

OFFICE MEMORANDUM

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MICHIGAN
STATE HIGHWAY DEPARTMENT
JOHN C. MACKIE, COMMISSIONER

December 23, 1963

To: W. W. McLaughlin
Testing and Research Engineer

From: E. A. Finney

Subject: Application and First Inspection of Epoxy Sealers Between Concrete and Bituminous Wearing Surface of Approach Deck Spans on International Bridge at Sault Ste. Marie (B01 of 17034, C3). Research Project R-59 F-53(2). Research Report No. 446.

Transmitted herewith are 12 copies of epoxy sealer report by A. J. Permoda and his section for your review and subsequent distribution. The report is in compliance with your memorandum to me of August 30, 1963, which stated that as part of the experimental aspect of this application, the Bureau of Public Roads will receive copies of these inspection reports.

A suggested distribution in accordance with J. E. Meyer's letter to N. E. MacDougall of August 22, 1963 on the subject of American approaches to the International Bridge also would include Messrs. Meyer, Laird, Rathfoot, Nordgren, Anderson, and Eichen.

The report summarizes application details for the two epoxy sealers used on this project, and reports on the condition of the deck and the effectiveness of the epoxy treatments after one year's service, determined by the first annual inspection as requested in your memorandum.

As would be expected, it is a little early for an inspection to show visible evidence of advantages of use of the subject treatment. However, from conditions noted in the inspection we feel that the advantages of the subject treatment could be increased by the use of a top sealer over the bituminous overlay. The top sealer would tend to plug capillaries in the bituminous overlay, thereby reducing the inflow of water and brine to adhesion interface and subsequent spreading along the interface to break the overlay's adhesive bond. Use of top sealers on several bridge resurfacings is under observation by the Department, and in other States.

In accordance with instructions, subsequent annual inspections will be made and reported.

OFFICE OF TESTING AND RESEARCH

A handwritten signature in cursive script that reads "E. A. Finney".

E. A. Finney, Director
Research Laboratory Division

EAF:js

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To: E. A. Finney, Director
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Subject: Application and First Inspection of Epoxy Sealers Between Concrete and Bituminous Wearing Surface of Approach Deck Spans on International Bridge at Sault Ste. Marie (B01 of 17034, C3). Research Project R-59 F-53(2). Research Report No. 446.

During construction of the International Bridge in 1962, the Department decided to use an epoxy sealer between the concrete deck and the bituminous concrete wearing surface on the approach spans similar to the treatment used on U. S. and Canadian deck portions of the bridge. The Department had requested and obtained Bureau of Public Roads cooperation and participation in the sealer treatment.

This experimental treatment was intended to provide a moistureproof barrier and prevent penetration into the concrete of water and salt solutions, which in time filter through the bituminous wearing surface. The sealer was to reduce deterioration of deck concrete which might result from exposure to freeze-thaw cycles while wetted with entrapped water or salt solutions.

Deck concrete on the Michigan approach spans was of 7-in. uniform thickness and was laid over stay-in-place forms, as shown in Fig. 1. The bituminous wearing surface was 1-1/2-in. thick. The deck had a 1-3/4-in. crown and a 3.75-percent grade.

For evaluation purposes, the deck of the 28-ft wide approach spans was divided into three areas. The north portion of about 985 lin ft (Piers 18R to 12) was coated with polysulfide epoxy sealer conforming to Departmental Supplemental Specification for Epoxy Seal Coat and Emulsified Asphalt Tack Coat. This was identical to the sealer used on the U. S. portion of the bridge deck and similar to that used on the Canadian portion. About 1,000 lin ft (Piers 12 to 2) adjoining these spans on the south were coated with coal-tar-modified epoxy conforming to the Department's Proposed Specification for Resinous Bridge Deck Waterproofing Membranes. About 96 lin ft adjoining these spans still farther south (Pier 2 to abutment) were left uncoated for purposes of control or comparison.

E. A. Finney

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December 23, 1963

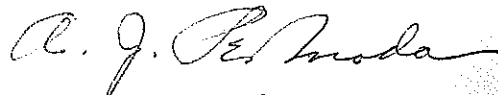
In accordance with W. W. McLaughlin's request and the Office of Construction outline of August 30, 1962, R. H. Merrill of the Research Laboratory Division observed application of the sealers between August 28 and September 15, 1962. This time interval for application of the sealers would have been significantly reduced under better weather conditions. Except for this delay, the application of the sealer was satisfactory, as reported by Mr. Merrill in the attached summary.

