

The difference between project **success** and **failure**

DESIGN, methodology, workmanship and technical specifications of the corrosion protection aspects of a contract, both at the beginning and particularly during maintenance interventions during the life of the structure, can literally mean the difference between success and failure of a project.

The attention to detail should also include such items as drainage features, fixings and cables. Much can be learnt from the work carried out on the Forth Road Bridge, where SPC has advised and inspected many miles of cabling. An expert team from SPC has also studied the corrosion effects of de-icing salts on the bridge, which have caused unexpected and advanced corrosion in hidden areas of bonding and joints

These studies have been published for the benefit of bridge owners and operators worldwide and were covered



in a paper presented by SPC to the 8th International Cable Supported Bridge Operators' (ICSBO) Conference in 2013. Copies of the paper, 'Steel Bridge

Painting - Achieving Optimum, Long Life Performance' are available from SPC head office. For this and other details, email: info@steel-protection.co.uk

Best practice in bridge maintenance

Selecting the correct maintenance option for any steel bridge is critical. Removing all existing coatings is costly and may not even be necessary; the wrong method or standard of surface preparation, or over-coating with the wrong paints, could be equally costly.

Paint surveys are essential in establishing condition of the existing paint system and determining the extent of the work necessary in a maintenance contract. Feasibility trials, particularly on older bridges, can save hundreds of thousands of pounds and prevent unnecessary delays in the maintenance contract.

SPC offers a comprehensive consultancy package in steel bridge protection for both new and existing bridges. Experienced, qualified senior consultants undertake paint surveys, prepare specifications and carry out feasibility trials in accordance with the Highways Agency's procedures, prior to maintenance painting.

SPC consultants have advised the City of London and its agent WS Atkins plc, on the painting of bridges over the River Thames for more than 40 years. Life expectancy of paint systems on Blackfriars, Southwark and Tower Bridges has trebled as a result of procedures now adopted.

The life expectancy of paint systems has trebled in recent years

Environmental regulations and health and safety legislative changes over the last quarter century have led to development of new surface preparation methods and VOC compliant coatings for bridges. These can be onerous for bridge owners and maintenance authorities and have resulted in several unexpected early failures of coatings.

Getting it right



In a joint paper presented to the Costain Group in October 2015, SPC's David H Deacon and Dr William M Cox argue that civil engineers need to take a more holistic view of protective coating and maintenance painting – giving examples of what happens when this advice is not fully heeded.

SPC's Speakers at the Costain Group conference



David H Deacon has been involved with the corrosion industry for more than 50 years, running his own consultancy for most of this time. He first joined the Institute of Corrosion Science and Technology (as it was then) in 1967. Among his many achievements he organised UK Corrosion and Correx exhibitions in the early 1980's, was Chairman of the Council from 1986-88, became an Honorary Life Fellow in 1992 and was President of ICorr from 2002-04.

David was honoured with a Lifetime Achievement Award by the Institute of Corrosion in 2009, recognising his, - "continuous unrivalled commitment and contributions over many years." He is the only person ever to have received this prestigious, unique award.



Dr William M Cox has had over 40 years' experience of corrosion related projects on a worldwide basis covering a range of structures and installations. He is a Director of Corrosion Management Ltd and a Senior Consultant with SPC.

His career as an Engineering Specialist on Materials, Corrosion and Coatings provides specialist technical support to SPC on all aspects of corrosion control.

Dr Cox has produced more than 70 published technical papers and articles, holds a number of corrosion control patents and is involved with numerous Committees, Societies and Associations on a worldwide basis on corrosion related matters.

Where one coat means 40 worry-free years

If evidence were needed that good forethought and professional expert advice can result in major long term savings in the maintenance of water defence systems, look no further than the Thames Barrier.

Specialist coatings experts from SPC did an impressive job in the 1970s advising the GLC on the right coatings systems for the iconic London floodgates. These not only lasted the full '25 years to first maintenance', but an extensive survey completed for the Environment Agency relatively recently extended the predicted life of this system by a further 15 years. In other words, a life to first maintenance of 40 years!

