by Concrete Canvas Ltd. The first stage of the process is the filling of the fabric with the specially formulated dry cementitious mix. The next stage of the process is coating of the fabric with the PVC layer, in order to provide the material with its waterproof properties. The third stage of the process only applies to orders which require the product to be re-processed into a different format such as Batched rolls or Wide rolls. Finally, the product is packaged in air-tight packaging and palletised prior to shipment out to the customer.

Manufacturing and Packaging (A1 – A3):

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material losses occurring during the manufacturing processes as well as losses during electricity transmission.

Transport and Installation (A4 – A5):

Transportation impacts occurred from final products delivery to construction site (A4) cover fuel direct exhaust emissions and environmental impacts of fuel production. The installation process requires water to hydrate the cement in place. These on-site water machines are powered by fuel. In addition, pegs and screws are used to keep the GCCM in place. It is assumed that the cardboard packaging is recycled and taken to waste treatment plant. The cardboard packaging is recovered for energy (D). The recycling of card avoids the use of virgin raw material, and the heat recovered from the combustion of card replaces the use of fossil fuels in energy production (D).

End of Life (C1 – C4, D):

At the end-of-life, in the demolition phase 100% of the product's waste is assumed to go to landfill (C4). The demolition process consumes energy in the form of diesel fuel used by machines (C1). None of the dismantled elements will be delivered to a waste treatment plant (C2).

Cut off Criteria:

The study does not exclude any modules or processes which are stated mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes for which data is available are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass. This study assumes negligible carbonation as the cement product does not store carbon dioxide.

Scenarios included for A1-A5, C1-C4, and D are currently in use and are representative for one of the most probable scenarios. There is no missing data in this analysis.

Transport to the Installation Site (A4):

Scenario Information	Value (per declared unit)	Unit
Deliveries outside of Europe were assumed to travel by a >32 metric tonne EURO5 lorry and a container ship. European deliveries, where possible, were assumed to travel via a ferry to mainland Europe and travel majority of the route by a >32 metric tonne EURO5 lorry. Default routes were assumed for different global regions. Ecoinvent data points used; Transport, freight, lorry >32 metric ton, EURO5 & Transport, freight, sea, container ship	Unknown	Litres of fuel
Distance – Asia: Lorry, Container Ship	550, 1330	km, km
Distance – Oceania: Lorry, Container Ship	550, 21052	km, km
Distance – Mainland Europe: Lorry, Container Ship	1599, 50	km, km
Distance – Scandinavia: Lorry, Container Ship	150, 2360	km, km
Distance – Americas: Lorry, Container Ship	550, 10679	km, km
Distance – United Kingdom: Lorry	350	km, km
Capacity Utilisation (no empty returns included)	Average	-
Bulk Density	Unknown	kg/m3
Volume capacity utilisation factor	N/A	N/A

Installation of the Product (A5):

Processes	Material	Per Declared Unit
Ancillary Materials for installation	N/A	-
Water Use	Water (kg)	0.267
Other Resource Use	Screws (kg)	0.000340
	Pegs (kg)	0.00106
	Sealant (kg)	0.0000886
Energy type and consumption	Petrol (kg)	0.00000910

Scenario Information	Value (per declared unit)	Unit
Packaging waste is sorted and taken to a waste processing site. All other materials are used on site for the installation of the product. No other waste from the product is anticipated during installation.	-	-
Waste materials on the building site before waste processing	N/A	N/A
Output materials as a result of waste processing at building site: Pallets (recycled)	0.0159	kg
Output materials as a result of waste processing at building site: Strapping (landfill)	0.000172	kg
Output materials as a result of waste processing at building site: Shrink Wrap and Plastic Bags (landfill)	0.000725	kg
Output materials as a result of waste processing at building site: Card (energy recovery)	0.00874	kg
Direct emissions to ambient air, soil, and water	0	kg

End of Life (C1 – C4, D):

Processes	Description	Per Declared Unit
Collection Process Specified by Type	kg collected separately	0
	kg collected with mixed construction waste	0.987
Recovery System Specified by Type	kg for re-use	0
	kg for recycling	0
	kg for energy recovery	0
Disposal specified by type	kg product or material for final deposition	0.987
Distance to waste disposal site	km	50
Assumptions for scenario development	All packaging materials are disposed of during A5. Pallets are recycled and all card packaging waste is used for energy recovery. All other waste is directed to landfill. A conservative distance of 50km to waste disposal sites were assumed.	

