NATIONAL BUREAU OF STANDARDS REPORT

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WATER PERMEABILITY OF HYDROCIDE COLORCOAT COATINGS APPLIED TO CONCRETE MASONRY

By

E. J. McCamley

Report to

Office of the Chief of Engineers
Department of the Army

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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Abstract

The water permeability of coatings of a resin base paint known as Hydrocide Colorcoat was determined. The coatings were applied both by spraying and brushing to walls of rough-textured concrete masonry. A sprayed coating of Colorcoat applied at a rate of 5.4 gal/100 ft^2 (19 ft^2/gal) postponed but did not prevent the appearance of visible water on the back of the wall. The wall was rated Very Poor before treatment and Poor after treatment. Another wall of similar construction having two brushed coatings of Colorcoat applied at a rate of 3.0 gal/100 ft^2 (34 ft^2/gal) was given a rating of Good to Excellent following the treatment.

1. INTRODUCTION

The resin base paint selected for testing by the Office of the Chief of Engineers, Department of the Army, Washington, D. C. was Hydrocide Colorcoat, manufactured by L. Sonneborn Sons, Inc. A test of different materials was requested in a letter dated November 23, 1954, reference ENGES, signed by H. B. Zackrison, Sr., Chief, Engineering Division, Military Construction.

A sample of Hydrocide Colorcoat was shipped to the National Bureau of Standards by the L. Sonneborn Company and arrived February 4, 1955. Two company representatives came to the National Bureau of Standards to supervise the application of the spray coating to a test wall. The coating was applied to a concrete masonry test wall of a known permeability (Wall E-1). After treatment, the permeability was again measured. The observed change in the permeability of

the wall, resulting from the treatment, was used to measure the ability of the coating to resist the penetration of a wind-driven rain.

A second concrete masonry wall (Wall D-13) was brush-coated at the request of the representatives of the company to demonstrate the brushability of the material as compared with its sprayability. Wall D-13 had not, previous to the application of the coating, been tested to determine its permeability untreated. However, it was constructed at the same time, using the same material as several other test walls which had been tested untreated and it could be presumed to have a similar rating of Very Poor.

2. DESCRIPTION OF MATERIALS AND METHODS OF APPLICATION OF HYDROCIDE COLORCOAT

2.1 Hydrocide Colorcoat

A 5-gal can of Hydrocide Colorcoat was supplied to the National Bureau of Standards by the manufacturer.

Directions printed on the container recommended that the surface to which the paint was to be applied be thoroughly dry and free from dust and soot. Brush coatings should be applied in such a manner as to flow the material on the wall and not brush it excessively. It was recommended that Colorcoat be used as it comes in the can, although in cool weather one half pint of mineral spirits or turpentine could be added to each gallon. It was claimed that one application of Colorcoat would give a durable film using the following recommended coverages:

Rough surfaces, concrete masonry units:
60 to 75 ft^2/gal.

Smooth surfaces, brick, cast concrete, etc.:
75 to 90 ft^2/gal.

The weight of the Hydrocide Colorcoat was found to be 11.08 lb/gal.

2.2 Test walls

A concrete masonry test wall (E-1), approximately 8-in. thick, 40-in. long, and 50-in. high, was built to accommodate the testing of the sprayed application of this material. The concrete hollow load bearing units were of nominal 8- by 12- by 8-in. size and met the requirements of Federal Specification SS-C-621, type I. The mortar contained 1:0.25:3 parts by weight of high-early-strength cement, hydrated lime and mortar sand. The wall was highly permeable and the workmanship used in its construction was that commonly used in concrete masonry buildings.

The second concrete masonry wall (D-13) was constructed some years ago when other permeability tests were being made, and which never was tested prior to the tests described in this report. This wall was of the same approximate dimensions as wall E-1 and was made of hollow concrete load-bearing units. The mortar contained 1:1:6 parts by volume of portland cement, hydrated lime and damp sand.

Both walls were similar to the test walls described in Report BMS95, "Tests of cement-water paints and other waterproofings for unit-masonry walls." There were no unsightly cracks or openings in the face of the walls.

