

TEST REPORT
RANDOM ROCKFILL MATERIAL
SHEARON HARRIS NUCLEAR POWER PLANT
CAROLINA POWER & LIGHT COMPANY
TEST VR-24-4-1

SO-400/401/402/403
14 2-2-79
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Prepared by
Power Plant Construction Department

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I. Introduction

This report contains the results of test fill VR-24-4-1 which includes large volume in-place density test and grain size distribution tests performed before and after the test fill was completed. Also field permeability tests were performed on the test fill in-place, and several constant head permeability tests were performed on the random rockfill material. All these tests were conducted by Power Plant Construction Department personnel in the field and in the site laboratory.

II. Objective

There were three objectives in performing this test program:

- A. To satisfy CP&L's commitment to NRC for defining the properties of rockfill material to be used in Class I dams and the west auxiliary dike.
- B. To assure CP&L that the engineering properties assumed for the random rockfill material in the design were consistent with the actual compacted in-place material properties.
- C. To determine if the test results are consistent with previous test fill properties which have already been deemed acceptable by the design engineer.

III. Procedure

Due to the fact that random rockfill material for Class I dams and dikes may be in short supply, it was determined that the blasted rock from the Cooling Tower Makeup Water Channel should be used if possible. In order to determine that the blasted rock material was suitable, an in-place test fill section was constructed on site to simulate the actual hauling, dumping, spreading and compaction process of the dam random 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 section designated VR-24-4-1 was constructed between 12/11 and 12/16, 1978, just south of the Emergency/Service Water Intake Channel. The area selected was free of excessive surface water and was reasonably level. The area was staked out and graded and then proof rolled with a vibratory roller until no appreciable settlement was detected. The test fill was conducted in accordance with PPCD - SHNPP Technical Procedure TP-1. The test section was approximately 40 feet by 55 feet with 24 settlement points. Also a ramp was

constructed with a 5 H to 1 V slope. The sides of the test section were maintained at approximately 1.5 H to 1 V. The material was end dumped, spread in approximately 24 inch thickness and was compacted with 10 passes of a Rascal 600-A roller. The roller produces a dynamic force of 45,000 pounds operating force with a vibration frequency between 1100 and 1500 VPM at a maximum speed of 3 mph. The test fill section consisted of four lifts. The number and thickness of the lifts placed, number and speed of roller passes, type and operation requirements of the compaction equipment, and the methods of spreading and compaction were determined from previous test fills.

- B. Material - The material used was blasted random rockfill removed from the Cooling Tower Makeup Water Channel. All the material came from approximately El. 220 and station 8 + 00. The material consisted of medium to fine grained sandstone with siltstone. Maximum particle size allowed for the test fill section was 22 inches or 90 percent of the lift thickness.
- C. Settlement Measurement - 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 assure the settlement points were relocated in the same plane 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 Caterpillar D 8 dozer. The method and operating time utilized by both types of equipment simulated anticipated field conditions. The surface of the lift after spreading was marked with paint sprayed directly on the lift surface for each settlement point. 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 and level readings were taken to determine the degree of settlement. The procedure was then repeated for a total of 10 passes for the first 3 lifts. 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 approximately 6 passes of the roller produced an optimum amount of settlement per compaction effort. The fourth lift was rolled with only 6 passes.

D. In-place Density Determination - After the final layer was compacted and all settlement data was recorded, an in-place density test was performed on December 16, 1978. The following procedure was used to conduct the test:

1. A wood frame measuring 8 feet x 8 feet x 7 inches high was placed over the test area and held in-place by stakes.
2. Level readings of all four corners at the frame were recorded from a nearby established bench mark.
3. One sheet of polyethylene was laid loosely over the frame so that they were in as close contact as possible with the inside of the frame 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.
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 ring 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.
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 - A before and after gradation analysis was performed on the random rockfill used in the test fill. One gradation sample was loaded on a flat bed truck directly from the point of blast production. This sample appeared to be representative of the type and size of material that was being excavated from the Cooling Tower Makeup Water Channel. The sample was taken directly to an enclosed area, spread out on a concrete floor, and heated with space heaters to remove the moisture. The material was graded by hand to remove all large rocks in the 12" to 24" range, then the 8" to 12" range, then the 4" to 8" range. 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 #100 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 #100.

The after compaction gradation sample was obtained from the in-place density test to determine how much breakup particles. The sample was dried and graded in the same manner as the before compaction test sample. The Percent Passing Total was computed for each sieve size and recorded.

Utilizing the above data the two gradation curves were plotted to obtain a visual aid in determining which sizes broke down the most. Most of the breakdown occurred in the 4" to #16 gradation range. There was not an appreciable increase in the amount passing the #100 sieve. However, the after compaction sample was, on the whole, finer than the before compaction sample due to rock breakdown.

F. Permeability Test - A total of five permeability tests were performed on the test fill and the random rockfill obtained from the test fill. A constant head method was used to determine the coefficient of permeability of the random rockfill material. A brief discussion of each permeability test will follow and the procedure used:

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

- a. An air track drilling rig drilled two holes in the top of the test fill. These holes were 2.83' deep.
- b. The sides of the well were scarified and all loose material was removed from the bottom of the holes.
- c. The well was filled to the top with Ottawa sand of known density.
- d. The volume of the well is then determined as is the radius of the well.
- e. Water is added through a float valve which assures a constant head in the well.
- f. Water was allowed to flow into the well for approximately 2 hours to saturate the area adjacent to the well.
- g. Measurements were then begun in 30 minute intervals to measure the quantity of water that flowed into the well. This was continued for 4 hours. An average flow rate was then calculated.
- h. All the data was compiled and entered into a formula to yield the permeability of the test fill.
- i. These two well permeability tests were designated as VR-24-4-1-PF-1 and VR-24-4-1-PF-2 respectively.

2. One laboratory permeability test was performed on a re-graded sample of the random rockfill material to gain more insight on the material's permeability. The following steps were performed in the laboratory trial:

- a. No gradation sizes larger than 3" were used in the test.
- b. The after-compaction gradation curve was used and redrawn to eliminate any sizes larger than 3". In essence, the curve was redrawn to indicate that 100% passed the 3" size and the new curve then blended back into the after compaction gradation curve between the 3/8" and the #4 sizes. This is the same method that was used by the Corps of Engineers, South Atlantic Division Laboratory dated October 24, 1974. The procedure is explained in detail in CP&L correspondence letter CE-03589. The purpose of redrawing the curve was to eliminate any sizes larger than 3" (which could not be adequately handled by our test equipment). The curve was redrawn in such a manner as to closely match the actual after-compaction gradation of the test fill section for sizes smaller than the #4 sieve.
- c. Quantities of test fill blasted rock were warm-air dried overnight and then sieved in a Gilson machine into the following gradation limits:
 1. 1" to 3" range
 2. 1/2" to 1" range
 3. #4 to 1/2" range
 4. Passing #4
- d. The percentages in each gradation range needed were calculated from the gradation curve drawn in step 6.
- e. The weights needed in each gradation range were calculated and then water was added to the weighed out sample to reproduce the water content of the blasted random rock material.
- f. The sample was then thoroughly mixed to combine all 4 gradation ranges into a homogeneous mass representative of the rockfill test fill material.
- g. The material was placed in three lifts into a cylindrical steel drum and compacted until a dry density of 137.8 #/ft³ was obtained. This was the density of the material in the compacted test fill.
- h. The surface between layers was scarified to eliminate

- the highly compacted layer of fines directly on the surface of each layer.
- i. The top of the cylindrical drum was sealed and a maximum of 5 psi vacuum pressure was applied to the top of the soil sample to pull water up through the soil sample thereby insuring complete saturation.
 - j. Once the sample was saturated, a constant head of water was maintained for a period of about 8 hours on the sample. Readings were taken every 30 minutes to determine the flow rate through the compacted sample.
 - k. This permeability test was marked VR-24-4-1 PL-1.
 - l. Once all the data was obtained, a coefficient of permeability, K , was computed from a constant head formula.
3. In addition, 2 more laboratory permeability tests were performed on the random rockfill material obtained directly from the compacted test fill area. The following steps were used in performing these permeability tests:
- a. A representative sample was excavated from the test fill and placed in buckets. Approximately 150# was retrieved.
 - b. The sample was taken to the lab where all sizes larger than 3" were removed from the sample and discarded.
 - c. The moisture content of the sample was determined.
 - d. The material was weighed out and compacted in three lifts until a dry density of 137.8 #/ft^3 was attained. This was the density of the compacted material in the test fill.
 - e. A layer of burlap was placed in the bottom of the cylindrical drum before the 3 rockfill lifts were compacted in the drum. The purpose of the burlap was to prevent fine particles from clogging the drain holes in the bottom of the drum.
 - f. The surface between lifts was scarified to eliminate the highly compacted layer of fines directly on the surface of each layer.

- g. The permeability test was then run utilizing the constant head test method. The top of the cylindrical drum was sealed and a maximum of 5 psi vacuum pressure was applied to the top of the soil sample thereby insuring complete saturation.
- h. Once the sample was saturated, a constant head of water was maintained for a period of time and the quantity of water flowing through the sample was measured. The flow rate was then computed.
- i. After all the data was collected, a coefficient of permeability value, K, was computed for the random rockfill sample.
- j. These 2 tests were marked VR-24-4-1-PL-2 and VR-24-4-1-PL-3 respectively.

IV. Tabulated Results

A. Gradation analysis -

1. Before - passing 1/4 inch = 17.5 %
2. After - passing 1/4 inch = 35.0 %

B. In-Place Density -

1. Wet Density - 147#/ft³
2. Dry Density - 137.8#/ft³
3. Moisture Content - 6.67%

C. Settlement Test - optimum number of 6 passes produced 1.2% settlement.

D. Permeability Tests - constant head:

1. In-place test fill permeability test 1 & 2
 - a. $K = 2.8 \times 10^{-4}$ cm/sec
 - b. $K = 2.8 \times 10^{-4}$ cm/sec
2. Laboratory constant head test using a reconstructed gradation produced by combining various sieve size particles.
 - a. $K = 7.28 \times 10^{-4}$ cm/sec
3. Laboratory constant head test using a random rockfill sample obtained from the test fill.
 - a. $K = 3.03 \times 10^{-3}$ cm/sec
 - b. $K = 2.6 \times 10^{-3}$ cm/sec

NOTES: The coefficient permeability listed above in 3a and 3b were determined for initial recorded data. See Discussion of Results for changes in

coefficient of permeability. Lowest permeability recorded was 9.8×10^{-4} cm/sec.

V. Discussion of Results

- A. Settlement of Test Fill - Test results indicate that an adequate amount of compaction is produced by 6 passes of a Rascal 600-A vibratory roller. The settlement curves which were drawn for each of the 4 lifts in the test fill began to flatten out at approximately 6 passes of the roller. Further rolling did result in additional compaction, but the greatest amount of compaction came in the first 6 passes of the roller. The approximate percentage settlement in 6 passes of the roller was 1.2%.
- B. Particle Gradation - A particle gradation was performed before roller compaction and again after roller compaction. The results are shown in the Data section of this report. There was an evident breakdown in particles due to the roller passes. The breakdown occurred over the entire spectrum of particle sizes but most notably in the 4" to #16 sieve sizes. The after compaction gradation for this test fill compared favorably with previous test fill samples that were sent to the Corps of Engineers for gradation analysis. In other words, the after compaction gradation for test fill VR-24-4-1 was similar to other test fill gradations that have been done at this site in the past.
- C. In-Place Density Test - The in-place density test performed on the roller compacted test fill revealed that a dry density of 137.8#/ft³ was obtained. The moisture content of the material was 6.7%. These values are consistent with test values of previous test fills performed on site.
- D. Permeability Tests - A total of 5 permeability tests were performed on the random rockfill material. Two tests were made in-place in the test fill itself. The first test resulted in a permeability of $K = 2.82 \times 10^{-4}$ cm/sec. The second test value was a permeability of $K = 2.86 \times 10^{-4}$ cm/sec. These two tests are identified as VR-24-4-1-PF-1 and VR-24-4-1-PF-2. The permeability of this material is less as compared to the permeability of previous test fill material performed by the Corps of Engineers.

One possible source of the reduced permeability in this test fill could be that an air track drilling rig was used to drill the two holes for the field permeability tests. As an air-track drills, it shatters the material below it and exerts great force upon the walls of the hole. This force could have helped to seal the hole with very fine shattered material that will impede the flow of water during a permeability test. However, the interior of the wells were scarified before the test was begun. Also, the test holes were drilled to a depth of about 33". This means that the hole penetrated into the second lift where the surface of the second lift was compacted by ten passes of the roller. The surface of the second lift and extending 2 or 3 inches deep is composed of highly compacted fines produced by the breakdown of rock particles caused by the 10 roller passes.

A third test was performed in the lab on material that was sieved and then recombined to artificially produce a gradation that had 100% passing the 3" sieve. A constant head permeability test was performed on a 9" thick sample inside a 12" diameter steel drum having perforations in its base to allow water to seep out. The results of this test give a permeability of $K = 7.28 \times 10^{-4}$ cm/sec. This test is designated as VR-24-4-1-PL-1. The permeability of this sample was a little lower than was anticipated. There were two factors which could have contributed to this low value:

1. The first 3" layer that was placed was compacted so much that many fines accumulated near the top creating an impervious glossy skim. This layer was not scarified to break up the glossy surface. This would have lowered the permeability.
2. The drain holes in the steel drum containing the sample became quite clogged with fine particles and prevented water from draining unrestrained from the sample. A porous layer of burlap was inadvertently omitted which was to have lain adjacent to the drain holes to prevent them from becoming clogged with fines.

Since it was suspected that the previous test may be erroneous, 2 more lab constant head tests were run. Material was taken directly from the test fill area and all particles larger than 3" were removed. The moisture content was determined. The material was then

compacted in three 3" lifts until a dry density of 137.8#/ft³ was obtained. Two layers of burlap were placed next to the drain holes before the first layer of soil was compacted. This was to prevent fines from clogging the holes. Care was also taken when compacting the sample so as not to over-compact any layer. The constant head permeability test was performed and a coefficient of permeability K value of 3.03×10^{-3} cm/sec and another of 2.6×10^{-3} cm/sec was obtained on tests designated as VR-24-4-1-PL-2 and VR-24-4-1-PL-3 respectively. A gradation was run on a representative sample of material not actually used in the test. The gradation matched up well with the artificially regraded and reconstructed test sample of VR-24-4-1-PL-1.

All three lab permeability tests had coefficients of permeability that reduced as time progressed. This lowering of the K value was attributed to migration of fines and clogging of the drain holes.

