MiTek®

Metal Truss Connector Plates and POSI-STRUT® Metal Webs

ASTM INTERNATIONAL

Environmental Product Declaration

Conducted in accordance with ISO 14025 and ISO 21930

EPDs are not intended to make comparisons with other products due to varying background data in LCA softwares and/or varying Program Operator rules or PCRs. The EPD and PCR process are informational only and do not warrant performance.

EPD SUMMARY

PROGRAM OPERATOR	ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA, 19428. https://www.astm.org/ ASTM Program Operator Rules. Version: 8.0, Revised 29 April 2020.
DECLARATION HOLDER	MiTek® Inc.
DECLARATION NUMBER	619
EPD TYPE & SCOPE	Product-specific EPD, Cradle-to-gate
DATASET VARIABILITY	Production-weighted average of MiTek facilities
REPORTED DATA YEAR	2022
DECLARED PRODUCT & UNIT	Metal Truss Connector Plates and POSI-STRUT® Metal Webs, per declared unit of 1 metric ton
MARKETS OF APPLICABILITY	Light wood-frame residential and commercial off-site construction
DATE OF ISSUE & VALIDITY	8 January 2024. Valid through 7 January 2029
SUBCATEGORY PCR	Product Category Rule Guidance for Building-Related Products and Services Part B: Designated Steel Construction Product EPD Requirements, UL 10010–34, 2nd edition, dated August 26, 2020. Reviewed by: Chair: Tom Gloria, LCACP, Industrial Ecology Associates; Brandie Sebastian, JBE Consultants; and James Littlefield, Independent Consultant
LCA SOFTWARE	SimaPro 9.4 LCA Software (2022)
LCI DATABASE(S)	DATASMART (2020)
LCIA METHODOLOGY	TRACI 2.1

This declaration was independently verified by Tim Brooke, ASTM International, in accordance with ISO 14044:2006/Amd1:2017/Amd2:2020, ISO 14025:2006 and ISO 21930:2017. The UL Environment "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," in conformance with ISO 21930:2017, serves as the core PCR, with additional considerations from the USGBC/UL Environment Part A Enhancement (2017) The verification was performed: ___ **I**nternally **_X__** Externally	
LCA conducted in accordance with ISO 14044 and the reference PCR by:	Anne Landfield Greig, LCACP, Four Elements Consulting, LLC https://www.fourelementsllc.com anne@fourelementsllc.com
LCA independently verified in accordance with ISO 14044 and the reference PCR by:	Lindita Bushi, PhD. Athena Sustainable Materials Institute

Limitations

The environmental impact results of steel 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 steel 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.

MiTek® Inc.

MiTek is a global provider of integrated building solutions that empower next-generation design, prefabrication, and construction for the building industry. Our vision is to transform communities through more efficient and sustainable building methods. Our mission is to advance the adoption of off-site construction by championing better building methods through our Design-Make-Build™ approach. MiTek's innovative and integrated building solutions consist of engineered systems and products, automation, software and services that enable our partners to transform the way the industry designs, makes, and builds.

MiTek Metal Truss Connector Plates and POSI-STRUT® Metal Webs capitalize on this by incorporating innovative off-site construction methods that minimize waste, reduce risk, improve quality and accelerate the building schedule. Additionally, our focus on off-site manufacturing concentrates on sustainability by eliminating job site waste, reducing equipment and trades required on a project site and minimizing impacts to the environment.

Product Descriptions

Metal Truss Connector Plates

MiTek Metal Truss Connector Plates are used as joint connector components of light wood-frame trusses in residential and commercial off-site construction under the International Building Code® (IBC) and under the International Residential Code® (IRC) when an engineered design is prepared in accordance with IRC Section R301.1.3, and under the National Building Code of Canada (NBC). MiTek Metal Truss Connector Plates are manufactured from ASTM A653 galvanized steel coil. Slots are punched along the perpendicular axis of the plate to form teeth in pairs at right angles to the face of the parent metal. The CSI MasterFormat section number for this product is 06 17 53 (Shop-Fabricated Wood Trusses). There is no UNSPSC code for this product.

Table 1 MiTek Metal Truss Connector Plates Technical Information

Property	Value, Unit
Metal Truss Connector Plate Types	MII16, MT18HS®, M18AHS, M18SHS™, MT20®, MT20HS®
Steel Specification	ASTM A653; SS, HSLAS, HSLAS-F
Steel Grades	40, 60 and 80
Nominal Thickness	16, 18 and 20 gage (0.0575, 0.0466 and 0.0356 in. total metal thickness)
Corrosion Protection	G60 / G90 (U.S. / Canada)
Weight (multiplier)	0.017, 0.014 and 0.011 lb./in^2 of metal connector plate

For SI: 1 inch = 25.4 mm; 1 lb. = 0.4536 kg. 1 lb. = 0.00045 metric ton (MT).