2.3 Application of coatings

The spray coating was applied to the test wall E-1 in a manner similar to actual spraying jobs done in the field. A commercial painter from the Edward W. Minte Company, Washington, D. C., hired by the manufacturer, applied the coating under the supervision of their representatives. The spraying equipment used was standard commercial equipment.

The face of the wall to be sprayed was clean and dry before the application. A quart of turpentine was added to the 5-gal can of Colorcoat to facilitate spraying. The wall was sprayed two times from the bottom to the top, then around the edges. At the painter's suggestion, spraying was stopped for a few minutes in order to let the paint set a little. Upon inspecting the wall, it could be seen that the paint had not filled the voids in the face of the wall, and that the paint around the edges was very thick and had started to lap. After about 8 minutes the painter, using just the air stream from the gun, tried to even out this excess paint and to fill the voids. More paint was then sprayed on the wall and again air

was used to even out the coating. After the application, it was noted that the wall had a very heavy coating of paint although voids could still be seen that were not filled with paint. The rate of coverage of the sprayed application was 19 ft^2/gal. This was about three times the amount recommended by the manufacturer. The treated wall was stored indoors for seven days before testing for permeability to allow plenty of time for the coating to dry.

The brush coating was applied to wall D-13 by the company's representative using a 7-in. whitewash brush dipping it directly into the 5-gal container. The coating seemed to brush easily and no special effort was made by the representative to scrub the coating into the wall. Voids could also be seen in the face of this wall at the conclusion of the application. The rate of application was 56 ft^2/gal, which is approximately that recommended. The wall was stored indoors for one day before testing at the recommendation of the representatives.

After wall D-13 was given a permeability test resulting in a rating of "Poor," it was decided to give the wall another brush coating to see if this would improve the rating. The same brush was used and again no special effort was made to scrub in the coating. However, pains were taken to fill all voids by allowing the paint to flow into them. The rate of application of the second brush coating was 84 ft^2/gal. The wall was allowed to set two days before being tested again. The combined rate of coverage for the two brush coatings was 34 ft^2/gal.

3. DESCRIPTION OF WATER PERMEABILITY TEST

The test exposures were as described in Report BMS95 and simulated an exposure to a heavy rain driven by a 50-mph wind.

3.1 Test apparatus and procedure

The exposed face of a test wall formed one side of a pressure chamber. Water at the rate of 40 gal/hr was applied to the top of the exposed face from a tube containing a line of small perforations spaced 3/4 in. apart. The air pressure on the exposed face was maintained at 10 lb/ft^2 above atmospheric pressure, equivalent to a hydrostatic head of 2 in. The tests were continued for a minimum of one day.

3.2 Definition of permeability test ratings

The water permeability test ratings are listed below:

Excellent (E) - No water visible on back of the wall (above the flashings) at the end of 1 day. Not more than 25 percent of the wall area damp at the end of 3 days. No leaks 1/ through the wall in 3 days.

Good (G) - No water visible on the back of the wall at the end of 1 day. Less than 50 percent of the wall damp at the end of 1 day. No leaks through the wall at the end of 1 day.

Fair (F) - No water visible on back of the wall during first 3 hours, but visible at the end of 1 day. The rate of leakage through the wall less than 1 liter/hr at the end of 1 day.

Poor (P) - Water visible on back of wall in 3 hr or less and at the end of 1 day. Rate of leakage through the wall less than 5 liter/hr at the end of 1 day.

Very Poor (VP) - Rate of leakage through the wall equal to or greater than 5 liter/hr at the end of 1 day.

Water-resistant coatings applied to permeable concrete masonry should preferably have permeability ratings of Good or Excellent.

Coating rated as Fair may possibly be considered to have a satisfactory resistance except when subjected to rain and to winds of high velocity.

Coatings rated as Poor or Very Poor would be expected to have an unsatisfactory resistance to the penetration of wind-driven rain.

1/ Leaks are defined as follows: A leak is a flow of water from one or both flashings, the combined rate of flow being equal to or greater than 0.05 liter/hr.