- E. Examination of Test Fill After Compaction - After the test fill was completed, a D-8 dozer cut a path through the area so as to examine the cross-section of the test fill. The material was generally firmly compacted and there was good bond between horizontal layers. There were very few noticeable areas of loose compaction or voids. These voids were mostly limited to areas underneath larger rocks that were placed directly on top of the previous lift. These few areas had voids of about 1" width underneath the large rocks. Only 2 or 3 such areas were noted. A few other places did not have voids but contained loosely compacted material underneath larger rocks lying directly on top of the previous lift. On the whole, the test fill appeared to be well compacted. A good estimate would be that over 95% of the cross section did not contain noticeable voids and areas of loose compaction.

VI. Recommended Method of Placement and Compaction

Based on the data collected and observations made during the process of constructing the test fill, the following recommended methods of place-

ment of random rockfill in Class I dams and dikes:

- A. A blast pattern of 8' x 10' should be used during production as this is the same blast pattern that was used on material in the test fill.
- B. Material will be end dumped from Euclid R-50 trucks in the random rockfill zone of the dam or dike as close as possible to its final resting position.
- C. D-8 dozers will spread the material in approximately horizontal lifts of 2 foot thickness.
- D. All rocks larger than 90% of the lift thickness shall be removed from the random rockfill zone.
- E. A minimum of 6 passes of a Rascal 600-A vibratory roller having a minimum dynamic force of 45,000 lbs. will be performed on each 2' thick lift. The roller shall not exceed 3 mph and passes shall overlap one foot.

For more in-depth information, see Ebasco Specification CAR-SH-CH-4, Rev. 6.

TEST FILL PROBLEM

SETTLEMENT DATA

Test Fill No. VR-24-4-1Date 12/12/78Lift No. 1By D. CLARKRequired Thickness 24"Type Compaction Equipment VIBRATING DRUM ROLLER (RM-60 RASCAL) 600-AMaterial Description ELASTED ROCK - BROWN SILTSTONE & CLAYSTONE W/
CLAYEY SILT FINESNOTE: 250x12:3000
21:6000

Settle- ment Point	Initial Level Reading	Initial Lift Reading	Final Reading N=1	Final Reading N=2	Final Reading N=3	Final Reading N=4	Final Reading N=5	Final Reading N=6	Final Reading N=7	Final Reading N=8	Final Reading N=9	Final Reading N=10
1/13	251.84	254.05	254.04	254.04	254.04	254.03	254.04	254.04	254.04	254.03	254.04	254.04
2/14	252.07	254.28	254.27	254.25	254.25	254.24	254.24	254.24	254.22	254.23	254.23	254.2
3/15	252.04	254.17	254.17	254.17	254.18	254.18	254.18	254.18	254.17	254.17	254.17	254.17
4/16	252.20	254.27	254.23	254.28	254.27	254.27	254.27	254.27	254.26	254.26	254.26	254.26
5/17	252.37	254.22	254.31	254.31	254.30	254.29	254.30	254.30	254.30	254.30	254.30	254.30
6/18	252.39	254.21	254.45	254.46	254.46	254.47	254.47	254.46	254.47	254.46	254.46	254.46
7/19	252.44	254.16	254.41	254.59	254.57	254.58	254.58	254.57	254.58	254.57	254.57	254.57
8/20	251.94	254.13	254.11	254.10	254.09	254.09	254.09	254.09	254.08	254.08	254.08	254.09
9/21	252.05	254.47	254.44	254.42	254.41	254.40	254.39	254.39	254.39	254.38	254.38	254.38
10/22	252.08	254.21	254.20	254.19	254.17	254.18	254.18	254.18	254.18	254.18	254.18	254.17
11/23	252.23	254.27	254.28	254.27	254.28	254.28	254.28	254.27	254.27	254.27	254.27	254.27
12/24	252.25	254.16	254.37	254.37	254.39	254.38	254.38	254.35	254.37	254.38	254.38	254.38
13/25	252.48	254.39	254.37	254.38	254.37	254.36	254.36	254.36	254.36	254.36	254.36	254.36
14/26	252.68	254.74	254.74	254.74	254.75	254.72	254.73	254.73	254.73	254.72	254.73	254.73
15/27	252.70	254.47	254.47	254.49	254.48	254.48	254.48	254.47	254.47	254.47	254.47	254.47
16/28	252.00	254.18	254.16	254.15	254.15	254.14	254.14	254.14	254.14	254.13	254.14	254.14
17/29	252.04	254.17	254.15	254.43	254.41	254.40	254.40	254.40	254.39	254.39	254.39	254.39
18/30	252.13	254.27	254.27	254.26	254.26	254.26	254.26	254.26	254.26	254.26	254.26	254.27
19/31	252.20	254.33	254.32	254.32	254.31	254.31	254.31	254.31	254.30	254.31	254.31	254.30
20/32	252.28	254.47	254.47	254.48	254.47	254.47	254.47	254.47	254.47	254.47	254.47	254.46
21/33	252.44	254.32	254.32	254.32	254.31	254.30	254.30	254.29	254.29	254.29	254.28	254.27
22/34	252.59	254.61	254.62	254.61	254.61	254.61	254.62	254.62	254.62	254.62	254.62	254.62
23/35	252.78	254.50	254.51	254.51	254.50	254.50	254.50	254.50	254.49	254.49	254.49	254.49
Avg.	252.31	254.37	254.36	254.36	254.35	254.35	254.35	254.34	254.34	254.34	254.34	254.34
Avg. Thickness		2.06	2.05	2.05	2.04	2.04	2.04	2.03	2.03	2.03	2.03	2.03
Percent Settlement			0.5	0.5	0.9	0.9	0.9	1.5	1.5	1.5	1.5	1.5

COMMENTS:

TEST FILL PROGRAM - RANDOM FILL

SETTLEMENT CURVE

CP&L - HARRIS SITE

Test Fill No VR-24-4-1

Date 12/20/78

Lift No 1

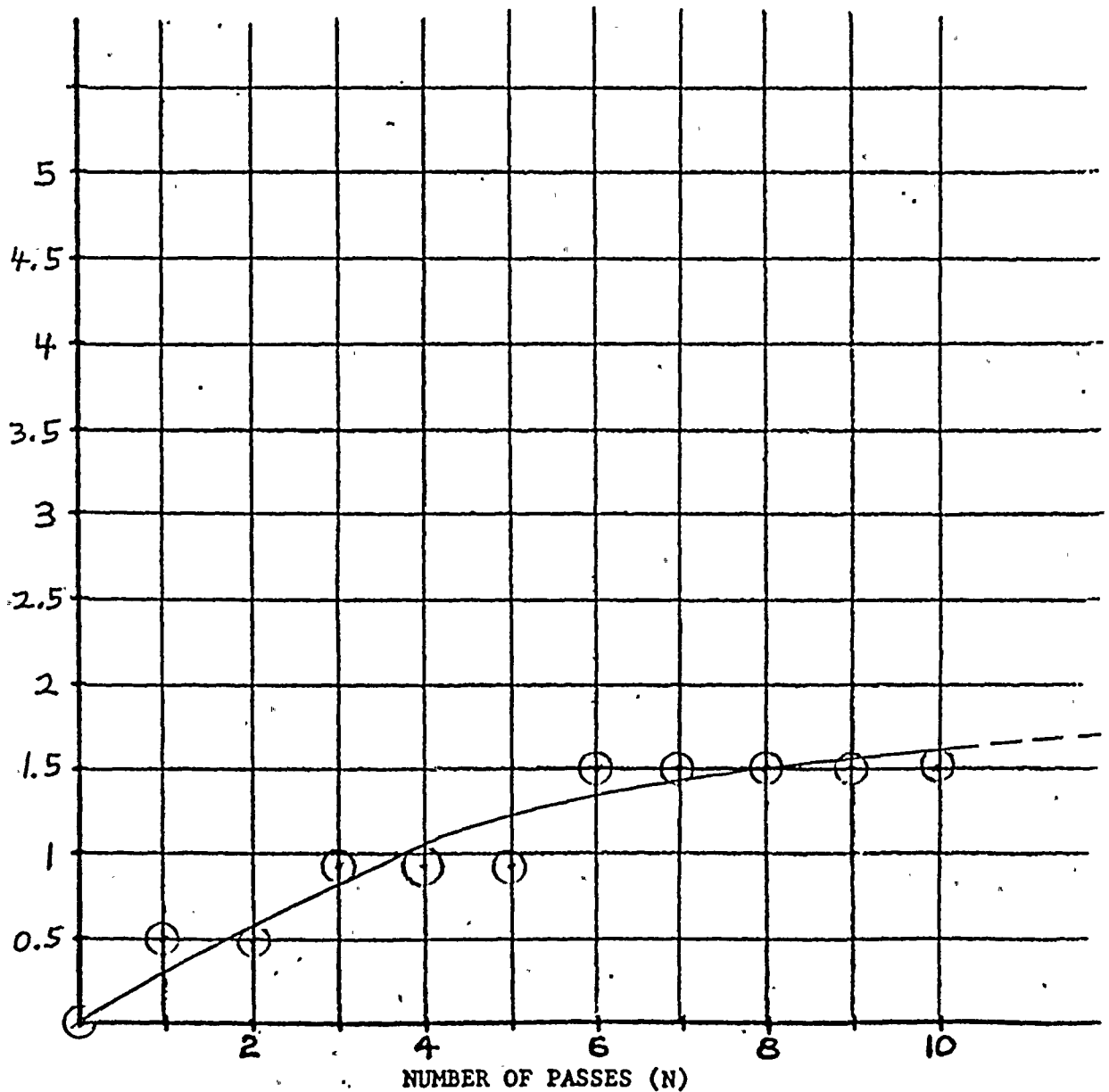
By Pridgen

Required Thickness 24"

Type Compaction Equipment Ray-Go 600A Vibrating Drum Roller

Remarks _____

%
Settlement



TEST FILL PROGRAM

SETTLEMENT DATA

Test Fill No. VR-24-4-1

Date 12/13/78

Lift No. 2

By D. CLAPIN / M. BROWN

Required Thickness 24 INCHES

Type Compaction Equipment RAY-60 RASCAL VIBRATING DRUM ROLLER 600 A

Material Description BLASTED ROCK MIX - BROWNISH GRAY SILTSTONE

CLAYSTONE FRAGMENT'S (TO 20 INCHES) w/ APPROX 25% CLAYEY SILT FINES

Settle- ment Point	Initial Level Reading	Initial Lift Reading	Final Reading N=1	Final Reading N=2	Final Reading N=3	Final Reading N=4	Final Reading N=5	Final Reading N=6	Final Reading N=7	Final Reading N=8	Final Reading N=9	Final Reading N=10
1/13	254.04	256.41	256.39	256.39	256.39	256.38	256.38	256.38	256.37	256.37	256.37	256.37
2/14	254.23	256.33	256.30	256.29	256.27	256.27	256.26	256.26	256.26	256.26	256.26	256.26
3/15	254.17	256.36	256.33	256.32	256.31	256.30	256.30	256.30	256.30	256.29	256.29	256.29
4/16	254.26	256.36	256.30	256.28	256.28	256.27	256.27	256.26	256.26	256.26	256.26	256.26
5/17	254.30	256.41	256.35	256.35	256.34	256.34	256.33	256.33	256.33	256.33	256.33	256.33
6/18	254.33	256.42	256.37	256.36	256.36	256.36	256.36	256.36	256.36	256.36	256.36	256.36
7/19	254.46	256.41	256.40	256.37	256.37	256.37	256.37	256.37	256.37	256.37	256.37	256.37
8/20	254.57	256.42	256.37	256.36	256.36	256.36	256.36	256.36	256.36	256.36	256.36	256.36
9/21	254.09	256.42	256.37	256.35	256.35	256.34	256.35	256.34	256.34	256.34	256.34	256.34
10/22	254.39	256.42	256.37	256.35	256.35	256.34	256.35	256.34	256.34	256.34	256.34	256.34
11/23	254.17	256.42	256.37	256.35	256.35	256.34	256.35	256.34	256.34	256.34	256.34	256.34
12/24	254.27	256.42	256.37	256.35	256.35	256.34	256.35	256.34	256.34	256.34	256.34	256.34
Avg.	254.34	256.33	256.32	256.31	256.31	256.31	256.31	256.31	256.30	256.30	256.30	256.30
Avg. Thickness	1.99	1.98	1.97	1.97	1.97	1.97	1.97	1.96	1.96	1.96	1.96	1.95
Percent Settlement		0.50	1.01	1.01	1.01	1.01	1.01	1.51	1.51	1.51	1.51	2.01

REMARKS:

TEST FILL PROGRAM - RANDOM FILL

SETTLEMENT CURVE

CP&L - HARRIS SITE

Test Fill No VR-24-4-1

Date 12/20/78

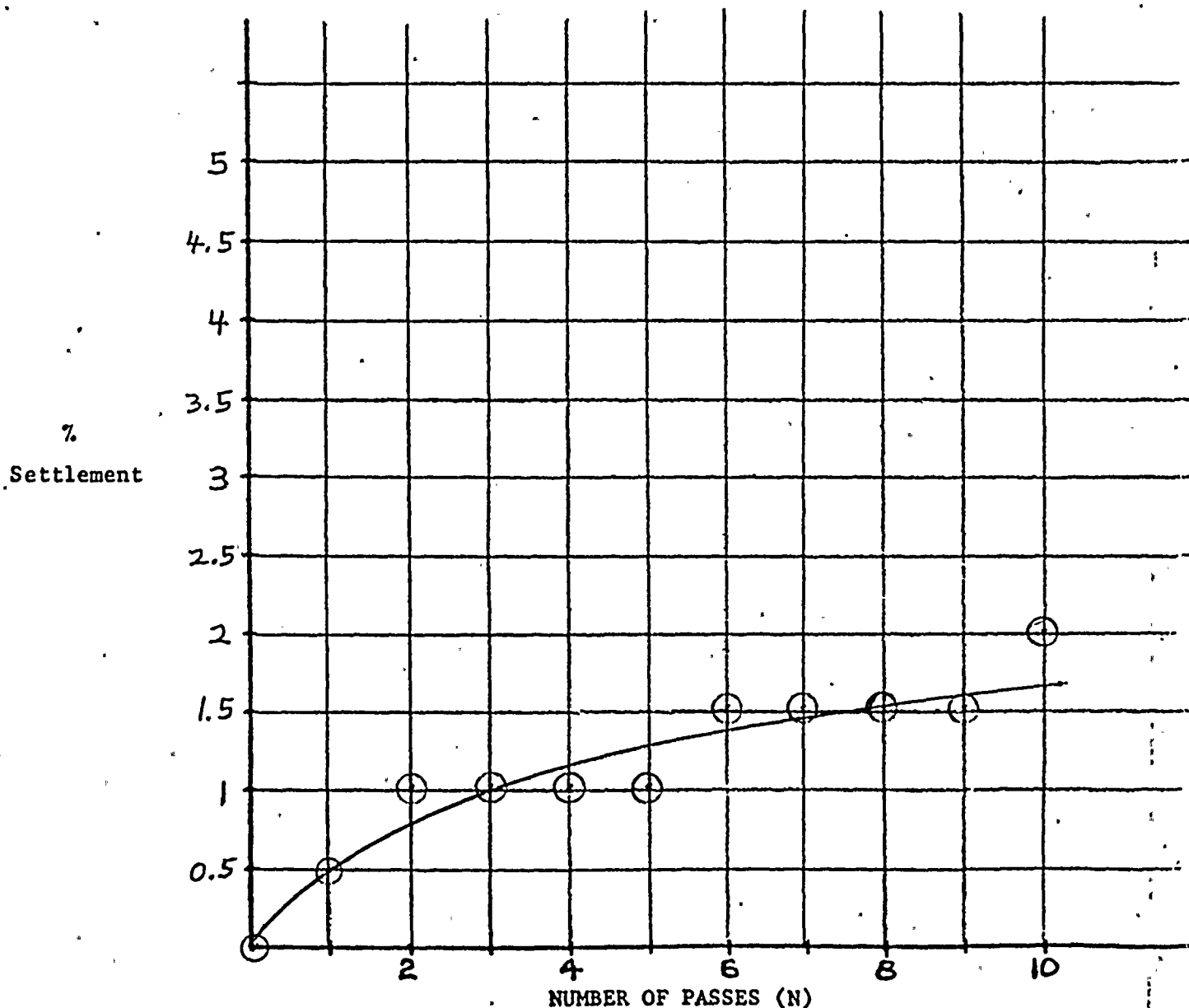
Lift No 2

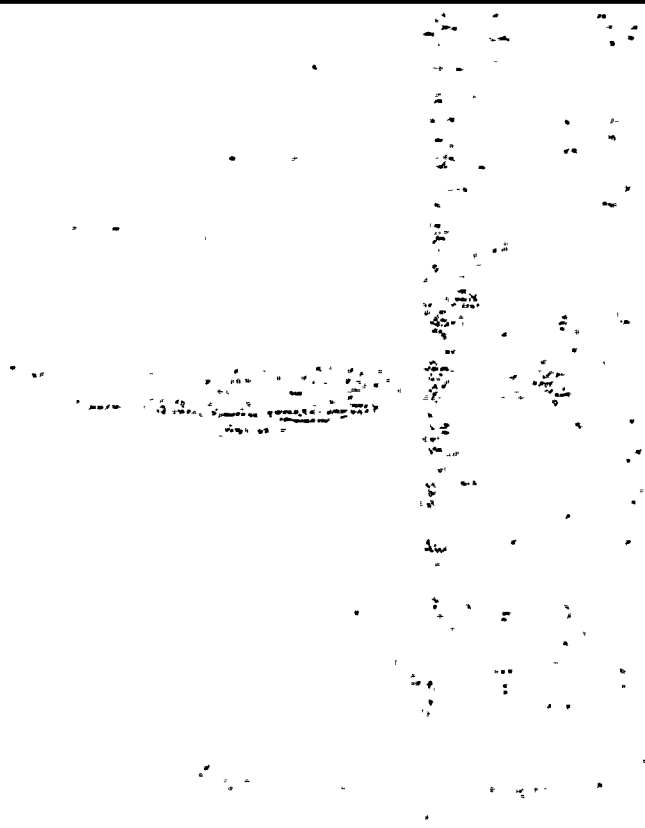
By Pridgen

Required Thickness 24"

Type Compaction Equipment Ray-Go Rascal 600A Vibrating Drum Roller

Remarks _____





TEST FILL PROBLEM

SETTLEMENT DATA

 Test Fill No. 1/R-24-4-1

 Date 12/14/78

 Lift No. 3

 By D. CLARK

 Required Thickness 24 INCHES

 Type Compaction Equipment RAY-GO RASCAL VIBRATING DRUM ROLLER 600 A

 Material Description Brown Sandy Siltstone

Settle- ment Point	Initial Level Reading	Initial Lift Reading	Final Reading N=1	Final Reading N=2	Final Reading N=3	Final Reading N=4	Final Reading N=5	Final Reading N=6	Final Reading N=7	Final Reading N=8	Final Reading N=9	Final Reading N=10
1/13	256.37	258.20	258.21	258.21	258.20	258.20	258.19	258.19	258.19	258.19	258.19	258.18
2/14	256.25	258.44	258.41	258.31	258.32	258.32	258.37	258.34	258.36	258.36	258.36	258.36
	256.21	258.17	258.18	258.17	258.19	258.19	258.19	258.18	258.18	258.19	258.18	258.18
	256.26	258.27	258.26	258.33	258.32	258.32	258.32	258.31	258.31	258.31	258.31	258.31
3/15	256.32	258.15	258.17	258.19	258.18	258.18	258.18	258.18	258.18	258.18	258.18	258.18
	256.17	258.32	258.34	258.32	258.37	258.31	258.31	258.30	258.30	258.30	258.30	258.30
4/16	256.36	258.19	258.18	258.18	258.17	258.17	258.16	258.15	258.16	258.15	258.15	258.15
	256.20	258.31	258.34	258.34	258.34	258.34	258.34	258.34	258.34	258.34	258.34	258.34
5/17	256.35	258.32	258.32	258.32	258.32	258.32	258.32	258.31	258.30	258.30	258.30	258.30
	256.20	258.47	258.45	258.44	258.42	258.42	258.41	258.41	258.41	258.40	258.40	258.40
6/18	256.33	258.33	258.28	258.27	258.26	258.26	258.25	258.25	258.25	258.25	258.24	258.24
	256.35	258.26	258.33	258.32	258.31	258.31	258.31	258.30	258.29	258.30	258.29	258.29
7/19	256.30	258.14	258.18	258.21	258.20	258.20	258.20	258.19	258.19	258.19	258.19	258.19
	256.18	258.17	258.19	258.18	258.19	258.19	258.19	258.19	258.18	258.19	258.18	258.18
8/20	256.31	258.31	258.31	258.31	258.31	258.32	258.31	258.31	258.32	258.32	258.32	258.32
	256.46	258.32	258.34	258.34	258.34	258.35	258.35	258.34	258.35	258.36	258.36	258.36
9/21	256.25	258.35	258.37	258.34	258.36	258.36	258.35	258.35	258.35	258.35	258.35	258.35
	256.16	258.27	258.27	258.27	258.28	258.28	258.28	258.27	258.27	258.27	258.26	258.26
10/22	256.27	258.31	258.33	258.31	258.31	258.30	258.30	258.29	258.29	258.29	258.29	258.29
	256.36	258.34	258.35	258.34	258.32	258.32	258.31	258.30	258.30	258.30	258.29	258.29
11/23	256.15	258.31	258.34	258.32	258.31	258.31	258.30	258.30	258.30	258.29	258.29	258.29
	256.37	258.05	258.07	258.07	258.07	258.07	258.06	258.08	258.08	258.08	258.07	258.08
12/24	256.32	258.40	258.40	258.39	258.39	258.39	258.38	258.39	258.39	258.39	258.39	258.38
	256.47	258.32	258.33	258.33	258.33	258.33	258.33	258.33	258.32	258.32	258.32	258.32
Avg.	256.30	258.29	258.29	258.29	258.28	258.28	258.28	258.28	258.28	258.28	258.27	258.27
Avg. Thickness		1.99	1.99	1.99	1.98	1.98	1.98	1.98	1.98	1.98	1.97	1.97
Percent Settlement			0	0	0.50	0.50	0.50	0.50	0.50	0.50	1.01	1.01

COMMENTS:

TEST FILL PROGRAM - RANDOM FILL

SETTLEMENT CURVE

CP&L - HARRIS SITE

Test Fill No VR-24-4-1

Date 12/20/78

Lift No 3

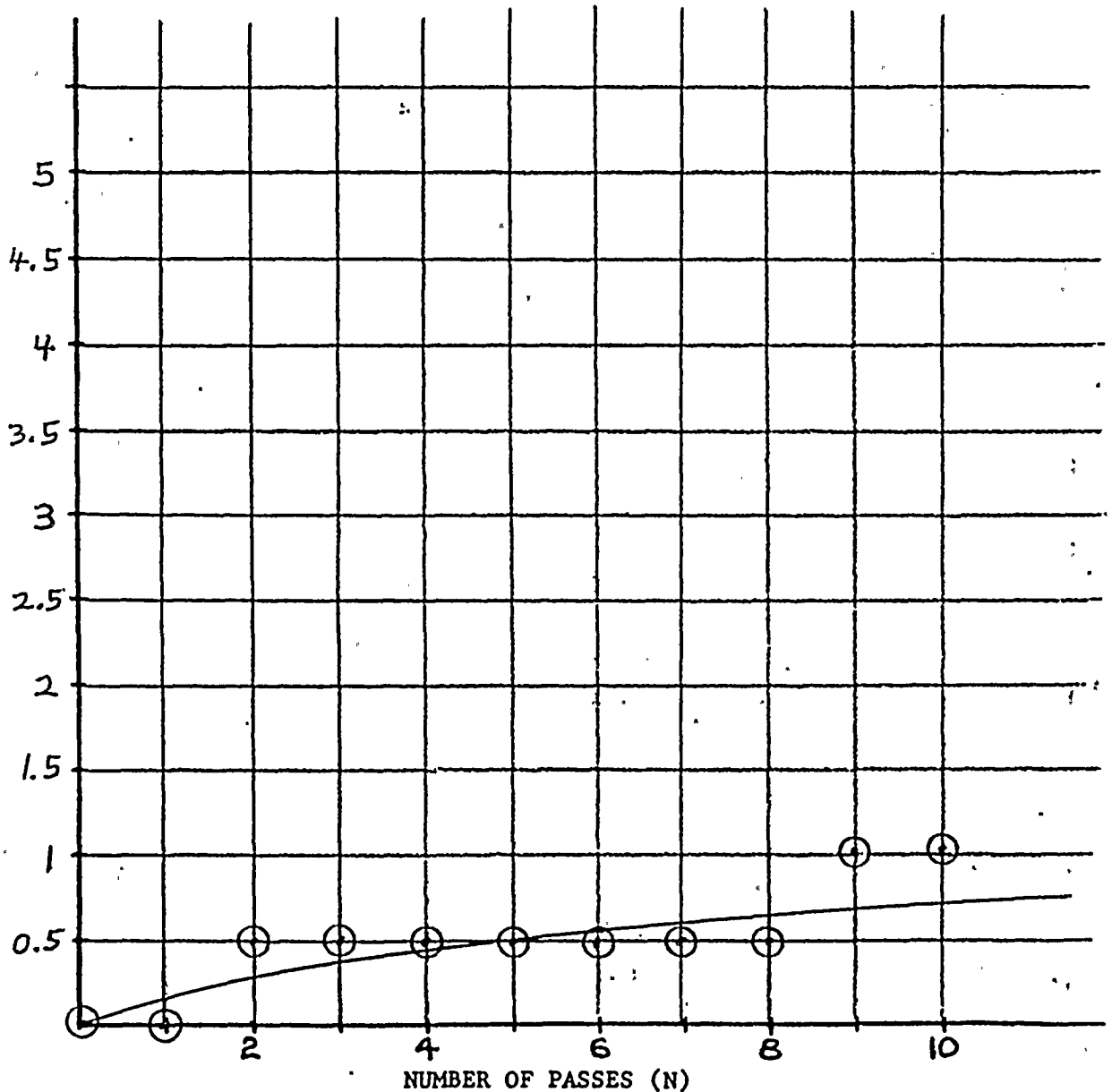
By Pridgen

Required Thickness 24"

Type Compaction Equipment Ray-Go 600A Vibrating Drum Roller

Remarks _____

%
Settlement



TEST FILL PROGRAM

SETTLEMENT DATA

 Test Fill No. VR-24-4-1

 Date 12-15-78

 Lift No. 4

 By D. CLARK

Required Thickness

24"

Type Compaction Equipment

RAY-60 RASCAL VIBRATING DRUM ROLLER

Material Description

Brown Sandy Siltstone

Settle- ment Point	Initial Level Reading	Initial Lift Reading	Final Reading N=1	Final Reading N=2	Final Reading N=3	Final Reading N=4	Final Reading N=5	Final Reading N=6	Final Reading N=7	Final Reading N=8	Final Reading N=9	Final Reading N=10
1/13	258.18	260.10	260.05	260.04	260.03	260.02	260.02	260.02				
2/14	258.36	260.08	260.22	260.22	260.20	260.20	260.19	260.19				
3/15	258.18	260.16	260.15	260.17	260.11	260.11	260.10	260.10				
4/16	258.30	260.20	260.28	260.28	260.27	260.27	260.27	260.26				
5/17	258.18	260.07	260.12	260.11	260.12	260.11	260.11	260.11				
6/18	258.34	260.21	260.21	260.22	260.25	260.24	260.25	260.25				
7/19	258.15	260.08	260.02	260.08	260.08	260.07	260.07	260.07				
8/20	258.40	260.06	260.06	260.06	260.07	260.06	260.07	260.07				
9/21	258.31	260.17	260.17	260.11	260.17	260.07	260.07	260.08				
10/22	258.40	260.15	260.15	260.15	260.11	260.17	260.07	260.09				
11/23	258.24	260.17	260.15	260.14	260.15	260.14	260.14	260.14				
12/24	258.29	260.25	260.22	260.22	260.21	260.22	260.22	260.20				
13/25	258.17	260.11	260.10	260.07	260.07	260.08	260.08	260.08				
14/26	258.18	260.14	260.15	260.15	260.14	260.14	260.14	260.14				
15/27	258.32	260.14	260.14	260.14	260.15	260.14	260.14	260.14				
16/28	258.36	260.20	260.18	260.17	260.16	260.16	260.15	260.15				
17/29	258.35	260.15	260.10	260.07	260.08	260.08	260.07	260.07				
18/30	258.26	260.08	260.04	260.04	260.04	260.03	260.03	260.02				
19/31	258.29	260.26	260.26	260.25	260.24	260.23	260.23	260.22				
20/32	258.29	260.27	260.24	260.25	260.22	260.21	260.21	260.21				
21/33	258.29	260.26	260.27	260.26	260.26	260.26	260.26	260.25				
22/34	258.08	260.24	260.25	260.25	260.24	260.23	260.23	260.22				
23/35	258.33	260.15	260.15	260.14	260.14	260.14	260.13	260.13				
24/36	258.32	260.15	260.15	260.16	260.15	260.14	260.14	260.14				
Avg.	258.28	260.17	260.16	260.16	260.15	260.15	260.14	260.14				
Avg. Thickness		1.89	1.88	1.88	1.87	1.87	1.86	1.86				
Percent Settlement			0.51	0.51	1.06	1.06	1.59	1.59				

COMMENTS:

TEST FILL PROGRAM - RANDOM FILL

SETTLEMENT CURVE

CP&L - HARRIS SITE

Test Fill No. VR-24-4-1

Date 12/20/78

Lift No. 4

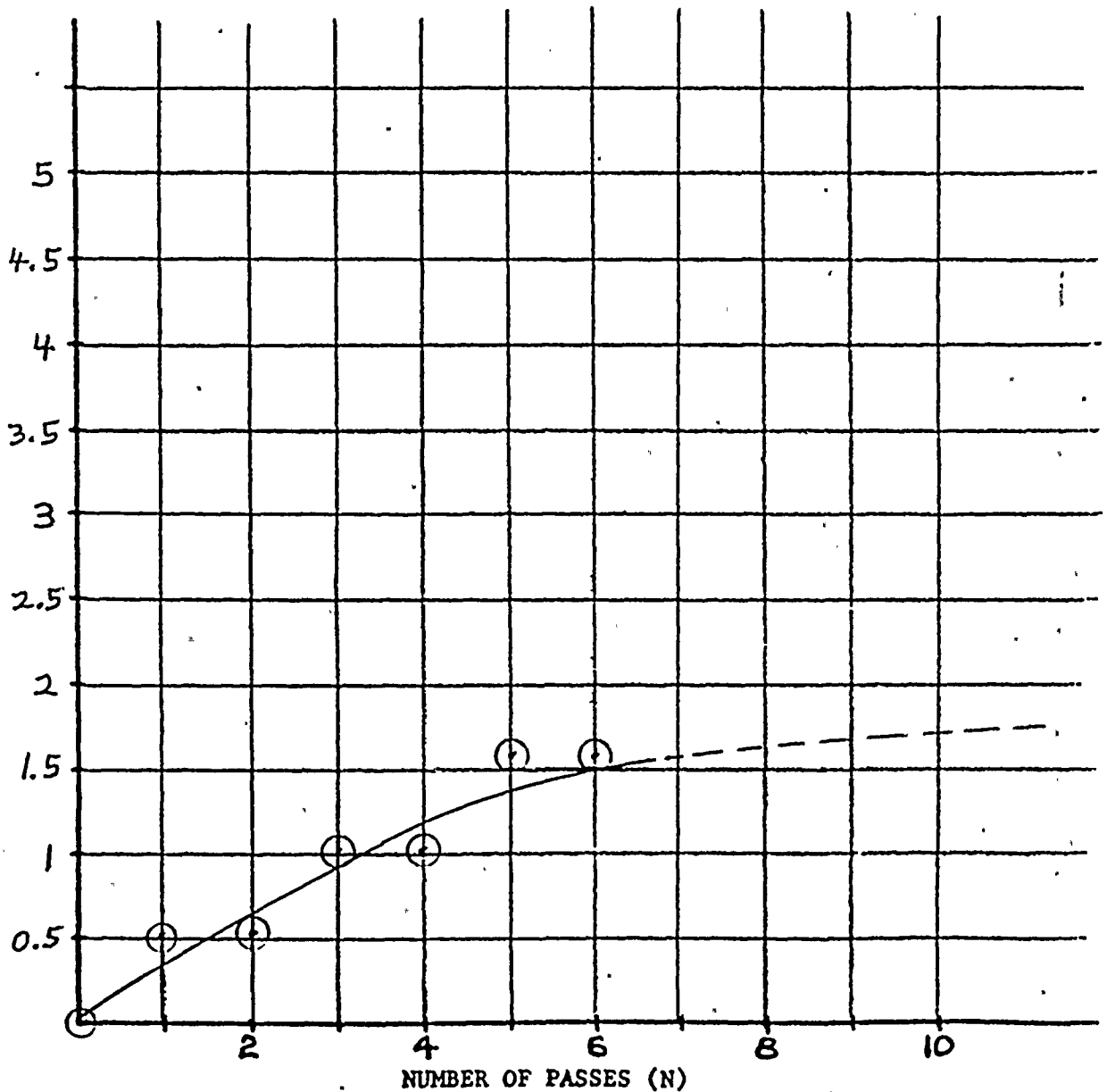
By Pridgen

Required Thickness 24"

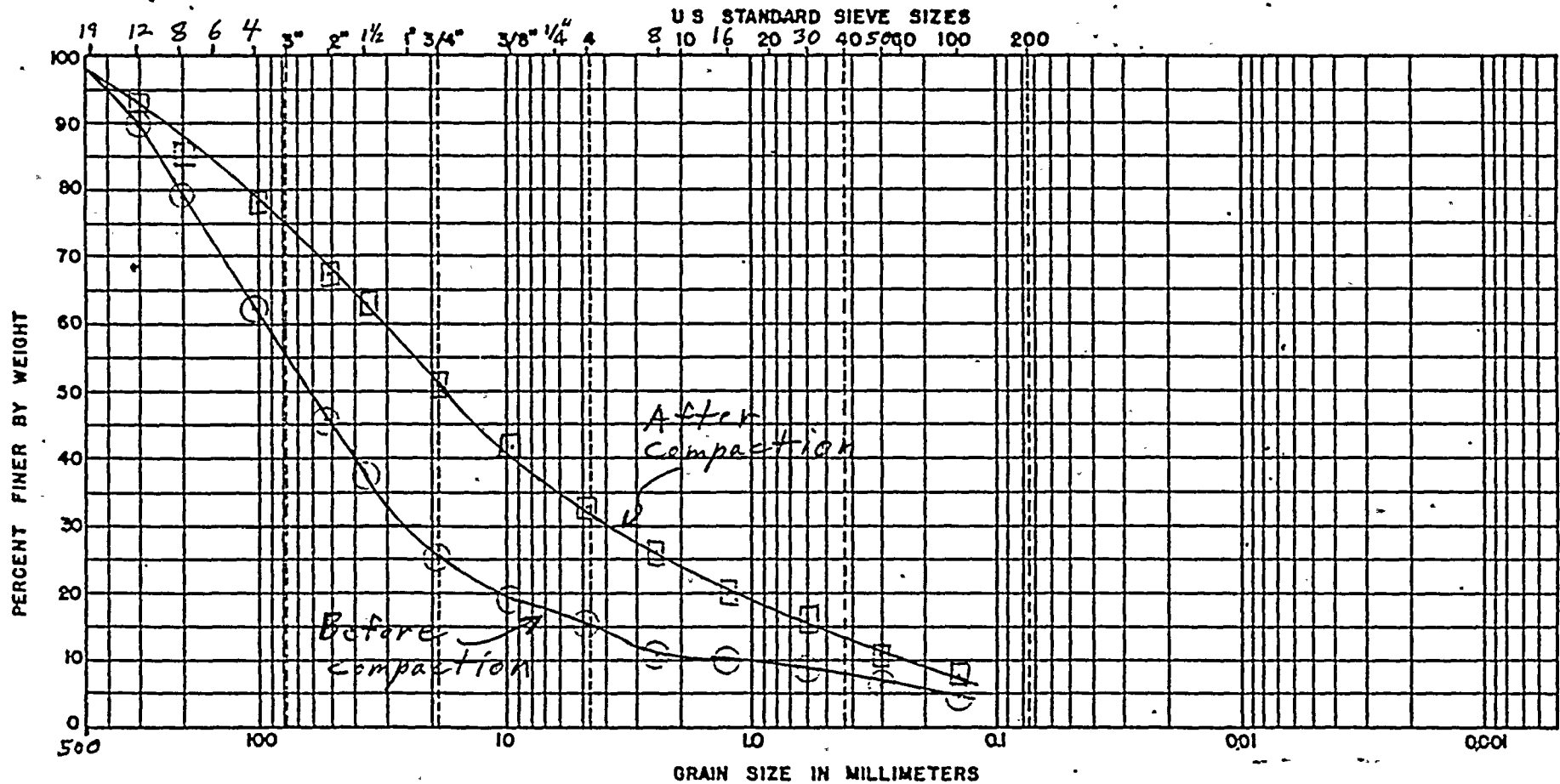
Type Compaction Equipment Ray-Go Rascal 600A Vibrating Drum Roller

Remarks _____

%
Settlement



CAROLINA POWER & LIGHT
HARRIS SITE



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

SAMPLE NO.	LOCATION	NAT WG	LL	PL	PI	DESCRIPTION OR CLASSIFICATION	GRAIN SIZE DISTRIBUTION
VR-24-4-1	Gradations conducted in CP&L warehouse and in aggregate lab					Test Fill VR-24-4-1 Sample taken from Cooling Tower Makeup Water Channel Before Compaction and	DATE 12/20/78 INSPECTOR <u>Brown/Nevill</u> CHECKED <u>Pridgen/Nevill</u> QA REVIEW _____

After compaction

CAROLINA POWER & LIGHT

SIEVE ANALYSIS
(Large Scale Gradation)SAMPLE NUMBER VP-24-4-1DATE 12-19-78LOCATION Sampled from Test Fill

TEST METHOD

DESCRIPTION Random Rock fill - After compaction

Sieve No./Size	Accumulative Weight Retained	Percent Retained	Percent Passing Subtotal	Percent Passing Subtotal	Percent Passing Total
24"	0	0			100
12"	296 lbs	6.3			93.7
8"	381	8.1			85.6
4"	350	7.5			78.1
2"	512	11.0			67.1
PAN	3136	67.0			—
1 1/2"	2.3 lbs	6.3	93.7		62.9
3/4"	6.2	12.0	76.7		51.5
3/8"	5.1	14.0	62.7		42.0
#4	4.7	12.9	49.8		33.4
#8	4.0	11.0	38.8		26.0
PAN	14.2	38.8			—
#16	26.9 gr	22.9		72.1	20.0
#30	20.5	12.5		59.6	15.5
#50	21.2	18.1		41.5	10.8
#100	14.5	12.4		29.1	7.6
PAN	34.2	29.1			

Calibrated Equipment Used:

Tool ID Number CP&L-M-43110Inspector S. M. BrownChecked W. O. PridgenQA Review Eugene Kelly

CAROLINA POWER & LIGHT

SIEVE ANALYSIS
(Large Scale Gradation)

SAMPLE NUMBER VP-24-4-1 DATE 12-19-78
 LOCATION Sampled in CT Makeup Channel TEST METHOD _____
 DESCRIPTION Random Rockfill - Before Compaction

Sieve No./ Size	Accumulative Weight Retained	Percent Retained	Percent Passing Subtotal	Percent Passing Subtotal	Percent Passing Total
24"	0	0			100
12"	495 lbs	10.0			90.0
8"	536	10.8			79.2
4"	803	16.2			63.0
2"	876	17.7			45.3
PAN	2248	45.3			—
1 1/2"	6.0 lbs	16.2	83.8		38.0
3/4"	10.0	27.0	56.8		25.7
3/8"	4.9	13.2	43.6		19.7
#4	3.8	10.2	33.4		15.1
#8	2.9	7.8	25.6		11.6
PAN	9.5	25.6			—
#16	13.2 gr	11.7		88.3	10.2
#30	12.7	11.3		77.0	8.9
#50	20.9	18.5		58.5	6.8
#100	19.3	17.1		41.4	4.8
PAN	46.7	41.4			

Calibrated Equipment Used:
 Tool ID Number CP-L-M-43110

Inspector S.M. Brown
 Checked W.O. Bridges
 QA Review Eugene Kelly

TEST FILL PROGRAM
COMPACTION OF RANDOM FILL
CP&L - HARRIS SITE

Test Fill No. UR-24-4-L Date 12/16/78
Layer Thickness approximately 24" By Nevill/Brown
Number Layers 4
Type Compaction Equip. Ray-Go Rascal Vibrating Drum Roller 600-A
Material Description Blasted Random Rock Fill

DENSITY

1. Volume of water for surface measurement 3 Brl Gal. 18.0 Ft.³
2. Top of water to top of frame 2.0 In.
3. Weight of truck empty 10440 Lb.
4. Weight of truck filled 20200 Lb.
5. Sample weight 9760 Lb.
6. Volume of water for hole measurement 13 Brl Gal. 78.0 Ft.³
7. Volume of hole Water to Frame = 3.2" [Correction = 69.4"] ⇒ 66.4 Ft.³
8. Wet density of material 147.0 Lb/Ft.³
9. Dry density of material 137.81 Lb/Ft.³

MOISTURE CONTENT

10. Weight wet moisture sample ~~+ container~~ 200 g ~~Lb.~~
11. Weight dry moisture sample ~~+ container~~ 182 g ~~Lb.~~
12. Weight water 12 g ~~Lb.~~
13. ~~Weight container~~ ~~Lb.~~
14. Weight dry material 182 g ~~Lb.~~
15. Moisture content 6.67 %

CAROLINA POWER & LIGHT

SIEVE ANALYSIS
(Large Scale Gradation)

SAMPLE NUMBER VR-24-4-1 DATE 12-19-78LOCATION Sampled in CT Make-up Channel TEST METHOD _____DESCRIPTION Random Rockfill - Before Compaction

Sieve No./ Size	Accumulative Weight Retained	Percent Retained	Percent Passing Subtotal	Percent Passing Subtotal	Percent Passing Total
24"	0	0			100
12"	495 lbs	10.0			90.0
8"	536	10.8			79.2
4"	803	16.2			63.0
2"	876	17.7			45.3
PAN	2248	45.3			—
1 1/2"	6.0 lbs	16.2	83.8		38.0
3/4"	10.0	27.0	56.8		25.7
3/8"	4.9	13.2	43.6		19.7
#4	3.8	10.2	33.4		15.1
#8	2.9	7.8	25.6		11.6
PAN	9.5	25.6			—
#16	13.2 gr	11.7		88.3	10.2
#30	12.7	11.3		77.0	8.9
#50	20.9	18.5		58.5	6.8
#100	19.3	17.1		41.4	4.8
PAN	46.7	41.4			

Calibrated Equipment Used:
Tool ID Number CP+L-M-43110

Inspector S.M. Brown
Checked W.O. Bridges
QA Review Eugene Kelly

FORM 906

N. C. DEPT. OF MOTOR VEHICLES

WEIGHT STATION 11 305

Date Dec. 15 1978

OWNER C. P. L.

STREET New Hill, 71 E.

CITY

0 6 2 4 0
1 3 9 6 0
20,200

1
2 or 2 & 3
3 or 3 & 4
4 or 4 & 5

Weighter Lt. W. W. Womble

FORM 906

N. C. DEPT. OF MOTOR VEHICLES

10490-Empty

WEIGHT STATION # 305

Date Dec. 15, 1978

OWNER C. P. L.

STREET

CITY New Hill, 71 E.

