Case Study 03 New York and Miami Light Poles

Moderate Urban and Rural Pollution
Moderate 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 A Boldly exposed Type 316 stainless steel light poles with a smooth finish provide good performance in most coastal applications. (Photo Courtesy of AISI)

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 Courtesy of 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.

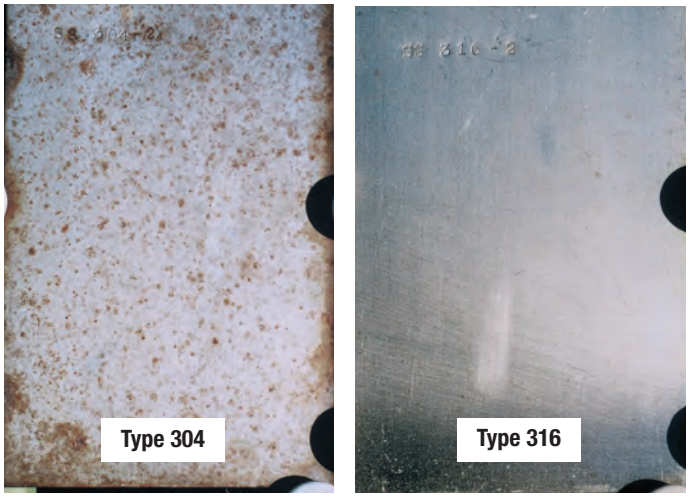

Figure C Kure Beach, North Carolina samples after 56 years. (Photo Courtesy of TMR Stainless)

INTERNATIONAL MOLYBDENUM ASSOCIATION

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 downloaded from www.imoa.info or ordered by emailing info@imoa.info.

Section 1: Environment	Score = 2

Both Jones Beach and Miami Beach have moderate levels of urban pollution with average sulfur dioxide levels of 34 µg/m^3 and 8 µg/m^3 and airborne particulate levels (PM10) of 23 µg/m^3 and 26 µg/m^3 respectively. There is no air pollution data available for Kure Beach.

Section 2: Costal 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 to10 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), which washes off corrosive surface deposits. Miami Beach is a wet tropical climate (score 0).

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%.

International Molybdenum Association
e-mail: info@imoa.info · www.imoa.info

Prepared by IMOA consultant Catherine Houska, TMR Consulting (www.tmrconsulting.com), layout Martina Helzel, circa drei (www.circadrei.de)

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