



**MAGLIN™**  
Site Furniture




# Environmental Product Declaration



**Environmental Product Declaration for Lexicon Modular Benches, in various sizes and with a range of options produced by Maglin Site Furniture at their facility in Woodstock, ON, Canada.**

## ADMINISTRATIVE INFORMATION

### International Certified Environmental Product Declaration

<b>Declared Product:</b>	This Environmental Product Declaration (EPD) covers bench products produced by Maglin Site Furniture. Declared unit: 1 modular bench configuration	
<b>Declaration Owner:</b>	Maglin Site Furniture	
	3-468 Innovation Way	
	Woodstock, ON <a href="https://www.maglin.com/">https://www.maglin.com/</a>	
<b>Program Operator:</b>	Labeling Sustainability	
	11670 W Sunset Blvd	
	Los Angeles, CA 90049	
	<a href="http://www.labelingsustainability.com">www.labelingsustainability.com</a>	
<b>Product Category Rule:</b>	ISO 21930:2017 Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services and Sub Product Category Rule for Site Furnishings, CSI MasterFormat, Section 32 33 00	
	PCR Program Operator: Labeling Sustainability	
	PCR review was conducted by: Geoffrey Guest, Ph.D.	
<b>Independent LCA Reviewer and EPD Verifier:</b>	This declaration was independently verified in accordance with ISO 14025:2006.	
	Independent verification of the declaration, according to ISO 14025:2006.	
	Internal <input type="checkbox"/> ; External <input checked="" type="checkbox"/> X	
	Third Party Verifier Geoffrey Guest, Certified 3rd Party Verifier under the Labeling Sustainability Program ( <a href="http://www.labelingsustainability.com">www.labelingsustainability.com</a> ), CSA Group ( <a href="http://www.csaregistries.ca">www.csaregistries.ca</a> )	
<b>Date of Issue:</b>	14 March 2022	
<b>Period of Validity:</b>	5 years; valid until 14 March 2027	
<b>EPD Number:</b>	fb93847a-61cf-46e9-a44f-50b0c9cf5f91-2	



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## COMPANY DESCRIPTION

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In 1983 Ian McAskile was inside crafting home furnishings, and the inspiration struck to take his craft outdoors. He knew from extensive experience that the indoors shows you walls. However, the outdoors serves the wonders – and those who want to make their exterior environment stunning and sustainable deserve to work with people with the same passion. Enter Maglin (named after Ian's daughters, Maggie and Lindsay), a site furniture company made to meet the need for contemporary outdoor amenities that are aesthetically pleasing while environmentally friendly. From benches, bollards, bike racks, and receptacles to panels, planters, tables, chairs, custom projects, and more – Maglin Site Furniture strategically configures and thoughtfully customizes adaptable solutions that will enhance any area.

Maglin continues to grow both as a company – offering new and expanding product lines in response to the needs of its clients, but also as a corporate citizen – building social consciousness into its operation; from supporting a variety of charitable causes, facilitating staff dialogue about diversity issues, to reevaluating our manufacturing process to strive for increasingly environmentally kind products.

## STUDY GOAL

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The intended application of this life cycle assessment (LCA) is to comply with the procedures for creating a Type III environmental product declaration (EPD) and publish the EPD for public review on the website, [www.labelingsustainability.com](http://www.labelingsustainability.com). This level of study is per EPD Product Category Rule (PCR) for Bench published by the International Standards Organization (ISO) 14025:2006 Environmental labels and declarations, Type III environmental declarations-Principles and procedures; ISO 14044:2006 Environmental management, Life cycle assessment- Requirements and guidelines; and ISO 14040:2006 Environmental management, Life cycle assessment-Principles and framework. The performance of this study and its subsequent publishing align with the business-to-business (B2B) communication requirements for the environmental assessment of building products. The study does not intend to support comparative assertions and is designed to be disclosed to the public.

This project report was commissioned to differentiate Maglin Site Furniture from their competition for the following reasons:

- Generate an advantage for the organization.
- Offer customers information to help them make informed product decisions.
- Improve the environmental performance of Maglin Site Furniture by continuously measuring, controlling, and reducing the environmental impacts of their products.
- Help project facilitators working on Leadership in Energy and Environmental Design (LEED) projects achieve their credit goal,
- And to strengthen Maglin Site Furniture's license to operate in the community.

The intended audience for this LCA report is Maglin Site Furniture's employees, their suppliers, project specifiers of their products, architects, and engineers. The EPD report is also available for policymakers, government officials interested in sustainability, academic professors, and LCA professionals. This LCA report does not include product comparisons from other facilities.



## DESCRIPTION OF PRODUCT AND SCOPE

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Maglin modular benches come in various options and sizes to meet their customers' project needs. This makes it difficult to capture every possible bench option that could manufacture and sold by Maglin for a project. To accomplish this goal, this EPD reports using two different methods. Firstly is the average method. This method is detailed in ISO 21930:2017, Section 5.3 Average EPDs for similar products groups. Next, a representative product is chosen for a product line. All product variations plus or minus 10% are included in this average value. All benches in this EPD are modular. Secondly is the "low" and "high" option by mass weight. Finally, the range method of reporting a complete product line is different from modeling just an average product for that range with a tolerance of plus or minus 10% deviation from the average product modeled. Using the range method allows manufacturers to capture a full product line within that range and understand the impacts of their options and product series add-ons. This method is compliant with the primary PCR for this EPD, ISO 21930: 2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services, and the sub-PCR, Sub Product Category Rule for Site Furnishings, CSI MasterFormat, Section 323300. Per the sub-PCR, the following statements describe the process for determining a product range and including the products. "By performing a realistic range for modeling hundreds of combinations of a piece of furniture also allows for longevity of the EPD by keeping up with the design aesthetic and customizing furniture. For the future options to be included in this EPD, they must appear on the list of features considered when creating the low and high options. The lowest and highest option shall be reported along with an average of the two when reporting the impacts. A complete table with the product's technical attributes, as defined in the Section on the Product Description, must be listed for the base case and worst cases with a complete Bill of Materials (BOM) to .1% by weight. If the impacts from the low, high, and average differ by more than 10%, an explanation must be included as part of the reporting. Similar products that vary less than 10% between models due to finished or mounting options can be included but noted. The table below outlines each product line's high and low options and the list of included models in that range. For example, the "low" option for the modular benches includes the seat only, while the "high" option includes the seat, arms, backs, legs, and other accessories as available in the product line. The "low" and "high" options were used to cover the modular bench product lines because the difference between the lowest and highest was greater than 10%. The product ranges cover all available options from hundreds of combinations. As a result, the "high" option for the bench can have a mass weight greater than 2.5 times the "low" option when all options and accessories are included. As a study, the manufacturer felt it was essential to model the maximum seats for each line to cover every available option. The number of seats modeled is also included in the description for the reader to understand the difference between the low and high options and that the actual product specified on a project will fall in between those two values. .

