INVESTIGATION OF EFFECTS OF DISTURBANCE ON UNDRAINED SHEAR STRENGTH OF BOSTON BLUE CLAY.

by

NILS-FREDRIK BRAATHEN

B.S.C.E. Northeastern

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Signature of Author...
Department of Civil Engineering, (May 20, 1966)

Certified by ....
Thesis Supervisor

Accepted by ....
Chairman, Departmental Committee on Graduate Students

ABSTRACT

INVESTIGATION OF EFFECTS OF DISTURBANCE ON UNDRAINED SHEAR STRENGTH OF BOSTON BLUE CLAY.

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Submitted to the Department of Civil Engineering on May 20, 1966 in partial fulfillment of the requirements for the degree of Master of Science.

This investigation examined the effects of sample disturbance on the behavior of Boston Blue Clay during undrained shear. A hypothetical field condition was simulated, and different amounts and types of disturbance was induced into the samples. Earlier investigations have determined a correlation of disturbance with effective stress on the sample prior to shear. At the same time overconsolidated samples were tested in accordance with Ladd and Lambe's method. The general result was that the "perfect sampling" s_u could be estimated on the basis of strength reduction versus overconsolidation ratio using the ratio of the perfect sampling effective stress to the preshear effective stress ($\bar{\sigma}_s$). Investigation of stress-strain data show that disturbance reduced the modulus of elasticity considerably, even below that obtained with the overconsolidated samples.

A direct application of the strength reduction vs O.C.R. was used to correct UU tests with $\bar{\sigma}_s$ measurements on undisturbed samples from the M.I.T. campus. The s_u corrected this way agreed very well with the theoretical estimate of the in situ s_u for triaxial compression.

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Title: Associate Professor of Civil Engineering

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CONTENTS.

1. Introduction:

For design problems where immediate stability is the problem, a total stress analysis assuming $\phi = 0$ is generally used. Basically it is assumed that no drainage takes place during construction. There is therefore a need to determine the in situ undrained shear strength. A field vane test will give "in situ" values directly but unfortunately there is a basic problem of interpretation of the kind of strength measured with a vane. Another approach is to take so-called "undisturbed" samples and test them in the laboratory. Since the effective stresses in the sample is reduced due to stress release and disturbance during the sampling process and handling in the laboratory, it is impossible to test a sample with the same water content and effective stress condition as in situ. By reconsolidating the samples to the in situ stress condition, the water content would be lower than in situ and the shear strength higher. Another approach is to run an unconsolidated-undrained (UU) test at the natural water content. This usually results in underestimation of in situ s_u for triaxial compression. The latter could result in a costly overdesign whereas the former generally results in unsafe designs. This investigation was aimed at correcting the s_u values obtained from UU tests to where they agree better with s_u in triaxial compression for a perfect sample i.e. one with no disturbance. Only the undrained shear strength in compression is considered and reduction due to difference in failure plan orientation and reorientation of principal stresses is neglected.

A hypothetical field condition was created in the laboratory by consolidating samples of Boston Blue Clay (prepared from a slurry) to a certain horizontal and vertical stress. Then some of these samples were tested at this "field" condition to give a "field" s_u. One sample is unloaded undrained and sheared in compression to give the s_u of a "perfect" sample. Other samples were disturbed by stress release, shearing, and/or remolding by hand. Data from these tests were then used to check the existing methods for correction of disturbance. The possibility of improvement of some of these methods was also investigated.

2. Background.

2.1 Field stresses.

For stress conditions in horizontal soil beds at rest (geostatic stresses) the following equations have been developed. The total vertical stress, σ_v, is equal to the total unit weight of soil, γ_t, times the depth, z,

$$\sigma_v = \gamma_t \cdot z$$

The water causes a pore pressure at the same elevation. If a hydrostatic condition exists this can be calculated as follows:

$$u = \gamma_w \cdot H_w$$

where γ_w is the unit weight of water and H_w is the height of the water table above the point in consideration.

The horizontal stress is indeterminate according to static considerations. In the special case where no lateral strain in the ground has taken place, we define the ratio of horizontal to vertical effective stress, $\bar{\sigma}_v/\bar{\sigma}_h$, as K_o.

Effective stress is defined as total stress minus the pore pressure and gives $\bar{\sigma}_v = \sigma_v - u$

and $\bar{\sigma}_h = \sigma_h - u = K_o \cdot \bar{\sigma}_v$

Several methods of estimating K_o have been proposed. There are expressions developed from elastic models and empirical approaches. Timoshenko and Goadier (1951) used linear stress-strain relationship of a semi infinite medium to calculate K_o:

$$K_o = \frac{\mu}{1-\mu} \quad (\mu \text{ is Poissons ratio})$$

Jaky (1944) developed an expression for K_o that is usually a good approximation for normally consolidated clays: $K_o = 1 - \sin\bar{\phi}$, Experimental work by Brooker and Ireland (1965) seemed to indicate that K_o is closer to $(0.95 - \sin\bar{\phi})$ for such soils. Rowe (1957) proposed to use Hvorslev's friction angle parameter $\bar{\phi}_e$ in the expression $K_o = \tan^2 (45° - \bar{\phi}_e/2)$.

Measurements of K_o has been obtained by measuring lateral pressures in oedometer tests and by attempting to keep lateral strains negligible in triaxial specimen during consolidation, with varying amount of success.

See figure 2.1-1 (Ladd, 1965) for values of K_o vs over-consolidation for some soils. K_o varies from about 0.5 for normally consolidated soils to well over 2 for heavily overconsolidated samples.

2.2 Origin of Disturbance:

To determine undrained shear strength of a certain soil bed, "undisturbed" samples are usually taken at desired depths and tested in the laboratory. Unconfined compression and unconsolidated-undrained triaxial tests are common means of determining S_u.

However there is a large discrepancy between S_u @ $\bar{\sigma}_{ps}$ and the maximum shear stress measured in UU tests on "undisturbed" samples. A good example is found in strength data obtained on Lada clay from Ottawa, Canada. Coates and McRostic (1963) report these findings for clay at a depth of 55 to 60 ft.

Type of Test and Sample	($tons/ft^2$)
1. Field Vane	0.85
2. Unconfined compression and triaxial	
a) 2 in. dia. open drive	0.6
b) 3.4 in dia. fixed piston	1.1
c) block sample	1.6
3. CIU triaxial, consolidated to overburden pressure	
a) 2 in. dia. fixed piston	0.9
b) N.G.I. piston sampler	1.35
c) block sample	1.65

The clay is moderately plastic, overconsolidated, and very sensitive with a high liquidity index. Fig. 3.36-2 shows s_u @ $\bar{\sigma}_{ps}$ ≫ s_u @ $\bar{\sigma}_3$ on an extensive testing program performed on "undisturbed" samples from M.I.T. Campus. Since the obviously remolded samples (determined by visual examination and $\bar{\sigma}_3$ measurements) had the lowest strength, a sizeable part of the strength loss is due to disturbance.

For common tube sampling, disturbance occurs during the following operations:

a) Stress release due to removal of overburden as the boring progresses.

b) Stress release during removal of boring equipment.

c) Compression induced when sampler is pushed into the soil.

d) Shear stresses developed between walls of sample tube and sample both during sampling and during extrusion of sample.

e) Stress release when sample is removed from tube.

f) Stresses developed during test preparation as trimming and mounting of sample.

Figure 2.2-1 (Ladd and Lambe 1963) shows how the effective stresses might change during these operations. Point A represents the in situ stresses. At P the original anisotropic stress condition is reduced to an isotropic stress condition, undrained. Since this is the minimum amount of stress change we can possibly achieve in "undisturbed" sampling, this is the condition called "perfect" sampling hereafter. The effective stress at this point is refered to as $\bar{\sigma}_{ps}$. This parameter is calculated by (Ladd and Lambe 1963):

$$\bar{\sigma}_{ps} = \bar{\sigma}_{vo}\left[K_o + A_u(1-K_o)\right]$$

where $A_u = \frac{\Delta u - \Delta\sigma_h}{\Delta\sigma_v - \Delta\sigma_h}$ is the "A"factor for the undrained release of shear stresses. This expression is good for both normally and overconsolidated samples. Point G refers to the actual sample's stress condition after sampling and trimming, and the isotropic effective stress is at this point denoted $\bar{\sigma}_s$. This stress can be determined by measuring the residual pore pressure. Since the confining pressure is zero, $\bar{\sigma}_s = -u_s$ provided u_s is less than one atmosphere. It is, however, preferable to use a confining pressure (σ_c) high enough to ensure a B-factor equal to unity so that $\bar{\sigma}_{ps} = \sigma_c - u$ where σ_c = confining pressure and u measured pore pressure.

2.3 Methods to correct for disturbance:

It seems logical to divide the change in effective stress during sampling and trimming into two different factors. First the release of the deviator stress $(\sigma_v - \sigma_h)$ brings the sample, undrained, to an isotropic stress condition with $\bar{\sigma} = \bar{\sigma}_{ps}$. Secondly "gross" disturbance reduces the effective stress from $\bar{\sigma}_{ps} \rightarrow \bar{\sigma}_s$ (See figure 2.2-1).

Corrections for differences in undrained strength between "perfect" samples and in situ strength seems to be relatively minor. Ladd and Varallyay (1965) report a 2-15% decrease in $s_u/\bar{\sigma}_{1c}$ for a variety of soils so the effort of this testing program is directed towards methods of correction for "gross" disturbance.

2.31 Casagrande and Rutledge (1947): (See figure 2.31-1)

The first method proposed for determining the strength of completely undisturbed samples was advanced by Casagrande and Rutledge (1947) They utilized the results of a series of isotropically consolidated undrained triaxial tests and a standard oedometer test. By plotting the relationship between strength and water content at failure for isotropically consolidated striaxial tests with consolidation pressures higher than the preconsolidation pressure and extrapolating this relationship back to the natural water content, the strength of a sample at the natural water content, can be determined. Actually there would be a series of such relationships corresponding to different degrees of disturbance. Since the samples used to establish the s_u vs w are somewhat disturbed too, the extrapolated value will not fully compensate for the effects of disturbance although it generally will be somewhat higher than the unconsolidated undrained strength of samples with the same amount of disturbance initially.

2.32 Calhoon Method (1956): (See figures 2.32-1 and -2)

Calhoon proposes the following elaborate procedure to improve the Casagrande-Rutledge method:

1. Extrapolate the field virgin consolidation curve from:
   a) one undisturbed oedometer test using a thick specimen (~ 1.5 in.)
   b) one undisturbed oedometer test using a thin specimen (~ .75 in.)
   c) one remolded oedometer test using a speciman thickness of either a) or b).
2. Determine the triaxial consolidation curve and undisturbed compressive strength curve from CIU and U tests.
3. The remolded consolidation curve from either oedometer or CIU tests on remolded samples and the remolded compressive strength curve from CIU and U tests on remolded samples are plotted.
4. The percentage of remolding in the undisturbed triaxial specimens is determined.
5. The field compressive-strength curve for the average natural water content or void ratio expected in the field is determined.

The percent disturbance is deduced from the ratio yz/xz on figure 2.32-1 based on oedometer tests. Calhoon then proceeds to correct the S_u obtained from the actual "undisturbed" samples by setting yz/xz = y'z'/x'z'.

By doing so it is assumed that only trimming produces sample disturbance. The disturbance ratio yz/xz, is based on both anisotropic and isotropic consolidation tests and neglects the effect of K on the location of the $\bar{\sigma}_c$ vs e relationships. The method besides require time consuming testing program.

2.33 Schertmann Method (1956): (See figures 2.33-1 and 2.33-2)

There is an apparent parallelism of strength vs water content relationship and the consolidation curve at pressures above the preconsolidation pressure for soil samples having equal degree of disturbance.

To use this observation for correction of disturbance, first determine the most probable field consolidation curve from a oedometer test on a good undisturbed sample, then run CIU tests on both "undisturbed" and fully remolded samples to construct the strengh-water content relationships. Theoretically these data should yield two straight lines on a ω vs log S_u plot that intersect at point O (figure 2.33-2). Now draw the field S_u through point O and parallel to field consolidation curve.

The main objection to this procedure is the need for equally disturbed samples to establish the field strength vs water content curve. This is very difficult without some measure of the amount of disturbance. Futhermore although this method is simpler than the foregoint method, it still requires an extensive testing program. A great uncertainity with the method is the parallelism assumed in the consolidation strength vs water content curves. Appreciable errors in strengths may result from a small error in fixing the slope of the field strength curve.

2.34 Ladd and Lambe methods (1963.)

2.341 To correct test data obtain from unconsolidated undrained test.

The authors propose that the decrease in effective stress caused by disturbance has an effect comparable to that caused by rebound of CIU tests on samples with $\bar{\sigma}_{cm} >> \bar{\sigma}_{vo}$ (to minimize disturbance). It is therefore proposed to determine a curve of $\frac{Su @ \bar{\sigma}_c}{Su @ \bar{\sigma}_{cm}}$ vs OCR for a series of CIU tests with maximum past pressure $\bar{\sigma}_{cm}$. Then the residual effective stress of the actual specimen is measured ($\bar{\sigma}_s$). By treating the ratio of $\bar{\sigma}_{ps}$ to $\bar{\sigma}_s$ as an overconsolidation ratio, we can use the curve obtained from the CIU tests to correct the undrained shear strength data from the actual disturbed specimen. (See fig. 2.341-1).

2.342 To obtain correct from CIU tests.

In terms of Hvorslev's strength parameters:

$$S_u = \alpha \bar{\sigma}_e + \bar{\sigma}_{3f} \tan \bar{\theta}_e$$

where $\alpha = \frac{\bar{c}_e}{\bar{\sigma}_e} \frac{\cos \bar{\phi}_e}{1 - \sin \bar{\phi}_e}$

$$\bar{\theta}_e = \frac{\sin \bar{\phi}_e}{1 - \sin \bar{\phi}_e}$$

$\bar{c}_e$ = Hvorslev cohesion.

$\bar{\phi}_e$ = Hvorslev friction angle.

$\bar{\sigma}_e$ = Hvorslev equivalent pressure.

It is assumed that the volume change caused by the consolidation of CIU samples to pressures between $\bar{\sigma}_{ps}$ and $\bar{\sigma}_{vo}$ has little effect on $\Delta u/\bar{\sigma}_c$ during undrained shear and therefore on $\bar{\sigma}_{3f}$. Thus Δu and $\bar{\sigma}_{3f}$ are not affected by disturbance. By futher assuming that $\bar{\phi}_e$ is also unaffected by disturbance, the last term, $\bar{\sigma}_{3f} \tan \bar{\phi}_e$, would be independent of disturbance.

Thus the strength increase due to lower w_f caused by disturbance, is calculated from change in Hvorslev cohesion, $\chi \Delta \bar{\sigma}_e$ comparable to the volume decrease upon reconsolidation to $\bar{\sigma}_{ps}$

To use this method, determination of the Hvorslev strength parameters is needed together with an isotropic consolidation curve for the soil.

Both these methods are based on empirical observations of the form of test data and used as engineering approximations for strength corrections.

3.35 Seed, Noorany and Smith (1963).

3.351 Method No 1.

The undisturbed sample strength is calculated by means of the following equation,

$$s_u @ \bar{\sigma}_{ps} = \frac{\bar{\sigma}_{ps} \sin \bar{\phi}_e + \bar{c}_e \cos \bar{\phi}_e}{1 + (2\bar{A}_f - 1) \sin \bar{\phi}_e}$$

$\bar{A}_f$, for a perfect sample, is found by extrapolation of test data on slightly disturbed samples as follows. Eight good quality "undisturbed" samples from the same location are needed. All samples are mounted in cells capable on measuring residual pore pressure. The effective stress in each sample is measured, ($\bar{\sigma}_s = \sigma - u_s$), and compared with the effective stress for perfect sampling (calculated by the equation given in section 2.2). Three pairs of the samples are gently disturbed to achieve a good range of degrees of disturbance in the four pairs of samples. On sample from each pair is then sheared unconsolidated-undrained. The other samples are consolidated to the perfect sampling stress and then sheared undrained. Both series are tested with pore pressure measurements.

($\bar{\sigma}_{ps} - \bar{\sigma}_s$) is used as a measure of disturbance and plotted versus $\bar{A}_f$ values obtained by the eight specimen in fig. 2.351-1. For a perfect sample ($\bar{\sigma}_{ps} - \bar{\sigma}_s$) = 0 and the $\overline{UU}$ and $\overline{CIU}$ should give the same $\bar{A}_f$ value. On this basis the actual test data are extrapolated to ($\bar{\sigma}_{ps} - \bar{\sigma}_s$) = 0, and $\bar{A}_f$ for perfect sampling determined.

Hvorslev's parameters are determined by a series of tests on overconsolidated samples. The authors describes two additional methods for obtaining these parameters that seem daubtful, especially the Noorany method of using results from CA-$\overline{UU}$ and $\overline{CAU}$ tests consolidated to the same stresses. These two tests will plot as two very close points on a ($\frac{\sigma_1 - \sigma_3}{2\bar{\sigma}_e}$) vs $\frac{\bar{\sigma}_{3f}}{\bar{\sigma}_e}$ graph that leave room for sizeable errors in $\bar{\phi}_e$ and $\bar{c}_e$ unless they are combined with other results. The Bishop and Henkel method of using the spread in results of normally consolidated samples has the same drawback if the soil exhibit any amount of normalized behavior.

By using these three somewhat uncertain values (*i.e.* $\bar{c}_e$, $\bar{\phi}_e$, & $\bar{A}_f$) into the calculation of "perfect" sample strength, the combination of errors in each individual value may be sizeable although the individual errors are small.

2.352 Method No 2. (Figure 2.352-1)

The same testing program as described in method No 1. is performed but the results are plotted with undrained shear strength instead on $\bar{A}_f$ versus disturbance, ($\bar{\sigma}_{ps} - \bar{\sigma}_s$). As the amount of disturbance decreases, the difference in s_u from $\overline{UU}$ and $\overline{CIU}$ tests decreases. For a sample with no disturbance the shear strength should be equal for the two types of tests. By drawing two converging curves the s_u @ $\bar{\sigma}_{ps}$ can be determined directly. This method seems much more appealing than the first method because of its simplicity.

2.353 Method No 3. (Figure 2.353-1)

This method uses data from a series of $\overline{CIU}$ tests with $\bar{\sigma}_c = \bar{\sigma}_{ps}$ to plot s_u vs water content. The more disturbed the sample the greater the Δw during consolidation. By extrapolating this curve back to in situ water content the perfect strength can be determined directly. Aside from the basic uncertainty of extrapolation, the determination of the in situ water content is very difficult. Considerable scatter is usually found in samples from the same ground location. By using $\Delta V/V_0$ instead of water content this problem could be eliminated however.

The basic problem with these three methods are that they work well only for slightly disturbed samples. If the amount of disturbance increases the spread in ($\bar{\sigma}_{ps} - \bar{\sigma}_s$) will be small and at the same time ($\bar{\sigma}_{ps} - \bar{\sigma}_s$) will be large. Since the sought value is found by extrapolating back to ($\bar{\sigma}_{ps} = \bar{\sigma}_s$) a small error in the actual values will be multipled by the large extrapolation needed to find the sought value.

These methods are, however, somewhat interrelated but not so much so that they can be used to check each other.

3. Testing Program.

3.1 General aim of testing program.

During the past years considerable amounts of testing has been done at M.I.T. in the field of sample disturbance. This effort has been limited mainly to correct for the reduction in s_u due to disturbance as compared with s_u for perfect samples. The basis for this correction has been the method proposed by Ladd-Lambe and described earlier in this report.

The testing program has consisted of two parts, First a series of triaxial tests were aimed at establishing $\frac{s_u @ \bar{\sigma}_c}{s_u @ \bar{\sigma}_{cm}}$ vs overconsolidation ratio and its dependency upon the K-ratio. Secondly an unknown amount of disturbance was induced into "perfect" samples and the resulting undrained shear strengths was used to check the relationship established in the first part of the testing program.

3.2 General Data on Sample Preparation and Triaxial Test Procedure.

3.21 Sample Preparation.

In this testing program Boston Blue Clay was the only soil tested. The clay was obtained from field pits, air dried, and ground up. Ten kilos of this dry powder was mixed into a slurry with tap water at a water content of about 400% and passed through a No 200 sieve. The salt content (NaCl) of the fluid was then increased to about 24 g/l. By allowing the slurry to settle and removing excess water, the water content was reduced considerably. Then the soil was heated to about 70°C, stirred, and placed in a 9.5 in diameter consolidometer under vacuum. A consolidation pressure of 1.5 kg/cm^2 made a 4.5 in. high cylinder of soil with enough material for about 18 triaxial test samples ($L = 8.0$ cm ; $A = 10.0$ cm^2). A more detail description of the consolidometer and its use is in Wissa (1961). In this manner a uniform supply of clay was obtained. The method yielded a clay with strength properties similar in many respects to those of a natural, normally consolidated clay of moderate sensitivity.

Two batches of clay was stored submerged in Mobilect Transformer Oil No 33 in a humid room until usage. The water content of these batches were 42.5 ± 05%, liquid limit 45.5%, plastic limit 23.2% and specific gravity 2.77. Grain size distribution is given in fig. 3.2-1.

Towards the end of the testing program there was a shortage of samples. Instead of making up another batch of samples it was decided to use samples already prepared the same way for another project. The only difference was the salt content (16 g/l NaCl) and water content ($\omega = 38.5\% \pm 0.5\%$). Atterberg limits are $\omega_L = 42.7\%$, $\omega_p = 23.9\%$.

A hypothetical "field" stress condition was selected at $\bar{\sigma}_{1c} = 6.0$ kg/cm^2 and $\bar{\sigma}_{3c} = 3.0$ kg/cm^2. The vertical stress of 6.0 kg/cm^2 was judged large enough to eliminate preconsolidation and disturbance effects (1.5 kg/cm^2 $\ll$ 6.0 kg/cm^2). $K_o = 0.5$ was selected on basis of earlier tests on Boston Blue Clay. Figure 2.2-1 showed K_o vs O.C.R. for some clays including Boston Blue Clay.

3.22 Triaxial Test Procedure:

Cells:

All tests were performed in standard Clockhouse and Wykeham-Farrance triaxial cells with exception of the cyclic compression extension and UU tests. Geonor cells were already equipped with top caps fastened to the pistons in such a way that they could be used for extension tests. It therefore was natural to use these cells for the cyclic compression extension tests. A Clockhouse cell was equipped with a very fine porous stone and a pressure transducer to measure residual pore pressures in the UU samples. The lead from the bottom pedestal to the transducer is made as rigid as possible to keep the flow of water into the sample an absolute minimum (see figure 3.22-1). The transducer was connected to a BLH Strain Indicator Model 120 with A.C. power pack. The four arm gridge on this instrument provided a very stable voltage supply and at the same time measured the output from the transducer. Sensitivity on this setup was about 1/1000 kg/cm^2 and the calibration factor stayed constant for over 3 months through intermittent work. Since an absolute transducer was used, however, there was experienced some difficulty with variations in barometric pressure. This could easily be prevented in the future with use of a transducer measuring the gauge not absolute pressure.

Loading frames:

The Geonor and Wykeham-Farrance loading frames were used for all the tests. To insure proper pressure equalization for the tests with pore pressure measurements the strain rate was set at 1% per hour.

For the UU tests on the other hand a typical strain of unconfined testing was used, about $\frac{1}{2}$%/min.

Pore pressure Measurements:

All the samples tested were sheared undrained. A N.G.I. null system was used to measure pore pressures in the samples during shear with exception of the UU tests. A description of their use can be found in Ladd and Varallyay (1965). To decrease the responce time the equilibration was improved by use of filter strips. In the cyclic tests no filterstrips were used because of unknown contribution to the measured deviator stress. To insure full saturation all the samples were back pressured to 3.0 kg/cm^2, at least during last step of consolidation.

The following procedure was used to measure $\bar{\sigma}_s$ for UU samples:

1. Standard triaxial size sample (10 cm^2 $\times$ 8.0 cm) is trimmed.
2. Excess water is removed from the top of bottom pedestal and the sample placed on the pedestal of a cell like the one shown in figure 3.22-1. Membranes, top cap and O-rings are placed and cell filled with water. The capillary pore pressure will attempt to suck water from the pore pressure line into the sample. Since the pore pressure line is constructed extremely rigid, only a minute amount of water will flow into the sample before the pressure difference between the sample and the pore pressure line becomes zero. Then the transducer records the pressure in the sample. The fine porous stone, which has a bubbling pressure in excess of several kg/cm^2, is needed to

prevent the sample from sucking water from stone into the sample.

3. The sample is kept at zero confining pressure (measured with a mercury column) until a constant residual pore pressure is recorded. Effective stress is then, $\bar{\sigma}_s = -u_s$

4. The confining pressure is raised and an increase in pore pressure is observed simultaneously. If the sample is saturated, the B parameter will be unity and the value of $\bar{\sigma}_s$ will be constant. But if the sample has some trapped air, the increase in pore pressure will be slightly less than the increase in confining pressure, a B = $\Delta u / \Delta\sigma_c < 1$

5. The confining pressure is increased until $\Delta u = \Delta\sigma_c$ (B-factor equal to unity and:

$$\bar{\sigma}_s = \bar{\sigma}_c - u \quad (S = 100\%)$$

Usually confining pressures of 1 to 3 kg/cm^2 are enough to ashive B equal to unity.

Consolidation:

The steps are summarized in tables 4.1-1 and 4.1-3.

Because of testing error the consolidation pressure for the first isotropically consolidated samples was indreased from 1.5 kg/cm^2 to 5.1 kg/cm^2 instead of 3.0 kg/cm^2. It was then decided to do the same for the rest of the isotropically consolidated samples.

Anisotropic consolidation was obtained by loading the piston with dead weights. For each increament the cell pressure was increased first and dead weight equal to deviatior stress times area of sample plus the force excerted by the cell pressure on the piston (area of piston times cell pressure) was added a few seconds later.

Calculations:

The calculations in this testing program was handled the same way as in Ladd and Varallyay (1965). Area during shear was calculated from $A = \frac{A_c}{1-\varepsilon}$ where ε is axial strain and A_c preshear area.

Corrections for deviator stress:

Filter Paper Correction (F.S.)

% Strain	Correction, to $(\sigma_1 - \sigma_3)$, kg/cm^2
0-2	$[\varepsilon(\%)/2] \times 0.10$
2 -	0.10

Piston Friction Correction.

% Strain	Correction, % of $(\sigma_1 - \sigma_3)$
0-2	0
2-4	0.5
4-6	1
6-8	1.5
8-10	2
etc.	

3.3 Triaxial Testing Program:

3.31 Tests to Establish $\frac{S_u @ \bar{\sigma}_c}{S_u @ \bar{\sigma}_{cm}}$ vs O.C.R.

3.311 $\overline{\text{CIU}}$ and $\overline{\text{CIOU}}$

A series of one normally consolidated and three overconsolidated (O.C.R. = 2, 4, and 8) isotropically consolidated undrained tests with pore pressure measurements were performed in order to establish the initial correction curve i.e. $\frac{S_u @ \bar{\sigma}_c}{S_u @ \bar{\sigma}_{cm}}$ vs. O.C.R.

