REPORT ON ROCK FILL TEST SECTIONS

MAIN DAM

SHEARON HARRIS NUCLEAR POWER PLANT

CAROLINA POWER & LIGHT COMPANY

MAY, 1979

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I. Introduction

Rockfill test sections VRMD 24-4-3 and VRMD 24-2-4 were constructed 1) to establish and evaluate placement and compaction procedures and 2) to evaluate engineering properties of materials to be placed in the rock shell portions of the main dam. Field construction was supervised by Carolina Power and Light and Ebasco Services personnel. Laboratory testing was performed by the Raleigh office of Law Engineering and Testing Company with the exception of large diameter triaxial tests which were performed by the Atlanta offices of the Corps of Engineers.

II. Summary of Test Fill Construction

Test sections of two gradation ranges were constructed; a) VRMD-24-4-3; maximum allowable particle size of 22 inch greatest dimension and b) VRMD 24-2-4; maximum allowable particle size of 22 inch average dimension. For each test section, slightly to moderately weathered granitics of as excavated gradation were placed in lifts and worked by dozer to exclude oversize and achieve a 24 inch lift thickness. Equipment used was similar to that which will be used during dam construction. Loose lifts were then compacted by 10 passes of a vibratory smooth drum roller with settlement readings surveyed after individual passes. Correlations made between compaction effort and measured settlement were related to visual observations of the condition of the lift surface. From this information, the optimum

compactive effort to minimize post-construction settlement and prevent excessive surface breakage was determined to be 8 passes. Lifts for documentation of engineering properties of rockfill were then compacted by 8 passes of the specified roller. Before and after compaction gradations, inplace density and permeability, and large-scale triaxial strength tests were performed to ensure that methods and materials utilized in the test section(s) satisfied all aspects of design requirements. Test sections were then cut in half to observe distribution of fines, interlock of large particles, and uniformity of compaction.

III. Conclusions

Test Section VRMD-24-4-3 was constructed using a criteria for maximum allowable particle size of 22 inch length or maximum dimension. Because of the rectangular shape of granitic fragments obtained from the spillway cut, it was found that exclusion of rock of greater than 22 inch length (1) effectively required removal of the majority of desirable fragments greater than 10-12 inch average dimension, and (2) indirectly caused excessive and undesirable overworking of the lift surface. Test Section VRMD-24-4-3 was therefore used only to aid in establishing placement technique and optimum amount of compactive effort.

Based on the above observations, Test Section VRMD 24-2-4 was constructed using a maximum allowable particle of 22 inch average dimension. A

representative after compaction gradation from lift 2 of this test section indicates a D_{50} size of approximately 4 inches. In order to allow for sample variance and to conservatively measure rockfill strength, a parallel gradation curve with D_{50} of 3 inches was modelled for large diameter triaxial strength tests. Data obtained from field and laboratory testing of Test Section VRMD-24-2-4 lift 2 are as follows:

a. gradation analysis

1. before compaction Dmax = 18" D_{50} = 6"
2. after compaction Dmax = 18" D_{50} = 4"

b. inplace density

1. dry density - 139.9 pcf
2. moisture content - 3.9%

c. settlement

8 passes of vibratory roller produced 3.5% settlement

d. permeability - constant head

an inplace permeability test indicated a permeability (k) of 1.1×10^{-2} cm/sec.

e. effective strength parameters per large scale triaxial shear tests ($\bar{R}$)

1. cohesion (c') = 0 psi
2. friction angle (Ø') = 40.5 degrees

Note: Strength parameters represent a rockfill gradation with D_{50} = 3 inches. A replacement gradation was tested at a density of 135 pcf at 4.0% moisture.

Because of the pattern of weathering, fresher granitics of coarser gradation will be obtained as the excavation increases in depth. It is therefore believed that strength and permeability as determined

by test section construction are conservative and will represent lower bounds for materials to be used in the main dam.

Based on our evaluation of these test sections, construction of main dam rockfill shells should be as outlined below:

Materials: Rockfill shall be well-graded durable fragments of grantics, as can be obtained from the spillway excavation. Deeply weathered zones shall be wasted so as to meet gradation requirements as specified below.

Placement: Rockfill shall be blasted by suitable means, loaded and end dumped by Euclid R-50 or equivalent haul truck on the fill surface. The material shall be spread diagonally outward from the core by D-8 dozer to place oversize materials at the exterior of the dam shell and to achieve a nominal 24 inch loose lift.

Compaction: Rockfill shall be compacted by a smooth drum vibratory roller (Raygo Rascal 600A) using forward and backward travel for a total of 8 overlapping passes. Roller frequency shall be between 1400 to 1500 vpm and roller speed shall be less than [illegible] equal to 3.0 mph.

Inplace Testing: Tests to docum[illegible] density and gradation shall be performed as pe[illegible] and Light Test Procedure TP08. Requirements shall be [illegible]s follows:

a. <u>inplace density</u>: average dry density shall be 135 pcf. Absolute minimum dry density shall be 130 pcf.

b. <u>inplace gradation:</u> the rockfill shall be well graded with a minimum D_{50} size of 3 inches. Maximum size shall be of 22 inch average dimension (90% of lift thickness) with a length to width ratio of less than or equal to 3:1.

IV. Procedures

As in-place test fill section was constructed on site to simulate the actual hauling, dumping, spreading, and compaction processes of main dam rockfill construction. From this test fill, in-place properties such as gradation, density, permeability, and settlement due to rolling were determined.

A. Description of Test Fill - Test fill sections designated VRMD-24-4-3 and VRMD-24-2-4 were constructed during February and March 1979 in separate areas adjacent to the site of the main dam. The areas selected were free of excessive surface water and reasonably level. The areas were staked out, graded, and then proof rolled with a vibratory roller until no appreciable settlement was detected. The test fills were constructed in accordance with PPCD - SHNPP Technical Procedure TP-01. The test sections were approximately 40 feet by 55 feet in plan dimension with 24 settlement points.

Ramps were constructed with 5 horizontal to 1 vertical slopes. The sides of the test section were maintained at approximately 1.5 H to 1V. The material was end dumped, spread to approximately 24 inch loose thickness, and compacted with 10 passes of a Raygo Rascal 600-A roller. The roller produces a dynamic force of 40,000 pounds for a vibration frequency between 1400 and 1500 VPM. The roller was operated at a maximum speed of 3 mph. Test fill Section VRMD-24-4-3 consisted of four lifts. Test Section VRMD-24-2-4 consisted of 2 lifts.

B. Material - The material used was slightly to moderately weathered granites and granite gneisses obtained from blasting in the spillway excavation. All material came from between Sta 10+50 and 11+75, El 250-260, West of centerline (Photo 1). Maximum particle size allowed for test fill VRMD-24-4-3 was 22 inches length or maximum dimension (corresponding to 90% lift thickness). Maximum particle size allowed for test fill VRMD-24-2-4 was 22 inches average dimension.

C. Settlement Measurement - VRMD-24-4-3 - Prior to placement of the first lift, initial readings were recorded for each of the 24 settlement points. A system of offset control was used to ensure proper relocation of settlement points after each lift placement. The rockfill material was then end dumped by Euclid R 50 trucks and spread in approximately 24 inch lifts by a dozer equivalent to that to be used on the dam (Photos 2 and 3). The method and operating time utilized by both types of equipment simulated anticipated field conditions.

After spreading, each settlement point was marked with paint sprayed directly on the lift surface. Level readings were recorded for each of the points and averaged to determine the initial lift thickness. The vibratory roller then made one pass over the entire surface of the lift without vibration and level readings were taken and averaged to determine the initial lift height. The procedure was then repeated with vibration for a total of 10 passes with settlement readings taken after each pass (Photos 4 thru 6). The settlement points were repainted as necessary. After completion of the first lift, settlement data was collected in the same manner for the second and third lifts. The final level readings recorded from a previous lift were used as the initial readings in determination of the thickness of the next lift. A plot of percent decrease in lift thickness versus number of passes was constructed from the data collected for each lift. An examination of the settlement plots for the first three lifts revealed that 8 passes of the roller produced an optimum amount of settlement per compaction effort. Therefore, the fourth lift was rolled with only 8 passes.

VRMD-24-2-4 - Settlement measurements for Test Section VRMD-24-2-4 were performed as per the above description except that only the first lift was compacted by 10 passes. After observation of settlement data and confirmation of the suitability of 8 passes, lift 2 was compacted with 8 passes in preparation for testing for documentation.

D. In-Place Density Determination - After the final layer of the respective test fills were compacted and all settlement data was recorded, in-place density test(s) were performed. The following procedure was used to conduct the tests:

1. A wood frame measuring 8 feet x 8 feet x 6 inches high was placed over the test area and held in-place by stakes.
2. Level readings of all four corners of the frame were recorded from a nearby established bench mark.
3. One sheet of polyethylene was laid loosely over the frame to be in as close contact as possible with the inside of the frame and the rock surface.
4. The depression in the slack membrane was filled with water via a calibrated barrel to within 3 or 4 inches of the top of the frame (Photo 7).
5. The volume of water added and the distance from the top of the frame to the water surface was measured and recorded.
6. The water was removed without disturbing the frame or damaging the membrane.
7. The polyethylene sheet was removed and checked for leaks.
8. The material within the frame was then carefully excavated and placed into a truck and enveloped in plastic.
9. The hole was then hand-cleaned to remove all loose or sharp material in the sides and bottom.
10. The weight of the total sampled excavated was determined by weighing the truck full and empty.

11. The polyethylene sheet was again placed loosely over the excavated hole and frame.

12. The hole was filled with water to the same level as in Step 4.

13. Level readings were again taken at all four corners of the frame to assure the frame had not moved.

14. The volume of water added was recorded.

15. Steps 6 and 7 were repeated.

E. Grain Size Distribution Test - Before and after gradation analyses were performed on the rockfill used in the test fills. Before compaction gradation samples were taken from the end dumped loose lift of the test fill prior to spreading. The after compaction gradation sample was obtained from the in-place density test. Samples weighing approximately 3500 lbs. were taken directly to the testing laboratory, spread out on a concrete floor, and heated with space heaters to remove the moisture. The material was graded by hand using square wooden sieves of 6, 12, 18, and 24 inch sizes. The sample was then reduced by quartering and graded down to the #8 sieve using a Gilson Sieve Shaker. A Ro-Tap Sieve Shaker was used to determine particle size down to the #200 sieve. The weights retained on each sieve were carefully measured and the Percent Passing Total was determined for each sieve ranging from 24" down to #200.

F. <u>Permeability Test</u> - In-place permeability tests were performed on the test fills. A constant head method was used to determine the coefficient of permeability of the rockfill material. A brief discussion of the permeability test used is presented below:

1. In-place permeability tests were performed on the test fill in accordance with a modification of the Bureau of Reclamation, Department of the Interior, Field Permeability Test (Well Permeameter Method) Designation E-19. The procedure used was as follows:

   a. An air track drilling rig drilled a hole in the top of the test fill to a 2.8 ft. depth.

   b. The sides of the well were scarified and all loose material was removed from the bottom of the well.

   c. The well was filled to the top with pea gravel of known density and a standpipe placed in the top of the hole.

   d. The volume and radius of the well were then determined.

   3. In order to provide a large enough reservoir of water to conduct each permeability test at anticipated flows, a pump truck was used instead of the calibrated 50 gallon barrel. Flow rates were controlled by pump rate and by valve and were measured by using an in-line calibrated flow meter at the collar of the hole (Photo 8).

   f. Water was kept at a constant head in the well by maintaining the free water surface within the 3 1/2 inch casing a constant distance beneath a string baseline.

g. Water was allowed to flow into the well for approximately one hour (or until a constant head could be maintained) to ensure saturation of the area adjacent to the well.

h. Measurements were then made at 15 minute intervals to measure the quantity of water that flowed into the well. This was continued for approximately 2 hours. An average flow rate was then calculated.

i. All the data was compiled and the permeability of the test fill determined for a constant head, low water table condition per Designation E19.

G. Large-Scale Triaxial Tests - Large diameter (15") triaxial strength testing was performed on material from a rockfill sample representative of material used to construct test section VRMD-24-2-4. Tests were conducted by the U. S. Army Engineer Division Laboratory, South Atlantic, under the direction of Mr. Robert J. Stephenson. The complete laboratory report is included as Appendix C.

Testing included a controlled strain 15-inch diameter consolidated undrained triaxial shear test with pore pressure measurements ($\bar{R}$ test). Tests were conducted at confining pressures (σ_3) of 1, 2, and 4 tons per square foot (tsf). Test specimens were reconstituted with material from a rockfill sample taken from test section VRMD-24-2-4. A "replacement gradation" containing minus 3-inch sizes was established for the tests based on the gradation of the total rockfill sample. Test samples were prepared by reconstituting samples of this replacement gradation to densities comparable to that measured from the test section. Individual samples were then saturated, consolidated to the applicable confining pressure, and axially loaded at a strain rate of approximately 0.1 percent per minute. Shear strength parameters were computed at 15 percent axial strain. Total and effective strength envelopes were then plotted.

V. Discussion of Results

A. Settlement

Settlement data were analysed using (a) raw settlement data and (b) smoothed data where settlement decreases are discarded. For test section VRMD-24-4-3 raw and smoothed cumulative settlement data are shown in Figures 1 thru 3 for the first through third lifts respectively. Breaks in the average rate of settlement per pass were noted for each lift between passes 1-2, 3 thru 8, and 9-10 as shown in Figures 4 and 5. Correlation between visual field observation (field inspection reports are included in Appendix B) and settlement data showed the following relationship:

Passes 1-2: 0.80% settlement per pass at initial high rate; rocks are repositioned and knit into a moderately compacted mass at a high rate of settlement per pass.

Passes 3-8: 0.30% settlement per pass at constant rate; rocks are tightly compacted, sharp corners are broken to form shards over 10-20% of the surface area.

Passes 9-10: 0.18% settlement per pass at decreasing rate; surface breakage only.

Based on the above, the fourth lift of Test Section VRMD-24-4-3 was compacted with 8 passes of the vibratory roller using forward and backward travel. The number of passes was chosen to minimize post-construction settlement and prevent excessive surface breakage. Settlement data and rates obtained from lift 4 are shown in Figure 6. These data show a relationship similar to data obtained from lifts 1-3.

Settlement data and settlement rates for the first lift of Test Section VRMD-24-2-4 are shown in Figures 7 and 8, respectively. Since these data showed consistent settlement rates to that observed in Test Section VRMD-24-4-3, intermediate lifts were believed to be unnecessary and the second lift was compacted to 8 passes for documentary purposes. Settlement data for lift 2 are shown in Figure 9.

B. Material Gradation

Before and after gradations for material placed in lift 4 of Test Section VRMD-24-4-3 are shown in Figure 10. A D_{max} of 24 inches and D_{50} of 6 inches were measured from a sample obtained prior to spreading the loose lift. After compaction gradations showed a D_{max} of 18 inches and D_{50} varying between 1.5 and 2 inches.

The differences in before and after gradation were attributed to three factors:

a. variance in actual material gradation.

b. removal of materials exceeding 22 inch length (or maximum dimension) from the loose lift prior to compaction, thereby creating an artificially fine sieve gradation. Note that rock fragments available are generally not cubic. With increasing length to width ratios, the difference between maximum dimension and sieve size increases and is believed to be significant.

c. removal of unacceptable sizes exceeding 22 inch length unavoidably requires removal of significant quantities of acceptable sizes.

d. particle breakage upon compaction.

Since it was believed that the effects of excluding material of 22 inch or greater dimension were appreciable, Test Section VRMD-24-2-4 was constructed using a maximum size particle of 22 inch average dimension with a length to width ratio not exceeding 3 to 1. Test Section VRMD 24-4-3 was therefore used only to establish placement technique and required compactive effort.

Before and after gradations of material placed in lift 2 of Test Section VRMD-24-2-4 are shown in Figure 11. A D_{max} of 18 inches and a D_5 of 7 inches were measured from a sample obtained prior to spreading the

loose lift. After compaction gradations of a representative sample showed a D_{max} of 18 inches and a D_{50} of 4 inches. Differences in before and after gradation are attributed to:

a. variance in actual material gradation,

b. removal of some acceptable sizes, as unacceptable sizes are rolled to the sides of the test area by dozer, and

c. particle breakage.

Based on visual observation of the compaction process, it is believed that particle breakage is minor and that before and after differences in gradation are due primarily to items a and b. Based on observation of test fill construction, it is believed, that inplace after compaction gradations of D_{50} greater than 3 inches are obtainable on a production basis using a maximum size criteria of 22 inch average dimension.

C. In-Place Density

In-place density measurements performed on test section VRMD-24-4-3 indicate densities as follows (see Appendix A for laboratory report):

Test 1 dry density 137.4 pcf at moisture content of 2.3%

Test 2 dry density 134.2 pcf at moisture content of 2.8%

Density measurements performed on Test Section VRMD-24-2-4 indicate a dry density of 139.9 pcf at a moisture content of 3.9%. These results indicate that densities averaging 135 pcf or greater can be reached on a production basis using 8 passes of the roller.

D. Permeability Measurement

Inplace permeability measurements (Appendix A) indicate permeabilities (K) = 8.1×10^{-3} cm/sec for Test Section VRMD-24-4-3 and K = 1.1×10^{-2} cm/sec for Test Section VRMD-24-2-4.

E. Strength Determinations

A gradation with D_{50} equal to 3 inches, parallel to that measured after compaction in VRMD-24-2-4, was modelled for testing by the Corps of Engineers (Report included as Appendix C). Figure 12 is a plot of the tested material replacement gradation in comparison to the inplace material gradation of D_{50} = 4 inches and the constructed parallel curve with D_{50} = 3 inches. For a test density of 135 pcf at 4% moisture, the large scale triaxial tests indicate effective strength parameters for this material and gradation as follows:

cohesion (C') - 0 psi

friction angle (Ø') - 40.5 degrees

F. Examination of Test Fill Cross Section

After the test fills were completed, cuts were made through all lifts. Observations made were as follows:

1. Test Section VRMD-24-4-3

A transverse cut was made thru all four lifts of Test Section VRMD-24-4-3. Good bonding between lifts was observed (Photo 9). No layering or segregation of large particles was observed, fines are distributed throughout and are uniformly compacted. Because of the material gradation, however, not all large particles interlock and in portions of the cross section, well compacted fines separate the larger rock particles (Photo 10).

2. <u>Test Section VRMD-24-2-4</u>

A longitudinal cut was made thru the two lifts of Test Section VRMD-24-2-4. As in Test Section VRMD-24-4-3, good bonding between each lift was observed. No layering or segregation of large particles can be seen (Photo 11). Fines are uniformly distributed and compacted. As in Test Section VRMD-24-4-3, small areas of the cross section have well compacted fines separating the larger rock particles (Photo 12).

