

# Environmental Product Declaration






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## HRB Handrails

ENVIRONMENTAL PRODUCT DECLARATION

HRB Handrails

Program Operator	NSF Certification LLC 789 N. Dixboro, Ann Arbor, MI 48105 www.nsf.org	
General Program instructions and Version Number	NSF Program Operator Rules, NSF International. February 23, 2015	
Manufacturer Name and Address	Construction Specialties Inc. 375-399 S Broad St, Hughesville, PA 17737	
Declaration Number	EPD10471	
Declared Product and Functional Unit	HRB Handrails Functional Unit: 1 linear meter of installed wall protection product for 75 years	
Reference PCR and Version Number	Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Version 3.2, 2018 Part B: Wall and Door Protection EPD Requirements, Version 1.0, 2019	
Product's intended Application and Use	Providing protection for vertical surfaces of wall or door	
Product RSL	15 years	
Markets of Applicability	North America	
Date of Issue	November 11 <sup>th</sup> , 2020	
Period of Validity	5 years from date of issue	
EPD Type	Product Specific	
Range of Dataset Variability	N/A	
EPD Scope	Cradle-to-Grave	
Year of reported manufacturer primary data	2017	
LCA Software and Version Number	GaBi 8.7.0.18	
LCI Database and Version Number	GaBi Database Version 8.7, Service Pack 35	
LCIA Methodology and Version Number	TRACI 2.1 CML 2001-Jan 2016	
The sub-category PCR review was conducted by:	Dr. Lindita Bushi – Athena Sustainable Materials Institute Lise Lauren – EarthShift Global Jim Mellentine – Ramboll Environment	
This declaration was independently verified in accordance with ISO 14025: 2006. The UL Environment "Part A: Life Cycle Assessment Calculation Rules and Report Requirements" v3.2 (December 2018), based on CEN Norm EN 15804 (2012) and ISO 21930:2017, serves as the core PCR, with additional considerations from the USGBC/UL Environment Part A Enhancement (2017) <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	Jenny Oorbeck joorbeck@nsf.org	
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Kai Wang, LCACP WAP Sustainability Consulting	
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Jack Geibig – EcoForm jgeibig@ecoform.com	
<p>Limitations: Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of Products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR. Full conformance with the PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared. Additional information on this LCA can be obtained by contacting the manufacturer at <a href="http://www.c-sgroup.com">www.c-sgroup.com</a></p>		

## Company

Founded in 1948, Construction Specialties (CS) is a family-owned, building products manufacturer that provides solutions to challenges architects, designers, contractors, building owners, and facility managers face every day. Since inventing the first extruded louver, Construction Specialties has become a global leader in Acrovyn® interior wall protection, impact-resistant doors and frames, entrance flooring including Gridline®, expansion joint covers, architectural louvers and grilles, sun controls, explosion and pressure relief vents and cubicle curtains and tracks. CS draws upon extensive expertise to provide high-quality products – many of which are a part of the Cradle to Cradle Certified™ Products Program. For details on this program and to find out which CS products are certified, please go to [c-sgroup.com](http://c-sgroup.com).

## Product Description

This EPD represents Construction Specialties’ full offering of HRB Handrails. The HRB handrail is a durable and simple profile designed to meet both functional and aesthetic requirements. Available in solid colors and woodgrain patterns, this handrail features Quick Lock brackets for fast installation. This model also includes options for ligature resistant applications as well as high load requirements.

HRB Handrails are categorized under Construction Specification Institute (CSI) Masterformat codes 10 26 00 and 10 26 16.

*Table 1: Product names and masses per functional unit*

Representative Product	Mass Per Functional Unit (m)	CS products represented by this EPD
HRB-4CN	11.83 kg/m	HRB-4CN; HRB-35N; HRB-4CCMHLN; HRB-35CMN; HRB-4CMN;HRB-4CHLN
The representative was chosen because it is the highest volume seller in this product category.		

## Application

Handrail products are typically used in indoor commercial buildings. They can be installed on various types of walls and provide both decorative and protective functions.

## Declaration of Methodological Framework

This LCA is a cradle-to-grave study, as represented by the flow diagram below. A summary of the life cycle stages can be found in Table 6. The reference service life (RSL) is outlined in the Reference Service Life & Estimated Building Service section of this EPD. The cut-off criteria are described in Cut-off Rules, and the allocation procedures are described in the Allocation section. No known flows are deliberately excluded from this EPD. Third party verified ISO 14040/44 secondary LCI data sets contribute more than 67% of total impacts in all impact categories required by the PCR.