3.312 CK_o-$\overline{UU}$ and CK_o-$\overline{CIOU}$.

To investigate effects of K on the curve above, five samples were consolidated to $\bar{\sigma}_{1c}$ = 6.0 kg/cm^2 and $\bar{\sigma}_{3c}$ = 3.0 kg/cm^2. One was sheared in compression directly to give "in situ" S_u. All the other tests were unloaded, undrained, to an isotropic stress condition to determine $\bar{\sigma}_{ps}$ directly. One sample was then sheared in compression to give S_u at "perfect" sampling. The remaining samples were rebounded isotropically to $\bar{\sigma}_c$ = 1.5, 0.75, and 0.25 kg/cm^2 and sheared undrained with pore pressure measurements.

3.32 Tests to Check Established Curve.

To test the reliability for the strength vs overconsolidation ratio as determined in the first part of the testing program, two different approaches have been used to induce disturbance and measure the corresponding undrained strengths.

3.321 Cyclic Undrained Tests.

A series of cyclic tests with pore pressure measurements and a slow strain rate (1% pr. hour) were run. Two samples were consolidated isotropically to $\bar{\sigma}_c$ = 6.0 kg/cm^2 and sheared by cycling between compression and extension. Each time the samples crossed the $K=1$ line, additional excess pore pressure built up, yielding another value of $\bar{\sigma}_s$.

The following shear in compression then gave the corresponding s_u value. The number of cycles was limited. As $\bar{\sigma}_s$ decreased the effect of cycling had smaller and smaller effect on $\Delta\bar{\sigma}_s$ because the sample started to behave more and more overconsolidated. As shear progressed $\bar{p}$ was increasing instead of decreasing as it did in the first couple of cycles.

Three samples were anisotropically consolidated to $\bar{\sigma}_{1c} = 6.0$ kg/cm^2 and $\bar{\sigma}_3 = 3.0$ kg/cm^2. One was sheared by cycling between $K = 1$ and the K_f line while the remaining two where taken into extension during the cyclic shear. The number of cycles was limited. As $\bar{\sigma}_s$ decreased the effect of cycling had smaller and smaller effect on $\Delta\bar{\sigma}_s$ because the sample started to behave more and more overconsolidated.

3.322 UU Tests.

Since the most typical test for obtaining undrained shear strength is an unconsolidated-undrained triaxial test with strain rate. about $\frac{1}{2}$ to 1% per min., it seemed sensible to do likewise.

One sample was isotropically consolidated to $\bar{\sigma}_c = 6.0$ kg/cm^2 and another consolidated anisotropically to $\bar{\sigma}_{1c} = 6.0$ kg/cm^2 and $\bar{\sigma}_{3c} = 3.0$ kg/cm^2. Then both were "sampled" i.e. dismantled and re-mounted in the modified cell for residual pore pressure measurements, and sheared. The residual pore pressure was measured again after the sample was unloaded undrained to isotropic stress. If the $\Delta\bar{\sigma}_s$ measured was high enough, another cycle of shearing and unloading was done. This was continued until the $\Delta\bar{\sigma}_s$ became insignificant. Then the sample was remolded by hand and a new $\bar{\sigma}_s$ and s_u measured.

3.33 Presentation and Discussion of Test Results.

3.331 Isotropically Consolidated Series.

(Consolidation data summarized in table 4.1-1 and figure 3.331-1. Strength data summarized in table 4.1-2 and figures 3.331-2 and 4.2-1).

The undrained shear strength of samples consolidated isotropically to 6.0 kg/cm^2 is needed for construction for the $\frac{S_u @ \bar{\sigma}_c}{S_u @ \bar{\sigma}_{cm}}$ vs log O.C.R. curve. The following list is a summary of the S_u from the normally consolidated samples in this series.

Test	S_u (kg/cm^2)	$\bar{\sigma}_c$ (kg/cm^2)	$S_u/\bar{\sigma}_c$	g/l NaCL	w_i %	w_f %	$\Delta V/V_o$
$\overline{\text{CIU}}$-P1	1.695	6.0	.282	23	42.0	31.6	14.8
$\overline{\text{CIU}}$-CyC-E P9	2.04	6.01	.340	23	42.6	31.1	14.6
$\overline{\text{CIU}}$-CyC-E P10	1.94	5.98	.324	23	42.4	31.1	16.0
$\overline{\text{CIU}}$-CyC-E P20	1.865	6.06	.308	16	38.4	29.9	11.2
$\overline{\text{CIU}}$-P21	2.005	6.06	.330	16	38.5	30.0	9.2

Average $S_u/\bar{\sigma}_c = 1.584/5 = .317$

It is difficult to explain the large variation in $S_u/\bar{\sigma}_c$ (.282 - .340). Examination of figure 3.331-1 will point out a large discreppancy in $\Delta V/V_o$ at the same consolidation pressures between the samples with 16 g/l NaCl and those with 23 g/l. The foregoing table indicates however that P20 and P21 have a range of $S_u/\bar{\sigma}_c$, (.308 - 330), that lies entirely within the range obtained with the samples prepared with 23 g/l NaCl. So the salt content seems to have little effect even though the water content at failure is quite different.

The overconsolidated samples are more difficult to evaluate directly because only one sample was tested at each consolidation pressure, but they can be compared to each other. Figure 4.2-1 gives $\bar{\phi} = 31.1^{\circ}$ and $\bar{c} = 0.08$ kg/cm^2. Comparing stress-strain characteristics in figure 3.331-2 we find that the samples behave as expected i.e. with increasing overconsolidation, s_u, Δu, and A-factor decrease while $\bar{\sigma}_1/\bar{\sigma}_3$ increases. The peculiarity in the stress-strain curve of P2 is probably due to improper seating of the piston in the top cap. The $\frac{s_u @ \bar{\sigma}_c}{s_u @ \bar{\sigma}_{cm}}$ versus O.C.R. is plotted in figure 3.331-3.

3.332 Anisotropically Consolidated Test Series.

(Consolidation data summarized in figure 3.332-1 and table 4.1-3. Strength data in figures 3.332-2 and 4.2-2 and table 4.1-4).

The following table summarizes undrained shear strength obtained from normally consolidated samples ($K = K_o$).

Test	s_u (kg/cm^2)	$\bar{\sigma}_{1c}$ (kg/cm^2)	$s_u/\bar{\sigma}_{1c}$
$\overline{CK_oU}$-CyC-E P15	1.93	5.99	.322
$\overline{CK_oU}$-CyC-E P16	2.00	5.99	.334
Average	s_u = 1.965		$s_u/\bar{\sigma}_{1c}$ = .328

The results from $\overline{CK_oU}$-CyC-P14 were not included in the table above because the sample was slightly overconsolidated prior to shear due to an error.

The $s_u @ \bar{\sigma}_{ps}$ measured by CK_o-$\overline{UU}$ P7 is high, however $s_u/\bar{\sigma}_{1c}$ = 1.94/6.09 = .318 or only about 3% lower than s_u from $\overline{CK_oU}$

tests. Ladd and Varallyay (1965) report that the difference is 10 ± 5 per cent less than the in situ strength in compression. The use of 10% reduction would bring $s_u @ \bar{\sigma}_{ps}$ down to 1.77 kg/cm^2 for $\bar{\sigma}_{1c}$ = 6.00 kg/cm^2.

$\bar{\sigma}_{ps}$ was established by averaging the effective stress measured after unloading from K_0 to K = 1. CK_o-$\overline{UU}$ P7 and CK_o-$\overline{CIOU}$ P11 - P12 - P13 tests gave a $\bar{\sigma}_{ps\,av}$ = 3.48 kg/cm^2 (3.60 to 3.22 kg/cm^2).

Since there has been done very little investigation into the overconsolidated range of B.B.C. there is no way of checking the results from P11 - P12 - P13 except against each other. The $\bar{p}$-q plott can be found in figure 4.2-2. Figure 3.342 summarizes the stress-strain behavior. There are no known irregularities in these tests.

With the results of this overconsolidated range available a similar curve $\frac{s_u @ \bar{\sigma}_c}{s_u @ \bar{\sigma}_{cm}}$ vs O.C.R. should be possible. Since all these samples have undergone a stress change somewhat similar to actual sampling it becomes natural to use the "perfect" sampling stress as a reference point. So $\frac{s_u @ \bar{\sigma}_c}{s_u @ \bar{\sigma}_{ps}}$ vs $\frac{\bar{\sigma}_{ps}}{\bar{\sigma}_c}$ is used. The results are tabulated below and plotted in figure 3.331-3.

	s_u	$\bar{\sigma}_c$	$\bar{\sigma}_{ps}/\bar{\sigma}_c$	$\frac{s_u @ \bar{\sigma}_c}{s_u @ \bar{\sigma}_{ps}}$
CK_o-$\overline{CIOU}$-P11	.92	.25	13.9	.516
CK_o-$\overline{CIOU}$-P12	1.13	.75	4.64	.635
CK_o-$\overline{CIOU}$-P13	1.38	1.5	2.32	.776

$s_u @ \bar{\sigma}_{ps}$ = 1.77 kg/cm^2

3.333 Cyclic Isotropic Test Series. (Summarized in table 4.1-5).

The S_u measured in the first cycle of these tests varies highly (2.04 - 1.865 kg/cm^2). It was therefore decided that in order to have reasonable agreement between the tests regarding the reduction in strength with disturbance, the initial S_u measured would serve as "S_u @ $\bar{\sigma}_{ps}$". Since $\bar{\sigma}_{ps}$ is equal to $\bar{\sigma}_c$ for these isotropic tests no basic error is involved. Examining the stress-strain plot and the $\bar{p}$-q plots, the effect of disturbance indeed has a similar behavior to that of overconsolidation. The only peculiarity discovered in all the cyclic tests, including the UU tests, is the S shape on the stress-strain curve of the last cycle (see figures 4.3-9, 4.3-10, 4.3-14). The strength increases gradually to 5 - 6% and then increases more rapidly before finally leveling off. No such behavior was observed in the stress-strain behavior of the overconsolidated samples (P2 figure 3.331-2).

The stress-strain data are summarized in table 4.1-5. Figures 4.2-3 and 4.2-4 contain the $\bar{p}$-q plots. The $\frac{S_u @ \bar{\sigma}_s}{S_u @ \bar{\sigma}_{ps}}$ vs $\frac{\bar{\sigma}_{ps}}{\bar{\sigma}_s}$ relationship is plotted in figure 3.333-1.

3.334 Cyclic Anisotropic Test Series. (Stress-strain characteristics are summarized in figures 4.3-11, 4.3-12, 4.3-13 and tables 4.1-6 and 4.1-7).

The anisotropically consolidated samples sheared cyclic also had some variation in the initial S_u. S_u for "perfect" sampling was selected as 1.77 kg/cm^2 for all the tests, however. As the stress-Strain plots show, the S_u drops as the number of cycles increased. The "workharening" phenomena observed in the isotropic test, also occurred to the anisotropically consolidated samples, although only for the tests sheared in cyclic compression-extension. CK_oU-CyC P-14 that was sheared in cyclic compression, did not exhibit this behavior. At the present time there seems to be no logical explanation. Careful check of the testing equipment and procedure used did not reveal any possibility for relative movements in the aparatus used for strain measurements nor any irregularities with the proving rings.

3.335 UU Remolded test series. (Stress-strain curves in figures 4.3-15 and 4.3-16. Stress characteristics are summarized in table 4.1-8)

As shearing progressed, $\bar{\sigma}_s$ dropped and s_u @ $\bar{\sigma}_s$ decreased too. The behavior was quite similar to the one observed in the much slower cyclic tests. The range in $\bar{\sigma}_s$ was increased in the UU tests by remolding the sample by hand. This was done after additional shearing failed to reduce $\bar{\sigma}_s$. Pore pressure measurements were not performed during shear. With such a high strain rate ($\varepsilon = \frac{1}{2} - 1$ %/hr.) the samples will not equalize the pore pressures fast enough to permit meaningful data.

3.34 Final Discussion.

3.341 General Results of Testing Program.

The results at an extensive testing program on the behavior of normally consolidated samples of Boston Blue Clay with a salt content of 16 g/l are reported by Ladd and Varallyay (1965). The following table shows the agreement between the results of these two testing programs.

	This testing program	Ladd & Varallyay
	$s_u/\bar{\sigma}_{1c}$	$s_u/\bar{\sigma}_{1c}$
$\overline{CIU}$	0.317	0.285
$\overline{CK_oU}$	0.328	0.33
CK_o-$\overline{UU}$	0.318	0.28
$\overline{CK_oU}$ - 10%	0.297	0.297

The "field" strength, s_u from $\overline{CK_oU}$, is in very good agreement. But both the isotropic and the "perfect" sampling strengths are high. As already mentioned earlier in the discussion of the tes results it was felt that 10% reduction in s_u @ $\overline{CK_oU}$ was a much more representative figure than s_u @ $\bar{\sigma}_{ps}$ obtained in CK_o-$\overline{UU}$-P7. Both the range in and the large differences in $s_u/\bar{\sigma}_{1c}$ between the two testing programs are hard to explain. There seems to little correlation between $\Delta V/V_o$ and the relative strengths of the tests. Close examination of the time allowed for consolidation at the last step reveal that all tests had 7000 min. or more. The strengths measured do not correlate with the length of application of the last consolidation pressure.

3.342 Use of Methods to Correct for Disturbance.

Casagrande-Ruthledge, Calhoon, and Schmertmann proposed methods which basically involve extrapolation of water content (or e) vs log s_u plot (from $\overline{CIU}$ data) to the in situ water content (or e_o) to obtain the strength of a "perfect" sample. These methods require reconsolidation of samples with various degrees of disturbance via CIU, CAU, and oedometer tests. The tesing program for this thesis was intended only to induce and hopefully to predict the effects of sampling from ~~a~~ hypothetical in situ condition. Therefore none of the samples were reconsolidated after the disturbance was induced. So, unfortunately it is impossible to evaluate these three methods. Seed, Noorany, and Smith's methods can be evaluated with available data.

Method No. 1:

The strength of a perfect sample is determined by evaluation of the following theoretical equation:

$$s_u @ \bar{\sigma}_{ps} = \frac{\bar{\sigma}_{ps} \sin \bar{\phi}_e + \bar{c}_e \cos \bar{\phi}_e}{1 + (2\bar{A}_f - 1) \sin \bar{\phi}_e}$$

Hvorslev's parameters ($\bar{c}_e$ and $\bar{\phi}_e$) could be determined for Boston Blue Clay at constant water content for different overconsolidation ratios with $\overline{\text{CIOU}}$ tests. But since it is already established that the cyclic tests behave overconsolidated as $\bar{\sigma}_s$ drops, we have direct measurements of s_u, $\bar{\sigma}_{3f}$, and $\bar{\sigma}_c$ at constant water content. Figure 3.342-1 show the resulting parameters. The cyclic tests also provided the needed information to estimate $\bar{A}_f$. Figure 3.342-2 shows $\bar{A}_f$ plotted against disturbance as recommended by Seed, Noorony, and Smith (1964). The resulting $\bar{A}_f$ from the anisotropic cyclic tests averages .50 as compared to .22 for CK_o-$\overline{\text{UU}}$-P7. P7, however, has shown too high $s_u @ \bar{\sigma}_{ps}$ and may warrant some caution in use of results. Ladd and Varallyay (1965) report an average $\bar{A}_f$ from CK_o-$\overline{\text{UUC}}$ of 0.50. So with use of $\bar{A}_f = 0.50$, $\bar{c}_e = .745$ kg/cm^2, $\bar{\phi}_e = 18^\circ$.

$$s_u @ \bar{\sigma}_{ps} = \frac{3.48 \cdot \sin 18^\circ + .745 \cos 18^\circ}{1 + (2 \cdot (0.50) - 1) \sin 18^\circ}$$

$$= 1.80 \text{ kg/cm}^2$$

which is low compared to CK_o-$\overline{\text{UU}}$-P7 but agree with $s_u @ \overline{CK_oU}$ minus 10%.

The small difference is probably due to contributing errors in the determination of the parameters.

Method No. 2:

s_u vs disturbance i.e. $(\bar{\sigma}_{ps} - \bar{\sigma}_s)$ is plotted in figure 3.342-3. The isotropic tests plotted so far to the right on the figure that any extrapolation back to $(\bar{\sigma}_{ps} - \bar{\sigma}_s) = 0$ is meaningless.

The anisotropic tests, however, yielded a better spread in $(\bar{\sigma}_{ps} - \bar{\sigma}_s)$. $s_u @ \bar{\sigma}_{ps}$ averaged 1.81 kg/cm^2 (vs 1.77 kg/cm^2 estimated from $s_u @ \overline{CK_oU}$ minus 10%). This method is simple and seems to give good agreement with other methods.

Method No.3:

Unfortunately none of the tests in this testing program were reconsolidated after disturbance so there are no data for evaluation of method no. 3.

Correction of Data from UU Test with Ladd and Lambe's Method.

The simplest way of checking this method is to see how well the curves of $\frac{s_u @ \bar{\sigma}_s}{s_u @ \bar{\sigma}_{ps}}$ vs $\frac{\bar{\sigma}_{ps}}{\bar{\sigma}_s}$ for the different types of disturbance agree with the curve of $\frac{s_u @ \bar{\sigma}_c}{s_u @ \bar{\sigma}_{cm}}$ vs O.C.R.

Figure 3.333-1 summarizes the results of the cyclic tests and the UU tests. The isotropically consolidated samples sheared in cyclic compression extension are the only tests that fall outside of a fairly narrow band. Close examination of testing procedure and even an additional test ($\overline{\text{CIU}}$-CyC-E P20) did not yield any hints as to reasons behind this behavior.

As for the rest of the tests they do agree reasonably well with the experimental curve established by CIU and CIOU tests. It is reasonable to believe that the s_u @ $\bar{\sigma}_{ps}$ used to plot the anisotropically consolidated samples should be somewhat higher than 1.77 kg/cm^2 since all these samples yield data ploting above the CIOU curve. The general shape of the curves for the different types of tests is the same, however, This leads one to believe that a sample consolidated anisotropically and sheared cyclic in a UU type test would yield enough data to establish the shape of the curve. Futhermore if the sample was first unloaded undrained and then sheared, $\bar{\sigma}_{ps}$ and s_u @ $\bar{\sigma}_{ps}$ could be determined with the same sample. In this way the methods testing can be reduced greatly. First only one good sample is needed. Secondly the time for testing is cut down considerably. Only pore pressure equalizations for $\bar{\sigma}_{ps}$ and $\bar{\sigma}_s$ take time since the sample can be sheared at a strain rate of $\frac{1}{2}$ - 1% per min.

Extension of the Ladd-Lambe method into the overconsolidated range would be desireable. Use of the same curve to correct for disturbance in overconsolidated camples can be explained easiest the following way:

1. Determine the overconsolidation ratio by oedometer tests (as an example use O.C.R. = 2).
2. Measure $\bar{\sigma}_s$ and s_u on triaxial size sample in cell similar to that one in figure 2.2-1 (say .55 kg/cm^2 and 1.20 kg/cm^2 respectively)
3. Estimate $\bar{\sigma}_{ps}$ from the equation in section 2.2 (for our example

use 2.20 kg/cm^2).

4. Then use portion of curve established as explaned in foregoing paragraph and the lower scale in figure 3.342-4 ($\bar{\sigma}_{ps}/\bar{\sigma}_s$ = 2.20/.55 = 4, s_u @ $\bar{\sigma}_s$ = 1.20 (pt. B), s_u @ $\bar{\sigma}_{ps}$ = 0.8/0.6 · 1.20 = 1.60 kg/cm^2 (pt. A)). The original abscissa can be used directly however by using O.C.R. times $\bar{\sigma}_{ps}/\bar{\sigma}_s$. (i.e. use of 2 × 4 = 8 on the upper abscissa is synonymus with 4 on lower abscissa).

3.35 Effect of Disturbance on Stress-Strain Characteristics.

Disturbed samples always show a much lower stress-strain modulus than good undisturbed sample during compression to reach the same level of stress. This behavior has long been used to judge the quality of "undisturbed" samples. It was therefore natural to examine the test data in this testing program the same way with the possibility in mind of correlating disturbed and undisturbed modulus in a manner similar to the strength correction.

A close look at figures 3.35-1 and 2 reveal that noe such possibility is apparent. All the overconsolidated samples (CK_o-CIOU and CIOU's) exhibit a much higher stress-strain moculus than the samples disturbed by shear or remolding for the same preshear $\bar{\sigma}$. Again it is shown that the results are independent of type of test used to induce disturbance. Even the isotropically consolidated tests sheared in cyclic compression and extension follow the general trend. It is believed that before any futher conclusions are made that a similar series of test be run where extreme care is taken to achieve the same

$w, S, \bar{\sigma}_c$ prior to shear. During investigation of the results of this triaxial program difficulty was experienced in evaluation of time effects on stress-strain behavior and slight variations in the initial stress condition.

3.36 Application of Theory on Data from M.I.T. Campus.

For two of the more recent buildings at M.I.T., the Student Center and the Center for Advanced Engineering Studies, a number of "undisturbed" samples were taken. From each sample an unconsolidated-undrained (UU) triaxial test was performed. Before shear the effective stress was determined (at a B factor of one). Since extensive testing of the remolded Boston Blue Clay has shown that it closely resembles the natural BBC it was natural to try to see how the Ladd-Lambe method would estimate $S_u @ \bar{\sigma}_{ps}$. Figure 3.36-1 shows the in situ stress condition below two buildings plus calculated $\bar{\sigma}_{ps}$ and measured $\bar{\sigma}_s$ values. Tables 4.1-9 and 4.1-10 give the summarized data from these test series. On figure 3.36-2 the result of the corrected values are compared with estimated in situ S_u and S_u for perfect sampling at these two sites. The strength estimates are from Ladd and Luscher (1965) based on several types of triaxial testing om BBC from M.I.T. campus. The uncorrected values are all lower than the estimated S_u for perfect sampling. By using the curve on figure 3.333-1 to correct these data, the results are much closer to the estimated S_u for perfect sampling but still on the conservative side. The two points falling very high are actually falling outside of the well defined range in figure 3.333-1. The $\bar{\sigma}_s$ values, measured on these samples were so low compared with the estimated $\bar{\sigma}_{ps}$ that there should be no difficulty in predicting that these samples were badly disturbed before testing.

The discrepancy at higher overconsolidation range may be attributed to possible error in the estimated s_u curves. Ladd and Luscher (1965) point out that the estimated s_u is taken from samples consolidated to high pressures and rebound whereas the soil in situ is believed to have been precompressed by partial drying and therefore may have lower strengths.

3.37 Final Conclusions.

The general conclusion of this testing program seems to indicate that the Ladd and Lambe's method works very well for correcting disturbance on "undisturbed" samples of Boston Blue Clay. The large number of tests proposed by Ladd and Lambe to establish the correction-curve can be drastically cut by using a sample consolidated to $\bar{\sigma}_{1c} \gg \bar{\sigma}_{vo}$ unloaded undrained, sheared, unloaded again and shear in cycles while $\bar{\sigma}_s$ and s_u is measured for each cycle, (see section 3.342 under "Correction of Data from UU Tests with Ladd and Lambe's Method" for closer discussion of this test).

The investigation of stress-strain behavior points out, however, that at the precent it is difficult to correct for disturbance in Youngs Modulus.

3.38 Proposed Future Research.

First of all there should be done some UU cyclic tests (as proposed in section 3.342) both for normally and overconsolidated samples with the same soil and the same hypothetical field condition.

This would serve to extend the proposed method into the overconsolidated region.

Next step would be to take an "undisturbed" sample of Boston Blue Clay consolidated it to $\bar{\sigma}_{1c} >> \bar{\sigma}_{vo}$ and shear it the same way as the tests above. The correction curve established would be used to correct the UU tests with σ_s measurements of M.I.T. Campus. At the same time it could be checked against the curve established on the remolded samples.

A closer investigation of stress-strain modulus and the effect of disturbance is warranted. As mentioned earlier there does not exist any method for correcting for disturbance.

3.39 List of References.

Bishop, A.W. and Henkel, D.J. (1962) "The Measurements of Soil Properties in the Triaxial Test. Ed. Arnold, London 2nd Edition".

Brooker, E.W. and Ireland, H.O. (1965) "Earth Pressures at Rest Related to Stress History", Canadian Geotechnical Journal, Vol. 2, No. 1, pp. 1-15.

Calhoon, M.L. (1956) "Effect of a Sample Disturbance on the Strength of a Clay" Transactions, ASCE, Vol. 121 pp. 925 - 939.

Casagrande, A. and Rutledge, P.C. (1947) "Cooperative Triaxial Shear Research", Waterways Experiment Station, Vicksburg, Miss.

Coates, D.F. and McRostic, G.C. (1963) "Some Deficiency in Testing Leda Clay", NRC-ASTM Sym. on Laboratory Shear Testing of Soils, ASTM STP No. 361, pp. 459 - 470.

Horn, H,M, (1964) "Recommended Procedures for Undisturbed Sampling of Clay on The M.I.T. Campus". Fermit Memorandum No. 1. Department of Civil Engineering M.I.T. February 1964 (unpublished)

Jaky, J. (1948) "Pressures in Silor", Proceedings, 2nd Inst. Conf. on Soil Mechanics and Foundation Engineering, Vol. II, 1. 16.

Ladd, C.C. and Lambe, T.W. (1963) "The Strength of Undisturbed Clay Determined From Undrained Tests" Proceedings. ASTM/NRC Symp. on Laboratory Shear Testing of Soils ASTM July 1963.

Ladd, C.C. (1964) "Stress - Strain Modulus of Clay from Undrained Triaxial Tests", ASCE Settlement Conference. June 1964.

Ladd, C.C. (1964) "Stress - Strain Behavior of Anisotropically Consolidated Clays During Undrained Shear". Sixth International Conference, International Society of Soil Mechanics and Foundation Engineering 1965.

Ladd, C.C. and Varallyay, J. (1965), "The Influence of Stress System on the Behavior of Saturated Clays During Undrained Shear". July 1965 Dept. of Civil Engineering, M.I.T. Research Report R 65-17, Soil Publication No. 117.

Ladd, C.C. and Luscher, Ulrich (1965 "Preliminary Report on the Engineering Properties of the Soils Underlying the M.I.T. Campus" Permit Report December 1965. Dept. of Civil Engineering, M.I.T. Research Report R65 - 58. Soil Publication No. 185.

Lambe, T.W. and Whitman, R.V. (1964) "An Introduction to Soil Mechanics" School of Engineering, M.I.T. September 1964.

Lambe, T.W. (1951) "Soil Testing for Engineers" John Wiley and Sons, Inc.

Preston, W.B. (1965) "The Effect of Sample Disturbance on the Undrained Strength Behavior of Boston Blue Clay". S.M. Thesis, Department of Civil Engineering, M.I.T. (unpublished).

