REFLECTION CRACK SEALING STUDY

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ACKNOWLEDGEMENTS

The writer wishes to express appreciation to all Maintenance personnel in the nine (9) Districts throughout the State, in particular to the Chief Maintenance and Operations Engineer and the District and District Maintenance Engineers for their assistance in performing and completing this study.

SYNOPSIS

This study is primarily an evaluation of the effectiveness of "Reclamite" when used as a sealant material for reflection cracks. A secondary objective was to determine the performance of our presently used material - cationic emulsified asphalt (RS-3K) and compare the results to those obtained with "Reclamite". This study was limited to and concerned only with reflection cracks that develop in hot mixed asphaltic concrete surfacings which had been placed directly on either Portland Cement stabilized bases or Portland Cement Concrete Pavements.

"Reclamite" is a proprietary product of the Golden Bear Oil Company of California and is a petroleum resin oil base uniformly emulsified with water. This product was specifically designed to penetrate asphaltic surfaces, soften and rejuvenate the asphalt thereby giving longer life. It was suggested that this material, due to its special characteristics, might perform as a very effective crack sealant by softening the asphalt, thereby permitting a kneeding together of the crack interfaces. The Louisiana Department of Highways maintenance forces had been sealing with RS-3K during the winter months when personnel were available and cracks were open. The exact effectiveness of using RS-3K was not known. In addition, in instances where cracks were numerous, sealing often resulted in an unsightly appearance as well as a slick surface.

Reflection cracks are defined as "cracks appearing in a resurface or overlay caused by movement at joints or cracks in underlying base or surface."(*1) As stated their cause is considered to be underlying conditions such as: pavement joints, pavement cracks, shrinkage cracks, etc. These type cracks are of great concern, for if reflection cracks are not kept sealed against the ingress of water and debris, it is felt that serious deterioration of the roadway surfacing may follow, causing possible inferior performance and a reduction in the life of the surfacing.

Louisiana is divided into nine (9) Highway Districts and each District Engineer was contacted and requested to select two (2) projects for this study. The selection was to be made from recent asphaltic concrete surfacing placed directly on either Portland Cement stabilized bases or Portland Cement Concrete Pavements. The projects selected were to be new enough that they had not been sealed and old enough that basic reflection cracking had been established. Seventeen projects, each approximately 6 miles in length were finally selected. Fifteen were approximately one (1) year old and two were approximately eight (8) years old. Each project was then divided into three sections with the first section being sealed with Reclamite, the second section sealed with RS-3K and the third section being left untreated for control purposes. All sealing was done during the winter months between December 1967 and March 1968.

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* - Number in parenthesis refer to list of references at end of report.

During the warm weather of September 1968, while the cracks tended to remain closed, the projects were observed and typical cracks selected for core locations and field water penetration tests. Water penetration tests were then run on these representative cracks, both in and out of the wheel paths prior to coring. Cores were then obtained, laboratory tested for water penetration and observed for depth of penetration of foreign matter.

In February 1969, during the cold weather, field water penetration tests were conducted on four (4) typical projects to determine the effects of cold weather.

The results indicate that neither sealant is satisfactory for use and that further studies should be made to evaluate other materials.

Results also indicated that the two eight (8) year old pavements were 78% sealed with foreign matter even prior to placing the sealant materials. This leads to the recommendation that the Department continue to observe the untreated sections used in this study to determine the effects of not sealing and if sealing is desirable or even necessary for reflection cracks occurring on rigid or stabilized bases.

INTRODUCTION

The Louisiana Department of Highways maintenance forces seal reflection cracks in asphaltic concrete surfaces with cationic emulsified asphalt (RS-3K). The exact effectiveness of using this material was not known. In instances where cracks were numerous, use of this material often resulted in a slick and unsightly surface.

Information pertaining to this problem, such as to materials available, sealing practices and performance results, was very limited. It was decided that this study should be undertaken in an effort to learn not only more about our own material and its performance, but to evaluate the effectiveness of "Reclamite" as compared to our presently used RS-3K.

The seventeen (17) projects selected from thoughout the State for this study were primarily recent asphaltic concrete surfacings placed directly on either Portland Cement stabilized bases or Portland Cement Concrete Pavements. These projects were new enough that they had not been previously sealed and old enough that basic reflection cracking had been established. One District had no such projects available and two 8 year old projects which had not been previously sealed were subsequently selected.

All sealing was done during the winter months between December 1967 and March, 1968. Coring and water penetration tests were conducted in September 1968. Four typical projects were tested for field water pentration tests in January, 1969.

METHODOLOGY

Projects were selected on a statewide basis. Louisiana is divided into nine (9) Highway Districts and each District Engineer was contacted and requested to select two (2) projects for this study.

The selection was to be made from recent asphaltic concrete surfacing placed directly on either Portland Cement stabilized bases or Portland Cement Concrete Pavements. The projects selected were to be new enough that they had not been sealed and old enough that basic reflection cracking had been established.

Seventeen projects (each approximately 6 miles in length) were finally selected. Fifteen were approximately one (1) year old and two (2) were approximately eight (8) years old. Each project was then divided into approximately three equal length sections. The first section was sealed with Reclamite, the second section sealed with cationic emulsified asphalt (RS-3K) and the third section was left untreated for control purposes.

All sealing was done during the winter months between December 1967 and March 1968.

For the actual field application Reclamite was used undiluted, agitated in the drums, drawn off into pouring pots and applied directly to the crack. The applied width averaged three inches. Fine sand was then cast upon the Reclamite to prevent traffic from spreading or smearing it and creating a slick surface.

The RS-3K was also applied directly to the crack through the use of the pouring pots in a similar manner.

During the warm weather of September 1968, while the cracks tended to remain closed, the projects were observed and typical cracks were selected for core locations and field water penetration tests. Field water penetration tests were then run on these representative cracks, both in and out of the wheel paths prior to coring.

Approximately 6 cores were taken on each of the three sections for each project as follows. In each section three representative cracks were selected for coring. On each of these three representative cracks two cores were taken, with one core being obtained from the wheelpath and one from outside the wheelpath. For the seventeen (17) projects this made a total of three hundred and six (306) cores. These cores were also laboratory tested for water penetration and were checked for depth of foreign matter penetration. Forty three (43) field water

penetration tests were run during warm weather in September 1968 and one hundred and eight (108) field water penetration tests were run in cold weather the following February 1969.

The test procedure for the field water penetration test consisted of using a one gallon can (6 3/8" diameter), open on both ends (photograph No. 7). The can was sealed to the pavement over the crack by the use of heavy grease placed around the lower edge. The can was then filled with water to a depth of two (2) inches and the water level was remeasured at the end of five minutes. If 1 7/8 to 2 inches of water remained the crack was considered sealed. The length of time required was noted for instances where the can was emptied before the end of the five minute period.

The test procedure for running the laboratory water penetration test employed the use of a lightweight stainless steel cylinder having an inside diameter of 6 3/4 inches and fitted with a standard air valve (photograph No. 11). Inside of each of these cylinders is a tubular rubber membrane, 6 inches in diameter. The core was placed in this cylinder, the lining inflated to approximately 4 psi and an application of heavy grease was used to seal around the top edges of the core and cylinder interface. Two inches of water was then placed in the cylinder above the core. After thirty minutes elapsed time the final depth of water was recorded. If 1 7/8 to 2 inches of water remained the crack was considered sealed. Again if the cylinder was emptied of water before thirty minutes time had elapsed the actual time required for emptying was recorded.

The core was then removed from the cylinder, opened along the crack to inspect for depth of penetration of foreign matter and the depth recorded.

Photographs were taken as deemed necessary throughout the study and are included.

DISCUSSION OF RESULTS

Field Water Penetration Tests - Warm Weather

When the sections were first observed during warm weather it appeared that both Reclamite and Cationic Emulsified Asphalt (RS-3K) were performing as desired. The initial warm weather field water penetration tests showed (Figure 1) that the RS-3K had 91.7% effectively sealed the reflection cracks against water (Photograph Nos. 1 & 3). Reclamite had sealed only 81.2%, however the wheel paths for both Reclamite and RS-3K were 100% sealed. This indicates that Reclamite is 100% effective only in the wheel path where a kneeding action is present. The untreated sections were only 46.7% sealed even under ideal conditions of warm weather (Photograph No. 8).

Laboratory Water Penetration Tests - Cores obtained during warm weather

The Laboratory water penetration tests run on cores obtained during warm weather verified the above results, in that cracks sealed with RS-3K resisted water penetration better than did those sealed with "Reclamite" or the unsealed cracks. (Figures 2, 3 and 4).

Laboratory Foreign Matter Penetration Tests - Cores obtained in warm weather

Again these results were in agreement with above data, in that the RS-3K was the most effective in preventing infiltration of foreign material. Cracks sealed with Reclamite had less penetration of foreign material than did the unsealed cracks. (Figures 5, 6 and 7). It was noted that for 77.7% of the cores obtained from the untreated sections the foreign material had penetrated to a depth of more than 2 inches. It was also especially noted that this material was not tightly packed.

Field Water Penetration Tests - Cold Weather

A. Two eight year old projects excluded.

When the projects were visited during cold weather it was observed that all cracks on all projects had opened to the extent that it was impractical to even continue running the field water penetration tests. After running 54 tests the results showed that none of the cracks were effectively sealed against water penetration during cold weather. (Photograph Nos. 4 and 9).

