

OFFICE MEMORANDUM



MICHIGAN
DEPARTMENT OF STATE HIGHWAYS

February 14, 1974

To: L. T. Oehler
Engineer of Research

From: F. J. Bashore and A. W. Price

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Subject: Dow Two-Component Self Leveling Urethane Joint Sealant.
Research Project 71 NM-302. Research Report No. R-904.

Purpose

The initial phase of this project was to conduct a laboratory evaluation of an experimental two-component urethane joint sealant being developed by The Dow Chemical Company. At the request of Dow Chemical, the project was expanded to include an experimental field installation.

Laboratory Evaluation

The objective of the laboratory evaluation was to compare the physical properties of the material with our present supplemental specification (4-12-71) and to determine if the material had a low tensile modulus as claimed by the manufacturer.

The initial sample of material (submitted in 1971) met all the requirements of our specifications. The sample submitted prior to the field installation in 1973 did not meet all requirements of the specifications. The compression set was high (70 percent compared to a specified maximum of 35 percent) and the resilience recovery was low (60 percent compared to a specified minimum of 85 percent). In addition it was found that if the polyethylene foam filler (placed at the bottom of the cavity between the bond blocks) had open surface cells the sealant would adhere to the polyethylene causing a concentrated stress at the concrete faces, thus resulting in adhesion failure. Tests repeated using round foamed material with a smooth skin appeared to be satisfactory. Laboratory tests showed that the tensile modulus of the sample submitted was higher than that of a sample submitted by another manufacturer.

Field Evaluation

The Maintenance Division selected two bridges for experimental installations. The maintenance crews sandblasted the concrete joint faces, cleaned the joint with forced air, installed the polyethylene rope filler, and poured the material. Dow Chemical representatives inspected the joint, primed the joint faces, and mixed the two-component material.

S06 of 63022 I 96 under Beck Road (Novi)

The center joint on this structure was sealed on October 16, 1973 with an air temperature of 51 F and a deck temperature of 59 F. The average joint width of the west three lanes was 1.910 in. For the most part, the sealant was 1 in. deep and the surface was 1/4 in. below the surface of the deck. The design movement of this joint was zero, but due to partial failure of the joints on either side, it was acting as an expansion joint.

On December 17, 1973 the joint was inspected and measurements were taken. At the time of the inspection the sealant in the roadway area had failed nearly 100 percent in adhesion (Fig. 1). The sidewalk area appeared to be completely sealed but further investigation showed that only the top 1/4 in. or less of the sealant still adhered to the concrete. A section was cut out of the sealant and filler for examination. The sealant was still bonded to the filler, thus causing a high stress build-up at the joint wall area resulting in adhesion failure (Fig. 2). It was also noted that there was a large number of gas pockets along the wall area, but very few in the internal portion of the sealant (Fig. 3). These may be caused by either water vapor from the concrete or by solvent from the primer.

A check of the temperatures recorded every three hours in that area between October 16 and December 17 indicates that during the first 48 hours after installation, the joint should not have opened more than 6 percent and the maximum opening during the two month period would have been about 19 percent on the west three lanes. The east lane has moved considerably more at this joint. Apparently the joints on each side of this joint are not working in this lane.

B02 of 55051 NB US 25 over the Clinton River (Mt. Clemens)

The selected joint on this structure was sealed on October 17, 1973, with an air temperature of 51 F and a deck temperature of 60 F. The average joint width was 1.954 in. and the sealant was poured 1 in. deep with the surface 1/2 in. below the surface of the deck. The joint had a design movement of zero but has experienced some movement in the past.

The joint was inspected on January 3, 1974. Our inspection and measurements indicate that the joint is not moving at this time and the sealant appears to be in excellent condition.

Conclusions

From our laboratory tests and field evaluation it appears that this material does not offer any advantages over the two-component materials we are pre-

sently using. It does have a disadvantage in that it adheres too well to the polyethylene foam filler which is also supposed to be a bond breaker.