Allocation, Estimates, and Assumptions:

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. All allocations are done as per the reference standards and the applied PCR. In this study, any assumptions have been done in the following ways:

Module	Assumptions
A1 Raw Materials	Packaging materials were allocated to the product(s) based on kg of product produced in the study period.
A2 Transport	A “default route” from each supplier to Concrete Canvas Limited’s site was assumed to be used for every delivery throughout the study period (September 2022 – August 2023).
A3 Manufacturing Energy	Energy usage was allocated to all products by using the ratio of kg of manufactured ‘T Series’ product range vs all other manufactured products.
A3 Manufacturing Waste	1.85% waste was assumed across all raw materials.
A4 Transport	Customer transport was separated into geographical regions where a “default route” was assigned for each region throughout the study period (September 2022 – August 2023).
A5 Assembly	Installation resources (fuel and water) were calculated using assumptions based on resources required per m2. Packaging waste is included in A5. There is no product waste expected during the installation process.
C1 Demolition	An assumption was made regarding how much diesel is required to deconstruct/demolish 1kg of concrete. These assumptions were calculated based on figures from research regarding off-road diesel consumption within construction and demolition.
C, D Incineration and Energy Recovery	It was assumed that majority of waste would be directed straight to landfill. Any card packaging waste was assumed to be incinerated for energy recovery. To derive the value of MJ used for exported energy electric, the following formula was used: kg x 13.99 x 11%. To derive the value of MJ used for exported energy electric, the following formula was used: kg x 13.99 x 62%. These formulas were derived from industry conversion factors for wood and card energy.
Infrastructure and Capital Goods	Infrastructure and capital goods are not included in this analysis.

Other Techinical Information:

Cradle to Gate (A1 – A3): The raw materials are delivered from UK suppliers to the singular manufacturing site located in Talbot Green (CF72 8HL). These materials are then combined (as per the system flow diagram) at the manufacturing site.

Custom Transport (A4): The products are then shipped to customers all over the world to regional distributors and independent customers.

Use Stages (B1 – B7): These life cycle stages have not been modelled and are not thought to dominate. There are not expected to be emissions during this phase. Emissions due to erosion have not been modelled. Repair is not thought to be significant because CC is BBA certified with a durability in excess of 120 years for erosion control applications.

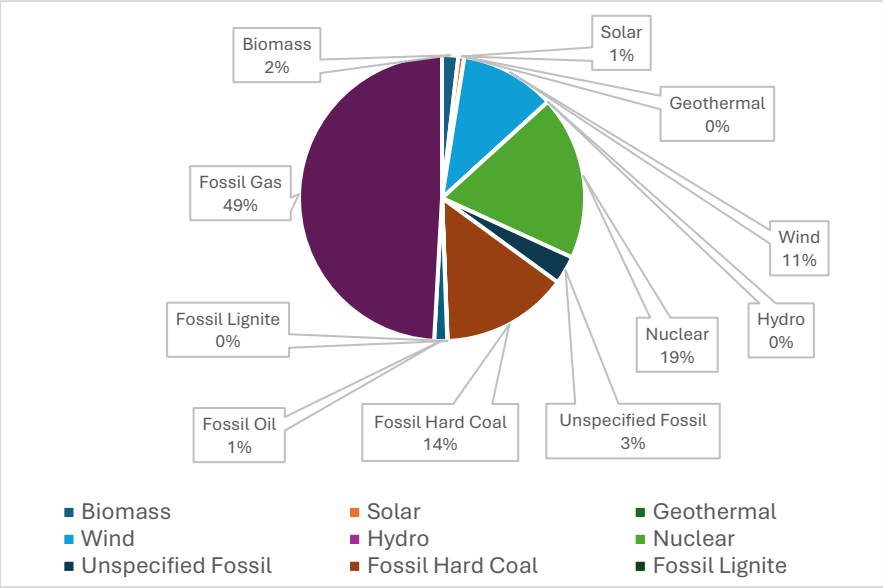
End of Life (C1 – C4): The assembly rate has been used for the deconstruction of the material, which is assumed to be conservative as less care has to be taken with it. Due to the combination of plastics and concrete we have been unable to find end of life options at scale other than landfill.