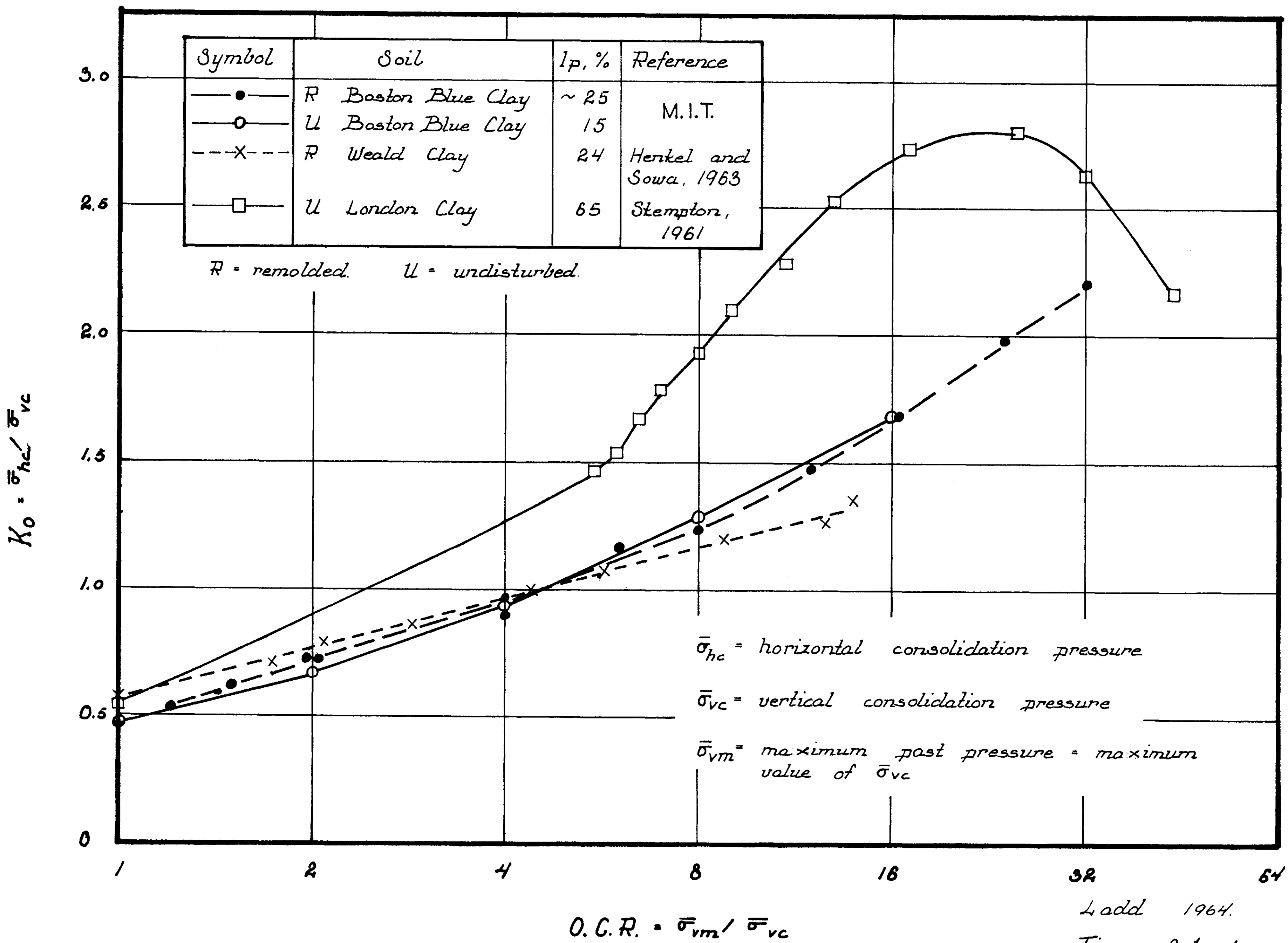
Rowe, P.W. (1957) " $c_e = 0$ Hypothesis for Normally Loaded Clays at Equilibrium". Proceedings, 4th Int. Cinf. on Soil Mechanics and Foundation Engineering.

Schmertmann, J. (1956) Discussion of Paper, "Effect of Sample Disturbance on the Strength of a Clay", *Transactions*, ASCE, Vol. 121 pp. 939 - 950.

Bolton Seed, H., Noorany, I. and Smith, I.M. (1964) "Effects of Sampling and Disturbance on the Strength of Soft Clays". Department of Civil Engineering, University of California, February 1964.

Wissa, A.E.Z. (1961) "A Study of the Effects of Enviromental Changes on the Stress - Strain Properties of Kaolinite", M.S. Thesis. Dept. of Civil Engineering M.I.T.

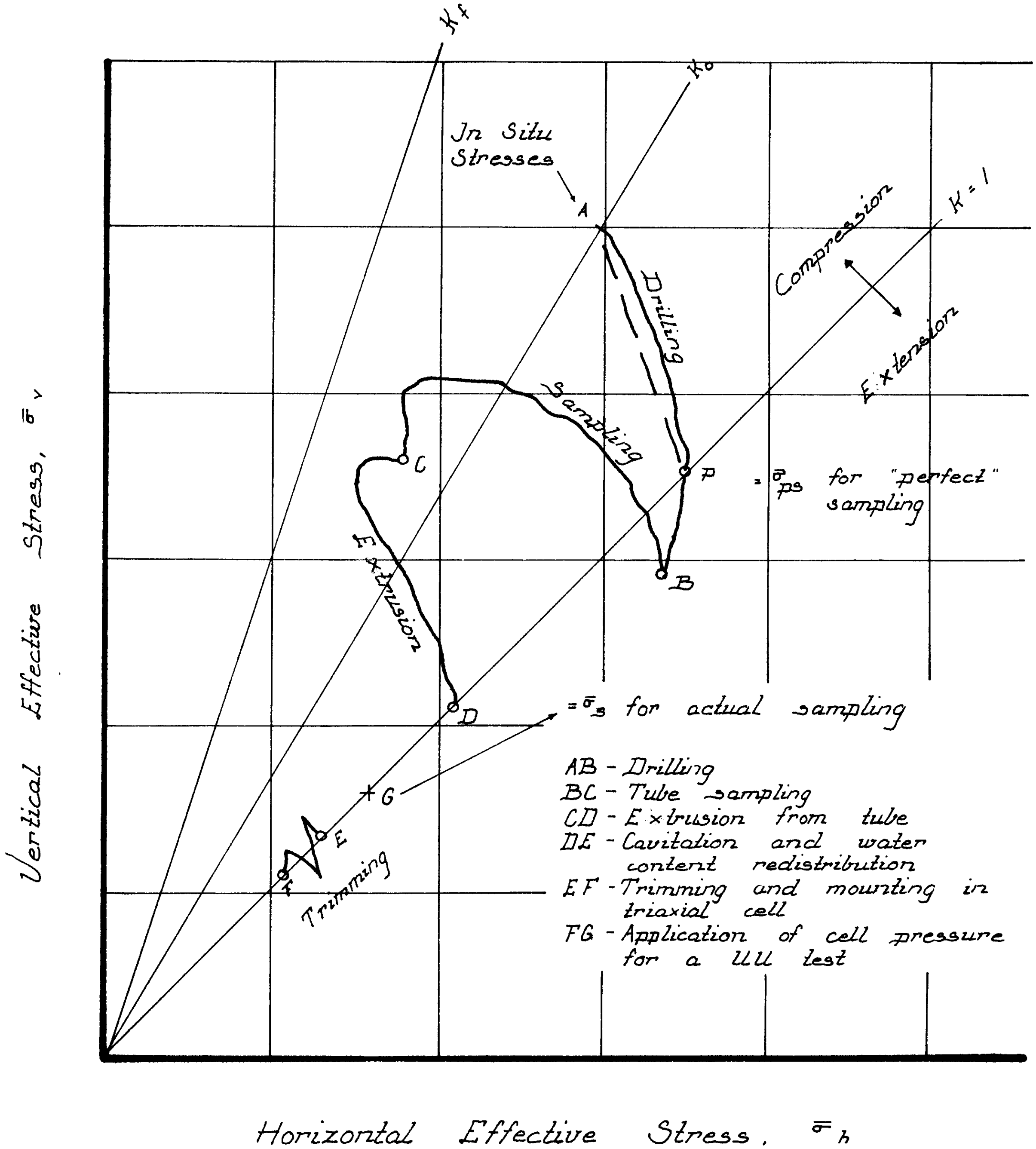
3.401 List of Figures.



Ladd 1964.

Figure 2.1 - 1

Hypothetical Stresses for a Normally Consolidated Clay Element during Tube Sampling



Ladd and Lambe 1963.

Figure 2.2-1.

Figure 2.31 - 1.

Casagrande :

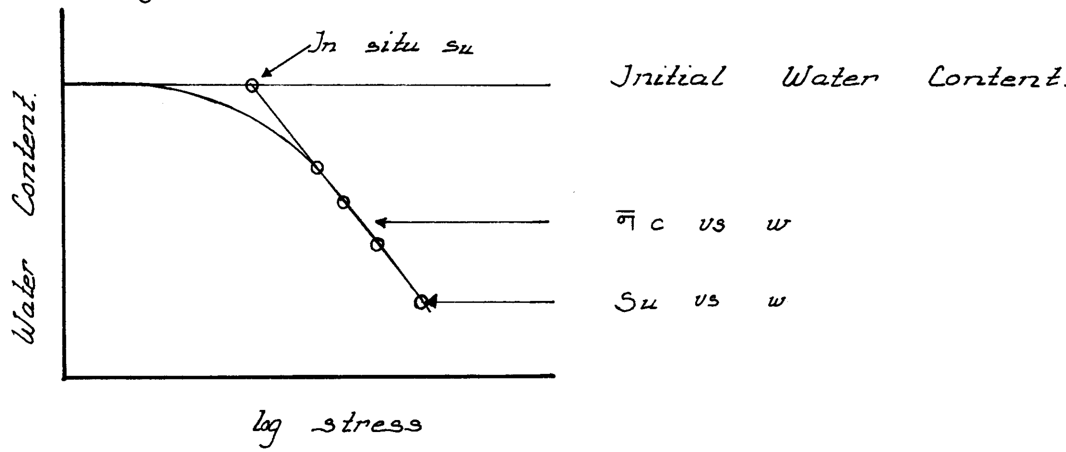


Figure 2.32 - 1

Calhoon :

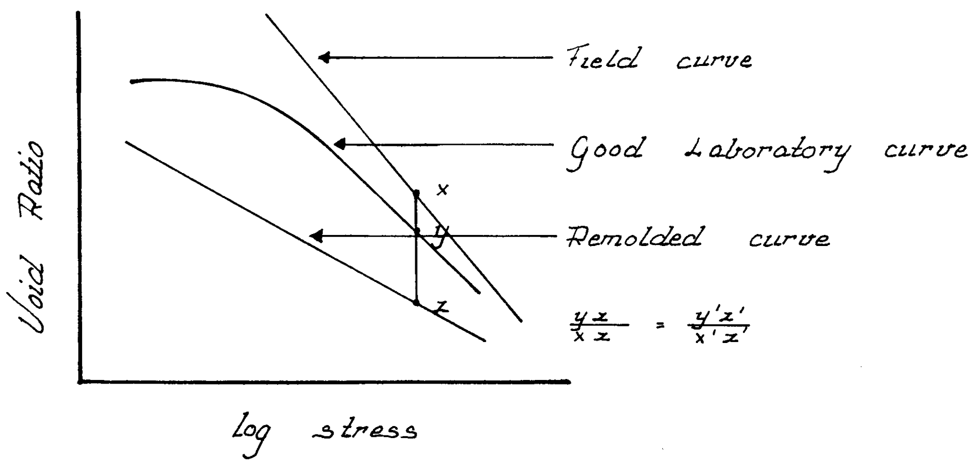


Figure 2.32 - 2

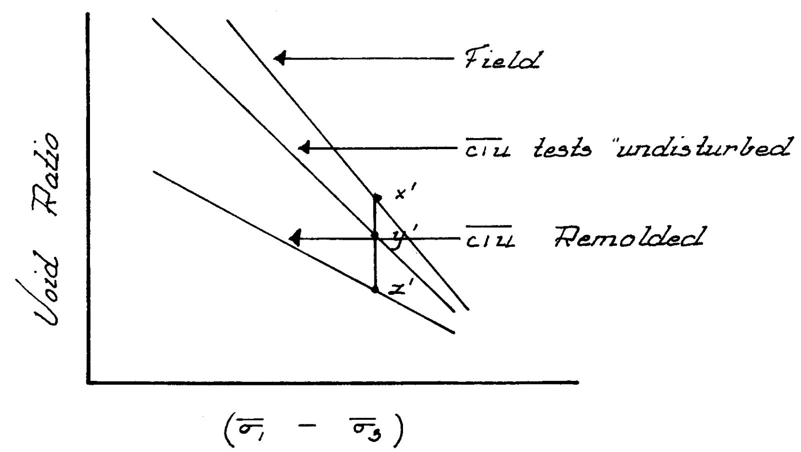


Figure 2.33 - 1
Schmertmann :

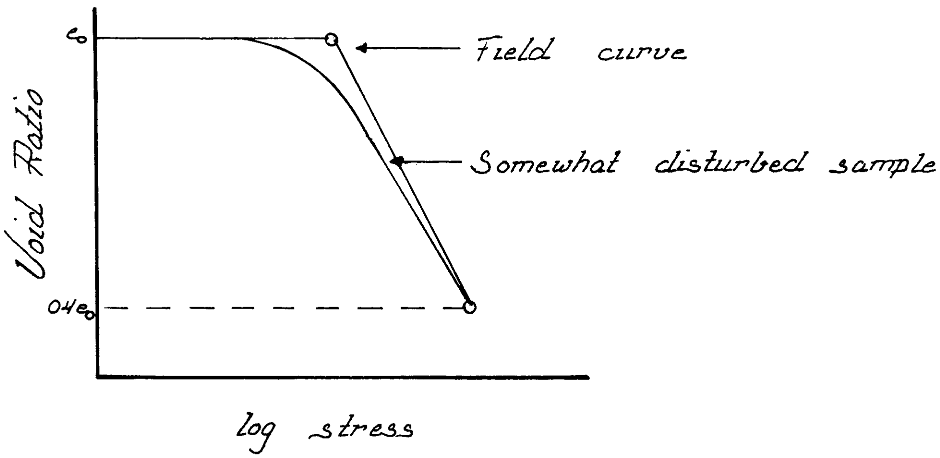


Figure 2.33 - 2.

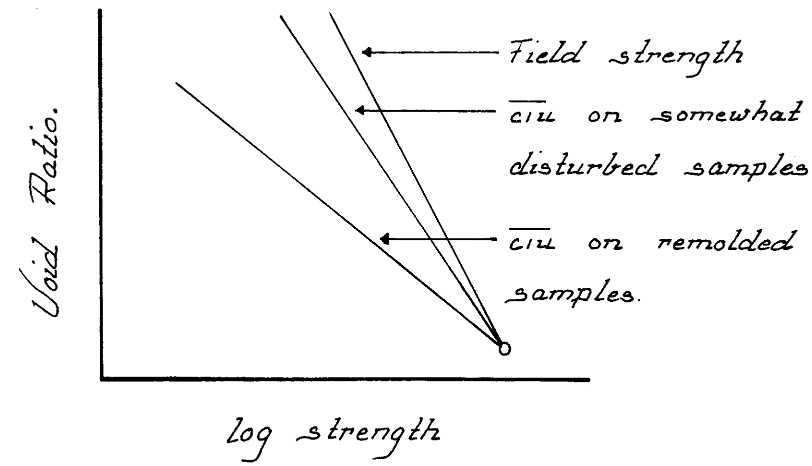
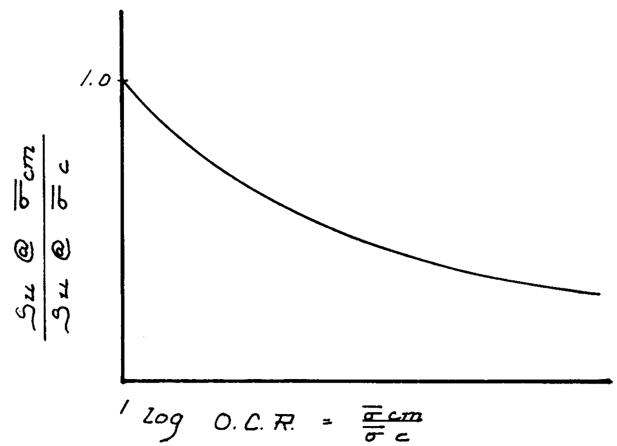


Figure 2.341 - 1
Ladd - Lambe :



Seed, Noorany and Smith :

Figure 2.351 - 1
Method #1

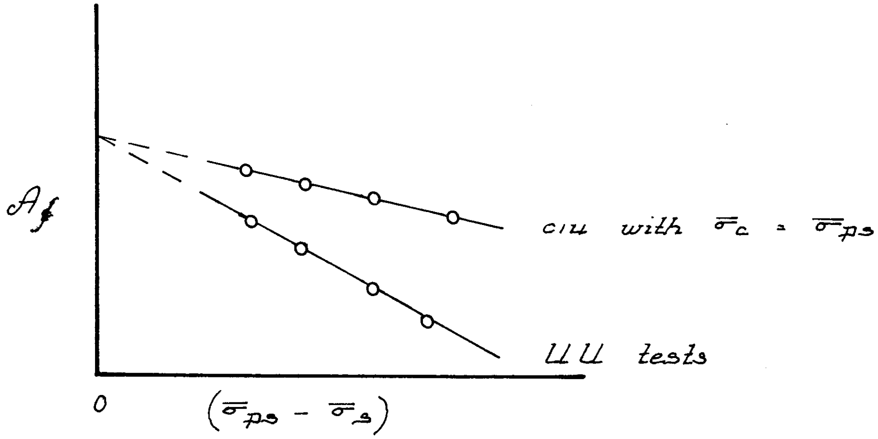


Figure 2.352 - 1
Method #2

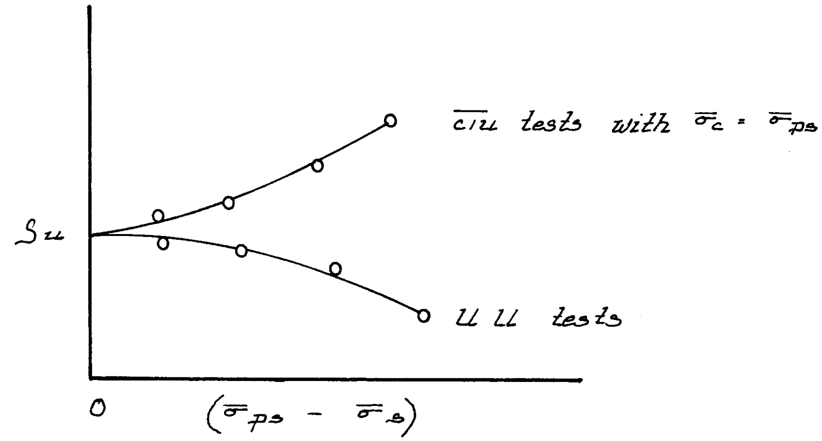
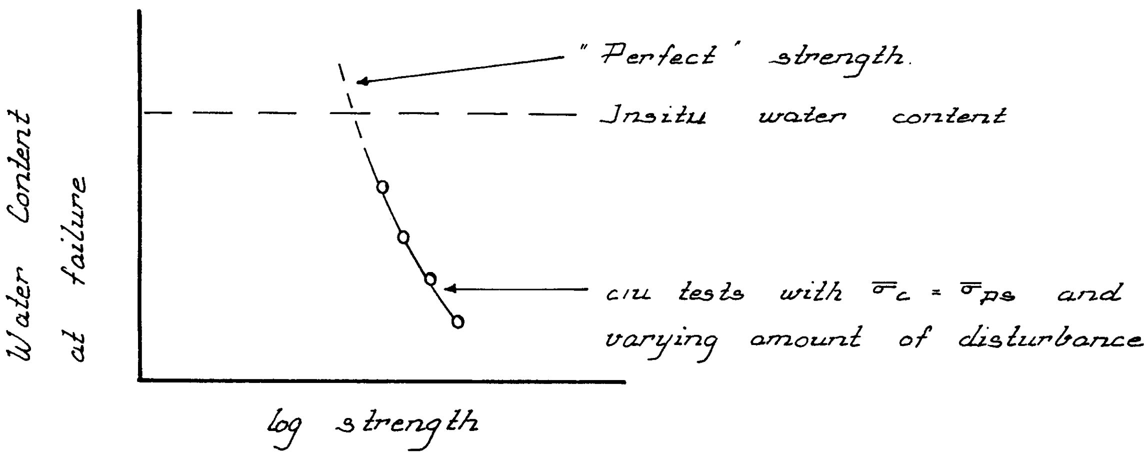


Figure 2.353 - 1
Method #3



From Seed et al 1964.

