KNOW YOUR CORROSION PROTECTION COSTS…ALL OF THEM

By Philip G. Rahrig

While initial cost is often the decisive factor when selecting a corrosion protection system for a project, there are often other costs that dwarf this initial funding outlay. Those costs are associated with a series of scheduled maintenance costs necessary to protect the project from corrosion over the planned service life. For maximum protection of the asset, plans should be based on an ideal maintenance cycle. For paint systems an ideal cycle calls for touchup, maintenance painting and full-repainting prior to visual evidence of substrate steel corrosion. However, on most projects a practical, less rigorous cycle is used and this means maintenance is conducted when the coating has deteriorated to the point where the project looks to be in disrepair and iron oxide (rust) is visibly evident. For a hot-dip galvanized corrosion protection system, maintenance is normally many decades after the initial coating is applied and usually only requires applying a zinc-rich spray coating.

To determine the timing of practical maintenance, most paint coating systems have been tested in a laboratory using accelerated corrosion mechanisms. To be sure, if the testing indicates a touchup painting should be performed in year eight, a maintenance paint applied in year 13, and a full repaint in year 18, the actual project may require maintenance according to the wear and tear on the project and the toll environmental corrosive elements have taken. That may mean earlier than planned maintenance based on the accelerated testing.

Comparing one system to another can be an arduous number crunching exercise further complicated by the various performance characteristics each coating system provides. A three-coat inorganic zinc-epoxy-polyurethane system may have initial durability, while hot-dip galvanizing provides corrosion protection inside hollow structural sections, and alkyds may be the standard of past projects. But, once the field is narrowed to a couple of optimal coating systems according to desired performance, it is important to use all the financial tools and models available to quantify future costs as accurately as possible, especially with maintenance budgets shrinking and substantial long-term costs.

One tool is the Life-Cycle Cost (LCC) Calculator now available at www.galvanizingcost.com. As the URL implies, this site will compare the initial and life-cycle costs for over thirty (one, two, or three coat) paint systems to hot-dip galvanizing. A unique feature of the software is it allows the user to customize the input to fit his/her particular project exactly. Input variables include total size in tons or square feet, surface preparation type, structural steel component size (small, medium, large), and planned service life of the project. The calculator allows the user to input in either metric or English units.

The primary driver and input variable of the life-cycle cost calculation is the corrosion data for the project's environmental location. If a project is in a rural area, corrosion rates are low because of lower corrosive elements in the air. For a project in an industrial area, aggressive corrosion may be initiated by sulfide and chloride emissions from production plants including high levels of automobile/truck exhaust. There are four input options for the environment and all correspond to categories described in ISO 12944-2 “Classification of Environments.”

The financial component of the LCC Calculator is also customizable and based on standard net future value (NFV) and net present value (NPV) calculations where the time value of money is considered. The user selects what rate of inflation is projected over the life of the project in order to determine the value of money at each maintenance time, and the average interest rate future expenditures on maintenance could earn, i.e. lost opportunity cost. Both are used to calculate the more easily understood and meaningful average annual equivalent cost (AEAC) for each coating system being modeled for any specific project.

$NFV = \text{initial cost}[(1+i)^n\}$, where i = inflation; n = project life in years
$NPV = NFV[1/(1+i)^n]$, where i = interest rate; n = project life in years
$AEAC = NPV[i(1+i)^n/(1+i)^n - 1]$, where i = interest rate; n = project life in years

The information on cost of each paint system and its practical service sequence in years for each of the ISO environments is contained in a database. [1] Based on the user’s selection of a particular coating system, the software accesses the appropriate field and incorporates the data into the life-cycle calculation. There are two options for the cost information of hot-dip galvanizing, also resident in a database. The user may either select the default, which is a U.S. average cost, or input any number in $/lb. or $/kg., based on market information in his/her locale.

Output of the LCC Calculator includes a printable summary of all selected input as well as tables containing the initial, NPV, total project, and AEAC for the coating system and hot dip galvanizing. The LCC calculator output is available in US dollars or in any country’s currency. The currency conversion is real time, making the LCC Calculator useful for export/import projects.
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[1] NACE Paper #06318 *Expected Service Life and Cost Considerations for Maintenance and New Construction Protective Coating Work*, Helsel, Melampy, & Wissmar, KTA-Tator, Inc. 2006.