

Hot-Dip Galvanizing (Zinc + Steel) Takes LEED® With Recycled Content

Project owners, designers, and architects have long recognized the structural and functional advantages of hot-dip galvanized steel. Increasingly, they are recognizing its environmental attributes, especially its high reclamation and recycled content.

Recycling zinc, and the steel it protects from corrosion, is not only economically smart but also conserves energy and reduces solid, liquid, and gaseous waste. In addition, it distributes the energy impact associated with the original mining and manufacturing of zinc and steel over infinite generations of hot-dip galvanized steel.

There are two measures of recyclability, percentage of recycling content and reclamation rate. Hot-dip galvanized steel rates highly on both measures, with approximately 70% of all steel and 30% of all zinc consumed made of recycled material. The primary reason more recycled zinc is not used is it is unavailable – it is so durable it is still in use! The reclamation rate, a measure of how often a product is actually recycled at the end of its useful life, is even higher for both, with virtually 100% of structural and plate steel and 80% of zinc recycled into new products.

The high interest in recycled material is primarily being driven by individual environmental awareness and the U.S. Building Council's Leadership in Energy and Environmental Design (LEED®) rating system. Currently, only the percentage of recycled content is considered in garnering LEED® points, and not the equally important reclamation rate.

Recyclability of Hot-Dip Galvanized Steel		
	Zinc	Steel ^a
Reclamation Rate	80%	100%
Recycling Rate	30%	70%

^a For structural and plate steel typically produced from electric arc furnaces

LEED® Materials & Resources Credit 4: Recycled Content Category

By promoting the use of established, creative practices, standards, and technologies, the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) rating system envisions buildings improving economic return, environmental performance, and personal health. Specifically, the Materials & Resources Credit 4: Recycled Content has the objective to increase the use of building products like hot-dip galvanized steel that have high recycled content, thus reducing the impacts caused by extraction and processing of raw metal and ores. As the calculations below indicate, hot-dip galvanized steel products contribute positively toward points under Credits 4.1 and 4.2. The following is required by LEED®-NC Versions 2.2 and 2009:

Credit 4.1 (1 point) "Use materials with recycled content such that the sum of the post consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% of the total value of the materials in the project."

Credit 4.2 (1 point) "Use materials with recycled content such that the sum of the post consumer recycled content plus one-half of the pre-consumer content constitutes at least an additional 10% beyond Credit 4.1 (total of at least 20%) 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 the assembly to determine the recycled content value.” Since hot-dip galvanized steel is both the material and the building product (zinc metallurgically reacts with iron in the steel becoming one product), the value of the steel building product is directly multiplied by hot-dip galvanized steel’s recycled content.

According to the International Zinc Association¹ (IZA), 30.2% or 3.2 million tons of the 10.6 million tons of zinc consumed each year are of recycled content. Of that 3.2 million tons, 1.5 million (14.6%) are post-consumer (end-of-life) and 1.7 million (15.6%) are pre-consumer (in-process sources such as skimmings, dross, and machined scrap). According to the Steel Recycling Institute², structural steel has post consumer recycled content of 56.9% and pre-consumer recycled content of 31.4%. For the average structural steel assembly of wide-flange beams, channels, angles, and plate with 250 ft²/ton, the zinc coating is 1.8% of the hot-dip galvanized product by weight. Thus, the combined recycled content is as follows:

$$\begin{aligned} &\text{Post-consumer recycled content – hot-dip galvanized steel} \\ &(1.8 \times 14.6\%) + (98.2 \times 56.9\%) = 56.1\% \end{aligned}$$

$$\begin{aligned} &\text{Pre-consumer recycled content – hot-dip galvanized steel} \\ &(1.8 \times 15.6\%) + (98.2 \times 31.4\%) = 31.1\% \end{aligned}$$

These percentages and values of hot-dip galvanized steel building products are easily entered into LEED® Letter Template spreadsheet for calculation. To illustrate the application of these steel recycled content values to LEED, a sample calculation is provided below.

Recycled Content Value for Typical Hot-Dip Galvanized Steel Product

$$\text{Value} = \$10,000 \times (56.1\% + 31.1\%/2) = \$10,000 \times 71.7\% = \$7,170$$

With more than 70% recycled content value, HDG is a positive net contributor to 10% and 20% goals of the Materials & Resources Credit 4: Recycled Content. Besides contributing LEED® points for recycled content, hot-dip galvanized steel contributes credits for dimensional stability and an exceptionally tight building envelope when properly used in design. Additionally, there is little or no scrap at construction sites because hot-dip galvanized steel is provided to exact specification and the magnetic properties make it easy to sort from other materials after demolition. Hot-dip galvanized steel has no volatile organic compounds (VOCs) and requires no maintenance for 75 years or more in most atmospheric conditions.

All of these attributes strongly support the aim of the LEED® Green Building Rating System to improve occupant well being, environmental performance, and economic return.

¹ International Zinc Association, Zinc Recycling, 2004, p. 6-7

² Steel Recycling Institute, Steel Takes LEED® with Recycled Content, March 2009