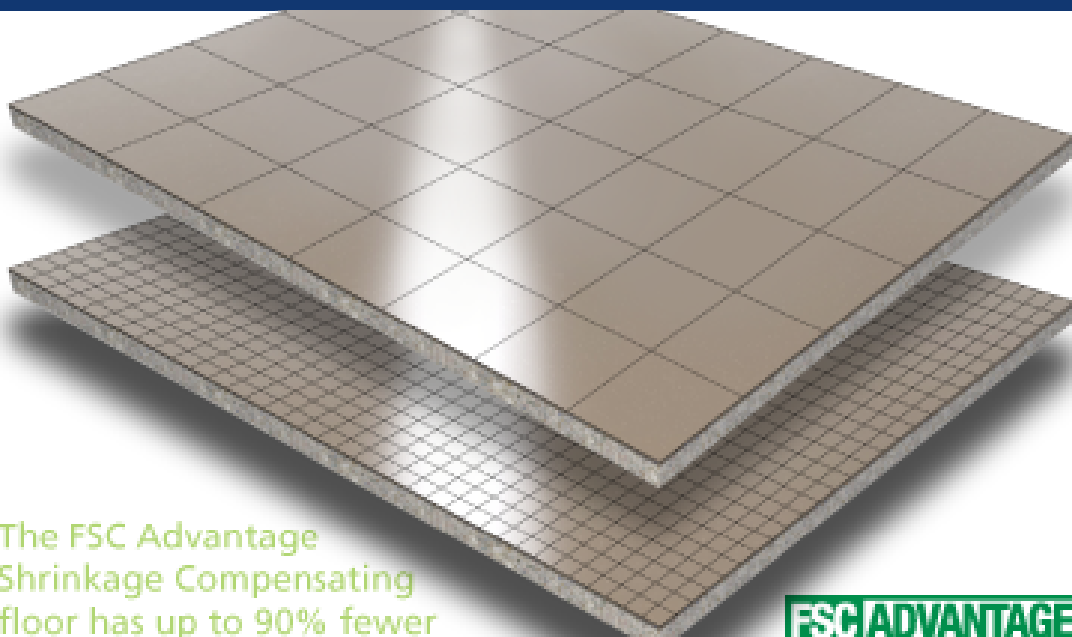


ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH ISO 14025 AND ISO 21930:2017

SmartEPD-2026-115-0743-01

FSC Advantage Shrinkage Compensating Floors



The FSC Advantage
Shrinkage Compensating
floor has up to 90% fewer

FSC ADVANTAGE™



Date of Issue:	Expiration:	Last updated:
Jan 30, 2026	Jan 30, 2031	Jan 30, 2026



General Information

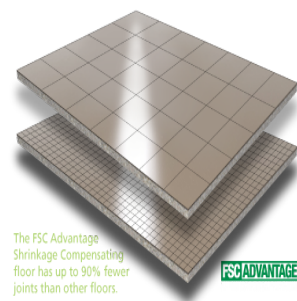
FRICKS

📍 1401 Ranchers Legacy Trail Fort Worth, Texas 76126

📞 817.560.8281

✉ info@fricksco.com

🌐 fricksco.com



Product Name:	FSC Advantage Shrinkage Compensating Floors
Declared Unit:	1 m3
Declaration Number:	SmartEPD-2026-115-0743-01
Date of Issue:	January 30, 2026
Expiration:	January 30, 2031
Last updated:	January 30, 2026
EPD Scope:	Cradle to gate with other options A1 - A3, A4, A5
Market(s) of Applicability:	North America

General Organization Information

The Fricks Company stands as a premier provider of industrial concrete flooring solutions, renowned for its excellence and innovation in the field. With a history spanning several decades, The Fricks Company has established itself as a leader in the design and construction of durable, high-quality concrete floors for a variety of industrial applications.

Fricks is a Nationwide Single-Source Design/Build Industrial Concrete Floor and Solutions Partners.

Limitations, Liability and Ownership

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

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 or construction works level, and therefore EPDs may not be used for comparability purposes when not considering the whole building life cycle. EPD comparability is only possible 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 in results upstream or downstream of the life cycle stages declared.

