



HOT-DIP GALVANIZED BUILDINGS AND ARCHITECTURE

DURABLE
VERSATILE
ATTRACTIVE
SUSTAINABLE
COST-EFFECTIVE
MAINTENANCE-FREE



Hot-Dip Galvanized Buildings and Architecture

Structural steel has been the material of choice in the building market for decades because of the numerous benefits it provides. While steel successfully and efficiently works when enclosed in the building envelope (framing), the portions of the steel exposed to the atmosphere need corrosion protection. Whether canopies, façade elements, handrail, architecturally exposed structural steel (AESS), or other exterior elements, hot-dip galvanizing is specified for optimum corrosion protection and enhanced aesthetic appeal.

The fact steel corrodes when exposed to the atmosphere should not be a deterrent to specifying the material; because, all construction materials (concrete, wood, etc.) do in fact deteriorate when exposed to the environment. However, steel is more upfront about its corrosion – the rust shows where weaknesses are forming, allowing maintenance crews to focus their attention for repairs. Other materials may hide the issues until the problem is magnified. The best way to conquer corrosion is to provide steel with a protective coating, which has more than 150 years of proven, real world performance – hot-dip galvanizing.

Galvanized steel is a large part of the solution to reduce corrosion costs; however, galvanized steel is not specified solely for its corrosion resistance. Hot-dip galvanized steel is also specified on building and architectural products for its durability and maintenance-free quality. Around the world, hot-dip galvanized steel is considered aesthetically pleasing, and the contemporary, industrial appearance of hot-dip galvanized steel is rapidly becoming a popular architectural choice. The sustainability and durability of the product are additional bonuses to achieving the desired appearance. Hot-dip galvanizing is used for corrosion protection on many building and architectural applications, including:

Architectural Panels	Fire Escapes	Mesh & Embedded Items	Stair Stringers
Beams	Garage Support Steel	Ornamental Steel	Supports
Columns	Handrail	Railings	Trash Containers
Curb Angles	HVAC Supports	Roof Trusses	Trellises
Embedments	Leveling Plates	Screens	Utility Covers
Fences/Gates	Light Poles	Security Gates	

AESTHETICS

The lightness of steel members, and the ability to bend, curve, and roll the pieces for architectural visual interest is highly desirable. The functional demands of structural steel can also become part of the exposed beauty and uniqueness of a project. The gray finish of galvanized steel affords a more modern, natural appearance, and compliments and blends in with any environment. Hot-dip galvanizing protects the steel from unsightly rust, providing continuing corrosion protection.

A duplex system of paint or powder coating over hot-dip galvanized steel allows a great deal of design freedom. For example, projects requiring a particular color scheme can use a duplex system to take advantage of the corrosion-resistant protection of galvanizing while incorporating a range of colors. The synergistic effect of combining the two coatings extends the service life for unparalleled corrosion protection, while the metallurgically-bonded galvanized coating serves as an ideal primer to provide an impervious barrier for the base steel. When paint and galvanized steel are used together, the corrosion protection is superior to either protection system used alone and can last from 1.5 to 2.3 times the combined lifetimes of both systems.



Duplex systems increase design freedom and add color to galvanized projects

AVAILABILITY & VERSATILITY

Hot-dip galvanized (HDG) steel is readily available. Because hot-dip galvanizing is a factory controlled process, it can be accomplished 24/7, 365 days a year, rain or shine, ensuring more reliable on-time delivery. Galvanized steel could realistically be galvanized, shipped to the site, and erected on the same day; however the common turnaround time is three to five days. Furthermore, because of hot-dip galvanized steel's durable, maintenance-free nature, elements can be stockpiled outside for years without compromising the zinc coating and its corrosion protection.

With galvanized steel, you can do more with less. Steel's high strength-to-weight ratio means one ton of steel provides the same strength as eight tons of concrete, minimizing substructure costs and saving money on transportation and handling. Due to the lighter, stronger members, steel designs are often more open, providing endless design options. Finally, lighter members allow ease in expansion later, as you can easily weld and bolt on new material often in the same footprint. Adding to existing structures allows maximum efficiency of available space.