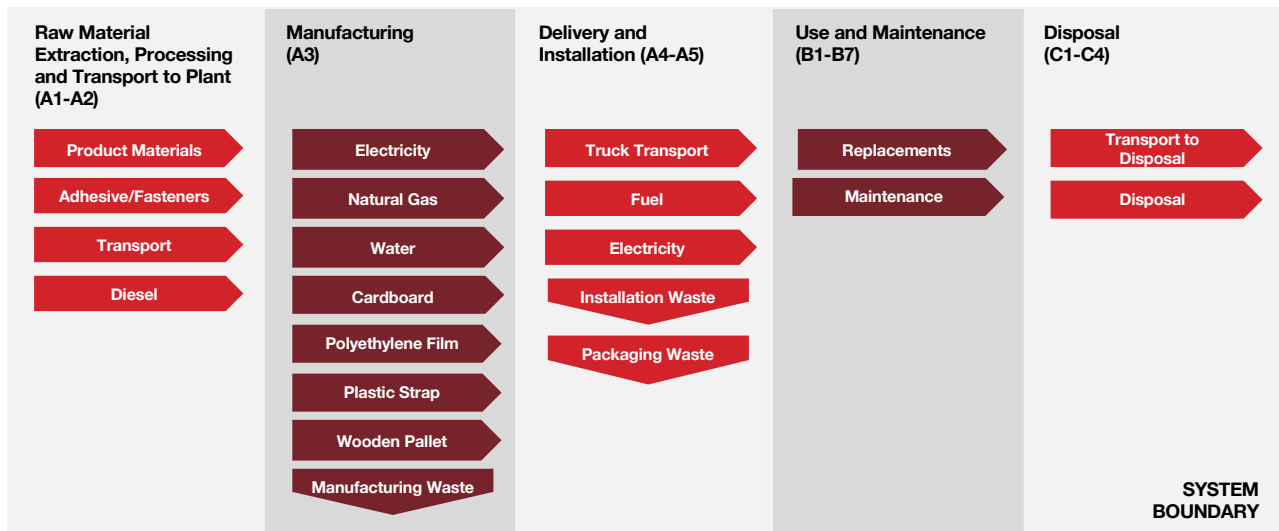


Figure 1: Flow Diagram

## Technical Requirements

The following technical data describe the product undergoing the life cycle assessment.

Table 2: Technical Details

Specification Characteristic	Test Method	Test Result*
Fire Performance	ASTM E84	Acrovyn Part: Flame Spread: 25 Smoke Developed: 450
Chemical and Stain Resistance -	ASTM D-543	Conducted
Bacterial Resistance -	ASTM G-22	Conducted
Fungal Resistance -	ASTM GG-21	Conducted
Impact Strength [inch] -	ASTM F476-84	19"
Taber Abrasion [cycle] -	ASTM D 4060-07	16,000-18,000
*Test results are available at <a href="https://www.c-sgroup.com/">https://www.c-sgroup.com/</a>		

## Properties of Declared Product as Delivered

HRB handrails delivered in lengths specified by the buyer and/or cut to size in the field.

## Material Composition

Table 3: Material Composition

Material	Mass %
Acrovyn*	37.43%
Aluminum	57.79%
Steel	4.78%
* Acrovyn is a formulated material proprietary to Construction Specialties. The LCA model for this EPD accounted for CS's proprietary formulation and included standard raw materials and optional pigments.	

This product does not contain substances that are required to be disclosed per relevant regulations.



## Manufacturing

The raw materials for the product were obtained from various parts of the USA. Some components are supplied pre-fabricated by the suppliers. Such components include the irregular shaped aluminum profile, splice, brackets, and end caps used on HRB handrails. All components that are not pre-fabricated, including Acrovyn profiles, are extruded or shaped in Muncy and Hughesville, PA facilities. Acrovyn compound is first fed to extruders to produce Acrovyn sheets. Acrovyn sheets are pressed for texture, cut and heat-bended to form the Acrovyn handrail cover for HRB handrails. The Acrovyn handrail cover is then cut to size and assembled with the pre-fabricated components with fasteners or adhesives to form the product and packaged for delivery.