The functional unit considers an entire product unit and therefore, the impacts attributed to each declared product in this EPD cannot necessarily be compared due to their differing seat capacities. In order to calculate comparable impacts, one should normalize the impacts to a per-seat basis.

Maglin standard paint colors include: Fine Textured (Preferred for all cast aluminum products)-Silver, Evergreen, Black, Gunmetal, Bronze, Slate, Titanium Gloss- Silver, Evergreen, Black, Gunmetal, Bronze, Graphite, Titanium

This LCA assumes the impacts from products manufactured in accordance with the standards outlined in this report. This LCA is a cradle-to-grave study.



## MODULAR BENCH CONFIGURATION DESIGN SUMMARY

The following tables provide a list of the modular bench configuration products considered in this EPD along with key performance parameters.

Table 1: Declared products with Modular Bench considered in this environmental product declaration.

Prod #	Unique name/ID	Short description	Product type	Unit	Density, dry kg/Unit	bio-carbon content, kg C/FU dry basis	product Group	Length (cm)	Width (cm)	Height (cm)	Diameter (cm)
9	Lexicon_Low_Metal	LEXICON BENCH, BKLS, 4FT, STRAIGHT, METAL, LEGS STYLE 1, ARMLESS, END CAPS (2 Seats)	Modular Bench	piece	46.88	0.00	Lexicon	131.45	52.52	45.72	na
10	Lexicon_High_Metal	LEXICON BENCH, 6FT, STRAIGHT, METAL, SS BACK, SQ PLANTER ENDS (3 Seats)	Modular Bench	piece	238.82	0.00	Lexicon	272.10	47.625	83.82	na
11	Lexicon_Low_Ipe	LEXICON BENCH, BKLS, 4FT, STRAIGHT, IPE, LEGS STYLE 1, END CAPS (2 Seats)	Modular Bench	piece	39.73	3.82	Lexicon	131.45	52.52	45.72	na
12	Lexicon_High_Ipe	LEXICON BENCH, 6FT, STRAIGHT, IPE, SQ PLANTER ENDS (3 Seats)	Modular Bench	piece	230.50	5.7198	Lexicon	272.100	47.625	83.82	na
13	Lexicon_Low_Thermal Ash	LEXICON BENCH, BKLS, 4FT, STRAIGHT, TMA, LEGS STYLE 1, ARMLESS,	Modular Bench	piece	38.01	2.14	Lexicon	131.450	52.52	45.72	na



		END CAPS (2 Seats)									
14	Lexicon_High_Thermal Ash	LEXICON BENCH, 6FT, STRAIGHT, TMA, SQ PLANTER ENDS (3 Seats)	Modular Bench	piece	225.46	3.20	Lexicon	272.1	47.625	83.82	na
15	Lexicon_Low_HDPE	LEXICON BENCH, BKLS, 4FT, STRAIGHT, HDPE OP, LEGS STYLE 1, ARMLESS, END CAPS (2 Seats)	Modular Bench	piece	39.40	0.00	Lexicon	131.45	52.52	45.72	na
16	Lexicon_High_HDPE	LEXICON BENCH, 6FT, STRAIGHT, HDPE OP, SQ PLANTER ENDS (3 Seats)	Modular Bench	piece	227.72	0.00	Lexicon	272.100	47.625	83.82	na
17	Lexicon_Low_HDPC	LEXICON BENCH, BKIS, 4FT, STRAIGHT, HDPC, LEGS STYLE 1, ARMLESS END CAPS (2 Seats)	Modular Bench	piece	42.08	0.00	Lexicon	131.450	52.52	45.72	na
18	Lexicon_High_HDPC	LEXICON BENCH, 6FT, STRAIGHT, HDPC, SQ PLANTER ENDS (3 Seats)	Modular Bench	piece	224.69	0.00	Lexicon	272.1	47.625	83.82	na

## A1 RAW MATERIAL RECYCLED CONTENT AND MATERIAL LOSSES

The following table provides a list of the raw material inputs (module A1) across all products considered, their recyclability content and assumed material losses.

Table 2: Module A1 raw material inputs, the recyclability content and assumed material losses (dry basis)

product.name	mix.category	primary.content	post.industrial.c content	post.consumer.c content	material.losses
<b>Metal Working, Steel</b>	metal working, average for steel product manufacturing	100%	0%	0%	0%
<b>lpe</b>	sawnwood, board, hardwood, dried (u=20%), planed	100%	0%	0%	0%



<b>HDPE</b>	polyethylene, high density, granulate	100%	0%	0%	0%
<b>Ash</b>	sawnwood, board, hardwood, dried (u=20%), planed	100%	0%	0%	0%
<b>Pallet</b>	EUR-flat pallet	50%	0%	50%	0%
<b>Plastic Packaging</b>	packaging film, low density polyethylene	100%	0%	0%	1%
<b>Steel Raw Material</b>	steel, low-alloyed	100%	0%	0%	0%
<b>Cardboard/Paper packaging</b>	corrugated board box	100%	0%	0%	1%
<b>Acrylic</b>	polyacrylamide	100%	0%	0%	0%
<b>Galvanization</b>	zinc coat, pieces	100%	0%	0%	0%
<b>Recycling, mixed</b>	container, for collection of post-consumer waste plastic for recycling	0%	0%	100%	0%
<b>Recycled HDPE</b>	waste polyethylene, for recycling, sorted	0%	100%	0%	0%
<b>Recycled Steel</b>	scrap steel	0%	100%	0%	0%