B. Two eight year old projects only.

It was interesting to note (Figure 8) that the reflection cracks on the two eight (8)

year old projects were tightly packed and almost sealed (78% not penetrated by water) with foreign matter even prior to placing any sealant material. (Photograph No. 10).

The application of the Reclamite material to these cracks brought the effectiveness of the seal to 100% , whereas the RS-3K only increased this effectiveness to 90%. (Photograph No. 2). Review of the data (Figure 9) showed that the cracks in the Reclamite section had possibly been better sealed initially by foreign matter than were the cracks in the RS-3K section.

CONCLUSIONS AND RECOMMENDATIONS

Reclamite and cationic emulsified asphalt (RS-3K) are not satisfactory for use in sealing reflection cracks on rigid or stabilized bases. Except for the two eight (8) year old projects which were sealed with foreign matter all cracks were open during the winter season. FURTHER STUDIES SHOULD BE MADE TO EVALUATE OTHER MATERIALS.

The two eight (8) year old pavements were 78% sealed with foreign matter even prior to placing the sealant materials.

IT IS RECOMMENDED THAT THE DEPARTMENT CONTINUE TO OBSERVE THE UNTREATED SECTIONS USED IN THIS STUDY TO DETERMINE THE EFFECTS OF NOT SEALING AND IF SEALING IS DESIRABLE OR EVEN NECESSARY FOR REFLECTION CRACKS OCCURRING ON RIGID OR STABILIZED BASES.

REFERENCES

1. "AASHO Highway Definitions" Prepared by Special Committee on Nomenclature Adopted by the American Association of State Highway Officials - June 1968, Page 12.

