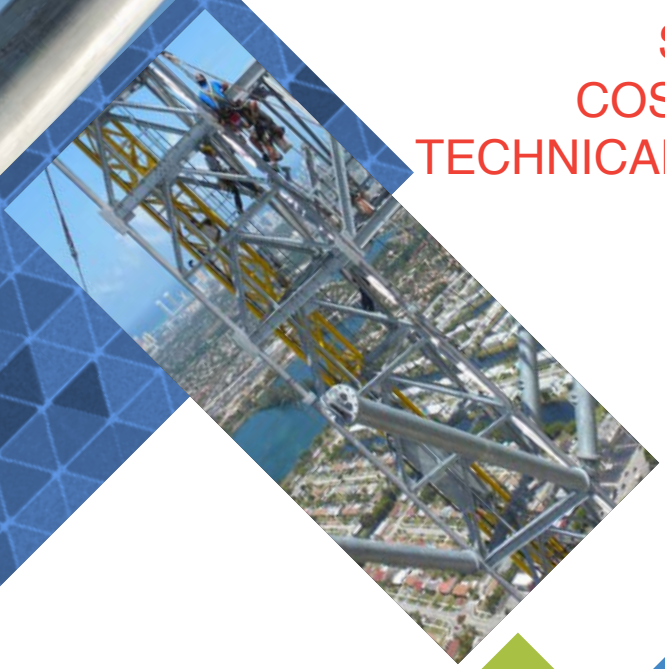


HOT-DIP GALVANIZED STEEL DISTRIBUTION POLES

DURABLE
AVAILABLE
SUSTAINABLE
COST-EFFECTIVE
TECHNICALLY FEASIBLE

AMERICAN GALVANIZERS ASSOCIATION

Hot-Dip Galvanized Steel Distribution Poles

The steel utility pole is a highly engineered product. It is designed to American Society of Civil Engineers (ASCE) criteria, National Electric Safety Code (NESC) minimum load requirements, and uses material and manufacturing to ASTM International specifications and welding to American Welding Society (AWS) specifications. The result is an extremely strong and reliable product with uniform dimensions and strength, but without twists, knots, splits or bows.[1] Through design, steel is a lighter product opposed to other construction methods, which reduces the cost of transportation, handling and constructions. It also allows it to be versatile within a variety of different locations and climates.

Steel as a construction method requires little maintenance, and this durability is further strengthened when the distribution pole is hot-dip galvanized. Not only is there little maintenance, but it will remain durable in all different atmospheric conditions. Galvanizing is used in substations, transmission structures, as well as transmission and distribution poles to provide maintenance-free functionality without interruption for decades. Inspections for damage caused by rot, insects, or woodpeckers are eliminated with galvanized steel poles, because they are impermeable to these forces of nature. Not only is there a high capacity and availability for steel, but with the combination of steel and hot-dip galvanizing there is a heightened level of durability, sustainability, and technical feasibility as well as improved life-cycle cost.

CAPACITY/AVAILABILITY

The demand and production of steel in North America is at a constant increase, and as steel pole manufacturers and galvanizers are located throughout North America, the positive economic impact has become more widespread. The current raw steel production capability utilization rate is at 75%, and the U.S. fabrication industry can certainly handle a gradual increase in steel pole demand, which is the forecast in the market.[2] The change in the transmission market has tripled in the last five years, leading most major steel utility pole producers to add significant capacity for transmission poles. Increased demand in the steel distribution market would likely spur a similar ramp-up in production. Also, steel poles perform well in storm events, so in an emergency situation there are fewer damaged poles, resulting in fewer customer service interruptions and less demand for replacement poles.[3]

LONGEVITY

Another benefit of utilizing hot-dip galvanizing (HDG) for steel distribution poles is its longevity. HDG is very well known for it's maintenance free longevity. Predicting time to first maintenance of galvanized steel distribution poles in different atmospheric conditions is possible by using the American Galvanizers Association's Time to First Maintenance Chart (*Figure 1*). The chart shows a utility that has a minimum of 3 mils of zinc on the surface will have a time to first maintenance of 55-95 years, depending on the environment.

In terms of steel distribution poles, galvanized steel performance below ground's average service life is 50-200 years. The service life of steel embedded in all different types of soils can be predicted using the Service Life in Soil Chart (*Figure 2)*, which can be found at **galvanizeit.org/soil**.