Variance Justification:

All three products are manufactured using the same raw materials which are from the same suppliers. The manufacturing process is near identical for all three products, except they vary in thickness. The three products share similar purposes in the construction world and so the difference in impact is solely based on the variance in thickness and the appropriate adjustments to the packaging of each. After reviewing the variance of each indicator, we were happy that any peaks in variance are due to the variation in packaging and therefore are happy to proceed with an average EPD. For impact categories where variance has exceeded 10%, we have reported the results from the worst case scenario for each impact category.

Electricity Declaration (A3):

The electricity datapoint was obtained from ecoinvent and is representative of residual mix electricity in the UK. The carbon impact of 1 kWh of electricity consumption is 0.436 kg CO2e. The chart below represents the different sources of residual grid electricity. This factor is used to represent the impact of electricity consumption in A3.



Data Quality:

Any generic and secondary data used in the model is less than 10 years old. Technological representativeness is excellent, as primary data are representative of actual technology used. Geographical representativeness is good. The temporal representativeness of the data used is very good as 12 months of primary data were collected from Sept-22 to Aug-23. Electricity is representative of the UK 2023 residual grid as reported by Ecoinvent 3.1 and Association of Issuing Bodies (AIB). Secondary data represents the global market.

Module	Data Source
A1 Raw Materials	All raw materials were sourced from internal procurement records. These records outline the weight and dates of all materials purchased. The raw materials were allocated to each product by considering the total production weight of each product. The estimated waste was then added onto this figure which produced a representative weight of each raw material per product.
A2 Transport	Information of locations and vehicle types of all suppliers were known. A “default route” from each supplier to Concrete Canvas Limited’s site was assumed to be used for every delivery throughout the study period (September 2022 – August 2023).
A3 Manufacturing Energy	Energy usage was allocated by using the ratio of kg of manufactured ‘T Series’ product range vs all other manufactured products.
A3 Manufacturing Waste	To calculate manufacturing waste, outgoing waste was measured. From this, it was assumed there was 1.85% manufacturing waste across all manipulated raw materials.
A4 Transport	Information on customer addresses and weight of deliveries were obtained. Customers were then grouped into regions where a default delivery route was created. Using this information, along with the number of customers/orders of each product, we were able to calculate the total distance travelled and total weight to each region.
A5 Assembly	Concrete Canvas provides customers with installation guidelines which indicates how much water is required per m2 to install each product. This was used to calculate the total water usage during installation. In addition, it was assumed all on-site water equipment was powered by fuel. Using wattage information, water output per litre, and running time of the machine, we were able to calculate the amount of fuel consumed. It was assumed that cardboard packaging materials were recycled for energy.
C1 - C4 End of Life	It was assumed all raw materials are sent to landfill after demolition due to the difficulty to separate materials.
D Beyond the System Boundaries	As it was assumed the cardboard packaging materials were recycled, we continued to make the assumption that these materials were incinerated to produce energy. Based on conversations with customers, incineration appears to be a representative assumption. Contractors on installation site are directly responsible for processing of waste from the installation site. It is assumed that contracts are in place to sort and recycle all waste for the entire project, not just this isolated product.