GRAIN SIZE DISTRIBUTION

For Remolded Boston Blue Clay

salt content : 23 g/l

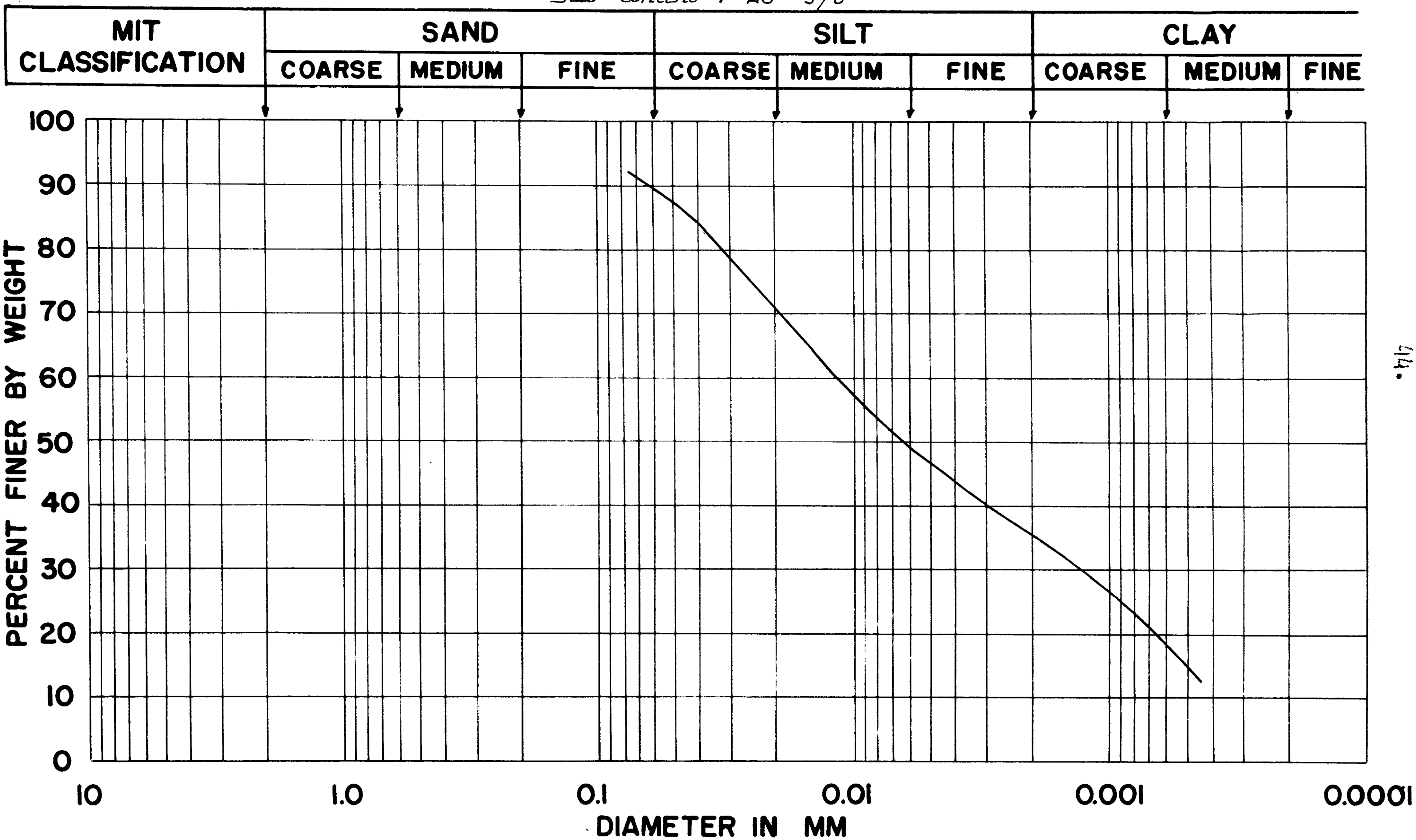


Figure 3.2-1

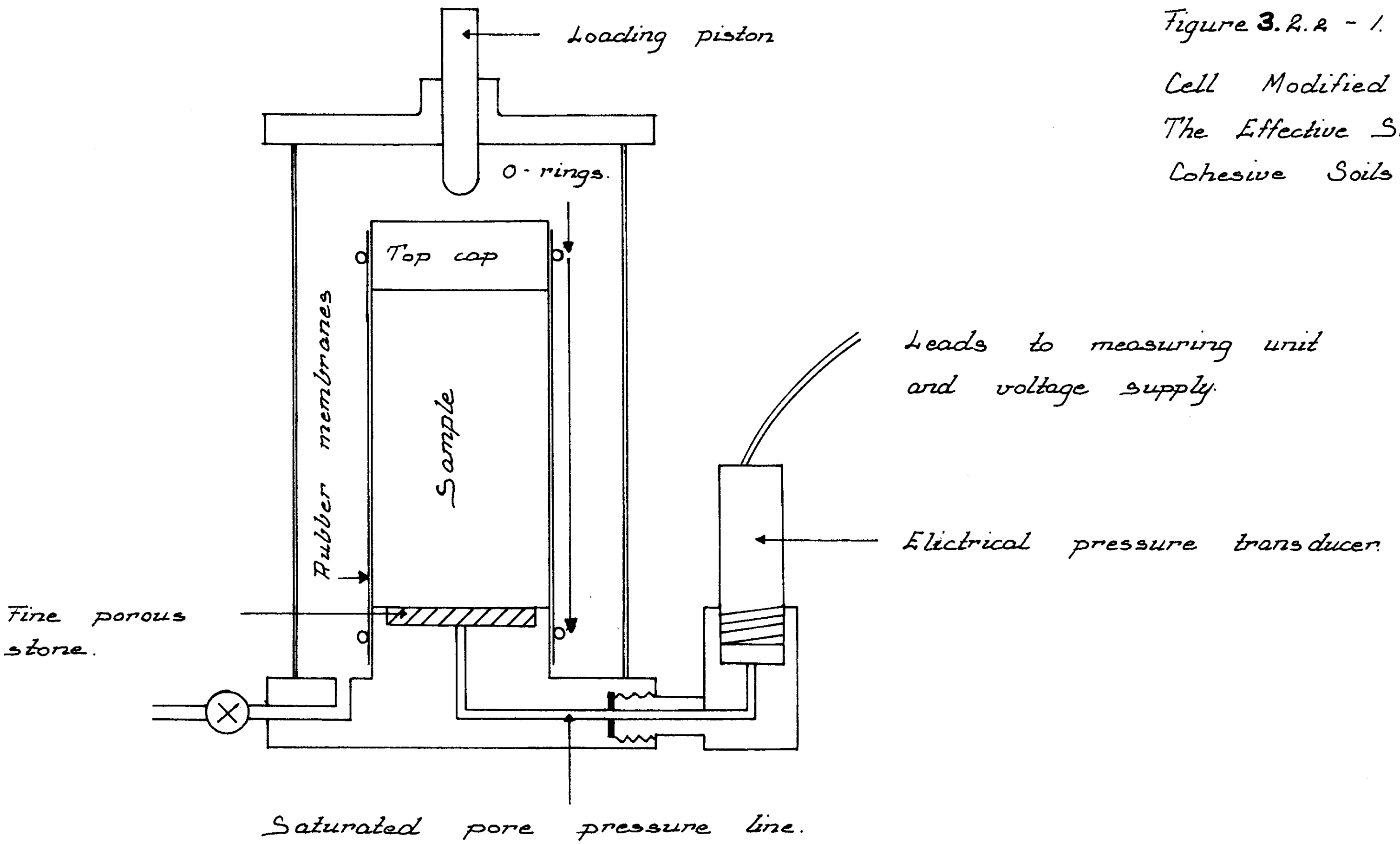
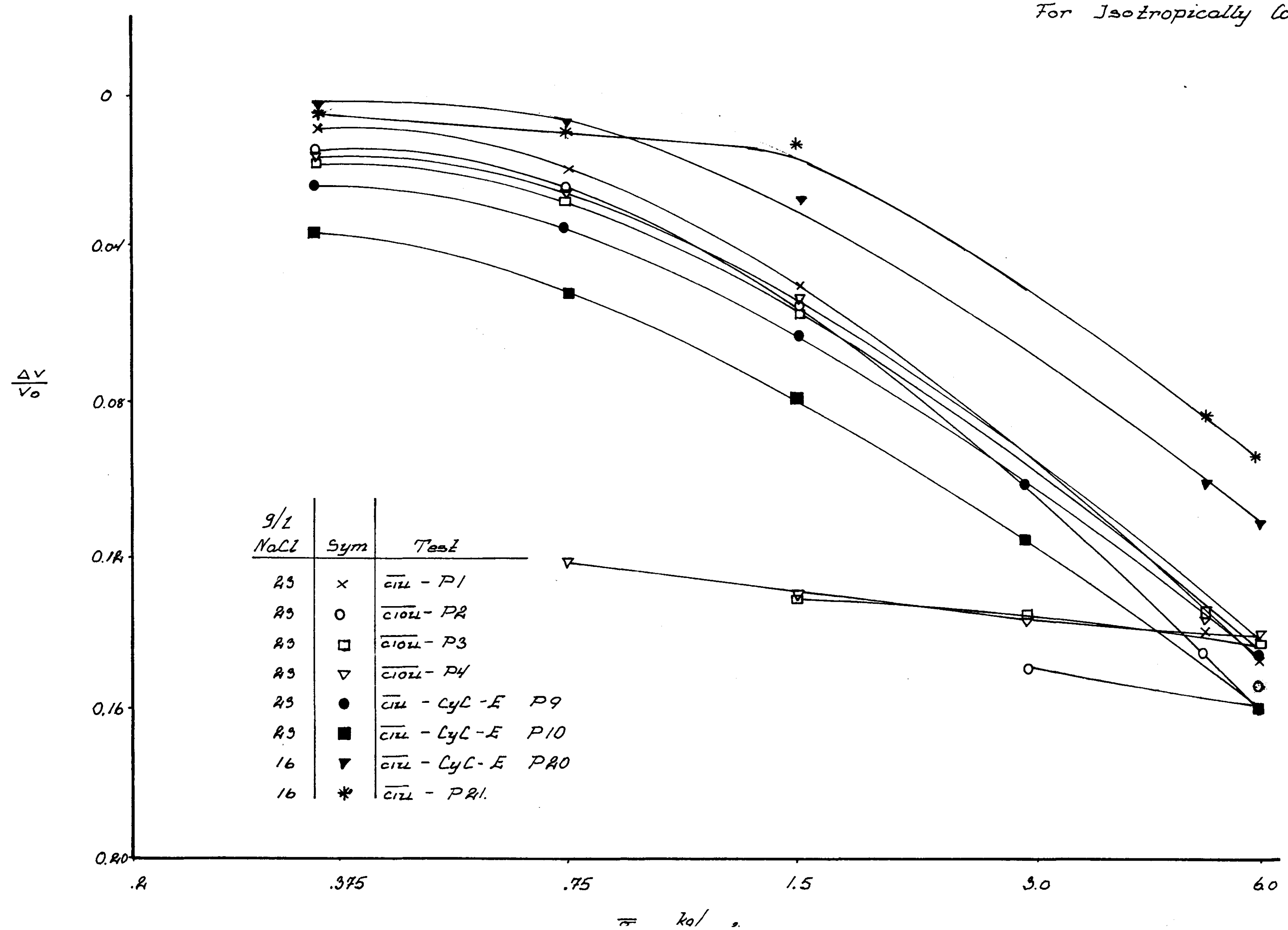


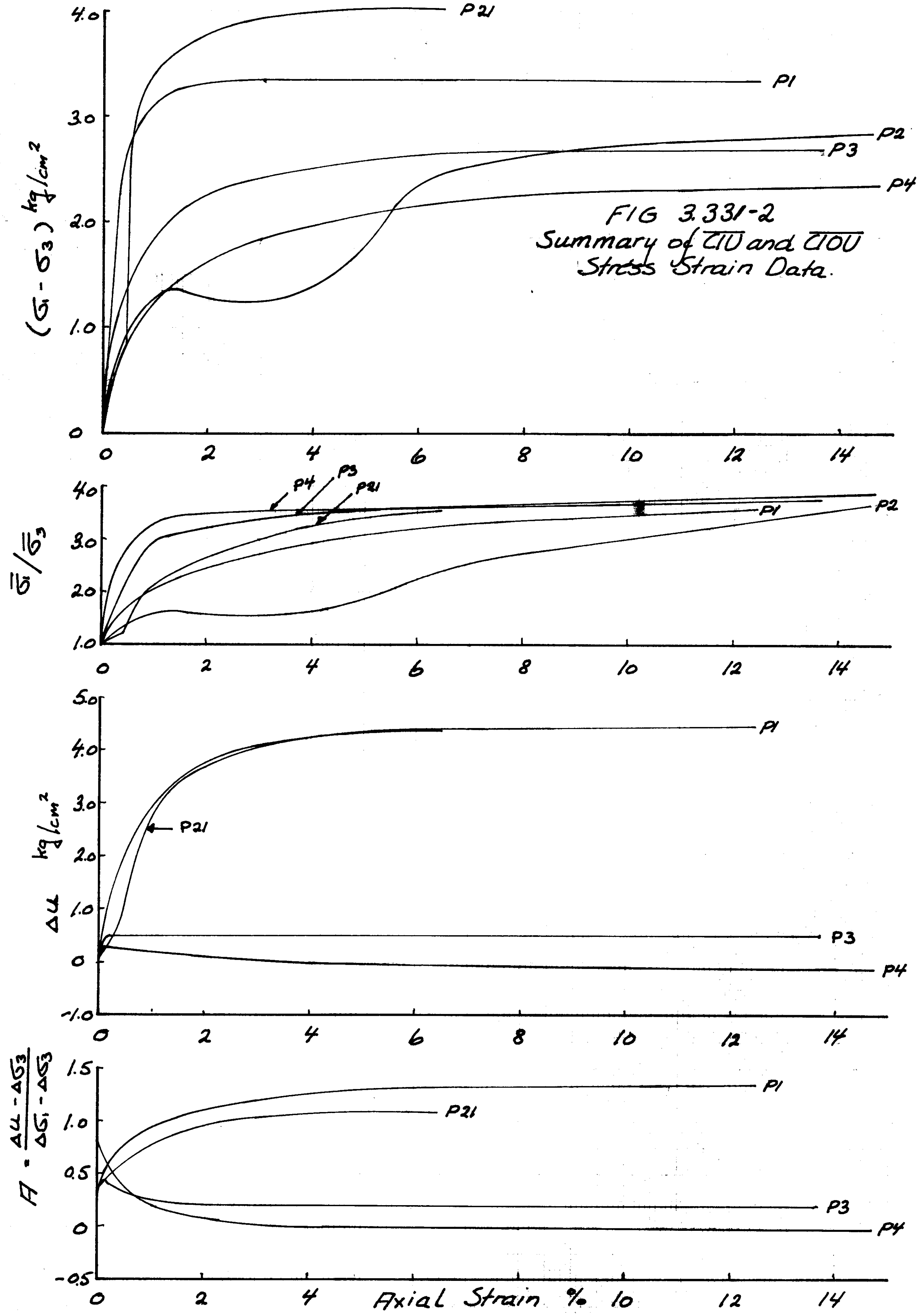
Figure 3.2.2 - 1.

Cell Modified For Measuring The Effective Stress of Saturated Cohesive Soils After Sampling.

Figure 3.331 - 1. $\Delta V/V_0$ vs log $\bar{\sigma}_c$.

For Isotropically Consolidated Samples.

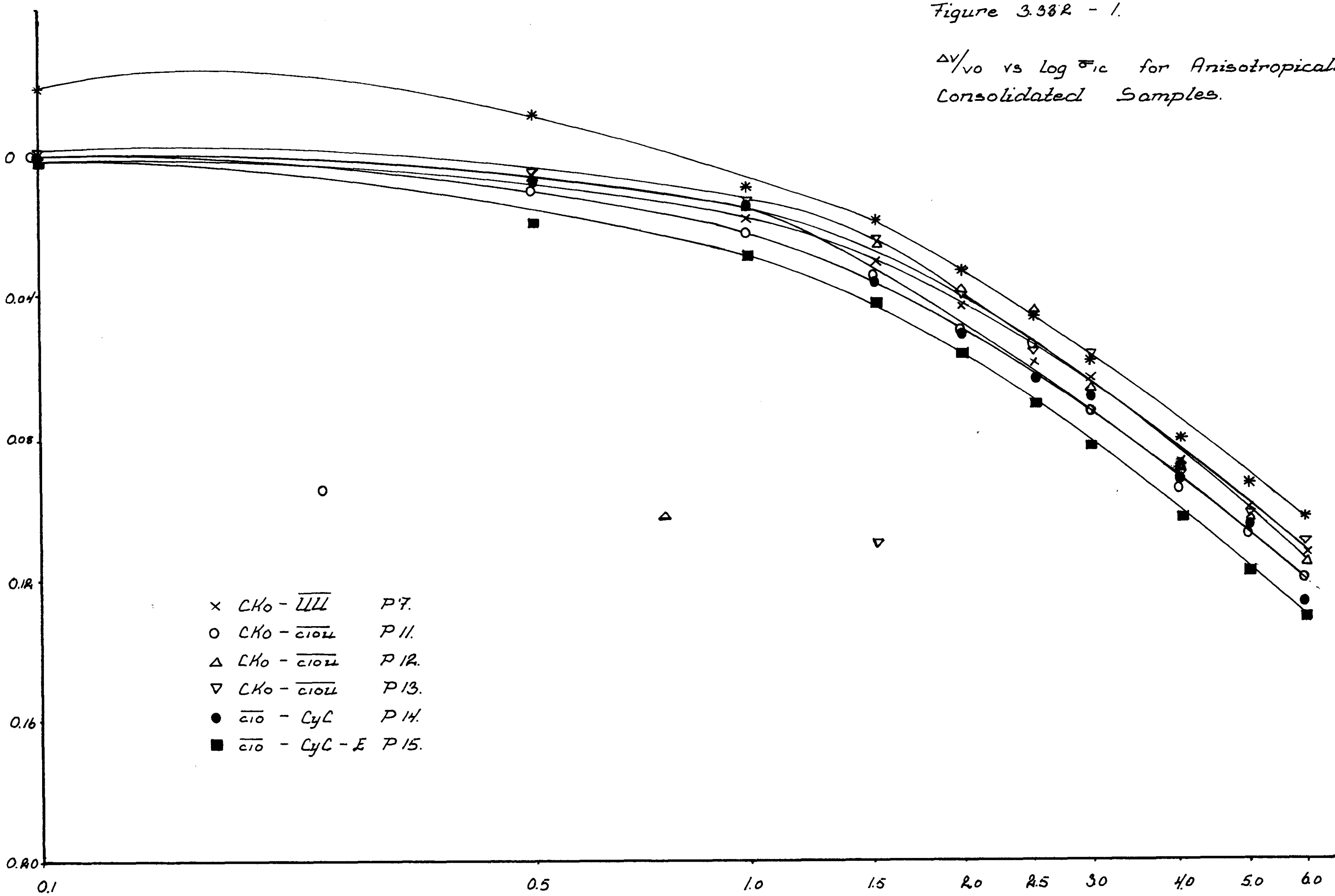




P21
P1
P2
P3
P4
FIG 3.331-2
Summary of CIU and CIOU
Stress Strain Data.
$(\sigma_1 - \sigma_3)$ kg/cm²
$\bar{\sigma}_1/\bar{\sigma}_3$
Δu kg/cm²
$A = \frac{\Delta u - \Delta\sigma_3}{\Delta\sigma_1 - \Delta\sigma_3}$
Axial Strain %

Figure 3.38R - 1.

ΔV/Vo vs Log $\bar{\sigma}_{ic}$ for Anisotropically Consolidated Samples.



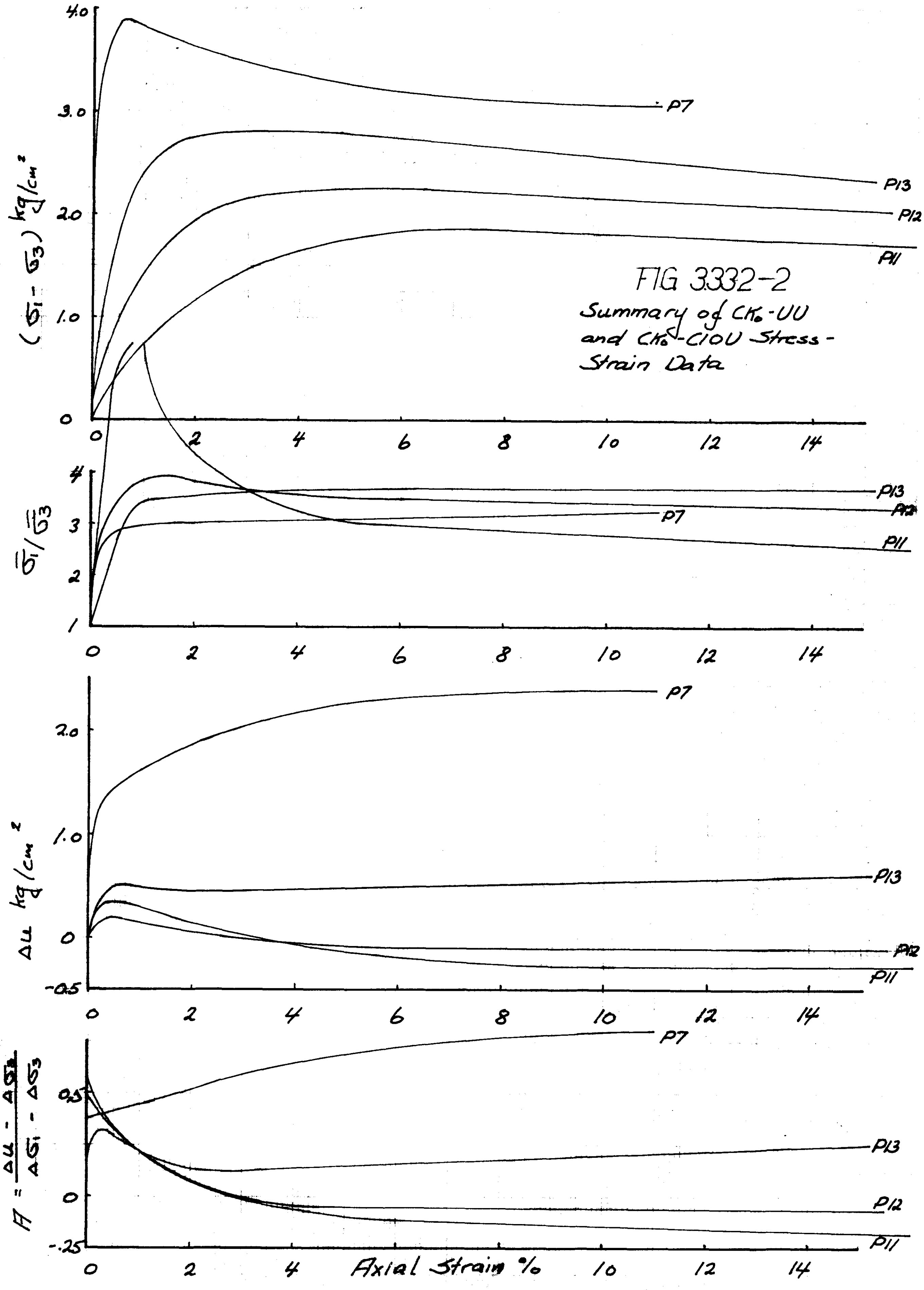


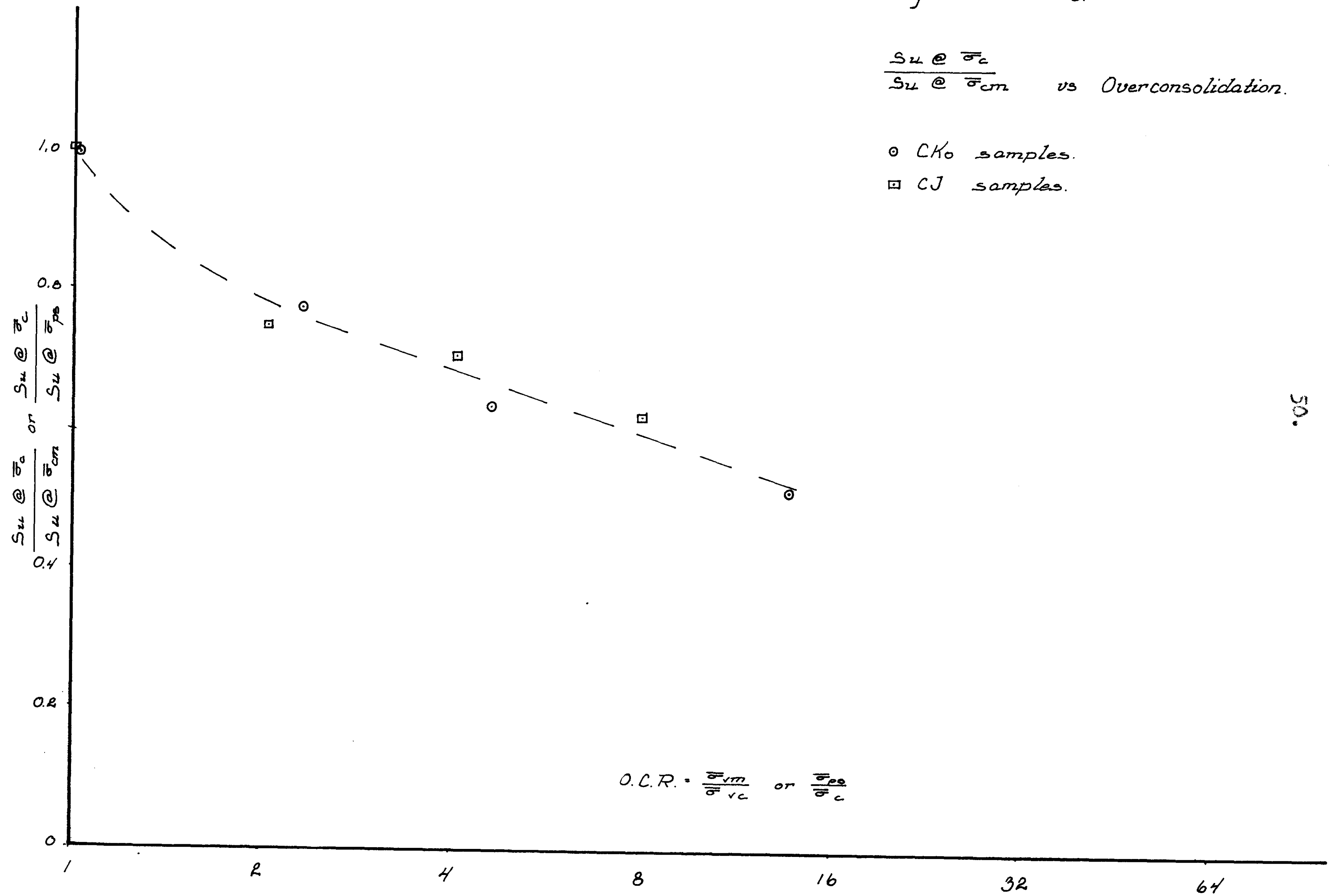
FIG 3332-2
Summary of CK_o-UU and CK_o-CIOU Stress-Strain Data

Figure 3.331 - 3.

$\frac{Su @ \bar{\sigma}_c}{Su @ \bar{\sigma}_{cm}}$ vs Overconsolidation.

⊙ CK_o samples.

⊡ CJ samples.



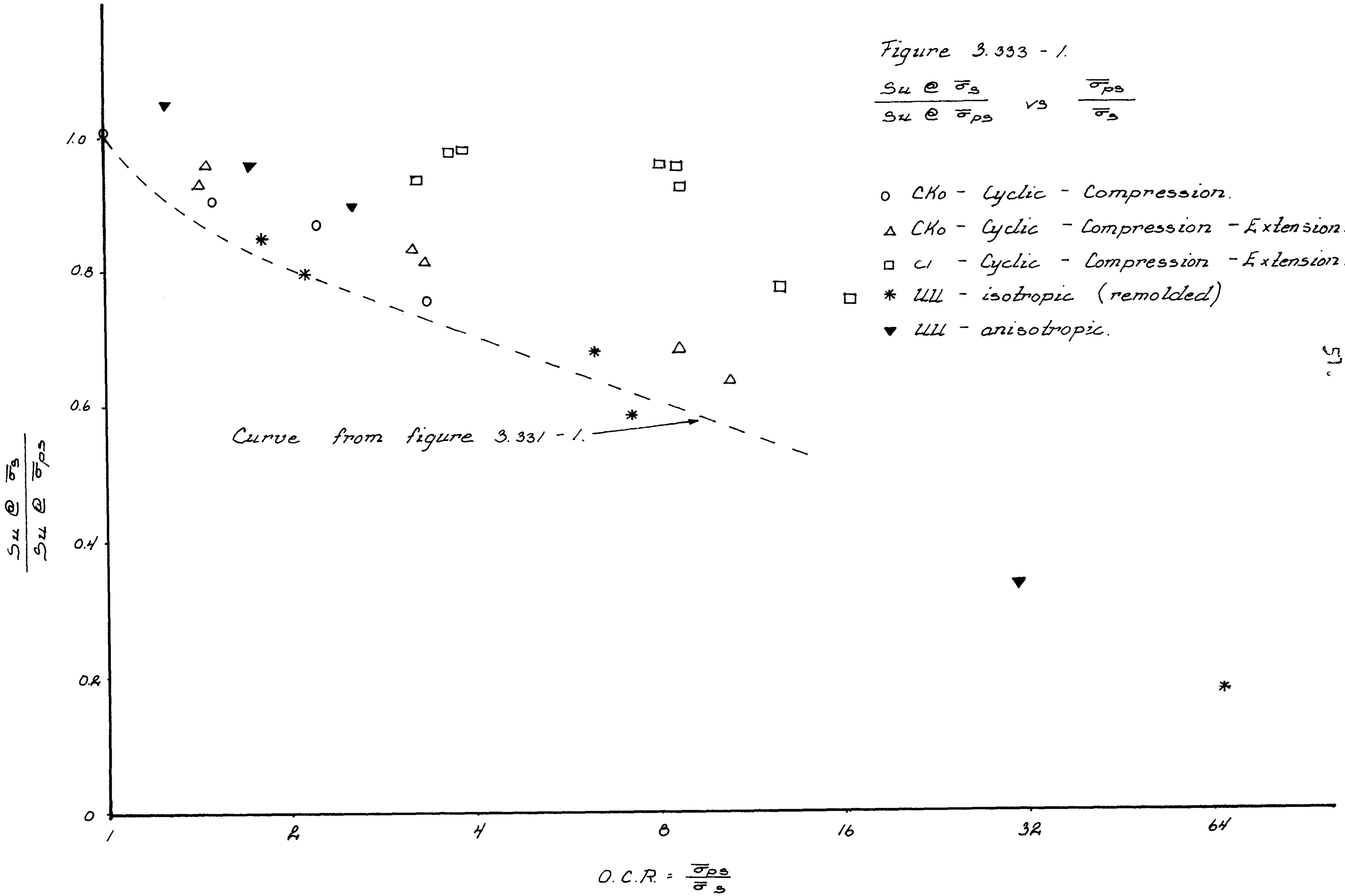
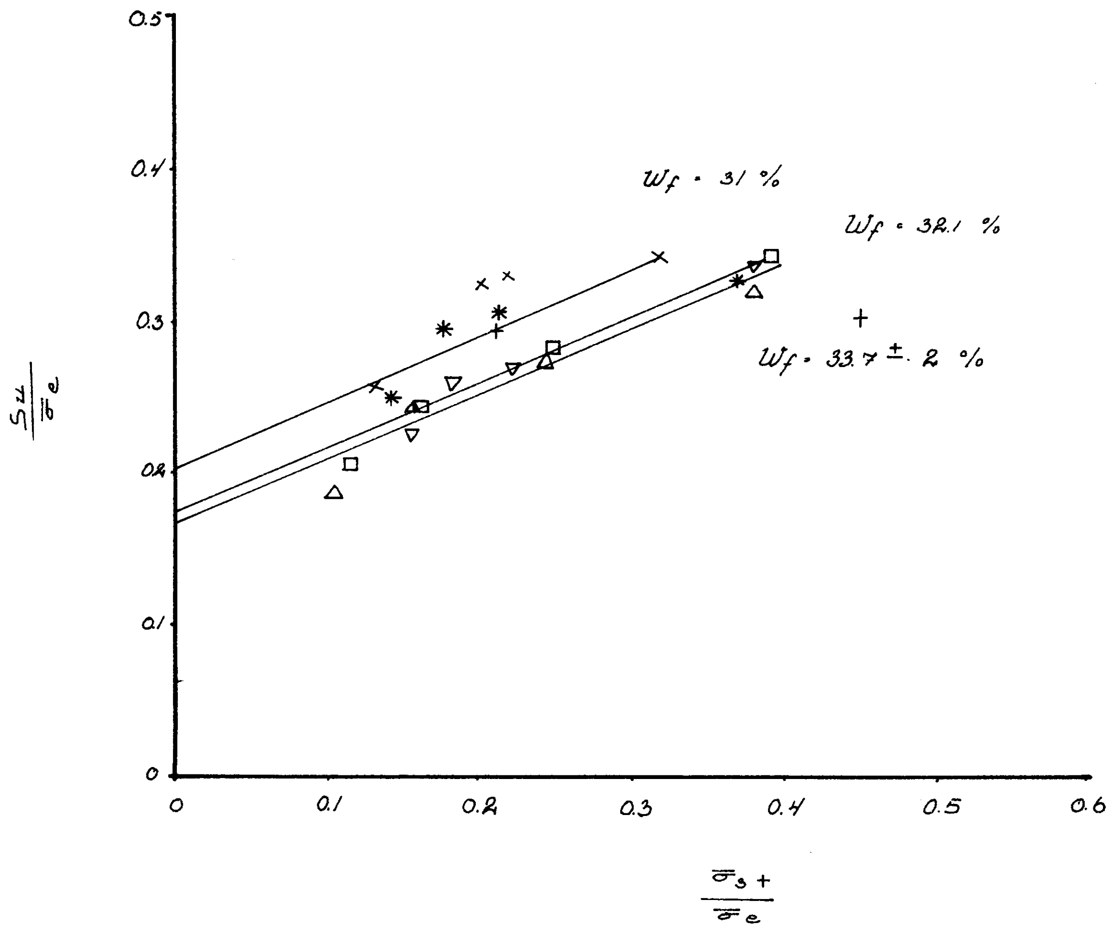


Figure 3.333 - 1.