The environmental impact results of products in this document are based on a declared unit and therefore do not provide sufficient information to establish comparisons. The results shall not be used for comparisons without knowledge of how the physical properties of the product impact the precise function at the construction level. The environmental impact results shall be converted to a functional unit basis before any comparison is attempted.

A manufacturer shall not make claims based on an industry-average EPD which leads the market to believe the industry-average is representative of manufacturer-specific or product-specific results.



Reference Standards

Standard(s):	ISO 14025 and ISO 21930:2017
Core PCR:	Smart EPD® Part A Product Category Rules for Building and Construction Products and Services, 1000, v1.2
	Date of issue: March 14, 2025
	Valid until: March 14, 2030
Sub-category PCR review panel:	Contact Smart EPD for more information.
General Program Instructions:	Smart EPD General Program Instructions v.2.0, March 2025

Verification Information

LCA Author/Creator:	Miguel Hernandez	
	EarthShift Global	
	info@earthshiftglobal.com	
EPD Program Operator:	Smart EPD	
	info@smartepd.com	
	www.smartepd.com	
	585 Grove St., Ste. 145, Herndon, VA 20170, USA	
Verification:	Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071:	External
	Mari Kirss mari.kirss@meetripuu.ee	
	Independent external verification of EPD, according to ISO 14025 and reference PCR(s):	External
	Mari Kirss mari.kirss@meetripuu.ee	

Product Information

Declared Unit:	1 m3
Mass:	2372.2 kg
Product Specificity:	Product Average
	Product Specific
Variation in GWP Result (Products):	-2% to +20%

Product Description

The Fricks shrinkage-compensating concrete slab (FSC Advantage Shrinkage Compensating Floor) is a high-performance industrial flooring system made for difficult conditions where durability, flatness, and few joints are very important. It employs a specific mix that includes an expansive cement (or an expansive additive).



Frick's shrinkage-compensating concrete slab have up to 90% fewer joints than conventional concrete with reduced curling and greater surface durability and easily withstands the abuse of excessive forklift traffic while maintaining its durable light reflective surface (The Fricks Company, 2025). The Fricks Company has successfully installed more than 400 million square feet of floors across the United States over the past 40 years—with zero failures—using its proven Shrinkage Compensating Concrete (SCC) system. Unlike shrinkage-reducing systems or admixtures, SCC uses expansive cement to counteract shrinkage through ettringite crystal formation. This compensating expansion is the key mechanism outlined in American Concrete Institute (ACI) 223. The Fricks Company follows the standards of both ACI 302 and ACI 223 rigorously to ensure consistent, high-performance results that minimize cracking, curling, and long-term durability issues.

The Fricks system employs Type K cement, as recommended by ACI 302, and follows best practices for placement, finishing, joint construction, and curing, resulting in Fricks having the most durable and low-maintenance floor in the world. Fricks SCC system is also environmentally responsible. It reduces the number of ready-mix trucks, which cuts fuel consumption and emissions. It eliminates the use of chemical cleaners and saw cuts, eliminating air pollution and requires 90% fewer joints, minimizing non-biodegradable material waste.

The result of all the aforementioned, along with other natural materials, is a long-lasting, high-quality floor that reliably performs while supporting a cleaner, more sustainable construction process.

The general process for installing shrinkage-compensating concrete slabs is described as follows. Once a contract for a new project is generated, a “material order form” is created. The coordination team begins planning the logistics to meet deadlines, as the size of the project will affect the volume of material and transportation, as well as all the equipment needed to process concrete and supplementary materials. Both the raw materials for concrete (e.g., additives, admixtures, sand) and supplementary materials (e.g., rebar or vapor barrier) are transported from suppliers' distribution centers.

Each project requires a specific concrete mix so that the material properties are achieved despite weather conditions. The concrete mixing process is carried out in a silo that is set up at a site close to the project location, usually less than 7 miles (11.2 km) away. Once mixed, it is transported to the job site and poured. Together with the supplementary materials, the final product is then installed. The final steps generally require a finishing process for the floor. The Fricks team coordinates project logistics so that once one project is complete, all the necessary equipment is moved directly to the location required for the next project.