APPENDIX

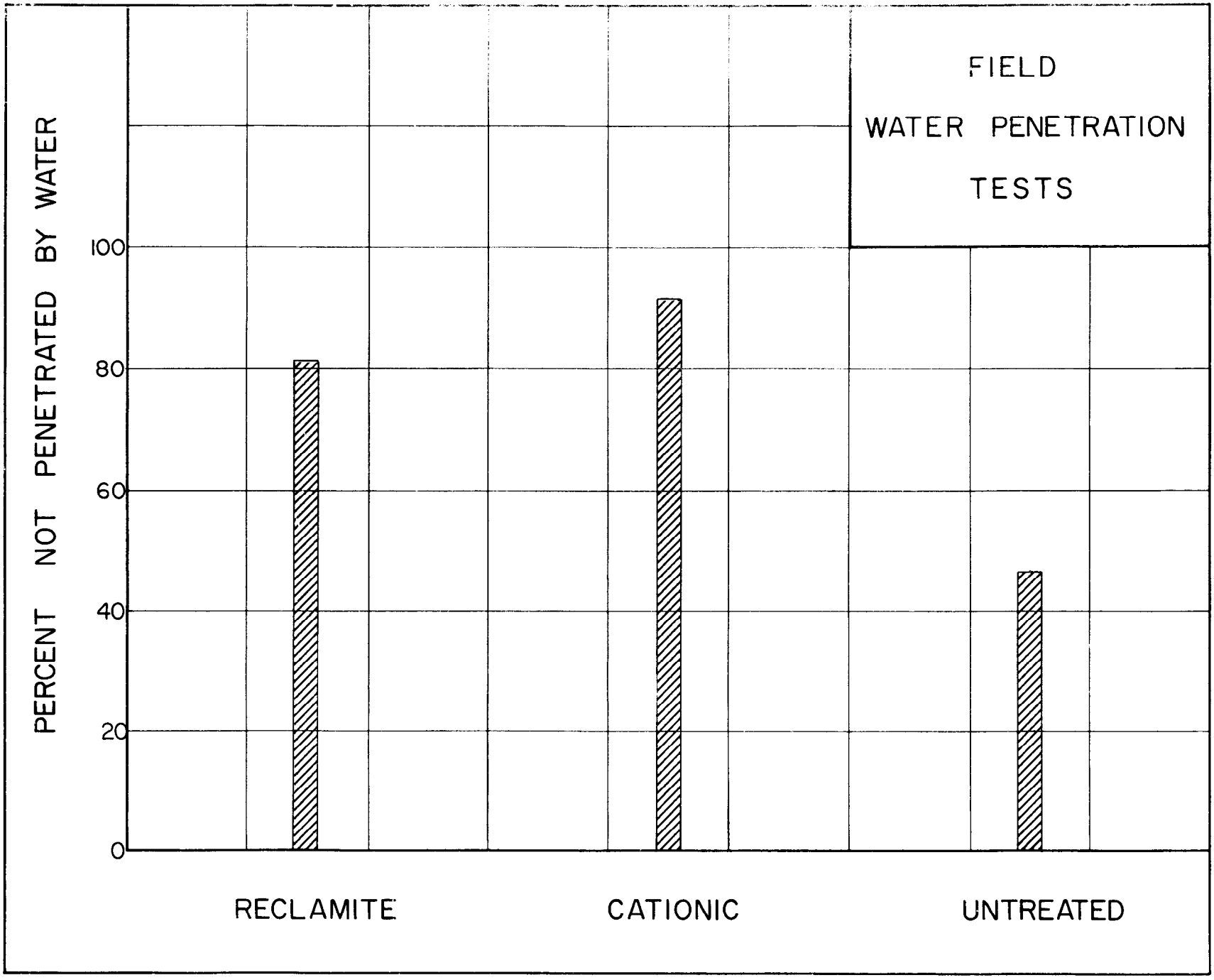


Figure 1: All Projects - Warm Weather September 1968

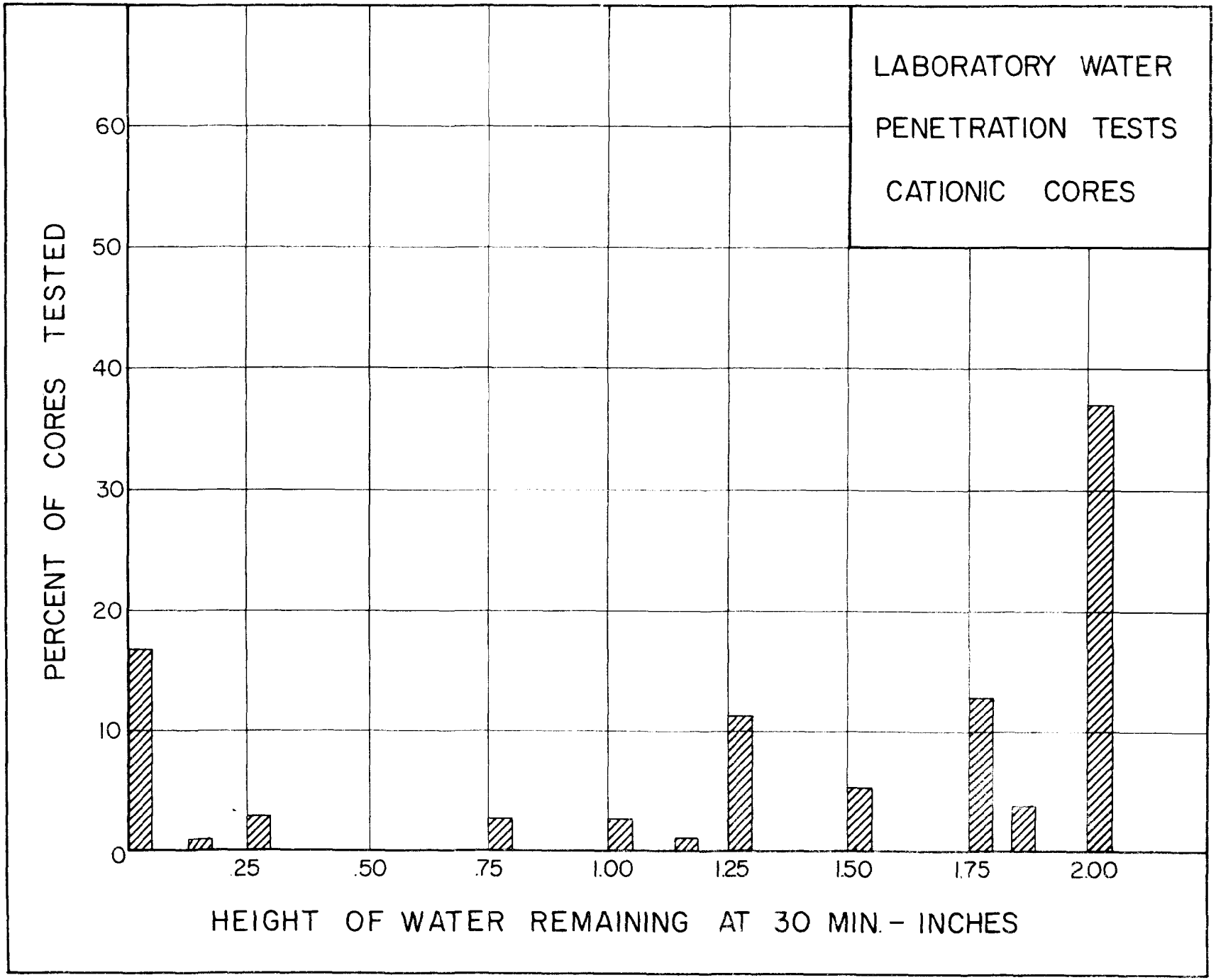


Figure 2: September 1968

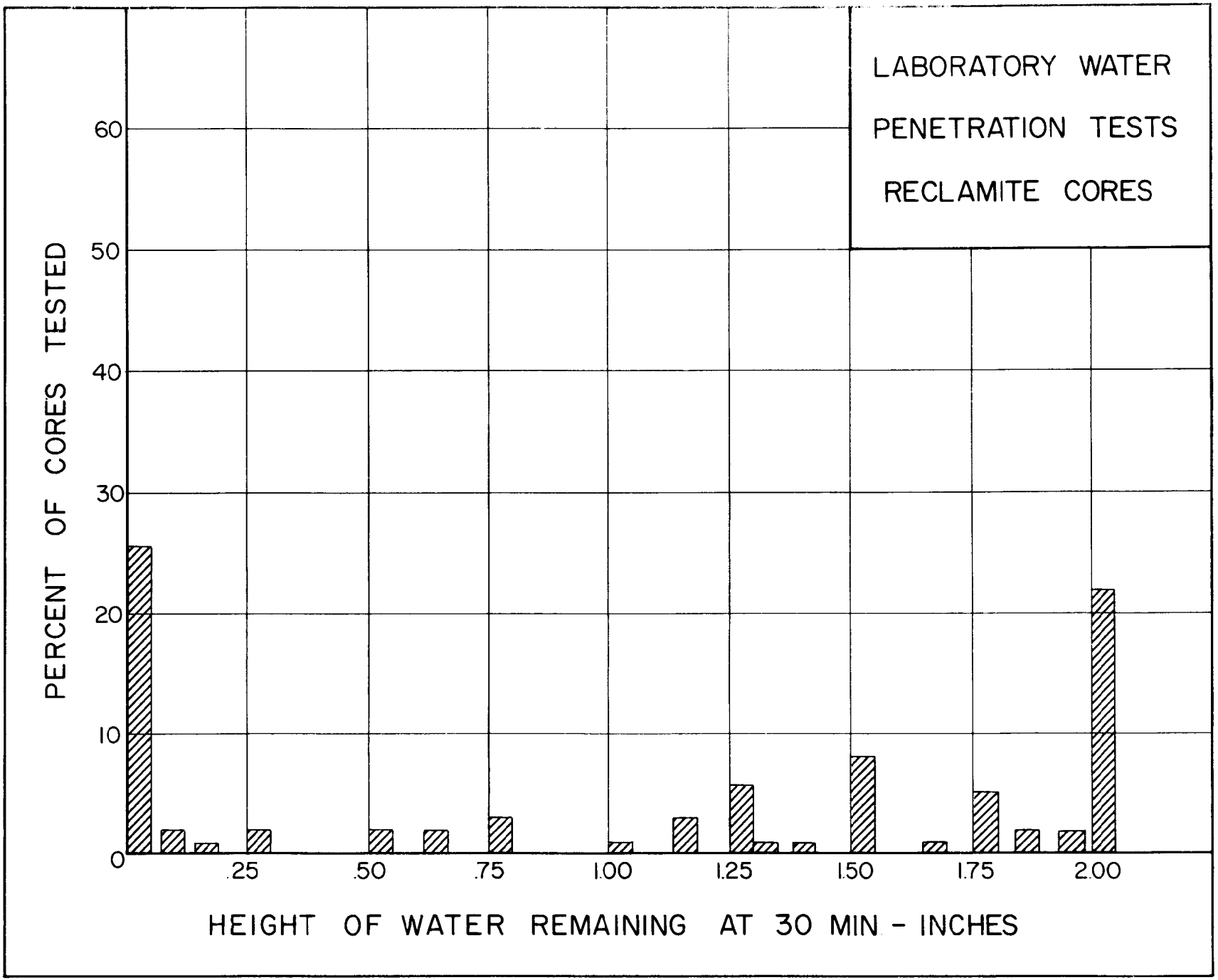


Figure 3: September 1968

