

OFFICE MEMORANDUM



MICHIGAN

DEPARTMENT OF STATE HIGHWAYS

August 10, 1971

To: L. T. Oehler
Engineer of Research

From: C. J. Arnold

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Subject: Pull-Out Tests of Adiprene-Coated Dowel Bars. Research Project
71 TI-32. Research Report No. R-782.

This report covers pull-out testing of Adiprene-coated dowel bars, submitted by the D. S. Brown Company. The program has been completed in a cooperative effort by the Research Laboratory's Concrete and Structures Groups.

Coatings

Adiprene is a polyurethane elastomer that is reported to possess a unique combination of hardness, resilience, and load bearing capacity. Typical properties for the coating material include Shore hardness of 70-D; tensile strength of 8,000 psi; elongation at break, 270 percent; and a specific gravity of 1.20, according to information supplied by the vendor. The coating supplied was transparent. The Adiprene coating thickness was approximately 0.010 in., and there was a slight amount of rippling of the coating on the bars furnished for this evaluation.

Test Procedure

Four concrete test blocks 9 by 9 by 12 in. were cast, each containing one bar. The bars were nominal 1-1/4 in. diameter, 18-in. long. Ends were sawed to eliminate the effect of shear deformations. Embedment depth was 9 in. A special fixture was used to maintain dowel alignment perpendicular to the block face (Fig. 1).

Concrete cylinders were cast along with the test blocks for determination of strength. Compressive strength of the concrete was approximately 6,000 psi at the time the bars were pulled.

Pull-out testing was done on a Universal testing machine; a dial gage was used to indicate relative movement between the bar and block (Fig. 2). Bars were pulled out a total of 1/2 in. in each test. No-load machine speed was approximately 0.030-in./min. None of the blocks was damaged during the tests.

Results

The maximum pull-out resistance developed by the Adiprene coated bars ranged from 7,600 to 9,800 lb. Average pull-out resistance varied from 7,300 to 9,100, (determined by averaging the load values at 0.1-in. increments of pull-out).

Discussion

Previous pull-out tests, conducted in the same manner as the subject tests, were reported in Research Report No. R-659, and in a letter of December 10, 1968. The previous results indicated maximum pull-out loads of 100 to 250 lb for asphalt-coated saw-cut bars; 380 to 450-lb for plastic coated saw-cut bars; 1,250-lb for asphalt-coated, shear-cut bars; and about 5,000 lb for shop-painted shear-cut bars.

Comparison of the previous results noted above with the results of this experiment indicates that the Adiprene coating, as applied, causes unusually high pull-out capacities. Apparently this was due, at least in part, to the rippled coating. Once cast in the block, the strength of the coating prevents easy deformation of the coating during pull-out. Strong, durable coatings are desirable for dowels, but a smooth cylindrical surface is required to allow the coated bar to move freely in the hardened concrete. Also, if concrete forms a strong bond with the coating, some sort of bond breaker would be required.

Conclusion

Adiprene coated dowel bars of the type submitted for this evaluation, should not be permitted for use in concrete pavement joints. While the material used in coating the bars may be suitable for such use, if properly applied and treated, the methods used in preparing the test bars were not adequate.

TESTING AND RESEARCH DIVISION



Physical Research Engineer
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CJA:bf