Product Specifications

Product Classification Codes: EC3 - Concrete -> ReadyMix

Material Composition

Material/Component Category	Origin	% Mass
Portland Cement	United States	10.45
Shrinkage-Compensating Additive	United States	2.35
Sand	United States	29.76
Stone	United States	46.71
Water	United States	6.74
Admixture	United States	0.06
Branded Armor Joint	United States	0.05
Lumber	United States	0.19
Poly Slip Sheeting	United States	0.05



Material/Component Category	Origin	% Mass
Rebar	United States	1.10
Stego Vapor Barrier	United States	0.02
Trap Rock	United States	2.50

Hazardous Materials
No regulated hazardous or dangerous substances are included in this product.

EPD Data Specifity

- Primary Data Year:2022-2024
- Manufacturing Specificity:

✗

 Industry Average

✓

 Manufacturer Average

✗

 Facility Specific

Averaging:
The composition of the supplementary materials on the concrete slabs, depends on the characteristics of the installation site of the floor. For the purposes of this EPD, this composition was obtained by averaging 6 different projects.

The results of the averaging process are shown in the following table:

Project ID	Concrete mix (%)	Supplementary materials (%)
Average	96.4%	3.6%
Mix 1	96.7%	3.3%
Mix 2	91.2%	8.8%
Mix 3	98.2%	1.8%
Mix 4	98.7%	1.3%
Mix 5	98.9%	1.1%
Mix 6	96.9%	3.1%

As Fricks' shrinkage-compensating concrete slab qualifies as a product-average according to PCR Part A and ISO 21930 Section 5.3, and because the aggregated A1 – A3 impacts differ by more than 10% in at least one impact category, the results are presented in terms of the most conservative scenario. Specifically, they correspond to the project, among those included in the weighted average, with the highest environmental impact in each category.



System Boundary

Production	A1	Raw material supply	✓
	A2	Transport	✓
	A3	Manufacturing	✓
Construction	A4	Transport to site	✓
	A5	Assembly / Install	✓
Use	B1	Use	ND
	B2	Maintenance	ND
	B3	Repair	ND
	B4	Replacement	ND
	B5	Refurbishment	ND
	B6	Operational Energy Use	ND
	B7	Operational Water Use	ND
End of Life	C1	Deconstruction	ND
	C2	Transport	ND
	C3	Waste Processing	ND
	C4	Disposal	ND
Benefits & Loads Beyond System Boundary	D	Recycling, Reuse Recovery Potential	ND

Note:

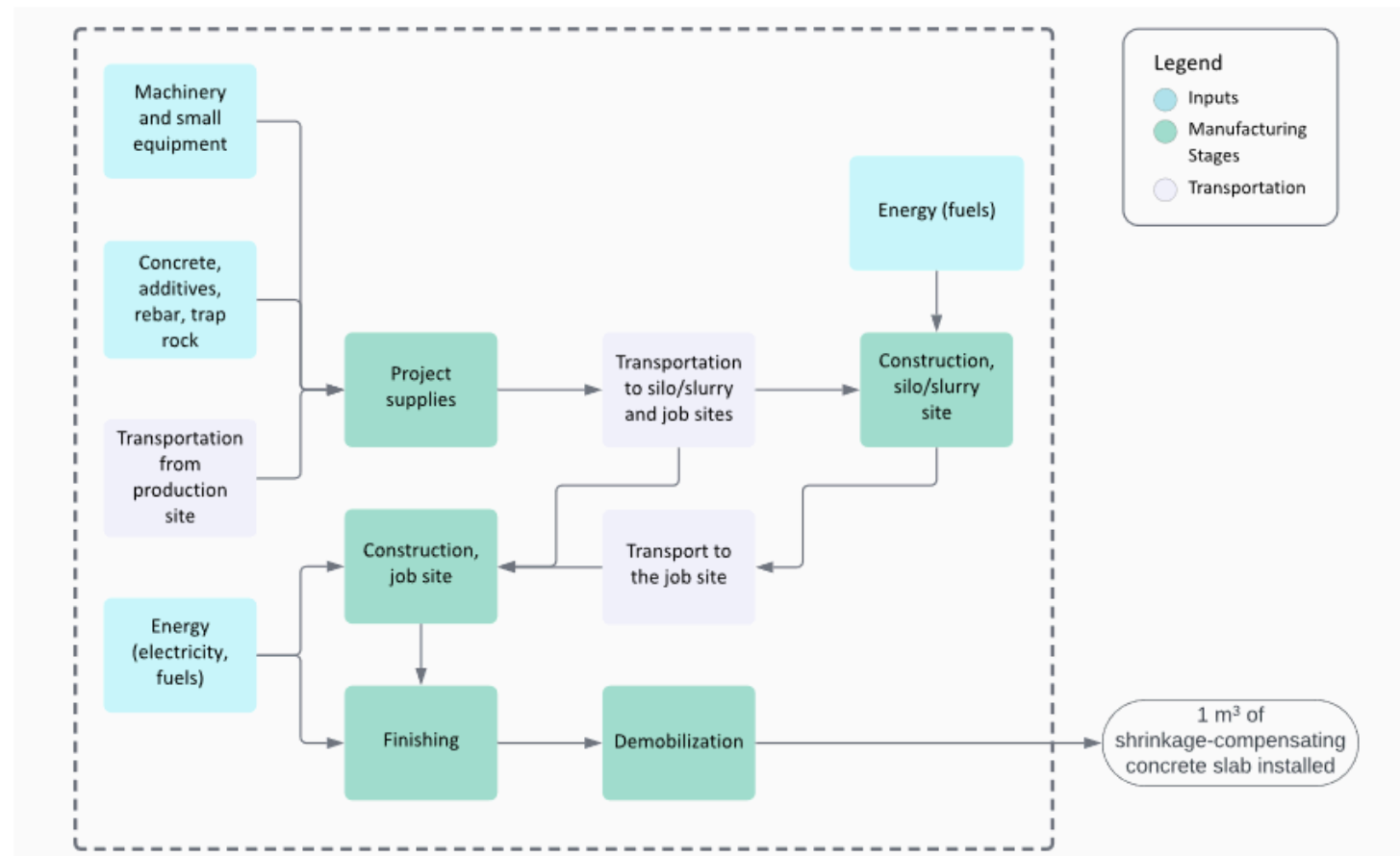
ND = Module not declared

Plants

-  Project TX 22-803 Texas, USA
-  Project FL 23-827 Florida, USA
-  Project PA 24-848 Pennsylvania, USA
-  Project NC-24-849 North Carolina, USA
-  Project NV 23-821 Nevada, USA
-  Project NC-24-849 North Carolina, USA

Project NC-24-849 North Carolina, USA
Project NC-24-849 North Carolina, USA

Product Flow Diagram



This LCA is cradle-to-gate with options in scope, and covers raw material supply for concrete mix, transportation to the silo and job site, supplementary materials manufacturing, transport of equipment and machinery to the silo and job sites and installation of shrinkage-compensating concrete slabs (modules A1-A5).

The stages in the production of shrinkage compensating concrete slabs include:

- **Raw materials supply (A1):** The primary materials for concrete production are included here, as well as the energy used for their manufacturing process, and the transportation to the production facility. These materials include cement, sand, rock, additives, shrinkage-compensating additive, and water. Since the ratios may vary by project, this study uses average ratios.
- **Raw materials transport (A2):** This stage includes the transportation of each raw material from the production site to the project work site, as well as to the nearby silo site. Packaging is not included because all materials are transported in trucks ready to be mixed.
- **Manufacturing (A3):** This includes ancillary materials or supplementary materials for the manufacture of shrinkage-compensating concrete slabs, including rebar, lumber, vapor barrier, plastic films, and trap rock. The transportation of these materials to the work site and to the silo site is also accounted for.
- **Transport to installation site (A4):** This stage includes transporting machinery and equipment to the job site, as well as transporting concrete mix from the site silo to the job site for pouring into the installation.