4. TEST DATA AND DISCUSSION OF TEST RESULTS

4.1 Permeability of the untreated walls

The test data obtained from tests of the spray-coated wall E-1 before and after treatment are listed in Table 1. It may be noted that the wall was highly permeable before treatment, and rated as Very Poor. The wall became wet on the back in about 4 minutes after the test was started and the maximum observed leakage was 47 liter/hr.

No preliminary data were available on the brush-coated wall D-13 before treatment.

4.2 Permeability of the spray coating of colorcoat

Throughout the test the face of the wall E-1 was highly repellent and the water ran down the face of the wall in separate streams. However, some of the water did penetrate the face of the wall and showed as dampness on the back of the wall in about 8 minutes after starting the test. Visible water appeared on the back of the wall above the upper flashing in about 35 minutes. This visible water remained throughout the test although it did not run or flow from the flashing. Visible water also appeared on the lower flashing about 5 hr after starting the test although this water did not flow from the lower flashing. The dampness on the back of the wall increased throughout the test and covered about 40 percent of the wall's area at the end of the test. The leakage was stopped by the spray coating of Colorcoat although it did permit some water to penetrate. The damp area was reduced a little more than half compared to the untreated wall. The wall was considered permeable and was rated as Poor.

4.4 Permeability of two brush coatings of Colorcoat

The face of the wall D-13 was highly repellent to water which ran down the face of the wall in separate streams throughout the test. Some water did penetrate the face of the wall, although it took a much longer time than when only one brush coating was applied. The time required for the dampness to appear was 2 1/4 hours from the start of the test. No visible water appeared on the back of the wall nor was any present at the end of the test. The damp area was reduced as

compared with the test of the one brush coating to 5 percent of the area of the back of the wall. This wall was considered water repellent and was rated Good to Excellent.

5. CONCLUSIONS

A spray coating of Colorcoat applied liberally (19 ft^2/gal) to a clean, dry face of a rough-textured concrete masonry test wall, postponed but did not prevent the appearance of visible water on the back of the wall. The test wall was rated Very Poor before treatment and Poor after treatment.

One brush coating of Colorcoat applied to a clean, dry face of a rough-textured concrete masonry wall, at approximately the recommended rate of coverage (56 ft^2/gal) probably would reduce but not stop the leakage of water through the wall. The test wall was rated Poor.

Two brush coatings of Colorcoat applied to the same test wall at a combined rate of coverage of 33.6 ft^2/gal (as against a rate of 60 ft^2/gal recommended by the manufacturer), did prevent leakage and visible water from appearing through the wall. The wall was rated Good to Excellent.

In the case of both the sprayed and the single brush coating, the paint did not fill the voids in the face of the wall. It was noted that pin holes were present in both coatings, although to what extent these holes allowed water to penetrate could not be determined.

After applying a second brush coating to the wall and filling most of the voids, much better results were obtained. Pin holes also developed in the second coating but the apparent backing up by the first coat prevented the water from going through the coating to any great extent.

Table 1. Water permeability test data

Wall No.	Condition of wall	Duration of test	Time to failure as indicated by: Damp on back	Visible water on back	Flashing leak	Maximum rate of leakage	Area damp at end of test	Rating
		day	hr	hr	hr	l/h	percent	
E-1	Before treatment	1	0.03	0.07	0.12	47.0	90	Very poor
	Spray-coated with Colorcoat	1	0.13	0.58	None	None	40	Poor
D-13	Before treatment	-	--	--	--	--	--	--
	One brush coating of Colorcoat	1	0.19	0.22	0.23	3.0	35	Poor
	Two brush coatings of Colorcoat	1	2.25	None	None	None	5	Good to Excellent 1/

1/ Wall tested for 1 day only although it could be presumed that the damp area would be less than 25 percent at the end of 3 days.

Table 2. Coverages

Method of application	Coverage	Coverage
	gal/100 ft^2	ft^2/gal
Sprayed	5.4	19
Brushed 1st coating	1.8	56
Brushed 2nd coating	1.2	84
Combined brushed coating	3.0	34

THE NATIONAL BUREAU OF STANDARDS

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