



CONCRETE REMOVAL IN REPAIRS INVOLVING CORRODED REINFORCING STEEL

Keywords: corrosion; reinforcing steel; repair; ring anode effect; surface preparation.

Introduction

The performance of a reinforced concrete repair depends significantly on the condition of concrete in the reinforcement vicinity and on the quality of (re-)encapsulation. The extent of concrete removal prior to repair must be adjusted in accordance with the degree of contamination and the nature of distresses affecting the member or structure.

Question

When corroded reinforcing steel is encountered in a repair, should the bar be undercut? How far should the bar be exposed along its length?

Answer

Concrete should be removed around the reinforcing bar, leaving in all directions a clear distance of at least 1/4 in. (6 mm) plus the dimension of the repair material maximum size aggregate. In addition, concrete removal along the reinforcing bar shall continue until the bar is essentially free from corrosion products.

Discussion

When a portion(s) of the electrically continuous reinforcing bar is exposed to a chloride-free repair material and the rest of the bar remains in contact with chloride-contaminated and/or carbonated concrete, corrosion in areas adjacent to the repair may be accelerated. This condition is often referred to as the “ring effect” or “halo effect.” Hence, when corrosion problems are encountered in a repair, the chloride ion concentration and the depth of carbonation in the existing concrete should first be determined.

The decision to undercut the reinforcing bar should be made based on the chloride ion concentration and/or extent of carbonation in the surrounding concrete. There is a high risk of continuing corrosion whenever, at the reinforcing steel level, the acid-soluble chloride content by weight of cement exceeds 1% (ASTM C114) or cement paste is carbonated. Significant contamination may require the removal of existing concrete surrounding the bar. Such a removal will avoid creating an environment where part of the circumference is depassivated and another part is still passive, a combination that may lead to accelerated corrosion.

The size of the repair shall be based on both technical and economic considerations. Minimally, if corroded reinforcement in the repair is exposed and found to have loose oxidation products or is not bonded to the surrounding concrete, it is recommended that the concrete be removed from around the bar (Fig. 1). The clear space behind the reinforcing steel should be not less than 1/4 in. (6 mm) plus the dimension of the maximum size aggregate in the repair material, as shown in Fig. 2.^{1,2} In addition, concrete removal along the reinforcing bar shall continue until the bar is essentially free from corrosion products. In some cases of advanced corrosion, it may be appropriate to replace the affected reinforcement and concrete along the entire length of the member.

Summary

When corroded reinforcing steel is encountered in a repair, surrounding contaminated concrete should be removed and the bars should be undercut and exposed along their entire affected length.

References

1. ICRI, “Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion (ICRI 310.1R-2008) [formerly No. 03730],” International Concrete Repair Institute, Rosemont, IL, 2008, 12 pp.

2. ACI Committee 546, "Concrete Repair Guide (ACI 564R-04)," American Concrete Institute, Farmington Hills, MI, 2004, 53 pp.

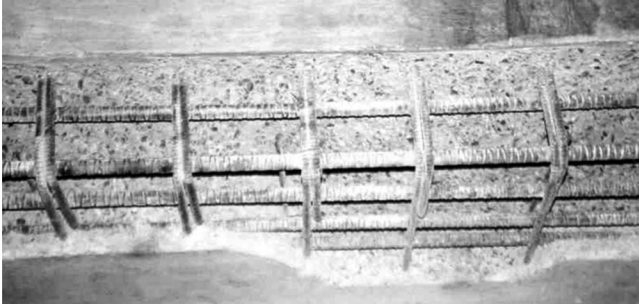


Fig. 1—Typical concrete removal around reinforcing bar.

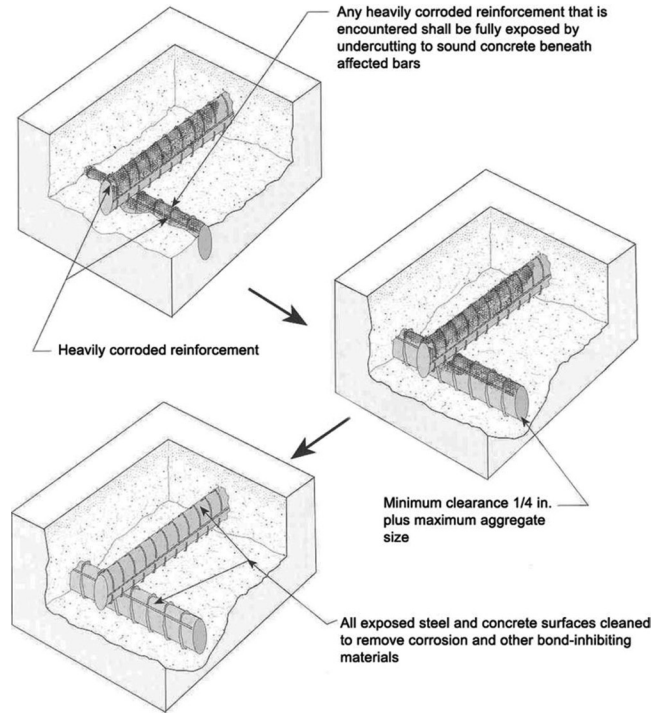


Fig. 2—Removal of concrete from around reinforcing bar (adapted from ICRI 310.1R-2008, formerly No. 03730).

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ACI 364.6T-02 was adopted and published July 2002.

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