

Moly Does the Job

This article is the latest in a series of case histories where the application of moly has helped companies to solve technical problems . It has been written by an IMOA consultant, Catherine Houska of TMR Stainless, who will play a leading part in IMOA's new effort to promote molybdenum containing stainless steels in the area of outdoor applications in architecture, building and construction in 2002.

Molybdenum Keeps Street Handrails Safe and Attractive

Summary

Handrails are expected to meet both structural safety and aesthetic requirements. Traditional carbon steel, cast iron, and aluminum handrails can deteriorate quickly in exterior or industrial installations with aggressive pollution and/or chloride exposure. In these environments, molybdenum-free Type 304 stainless steel handrails provide longer service life, but regular cleaning and/or coatings are required to maintain an attractive appearance.

More corrosion resistant Type 316 stainless steel handrails, which contain 2% molybdenum, are the most cost effective choice in demanding environments. They require minimal maintenance, no paint or coating and provide safety and an attractive appearance. In stainless steel, molybdenum improves resistance to pitting and crevice corrosion and is particularly helpful in preventing chloride damage.

The growth potential for Type 316 stainless steel in aggressive exterior applications is significant and is not limited to handrails. Doors, canopies, store fronts, street furniture, bus shelters, trash cans, bicycle racks,

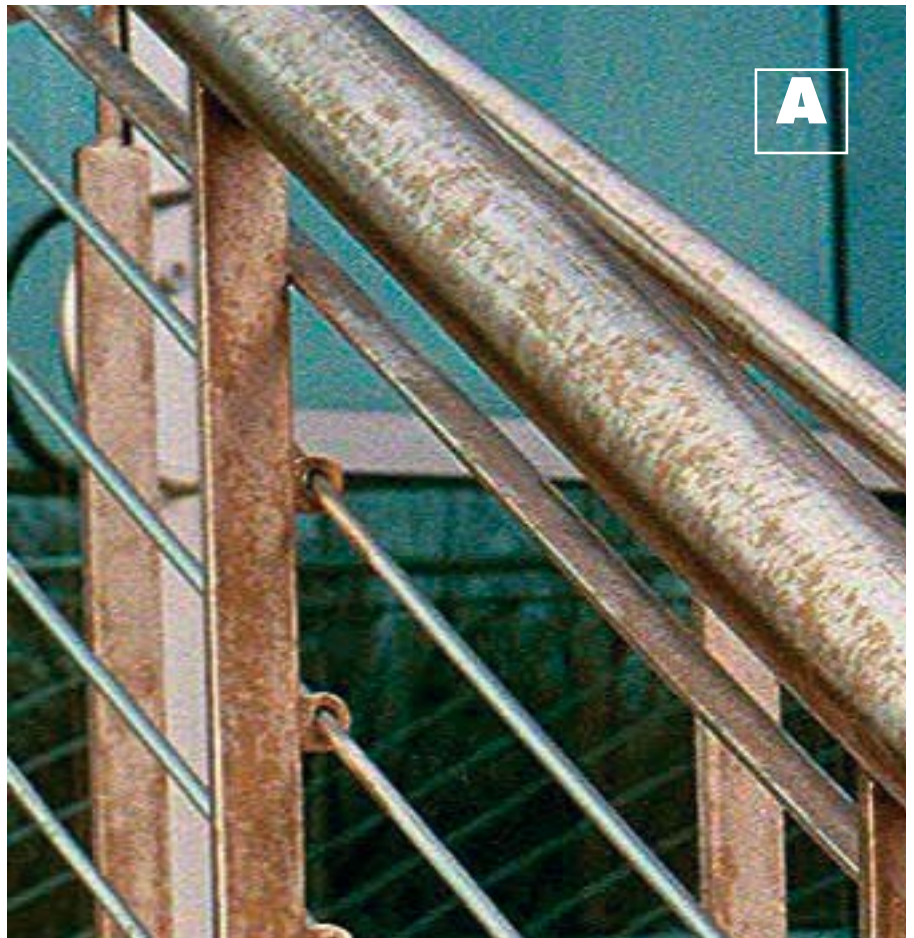
security barriers, gates, fences, wall panels and column covers, all face the same corrosion challenges in salty or polluted environments.

