Dehumidification – An Effective Strategy for Preserving the Cables of Suspension Bridges

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Abstract

The majority of suspension bridge cables consist of thousands of high-strength galvanized steel wires typically around 5mm in diameter. The wires are compacted into a near-circular shape then traditionally protected by externally applied red lead or zinc paste, galvanized wrapping wire, and paint. As evidenced by cable inspections, water inevitably intrudes into the interstices of the cable causing atmospheric corrosion, hydrogen-induced stress corrosion cracking and broken wires.

Since its first application on the Akashi-Kaikyo Bridge in Japan, cable dehumidification has emerged as an effective method of protecting cables from the damaging effects of water. This paper will discuss the types of suspension cables, traditional cable protection systems, typical findings from internal cable inspections, and the history and effectiveness of dehumidification as a technique for protecting the main cables of suspension bridges.

Keywords: Bridge, Suspension, Cable, Dehumidification, Corrosion, Preservation.

1 Introduction

Suspension bridges have been used since the early 1800s to span the world's largest crossings. Today, there are approximately 150 major cable suspension bridges around the world, most of which built decades if not over a century ago. This has led to an aging inventory which requires intervention in order to sustain these iconic structures for years to come.

Several cable protection systems have been used over time, but evidence from internal cable inspections has revealed that these systems have been less than ineffective. The intrusion of water into the cable has inevitably occurred leading to corrosion, hydrogen-induced stress corrosion cracking and brittle failures.

Cable dehumidification was first implemented in Japan nearly two decades ago. Since then there has been a steady growth in application throughout Asia, Europe and North America, with the first cable dehumidification system installed in the US on the William Preston Lane Jr. Memorial (Bay) Bridge in 2015.

With the growth in application, there is an increasing amount of data from a subset of bridges evaluated which demonstrates the effectiveness of dehumidification in reducing the rate of corrosion and occurrence of wire breaks.

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