LEED® v4 & LEED® 2009

Green Building Information for Light Steel Framing

The Steel Network, Inc.
www.steelnetwork.com
1-888-474-4876

The Steel Network, Inc. (TSN) is committed to producing the highest quality light steel framing construction products that assist designers and installers in building greener and more sustainable structures. We proudly support the efforts of the US Green Building Council (USGBC) and their commitment to transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous environment that improves the quality of life.

Cold Formed Steel (CFS) / Light Steel Framing (LSF) is one of the most sustainable construction materials in the world. It can be easily recycled and not land-filled when its useful life is completed. CFS exhibits a minimum recycled content of 25% which aids in qualifying your project for LEED® points as defined in the LEED rating system. In 2014, The Steel Recycling Institute announced that the current recycling rate for steel has reached a record high of 86%!

SUSTAINABLE STEEL

Steel is one of the world's most sustainable construction materials. Its strength and durability coupled with its ability to be endlessly recycled without ever losing quality make it truly compatible with long-term sustainable development. The steel industry is one of the few industries that can claim to have truly embraced the benefits of reducing energy to manufacture its products. Since 1990 the steel industry in North America has reduced the energy use per ton of steel produced by 31%.

An authentic solution for sustainable building construction

Each year, more steel by weight is recycled in North America than paper, plastic, aluminum and glass, combined. In 2012 alone, 88 million tons of steel were recycled in North America.

- Recycling steel saves the energy equivalent to power 20 million homes for one year.
- All North American steel products have a significant amount of recycled content, including some products with more than 90 percent.
- While other building materials can only be recycled into a lower quality product, steel can be recycled repeatedly and remade into new products without any loss of quality.
- It's the only true cradle-to-cradle building material.
- Steel is durable. It doesn't rot or serve as food for termites. Coated cold-formed steel used in construction has built-in corrosion resistance that will last hundreds of years beyond the life of a building. Cold-formed steel framing doesn't need maintenance or replacement like other materials.
- Steel used in buildings produces little to no construction waste, unlike other structural materials. Cold-formed steel is typically delivered to building sites in pre-manufactured or cut-to-length products to minimize costs and waste.

LEED® & GREEN BUILDING WITH CFS

CFS is well suited to meet the highest sustainability standards in all major green building standards and rating programs, including the National Green Building Standard (ICC-700) for residential buildings, the ASHRAE Standard 189.1 for commercial construction, the International Green Construction Code (IgCC), and the US Green Building Council's LEED program, which covers all types of buildings.

LEED is one of the most popular sets of criteria for scoring the sustainability of a building. Developed by the U.S. Green Building Council, LEED is known as Leadership in Energy & Environmental Design. LEED aims to improve occupant well-being, environmental performance, and economic returns of buildings using established and innovative practices, standards, and technologies. CFS can play a role in any high-performance building designed to meet LEED requirements.

LEED requirements have been evolving over time. As new versions are introduced, older versions are phased out. Determining which version of LEED you can use depends on when your project was registered, which differs from the date you "start" the certification with an initial application for design or preliminary review. Projects that were registered with the USGBC before October 31, 2016 are eligible to use the LEED 2009 rating system. Projects registered on or after October 31, 2016 must use LEED v4. For projects registered under the 2009 system, June 30, 2021 is the last date any project can start the certification process with an initial application.

CFS can help earn over a dozen points under both the LEED V4 and 2009 programs. However, the use of CFS or any other single framing material doesn't automatically qualify a project for points under any of the credits. Rather, framing materials can contribute to specific points in various categories. The LEED process is complex and requires consideration of multiple variables including material characteristics, qualities, and other products in an assembly.

It is always recommended to work closely with your design team and not assume a credit or points are applicable. In addition, not all points can always be earned on the same project because LEED prohibits some credits with similar impacts from being applied simultaneously to avoid double counting.

The CFS industry should be aware that LEED® requirements are gradually minimizing the impact of structural materials. For example, material credits now limit the amount that structure and enclosure materials can contribute to earning points for items such as recycled content. More importance is being placed on what goes into a product. Thus, the emphasis seems to be turning toward items such as product declarations (ingredients and their impacts) and similar base characteristics of materials. This is evident in LEED V4 when compared to prior LEED versions. This trend will similarly affect other structural products.

LEED® v4

LEED® v4 was introduced in 2013 and is the newest version of the world's premier benchmark for high-performance green buildings. The minimum number of points for the basic "Certified" level is 40. Points are not easy to come by so every point is important to a designer or owner seeking certification or a higher level of LEED® Silver (50 points), Gold (60 points), or Platinum (80 points).

The environmental benefits of steel framing, particularly high recycling rates, recycled content, and steel's inert, non-organic nature, make key contributions to achieving LEED certification. Credits in LEED v4 that cold-formed steel can help achieve are summarized in this section. Unless otherwise noted, requirements attributed to LEED are based on the US Green Building Council document titled "LEED v4 for BUILDING DESIGN AND CONSTRUCTION, Updated July 8, 2017," referred to as the LEED documentation in this document.

Materials and Resources (MR) Credit Category

LEED® documentation states that the MR "credit category focuses on minimizing the embodied energy and other impacts." Thus, processes such as extraction, manufacturing, or disposal are addressed as well as disclosures related to ingredients or emissions. This credit category recognizes the benefits of reuse and optimized use of materials that are some of the strengths of CFS.

MR CREDIT: BUILDING LIFE CYCLE IMPACT REDUCTION (4 POINTS)

Option 3 of this credit is applicable to CFS. This option gives up to 4 points based on the percentage of structure reused:

Percentage of completed project surface area reused	Points for BD&C (e.g. New construction)
25	2
50	3
75	4*

Source: USGBC. *For core and shell buildings, the 75% level can earn an additional point.

This option allows points for both reuse or use of salvaged building materials from off site or on site. CFS materials used in floors, walls, and roofs included in the enclosure and interior framing can be included in the calculations. Materials may not contribute toward this credit if also applying the MR Credit Material Disclosure and Optimization.