- **Installation (A5):** This stage includes the consumption of all fuels required by the machinery and equipment used for the installation of shrinkage-compensating concrete slabs. In addition, it also includes the consumption of water required to maintain optimal concrete curing conditions. All electricity needed during installation is supplied by on-site generators, so no electricity use is reported during installation.

It should be noted that each product and life cycle stage include the resource use and emissions associated with extraction and processing of raw materials, manufacturing processes and transportation.

Software And Database

LCA Software:	SimaPro v. 10.2
LCI Foreground Database(s):	Ecoinvent v. 3.11 Efforts were made to choose US geography datasets or alter datasets to reflect US conditions, however, due to data availability regional and global averages were also used Cut-off
LCI Background Database(s):	Ecoinvent v. 3.11 Efforts were made to choose US geography datasets or alter datasets to reflect US conditions, however, due to data availability regional and global averages were also used Cut-off

A foreground LCI database is the database used to model the primary, site-specific data collected for this EPD. A background LCI database is the database used to model generic or non-specific data.

Data Quality

Category	Data Quality Information
<i>Time-related coverage</i>	The data used for foreground and background data is from 2010 to 2024. The quantity of materials and energy required for the shrinkage-compensating concrete slab's manufacturing and distribution is from 2022 to 2024. Secondary data was obtained from ecoinvent 3.11 which were updated in 2025 (as described in the general information of the database library). Overall, time coverage is estimated to be very good.
<i>Geographical coverage</i>	The data used to model the inputs and outputs of manufacturing for the shrinkage-compensating concrete slab is from the U.S. When there was no data from the U.S., but there was from other regions, the electricity source was changed, to reflect the U.S. conditions. For background data, global average data sets were used.
<i>Technology coverage</i>	The technology for manufacturing shrinkage-compensating concrete slab reflects the actual technology. For background data, global average data were used.
<i>Precision and completeness</i>	The data obtained was as precise as possible, using information available in literature. This dataset can be considered complete with emissions reported in every unit process. The data set is represented by primary data for the BOM, main manufacturing (energy and water) and distribution inputs. Primary information provided by the company represents the foreground system for these products
<i>Completeness</i>	Every effort was made to perform a comprehensive analysis and to include as much detail as possible, following the cut-off criteria established for the project.
<i>Representativeness</i>	This aspect of data quality is largely based on assessing temporal, geographic, and technological representativeness. These elements were described above and also assessed quantitatively using the pedigree matrix scoring system and Monte Carlo analysis.
<i>Consistency</i>	All systems were modeled using the same calculation tool, data sources and background databases.
<i>Reproducibility</i>	The information provided is enough and transparent, so that an independent practitioner is able to reproduce the results reported in the study.
<i>Sources of the data</i>	Data sources are identified for all parts of the LCI systems modeled.

Data Sources

Material/Process Category	Module	Material/Process Name	Inventory Dataset Name	Dataset Geographic Region	Reporting Period/Year Dataset Represents	Reference	Amount (if relevant)	Unit
Concrete materials	A1	Portland cement	Cement, Portland {US} cement production, Portland Cut-off, U, modified	US	2005-2025	ecoinvent 3.11, ESG modified	248	kg
Concrete materials	A1	Shrinkage-compensating additive	Cement, type I-PM {US} cement production, type I-PM Cut-off, U	US	2005-2025	ecoinvent 3.11	55.7	kg
Concrete materials	A1	Sand	Sand {RoW} gravel and sand quarry operation Cut-off, U	RoW	1997-2025	ecoinvent 3.11	706	kg
Concrete materials	A1	Stone	Limestone, unprocessed {RoW} limestone quarry operation Cut-off, U	RoW	1992-2025	ecoinvent 3.11	1108	kg
Concrete materials	A1	Water	Tap water {CA-QC} market for tap water Cut-off, U	CA-QC	2012-2025	ecoinvent 3.11	160	kg
Concrete materials	A1	Admixture	Polycarboxylates, 40% active substance {RoW} polycarboxylates production, 40% active substance Cut-off, U	RoW	1993-2025	ecoinvent 3.11	1.4	kg
Transport of concrete materials	A2	Transportation by truck	Transport, freight, lorry, >32 metric ton, diesel, EURO 4 {RoW} transport, freight, lorry, >32 metric ton,	RoW	2009-2025	ecoinvent 3.11	255725.17	kg*km