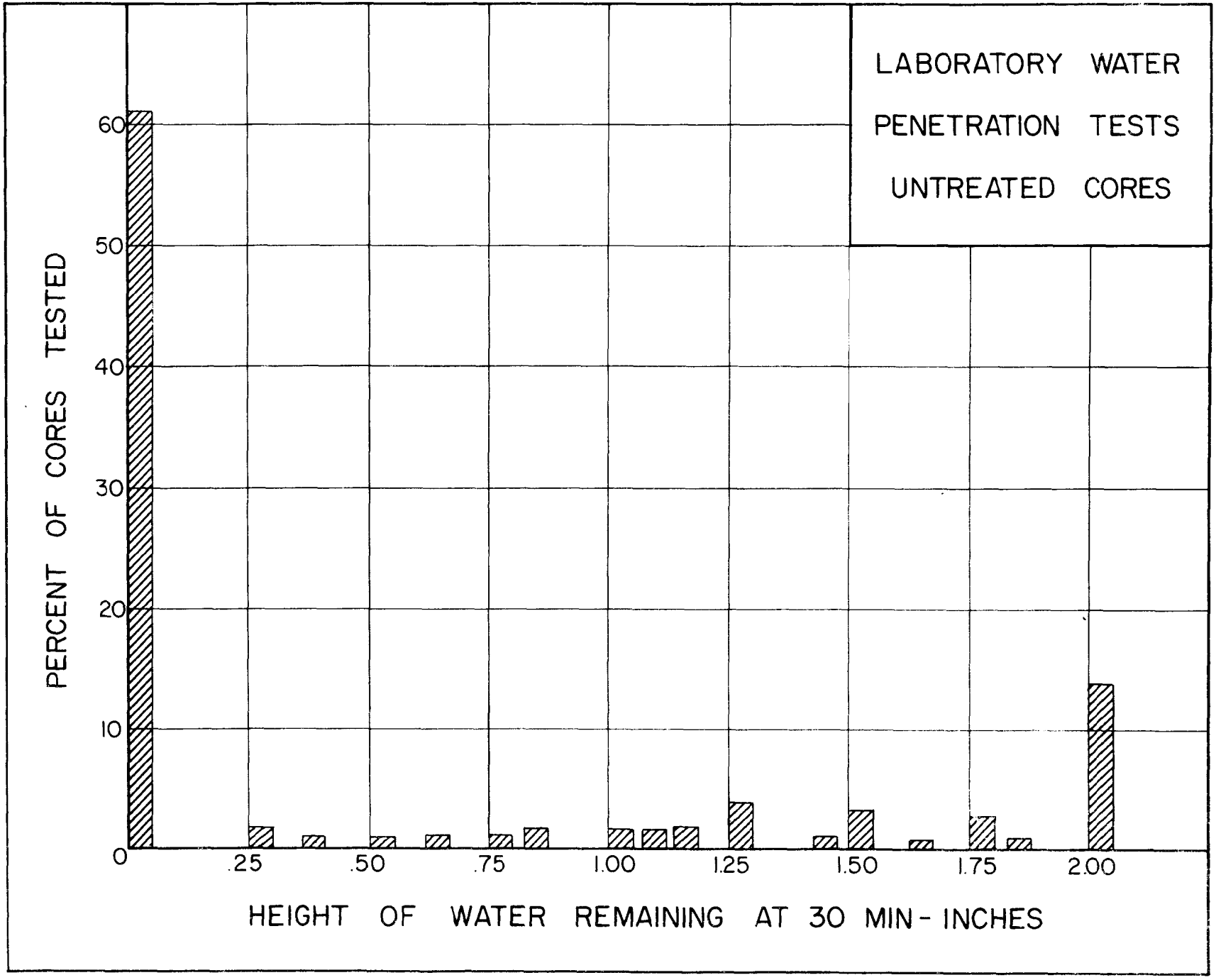


Figure 4: September 1968

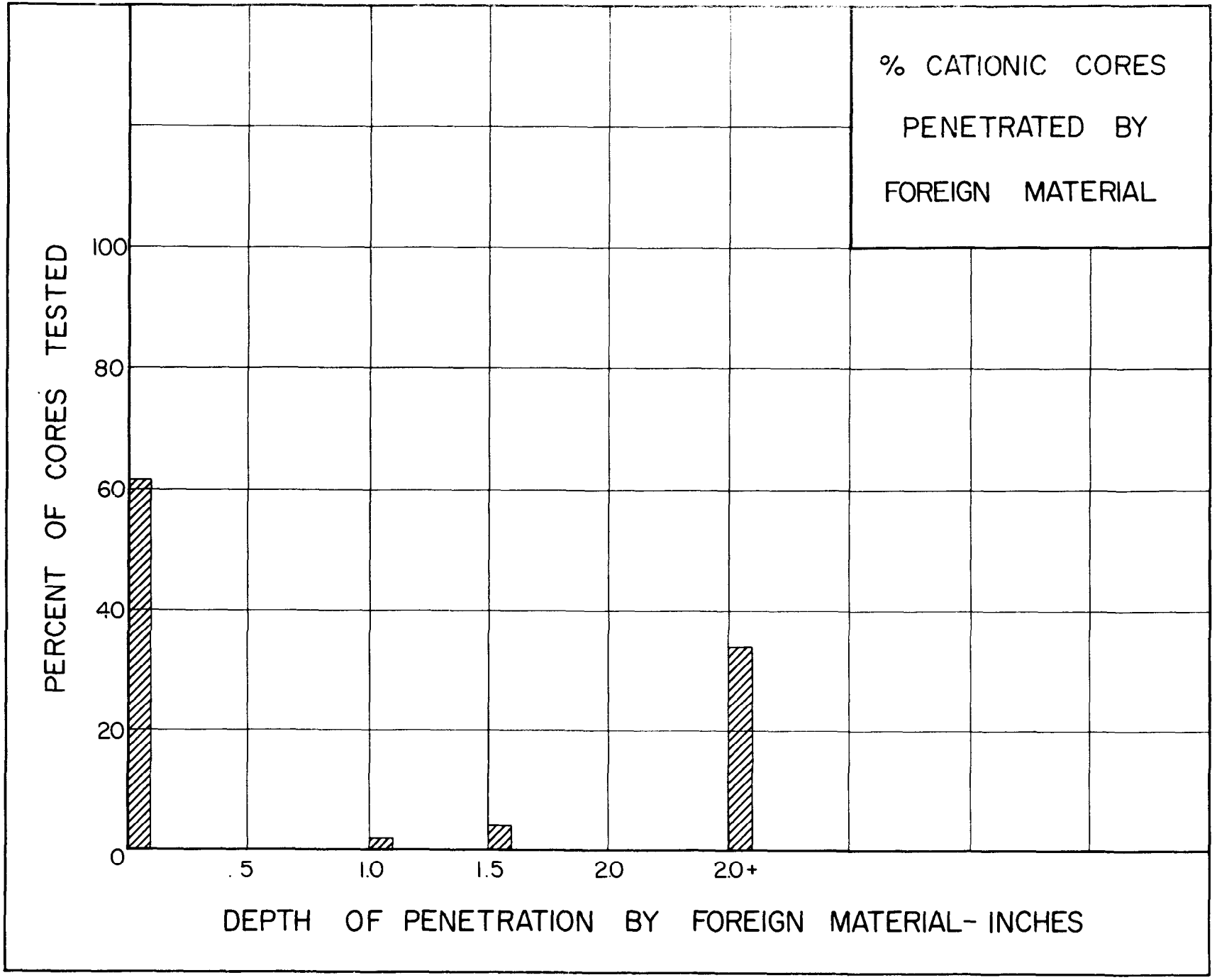


Figure 5: September 1968

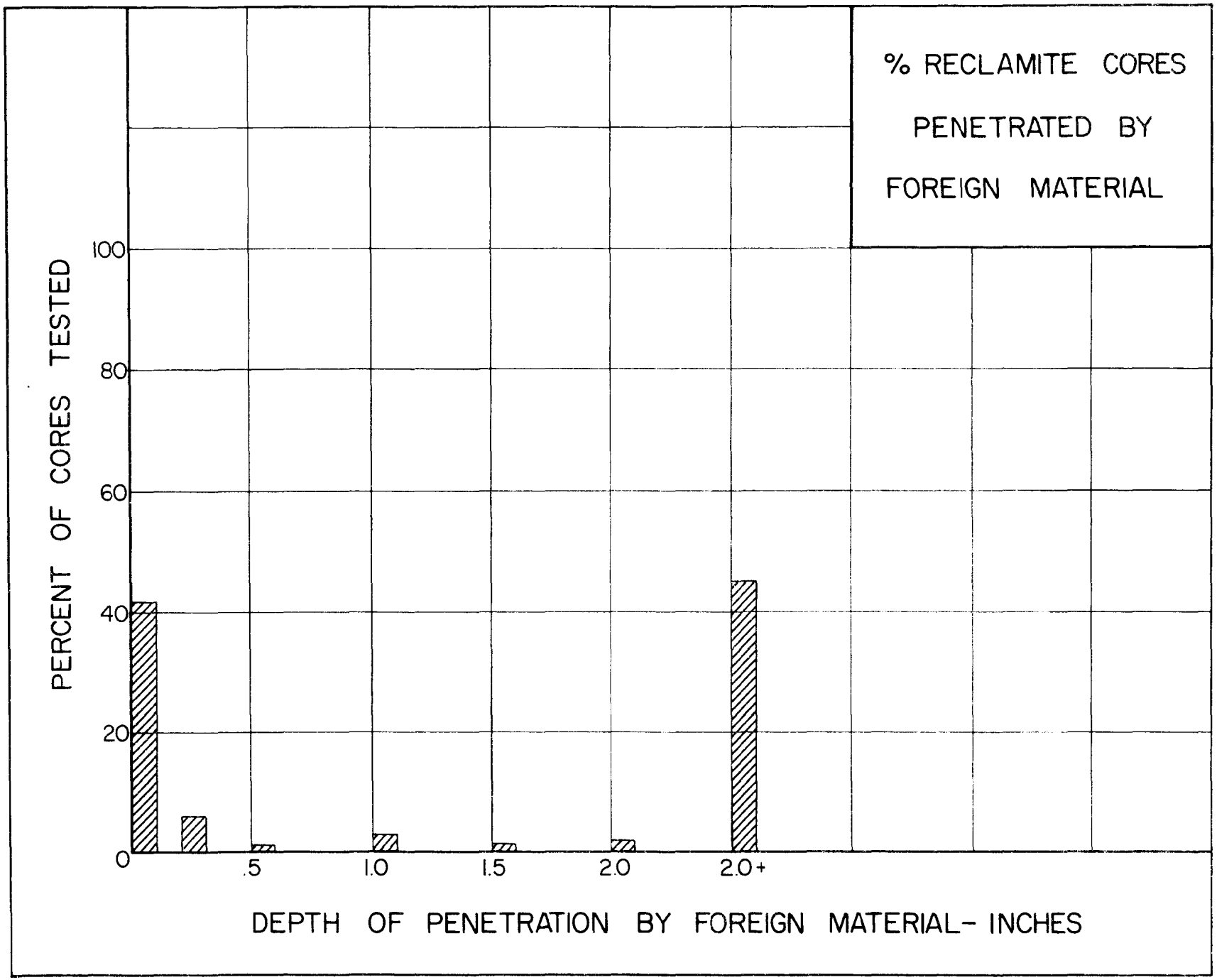


Figure 6: September 1968

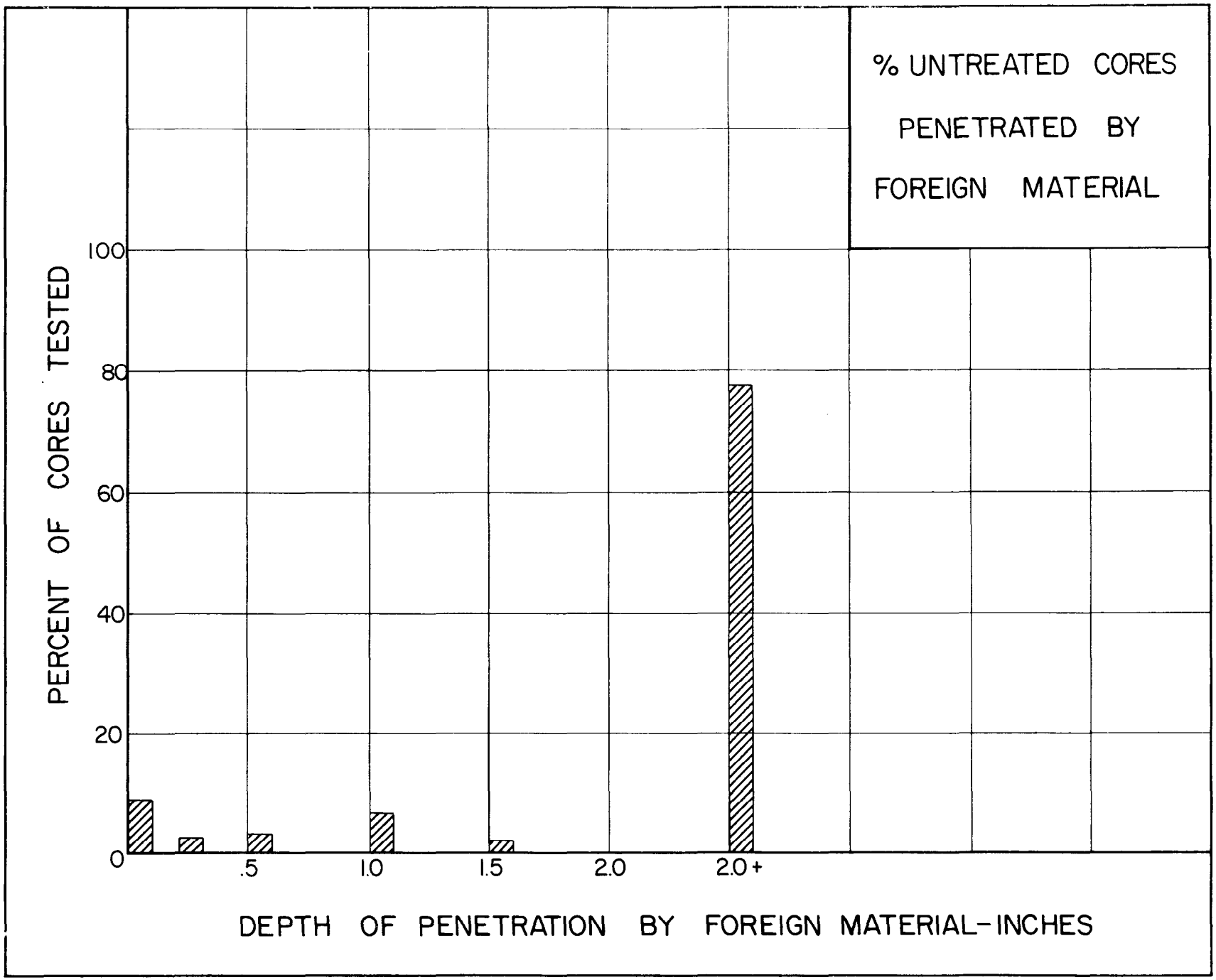