APPENDIX A

PERCENT SETTLEMENT VS. NUMBER OF PASSES

SHEARON HARRIS MAIN DAM
TEST FILL [illegible]
LIFT NO 1 21.4" THICKNESS
RAYGO 600A VIBRATORY SMOOTH DRUM ROLLER
FREQUENCY M-1500 VPM SPEED ≤ 3 MPH

DATE 2/27/[illegible]
PREPARED [illegible]
CHECKED

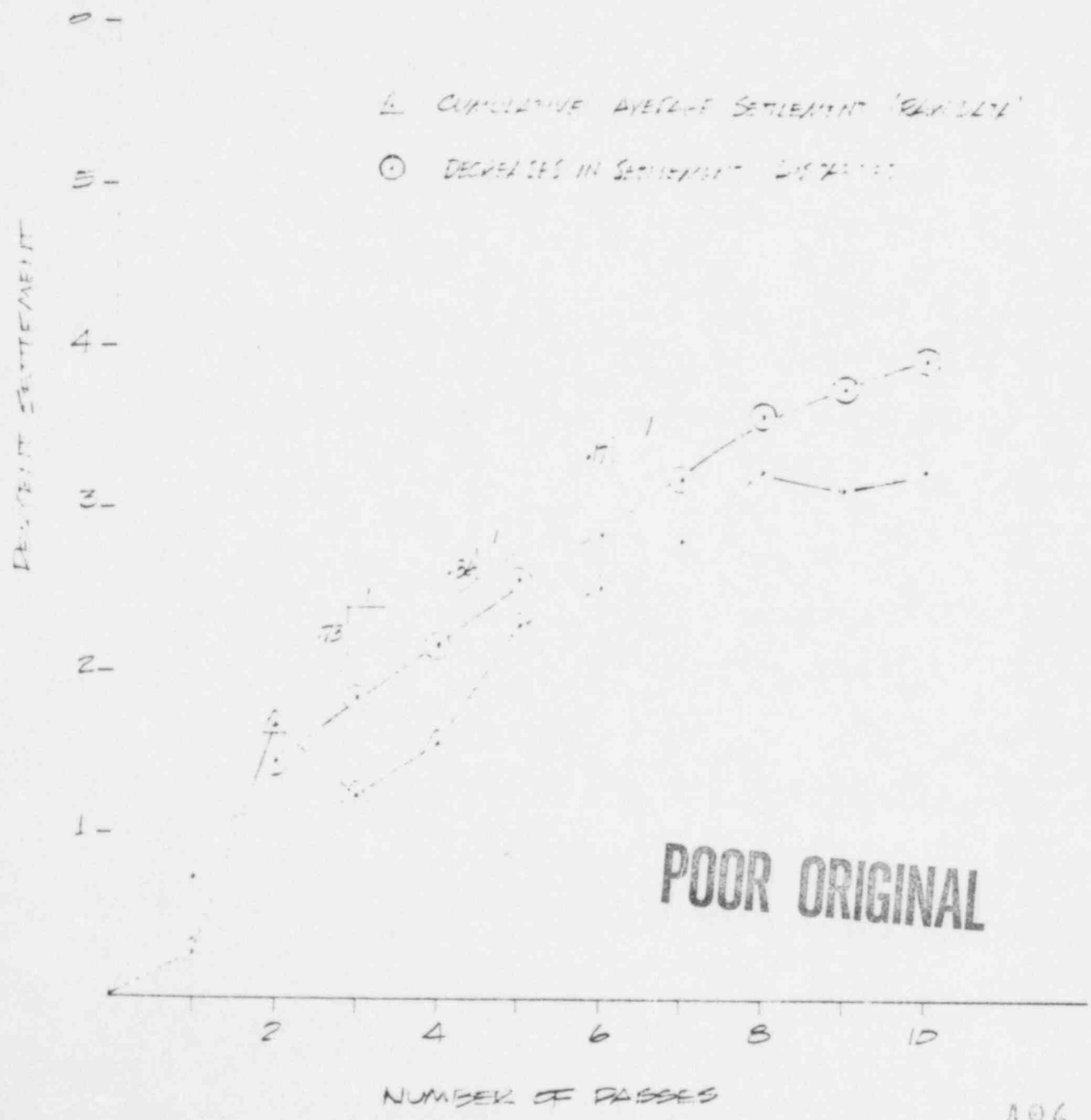

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FIGURE 1

PERCENT SETTLEMENT VS. NUMBER OF PASSES

SHEARON HARRIS MAIN DAM
TEST FILL VRMD-24-4-3
LIFT NO 2 22.8" THICKNESS
RAYGO 600A VIBRATORY SMOOTH DRUM ROLLER
FREQUENCY 14-1500 VPM SPEED ≤ 3 MPH

DATE 3/1/77
PREPARER REH
CHECKED

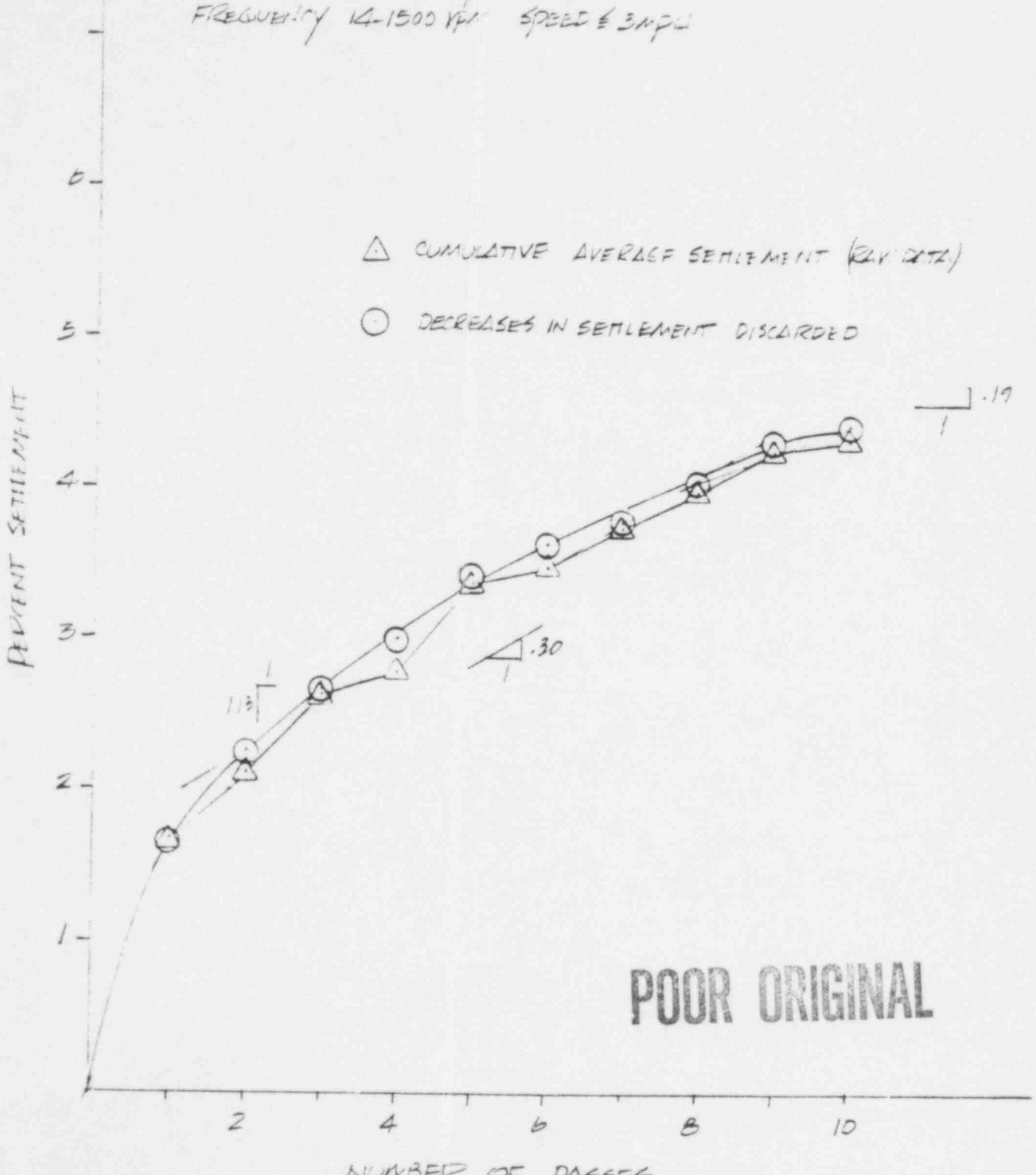

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FIGURE -

PERCENT SETTLEMENT VS. NUMBER OF PASSES

SHEARON HARRIS MAIN DAM — DATE 3/5/79

TEST FILL VRMD-24-4-3 — PREPARER REL

LIFT NO 3 31.1" THICKNESS — CHECKED

RAYGO 600A VIBRATORY SMOOTH DRUM ROLLER

FREQUENCY 14-1500 VPM SPEED ≤ 3MPH

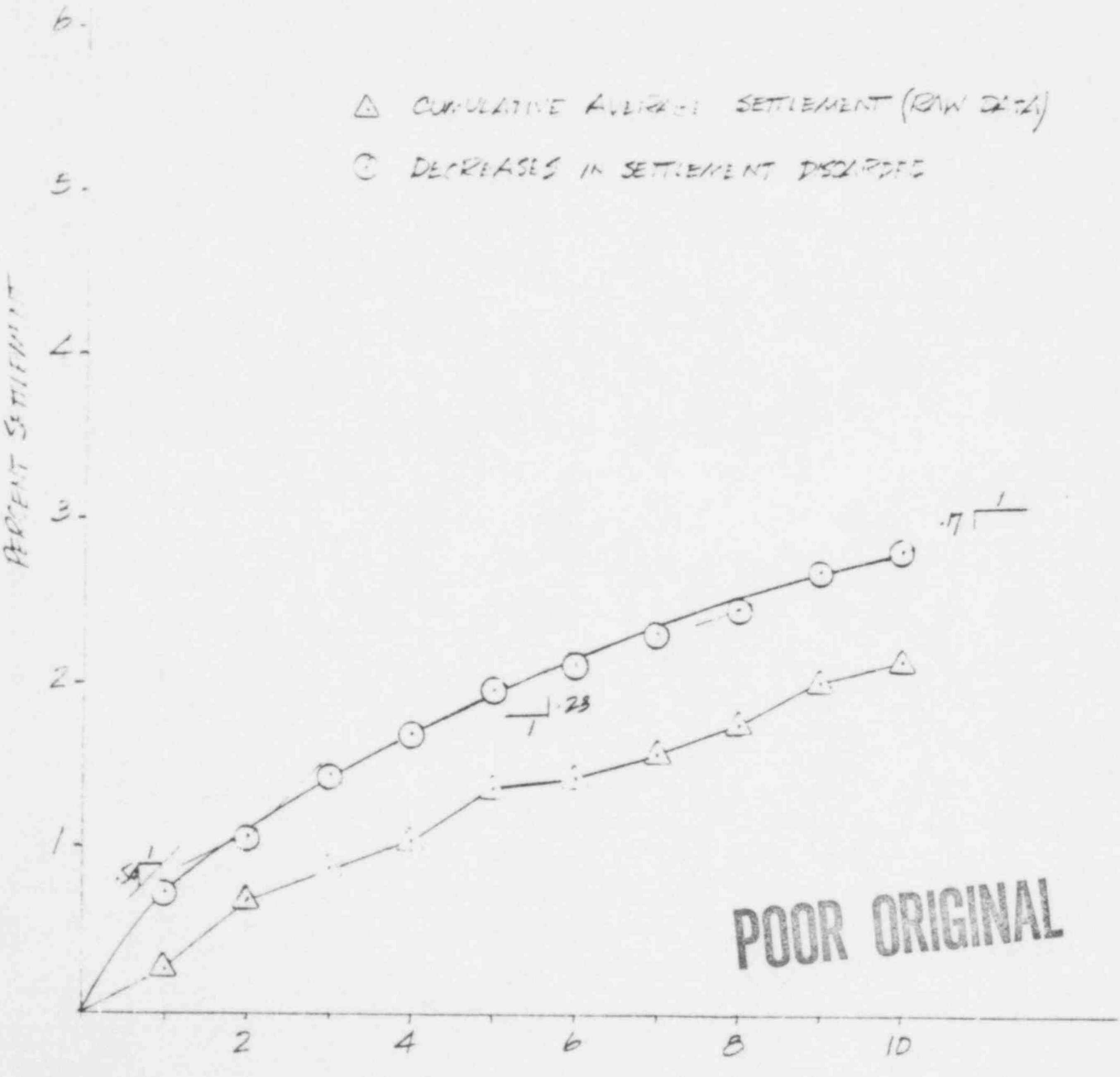

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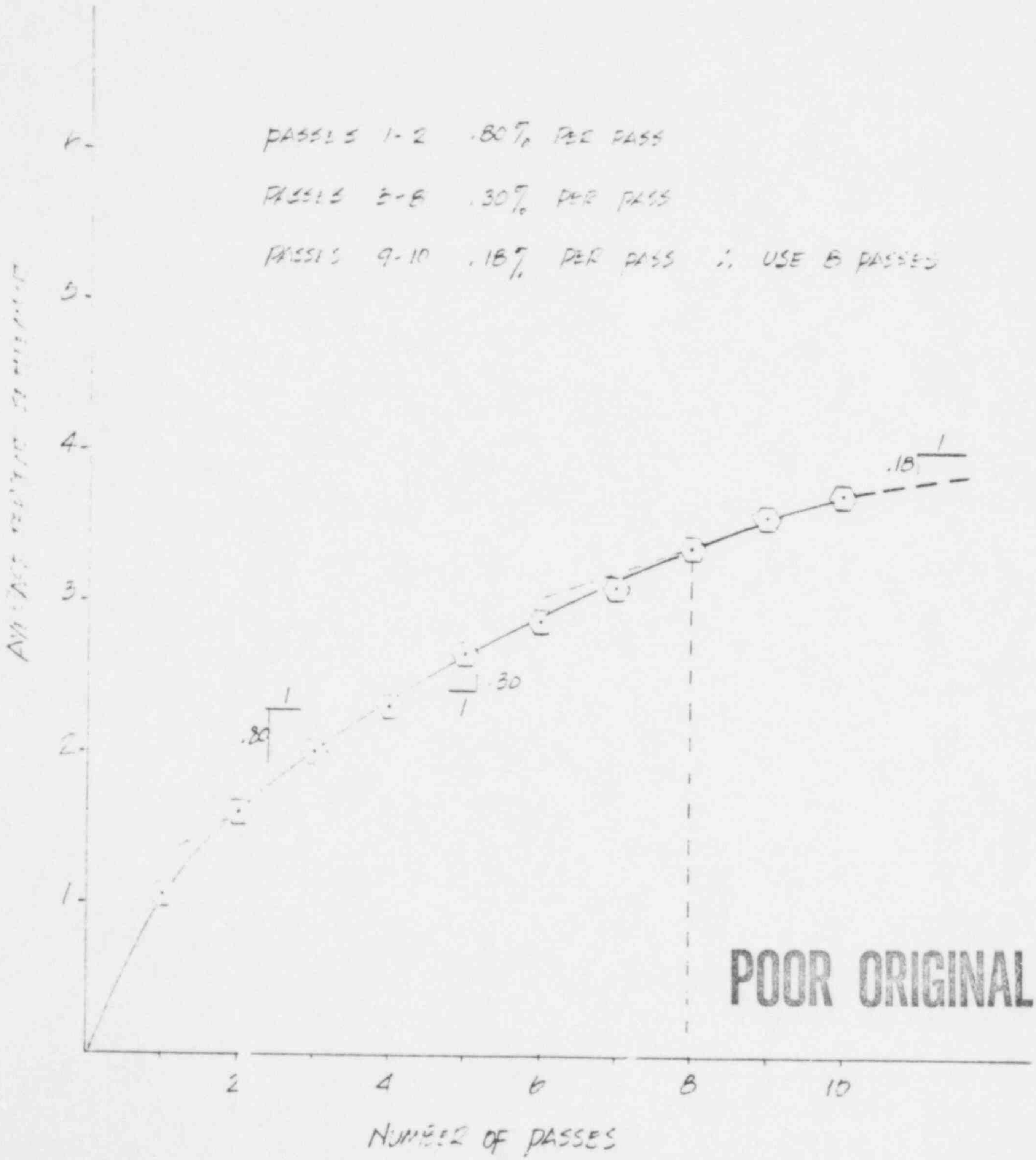
FIGURE 5

VRWD 22-4-3
3/5/77 KEH

AVERAGE PERCENTAGE SETTLEMENT VS NUMBER OF PASSES

LIFTS 1 THRU 3



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AVERAGE PERCENTAGE SETTLEMENT PER PASS
VS NUMBER OF PASSES
LIFTS 1-3

