FEASIBILITY OF USING PELLETIZED LIME

by

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ERRATA

On page 12, caption under Photograph 5 should be under Photograph 6 and caption under Photograph 6 should be under Photograph 5.

PREFACE

There has been a wide spread use of hydrated lime by the Texas Highway Department, in the past twenty-five years or more, in the stabilization of subgrade soils, subbases and base materials. Hydrated lime, both in a slurry and a dry condition, has been used about equally and is preferred to quicklime or calcium oxide in the dry form largely due for fear of injury or burns to personnel and to the public. The hydrated lime itself has presented problems in city street and highway construction when applied dry; and, therefore a more dust free lime would be preferred, not only in city sections but also, where dry lime could be lost due to wind in rural sections.

The Research Division of the U. S. Gypsum Company has developed a mixture of hydrated and quick lime in a pellet form in the hope that the problem with dust in dry application of lime would be minimized. This lime having an approximate 50-50 blend of quick and hydrated lime was used in this study.

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I. CONCLUSIONS

1. Pelletized lime can be produced which is practically dustless in normal application through ordinary truck distributors.

2. The use of pelletized lime probably requires more water sprinkling equipment on the job since water for hydration is also required.

3. Pelletized lime must have access to water in order to slake completely or else it may be mixed and compacted partially slaked or "hot." In the laboratory using the mixing methods, described later, it was relatively easy to wet and slake the lime. The resultant mixture was buttery or pasty and upon being passed through 1/4-inch hardware cloth left specimens very spotted and indicated poorer distribution of lime. Strength tests on two soils in this report are inconclusive as to any detrimental effects from this spotting or apparent lack of lime distribution.

4. The use of pelletized lime appears to be feasible from the standpoint of dusting in city section type usage, but the choice of placing lime in a dry form or slurry form would be defined by economic and other factors not taken into account in this report.

II. RECOMMENDATIONS

1. It is recommended that District 20 and interested Austin office Divisions observe the two sections of pelletized and hydrated lime stabilized subgrade on State Highway 87 from time to time, to try to ascertain any significant advantage one might possess over the other in service.

2. Since it appears that the use of pelletized lime is feasible in controlling the lime dusting aspect, but shows little else as being superior to present lime methods it is recommended that pelletized lime usage be considered where dusting is a problem and where it can be shown to be economical to the Texas Highway Department, or where it can be shown to have additional benefits to offset additional costs.

3. If it can be shown to be an economical product and it is desired to use lime in pelletized form containing quicklime, then it is recommended that specifications be written to cover this product with the inclusion of an acceptable purity.

4. It is further recommended that in the event specifications are written for purchase of pelletized lime containing quicklime and hydrated lime mixtures that a suitable test method be written since present test methods on lime do not sufficiently cover this product.

III. RESULTS

It was apparent to those observing the placement of pelletized lime that there was very little dusting as compared to dry placing of hydrated lime. During placement of lime on the Orange County job one man from the U. S. Gypsum Company followed the distributor and water trucks very closely on foot. He used no protective clothing or equipment and in approximately two hours showed no apparent ill effects to his eyes, nose or skin. One reason for this undoubtedly could be attributed to the larger grain sizes of the dry pelletized lime causing it to settle quickly.

Laboratory tests showed the hydrated lime to be slightly more effective in reduction of liquid limits and plasticity indices of roadway samples.

Results of unconfined compressive strengths are inconclusive. For equal $Ca(OH)_2$ equivalencies the hydrated lime gave better strengths on a heavv clay soil but the pelletized lime gave better strengths on soil from the job site. Lime contents used on the job were one to two percentage points above amounts recommended in AASHO test procedures.

No immediate apparent benefits could be explained in using pelletized lime other than in the dry form to relieve the lime dusting effect during spreading. Its use in lime slurry would likely be based wholly on economics.

IV. DISCUSSION

The U. S. Gypsum Company, having developed a pelletized lime product which contained an approximate 50-50 blend of quick and hydrated lime, made the necessary arrangements with the Beaumont District of the Texas Highway Department for the use of pelletized lime on a test section of subgrade soil on State Highway 87 in Orange County. Sufficient quantities of this product were produced, in a pilot plant in New Braunfels, Texas to supply the Beaumont job and later a section of U. S. 59 at the Harris County - Ft. Bend County Line. This lime, after production, was sealed in plastic bags within drums in order to negate or minimize air hydration.

When the job in District 20 progressed to the point of application of lime, representatives of the Materials and Tests Division and the

Design Division of Austin, U. S. Gypsum Company and any other interested parties observed placement and mixing operations. At that time arrangements were made with District 20 Laboratory personnel to sample the new subgrade soil, our laboratory number 72-235-R, and ship it to the Materials and Tests Division. In addition, District 20 agreed to sample and test the lime treated subgrade soil on both the pelletized and hydrated lime sections at ten, thirty, sixty and ninety days after placement. Results of the liquid limit, plasticity index and percent soil binder of these tests are given in Table II.

The subgrade soil is designated by the U. S. Soil Conservation Service as Midland-Crowley-Waller Series having an average triaxial classification of 4.5. Its liquid limit is 30, plasticity index of 13, shrinkage ratio 1.78 and has less than 1/2 percent retained on the No. 40 sieve. The subgrade soil is a rather "tough" sand clay.

Photographs 1 through 3 show the distributing of pelletized lime on the Orange County job. The dusting shown in Photograph 3 happens when the truck is emptying its last lime. At all other times Photographs 1 and 2 depict normal dusting. Photograph 4 shows steaming after sprinkling by the water truck at the far right. Photographs 5 through 7 are from the U. S. 59 job near Houston. Photograph 6 shows distribution of hydrated lime and its dusting while Photograph 5 shows a dust comparison with pelletized lime distributed dry on the left and the truck at right distributing hydrated lime. Photograph 7 shows the beginning of mixing the pelletized lime. It was apparent on this job that ample water sprinkling equipment was very necessary for smooth operations.

The subgrade soil from the Orange County job in Beaumont was set up to use 5% hydrated lime by weight. In order to make laboratory specimens of equal hydrate values the Chemical Section gave a factor of 1.1326 to 1.0000 interms of lime being used. This meant that 4.42 percent of the pelletized lime had the equivalent $Ca(OH)_2$ content when completely hydrated as the hydrated lime of 94.06 percent $Ca(OH)_2$. This data on hydrate equivalency is presented in the calculations designated as Appendix I.

