

Case Study 06 Canary Islands Railings and Lampposts

Low Urban Pollution

High to Moderate Coastal Salt Exposure

The beautiful Canary Islands are a popular vacation destination because of their clean air and warm climate. Maintaining railings and other equipment in public areas can be challenging, because coastal salt (chloride) exposure will corrode most architectural metals, including some stainless steels.

In the 1980's, the government began replacing galvanized carbon steel railings and lampposts with stainless steel to reduce long-term municipal costs. Two stainless steels were used, 2205 (UNS S32205, EN 1.4462, SUS 329J3L) and Type 316 (UNS S31600, EN 1.4401, SUS 316). Both contain molybdenum, which helps to prevent salt damage by improving pitting and crevice corrosion resistance. Type 316 stainless steel was initially used for both railings and lamppost applications. Light corrosion staining appeared on the railings that were exposed to occasional salt spray or splashing. This staining did not cause structural deterioration, but it was unsightly.



Figure A These 2205 stainless steel railings are exposed to salt spray and occasional splashing. They are in the town of San Augustin in the Canary Islands. There has been no corrosion staining despite exposure to sea spray. (Photo Courtesy of Outokumpu)



Figure B This shiny Type 316 stainless steel lamppost has been in service for over 10 years. It replaced corroding galvanized steel. (Photo Courtesy of Outokumpu)

Subsequent coastal railing installations were upgraded to 2205 stainless steel, which contains more molybdenum than Type 316. They have remained attractive. **(Figure A)** The much higher strength of 2205 can be used to reduce structural section size, and this weight savings can offset the higher cost of the more corrosion resistant stainless steel.

Type 316 stainless steel with a smooth finish is usually the most cost effective choice for low- or no-maintenance applications that are exposed to coastal air but not to seawater spray or splashing. The Type 316 railings and lampposts that are not exposed to sea spray have retained their attractive appearance. **(Figure B)**

If an architectural metal is susceptible to salt corrosion, regular maintenance is required to ensure long-term structural integrity and appearance. But public works maintenance budgets are usually limited. Carbon steel will corrode rapidly in coastal applications once the protective galvanizing or paint coating is gone. Even with maintenance, replacement due to structural deterioration of carbon steel is sometimes needed in less than ten years. Although its corrosion is less visible, aluminum is also susceptible to rapid corrosion in coastal environments.

Selecting the right stainless steel for each application eliminates maintenance cleaning and painting, ensures long-term structural integrity, and avoids the high replacement and liability costs associated with metal failure due to corrosion.

Stainless Steel Selection Criteria

The IMOA publication, *Which Stainless Steel Should Be Specified for Exterior Applications?*, provides stainless steel selection assistance. The site and design scores below are based on the guidelines in that brochure. Copies can be obtained at www.imoa.info or by calling IMOA +32 2 770 8878.

Section 1: Environment

Score = 0

The Canary Islands have no significant industrial pollution. The primary source of air pollution is vehicular exhaust. Air borne particulate levels are occasionally high, but they are attributed to dust storms originating in the Sahara Desert. This dust is not corrosive. The cities where the stainless steel was installed are considered to have low levels of urban pollution.

Section 2: Coastal Salt Exposure

Score = 3 to 5

More salt accumulates on railings that are exposed to some salt spray or occasional splashing, and the spray dampens the salt and makes it more corrosive. These locations have a score of 5. The remaining railing and lamppost locations vary in their distance from the ocean. Locations that are further inland will accumulate less salt and have a lower score (3 to 4). Typically, all locations on an island are considered coastal because weather patterns usually carry salt much further inland and in higher concentrations.

Section 3: Local Weather Pattern

Score = 1

The Canary Islands are considered subtropical but like most volcanic islands they have microclimates ranging from snow-capped peaks to deserts. The temperature varies between 10 and 39°C (50 and 102°F). The average annual precipitation is 165 mm (6.5 inches), but this varies with the location. Some coastal areas are deserts while others are green and receive up to 1000 mm (39 inches) of rain a year. Locations with more rainfall are less corrosive, because heavy rain helps to remove corrosive salt deposits. The humidity level is typically over 70%. Humidity combines with salt to make it corrosive. The coastal locations where the stainless steel is installed have infrequent rain. The combination of warm temperatures, higher humidity levels, and infrequent rainfall makes the climate more corrosive.

Section 4: Design Considerations

Score = -1 to -2

All of the applications are designed so they will be washed when it rains. The most significant design factor influencing performance is surface roughness. The Type 316 stainless steel has a smooth finish which improves its corrosion resistance. This can be seen in the mirror-like finish on the lampposts in Figure B. Either 1 or 2 points can be subtracted depending on the surface roughness.

Section 5: Maintenance Schedule

Score = 0

None of the stainless steel applications are manually washed.

Stainless Steel Selection

Total:

Score = 3 to 5

The local weather pattern makes these locations a little more corrosive, but the most important factors in determining the scores for each application are their level of salt exposure and surface finish. The 2205 stainless steel railings are exposed to salt spray (5), a corrosive weather pattern (1) and have a smooth surface finish (-1) giving them a score of 5. If a location has a score of 5 or above, more corrosion resistant stainless steels such as 2205 should be used if corrosion staining is not acceptable and there will be no maintenance cleaning to reduce the score.

The Type 316 stainless steel lampposts are further inland, which reduces their salt exposure (3). They are exposed to a corrosive weather pattern (1) but their smooth finish (-1) reduces their score to 3. Type 316 is generally the most cost effective choice if an application has a score of 3.

Acknowledgement: The author gratefully acknowledges the assistance provided by Outokumpu in developing this case study. They supplied the stainless steel that was installed in these applications and have monitored the components' performance over time.