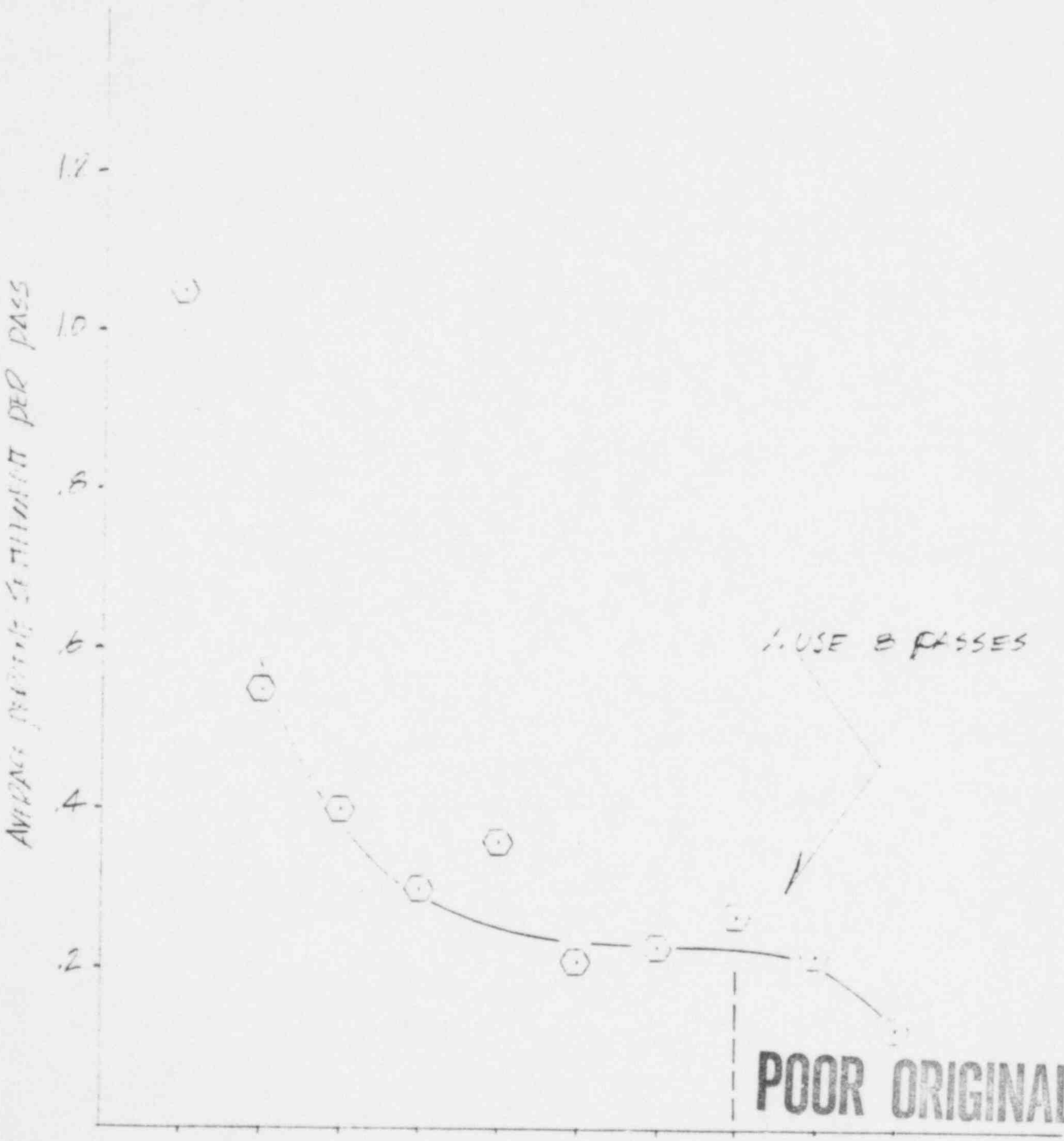

FIGURE 5

PERCENT SETTLEMENT VS NUMBER OF PASSES

SHEARON HARRIS MAIN DAM
TEST FILL VRMD-24-6-3
LIFT NO. 4 24.6 THICKNESS
RAYGO 600 L VIBRATORY SMOOTH DRUM ROLLER
FREQUENCY 1-1500 VPM SPEED ≤ 3 MPH

DATE 3/12/79
PREPARER RFH
CHECKED

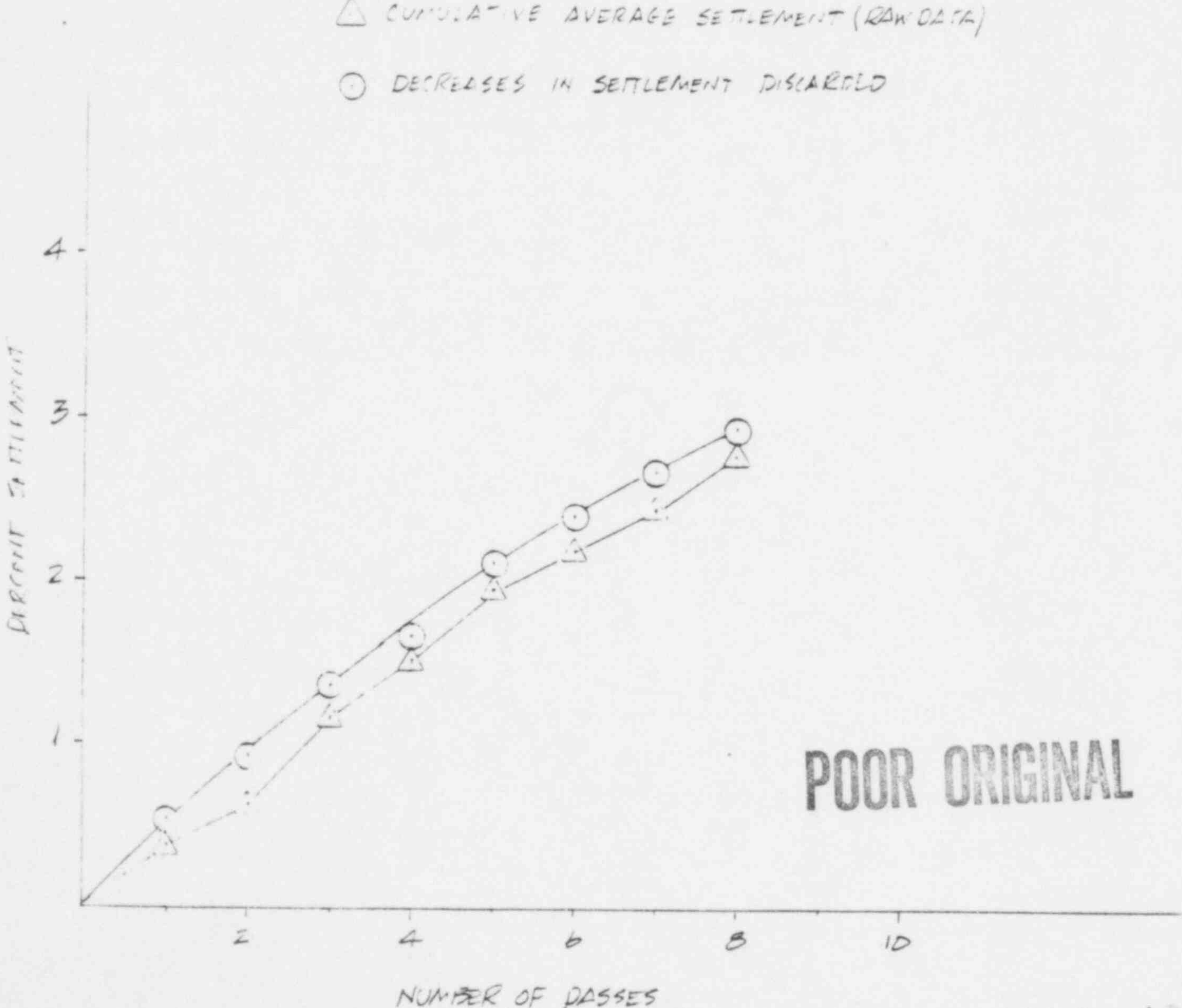

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FIGURE 6

PERCENT SETTLEMENT VS NUMBER OF PASSES

SHEARON HARRIS MAIN DAM
TEST FILL VRMD 24-2-4
LIFT NO. 1 25.7" THICKNESS
RAYGO 600A VIBRATORY SMOOTH DRUM ROLLER
FREQUENCY 14-1500 VPM SPEED ≤ 3 MPH