$\frac{Su \text{ @ } \bar{\sigma}_s}{Su \text{ @ } \bar{\sigma}_{ps}}$ vs $\frac{\bar{\sigma}_{ps}}{\bar{\sigma}_s}$

Figure 3.342-1. Hvorslev's Parameters for BBC.



Hypothetical field condition

$\bar{\sigma}_1$ = 6.0 kg/cm² $\bar{\sigma}_3$ = 3.0 kg/cm² W = 33 %

Hvorslev's parameters

$\mathcal{H}$ = .170 $\bar{\theta}$ = 24°

$\bar{c}_e$ = .124 $\bar{\sigma}_e$ $\bar{\phi}_e$ = 18°

Test	No	W_f	Sym
$\overline{CIU}$ - CyC-E	P9	31.1	×
$\overline{CIU}$ - CyC-E	P10	31.1	✳
$\overline{CIU}$ - CyC-E	P20	30.7	+
$\overline{CK_oU}$ - CyC	P14	33.8	▽
$\overline{CK_oU}$-CyC - E	P15	33.5	△
$\overline{CK_oU}$-CyC - E	P16	32.1	□

Figure 3.342 - 2 $\overline{A}_f$ vs $(\overline{\sigma}_{ps} - \overline{\sigma}_3)$ for Samples Shear Cyclic.

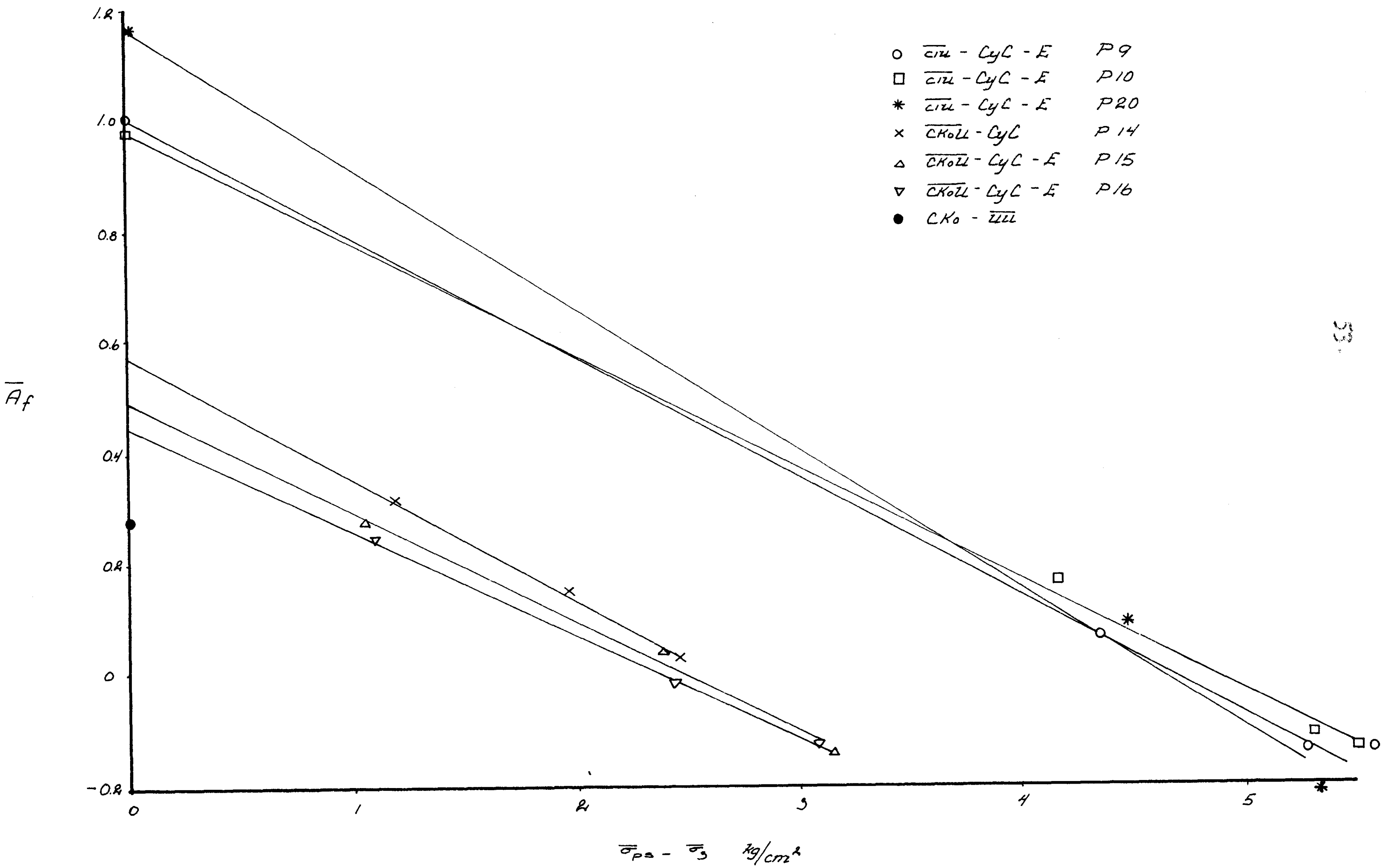
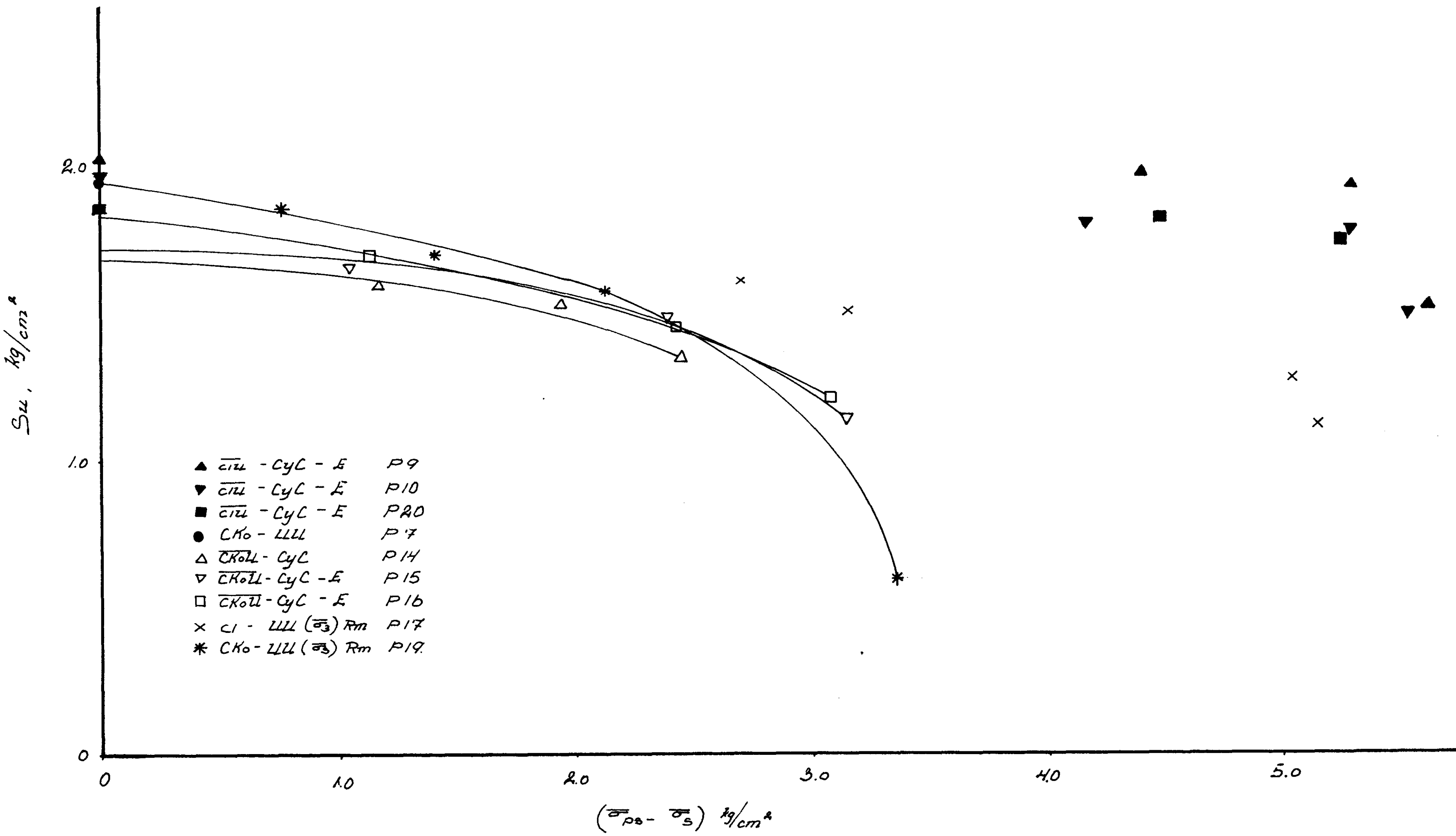


Figure 3.342 - 3. Su vs ($\bar{\sigma}_{ps} - \bar{\sigma}_s$)



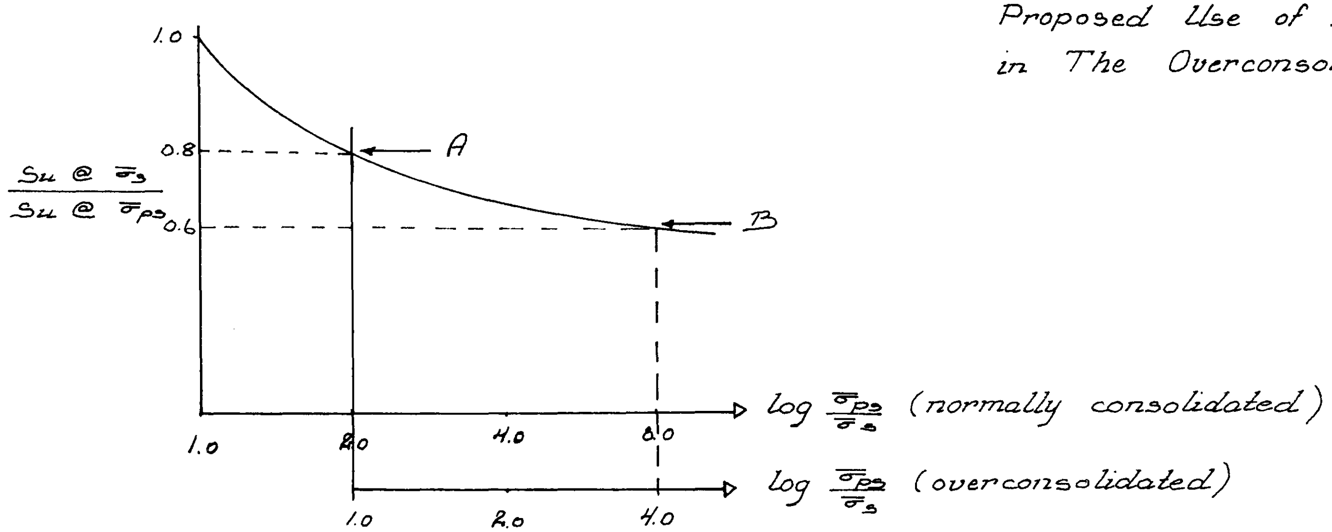


Figure 3.342 - 4.

Proposed Use of Standard Curve in The Overconsolidated Range.

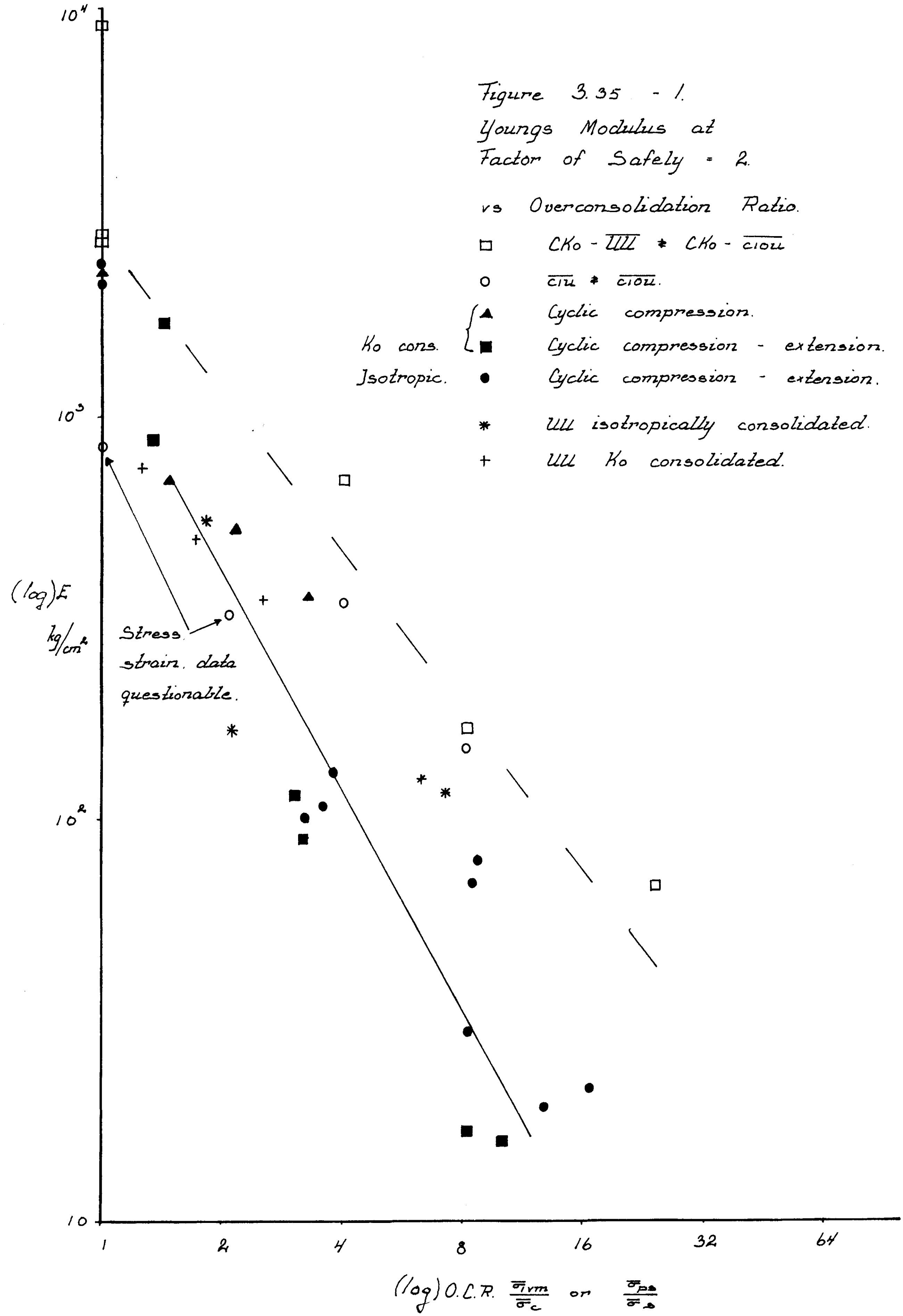


Figure 3.35 - 1.
Youngs Modulus at
Factor of Safety = 2.
vs Overconsolidation Ratio.
CKo - UU + CKo - CIOU
CIU + CIOU.
Cyclic compression.
Ko cons.
Cyclic compression - extension.
Isotropic.
Cyclic compression - extension.
UU isotropically consolidated.
UU Ko consolidated.
Stress strain data questionable.
(log)E
kg/cm²
10⁴
10³
10²
10
1
2
4
8
16
32
64
(log) O.C.R. σ̄vm/σ̄c or σ̄ps/σ̄s

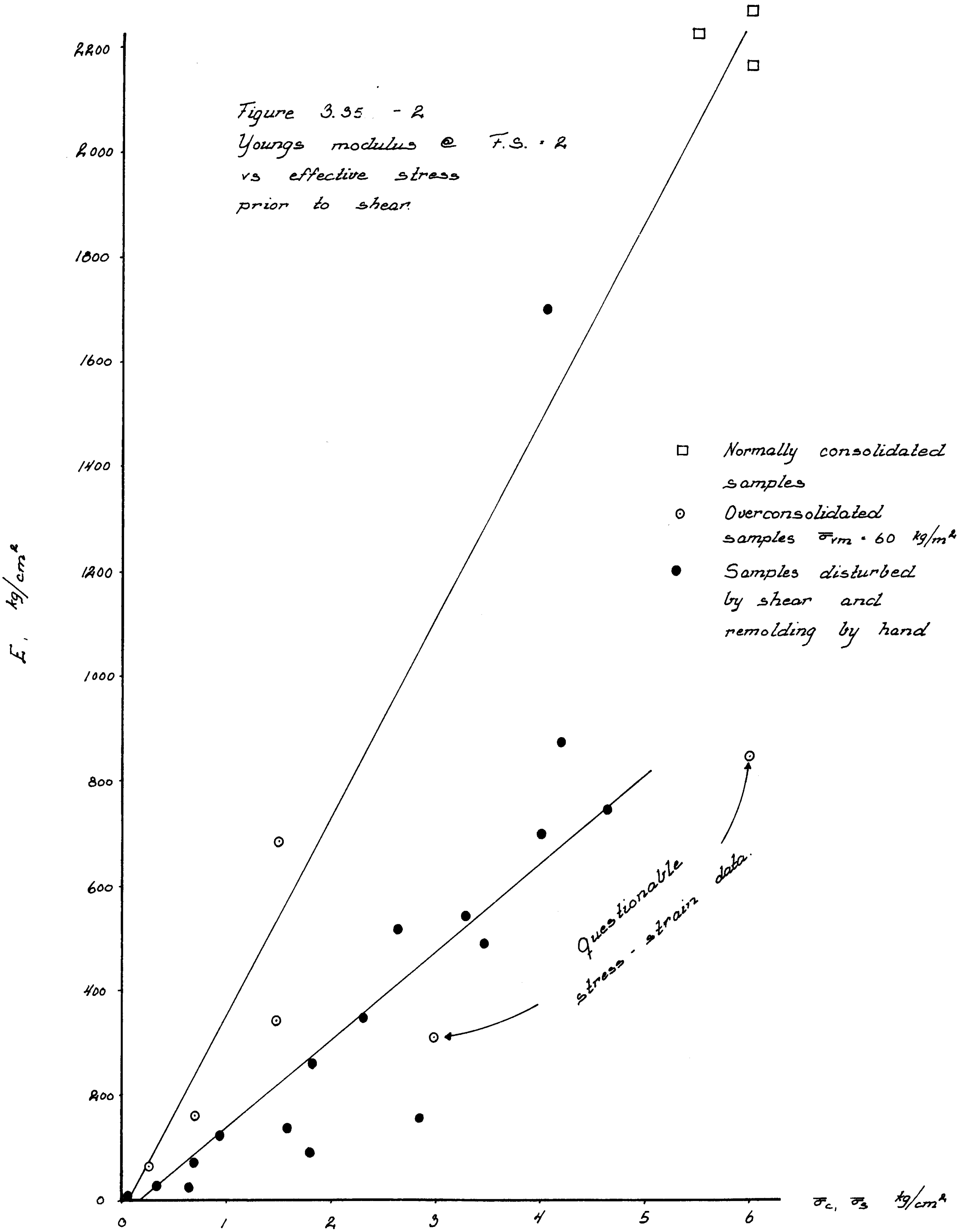
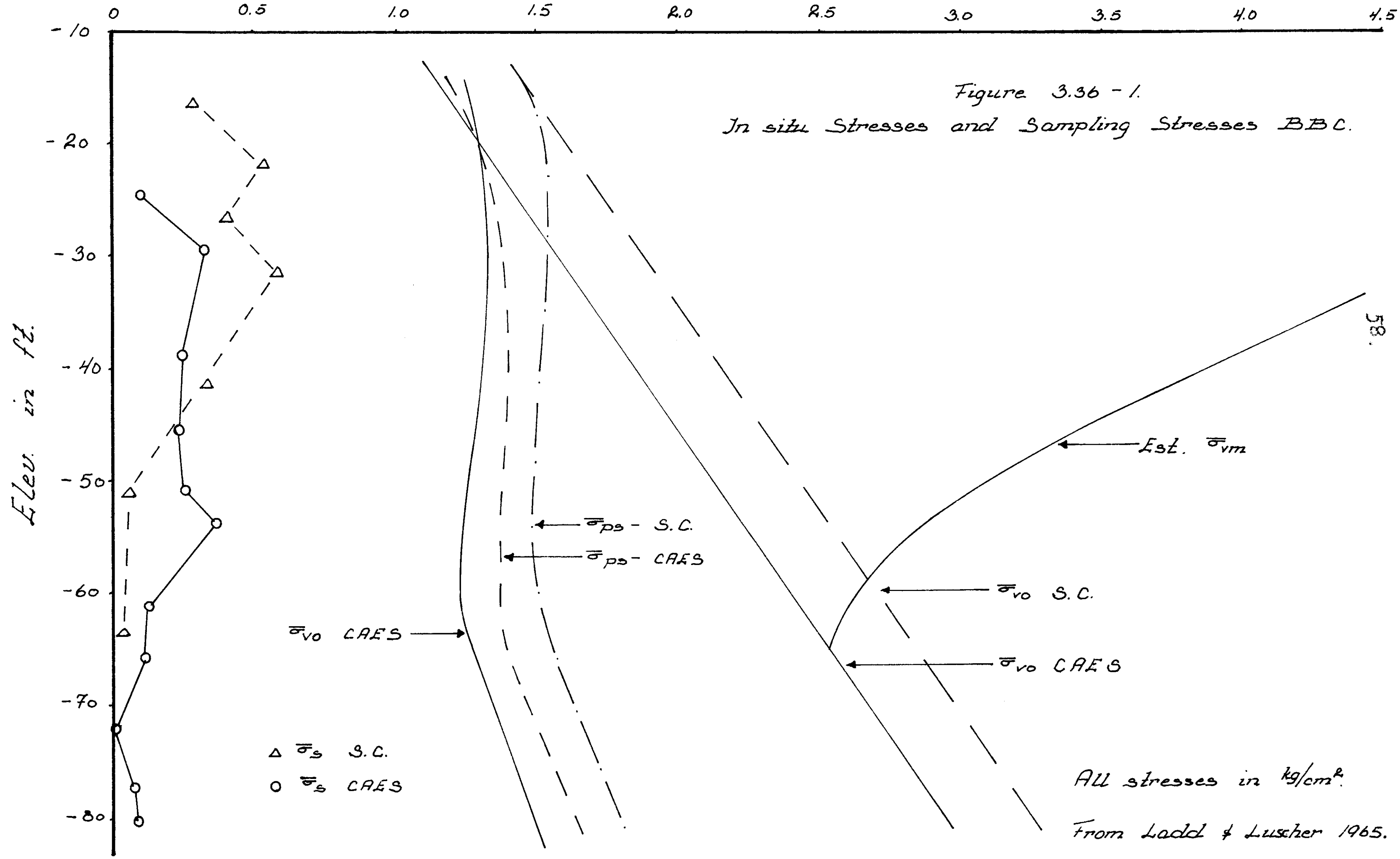


Figure 3.35 - 2
Youngs modulus @ F.S. = 2
vs effective stress
prior to shear
E, kg/cm²
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
1
2
3
4
5
6
σc, σs kg/cm²
Normally consolidated samples
Overconsolidated samples σ̄vm = 60 kg/m²
Samples disturbed by shear and remolding by hand
Questionable stress - strain data.

Figure 3.36 - 1.

In situ Stresses and Sampling Stresses BBC.

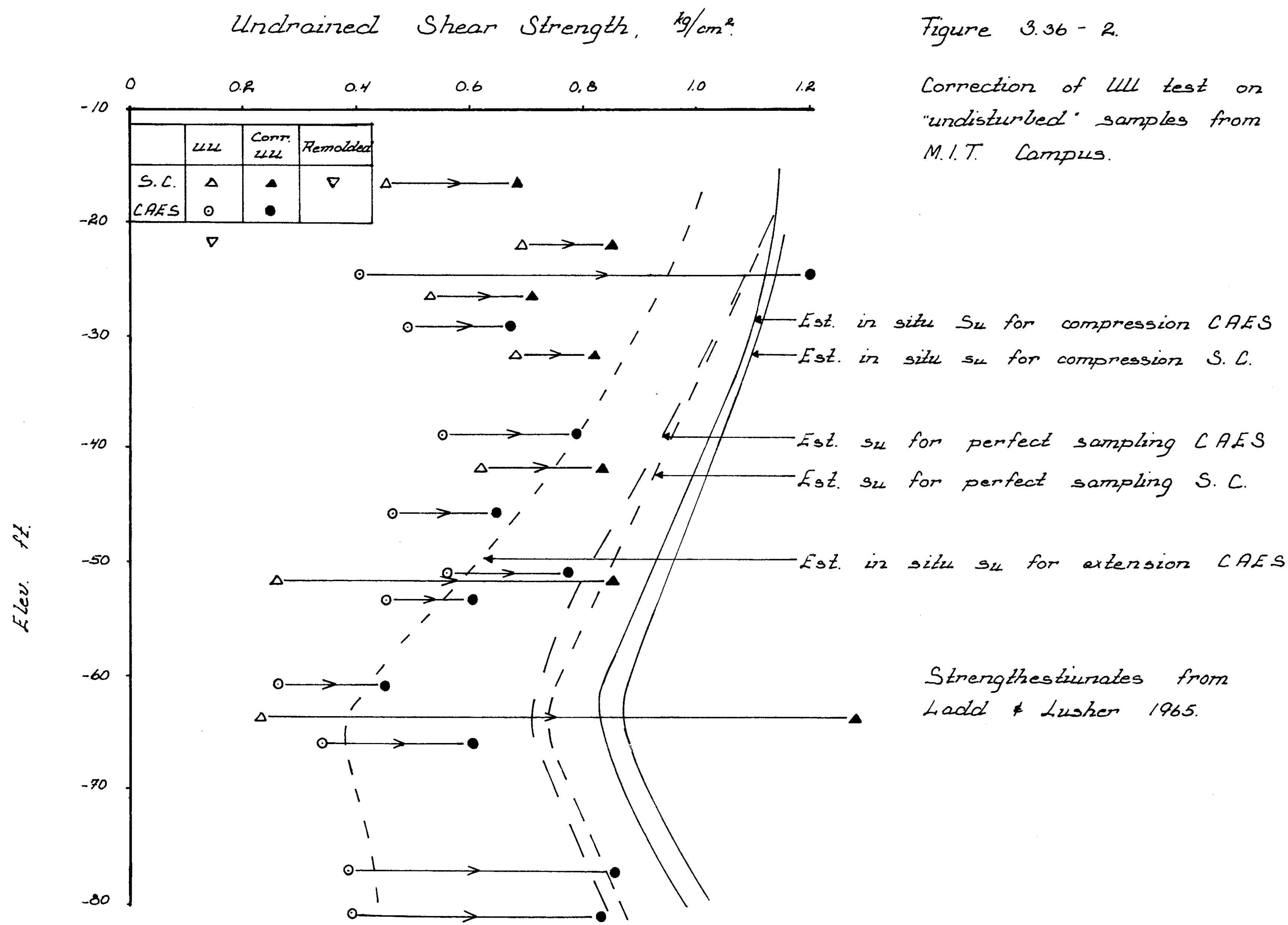


All stresses in kg/cm².

