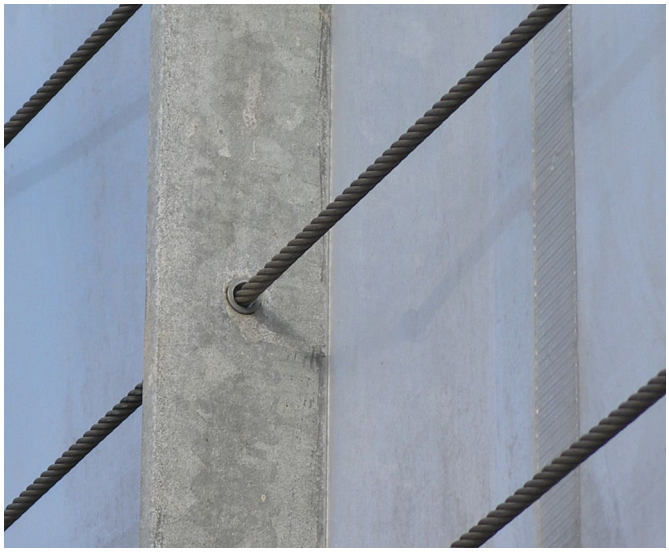
After 9 years, the average coating thickness of the structural steel is 2 to 3 times (160 – 220 µm) the required level of AS/NZS 4680.



Use of plastic inserts prevents dissimilar corrosion between stainless steel and galvanized steel in coastal environment

CASE STUDY 2: Geelong Carousel Pavilion

The Geelong Carousel Pavilion is located in the city of Geelong on the foreshore of Port Phillip Bay.

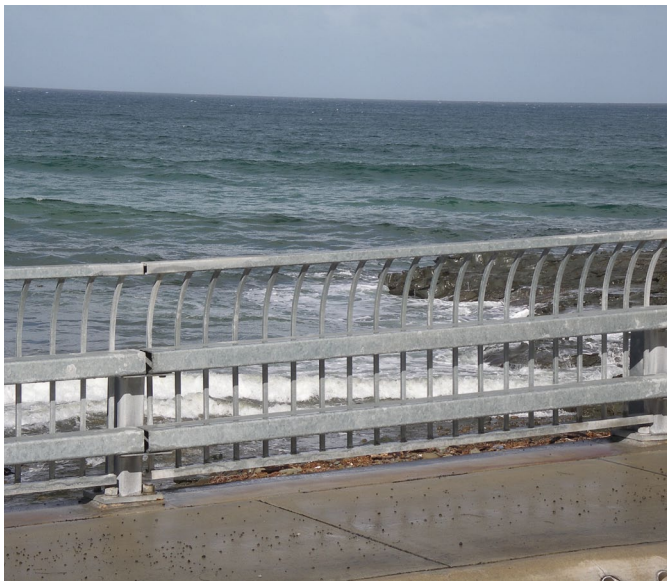
The Pavilion houses the oldest and most valuable carousel in Australia, hand carved in the United States in 1892. The carousel is powered by an 1888 steam engine and is accompanied by an 1898 Gavioli band organ.

All of the structural steel in the Pavilion is hot dip galvanized steel and most of it is exposed to the sea. An indication of the potential for significant chloride deposition is that one of the major structural design parameters for the building was the offshore wind loading. The design of the structure paid due consideration to corrosion through the use of bolting, the minimization of "corrosion hotspots" due to proper detailing and the expanded metal roofing that reduced the wind loading and allowed the washing effects of rain on external steelwork.

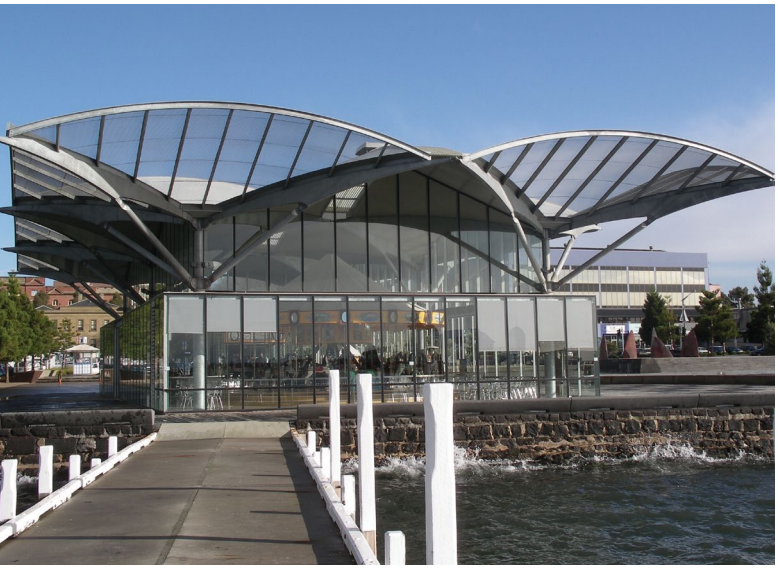
The carousel is a popular tourist attraction and during school holidays it is subject to considerable stress due to children's parties and general public traffic. It has been open for 6 years and has required no maintenance in that time. The steelwork is in excellent condition and all of the galvanizing is 2 to 3 times in excess of the levels required by AS/NZS 4680.