## Environment & Health During Manufacturing

During the manufacturing of the products covered in the EPD, all legal regulations regarding emissions to air, wastewater discharge, solid waste disposal and noise emissions are followed.

## Packaging

Depending on the quantity and size dimensions, handrails are delivered in packaging of different sizes. The average packaging utilized in the shipment of the product is provided in Table 4.

Table 4: Packaging

Material	Amount (kg)
LLPDE	1.86E-04
Cardboard	1.21E-01
LDPE	3.00E-02
Wood	1.55E-02

## Transportation

It is assumed that all the raw materials sourced from the US are distributed by truck. An ingredient-weighted average distance using the locations of suppliers and the manufacturing facilities was calculated and used in the model.

An average shipping distance of 1,529 km from the manufacturing facility to the customer was utilized and was calculated from sales records. The transportation distance for all waste flows is assumed to be 161 km based on a conservative assumption.

## Product Installation

Detailed installation instructions are provided online at [c-sgroup.com](http://c-sgroup.com). Installation equipment such as drills and saws common to construction work are required though not included in the study as these are multi-use tools and the impacts-per-functional unit is considered negligible. All waste generated during installation, including packaging waste, is disposed as per PCR Part A Section 2.8.5. Details are provided in Table 9.

## Environment & Health During Installation

All recommended personal protective equipment (PPE) should be utilized during installation, as indicated on the SDS found online.

## Use

The assumptions required to model the maintenance phase are detailed in PCR Part B Section 3.3. These assumptions are listed in the table below.

*Table 5: Production Cleaning Assumptions*

Parameter	Input Per Square Meter	Unit
Cleaning Per Week	1	#
Cleaning Per 75 Years	3900	#
Water Usage Per Week	3.44E-02	Liter
Hydrochloric Acid (32%) Usage Per Week	1.56E-02	kg
Water Usage Per 75 Years	1.34E+02	Liter
Hydrochloric Acid (32%) Usage Per 75 Years	6.09E+01	kg

## Reference Service Life & Estimated Building Service

The reference service life for the product is 15 years, as required by PCR Part B Section 2.13. For a building's estimated service life of 75 years, there will be four replacements needed after initial installation.

## Re-use Phase & Disposal

Handrails may be recyclable if local recycling facilities are available and may be incinerated for energy recovery if local facilities are available. Re-use after service is not recommended. End-of-life LCA modeling is based on the requirements of PCR Part A. Section 2.8.5.

## LCA CALCULATION RULES

### Functional Unit

The functional unit of the wall surface protection product is 1 linear meter of product over a building's estimated service life of 75 years.

### System Boundary

The type of EPD is cradle-to-grave. All relevant LCA modules are included and are summarized in Table 6.

Table 6: System Boundary

Module Name	Description	Analysis Period	Summary of Included Elements
A1	Product Stage: Raw Material Supply	2017	Raw Material sourcing and processing as defined by secondary data.
A2	Product Stage: Transport	2017	Shipping from supplier to manufacturing site. Fuel use requirements estimated based on product weights and estimated distance.
A3	Product Stage: Manufacturing	2017	Energy, water and material inputs required for manufacturing products from raw materials. Packaging materials and manufacturing waste are included as well.
A4	Construction Process Stage: Transport	2017	Shipping from manufacturing site to project site. Fuel use requirements estimated based on product weights and mapped distance.
A5	Construction Process Stage: Installation	2017	Installation waste and packaging material waste. As per Part A Section 2.8.4.2, the product is sold as a system and the impacts from the production of installation material is declared in A1-A3.
B1	Use Stage: Use	2017	The use of the product does not involve any consumption of energy and resources
B2	Use Stage: Maintenance	2017	Cleaning energy, water, and materials, including refinishing the product.
B3	Use Stage: Repair	2017	Materials provided to repair the product.
B4	Use Stage: Replacement	2017	Total materials and energy required to manufacture a replacement.
B5	Use Stage: Refurbishment	2017	Materials and energy required to refurbish the product. The product does not require refurbishment once installed.
B6	Operational Energy Use	2017	The product does not impact the operational energy use of the building.
B7	Operational Water Use	2017	The product does not impact the operational energy use of the building.
C1	EOL: Deconstruction	2017	No inputs required for deconstruction.
C2	EOL: Transport	2017	Shipping from project site to landfill. Fuel use requirements estimated based on product weight and mapped distance.
C3	EOL: Waste Processing	2017	Waste processing not required. All waste can be processed as is.
C4	EOL: Disposal	2017	The disposal process of the product varies with the material type as per Part A Section 2.8.5. The impacts from landfilling are modeled based on secondary data.
D	Benefits beyond system	MND	Credits from energy or material capture. This module is not considered.



