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Guide for Concrete Highway Bridge Deck Construction

Reported by ACI Committee 345

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The service-life performance of concrete bridge decks, including maintenance, repair, and rehabilitation needs, is directly related to the care exercised from the preconstruction through post-construction period. This guide provides recommendations for bridge deck construction based on considerations of durability, concrete materials, reinforcement, placing, finishing and curing, and overlays.

Keywords: admixtures; aggregate; air entrainment; bridge decks; concrete curing; concrete finishing; concrete overlays; concrete placing; cracking; durability; polymer concrete; reinforcing bars; scaling; shrinkage; skid resistance.

CONTENTS

ACI 345R-11 supersedes 345R-91 and was adopted and published September 2011.

CHAPTER 1—INTRODUCTION AND SCOPE

1.1—Introduction

The deck of a highway bridge serves both structural and functional purposes for the structure. As a structural component, it provides the load path to safely transfer forces from wheel loads to the supporting superstructure and substructure elements. It may also contribute, through composite action, to the performance of primary superstructure components. Equally, the construction and condition of a deck directly impacts serviceability or the ability of the structure to safely and efficiently carry highway traffic by providing smoothness, skid resistance, and resistance to deflections under wheel loads. The riding surface of a highway bridge deck should provide a continuation of the pavement segments that it connects. The surface should be free from characteristics or profile deviations that impart objectionable or unsafe riding qualities. The desirable qualities should persist with minimum maintenance throughout the projected service life of the structure.

Roughness, cracking, spalling, scaling, and poor skid resistance are defects that result when the many details that influence their occurrence are not given sufficient attention. Recognition of the interaction of design, materials, and construction practices, as well as environmental factors, is the important first step in achieving smooth and durable decks.

Many decks remain smooth and free from surface deterioration and retain skid resistance for many years. When deficiencies occur, they usually take one of the forms described in this guide. The contribution of various aspects of deck construction to defects is discussed and guidelines based on theory and experience presented that should reduce the probabilities of occurrence to acceptable levels.

1.2—Scope

This guide presents considerations to be taken in the design and a summary of construction practices for conventionally reinforced concrete highway bridge decks. Such decks are typically supported by multiple simple or continuous-span steel or prestressed concrete girders, or integral reinforced concrete members. The service life performance of concrete bridge decks, including maintenance, repair, and rehabilitation needs, is directly related to the care exercised from preconstruction through the post-construction period. Recommendations are presented for design and durability considerations, concrete materials, reinforcement, placing, finishing and curing, and the use of overlays.

Although some performance and durability factors discussed may be applicable, design and construction of prestressed bridge decks are presently beyond the scope of this guide. Thus, prestressing steel is not included in the reinforcement section. Guidance for the design of prestressed bridge decks is being developed elsewhere (Swartz and Schokker 2008).

CHAPTER 2—DEFINITIONS

2.1—Definitions

ACI provides a comprehensive list of definitions through an online resource, "ACI Concrete Terminology," at http://terminology.concrete.org. Definitions provided herein complement that resource.

crack, reflective—a crack that forms in a bonded overlay or wearing course caused by upward extension of moving crack or joint in the substrate.

washboarding—undulations in the finished surface of a deck that cause vibrations of undesirable frequency and amplitude in passing vehicles.

CHAPTER 3—DESIGN AND DURABILITY CONSIDERATIONS

3.1—General

Chapter 3 emphasizes design factors that may affect the resistance of a bridge deck to chemical and environmental exposure, including potential for freezing and thawing, deleterious chemical reactions with concrete constituents, or chloride-induced corrosion damage. The design considerations of this chapter are not concerned with the structural analysis of the bridge deck. Structural aspects of the design, however, can have implications in the development of internal stresses