DATE 6/3/79
PREPARER RBH
CHECKED

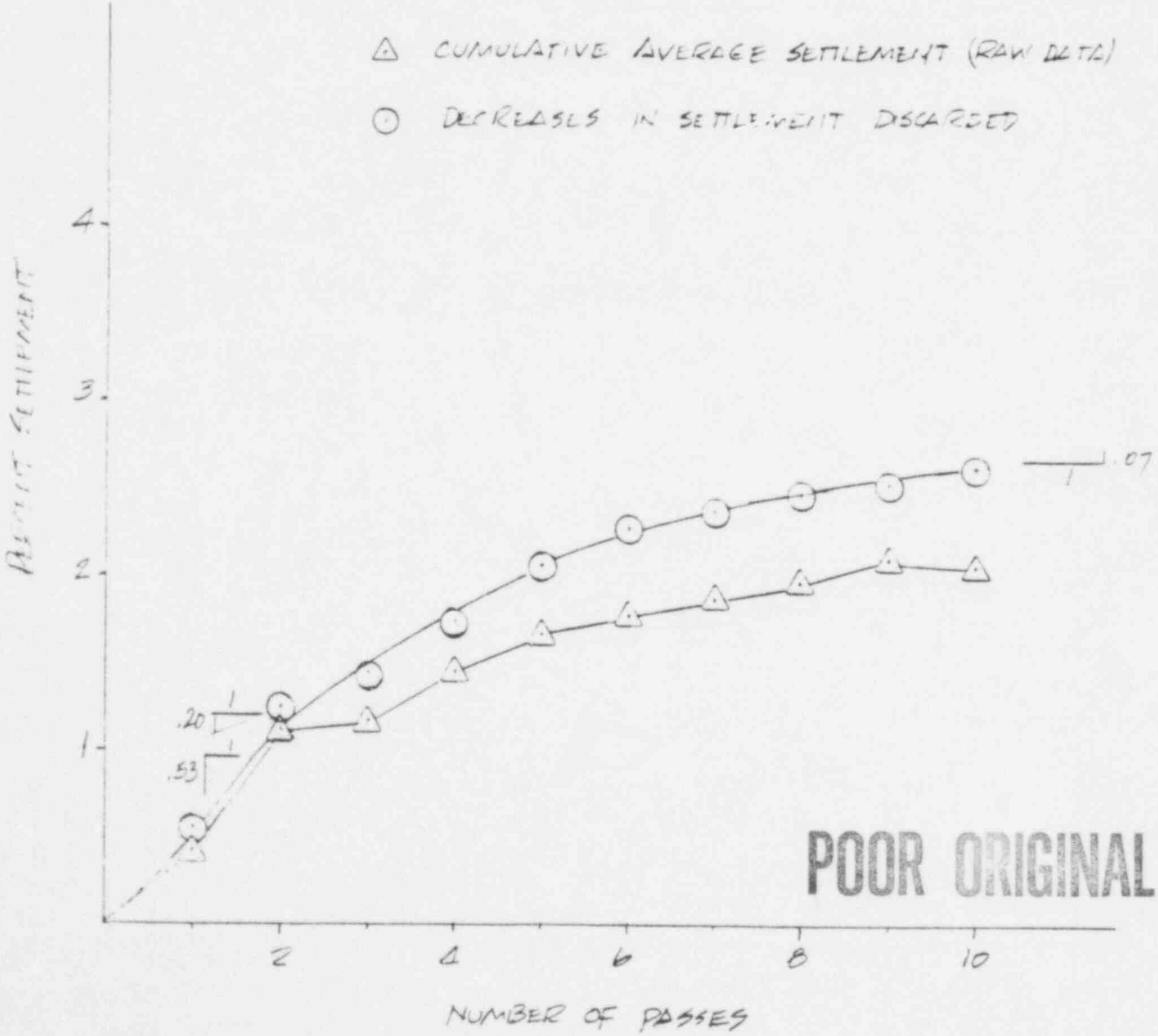

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FIGURE 7

VRN-D-4-2-4
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PERCENT SETTLEMENT PER PASS
VS NUMBER OF PASSES

LIFT 1

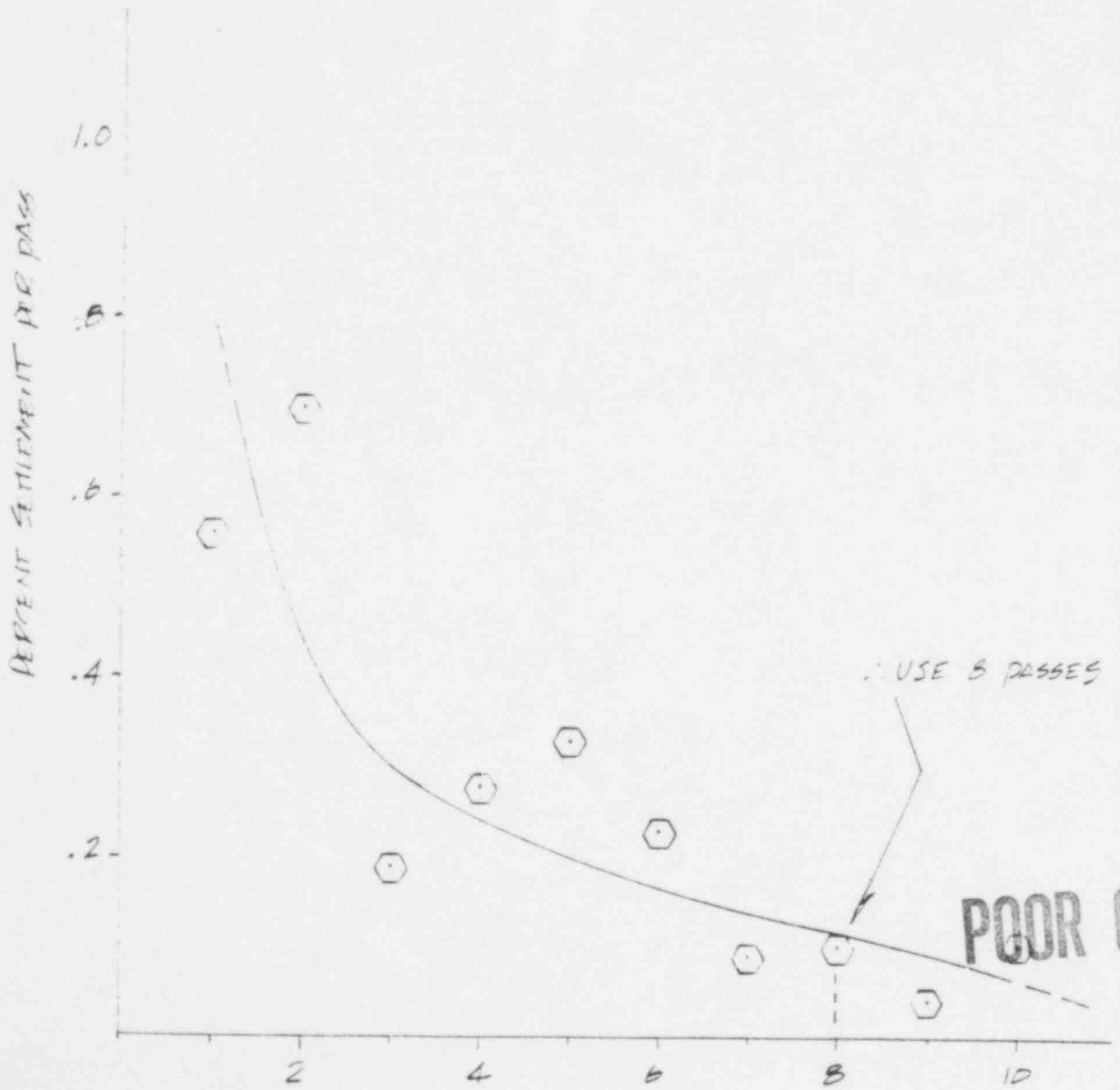

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FIGURE 8

PERCENT SETTLEMENT VS NUMBER OF PASSES

SHEARON HARRIS MAIN DAM

TEST FILL VRMD 24-2-4

LIFT NO. 2 23.3' THICKNESS

RAYGO 600 A VIBRATORY SMOOTH DRUM ROLLER

FREQUENCY 12-1500 VPM SPEED ≤ 3MPH

DATE 6/5/79

PREPARER REH

CHECKED

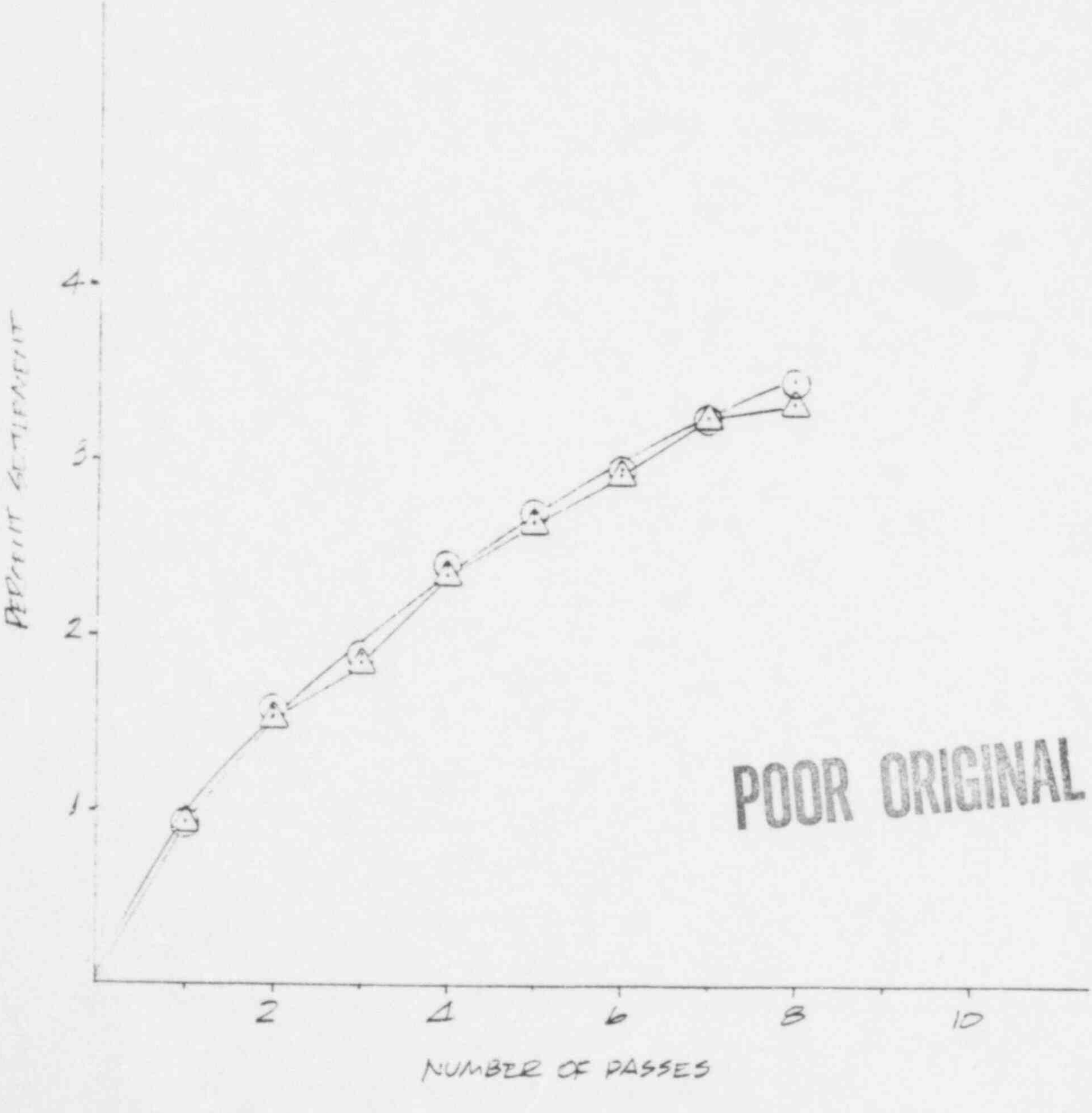

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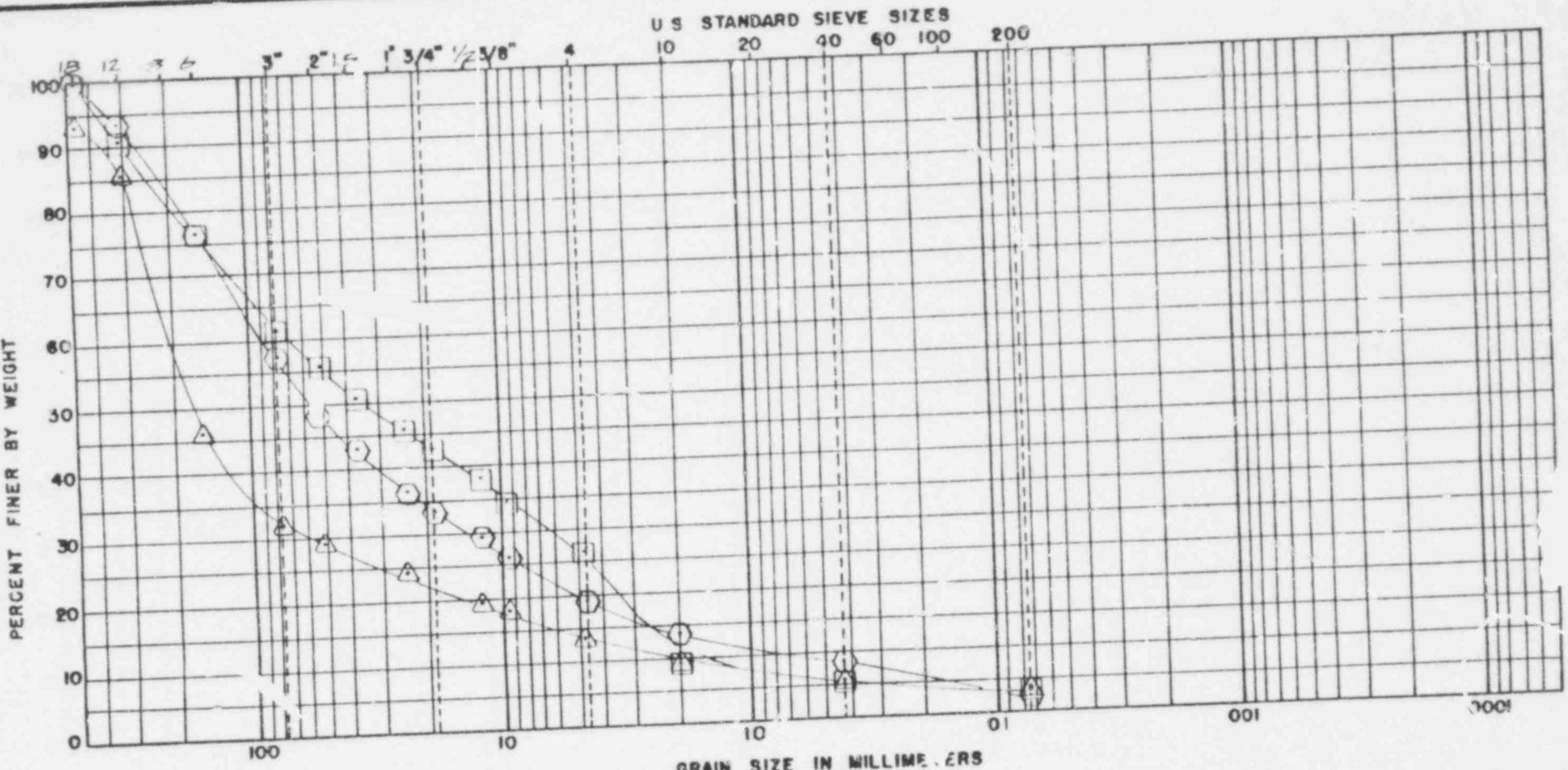
FIGURE 7



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO	ELEV OR DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
						△ LIFT 4 BEFORE COMPACTION
						⊡ LIFT 4 AFTER COMPACTION DENSITY #1
						⊙ LIFT 4 AFTER COMPACTION DENSITY #2

GRAIN SIZE DISTRIBUTION

TEST SECTION VRMD-24-4-3

FIGURE 10

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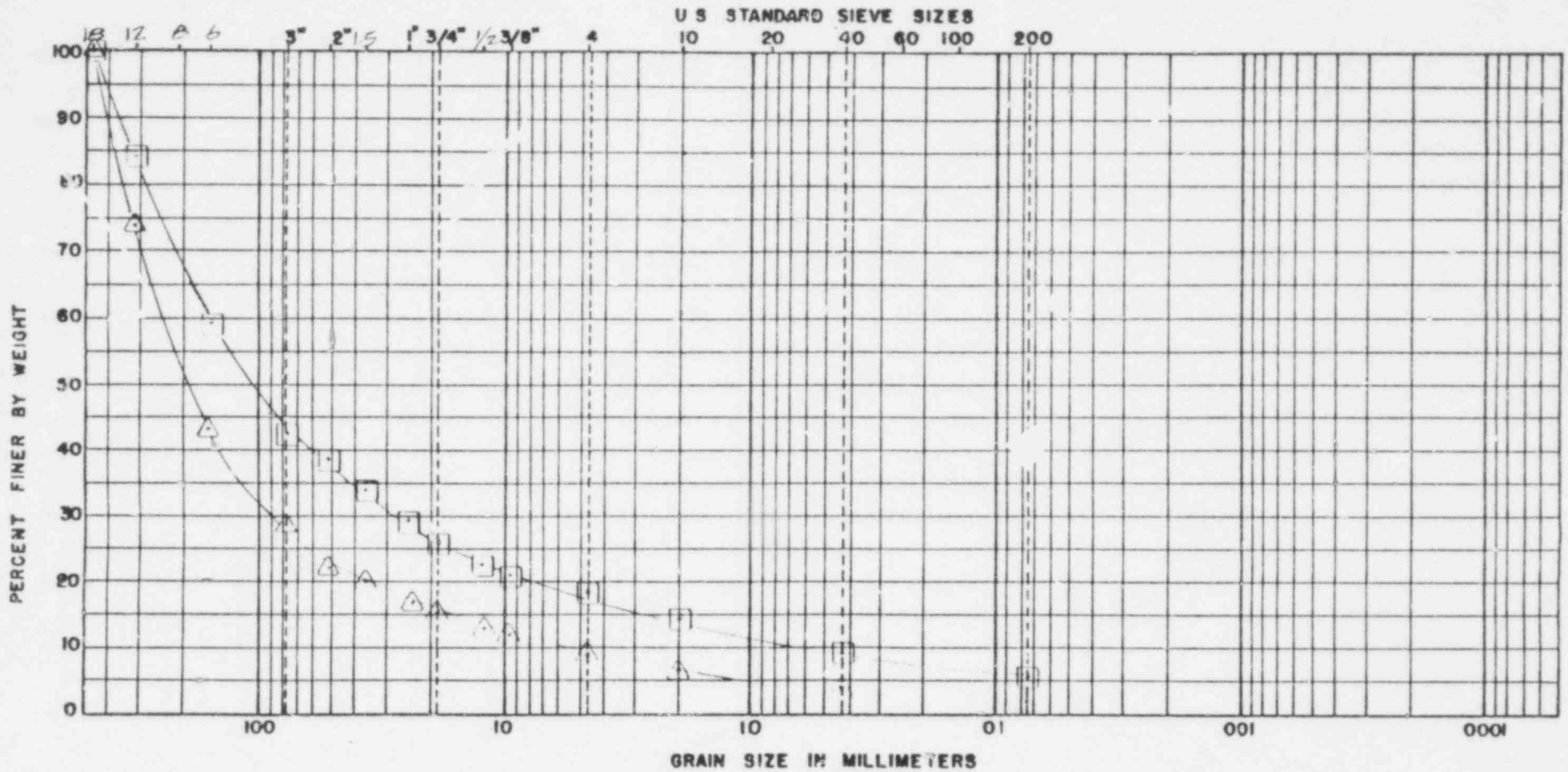
[illegible] 4/12/79



BOUL DERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO	ELEV OR DEPTH	NAT WC	L L	PL	P I	DESCRIPTION OR CLASSIFICATION
						△ LIFT 2 BEFORE COMPACTION
						□ LIFT [illegible] AFTER COMPACTION [illegible]

GRAIN SIZE DISTRIBUTION

[illegible] SECTION VRMD-24-1-4
FIGURE 11

DENSITY TEST DATA RAG-1136 A

Test Fill No. MDVR 24-4-3DA — Date 3-12-79

Layer Thickness 24 INCHES — By Canady, Atwater, Harward

Number Layers 4

Type Compaction Equp. RAY-GO RASCAL Model 600 A Vibratory

Material Description Rockfill

DENSITY

1.	Volume of water for surface measurement	24	$Ft.^3$
2.	Top of water to top of frame	N.W. 2", N.E. 1 3/4", S.W. 2 1/4", S.E. 2 5/8"	In.
3.	Weight can (X No. of times filled)	10274	lb.
4.	Weight can filled (total)	20680	lb.
5.	Sample weight (4-3)	10406	lb.
6.	Weight of sand mortar - before	0	lb.
7.	Volume of sand mortar bucket - before	0	$Ft.^3$
8.	Density of sand mortar (6/7)	0	$lb/Ft.^3$
9.	Weight of sand mortar - after	0	lb.
10.	Weight of sand mortar in hole (6-9)	0	lb.
11.	Volume of sand mortar in hold (10/5)	0	$Ft.^3$
12.	Volume of water for hole measurement — Gal.	98	$Ft.^3$
13.	Volume of hole (12 -1+11)	74	$Ft.^3$
14.	Wet density of material (5/13)	140.6	$lb/Ft.^3$
15.	Dry density of material (14/one + 21)	137.4	$lb/Ft.^3$

MOISTURE CONTENT

16.	Weight wet moisture sample + container	10,406	lb.
17.	Weight dry moisture sample + container	10,168.4	lb.
18.	Weight water (16-17)	237.6	lb.
19.	Weight container	*	lb.
20.	Weight dry material (17-19)	10,168.4	lb.
21.	Moisture content (15/20)	2.3%	lb.

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Shearon Harris Nuclear Power Plant
Main Dam Rock Fill
LETCO Job. No. RAG-1136 A

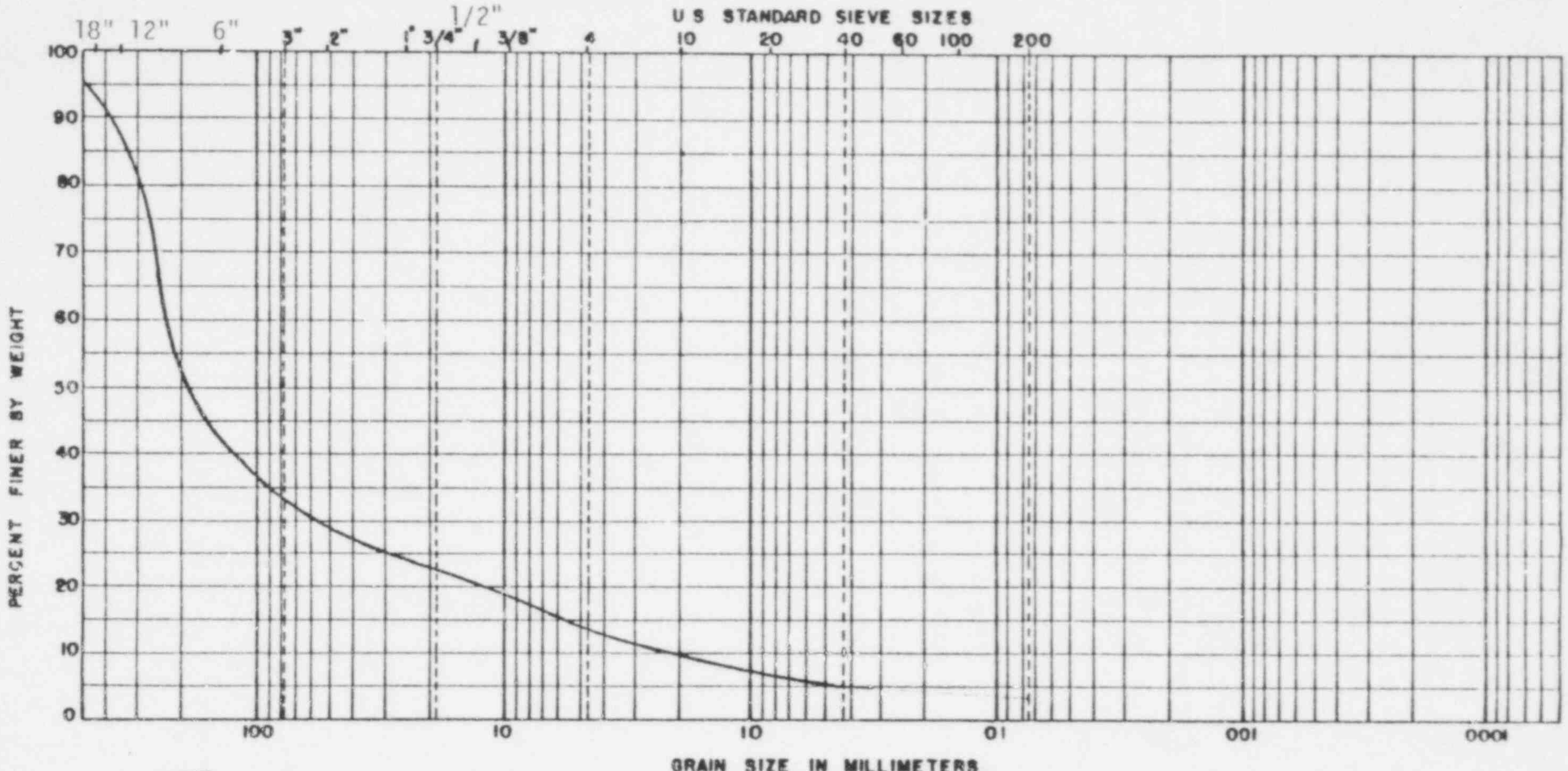
LABORATORY TEST DATA

SIEVE ANALYSIS

SAMPLE NO: BEFORE TEST MDVR 24-4-3

SIEVE SIZE U.S. STANDARD	PERCENT, BY WEIGHT, PASSING
24"	100
18"	93
12"	85
6"	46
3"	32
2"	29
1"	25
1/2"	20
3/8"	18
#4	14
#10	10
#40	5
#200	2.9

TOTAL SAMPLE WEIGHT, lbs.: 4886.0



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO	ELEV OR DEPTH	NAT WC	L L	PL	P I	DESCRIPTION OR CLASSIFICATION
						RAW STOCKPILE SAMPLE MDVR-24-4-3 BEFORE TEST

GRAIN SIZE DISTRIBUTION

JOB NO RAG-1136 A

LAW ENGINEERING TESTING COMPANY

496 198

Snearon Harris Nuclear Power Plant
Main Dam Rock Fill
LETCO Job No. RAG-1136 A

LABORATORY TEST DATA

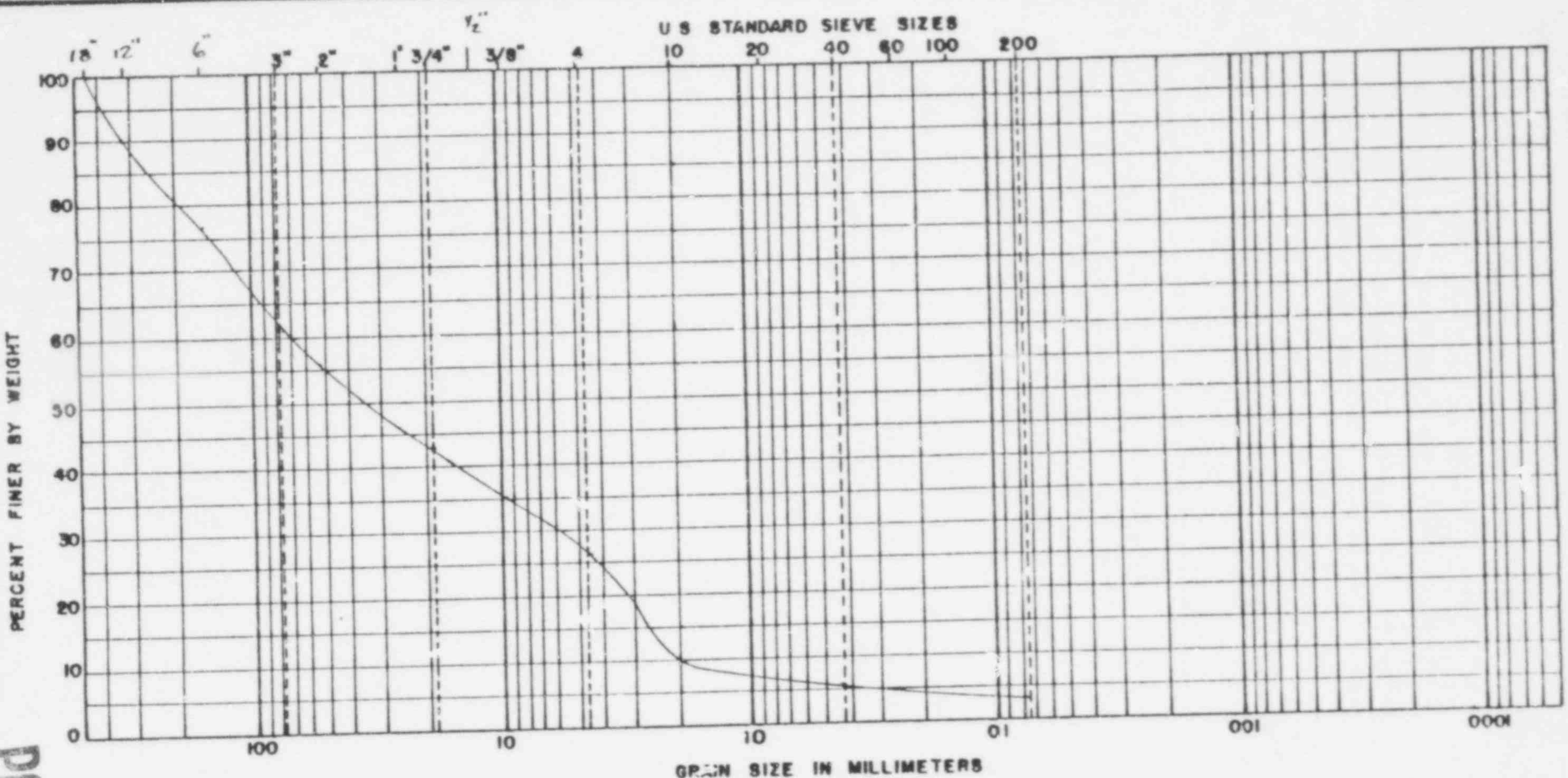
SIEVE ANALYSIS

SAMPLE NO: AFTER TEST MDVR 24-4-3DA

SIEVE SIZE U.S. STANDARD	PERCENT, BY WEIGHT, PASSING
24"	100
18"	100
12"	90
6"	77
3"	61
2"	56
1 1/2"	51
1"	46
3/4"	43
1/2"	38
3/8"	35
#4	27
#10	10
#40	5.7
#200	3 0

