Hot-Dip Galvanized

Construction Products

Safe

Durable

Attractive

Sustainable

Cost-Effective

Maintenance-Free

American Galvanizers Association

Hot-Dip Galvanized Construction Products

A variety of commercial and residential construction products have utilized hot-dip galvanized steel for more than a century because of its outstanding durability and maintenance-free qualities. Over time, corrosion has become an enormous concern throughout the nation and world. Hot-dip galvanized steel is the most widely used metallic coating corrosion protection system. Estimates show the amount currently spent on corrosion protection is approximately $121 billion or 1.38% of the GDP in the United States. This figure includes all types of corrosion protection, regardless of their suitability and effectiveness.

Although the expenditure for corrosion protection sounds like a significant figure, when you compare it to the cost of steel corrosion, caused by unprotected or inadequately protected steel, you will discover corrosion protection is a wise investment. The annual direct cost of steel corrosion in the US is $297 billion, more than double the amount spent on corrosion protection. Additionally, the indirect cost of corrosion in the US is up to 10 times the direct cost, meaning the true cost of corrosion is anywhere from $594 billion – $2.97 trillion or 6-34% of the GDP.

"The annual direct cost of steel corrosion in the US is $297 billion...

Galvanized steel can decrease these corrosion costs significantly."

Galvanized steel is a large part of the solution to decrease corrosion costs, however, galvanized steel is not specified solely for its corrosion resistance. Hot-dip galvanized steel is also specified on construction products for aesthetics, safety, sustainability, and its 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 the preferred corrosion protection system for steel, as demonstrated on many residential construction products, including the following:

- Brick lintels & angles
- Grating
- Trusses
- Steel joists
- Fencing
- Columns
- Metal framing
- Nails
- Scaffolding
- Window wells
- Fasteners
- Gutters
- Structural steel
- Downspouts

An unsightly, rusted brick angle begins staining the window frame and the bricks.

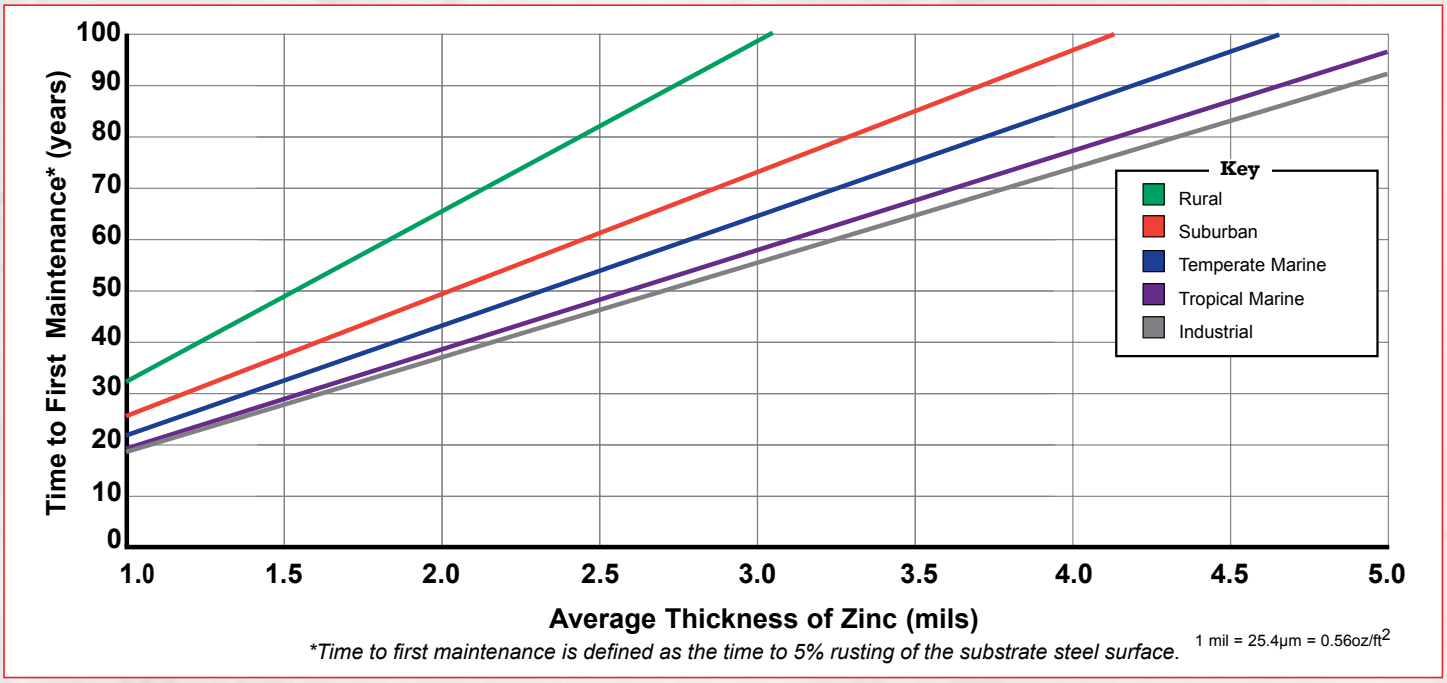
A galvanized brick angle continues to look great for decades to come.