In accordance with W. W. McLaughlin's subsequent request of August 30, 1963, and in compliance with previous arrangements, the Office of Testing and Research arranged for the first annual inspection to check the condition of the deck and the effectiveness of the epoxy treatment.

R. H. Merrill and the writer made this inspection on November 20 and 21, 1963, accompanied by O. F. Eichen, District Maintenance Engineer, and D. Dell, Engineer of the International Bridge Authority. No photos were taken because of the prevailing rainy weather. After one year's service the deck with epoxy seal and bituminous surfacing had a good appearance, which actually should be expected. An underside inspection showed no leakage through the galvanized stay-in-place forms under the deck slabs, though there was some occurring at the joints and there had been some at drain outlets as evidenced by red staining at some of these locations. At the time of inspection, the drain inlets were plugged with metal plates caulked in place as per instructions in J. E. Meyer's letter of August 22, 1963.

Inspection of the top of the deck disclosed two transverse hairline cracks in the bituminous overlay, to be repaired, and about six small round breaks in the west tire track area near Pier 14, which had been repaired. There was evidence of slight lifting of the bituminous surfacing surrounding these repaired breaks, indicating the possibility of adhesion failure. Otherwise, the top of the deck looked good in all three test sections. These areas will be thoroughly examined in the next annual inspection to check on effectiveness of the epoxy treatment.

OFFICE OF TESTING AND RESEARCH



A. J. Permoda, Supervisor
Materials Research Section
Research Laboratory Division

AJP:js

Attachment

APPLICATION OF EPOXY SEALERS
ON INTERNATIONAL BRIDGE APPROACH SPANS

Application of the subject sealers was observed as per instructions. The contractor applying the sealers was C. L. Wolff & Sons, an industrial painting contractor from Benton Harbor, using a seven-man crew. The same contractor also applied the sealer on the U. S. portion of the bridge deck. Application of the epoxy sealer proceeded in the following chronological sequence:

1. August 28, 1962.

It was reported that a burlap drag was not used in finishing of the concrete deck, which accounted for the smooth textured surface. This surface was spot scraped and ground to remove any heavy mortar deposits. Laitance removal and etching were done with diluted muriatic acid as directed in the Surface Preparation requirement of Supplemental Specification for Epoxy Seal Coat. Accordingly, the applied acid was spread out by brooming, followed by flushing with clean water. The etching was started at pier 18R so that the flow would be obtained southward along the slope of the deck. About 4000 sq yd were completed on this date.

2. August 29, 1962.

- (a) Completed acid etching to pier 2 (Fig. 2).
- (b) Swept northern portion of deck to remove powderiness.
- (c) Began applying polysulfide epoxy (Desco PE 150) at pier 18R.

Area coated = 230 sq yd
 Sealer used = 20 gal
 Coverage = 11.5 sq yd per gal
 = 104 sq ft per gal
 Sand applied = about 460 lb

Grayco pumps and airless spray guns were used in the application, giving very little overspray. A truck transported the air compressor which provided air for cleaning and power for the stirrer and spray pumps, and also transported the polysulfide epoxy sealer packaged in 5-gal containers for both components. These were mixed in 1:1 ratio by volume for 5 minutes in 10 gal quantities before application. The pot life was 45 minutes for spraying consistency. Immediately after spraying, sand was broadcast by hand onto the surface at a rate of about 2 lb per sq yd to provide a mechanical interlock with the subsequent bituminous surfacing. An attempt to apply the sand by blast cleaning equipment was not entirely satisfactory and was abandoned. Due to rain and inclement weather, work was stopped until September 6.

3. September 6, 1962.

Resumed polysulfide epoxy application. The coverage was found to be thin in spots which would be resprayed later.

Area coated = 900 sq yd
 Sealer used = 70 gal
 Coverage = 12.8 sq yd per gal
 = 115 sq ft per gal
 Sand applied = about 1800 lb

4. September 7, 1962.

Continued polysulfide epoxy application to pier 12.