Specimens were than molded using 4.42 percent pelletized lime and with 5.00 percent hydrated lime used in the Orange County job. Molding and testing was accomplished in accordance with Test Method Tex-121-E, Appendix II, except that for testing unconfined only two specimens were molded rather than three. Results of the two unconfined compressive strengths were averaged and reported as one value for ages of 10, 30, 60 and 90 days. One other deviation from the test method was necessary in molding the pelletized lime in that the raw soil was sieved over the No. 20 sieve and the plus No. 20 fraction was placed in the mixing pan, levelled and then all the pelletized lime placed in a thin layer on top of the soil. Then the mixing water was sprinkled on the lime in order to give it water for hydrating before being intimately mixed with the soil particles. One full set of specimens was molded using both limes for triaxial classification according to Test Method Tex-117-E. Molding data is not presented since the amounts of lime used were so much in excess of that recommended by AASHO T 220-66 that it was almost a certainty to be a high Class 1 triaxially. Figure 1 shows this to be the case.

Figure 1 shows the triaxial classifications using both limes with Manor Clay, Laboratory No. 39-11-MR, a clay soil from the Houston Black Soil Series and having a raw soil classification of 5.3 or 5.4. Soil 39-11-MR has a liquid limit of 63, plasticity index of 42, shrinkage ratio 2.06 and 4 percent retained on the No. 40 sieve. The molding and curing of these specimens were as described above for the Orange County job and lime percentages of 4.9 for the pelletized and 5.7 for the hydrate were used. Two specimens, whose unconfined compressive strengths were averaged, were molded for each lime and soil 39-11-MR and they were tested at 10, 30, 60 and 90 day intervals for strength comparisons on another soil which had been experimented with extensively. The amount of lime used is close to that recommended in AASHO T 220-66.

Table I gives the unconfined compressive strengths of both soils with both limes together with other data on raw and treated plasticity indices, moisture contents, etc.

Figures 2 and 3 show data from Table I in graphical form with Figure 2 giving unconfined compressive strengths versus time for the four mixtures and with Figure 3 giving testing moisture (after capillarity) versus time.

Personnel from District 20 took samples of the in situ lime treated subgrades, pelletized and hydrated lime sections, at the same time intervals of 10, 30, 60 and 90 days. Tests were performed to determine the liquid limit, plasticity index and percent passing the No. 40 sieve. The results of these tests are given in Table II. A study of the data from these tables show that the hydrated lime was slightly more effective in reducing the plasticity index although none of the plasticity indices were excessive.

Data for the molding of individual specimens is not presented, herein, due to voluminous data. All test specimens were specimens at the peak of the moisture-density curve after having been molded in accordance with Test Method Tex-121-E with exceptions as noted above. The compactor used was equipped with sector hammer weighing ten pounds and dropping fifty times on each 2-inch layer. Specimens were 6-inch diameter by 8-inches in height. Figures 4 and 5 show the moisture density curves for all four soil lime combinations molded.

Appendix III, Hydrated Lime and Lime Slurry Test Report, gives the test data on the hydrated lime from the Orange County job and Appendix I gives an analysis of the hydrated lime used in the laboratory with clay soil 39-11-MR.

While a dry screen analysis has no validity in present lime testing procedures, and it is recognized that the amount of screening can alter the sieve analysis to some extent, the following screen analysis is presented to allow the reader to better visualize the pelletized lime used in this project.

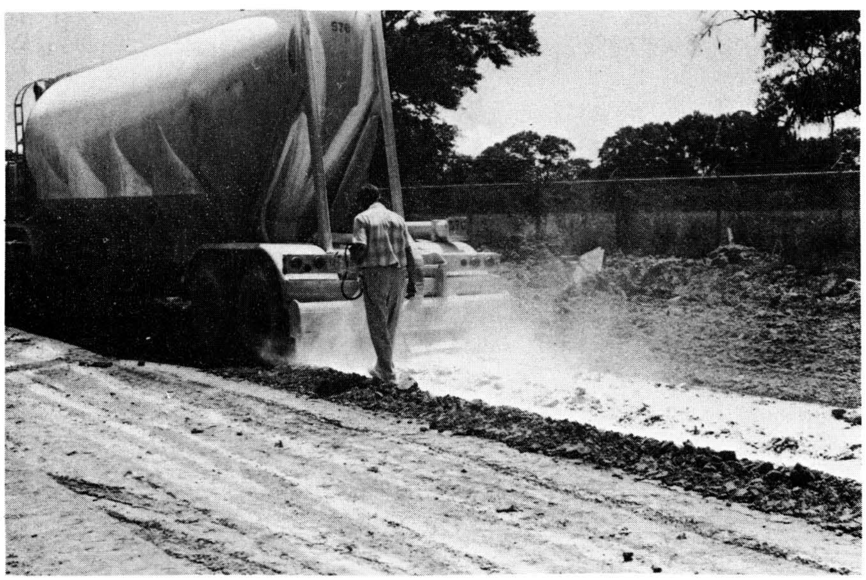
Dry Screen Analysis

Sieve Size	% Accumulated Retained
No. 20	0
30	16.8
40	39.3
50	61.4
60	72.8
Passing No. 60	26.7

ACKNOWLEDGEMENT

The sampling and performance of tests by personnel of District 20 is gratefully acknowledged.

Photograph 1. Distributing and Sprinkling Pelletized Lime on Orange County Job.