## Estimates & Assumptions

All estimates and assumptions are within the requirements of ISO 14040/44 and PCR Part A & B. The majority of the estimations are within the primary data. The primary data was collected as annual totals including all utility usage and production information. For the LCA, the consumption information was divided by the production to create an energy and water use-per-kilogram. The manufacturing waste generation quantity was estimated based on the manufacturer's process improvement project. Another assumption is that the installation tools are used enough times that the per square meter impacts are negligible, while the electricity to power the tools is included.

## Cut-off Rules

All inputs in which data were available were included. No known flows are deliberately excluded from this EPD.

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

The list of excluded materials and energy inputs include:

- The colorants used in Acrovyn (0%-0.45%).

## Data Sources

Primary data were collected by facility personnel and was used for all manufacturing processes. Whenever available, supplier data was used for raw materials used in the production process. When primary data did not exist, secondary data for raw material production was utilized from GaBi Database Version 8.7, Service Pack 35.

## Data Quality

The geographical scope of the manufacturing portion of the life cycle is Muncy and Hughesville PA. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered excellent. The primary data provided by the manufacturer represent all information for calendar year 2017. Using this data meets the PCR requirements. Time coverage of this data is considered very good. Primary data provided by the manufacturer is specific to the technology that Construction Specialties uses in manufacturing their products. It is site- specific and considered of good quality. It is worth noting that the energy and water used in manufacturing the products includes overhead energy such as lighting, heating and sanitary use of water. Sub-metering would improve the technological coverage of data quality. Data necessary to model cradle-to-gate unit processes was sourced from GaBi LCI datasets. Improved life cycle data from suppliers would improve technological coverage.

## Period Under Review

The period under review is calendar year 2017.

## Allocation

General principles of allocation were based on ISO 14040/44. Where possible, allocation was avoided. When allocation was necessary it was done on a physical mass basis. In the study, the annual facility-level electricity, water, and natural gas usages were allocated to products based on the mass of the annual production. Allocation was most prevalent in the secondary GaBi datasets used to represent upstream processes. As a default, GaBi datasets use a physical mass basis for allocation.

Table 7: Description of the system boundary modules included in the LCA

	PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE						END-OF-LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY		
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
	Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential	
Cradle to Grave	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND

An X in the table above signifies that a module was included in the life cycle assessment. MND stands for Module Not Declared and signifies that a life cycle stage was not evaluated in the life cycle assessment.

## LCA SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

Table 8: Transport to the building site (A4) per linear meter

Parameter	Value	Unit
Fuel Type	Diesel	-
Liters of fuel	38.81	l/100km
Vehicle Type	Truck – Trailer, basic enclosed/ 45,000 lb. payload	-
Transport distance	1529.04	km
Capacity utilization	78	%
Weight of products transported	2.53	kg
Capacity utilization volume factor	1	-

Table 9: Installation into the building (A5) per linear meter

Parameter	Value	Unit
Ancillary Materials*	N/A*	kg
Electricity consumption	6.00E-02	kWh
Waste materials at the construction site before waste processing, generated by product installation	1.67E-01	kg
Plastic Recycling (15%)	4.53E-03	kg
Plastic Landfilling (68%)	2.05E-02	kg
Plastic Incineration (17%)	5.13E-03	kg
Total Plastic Packaging Waste	3.02E-02	kg
Pulp and Wood Recycling (75%)	1.02E-01	kg
Pulp and Wood Landfilling (20%)	2.73E-02	kg
Pulp and Wood Incineration (5%)	6.83E-03	kg
Total Pulp Packaging Waste	1.37E-01	kg
Biogenic carbon contained in packaging	5.02E-01	kg CO <sub>2</sub>
VOC emissions	<500	µg/m <sup>3</sup>

\*The manufacturing of fasteners has been accounted in Stage A1-A3

Table 10: Reference Service Life (RSL)

Parameter	Value	Unit
RSL	15	Years
Declared product properties and finishes, etc	See Table 2	Units as appropriate
Design application parameters	Installation as per recommendation by manufacturer	Units as appropriate
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Accepted industry standard	Units as appropriate
Indoor environment	Normal building operating conditions	Units as appropriate
Use conditions	No special use conditions required	Units as appropriate
Maintenance	See Table 5 and Table 11	Units as appropriate