## SYSTEM BOUNDARIES

The following figure depicts the cradle-to-grave system boundary considered in this study:

### Life Cycle Impacts

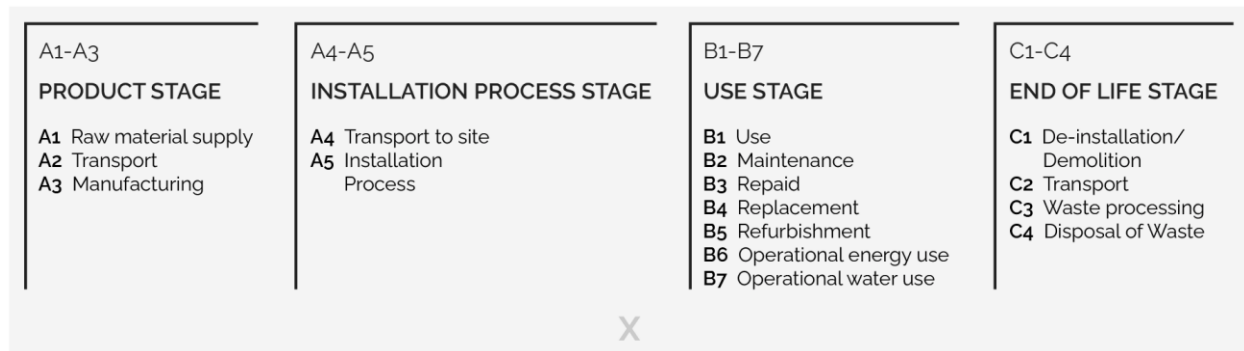


Figure 1: General life cycle phases for consideration in a construction works system

This is a Cradle-to-grave life cycle assessment, and the following life cycle stages are included in the study:

- A1: Raw material supply (upstream processes) - Extraction, handling, and processing of the materials used in manufacturing the declared products in this LCA.
- A2: Transportation - Transportation of A1 materials from the supplier to the "gate" of the manufacturing facility (i.e., A3).
- A3: Manufacturing (core processes)- The energy and other utility inputs used to store, move, and manufacture the declared products and to operate the facility.
- A4: Product plant gate-to-site of use logistics
- A5: Product at-site installation requirements





- B: Product use phase requirements and direct emissions (if applicable)
- C: Product end-of-life requirements

As according to the PCR, the following figure illustrates the general activities and input requirements for producing bench products and is not necessarily exhaustive.

<b>A1</b>	Raw Material Extraction and Processing: Steel, Aluminum, Coatings, Packaging	SYSTEM BOUNDARY
<b>A2</b>	Transportation to Maglin Facility: Truck	
<b>A3</b>	Warehousing: Electricity, Water, Waste	
<b>A4</b>	Delivery to the Customer: Truck	
<b>A5</b>	Installation	
<b>B1-B5</b>	Use, Maintenance, Replacement, Refurbishment: NOT COVERED	
<b>C1-C4</b>	End of Life: Recycling, Landfill Disposal	

Figure 2: **Process Flow Diagram for processes covered in this study**

In addition, as according to the relevant PCR, the following requirements are excluded from this study:

- Production, manufacture, and construction of A3 building/capital goods and infrastructure;
- Production and manufacture of steel production equipment, steel delivery vehicles, earthmoving equipment, and laboratory equipment;
- Personnel-related activities (travel, furniture, office supplies)
- Energy use related to company management and sales activities.

For this LCA the manufacturing plant, owned and operated by Maglin. Site Furniture, is located at their Modular Benches facility in Ontario. All operating data is formulated using the actual data from Maglin Site Furniture's plant at the above location, including water, energy consumption and waste generation. All inputs for this system boundary are calculated for the plant.

This life cycle inventory was organized in a spreadsheet and was then input into an RStudio environment where pre-calculated LCIA results for relevant products/activities stemming from the ecoinvent v3.8 database and a local EPD database in combination with primary data from Maglin Site Furniture were utilized. Explanations of the contribution of each data source to this study are outlined in the section 'Data Sources and Quality'. Further LCI details for each declared product are provided in the sections 'Detailed LCI tables' and 'Transport tables' of the detailed LCA report. A parameter uncertainty analysis was also performed where key statistical results (e.g. min/mean/max etc.) are provided in the detailed LCA report.



No known flows are deliberately excluded from this EPD.

## CUT-OFF CRITERIA

ISO 14044:2006 and the focus PCR require the LCA model to contain a minimum of 95% of the total inflows (mass and energy) to the upstream and core modules be included in this study. The cut-off criteria were applied to all other processes unless otherwise noted above. A 1% cut-off is considered for all renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process where the neglected inputs do not exceed 5%.

## DATA SOURCES AND DATA QUALITY ASSESSMENT

No recovered on-site energy occurs at this facility.

Table 3: Reused or recycled components/materials at the A3 facility site

Component/material for re-use/recycling	Value	Units	Re-used/recycled on-site or off-site
Plastic packaging	115,551.4	kg	Off-site
Cardboard packaging	9,660,280.7	kg	Off-site
Plastic components	331,774.4	kg	Off-site
Steel components	5,342,037.9	kg	Off-site

The following statements explain how the above facility requirements/generation were derived:

**Raw material transport:** Maglin does not produce 100% of the materials for their products in-house; they primarily prep and assemble products manufactured by outside vendors. Maglin used engineering drawings to determine each product's exact parts and weights. The pieces were then further refined by a supplier. When multiple suppliers can manufacture the same part, allocation by purchased percentage during the reference period was used to determine transportation distances and geographical reference data. All raw material inputs are not primary information, and the ecoinvent database was used to model their raw material inputs and manufacturing processes—for example, transportation between suppliers and Maglin's primary data provided by Maglin.

