BRIDGE DECK MEMBRANE REPORT

1.0 Introduction

One of the main problems of bridge maintenance in Iowa is the spalling and scaling of the decks. This problem stems from the continued use of deicing salts during the winter months. Since bridges will frost or freeze more often than roadways, the use of deicing salts on bridges is more frequent.

The salt which is spread onto the bridge dissolves in water and permeates into the concrete deck. When the salt reaches the depth of the reinforcing steel and the concentration at that depth reaches the threshold concentration for corrosion[1] (1.5 lbs./yd.^{3}), the steel will begin to oxidize. The oxidizing steel must then expand within the concrete. This expansion eventually forces undersurface fractures and spalls in the concrete. The spalling increases maintenance problems on bridges and in some cases has forced resurfacing after only a few years of service.

There are two possible solutions to this problem. One solution is discontinuing the use of salts as the deicing agent on bridges and the other is preventing the salt from reaching or attacking the reinforcing steel. This report deals with one method which stops the salt from reaching the reinforcing steel.

(1) From the report "Corrosion Autopsy of a Structurally Unsound Bridge Deck" by Richard A. Stratfull of the California Division of Highways.

The method utilizes a waterproof membrane on the surface of a bridge deck. The waterproof membrane stops the water-salt solution from entering the concrete so the salt cannot reach the reinforcing steel.

2.0 Purpose

The purpose of this study is to:

1. Determine a set of tests to evaluate bridge deck membranes.
2. Evaluate the various membranes.

8.0 Summary

The minimum requirements set for the tests used in evaluating bridge deck membranes were:

Resistivity

500,000 ohm/ft.^{2} after 3 hours.

Crack Bridging

Bridge a ¼ inch crack at 0° F. without tears totaling ½ inch in length.

Shear

No minimum - 11.5 psi used for comparison

The minimum requirements set for these tests provided a means for classifying the numerous membrane systems. Each system was subjected to the tests to determine its reliability and effectiveness as a waterproofing membrane. A number of systems were found to be unacceptable when they failed either the crack bridging or resistivity test. The membrane systems which met the minimum requirements are:

Butyl Rubber (Carlisle)

Deck Coat

Gacoflex N-36 Neoprene Rubber

Gacoflex UWM-28

Heavy Duty Bituthene

Nordel

Protecto Wrap M-400

Super Seal 4000

While some of the above membrane materials are liquid their use may be questionable due to the "out-gassing phenomena. It would be anticipated that pin holes could develop through these materials before they have completely cured thereby allowing salt water to penetrate to the underlying bridge deck.

The field application testing determined:

A 1. that most blisters are caused by the "out gassing" of moisture in the bridge deck.

A 2. that all membranes are subject to some form of "out gassing".

A 3. that an epoxy seal could not effectively eliminate "out gassing".

B 1. that placing the protection board into "wet" UWM-28 would keep it from flowing on a grade of 7%.

C 1. if warped protection board is used it should not be placed till the Gardox adhesive has cured for three to five hours and then it may not fully bond.

D 1. that P-100 is the desired protection board with the Protecto Wrap membrane.

D 2. that the inconsistant resistivity readings on the Protecto Wrap system may have been due to flaws in the membrane or the addition of the asphalt overlay.

E 1. that possible incompatability between Protecto Wrap and asphalt protection board, if such incompatability exists, could not be measured by the methods utilized in this study.