Table 11: Maintenance (B2) - Per Estimated Service Life (ESL) of the building (75 years)

Parameter	Value	Unit
Maintenance process information	PCR Part B Prescribed	-
Maintenance cycle	780	Cycles/ RSL
Maintenance cycle	3900	Cycles/ ESL
Net freshwater consumption specified by water source and fate	1.34E-01	m <sup>3</sup>
Hydrochloric Acid (32%)	6.09E+01	kg
Direct emissions to ambient air (Hydrochloric Acid Evaporation)	19.49	kg

Table 12: Repair (B3) - Per Estimated Service Life (ESL) of the building (75 years)

Parameter	Value	Unit
Repair process information	Use Fil-Stik to patch the dent. Use Pro-Mark II for stain restoration.	-
Repair cycle	Contingent	cycles/RSL
Repair cycle	Contingent	cycles/ESL
Ancillary materials	3.57E-01	kg
Direct emission to ambient air, soil and water	<1.22E-01*	kg
Further assumptions for scenario development	It is assumed the supplied repairing kit is used up during the life of the product.	
*Calculated based on SDS		

Table 13: Replacement (B4) - Per Estimated Service Life (ESL) of the building (75 years)

Parameter	Value	Unit
Reference Service Life	15	Years
Replacement cycle	4	(ESL/RSL)-1
Energy input, specified by activity, type and amount	2.40E-01	kWh

Table 14: End-of-life (C1-C4)

Parameter	Value	Unit
Assumptions for scenario development	PCR Part A Prescribed	
Collected as mixed construction waste	2.37E+00	kg
Non-metal Landfilling (100%)	8.86E-01	kg
Metal Waste Recycling (85%)	1.26E+00	kg
Metal Waste Landfilling (15%)	2.22E-01	kg
Removals of biogenic carbon (excluding packaging)	3.06E-01	kg CO <sub>2</sub>

Per the PCR requirements, modules B1, B5, B6, and B7 shall be reported as “0” impact. As such, the scenario tables for these modules are excluded from this EPD.

## LCA Results

All results are given per functional unit, which is 1 linear meter of installed product over an estimated building life of 75 years. Environmental Impacts were calculated using the GaBi software platform. Impact results have been calculated using both TRACI 2.1 and CML 2001-Jan 2016 characterization factors. LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Table 15: Key of Acronyms Used in the Results Tables

LCIA Indicators			
ADPe	Abiotic depletion potential for non-fossil resources	GWP	Global warming potential (including biogenic carbon)
ADPf	Abiotic depletion potential for fossil resources	OPD	Depletion of stratospheric ozone layer
AP	Acidification potential of soil and water	POCP	Photochemical ozone creation potential
EP	Eutrophication potential	Resources	Depletion of non-renewable fossil fuels
These impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development, however the EPD users shall not use additional measures for comparative purposes.			
LCI Indicators			
RPR <sub>E</sub>	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	RE	Recovered energy
RPR <sub>M</sub>	Use of renewable primary energy resources used as raw materials	SM	Use of secondary materials
RPR <sub>T</sub>	Total use of renewable primary energy resources	RSF	Use of renewable secondary fuels
NRPR <sub>E</sub>	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	NRSF	Use of non-renewable secondary fuels
NRPR <sub>M</sub>	Use of non-renewable primary energy resources used as raw materials	FW	Net use of fresh water
NRPR <sub>T</sub>	Total use of non-renewable primary energy resources	MR	Materials for recycling
HWD	Disposed-of-hazardous waste	MER	Materials for energy recovery
NHWD	Disposed-of non-hazardous waste	EE	Exported energy
HLRW	High-level radioactive waste, conditioned, to final repository	CRU	Components for reuse
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository		
Carbon Emissions and Removals			
BCRP	Biogenic Carbon Removal from Product	BCEW	Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes
BCEP	Biogenic Carbon Emission from Product	CCE	Calcination Carbon Emissions
BCRK	Biogenic Carbon Removal from Packaging	CCR	Carbonation Carbon Removals
BCEK	Biogenic Carbon Emission from Packaging	CWNR	Carbon Emissions from Combustion of Waste from Non- Renewable Sources used in Production Processes

## HRB Handrails

The results are provided based on a functional unit of 1 linear meter of installed product over an estimated building service life of 75 years and are given for the representative product HRB-4CN, with the lowest impact product being HRB-35N and the highest impact product being HRB-4CCMHLN.