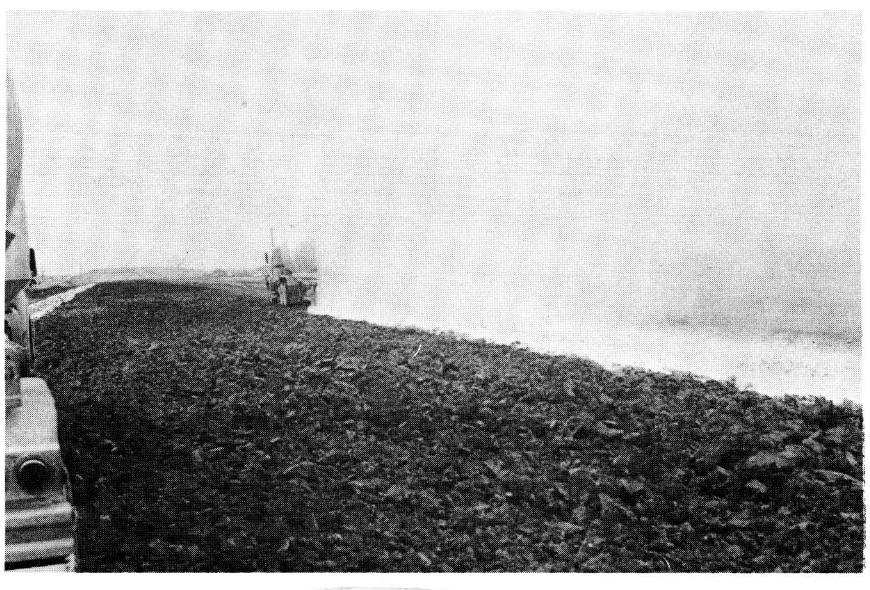


Photograph 2. Showing Close Up View of Pelletized Lime Distribution.

Photograph 3. Showing Pelletized Lime Dusting Upon Nearing Final Emptying of Truck.

Photograph 4. Showing Steaming of Quicklime in Pelletized Lime After Sprinkling.

Photograph 5. Showing Dusting of Hydrated Lime on U. S. 59 Near Houston.



Photograph 6. Showing Pelletized Lime Being Distributed on Left, Hydrated Lime on Right.

Photograph 7. Beginning of Mixing of Pelletized Lime.

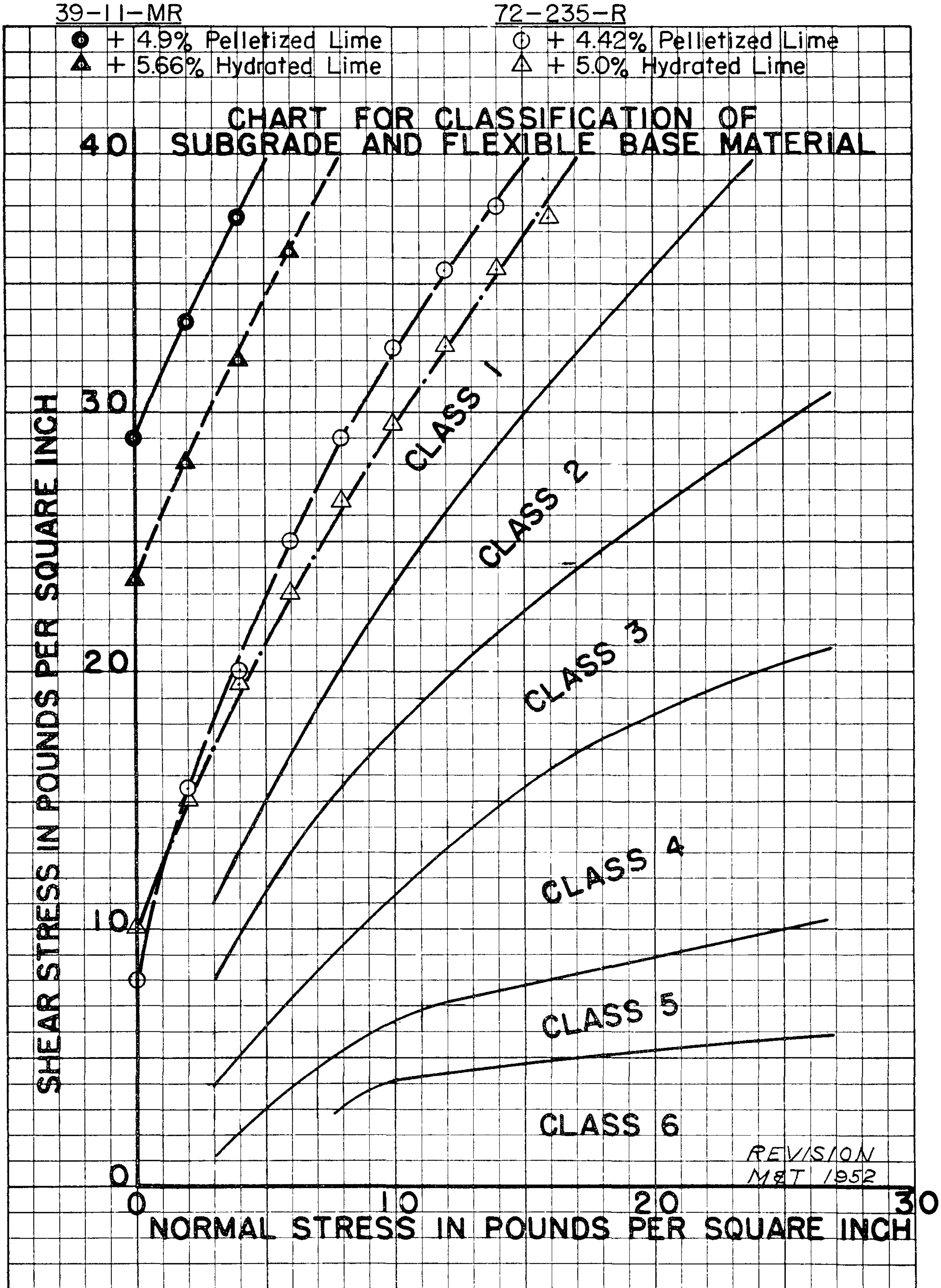

39-11-MR
+ 4.9% Pelletized Lime
+ 5.66% Hydrated Lime
72-235-R
+ 4.42% Pelletized Lime
+ 5.0% Hydrated Lime
CHART FOR CLASSIFICATION OF
SUBGRADE AND FLEXIBLE BASE MATERIAL
SHEAR STRESS IN POUNDS PER SQUARE INCH
NORMAL STRESS IN POUNDS PER SQUARE INCH
0
10
20
30
40
CLASS 1
CLASS 2
CLASS 3
CLASS 4
CLASS 5
CLASS 6
REVISION
M&T 1952