Scope:

	Product stage			Assembly Stage		Use stage						End of life stage				Beyond the System Boundaries		
	Raw Materials	Transport	Manufacturing, waste, & packaging	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstr./demol.	Transport	Waste Processing	Disposal	Reuse	Recovery	Recycling
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D		
Modules Declared	x	x	x	x	x	ND	ND	ND	ND	ND	ND	ND	x	x	x	x	x		
Geography	UK	UK	UK	Global	Global	-	-	-	-	-	-	-	Global	Global	Global	Global	Global		
Specific Data Used	12%			-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Variation - Products	-2.8% - 1.2%			-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Variation - Sites	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-		

Content Information:

To calculate the average, all data for all three products were collated and scaled down based on their average kg per m3 value.

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% of product	Biogenic material, kg /product or declared unit
Filler	0.416	0%	0%	0
Cement	0.247	0%	0%	0
PVC Paste	0.0238	0%	0%	0
Fabric/Geosynthetic	0.0303	0%	0%	0
Water	0.267	0%	0%	0
Screws and Pegs	0.00140	0%	0%	0
Sealant	0.0000887	0%	0%	0
Total	0.986	0%	0%	0
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, %**	**Weight biogenic carbon, kg C/kg**
Pallets	0.0159	1.61%	40%	0.00636
Strapping	0.000172	0.02%	0%	0.00
Corrugated Roll	0.000918	0.09%	47%	0.000432
Shrink Wrap and Plastic Bags	0.000725	0.07%	0%	0.00
Tubing	0.00163	0.17%	47%	0.000766
Card Tube	0.00276	0.28%	47%	0.00130
Pallet Wedges	0.00299	0.30%	47%	0.00141
Batch Roller Stacker	0.000447	0.05%	47%	0.000210
TOTAL	0.0265	2.69%	47%	0.0105

The % biogenic carbon in materials were obtained from credible sources in the references. Biogenic carbon kg = biogenic carbon % * Weight, kg. Biogenic CO2 removals and emissions from packaging at end-of-life is calculated as 0.0105x44/12=0.384 kg CO2e. Dangerous substances from the candidate list of SVHC for Authorisation are not applicable.

Results of the Environmental Indicators:

Results are presented per 1 kg of GCCM concrete roll product averaged across CCT1®, CCT2® and CCT3® products. However, the worst case (largest value for the three products) was reported for 13 indicators due to variability higher than 10% so as to not underestimate impacts. The indicators are PERE, PERM, SM, GWP-biogenic, GWP-LULUC, Human toxicity (carc.), SEQ, ODP, Particulate matter formation (human health), WDP, Material for energy recovery, Material for recycling, and exported energy (electricity and thermal). The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins, and/or risks.

EN 15804+A2 required disclaimer, the results of these impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator: ADPE-non-fossil resources, ADPF-fossil resources, Water deprivation potential (WDP), Ecotoxicity (freshwater), Human toxicity, cancer, Human tox. non-cancer, and Land use/soil quality (SQP).

As the end of life (C) modules are included in this study, it is discouraged to use the results of modules A1 – A3 without considering the results of module C.

Results Acronyms:

GWP-fossil = Global Warming Potential fossil fuels; 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; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals & metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption

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 re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water.

Ionizing radiation = EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; SQP = Land use related impacts/soil quality.

Mandatory Impact Category indicators According to EN 15804+A2:

Impact category	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP – total	kg CO2e	4.43E-01	9.17E-02	3.92E-02	1.26E-03	8.95E-03	0.00E+00	2.32E-02	-1.40E-02
GWP – fossil	kg CO2e	4.78E-01	9.16E-02	3.76E-03	1.26E-03	8.95E-03	0.00E+00	2.30E-02	-1.48E-02
GWP – biogenic	kg CO2e	-3.59E-02	1.02E-05	4.45E-02	2.33E-07	1.33E-06	0.00E+00	1.24E-04	7.94E-04
GWP – LULUC	kg CO2e	4.24E-04	4.16E-05	2.58E-06	3.16E-07	3.39E-06	0.00E+00	2.22E-05	-9.54E-07
Ozone depletion pot.	kg CFC-11e	9.24E-08	1.18E-09	9.37E-11	7.94E-11	1.24E-10	0.00E+00	2.69E-10	-7.83E-10
Acidification potential	mol H+e	1.59E-03	1.40E-03	2.43E-05	5.79E-06	2.91E-05	0.00E+00	8.27E-05	-3.06E-05
EP-freshwater	kg Pe	7.94E-05	5.15E-06	3.35E-06	7.16E-08	6.99E-07	0.00E+00	2.56E-05	-6.66E-07
EP-marine	kg Ne	3.99E-04	3.62E-04	2.35E-05	8.91E-07	9.22E-06	0.00E+00	4.49E-05	-8.06E-06
EP-terrestrial	mol Ne	4.22E-03	4.00E-03	7.73E-05	9.49E-06	1.00E-04	0.00E+00	3.54E-04	-8.23E-05
POCP (“smog”)	kg NMVOCe	1.50E-03	1.17E-03	3.13E-05	1.08E-05	3.97E-05	0.00E+00	1.25E-04	-2.75E-05
ADPE-non-fossil resources	kg Sbe	3.37E-06	1.77E-07	1.06E-08	1.03E-09	2.90E-08	0.00E+00	3.35E-08	-2.10E-08
ADPF-fossil resources	MJ	5.69E+00	1.22E+00	4.01E-02	7.85E-02	1.23E-01	0.00E+00	2.14E-01	-3.40E-01
Water deprivation potential	m3e depr.	7.76E-02	5.30E-03	1.46E-03	9.81E-05	5.38E-04	0.00E+00	7.51E-03	-2.03E-03

Additional Voluntary Impact Category Indicators (EN15804+A1):

Impact category	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Particulate matter	Incidence	1.88E-08	6.60E-09	1.48E-09	5.13E-11	6.30E-10	0.00E+00	1.55E-08	-1.26E-10
Ionizing radiation	kBq U235e	2.77E-02	8.58E-04	1.33E-04	1.70E-05	1.03E-04	0.00E+00	1.95E-04	-9.47E-03
Ecotoxicity (freshwater)	CTUe	1.96E+00	2.59E-01	1.34E-01	5.25E-03	3.31E-02	0.00E+00	4.94E-01	-1.55E-02
Human toxicity, cancer	CTUh	1.31E-09	3.76E-10	1.11E-10	5.45E-12	4.10E-11	0.00E+00	3.72E-09	-1.72E-11
Human tox. non-cancer	CTUh	3.83E-09	5.98E-10	2.34E-09	6.60E-12	7.42E-11	0.00E+00	3.87E-10	-3.91E-11
Land use/soil quality (SQP)	-	5.20E+00	7.32E-01	2.40E-02	5.13E-03	6.49E-02	0.00E+00	3.75E-01	-1.60E-02

Resource Use Indicators:

Option A from PCR 2019:14 was used to separate the use of primary energy into energy used as raw material and energy used as energy carrier. The energy used as raw material is declared as an input in A1-A3 and as an equally large output that exits the product system in A5 (for packaging) and C3 and C4 for product content. The packaging was considered when calculating the LCI-related indicators.

Impact category	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	4.29E-01	1.31E-02	0.00E+00	2.16E-04	1.70E-03	0.00E+00	3.29E-03	-2.16E-01
PERM	MJ	3.01E-01	0.00E+00	2.22E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	7.31E-01	1.31E-02	2.22E-01	2.16E-04	1.70E-03	0.00E+00	3.29E-03	-2.16E-01
PENRE	MJ	4.40E+00	1.22E+00	0.00E+00	1.43E-02	1.23E-01	0.00E+00	0.00E+00	-1.23E+00
PENRM	MJ	1.29E+00	0.00E+00	5.90E-02	6.42E-02	0.00E+00	0.00E+00	1.09E+00	0.00E+00
PENRT	MJ	5.69E+00	1.22E+00	5.90E-02	7.85E-02	1.23E-01	0.00E+00	1.09E+00	-1.23E+00
Secondary materials	kg	7.36E-03	6.97E-04	5.94E-04	7.10E-06	5.50E-05	0.00E+00	3.63E-02	3.12E-04
Renew. secondary fuels	MJ	6.14E-03	4.35E-06	5.13E-07	4.87E-08	6.30E-07	0.00E+00	1.95E-06	-4.39E-08
Non-ren. secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m3	2.27E-03	1.36E-04	2.57E-04	2.14E-06	1.52E-05	0.00E+00	2.17E-05	-5.08E-05

