Case Study 13 Rio de Janeiro Building Exterior

Moderate Industrial Pollution Exposure
Low Coastal Salt Exposure

VIVO's new headquarters in Rio de Janeiro was completed in 2005. The three-story building (42,397 m^2 or 456,357 ft^2) was designed by the Brazilian architecture firm Edo Rocha.

The company's previously completed regional headquarters in São Paulo, Brazil also has a stainless steel exterior. The owners wanted to project a uniform corporate image. Both buildings were designed to suggest movement and to radiate technology. Their exteriors reflect surrounding fragments of images and colors creating a kaleidoscope effect.

Two different stainless steel finishes were used for the façade. The curved panels have a No.7 finish making them quite reflective. The flat panels have a No. 4 finish. The surface finishes have a maximum surface roughness of R_a 0.4 µm (16 µin).

The building is in the Barra da Tijuca section of Rio de Janeiro, which has the second highest industrial and urban pollution level in the country. A mountain between this area and the coast prevents wind from carrying away air pollution.

Figure A A view of the exterior of the new VIVO building in Rio de Janeiro. Photo courtesy of Núcleo Inox

This is especially true between May and September when high-pressure systems cause temperature inversions. Particulate levels are particularly high during this period and heavy rainstorms are infrequent. This is the most corrosive period of the year.

Figure B Close-up of the building exterior. Photo Courtesy of Núcleo Inox

The building is about 3 km (1.9 miles) from the ocean. Generally, areas within 16 km (10 miles) of a large saltwater body are considered coastal. The highest salt exposure levels are usually within the first 1.6 km (1 mile) so this location is assumed to have low coastal salt exposure.

Type 316 (UNS S31600, EN 1.4401, SUS 316) or 444 (UNS S44400, EN 1.4521, SUS 444) stainless steel with a smooth finish is generally the most cost-effective choice for boldly exposed, long-term applications with exposure to industrial pollution and low salt levels. Both grades were used for this project. They contain about 2% molybdenum, which helps to prevent pitting and crevice corrosion caused by salt and pollution. The Brazilian stainless steel producer ACESITA provided technical assistance with stainless steel specification, panel fabrication and installation.

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 or NÚCLEO INOX nucleoinox@nucleoinox.org.br.

Section 1: Environment — **Score = 3 to 4**

This building is near an industrial area, Jacarepaguá, which has pharmaceutical and other plants. The sulfur dioxide and nitrogen oxide levels are moderate but the particulate levels from industry and automotive emissions are high. Acid rain also contributes to the corrosiveness of the environment. Although the area immediately around the building is urban, nearby industry makes this a moderate industrial pollution exposure environment during most of the year. Between May and September, pollution levels increase due to temperature inversions. During the same time rainfall levels drop and this may become a high industrial pollution environment.

Section 2: Coastal Salt Exposure — **Score = 1**

The building is approximately 3 km (1.9 miles) from Barra da Tijuca beach and it is exposed to low levels of coastal salt.

Section 3: Local Weather Pattern — **Score = 0**

This location has a tropical climate with regular heavy rain. The average daily temperatures are between 20°C and 30ºC (69°F to 86ºF) and the morning and evening humidity levels, respectively, average 59% and 89%. High humidity and temperature levels increase corrosion rates. But high average annual rainfall levels (1090 mm (43.3 inches)) and frequent thunderstorms (55 per year) minimize surface deposits on boldly exposed surfaces, which helps to reduce corrosion rates.

Section 4: Design Considerations — **Score = -1**

The surface roughness of the finishes is less than R_a 0.5 µm (20 µin). Smooth finishes retain fewer corrosive substances and dirt. As long as the surfaces are boldly exposed, this also makes natural rain-washing more effective. The specification of smooth finishes reduces cleaning requirements and helps to keep the building sparkling clean.

Section 5: Maintenance Schedule — **Score = -1**

The VIVO building is washed at least once a year to minimize surface deposit accumulation and improve the appearance and corrosion performance. Manual cleaning will be most important between May and September when there are extended periods without heavy rain and with higher pollution levels.

Stainless Steel Selection — **Score = 2 to 3**

Types 316 and 444 were a conservative choice for this location. With regular cleaning and smooth finishes, they are corrosion resistant enough to withstand the conditions in the drier months when pollution levels are highest and there is minimal natural rain cleaning. These stainless steels are appropriate for low salt exposure coastal applications with moderate industrial pollution exposure. They perform best if relatively smooth finishes are used and the design takes advantage of rain cleaning. If a rougher finish had been used on this project, more frequent manual cleaning or a more corrosion resistant stainless steel would have been necessary.

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