FIG. 1

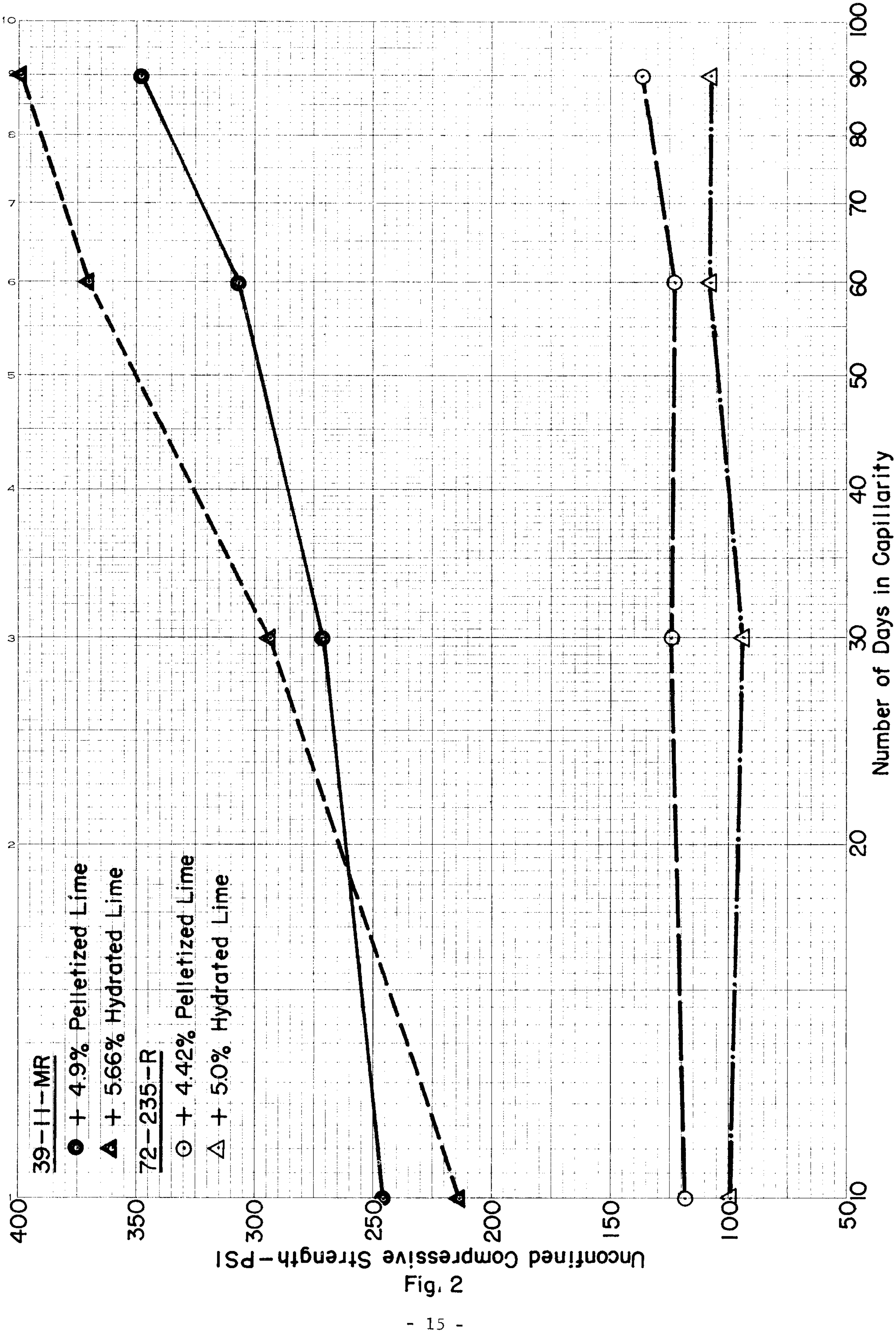