AESTHETICS

Although not always a deciding factor, aesthetics are usually considered when specifying a steel construction product. Hot-dip galvanized steel has a distinct appearance that naturally blends with its surroundings. As stated before, the appearance of hot-dip galvanized steel has grown in popularity over the past few years. The contemporary, industrial look can complement almost any structure; however, if the natural appearance isn't suitable, hot-dip galvanized steel can be painted.

By painting galvanized steel, the desired appearance can be achieved without sacrificing corrosion protection. Rust and rust staining not only severely impacts the aesthetic appeal of structures, but may also lead to more serious structural deficiencies. Hot-dip galvanizing or painted hot-dip galvanizing provides a uniform appearance, free from rust for 50+ years.

Figure 1: *Time to First Maintenance Chart*



*Time to first maintenance is defined as the time to 5% rusting of the substrate steel surface.

1 mil = 25.4µm = 0.56oz/ft^2

DURABILITY

Hot-dip galvanized (HDG) steel provides superior corrosion protection lasting 50+ years, or in most cases, the life of the project. 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 most harsh environment (Industrial) first maintenance will not be required for approximately 73 years.

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.

SUSTAINABILITY

Sustainable development is an increasingly important consideration in construction projects, and to that end the zinc of the hot-dip galvanized coating, as well as the steel itself, is 100% recyclable. Furthermore, 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.

The zinc in hot-dip galvanized coatings is a natural element, the 27th most abundant in the Earth's crust, and is essential to all life. 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, and in fact, a large percentage of the original product is produced from recycled material (zinc and steel).

Calculate the value of utilizing HDG in your next project - visit www.galvanizingcost.com

LIFE-CYCLE COST

Hot-dip galvanized steel construction products are economically superior on a life-cycle basis. Because of the durability and maintenance-free nature of the zinc coating, your initial investment will be the total cost of the product throughout its life. In addition to being competitive with other corrosion protection systems in terms of initial investment, when you take into account the long-term advantages of the galvanized coating, you will discover it is well worth the investment. Consider the cost of an accident on the job site because a worker slipped on a painted walking surface, the cost to blast clean stained bricks caused by rust bleeding from angles, or the cost to remove mold from wood framing. Additionally, consider the immeasurable costs such as damage to your company reputation, personal pride, and/or health. 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.

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MAINTENANCE-FREE

Many steel construction products are placed into service in difficult to access locations, which increases the cost to maintain the steel. Even if the steel is in an accessible, exposed area, maintenance is time-consuming and expensive. When using HDG steel, maintenance can be virtually eliminated. Hot-dip galvanized coatings exposed to the environment last 50+ years, and interior or enclosed galvanized coatings have been shown to last well over 100 years. For most construction 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. Maintenance-free galvanized steel frees up time and money to be exerted in the creation of new products rather than in maintaining old ones.