TOTAL SAMPLE WEIGHT, lbs.: 10168.4

496 199



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO	ELEV OR DEPTH	NAT WC	L L	PL	P I	DESCRIPTION OR CLASSIFICATION
						MDVR 24-4-3DA AFTER TEST

GRAIN SIZE DISTRIBUTION

JOB NO. RAG-1136 A

LAW ENGINEERING TESTING COMPANY

POOR ORIGINAL

496 200

TEST FILL [illegible]

RAG-1136 A

DENSITY TEST DATA

Test Fill No. MDVR-24-4-3DB

Date 3-16-79

Layer Thickness 24 INCHES

By Harward, Canady, Hightower

Number Layers 4

Type Compaction Equp. RAY-GO RASCAL Model 600 A Vibratory

Material Description Rockfill

DENSITY

1.	Volume of water for surface measurement	24	$Ft.^3$
2.	Top of water to top of frame	N.W. 2", N.E. 1 7/8", S.W. 3 1/8", S.E. 2 1/4"	In.
3.	Weight can (X No. of times filled)	10,040	lb.
4.	Weight can filled (total)	20,800	lb.
5.	Sample weight (4-3)	10,760	lb.
6	Weight of sand mortar - before	0	lb.
7.	Volume of sand mortar bucket - before	0	$Ft.^3$
8.	Density of sand mortar (6/7)	0	$lb/Ft.^3$
9.	Weight of sand mortar - after	0	lb.
10.	Weight of sand mortar in hole (6-9)	0	lb.
11.	Volume of sand mortar in hold (10/5)	0	$Ft.^3$
12.	Volume of water for hole measurement	Gal. 102	$Ft.^3$
13.	Volume of hole (12 -1+1)	78	$Ft.^3$
14.	Wet density of material (5/13)	137.9	$lb/Ft.^3$
15.	Dry density of material (14/one + 21)	134.2	$lb/Ft.^3$

MOISTURE CONTENT

16.	Weight wet moisture sample + container	10,760	lb.
17.	Weight dry moisture sample + container	10,471	lb.
18.	Weight water (16-17)	289	lb.
19.	Weight container	*	lb.
20.	Weight dry material (17-19)	10,471	lb.
21.	Moisture content (15/20)	2.8	lb.

496 201

Shearon Harris Nuclear Power Plant
Main Dam Rock Fill
LETCO Job No. RAG-1136 A

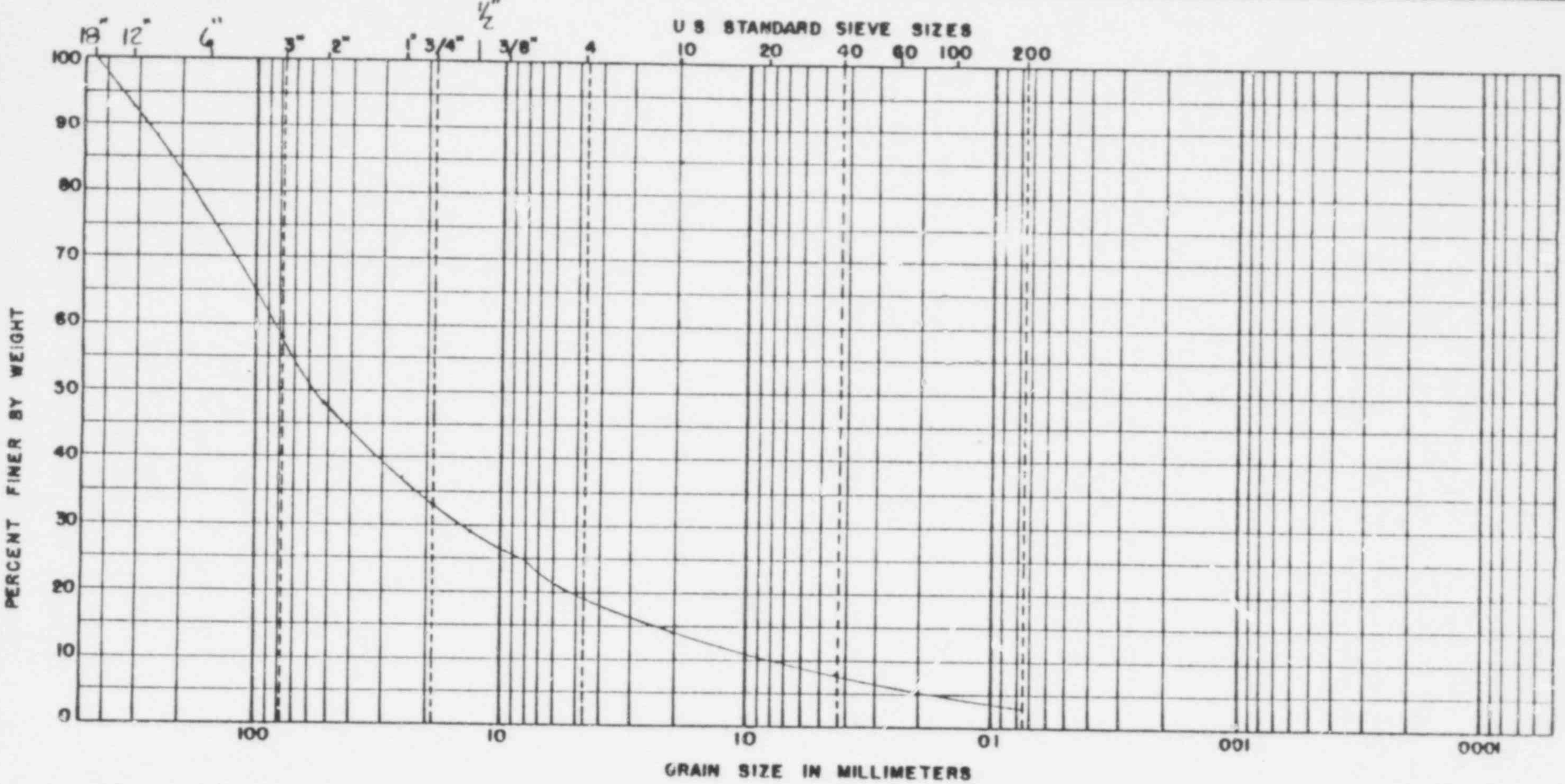
LABORATORY TEST DATA

SIEVE ANALYSIS

SAMPLE NO: AFTER TEST MDVR 24-4-3DB

SIEVE SIZE: U.S. STANDARD	PERCENT, BY WEIGHT, PASSING
24"	100
18"	100
12"	93
6"	76
3"	58
2"	48
1 1/2"	43
1"	37
3/4"	33
1/2"	29
3/8"	26
#4	19
#10	14
#40	8
#200	2.5

TOTAL SAMPLE WEIGHT, lbs.: 9848.5



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO	ELEV OR DEPTH	NAT WC	L L	PL	P I	DESCRIPTION OR CLASSIFICATION
						MDVR 24-4-3DB AFTER TEST

GRAIN SIZE DISTRIBUTION

JOB NO. RAG-1136 A

LAW ENGINEERING TESTING COMPANY

496 203

WELL PERMEAMETER TEST
DETERMINATION OF TEST WELL DIMENSIONS

JOB NAME: Carolina Power & Light Company SHNPP, Main Dam, Rock Fill, New Hill, N.C. JOB NO.: RAG-1136A

TEST NO.: 1 GROUND ELEVATION: Top DATE: 5/16/79 MADE BY: FRF
LOCATION: Rock Fill Test Strip
I.D. NO.: MDVR 24-4-3PI

OBSERVATION HOLE

STRATA DEPTH (ft.) FROM	TO	SOIL CLASSIFICATION
0	37"	Rock Fill With Moderate Fines

1. DEPTH (ft.) TO WATER TABLE: N/A

WELL DIMENSIONS (DEPTHS FROM STRING BASELINE)

2. DEPTH (ft.) TO GROUND SURFACE: 1.080
3. DEPTH (ft.) TO BOTTOM OF WELL: 3.917
4. DEPTH (ft.) TO TOP OF SAND: 1.708
5. DEPTH (ft.) OF SAND (3)-(4): 2.209
6. DEPTH (ft.) TO WATER SURFACE IN WELL: 1.542
7. DEPTH (ft.) OF WATER IN WELL h=(3)-(6): 2.375

DETERMINATION OF WELL RADIUS

8. DENSITY (pcf) OF STANDARD SAND: 102.2
9. WEIGHT (lb.) OF GRAVEL + CONTAINER BEFORE FILLING WELL: 50.00
10. WEIGHT (lb.) OF GRAVEL + CONTAINER AFTER FILLING WELL: 19.65
11. WEIGHT (lb.) OF GRAVEL USED (9)-(10): 30.35
12. VOLUME (cu. ft.) OF WELL (11)÷(8): 0.297
13. RADIUS (ft.) OF WELL $r=\sqrt{\frac{(12)}{(5)\pi}}$: 0.207

CALIBRATED TOOL ID: C-4353 (Homs Scales)

496 204

WELL PERMEAMETER TEST
RECORD OF TIME AND VOLUME MEASUREMENTS

JOB NAME: SHNPP, Main Dam, Rock Fill, New Hill, N.C. JOB NO.: RAG-1136A

TEST NO.: MDVR-24-4-3PI DATE: 5/16/79 MADE BY: FRF

TEST LOCATION: Rock Fill Test Strip SHEET 1 OF 1

DEPTH FROM STRING BASELINE TO WATER LEVEL: 18½" GROUND TEMP.: 22°C

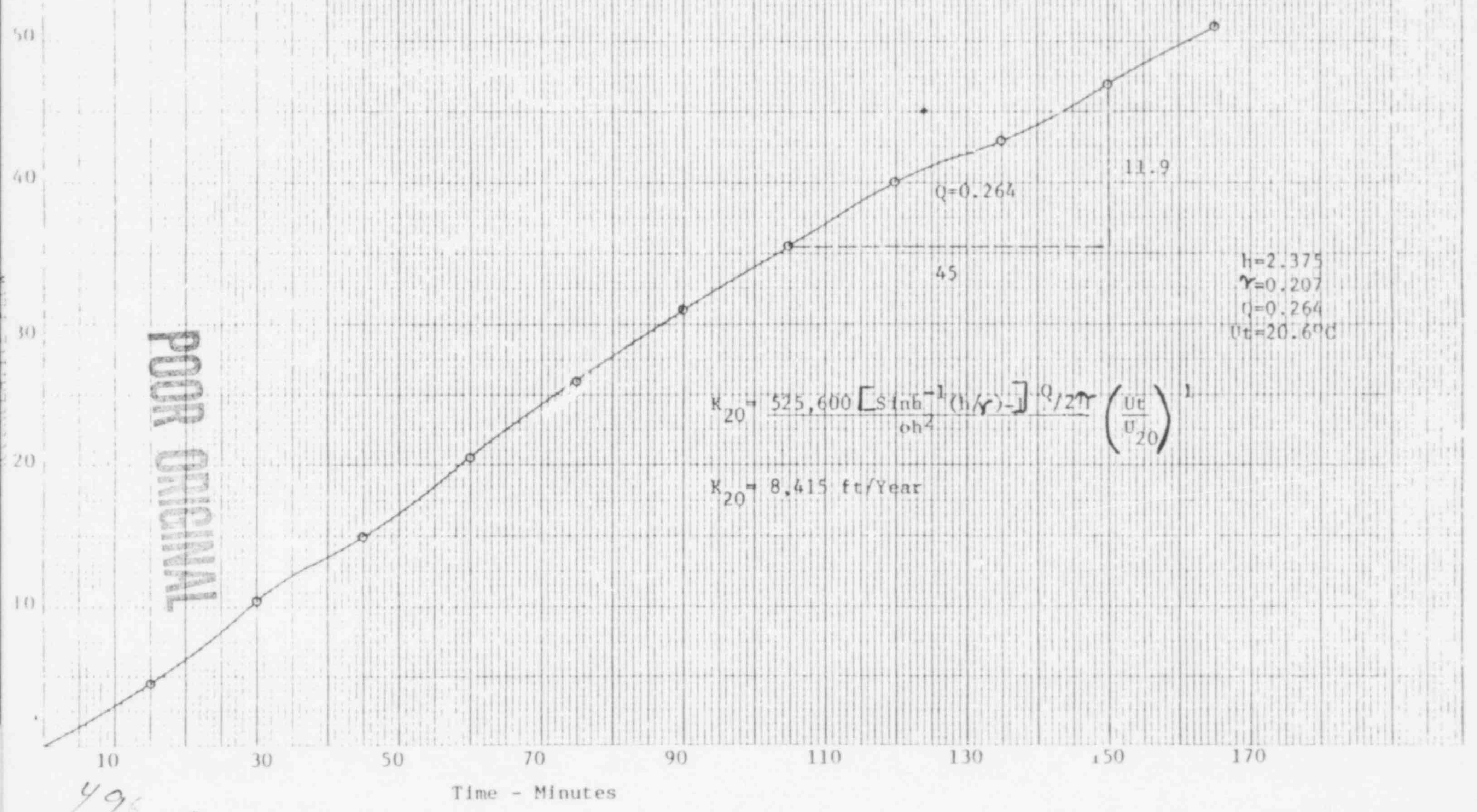
TIME		WATER VOLUME (CUBIC FEET)						WATER TEMP. (Tw)
		DRUM NO.		DRUM NO.		TOTAL DIFF.	ACCUM. FLOW	
CLOCK	ACCUM. (MIN.)	READ.	DIFF.	READ.	DIFF.			
2:45 PM	0	0	0				0	20°C
3:00	15	4.6	4.6				4.6	20°C
3:15	30	10.4	5.8				10.4	20.3°C
3:30	45	15.5	5.1				15.5	20.6°C
3:45	60	20.9	5.4				20.9	20.6°C
4:00	75	26.1	5.2				26.1	21.1°C
4:15	90	30.9	4.8				30.9	21.1°C
4:30	105	35.5	4.6				35.5	20.6°C
4:45	120	39.8	4.3				39.8	20.6°C
5:00	135	43.4	3.6				43.4	20.6°C
5:15	150	47.4	4.0				47.4	21.1°C
5:30	165	51.0	3.6				51.0	20.6°C
							AVG:	20.6°C
	TEST TERMINATED							

CALIBRATED TOOL ID: M 4590 (Flow Meter)

496 205

Test No: MDVR-24-4-3PI
Rock Fill Test Strip
Test Method: USBR E-19

SHNPP Main Dam
New Hill, N. C.
RAG-1136 A
5-16-79



495 206

DENSITY TEST DATA RAG-1136 A

Test Fill No. MDVR 24-2-4D Date 4-2-79

Layer Thickness 24" By Canady / Harward

Number Layers 2

Type Compaction Equp. Ray-Go Rascal Model 600 A Vibratory

Material Description Rockfill

DENSITY

1.	Volume of water for surface measurement 5 barrels	30	$Ft.^3$
2.	Top of water to top of frame NE 7/8" SE 1 5/8" SW 4" NW 4 15/16"		In.
3.	Weight can (X No. of times filled)	10280	lb.
4.	Weight can filled (total)	18420	lb.
5.	Sample weight (4-3)	8140	lb.
6.	Weight of sand mortar - before	0	lb.
7.	Volume of sand mortar bucket - before	0	$Ft.^3$
8.	Density of sand mortar (6/7)	0	lb/Ft.
9.	Weight of sand mortar - after	0	lb.
10.	Weight of sand mortar in hole (6-9)	0	lb.
11.	Volume of sand mortar in hold (10/5)	0	$Ft.^3$
12.	Volume of water for hole measurement Gal.	86	$Ft.^3$
13.	Volume of hole (12 -1+11)	56	$Ft.^3$
14.	Wet density of material (5/13)	145.4	lb/Ft.
15.	Dry density of material (14/one + 21)	139.9	lb/Ft.

MOISTURE CONTENT

16.	Weight wet moisture sample + container	8140	lb.
17.	Weight dry moisture sample + container	7833.5	lb.
18.	Weight water (16-17)	306.5	lb.
19.	Weight container *	*	lb.
20.	Weight dry material (17-19)	7833.5	lb.
21.	Moisture content (15/20)	3.9	lb.