MiTek POSI-STRUT® Metal Webs

MiTek POSI-STRUT® Metal Webs are used as structural web members in parallel chord wood trusses in light wood-frame residential and commercial off-site construction under the International Building Code® (IBC) and under the International Residential Code® (IRC) when an engineered design is prepared in accordance with IRC Section R301.1.3, and under the National Building Code of Canada (NBC). POSI-STRUT® Metal Webs are V-shaped channel members with integrally formed metal truss connector plates at the upper and lower ends with teeth identical to those of the MiTek MT20™ Metal Truss Connector Plate. The CSI MasterFormat section number for this product is 06 17 36 (Metal-Web Wood Joists). There is no UNSPSC code for this product.

Table 2 MiTek POSI-STRUT® Metal Webs Technical Information

Property	Value, Unit
POSI-STRUT® Metal Web Types	10, 10V2, 12, 12I, 13, 14, 14V3, 16, 16V3
Steel Specification	ASTM A653
Steel Grade	40
Nominal Thickness	20 gage (0.0356 in. total metal thickness)
Corrosion Protection	G60 / G90 (U.S. / Canada)
Weight (multiplier)	0.73 – 1.22 lbs. per V web

For SI: 1 inch = 25.4 mm; 1 lb. = 0.4536 kg. 1 lb. = 0.00045 metric ton (MT).

Manufacturing

MiTek's Metal Truss Connector Plates and POSI-STRUT® webs are manufactured at five facilities in North America: Edenton, NC; Hazelwood, MO; Tampa, FL; Tolleson, AZ, U.S. and Bradford, ON, Canada. The manufacturing process for MiTek Metal Truss Connector Plates and POSI-STRUT® Metal Webs commences with the issuance of a work order to the shopfloor, stating the production requirements. Externally sourced zinc coated, mild steel coils of the correct grade and specification are taken to a designated coil slitting line. The full width steel coils are slit down to the required size for manufacturing the products in the stamping dies.

The slit coils (ribbons) are taken to the designated press-lines in the MiTek manufacturing facility. Press-lines are made up of a range of power presses of varying tonnage capacity and ancillary equipment such as de-coiler and straightener machines. Press selection is dependent upon the product type and size required. The machinery is started, and the slit steel coil is loaded onto an automatic de-coiler machine, fed through the straightener machine and into the press tooling by the press setter. The setter operates

the press to produce a first-off sample, to confirm that the product complies with the specification, and the production run proceeds.

As the steel passes through the tooling automatically, the press will cycle, and the tooling will strike the steel to produce the finished component. The finished component is collected at the front of the press by the press operator. Products are either manually packaged or packaged by automated equipment in boxes or banded packs and stacked onto a pallet. All finished goods manufactured in North America have a MiTek brand label.

End-of-Life

These construction products are 100% recyclable when sent to a recycler. No benefits or loads for recycling the product at end-of-life have been calculated so are not declared.

Life Cycle Assessment Overview

Cradle-to-gate Life Cycle Assessments (LCAs) were completed on MiTek Metal Truss Connector Plates and POSI-STRUT® Metal Webs in accordance with ISO 14040 / ISO 14044, and the study was reviewed for conformance with ISO 14044, ISO 21930:2017, ASTM program operator rules, and the PCR subcategory. The product assessed was based on data from five MiTek facilities in North America.

System Boundaries

The LCA evaluated the cradle to gate of the construction materials system. This includes: raw material extraction and processing (A1), transportation of the materials to manufacturing plants (A2), and manufacturing (A3). This is depicted below in the context of the construction works life cycle (adapted from 21930:2017 Fig 1). The LCA follows the attributional LCA approach.

Table 3 EPD System Boundary Modules

A1-A3			A4-A5		B1-B7					C1-C4				D
PRODUCTION Stage			CONSTRUC-TION Stage		USE Stage					END-OF-LIFE Stage				Benefits & Loads
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Product Use	Maintenance	Repair	Full replacement	Refurbishment	Deconstruction / Demolition	Transport to waste processing or disposal	Waste processing	Disposal of waste	Reuse, recovery, recycling potential
Mandatory			Scenarios		Scenarios B6 Operational energy use scenario B7 Operational water use scenario					Scenarios				Scenario
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Note: MND = module not declared

Figure 1 presents A1-A3 as they pertain to these products and additionally provides aspects of the life cycle that are excluded from the study.