SAFETY

Safety is always a concern within the construction industry. Hot-dip galvanized steel offers a number of increased safety features not only during construction, but also throughout the life of the project. Hot-dip galvanized steel is slip-resistant, fire-resistant, and has a high strength-to-weight ratio, all of which increase safety. The slip resistance of HDG provides a safe walking surface for workers on site (see *Figure 2* below), reducing the number of accidents.

Figure 2: *Slip Resistance of Galvanized Surfaces*

Slip Resistance of Galvanized Surfaces

OSHA 1926.754 (c) (3)

High-Silicon Samples				
Sample	**H1**	**H2**	**H3**	**H4**
Test 1	0.69	0.81	0.86	0.70
Test 2	0.71	0.77	0.82	0.70
Test 3	0.69	0.81	0.85	0.74
Test 4	0.67	0.78	0.84	0.72
Average	0.69	0.79	0.84	0.72
TOTAL AVERAGE: 0.76				

Low-Silicon Samples				
Sample	**H1**	**H2**	**H3**	**H4**
Test 1	0.56	0.67	0.52	0.50
Test 2	0.56	0.71	0.55	0.49
Test 3	0.52	0.66	0.55	0.54
Test 4	0.54	0.67	0.50	0.53
Average	0.54	0.68	0.53	0.52
TOTAL AVERAGE: 0.57				

Additionally, the fire resistant property of HDG steel will help protect workers during construction, as well as the product throughout its life. HDG steel is not flammable and does not add combustable material to a fire already in progress, and in fact studies show galvanized steel to have little or no damage in house or commercial building fires. Finally, because steel has a high strength-to-weight ratio, it is better suited to sustain high winds or seismic force. The ductility and resiliency of steel help it survive natural disasters such as tornadoes, hurricanes, and earthquakes throughout the life of the product.

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Construction Forms

The integrity of construction forms such as scaffolding, shoring, and forming structures, is crucial to the building process. OSHA describes frame or fabricated scaffolds as "versatile, economical, and easy to use," often utilized by residential contractors, painters, large-scale construction jobs and more.[1] Because of this widespread use, safety regulations for these structures have become imperative to protect both the worker and the project. The initial investment to hot-dip galvanize a construction form means decades of corrosion protection that will keep structures safe for operation and prevent project delays due to costly maintenance or replacement.

The zinc coating created during the galvanizing process will protect the base steel from corrosion for decades, holding rust at bay and keeping structures sound. Unlike paint or other corrosion protection measures, galvanizing requires no maintenance – this means no time or money will be wasted putting a project on hold to repair or replace construction forms. A gleaming zinc exterior will represent quality service, and the sustainability of the galvanizing process will cause minimal harm to the environment. Hot-dip galvanized steel means the project will be completed in a safe, timely manner with as little cost as possible.

Galvanized steel makes construction forms such as scaffolding, shoring systems, and forming structures safer for workers.

Durability

The primary reason for galvanizing construction forms is to improve their durability. For a small investment, these structures can be hot-dip galvanized for corrosion protection and preserved for use time and time again. The tough zinc coating, which is harder than the substrate steel, will hold up for years against abrasive construction environments.

Barrier protection created by the zinc coating will defend the steel against the corroding effects of outdoor exposure, guarding the steel from scorching heat and corrosive rain. However, the metallurgical reaction created during the galvanizing process also protects the steel cathodically – meaning nicks and scratches exposing the substrate steel will be protected from rust by the properties of the surrounding zinc. This makes galvanized steel particularly well-suited for rough construction environments, where scaffolding and other construction forms can easily be scratched and abused. A galvanized coating will protect the structures from corrosion for decades, so workers can put the reliability of their work structures out of mind and focus on getting jobs done quickly and effectively.

