WETALLURGIST Don't Let Corrosion Eat Away Your Bottom Line

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Metal corrosion is a natural process caused by the reaction of metal with oxygen. It cannot be stopped, but it can be slowed, planned for, and its damage minimized.

Corrosion happens any time metal is exposed to air, but when metals are exposed to moisture, salt, or pollutants, or when dissimilar metals are fastened together, it is accelerated. It may cover an entire unprotected surface, begin under screwheads, or in cracks and seams where moisture becomes trapped. It can even find a foothold in the microscopic stress fractures that form in metals under load.

In the construction trades metals are everywhere. They hold up our buildings and bridges as well as provide beautiful accents and ornaments on their surfaces. But unprotected from corrosion, decorative metals can become unsightly very quickly, and structural metals will eventually fail, causing the destruction of property and potentially the loss of life. Corrosion has an economic impact as well. Preventing corrosion damage requires routine maintenance and inspection. Additionally, repairing and replacing damaged metal is expensive, and delay can devalue the property of which it is part.



and dangers. Often, it is enough to select the right metal or metals. Stainless steel provides a beautiful finish and is highly resistant to corrosion in most environments. Yet despite its name, stainless steel can rust. The thing that makes stainless different from regular steel is its chromium content. The chromium on the surface of the metal reacts with oxygen in the air forming a metal oxide coating. This coating is itself a form of corrosion, but it is too thin to see, and it forms a barrier that protects the underlying metal. Effectively, stainless corrodes in a way that usually stops further corrosion. However, pooled water, salt spray, contact with other metals including steel, aluminum, and zinc, and various other chemicals will eventually cause stainless steel to rust.

There are several strategies to mitigate these costs





Aluminum Surface Corrosion Credit: Kloeckner Metals

Below: The Fern Hollow Bridge in Pittsburgh, Pennsylvania, collapsed on January 28, 2022, as a result of metal corrosion. Ten motorists were injured. Despite parts of the bridge falling as much as 100', there were no fatalities. A couple of hours later, the bridge crowded with rush hour traffic, it would have been much worse. The cost to replace the bridge was over twenty-five million dollars.





Structural steel corrosion and poor design were implicated in the 2021 collapse of Champlain Towers South in Surfside, Florida. The collapse killed 98 residents and injured 11 others, destroyed a billion-dollar property, and resulted in a billion-dollar class action lawsuit settlement.



Aluminum is also resistant to corrosion, and for a similar reason. Aluminum itself forms an oxide coating on the surface of the metal that helps to protect it from the environment. It is not as resistant to corrosion as stainless, and can be compromised in similar ways, but it is still more corrosion resistant than carbon steel.

Steel is the most common metal for structural use. Although it is more prone to corrosion, nothing else can touch it for strength per dollar. Because of its susceptibility to rust, a proper finish and moisture resistant design are especially important with steel, but its economic advantages often make it worthwhile.

Whatever materials are chosen, they must be protected and properly cared for to maximize their useful life. If used together, dissimilar metals must be isolated from one another with coatings or gaskets. Surfaces must be protected from the environment, either by their own resistant chemistry as with stainless steel, or with a coating appropriate to their environment and intended use. Such coatings could include paints, powder coating, anodizing, or zinc plating, among others. See our article for a more detailed look at architectural finish selection.



In addition, metals require cleaning and maintenance. Each metal and coating has its own best care and use profile, but proper design, finishing, and maintenance can greatly extend their lifespan. Routine maintenance is also an excellent opportunity to inspect structural metals to anticipate and prevent failure.

Although corrosion is a natural process, and eventually inevitable, thoughtful design can postpone its onset and minimize its structural and economic impact. Construction methods that prevent water penetration and pooling, reduce seams and fasteners, and utilize optimal finishes, can all help to limit corrosion, keep decorative metals looking their best, and decrease the costs of maintenance and repair.