Figure 7: September 1968

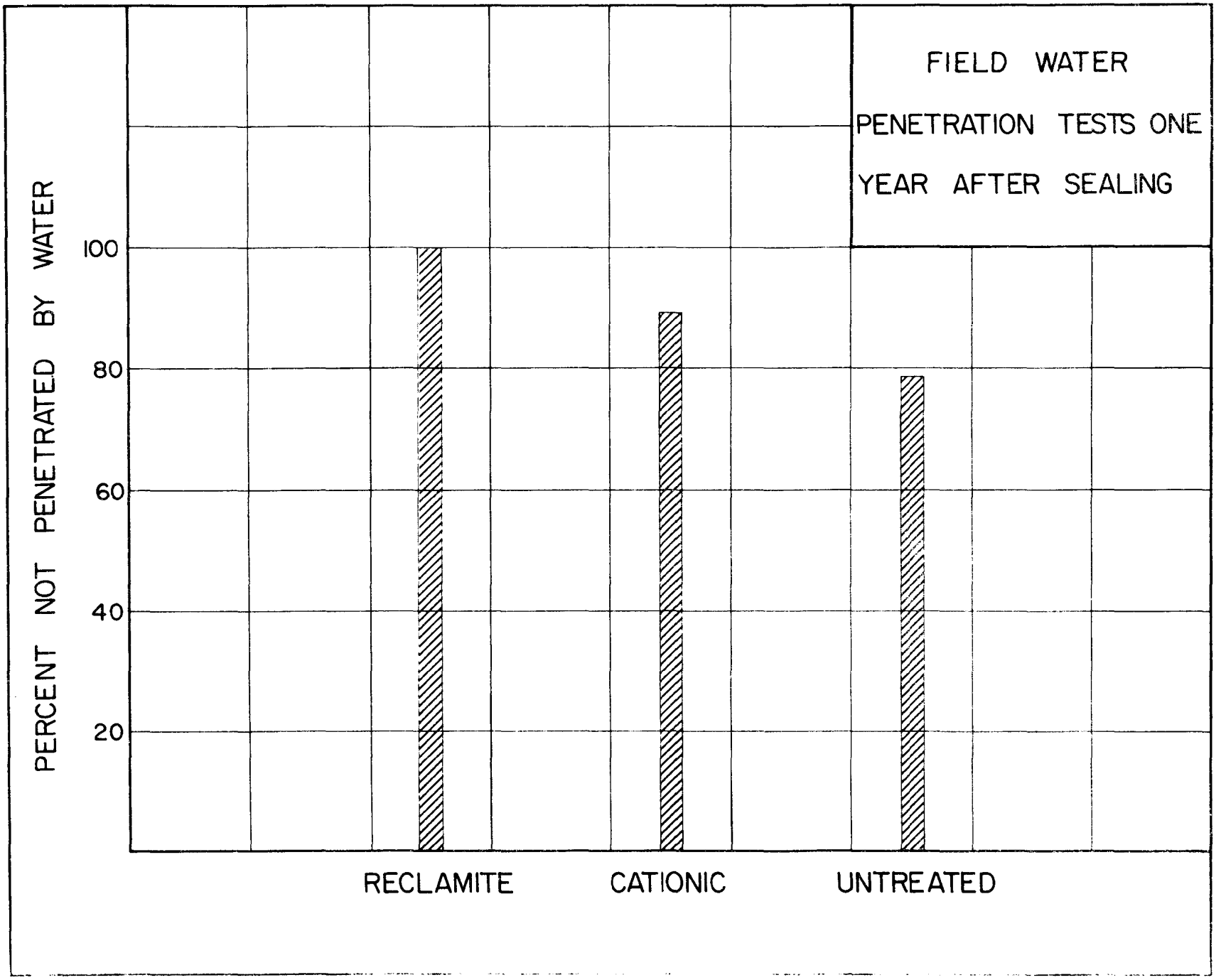


Figure 8: Two Eight Year Old Pavements Run in Cold Weather February 1969

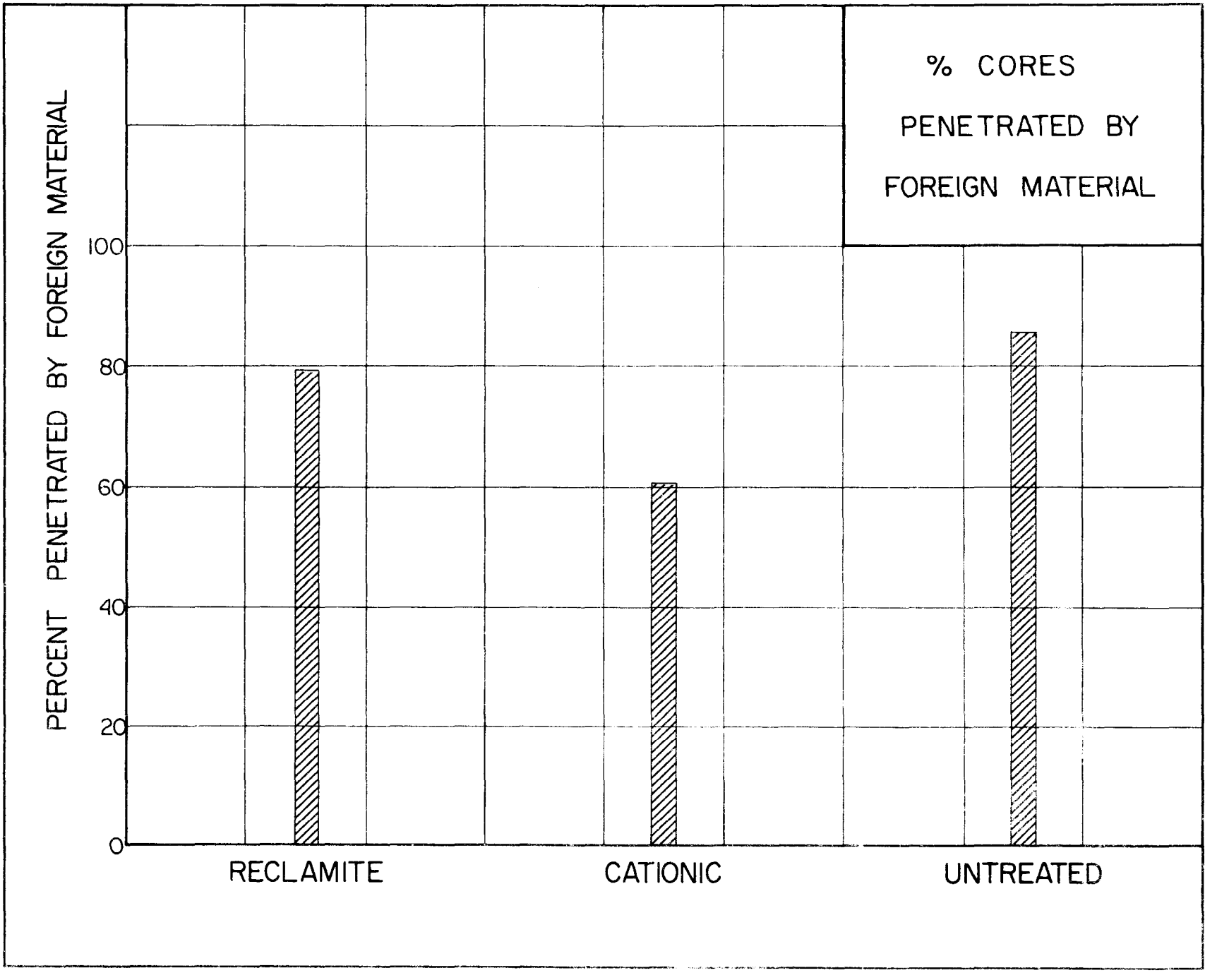
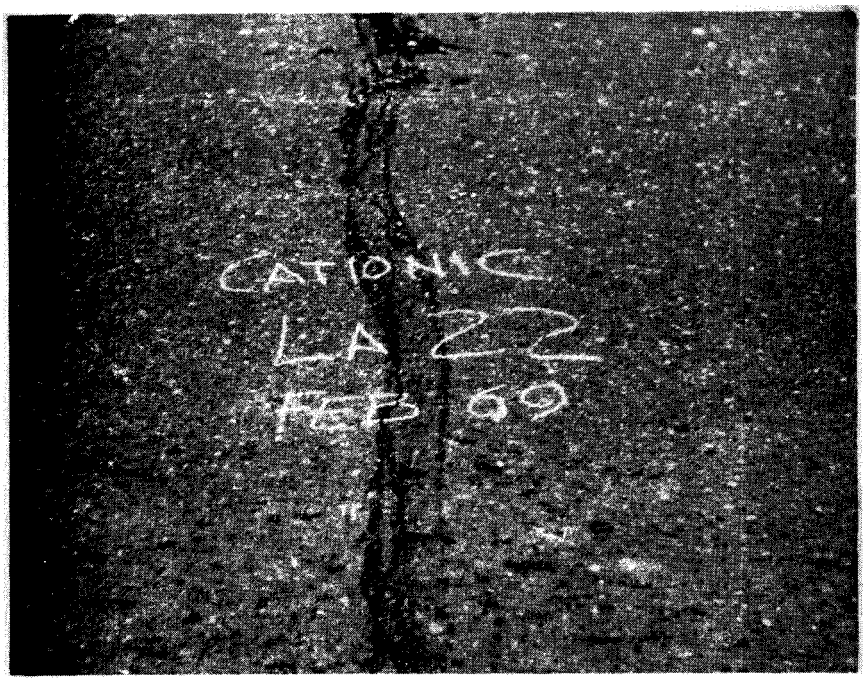