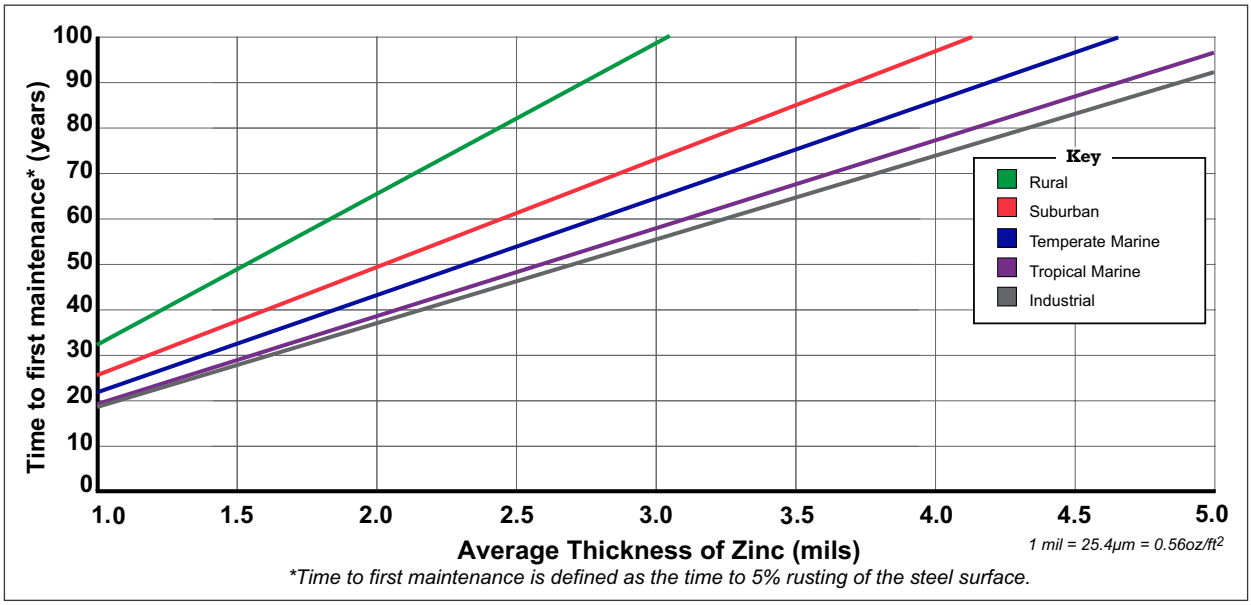


Figure 1: Time to First Maintenance Chart

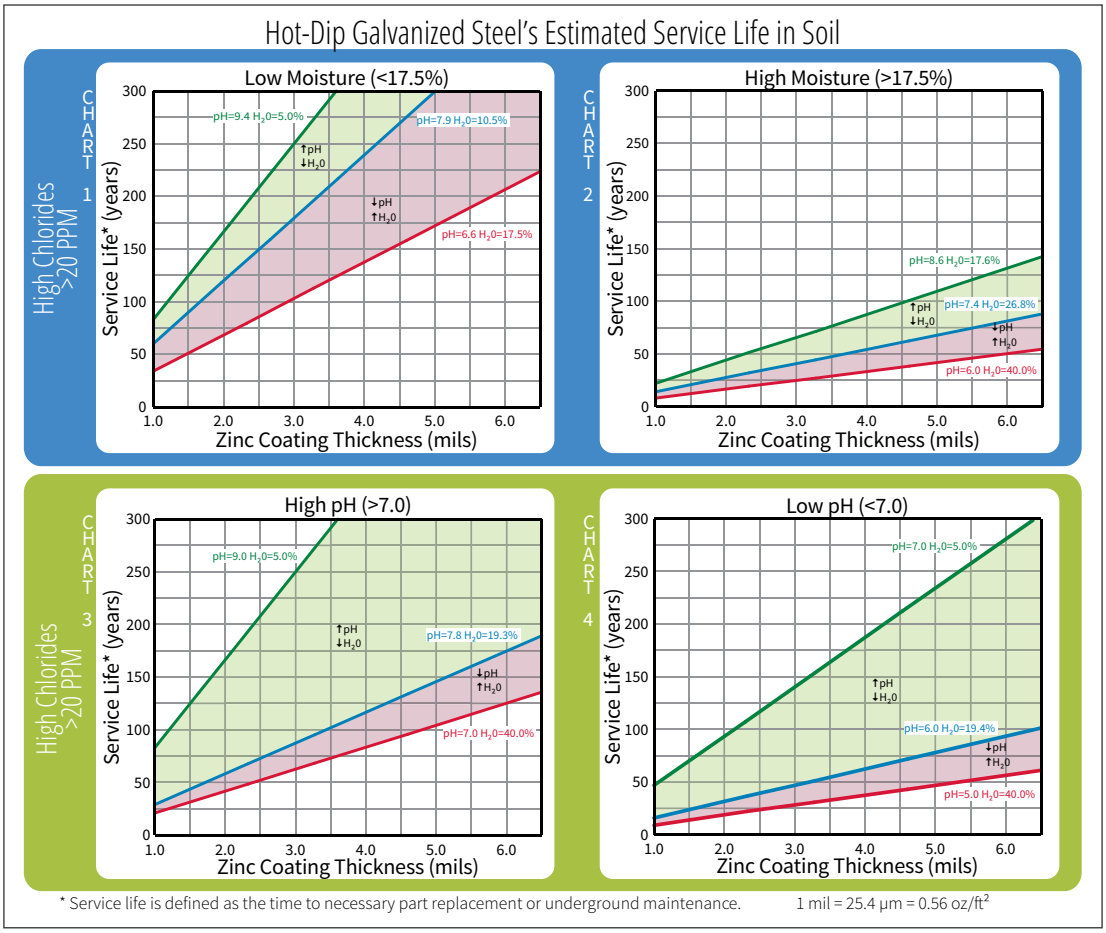


Figure 2: Service Life in Soil Chart

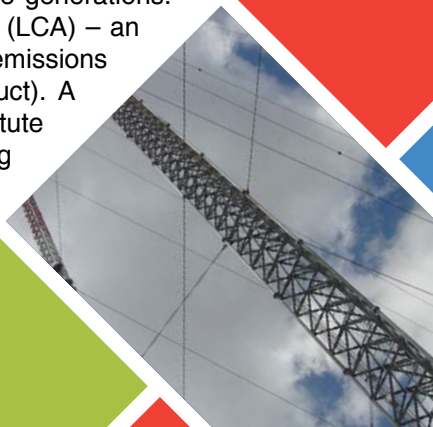
DURABILITY

Galvanized steel is a strong, durable material that can withstand transportation and installation practices as well as a variety of atmospheric conditions. Galvanized steel is metallurgically-bonded to the steel providing a corrosion and abrasion resistant coating. These layers develop naturally during a metallurgical reaction between the iron in the steel and zinc in the kettle. Throughout this process, the zinc coating has both a uniform coverage, meaning the zinc is growing perpendicular to the surface of the steel leaving no weak points, and also complete coverage, meaning both the interior and exterior of the steel structure will be coated. This durability of hot-dip galvanized steel in a wide range of atmospheric environments and in-soil settings has been demonstrated by its use in high voltage transmission towers that have that have been used worldwide for many decades.

SUSTAINABILITY

The North American steel industry has invested billions of dollars in new technologies over the past two decades. Expenditures directed towards these investments have had notable results, including reductions in energy consumption, reduced carbon dioxide emissions, a reduced life-cycle impact, and increased volumes of steel scrap being recycled. These achievements are making steel a more sustainable material. The North American steel industry's commitment to sustainability has transformed steel into the world's most recycled material, with more than 80 million tons recycled yearly in the US alone.

Galvanizing steel can contribute positively to sustainable development initiatives because of its maintenance-free longevity, 100% recyclability, minimal environmental impact, and economic savings for future generations. The low environmental impact of hot-dip galvanized steel is based on life-cycle assessment (LCA) – an objective, thorough study of a product or material's greenness. LCA measures energy use and emissions form the cradle (mining of