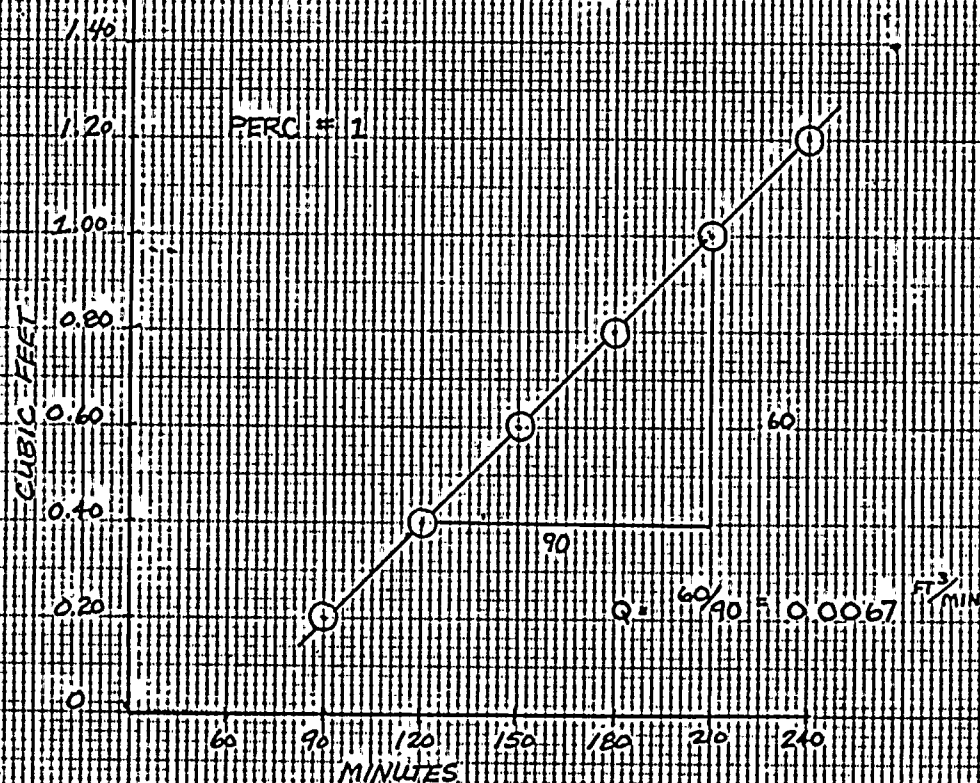
0 6 2 4 0
1 3 9 6 0
20,200

1
2 or 2 & 3
3 or 3 & 4
4 or 4 & 5

Weighter Lt. W. W. Womble

25,000

Test # VR-24-4-1-PF-1



$$K_i = \frac{525,600 [\sinh(\frac{h}{h_0}) - 1] \frac{Q}{2\pi} (\frac{h}{h_0})}{h^2}$$

$$= \frac{525,600 [3.076 - 1] 0.0067 / 6.28}{4.0}$$

$$= \frac{525,600 [2.076] 0.0067 / 6.28}{4.0}$$

$$= 1167.52 / 4.0$$

$$K_i = 291.88 \text{ FT/YR} = 2.82 \times 10^{-4} \text{ CY/SEC}$$

SHNPP

WELL PERMEAMETER TEST #VR-24-4-1-PF-1

LOCATION TEST FILL VR-24-4-1
N 100 W 2500TESTED
BYM. BROWN / S. BROWN

OBSERVATION HOLE

SOIL CLASSIFICATION

STRATA DEPTH (ft.)--

FROM

TO

02.0BROWN CLAYEY SANDSTONETEST FILL (RANDOM ROCKFILL)

1. DEPTH (ft.) TO WATER TABLE:

N/A

2. DEPTH (ft.) TO GROUND SURFACE

N/A

3. DEPTH (ft.) TO BOTTOM OF WELL:

2.93

4. DEPTH (ft.) TO TOP OF SAND:

0.00

5. DEPTH (ft.) OF SAND (3) -(4)

2.83

6. DEPTH (ft.) TO WATER SURFACE IN WELL:

0.83

7. DEPTH (ft.) OF WATER IN WELL h=(3) -(6):

2.00

8. DENSITY (pcf) OF STANDARD SAND

95.40

9. WEIGHT (lb) OF SAND + CONTAINER BEFORE FILLING WELL:

32.15

10. WEIGHT (lb) OF SAND + CONTAINER AFTER FILLING WELL:

3.05

11. WEIGHT (lb) OF SAND USED (9)-(10):

29.10

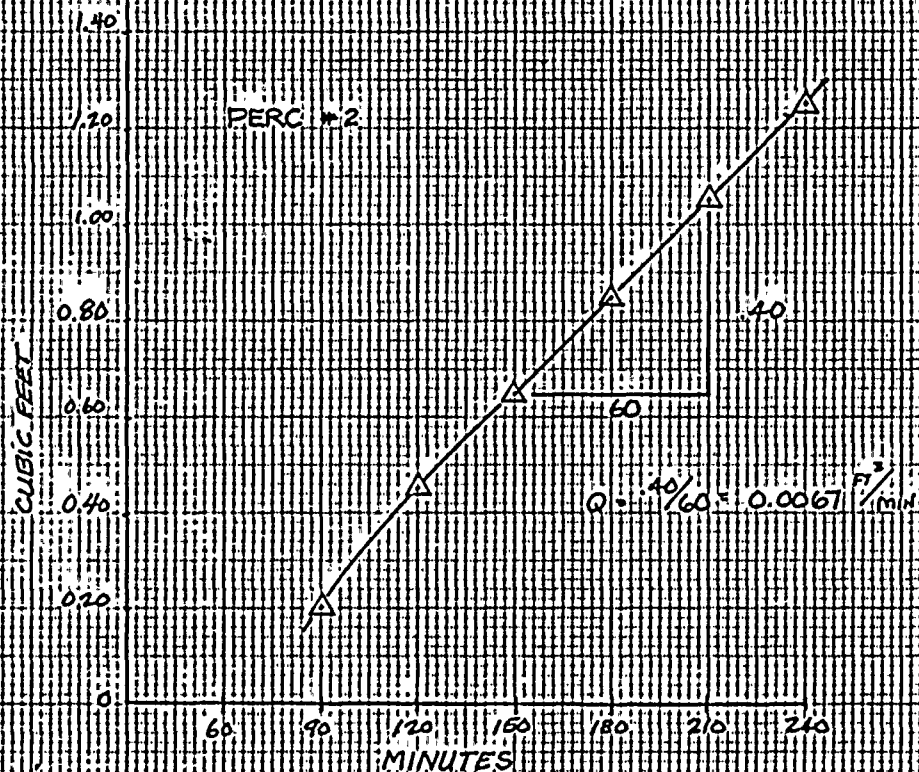
12. VOLUME (cu. ft.) OF WELL (11)+(8):

0.30513. RADIUS (ft.) OF WELL $r = \sqrt{\frac{(12)}{(5)\pi}}$ 0.185TOOL ID CPL-C-4366

WELL PERMEAMETER TEST VR-24-4-1-PF-1

~~SECRET~~[illegible]

Test # VR-24-4-1-PF-2



$$K_2 = \frac{525600 [\sinh^{-1} \left(\frac{h}{r} \right) - 1] Q/2 \left(\frac{F^3}{MIN} \right)}{h^2}$$

$$= \frac{525600 [3.11 - 1] 0.00107}{h^2}$$

$$= \frac{525600 [2.11] [0.00107]}{4.0}$$

$$= 186.64 / 4.0$$

$$K_2 = 296.66 F/YR = 2.867 \times 10^{-4} CM/SEC$$

Test # VR-24-4-1-PF-2

LOCATION TEST FILL VR-24-4-1
N 100 W 2500

TESTED BY S.M. BROWN

OBSERVATION HOLE

SOIL CLASSIFICATION

STRATA DEPTH (ft.)
FROM TO

0'	4'

BROWN CLAYEY SANDSTONE
RANDOM ROCKFILL

1. DEPTH (ft.) TO WATER TABLE:

N/A

2. DEPTH (ft.) TO GROUND SURFACE

N/A

3. DEPTH (ft.) TO BOTTOM OF WELL:

2.83

4. DEPTH (ft.) TO TOP OF SAND:

0.00

5. DEPTH (ft.) OF SAND (3) -(4)

2.83

6. DEPTH (ft.) TO WATER SURFACE IN WELL:

0.83

7. DEPTH (ft.) OF WATER IN WELL h=(3) -(6):

2.00

8. DENSITY (pcf) OF STANDARD SAND

95.4

9. WEIGHT (lb) OF SAND + CONTAINER BEFORE FILLING WELL:

35.3

10. WEIGHT (lb) OF SAND + CONTAINER AFTER FILLING WELL:

8.0

11. WEIGHT (lb) OF SAND USED (9)-(10):

27.3

12. VOLUME (cu. ft.) OF WELL (11)+(8):

0.286

13. RADIUS (ft.) OF WELL $r = \sqrt{\frac{(12)}{(5)\pi}}$

0.179

TOOL ID CPL-C-4366

WELL PERMEAMETER TEST

[illegible]

CAROLINA POWER & LIGHT
SHEARON HARRIS' NUCLEAR POWER PLANT
COEFFICIENT OF PERMEABILITY

Sample No. VR-24-4-1 - PL-1 Date 12-26-78
Location N 100 W 2500 Tested By S. M. Brown / W.O. FIDGEN
Description BLASTED ROCK (RANDOM FR. ROCK FILL)

WATER CONTENT

DENSITY

Wt. Container N/A Wt. Mold + Soil N/A
Wt. Cont. + Wet Soil 200.0 Wt. Mold N/A
Wt. Cont. + Dry Soil 187.5 Wet Density 147.0
Moisture Content 6.67 Dry Density 137.8

Standpipe Cross Sectional Area, $a =$ N/A sq cm

Sample Cross Sectional Area, $A =$ 730.6 sq cm

Sample Length, $L =$ 22.86 cm

Constant Head

$$K = \frac{QL}{Aht}$$

Test No.	h , cm	t , sec	Q , cc	T , °C	k , cm/sec
1	45.72	1143.0	1200	20.0	7.2×10^{-4}

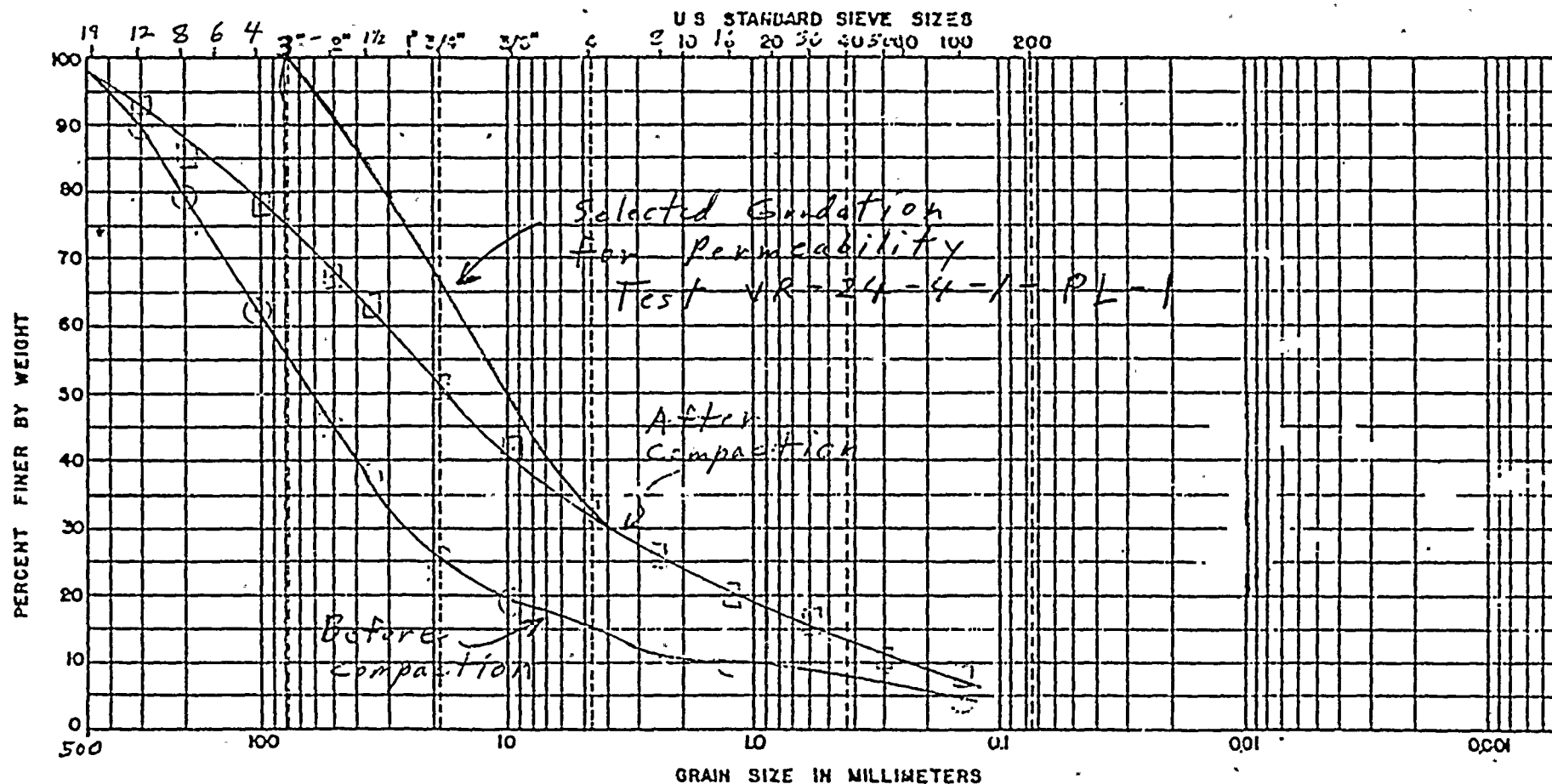
Variable Head

$$K = \frac{aL}{At} \ln \frac{h_1}{h_2}$$

Test No.	h_1 , cm	t_1	h_2 , cm	t_2	k , cm/sec

COMMENTS

CAROLINA POWER & LIGHT
HARRIS SITE



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

SAMPLE NO.	LOCATION	NAT	WG	LL	PL	PI	DESCRIPTION OR CLASSIFICATION	GRAIN SIZE DISTRIBUTION
VR-24-41	Gradations conducted in CP4L warehouse and in aggregate lab						Test Fill VR-24-4-1 Sample taken from Cooling Tower Make up Water Channel Before Compaction	DATE 12/20/78 INSPECTOR Brown/Nevill CHECKED Bridger/Nevill QA REVIEW

CAROLINA POWER & LIGHT
SHEARON HARRIS' NUCLEAR POWER PLANT
COEFFICIENT OF PERMEABILITY

Sample No. VR-24-4-1-PL-2 Date 12-8-78
 Location N 100 W 2500 Tested By S.M. BROWN / W.O. PRIDGEN
 Description TEST FILL SAMPLE
BLASTED ROCK (RANDOM SIZE) Rockfill

WATER CONTENT		DENSITY	
Wt. Container	<u>N/A</u>	Wt. Mold + Soil	<u>N/A</u>
Wt. Cont. + Wet Soil	<u>200.0 g</u>	Wt. Mold	<u>N/A</u>
Wt. Cont. + Dry Soil	<u>189 g</u>	Wet Density	<u>146.0</u>
Moisture Content	<u>5.8 %</u>	Dry Density	<u>137.8</u>