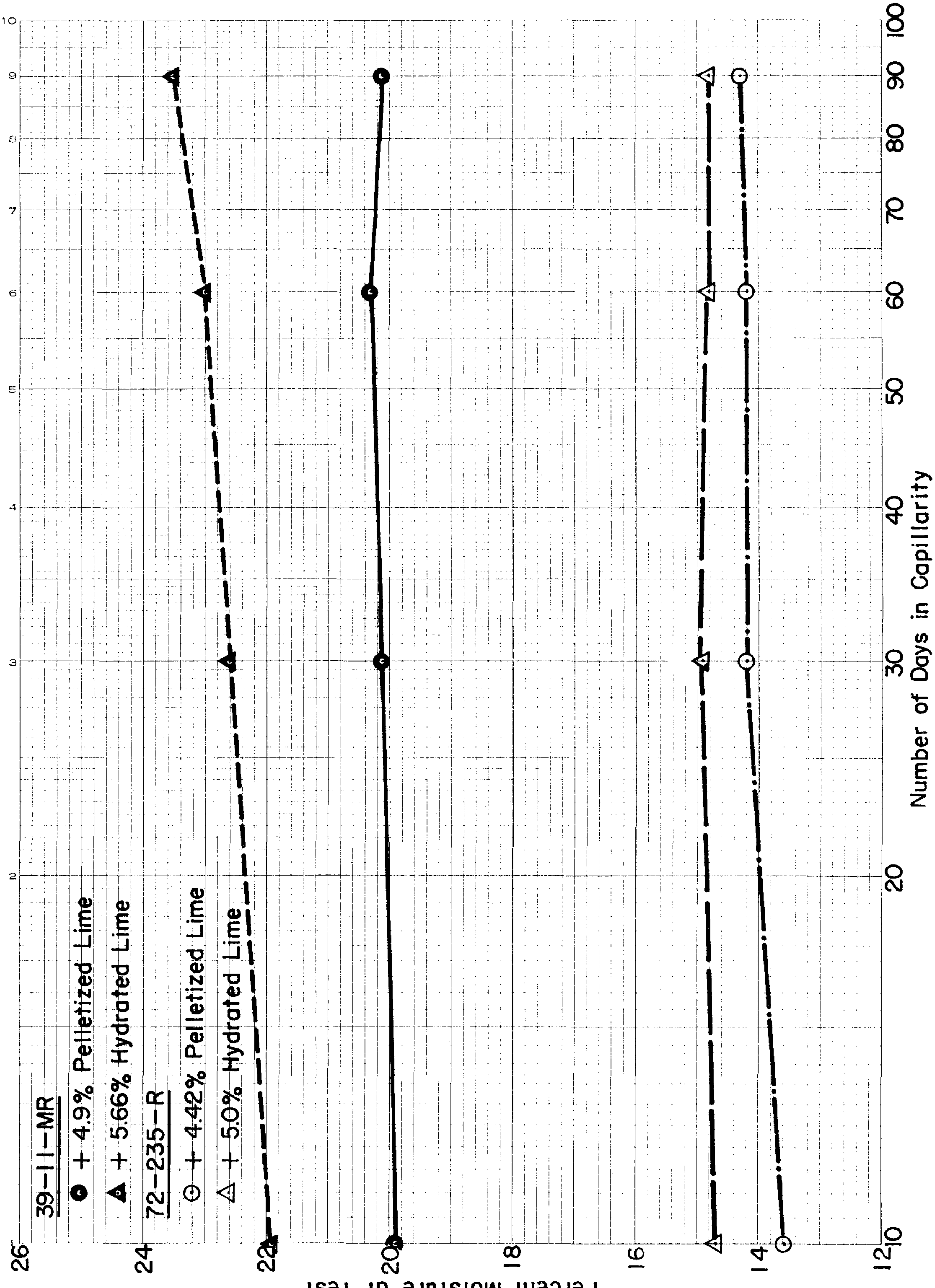
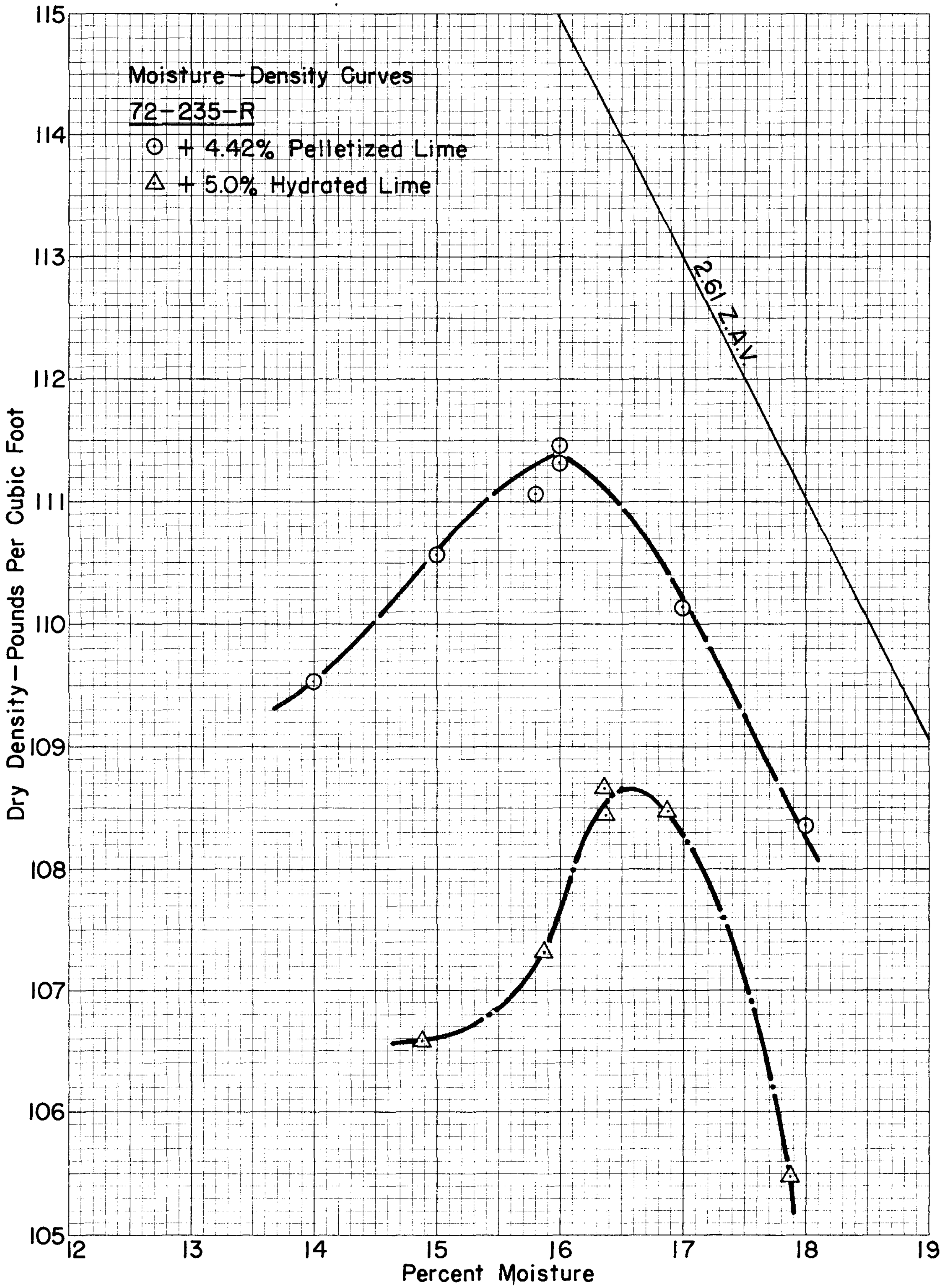