From Ladd & Luscher 1965.

Figure 3.36 - 2.

Correction of UU test on "undisturbed" samples from M.I.T. Campus.



4. Appendix

4.1 SUMMARY TABLES OF TEST RESULTS.

Table 4.1-1 Consolidation Data for Isotropically Consolidated Tests.

Test	A_c cm²	L_c cm	W_i %	W_f %	Consolidation $\bar{\sigma}_c \rightarrow$	0	.375	.75	1.5	5.1	6.0	3.0	1.5	.75	Preshear+ $\bar{\sigma}_c$	Preshear+ time min	g/l NaCl	Comments	$S_u/\bar{\sigma}_c$
$\overline{\text{C12U}}$					time in min		262	606	4477	1189	1406							short time	.282
P 1	9.30	7.41	42.0	31.6	ΔV		-.80	-.80	-2.38	-7.28	-.60				6.0	4392	23	@ .375 & .75	
$\overline{\text{C10U}}$					time in min		1270	1758	4490	1185	1399	1403							
P 2	9.29	7.66	41.2	32.0	ΔV		-1.17	-.82	-2.52	-6.18	-.67	+.43			3.0	4275	23		
$\overline{\text{C10U}}$					time in min		1263	1313	4543	1187	1404	1443	363						
P 3	9.05	7.82	41.7	32.7	ΔV		-1.29	-.83	-2.37	-6.30	-.63	+.44	+.49		1.5	2540	23		
$\overline{\text{C10U}}$					time in min		1254	1316	4470	1212	1427	1452	1857	994					
P 4	9.11	7.79	42.5	33.0	ΔV		-1.13	-.85	-2.50	-6.34	-.65	+.43	+.48	+.70	.75	1270	23		
$\overline{\text{C12U}}$ Cyc-E					time in min		1235	1529	1413	1543*	2647							$\bar{\sigma}_c$ = 3.0 kg/cm² instead of 5.1	.340
P 9	8.97	7.64	42.6	31.1	ΔV		-1.84	-.97	-2.14	-3.17	-3.64				6.01	7395	23		
$\overline{\text{C12U}}$ Cyc-E					time in min		1119	1481	1455	1537*	1198							$\bar{\sigma}_c$ = 3.0 kg/cm² instead of 5.1	.324
P 10	8.96	7.64	42.4	31.1	ΔV		-3.47	-1.35	-2.23	-2.98	-3.56				5,98	7325	23		
$\overline{\text{C12U}}$					time in min		1466	1265	5529	1612	5605								.330
P 21	9.03	7.42	38.5	30.0	ΔV		-.22	-.34	-.36	-5.50	-.72				6.06	1440	16		
$\overline{\text{C12U}}$ Cyc-E					time in min		1556	1266	5531	1614	5603								.308
P 20	9.14	7.80	38.4	29.9	ΔV		-.22	-.42	-1.56	-5.91	-.88				6.06	1412	16		

+ Time in loadingframe prior to shear

* $\bar{\sigma}_c$ = 3.0 kg/cm²

Table 4.1-2 Summary of Strength Data from Isotropically Consolidated Tests.

All stresses in kg/cm^2

Test	w_i %	w_f %	$\bar{\sigma}_{cm}$	$\bar{\sigma}_c$	OCR	At $(\bar{\sigma}_1 - \bar{\sigma}_3)_{max}$ ε %	S_u	$\bar{P}$	A	$\bar{\sigma}_1/\bar{\sigma}_3$	At $\bar{\sigma}_1/\bar{\sigma}_3$ ε %	q	$\bar{P}$	A	$\bar{\sigma}_1/\bar{\sigma}_3$	At $(\sigma_1 - \sigma_3)_{max/2}$ ε %	$\sigma_1 - \sigma_3$	E	g/l NaCl
$\overline{\text{ciu}}$ - P1	42.0	31.6	6.0	6.0	1.0	9.54	1.695	3.135	1.347	3.36	Not reached					20	1.695	847	23
$\overline{\text{ciou}}$ - P2	42.1	32.0	6.0	2.92	2.06	13.8	1.41	2.53	.667	352	Not reached					? 45	1.41	? 313	23
$\overline{\text{ciou}}$ - P3	41.7	32.7	6.0	1.48	4.06	9.08	1.33	2.30	.20	3.75	Same					.39	1.33	3.41	23
$\overline{\text{ciou}}$ - P4	42.5	33.0	6.0	.74	8.10	14.0	1.18	1.98	-.034	3.84	Same					.79	1.18	150	23
$\overline{\text{ciu}}$ - CyC - E P9	42.6	31.1	5.01	6.01	1.0	3.04	2.04	3.95	1.00	3.14	Not reached					.09	2.04	2260	23
$\overline{\text{ciu}}$ - CyC - E P10	42.4	31.1	5.98	5.98	1.0	1.78	1.94	4.14	.98	2.46	Not reached					.09	1.94	2160	23
$\overline{\text{ciu}}$ - CyC - E P20	38.4	29.9	6.06	6.06	1.0	3.60	1.865	3.56	1.17	3.20	Same					.02	1.865	9325	16
$\overline{\text{ciu}}$ - P21	38.5	30.0	6.06	6.06	1.0	4.45	2.005	3.78	1.07	3.27	Not reached					.07	2.005	2860	16

Table 4.1-3. Consolidation Data for Anistropically Consolidated Tests.

Test	w_i %	w_f %	A_c cm^2	L_c cm	Consolidation stage: $\bar{\sigma}_{1c}$ / $\bar{\sigma}_{3c}$	.10 / .10	.50 / .25	1.0 / .5	1.5 / .75	2.0 / 1.0	2.5 / 1.25	3.0 / 1.5	4 / 2	5 / 2.5	6 / 3	$\bar{\sigma}_{ps}$	1.5	.75	.25	Reshear* $\bar{\sigma}_{1cf}$	Reshear* t min	g/l NaCl
CKo-$\overline{UU}$					time in min	1146	1421	1469	1605	1311	1472	1281	1489	1418	6042							
P7	42.0	32.7	9.85	7.38	Δ V	-.16	-.61	-.74	-1.01	-.99	-1.33	-.42	-1.73	-1.17	-1.01	3.60				5.98	3080	23
CKo-$\overline{C10U}$					time in min	?	1023	4527	1334	1392	1356	1484	1433	1504	4374		1055	1510	5673			
P11	42.8	35.3	9.82	7.21	Δ V	?	-.98	-.84	-1.08	-1.13	-.35	-1.45	-1.80	-1.10	-.97	3.39	+.53	+.61	+.95	6.04	1380	23
CKo-$\overline{C10U}$					time in min	789	1690	5955	2748	5105	1352	1507	1410	1512	~152		1163	3071				
P12	42.6	34.4	9.93	7.16	Δ V	-.08	-.63	-.58	-.80	-1.01	-.65	-1.52	-1.96	-1.15	-.98	3.28	+.53	+.65		5.99	+1500	23
CKo-$\overline{C10U}$					time in min	5853	1358	1489	1427	1515	4516	1065	1490	1515	3015		2535					
P13	42.8	35.8	10.02	7.05	Δ V	-.01	-.60	-.62	-.80	-1.26	-1.23	-0.31	-2.50	-1.37	-.85	3.22	+.55					23
$\overline{CKoU}$-CyC					time in min	5876	1387	1467	1417	1516	4566	1074	1489	1523	6328							
P14	42.8	33.8	10.00	6.97	Δ V	-.07	-.72	-.49	-1.68	-1.02	-1.14	-.41	-2.46	-1.26	-.90					5.58	600	23
$\overline{CKoU}$-CyC-E					time in min	1666	4404	1090	1450	1508	1590	1472	1589	1371	1320							
P15	42.9	33.5	9.99	7.01	Δ V	+.19	-1.40	-.73	-1.13	-1.13	-1.15	-1.05	-1.58	-1.17	-1.00					5.99	1246	23
$\overline{CKoU}$-CyC-E					time in min	1695	4379	1111	1455	1512	1548	1494	1580	1271	1295							
P16	41.5	32.1	10.02	7.05	Δ V	+1.40	-.51	-1.44	-.99	-1.23	-1.03	-1.03	-1.76	-.82	-.91					5.99	1260	23

* Time in frame before testing.

Table 4.1-4. Summary of Stress - Strain Data for Anisotropically Consolidated Tests

All stresses in kg/cm^2

Test	w_i %	w_L %	$\bar{\sigma}_{1cm}$	$\bar{\sigma}_{3cm}$	$\bar{\sigma}_{1c}$	$\bar{\sigma}_{1cm}/\bar{\sigma}_{1c}$	At $(\sigma_1 - \sigma_3)$ max: ε %	S_u	$\bar{p}$	A	$\bar{\sigma}_1/\bar{\sigma}_3$	At $\bar{\sigma}_1/\bar{\sigma}_3$: ε %	q	$\bar{p}$	A	$\bar{\sigma}_1/\bar{\sigma}_3$	At $(\sigma_1 - \sigma_3)max/2$: ε	$\sigma_1 - \sigma_3$	E	g/l NaCl
CK_0 - $\overline{UU}$ P 7	42.0	32.7	6.09	3.00	5.98	1.02	.58	1.94	4.09	.22	2.80	7.67	1.57	2.86	.54	3.43	.08	1.94	2825	23
CK_0 - $\overline{CIOU}$ P 11	42.8	32.3	6.11	3.00	.25	24.4	9.76	.92	1.45	-.152	4.47	1.11	.432	.50	.225	12.4	1.35	.92	68	23
CK_0 - $\overline{CIOU}$ P 12	42.6	34.4	6.04	3.00	.75	8.05	4.48	1.13	2.00	-.05	3.59	.97	.67	1.02	.224	3.97	.69	1.13	164	23
CK_0 - $\overline{CIOU}$ P 13	42.8	36.8	5.98	3.00	1.5	4.0	2.55	1.88	2.48	.145	3.51	6.35	1.35	2.34	.189	3.76	.20	1.38	690	23
$\overline{CK_0U}$ - CyC P 14	42.8	33.8	6.00	3.00	5.49	1.09	.37	2.00	4.27	.530	2.76	.95	1.90	3.82	.898	2.98	.09	2.00	2220	23
$\overline{CK_0U}$ - CyC - E P 15	42.9	33.5	6.00	3.00	5.99	1.00	.43	1.93	4.19	.85	2.71	not	reached				.002	1.93	86500	23
$\overline{CK_0U}$ - CyC - E P 16	41.5	32.1	5.99	3.01	5.99	1.00	.35	2.00	4.33	.66	2.72	not	reached				.01	2.00	20000	23

Table 4.1-5 Summary of Isotropically Consolidated Undrained Tests Sheared in Cyclic Compression and Extension.

Test	Cycle No	W_i %	W_f %	$\bar{\sigma}_c$	$\bar{\sigma}_3$	$\bar{\sigma}_{pa}/\bar{\sigma}_3$	$(\sigma_1 - \sigma_3)$ max: ε %	Su	$\bar{P}$	A	$\bar{\sigma}_1/\bar{\sigma}_3$	$\bar{\sigma}_1/\bar{\sigma}_3$ max: ε %	q	$\bar{P}$	A	$\bar{\sigma}_1/\bar{\sigma}_3$	$(\sigma_1 - \sigma_3)$max/2: ε %	$\sigma_1-\sigma_3$	E	Su @ $\bar{\sigma}_3$ / Su @ $\bar{\sigma}_{pa}$	All stresses in kg/cm^2
$\overline{CIU}$ - CyC - E P9	1	42.6	31.1	6.00	6.00	1.00	3.04	2.04	3.95	1.00	3.14	3.04	3.04	3.95	1.00	3.14	.09	2.04	2260	1.00	23 g/l NaCl
	2				1.63	3.68	7.94	1.98	3.30	.076	4.00	3.30	1.98	3.30	.076	4.00	1.90	1.98	104	.97	
	3				.70	8.58	10.3	1.94	3.16	-.132	4.18	3.38	1.19	1.81	-.031	4.82	2.82	1.94	69	.95	
	4				.36	16.7	12.5	1.52	2.31	-.135	4.83	5.0	.34	.48	.35	5.92	7.30	1.52	21	.75	
$\overline{CIU}$ - CyC - E P10	1	42.4	31.1	5.98	5.98	1.00	1.78	1.94	4.14	.98	2.76	1.78	1.94	4.17	.97	2.76	.09	1.94	2160	1.00	23 g/l NaCl
	2				1.84	3.25	8.27	1.80	3.08	0.17	3.82	4.7	1.70	3.02	.20	3.85	1.80	1.80	100	.93	
	3				.69	8.68	9.3	1.78	2.84	-.100	4.35	4.85	1.20	1.87	.02	4.58	2.31	1.78	78	.92	
	4				.47	12.7	13.0	1.49	2.85	-.13	4.47	9.0	.93	1.40	0	4.96	7.85	1.49	19	.77	
$\overline{CIU}$ - CyC - E P20	1	38.4	30.7	6.06	6.06	1.00	3.60	1.865	3.56	1.17	3.20	3.60	1.865	3.56	1.17	3.20	.02	1.865	9325	1.00	16 g/l NaCl
	2				1.51	3.86	6.79	1.82	3.13	.099	3.78	3.47	1.52	2.57	.171	3.90	1.4	1.82	130	.91	
	3				.75	8.09	10.8	1.775	3.055	-.208	3.78	7.10	1.51	2.46	-.136	4.18	6.2	1.775	29	.95	

Table 4.1-6. Summary of K_o-consolidated Undrained Test Sheared in Cyclic Compression. All stresses in kg/cm^2

Test	Cycle No	w_i %	w_f %	$\bar{\sigma}_{1c}$	$\bar{\sigma}_3$	$\bar{\sigma}_{ps}/\bar{\sigma}_3$	$(\sigma_1-\sigma_3)$ kg/cm^2: ε %	Su	$\bar{p}$	A	$\bar{\sigma}_1/\bar{\sigma}_3$	$\bar{\sigma}_1/\bar{\sigma}_3$ max: ε %	q	$\bar{p}$	A	$\bar{\sigma}_1/\bar{\sigma}_3$	$(\sigma_1-\sigma_3)max/2$: ε %	$\sigma_1-\sigma_3$	E	$\frac{Su @ \bar{\sigma}_3}{Su @ \bar{\sigma}_{ps}}$
$\overline{CK_oUU}$ - CyC - E P14	1	42.8	33.8	6.49			.37	2.00	4.27	.530	2.76	.95	1.90	3.82	.898	2.98	0.09	2.00	2220	1.13
	2				2.30	1.51	2.34	1.60	2.93	.313	2.41		not reached				.23	1.60	695	.903
	3				1.55	2.25	3.28	1.54	2.63	.147	3.62		same				.30	1.64	513	.870
	4				1.03	3.38	4.34	1.35	2.28	.033	3.92	1.79	1.14	1.84	.140	4.25	.52	1.35	260	.762

$\bar{\sigma}_{ps}$ - 3.48 kg/cm^2

All stresses in kg/cm^2

23 g/l NaCl

Table 4.1 - 7. Summary of K_o- consolidated Undrained Tests Sheared in Cyclic Compression and Extension.

Test	Cycle No	w_i %	w_f %	$\bar{\sigma}_{1c}$	$\bar{\sigma}_3$	$\bar{\sigma}_{pe}/\bar{\sigma}_3$	$(\sigma_1 - \sigma_3)$ max: ε %	Su	$\bar{p}$	A	$\bar{\sigma}_1/\bar{\sigma}_3$	$\bar{\sigma}_1/\bar{\sigma}_3$ max: ε %	q	$\bar{p}$	A	$\bar{\sigma}_1/\bar{\sigma}_3$	$(\sigma_1 - \sigma_3)$max/2: ε %	$\sigma_1 - \sigma_3$	E	Su @ $\bar{\sigma}_3$ / Su @ $\bar{\sigma}_{pe}$	
$\overline{CK_oU}$ - CyC - E P15	1	42.9	33.5	5.99			1.43	1.93	4.19	.86	2.71	not reached					.002	1.93	86500	1.09	23 9/2 NaCl
	2				2.42	1.44	1.46	1.65	3.11	.28	3.25	3.01	1.63	2.91	.337	3.54	.19	1.65	869	.932	
	3				1.08	3.22	6.24	1.47	2.43	.041	4.05	same					1.30	1.47	113	.836	
	4				.33	10.5	13.4	1.13	1.76	-.133	4.64	11.4	1.04	1.53	-.082	5.25	7.35	1.13	15.4	.638	
$\overline{CK_oU}$ - CyC - E P16	1	41.5	32.1	5.99			.35	2.00	4.83	.066	2.72	not reached					.01	2.00	20000	1.13	23 9/2 NaCl
	2				2.34	1.49	1.25	1.70	3.20	.24	3.26	not reached					.10	1.70	1700	.960	
	3				1.05	3.32	6.96	1.45	2.42	-.017	3.99	4.0	1.38	2.25	0.02	4.05	1.65	1.45	88	.819	
	4				.40	8.70	13.3	1.21	1.88	-.128	4.62	7.80	0.68	0.97	.051	5.69	7.20	1.21	16.8	.684	

$\bar{\sigma}_{pe}$ = 3.48 kg/cm^2 All stresses in kg/cm^2

Table No 4.1 - 8. Summary of Normally Consolidated UU Tests.

$\bar{\sigma}_s$ measured after each cycle.

All stresses in kg/cm^2

Test	Cycle No	$\bar{\sigma}_{1c}$	$\bar{\sigma}_{3c}$	S_u	ε_f	$\bar{\sigma}_s$	$\bar{\sigma}_{ps}$	$\frac{\bar{\sigma}_{ps}}{\bar{\sigma}_s}$	$\frac{S_u @ \bar{\sigma}_s}{S_u @ \bar{\sigma}_{ps}}$	$E @ \frac{(\sigma_1 - \sigma_3)_f}{2}$	Type of disturbance
C1 - UU ($\bar{\sigma}_s$) Rm P 17 23 g/l NaCl	1	6.00	6.00	1.61	4.72	3.30	6.00	1.82	.848	540	Removed from cell and mounted in $\bar{\sigma}_s$ cell.
	2			1.51	6.40	2.82		2.13	.795	156	Shear
	3			1.29	6.33	.96		6.35	.680	122	Shear
	4			1.11	6.75	.85		7.07	.585	117	Shear
	5			.34	14.8	.09		66.7	.179	6.0	Remolded by hand
CK_0 - UU ($\bar{\sigma}_s$) Rm P 19 16 g/l NaCl	1	5.92	3.00	1.85	1.82	2.70	3.48	1.29	1.045	740	Removed from consolidation cell to $\bar{\sigma}_s$ cell.
	2			1.68	3.12	2.03		1.71	.95	488	Shear
	3			1.57	7.55	1.35		2.58	.888	349	Shear
	4			.59	?	.11		30	.333		Remolded by hand

K_0 : $S_u @ \bar{\sigma}_{ps} = 1.77\ kg/cm^2$

$K = 1$ $S_u @ \bar{\sigma}_{ps} = 1.90\ kg/cm^2$

Table 4.1 - 9. Summary of UU Tests on "Undisturbed" Samples of BBC from Student Center, M.I.T. Campus.

All stresses in kg/cm^2

Sample No	Depth ft	Elev ft	$\bar{\sigma}_{vo}$	Est $\bar{\sigma}_{ps}$	$\bar{\sigma}_s$	W_f %	ε_f %	S_u	E at F = 2	$\bar{\sigma}_c$	Est $\bar{\sigma}_{cm}$	O.C.R.	$\frac{\bar{\sigma}_{ps}}{\bar{\sigma}_s}$	O.C.R. $\cdot \frac{\bar{\sigma}_{ps}}{\bar{\sigma}_s}$	$\frac{S_u @ \bar{\sigma}_s}{S_u @ \bar{\sigma}_{ps}}$	$\frac{S_u @ \bar{\sigma}_c}{S_u @ \bar{\sigma}_{cm}}$	Corr factor	S_u corr.
UU - 1	39.0	-16.5	1.52	1.49	0.28	37.4	~ 8	0.45		2.96	5.8	3.8	5.32	20.2	.47	.71	1.51	.68
UU - 2	44.5	-22.0	1.66	1.54	0.53	38.1	2.9	(.145) 0.69		2.94	5.3	3.2	2.85	9.1	.59	.73	1.24	.85
UU - 3	49.0	-26.5	1.78	1.54	0.40	36.1	2.7	0.53		2.90	5.0	2.81	3.86	10.8	.56	.75	1.34	.71
UU - 4	54.0	-31.5	1.91	1.54	0.59	35.8	4.1	(.096) 0.68		2.98	4.6	2.4	2.61	6.3	.64	.77	1.20	.82
UU - 6	64.0	-41.5	2.20	1.51	0.33	36.1	1.6	(.061) 0.62		2.96	3.7	1.7	4.57	7.8	.61	.82	1.34	.83
UU - 8	74.0	-51.5	2.46	1.50	0.05	39.5	9.6	0.26		3.02	3.0	1.2	30	36	.28	.92	3.28	.85
UU - 10	86.0	-63.5	2.80	1.53	0.02	27.0	~15	0.23		2.97	2.8	1.0	76.5	76.5	.18	1.00	5.56	1.28

Remolded values in ( )

Table 4.1-10. Summary of UU Tests on "Undisturbed" Samples of BBC from Center for Advanced Engineering Studies, M.I.T. Campus.

All stresses in kg/cm^2

Sample No	Depth ft	Elev. ft	$\bar{\sigma}_{vo}$	Est $\bar{\sigma}_{ps}$	$\bar{\sigma}_3$	w_f %	ε_f %	S_u	E at F=2	$\bar{\sigma}_c$	Est $\bar{\sigma}_{om}$	O.C.R.	$\bar{\sigma}_{ps}/\bar{\sigma}_3$	O.C.R. × $\bar{\sigma}_{ps}/\bar{\sigma}_3$	S_u @ $\bar{\sigma}_3$ / S_u @ $\bar{\sigma}_{ps}$	S_u @ $\bar{\sigma}_c$ / S_u @ $\bar{\sigma}_{om}$	Corr. factor	S_u corr.
U7-16	45.5	-24.5	1.43	1.35	.10	36.4	8.0	.40		1.0	5.2	3.6	13.5	48.6	.24	.72	3.0	1.20
U7-2	50.0	-29.0	1.55	1.38	.33	39.5	12.2	.49		1.0	4.7	3.1	4.2	13.0	.54	.74	1.37	.67
U7-3	59.5	-38.5	1.82	1.41	.25	38.7	8.3	.55		1.0	3.6	2.0	5.6	11.2	.56	.80	1.43	.79
U7-4	66.5	-45.5	2.00	1.40	.24	33.9	9.2	.46		1.0	3.4	1.7	5.8	9.9	.58	.82	1.42	.65
U7-5	74.3	-53.3	2.20	1.37	.37	49.8	1.9	.45		1.0	2.9	1.3	3.7	4.8	.67	.89	1.33	.60
U7-6d	93.0	-72.0	2.73	1.50	~ 0	35.3	~15	.13		1.0	2.7	1.0	—	—	—	—	—	—
U7-7	98.0	-77.0	2.88	1.58	.07	29.6	18.0	.39		1.0	2.9	1.0	22.6	22.6	.46	1.00	2.18	.85
U10-13	71.5	-50.8	2.14	1.38	.27	38.6	8.0	.56		1.5	3.1	1.5	5.1	7.7	.62	.85	1.37	.77
U10-15	81.5	-60.8	2.40	1.36	.13	42.8	14.7	.26		1.5	2.6	1.1	10.5	11.5	.55	.95	1.73	.45
U10-16	86.5	-65.8	2.54	1.40	.12	36.7	9.5	.34		1.5	2.5	1.0	11.7	11.7	.55	1.00	1.82	.62
U10-19	101.5	-80.8	2.96	1.64	.08	—	11.1	0.39		1.0	3.0	1.0	20.5	20.5	.47	1.00	2.13	.83

Table 4.1 - 11.

Summary of Strength Data from Anisotropically Overconsolidated UU Tests.

Test	Cycle No	W_i	W_f	$\bar{\sigma}_{1cm}$	$\bar{\sigma}_{1c}$	O.C.R.	$\bar{\sigma}_s$	$\bar{\sigma}_{ps}$	$\frac{\bar{\sigma}_{ps}}{\bar{\sigma}_s}$	O.C.R. $\frac{\bar{\sigma}_{ps}}{\bar{\sigma}_s}$	ε_f %	Su	$\frac{Su @ \bar{\sigma}_s}{Su @ \bar{\sigma}_{ps}}$	Disturbance
CK_o - UU ($\bar{\sigma}_s$) Rm - P22 16 g/l NaCl.	1	39.8	32.8	6.00	3.00	2.00	2.07	2.27	1.1	2.2	2.10	1.750	.988	Shear
	2						1.63		1.4	2.8	3.56	1.614	.923	Shear
	3						1.09		2.1	4.2	5.54	1.49	.842	Shear
	4						.85		2.86	5.36	5.49	1.375	.776	Shear

Normally consolidated Su @ $\bar{\sigma}_{ps}$ = 1.77 kg/cm^2

4.2 $\overline{p}$-q PLOTTS.

FIG 4.2-1 Effektive Stress Paths $\overline{ciu}$ - $\overline{ciou}$ Tests on BBC.