Figure 9: Two Eight Year Old Pavements September 1968

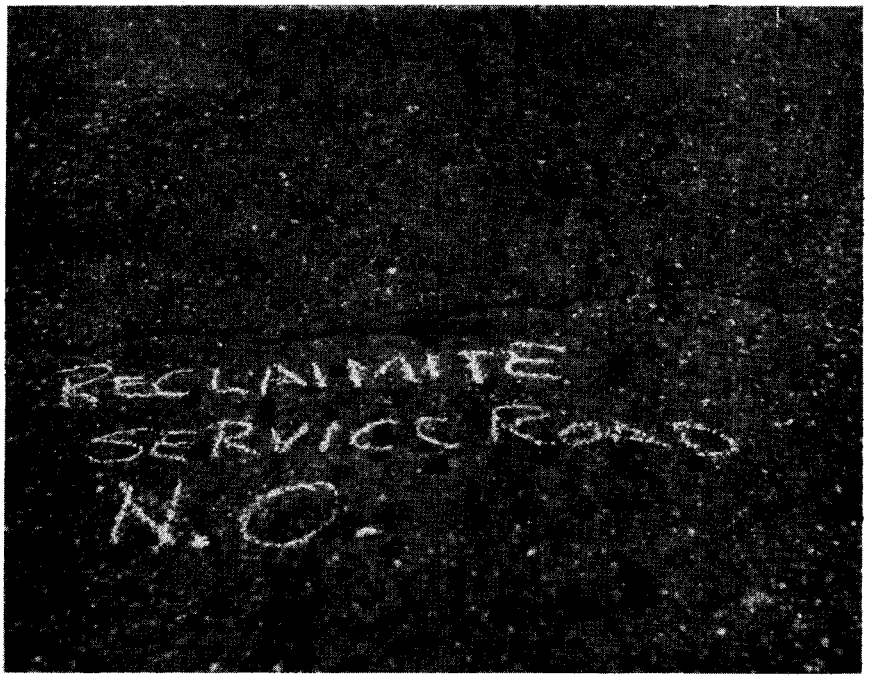
Photograph No. 1: RS-3K Treated Crack on New Orleans Service Road During September 1968

Photograph No. 2: RS-3K Treated Crack on New Orleans Service Road During February 1969

Photograph No. 3: RS-3K Treated Crack on La. 22 During September 1968



Photograph No. 4: RS-3K Treated Crack on La. 22 During February 1969

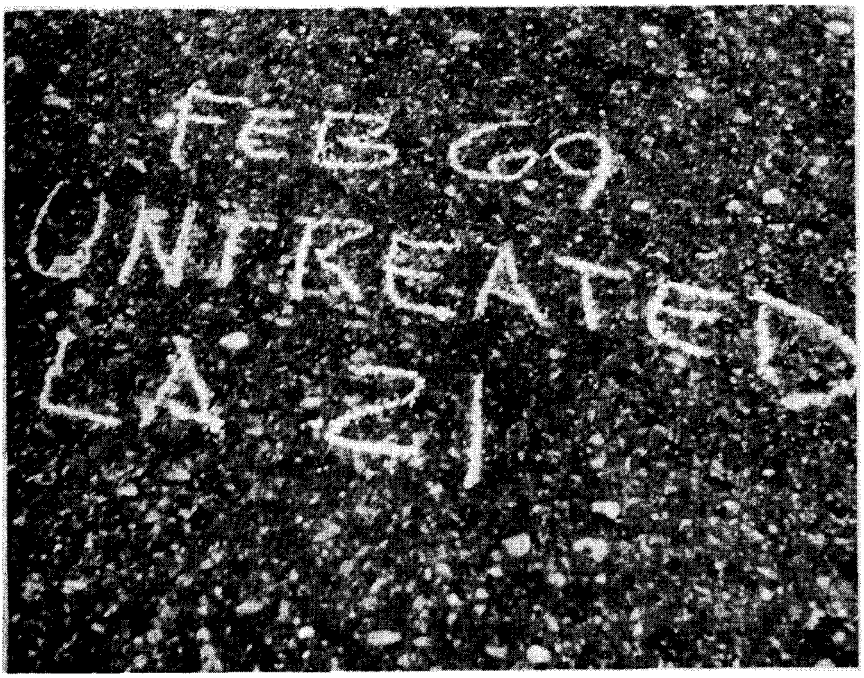


Photograph No. 5: Reclamite Treated Crack on New Orleans Service Road During September 1968

Photograph No. 6: Reclamite Treated Crack on La. 21 During September 1968

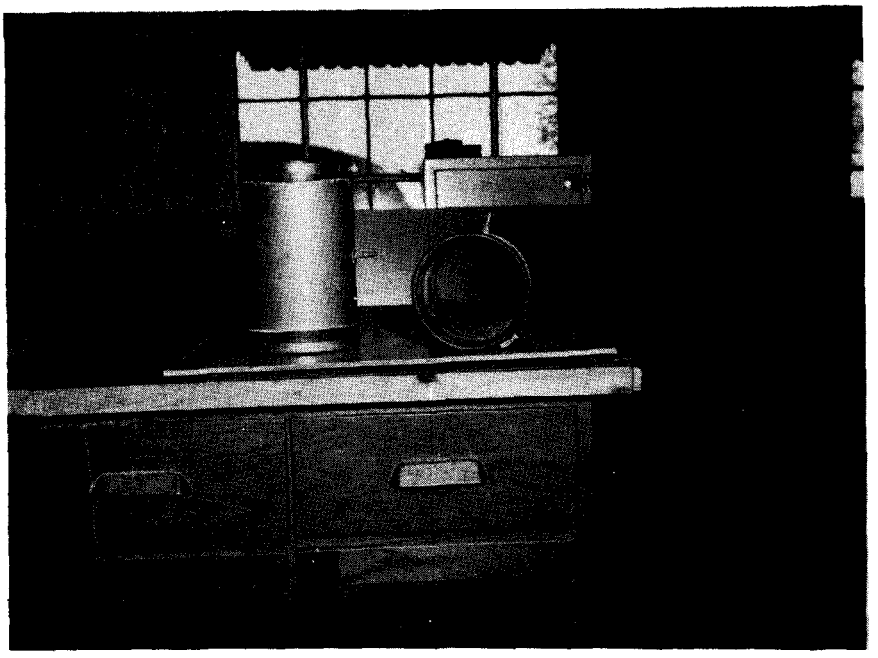
Photograph No. 7: Water Penetration Test on Reclamite Treated Section on La. 34 During September 1968

Photograph No. 8: Untreated Crack on La. 21 During September 1968



Photograph No. 9: Untreated Crack on La. 21
During February 1969

Photograph No. 10: New Orleans Service Road - Untreated Crack
During September 1968



Photograph No. 11: Axial Cell With Tubular Rubber Membrane

TABLE 1

PROJECT DATA
APPLICATION AND LOCATION INFORMATION

Date of Application - Reclamite	Temp. at Time of Application	Dist. No.	Hwy. No.	Location of Reclamite Section	Location of Cationic and Control Sections
12-20-67	45°	61	67	North of Jct. of 67 & 74 in northbound lane	Southbound lane and north of Reclamite section
1-8-68	32°	61	190	West of the Amite River Bridge in the westbound lane	West of the Reclamite section
1-16-68	40° to 60°	58	124	Begin 10.75 miles south of the Jct. of 84 & 124 in Jonesville, Louisiana	South of the Reclamite section
1-18-68	50° to 70°	58	566	Begin at the Jct. of 566 & 751 north of Clayton proceed East	East of the Reclamite section
1-25-68	45° to 70°	8	1	Begin at the Jct. of 1 & 498 and proceed North	North of the Reclamite section
1-25-68		8	1		
		3	71	Begin at Jct. of 10 and proceed Southeast	Southeast of the Reclamite section
		3	82	Begin 6.86 miles East of the Cameron Parish Line and proceed West	West of the Reclamite section

TABLE 1 (CONTINUED)