The Application

In new or existing applications, stainless steel is increasingly replacing carbon steel and aluminum handrails because of concern about safety, long-term maintenance and replacement costs, and because of fashion. Growth in stainless steel handrail use has been greatest in areas where coastal or deicing salts are present and/or where pollution levels are high. In some sectors of

the North American exterior handrail market, stainless steel has close to a 30% market share. Industrial applications are a small but rapidly growing market for stainless steel, particularly in corrosive plant environments.

Fabricators and specifiers are often unaware of the benefits of using a molybdenum-containing stainless steel. The stainless steel most commonly specified is Type 304 with a polished finish. Type 316 is most likely to be specified in industrial applications or within a few hundred feet of a saltwater body. It is rarely used in locations with deicing salt exposure.



B



Photos A, B and C: These Type 304 handrails have a rough polished finish.

The building owner does not use deicing salt.

The chloride source is road salt mist from a busy highway about 300 yards downhill from the building.

The handrails were installed in the fall and had no signs of corrosion prior to winter. Heavy staining was visible the following spring.

The Corrosion

Deicing salt can create a more aggressive environment than what is found in most coastal applications. It is not unusual to see piles of salt crystals around exterior handrails. Even with regular maintenance, traditional carbon steel and aluminum handrails may have to be replaced in as little as five to ten years.

Type 304 handrails are increasingly being selected for locations where deicing salt is used because building owners and architects assume it will remain "stainless". They usually become very unhappy when finding red rust on Type 304 after the first winter as in photos A, B and C. Corrosion is particularly severe when rough surface finishes are used, the handrails are sheltered, the design encourages salt accumulation, or piles of salt are left around the handrail base. Conditions are often made worse by lack of maintenance.

Deicing salt is not a seasonal corrosion problem. Salt accumulates in soil near roadways and salt-containing dust can be blown onto surfaces during the warmer months. Salt particles remain on surfaces unless they are washed off by hand or heavy rain. An aggressive slurry is formed when salt combines with the humidity in the air. This can occur once temperatures are above 0°C and humidity levels exceed 45%. This salt slurry can form without the presence of rain or other sources of liquid water.

Type 304 handrails, which are exposed to deicing salt, must be cleaned at least once a year in the spring to restore their appearance. When pitting becomes visible, refinishing may be required or handrails have to be replaced. Either option is expensive. In an effort to prevent corrosion, building owners often have cleaning companies apply clear polyurethane or wax coatings. To be effective, these coatings must be stripped and reapplied annually making maintenance costs high.



The Solution

The fabricators of stainless steel handrails and the architects and building owners who specify handrails must be informed so that they understand that all stainless steels are not alike. In most installations with deicing or marine salt exposure, Type 316 handrails will remain attractive and safe with little or no maintenance as photo D shows. Designers must be warned to avoid crevices and designs that allow the accumulation of salt, and encouraged to use smooth finishes and the right grade of stainless steel.

The Cost Savings

Type 316 handrails provide significant life cycle cost savings when compared to traditional carbon steel, iron or aluminum handrails which need regular maintenance and, in aggressive locations, may provide as little as five to ten years of service.

The service life of carbon steel and aluminum is typically limited by corrosion damage which reduces structural integrity and appearance. An important aspect of structural integrity is the perceived ability of a handrail to withstand the load associated with one or more large persons or individuals accidentally falling against or climbing on it. In comparison, Type 316 handrails often receive little or no maintenance and could remain structurally sound for hundreds of years.

Photo D: This Type 316 handrail on a coastal pier is exposed to a much more aggressive environment than the Type 304 handrail (Photos A,B,&C). This handrail is exposed to coastal and deicing salt. However, it shows no signs of corrosion. For maximum performance, a very smooth polished finish was selected and joint crevices were sealed after installation. The design allows salt to be easily washed off by rain.



In corrosive locations with aggressive pollution and/or chloride exposure, Type 316 also provides a maintenance cost savings over Type 304 stainless steel.

Type 304 must be cleaned regularly in these environments to remove salt accumulation and corrosion staining. When staining is severe, refinishing or replacement may be required.