Once Maglin receives the specific part, it is prepped and transferred to a coating manufacturer. Maglin uses three types of coatings. First, E-Coat is used on steel or aluminum before powder coating. E-Coat is applying a coating with an electrical current onto the material. The process is standard in the automotive industry but can vary for each supplier. Three (3) main stages are typical: Pre-treatment, E-Coat, and Curing. The Pre-treatment stage includes cleaning, pre-treatment, and rinsing. The second stage is E-Coating Process. The final step is Post Rinse and Baking. This wet film process allows the coating to get into interior recesses and cavities (like galvanizing), which makes it superior to a Prime base coat in most instances. The result is a flat black finish and is ready to receive the powder coating. Aluminum parts receive an Alodine treatment before powder coating. The Alodine method used on Maglin products is a military specification developed and used by the US department of defense to boost corrosion resistance and provide a good base for the subsequent application of paint. The finish is clear. There is a size limitation with Alodine because it is a batch process versus a line system in e-coating, so Maglin only processes smaller aluminum parts. Once properly treated, they are transported by truck back to Maglin, where they will be inspected and transported to the powder coating facilities.



**Electricity:** Primary electricity consumption was calculated for the Maglin facility from electricity bills. Since 2020 was an uncommon year due to the pandemic, 12 consecutive months were used, from June 2020 to July 2021. Maglin's utility provider provides monthly usage in kilowatt-hours (kWh), so no conversions were performed.

To calculate the amount of utility allotted to the product line, the total used was multiplied by the percentage of sales by dollar amount and then divided by the number of parts manufactured for the modular bench lines.

**Process/space heating:** The facility is heated by natural gas. All direct usage, as reported in monthly utility bills, was reported. Since 2020 was an uncommon year due to the pandemic, 12 consecutive months were used, from June 2020 to July 2021. Natural gas is reported in m<sup>3</sup> of usage. The conversion factor used for m<sup>3</sup> to MJ to represent the burning of the natural gas was 1 m<sup>3</sup> of natural gas= 38.3 MJ of energy.

**Fuel required for machinery:** On-site machinery for moving materials uses electricity; therefore, no additional fuel usage was reported.

**Waste generation:** All waste was calculated using primary information from Maglin utility bills. Transportation defaults were used because the driver route and ultimate destination are unknown. Therefore, the exact mileage could not be confirmed by the waste hauler.

**Recovered energy:** No on-site energy is recovered on site.

**Recycled/reused material/components:** This study considered two types of recycling: on-site at Maglin facilities and the product end-of-life, off-site at the customer location. On-site Maglin recycling mixed composition was based on direct Maglin waste hauling receipts. Assumptions were made for the end-of-life scenario.

According to the Advancing Sustainable Materials Management: 2018 Fact Sheet (US EPA), only 14% of the total plastic packaging and 81% of paper/cardboard packaging is recycled in the USA, and hence, this value was considered to be the same for Canada. Similarly, 7% Plastic and 24% steel components of the modular benches were assumed to be recycled off-site at the end of their service life. However, it is assumed that 98% of steel sent to the incinerator is collected from the bottom ash and recycled (Rainer Bunge 2016).

**Module A1 material losses:** Default material losses were used.

**Direct A3 emissions accounting:** Direct emissions for on-site natural gas heating was based on a representative ecoinvent process.

**A4 Product transport requirements:** Maglin reported the average customer distance based on direct calculations of distance and number of modular benches purchased from purchased orders. For example, the distance of 1,058 km is a representative distance a product is trucked to a customer.

**A5 product installation:** Maglin provides its clients with installation documents that detail the various methods which could be adopted to install their products. For modular bench configurations, it has been assumed that all bench products were installed using 3/8" Anchor bolts which were accounted for as a raw material input. Since modular bench configurations are installed manually, no additional process energy or material requirements were assumed for the installation phase.



**B product use phase:** No use phase material or energy inputs for modular benches were assumed in this study.

**C product end-of-life:** To determine end-of-life in this study, it is assumed that 60% of the steel components of the modular benches will be sent to a landfill at the end of its service life and about 13% is incinerated. However, 98% of the steel components sent to the incinerator are collected from the bottom ash and then recycled. This assumption has been made based on the Advancing Sustainable Materials Management: 2018 Fact Sheet (US EPA). Similar end-of-life disposal values for wood and plastics were also derived from the Advancing Sustainable Materials Management: 2018 Fact Sheet (US EPA). Maglin has been in business for 40 years; therefore, they do not have direct knowledge of what their customers would do at the end of the estimated service life of 50 years.

The following tables depict a list of assumed life cycle inventory utilized in the LCA modeling to generate the impact results across the life cycle modules in scope. An assessment of the quality of each LCI activities utilized from various sources is also provided.

Table 4: LCI inputs assumed for module A1 (i.e., raw material supply) Data Quality Assessment Key Poor=0, Fair=1, Good=2, Very Good =3.

Input	LCI.activity	Data.source	Geo	Year	T e c h n o l o g y	T i m e	G e o g r a p h y	R e l i a b i l i t y	C o m p l e t e n e s s
Galvanization	market for zinc coat, pieces/zinc coat, pieces/GLO/m2	ecoinvent v3.6	No Additional	v3.6 in 2019	2	3	2	3	3
Pallet	market for EUR-flat pallet/EUR-flat pallet/GLO/unit	ecoinvent v3.8	Multiple Regions	v3.8 in 2021	1	3	1	3	3
Ipe	market for sawnwood, board, hardwood, dried (u=20%), planed/sawnwood, board, hardwood, dried (u=20%), planed/GLO/m3	ecoinvent v3.8	Multiple Regions	v3.8 in 2021	2	3	2	3	3
Acrylic	market for polyacrylamide/polyacrylamide/GLO/kg	ecoinvent v3.6	Utah	v3.6 in 2019	2	3	2	3	3
Cardboard /Paper packaging	market for corrugated board box/corrugated board box/RoW/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	1	3	1	3	3
Plastic Packaging	market for packaging film, low density polyethylene/packaging film, low density polyethylene/GLO/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	1	3	1	3	3