MR Credit: Building Product Disclosure and Optimization— Environmental Product Declarations (2 POINTS)**

LEED v4 approaches building materials content credits in a slightly different way than previous editions of LEED® by placing an emphasis on transparency and documentation. Cold formed steel can contribute toward achieving points with two options under this credit. These points are generally achieved through submission of Environmental Product Declarations (EPD).

- In the first option, points are earned when at least 20 installed products from at least five manufacturers provide an EPD. Members of the SFIA will be able to provide an industrywide EPD for cold-formed steel to qualify as ½ of a product(see attached). This can be increased to one whole product if your manufacturer member is able to provide a Product-Specific (i.e., a Type III) EPD. The Steel Network, Inc. does not currently have product specific EPD's.
- A second option provides for an additional point when the value of products covered by a EPD represents 50% of the project cost. To achieve this point, a Product-Specific Type III EPD must show improvement in three of five specified impact categories versus the Industry-wide (generic) EPD. A CFS building will not be able to meet the requirements completely based on the CFS components because LEED limits the contribution from the structure to 30% of the total project cost contribution. However, given the cost of the structure and enclosure of a building, it would be difficult to secure this point without the framing component. The Steel Network, Inc. does not currently have product specific EPD's

When calculating points for either of these options, design teams should remember that CFS framing consists of many different "unique" products. For example, track, studs, strapping, and blocking, are unique products. Similarly, a floor system consists of products different from those in a roof truss system or a wall system. The total number of unique products used in a building should be considered.

**Designers should take note that LEED also has credits for Innovation (IN) that may apply to the first option of this MR Credit. The IN Credit has an option that allows for an exemplary performance point to be earned by doubling the number of products covered by EPDs. CFS can help meet the next higher level of 40 products since any given building with CFS framing will contain many different CSF products. See the section on the Innovation (IN) Credit for additional information.

MR Credit: Building Product Disclosure and Optimization—Sourcing of Raw Materials (1 POINT)

Option 2 of this credit recognizes the value of recycled content in materials such as cold-formed steel. A point is available for projects where at least 25%, by cost, of the total value of permanently installed building products in the project meet the criteria for responsible extraction. The recycled content of cold-formed steel makes an important contribution to achieving this goal. Structural material, such as framing, can contribute a maximum of one-half of the cost to this point.

MR Credit: Building Product Disclosure and Optimization – Material Ingredients (1 POINT)***

Points can be earned under this credit for products and materials that provide certain information related to life cycle performance or material ingredients. Option 1 is like the EPD points discussed previously, where information is required on at least 20 different products from at least 5 different manufacturers. CFS can contribute toward the 20 products, with the most direct method being to provide a Health Product Declaration (HPD). An HPD must disclose known hazards of material ingredients following the Health Product Declaration Open Standard (www.hpdcollaborative.org). Although there is no industry-wide HPD for CFS, some manufacturers have developed them for their products. The Steel Network, Inc. does not currently have an HPD.

***As with the EPD points discussed previously, an additional exemplary performance point can be earned if the number of products with an HPD is doubled to 40. Different steel products (roof, floor, walls, stud, track, bracing, etc.) should be submitted as separate products for this purpose. See the Innovation (IN) credit category for additional information on exemplary performance points.

MR Credit: Design for Flexibility (1 POINT)

This credit, although limited to health care buildings, allows one point for efficient use of space including future expansion. Cold-formed steel can be used for at least two of the strategies that can be employed to earn this point (only one strategy is required). One strategy involves building extra shell space that can be used to expand into later. The other strategy recognizes roof-top expansion. There are many projects where CFS has been used successfully for roof top expansion on existing buildings, taking advantage of CFS's light weight.

MR Credit: Construction and Demolition Waste Management (1-2 points)

This credit has two options but only one can be applied to a given project. The first option can award 1 or 2 points depending on which of two "paths" are selected. The second option is limited to 1 point.

- Option 1 is based on achieving a reduction in construction waste going to a landfill. It has two paths. The first path awards a point for diverting 50% of waste with a minimum of three materials included in the calculations. The second path awards 2 points for diverting 75% of waste and using four materials in the calculations. Cold-formed steel framing is 100% recyclable, an attribute that can contribute toward the points in either path. However, steel can only be counted as one of the three materials in either path. Other products must be included in the calculations to award the points.
- Option 2, the total project waste must be less than 2.5 pounds per square foot of floor area of the building to be awarded 1 point. Cold-formed steel from most manufacturers is cut to length and/or panelized off site. Thus, it can be a critical contributor to the points under this option compared to other structural materials that contribute extensive amounts of waste at the construction site.

Indoor Environmental Quality (EQ) Credit: IAQ Assessment (2 POINTS)

The IAQ Assessment option under this credit awards two points to buildings that successfully pass air quality testing for VOCs. Steel is an Inherently Non-Emitting Source. Thus, it will not contribute to the contaminants that are required to be evaluated and should be a preferred building material for those seeking points under this credit.

IN Credit: Innovation (Exemplary Performance) (1-2 POINTS)

The IN credit is designed to recognize exceptional performance or the use of innovative designs. The third option under this credit includes points for exemplary performance that apply to at least two areas related to CFS-- the use of EPDs and the use of HPDs (See prior MR credits

Memberships:

LEED 2009® (LEED-New Construction and Major Renovation)

For those opting to use the LEED® 2009 version, CFS contributes to earning points in the following credits:

Credit MR 1.1: Building reuse (up to 3 points)

This credit is designed to encourage the use of existing buildings and their components. CFS is used routinely in rehabilitation/remodeling projects, for example, in reconfiguring a building for a new tenant, while allowing the main building structure and devising walls to remain intact.

CFS has also been used as a method for expanding upward on older existing buildings as opposed to a teardown and rebuild. Its light weight often makes it feasible to add new stories to existing buildings, especially in older urban areas.

Credit MR 2 Construction Waste Management (up to 2 points)

Credits are awarded based on recycling and recovery rates for construction products. Steel is 100% recyclable. Because it plays a key role in diverting construction debris from the waste stream, steel is eligible for Credits MR 2.1 and 2.2. The specific contribution will vary by project and must be determined by the contractor and/or design team.