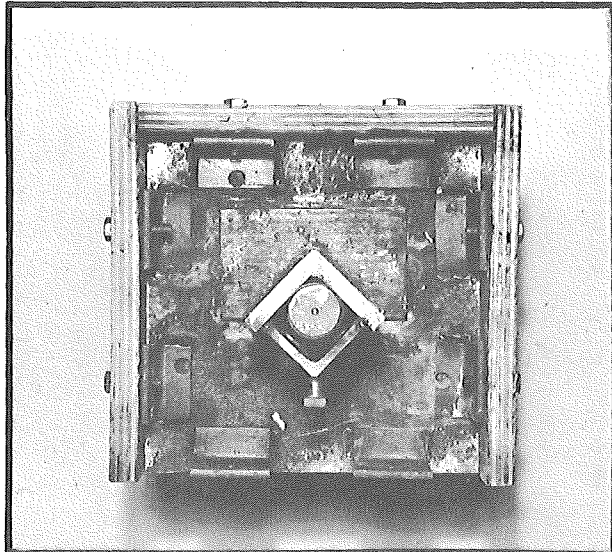
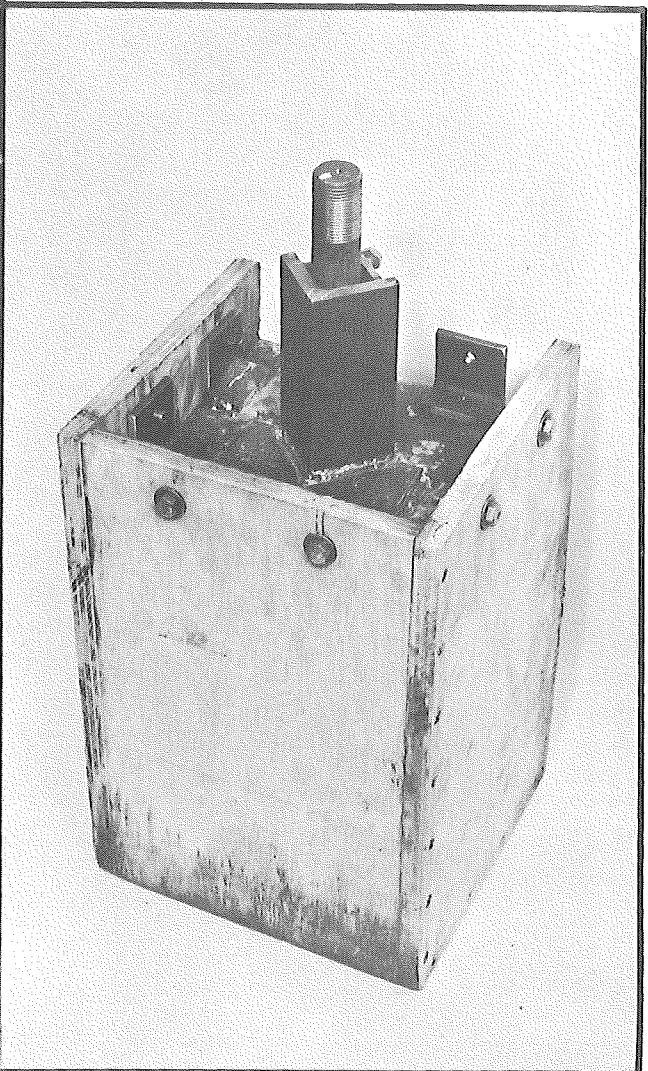
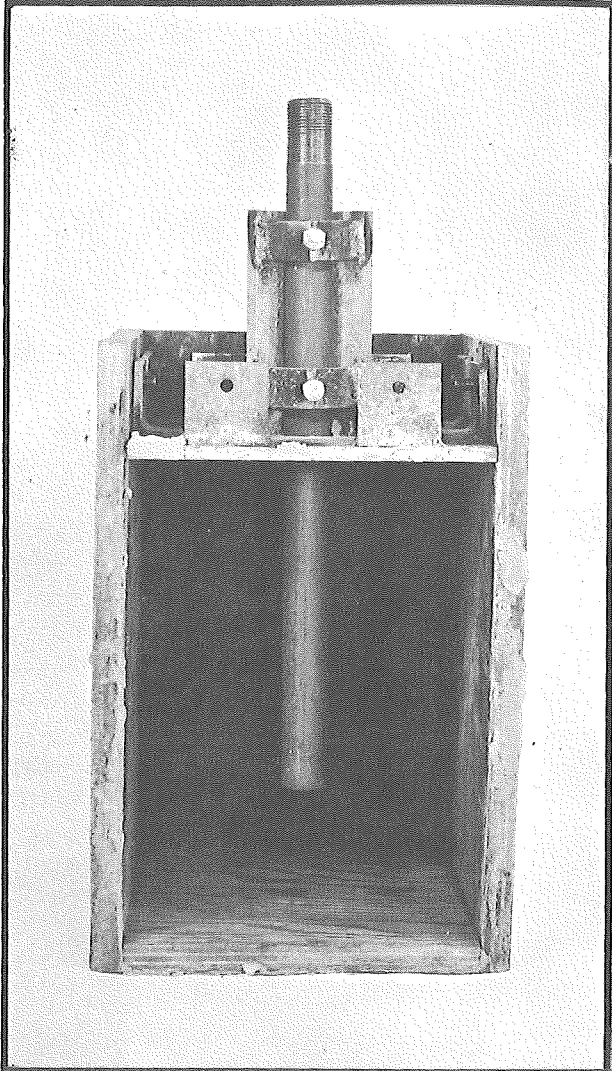


Figure 1. Test block forms showing dowel-locking fixture.