PROJECT DATA
APPLICATION AND LOCATION INFORMATION

Date of Application - Reclamite	Temp. at Time of Application	Dist. No.	Hwy. No.	Location of Reclamite Section	Location of Cationic and Control Sections
1-30-68	70°	4	171	Begin at the end of concrete on 171, South of the Jct. of 171 and 84, proceed South	South of the Reclamite section
2-7-68	45° to 60°	5	34	Begin at the Jct. of 34 & 557 and proceed West	West of the Reclamite section
2-8-68	35° to 40°	5	34	Begin at the Jct. of 34 & 4 and proceed North	North of the Reclamite section
2-13-68		62	21	Begin at the first bridge North of the East Jct. of 436 & 21 and proceed North	North of the Reclamite section
2-14-68		62	22	Begin 2 miles East of the Tangipahoa Parish Line	East of the Reclamite section
2-28-68	50°	3	90	Begin at first Overpass East of Crowley on U.S. 90	East of the Reclamite section
3-5-68	60° to 70°	2		Begin at the Southwest corner of the Westbank expressway and Barataria Boulevard on the South Service Road and proceed West	West of the Reclamite section
3-7-68	40°	2	18	Begin where La. 18 turns East off Barataria Boulevard and proceed East	East of the Reclamite section

TABLE 1 (CONTINUED)

PROJECT DATA
APPLICATION AND LOCATION INFORMATION

Date of Application - Reclamite	Temp. at Time of Application	Dist. No.	Hwy. No.	Location of Reclamite Section	Location of Cationic and Control Sections
3-13-68	45°	7	167	Begin at the Jct. of 10 & 167, one mile West of Ville Platte and proceed North in northbound lane	Southbound Lane
3-14-68	50°	7	95	Begin in Mamou at the Jct. of 104 & 95 and proceed East in the eastbound lane	Westbound Lane

TABLE 2 (CONTINUED)

CATIONIC SECTION TEST DATA

Highway Number	Core Number	Approx. Age, Years	Thickness Inches	Laboratory Water Penetration Test-Height, Inches Remaining Cores	Penetration By Foreign Material Depth, Inches	Field Water Penetration Tests Height Remaining, Inch Summer C	Summer W.P.	Winter C	Winter W.P.
18	327	8	2	-	0.0			0.0	
18	328	8	1 5/8	-	0.0			0.0	
18	329	8	2 1/2	-	0.0			2	
90	348	1	2 1/4	2.00	0.0	2			
90	349	1		2.00	-				
90	350	1	4 3/4	0.0	2.5				
90	351	1	5 1/2	0.0	3.25				
90	352	1	1 3/4	1.0	0.0				
90	353	1	1 3/4	1.5	0.0				
90	354	1	-	2.0	-	2			
21	373	1	3 5/8	0.0	3.63			0.0	0.0
21	374	1	3 3/4	2.0	3.75			0.0	0.0
21	375	1	3 3/4	1.75	1.5			0.0	0.0
21	376	1	3 3/4	1.75	3.75			0.0	
21	377	1	3 1/2	0.0	3.50			0.0	
21	378	1	3 3/4	0.25	1.5			0.0	
22	391	1	-	1.25	-	1 7/8		0.0	0.0
22	392	1	3 1/2	0.75	3.5			0.0	0.0
22	393	1	3 7/8	2.0	0.0			0.0	0.0
22	394	1	1 1/2	1.25	0.0			0.0	
22	395	1	1 3/4	2.00	0.0			0.0	
22	396	1	1 3/4	2.00	0.0			0.0	

TABLE 3

RECLAMITE SECTION TEST DATA

Highway Number	Core Number	Approx. Age, Years	Thickness, Inches	Laboratory Water Penetration Test-Height, Inches Remaining Cores	Penetration By Foreign Material Depth, Inches	Field Water Penetration Tests Height Remaining, Inches Summer C	Summer W.P.	Winter C.	Winter W.P.
67	1								
67	2	1		1.16					
67	3	1	4	1.94	4.0				
67	4	1	4 1/4	1.50	0.0				
67	5	1	4	0.50	4.0				
67	6	1	3 3/4	1.95	3.75				
67	7	1	4	0.0	4.0				
67	8	1	3 3/4	0.0	3.75				
67	9	1	3 1/2	0.00	3.5				
67	10	1	4	1.38	1.00				
67	11	1		0.0	-				
67	12	1	3	None	0.0				
67	13	1	4	0.0	4.0				
67	14	1		0.0	-				
190	26	1	4 1/2	0.0	1				
190	27	1	1 3/4	0.0	1.75				
190	28	1	3 3/4	0.64	3.75				
190	29	1	3 1/2	1.10	0.25				
190	30	1	5 1/4	1.30	5.25				
190	31	1		0.0	-				
190	32	1	3 1/2	0.78	3.5				
190	33	1	3 1/4	0.0	3.25				
190	34	1	3 1/4	0.0	3.25				
190	35	1	3 3/8	0.10	0.0				
190	36	1	3/58	0.0	3.63				
34	60	1	3 7/8	1.97	0.0				
34	61	1	4 1/8	2.0	0.0		2		

TABLE 3 (CONTINUED)

RECLAMITE SECTION TEST DATA

Highway Number	Core Number	Approx. Age, Years	Thickness, Inches	Laboratory Water Penetration Test-Height, Inches Remaining Cores	Penetration By Foreign Material Depth, Inches	Field Water Penetration Tests Height Remaining, Inches Summer C	Summer W.P.	Winter C	Winter W.P.
34	62	1	3 1/4	2.0	0.0				
34	63	1	3 3/8	2.0	0.0		2		
34	64	1	3 1/4	0.16	0.0				
34	65	1	3 1/4	1.50	0.0	2			
-	-	-			-				
34	70	1	3	2.0	0.5		2		
34	71	1	3 3/4	1.66	3.75				
34	72	1	3 3/4	0.25	0.0				
34	85	1	3 1/4	2.0	0.0				
34	86	1	3	0.75	0.0				
171	87	1	3	0.0	0.0				
171	88	1	4	0.0	4.0				
171	89	1	3 3/8	0.25	3.38				
171	90	1	3 1/8	1.25	3.12				
171	91	1	4 3/8	0.0	4.38				
171	92	1	4 3/8	0.0	4.38				
1	99	1	4 1/2		0.0				
1	100	1	3 1/4	2.0	0.0				
1	101	1	3 1/2	1.5	0.0				
1	102	1	2 3/4	2.0	0.0				
1	103	1	3 1/2	1.5	0.0				
1	104	1	2 1/2	2.0	2.5				
566	111	1	1 3/4	0.75	0.0				
566	112	1	1 3/4	1.5	0.0	1 5/8			
566	113	1	2	2.0	0.0				
566	114	1	1 3/4	1.25	1.75	1 1/2			
566	115	1	1 3/4	2.0	0.0				
566	116	1	1 5/8	0.0	1.62				

TABLE 3 (CONTINUED)

RECLAMITE SECTION TEST DATA

Highway Number	Core Number	Approx. Age, Years	Thickness, Inches	Laboratory Water Penetration Test-Height, Inches Remaining Cores	Penetration By Foreign Material Depth, Inches	Field Water Penetration Tests Height Remaining, Inches Summer C	Summer W.P.	Winter C	Winter W.P.
124	129	1	1 3/4	0.0	1.75				
124	130	1		2.0	-	2			
124	131	1	1 1/2	1.5	0.25				
124	132	1	1 1/2	1.16	1.5				
124	133	1	1 3/4	0.0	1.75				
124	134	1	1 3/4	1.75	1.75				
1	147	1		0.0	-				
1	148	1	1 3/4	2.0	1.75	2			
1	149	1	1 3/4	2.0	1.75				
1	150	1	5 1/2	2.0	5.5				
1	151	1	5	2.0	0.0				
1	152	1	5 1/4	2.0	5.25				
1	165	1	1 3/4	2.0	1.75				
1	166	1	1 1/2	0.0	1.5	2			
1	167	1	1 3/4	1.25	0.25				
1	168	1	1 1/4	0.62	1.25				
1	169	1	1	0.0	1.0				
1	170	1	1	0.0	1.0				
167	183	1	2 1/4	2.0	2.0				
167	184	1	3 3/4	2.0	2.0	2			
167	185	1	3 1/2	0.0	0.25				
167	186	1	3 1/4	1.5	0.25				
167	187	1		1.5	-				
167	188	1	3 1/4	2.0	3.25				
Frontage Road	300	8	1 7/8	0.0	1.87			2	2
Frontage Road	301	8	1 5/8	0.0	1.63	2		2	2

TABLE 3 (CONTINUED)

RECLAMITE SECTION TEST DATA

Highway Number	Core Number	Approx. Age, Years	Thickness, Inches	Laboratory Water Penetration Test-Height, Inches Remaining Cores	Penetration By Foreign Material Depth, Inches	Field Water Penetration Tests Height Remaining, Inches Summer C	Summer W.P.	Winter C	Winter W.P.
Frontage Road	302	8		0.0	-			2	2
Frontage Road	303	8	1 3/4	0.0	1.75			2	
Frontage Road	304	8	1 1/2	1.75	0.0			2	
Frontage Road	305	8	2 1/8	1.25	2.12			2	
18	318	8	1 7/8	0.0				2	2
18	319	8		0.0	-	2		2	2
18	320	8		0.0	-			2	2
18	321	8	2	0.0	2.0			2	
18	322	8	2	0.0	2.0			2	
18	323	8	2	0.0	0.0			2	
90	342	1	3	1.85	1		2		
90	343	1	2	2.0	0.0				
90	344	1	1 1/4	1.66	0.0				
90	345	1	1 1/2	0.0	0.0				
90	346	1		1.25	-				
90	347	1	2	2.0	0.0				
82	355	1	2 1/2	2.0	0.0	1 15/16			
82	356	1	2 1/2	2.0	0.0				
82	357	1	2 1/2	0.50	0.0				
82	358	1	2 3/8	1.75	0.0				
82	359	1	2 1/4	1.25	0.0				
82	360	1	2 1/4	1.75	0.0				
21	367	1	3 1/2	0.00	0.0	1 1/2		0.0	0.0
21	368	1	3 3/4	0.0	0.0			0.0	0.0

