

TECHNICAL STUDY ON USING SILICONE PROTECTIVE COATING FOR CORROSION AND RUST PREVENTION

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Abstract— Corrosion of steel structure leads to its degradation that affects the integrity the structures especially those that are exposed to saline environment. This paper presents the methodology and results of the investigation on the causes of structural damage which led to persistent rusting and corrosion to a Seal Tank Rim in Virginia Marine Science Museum. Repair and maintenance of existing structures comes easy with the newly introduced mitigation product – Silicone Protective Coating.

I. INTRODUCTION

Virginia, USA – A seal tank rim, made of raw steel, which holds the clear acrylic sheet of water back is severely damaged. Observed scratches, grooves, imperfect welds and other imperfections have led the steel rim to rusting and corrosion. Several attempts of coating were done using acrylic, oil or synthetic based resin, but none were able to mitigate the rusting and corrosion.

Selection of corrosion coating options shall be approved by the Marine Science Museum to ensure the absence of toxic substance leaching out when exposed to cold and salty water inside the tank.

II. CORROSION COATING OPTIONS

Any material composed of iron that is exposed to oxygen and water will rust. The chemical reaction that occurs during the exposure of steel to oxygen and water is called corrosion. Steel when exposed to salty water rusts faster than it does in a freshwater, having salt as a catalyst to the chemical reaction.

A. Acrylic/Urethane, Oil and Synthetic-based Coating

Acrylic/Urethane-based coatings are water based and are water permeable, which means water vapor can go both ways. When the water vapor pressure pushes into the coating system, the water molecule of oxygen in the water hits the steel and explodes. Thus, rust is the explosion on a molecular level when oxygen and water react with iron in the steel.



Fig. 1. Rust penetrated through an acrylic/urethane-based coating

Same goes with the oil and synthetic-based coating, rust formation was observed weeks after the application. These type of coating systems failed because of their property to trapped water vapor or letting in too much of it. They may be effective as rust prevention but not be a rust prevention for steel structures with existing rusts and corrosion.

B. Solvent-free Silicone Protective Coating

Solvent-free silicone protective coating is a top-notch resistance to weathering, water and chemical substances, making it ideal to use in coastal, industrial and desert areas. Silicone protective coating material safety data sheet (MSDS) was submitted to the Director of Mammals Exhibits to verify that there were no chemical or other substances present that are dangerous. Upon the approval, two-parts of silicone protective coating – water-based epoxy E5230 primer, were applied to the sanded and treated rim to fill-in any cracks or imperfections. Six to eight coats of silicone protective coating 100% solvent-free silicone white coating were applied and S2000 solvent-free seamseal fibered coatings were applied to flanges and bolts. Total curing period is only 3 days.

Six (6) months after the application, at 37°C and with a relative humidity for about 80%, no formation of rust and corrosion were observed.



Fig. 2. Flanges after Silicone Protective Coating application



Fig. 3. Seal tank rim after Silicone Protective Coating application

III. ECONOMIC EVALUATION

Research by NACE International, worldwide corrosion authority, demonstrated, that the annual cost of this corrosion problems come to a total of \$2.3 trillion.

Additional cost on the other corrosion coating options may have been saved when Solvent-Free Silicone Protective Coating was then introduced earlier. Silicone protective coating will last more than ten (10) years in challenging environment making it cost-efficient for operational expenditures (OPEX) specifically on the maintenance cost.

REFERENCES

- [1] Warwick Builders LLC. William W. Warwick IV, "GACO Solvent Free Silicone Surpasses all other for Corrosion and Rust Prevention on Harbour Seal Tank at Virginia Marine Science Museum after 6 Months" July 2017.
- [2] Capital Steel & Wire Inc., "Why does steel rust? Plus other steel rusting questions answered" April 2014.