CASE STUDY 3: Great Ocean Road Bridge Rails

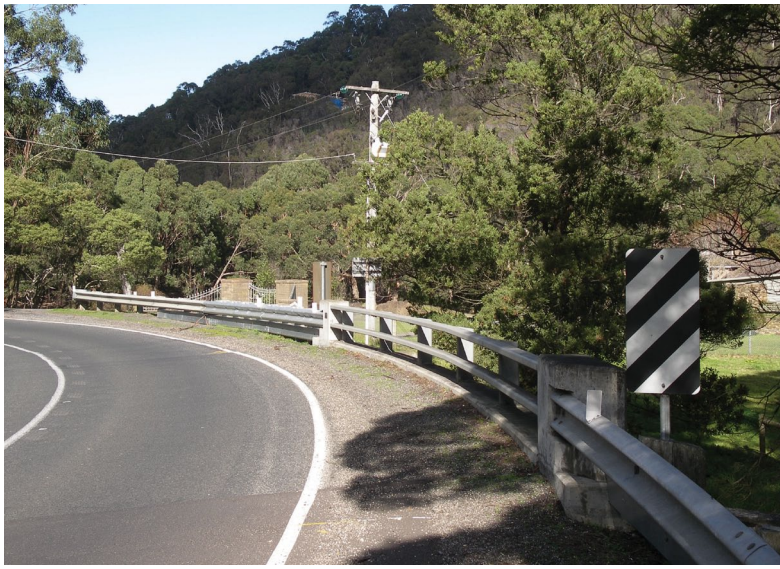
12 bridge rails were examined along the Great Ocean Road on the south-west of Victoria with the assistance of the local roads authority. All of the bridge rails were performing well and it is standard for them to be hot dip galvanized and either left bare or painted in instances where aesthetic requirements demanded. Of interest is the fact that even though many of the bridge rails were in the surf zone and approximately 10 – 30m from the breaking surf and over estuarine waters, they were in excellent condition. Conferral with the responsible engineers indicated that they were performing as expected and that a life of over 20 years with minimal maintenance was the expected performance.



Bridge rail at Smythes Creek on Great Ocean Road (10 years old)

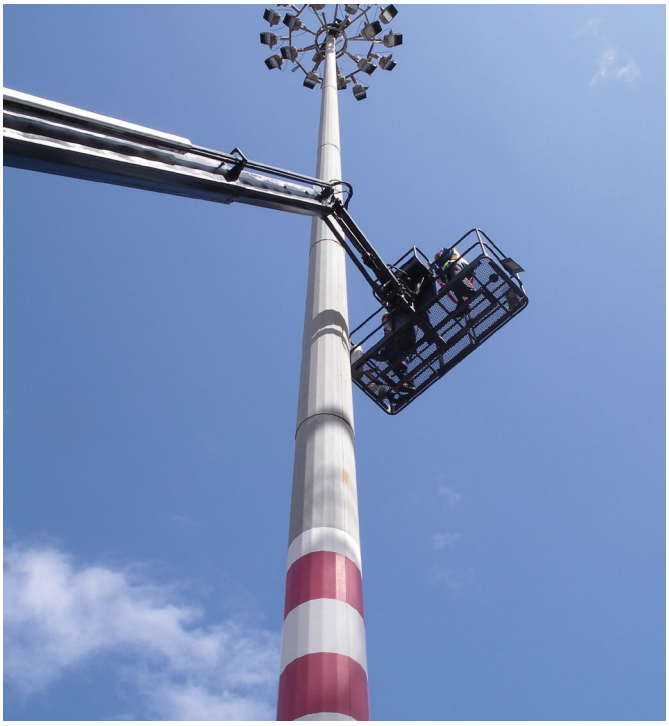


Geelong Carousel Pavilion



Bridge rail at Grassy Creek on Great Ocean Road (24 years old)

CASE STUDY 4:
Port of Botany Light Towers at DP World Terminal



Port of Botany light tower being examined (27 years old)

The DP World terminal is located in Botany Bay. Depending on wind levels, water agitation and other factors, then the corrosivity environment may be classed as either a C: Medium to AS/NZS 2312 (C3 ISO 9223) or D: High (C4 ISO 9223). During the time of the inspections, the wind was very strong coming off the bay and there was considerable spray indicating that for certain weather conditions there would be periods where the environment approaches that of an E-M Very High Marine (C5 ISO 9223).

The coating appeared to be in good condition considering its exposure environment and age of 27 years. All of the thickness measurements were above what would be required by Australian Standards for a new installation (AS/NZS 4680).

Based on the conventionally accepted corrosion rates for zinc and taking into account the lowest measured thicknesses for each tower, it was conservatively determined that the remaining life of the coating was approaching at least 20 to 25 years.

Conclusion

Galvanized steel has a long history of use on the Australian coastline. The requirements for the corrosion protection of steel will continue to increase due to the nature of the general "seachange" in society and the fact that most of Australia's population and industry is located in coastal environments. In the overwhelming amount of cases examined, galvanized steel has performed at least to or above expectations. Much of this can be attributed to the fact that the use of galvanized steel by experienced engineers and specifiers means that detailing and corrosion protection are taken into account in the design of structures. However, much historical "proof of performance" has been passed down by practitioners without any specific detailing of the reasons why it actually works and its use in many applications has become a "cultural" norm rather than a scientifically based process.

It would appear that, in some instances, standards may have underestimated the performance of galvanized steel in coastal environments. Case studies and documented evidence are required so that a scientific basis for the successful and economic use of materials such as galvanized steel can be presented to show that they are an option as a construction material in some of the harshest environments. This will require further work on both an exposition and recording of the condition of practical structures over their life cycle and also how this relates to theoretical performance.

The GAA is currently conducting the next stage of the study which will provide a closer examination of the galvanizing thicknesses and corrosion by-products. It is hoped this provides further insight in the performance of galvanized steel in such environments. Galvanize readers will be provided with the results.

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We provide information, publications and assistance on all aspects of design, performance and applications of hot dip galvanizing.
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