Table 16: LCIA Impacts

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	Total	Low	High
CML Results																	
ADPe [kg Sb eq]	3.18E-05	5.50E-08	7.17E-09	0.00E+00	2.63E-04	5.28E-07	1.28E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.41E-09	0.00E+00	2.01E-08	4.23E-04	4.78E-04	7.10E-04
ADPf [MJ]	1.95E+02	4.07E+00	3.72E-01	0.00E+00	3.47E+02	2.07E+01	8.01E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.01E-01	0.00E+00	7.58E-01	1.37E+03	1.02E+03	2.24E+03
AP [kg SO2 eq]	8.02E-02	1.09E-03	1.72E-04	0.00E+00	4.76E-02	1.18E-03	3.27E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.69E-05	0.00E+00	2.06E-04	4.58E-01	3.44E-01	9.56E-01
EP [kg Phosphate eq]	5.36E-03	3.01E-04	6.14E-05	0.00E+00	8.65E-03	2.57E-04	2.31E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E-05	0.00E+00	3.10E-05	3.78E-02	2.95E-02	6.87E-02
GWP [kg CO2 eq]*	1.54E+01	2.90E-01	8.83E-02	0.00E+00	2.50E+01	6.44E-01	6.35E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.84E-02	0.00E+00	4.89E-02	1.05E+02	8.24E+01	1.83E+02
ODP [kg CFC 11 eq]	4.19E-11	2.74E-17	9.29E-17	0.00E+00	6.83E-13	1.03E-14	1.68E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.69E-18	0.00E+00	1.78E-16	2.11E-10	1.94E-09	2.75E-09
POCP [kg Ethene eq]	4.29E-03	-4.13E-04	2.97E-05	0.00E+00	4.17E-03	1.91E-04	1.56E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.28E-05	0.00E+00	1.76E-05	2.39E-02	1.89E-02	4.78E-02
TRACI 2.1 Results																	
AP [kg SO2 eq]	7.70E-02	1.49E-03	2.64E-04	0.00E+00	5.59E-02	1.32E-03	3.16E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.96E-05	0.00E+00	2.33E-04	4.52E-01	3.43E-01	9.30E-01
EP [kg N eq]	2.26E-03	1.21E-04	5.03E-05	0.00E+00	6.73E-03	1.43E-04	9.82E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.29E-06	0.00E+00	1.52E-05	1.91E-02	1.56E-02	3.21E-02
GWP [kg CO2 eq]*	1.54E+01	2.89E-01	8.51E-02	0.00E+00	2.49E+01	6.34E-01	6.34E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.83E-02	0.00E+00	4.86E-02	1.05E+02	8.23E+01	1.83E+02
ODP [kg CFC 11 eq]	4.21E-11	2.74E-17	9.33E-17	0.00E+00	6.86E-13	1.03E-14	1.68E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.70E-18	0.00E+00	1.78E-16	2.11E-10	1.94E-09	2.75E-09
Resources [MJ]	2.03E+01	5.45E-01	3.16E-02	0.00E+00	3.18E+01	2.90E+00	8.40E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.36E-02	0.00E+00	9.76E-02	1.40E+02	9.93E+01	2.20E+02
POCP [kg O3 eq]	8.25E-01	3.39E-02	1.38E-03	0.00E+00	1.11E+00	2.43E-02	3.47E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.01E-03	0.00E+00	4.47E-03	5.47E+00	4.24E+00	1.03E+01
The products within this product group have varying impacts depending on the exact material composition and product features. Because of that, the highest and lowest impact products have results shown in the tables above indicating the range of impacts found in this category.																	
* As required by the Product Category Rules, the GWP value includes biogenic carbon.																	

Table 17: Carbon Removals and Emissions

Impact	Value	Impact	Value	Impact	Value	Impact	Value
<b>BCRP [kg CO<sub>2</sub>]</b>	3.06E-01	<b>BCRK [kg CO<sub>2</sub>]</b>	5.02E-01	<b>BCEW [kg CO<sub>2</sub>]</b>	0.00E+00	<b>CCR [kg CO<sub>2</sub>]</b>	0.00E+00
<b>BCEP [kg CO<sub>2</sub>]</b>	2.02E-01	<b>BCEK [kg CO<sub>2</sub>]</b>	2.25E-01	<b>CCE [kg CO<sub>2</sub>]</b>	0.00E+00	<b>CWNR [kg CO<sub>2</sub>]</b>	0.00E+00



The results are provided based on a functional unit of 1 linear meter of installed product over an estimated building service life of 75 years and are given for the representative product HRB-4CN, with the lowest impact product being HRB-35N and the highest impact product being HRB-4CCMHLN.