Standpipe Cross Sectional Area, $a =$ N/A sq cm
 Sample Cross Sectional Area, $A =$ 730.62 sq cm
 Sample Length, $L =$ 22.86 cm

Constant Head

$$K = \frac{QL}{Aht}$$

Test No.	h, cm	t, sec	Q, cc	T, °C	k, cm/sec
P2-2-A	43.5	600	2505	20.0	3.03×10^{-3}
" - B	43.5	1200	4850	20.0	2.91×10^{-3}
" - C	43.5	1200	4780	20.0	2.86×10^{-3}

Variable Head

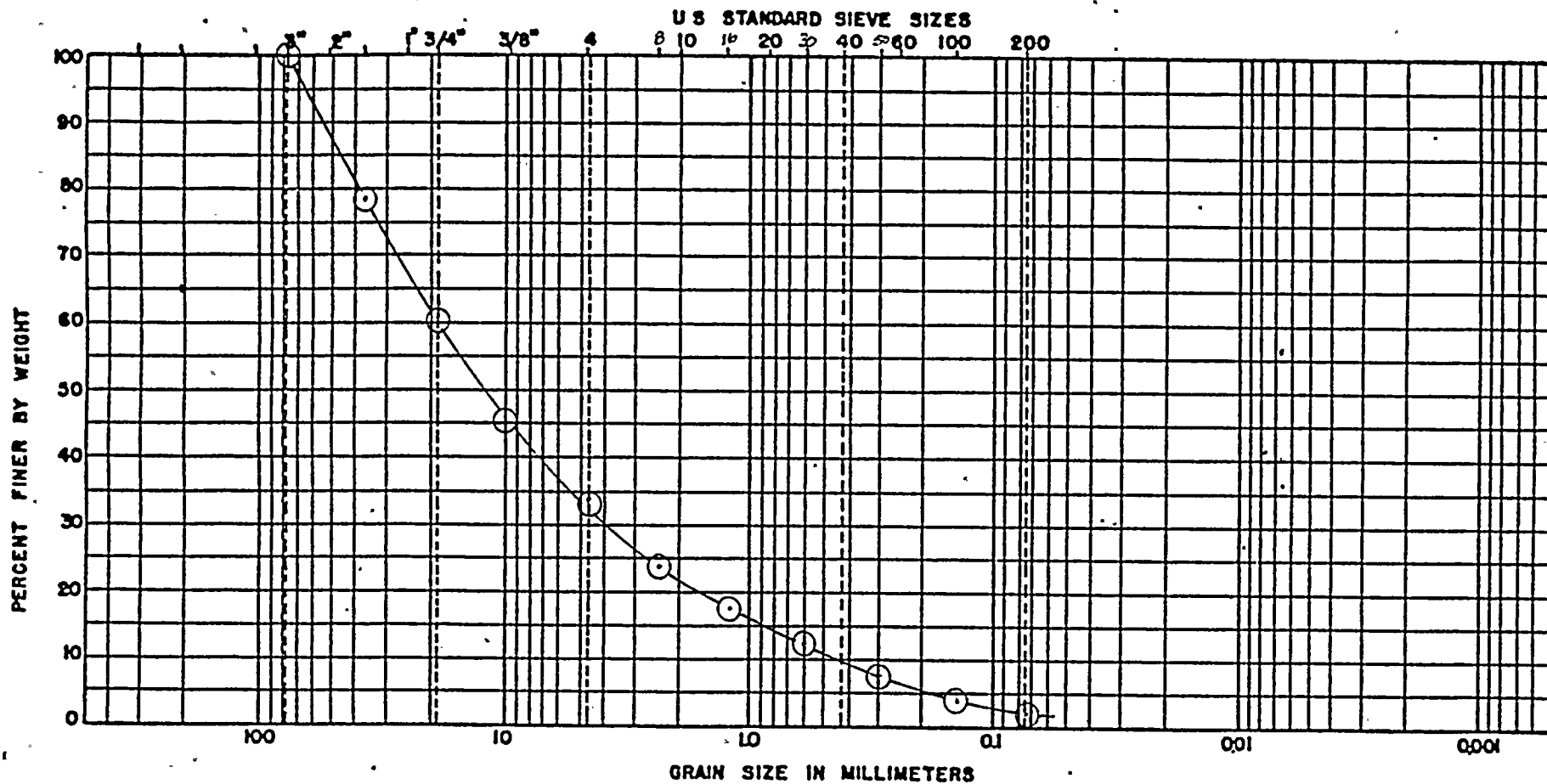
$$K = \frac{aL}{At} \ln \frac{h_1}{h_2}$$

Test No.	h_1 , cm	t_1	h_2 , cm	t_2	k, cm/sec
		<u>N/A</u>			

COMMENTS

CAROLINA POWER & LIGHT CO.

HARRIS SITE



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

SAMPLE NO.	LOCATION	NAT WG	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
VR-24-4-1 PL-2	N 100 W 2500 TEST FILL VR-24-4-1	—	N/A	—		BLASTED ROCK, RANDOM ^{PACKED} FILL Gradation of material obtained directly from compacted test fill

GRAIN SIZE DISTRIBUTION

DATE: 12-27-78

INSPECTOR S.M. Brown

CHECKED W.D. PRIDGEN

Q/A REVIEW

CAROLINA POWER & LIGHT

SIEVE ANALYSIS
(Large Scale Gradation)

SAMPLE NUMBER VR-24-4-1DATE 12-27-78LOCATION N 100 N 2500TEST METHOD ASTM-D 422DESCRIPTION TEST FILL SAMPLE (BLASTED ROCK, RANDOM FILL)(SAMPLE GRADATION RELATIVE TO PERM. TEST VR-24-4-1 - PL 2

Sieve No./Size	Accumulative Weight Retained	Percent Retained	Percent Passing Subtotal	Percent Passing Subtotal	Percent Passing Total
3	0.00	0.00			100.00
1 1/2	12.22	21.40	87		78.60
3/4	22.29	39.40 39.04	N/A	N/A	60.40 60.96
3/8	30.67	53.71			46.29
4	37.54	65.74			34.26
5	43.09	75.46			24.54
PAN	57.10	-			
14	110.60 g	27.65	72.35		17.75
30	200.90 g	50.23	49.77		12.21
50	272.85 g	68.21	31.79		7.80
100	325.14 g	81.29	18.71		4.59
200	363.21 g	90.80	09.20		2.26
PAN	400.00 g	-			

Calibrated Equipment Used:

Tool ID Number CPL-499364Inspector STEPHEN MARK BROWNChecked W.O. PRIDGENQA Review Eugene Kelly

CAROLINA POWER & LIGHT
SHEARON HARRIS' NUCLEAR POWER PLANT
COEFFICIENT OF PERMEABILITY

Sample No. VR-24-4-1-PL-3 Date 12/28/78
Location N 100 W 2500 Tested By S.M. Brown / W.O. Pridgen
Description Blasted Random Rockfill

WATER CONTENT DENSITY

Wt. Container tared Wt. Mold + Soil N/A
~~Wt. Cont.~~ + Wet Soil 200.0 g Wt. Mold N/A
~~Wt. Cont.~~ + Dry Soil 190.0 g Wet Density 145.1 #/ft³
Moisture Content 5.3 % Dry Density 137.8 #/ft³

Standpipe Cross Sectional Area, a = N/A sq cm
Sample Cross Sectional Area, A = 730.6 sq cm
Sample Length, L = 22.86 cm

Constant Head

$$K = \frac{QL}{Aht}$$

Test No.	h, cm	t, sec	Q, cc	T, °C	k, cm/sec
A	43.6	600	2162	20	2.6×10^{-3}
B	}	900	2930	}	2.3×10^{-3}
C		600	1740		2.08×10^{-3}
D		300	850		2.03×10^{-3}
E		600	1125		1.34×10^{-3}
F		1200	1875		1.12×10^{-3}
G	↓	600	825	↓	9.8×10^{-4}

Variable Head

$$K = \frac{aL}{At} \ln \frac{h_1}{h_2}$$

Test No.	h ₁ , cm	t ₁	h ₂ , cm	t ₂	k, cm/sec
N/A					

COMMENTS

Tests A through F were run during a 2 hour period on 12/28/78. Test G was conducted on 1/2/79 after allowing the test sample to percolate for 4 days. A steady state of permeability was reached after 4 days. The permeability dropped up to this point.

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 12/11/78 Spec. No. CH-4 TP-01
Location N100 W2500 Inspector S.M. Brown
Elevation 256 Shift Dry
Weather Cloudy Windy, Cool

COMMENT

PAGE 1 of 2

TEST FILL VR-24-4-1 WAS STARTED TODAY AFTER SELECTING AN AREA ADJACENT TO THE EMERGENCY SERVICE H₂O INTAKE CHANNEL. THE AREA WAS SCRAPED TO A LEVEL, SMOOTH SURFACE AND THEN ROLLED BY A VIBRATORY ROLLER (SELF-PROPELLED). TO ENSURE A FIRM BASE, TEN POINTS (EXPECTED TO BE WITHIN THE PRINCIPAL AREA OF THE TEST FILL) WERE SELECTED AND THEIR ELEVATIONS RECORDED. AFTER TEN (10) ROLLER PASSES, THE POINTS WERE "RESHOT" TO CALCULATE POSSIBLE SETTLEMENT. THE SETTLEMENT WAS NEGLIGIBLE.

AFTER SETTING UP THE BOUNDARIES FOR THE TEST, THE FIRST LIFT WAS END-DUMPED ^{FROM} ~~ON~~ THE EASTERN BORDER. IT WAS THEN SPREAD INTO A 24-INCH LIFT BY A D-8 DOZER. TRAVEL UPON THE LIFT BY BOTH THE EXCAVATOR AND DOZER WAS KEPT TO THE BARREST MINIMUM. AFTER COMPLETING THE FILL AND BOTH RAMPS, THE OPERATOR "BACK-DROGGED" THE ENTIRE AREA TO SMOOTH THE SURFACE.

THE ROLLER, A RASCAL 600A VIBRATORY, PROCEEDED TO FURTHER SMOOTH THE AREA MAKING AN INITIAL PASS AS PROVIDED IN SECTION 4.1.4 OF TP-01. THE TWENTY-FOUR (24) SETTLEMENT POINTS WERE THEN PAINTED ON THE SURFACE TO BEGIN THE ACTUAL PROCEDURE.

HOWEVER, DUE TO TIME LIMITATIONS, ROLLING OPERATIONS COULD NOT BE STARTED. (CONT'D)

INSPECTOR _____

Q A REVIEW _____

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 12/11/78 Spec. No. CH-4 TP-01
Location N 100 W 2500 Inspector S. M. BROWN
Elevation 256 Shift DAY
Weather WINDY, CLEAR & COOL

COMMENT

PAGE 2 OF 2

THE MATERIAL FOR THIS FIRST LIFT WAS TAKEN FROM ELEVATION
220 NEAR STATION 8+00 OF THE COOLING TOWER MAKE-UP
H₂O LINE. IT CONSISTS OF A BROWN SANDY SILTSTONE AND
IS GRADED UP TO 21 INCHES WITH MOST FRAGMENTS CLOSER TO
5 INCHES IN ^{LENGTH} ~~LENGTH~~.

AFTER RECORDING THE INITIAL LIFT THICKNESS AND SCHEDULLING
NEXT DAYS ACTIVITIES, WORK WAS HALTED DUE TO DARKNESS.

INSPECTOR

Q A REVIEW

Stephen Mark Brown
Eugene Kelly 1-18-79

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 12/12/78 Spec. No. CH-4 TPO1
Location N 100 W 2500 Inspector S.M. Brown
Elevation 258 Shift Day
Weather WINDY & COOL

COMMENT

PAGE 1 OF 2

AFTER THE INITIAL LIFT THICKNESS AND TBM WERE "RESHOT", THE VIBRATORY ROLLER BEGAN ITS INITIAL PASSES. ITS SPEED WAS BASED ON 3 MILES/HOUR SO IT AVERAGED 19.5 SECONDS TO COVER THE 55 FEET OF TEST AREA. THE VIBRATIONS WERE RECORDED TO BE WITHIN THE 1100 TO 1500 RPM RANGE, SO FOR THE FIRST PASSES, THE VIBRATORY ROLLER WAS IN COMPLIANCE WITH TP-01.

(TO REDUCE THE POSSIBILITY OF OVERLAP ON THE SETTLEMENT POINTS, THE ROLLER WAS INSTRUCTED TO CENTERLINE ITSELF ON THE POINTS OF EACH ROW AND THEN OVERLAP BY 100 MORE FEET.)

AFTER EACH OF THE TEN PASSES, THE POINTS WERE SHOT TO COMPUTE SETTLEMENT WITH THE LARGEST DIFFERENCE SEEN AFTER THE INITIAL PASS. BREAKDOWN OF THE SURFACE OCCURRED SUCH THAT AFTER THE THIRD PASS, THE VOIDS BEGIN TO FILL. AFTER SIX PASSES THE SURFACE WAS GENERALLY UNIFORM WITH MINOR EXCEPTIONS (I.E. LARGER BOULDERS PROTRUDING, ETC.).

THE COMPLETION OF THE TENTH SETTLEMENT CHECK SIGNALLED THE BEGINNING OF THE SECOND LIFT. AS STATED IN YESTERDAY'S REPORT, THE MATERIAL WAS END-DUMPED BY EUCLIDS ON THE EAST SIDE AND PUSHED WESTWARD BY THE D-8 DOZER INTO A 24 INCH LIFT.

THE MATERIAL, AS WELL AS ALL PLACED IN THE TEST FILL, WAS EXCAVATED

CONT'D

INSPECTOR _____

Q A REVIEW _____

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 12/12/78 Spec. No. CH-4 TP-01
Location N100 W 2500 Inspector S. M. Brown
Elevation 258 Shift Day
Weather WINDY & COOL

COMMENT

PAGE 2 OF 2

FROM THE COOLING TOWER MAKEUP H₂O LINE SOUTHEAST OF THE PLANT,
THIS SECOND LIFT, ALSO BLASTED ROCK, WAS GRAYISH BROWN IN
COLOR AND CONSISTED OF MEDIUM TO FINE GRAINED SANDSTONE W/SILTSTONE
IT WAS TAKEN FROM ELEVATION 215. THIS TIME, THE LIFT WAS
"BACK-DRAWED" BUT NOT INITIALLY ROLLED AS IN THE FIRST.
AGAIN, AS RECORDED YESTERDAY, ROLLING WILL NOT BEGIN UNTIL
TOMORROW DUE TO TIME LIMITATIONS.