Credit MR 4 Recycled Content (up to 2 points)

Cold-formed steel framing contains a high percentage of recycled content, earning one point for recycled content that constitutes 10% of the total value of construction materials and a second point when recycled content is 20% of the total cost.

The Steel Network's steel complies with industry procedures for the manufacturing of cold-formed steel products produced by the Basic Oxygen Furnace (BOF) process. BOF uses 25% to 35% old steel to make new steel. Typical recycled content for steel studs manufactured by the BOF process is outlined in Steel Takes LEED® with Recycled Content, October 2012 issue (see attached).

1. Post-Consumer Recycled Content: 19.8%
2. Pre Consumer Recycled Content: 14.4%
3. Total Recycled Content: 36.9%
4. Recycled Content Information Resource: Steel Recycling Institute

Additional points for the Innovation in Design (ID) credit are available if a project's overall recycled content exceeds 30% or higher. See the section on Credit ID: Innovation in Design.

Credit MR 5 Regional Materials (up to 2 points)

Credit MR 5 requires the jobsite to be within a 500-mile radius of the manufacturing facility and the location where raw materials are extracted. One hundred percent of the material does not have to be extracted and manufactured within the 500 miles. The requirements allow for a percentage of the product to qualify. The Steel Network's steel is obtained from various mills across the United States, with its manufacturing facility at 2012 TW Alxeander Drive, Durham, NC 27709, frequently satisfying the requirement for raw materials to be harvested within 500 miles from the project site.

Credit IEQ 3.2: Construction Indoor Air Quality Management Plan – Before Occupancy (1 point)

Option 2 under this credit awards one point for air testing before occupancy. Because of its inert nature, steel will not contribute any emissions identified in the requirements. CFS framing is a key strategy used to obtain this point.

Credit ID 1: Innovation in Design (up to 3 points)

Path 2 under this credit awards up to three points for exemplary performance above and beyond the basic levels for other LEED® credits. By reaching the next incremental thresholds (30%, 40%, etc.) for a credit, a building will receive up to a maximum of three credits.

CFS is a natural for helping to achieve these points given the minimum default rate for recycled content reported by the Steel Recycling Institute is 34.9%. Your SFIA member manufacturer is likely to produce or have available cold-formed steel framing with even higher recycled content.

Steel Recycling Institute
680 Andersen Drive
Pittsburgh, PA 15220 USA

A complete list of manufacturers represented by this EPD can be found here: www.recycle-steel.org/epd-companies

Product

Industry-wide Cold-Formed Steel Studs and Track manufactured in U.S. and Canada.

Declared Unit

One metric ton of cold-formed steel studs and/or track. Results are also presented for one short ton of cold-formed steel studs and/or track.

EPD Number and Period of Validity

SCS-EPD-03838

Beginning Date: January 19, 2016 – End Date: January 18, 2021

Product Category Rule

North American Product Category Rule for Designated Steel Construction Products. May 2015.

Program Operator:

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PCR review, was conducted by	Thomas P. Gloria, Ph.D., Industrial Ecology Consultants t.gloria@industrial-ecology.com
Approved Date: January 19, 2016 - End Date: January 18, 2021	
Independent verification of the declaration and data, according to ISO 14025:2006 and ISO 21930:2007	☐ internal ☑ external
Third party verifier	Tom Gloria, PhD, Industrial Ecology Consultants

PRODUCT SCOPE

This EPD represents cold-formed steel (CFS) studs and track made from hot-dip galvanized steel, produced and manufactured in U.S. and Canada. The steel in the studs and track is produced at a mix of steel mill types in the U.S. and Canada, which use both the BOF (basic oxygen furnace) and EAF (electric arc furnace) route for steelmaking. The dimensions of the CFS studs and track in the study are described in Table 1 and Table 2.

Table 1. *Dimensions of CFS studs.*

Dimensions of Cold-Formed Steel Studs included in the scope	
Web Depth	1 5/8 to14 inches (41.3 to 356 mm)
Flange Width	1 1/4 to 3 1/2 inches (31.8 to 88.9 mm)
Design Thickness	0.0188 to 0.1242 inches (0.478 to 3.155 mm)

Table 2. *Dimensions of CFS track.*

Dimensions of Cold-Formed Steel Track included in the scope	
Web Depth	1 5/8 to 14 inches (41.3 to 356 mm)
Flange Width	1 1/4 to 3 inches (31.8 to 76.2 mm)
Design Thickness	0.0188 to 0.1242 inches (0.478 to 3.155 mm)

The CFS studs and track can be used in a large number of building designs and applications, ranging from commercial to residential applications, in buildings of many different sizes, designs, and locations. While the functions of these product systems are for construction, the large number of applications means that a single functional unit cannot be clearly defined. Accordingly, a declared unit is used, in lieu of a functional unit, as described in Table 3.

Table 3. *Declared unit for CFS Studs and Track and the approximate density.*

Parameter	Value, SI Units	Value, US Customary Units
Declared Unit	1 metric ton	1 short ton
Density	7,769 to 7,849 kg/m^3	485 to 490 lb/ft^3

MATERIAL CONTENT

The approximate content of the cold-formed steel studs and track are shown below in Table 4.