TESTING AND RESEARCH DIVISION

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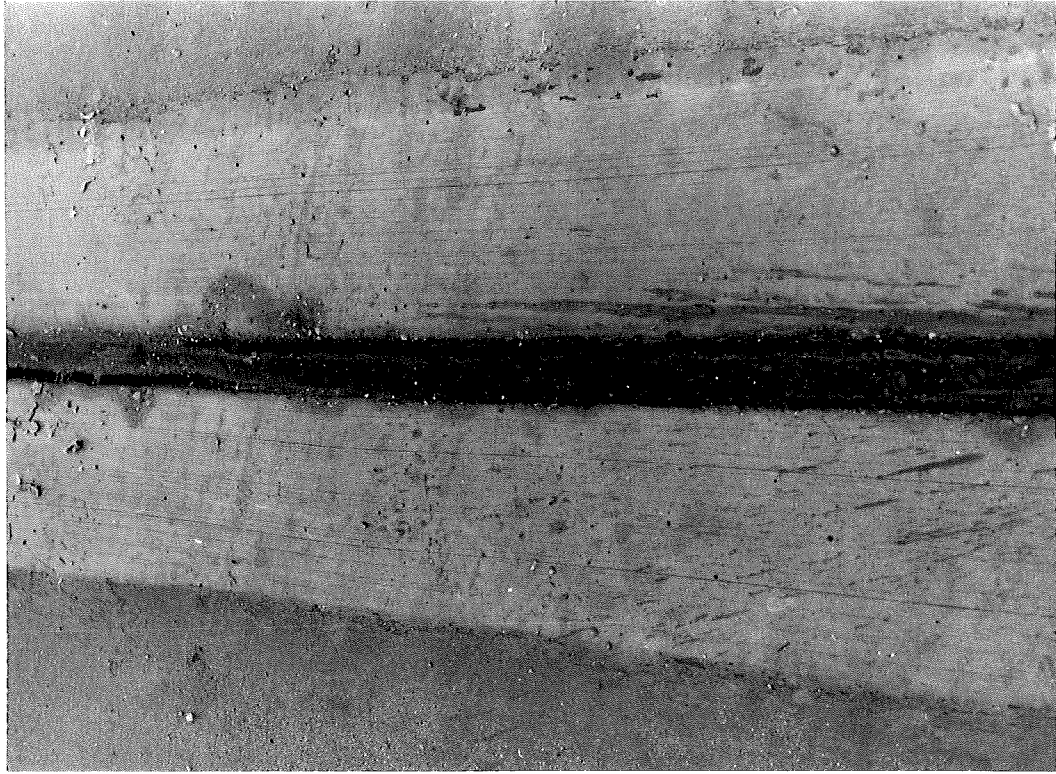
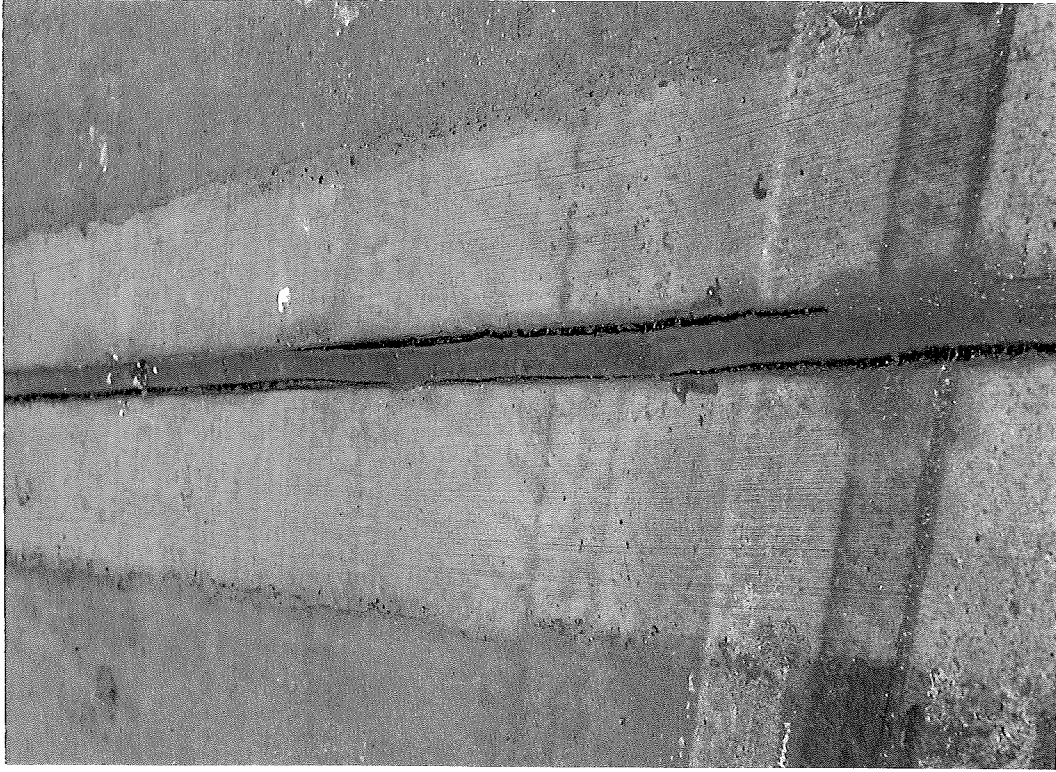