Material/Process Category	Module	Material/Process Name	Inventory Dataset Name	Dataset Geographic Region	Reporting Period/Year Dataset Represents	Reference	Amount (if relevant)	Unit
			diesel, EURO 4 Cut-off, U					
Transport of concrete materials	A2	Transportation by train	Transport, freight, train, fleet average {US} transport, freight, train, diesel Cut-off, U	US	2011-2025	ecoinvent 3.11	84471.82	kg*km
Transport of concrete materials	A2	Transportation by ship	Transport, freight, sea, container ship, heavy fuel oil {GLO} transport, freight, sea, container ship, heavy fuel oil Cut-off, U	GLO	2007-2025	ecoinvent 3.11	45083.01	kg*km
Supplementary materials	A3	Branded Armor Joint	Steel, chromium steel 18/8, hot rolled {RoW} steel production, chromium steel 18/8, hot rolled Cut-off, U	RoW	2011-2025	ecoinvent 3.11	1.125	kg
Supplementary materials	A3	Branded Armor Joint	Nylon 6 {RoW} nylon 6 production Cut-off, U	RoW	1993-2025	ecoinvent 3.11	0.125	kg
Supplementary materials	A3	Branded Armor Joint	Injection moulding {GLO} market for injection moulding Cut-off, U	GLO	1993-2025	ecoinvent 3.11	0.125	kg
Supplementary materials	A3	Stego Vapor Barrier	Chemical, organic {GLO} chemical production, organic Cut-off, U	GLO	2025-2025	ecoinvent 3.11	0.0274	kg
Supplementary materials	A3	Stego Vapor Barrier	Polyethylene, low density, granulate	RoW	2011-2025	ecoinvent 3.11	0.5206	kg



Material/Process Category	Module	Material/Process Name	Inventory Dataset Name	Dataset Geographic Region	Reporting Period/Year Dataset Represents	Reference	Amount (if relevant)	Unit
			{RoW} polyethylene production, low density, granulate Cut-off, U					
Supplementary materials	A3	Stego Vapor Barrier	Extrusion, plastic film {RoW} extrusion, plastic film Cut-off, U	RoW	1993-2025	ecoinvent 3.11	0.5206	kg
Supplementary materials	A3	Lumber	Sawnwood, board, softwood, raw, dried (u=20%) {RoW} board, softwood, raw, kiln drying to u=20% Cut-off, U	RoW	2011-2025	ecoinvent 3.11	4.58	kg
Supplementary materials	A3	Poly Slip Sheeting	Polyethylene, low density, granulate {RoW} polyethylene production, low density, granulate Cut-off, U	RoW	2011-2025	ecoinvent 3.11	1.2	kg
Supplementary materials	A3	Poly Slip Sheeting	Extrusion, plastic film {RoW} extrusion, plastic film Cut-off, U	RoW	1993-2025	ecoinvent 3.11	1.2	kg
Supplementary materials	A3	Rebar	Reinforcing steel {RoW} reinforcing steel production Cut-off, U	RoW	2000-2025	ecoinvent 3.11	26.1	kg
Supplementary materials	A3	Trap rock	Basalt {RoW} basalt quarry operation Cut-off, U	RoW	2003-2025	ecoinvent 3.11	59.4	kg
Transport of supplementary materials	A4	Transport of equipment and machinery	Transport, freight, lorry, >32 metric ton,	RoW	2009-2025	ecoinvent 3.11	7840	kg*km