Area coated = 1933 sq yd
 Sealer used = 200 gal
 Coverage = 9.7 sq yd per gal
 = 87 sq ft per gal
 Sand applied = about 3870 lb

5. September 8, 1962.

(a) Resprayed thin spots in application of September 6.

Total test area coated, piers 18R to 12 = 3063 sq yd
 Total sealer used = 315 gal
 Coverage = 9.7 sq yd per gal
 = 88 sq ft per gal

The coverage gave a slightly heavier film than the 100 sq ft per gal specification requirement, and a check showed the applied sealer to have cured satisfactorily.

(b) Began application of coal-tar-modified epoxy sealer (Permalastic Guard Kote 140) at pier 2. Initial application was by Grayco airless spray equipment used above, but proved unsatisfactory because of the short pot life of the mixture and atomization problems. The next method was to apply the sealer by brooming, but this proved to be slow and expensive. It was then decided to obtain Pyles Duo Mix two-component spray equipment, as used on the Canadian part of the bridge.

6. September 14 and 15, 1962.

Resumed and completed application of two-component coal tar epoxy sealer using Pyles equipment, which worked satisfactorily.

Total test area coated (piers 12 to 2) = 3,120 sq yd

Total sealer used = 4,705 lb

Coverage = 1.5 lb per sq yd, which met specification requirement of 1-1/2 lb per sq yd (about 60 sq ft per gallon). Applied sealer is shown in Fig. 3.

As in the other sealer, sand was broadcast by hand, but at a rate of about 4 to 5 lb per sq yd.

Prior to application of the bituminous wearing surface, an emulsified asphalt tack coat was applied for the entire length of approach span deck in accordance with the requirement of the specification covering polysulfide epoxy sealer.

R. H. Merrill
2-15-63

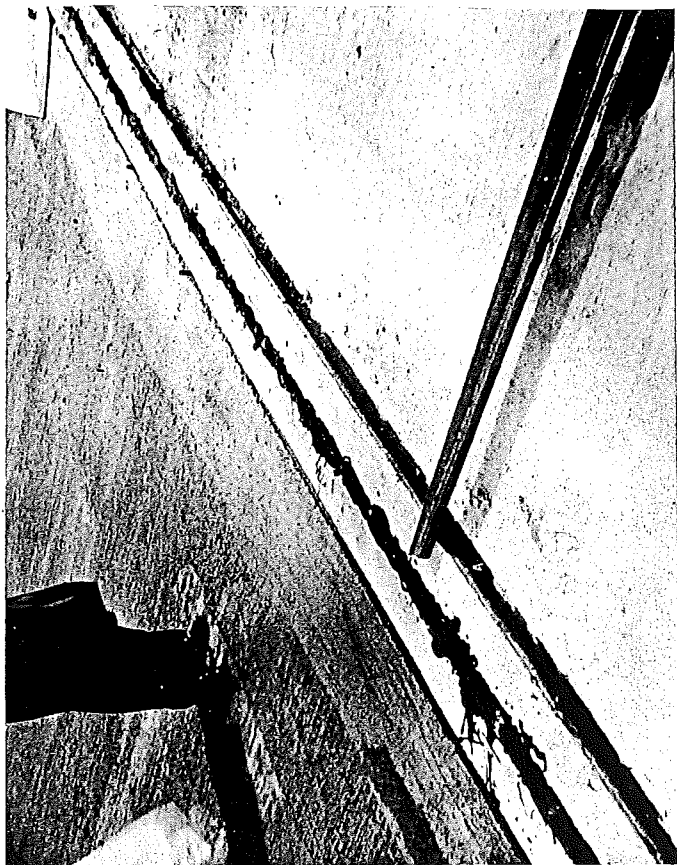


Figure 1 (upper left). Stay-in-place forms on bridge approach looking north toward spans over locks.

Figure 2 (upper right). Acid-etched deck above joint, ready for sealer application. Raised concrete at joint will abut bituminous wearing course to be placed in foreground.

Figure 3 (lower left). Coal-tar modified epoxy sealer application on left portion of approach deck. Excess sand on sealer was subsequently broomed off, prior to tack coat and overlay application.

