

## Standard Practice

# Corrosion Management of Atmospherically Exposed Reinforced Concrete Structures

This NACE International standard represents a consensus of those individual members who have reviewed this document, its scope, and provisions. Its acceptance does not in any respect preclude anyone, whether he or she has adopted the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not in conformance with this standard. Nothing contained in this NACE International standard is to be construed as granting any right, by implication or otherwise, to manufacture, sell, or use in connection with any method, apparatus, or product covered by Letters Patent, or as indemnifying or protecting anyone against liability for infringement of Letters Patent. This standard represents minimum requirements and should in no way be interpreted as a restriction on the use of better procedures or materials. Neither is this standard intended to apply in all cases relating to the subject. Unpredictable circumstances may negate the usefulness of this standard in specific instances. NACE International assumes no responsibility for the interpretation or use of this standard by other parties and accepts responsibility for only those official NACE International interpretations issued by NACE International in accordance with its governing procedures and policies which preclude the issuance of interpretations by individual volunteers.

Users of this NACE International standard are responsible for reviewing appropriate health, safety, environmental, and regulatory documents and for determining their applicability in relation to this standard prior to its use. This NACE International standard may not necessarily address all potential health and safety problems or environmental hazards associated with the use of materials, equipment, and/or operations detailed or referred to within this standard. Users of this NACE International standard are also responsible for establishing appropriate health, safety, and environmental protection practices, in consultation with appropriate regulatory authorities if necessary, to achieve compliance with any existing applicable regulatory requirements prior to the use of this standard.

**CAUTIONARY NOTICE:** NACE International standards are subject to periodic review, and may be revised or withdrawn at any time in accordance with NACE technical committee procedures. NACE International requires that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of initial publication and subsequently from the date of each reaffirmation or revision. The user is cautioned to obtain the latest edition. Purchasers of NACE International standards may receive current information on all standards and other NACE International publications by contacting the NACE International FirstService Department, 1440 South Creek Dr., Houston, Texas 77084-4906 (telephone +1 281-228-6200).

Approved 2012-06-23  
NACE International  
1440 South Creek Drive  
Houston, Texas 77084-4906  
+1 281-228-6200

ISBN 1-57590-256-7  
©2012, NACE International

Currently in preview, click buy full version

---

## Foreword

This NACE International standard practice provides a structure for setting up and maintaining a Corrosion Management System (the System) for existing conventionally reinforced concrete structures. This standard is concerned with the risk-based management of corrosion to maintain the safe operation of structures and plants and to minimize the risk of unexpected failures and unplanned closures and outages.

The System may require investigation and evaluation by qualified corrosion, materials, and structural engineering personnel, depending on the nature and extent of the distress.

This standard is intended for use by corrosion specialists, civil engineers, structural engineers, and asset owners involved with the maintenance, management, and operation of reinforced concrete structures susceptible to corrosion-induced deterioration.

This standard was prepared by NACE TG 400, which is administered by Specific Technology Group (STG) 01, "Reinforced Concrete," and is also sponsored by STG 08, "Corrosion Management," and STG 46, "Building Systems." The TG is composed of manufacturers, users, consulting engineers, and other interested parties and this standard represents a consensus of those members. This standard is issued by NACE under the auspices of STG 01.

In NACE standards, the terms *shall*, *must*, *should*, and *may* are used in accordance with the definitions of these terms in the *NACE Publications Style Manual*. The terms *shall* and *must* are used to state a requirement, and are considered mandatory. The term *should* is used to state something good and is recommended, but is not considered mandatory. The term *may* is used to state something considered optional.

---

---

**NACE International  
Standard Practice**

**Corrosion Management of Atmospherically Exposed  
Reinforced Concrete Structures**

**Contents**

1. General .....	1
2. Definitions .....	1
3. Objectives .....	1
4. Organization and Management.....	2
5. Planning and Implementation .....	3
6. Performance of Corrosion Management Team (the Team).....	4
References.....	5

---

---

## Section 1: General

1.1 Corrosion management is the part of an overall management system that is concerned with the development, implementation, review, and maintenance of the corrosion policy for the owners of fixed assets. This standard is not intended to be all encompassing. This standard is not concerned with the actual techniques used to carry out evaluations, which are covered by other NACE standards.<sup>1,2</sup>

1.1.1 Because of the properties inherent in reinforced concrete and different exposure conditions, corrosion of reinforced concrete structures has unique characteristics and associated consequences when compared to other assets that suffer from corrosion. Corrosion management of reinforced concrete therefore requires unique knowledge and skills.

1.1.2 For example, 50 to 100  $\mu\text{m}$  ( $2$  to  $4 \times 10^{-3}$  in) section loss of reinforcing steel can typically cause concrete cover to crack and spall.<sup>3</sup> This amount of section loss is several orders of magnitude less than that considered significant in most structural steel elements or steel containment structures. Also, the consequences of concrete at high elevation spalling if a structure can result in very different health and safety issues compared to section loss of a structural beam or column or perforation of a pipe or a containment vessel.

1.2 To establish the System for reinforced concrete assets, the Owner shall establish a corrosion policy, either standalone or within an overall integrity management policy and system. The Owner and managers of the assets shall identify the risks to safety and to the business resulting from the effects of corrosion. The requirements of national health and safety legislation shall also be incorporated into the System. The environmental impacts of corrosion and of corrosion control and mitigation techniques shall be considered as part of the System.

1.3 The System shall establish an objective of cost-effective life extension of reinforced concrete structures while ensuring safe and reliable operation with minimum disruption to all aspects of the operation of the structure during inspection and rehabilitation. To achieve this objective the System shall include the following steps:

1.3.1 Planning and Implementation: Review of reinforced concrete structure condition, inspection planning, identification of damage mechanisms, selection and application of remedial measures and their performance monitoring (e.g., measure of cathodic protection [CP] performance, use of inspection/embedded sensors for assessment of repair/inhibition, etc.).

1.3.2 Evaluate Performance of the Corrosion Management Team (the Team): Have actions been completed, have data been collected and reviewed as planned, etc.? What could have been done better? Adjust planning/procedures to reflect experience (good and bad).

1.3.3 Independent Audit: Review of actions of the Team by external verifiers.

1.4 The benefits from the implementation of the System are often realized in the medium-to-long term so the Owner should be steadfast in the initial stages. Like any change in general that can lead to tangible benefits in the medium-to-long run, the implementation of the System can cause initial disruption and inefficiencies.

---

## Section 2: Definitions

Owner: The legal entity responsible for the reinforced concrete assets that are the subject of the System.

---

## Section 3: Objectives

3.1 Objectives shall be established. The principal objective is the cost-effective life extension of the owner's reinforced concrete assets while ensuring safe and reliable operation with minimum disruption to users of the structure. The objectives may also include issues specific to the asset Owner, the structure(s), and their use. When necessary the objectives shall also differentiate among users who are the general public, the general staff of the organization, and the operatives working on the asset.

3.2 To implement the objectives, maintenance functions included in the maintenance budget and items of capital expenditure must be clearly identified. Examples of periodic maintenance are given in NACE SP0390.<sup>1</sup>