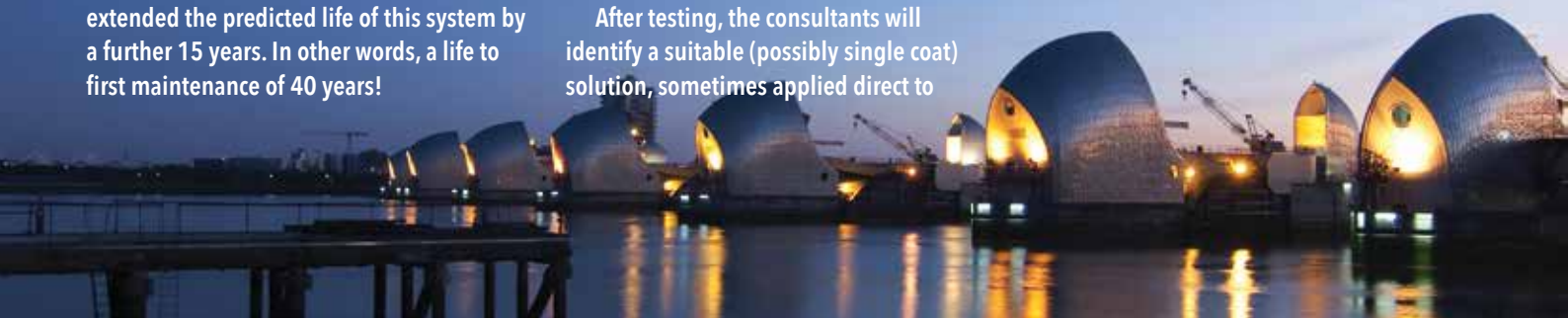
This result flies in the face of what so often happens in the water defence industry. Disasters can occur when the potential life of a coating, expected to last many years, starts to fail within five to ten years of the structure being commissioned.

Not so with SPC, whose independent consultants can arrange a series of testing and evaluation regimes that eliminate all but the very of the dozens of coating options that might be considered on a water defence system.

After testing, the consultants will identify a suitable (possibly single coat) solution, sometimes applied direct to

the clean steel without the need for an anti-corrosive primer.

The coating system, a solvent-free hot applied epoxy coating, has subsequently been used on tank linings and process steelwork in the water treatment industry. It is one of a range of coatings and coating systems for various sewage, river and coastal flood applications to be selected and, if applied correctly, will provide optimum performance for corrosion protection of steel structures for a surprising number of years.



first time

WHEN a group of offshore wind turbines were installed in the Irish Sea, few people could have predicted that some would soon need to be repaired at a cost estimated to be nearly four times that of the original structures.

Installed off the east coast of Ireland in 2007, six towers out of a total of 105 showed serious signs of corrosion after only three months in operation. Each one had cost €130,000 to manufacture and install and, like the others, had been treated with a two pack solvent free, glass flake, one coat application prior to installation. In all, 3,000 square metres of steel surface had been coated in this way.


The corrosion issues were very bad news for the operator. This was because repainting of the six structures needed to be done in situ, meaning that the cost of tackling the problem rocketed to around €3 million. Worse still, as a result of this the cost of painting insurance was raised to €160,000 per structure – far more than the original cost of manufacture and installation.

“This is a prime example of coatings being applied where inadequate attention had been made in the early stages to ensuring that the coating system applied would be fit for purpose,” says David Deacon, senior consultant at the Steel Protection Consultancy (SPC).

“The Irish Sea is one of the most corrosive environments in which to install a steel structure, so the need for extensive research and advice should have been critical in ensuring that these expensive wind turbines were as effectively protected as possible.”

This is a view shared by Dr William Cox, SPC senior consultant, who says: “Thousands of wind turbines have been installed in a variety of onshore and offshore locations and there are several different types. Each have their own mechanical and operational differences but the one common problem is corrosion control and the difficult access problems attached to this.”

This example is just the tip of the iceberg. With the annual cost of corrosion failures estimated to be billions of pounds in the UK every year – equivalent to 3.5 per cent of the national GDP – much of it is due to inappropriate specification of the surface preparation and coating systems applied.



At Barking in Essex, the flood barrier on the River Thames faced serious problems when corrosion was discovered, purely by chance, in 1985 – only five years after being commissioned.

The barrier, which experiences only occasional immersion into the brackish waters of the Thames Estuary, had been given a coating system consisting of aluminium metal spray with a chlorinated rubber sealer, plus four additional coats.

A few years later, a team of SPC consultants was called in to inspect the structure. Consultants prepared a detailed report on the corrosion issues. They discovered that aluminium salts had blistered through four top

paint coat after seven years and severe rusting had occurred in the steel substrate after 12 years.

As a result of experience gained over more than 40 years, the SPC consultancy team was able to advise engineers in ‘departures from standards’ for structures to be coated with Highways Agency specifications. Experts advised that aluminium metal spray should not be adopted on unsuitable structures for this type of coating.

