Hot Dip Galvanized Case Study No. 25
Pandrol rail fasteners - Natal

The Application

This case study has been based on an extended survey of hot dip galvanized rail fasteners within a marine environment. Two Natal South Coast sites, from the country wide survey, have been used to for this review.

Two different sites were chosen, both well within a marine environment 100 to 200 metres from the ocean

Environmental Conditions

The two selected sites would be categorised as a C5 marine environments in terms of ISO 9225. An extract from the specification description of this corrosive category is as follows:

"Subtropical to tropical, periods of time of wetness, very high industrial pollution (SO2 90 to ≤ 250pg/m^3) or significant chloride effect/deposits, e.g. industrial polluted areas, jetties and offshore structures, within a few hundred metres of the ocean and certain exposed areas along the coastline".

Refer to the Association's web site www.hdgasa.org.za, information sheet No8 "Corrosion of Zinc – Corrosivity of Atmospheres".

Corrosion rates in a C5 environment are given as 4 to 8µm per year. As a guide to the determination of a typical service life of an 80µm of a zinc coating would equate to 10 to 20 years. This is a simple arithmetic calculation as other factors such as prevailing winds, topography and even vegetation of the site will influence the final corrosion rate of a specific location.

The Site

Two sites were selected on the Natal South Coast, viz, Park Rynie some 65 kms south of Durban and Port Shepstone, 115 kms south of Durban. Both areas were selected on the basis of their proximity to the sea being within 100 to 200 metres of the high water tide level. Surrounding corrosive conditions were observed by the review of other steel components

Park Rynie

Aa epoxy tar painted steel mast at the Park Rynie rail crossing illustrates the severity of corrosive environment of the site

Pandrol rail fasteners - Natal

Port Shepstone

The sea is approximately 200 metres to the left of the Port Shepstone site

The town is in the distance some 6kms further south

Findings

Park Rynie

Numerous coating thickness measurements were taken of the hot dip galvanized Pandrol rail fastener with the following zinc coatings recorded; maximum of 150µm, a mean of 121µm and a minimum 83µm.

The galvanized components were estimated to have been in service for the past 18 to 20 years

Note the corrosion of the uncoated rail

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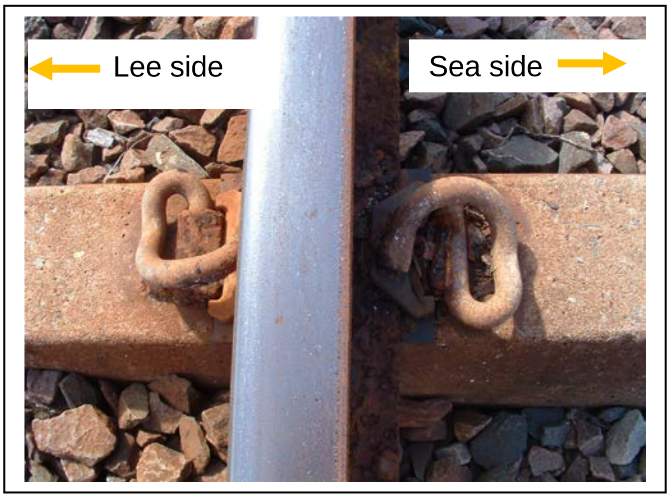
Port Shepstone

Zinc coating thicknesses measured as follows: 136µm minimum, 154µm mean and 197µm maximum.



Fasteners that face the sea were affected to a greater extent than those on the lea side of the track

The rail height provides a degree of "shielding" from the sea spray

The sea side (using an ungalvanized cast iron) shoulder had corroded away exposing the hot dip galvanized Pandrol. Holding capacity of this assembly had been lost and is totally ineffective. Note the condition of the "land (lee) side" of the rail, where the system is intact and operative.

Conclusion

It was clear that the side of the rail, together with the fasteners that face the sea were affected to a greater extent than those on the lea side of the track. The rail provides a degree of "shielding" from the sea spray. This is a subjective observation as it is also clear that the severe corrosive environment is attacking both sides of the rail.

In some positions the un-galvanized cast-in shoulder had corroded away and was no longer operative. In four instances the Pandrol rail fastener together with its cast-iron (un-galvanized) shoulder had completely disappeared.

In general, all the hot dip galvanized Pandrol fasteners were in very good condition while the occasional un-galvanized Pandrol fastener and many of the un-galvanized cast-iron shoulders were exhibiting severe and advanced state of corrosion.

It could not be determined exactly how long these components have been in service other than the date embossed on the concrete sleeper being June 1971. This date would suggest an estimated current service life of approximate 20 years.