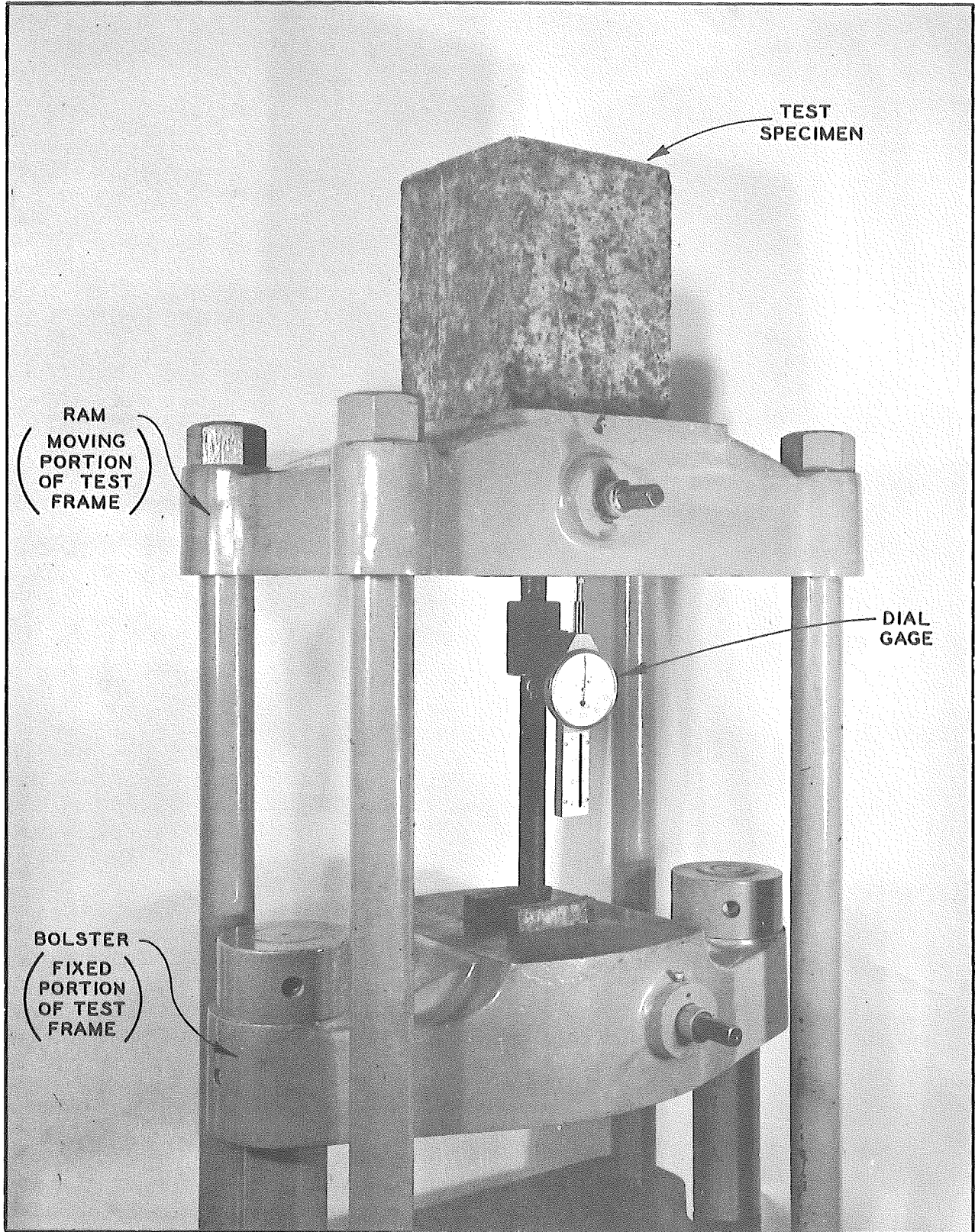


Figure 2. Pull-out test equipment.