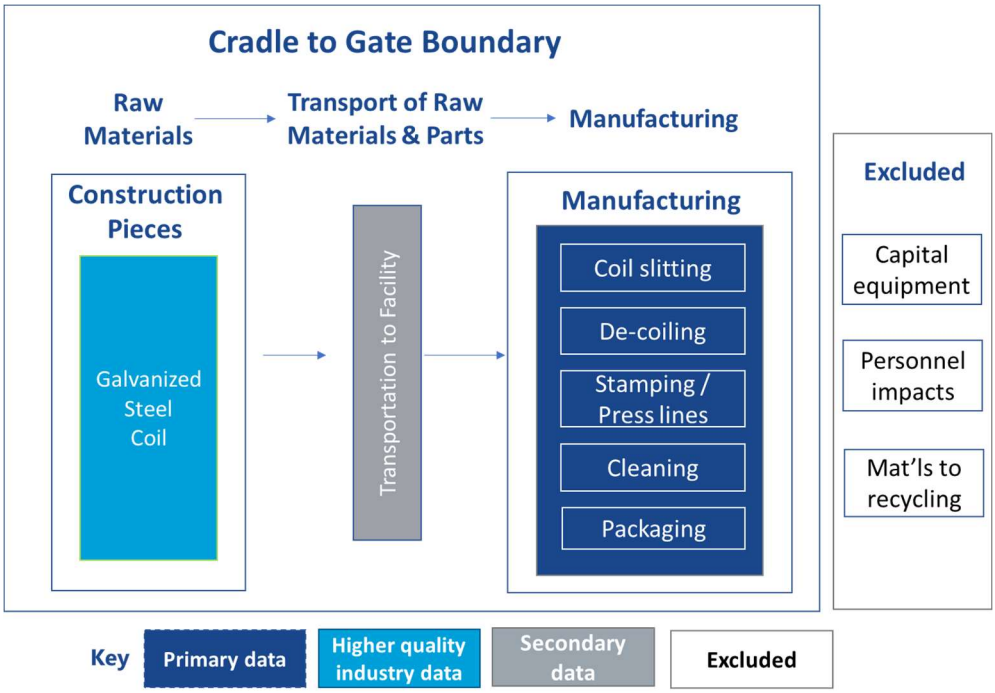

Figure 1 Construction Product System Boundary and Data

Declared Unit

The declared unit is one metric ton (MT) of the MiTek Metal Truss Connector Plates or POSI-STRUT® Metal Webs produced at MiTek manufacturing plants in Edenton, NC, Hazelwood, MO, Tampa, FL, Tolleson, AZ, U.S. and Bradford, ON, Canada. A functional unit is not reported since the product system boundaries are cradle-to-gate, and no use phase over a reference service life has been modeled.

A1 Raw Material Extraction and Processing

Module A1 accounts for the production of galvanized steel coil, specifically: extraction of iron ore and other materials from the earth, secondary steel recovery, and primary and secondary steel production into galvanized steel coil.

A2 Transportation to Manufacturing

Module A2 accounts for transportation of steel coil to the manufacturing plants in North America. The distances traveled by heavy duty truck, rail, barge and ocean freighter were based on supplier data provided by MiTek.

A3 Manufacturing

Module A3 includes manufacturing of the products. 2022 energy use, emissions, and waste management were included in the model. Regional electricity grid mixes were accounted for, for each facility.

Cut-off Criteria

All efforts were made to include all known inputs of mass and energy flows and all known outputs. No known flows have been deliberately excluded from this EPD. Data gaps on materials were filled by proxy data deemed appropriate.

Allocation

Data was provided on a total facility basis. Total mass allocations were made for the products in the EPD based on facility outputs.

Software and Data Used

The SimaPro LCA software was used to model the construction products. Primary data came from the MiTek facilities that manufacture these products. Datasets came from sources appropriate for the products, with intentional choices for the highest data quality. Worldsteel provided data for the galvanized steel and secondary data came from DATASMART, which was chosen for its focus on North American energy, transportation, materials, and processing.