Safety

In the *Guide to Safety Procedures for Vertical Concrete Formwork*, the Scaffolding, Shoring, and Forming Institute (SSFI) explained proper and safe use of construction forms should be emphasized due to widespread and growing use in the industry.[2] In order for scaffolding, shoring, or forming structures to be utilized safely, corrosion must not be present. As rust gnaws at the steel, the steel becomes increasingly weak – and if one support or piece of the structure is weakened, the whole construction form is at risk for failure. Crumbling, deteriorating scaffolds pose a severe safety hazard to both the individuals at work and those below them, not to mention property damage. Hot-dip galvanizing protects steel from corrosion for decades, assuring workers can trust the stability of the structure beneath their feet.

Maintenance-free

Another advantage of utilizing hot-dip galvanized steel for corrosion protection is coated structures require no maintenance for years to come. Unlike paint, which has to be reapplied and touched-up frequently throughout use of the product, galvanized construction forms will be protected for decades with no maintenance. According to OSHA standards for supported scaffolds, "any part of a scaffold that has been damaged or weakened so it no longer meets OSHA strength requirements must be repaired, replaced, braced, or removed from service."[3]

Construction owners and workers do not have the time or money to waste on repairs or maintenance – much less to waste on replacing structures disabled by corrosion. Waiting for maintenance or delaying construction while a necessary structure is removed from service is an unacceptable, costly waste of time, especially when there is an alternative that will keep workers on the go. With the corrosion protection of hot-dip galvanized steel, there will be nothing to slow you down.

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Aesthetics

The clean, metallic sheen of galvanized steel not only makes construction forms look attractive from the road, it also serves as a positive reflection on the construction company using them. Communities respect and trust a company that takes pride in its work and representation at the job site, and this translates into more business. The uncorroded exterior of the structures also allows workers to approve scaffolding or forms by sight during inspection – meaning no delays to determine whether or not a structure is usable.

Galvanized scaffolding (left) is safer and more attractive than rusted scaffolding, right.

Sustainability

Hot-dip galvanizing is a process that utilizes the natural properties of zinc to protect structures from corrosion. An element essential to personal health, zinc projects little harm on the environment, and is 100% recyclable. With no need for the carbon footprint of continual maintenance, galvanized-steel is the most earth-friendly option available for corrosion protection.

A galvanized zinc coating will protect the EFCO Deck System from harsh construction environments.

Case Study – EFCO Deck Systems

EFCO, a manufacturer of systems for concrete construction created a newly developed Handset Shoring System for cycling large deck panel systems from floor-to-floor with a crane. Designed for slab construction where flying tables are not practical, the system is gaining popularity and has been used in the construction of several high-rise renovations and apartment complexes around the world.

All deck components of the shoring system are galvanized for corrosion protection. As a construction product, galvanizing was specified because it handles the abrasive environment of a construction site far better than a painted product. The barrier and cathodic protection of galvanized steel will protect the structure from inevitable nicks and scratches of an active site.

A lease program for the EFCO decks means the forms need quick turnover, with no delays for maintenance or repair. With minimal clean-up and no need for continued maintenance, the shoring system is quickly put back into the field for the next user. Galvanized steel means corrosion will not slow a project down.

[1] *Supported Scaffolds*, "Frame or Fabricated." Occupational Safety & Health Administration.
[2] *Guide to Safety Procedures for Vertical Concrete Formwork*, pg. 1. Scaffolding, Shoring, and Forming Institute (SSFI).
[3] *Supported Scaffolds*, "Keeping Upright." OSHA Article 1926.451(f)(4), Occupational Safety & Health Administration.

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Brick Lintels & Angles

For generations, brick homes have been viewed as prestigious, beautiful, and enduring. Studies by the National Association of Home Builders and other building organizations have found 60% of the nation's homebuyers prefer brick homes. Bricks are aesthetically pleasing, durable, and maintenance-free, all of which contribute to the reputation of the product. For builders and homebuyers, brick homes are a sound investment; they sell faster and bring a higher resale price, are free from termite damage and rotting, are energy efficient, and can lower fire insurance premiums. Bricks alone will increase the value of a home 4-6% over an identical house with other siding. So why would a builder or home owner want to jeopardize all the beneficial qualities bricks offer by using painted lintels and angles, which will need to be repainted when they begin to rust?