39-11-MR
+ 4.9% Pelletized Lime
+ 5.66% Hydrated Lime
72-235-R
+ 4.42% Pelletized Lime
+ 5.0% Hydrated Lime
Number of Days in Capillarity
Unconfined Compressive Strength-PSI
10
20
30
40
50
60
70
80
90
100
50
100
150
200
250
300
350
400

Fig. 2



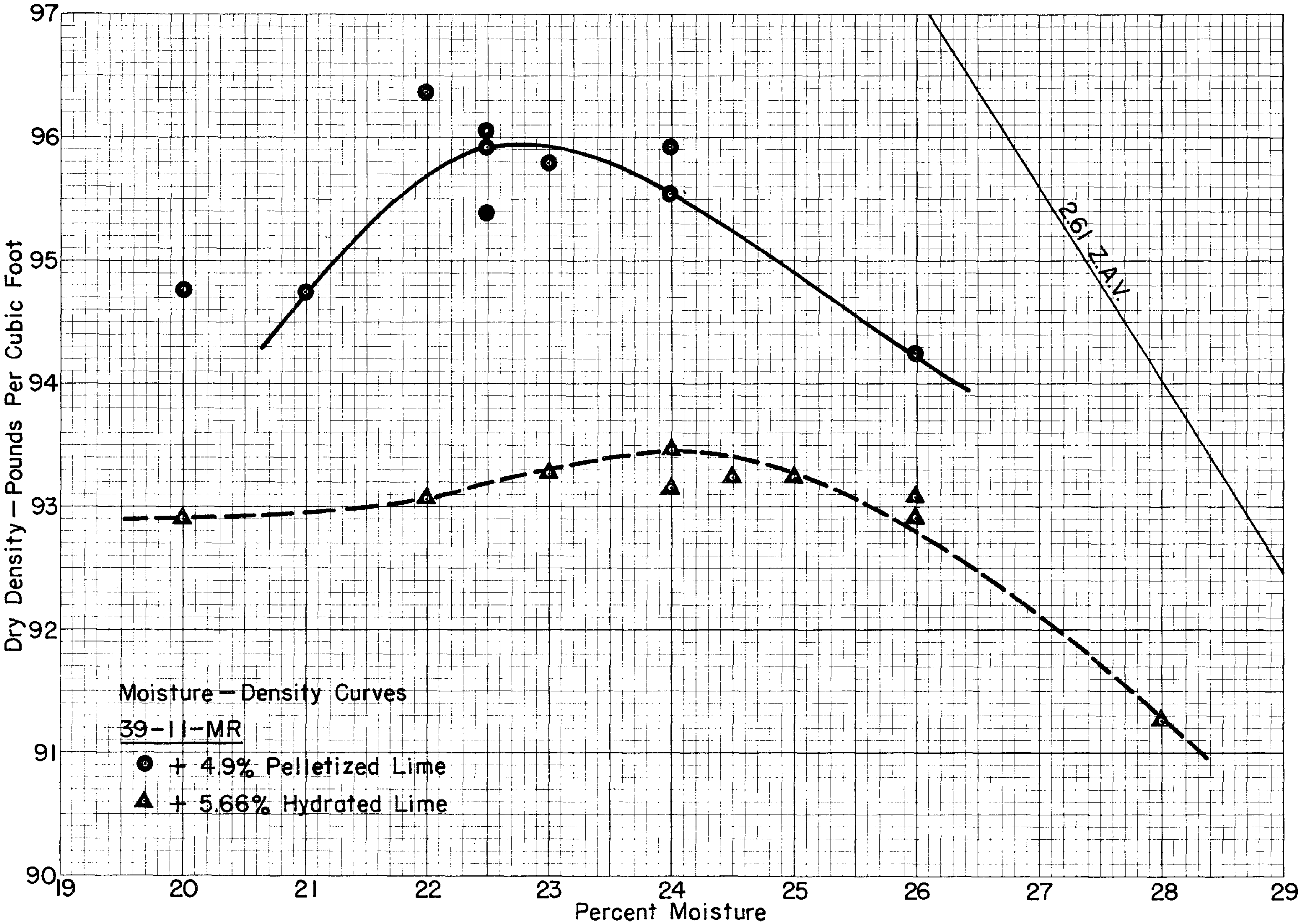
39-11-MR
+ 4.9% Pelletized Lime
+ 5.66% Hydrated Lime
72-235-R
+ 4.42% Pelletized Lime
+ 5.0% Hydrated Lime
10
20
30
40
50
60
70
80
90
100
Number of Days in Capillarity
12
14
16
18
20
22
24
26
Percent Moisture at Test

Fig. 3



Moisture—Density Curves
72-235-R
⊙ + 4.42% Pelletized Lime
△ + 5.0% Hydrated Lime
2.61 Z.A.V.
Dry Density—Pounds Per Cubic Foot
115
114
113
112
111
110
109
108
107
106
105
12
13
14
15
16
17
18
19
Percent Moisture

Fig. 4



Dry Density — Pounds Per Cubic Foot
Percent Moisture
2.61 Z.A.V.
Moisture — Density Curves
39-11-MR
+ 4.9% Pelletized Lime
+ 5.66% Hydrated Lime
97
96
95
94
93
92
91
90
19
20
21
22
23
24
25
26
27
28
29

Fig. 5

TABLE I

TABLE OF TEST RESULTS

Sample No.	Type Lime	% Lime	No. Days in Capillarity	Compression Test (psi)	P.I. After Capillarity	P.I. Raw Soil	Percent Molding Moist. (Opt.Moist.)	Percent Moist. After Capillarity
72-235-R	Pelletized	4.42	10	118.2	9.1	13.0	14.74	13.62
72-235-R	Pelletized	4.42	30	124.0	6.8	13.0	14.86	14.15
72-235-R	Pelletized	4.42	60	122.3	8.2	13.0	15.10	14.22
72-235-R	Pelletized	4.42	90	135.6	6.7	13.0	15.03	14.27
72-235-R	Hydrated	5.0	10	98.8	6.0	13.0	16.05	14.67
72-235-R	Hydrated	5.0	30	92.8	7.6	13.0	16.14	14.85
72-235-R	Hydrated	5.0	60	106.6	6.6	13.0	16.07	14.77
72-235-R	Hydrated	5.0	90	107.2	6.4	13.0	16.05	14.81
39-11-MR	Pelletized	4.9	10	245.1	5.1	40.0	20.99	19.92
39-11-MR	Pelletized	4.9	30	271.1	4.6	40.0	20.85	20.07
39-11-MR	Pelletized	4.9	60	305.8	5.1	40.0	20.79	20.30
39-11-MR	Pelletized	4.9	90	348.0	4.8	40.0	20.91	20.13
39-11-MR	Hydrated	5.66	10	213.4	3.9	40.0	22.67	21.90
39-11-MR	Hydrated	5.66	30	293.3	4.0	40.0	23.66	22.64
39-11-MR	Hydrated	5.66	60	369.7	3.8	40.0	24.02	23.03
39-11-MR	Hydrated	5.66	90	399.3	3.2	40.0	24.33	23.46

TABLE II

Summary of Tests on Hydrated and Pelletized Lime in Place

Orange County, State Highway 87, Project U-649(4), Control 305-7-24, Station 3+00

	Hydrated Lime				Pelletized Lime			
Age After Lime Application (days)	10	30	60	90	10	30	60	90
Liquid Limit	41.1	40.4	39.4	37.1	42.3	40.6	40.9	42.4
Plasticity Index	6.4	8.6	6.0	7.3	9.9	9.9	6.9	9.1
% Soil Binder	99.1	-	-	-	-	100	99.9	100

APPENDIX I

<u>Lime Equivalency Calculations</u>

The last sample of pelletized lime from the Houston pelletized lime project has been analyzed and related in terms of potential calcium hydroxide content to the bag of lime hydrate which was obtained from the plant.