INSPECTOR Stephen Mark Brown
Q A REVIEW Eugene Kelly 1-18-79

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 12/13/78 Spec. No. CH-4 TPO1
Location N100 W2500 Inspector S.M. BROWN
Elevation 258 Shift DAY
Weather CLEAR / WINDY / COLD

COMMENT

DUE TO WORK AT THE CORE TRENCH, WORK BEGAN ON THE
TEST FILL AFTER LUNCH. AS STATED PREVIOUSLY, THE SECOND LFT
WAS PLACED AND INITIAL THICKNESS RECORDED. THE VIBRATORY ROLLER
WAS AGAIN CHECKED FOR SPEED (~3 MPH) AND VPM (~1250). BOTH
WERE WITHIN SPECIFICATIONS.

AFTER EACH PASS OF THE AREA, ELEVATIONS WERE "SHOT" TO
CHECK FOR SETTLEMENT DIFFERENCES. AS EXPECTED, THE DIFFERENCE
AFTER THE FIRST PASS WAS SIGNIFICANT SINCE IT WAS NOT ROLLED
BEFORE PLACEMENT OF SETTLEMENT POINTS. THE MATERIAL BEGAN TO
BREAK DOWN ON THE SURFACE AFTER THE THIRD (3RD) PASS AND BECAME
SMOOTH APPROXIMATELY AFTER THE SIXTH (6TH). SETTLEMENT ALSO
TAPERED OFF AFTER THIS PASS. IN THE REMAINING FOUR PASSES SETTLEMENT
WAS MINIMAL. AFTER COMPLETION OF THE TENTH (10TH) PASS, IT WAS
NOTED THERE WAS NO SIGNIFICANT CHANGE IN THE SURFACE APPEARANCE SINCE
THE SIXTH (6TH) PASS.

INSPECTOR Stephen Mark Brown
Q A REVIEW Eugene Kelly 1-18-79

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 12 / 14 / 78 Spec. No. CH-7 TP-01
Location N 100W 2500 VR-24-4-1 TEST FILL Inspector S. M. BROWN
Elevation 260 Shift Day
Weather Partly Cloudy & Cool

COMMENT

WORK ON THE TEST FILL BEGAN TODAY WITH THE PLACEMENT OF THE
THIRD LIFT. THE MATERIAL, A BROWN SANDY SILTSTONE ^{BLASTED THEN} WAS EXCAVATED
FROM THE COOLING TOWER MAKE-UP H₂O LINE, STATION 6+50, ELEVATION 200.
END-DUMP EUCLIDS DUMPED THE MATERIAL ON THE EAST SIDE SO THAT
A D-8 DOZER WOULD SPREAD IT IN A WESTERLY DIRECTION, 24 INCHES
THICK.

AFTER "BACK-DRAWING" AND RECORDING THE INITIAL LIFT THICKNESS, THE
24 SETTLEMENT ^{POINTS} WERE SPRAYED ON THE SURFACE IN 4 ROWS OF SIX (6).
AFTER EACH PASS, ELEVATIONS WERE RECORDED WITH THE FIRST PASS
REVEALING THE MOST SETTLEMENT. AGAIN, THE SURFACE BECAME SMOOTH
AFTER THE FOURTH PASS AND SETTLEMENT TAPERED OFF AFTER THE SIXTH (6TH)
AT LEAST ONCE DURING EACH PASS, THE VIBRATORY ROLLER WAS
CHECKED VIA STOPWATCH FOR SPEED AND RPM, 3 MPH AND 11-1500 RPM
RESPECTIVELY. AFTER TEN (10) PASSES THERE WAS NO SIGNIFICANT CHANGE IN APPEARANCE.

IMMEDIATELY AFTER COMPLETION, THE FOURTH LIFT WAS PLACED
IN THE SAME MANNER, MENTIONED ABOVE. THE BROWN SILTY SANDSTONE
WAS PLACED BY A D-8 DOZER IN A 24 INCH LIFT AND THEN
BACKDRAGGED TO RECORD THE INITIAL LIFT THICKNESS.

ROLLING OF THIS LIFT BEGINS TOMMORROW. A SAMPLE WAS TAKEN
TO THE WAREHOUSE FOR A LARGE-SCALE GRADATION. (SAMPLE WAS
NOT SUBJECTED TO SPREADING OR COMPACTION.)

INSPECTOR Stephen Mark Brown

Q A REVIEW Engine Kelly 1-18-79

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 12/15/78

Spec. No. CH-4 TP-01

Location N 100 W 2500 ^{TEST} _{FILL}

Inspector S.M. Brown

Elevation 262

Shift Day

Weather CLEAR & COLD

COMMENT

PAGE 1 of 2

LATE YESTERDAY AFTERNOON, IT WAS DETERMINED THE MAJORITY OF SETTLEMENT OCCURRED BEFORE THE SEVENTH PASS OF THE VIBRATORY ROLLER. THIS DETERMINATION IS BASED ON THE READINGS OF THE THREE PREVIOUS LIFTS. THEREFORE THIS FINAL LIFT WILL BE ROLLED ONLY SIX (6) TIMES. THE STANDARD PROCEDURES WILL STILL BE FOLLOWED BETWEEN PASSES. THIS INCLUDES RECORDING THE SETTLEMENT ON THE TWENTY-FOUR POINTS.

AS PREDICTED, SETTLEMENT READINGS STABILIZED ON THE SIXTH (6TH) PASS. THE NEXT STEP IS TO PREPARE A LARGE SCALE IN-PLACE DENSITY TEST. THIS INCLUDES THE FOLLOWING:

1. PLACE A WOOD FRAME 8'x8'x7" OVER THE TEST AREA
2. RECORD LEVEL READINGS (4 CORNERS) RELATIVE TO A TBM.
3. PLACE POLYETHYLENE INSIDE THE FRAME FLUSH TO IT

AND THE GROUND SURFACE AND FILL WITH H₂O TO WITHIN 2 INCHES TO SURFACE.

4. THE VOLUME USED AND DISTANCE TO TOP WERE RECORDED.

5. THE WATER ^{AND POLY} WAS REMOVED AND THE "POLY" CHECKED FOR LEAKS.

6. THE MATERIAL WITHIN THE FRAME WAS REMOVED AND PLACED ONTO AN "ALREADY TARED" FLATBED TRUCK. IT WAS THEN WEIGHED AT THE NORTH CAROLINA VEHICLE WEIGHT STATION, APEX.

7. THE "POLY" WAS AGAIN PLACED INSIDE THE FRAME AND FILLED

INSPECTOR _____

CONT.

Q A REVIEW _____

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 12/15/78 Spec. No. CH-4 TPO1
Location N/100 W2500 TEST FILL Inspector S.M. Brown
Elevation 262 Shift Day
Weather CLEAR & COOL

COMMENT

PAGE 2 OF 2

TO THE PREVIOUSLY MARKED LEVEL. (~ 2 INCHES FROM SURFACE)

8. LEVEL READINGS WERE REPEATED TO INSURE NO MOVEMENT
ABOUT THE FRAME.

9. THE VOLUME OF H₂O USED WAS RECORDED AND THEN
REMOVED, BY SUCTION.

10. THE "POLY" WAS AGAIN CHECKED FOR LEAKS.

THE RESULTS OF THE TEST ACCOMPANY THIS REPORT. AFTER
COMPLETION, AN AREA (INCLUDING THE TEST LOCATION) WAS EXCAVATED
PERPENDICULAR TO THE TEST FILL RAMPS TO GIVE A VISUAL
& CROSS-SECTION OF THE TEST FILL ITSELF. LATER, IT WAS HAND
CLEANED ^{TO} CHECK FOR VOIDS AND BONDING OF LIFTS. THE MATERIAL
IS COMPACTED AND BONDED NICELY, WITHOUT MAJOR VOIDS-ALTHOUGH
SOME WERE DISCOVERED UNDER THE LARGER FRAGMENTS. THESE
APPEARED TO BE MINIMAL IN NATURE.

INSPECTOR

Stephen Mark Brown

Q A REVIEW

Eugene Kelly

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

FIELD INSPECTION REPORT

Date 12/16/78 Spec. No. CH-4 TPO1
Location N 100 W2500 TEST FILL Inspector S.M. Brown
VR-24-4-1
Elevation 262 Shift Day
Weather Partly Cloudy w/ LIGHT RAIN

COMMENT

AFTER COMPLETION OF THE IN-PLACE DENSITY TEST, A PERMEAMETER TEST WAS CONDUCTED APPROXIMATELY FIVE (5) FEET WEST OF THE FRAME. THE PROCEDURE WAS AS FOLLOWS:

1. EXCAVATE A WELL THROUGH THE FIRST LIFT, BARELY INTO THE NEXT, BY MEANS OF A MANUAL AUGER (A TRAC-DRILL WAS USED IN THIS CASE).

2. MEASURE / RECORD THE DEPTH OF THE WELL

3. FILL THE WELL WITH MEDIUM COARSE SAND (PREMEASURED WEIGHT). WEIGH AMOUNT REMAINING TO DETERMINE AMOUNT USED. / UNIT WEIGHT

4. SUBTRACT DIFFERENCE BETWEEN TOP OF GROUND SURFACE AND TOP OF SAND. NOTE: #2, 3 & 4 DETERMINE VOLUME OF WELL

5. FILL DEVICE WITH WATER AND RECORD STARTING INCREMENT. (IT MAY BE NECESSARY TO REFILL BARREL AFTER INITIAL DISCHARGE TO INSURE A SUFFICIENT QUANTITY OF WATER. THIS IS RELATIVE TO MATERIAL) (BEFORE RECORDING FLOW)

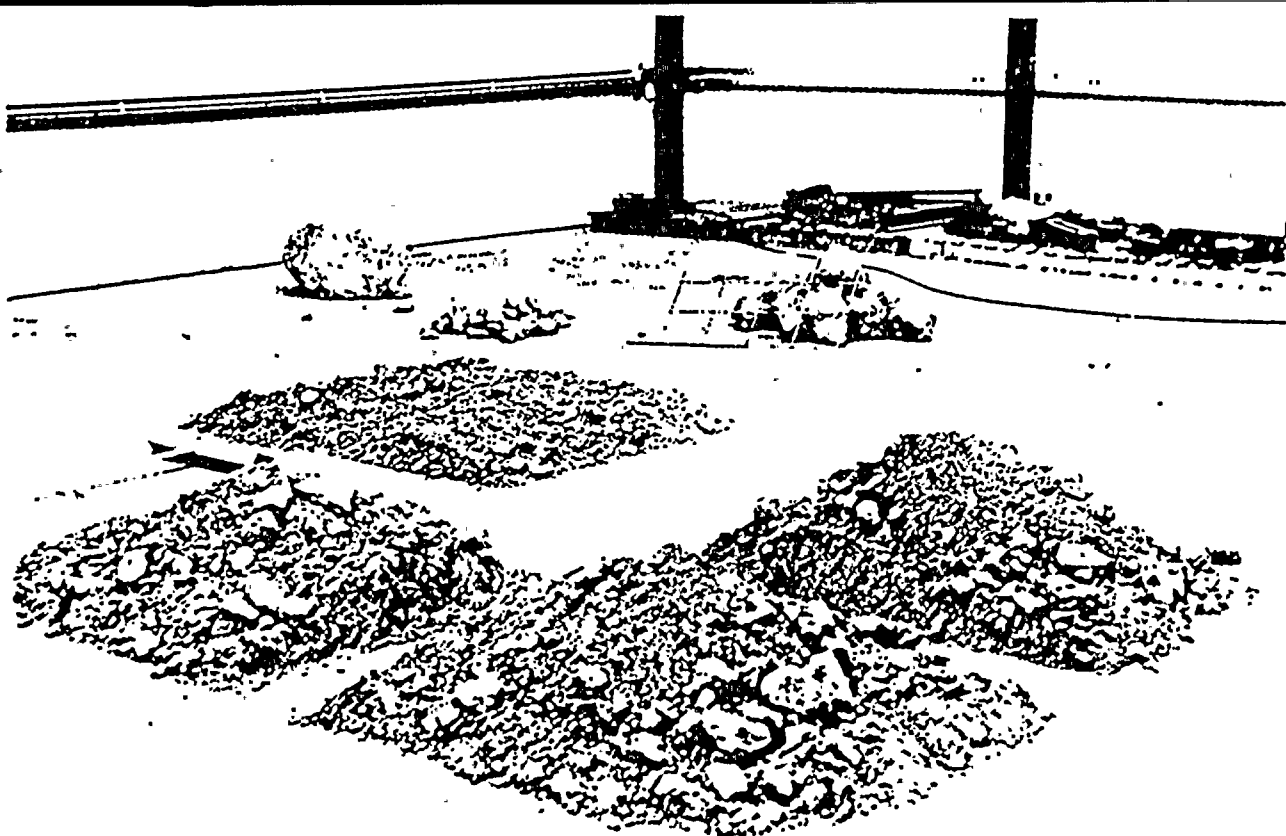
6. RELATIVE TO THE APPARENT FLOW, RECORD DISCHARGE AT LEAST EVERY HOUR UNTIL ENOUGH DATA HAS BEEN COLLECTED TO PLOT FLOW CURVE.

PLOT CURVE TO DETERMINE "Q" (FLOW RATE) IN CUBIC FEET PER MINUTE.