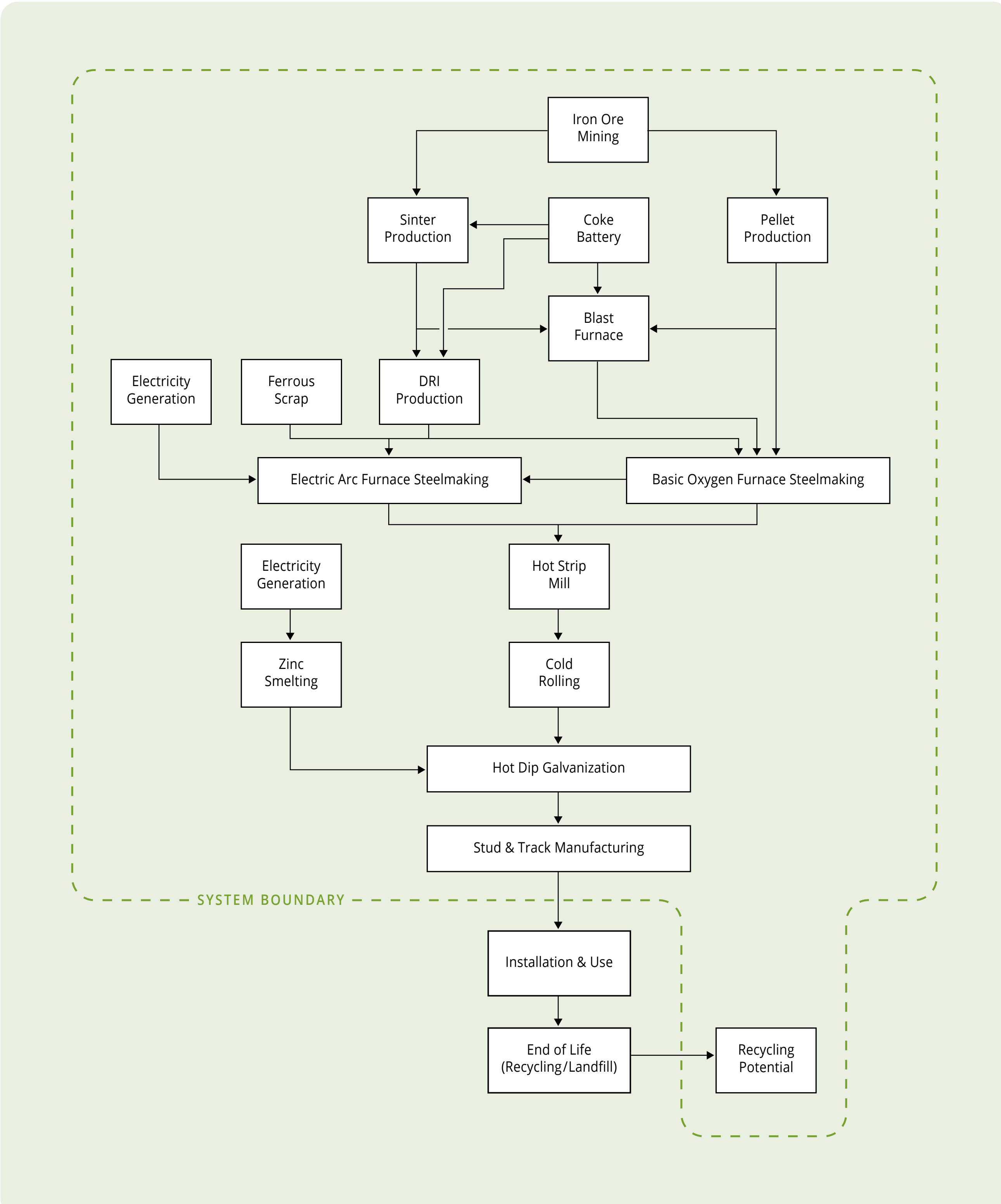
Table 4. *Material composition of CFS studs and track.*

Material	Percentage of Total Mass of Product
Steel	91.9 to 99.3%
Zinc Coating	0.7 to 8.1%

CFS studs and track used inside the building envelope do not include materials or substances which have any potential route of exposure to humans or flora/fauna in the environment.

PRODUCT LIFE CYCLE FLOW DIAGRAM

The diagram below is a representation of the most significant contributions to the production of cold-formed steel studs and track. This includes resource extraction, steelmaking, transport to manufacturer, and product manufacture.



LIFE CYCLE ASSESSMENT STAGES AND REPORTED INFORMATION

The following life cycle stages are included: raw material extraction and steel production, transport to manufacturer, manufacture of stud/track, and benefits and loads beyond the system boundary (reported in Module D). The EPD does not cover life cycle stages for product use, building operation, and product disposal. Since the EPD is cradle-to-gate, the RSL (reference service life) of the product is not specified.

Module D represents the potential avoided production of primary steel as a result of the net steel scrap produced across the product life cycle. The Module D calculation accounts for all steel scrap material flows entering or recovered from the product system, including steel recovered at end-of-life, as well as the steel scrap generated during stud and track manufacture. To calculate the potential avoided burden, a World Steel Association inventory dataset representing steel scrap was used. These data were calculated in accordance with the methodology described in Appendix 10 of the World Steel Association LCA Methodology Report. The steel scrap dataset uses current industry-average data to represent processes which will occur at the end of the service life of the studs and track.

The potential avoided burden per ton of product for a specific inventory flow, AB_{FLOW}, was assessed using the following equation:

$$AB_{FLOW} = (RR - S) \times Scrap_{FLOW}$$

AB_{FLOW} = *The potential avoided burden credit (or burden) for a specific inventory flow per ton of steel product (CFS stud/track)*

RR = *0.95 (the recovery rate per ton of steel product)*

S = *0.45 (the amount of scrap used in the steelmaking process per ton of steel product)*

$Scrap_{FLOW}$ = *The inventory flow per ton of steel scrap (from the World Steel Association steel scrap dataset).*

The Module D calculation takes into account all steel scrap material flows undergoing recovery processes during any part of the product system. This includes the amount of steel recovered at end-of-life, as well as the steel scrap generated during stud and track manufacture.

LIFE CYCLE IMPACT ASSESSMENT

Results are reported according to the LCIA methodologies of Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI version 2.1) or CML-IA version 4.1 as required by the PCR. All considerations of scoping and inventory are the same. There are impact categories which are not addressed by this EPD, including impacts to biomes, habitat disruption, and human health.

