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# Guide to Maintenance of Concrete Bridge Members

Reported by ACI Committee 345



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## **Guide to Maintenance of Concrete Bridge Members**

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*This guide addresses typical problems and cost-effective maintenance techniques for highway bridges and their members, providing guidance to engineers and maintenance staff. Maintenance is crucial to a bridge's lifespan and continued functionality, as well as to the public safety. Continuous and systematic maintenance of a bridge will extend its service life and reduce its overall operating cost.*

*Concrete bridge maintenance is defined as those activities that are relatively inexpensive and repeatable, performed when a concrete member is still in good to fair condition, and are intended to prevent or minimize deterioration of the concrete. These activities include sealing, washing, caulking, crack repair, and other minor repairs intended to prolong functionality of bridge members. This guide does not cover major rehabilitation, reconstruction, or bridge inspection. Detailed methods of repairing and inspecting bridges are referenced wherever necessary throughout the guide relative to the subject matter.*

**Keywords:** bridges; cementitious; coating; maintenance; placement; polymer; sealant.

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## CHAPTER 1—INTRODUCTION AND SCOPE

### 1.1—Introduction

Bridges represent a substantial investment of public funds and are expected to provide satisfactory performance and remain in service for many years. The longevity of constructed concrete bridges can be expected to be 75 to 100 years if proper maintenance action is executed in a timely manner. Structural concrete members that deteriorate over time and eventually lose functionality could become life-threatening to the public. Aggressive environmental conditions for bridges involve cycles of freezing and thawing and wetting and drying with or without the presence of chloride. Corrosion of reinforcing steel will usually result in spalling of concrete cover and reduction of the cross-sectional area of the reinforcing steel, which reduces the strength of the member. The time required for deterioration to occur varies considerably, depending on severity of the exposure conditions and characteristics of structural concrete and rein-

forcing steel. Traffic fatigue loading may become more dominant over time. Continuous and systematic maintenance of a bridge will extend its service life and reduce its overall operating cost. This guide presents various technical aspects related to bridge maintenance, including the sources of deterioration and technical action that can improve the performance of existing bridge members.

### 1.2—Scope

The contents discussed in this guide are classified into two categories: 1) deterioration of constructed bridges; and 2) maintenance activities to address potential problems associated with such bridges. The first category is dedicated to various distressful attributes influencing the performance of existing bridge members and their consequences, whereas the second category is concerned with timely preventive or corrective maintenance actions with an emphasis on drainage, sealing, patching, joint repair, and other relevant topics. The following is outside the scope of the present report: major rehabilitation, reconstruction, inspection, condition evaluation, and load rating.

## CHAPTER 2—DEFINITIONS

ACI provides a comprehensive list of definitions through an online resource, <https://www.concrete.org/store/product-detail.aspx?ItemID=CT16>. Definitions provided herein complement that source.

**bridge deck**—structural concrete slab or other structure that is supported on the bridge superstructure and serves as the roadway or other traveled surface.

**damage**—various forms of disruption to a member (cracking, spalling, delamination, scaling, dissolution, and permanent deformation), such as result from environmental (freezing and thawing, erosion), chemical (alkali-silica reaction, sulfate attack), and physical (impact, overload, fatigue) stresses that disrupt its intended condition and function.

**grout**—mixture of cementitious materials and water, or other binding medium such as magnesium phosphate or epoxy, often mixed with fine aggregate to form a thin, coarse mortar that can be poured into narrow cavities to fill them and consolidate the adjoining objects into a solid mass

**overlay**—layer of hydraulic-cement concrete, mortar, or asphalt, seldom thinner than 1 in. (25 mm), placed on and usually bonded onto the worn or cracked surface of a concrete slab to either restore or improve the functionality of the previous surface, also a layer of polymeric concrete usually less than 0.4 in. (10 mm) thick.

**superstructure**—part of a bridge providing the horizontal span.

## CHAPTER 3—MAINTENANCE OF BRIDGES

### 3.1—Bridge maintenance

Initial bridge deterioration occurs slowly and, therefore, is often overlooked. In later stages of deterioration, however, sudden catastrophic events could occur, demanding immediate action. Progressive deterioration can be slowed, and sometimes avoided, if proper systematic preventive mainte-