TABLE 3 (CONTINUED)

RECLAMITE SECTION TEST DATA

Highway Number	[illegible] Number	Approx. Age, Years	Thickness, Inches	Laboratory Water Penetration Test-Height, Inches Remaining Cores	Penetration By Foreign Material Depth, Inches	Field Water Penetration Tests Height Remaining, Inches Summer W.P.	Winter C	Winter W.P.
2[illegible]	3[illegible]		[illegible]	.25	0.0	0.0		0.0
3[illegible]	3[illegible]		[illegible]	1.0	3.37	0.0		
2[illegible]	3[illegible]		[illegible]	.35	0.0	0.0		
2[illegible]	3[illegible]		[illegible]	.75	0.0	0.0		
2[illegible]	3[illegible]		3	1.0	0.0	0.0		0.0
3[illegible]	3[illegible]		4 1/4	.16	1.3	0.0		0.0
2[illegible]	3[illegible]		1 1/2	1.0	0.37	0.0		0.0
3[illegible]	3[illegible]		1 3/4	.5	0.0	0.0		
22[illegible]	3[illegible]		4	.66	4.0	0.0		
22[illegible]	3[illegible]		4 1/4	1.0	4.25	0.0		

TABLE 4

UNTREATED SECTION TEST DATA

Highway Number	Core Number	Approx. Age, Years	Thickness, Inches	Laboratory Water Penetration Test-Height, Inches Remaining Cores	Penetration By Foreign Material Depth, Inches	Field Water Penetration Tests Height Remaining, Inches Summer C	Summer W.P.	Winter C	Winter W.P.
67	15	1	4	0.0	4.0				
67	16	1	3 1/2	0.0	3.5				
67	17	1	4 1/4	0.0	4.25				
67	18	1	3 1/2	0.0	3.5				
67	19	1	3 3/4	0.0	3.75				
67	20	1	3 3/4	0.0	3.75				
67	21	1	-	0.0	-				
67	22	1	3 7/8	1.08	3.87				
67	23	1	4	0.0	4.0				
67	24	1	3 3/4	0.0	3.75				
67	25	1	4	0.0	4.0				
190	37	1	3 1/4	0.0	3.25				
190	38	1	3 1/4	0.0	3.25				
190	39	1	3 1/4	0.0	3.25				
190	40	1	3 1/2	0.0	3.50				
190	41	1	3	0.0	3.0				
190	42	1	3 1/2	0.0	3.5				
190	43	1	4	0.0	4.0				
190	44	1	3 3/4	0.0	3.75				
190	45	1	-	0.0	-				
190	46	1	3 3/4	0.0	3.75				
190	47	1	4	0.42	4.0				
190	48	1	-	0.0	-				
34	49	1	3 3/4	1.45	3.75				
34	50	1	3 1/2	0.0	3.5		1/4		
34	51	1	3 1/2	0.50	1.0				
34	52	1	3 1/4	1.16	1.0		3/4		
34	53	1	3	0.16	3.0				

TABLE 4 (CONTINUED)

UNTREATED SECTION TEST DATA

Highway Number	Core Number	Approx. Age, Years	Thickness, Inches	Laboratory Water Penetration Test-Height, Inches Remaining Cores	Penetration By Foreign Material Depth, Inches	Field Water Penetration Tests Height Remaining, Inches			
						Summer		Winter	
						C	W.P.	C	W.P.
34	54	1	3	0.75	3.0		1		
34	55	1	4 1/4	0.0	4.25				
34	56	1	3 1/4	0.85	0.0				
34	57	1	3 3/8	0.0	0.50				
34	58	1	3 3/4	0.85	3.75				
34	59	1	4	1.10	0.0		1 1/2		
34	73	1	3	0.0	3.0				
34	74	1	3	0.0	3.0				
34	75	1	3 1/4	0.0	3.25				
34	76	1	3	0.0	3.0				
34	77	1	3 1/4	0.0	1.0				
34	78	1	3 1/4	0.25	1.5				
171	93	1	3 1/2	0.25	3.5				
171	94	1	3 3/8	0.0	3.37				
171	95	1	3 1/4	0.0	3.25				
171	96	1	3	2.0	0.0				
171	97	1	3 1/2	0.0	3.5				
171	98	1	3 1/4	0.0	3.25				
1	105	1	-	0.0	-				
1	106	1	-	0.0	-				
1	107	1	4 3/4	0.0	4.75				
1	108	1	2 1/2	0.0	2.5				
1	109	1	3 1/2	2.0	0.0				
1	110	1	3	2.0	3.0				
544	133	1	1 1/2	0.66	1.5				

TABLE 4 (CONTINUED)

UNTREATED SECTION TEST DATA

Highway Number	Core Number	Approx. Age, Years	Thickness, Inches	Laboratory Water-Penetration Test-Height, Inches Remaining Core	Penetration By Foreign Material Depth, Inches	Field Water Penetration Tests Height Remaining, Inch Summer C	Summer W.P.	Winter C	Winter W.P.
566	124	1	-	0.0	-				
566	125	1	1 1/2	0.0	1.5				
566	126	1	1 3/4	0.0	1.75	1/2			
566	127	1	1 1/2	1.5	1.5				
566	128	1	1 1/4	0.0	1.25				
124	141	1	1 1/2	0.0	1.5				
124	142	1	1 1/2	1.0	1.5	2			
124	143	1	1 1/2	0.0	1.5				
124	144	1	-	0.0	-				
124	145	1	1 5/8	0.0	1.63				
124	146	1	2	0.0	2.0				
1	159	1	4 3/4	0.0	4.75				
1	160	1	-	1.25	-	2			
1	161	1	4	1.75	0.0				
1	162	1	4 1/2	0.0	4.5				
1	163	1	4 1/4	0.0	4.25				
1	164	1	4 3/4	0.0	4.75				
1	171	1	1 3/4	0.0	1.75				
1	172	1	1 5/8	2.0	1.0	2			
1	173	1	1 3/4	2.0	1.75				
1	174	1	-	2.0	-				
1	175	1	1 1/4	0.0	1.25				
1	176	1	1 1/4	0.0	1.25				
167	189	1	3 3/4	2.0	3.75				
167	190	1	3 1/2	0.0	3.50	2			

TABLE 4 (CONTINUED)

UNTREATED SECTION TEST DATA

Highway Number	Core Number	Approx. Age, Years	Thickness, Inches	Laboratory Water Penetration Test Height, Inches Remaining Core	Penetration By Foreign Material Depth, Inches	Field Water Penetration Tests Height Remaining, Inches Summer C	Summer W.P.	Winter C	Winter W.P.
167	191	1	3 3/4	1.5	0.0				
167	192	1	4	1.25	4.0				
167	193	1	4 1/4	1.5	0.0				
167	194	1	-	2.0	-				
Frontage Road	312	8	2 1/4	1.25	2.25			2	2
Frontage Road	313	8	1 7/8	2.00	1.5	2		2	2
Frontage Road	314	8	2	2.00	2.0			2	2
Frontage Road	315	8	2	2.00	2.0			2	
Frontage Road	316	8	1 3/4	0.0	1.75			2	
Frontage Road	317	8	2 1/2	0.0	2.5			2	
18	330	8	2	-	0.0			0.0	0.0
18	331	8	-	-	-		2	2	2
18	332	8	1 7/8	-	1.87			2	2
18	333	8	-	-	-			2	
18	334	8	-	-	-			0.0	
18	335	8	-	-	-			0.0	
90	336	1	-	-	-	1 3/4			
90	337	1	3 3/8	1.16	3.37				
90	338	1	3 1/2	2.0	3.5				

TABLE 4 (CONTINUED)

UNTREATED SECTION TEST DATA

Highway Number	Core Number	Approx. Age, Years	Thickness, Inches	Laboratory Water Penetration Test-Height, Inches Remaining Core	Penetration By Foreign Material Depth, Inches	Field Water Penetration Tests Height Remaining, Inches Summer C	Summer W.P.	Winter C	Winter W.P.
90	339	1	3 3/4	2.0	0.5				
90	340	1	3 3/4	0.0	3.75				
90	341	1	3 1/2	1.75	3.5				
82	361	1	1 3/4	0.0	0.0		1 7/8		
82	362	1	2 1/2	1.25	0.25				
82	363	1	2 1/2	1.75	0.50				
82	364	1	3 1/4	0.25	1.0				
82	365	1	2 1/2	1.50	0.25				
82	366	1	2 1/8	0.0	2.12				
21	379	1	3 3/8	0.16	3.37	2.0			
21	380	1	3 3/4	2.0	1.0				
21	381	1	3 1/2	1.0	3.5				
21	382	1	3 1/2	0.0	3.0				
21	383	1	3 3/8	2.0	1.0				
21	384	1	3 1/4	0.0	3.25				
22	397	1	2	0.0	2.0	1 1/4			
22	398	1	1 1/4	0.0	1.25				
22	399	1	4	0.0	4.0				
22	400	1	4 1/2	0.0	4.5				
22	401	1	1 1/4	0.0	1.25				
22	402	1	1 1/4	0.0	1.25				