Table 6. *Results for the declared unit of CFS studs and track.*

				PRODUCT STAGE			CREDITS AND BURDENS BEYOND THE SYSTEM BOUNDARY
				Raw Material Extraction / Processing	Transport to the Manufacturer	Manufacturing	Reuse, Recovery, Recycling Potential
Impact Category	**Category Indicator**	**Indicator Description**	**Unit**	**A1**	**A2**	**A3**	**D**
Global warming [a]	Global Warming Potential	Global Warming Potential (GWP)	ton CO_2 eq/ ton [d]	2.2	$3.6x10^{-2}$	$4.4x10^{-2}$	-0.76
Ozone Depletion [a]	Ozone Depletion Potential	Depletion potential of the stratospheric ozone layer (ODP)	ton CFC-11 eq/ ton [d]	Negligible [f]	Negligible [f]	Negligible [f]	Negligible [f]
Acidification of land and water [a]	Acid Emissions	Acidification Potential of soil and water (AP)	ton SO_2 eq/ ton [d]	$1.0x10^{-2}$	$3.4x10^{-4}$	$2.8x10^{-4}$	$-1.7x10^{-3}$
Eutrophication (freshwater) [a]	Phosphorus and nitrogen emissions	Eutrophication potential (EP)	ton N eq/ ton [d]	$4.7x10^{-4}$	$1.9x10^{-5}$	$1.3x10^{-4}$	$-9.0x10^{-5}$
Photochemical Ozone Creation [a]	Max. Pot. for Ozone Formation	Formation potential of tropospheric ozone (POCP)	ton O_3 eq/ ton [d]	0.18	$1.0x10^{-2}$	$2.1x10^{-3}$	$-1.8x10^{-2}$
Depletion of abiotic resources (elements) [b,c]	Aggregated Depletion of Extracted Resources	Abiotic depletion potential (ADP-elements) for non-fossil resources	ton Sb eq/ ton [d]	$5.4x10^{-5}$	Negligible	$7.6x10^{-8}$	$2.1x10^{-9}$
Depletion of abiotic resources (fossil) [b]	Fossil fuel consumption	Abiotic depletion potential (ADP-fossil fuels) for fossil resources	BTU/short ton (MJ/metric ton) [e]	$3.0x10^{7}$ (29,000)	$5.1x10^{5}$ (490)	$5.8x10^{5}$ (560)	$-9.3x10^{6}$ (-8,900)

[a] Calculated using TRACI v2.1. [b] Calculated using CML-IA v4.1. [c] This indicator is based on assumptions regarding current reserves estimates. Users should use caution when interpreting results because there is insufficient information on which indicator is best for assessing the depletion of abiotic resources. [d] Results shown represent both short ton per short ton of steel product, and metric ton per metric ton of steel product (these values are equivalent). [e] Results shown represent US Customary (BTU per short ton of steel product) and SI (MJ per metric ton of steel product) units. SI units are shown using parenthesis. [f] Results for this indicator are negligible.

Table 7. *Results for resource use, wastes, and output flows for one ton of CFS stud and track.*

		PRODUCT STAGE			CREDITS AND BURDENS BEYOND THE SYSTEM BOUNDARY
		Raw Material Extraction / Processing	Transport to the Manufacturer	Manufacturing	Reuse, Recovery, Recycling Potential
Impact Category	**Unit**	**A1**	**A2**	**A3**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials.	BTU/ short ton (MJ/metric ton) [a]	950,000 (1,100)	None	19,000 (22)	None
Use of renewable primary energy resources used as raw materials	-	None	None	None	None
Total use of renewable primary energy resources	BTU/ short ton (MJ/metric ton) [a]	950,000 (1,100)	None	19,000 (22)	None
Use of nonrenewable primary energy excluding nonrenewable primary energy resources used as raw materials	BTU/ short ton (MJ/metric ton) [a]	2.4×10^7 (28,000)	380,000 (440)	630,000 (730)	-5.5×10^6 (-6,400)
Use of nonrenewable primary energy resources used as raw materials		Negligible	Negligible	Negligible	Negligible
Total use of nonrenewable primary energy resources (primary energy and primary energy resources used as raw materials)	BTU/ short ton (MJ/metric ton) [a]	2.4×10^7 (28,000)	380,000 (440)	630,000 (730)	-5.5×10^6 (-6,400)
Use of secondary materials	ton/ton [b]	0.45	None	None	N/A
Use of renewable secondary fuels	-	Negligible	Negligible	Negligible	Negligible
Use of nonrenewable secondary fuels	-	Negligible	Negligible	Negligible	Negligible
Net use of fresh water	Gallons/short ton (m^3/metric ton) [a]	Not available [c]	2.9 (1.2×10^{-2})	260 (1.1)	None
Nonhazardous waste disposed	ton/ton [b]	3.3×10^{-3}	None	1.4×10^{-3}	None
Hazardous waste disposed	ton/ton [b]	2.3×10^{-2}	None	None	None
Radioactive Waste disposed	ton/ton [b]	5.6×10^{-4}	Negligible	Negligible	Negligible
Components for re-use	ton/ton [b]	Negligible	Negligible	Negligible	N/A
Materials for recycling	ton/ton [b]	Data not available [d]	None	0.03	N/A
Materials for energy recovery		Negligible	Negligible	Negligible	Negligible
Exported energy		Negligible	Negligible	Negligible	Negligible

[a] Results shown represent US Customary units per short ton of steel, and SI units per metric ton of steel. SI units are shown using parenthesis.
[b] Results shown represent both short ton per short ton of steel, and metric ton per metric ton of steel (these values are equivalent).
[c] Due to data quality issues, water use is not reported. This will be a focus area in future data collection efforts.
[d] The dataset on which this module is based does not provide this information. See Section 4.1.

Disclaimer

This Environmental Product Declaration (EPD) conforms to ISO 14025, 14040, ISO 14044, and ISO 21930.

Scope of Results Reported: The PCR requires the reporting of a limited set of LCA metrics; therefore, there may be relevant environmental impacts beyond those disclosed by this EPD. The EPD does not indicate that any environmental or social performance benchmarks are met nor thresholds exceeded.

Accuracy of Results: This EPD has been developed in accordance with the PCR applicable for the identified product following the principles, requirements and guidelines of the ISO 14040, ISO 14044, ISO 14025 and ISO 21930 standards. The results in this EPD are estimations of potential impacts. The accuracy of results in different EPDs may vary as a result of value choices, background data assumptions and quality of data collected.

Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. Such comparisons can be inaccurate, and could lead to the erroneous selection of materials or products which are higher-impact, at least in some impact categories. Any comparison of EPDs shall be subject to the requirements of ISO 21930. For comparison of EPDs which report different module scopes, such that one EPD includes Module D and the other does not, the comparison shall only be made on the basis of Modules A1, A2, and A3. Additionally, when Module D is included in the EPDs being compared, all EPDs must use the same methodology for calculation of Module D values.

Interpreting the Results in Module D: The values in Module D include a recognition of the benefits or impacts related to steel recycling which occur at the end of the product's service life. The rate of steel recycling and related processes will evolve over time. The results included in Module D attempt to capture future benefits, or impacts, but are based on a methodology that uses current industry-average data reflecting current processes.

Hot-Dip Galvanized LCI Data: The majority of impacts of cold formed steel stud and track can be attributed to the production of hot-dip galvanized steel. The industry average emissions for the production of HDG steel have been provided by the Steel Recycling Institute/World Steel Association and have not been subject to critical review. However, this critical review is not a requirement of the relevant ISO standards. The data collection process and methodology for global steel LCI data have been critically reviewed by a panel of experts.

SUPPORTING TECHNICAL INFORMATION

Data Sources:

The life cycle inventory (LCI) analysis was conducted using SimaPro v8.0 software, using a mix of primary and secondary data sources, shown in Table 8. These inventory data sources were used to create results for each inventory flow relative to the declared unit of one metric ton.

Table 8. *Data sources used for the LCA.*

Module	Scope	Technology Source	Data Source	Region	Year
A1	Extraction through production of HDG steel	Extraction through production of HDG steel	World Steel Association	U.S. & Canada	2006 to 2010
A2	Transportation to stud/track manufacturer	Diesel combination truck	USLCI database and AISC [a]	North America	2008
A3	Stud/track manufacturing	Manufacture of steel studs/track	Steel Framing Alliance	North America	2014
D	Credit or burden at end-of-life	Value of scrap	World Steel Association	Global	2005-2008
	Other Processes [b]		ecoinvent and USLCI databases	Varies	Varies

[a] Transport distances from correspondence with AISC.

[b] This includes inputs to Modules A2 and A3.

Table 9. *Data quality assessment of Life Cycle Inventory.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data should be collected	For Modules A1-A3, the data used are the most current available. The data representing HDG steel production (Module A1) is from within the last 8 years, although the generic data used may be as old as 15 years old. For Module A3, data is from 2012. Module D represents avoided steel production occurring many decades into the future, using current data on recycling rates, steel production, electricity grid mix, and emissions controls. Module D therefore has poorer time-related coverage than the other modules, a limitation which should be considered in the interpretation of results.
Geographical Coverage: Geographical area from which data for unit processes should be collected to satisfy the goal of the study	The data sources used for Modules A1 to A3 are from North America, and so provide good geographical coverage. Module D uses global data to represent avoided steel production. Although the location of the avoided steel production is unknown, it is most likely occurring mainly in North America. Module D therefore has poorer geographical coverage than the other modules, which is related both to a lack of knowledge of the geographical boundaries of Module D impacts, and lack of regional specificity in the data.
Technology Coverage: Specific technology or technology mix	For Module A1, the technological coverage is considered good, as the data is based on primary data from a representative mix of the U.S. and Canadian EAF and BOF steel mills. For Modules A2 and A3, technology coverage is good. For Module D, technology coverage is based on current practices, consistent with the guidance of EN 15804. Module D attempts to capture benefits or impacts associated with recycling which occurs years in the future, and these processes may evolve over time.
Precision: Measure of the variability of the data values for each data expressed	None of the datasets used to assess results for any module include statistical information regarding the confidence in results, so it is not possible quantitatively to evaluate the precision in results, which is affected by sampling variability and measurement error.
Completeness: Percentage of flow that is measured or estimated	All datasets included are considered to have a high degree of completeness, except for the lack of data on net water use for Module A1. As this module is expected to account for a larger degree of net water use than the other modules, this is a clear study limitation.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest.	The representativeness of Modules A1 to A3 is good overall. Module D has poor representativeness, due to a lack of time-related and geographical coverage.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis.	For all Modules, assumptions and methodology are largely consistent. The approach of system expansion is used, in lieu of allocation, as much as possible.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study.	Provided the practitioner had access to the same data sources described in the report, the results would be reproducible.
Sources of the data: Data quality assessment examples include (but not limited to) USLCI and ILCD.	The sources of the data provided by the World Steel Association used to model Module A1 are presented as aggregated values, with no detail on the contribution of individual flows or unit processes. The same applies to the aggregated data used to model Module D.
Uncertainty of the information: E.g. data, models, and assumptions	It is not possible to assess the uncertainty of Modules A1 and D, due to the World Steel data being provided in an aggregated manner. For the other modules, the uncertainty is likely to be low, although there is some additional uncertainty associated with the generic data used to model results for Modules A2. As it uses current data and assumptions to model processes occurring far in the future, Module D has higher uncertainty than the other modules.

Allocation:

The LCA followed the allocation guidelines of ISO 14044 and the PCR. Co-products from hot-dip galvanized steelmaking were allocated using system expansion, as described in the World Steel Association LCA Methodology Report (2011). Net steel scrap, accounting for scrap input to the product system and scrap generated from product manufacturers and at end-of-life, is modeled as a potential avoided burden and is reported as Module D.

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Steel Takes LEED® with Recycled Content

steel beams and columns

steel studs

steel roofing

steel decking

steel doors

ductwork

steel siding

corrugated steel pipe

other steel components

American Iron and Steel Institute

Designers and builders have long recognized and lauded steel for its strength, durability, and functionality. Increasingly, however, architects and engineers are recognizing steel's important environmental attributes—especially its high recycled content and high recovery rate.