<b>Steel Raw Material</b>	market for steel, low-alloyed/steel, low-alloyed/GLO/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	2	3	2	3	3
<b>Recycling, mixed</b>	market for container, for collection of post-consumer waste plastic for recycling/container, for collection of post-consumer waste plastic for recycling/RoW/unit	ecoinvent v3.6	Ontario	v3.6 in 2019	2	3	2	3	3
<b>Metal Working, Steel</b>	metal working, average for steel product manufacturing/metal working, average for steel product manufacturing/RoW/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019					
<b>Recycled HDPE</b>	market for waste polyethylene, for recycling, sorted/waste polyethylene, for recycling, sorted/RoW/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	2	3	1	3	3
<b>HDPE</b>	polyethylene production, high density, granulate/polyethylene, high density, granulate/RoW/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	2	3	2	3	3
<b>Recycled Steel</b>	Waste produced off-site	See A3 inputs	Multiple Regions	See A3 inputs	2	A3	1	A3	A3

Table 5: LCI inputs assumed for module A2 (i.e., transport of A1 inputs) Data Quality Assessment Key Poor=0, Fair=1, Good=2, Very Good =3.

Input	LCI.activity	Data.source	Geo	Year	T e c h n o l o g y	T i m e	G e o g r a p h y	R e l i a b i l i t y	C o m p l e t e n e s s
<b>Acrylic-freight transport via Truck</b>	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	RoW	v3.6 in 2019	2	3	1	3	3
<b>Ash- freight transport via Truck</b>	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	RoW	v3.6 in 2019	2	3	1	3	3



<b>Bulk Waste-freight transport via Truck</b>	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	RoW	v3.6 in 2019	2	3	1	3	3
<b>Cardboard/Paper packaging-freight transport via Truck</b>	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	RoW	v3.6 in 2019	2	3	1	3	3
<b>HDPE-freight transport via Truck</b>	market for transport, freight, lorry 7.5-16 metric ton, EURO6/transport, freight, lorry 7.5-16 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	RoW	v3.6 in 2019	2	3	1	3	3
<b>Ipe- freight transport via Truck</b>	market for transport, freight, lorry 7.5-16 metric ton, EURO6/transport, freight, lorry 7.5-16 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	RoW	v3.6 in 2019	2	3	1	3	3
<b>Metal Working, Steel-freight transport via Truck</b>	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	RoW	v3.6 in 2019	2	3	1	3	3
<b>Ilastic Packaging-freight transport via Truck</b>	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	RoW	v3.6 in 2019	2	3	1	3	3
<b>Recycled HDPE-freight transport via Truck</b>	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	RoW	v3.6 in 2019	2	3	1	3	3
<b>Recycled Steel-freight transport via Truck</b>	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	RoW	v3.6 in 2019	2	3	1	3	3
<b>Recycling, mixed-freight transport via Truck</b>	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	RoW	v3.6 in 2019	2	3	1	3	3
<b>Steel Raw Material-freight transport via Truck</b>	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	RoW	v3.6 in 2019	2	3	1	3	3



Table 6: LCI inputs assumed for module A3. Data Quality Assessment Key Poor=0, Fair=1, Good=2, Very Good =3.

Input	LCI.activity	Data.source	Geo	Year	Technology	Time	Geography	Reliability	Completeness
<b>Bulk Waste</b>	process-specific burdens, inert material landfill/process-specific burdens, inert material landfill/RoW/kg	ecoinvent v3.6	Ontario	v3.6 in 2019	2	3	2	3	3
<b>Electricity</b>	market for electricity, medium voltage/electricity, medium voltage/CA-ON/kWh	ecoinvent v3.6	Ontario	v3.6 in 2019	2	3	2	3	3
<b>Natural Gas</b>	heat production, natural gas, at boiler modulating >100kW/heat, district or industrial, natural gas/CA-QC/MJ	ecoinvent v3.6	Ontario	v3.6 in 2019	2	3	2	3	3
<b>Powder Coating, steel</b>	market for powder coat, steel/powder coat, steel/GLO/m2	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	2	3	2	3	3

Table 7: LCI inputs assumed across modules A4 to C4 (i.e., from plant gate-to-grave if applicable) Data Quality Assessment Key Poor=0, Fair=1, Good=2, Very Good =3.

Input	LCI.activity	Data.source	Geo	Year	Technology	Time	Geography	Reliability	Completeness
<b>C3. Cardboard packaging waste</b>	market for waste paperboard/waste paperboard/RoW/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	1	3	1	3	3
<b>C2. Cardboard packaging waste-freight</b>	market for transport, freight, light commercial vehicle/transport, freight, light	ecoinvent v3.6	see corrsp. product input above	v3.6 in 2019	2	3	1	3	3



<b>transport via Truck</b>	commercial vehicle/RoW/tkm								
<b>A5. Fasteners</b>	market for steel, low-alloyed/steel, low-alloyed/GLO/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	1	3	1	3	3
<b>A5. Fasteners-freight transport via Truck</b>	market for transport, freight, lorry 7.5-16 metric ton, EURO6/transport, freight, lorry 7.5-16 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	see corrsp. product input above	v3.6 in 2019	2	3	1	3	3
<b>C3. Incinerated Waste steel bench</b>	treatment of scrap steel, municipal incineration/scrap steel/RoW/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	1	3	1	3	3
<b>C2. Incinerated Waste steel bench-freight transport via Truck</b>	market for transport, freight, lorry 7.5-16 metric ton, EURO6/transport, freight, lorry 7.5-16 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	see corrsp. product input above	v3.6 in 2019	2	3	1	3	3
<b>C3. Landfill Waste steel bench</b>	treatment of scrap steel, inert material landfill/scrap steel/RoW/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	1	3	1	3	3
<b>C2. Landfill Waste steel bench-freight transport via Truck</b>	market for transport, freight, lorry 7.5-16 metric ton, EURO6/transport, freight, lorry 7.5-16 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	see corrsp. product input above	v3.6 in 2019	2	3	1	3	3
<b>C3. Plastic Packaging waste</b>	treatment of waste plastic, mixture, sanitary landfill/waste plastic, mixture/RoW/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	1	3	1	3	3
<b>C2. Plastic Packaging waste-freight transport via Truck</b>	market for transport, freight, light commercial vehicle/transport, freight, light commercial vehicle/RoW/tkm	ecoinvent v3.6	see corrsp. product input above	v3.6 in 2019	2	3	1	3	3
<b>A4. Truck Transport</b>	Product-to-site transport requirements	See A4 transport requirements	Ontario	2020-06-01 to 2021-05-31	NA	NA	NA	NA	NA
<b>A4. Truck Transport-freight transport via Truck</b>	market for transport, freight, lorry 7.5-16 metric ton, EURO6/transport, freight, lorry 7.5-16 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	see corrsp. product input above	v3.6 in 2019	2	3	1	3	3