Figure 1. Adhesion failure of subject sealant on S06 of 63022.

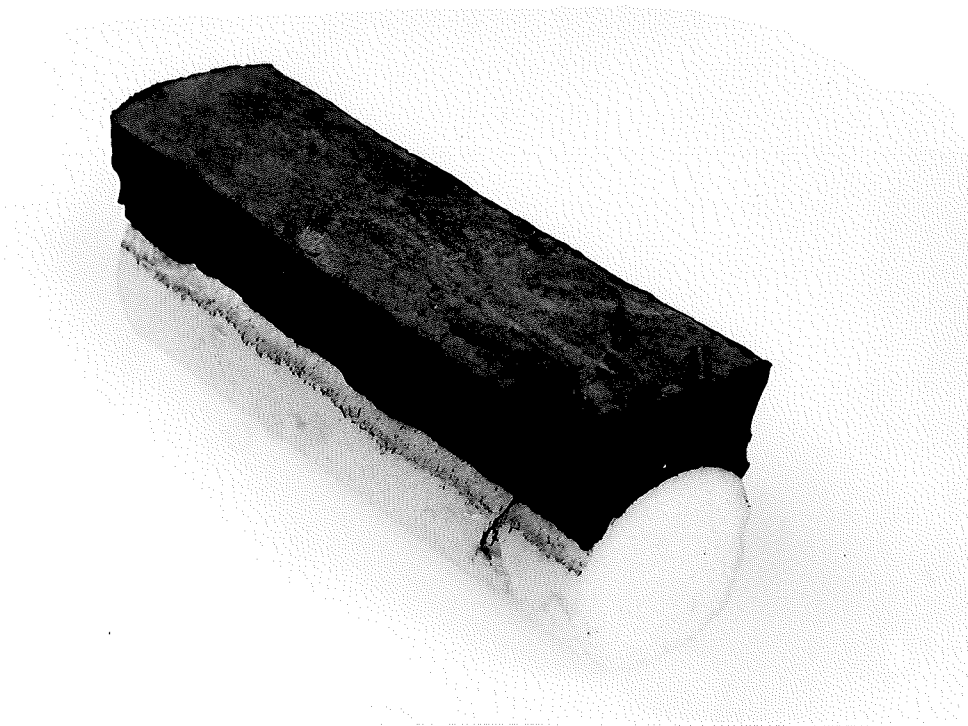


Figure 2. Polyethylene bonded to the two-component polyurethane.

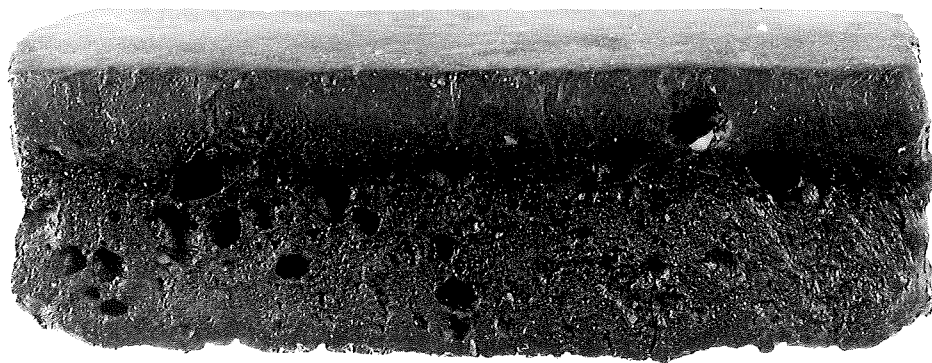


Figure 3. Gas pockets along the wall of the sealant.