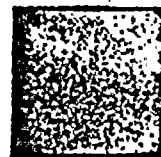
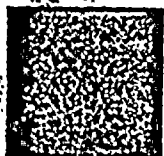
TWO (2) "PERC TESTS" WERE CONDUCTED RESULTING IN FLOW RATES OF $291.88 \frac{\text{FT}^3}{\text{MIN}}$ AND $296.66 \frac{\text{FT}^3}{\text{MIN}}$

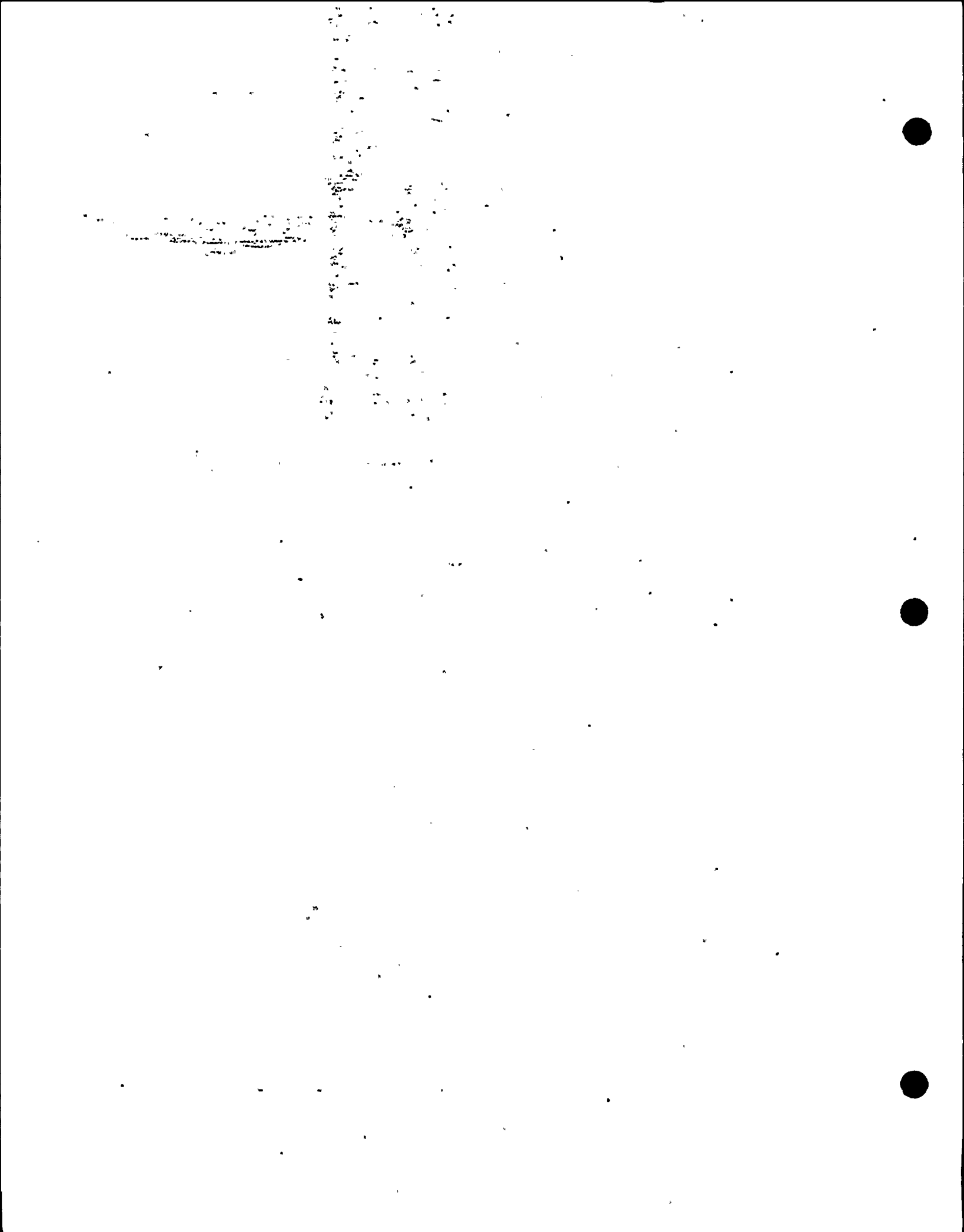
PLOTTING AND CALCULATING THE COEFFICIENT OF PERMEABILITY BASED ON THESE "PERC TESTS", RESULT IN $2.8 \times 10^{-4} \frac{\text{IN}}{\text{SEC}}$ AND $2.87 \times 10^{-4} \frac{\text{IN}}{\text{SEC}}$, RESPECTIVELY. CURVES AND DATA ARE FOUND ON ACCOMPANYING SHEETS.

INSPECTOR Stephen Mark Brown
Q A REVIEW Edgar Kelly 1-18-79



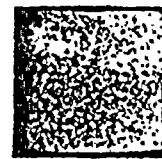
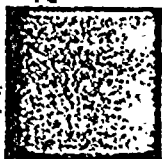
QUARTERING OF GRADATION SAMPLE AFTER REMOVING STONES IN 12" to 24" RANGE; 8" TO 12" RANGE; AND 4" TO 8" RANGE.





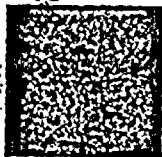


A BEFORE TEST GRADATION SAMPLE OF MATERIAL TAKEN FROM THE BLAST :
PRODUCTION AREA IN THE COOLING TOWER MAKE-UP WATER CHANNEL.





BRUSHING ALL FINES FROM THE BOTTOM OF THE EXCAVATION DURING THE
IN-PLACE DENSITY TEST.

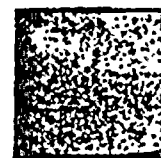
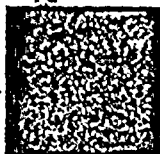


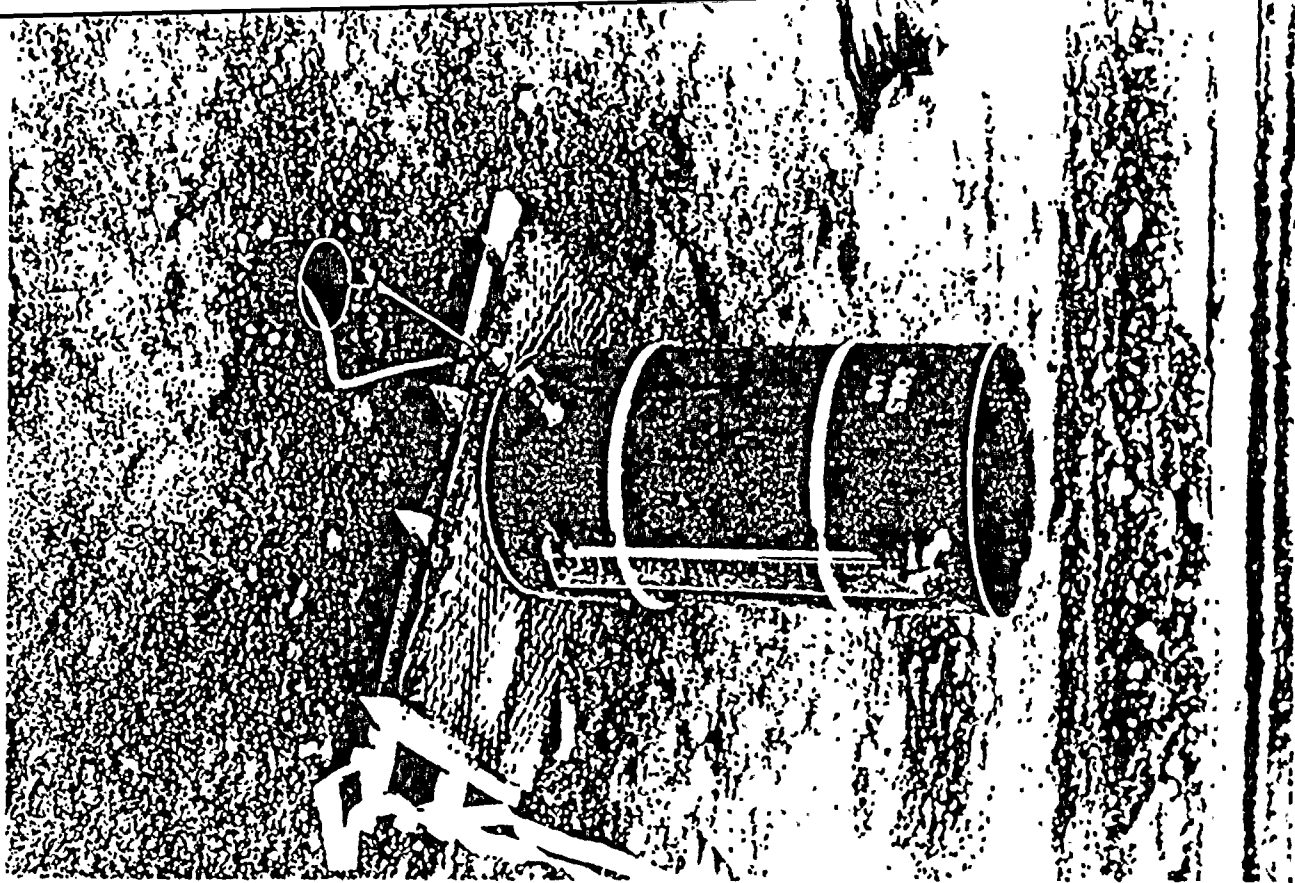


FILLING PLASTIC MEMBRANE WITH WATER TO DETERMINE THE VOLUME OF THE HOLE DURING THE IN-PLACE DENSITY TEST.

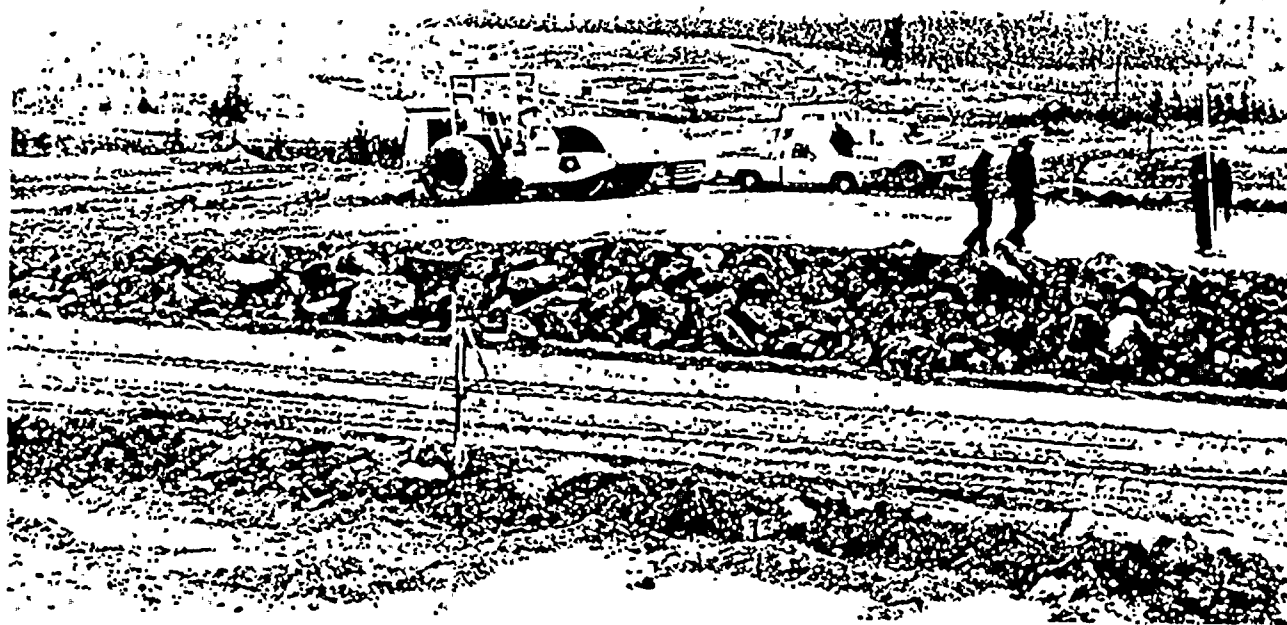


CROSS-SECTIONAL VIEW OF RANDOM ROCKFILL MATERIAL IN THE TEST FILL.
NOTE THE GOOD COMPACTION AND LACK OF VOID AREAS.

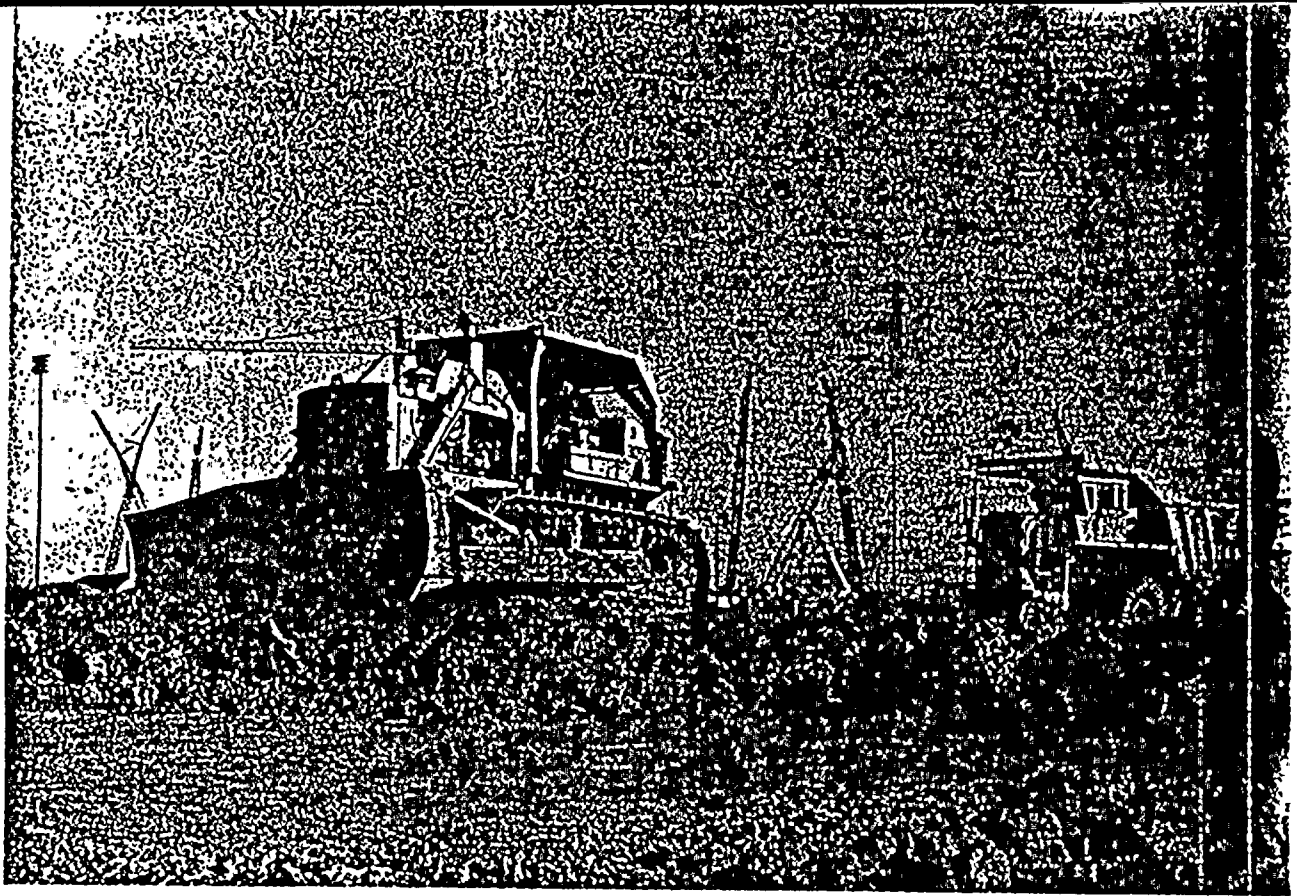




SET UP FOR PERMEABILITY TEST CONDUCTED IN THE FIELD IN ACCORDANCE WITH
BUREAU OF RECLAMATION DESIGNATION E-19.



TAKING SETTLEMENT READINGS AFTER A PASS OF THE VIBRATORY ROLLER.



SPREADING OF ROCKFILL MATERIAL IN TEST FILL BEING CONTINUALLY MONITORED
BY A CERTIFIED SOILS INSPECTER.