Data Quality

The data applied to this study represent the current production of MiTek Metal Truss Connector Plates and POSI-STRUT® Metal Webs. MiTek's facilities in Edenton, NC, Hazelwood, MO, Tampa, FL, Tolleson, AZ, U.S. and Bradford, ON, Canada, supplied 2022 process data, which was based on manufacturing and packaging these construction products in preparation for use in off-site construction. Energy and transportation data are based on the high 2010's, and production data for steel are based on 2018 industry-average primary data. Data for energy, transportation, materials and processes are North American-based, and were specific to MiTek supplier locations. Technological coverage for the upstream materials and processes is generally industry average, and in some instances, it is typical technology.

Results and Contribution Analysis

Results are for MiTek's processing of 1 MT of these products. The Life Cycle Impact Assessment (LCIA) results were calculated using Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI) v.2.1, a North American impact assessment methodology. Global Warming Potential is based on IPCC 6th Assessment. Abiotic Depletion Potential for fossil fuels is based on CML's baseline methodology. LCIA results in Table 4 and Table 5 are presented for the cradle to gate totals, showing A1, A2, and A3 as absolute values and as percentages, respectively. The Life Cycle Inventory (LCI) results follow. The end-user of this EPD can use these results to calculate impact profiles for each MiTek product listed in the tables below. The results are to be multiplied by the mass per unit of the respective product.

Table 4 Impact Assessment Results – absolute values

1 MT Metal Truss Connector Plates or 1 MT POSI-STRUT® Metal Webs			Materials production	Transport to facility	Manuf-acturing
Impact Categories – LCIA	**Unit**	**TOTAL**	**A1**	**A2**	**A3**
Global warming potential	kg CO2-e	2,292	2,210	1.44	81
Acidification potential	kg SO2-e	4.75	4.41	0.023	0.321
Eutrophication potential	kg N-e	0.402	0.226	0.00165	0.175
Smog creation potential	kg O3-e	81.3	76.0	0.73	4.5
Ozone depletion potential	kg CFC11-e	4.17 E-06	-1.83 E-12	2.53 E-09	4.17 E-06
ADP fossil	MJ, LHV	27,963	26,900	18.0	1,045
Total energy (used as fuel)	MJ, LHV	29,986	28,282	18.3	1,686

Comparability. 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. 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.

Table 5 Impact Assessment Results – percentages

1 MT Metal Truss Connector Plates or 1 MT POSI-STRUT® Metal Webs			Materials production	Transport to facility	Manuf-acturing
Impact Categories – LCIA	**Unit**	**TOTAL**	**A1**	**A2**	**A3**
Global warming potential	kg CO2-e	2,292	96.4%	0.06%	3.53%
Acidification potential	kg SO2-e	4.75	92.8%	0.48%	6.76%
Eutrophication potential	kg N-e	0.402	56.2%	0.41%	43.4%
Smog creation potential	kg O3-e	81.3	93.5%	0.90%	5.59%
Ozone depletion potential	kg CFC11-e	4.17 E-06	0.00%	0.06%	99.9%
ADP fossil	MJ, LHV	27,963	96.20%	0.06%	3.74%
Total energy (used as fuel)	MJ	29,986	94.3%	0.06%	5.62%

Note: numbers may not add to 100% due to rounding.

Table 6 Inventory Results

1 MT Metal Truss Connector Plates or 1 MT POSI-STRUT® Metal Webs			Materials production	Transport to facility	Manuf-acturing
Additional Categories – LCI	**Unit**	**TOTAL**	**A1**	**A2**	**A3**
Resource Use: Energy					
Non-renewable primary energy – fuel	MJ (LHV)	28,259	26,877	18.2	1,363
Non-renewable primary engy. res. – raw materials	MJ (LHV)	0.00	0.00	N/A	0.00
Renewable primary energy – fuel	MJ (LHV)	1,728	1,405	0.041	323
Renewable primary engy. res. – raw materials	MJ (LHV)	0.00	0.00	N/A	0.00
Resource use: Materials					
Use of secondary materials	kg	3,610	3,610	N/A	0.00
Use of renewable secondary fuels	MJ (LHV)	0.00	0.00	N/A	0.00
Use of non-renewable secondary fuels	MJ (LHV)	0.00	0.00	N/A	0.00
Use of recovered energy	MJ (LHV)	0.00	0.00	N/A	0.00
Use of net fresh water (inputs minus outputs)	m^3	11.9	10.5	1.59 E-04	1.41
Waste categories					
Non-hazardous waste disposed	kg	3.16	0.00	N/A	3.16
Hazardous waste disposed	kg	0.029	0.00	N/A	0.029
High-level radioactive waste	kg	9.04 E-04	0.00	7.68 E-07	9.03 E-04
Intermediate- & low-level radioactive waste	kg	2.01 E-03	0.00	1.71 E-06	2.01 E-03
Other output flows					
Components for reuse	kg	0.00	0.00	0.00	0.00
Materials for recycling	kg	30.2	0.00	0.00	30.2
Materials for energy recovery	kg	0.00	0.00	0.00	0.00
Exported energy	MJ (LHV)	0.00	0.00	0.00	0.00

Carbon emissions and removals from biogenic sources, calcination, carbonation, and combustion of waste from non-renewable sources are not applicable to the products in the LCA and this EPD. The GWP impact category results do not account for these.

