3878
C.2

LIBRARY COPY
Materials & Research Dept.

69-37

ClibPDF - www.fastio.com

ClibPDF - www.fastio.com

F-64

STATE OF CALIFORNIA—TRANSPORTATION AGENCY

RONALD REAGAN, Governor

DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
MATERIALS AND RESEARCH DEPARTMENT
5900 FOLSOM BLVD., SACRAMENTO 95819

November 1969

Final Report
M & R No. 642107

Mr. J. L. Beaton
Materials and Research Engineer

Dear Sir:

Submitted herewith is a report titled:

EFFECT OF ENZYMATIC WETTING AGENTS ON SOIL PERMEABILITY

TRAVIS SMITH
Principal Investigator

A. D. HIRSCH
Co-Principal Investigator

Very truly yours,

Travis Smith

Travis Smith
Assistant Materials and
Research Engineer - Foundation

Attach
cc:J Woodstrom
A Hirsch
R Forsyth

ClibPDF - www.fastio.com

ClibPDF - www.fastio.com

ABSTRACT

REFERENCE: Smith, Travis and Hirsch, A. D., "Effect of Enzymatic Wetting Agents on Soil Permeability," State of California, Department of Public Works, Division of Highways, Materials and Research Department. Research Report 642107, November, 1969.

ABSTRACT: A enzymatic wetting agent has been tested for its ability to enhance soil permeability. Some slight increase was noted in flows from horizontal drains in the areas of landslides where the product was used. Consideration in further research on the use of enzymatic wetting agents is recommended.

KEY WORDS: field experiments, vertical wells, horizontal drains, enzymatic wetting agent, soil permeability.

ClibPDF - www.fastio.com

ClibPDF - www.fastio.com

ACKNOWLEDGMENTS

The Materials and Research Department wishes to express their appreciation for the cooperation accorded these field experiments by the developers of the product, "Terra-Zym," namely, the Bio-Quad Company, Inc., Mr. Anthony Roman, Director Technical Services, Mr. Arthur Lance, President, and Laboratory and Testing Director, and Mr. John Laird, Sales Representative.

ClibPDF - www.fastio.com

ClibPDF - www.fastio.com

I. INTRODUCTION

Reference is made to the memorandum dated August 11, 1969, from J. H. Woodstrom to Travis Smith reporting laboratory and field experiments to determine the effectiveness of wetting agents on soil permeability. Since the results of the first field application were inconclusive, a second location was selected for further study. This report covers the procedures which were followed at the second location and the data obtained.

II. CONCLUSIONS AND RECOMMENDATIONS

Some slight increase in flow from horizontal drains was observed in a few of the horizontal drains in areas which were subjected to treatment with the wetting agent. This negligible amount of flow increase for a short period of time would not justify the use of this product to enhance soil permeability for sub-surface drainage purposes. No further work is proposed at this time.

In future research on the use of this type of enzymatic wetting agent consideration should be given to horizontal drain installations where flow rates of intercepted ground water, whether from drainage galleries or natural foundations, are known to have decreased over a period of time.

III. METHOD OF EXPLORATION

The Pinole slip-out area on U.S. Highway 80 in District 04 was the site chosen for injection of the enzymatic wetting agent "Terra-Zym" into one of a series of vertical wells located uphill and approximately parallel to the freeway where the failure occurred. As an emergency drainage measure, horizontal drains had been drilled from near the push-up at the toe of the slipout on the west side of the fill through the original ground beneath the roadway to the area of the 3-foot diameter vertical wells. These vertical wells had been drilled on about 50-foot centers along the toe of the newly constructed detour fill. This fill had been placed immediately adjacent to the existing roadway fill slope on the east side.

Flow from the horizontal drains was measured several times over a period of about one week prior to injection of the wetting agent into the vertical boring. Ground water levels in the vertical borings were also measured and recorded.

A mixture of "Terra-Zym" and water was first poured into the vertical boring and then 50 lbs of dry ice was dropped in. The hole was sealed off at the surface, and the evaporating

ClibPDF - www.fastio.com

ClibPDF - www.fastio.com

ice caused a pressure build-up to about 10 psi before leaks around the outside of the casing and in the casing seal permitted the pressure to subside.

Immediately after pressurization, it was noted that the free water in the vertical hole had been forced out. However, within about three hours, the water level in the boring had raised again. No appreciable increase was noted in flows from horizontal drains.

A tabulation of ground water levels and a report of flow from horizontal drains before and after pressurization of the vertical boring are attached to this report.

ClibPDF - www.fastio.com

ClibPDF - www.fastio.com

RESEARCH PROJECT - ENZYMATIC AGENT
Pinole Slipout Area 04-CC-80

REPORT OF FLOWS FROM HORIZONTAL DRAINS

Horiz. Dr. No.	8-15-69	8-16-69	8-17-69	8-19-69	8-25-69	8-26-69	8-27-69
1	70 GPD	70 GPD	80 GPD	70 GPD	(Vertical	70 GPD	70 GPD
2	720	720	720	696	boring P-8	720	675
3	Drip	Drip	Drip	Drip	charged	Dry	Dry
4	407	407	407	400	with enzy-	393	385
5	Dry	Dry	Dry	Dry	matic agent	Dry	Dry
6	"	"	"	"	and pres-	"	"
7	"	"	"	"	surized at	"	"
8	"	"	"	"	1100 hrs.)	"	"
9	"	"	"	"		"	"
10	940	940	940	982		940	720
11	625	635	635	600		675	675
12	1964	1964	1964	1964		1800	1800
Total Flows	4726	4736	4746	4712		4598	4325

Boring No.	*Depth to water:						
P-7	23.2'	22.7'	22.7'	22.8'	22.7'		22.9'
P-8	30.4'	29.1'	29.1'	29.9'	29.9'		28.1'
P-9	30.1'	29.6'	29.7'	29.9'	30.2'		29.4'
P-10	23.7'	23.7'	23.7'	23.9'	23.9'		-

*Measurements taken from top of casing to water level in each boring.

ClibPDF - www.fastio.com

ClibPDF - www.fastio.com