Case History
No. 03/2005

Mitchelsplein Train Station / Transport Interchange

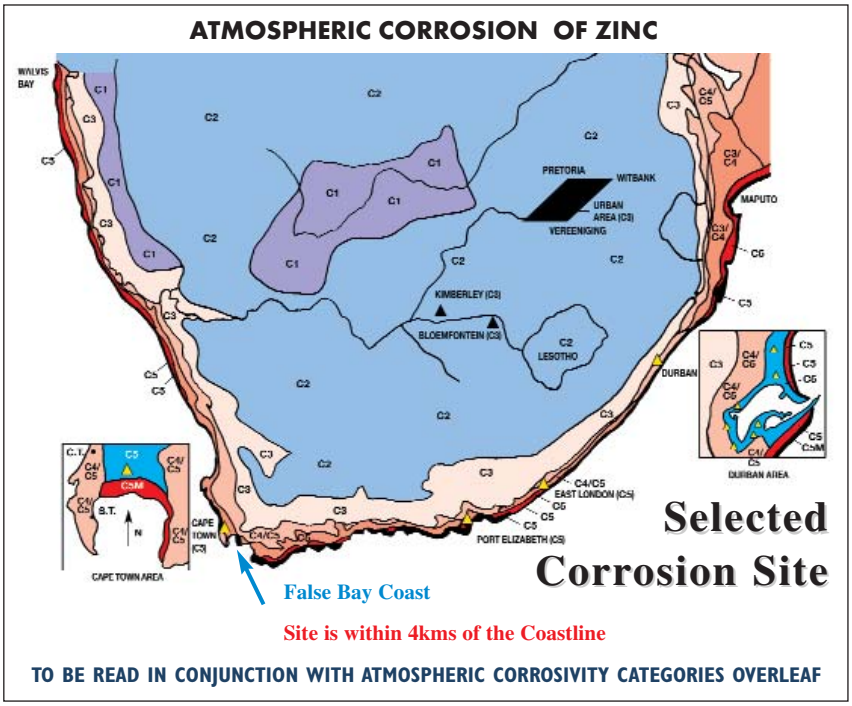
The application

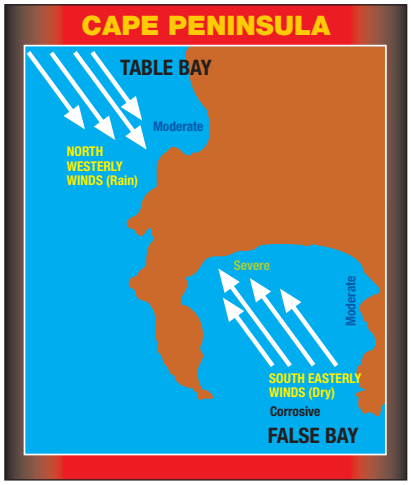
Many parts of the Cape flats are considered aggressive to hot dip galvanizing on its own. In this evaluation and case history hot dip galvanized coatings have preformed remarkably well and has lead to further specifying of the coating to protect the structural steelwork at the new Mitchelsplein Transport Interchange in Cape Town.

This case history includes an evaluation of hot dip galvanized coatings on two existing light poles and a fence support, which were installed at the time the station was built in 1979 (about 26 years old). The one light pole was installed in 1992 (13 years old). The inspection and evaluation took place at the railway station adjacent to the 1st phase Taxi Rank, which is part of the subsequent phases of the transport interchange.

The Environmental Conditions

The environmental conditions of the Mitchelsplein Train Station is off the False Bay coastline, approximately 4km from the sea. The area is subjected to the prevailing winds being the south easterly. Steel structures exposed to these conditions are therefore subjected to high levels of coastal saline atmospheres.





The coastline of False Bay is considered to be extremely corrosive, due to the South Easter (bringing chloride laden air into the low lying land form), high wave action and lack of rainfall from the south east. Conversely, the coastline off Table Bay is mildly corrosive due mostly to the wash-off effect of the rain.

General view of the light pole that has been exposed to the elements for 26 years.

Close-up of the coating on the marine side showing the scraped surface.

Coating thickness (95µm) on the scraped surface.

Residual coating thickness (133µm) on the light pole installed in 1992.