<b>C3. Waste HDPE to incinerator</b>	treatment of waste plastic, mixture, municipal incineration/waste plastic, mixture/RoW/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	1	3	1	3	3
<b>C2. Waste HDPE to incinerator-freight transport via Truck</b>	market for transport, freight, light commercial vehicle/transport, freight, light commercial vehicle/RoW/tkm	ecoinvent v3.6	see corrsp. product input above	v3.6 in 2019	2	3	1	3	3
<b>C3. Waste HDPE to landfill</b>	market for waste plastic, mixture/waste plastic, mixture/RoW/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	1	3	1	3	3
<b>C2. Waste HDPE to landfill-freight transport via Truck</b>	market for transport, freight, light commercial vehicle/transport, freight, light commercial vehicle/RoW/tkm	ecoinvent v3.6	see corrsp. product input above	v3.6 in 2019	2	3	1	3	3
<b>C3. Waste wood to incinerator</b>	treatment of waste wood, untreated, municipal incineration/waste wood, untreated/RoW/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	1	3	1	3	3
<b>C2. Waste wood to incinerator-freight transport via Truck</b>	market for transport, freight, lorry 7.5-16 metric ton, EURO6/transport, freight, lorry 7.5-16 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	see corrsp. product input above	v3.6 in 2019	2	3	1	3	3
<b>C3. Waste wood to landfill</b>	treatment of waste wood, untreated, sanitary landfill/waste wood, untreated/RoW/kg	ecoinvent v3.6	Multiple Regions	v3.6 in 2019	1	3	1	3	3
<b>C2. Waste wood to landfill-freight transport via Truck</b>	market for transport, freight, lorry 7.5-16 metric ton, EURO6/transport, freight, lorry 7.5-16 metric ton, EURO6/RoW/tkm	ecoinvent v3.6	see corrsp. product input above	v3.6 in 2019	2	3	1	3	3

## DATA QUALITY ASSESSMENT

Data quality/variability requirements, as specified in the PCR, are applied. This section describes the achieved data quality relative to the ISO 14044:2006 requirements. Data quality is judged based on its precision (measured, calculated, or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied within a study serving as a data source), and representativeness (geographical, temporal, and technological).



**Precision:** Through measurement and calculation, the manufacturers collected and provided primary data on their annual production. For accuracy, the LCA practitioner and 3rd Party Verifier validated the plant gate-to-gate data.

**Completeness:** All relevant specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled to represent the specified and declared products. The majority of relevant background materials and processes were taken from ecoinvent v3.8 LCI datasets where relatively recent region-specific electricity inputs were utilized. The most relevant EPDs requiring key A1 inputs were also utilized where readily available.

**Consistency:** To ensure consistency, the same modeling structure across the respective product systems was utilized for all inputs, which consisted of raw material inputs and ancillary material, energy flows, water resource inputs, product and co-products outputs, returned and recovered Bench materials, emissions to air, water and soil, and waste recycling and treatment. The same background LCI datasets from the ecoinvent v3.8 database were used across all product systems. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the plant and selected process level to maintain a high level of consistency.

**Reproducibility:** Internal reproducibility is possible since the data and the models are stored and available in a machine readable project file for all foreground and background processes, and in Labeling Sustainability's proprietary Bench LCA calculator\* for all production facility and product-specific calculations. A considerable level of transparency is provided throughout the detailed LCA report as the specifications and material quantity make-up for the declared products are presented and key primary and secondary LCI data sources are summarized. The provision of more detailed publicly accessible data to allow full external reproducibility was not possible due to reasons of confidentiality.

\*Labeling Sustainability has developed a proprietary tool that allows the calculation of PCR-compliant LCA results for Bench product designs. The tool auto-calculates results by scaling base-unit technosphere inputs (i.e. 1 kg sand, 1 kWh electricity, etc.) to replicate the reference flow conversions that take place in any typical LCA software like openLCA or SimaPro. The tool was tested against several LCAs performed in openLCA and the tool generated identical results to those realized in openLCA across every impact category and inventory metric (where comparisons could be readily made).

**Representativeness:** The representativeness of the data is summarized as follows.

- Time-related coverage of the manufacturing processes' primary collected data from 2020-06-01 to 2021-05-31.
- Upstream (background) LCI data was either the PCR specified default (if applicable) or more appropriate LCI datasets found in the country-adjusted ecoinvent v3.8 database.
- Geographical coverage for inputs required by the A3 facility(ies) represents its region of focus; other upstream and background processes are based on US, North American, or global average data and adjusted to regional electricity mixes when relevant.
- Technological coverage is typical or average and specific to the participating facilities for all primary data.



## ENVIRONMENTAL INDICATORS AND INVENTORY METRICS

Per the PCR, this EPD supports the life cycle impact assessment and inventory metrics listed in the tables below. As specified in the PCR, the most recent US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), impact categories were utilized to provide a North American context for the mandatory category indicators to be included in the EPD. Additionally, the PCR requires a set of inventory metrics to be reported with the LCIA indicators (see tables below).