Here is a rough outline of the method of calculation employed to arrive at the figure of 5.7# of this bagged hydrate being needed for a mix to correspond to mixes where 4.9# of pelletized U. S. Gypsum material is used.

Given:

analysis of pelletized lime:

41.26% CaO

55.32% $Ca(OH)_2$

<u>3.42%</u> Impurities (SiO_2 @ 1.65% & $CaCO_3$ @ 1.77%)
100.00% Total

analysis of hydrated lime:

94.06% Ca(OH)

<u>5.94%</u> Impurities (SiO_2 @ 0.86 & $CaCO_3$ @ 4.73 & H_2O @ 0.35%)
100.00% Total

Calculation:

Assume complete hydration of 100# of pelletized lime & calculate its hypothetical analysis on a 100% basis:

41.26% CaO in pellets x factor 1.32126 to convert CaO to $Ca(OH)_2$ = 54.52# $Ca(OH)_2$ from CaO

55.32# $Ca(OH)_2$ originally

3.42# Impurities

113.26# Total completely hydrated pellets

Since 100# of original pellets will give 113.26# of completely hydrated pellets, proceed to calculate the pounds of ingredients of the hydrated pellets on a 100% analysis basis:

To convert to a percentage basis, multiply values by factor of $\frac{100.00}{113.26}$ or 0.88292 as follows;

54.52# $Ca(OH)_2$ in hydrated pellets x 0.88292 = 48.14% $Ca(OH)_2$

55.32# $Ca(OH)_2$ in hydrated pellets x 0.88292 = 48.84% $Ca(OH)_2$

3.42# Impurities in hydrated pellets x 0.88292 = 3.02% Impurities

100.00% Total

The purity of the hydrated pellets is 96.98% $Ca(OH)_2$ which is the sum of 48.14% + 48.84% $Ca(OH)_2$.

Now:

100# "as received" pellets = 113.26# of hydrated lime of 96.98% $Ca(OH)_2$ purity.

How many pounds of "as received" pellets would be equivalent to 100# of hydrated lime of 94.06% $Ca(OH)_2$ purity.

Calculation:

$$100\# \text{ lime hydrate of } 94.06\ Ca(OH)_2 = 100\# \times \frac{94.06\%}{96.98\%} \times \frac{100.00\#}{113.26\#} =$$

$$= 100\# \times 0.96989 \times 0.88292$$

$$= 100\# \times 0.85634$$

= 85.63# of "as received" pellets

Summation:

100# of hydrated lime of 94.06% $Ca(OH)_2$ is equivalent in $Ca(OH)_2$ content to 85.63# of "as received" pelletized lime <u>assuming</u> that in use the pellets will <u>completely</u> hydrate to give a hydrated lime of 96.98% $Ca(OH)_2$ content.

Sample Calculation:

4.9# of pelletized lime is equivalent in $Ca(OH)_2$ when completely hydrated to how many pounds of lime hydrate of 94.06% $Ca(OH)_2$?

Calculation: $$\text{lime hydrate} = 4.9\# \times \frac{100.00}{85.63} =$$

$$= 4.9\# \times 1.16782 = 5.7$$

APPENDIX II

Texas Highway Department

Materials and Tests Division

SOIL-LIME COMPRESSIVE STRENGTH TEST METHODS

Scope

This method describes a procedure for determining the triaxial classification and unconfined compressive strength as an index of the effectiveness of hydrated lime treatment in imparting desirable properties to flexible base and subgrade materials.

Apparatus

The apparatus outlined in Test Methods Tex-101-E, Tex-113-E, Tex-117-E and a Compression Testing Machine meeting the requirements of A.S.T.M. Designation D 1633-59T. Capacity 60,000 lbs. The Tri-Axial Screw Jack Press Tex-117-E may be used when anticipated strengths are not in excess of 300 to 400 psi.

Materials

1. A fresh supply of hydrated lime.

2. Water - a good quality tap water.

Test Record Form

Record test data on "M-D and Triaxial Work Sheet", "Triaxial Test Data Sheet", Form 1062, and "Triaxial Compression Test Capillary Wetting Data". See Test Method Tex-117-E.

Preparation of Sample.

Select a representative sample approximately 200 pounds in size and prepare the material according to the procedure of Part II in Test Method Tex-101-E. See General Notes

Procedure

1. Determining optimum moisture and density: Use the method described under Test Method Tex-113-E and determine the optimum moisture and maximum density for the soil-lime mixture. The amount of lime to use is a percentage based on the dry weight of the soil. In performing this part of the test, mix the lime with the portion of material passing the No. 10 sieve. Wet the plus No. 10 portion with some or all of the weighed quantity of water (depending on how little or how much plus No. 10 the sample contains) and stir and wet the aggregates thoroughly. Then add in the mixture of minus No. 10 material with lime, mix thoroughly and compact each layer with a compactive effort of 13.26 ft.-lbs. per cubic inch. (50 blows per 2 inch layer using the 10 pound ram with 18 inch drop).

Note: In clay soils separate the material on the No. 20 sieve. Mix approximate proportionate amounts of the lime to be used with both fractions. Sprinkle the mixing water on the + No. 20 fraction using most or all of the water as required. Add in the - No. 20 fraction and the remainder of water if any. Mix thoroughly and mold as above.

2. Compaction of the Test Specimen: Compact six specimens 6" in diameter and 8" in height at the optimum moisture and density found by using 13.26 ft. lbs. /cu. in. compactive effort for each percentage of lime selected. These lime-treated subgrade soil or flexible base specimens molded for the triaxial test should be compacted as nearly identical as possible. If the material to be improved by lime treatment is a flexible base material and the unconfined compression test is used to evaluate the strength, only three identical specimens need to be molded for each percentage of hydrated lime.

