

Use of Extra Coating Thickness on Epoxy-Coated Bars in Concrete Deck Replacement

Sandra Villamizar, Rachel E. Henkhaus, Julio Ramirez

Purdue University, West-Lafayette, IN, USA

Contact: ramirez@purdue.edu

Abstract

Current standard specification for epoxy-coated steel reinforcing bars (ASTM A775/A775M) allows coating thicknesses between 175 to 400 μm . This paper presents an experimental program conducted to evaluate the bond performance in normal-weight concrete of epoxy-coated bars with coating thickness up to 460 μm . Two different bar sizes were investigated, No. 16 and No. 29 bars. Single splices as well as splices of bundled bars were evaluated in the experimental program. The results of the study were implemented in the form of design recommendations for bond of epoxy-coated bars with thicker coatings. The goal is to enhance the future sustainability of concrete bridges by improving the performance of epoxy-coated bars as a corrosion protection system.

Keywords: bond strength; bridge deck; epoxy-coating; thickness; reinforcing bars.

1 Introduction

Epoxy-coating has been widely used in concrete structures to mitigate corrosion of reinforcing steel. The effectiveness of epoxy-coating as a corrosion protection system can be most effective if any damage to the coating during the construction of the structure is reduced. A possible strategy to minimize damage to the coating is to increase its thickness. However, previous studies [1-4] have shown that thicker epoxy-coating reduces the bond strength of steel deformed bars when is compared with that of uncoated bars. Test results of Treece and Jirsa [1], Johnston and Zia [2], Choi et al. [3], and Cleary and Ramirez [4] have shown reductions of around 34%, 15%, 17%, and 18%, respectively. These observed reductions on bond strength on epoxy-coated bars are mainly due to the smooth surface the coating creates.

A considerable number of experimental studies [1-5] have studied the effect of epoxy-coating on

bond in reinforced concrete compared to uncoated reinforcement. However, only a few test programs focused on the effects of thickness of epoxy-coating beyond the current upper limit in the U.S. specifications. For example, Miller et al. [5] using beam end specimens (ASTM A 944) concluded that the increase in coating thickness with ASTM A 775 epoxy-coatings reduced the bond strength of smaller diameter bars (No. 16 and smaller) while larger diameter bars (No. 19 and larger) seemed to be almost not affected. This observation was based on the tests of specimens containing bars with coatings in the range of 160 to 420 μm . If the upper limit of coating thickness was increased to 510 μm , the bond strength of No. 19 deformed bars was reduced. The authors of the study concluded that the maximum allowable coating thickness could be increased from 300 μm to 420 μm for No. 19 and larger bars meeting the requirements of ASTM A 755. A brief summary of previous test programs, including Treece and Jirsa [1], Choi et al. [3], Miller et al. [5], and Hester et al. [6], is given in Table 1.