For many years, there has been a strong economic motive to incorporate recycling into the process for making steel, but today's environmental concerns make recycling even more important. Recycling saves money while conserving energy and other resources, as well as reducing solid, liquid, and gaseous wastes.

Recycled content is a measure of how much recycled material is contained in a finished product. On the other hand, the efficiency with which a material is recycled is indicated by its *recovery rate*. This is a measure of how often a product is recycled at the end of its useful life. Steel's high recovery rate is a direct result of the fact that it is a cradle-to-cradle material constantly being multi-cycled into the array of steel products in our economy.

Thus, steel is an exceptional performer by both measurements. In the construction industry, increased interest in recycling has been driven largely by the U.S. Green Building Council's *Leadership in Energy and Environmental Design* (LEED®) rating system. The LEED rating system provides credit for the use of materials with high levels of recycled content. No credits are granted for the equally important recovery rate of the materials. However, the International Green Construction Code considers both the recycled content and the recovery rate of materials.

Scrap consumption in the United States is maximized between the two types of modern steel mills, each of which generates products that are 100% recyclable and therefore contribute to steel's high recovery rate. One process produces much of the steel for light flat-rolled steel products, with about 30% *recycled content*. The other process makes steel for a wide range of products, including flat-rolled, but is the only method used domestically for the production of structural shapes, which have over 90% *recycled content*. (These processes are covered in detail on the following pages.)

The amount of recycled content in steel products will vary as a function of the cost and availability of steel scrap, as well as metallurgical requirements. As the worldwide demand for steel increases, the available scrap will be stretched among more and more steel products, meaning that more steel from virgin materials will enter the production stream to meet the demand. However, because of steel's high recovery rate, more scrap will also be available for future recycling, thus minimizing the long-term amount of virgin material required.

In addition to recycled content, steel can contribute toward several other LEED credits, either directly or indirectly. Steel is dimensionally stable and, when properly designed, can provide an exceptionally tight building envelope for less air loss and better HVAC performance over time. Steel is made to exact specifications, so on-site waste is minimized. Material from demolition or construction can be easily recycled, with the magnetic properties of steel greatly facilitating its separation from other materials. Thus, in addition to its outstanding recycled content and an enviable recovery rate, steel's other functional properties contribute to the material's solid environmental performance.

As with any building process or material, there are areas for improvement. A great benefit of LEED is that it can help the steel industry recover even more scrap, as contractors improve their recycling collection methods at the job site so that less incidental iron and steel scrap escapes

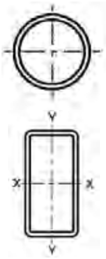
Online Steel Recycling Resources

www.recycle-steel.org
Includes detailed information on recycling rates, recycling databases, and the environmental benefits of steel for homes, buildings, steel roofing, and bridges.

www.aisc.org/sustainability
Includes detailed information on how steel factors into the LEED® rating system, steel mill recycled content documentation, and articles about the use of steel in sustainable projects.

Modern Steel Production Technologies

Typical BOF Products



hollow structural sections

steel studs

steel deck

plate

purlins

to landfills. Similarly, commercial buildings and residential housing can have better disciplined recycling systems for increased recovery. As steel products reach the end of useful life, we want to see the recovery rate continue to increase so that even more scrap is recycled into new steel products for future service to society.

Steel is the most recycled material in North America and, indeed, the world. In the United States alone, almost 86 million tons of steel were recycled or exported for recycling in 2011. This is done for economic as well as environmental reasons. However, it should also be clearly understood that many steel products are durables, and even though two out of every three pounds of new steel are produced from old steel, the fact that cars, appliances, and bridges last a long time makes it necessary to continue to extract virgin ore to supplement the production of new steel. Economic expansion, domestically and internationally, creates additional demand that cannot be fully met by available scrap supplies.

Unlike other competing industries, recycling in the steel industry is second nature. The **North American steel industry** has been recycling steel scrap for over 170 years through a vast network of scrap facilities. Today, this network includes some 2,500 scrap processors and 12,500 auto dismantlers. Many have been in the business for more than 100 years. The pre-consumer, post-consumer, and total recycled content of steel products in the United States can be determined for the calendar year 2011 using information from the American Iron and Steel Institute (AISI), the Institute of Scrap Recycling Industries (ISRI), and the U.S. Geological Survey. Additionally, a study prepared for the AISI by William T. Hogan, S.A., and Frank T. Koelble of Fordham University is used to establish pre- and post-consumer fractions of purchased scrap.

The steel and iron industries enjoy an open-loop recycling capability, with available scrap typically going to the closest melting furnace. This open-loop recycling allows, for example, an old car to be melted down to produce a new soup can; then, as the new soup can is recycled, it is melted down to produce a new car, appliance, or perhaps a structural beam used to repair some portion of the Golden Gate Bridge. For this reason, average industry statistics more accurately portray the overall impact of industry recycling activity than do those of an individual company.

Basic Oxygen Furnace

Domestic basic oxygen furnace (BOF) facilities consumed a total of 13,957,000 tons of ferrous scrap in the production of 37,798,500 tons of raw steel during 2011. Based on U.S. Geological Survey statistics, 4,971,000 of these ferrous scrap tons had been generated as unsalable steel product within the confines of these steelmaking sites. In the steel industry, these tons are a mix of “runaround scrap” and pre-consumer scrap. (The runaround scrap is specifically excluded from recycled content since it is scrap that is recovered within the same steel mill process that generated it.) Estimates by the Steel Recycling Institute identify about 80% of this unsalable steel as pre-consumer scrap, equating to 3,976,800 tons (4,971,000 x 80%). Additionally, these operations reported that they consumed 45,000 tons of obsolete scrap (buildings and warehouses dismantled on-site at the mill) during this timeframe. This volume is classified as post-consumer scrap.

As a result of the above, based on the total scrap consumed, outside purchases of scrap equate to 8,941,000 tons [13,957,000 – (4,971,000+ 45,000)]. According to the Fordham University study, the post-consumer fraction of the purchased ferrous scrap would be 83.4%, while 16.6% of these purchases would be pre-consumer. This equates to 1,484,200 tons of pre-consumer scrap (8,941,000 x 16.6%) which is mainly generated by manufacturing processes for products made with steel.