Test	Sym	W_l
$\overline{ciu}$ - P1	o	31.6
$\overline{ciou}$ - P2	△	32.0
$\overline{ciou}$ - P3	◻	32.7
$\overline{ciou}$ - P4	×	33.0
$\overline{ciu}$ - P21	•	30.0

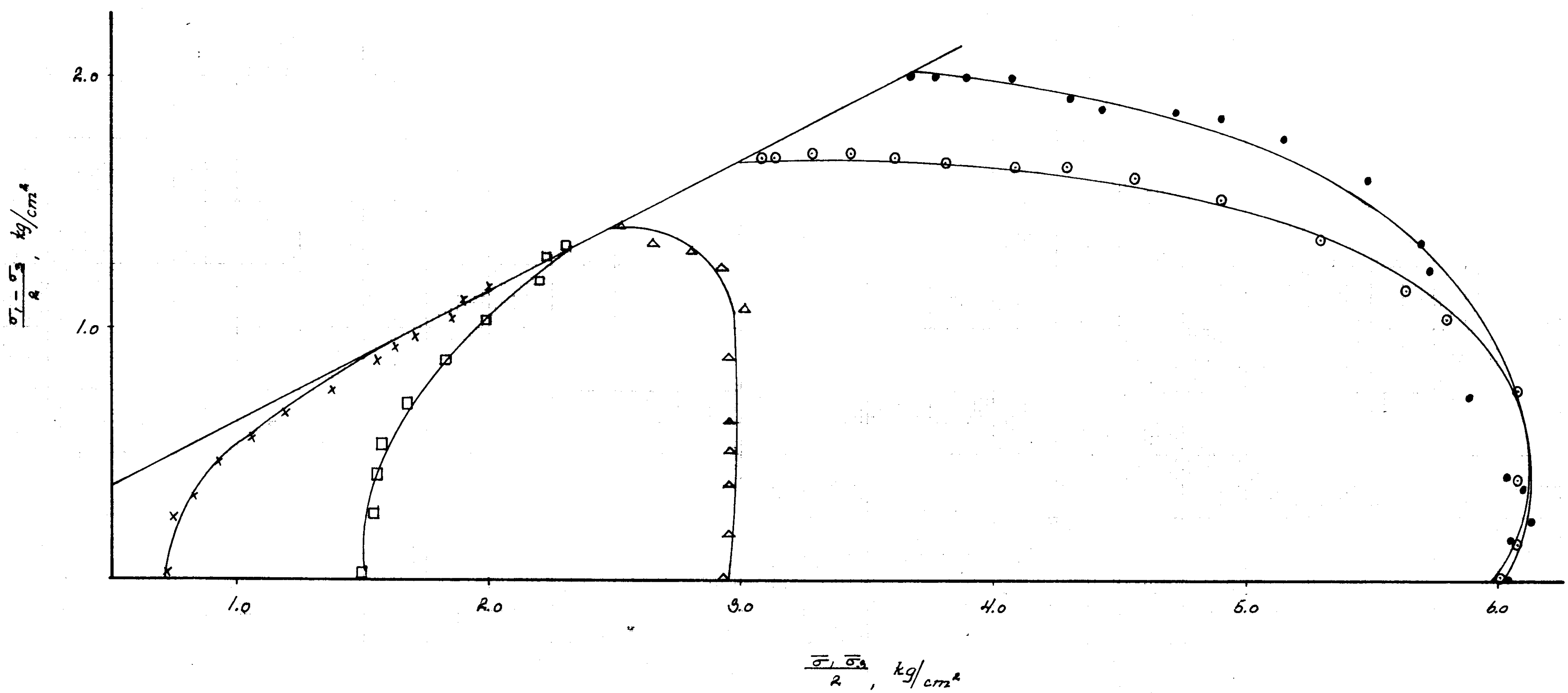


Figure 4.2 - 2

Effective Stress Paths For Anisotropic Tests On B.B.C.

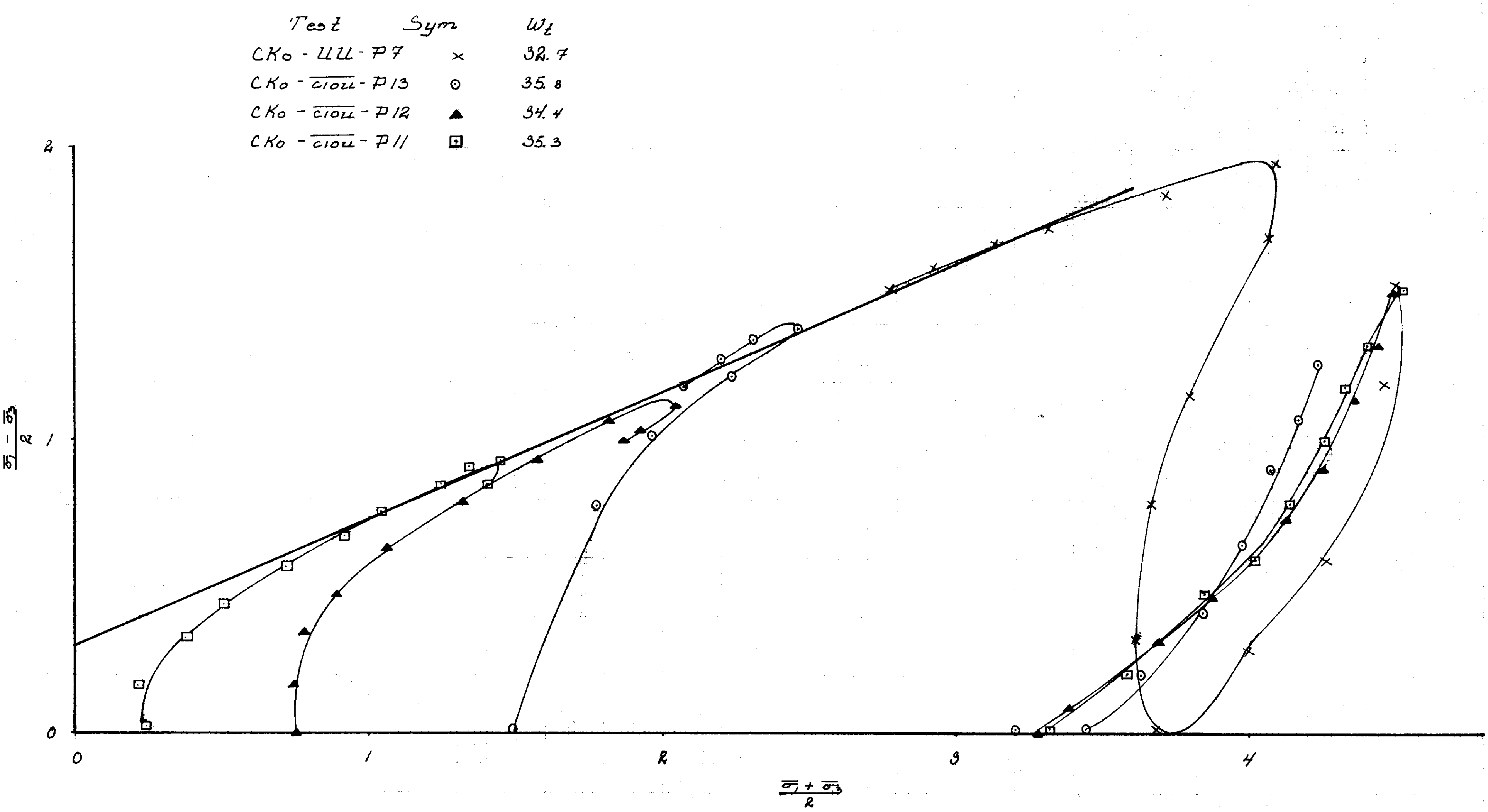


Figure 4.2 - 3

$\bar{P}$ - Q plott for $\overline{CIU}$ - CyE - C P9

$\bar{\sigma}_c$ = 6.00 kg/cm². W_f = 31.1 %. 23 g/L NaCl.

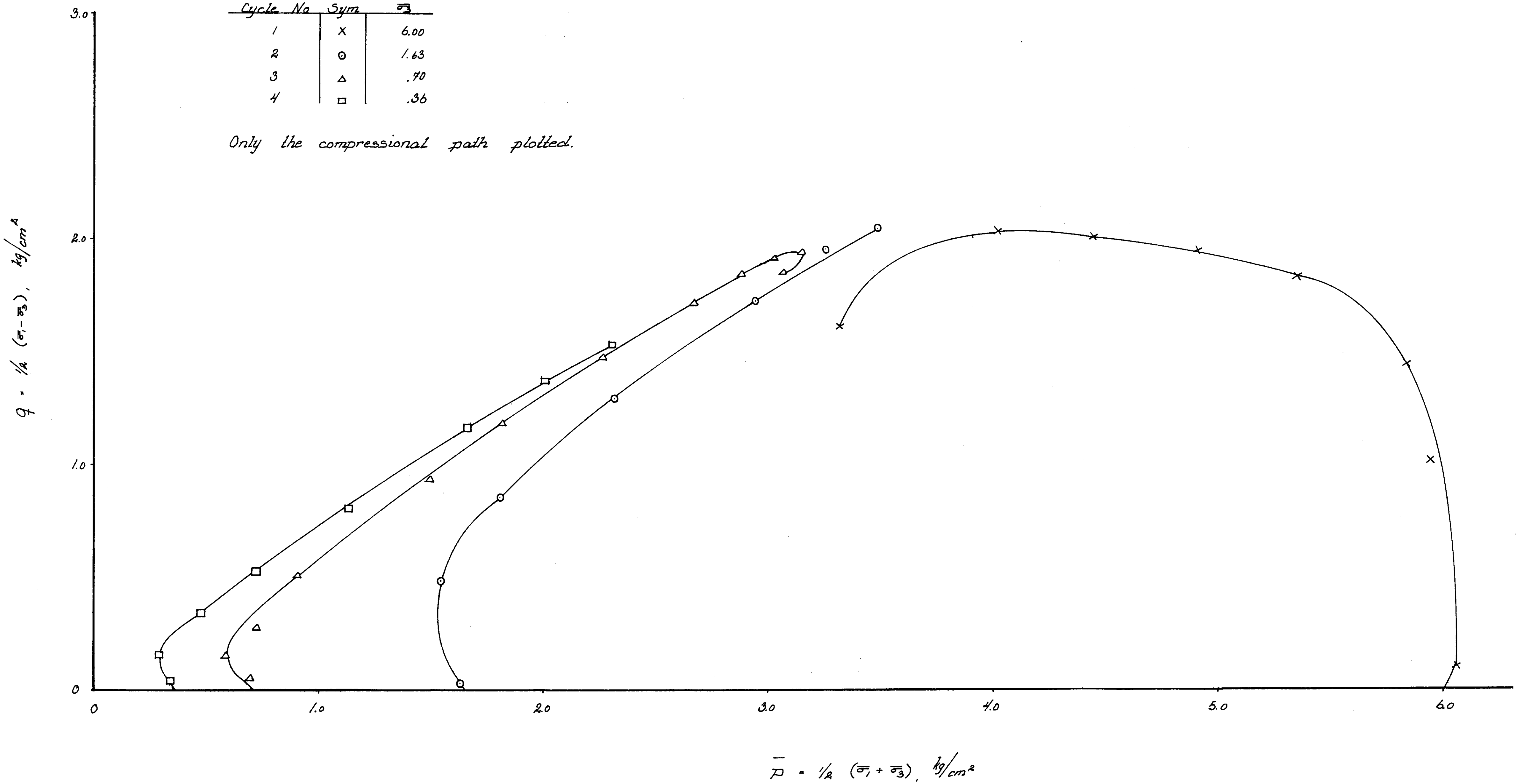


Figure 4.2 - 4.

$\bar{p}$ - q plot for $\overline{ciu}$ - CyC - E. P 10

$\bar{\sigma}_c$ = 5.98 kg/cm². W_f = 31.1 %. 23 g/l NaCL.

Cycle No	Sym	$\bar{\sigma}_3$
1	×	5.98
2	⊙	1.84
3	△	.69
4	□	.47

Only the compressional path plotted.

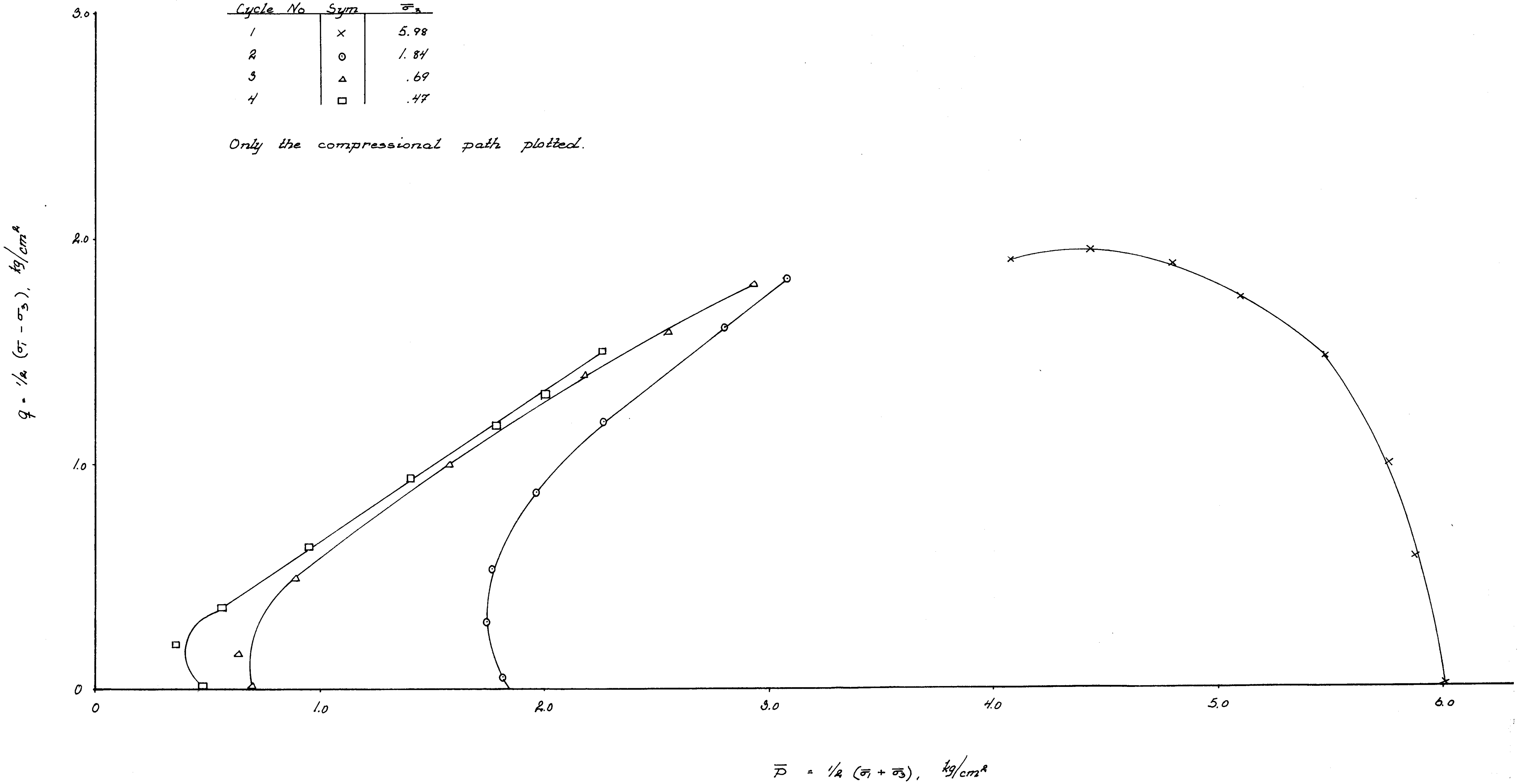


Figure 4.2 - 5.

$\bar{p}$ - q plott of CKoll - CyC P14.

W_f = 33.8 %. 23 g/l NaCl

$\bar{\sigma}_1$ cm = 6.00 kg/cm²
$\bar{\sigma}_3$ c = 3.00 kg/cm²
$\bar{\sigma}_1$ c = 5.58 kg/cm²
$\bar{\sigma}_3$ c = 3.00 kg/cm²

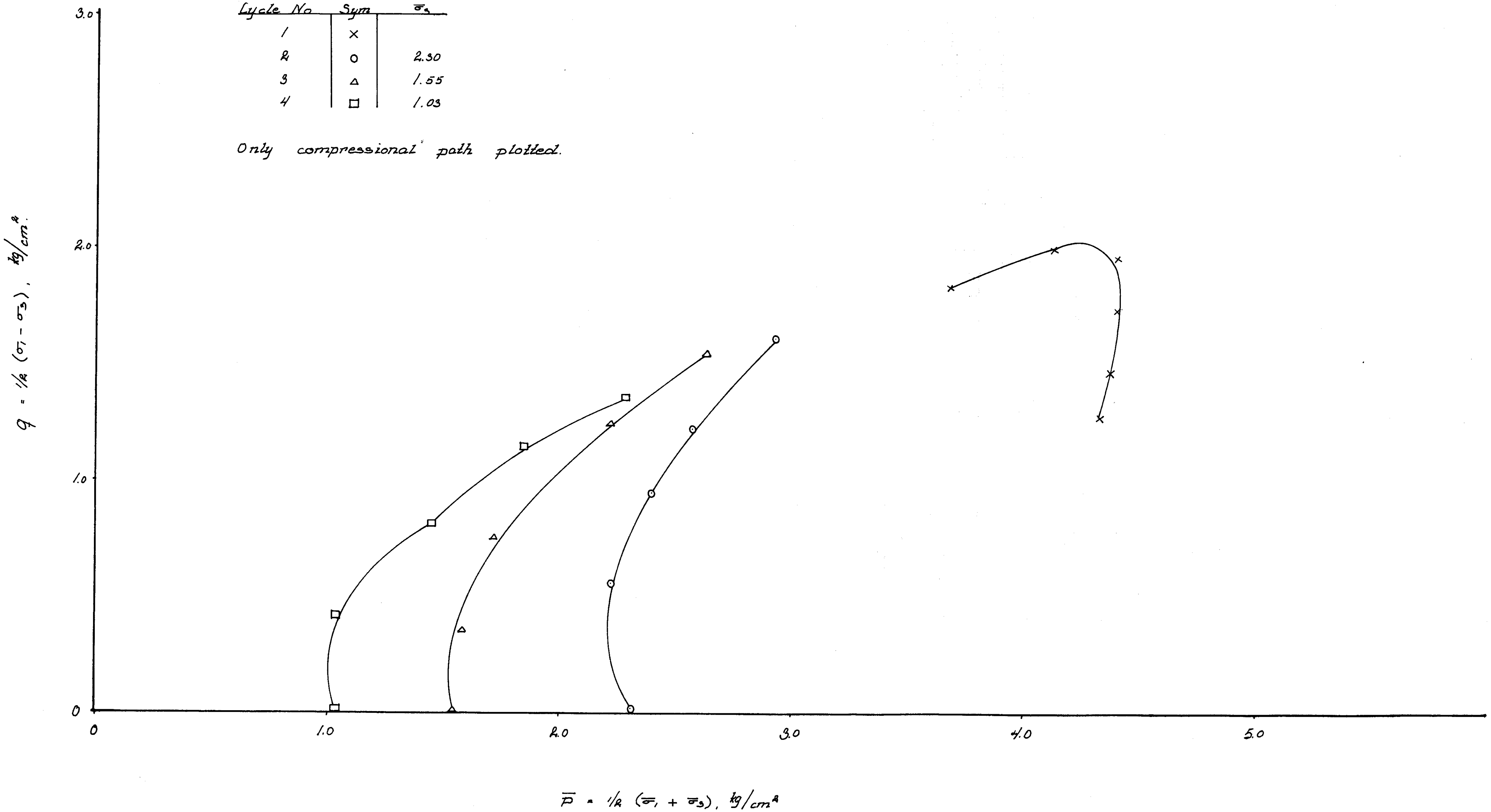


Figure 4.2 - 6.

$\bar{p} - q$ plott of CKoU - CyC - E P 15.

W_f = 33.5 % 23 g/l NaCl.

$\bar{\sigma}_{1cm} = \bar{\sigma}_{1c} = 5.99\ kg/cm^2$

$\bar{\sigma}_{3cm} = \bar{\sigma}_{3c} = 3.00\ kg/cm^2$

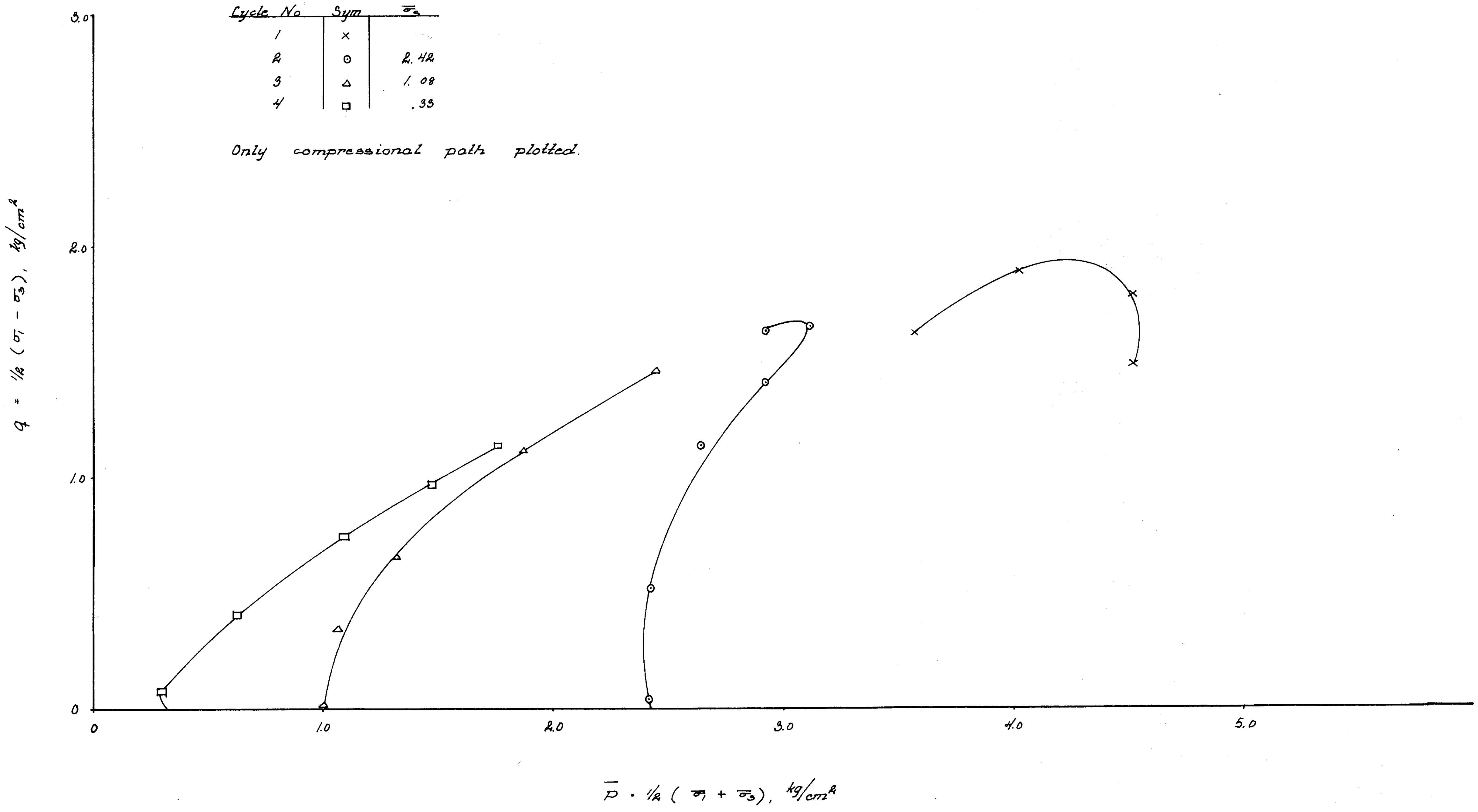


Figure 4.2 - 7.

$\overline{P}$ - q plott of CKoU - CyC - E P 16.

W_f = 32.1 % 23 g/L NaCL.