Waste Indicators:

Impact category	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	2.04E-02	1.89E-03	7.81E-04	3.05E-05	2.13E-04	0.00E+00	2.49E-01	-2.97E-04
Non-hazardous waste	kg	2.33E+00	3.15E-02	8.26E-02	4.55E-04	4.10E-03	0.00E+00	3.02E-01	-2.68E-03
Radioactive waste	kg	4.91E-06	1.48E-07	2.22E-08	2.75E-09	1.76E-08	0.00E+00	3.42E-08	-1.65E-06

Output Flow Indicators:

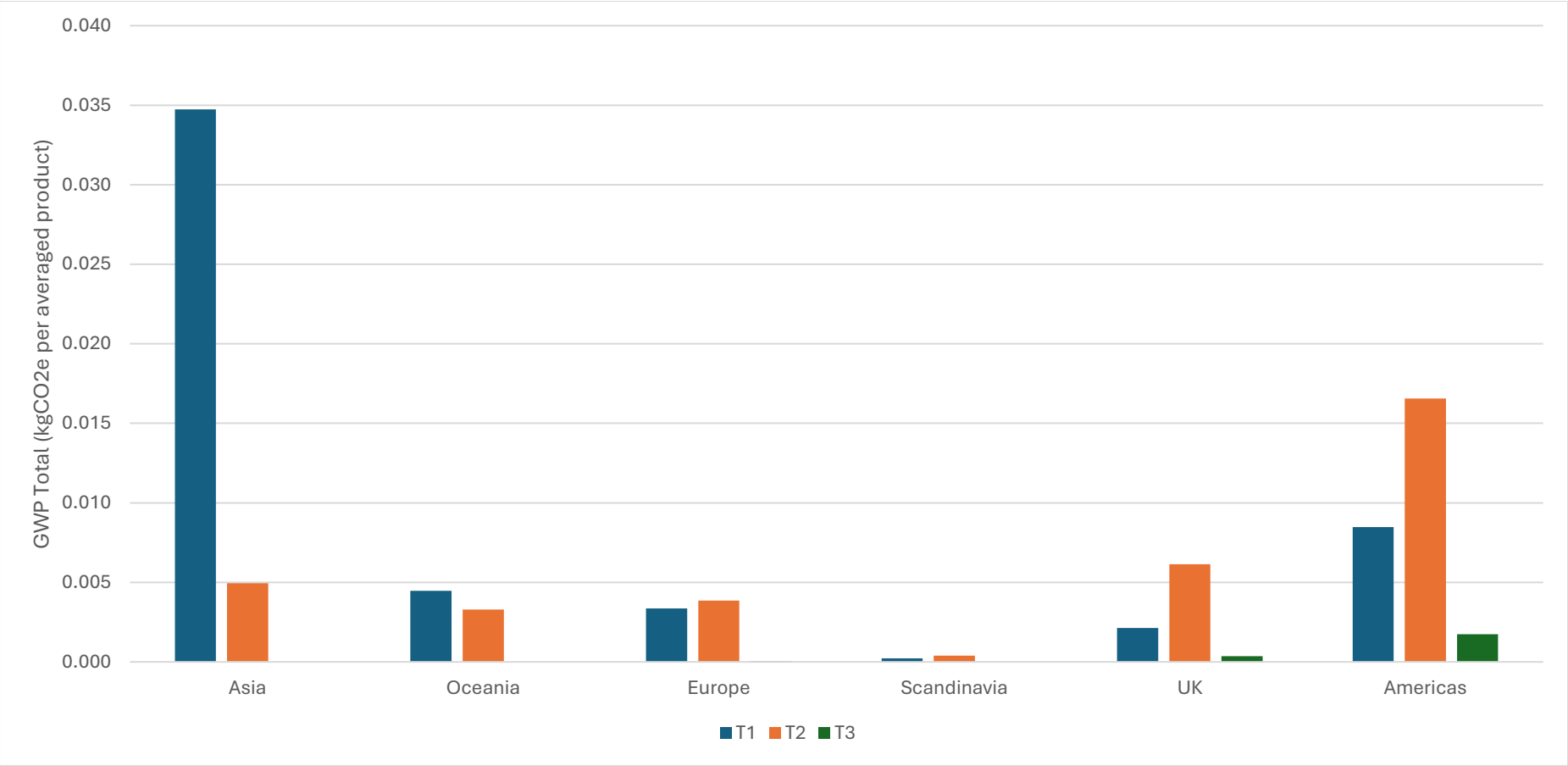
Impact category	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	1.03E-03	5.30E-05	1.53E-06	1.37E-07	9.45E-07	0.00E+00	1.59E-06	-5.73E-06
Materials for energy rec	kg	1.67E-06	3.83E-08	3.94E-09	5.77E-10	1.02E-08	0.00E+00	1.05E-08	-2.34E-09
Exported electrical energy	MJ	1.01E-02	9.38E-05	1.15E-03	1.16E-06	9.14E-06	0.00E+00	1.79E-05	-4.55E-03
Exported thermal energy	MJ	1.11E-03	8.36E-05	8.84E-06	5.76E-07	1.10E-05	0.00E+00	2.15E-05	1.99E-01