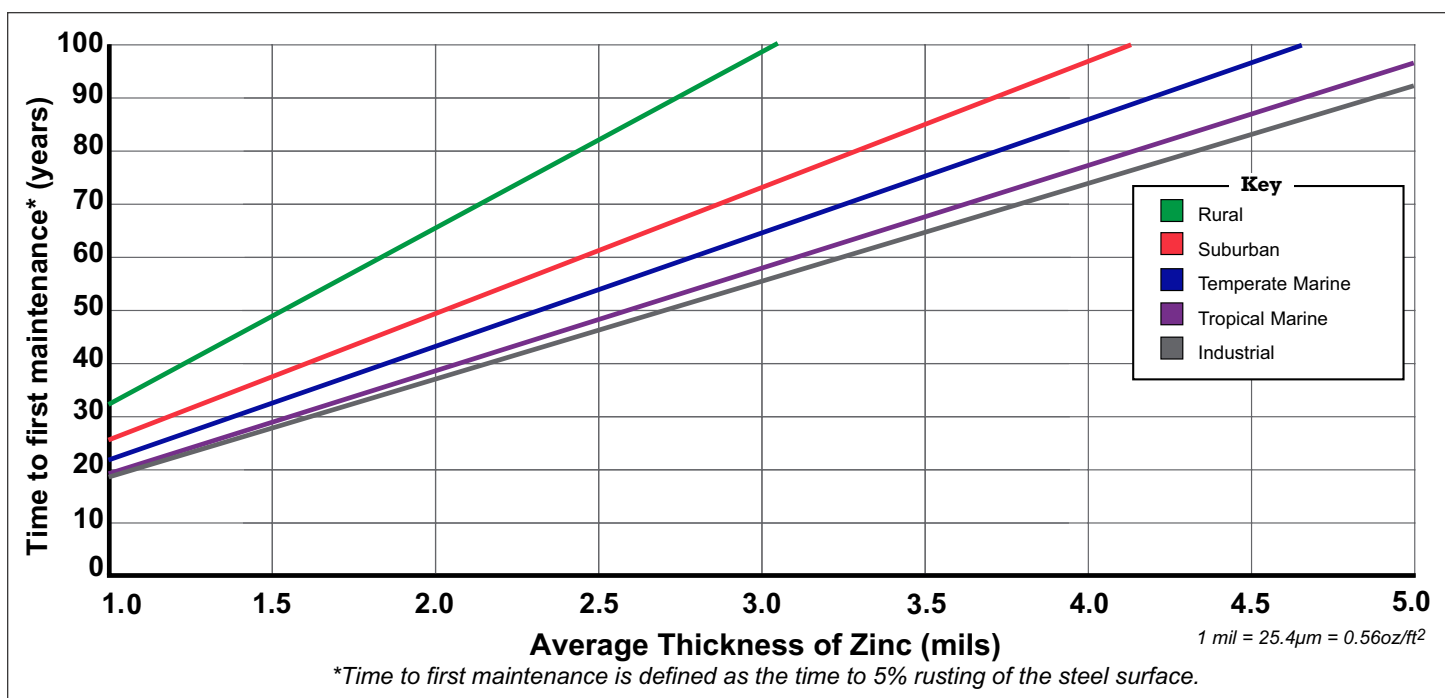


Figure 1: Time to First Maintenance Chart

MAINTENANCE FREE DURABILITY

Hot-dip galvanized steel provides superior corrosion protection for at least 75 years. The Time to First Maintenance Chart (*Figure 1*) shows the durability of hot-dip galvanized coatings in five environments representing atmospheric conditions. As you can see, in the harshest environment (industrial), first maintenance will not be required for nearly 75 years. Many building and architectural projects are located in less corrosive environments, such as the suburban/tropical marine environment of the San Diego Library, giving them potentially even longer service lives.

However, the corrosion resistance of the coating is not the only durable quality of HDG steel. Hot-dip galvanized coatings can withstand rough handling, thereby resisting abrasion because of the bond strength of the zinc coating to the steel substrate. During the hot-dip galvanizing process, the steel is dipped in a bath of molten zinc which metallurgically bonds to the steel creating a series of zinc-iron intermetallic layers which are harder than the base steel. It is because of this metallurgical reaction HDG steel has superior bond strength and abrasion resistance.

Hot-dip galvanized coatings exposed to the environment last at least 75 years, and interior or enclosed galvanized coatings have been shown to last well over 100 years. For most products, this maintenance-free period lasts as long as or longer than the project design life. Eliminating the need for maintenance also eliminates the costs associated with maintenance, meaning the initial investment for HDG steel is the total cost over the life of the project.

LIFE-CYCLE COST

There has long been a perception in the specifying community that hot-dip galvanized steel is cost prohibitive on an initial basis. However, due to regular process improvements, galvanized steel is not only competitive but often less expensive than other corrosion protection systems initially. Furthermore, because of quick turnaround and erection, utilizing hot-dip galvanized steel often provides wider-ranging cost savings during construction. The costs of steel and zinc have remained relatively stable and increased at a slower pace than other construction materials over the last 30 years. Comparative studies indicate steel is often 5-7% less expensive than concrete in structures such as parking garages, and may be even more significant in other projects. Hot-dip galvanizing enhances the overall economic efficiency of steel by eliminating costly maintenance throughout the life of the project.



The San Diego Central Library utilizes galvanized steel for corrosion protection

Calculate the value of utilizing
HDG in your next project.
Visit lccc.galvanizeit.org

Hot-dip galvanized steel products are economically superior on a life-cycle basis. Because of the durability and maintenance-free nature of the zinc coating, the initial investment will be the total life-cycle cost of the product. In addition to being competitive with other corrosion protection systems in terms of initial investment, when the long-term advantages of the galvanized coating are taken into account, one will discover it is well worth the investment. Using hot-dip galvanized steel ensures an upgraded product competitive on an initial cost basis, and over the life of the product delivers an attractive return on investment.

SUSTAINABILITY

Sustainable development is an increasingly important consideration in building and architectural materials. Zinc is necessary in many biological processes, and is used in many common products such as diaper rash cream, sun block, and common cold remedies. It does not add to landfills like paints and other materials do. Zinc is the 27th most abundant material in the Earth's crust, and iron ore is the 4th; both are also 100% recyclable without the loss of any chemical or physical properties. This essentially ensures galvanized steel is an infinitely renewable building material.

Steel is the most recycled material in the world, with nearly 90% of all structural steel coming from recycled sources and the reclamation rate (amount of steel available for recycling that is in fact recycled) is 100%. Similarly, 30% of all zinc comes from recycled sources, and 80% is reclaimed. Furthermore, in the past 20 years, structural steel has reduced its carbon footprint nearly 50%, and the energy used in the production of structural steel has decreased 30%, and the conservation of water used in the closed-loop recycling has improved. Coupling the advances of structural steel with the longevity of hot-dip galvanizing enhances the sustainability even more.

The longevity of the coating eliminates the need for expending additional energy in the future on maintenance and upkeep. Additional energy is saved by eliminating the need to replace hot-dip galvanized products, which would require more energy and natural resources to create and transport new steel.



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Case Studies

SAN DIEGO CENTRAL LIBRARY - SAN DIEGO, CA

San Diego's Central Library opened its doors to the general public on September 28, 2013. Located in downtown's East Village, the library has beautiful views across the bay to Coronado Island. Completion of the new library was highly anticipated and gained overwhelming community support. The dome structure has become a proud architectural achievement for the city.

Hot-dip galvanizing was the master key the design team had been looking for to address their concerns pertaining to corrosion protection. Durable and virtually maintenance-free, coupled with a record of outstanding sustainability, hot-dip galvanized steel was specified and used to construct the outside façade of the building, including the magnificent 3-story arched domed terrace.



Hot-dip galvanized steel is prominently displayed on both the interior and exterior of this structure, adding a final appearance of character and distinction to the library's hip, ultramodern aesthetics. The hot-dip galvanizing industry is proud and humbled to play such an essential role in providing this new downtown landmark to what has been nicknamed America's Finest City.

CHARLOTTE DOUGLAS AIRPORT PARKING GARAGES - CHARLOTTE, NC



Watch the Galvanized Steel Study video of the Charlotte Douglas Airport Parking Decks online at www.galvanizeit.org/charlotte

As the passenger traffic has increased at the Charlotte Douglas International Airport over the past few years, so has the demand for more parking. The designer of the new parking decks wanted to break away from the normal square, concrete box structure of parking facilities, and envisioned a facility that would mirror the curvature of an airplane wing.

In order to accomplish this design, the architect and engineer decided to attach stainless steel cladding to a galvanized structural steel frame. Galvanized steel was specified for its exceptional maintenance-free service life, overall aesthetic appearance, and compatibility with stainless steel. When used together, galvanized and stainless steel provide a uniform appearance and an economical alternative to specifying stainless steel for the entire structure.

Hot-dip galvanized (HDG) steel was chosen for corrosion protection in this structure not only because of the great success the specifier had in the past, but also for its outward appearance. HDG gives the structure a

distinctly industrial, but aesthetically pleasing overall appearance when compared to ordinary concrete structures. A total of 350 tons of steel were galvanized for this project, including bow-string trusses that support perforated stainless steel panels. These panels allow light to penetrate the structure during the day and emit a neon glow at night. Hot-dip galvanized steel ensures all of the structures will remain a corrosion-free centerpiece of the airport landscape for years to come.

PYRAMID RESIDENTIAL BUILDING - NEW YORK, NY

In the heart of New York City, along the Hudson River, gleams this very visible monument to hot-dip galvanizing. The VIA 57WEST housing project, designed by Bjarke Ingels Group (BIG) of New York, stands out as something different in a city that has hundreds of buildings trying to stand out. The project began when Douglas Durst visited the Ingels' Copenhagen studio in 2010 and was fascinated by the unique designs, particularly that each was so different and specifically designed for its location. Featuring angular balconies and an impressive green plaza, it was built to provide great views with little traffic noise.

The VIA 57WEST is a dramatic, gateway to the Manhattan skyline and really incorporates both European and New York influences. Bjarke Ingels Group, which originates in Denmark, worked with the local steel fabricator and galvanizer to achieve the goal of building something that



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stands out. Hot-dip galvanizing was chosen for the building structure thanks to its maintenance-free longevity, while also being a nod to BIG's European influences, where hot-dip galvanizing is used much more prominently in buildings than in North America.

It is easy to see BIG accomplished their mission of standing out in a city where so many iconic structures already stand. On a sunny day the pyramid can be seen from most spots in Manhattan and Brooklyn. The beautifully designed building, which is in an area with the highest level of renovation in the past five years, is an amazing addition to the famous skyline. Thanks to hot-dip galvanized steel, VIA 57WEST will adorn that skyline beautifully for many generations to come.

HARLEY DAVIDSON MUSEUM - MILWAUKEE, WI



The designers of the Harley Davidson Museum turned to the motorcycles themselves for inspiration. Durability, long-life, quality – hot-dip galvanized steel encompasses all of these ideals, making it the natural selection to serve as an honest representation of the elements of Harley Davidson engineering. The architecture of the museum reveals exposed I-beams, columns, gusset plates and cross bracing, all open to the harsh effects of sun, snow, and rain. Hot-dip galvanized steel will withstand these tough elements, providing maintenance-free protection from the damaging effects of corrosion, both structurally and aesthetically.

With 2.5 million pounds of galvanized steel, good communication between the designers, fabricator, and galvanizer resulted in a smooth process with a quality product. Quick turnover and enormous savings compared to rendering the same look with paint sweetened the deal, as well. Now, this galvanized structure will stand as a durable, corrosion free homage to Harley Davidson history, culture, and engineering for many decades into the future.

SALVADOR DALI MUSEUM - ST. PETERSBURG, FL

The Salvador Dali Museum, located in the highly corrosive Floridian coastal environment, faced several development challenges. All steel elements of the museum needed a durable, low-maintenance corrosion protection system to guard against unsafe and unsightly corrosion; however, the appearance of the structure must also be pleasing to the eye, without distracting from the glass structure. Finally, the complexity and scale of the architecture required the steel elements be fabricated, processed, and delivered to the job site in order and without loss.



Incorporating a duplex system of powder coating over hot-dip galvanized steel for corrosion protection was the ideal solution for addressing all of these concerns. A duplex system combines the superior protection of galvanized steel with the additional benefits of another corrosion protection system, such as powder coating or paint, to extend the maintenance-free life of the project. The powder coated finish allowed a color selection that would blend with the facility, while the galvanized steel beneath ensured the pieces would be protected by the most durable corrosion protection system available- the best of both worlds.

Galvanizing was ideal for the elements of this project, as the glass structure is formed with structural steel tubing, with access holes that would expose the inside of the tubing. As the steel pieces are lowered into the zinc bath during the galvanizing process, the molten zinc flows in and throughout the element being dipped. This means the interior of hollow tubes develop the same corrosion protection as the exterior- and will be protected from corrosion both inside and out for generations.



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