*Container Tare

496 207

Shearon Harris Nuclear Power Plant
Main Dam Rock Fill
LETCO Job No. RAG-1136 A

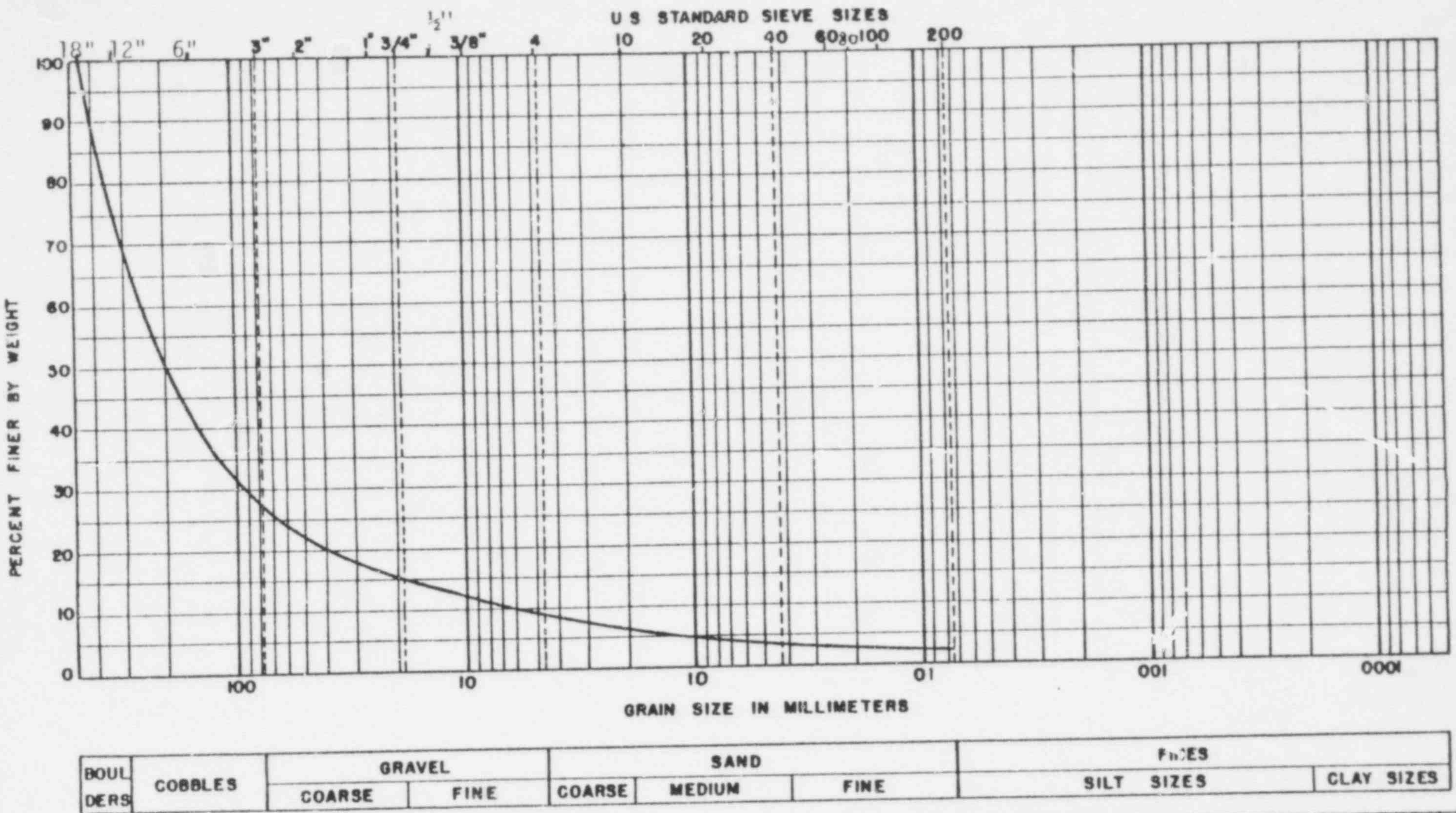
LABORATORY TEST DATA

SIEVE ANALYSIS

SAMPLE NO. BEFORE TEST MDVR 24-2-4

SIEVE SIZE U.S. STANDARD	PERCENT, BY WEIGHT, PASSING
24"	100
18"	100
12"	74
6"	43
3"	28
2"	22
1 1/2"	20
1"	17
3/4"	15
1/2"	13
3/8"	12
#4	9
#10	7
#40	4
#200	1.9

TOTAL SAMPLE WEIGHT, lbs.: 4829



BORING NO	ELEV OR DEPTH	NAT WC	L L	PL	P I	DESCRIPTION OR CLASSIFICATION
						Main Dam Rock Fill MDVR 24-2-4 BEFORE TEST

GRAIN SIZE DISTRIBUTION

JOB NO. RAG-1136 A

LAW ENGINEERING TESTING COMPANY

G-1

Snearon Harris Nuclear Power Plant
Main Dam Rock Fill
LETCO Job No. RAG-1136 A

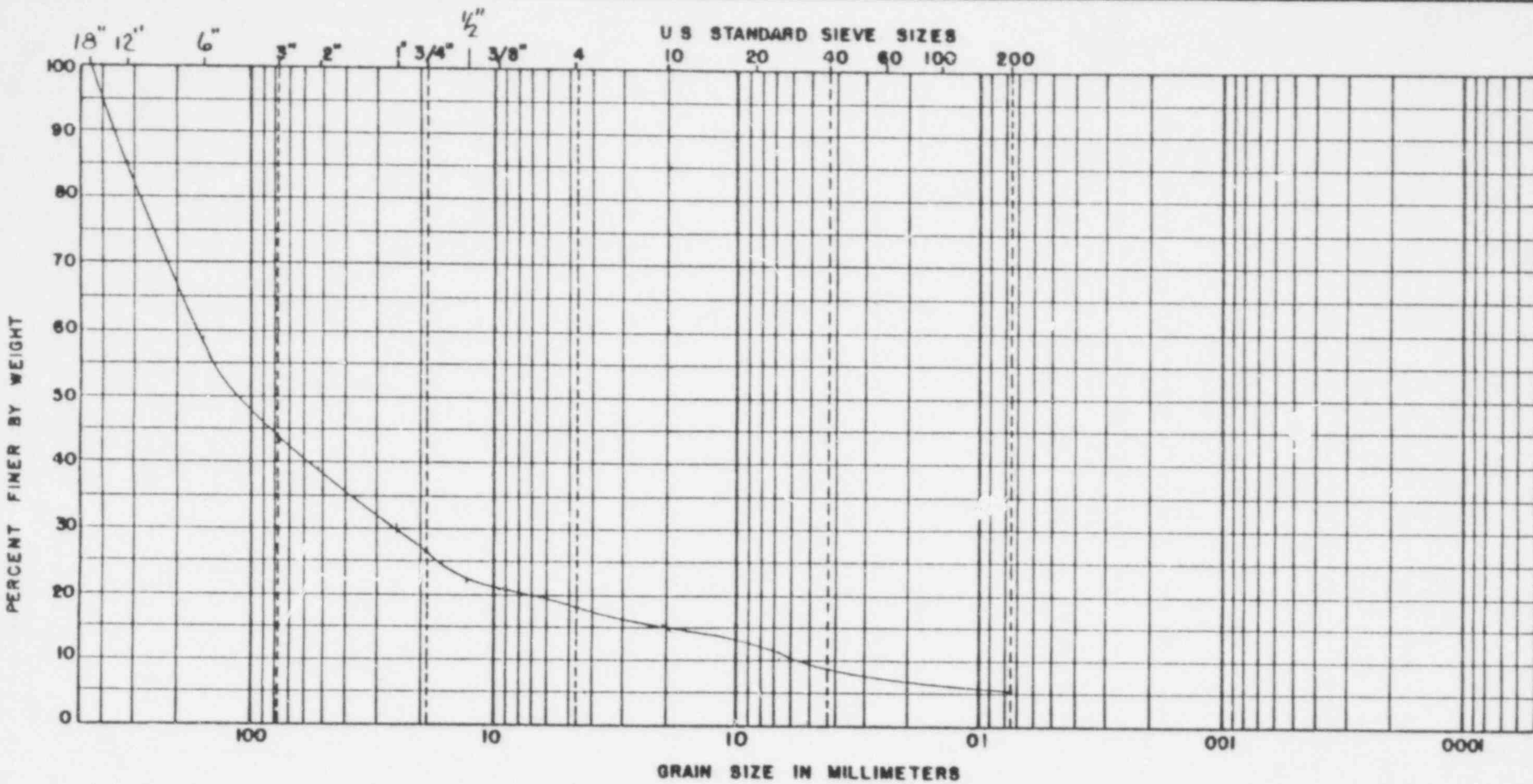
LABORATORY TEST DATA

SIEVE ANALYSIS

SAMPLE NO.: (AFTER TEST) MDVR 24-2-4D

SIEVE SIZE U.S. STANDARD	(Percent, By Weight, Passing)
24"	100
18"	100
12"	85
6"	59
3"	43
2"	39
1 1/2"	34
1"	30
3/4"	26
1/2"	22
3/8"	21
#4	18
#10	15
#40	9
#200	5.2

TOTAL SAMPLE WEIGHT, lbs.: 7833.5



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

BORING NO	ELEV OR DEPTH	NAT WC	L L	PL	P I	DESCRIPTION OR CLASSIFICATION
						MDVR 24-2-4D AFTER TEST

GRAIN SIZE DISTRIBUTION

JOB NO. RAG-1136

LAW ENGINEERING TESTING COMPANY

WELL PERMEAMETER TEST
DETERMINATION OF TEST WELL DIMENSIONS

JOB NAME: Carolina Power & Light Company, SHNPP, Main Dam, Rock Fill, New Hill, North Carolina JOB NO.: RAG-1136A

TEST NO.: 2 GROUND ELEVATION: Top DATE: 5-16-79 MADE BY: F.R. Foster

LOCATION: Rock Fill Test Strip

I.D. NO.: MDVR-24-2-4PI

OBSERVATION HOLE

STRATA DEPTH (ft.) FROM	TO	SOIL CLASSIFICATION
0	39"	Rock Fill with Moderate Fines

1. DEPTH (ft.) TO WATER TABLE:

WELL DIMENSIONS (DEPTHS FROM STRING BASELINE)

2. DEPTH (ft.) TO GROUND SURFACE: 1.250
3. DEPTH (ft.) TO BOTTOM OF WELL: 4.438
4. DEPTH (ft.) TO TOP OF SAND: 1.833
5. DEPTH (ft.) OF SAND (3)-(4): 2.604
6. DEPTH (ft.) TO WATER SURFACE IN WELL: 1.771
7. DEPTH (ft.) OF WATER IN WELL h=(3)-(6): 2.667

DETERMINATION OF WELL RADIUS

8. DENSITY (pcf) OF STANDARD SAND: 102.2
9. WEIGHT (lb.) OF GRAVEL + CONTAINER BEFORE FILLING WELL: 50.00
10. WEIGHT (lb.) OF GRAVEL + CONTAINER AFTER FILLING WELL: 18.64
11. WEIGHT (lb.) OF GRAVEL USED (9)-(10): 31.36
12. VOLUME (cu. ft.) OF WELL (11)÷(8): 0.3068
13. RADIUS (ft.) OF WELL $r=\sqrt{\frac{(12)}{(5)\pi}}$ 0.194

Calibrated Tool ID: C-4353 (Homs Scales)

WELL PERMEAMETER TEST
RECORD OF TIME AND VOLUME MEASUREMENTS

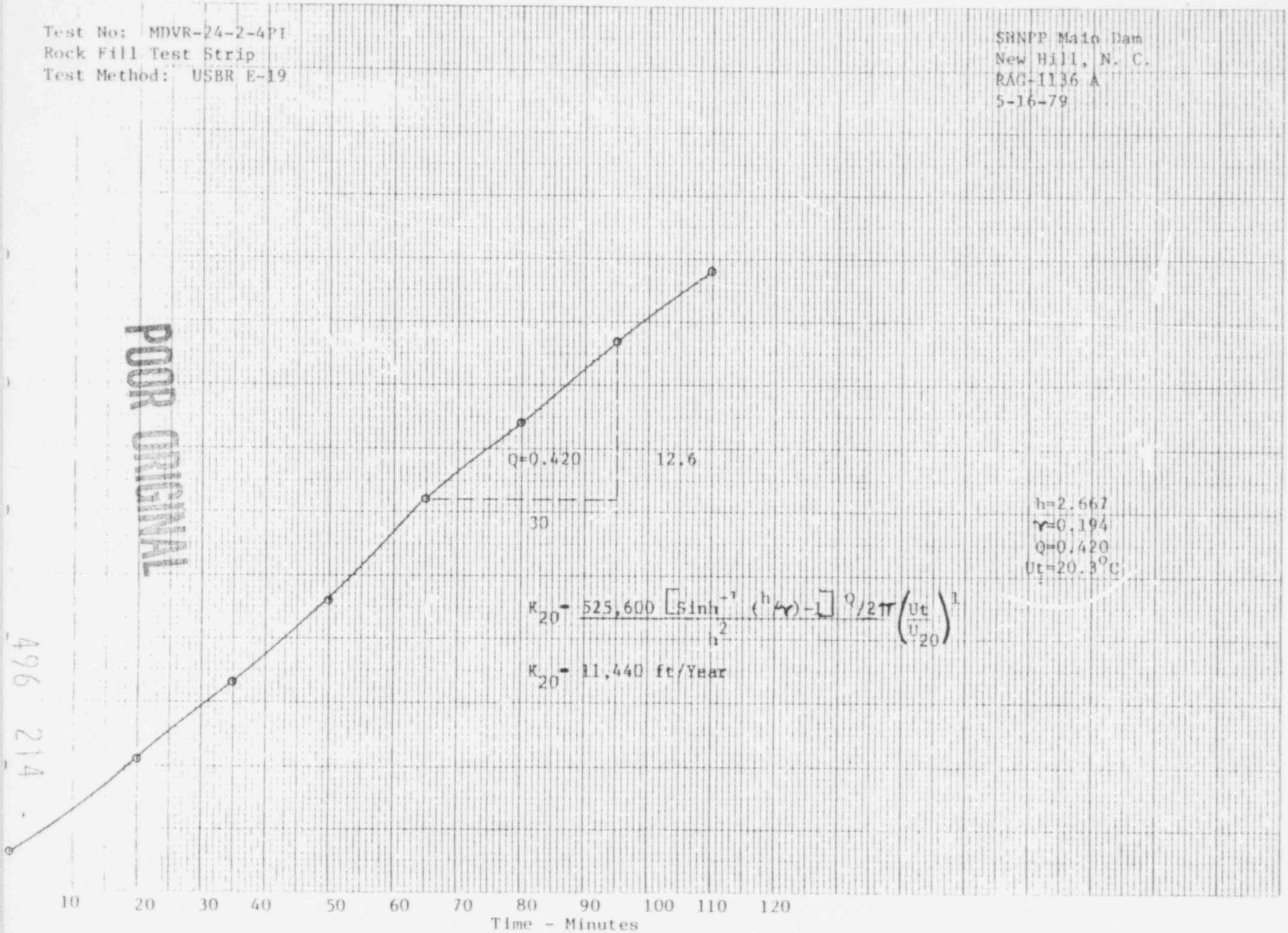
JOB NAME: SHNPP, Main Dam, Rock Fill, New Hill, N. C. JOB NO.: RAG-1136A
TEST NO.: MDVR-24-2-4PI DATE: 5-16-79 MADE BY: F. R. Foster
TEST LOCATION: Rock Fill Test Strip SHEET 1 OF 1
DEPTH FROM STRING BASELINE TO WATER LEVEL: 1.771 ft. GROUND TEMP.: 21.7°C

TIME		WATER VOLUME (CUBIC FEET)						WATER TEMP. (Tw)
		FLOW METER		DRUM NO.				
CLOCK	ACCUM. (MIN.)	READ.	DIFF.	READ.	DIFF.	TOTAL DIFF.	ACCUM. FLOW	
10:45AM	0	0	0					
11:00	WATER	CONNECTION	BROKE-RESTART TEST					19.4°C
11:10	0	0	0				0	
11:15	5	2.9	2.9				2.9	19.4°C
11:30	20	10.4	7.5				10.4	19.7°C
11:45	35	16.4	6.0				16.4	20.0°C
12:00PM	50	23.3	6.9				23.3	20.0°C
12:15	65	30.8	7.5				30.8	20.6°C
12:30	80	37.2	6.4				37.2	20.6°C
12:45	95	43.4	6.2				43.4	21.1°C
1:00	110	49.1	5.7				49.1	21.1°C
	TEST TERMINATED						AVG:	20.3°C

Calibrated Tool ID: M 4590 (Flow Meter)

Test No: MDVR-24-2-4PI
Rock Fill Test Strip
Test Method: USBR E-19

SHNPP Main Dam
New Hill, N. C.
RAG-1136 A
5-16-79



496 214

APPENDIX B

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 2-15-79 Spec. No. CAR-SH-CE 4 & 8 (TP 01)

Location N 662,405 ; E 2,009,017 Inspector D S Canady

Elevation 225 ft Shift Day

Weather Clear & Warm

MDUR-24-4-3

COMMENT

THE MORNING WAS SPENT GRADING AND ROLLING OUT THE TESTFILL AREA. THE WEATHER WAS THE MAJOR FACTOR IN THE BASE PREPARATION. SHORTLY AFTER LUNCH THE FIRST MATERIAL WAS PLACED FOR THE [illegible] RAMP. THE RAMP WAS BUILT ACCORDING TO THE DESIGN IN TP 01. AT APPROXIMATELY MID-AFTERNOON, THE FIRST LOAD OF ROCK WAS BEING DUMPED BY THE R-52 EUCLIDS ONTO THE TEST AREA. A D-6 CRAWLER WAS USED TO LEVEL OUT THE ROCK TO THE 24" LIFT AND WORKED OUT ALL THE OVER 22" ROCK TO THE SIDES OF THE TOWER. THE ENTIRE LIFT WAS NOT COMPLETED TODAY, THEREFORE, THE ENTIRE AREA WAS COVERED WITH PLASTIC IN CASE OF RAIN.

THE RAYGO 400A METAL DRUM VIBRATING ROLLER WAS TESTED FOR THE CORRECT FREQUENCY UTILIZING THE "SINCO" S-2 VIBRATION MONITOR. THE SPEED WAS CHECKED OVER A MEASURED DISTANCE. BOTH THE SPEED AND FREQ. WERE SET ACCORDING TO TP 01 REQUIREMENTS

POOR ORIGINAL

496 216

INSPECTOR David S Canady

Q A REVIEW Eugene Kelly 6/18/79

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 2-16-79 Spec. No. CAR-SH-CH 4 & E

Location N 662,405; E 2,004,617 Inspector D S Canady

Elevation 225 FT. Shift Day

Weather Cloudy & Mild

MDVR-24-4-3

COMMENT

THE FIRST LIFT WAS FINISHED TO GRADE (24" AVERAGE). THE INITIAL ROLL WAS MADE WITHOUT VIBRATION AS DESCRIBED IN TP-C1 THE SETTLEMENT PTS. WERE CHECKED BETWEEN EACH PASS. (TEN LOADS OF MATERIAL WERE REQUIRED TO GET ENOUGH MATERIAL, THE RIGHT SIZE)

AFTER BUILDING THE SOUTH RAMP TO ACCOMMODATE THE SECOND LIFT. THE SECOND LIFT CONTAINED, AN OVERALL AVERAGE, LESS OVERSIZED MATERIAL AND THEREFORE REQUIRED ONLY 8 LOADS TO BUILD THE TEST AREA.

THE TEST FILL WAS COVERED WITH PLASTIC FOR THE WEEKEND.