Table 8: Life cycle impact categories and life cycle inventory metrics

ID	LCIA.indicators	Abbreviations	Units
1	Environmental impact: acidification	AP	moles of H <sup>+</sup> -Eq
2	Environmental impact: eutrophication	EP	kg N
3	Environmental impact: global warming	GWP	kg CO <sub>2</sub> -Eq
4	Environmental impact: ozone depletion	ODP	kg CFC-11-Eq
5	Environmental impact: photochemical oxidation	PCOP	kg NO <sub>x</sub> -Eq
6	Material resources: metals/minerals: abiotic depletion potential (ADP): elements (ultimate reserves)	ADPe	kg Sb-Eq
7	Energy resources: non-renewable: abiotic depletion potential (ADP): fossil fuels	ADPf	MJ, net calorific value
Inventory metrics			
8	Total primary energy	TPE	MJ-Eq
9	Renewable energy	RE	MJ-Eq
10	Non-renewable energy	NRE	MJ-Eq
11	Non-Renewable Resources	NRR	kg
12	Renewable Resources	RR	m <sup>3</sup>
13	Water depletion: WDP	WDP	m <sup>3</sup>
14	Land filling: bulk waste	LFW	kg waste
15	Land filling: hazardous waste	LFHW	kg waste

It should be noted that emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in any of the following categories.

- Renewable primary energy resources as energy (fuel);
- Renewable primary resources as material;
- Non-renewable primary resources as energy (fuel);
- Non-renewable primary resources as material;
- Secondary Materials;
- Renewable secondary fuels;
- Non-renewable secondary fuels;
- Recovered energy;
- Abiotic depletion potential for non-fossil mineral resources.
- Land use related impacts, for example on biodiversity and/or soil fertility;
- Toxicological aspects;
- Emissions from land use change [GWP 100 (land-use change)];
- Hazardous waste disposed;
- Non-hazardous waste disposed;
- High-level radioactive waste;



- Intermediate and low-level radioactive waste;
- Components for reuse;
- Materials for recycling;
- Materials for energy recovery;
- Recovered energy exported from the product system.

## TOTAL IMPACT SUMMARY

The following table reports the total LCA results for each product produced at the given modular bench configuration facility on a per 1 Lexicon configuration basis.

Table 9: Total life cycle (across modules in scope) impact results for Lexicon, assuming the geometric mean point values, on a per 1 Lexicon configuration basis.

### Midpoint Impact Categories: Lexicon

Indicator/LCI Metric	AP	EP	GWP	ODP	PCOP	ADPe	ADPf
Unit	moles of H <sup>+</sup> -Eq	kg N	kg CO <sub>2</sub> -Eq	kg CFC-11-Eq	kg NO <sub>x</sub> -Eq	kg Sb-Eq	MJ, net calorific value
Minimum	26.9	0.047	121	9.43e-06	0.304	0.00095	1570
<b>Maximum</b>	<b>195</b>	<b>0.332</b>	<b>881</b>	<b>6.71e-05</b>	<b>2.14</b>	<b>0.007</b>	<b>10900</b>
Mean	106	0.181	484	3.65e-05	1.17	0.00379	5950
Median	105	0.18	486	3.64e-05	1.16	0.00379	5960
Lexicon_Low_Metal	36.9	0.0626	167	1.28e-05	0.41	0.00132	2130
Lexicon_High_Metal	195	0.332	881	6.71e-05	2.14	0.007	10900
Lexicon_Low_Ipe	26.9	0.0472	121	9.5e-06	0.305	0.00095	1580
Lexicon_High_Ipe	180	0.309	811	6.21e-05	1.98	0.00643	10000
Lexicon_Low_Thermal Ash	26.9	0.047	121	9.43e-06	0.304	0.000952	1570
Lexicon_High_Thermal Ash	179	0.307	806	6.16e-05	1.97	0.0064	9960
Lexicon_Low_HDPE	28.3	0.0481	140	9.88e-06	0.319	0.00102	1700
Lexicon_High_HDPE	181	0.309	837	6.24e-05	2	0.00652	10200
Lexicon_Low_HDPC	28.1	0.0478	145	9.85e-06	0.319	0.00101	1700
Lexicon_High_HDPC	174	0.297	814	6.01e-05	1.92	0.00626	9800

### Inventory Metrics: Lexicon

Indicator/LCI Metric	TPE	RE	NRE	NRR	RR	WDP	LFW	LFHW
Unit	MJ-Eq	MJ-Eq	MJ-Eq	kg	m <sup>3</sup>	m <sup>3</sup>	kg waste	kg waste
Minimum	2000	205	1650	75.4	0.00962	1.25	77.6	0.00449
<b>Maximum</b>	<b>12500</b>	<b>1110</b>	<b>11500</b>	<b>557</b>	<b>0.0439</b>	<b>9.07</b>	<b>516</b>	<b>0.0331</b>
Mean	6920	627	6280	301	0.0239	4.9	284	0.018
Median	6850	598	6320	300	0.0234	4.9	282	0.0181
Lexicon_Low_Metal	2500	250	2240	105	0.0106	1.74	102	0.00621
Lexicon_High_Metal	12500	966	11500	557	0.028	9.07	516	0.0331
Lexicon_Low_Ipe	2010	327	1660	75.8	0.021	1.25	81.8	0.00449
Lexicon_High_Ipe	11700	1110	10600	514	0.0436	8.32	487	0.0305



<b>Lexicon_Low_Thermal Ash</b>	2010	325	1650	75.4	0.02	1.26	79.5	0.00449
<b>Lexicon_High_Thermal Ash</b>	11700	1110	10500	511	0.0439	8.28	480	0.0303
<b>Lexicon_Low_HDPE</b>	2000	205	1800	79.6	0.00962	1.33	77.8	0.00493
<b>Lexicon_High_HDPE</b>	11600	898	10700	515	0.0265	8.4	478	0.031
<b>Lexicon_Low_HDPC</b>	2020	208	1800	79.7	0.0101	1.31	77.6	0.00497
<b>Lexicon_High_HDPC</b>	11200	869	10400	496	0.0258	8.05	461	0.0299

## INTERPRETATION

It should be noted that the results are presented on a whole unit product basis, and therefore, the impacts attributed to each declared product in this EPD cannot necessarily be compared due to their differing capacities based how the number of seats. Thus, to calculate comparable impacts, one should normalize the impacts to a per seat basis.

