

Case Study 03 Stainless Steel Light Poles

Moderate Urban and Rural Pollution Levels
High Coastal Salt Exposure

Stainless steel light fixture supports were installed at Jones Beach, New York, USA in 1967. They have a smooth No. 4 finish with a surface roughness below R_a 0.5 μm or 20 μin (**Figure A**). Although they are in the parking area adjoining the beach and are exposed to coastal salt, there is no sign of corrosion. The park is closed during the winter and the poles are not exposed to deicing salt. They have never been cleaned but are regularly washed by rain. The poles are made of molybdenum-containing Type 316 (UNS S31600, EN 1.4401, SUS 316) stainless steel, which provides improved resistance to corrosion caused by salt and pollution.

In comparison, **Figure B** shows a close-up of a sheltered exterior light fixture support made of Type 304 (UNS S30400, EN 1.4301, SUS 304) stainless steel, which does not contain molybdenum. It is a few blocks from the ocean in Miami Beach, Florida, USA. The surface finish was applied by abrasive blasting a rough mill plate, producing a surface roughness greater than R_a 1 μm or 40 μin . The light fixture is not manually cleaned and its sheltered location prevents effective natural rain cleaning. After only one year, pitting and discoloration caused by coastal salt (chloride) corrosion are visible.



Figure B Sheltered Type 304 stainless steel components like this light pole will corrode in most coastal applications unless they are cleaned frequently. Monthly cleaning may be necessary. (Photo credit – TMR Stainless)

The samples of Types 304 (left) and 316 (right) stainless steel, which are shown in **Figure C**, have a smooth finish. They were installed 250 meters (820 feet) from mean high tide at Kure Beach, North Carolina, USA. When this photo was taken, they had been in place for 56 years, and are cleaned only by rain. Some light scratching from wind blown sand is visible. The North Carolina, New York and Florida applications are about the same distance from the ocean.

The Type 316 sample has a few superficial corrosion spots that could easily be removed by cleaning but it still looks attractive. The Type 304 sample is badly stained. Like the two light poles, these samples illustrate Type 316's superior resistance to staining and corrosion in a coastal location.



Figure A Boldly exposed Type 316 stainless steel light poles with a smooth finish provide good performance in most coastal applications. (Photo credit – AISI)

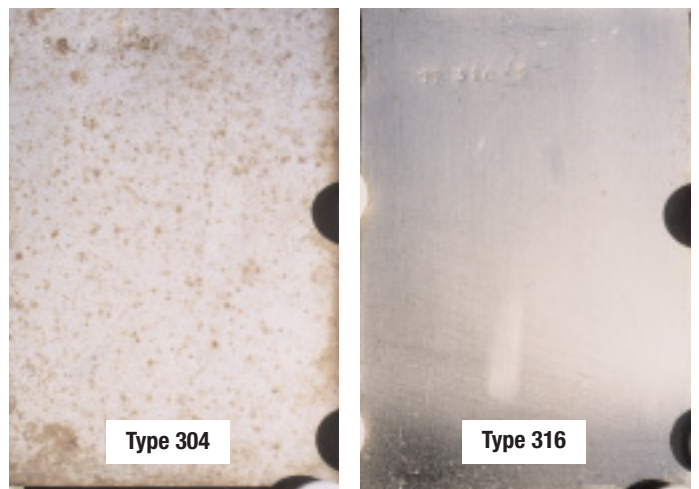


Figure C Kure Beach, North Carolina samples after 56 years. (Photo credit – TMR Stainless)

Stainless Steel Selection Criteria

The IMO A 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 IMO A +44 20 8742 2274

Section 1: Environment

Score = 2

Both Jones Beach and Miami Beach have moderate levels of urban pollution with average sulfur dioxide levels of 0.013 ppm and 0.003 ppm and airborne particulate levels (PM10) of 23 µg/m³ and 26 µg/m³ respectively. There is no air pollution data available for Kure Beach.

Section 2: Coastal Salt Exposure

Score = 3

Sea salt will corrode most architectural metals and some stainless steels.¹ Sea salt particles are carried inland by wind, rain, and fog. In some locations, marine salt accumulations are only a factor within 1.5 km (0.9 miles) of the shore, but in others, salt deposits have been measured more than 43 km (27 miles) inland. Generally, locations within 8 to 16 km (5 to 10 miles) of salt water are at risk for corrosion. The Jones, Kure and Miami Beach locations are less than 1.6 km (1 mile) but more than 30 m (100 feet) from the ocean.

Section 3: Local Weather Pattern

Jones Beach Score = -1

Miami Beach Score = 0

Average daily temperatures are -26°C to 38°C (-15°F to 100°F) in Jones Beach, -2°C to 38°C (28°F to 100°F) in Miami, and 3°C to 32°C (37°F to 89°F) in Kure Beach. Average annual rainfall is 1067 mm (42 inches) at Jones Beach, 1524 mm (60 inches) at Miami Beach and 1295 mm (51 inches) at Kure Beach. Jones Beach and Kure Beach are temperate climates with regular heavy rain (score -1). Miami Beach is a wet tropical climate (score 0). All three locations have heavy enough rain to remove surface deposits, but the Miami Beach application is sheltered and does not benefit from this rain-washing.

Section 4: Design Considerations

Jones Beach Score = -1

Miami Beach Score = 3

The light poles in Jones Beach have a smooth finish with a surface roughness below R_a 0.5 µm or 20 µin and few components are sheltered. Smooth finishes retain less salt, reducing the possibility of corrosion (score -1). The Miami lights have a surface roughness above 1 µm or R_a 40 µin (score +2) and are sheltered from rain-washing (score +1). Sheltered components and rough finishes generally have heavier salt deposits. If a design includes sheltered components and there is salt exposure, it is advisable to obtain assistance from a stainless steel corrosion specialist. The Kure Beach sample surface roughness is not known.

Section 5: Maintenance Schedule

Score = 0

The light poles and samples have never been washed.

Stainless Steel Selection

Total:

Jones Beach Score = 3

Miami Beach Score = 8

The Miami Beach light pole component's rough finish and sheltered location make it a very corrosive application for Type 304. The Kure Beach sample shows that, even with a smooth finish and regular heavy rain-washing, Type 304 will experience corrosion staining over time in a coastal location without supplementary manual cleaning. If the sheltered design is retained and there is regular cleaning, Type 316 with a smooth finish could be considered. If less maintenance is desired, a more corrosion resistant stainless steel or a design that eliminates sheltered components should be considered.

In most coastal locations like Jones Beach and Kure Beach with regular rain-washing and low to moderate pollution levels, Type 316 will retain an attractive appearance if a smooth surface finish is selected and sheltered designs are avoided. Some minor corrosion staining may occur after many years of exposure, but this can usually be removed by manual washing.

¹ Concentrated, corrosive salt solutions begin to form on surfaces at temperatures above 0°C (32°F) and at humidity levels above 45%.