Other Environmental Performance Indicators:

These additional indicators are included as they are required by the standards followed. GHG-GWP is required by PCR 2019:14 and the other reported indicators are specified by ISO 21930.

Impact category	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP - GHG	kg CO2e	4.80E-01	9.08E-02	2.67E-02	1.26E-03	8.95E-03	0.00E+00	2.31E-02	-1.48E-02
Ozone depletion Pot.	kg CFC-11e	9.24E-08	1.18E-09	9.37E-11	7.94E-11	1.24E-10	0.00E+00	2.69E-10	-7.83E-10
Acidification Potential	kg SO2e	1.41E-03	1.20E-03	2.22E-05	4.74E-06	2.58E-05	0.00E+00	7.97E-04	-2.62E-05
Eutrophication	kg PO43e	1.71E-03	1.59E-04	1.35E-04	8.48E-07	7.89E-06	0.00E+00	2.95E-04	-2.87E-06
POCP (“smog”)	kg ethylene-Eq	9.71E-05	6.01E-05	7.45E-06	5.52E-07	1.97E-06	0.00E+00	1.08E-05	-1.84E-06
ADP-elements	kg Sbe	3.83E-09	5.98E-10	2.34E-09	6.60E-12	7.42E-11	0.00E+00	3.87E-10	-3.91E-11
ADP-fossil	MJ	5.69E+00	1.22E+00	4.01E-02	7.85E-02	1.23E-01	0.00E+00	2.14E-01	-3.40E-01

Customer Deliveries:

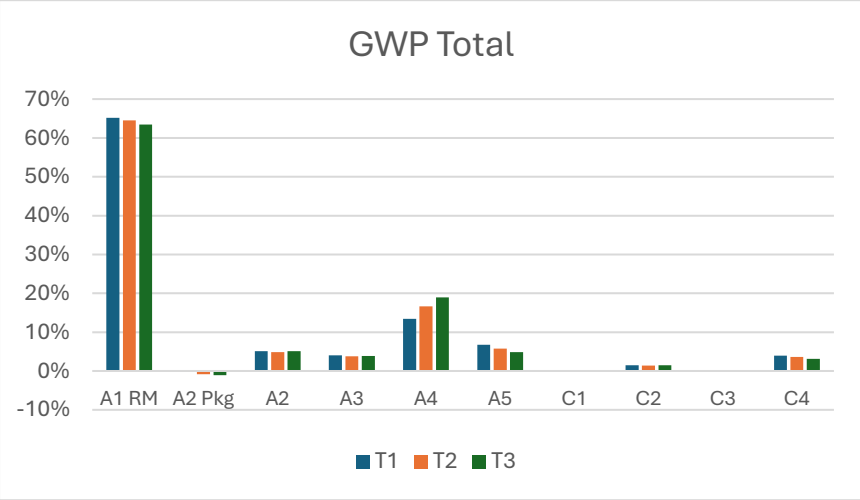


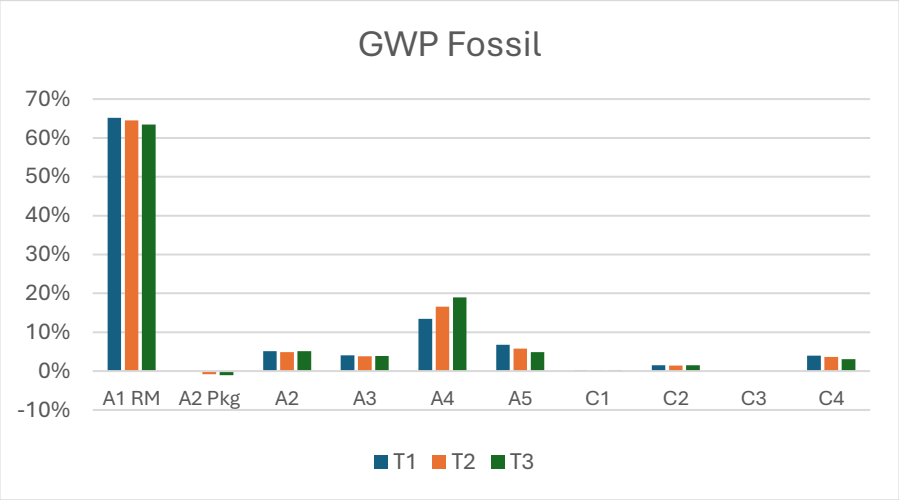
The chart above conveys the A4 GWP Total split between different regions for each product. This demonstrates that CCT1® deliveries to Asia are responsible for 38% of total A4 emissions with CCT1®, CCT2® and CCT3® products to Scandinavia responsible for <1% of total A4 emissions. Meanwhile, CCT3® is mainly delivered to the Americas and accounts for <2% of total A4 emissions.

Dominance Analysis:

The below table demonstrates a dominance analysis for the impact categories GWP Total and GWP Fossil. This highlights that approximately two thirds of the impact lies within the raw materials with no more than 5% being the result of packaging for each product. Customer transportation then sees the next highest impact with it being responsible for between 14% and 19% for each product's impact.

Product	Unit	Unit	A1 RM	A2 Pkg	A2	A3	A4	A5	C1	C2	C3	C4	Total
CCT1®	GWP Total - kgCO2e	KgCo2e	65%	0%	5%	4%	13%	7%	0%	2%	0%	4%	100%
CCT2®		KgCo2e	64%	-1%	5%	4%	17%	6%	0%	1%	0%	4%	100%
CCT3®		KgCo2e	63%	-1%	5%	4%	19%	5%	0%	1%	0%	3%	100%
CCT1®	GWP Fossil - kgCO2e	KgCo2e	66%	5%	5%	4%	14%	1%	0%	2%	0%	4%	100%
CCT2®		KgCo2e	65%	3%	5%	4%	17%	0%	0%	1%	0%	4%	100%
CCT3®		KgCo2e	64%	2%	5%	4%	19%	0%	0%	2%	0%	3%	100%





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