## ADDITIONAL ENVIRONMENTAL INFO

No regulated substances of very high concern are utilized on site.

"The Sub PCR, Sub Product Category Rule for Site Furnishings, CSI MasterFormat, Section 323300, states "A chemical schedule of hazardous materials and substances shall be included in the EPD report. The general cut-off rules do not apply to such substances. This includes paints, finishes, adhesives, and sealants. The EPD shall consist of a chemical schedule of all paints, finishes, adhesives, and sealants used on the product ranges, whether they appear in the LCA product model or not. Substances shall be listed by name, Chemical Abstract Registry Numbers (CAS RN), and hazard category according to the GreenScreen methodology. The finish schedule shall be completed to 0.1% or 1,000 ppm whenever possible."

Metal components of the Maglin modular benches can be powder coated. The chemical inventory below is for the powder coating of their products. It covers the full color line with all work performed by an outside vendor. Maglin does not have operational control over the painting process. An average amount of powder coating per bench component ranges from 0.01 to 0.06 kilograms of coating.

Table 10: Hazard Screening for Powder Coating Substances

Substance (May Contain)	CAS RN	Weight by %	GreenScreen Score
<b>1,3-Benzenedicarboxylic acid (May Contain)</b>	1.214996e+12	< 10	LT - UNK: Present on a GreenScreen Specified List, but there is insufficient information to classify the hazard This material was added based on the Quartz database of common building materials. The manufacturer would not disclose any trade secrets therefore this material may or may not be in the actual product.
<b>Aluminum Powder (May Contain)</b>	7429-90-5	1634256000	BM1: Avoid - Chemical of High Concern
<b>Amorphous silica (May Contain)</b>	7631-86-9	< 3	BM1: Avoid - Chemical of High Concern



<b>Aluminum hydroxide (May Contain)</b>	21645-51-2	1635552000	BM 2: Use but Search for Substitutes
<b>Titanium Dioxide (May Contain)</b>	13463-67-7	25-30	LT-1: GreenScreen Benchmark-1 Avoid - Chemical of High Concern
<b>1,3,5-Triglycidyl-s-triazinetriene (May Contain)</b>	2451-62-9	1609804800	LT-1: GreenScreen Benchmark-1 Avoid - Chemical of High Concern
<b>Quartz (May Contain)</b>	14808-60-7	1615161600	LT-1: GreenScreen Benchmark-1 Avoid - Chemical of High Concern
<b>Diiron Trioxide (May Contain)</b>	1309-37-1	1614902400	BM1: Avoid - Chemical of High Concern
<b>Silica gel (Main Contain)</b>	112926-00-8	1615161600	LT – UNK: Present on a GreenScreen Specified List, but there is insufficient information to classify the hazard

Galvanized coating is a zinc coating applied to prevent corrosion or rusting from the steel or iron structure. The application of zinc on a steel structure is a process called "galvanization." Metal components of the Maglin benches can be galvanized. The chemical inventory below is for an outside vendor's galvanizing of their products. Maglin does not have operational control over the process. The average galvanized coating per modular bench component is 0.0608 kilograms of coating per kilogram of steel.

Galvanized coating is a zinc coating applied to prevent corrosion or rusting from the steel or iron structure. The application of zinc on a steel structure is a process called "galvanization." Metal components of the Maglin benches can be galvanized. The chemical inventory below is for an outside vendor's galvanizing of their products. Maglin does not have operational control over the process. The average galvanized coating per modular bench component is 0.0608 kilograms of coating per kilogram of steel.

## REFERENCES

### ISO Standards:

- ISO 6707-1: 2014 Buildings and Civil Engineering Works - Vocabulary - Part 1: General Terms
- ISO 14021:1999 Environmental Labels and Declarations - Self-declared Environmental Claims (Type II Environmental Labeling)
- ISO 14025:2006 Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures
- ISO 14040:2006 Environmental Management - Life Cycle Assessment - Principles and Framework
- ISO 14044:2006 Environmental Management - Life Cycle Assessment - Requirements and Guidelines
- ISO 14067:2018 Greenhouse Gases – Carbon Footprint of Products – Requirements and Guidelines for Quantification



- ISO 14050:2009 Environmental Management - Vocabulary
- ISO 21930:2017 Sustainability in Building Construction - Environmental Declaration of Building Products

#### EN Standards:

- EN 16757 Sustainability of construction works - Environmental product declarations – Product Category Rules for concrete and concrete elements
- EN 15804 Sustainability of construction works - Environmental product declarations -Core rules for the product category of construction products

#### Other References:

- Labeling Sustainability (2021) ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services and Sub Product Category Rule for Site Furnishings, CSI MasterFormat, Section 32 33 00, <http://labelingsustainability.com/>.
- USGBC LEED v4 for Building Design and Construction, 11 Jan 2019 available at <https://www.usgbc.org/resources/pcr-committee-process-resources-part-b>
- USGBC PCR Committee Process & Resources: Part B, USGBC, 7 July 2017 available at <https://www.usgbc.org/resources/pcr-committee-process-resources-part-b>.
- Recovery of metals from waste incinerator bottom ash, Rainer Bunge (2016), <https://vbsa.ch/wp-content/uploads/2016/07/Studie-Bunge-Internetversion.pdf>
- US EPA (2020) Advancing Sustainable Materials Management: 2018 Fact Sheet, [https://www.epa.gov/sites/production/files/2021-01/documents/2018\\_ff\\_fact\\_sheet\\_dec\\_2020\\_fnl\\_508.pdf](https://www.epa.gov/sites/production/files/2021-01/documents/2018_ff_fact_sheet_dec_2020_fnl_508.pdf)