SPC's five point checklist

SPC is always available to give advice to civil engineers on this complex and potentially very costly subject. In a nutshell, it recommends a five point checklist for all new steel structures that will help to ensure they always ‘Get it right first time’:

- A minimum 25 year life to first maintenance should be the target
- A full understanding of the design and condition of the structure is crucial
- A detailed and meaningful specification is required
- An approved and registered contractor should be used
- Detailed feasibility trials should be conducted at the earliest opportunity

It's a costly business – but not as costly as alternative

M AINTAINING and repainting the UK's major structures comes at a significant cost to the economy - none more so than with steel bridges. Getting it right first time is therefore crucial.

This is exemplified in SPC's case studies of three of the UK's most iconic bridges: Forth Road near Edinburgh, Tamar in Plymouth and QEII across the Thames Estuary at Dartford.

As required by the UK's Highways Agency, the surveys on these three bridges were undertaken by an experienced SPC coatings team lead by a qualified paint technologist and assisted by Institute of Corrosion qualified painting inspectors.

The SPC team surveyed the Forth Road Bridge in 2002, the QEII Bridge in 2011 and the Tamar Road Bridge in 2012.

"Our surveys of these and many other major bridges worldwide, have shown that there has been premature breakdown of a number of different systems, due to diverse reasons, including specification faults, material and application problems," explains SPC managing director, William Deacon.

"Many of these could have been prevented by careful surveys, accurate technical specifications and careful control

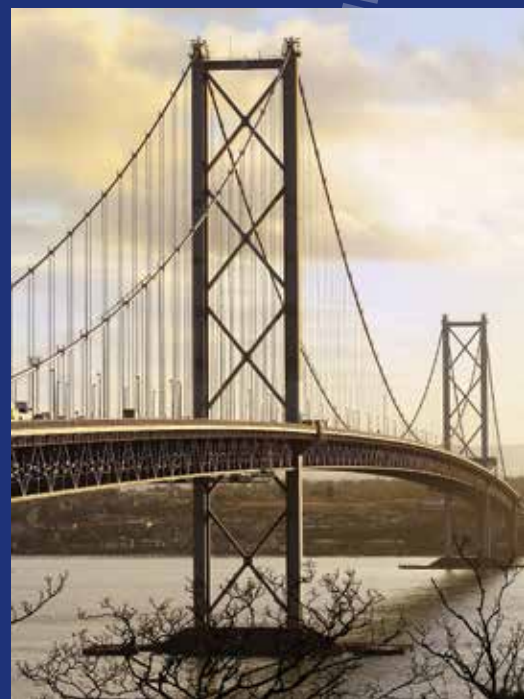
of the application of the maintenance system.

"Decisions taken in the past, about when to re-paint the early coated structures was made more from appearance rather than evidential corrosion and paint degradation. This is because more rapid colour deterioration meant the structure looked drab. The decision to apply more coats of paint was for aesthetic purposes, rather than to purely prevent the onset of corrosion resulting from degradation of the coating."

In the case of the Forth Road Bridge (see picture right), the metal coating selected was zinc. Development work carried out by the British Iron & Steel Research Association (BISRA) Laboratories showed that the molten liquid metal had to be sprayed using a very carefully controlled methodology, to prevent serious problems occurring with both porosity and vacuoles within the metal layer which, if inadequately sealed, absorb atmospheric moisture and fail prematurely.

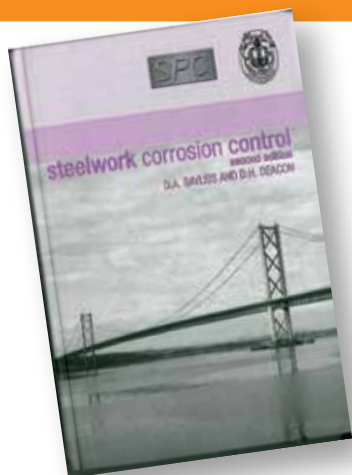
Compare this with 50 years ago, when the Forth Road and Tamar Bridges were being designed and constructed. In those days, consideration was given to the use of thermally sprayed molten metal.

The corrosion protection and



maintenance painting of bridges never fails to reveal interesting facts. The SPC coating survey for the high profile centenary repainting of London's Tower Bridge resulted in the discovery of flakes 28 layers of paint, which had been applied one over the other. All these needed to be completely removed to provide a coatings system that was significantly better than before.

Steelwork Corrosion Control



This specialist book is very popular on SPC's series of training courses and has been distributed to all parts of the world.

For those engineers who wish to have a wide and highly informative view of this important subject, the 400 page 'Steelwork Corrosion Control',

by D A Bayliss and D H Deacon, covers the subject in great detail in 16 chapters. It is available from SPC in a hard bound book format. The book is also available for the Far East in the Mandarin language.

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