Material/Process Category	Module	Material/Process Name	Inventory Dataset Name	Dataset Geographic Region	Reporting Period/Year Dataset Represents	Reference	Amount (if relevant)	Unit
		from one job site to another	diesel, EURO 4 {RoW} transport, freight, lorry, >32 metric ton, diesel, EURO 4 Cut-off, U					
Transport of supplementary materials	A4	Transport of concrete from slurry to job site	Transport, freight, lorry, >32 metric ton, diesel, EURO 4 {RoW} transport, freight, lorry, >32 metric ton, diesel, EURO 4 Cut-off, U	RoW	2009-2025	ecoinvent 3.11	25700	kg*km
Installation	A5	Water	Tap water {CA-QC} market for tap water Cut-off, U	CA-CQ	2012-2025	ecoinvent 3.11	86.2	kg
Installation	A5	Diesel, for machinery	Diesel, burned in building machine {GLO} market for diesel, burned in building machine Cut-off, U	GLO	1996-2025	ecoinvent 3.11	236	MJ
Installation	A5	Gasoline, for machinery	Petrol, unleaded, burned in machinery {GLO} market for petrol, unleaded, burned in machinery Cut-off, U	GLO	2009-2025	ecoinvent 3.11	161	MJ

Life Cycle Module Description

- **Raw materials supply (A1):** The primary materials for concrete production are included here, as well as the energy used for their manufacturing process, and the transportation to the production facility. These materials include cement, sand, rock, additives, shrinkage-compensating additive, and water. Since the ratios may vary by project, this study uses average ratios.

- **Raw materials transport (A2):** This stage includes the transportation of each raw material from the production site to the project work site, as well as to the nearby silo site. Packaging is not included because all materials are transported in trucks ready to be mixed.
- **Manufacturing (A3):** This includes ancillary materials or supplementary materials for the manufacture of shrinkage-compensating concrete slabs, including rebar, lumber, vapor barrier, plastic films, and trap rock. The transportation of these materials to the work site and to the silo site is also accounted for.
- **Transport to installation site (A4):** This stage includes transporting machinery and equipment to the job site, as well as transporting concrete mix from the site silo to the job site for pouring into the installation.
- **Installation (A5):** This stage includes the consumption of all fuels required by the machinery and equipment used for the installation of shrinkage-compensating concrete slabs. In addition, it also includes the consumption of water required to maintain optimal concrete curing conditions. All electricity needed during installation is supplied by on-site generators, so no electricity use is reported during installation.

LCA Discussion

Allocation Procedure

Secondary data were from ecoinvent were used for this study. The ecoinvent unit processes used were based on the cut-off approach, and no changes in allocation approach were made to the secondary data.

Cut-off Procedure

Every effort was made to include all the flows associated with the processes studied. The environmental significance criterion is also used when selecting proxies and prioritizing data refinements. This specific criterion is evaluated through a sensitivity analysis intended to test the sensitivity of the results to the exclusions, assumptions and data substitutions made.

Renewable Electricity

Energy Attribute Certificates (EACs) such as
Renewable Energy Certificates (RECs) or Power
Purchase Agreements (PPAs) are included in the
baseline reported results: ✗ No

Results

Environmental Impact Assessment Results

IPCC AR6 GWP 100, TRACI 2.2

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Impact Category	Method	Indicator	A1	A2	A3	A1 - A3	A4	A5
GWP-total	IPCC AR6 GWP 100	ND	2.58e+2	3.55e+1	1.38e+2	4.32e+2	3.70e+0	3.85e+1
GWP-biogenic	IPCC AR6 GWP 100	ND	4.37e-2	8.71e-3	6.83e-2	1.21e-1	8.78e-4	3.49e-3
GWP-fossil	IPCC AR6 GWP 100	ND	2.58e+2	3.55e+1	1.37e+2	4.31e+2	3.70e+0	3.85e+1
GWP-luluc	IPCC AR6 GWP 100	ND	3.59e-2	1.70e-2	8.01e-2	1.33e-1	1.69e-3	3.91e-3
ODP	TRACI 2.2	ND	7.51e-7	5.17e-7	1.40e-6	2.67e-6	5.60e-8	5.97e-7
AP	TRACI 2.2	ND	5.23e-1	1.87e-1	4.92e-1	1.20e+0	1.41e-2	2.62e-1
EP-freshwater	TRACI 2.2	ND	1.52e-2	2.43e-3	2.57e-2	4.33e-2	2.61e-4	6.45e-4
EP-marine	TRACI 2.2	ND	1.03e-1	3.99e-2	8.41e-2	2.27e-1	2.97e-3	6.88e-2
POCP	TRACI 2.2	ND	1.10e+1	4.71e+0	9.60e+0	2.53e+1	3.49e-1	8.22e+0