Hot-dip galvanized lintels and angles will ensure your investment in a brick home will be protected. Hot-dip galvanized coatings on steel are the equivalent of brick siding on homes; an upgrade product which offers aesthetic appeal, durability, and maintenance-free performance. For a slightly higher initial investment, typically less than 0.1% of the cost of the new home, galvanized lintels pay off in the long-term, eliminating costly maintenance. Whether a builder or homebuyer, galvanized lintels and angles are the logical choice to protect brick homes.

AESTHETICS

Brick homes are beautiful and preferred by 60% of home buyers. Painted lintels and angles start to corrode after only a few years and will mar the bricks with unsightly and difficult to remove rust staining. By using hot-dip galvanized lintels and angles, which protect against corrosion for 50+ years, the unsightly staining is eliminated. Eliminating this eyesore not only ensures the home owner a continually beautiful appearance, but will also protect the reputation of the builder within the community, and save the homeowner money that would have been spent maintaining panted lintels.

DURABILITY

Similar to the long-lasting toughness of bricks, hot-dip galvanized steel coatings will protect against corrosion for 50+ years, often exceeding the life of the house. Abrasion resistance is part of the reason for the long service-life of galvanized products. During the galvanizing process, the molten zinc in the galvanizer's kettle and the iron in the steel metallurgically react, creating a series of zinc-iron alloy layers that are actually harder than the steel itself. The intermetallic layers create the abrasion-resistance, which is important as lintels are rarely handled with care on the job site. Painted lintels only provide a minimal amount of corrosion protection, and if damaged by rough handling, the protection will be compromised even more. Protecting the steel lintels and angles with the zinc of hot-dip galvanizing will protect your brick investment.

SUSTAINABILITY

As the need for sustainable building products continues to become a high priority, it is necessary to consider the sustainability of every product used. Galvanized steel is produced by immersing steel in molten zinc. Both the substrate steel and the zinc of the galvanized coating are 100% recyclable. Additionally, by using galvanized lintels and angles, no energy is needed to clean stained bricks and repaint lintels. Once galvanized lintels are installed, they will not require any additional energy output during the life of the house.

"Hot-dip galvanized coatings on steel are the equivalent of brick siding on homes; an upgrade product which offers aesthetic appeal, durability, sustainability, and maintenance-free performance."

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MAINTENANCE-FREE

When painted lintels corrode, the rust bleeds onto the bricks, causing a maintenance nightmare. The rust staining is difficult to remove from the bricks and once it is removed, you still have to repaint the lintels to avoid further staining. Repainting the lintels is tedious and expensive, and often has to be done every few years. Over time the cost of maintaining painted lintels and angles more than justifies the decision to invest slightly more initially to upgrade to galvanized products. Hot-dip galvanized lintels and angles will provide maintenance-free corrosion protection throughout the life of the home.

CASE STUDY

Image 1: Rusting brick lintel

Image 2: Galvanized steel brick lintel

The images above show two houses built and bricked at approximately the same time. The brick lintels used on the house in *Image 1* were not galvanized, and in just 2-5 years have already begun to rust. This corrosion has not only made the lintel itself unsightly, but has also begun to bleed onto and stain the exposed window frame. If this lintel remains untreated, the rust will start to bleed onto the surrounding bricks. Cleaning the unsightly stains from the bricks is not only tedious, but also expensive.

Protected by the zinc coating, the steel within the galvanized lintel in *Image 2* has shown no signs of corrosion, and will continue to be rust-free for decades to come. The cost of this protection is minimal, increasing the cost of your home by only approximately 0.02%. For a $300,000 custom home, switching from painted to galvanized lintels would only increase the cost by approximately $60. Investing in hot-dip galvanized lintels eliminates the chance of rust bleeding, and insures your beautiful brick home will stay attractive for generations to come.

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