POOR ORIGINAL

INSPECTOR David S Canady

Q A REVIEW Eugene Kelly 6/18/79

496 217

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 2-28-79
Spec. No. CAR SH-CH 4?E (TP-C1)
Location N662, 4C3; E2, 609, E77
Inspector D.S. Canady
Elevation 225 Ft
Shift Day
Weather Sunny & mild

MDVR-24-4-3

COMMENT

Bad weather has hampered the construction of the test fill. Started the initial pass on second lift without vibration. After checking the frequency of the Range Roller and the speed, ten passes were made with settlement readings between each pass. After the 10th pass the test fill was covered with plastic until tomorrow.

POOR ORIGINAL

496 218

INSPECTOR [signature]

Q A REVIEW Eugene Kelly 6/18/79

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 3-1-79 Spec. No. CAR-SH-CH 4 & E (TP C.1)

Location N662,403; E2,001,097 Inspector D.S. Canady

Elevation 225 Ft Shift Day

Weather Overcast & mild

MDVR-24-4-3

COMMENT

The South Ramp was built to accomodate the 3rd lift Lift No 3 was built as # 1 & 2 with the backdumping of the R-50 Euclids and Wableys and spreading the material with the D-6-Dozer.

The entire day was used to build Lift No. 3. Quite a bit of oversize rock had to be worked out of the lift. This lift had to be worked considerably more due to the excessive oversize.

The test fill was covered and plans are to complete the North Ramp tomorrow morning & start the settlement pts.

POOR ORIGINAL

INSPECTOR David S Canady

Q A REVIEW Eugene Kelly 6/18/79

496 219

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 3-2-79 Spec. No. CAR-SH-CH-4/8 (TP-61)
Location N662,403; E2,005,637 Inspector D. S. Canady
Elevation 225 ft. Shift Day
Weather Mild & Sunny

MDDR-24-4-3

COMMENT

THE NORTH lamp was completed prior to starting the vibration rolls. THE initial roll was made without vibration as per TP-61. The rolling speed and vibration frequency were checked prior to the 10 passes. Settlement data was taken after each pass.

Lift number 4 will be started Monday with an anticipated number of 8 passes for max compaction. (Data obtained from these 3 lifts.)

The visual observations on the lifts were as follows:

AFTER 2 PASSES – THE SURFACE PTS. HAVE BEEN BROKEN AND A GENERAL SHIFTING OR FILLING OF THE VOIDS WAS OBSERVED

3-8 PASSES – A BREAKING OF THE TOP SURFACE TO CREATE MORE FINES AND A MORE UNIFORM COMPACTION WAS OBSERVED

9-10 PASSES – FURTHER COMPACTION OF THE SURFACE WAS NOT OBSERVED, BUT THE SURFACE MATERIAL SEEMS TO BE BREAKING DOWN INTO MOSTLY FINES WITH THE OBSERVATION OF BEING OVERWORKED.

POOR ORIGINAL

496 220

INSPECTOR [signature]

Q A REVIEW Eugene Kelly 6/18/79

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 3-7-79

Spec. No. CAR SHCH 4 & 8 (TP-01)

Location N 662,403, E 2,009,097

Inspector D.S CANADY

Elevation 225 FT.

Shift Day

Weather MILD

COMMENT

AFTER NUMEROUS PROBLEMS OBTAINING OPERATOR TO RUN EQUIPMENT, FINALLY STARTED THE SOUTH RAMP ON LIFT NO. 4. THE 4th LIFT WAS BUILT AS WERE THE PRECEDING 3 LIFTS. APPROXIMATELY 3/4 OF THE LIFT WAS completed prior TO EQUIP. PROBLEMS. THE DOZER WENT DOWN FOR THE REMAINDER OF THE DAY - THE 4th LIFT WILL BE CONTINUED TOMORROW.

POOR ORIGINAL

INSPECTOR [signature]

Q A REVIEW Eugene Kelly 6/18/79

496 221

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 3-8-79 Spec. No. CAR-SH-CH-4&8 (TP-01)

Location N 662,403; E 2,009,057 Inspector D.S. CANADY

Elevation 225 Ft. Shift Day

Weather OVERCAST

COMMENT

CONTINUED ON THE 4TH LIFT. HAD LAW ENG. & TESTING CO. TAKE A LOAD OF MATERIAL TO RUN GRADATION ON THE LIFT. THE TEST AREA WAS COMPLETED AND THE NORTH RAMP AREA STARTED WHEN RAIN STARTED. THE TEST FILL WAS COVERED WITH PLASTIC AND PUT OFF UNTIL TOMORROW.

POOR ORIGINAL

INSPECTOR [signature]

Q A REVIEW Eugene Kelly 6/18/79

496 222

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 3-9-79
Location N662,403/E 2,004,097
Elevation 225 FT.

Spec. No. CAR-SH-CH 4 & 8 (TP-01)
Inspector D.S. CANADY
Shift DAY
Weather

COMMENT

FINISHED BUILDING THE NORTH RAMP. THE SURVEYORS REPLACED THE TEST GRID AND A PRELIMINARY depth check was taken. By NOON THE first pass WITHOUT VIBRATION WAS RUN AND THE INITIAL READING WERE MADE. THE 8 PASSES WERE RUN USING AN ALTERNATING FORWARD-REVERSE PASS AND ALTERNATING APPROACHES TO THE SIDES. THE VIBRATIONS OF THE RAYGO DRUM WERE CHECKED WITH THE "SINCO" VIBRATION MONITOR AND CROSS-CHECKED WITH THE TACH. ON THE RAYGO.
(THE REVERSE OPERATION REQUIRED A GUIDE-ON TO KEEP THE ROLLING OPERATION ON A MINIMAL OVERLAP & CENTERING OF THE SETTLEMENT POINTS.
EQUIPMENT IS SET UP TO START THE DENSITY TEST MONDAY.

POOR ORIGINAL

INSPECTOR [signature]

496 223

Q A REVIEW [signature] 6/18/79

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 3-12-79
Location N662,403 / E 2009,097
Elevation 225 FT.

Spec. No. CAR-SH-CH 4 & 8 (TP.01)
Inspector D. S. CANADY
Shift DAY.
Weather MILD

COMMENT

IN PREP. FOR THE DENSITY TEST, THE 8'x8' WOODEN FRAME WAS PLACED ON THE INTENDED TEST AREA. THE CORNERS WERE CHECKED FOR OVERALL LEVELNESS. A PICTURE WAS TAKEN OF THE SURFACE PRIOR TO LINING THE FRAME WITH PLASTIC. FOUR 6 ft^3 BARRELS OF WATER WERE CAREFULLY POURED INTO THE FRAME FOR THE SURFACE MEASUREMENT. ALL CORNERS WERE CHECKED FOR WATER TO TOP OF FRAME HEIGHT. UTILIZED THE SUMP VACUUM TRUCK TO GET THE WATER OUT OF THE FRAME. USED THE GRADALL WITH A 2 FT BUCKET TO DIG THE MATERIAL OUT OF THE HOLE. WITH THE BUCKET & THE TENDENCY OF THE ROCK TO PULL OUT FROM UNDER THE FRAME, MOST EXCAVATION WAS MANUAL - SHOVEL & HAND. THE FLAT-BED TRUCK WAS LINED WITH PLASTIC TO AVOID LOOSING MATERIAL ON THE BED. A BAG SAMPLE WAS TAKEN TO OBTAIN MOISTURE CONTENT. THE HOLE WAS DUG TO A DEPTH OF 24", (THE DEPTH OF THE LIFT.) THE MATERIAL WAS OBSERVED TO CONTAIN A LARGE PORTION OF FINES. THE DIGGING REQUIRED THE REMAINDER OF THE WORK DAY, THEREFORE THE TRUCK WILL REMAIN, COVERED, ON SITE UNTIL TOMORROW MORNING BEFORE SENDING THE SAMPLE TO THE LAW LAB. DOWNTOWN. THE AREA WAS COVERED WITH PLASTIC FOR THE NIGHT

INSPECTOR David S. Canady Jr.

Q A REVIEW Eugene Kelly 6/18/79

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POOR ORIGINAL

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 3-13-79
Location N662,403/E 2,009,097
Elevation 225 FT.

Spec. No. CAR SH-CH 498 (TP-01)
Inspector D.S. CANADY
Shift DAY
Weather

COMMENT

ELEVATIONS WERE CHECKED ON THE CORNERS PRIOR TO plastic Lining the Density test hole. THE FRAME WAS STILL IN PLACE. DUMPING OF THE MEASURED BARRELS OF WATER BEGAN TO FILL THE LINED HOLE TO THE TOP OF THE FRAME (THE ORIGINAL MARKS.) WATER TEMP WAS 58°F. Sixteen barrels (6ft³) plus four 1/2 ft³ BUCKETS WERE REQUIRED TO FILL THE WATER LEVEL TO THE ORIGINAL MARK. SUBTRACTING THE BEGINNING SURFACE MEASUREMENT OF 24 ft³ FROM THE FINAL VOLUME, 98 ft³ YIELDED THE VOLUME OF THE HOLE TO BE 74 CUBIC FT. THE SUMP VACUUM TRUCK WAS AGAIN USED TO REMOVE THE WATER. THE HOLE WAS CHECKED UNDER THE PLASTIC FOR LEAKS — NONE WERE FOUND. (NO MORTAR WAS REQUIRED, BECAUSE THE LARGE AMT. OF FINES LEFT THE EXCAVATED SIDES WITHOUT ANY SHARP CORNERS OR VOIDS.)

POOR ORIGINAL

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INSPECTOR David S. Canady

Q A REVIEW Eugene Kelly 6/18/79

Sheet 1 of 1

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 3-23-79

Location N 661030.74 / E 2,005,774.38

Elevation 242

Spec. No. CAR SH-CH-4 & 8 (TP-01

Inspector D. S. Canady

Shift Day.

Weather Overcast, Windy & Cool

MDUR 24-2-4

COMMENT

[illegible] in the test pattern as shown in TP-01. Ramp sections [illegible] rolled with the [illegible] as [illegible] for settlement. At approximately 9:00 am started dumping material at the south ramp. On this position, a D8 was used to spread the material since the D6 was down. The first lift was built according to TP-01, using a [illegible] to backdump the material on the previous [illegible] and then spread the material with the D-8.

After building the lift and the ramps, the first roll was made, without vibration, to generally level out the [illegible] points. The first round of settlement points were made to check [illegible] thickness. Then ten passes were made with the [illegible] roller with settlement point checked between each roller pass. The roller was checked with the [illegible] vibration monitor to check the frequency of the roller. The roller speed was calibrated with [illegible] time over a measured distance.

The first lift was completed at 3:[illegible] **POOR ORIGINAL**

The surface breakdown was similar to as previously described

INSPECTOR David S Canady

Q A REVIEW Eugene Kelly 6/18/79

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GLOVER PRINTING INC. RALEIGH N.C.

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date: 3-15-79
Location: N662,403 / E 2,009,097
Elevation: 225 FT.
Spec. No.: CAR SHCH 4&8 (TP-01)
Inspector: D.S. CANADY
Shift: DAY
Weather: CLEAR, COOL, WINDY

COMMENT

BASED ON THE FACT THAT AN UNUSUALLY LARGE AMT. OF FINES OBSERVED IN THE 1st TEST HOLE, WERE NOT REPRESENTATIVE OF THE ENTIRE LIFT; A SECOND TEST HOLE HAS BEEN STARTED ON THE 4th LIFT. A PLACE WAS CHOSEN FOR THE FRAME THAT APPEARED TO BE MORE REPRESENTATIVE. THE SAME PROCEDURES WERE FOLLOWED AS WERE DESCRIBED IN THE DENSITY HOLE (3-13, 3-13 REPORTS). THIS SECOND HOLE WAS ON THE NORTH EASTERN PORTION OF THE TEST GRID. THE SCREENING SEEMED TO BE MORE REPRESENTATIVE OF THE ENTIRE TEST FILL.

POOR ORIGINAL

INSPECTOR [signature]

Q A REVIEW Eugene Kelly 6/18/79

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Sheet 1 of 1

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 3-26-79 Spec. No. CAR-SH-CH-49E (TP-01)

Location N661030 / E2109,774 Inspector D.S. Chasdy

Elevation 242 Shift Day

Weather

M0112-24-2-4

COMMENT

Started building lift number 2 at 9:00 a.m. The loader was loading material from the existing elevation. The material from the upper elevation appeared to contain a large amount of fine materials. Very little oversize was observed in this lift.

Law Engr. Co. came out to get a sample of material for the future compaction gradation.

By 11:20 the lift had been compacted and was ready for the 1st roll without vibration.

Started the 8 passes with settlement checks between each pass. (8 passes was determined from the previous test fill and the compaction break on the first lift of this test fill.)

Surface observations as before, most surface evidence of compaction exhibited after 2 passes. 3 to 4 passes appeared to fill voids and generally ~~[illegible]~~ the surface appeared to be a generally level top. Surface change not noticeable after the 4 or 5 pass.

POOR ORIGINAL

INSPECTOR [signature]

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Q A REVIEW Eugene [illegible] 6/18/79

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 4-2-79

Spec. No. CAR-SH-CH-4; E (TP-01)

Location N661,030 / E 6000,774

Inspector D. S. Canady

Elevation 242

Shift Day

Weather Overcast

VRMD - 24-24

COMMENT

In preparation for the density test, an area that would be representative was chosen to place the 8'x8' wooden frame. Levels were run to check the elev. of the frame. The frame was lined with plastic and the initial calibrated buckets of water were dumped for the initial reading. The 5'x5'x24" hole was dug and the material was loaded on a plastic lined flatbed truck. The truck was sent to be weighed & scaled. The dug hole was again lined with plastic and carefully filled to the calibrated level. The difference was calculated to determine the volume of the sample removed.

POOR ORIGINAL

496 229 INSPECTOR David S. Canady

Q A REVIEW Eugene Kelly 6/18/79

APPENDIX C

U.S. ARMY ENGINEER DIVISION LABORATORY
SOUTH ATLANTIC

LARGE SCALE TRIAXIAL SHEAR AND GRADATION TESTS
ON
ROCK TEST FILL MATERIAL

SHEARON HARRIS NUCLEAR POWER PLANT
CAROLINA POWER AND LIGHT COMPANY

12 JULY 1979

CORPS OF ENGINEERS
MARIETTA, GEORGIA

REQUISITION NO.	WORK ORDER NO.
H-11291	1366

SADEN-FL 13 July 1979

PREFACE

By letter dated 26 July 1978, the Carolina Power and Light Company (CP&L), Raleigh, North Carolina, requested the U. S. Army Engineer Division Laboratory, South Atlantic, perform laboratory tests on material from a rock test fill at the Shearon Harris Nuclear Power Plant main dam site. The sample was delivered to the Laboratory in April 1979 and the work was accomplished under he provisions of ER 1140-1-210. The tests conducted were: one 15-in. diameter, consolidated, undrained triaxial shear ($\bar{R}$) test and an after-test gradation analysis.

The work was performed under the general direction of Mr. Robert J. Stephenson, P. E., Director, South Atlantic Division Laboratory. The tests were supervised by Mr. Coy A. Colwell, Supervisory Civil Engineering Technician. Messrs. Colwell and Stephenson analyzed the data and prepared this report.

CONVERSION FACTORS

BRITISH TO METRIC UNITS OF MEASUREMENT

British units of measurement used in this report can be converted to metric units as follows:

Multiply	By	To Obtain
inches	2.54	centimeters
pounds	0.45336	kilograms
cubic feet	0.028317	cubic meters
pounds per square inch (psi)	703.1	kilograms per square inch
tons per square foot	0.9765	kilograms per square centimeter
centimeters per second	1.969	feet per minute

SADEN-FL

13 July 1979

LARGE SCALE TRIAXIAL SHEAR AND GRADATION TESTS
on
ROCK TEST FILL MATERIAL

SHEARON HARRIS NUCLEAR POWER PLANT
CAROLINA POWER AND LIGHT COMPANY

1. OBJECT:

The object of this test program was to determine the triaxial shear ($\overline{R}$-test) and the after-test gradation of a rockfill sample. The test specimens were reconstituted using material in a test sample obtained from a rock test fill at the Carolina Power and Light Company (CP&L) Shearon Harris Nuclear Power Plant main dam site.

2. REFERENCES:

a. Previous report: "Large Scale Triaxial Shear and Permeability Tests, Shearon Harris Nuclear Power Plant, Carolina Power and Light Company," Requisition No. H-02022, Corps of Engineers, South Atlantic Division Laboratory, Marietta, Georgia, April 1975.

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b. Engineering Manual 1110-2-1906, Labo· ·ory Soils Testing, Department of the Army, Office of the Chief of Engineers, 30 Nov 1970.

3. SPECIAL EQUIPMENT:

The controlled-s·.rain triaxial apparatus and the gradation equipment were the same used in the previous test program and described in paragraph 3 of reference 2a.

4. DESCRIPTION OF SAMPLE:

The test sample was provided by CP&L already separated on various sieves ranging from minus 3-in. to minus No. 4 sieve sizes. The material, which was shipped sealed in 55-gallon metal drums, was received 17 April 1979. According to CP&L's letter dated 9 May 1979, the test sample had been obtained from a rock test fill at the Shearon Harris Nuclear Power Plant main dam site. The same letter contained the field gradation data to use as the basis for computing the replacement gradation for the test specimens. Based on the field gradation, the sample classified as a tan, poorly graded, silty gravel (GP-GM) with about 50 percent cobble sizes up to 12-in. maximum size.

5. SCOPE OF TESTS:

The rockfill material was recombined at the replacement gradation for each of the three 15-in. diameter triaxial specimens which were then tested in consolidated undrained triaxial shear with pore pressure measurements ($\bar{R}$-tests). In the CP&L letter of 9 May, it was requested that the specimens be compacted to 138 pcf dry density at 4 percent moisture content. After the first specimen was tested at a confining pressure (σ_3) of 2.0 tons/sq. ft., Messrs. Alex Fuller (CP&L) and Mike Pavone (Ebasco) telephoned instructions to reduce the specimen density to 135 pcf in the other two specimens. After the triaxial tests, a gradation analysis was performed on the specimen tested at the highest confining pressure.

6. TEST PROCEDURES:

The test procedures were the same as those used in the previous test program and described in paragraph 6b of reference 2a. Only the specimen densities and moisture contents were changed to comply with the current request and instructions from CP&L representatives.

7. TEST RESULTS:

The results of all the tests are shown on the attached standard forms as listed below.

Test	Attachment No.
Gradation Curves, ENG Form 2087	1
Triaxial Compression Test Report, ENG Form 2089	2

8. DISCUSSION OF TEST RESULTS:

a. Gradation Curves. The sample furnished for this test program was not well graded like the 1975 sample. It contained more gravel sizes and less sand sizes. The percentage of fines (minus No. 200 sieve sizes) was about the same in both samples. As a result, there was less sand available to "cushion" the gravel size particles in the specimens prepared for these tests. That probably caused more apparent degradation in these tests than occurred in the sample tested earlier.

b. Triaxial Shear.