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particular Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted. Any comparison of EPDs shall be subject to the requirements of ISO 21930 or EN 15804. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate, and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Resource Use Indicator

Indicator	Unit	A1	A2	A3	A1 - A3	A4	A5
PERT	MJ, net calorific value	6.52e+1	7.76e+0	8.88e+1	1.62e+2	7.38e-1	2.72e+0
PENRT	MJ, net calorific value	1.23e+3	5.30e+2	1.87e+3	3.63e+3	5.67e+1	5.31e+2
SM	kg	0	ND	0	0	ND	0
RSF	MJ, net calorific value	ND	ND	0	0	ND	0
NRSF	MJ, net calorific value	ND	ND	0	0	ND	0
RE	MJ	ND	ND	0	0	ND	0
ADPF	MJ	1.06e+3	4.91e+2	1.71e+3	3.26e+3	5.26e+1	4.97e+2
FW	m3	1.67e+0	7.76e-2	9.06e-1	2.65e+0	8.23e-3	1.17e-1

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

RPRE or PERE = Renewable primary resources used as energy carrier (fuel), RPRM or PERM = Renewable primary resources with energy content used as material, RPRT or PERT = Total use of renewable primary resources with energy content, NRPRE or PENRE = Non-renewable primary resources used as an energy carrier (fuel), NRPRM or PENRM = Non-renewable primary resources with energy content used as material, NRPT or PENRT = Total non-renewable primary resources with energy content, SM = Secondary materials, RSF = Renewable secondary fuels, NRSF = Non-renewable secondary fuels, RE = Recovered energy, ADPF = Abiotic depletion potential, FW = Use of net freshwater resources, VOCs = Volatile Organic Compounds.

Waste and Output Flow Indicators

Indicator	Unit	A1	A2	A3	A1 - A3	A4	A5
HWD	kg	ND	ND	0	0	ND	0
NHWD	kg	ND	ND	0	0	ND	0
HLRW	kg	ND	ND	ND	ND	ND	ND
ILLRW	kg	ND	ND	ND	ND	ND	ND
CRU	kg	ND	ND	ND	ND	ND	ND
MFR	kg	ND	ND	0	0	ND	0
MER	kg	ND	ND	0	0	ND	0
EE	MJ	ND	ND	0	0	ND	0

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

Interpretation

Key findings from the analysis include:

- Raw material supply (A1) is the primary contributor to impacts in all categories. Within raw material supply, Portland Cement is the primary contributor.

- Raw material transport (A2), Manufacturing (A3), and Assembly and Install (A5) all show up as secondary impacts at roughly similar intensity. Within these manufacturing of rebar and use of diesel at the installation site are the major contributors.
- Raw materials transport (A2) and transportation to the installation site (A4) are minor contributors to all impacts.

Additionally, an uncertainty analysis was performed using the Pedigree Matrix Approach for data quality assessment and 1,000 Monte Carlo runs. In LCA, uncertainty can occur due to many reasons, including dataset (ecoinvent) uncertainty, primary data uncertainty, model assumptions, and LCA practitioner choice uncertainty. In this study, several ecoinvent datasets were used to model background processes. These data were often from global datasets, which have geographical and technological differences when compared to the system under study. While efforts were made to choose US geography datasets or alter datasets to reflect US conditions, there is still uncertainty associated with the ecoinvent dataset selection.

Although primary data is preferred over ecoinvent data, it is important to be aware that mechanical errors or human errors can result in primary data uncertainty. In this study, primary data was collected by Fricks based on utility bills and annual reports. Although there can be uncertainty associated with primary data collection, the primary data in this study is not expected to significantly influence the uncertainty of the results.

Results are presented in the table below:



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