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Our Findings

On the three areas registered for evaluation, the coating is in remarkably good condition despite the misleading surface contamination.

The residual coating thickness on the light pole (95µm) and on the diagonal fence support (98µm) is still in excess of the coating thickness required by the specification (SANS 121) after 26 years of exposure. The specification requires an individual coating thickness of 55µm with a mean of 70µm for steel equal to and greater than 3mm but not greater than 6mm thick.

Conclusion

After approximately 26 years of service, the hot dip galvanized coatings on these light poles and fence supports installed at Mitchelsplein Train Station, will continue to provide adequate and effective corrosion protection for at least another 25 years.

There is little doubt that hot dip galvanizing can and does provide cost effective solutions to the often vexed question of corrosion protection in questionable areas adjacent to the coast.

Due to the performance of the hot dip galvanized coating in this instance it was decided that the coating on its own be specified for the protection of all the steelwork in all the phases of the Transport Interchange currently being erected adjacent to this site. See a photo of a general view of the transport interchange below.

1	2	3	4	5	6	7
				MAINTENANCE FREE LIFE OF THE COATING		
Corrosion category	Description of environment	Corrosion rate (av. loss of steel in µm/yr.)	Corrosion rate (ave. loss of zinc in µm/yr.)	Continuously hot dip galvanized sheeting Coating class – Z275 (±20µm)	Hot dip galvanized coating (85µm) Steel thickness ≥ 6mm	DUPLEX COATING SYSTEM Hot dip galvanizing + an appropriate paint system
C1	Interior: dry	≤ 1.3	≤ 0.1	>50	>50 #1	Not required for corrosion protection #2
C2	Interior: occasional condensation Exterior: exposed rural inland	> 1.3 to 25	0.1 to 0.7	>40	>50 #1	Not required for corrosion protection #2
C3	Interior: high humidity, some air pollution Exterior: urban inland or mild coastal	> 25 to 50	0.7 to 2.1	10 to 40	>40	Not required for corrosion protection #2
C4	Interior: swimming pools, chemical plant, etc. Exterior: industrial inland or urban coastal	>50 to 80	21 to 4.2	5 to 10	20 to 40	Coating life in columns 5 & 6, plus the paint life multiplied by a factor of at least 50%
C5-I or C5-M	Exterior: industrial with high humidity or high salinity coastal	>80 to 200	4,2 to 8,4	2 to 5	10 to 20	Coating life in columns 5 & 6, plus the paint life multiplied by a factor of at least 50%

#1 Although mathematically incorrect (coating thickness divided by the corrosion rate), the maintenance free life indicated in column 6 has for practical purposes been curtailed to a maximum of 50 years.

General hot dip galvanizing specifications state the local (minimum) and the mean coating thicknesses. The coating thickness actually achieved, varies with the steel composition and this can range from the minimum to at least 50% greater.

As life expectancy predictions are normally based on the minimum coating thickness, they are usually conservative.

#2 A duplex system may also be specified in order to provide a colour for aesthetic reasons.

Note 1: The specification does not stipulate a maximum upper coating thickness limitation, however, excessively thick coatings on threaded articles are undesirable. In order to ensure effective tensioning, the coating thickness on the bolt should not exceed a maximum of 65µm, this applies particularly to high strength bolts. See note 2.

Note 2: The coating thickness referred to in the Association's booklet, "Steel Protection by Hot Dip Galvanizing and Duplex Systems" in chapter 10 page 33 states this maximum to be 90µm. This is incorrect and should be amended to read 65µm.

Where the service life of the coating is based on the coating thickness on the structure, all hot dip galvanized fasteners should be over coated with an appropriate paint system (duplex coating) in order to derive a similar life to that of the structure.

Note 3: The loss values used for the corrosivity categories are identical to those of ISO 12944 part 2 and SANS 14713 (ISO 14713).

Note 4: In coastal areas in hot humid zones, the coating thickness loss can exceed the limits of category C5-M. Special precautions must therefore be taken when selecting a protective coating system for steel structures in such areas.

Atmospheric corrosivity categories and examples of typical environments taken from ISO 9223.

An end view of one of the bus shelters which forms part of the new Transport Interchange.

General view of the hot dip galvanized fence support installed in 1979 (26 years old).

Residual coating thickness (98µm) on the diagonal fence support.

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