zinc and steel) to the grave (end of life of the galvanized product). A detailed life-cycle assessment study commissioned by the Steel Market Development Institute (SMDI), a business entity of the American Iron and Steel Institute, found that when comparing overall environmental performance, galvanized steel utility poles outperform wood poles in key environment measures. When utilizing advanced life-cycle assessment methods, the study showed replacing wood utility poles with galvanized steel will result in lover levels of greenhouse gases and aerosol emissions associated with global climate change.



continued on back page...

LIFE-CYCLE COST

When considering the cost of galvanized steel, it is important to not only consider initial cost, but more so its life-cycle cost due to its maintenance-free longevity. For example, steel poles under 55' may cost more than wood poles initially, but 55' poles are very cost competitive on an initial cost basis. For both low- and large-class poles, the total life-cycle costs of steel are very cost competitive and may have an advantage. A study of Texas based Bluebonnet Electric Cooperative found the steel poles save the utility 10-20% in life-cycle costs when compared with wood poles. The utility states, "The big savings is that we don't have to go back in 30 years (which is the average lifespan of a wood pole) to replace hard-to-reach poles."[4]

TECHNICAL FEASIBILITY

Both steel poles and wood poles serve for a particular channel of heat, electricity, sound, etc., but steel poles are easily grounded with a grounding nut and copper wire near the base of the pole, eliminating the risk of electrocution. Due to steel's strength to weight ratio, steel can be fabricated for all size and design standards. Steel also has a higher fire-resistance than wood; therefore, steel distribution poles can be heated if need be for fabrication practices. In fact, steel poles can be manufactured to replace wood poles in an existing line without the need to rerun lines or add new poles.[5] In an event of a fire, steel coatings can degrade, but typically remain unchanged as long as the pole is upright and the shape is maintained.

