



Hot Dip Galvanized Case Study No. 22 Bellville Transport Interchange Upgrade

The Application

The original construction of the Bellville Transport Interchange was completed in 2002. Hot dip galvanizing of the steel structure was selected due to the specified 25 year maintenance free service life.

The steel structure comprised an 'upside down spiders' that was too large for a single immersion in the largest galvanizing kettle available in Cape Town. As a result double end dipping would be required with a potential risk of distortion.

As a result of potential distortion, it was decided to cut off two of the 'upside down spider' roofing legs and mask the area of the cut ends with "Galvstop". After galvanizing, the ends were cleaned to achieve a zinc free surface so that re-welding of the roof legs could be undertaken. The weld areas were then cleaned and repaired by the application of a zinc rich epoxy such as "Galvpatch" or "Zinc Fix". It was accepted that the zinc rich epoxy repair would be the first to exhibit corrosion should a specified minimum of 100µm coating over the weld area not being achieved.



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Environmental Conditions

In terms of the environmental conditions reference to the ISO 9223 specification – Corrosion of Metals and Alloys – Corrosivity of Atmospheres – Classification is used, as a guide when determining an approximate service life of an installation. The Bellville Transport Interchange is considered to be a corrosivity category of a C5 environment.

A C3 environment is described in terms of the following;

“Temperate zone with medium (SO_2 5 to $\leq 30\mu g/m^3$) or some effect of chlorides, e.g. urban areas, between one to thirty kilometres (depending on prevailing winds, buildings, vegetation and topography) from the ocean, or within one hundred metres of sheltered coastal areas with low chloride deposits”

The specification attributes the zinc corrosion rates for a C3 environment in a range of between 0.7 and $<2\mu m$ per year.

For a guide to the ISO 9223:2012 specification, refer to the Association Information Sheet No.8 **“Corrosion of Zinc – Corrosivity of Atmospheres”**.

The Site

The site is located on the Cape Flats and subject to both the dry South Easterly winds and well as the washing effects of the rain bearing winds from the West and North West. In addition, further corrosion control is provided by the shielding from surrounding buildings and the carbon dioxide emissions from taxis. The carbon dioxide helps promote the development of the protective zinc carbonates, which in turn provides corrosion control of the hot dip galvanized steel.

Findings

The hot dip galvanizing is performing to specifications. Judging by the residual coating thickness on the structure as well as the holding down bolts and nuts, we predict the galvanizing will provide a further 30 to 50 years of service-free life.

The areas where the ‘upside down spiders’ were welded and originally repaired using A zinc rich epoxy should be cleaned and recoated with either Galvpatch or equivalent.

A row of pipe bracings which were originally only painted were showing signs of some corrosion and will also require future maintenance or replacement.

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The use of a zinc rich "silver spray" paint that draws attention to the welding repairs as the hot dip galvanized surfaces form the matt grey surface protective zinc carbonate patina



The "upside down spiders", as delivered to site, have similar similarly grey surface tones to that of the galvanized components when Galvpatch or Zincfix are used for repairs



Where the zinc rich epoxy has been incorrectly applied (too thin and less than 100µm) premature corrosion is evident

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A row of pipe bracings were originally painted and showing signs of corrosion



Zinc coating thicknesses taken on the hot dip galvanized tubular purlins were found to be in excellent condition with more than 130 μ m of residual zinc remaining



Hot dip galvanized I-Beam tubular purlin support, showing a residual coating thickness of 252 μ m

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Conclusion

The Bellville Transport Interchange was upgraded 12 year after the original construction. This case study has been based on the findings relating to the original hot dip galvanized steel installed as part of the 2002 project.

From the recorded residual hot dip galvanized coating thicknesses that range from approximately 130 to over 200µm and a zinc corrosion rate of say 2µm per year, it can be calculated that a further 60 plus years of service life is anticipated.

This is a further example of a cost effective hot dip galvanized installation that is living up to its performance requirements of a maintenance free service life.



Views of the busy Bellville Transport Interchange showing the curved purlins and 'upside down spider' supports