Field Examination of Epoxy Coated Rebars in Concrete Bridge Decks
FIELD EXAMINATION OF EPOXY COATED REBARS IN CONCRETE BRIDGE DECKS

Interim Report

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EXECUTIVE SUMMARY

A limited field survey was conducted to determine the extent of corrosion of epoxy coated rebars in bridge decks in Minnesota. One core was taken from each of ten bridge decks and examined in the laboratory for evidence of rebar corrosion. The bridges are located on I-35E south of St. Paul, Minnesota, and were constructed in the late 1970's with the upper rebar mat epoxy coated and the lower mat uncoated black steel.

Conclusions that appear justified are:

• The first bridge deck built in Minnesota with epoxy coated rebars shows no signs of distress after almost 20 years of service.

• The significant corrosion of epoxy coated rebars that has been observed in highway structures by other transportation agencies was not discovered by this limited survey.

• The bridge decks with prestressed concrete girders tended to show fewer transverse cracks than the decks with steel girders.
INTRODUCTION

Background

Coating reinforcing bars with epoxy was assumed to be the answer to corrosion problems in highway structures when it was developed. In the last few years, this assumption has been seriously questioned. Cases of damage to structures resulting from corrosion of epoxy coated steel have been reported in Florida, New York and Ontario. In 1992, the Physical Research Section was asked by the Office of Bridges and Structures at the Minnesota Department of Transportation to conduct a limited field survey to determine if a problem existed in Minnesota.

The first bridge deck in Minnesota to be constructed with epoxy coated rebars was Southbound TH 3 over Southview Boulevard in Inver Grove Heights, built in 1974. By the late 1970's the use of epoxy coated rebars in Minnesota became widespread. For a period of several years, only the top mat of rebars was coated, the bottom mat being unprotected black steel. It was felt that because the lower mat would be protected by concrete uncontaminated by chlorides from deicing chemicals, there was no need for the lower mat to be coated. However, it was found that corrosion at flaws or breaks in the epoxy coating could be greatly accelerated by electrochemical reaction with the uncoated lower mat. Since the early 1980's, all bridge deck rebars are now epoxy coated.

Performance of epoxy coated rebars can be affected by damage to the coating in the field due to rough handling and/or poor quality coating jobs at the factory. This has caused the integrity of the epoxy coating itself to be questioned. The Minnesota Department of Transportation relies heavily on epoxy coated steel to protect its bridge decks and other highway structures. Premature damage to bridge decks due to corrosion of epoxy coated rebars has not yet been noted in Minnesota.

Scope

Ten bridge decks on I-35E south of St. Paul were selected for this investigation. These decks were all constructed in the late 1970's with epoxy coated rebars in the upper mat and uncoated black steel rebars in the lower mat.

There is a lack of a reliable non-destructive test to determine the presence of corrosion of epoxy coated rebars. Thus, it was necessary to take cores to below the level of the top rebar.
One core was taken from each deck and examined visually for evidence of corrosion. Each core was taken at a crack in the concrete deck surface and centered over a rebar. Cores were taken at these locations because it was felt that cracks would provide the most aggressive environment for corrosion to occur. Moisture, chlorides and oxygen would have ready easy access to the rebars, and if a break or holiday were present in the epoxy coating, signs of corrosion would likely be found.

The ten bridges cored were:

- Bridge No. 19809, Southbound I-35E over I-35W.
- Bridge No. 19811, Southbound I-35E over CSAH 42.
- Bridge No. 19812, Northbound I-35E over CSAH 42.
- Bridge No. 19816, Cliff Road over I-35E.
- Bridge No. 19817, Diffley Road over I-35E.
- Bridge No. 19859, Southbound TH 77 over I-35E.
- Bridge No. 19860, Northbound TH 77 over I-35E.
- Bridge No. 19866, 138th Street over I-35E.
- Bridge No. 19882, Blackhawk Road over I-35E.
- Bridge No. 19889, Portland Avenue over I-35E.

**EVALUATION**

The first epoxy coated rebar deck, Bridge No. 19016, was examined visually. No signs of distress were apparent.

Bridge No. 19809 was constructed in 1964, but the roadway was not built at that time. In 1980, before being opened to traffic, the deck was widened and overlaid with four inches of concrete. Epoxy coated rebars were placed in part of the overlay, but not on the side that was cored. The obtained core contained an uncoated rebar with considerable corrosion product and apparent loss of steel section. Due to time constraints, no additional cores were taken from this deck.

The two decks on TH 77 are supported by prestressed concrete girders. It was difficult to locate cracks in these decks, other than a few hairline cracks. These cracks were found to penetrate about one inch below the deck surface. No corrosion of the rebar was apparent.

The remaining seven bridges were constructed with steel girders. These decks had numerous transverse cracks. Only one of the rebars showed any sign of corrosion, contained in the core from Bridge No. 19811. There was a rust-covered area about one inch long on the rebar. After removing the surface
rust, an area about 1/8 inch in diameter showed corrosion damage at a holiday in the epoxy coating. The amount of metal loss appeared to be slight.

FINDINGS AND CONCLUSIONS

1. The first bridge deck built in Minnesota with epoxy coated rebars shows no signs of distress after almost 20 years of service.

2. The significant corrosion of epoxy coated rebars that has been observed in highway structures by other transportation agencies was not discovered by this limited survey.

3. The bridge decks with prestressed concrete girders tended to show fewer transverse cracks than the decks with steel girders.