[1] *"About Steel Poles | Steel Utility Poles and Lineman."* Steel Market Development Institute. http://lineman.steel.org/about-steel-poles.aspx.

[2] Raw Steel Production Statistics, Steel Market Development Institute (SMDI). www.steel.org/About%20AISI/Statistics.aspx.

[3] Lining up with Steel – Tucson Electric Power in TD World.

[4] *Steel Distribution Pole Case Study: BlueBonnet Electric Cooperative. Steel Market Development Institute (SMDI); 2011.*

[5] *Utility Lineman Training with Steel Distribution Poles. American Iron and Steel Institute (AISI); 2009.*

[6] *Kansas Electric Co-Op Builds Distribution Networck with Backbone of Steel.* Steel Market Development Institute; May 5, 2016

American Galvanizers Association
6881 South Holly Circle, Suite. 108
Centennial, CO 80112
720.554.0900
www.galvanizeit.org

Case Studies

IDAHO POWER - IDAHO, ID

The designers of the Idaho Power poles had two things in mind when considering corrosion protection for their most recent project: durability and cost. Hot-dip galvanizing was chosen for its proven ability to withstand corrosion in even the most damaging and abrasive environments. With constant exposure to the elements, this structure will benefit from the superior barrier protection of the zinc coating. Also addressing specifier concerns, the low life cycle cost of HDG steel far exceeds all other corrosion protection options. Because HDG steel requires little to no maintenance for at least 70 years, no expenses will occur on costly upkeep. The transmission poles and the arms were galvanized on this project, ensuring the poles remain standing for decades of stability.

KANSAS ELECTRIC CO-OP DISTRIBUTION NETWORK

As one of the top three electric co-ops in the state, Rolling Hills Electric Cooperative, Inc. provides power to members in 16 counties, across about 3,800 square miles, in rural North Central Kansas. Rolling Hills initiated an extensive replacement of wood poles with steel poles following two major ice storm events, which occurred in 2007 and 2009, causing in excess of $35 million in damage. Both of these events qualified as FEMA natural disasters.

Today, the co-op has about 1,500 steel poles located at critical points—and the benefit of those poles is visible in measurable savings. Melvin Jeardoe, operations manager for the co-op's district three, concludes, "Ten years ago, line crews would put in an average of 15-20 hours overtime every week handling outages and maintenance work. Today, we might go three weeks without any overtime. We know the initial cost of steel poles is higher than wood poles, but the life-cycle benefits we gain in a more resilient, less labor-intensive network more than make up the difference."

WHITING 115KV LINE - GUYMON, OK

Ease of specification and familiarity with hot-dip galvanizing led specifiers to choose HDG for corrosion protection on the Whiting 115KV Line. The strong, durable, HDG coating will stand strong against the rigors of constant exposure to wind, rain, and sun, keeping the transmission poles standing strong and corrosion-free. The gray zinc coating of the galvanized steel also provides an attractive natural finish. As this project will be highly visible to passersby, aesthetics were important to the specifier. A total of 108 tons of steel were galvanized to complete this project, ensuring it will remain corrosion free for many decades.

continued on back...

BASS RIVER CROSSING - STAFFORD TOWNSHIP, NJ

This project is located in a salty and corrosive environment. Because the poles are galvanized, they require very minimal repairs to the coating. These poles are embedded into the ground between 25-30 feet deep for stability of the sections.

HDG was chosen for this project for the benefits in corrosion performance, initial cost, life-cycle cost and turnaround time. Highly corrosive soils such as this dictates the need for a reliable corrosion protection system, such as HDG, to ensure long-term protection. In numerous types of soils, such as salty and corrosive, hot-dip galvanizing can provide the necessary corrosion protection to extend the life of the steel by many years. The properties of soil that have the most effect on the corrosion rate of zinc are aeration, moisture content (or time of wetness), pH, temperature, and resistivity. In this temperate marine environment with salty and corrosive salt, HDG was chosen to meet the performance and longevity goals of the project.

AEP BOLD™ TRANSMISSION - FORT WAYNE, IN

In an era of regulatory changes, evolving sources of power generation, and replacement of an aging infrastructure, American Electric Power (AEP) has developed a revolutionary new compact line design for the electric power transmission market. Employing hot-dip galvanized steel structures, the high-capacity, high efficiency design represents the next generation of transmission line. The Breakthrough Overhead Line Design™ (BOLD™) has an aesthetic, crescent-shaped crossarm with a compact conductor configuration that boosts capacity and challenges traditional technologies.

The innovative design marries form and function, delivering more power with a lower structure and using less right-of-way. BOLD™ addresses the needs of stakeholders with the most innovative electric transmission technology in more than 35 years.

American Galvanizers Association
6881 South Holly Circle, Suite. 108
Centennial, CO 80112
720.554.0900
www.galvanizeit.org