Therefore, the **total recycled content** to produce the 37,798,500 tons of raw steel in the BOF is:

13,957,000 / 37,798,500 = 36.9%

(Total Tons Ferrous Scrap / Total Tons Raw Steel)

Also, the **post-consumer recycled content** is:

(8,941,000 – 1,4,84,200) + 45,000 = 7,501,800

and

7,501,800 / 37,798,500 = 19.8%

(Post-Consumer Scrap / Total Tons Raw Steel)

Finally, the **pre-consumer recycled content** is:

(3,976,800 + 1,484,200) / 37,798,500 =

5,461,000 / 37,798,500 = 14.4%

(Pre-Consumer Scrap / Total Tons Raw Steel)

Electric Arc Furnace

The electric arc furnace (EAF) facilities consumed a total of 49,575,000 tons of ferrous scrap in the production of 55,152,600 tons of raw steel during 2011. Based on U.S. Geological Survey adjusted statistics, 3,968,000 of these ferrous scrap tons had been generated as unsalable steel product within the confines of these steelmaking sites. Again, in the steel industry, these tons are a mix of "runaround scrap" and pre-consumer scrap. Estimates by the Steel Recycling Institute identify about 80% of this unsalable steel as pre-consumer scrap, equating to 3,174,400 tons (3,968,000 x 80%). Additionally, these operations reported that they consumed 69,000 tons of obsolete scrap (buildings and warehouses dismantled on-site at the mill) during this time frame. This volume is classified as post-consumer scrap.

As a result, based on the total scrap consumed, outside purchases of scrap equate to 45,538,000 tons [49,575,000 – (3,968,000 + 69,000)]. According to the Fordham University study, the post-consumer fraction of the purchased ferrous scrap would be 83.4%, while 16.6% of these purchases would be pre-consumer. This equates to 7,559,300 tons of pre-consumer scrap (45,538,000 x 16.6%) which is mainly generated by manufacturing processes for products made with steel.

Therefore, the **total recycled content** to produce the 55,152,600 tons of raw steel in the EAF is:

49,575,000 / 55,152,600 = 89.89%

(Total Tons Ferrous Scrap/Total Tons Raw Steel)

Also, the **post-consumer recycled content** is:

(45,538,000 - 7,559,300) + 69,000) = 38,074,700

38,074,700 / 55,152,600 = 69.0%

(Post-Consumer Scrap / Total Tons Raw Steel)

and

Finally, the **pre-consumer recycled content** is:

(3,174,400 + 7,559,300) / 55,152,600 =

10,733,700 / 55,152,600 = 19.5%

(Pre-Consumer Scrap / Total Tons Raw Steel)

The above discussion and calculations demonstrate conclusively the inherent recycled content of **steel produced today in North America**. To buy domestic steel is to "Buy Recycled."

Understanding the recycled content of steel, one should not attempt to select one steel producer over another on the basis of a simplistic comparison of relative scrap usage or recycled content. After its useful product life, steel is recycled back into another steel product. Thus steel with about 30% recycled content or with about 90% recycled content are both complementary parts of the holistic cradle-to-cradle infrastructure of steelmaking, product manufacture, scrap generation, and recycling.

Steel is truly the most recycled material.

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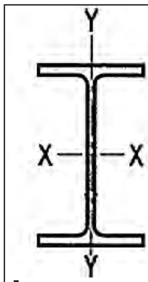
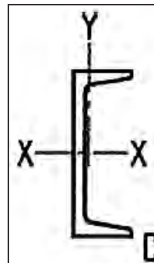
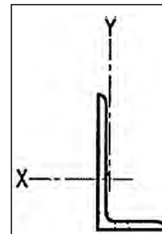
Typical EAF Products



beams and columns



channels



angles

plate

steel deck

piling

To: Architects, Engineers, Designers, and Specifiers
Re: LEED®-NC 2009 Recycled Content Value of Steel Building Products

The U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED®) Green Building Rating System aims to improve occupant well-being, environmental performance, and economic returns of buildings using established and innovative practices, standards, and technologies.

Materials & Resources Credit 4: Recycled Content intends to increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials. As discussed and demonstrated below, **North American** steel building products contribute positively toward both available points. The following is required by LEED-NC:

> **Credit 4 (1 or 2 points)** "Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% or 20% (based on cost) of the total value of the materials in the project."

"The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value." Since steel (the material) and steel (the building product) are the same, the value of the steel building product is directly multiplied by steel's recycled content, or:

Steel Recycled Content Value = (Value of Steel Product) (Post-Consumer % + ½ Pre-Consumer %)

The information contained within this brochure provides post-consumer and pre-consumer recycled content percentages for **North American steel building products** and is considered acceptable documentation by the USGBC LEED rating system and green codes and standards. These percentages and values of steel building products are easily entered into the LEED Letter Template spreadsheet for calculation.

To illustrate the application of these steel recycled content values to LEED, manual calculations are shown below for typical Basic Oxygen Furnace (BOF) and Electric Arc Furnace (EAF) steel building products with nominal $10,000 purchases, using 2011 data. Steel building products include steel stud framing, structural steel framing (wide-flange beams, channels, angles, etc.), rebar, roofing, siding, decking, doors and sashes, windows, ductwork, pipe, fixtures, hardware (hinges, handles, braces, screws, and nails), culverts, storm drains, and manhole covers.

BOF Steel Recycled Content Value for Typical Product:
Steel Stud Framing
BOF Steel Recycled Content Value = 19.8% + (½ x 14.4%) = 27%
Value = ($10,000) (27.0%) = $2,700
(Positive net contributor to 10% and 20% minimum percentage for each point threshold)

EAF Steel Recycled Content Value for Typical Product:
Wide-Flange Structural Steel Framing
EAF Steel Recycled Content Value = 69.0% + (½ x 19.5%) = 78.8%
Value = ($10,000) (78.8%) = $7,880
(Positive net contributor to 10% and 20% minimum percentage for each point threshold)

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