(1) The shear strength parameters were arbitrarily

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computed at 15 percent axial strain. As noted above, the No. 2 test specimen was prepared at a higher density than the others, so it was not surprising that the strength circles did not generate a "good" total strength envelope. Hence, no total strength envelope is shown on the report sheet. The induced pore pressures, however, caused the strength circles to shift and line up very well tangent to an effective strength envelope with an angle of internal friction (Ø') of 40.5 degrees. This compares favorably with the Ø' of 40.0 degrees obtained in the previous test program.

(2) The negative induced pore pressures indicate the specimens tested under the lower confining pressures dilated. The specimens tested in the previous program did not exhibit this characteristic. This change in behavior between the two samples, however, is consistent with the higher percentage of gravel sizes in the current sample.

c. Photographs. Photographs were made as the tests progressed. Unfortunately, the entire roll of film was bad and no pictures are available. For all practical

purposes, however, the photographs in the previous report are also typical for these tests.

9. CONCLUSIONS:

a. This material exhibits some sensitivity to changes in gradation and density. The maximum deviator stresses, $(\sigma_1 - \sigma_3)_{max}$ measured in these tests were consistently higher than those obtained in the previous sample which was more well graded. The one specimen tested at a higher density was also relatively stronger than the others, but more data would be required to confirm this apparent phenomena.

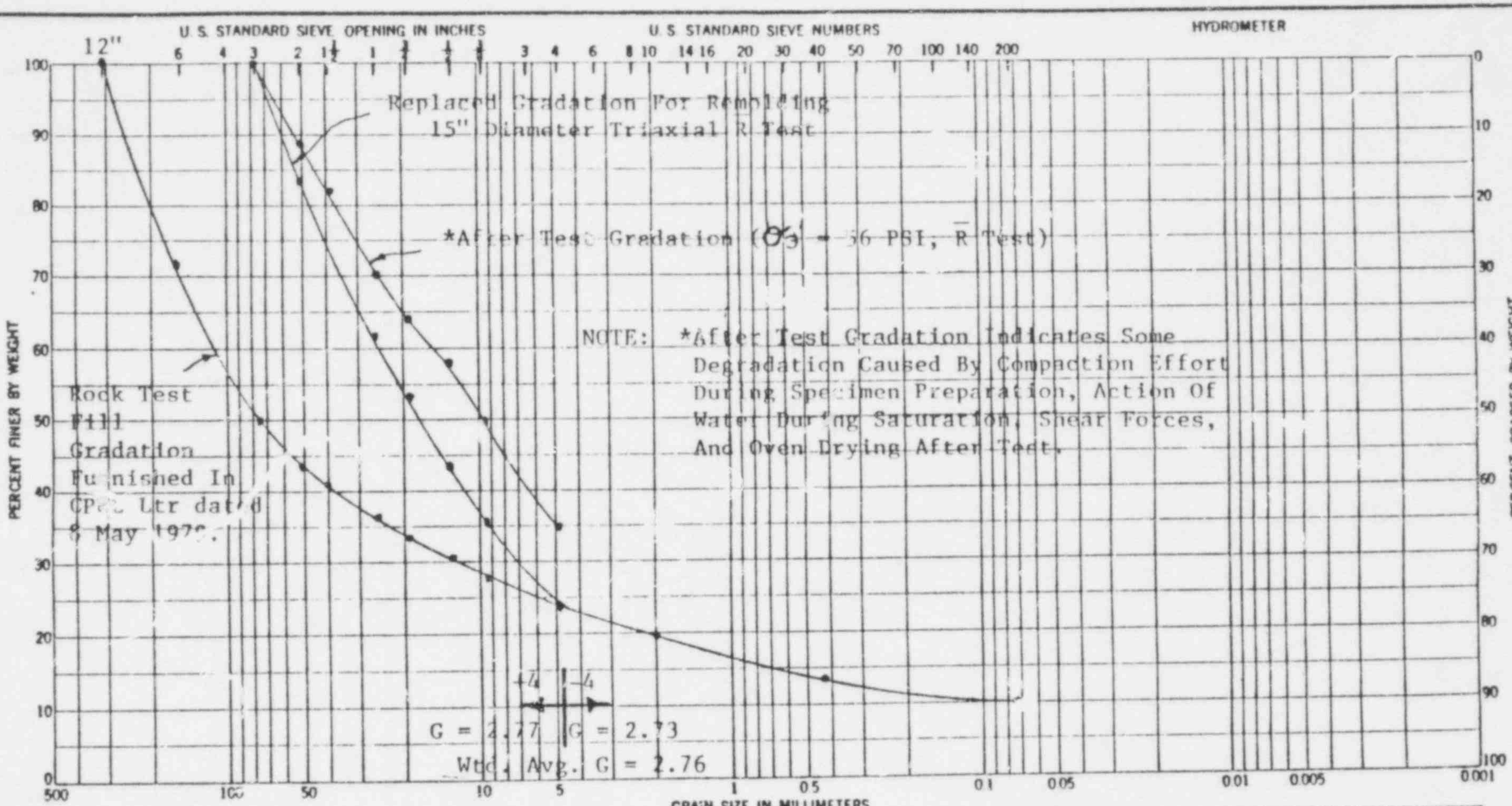
b. Notwithstanding the differences in the measured deviator stresses, the effective shear strength parameters for this material under $\bar{R}$-test conditions are essentially constant for the range of gradations and densities tested on this sample and the sample tested in 1975.

2 Attachments
ENG Form 2087
ENG Form 2089

CO TA, G 1 P..

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA. 30061

WORK ORDER NO. 1366
Req. No. P.O. H11291 Dated 15 Feb 1979



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI	
--	--	Visual Tan, Poorly Graded Silty Gravel (GP-GM) With 50% Cobble Sizes Up To 12" Max. Size. (Based On CPL Gradation Furnished)	--	(Not Requested)			Project Shearon Harris Nuclear Power Plant Carolina Power and Light Company Lab No. 145/418 $\bar{R}$ Test Area Main Dam Site Boring No. Rock Test Fill Date 10 July 1979

GRADATION CURVES

POOR ORIGINAL

Att. 1

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APPENDIX D

Photo 1 Stockpile of blasted rock used in construction of Test Sections. Base of stockpile is at El 250±. Spillway Excavation invert to be El 203 at this location.

Photo 2 End dumping of Rock on Test Section VRMD 24-4-3.

Photo 3 Spreading of Rock to 24 inch nominal lift thickness with dozer.

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Photo 4 Test Section VRMD-24-2-4 after spreading but prior to rolling.

Photo 5 Test Section VRMD-24-4-3 during rolling with smooth drum vibratory roller.

Photo 6 Test Section VRMD-24-2-4 lift surface after rolling (8 passes)

Photo 7 Volume measurement of density hole.

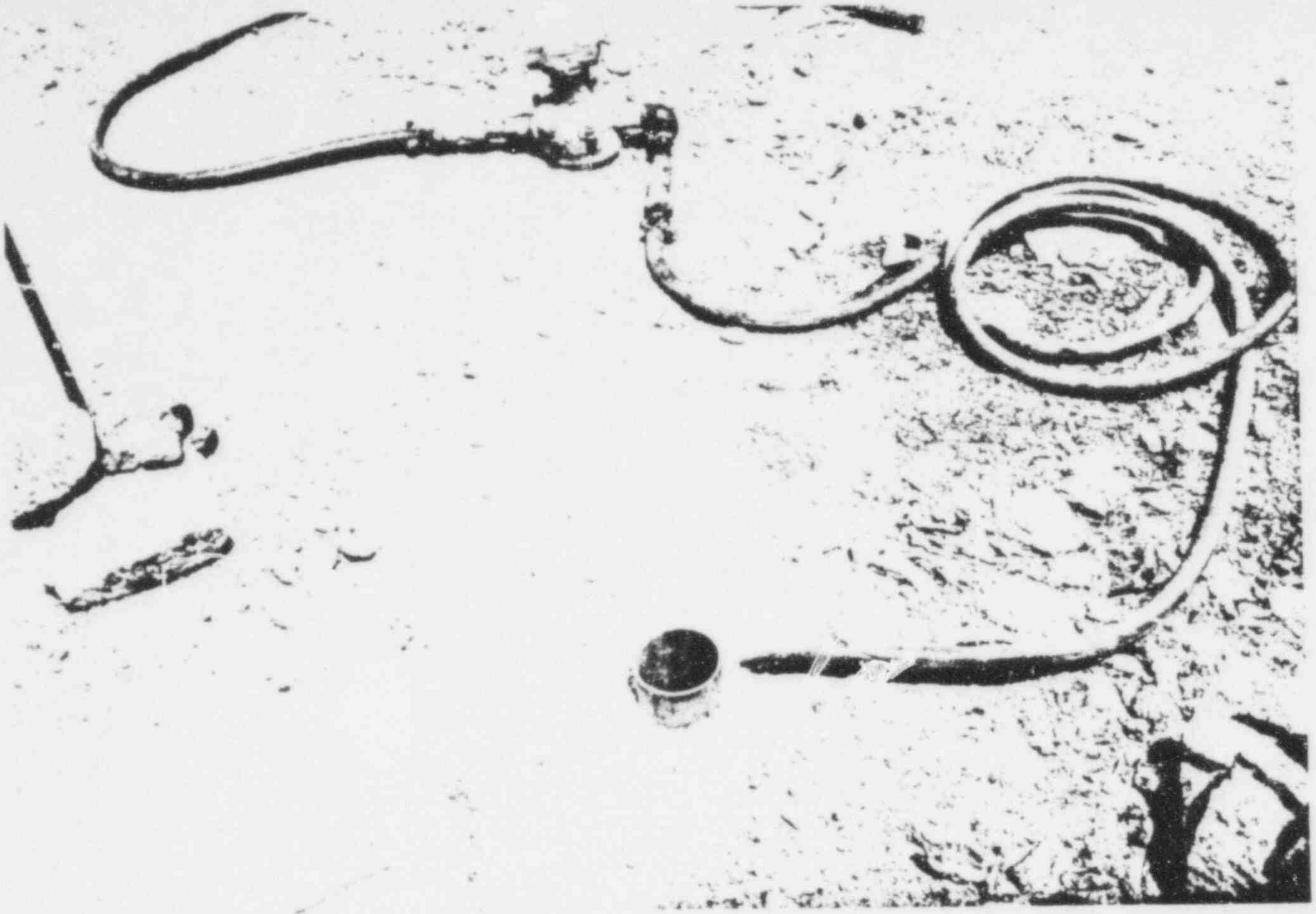

Photo 8 Test Equipment used in in-place permeability test.

Photo 9 Overall View of Cross Section of Test Section VRMD-24-4-3. Four 24" lifts shown

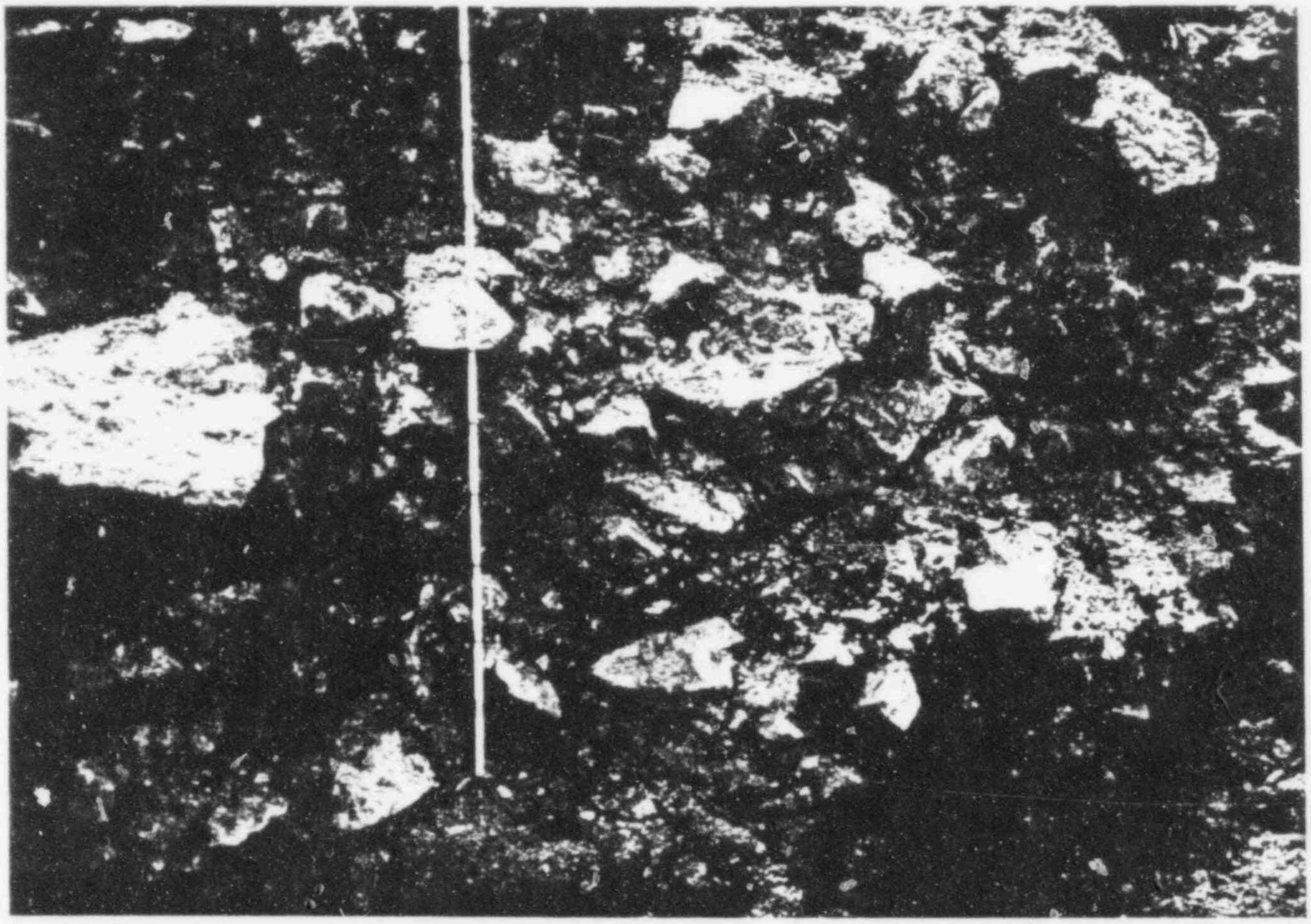

Photo 10 Close-up of Cross Section of Test Section VRMD-24-4-3

Photo 11 Overall View of Cross Section of Test Section VRMD-24-2-4. Two 24" lifts shown.

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POOR ORIGINAL

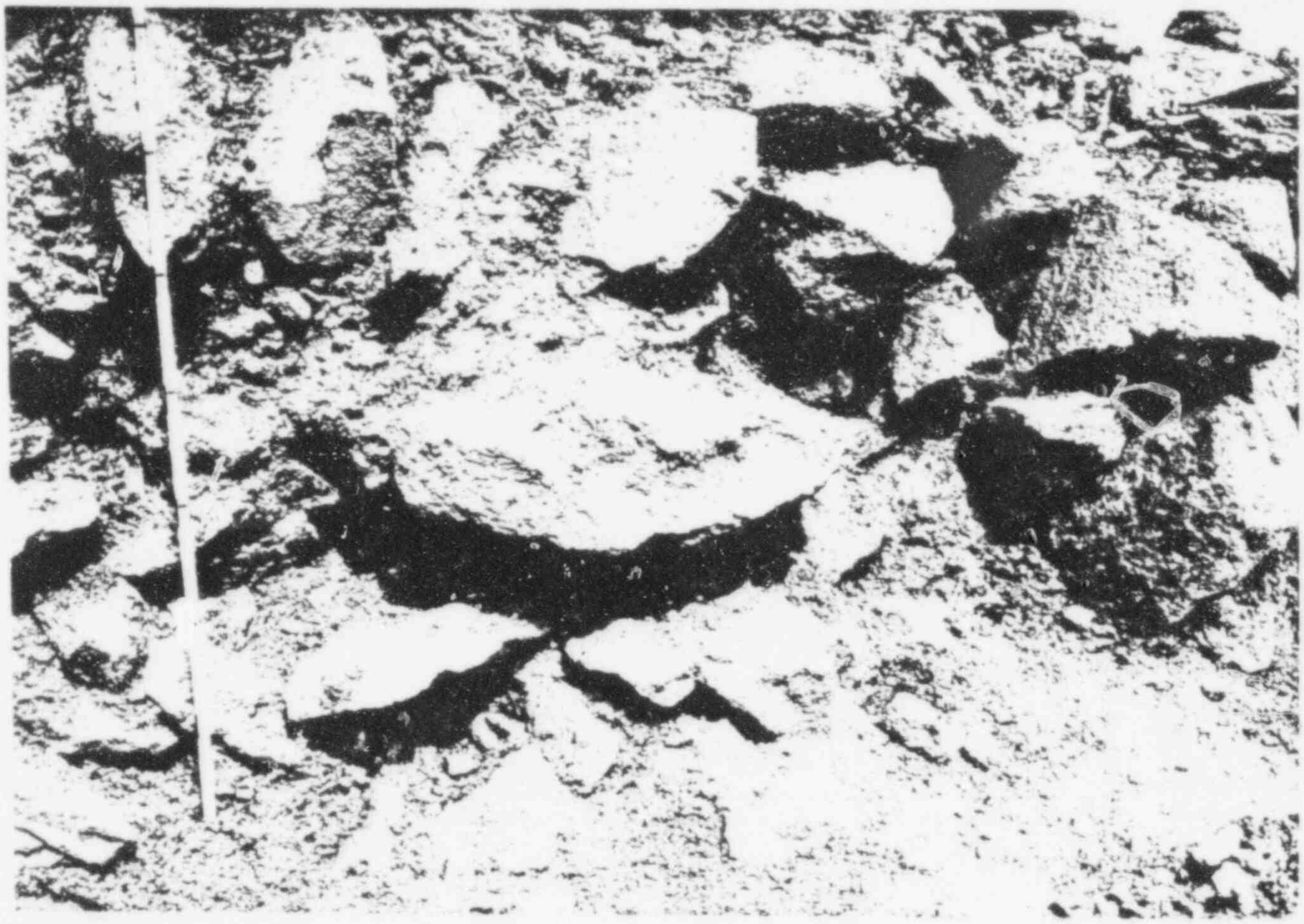

Photo 12 Close-up of Cross Section of Test Section VRMD-24-2-4