MiTek Environment and Health During Manufacturing

The MiTek Stamping Process manufactures Metal Truss Connector Plates and POSI-STRUT® Metal Webs. This process uses steel coil material that is run through mechanical power presses (MPP) where the steel is punched, sheared, and stamped. In the process, coolant product is used in a 10:1 mixture ratio with water for temperature control. Some of the coolant/water mixture stays with the finished product; however, greater than 95% is contained within the MPP and reservoir. Waste generated from this process

is managed through containment and proper disposal through a MiTek designated waste management company.

The stamping process does not produce air emissions concerns or hazardous waste. The process does generate used oil and/or universal waste, wastewater, and scrap metal. All waste streams are managed through a waste disposal process or recycling process.

The MiTek Stamping Process generates noise levels that can exceed 85 decibels (db). MiTek conducts noise surveys, training, and annual audiometric testing for all exposed employees. All exposed employees and visitors are provided with, and required to wear, noise protection devices on the shop floor to reduce exposure below the 85 db level.

Chemical management within all MiTek manufacturing facilities is managed through MiTek's Hazardous Communication Policy. This policy outlines handling, storage, labeling and training for all chemicals on site. SDS Pro manages and houses all Safety Data Sheet (SDS) documents and provides access through their software system that any MiTek employee can access.

MiTek Environmental Activities and Certifications

The MiTek Stamping Process manufacturing facilities utilize third party Environmental Engineering companies to conduct complete environmental assessments for evaluation of MiTek's environmental compliance. MiTek is in the process of ensuring all North American manufacturing facilities have the required environmental permits, testing, plans, documentation, and training. The assessments reviewed air emissions potential (PtE), National Emission Standards for Hazardous Air Pollutants (NESHAP), wastewater, stormwater, waste management, Chemical Inventory Report Level Tier II, Toxic Release Inventory (TRI) and Ozone-Depleting Substance (ODS). MiTek participates in recycling programs for metal, cardboard, and wood products. All MiTek manufacturing facilities are required to have a Stormwater Permit, Storm Water Pollution Prevention Plan (SWPPP) and training. All required sites have or are working on a Spill Prevention, Control and Countermeasure (SPCC) plan and employee training.

Additional Environmental Information

At end of life, 100% of the total mass of the products may be recycled. There are no substances in the products that are on the Candidate List of Substances of Very High Concern. No materials are hazardous to human health and the environment.

Certifications and Reference Standards

- ICC-ES Evaluation Reports ESR-1988; ESR-2685; ESR-4722
- ICC-ES Listing Report ESR-1388
- ICC-ES Acceptance Criteria for Metal Hinge Plate Connectors for Wood Trusses (AC283)
- ICC-ES Acceptance Criteria for Metal Webs for Parallel Chord Wood Trusses (AC387)
- ANSI / TPI 1 National Design Standard for Metal Plate Connected Wood Truss Construction

- ASTM A653 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- ASTM A924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
- ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
- CCMC Standard Compliance Evaluation 10319-L
- CCMC Standard Compliance Evaluation 11996-L
- CCMC Standard Compliance Evaluation 13270-L
- CSA O86 Engineering Design in Wood
- CSA S347 Method of Test for Evaluation of Truss Plates Used in Lumber Joints
- Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses, TPIC
- CCMC Canadian Code Compliance Evaluation Report 12691-R

Limitations & Comparability

Comparability has been discussed after Table 4. Full conformance with the PCR for products allows EPD comparability only when all stages of a life cycle have been considered, including the product's Use phase in a building. Importantly, different databases and background datasets may lead to different results in the life cycle stages declared. For this reason, such comparisons can be inaccurate, and could lead to erroneous selection of materials or products or process decision-making. If comparisons to other EPDs are done, the variations and deviations of different databases must be acknowledged. Furthermore, EPDs are comparable only if they comply with ISO 21930: 2017, use the same sub-category PCR, include all relevant information modules, and are based on equivalent scenarios with respect to the context of construction works.

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ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.

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