Table 18: Resource Use and Waste Outputs

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	Total	Low	High
Resource Use																	
RPRE [MJ]	5.38E+01	1.27E-01	5.92E-02	0.00E+00	1.14E+02	3.09E-01	2.16E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E-02	0.00E+00	5.93E-02	3.84E+02	3.09E+02	7.11E+02
RPRM [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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RPRT [MJ]	5.38E+01	1.27E-01	5.92E-02	0.00E+00	1.14E+02	3.09E-01	2.16E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E-02	0.00E+00	5.93E-02	3.84E+02	3.09E+02	7.11E+02
NRPRE [MJ]	2.07E+02	4.10E+00	4.62E-01	0.00E+00	3.98E+02	2.10E+01	8.52E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.03E-01	0.00E+00	7.77E-01	1.48E+03	1.11E+03	2.42E+03
NRPRM [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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPRT [MJ]	2.07E+02	4.10E+00	4.62E-01	0.00E+00	3.98E+02	2.10E+01	8.52E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.03E-01	0.00E+00	7.77E-01	1.48E+03	1.11E+03	2.42E+03
SM [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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m3]	2.23E-01	4.88E-04	1.93E-04	0.00E+00	2.65E-01	2.26E-03	8.93E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.80E-05	0.00E+00	8.94E-05	1.38E+00	1.05E+00	2.69E+00
Waste Outputs																	
HWD [kg]	1.08E-03	3.32E-08	5.67E-10	0.00E+00	1.11E-06	2.18E-05	4.32E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.27E-09	0.00E+00	2.72E-09	5.42E-03	3.94E-03	1.22E-02
NHWD [kg]	2.79E+00	1.54E-04	5.09E-02	0.00E+00	5.03E-01	9.29E-03	1.58E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-05	0.00E+00	1.11E+00	2.03E+01	1.36E+01	3.96E+01
HLRW [kg]	6.22E-06	1.09E-08	4.20E-08	0.00E+00	2.60E-05	1.10E-07	2.51E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-09	0.00E+00	9.45E-09	5.75E-05	4.75E-05	8.87E-05
ILLRW [kg]	5.00E-03	9.07E-06	3.51E-05	0.00E+00	2.01E-02	8.90E-05	2.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.92E-07	0.00E+00	7.52E-06	4.54E-02	3.74E-02	7.06E-02
CRU [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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR [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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER [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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE [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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

The products within this product group have varying impacts depending on the exact material composition and product features. Because of that, the highest and lowest impact products have results shown in the tables above indicating the range of impacts found in this category.

## LCA Interpretation

From the perspective of the service life of a whole building, the two stages with the most prominent impacts are the maintenance stage (B2) from cleaning (24% of GWP, 10% of AP, and >17% in all other LCI and LCIA impacts except ODP) and the replacement stage (B4) (61% of GWP, 30% to ADPe, and >51% in all other impacts). Though the cleaning assumptions prescribed by the PCR may not fully reflect real world practice, the results suggest that the cumulative impacts from cleaning the product over the lifetime of a building are significant. With regard to the reported impacts in the replacement stage, these values will change based on the length of time the customer uses the product. If the customer uses the product for more than 15 years, the impacts in B4 will go down. If the customer uses the product for less than 15 years, the impacts in B4 will go up.

## Extraordinary Effects

### Fire

The products' fire performance can be found in the technical specification found in Table 2.

### Water

Should the product become flooded, the water should be removed by means of extraction and drying and the product should behave as originally intended. There are no environmental impacts associated with the product being flooded.

### Mechanical Destruction

If the product is mechanically destroyed, it should be disposed of using standard procedures and replaced in a timely manner.

## Environmental Activities & Certifications

All general information about the environmental certifications of Construction Specialties' products can be found on Construction Specialties' Sustainability website. Product-specific environment certification information can be located at each product detail webpage under the tab "Data Sheets & Sustainability".

## References

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