3. Curing Test Specimens

(a) The test specimens with top and bottom porous stone in place are covered with a triaxial cell immediately after extruding from the forming mold. The specimens are now stored at room temperature for a period of 7 days.

(b) After this moist curing period, remove the cells and place the specimens in an air dryer and dry at a temperature not to exceed 140°F. for about 6 hours of until one-third to one-half of the molding moisture has been removed. All lime-treated soils are dried as given above even though a considerable amount of cracking may occur. Allow the specimens to cool to room temperature before continuing the test.

(c) Weigh, measure, and enclose the specimens in triaxial cells and subject them to capillarity for ten days. Use a constant lateral pressure of 1 p.s.i. and a surcharge weight of 1/2 p.s.i. to 1 p.s.i. depending upon the use of the material being tested.

4. Testing the Specimens: The specimens are prepared and tested as outlined in Test Method Tex-117-E. A compression testing machine of adequate range and sensitivity may be used.

Calculations and Graphs

The calculations, plotting of test data and interpretation of test results are the same as for the Triaxial Compression Test, Part I, of Test Method Tex-117-E, except that lime stabilized clay soils are not currently recommended for top course of base, regardless of the triaxial class.

Reporting of Test Results

Report the test results on Compression Test Results, Figure 2. Include triaxial strength classification or unconfined compressive strength values, density, moisture and recommended lime contents.

General Notes

Wetted stabilized materials taken from the roadway during construction should be quartered to approximate specimen size batches and molded. This material should not be prepared in accordance with Test Method Tex-101-E. Where M-D curves are desired, material drier than the roadway mix can be produced by stirring the material or by drying back under a fan while stirring the mix.

Store hydrated lime in air tight container or use a fresh supply.

Notes

This test has been devised as a means of determining the quality of soils treated with hydrated lime to be used for subbase or base protected with a wearing surface. Flexible base materials and granular soils can usually be stabilized with about 3% hydrated lime. A larger amount may be required to improve the strength of a very plastic clay subgrade if it is intended to improve and use the treated clay as part of the subbase. Unconfined compressive strength of 100 p. s. i. is satisfactory for final course of base construction and it is desirable that materials for such courses contain a minimum of 50 percent plus No. 40 before treatment. Various soil materials may be treated for subbase and in such cases the minimum suggested unconfined compressive strength should be 50 p. s. i.

It is intended that field density control shall be based on testing road mix samples in accordance with Test Method Tex-114-E. It is suggested that a minimum of 98% of compaction ratio density be obtained for base course treatments and 95% of compaction ratio density be obtained for subgrade treatments.

COMPRESSIVE STRENGTH TEST WORKSHEET
FOR SOIL-LIME MIXES

Sample No.						
Date Molded						
Date Tested						
Percent Lime						
Percent Water Added						
Percent Hygro. Moist						
Total % Moist. in Spec.						
Pounds Soil (Dry)						
Pounds Lime						
Lbs. Soil (Dry) + Lime						
Lbs. Soil + (Hygro. Moist.)						
Pounds Lime						
Lbs.Soil+Hygro.Moist.+Lime						
Wt. Water Added						
Tare Wt. Jar						
Wt. Water + Jar						
Wt. Per Layer						
Mold No.						
Wet Wt. Spec. + Mold						
Tare Wt. Mold						
Wet. Wt. Specimen						
Dry Wt. Specimen						
Height Specimen						
Vol. per Lin. Inch						
Volume of Spec.						
Dry Density Spec.						
Total Load-Comp.						
Comp. Str. P.S.I.						
Remarks:						

Figure I

COMPRESSION TEST RESULTS

LAB. NO.	PERCENT LIME ON BASIS OF DRY WEIGHT OF SOIL	DRY DENSITY IN #/CU. FT. OF SOIL AND LIME	COMPRESSIVE STRENGTH P.S.I.	PERCENT MOISTURE ABSORBED	OPTIMUM MOISTURE OF SOIL PLUS LIME

Figure 2

APPENDIX III

 69920-561-20m

HYDRATED LIME AND LIME SLURRY TEST REPORT

No Charge

Laboratory No. 72-2352-J
Date Rec'd. 10-17-72 Date Reported 10-19-72
Dist. or Res. Engr.
Address
Sampler Warren Dudley
Sampler's Title
Contractor
Producer
Sampled from
Quantity represented by sample
Proposed for use as

Material: HYDRATED LIME

Control No.	Sect. No.	Job No.
INFORMATIONAL		

County	Federal Project No.	Hwy. No.

District No.	Req. No.	Date Sampled
		10-12-72

Identification
Specification Item No.
Seal No.

DETERMINATIONS

Type A, Hydrated Lime

Chemical Composition:	*Code*	*% by Wt.*
Hydrate alkalinity, $Ca(OH)_2$	I	93.3
Unhydrated lime content, CaO	K	-
"Free water" content, H_2O	J	0.5
Residue:		
Ret. on No. 6 (3360 micron) sieve	M	None
Ret. on No. 10 (2000 micron) sieve	N	0.0
Ret. on No. 30 (590 micron) sieve	O	0.0

Lab. Remarks: The following data furnished as additional information:

	Code	
Carbonate alkalinity, $CaCO_3$	B′	5.3
"Inert Matter," SiO_2 etc.	L	0.9

Type B, Commercial Lime Slurry

Chemical Composition:	*Code*	*% by Wt.*
Hydrate alkalinity of the "solids content", $Ca(OH)_2$	Q	
"Dry solids content"	P	
Residue:		
Ret. on No. 6 (3360) micron sieve (expressed as % by wt. of the "solids content" of the slurry)	M	
Ret. on No. 10 (2000 micron) sieve (expressed as % by wt. of the "solids content" of the slurry)	N	
Ret. on No. 30 (590 micron) sieve (expressed as % by wt. of the "solids content" of the slurry)	O	

Lab. Remarks: The following data furnished as additional information:

	Code	
Bulk density of the slurry at 77°F. in lbs./gal. (U.S.)	R	
Equivalent dry lime content of the slurry, in lbs. of lime/gal. (U.S.) at 77°F.	S	

Remarks: