

INSTALLATION REPORT

USE OF HYDRATED LIME AS AN ANTISTRIPPING ADDITIVE

by

G. W. Maupin, Jr.
Research Scientist

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

Virginia Highway and Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the Virginia
Department of Highways & Transportation and
the University of Virginia)

In Cooperation with the U. S. Department of Transportation
Federal Highway Administration

Charlottesville, Virginia

February 1983

VHTRC 83-R26

BITUMINOUS RESEARCH ADVISORY COMMITTEE

- A. D. BARNHART, Chairman, District Materials Engineer, VDH&T
J. D. BARKLEY II, Resident Engineer, VDH&T
P. F. CECCHINI, District Engineer, VDH&T
J. L. CORLEY, District Engineer, VDH&T
W. R. DAVIDSON, Assistant Maintenance Engineer, VDH&T
R. J. DAVIS, Area Engineer, FHWA
C. E. ECHOLS, Asst. Prof. of Civil Engineering, U. Va.
R. J. GIBSON, Resident Engineer, VDH&T
W. L. HAYDEN, Asst. Materials Engineer, VDH&T
C. S. HUGHES III, Highway Research Senior Scientist, VH&TRC
A. B. JOHNSON, Assistant Construction Engineer, VDH&T
J. T. LOVE, Materials Engineer, Materials Division, VDH&T
T. W. NEAL, JR., Chemistry Lab. Supvr., Materials Div., VDH&T
R. D. WALKER, Chairman, Dept. of Civil Engineering, VPI & SU

SUMMARY

The purpose of this investigation is to evaluate the effectiveness of hydrated lime as an antistripping additive in several test sections. The two sections installed in 1982 contain S-5 surface mixes with (1) hydrated lime, (2) a chemical additive, and (3) no additive. Stripping tests on the mixes have predicted that those containing hydrated lime are less susceptible to stripping than the identical mixes with conventional chemical additives. The construction of at least two additional test sections is planned for 1983.

1666

INSTALLATION REPORT

USE OF HYDRATED LIME AS AN ANTISTRIPPING ADDITIVE

by

G. W. Maupin, Jr.
Research Scientist

PURPOSE AND SCOPE

In Virginia chemical antistripping additives are used in most hot plant mix containing non-carbonate aggregates. Although chemical additives provide short-term benefits there is some doubt concerning their long-term effectiveness.^(1,2) Because an alternative additive, hydrated lime, has been used with apparent long-term success by some states, this study was undertaken to determine, on a limited basis, whether the addition of hydrated lime might be beneficial to mixes produced in Virginia. Test sections of asphaltic concrete containing hydrated lime have been installed and their performance is being evaluated through stripping tests and periodical observations. This investigation is supplementary to an extensive laboratory study that is in progress at the Research Council but is being financed and reported upon separately.

TEST SECTIONS

While it was planned that four test sections would be placed, only two could be installed during the 1982 construction season. These installations are described below.

Installation No. 1

On installation no. 1, S-5 surface mixes were placed in a 1.4 in. (36 mm) thick lift on the eastbound traffic lane of Route 58 east of Martinsville by APAC-Virginia, Inc. The sources of materials are listed in Table 1 and the target gradation and asphalt content in Table 2. As noted in Figure 1, the installation comprised a section of S-5 containing a chemical additive, one with hydrated lime, and one with no additive. There was no difference in the appearance of the three mixes.

The mix containing a chemical additive was placed on June 9, 1982. With rain having prevented paving on June 10, the mixes containing no additive and the one with hydrated lime were placed on June 11.

Table 1. Amounts and Sources of Materials

Installation No. 1

50%	#8 crushed granite	Martinsville Stone, Fieldale
20%	stone sand	Martinsville Stone, Fieldale
30%	#10 crushed granite	Martinsville Stone, Fieldale
1%	hydrated lime	Virginia Lime Co., Kimballion
5.9%	AC-20 asphalt cement	Amoco, Chesapeake
0.5%	Pave Bond special additive	

Installation No. 2

75%	S-5 blend crushed granite	Jack Quarry, Petersburg
25%	sand	Lone Star (Puddledock Farm) Petersburg
1%	hydrated lime	Virginia Lime Co., Kimballion
6.1%	AC-20 asphalt cement	Exxon & Chevron, Richmond
0.5%	Kling Beta XP-251 additive	

Table 2. Target Mix Gradation and Asphalt Content

<u>Sieve</u>	<u>Percent Passing</u>	
	<u>Install. No. 1</u>	<u>Install. No. 2</u>
1/2	100	100
4	53	65
30	20	27
200	6	5.5

Asphalt content, %	5.9	6.1

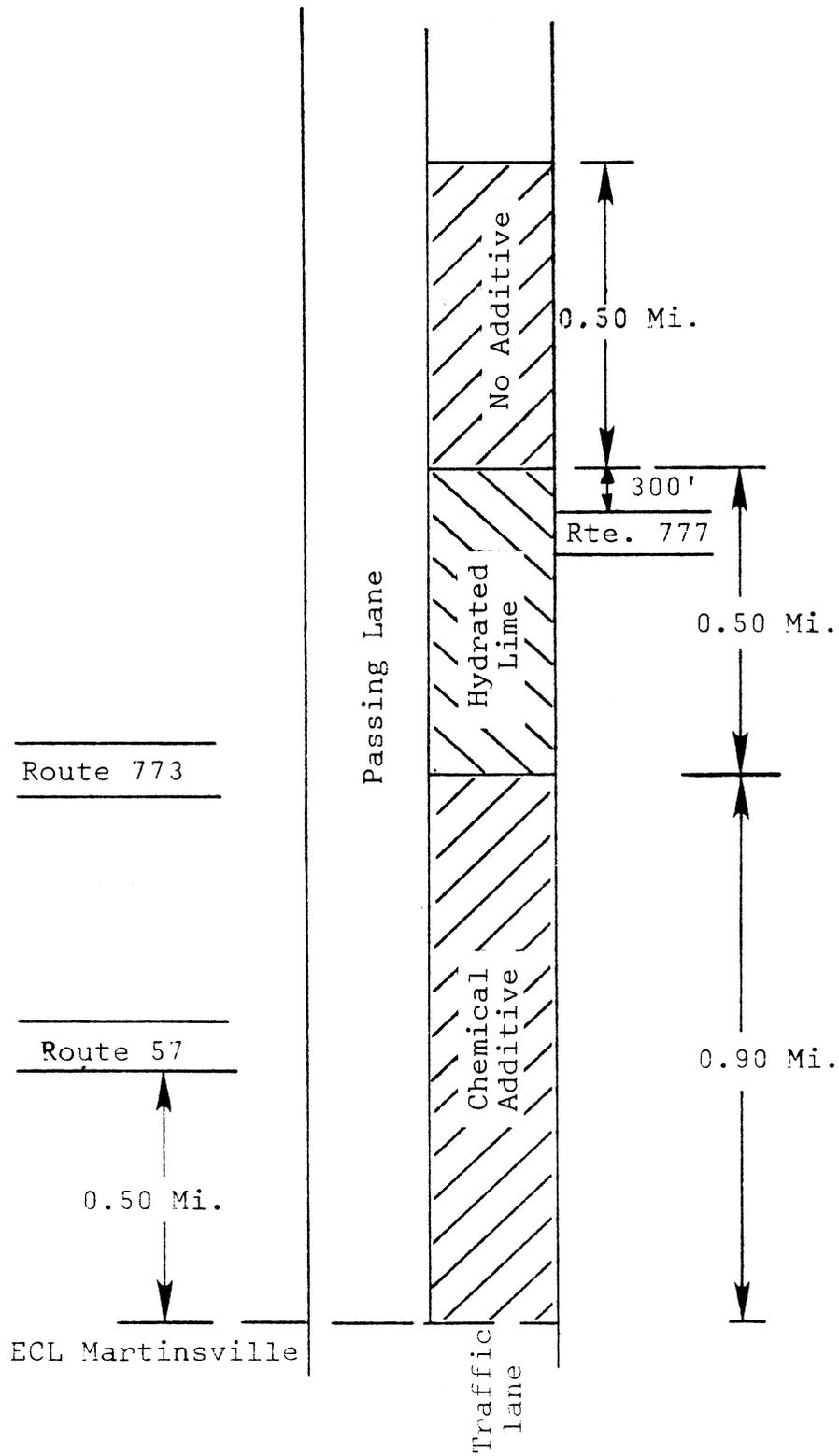


Figure 1. Installation No. 1 - eastbound lane of Route 58.

One 50-lb. (22-kg) bag of hydrated lime was added to each 5,000 lb. (2.3-Mg) batch of mix by two workers through a hole in the pugmill. The batch was dry mixed for 5 seconds and then wet mixed for 30 seconds. The 30-second wet-mix time was adopted when some uncoated aggregate particles were observed in the mix after 25 seconds of wet mixing.

No problems were encountered in placing and compacting the mixes over the existing slurry seal surface, which was moderately to severely cracked.

Installation No. 2

On the second installation, the mixes were placed in a 1.1 in. (28 mm) thick layer on July 28 and 29, 1982, by the Short Paving Company, Inc. The installation is on Route 600 between the Appomattox River and 0.1 mi. (0.2 km) west of Route 226 (Figure 2). As for installation no. 1, the sources of materials are listed in Table 1 and the target gradation and asphalt content are listed in Table 2. Although it would have been desirable to use the same brand of asphalt for all mixes, it was necessary for the contractor to purchase asphalt with no additive from Exxon and asphalt with 0.5% chemical additive from Chevron. Two tankers of the Exxon asphalt cement were used for the lime mix and the mix with no additive.

The lime (1%) was added using the same procedure that was used on installation no. 1. The contractor used a 40-second dry-mix cycle and a 25-second wet-mix cycle.

The existing plant mix surface had numerous skin patches, but the paving operations went smoothly with no problems. Again, there was no difference in the appearance of the three mixes.

TEST RESULTS

Voids

Slabs were cut from the pavements after they had cooled, and the voids were determined immediately by Department district personnel for installation no. 1, and subsequently in the Research Council laboratory for installation no. 2 (Table 3). The value of voids for the mix with no additive from installation no. 2 appears suspect because the mix containing a chemical additive and the one with hydrated lime had considerably lower voids yet there was no difference in the appearance of the mixes, loose or compacted.

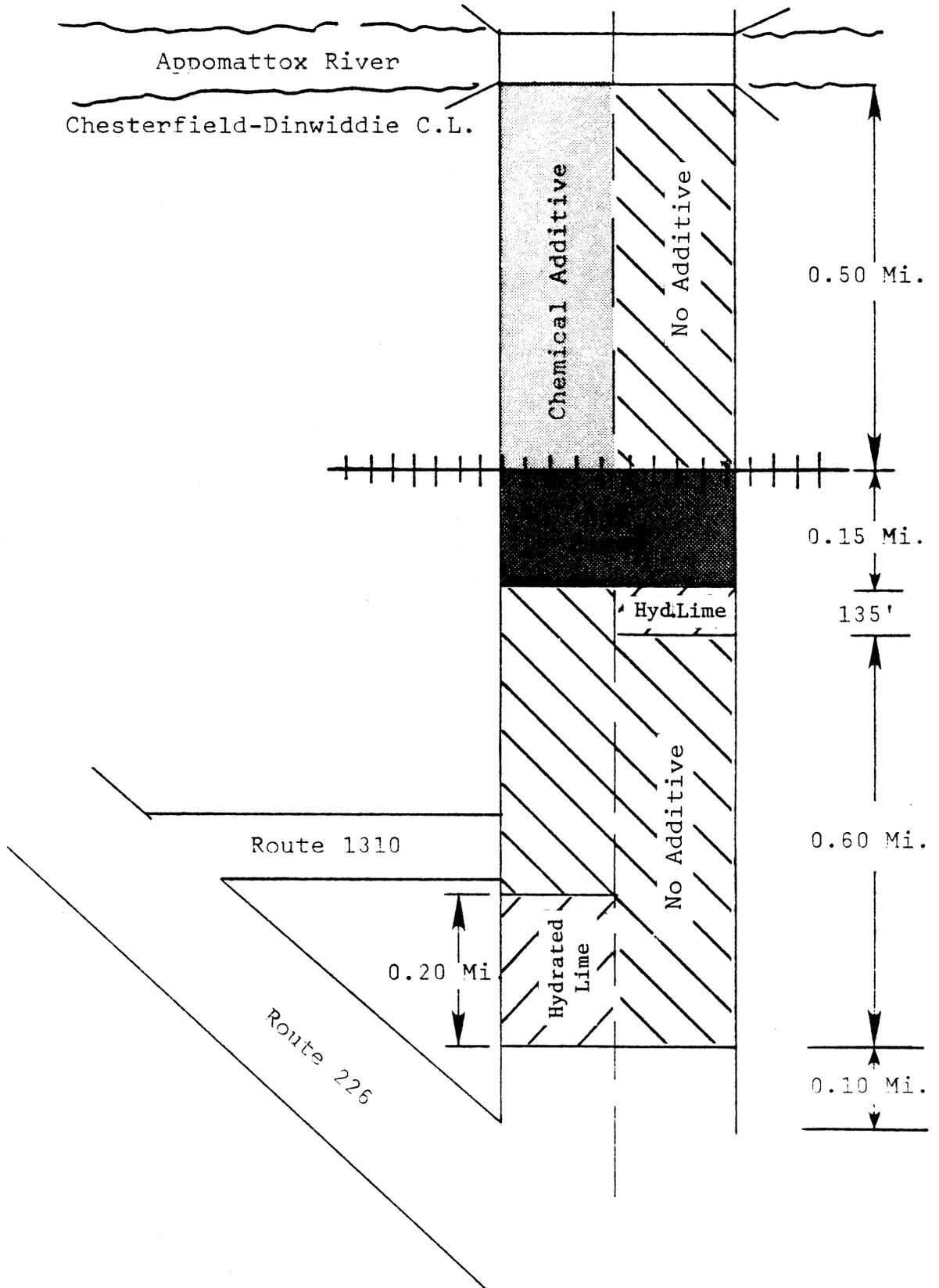


Figure 2. Installation No. 2 - Route 600.

Table 3. Average Pavement Voids, percent
(Average of 4 Slabs)

<u>Mix</u>	<u>Install. No. 1</u>	<u>Install. No. 2</u>
No additive	7.2	12.5
Chemical additive	8.8	6.9
Lime	6.6	5.0

Asphalt Recovery

Utah has reported that mixes containing hydrated lime were found to harden at a slower rate than mixes with no lime.^(3,4) Consequently, viscosity and penetration tests were performed on asphalt recovered from pavement samples obtained immediately after construction, and the results (Table 4) will be compared with those of future periodic tests to determine the influence of hydrated lime on the hardening rate. A decrease in the hardening rate could result in an increase in pavement life.

Stripping

Stripping tests were performed on samples of the mixes obtained during construction of the test sections. The results, illustrated in Figure 3, predict that both mixes containing lime are less susceptible to stripping than identical mixes with conventional chemical additives. The chemical additive benefited the mix on installation no. 1; however, there was only a very slight increase of the tensile strength ratio when it was added to the mix on installation no. 2.

FUTURE WORK

As mentioned previously, only two test sections could be installed in 1982. It is anticipated that at least two additional sections will be placed and tested during the 1983 construction season. Samples approximately 1 year old will be obtained from the sections installed in 1982, and the asphalt recovered and its physical properties determined. Performance and any indication of stripping will be determined visually. At that time, a progress report will be submitted.

No additional funds or time extension for this study is anticipated at this time. The amount appropriated for the 1982-83 fiscal year was \$18,000. Expenditures to December 1, 1982, totaled approximately \$10,611.49, leaving a balance of approximately \$7,388.51.

Table 4. Asphalt Properties

Install.	Sample	Viscosity at 140°F. (60°C.),		Viscosity at 275°F. (135°C.),		Pen., mm
		poises	poises	poises	poises	
No. 1	*Asphalt (chemical additive)	—	—	—	—	—
	*Asphalt (no additive)	—	—	—	—	—
	Mix (chemical additive)	6,020		730		51
	Mix (no additive)	4,880		670		59
	Mix (hydrated lime)	4,460		640		61
No. 2	Asphalt (chemical additive)	1,750		390		83
	Asphalt (no additive)	1,820		410		76
	Mix (chemical additive)	4,010		670		51
	Mix (no additive)	4,770		620		51
	Mix (hydrated lime)	4,500		600		50

*No tests were possible.

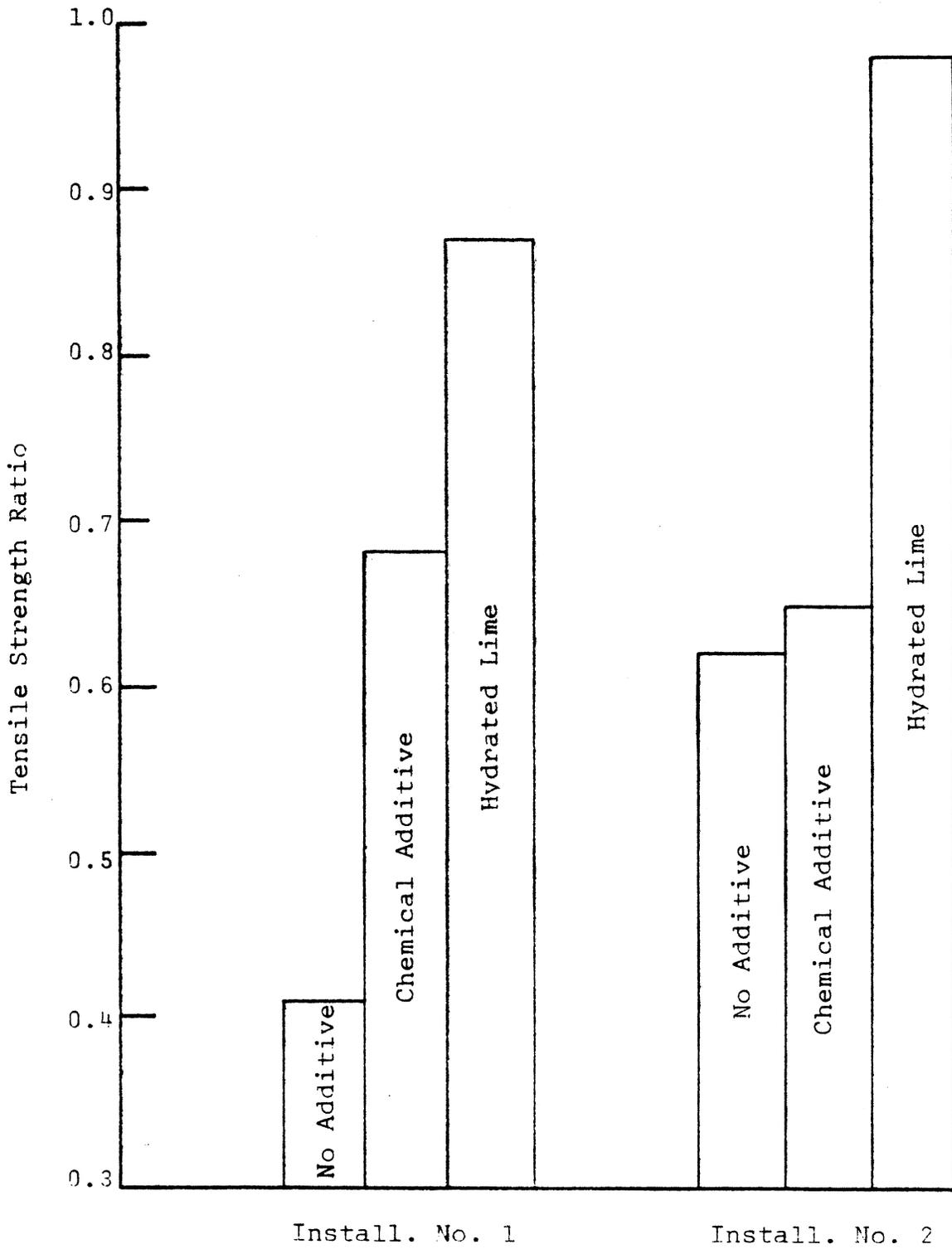


Figure 3. Stripping test results.

REFERENCES

1. Brown, Ronald A., and Thomas E. Wohlscheid, "Performance of Asphalt Concrete Pavements Containing Anti-Stripping Additives," Technical Report 81-3, New York Department of Transportation, December 1981.
2. Maupin, G. W., Jr., "The Use of Antistripping Additives in Virginia," presented at the 1982 annual meeting of the Association of Asphalt Paving Technologists.
3. Welch, Bob H., and Max L. Wiley, "Investigation of Hydrated Lime-Asphalt and Aggregate Interactions," Utah Department of Transportation, 1976.
4. Liddle, Wallace J., Dale E. Peterson, and Max L. Wiley, "Use of Hydrated Lime in Bituminous Mixtures to Decrease Hardening of the Asphalt Cement," Utah State Highway Department, December 1971.