$\overline{\sigma}_{1c} = \overline{\sigma}_{1cm} = 5.99$ kg/cm²
$\overline{\sigma}_{3c} = \overline{\sigma}_{3cm} = 3.00$ kg/cm²

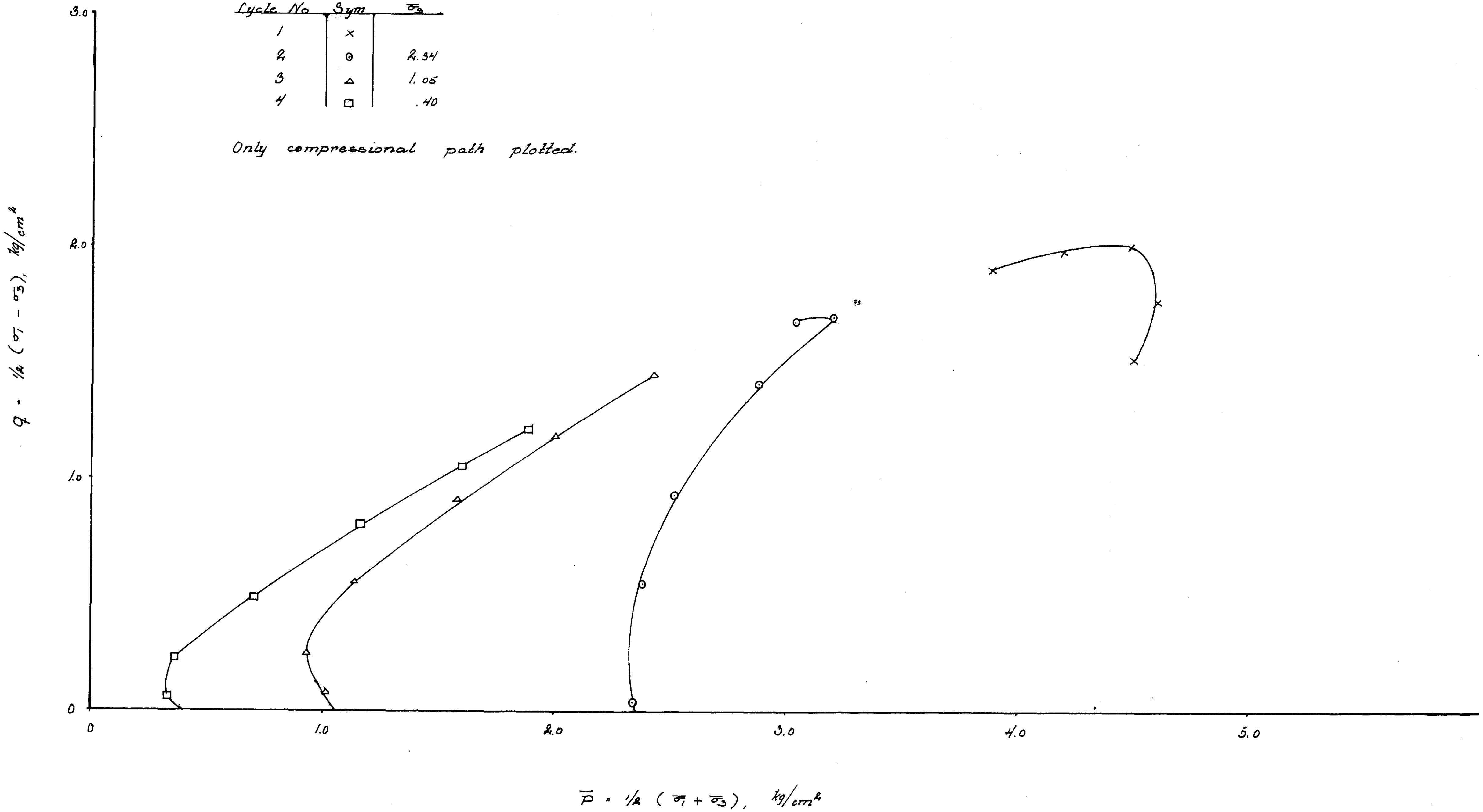
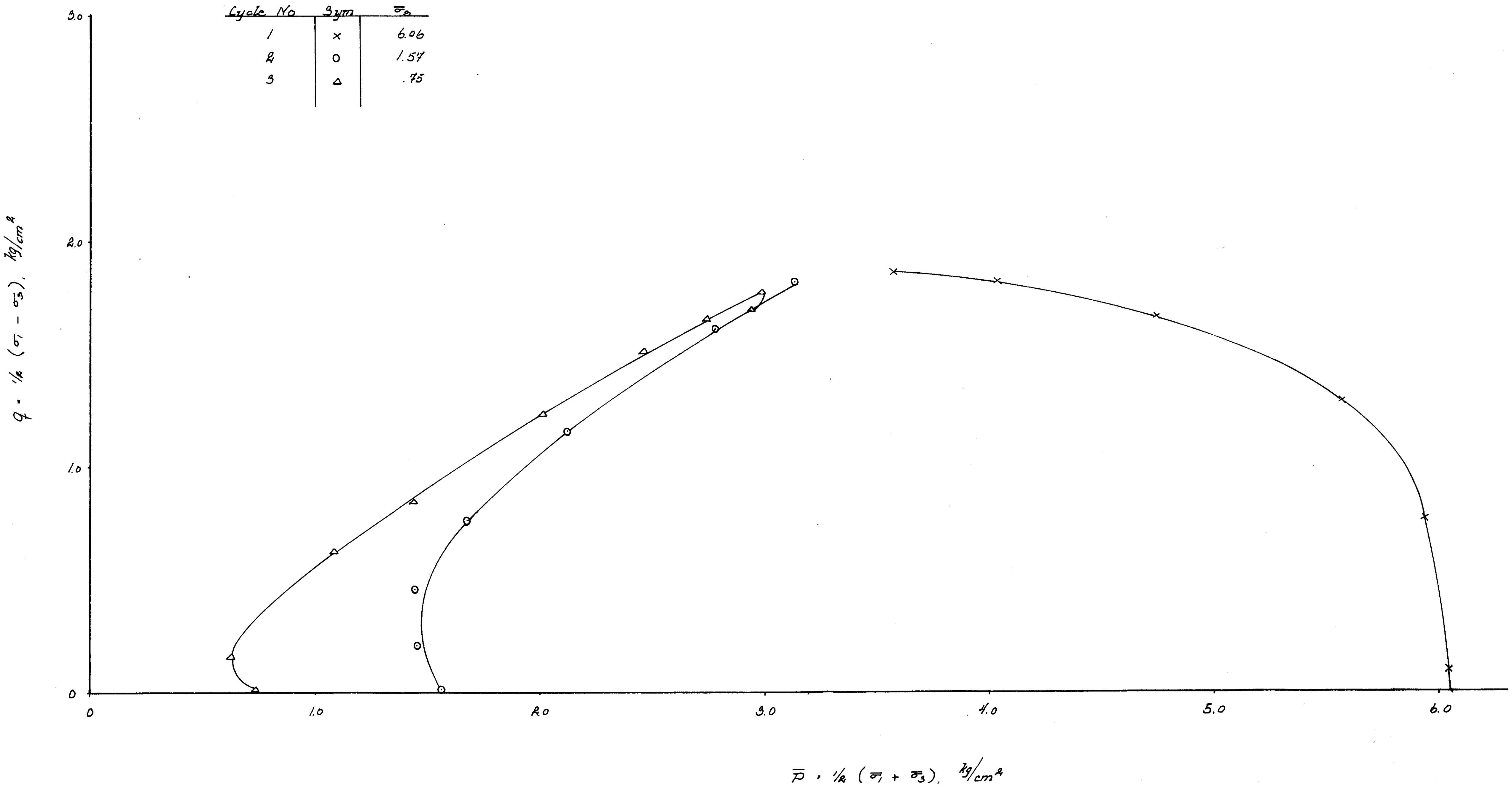


Figure 4.2 - 8.

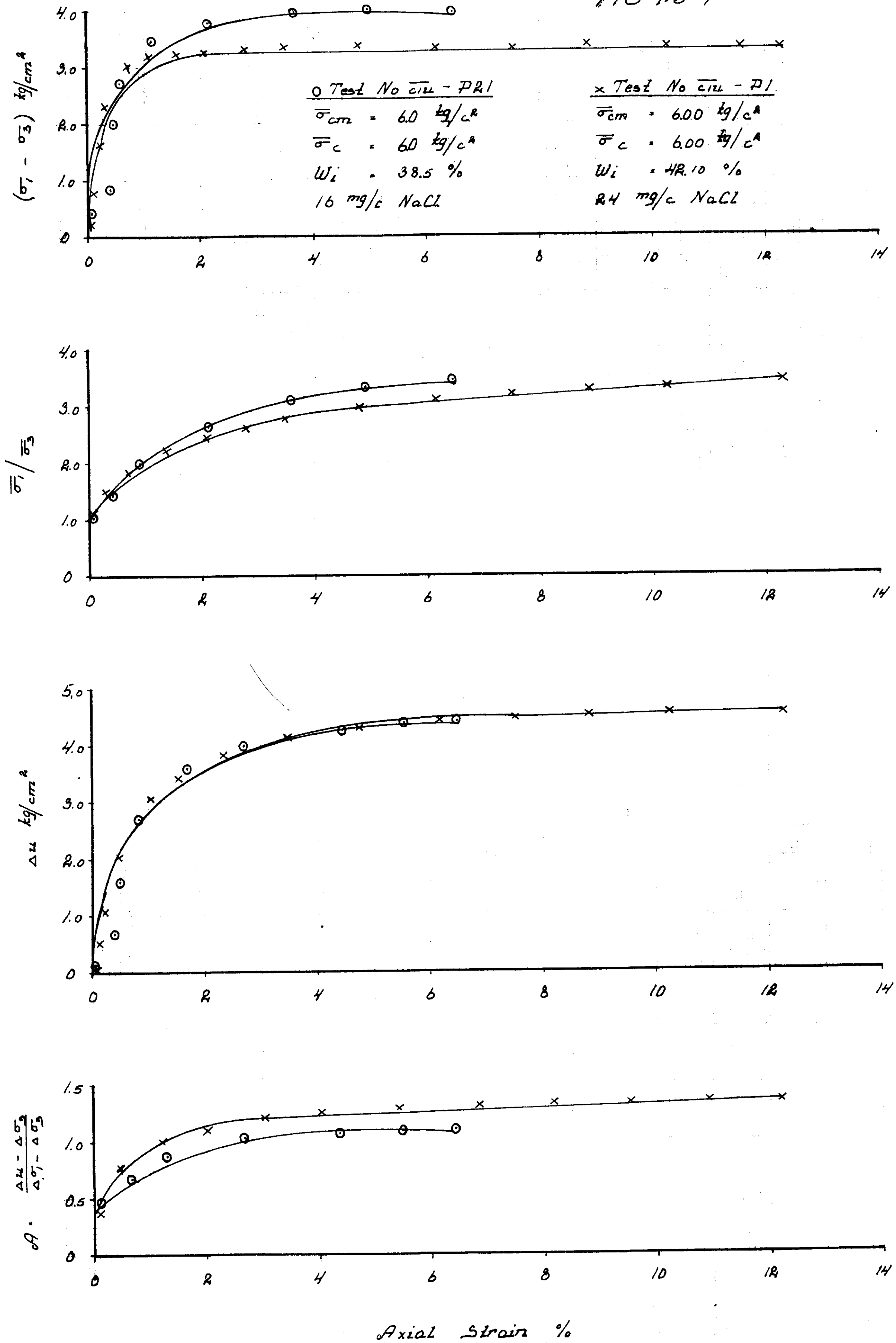
$\bar{P}$ - q plott for CIU - CyC - E P20.

$\bar{\sigma}_c$ = 6.06 kg/cm² W_f = 30.7 %. 16 g/l NaCl.

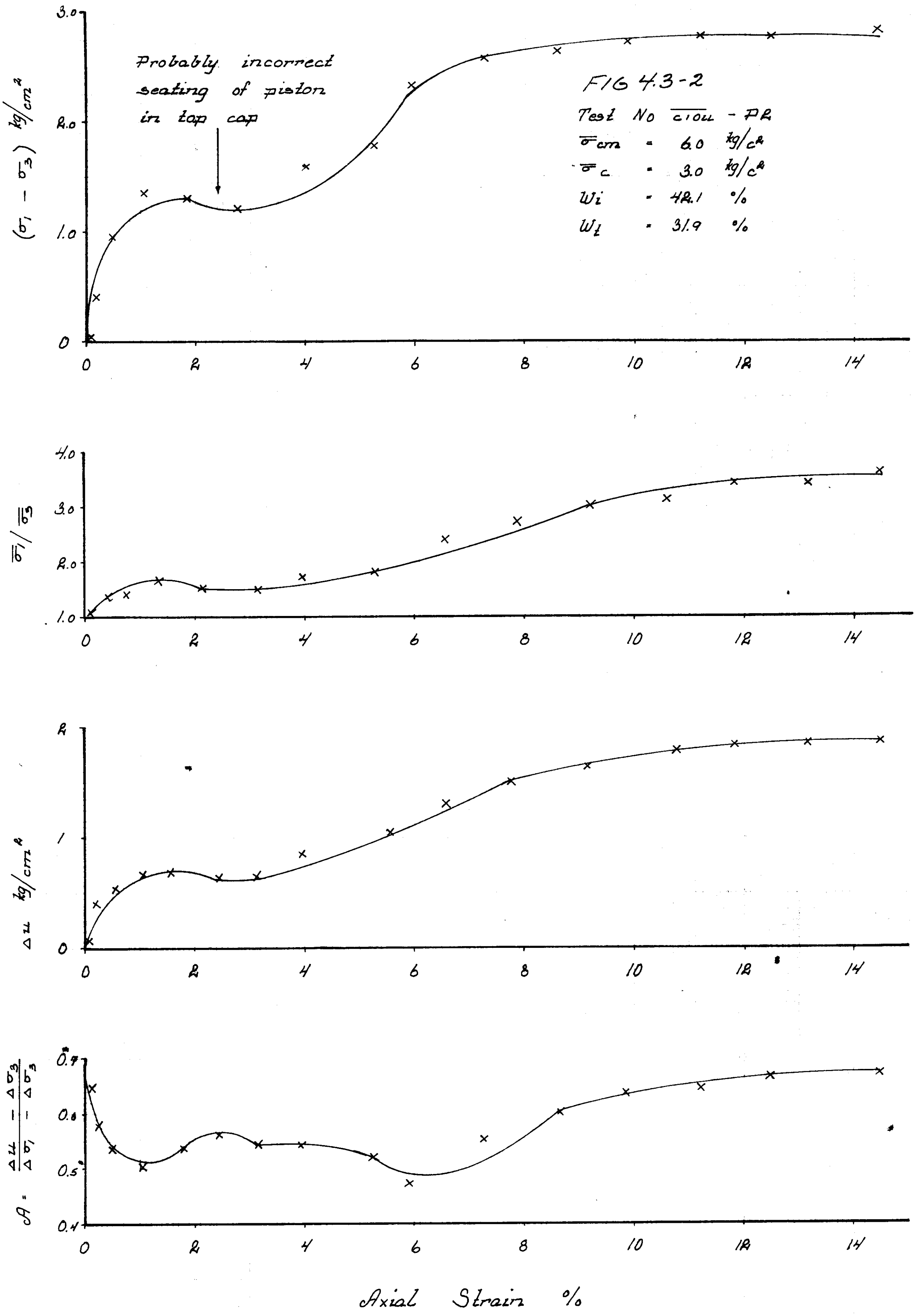


4.3 STRESS - STRAIN PLOTS FOR INDIVIDUAL TESTS.

FIG 4.3-1



$(\bar{\sigma}_1 - \bar{\sigma}_3)$ kg/cm²
o Test No $\overline{ciu}$ - P21
$\bar{\sigma}_{cm}$ = 6.0 kg/c²
$\bar{\sigma}_c$ = 6.0 kg/c²
W_i = 38.5 %
16 mg/c NaCl
× Test No $\overline{ciu}$ - P1
$\bar{\sigma}_{cm}$ = 6.00 kg/c²
$\bar{\sigma}_c$ = 6.00 kg/c²
W_i = 42.10 %
24 mg/c NaCl
$\bar{\sigma}_1 / \bar{\sigma}_3$
Δu kg/cm²
$A = \frac{\Delta u - \Delta\sigma_3}{\Delta\sigma_1 - \Delta\sigma_3}$
Axial Strain %


Probably incorrect seating of piston in top cap
FIG 4.3-2
Test No c10u - PR
σ̄cm = 6.0 kg/c²
σ̄c = 3.0 kg/c²
Wi = 42.1 %
Wf = 31.9 %
(σ1 - σ3) kg/cm²
σ̄1/σ̄3
Δu kg/cm²
A = (Δu - Δσ3)/(Δσ1 - Δσ3)
Axial Strain %

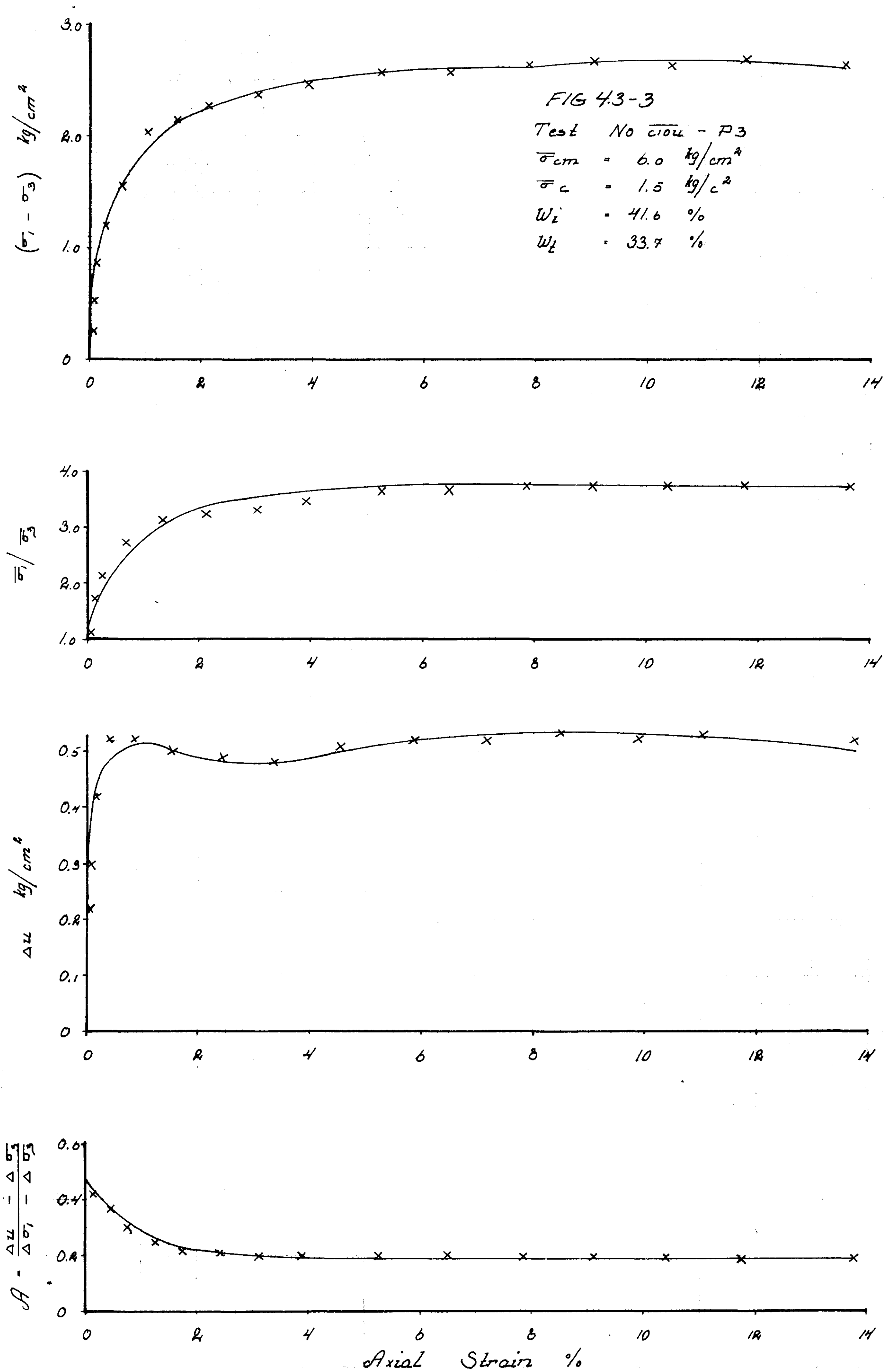


FIG 4.3-3
Test No C10U - P3
$\bar{\sigma}_{cm}$ = 6.0 kg/cm²
$\bar{\sigma}_{c}$ = 1.5 kg/c²
W_i = 41.6 %
W_f = 33.7 %
$(\bar{\sigma}_1 - \bar{\sigma}_3)$ kg/cm²
0
1.0
2.0
3.0
$\bar{\sigma}_1 / \bar{\sigma}_3$
1.0
2.0
3.0
4.0
Δu kg/cm²
0
0.1
0.2
0.3
0.4
0.5
$A = \frac{\Delta u - \Delta \bar{\sigma}_3}{\Delta \bar{\sigma}_1 - \Delta \bar{\sigma}_3}$
0
0.2
0.4
0.6
0
2
4
6
8
10
12
14
Axial Strain %

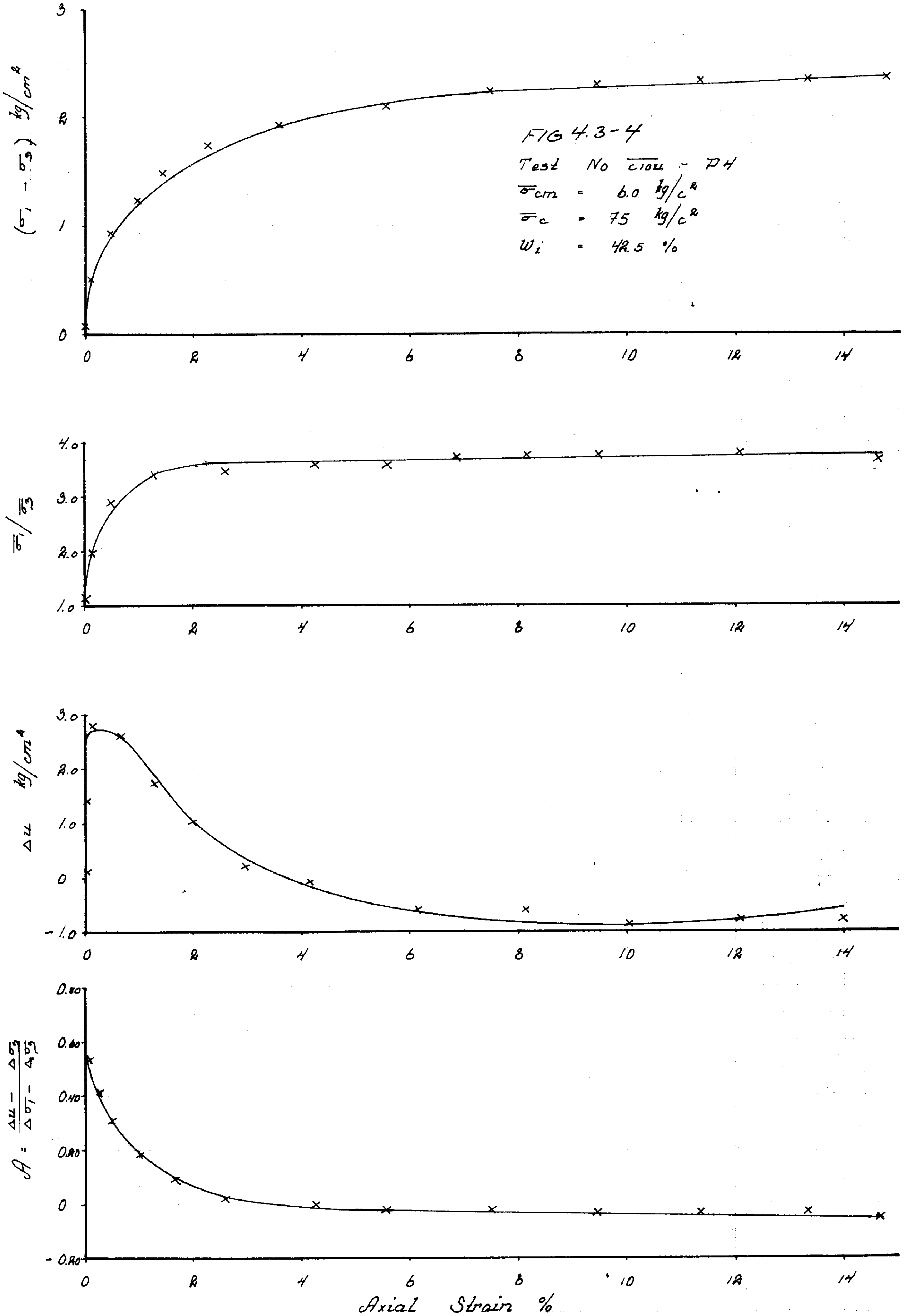


FIG 4.3-4
Test No $\overline{CIOU}$ - P4
$\bar{\sigma}_{cm}$ = 6.0 kg/c²
$\bar{\sigma}_c$ = 75 kg/c²
w_i = 42.5 %
$(\bar{\sigma}_1 - \bar{\sigma}_3)$ kg/cm²
$\bar{\sigma}_1 / \bar{\sigma}_3$
Δu kg/cm²
$A = \frac{\Delta u - \Delta \sigma_3}{\Delta \sigma_1 - \Delta \sigma_3}$
Axial Strain %

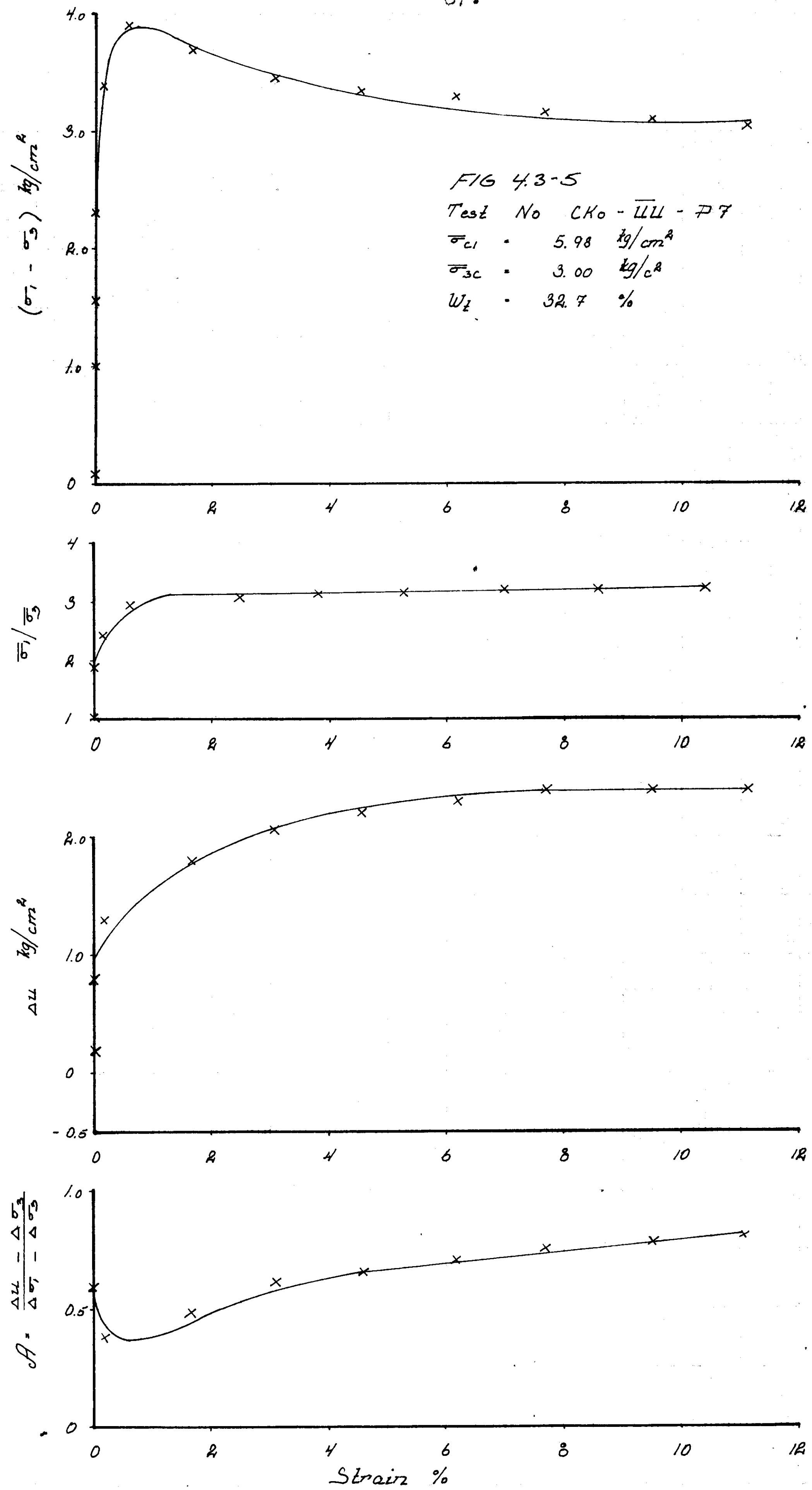


FIG 4.3-5
Test No CKo - $\overline{UU}$ - P7
$\bar{\sigma}_{c1}$ - 5.98 kg/cm²
$\bar{\sigma}_{3c}$ - 3.00 kg/c²
W_t - 32.7 %
$(\sigma_1 - \sigma_3)$ kg/cm²
$\bar{\sigma}_1 / \bar{\sigma}_3$
Δu kg/cm²
$A = \frac{\Delta u - \Delta\sigma_3}{\Delta\sigma_1 - \Delta\sigma_3}$
Strain %

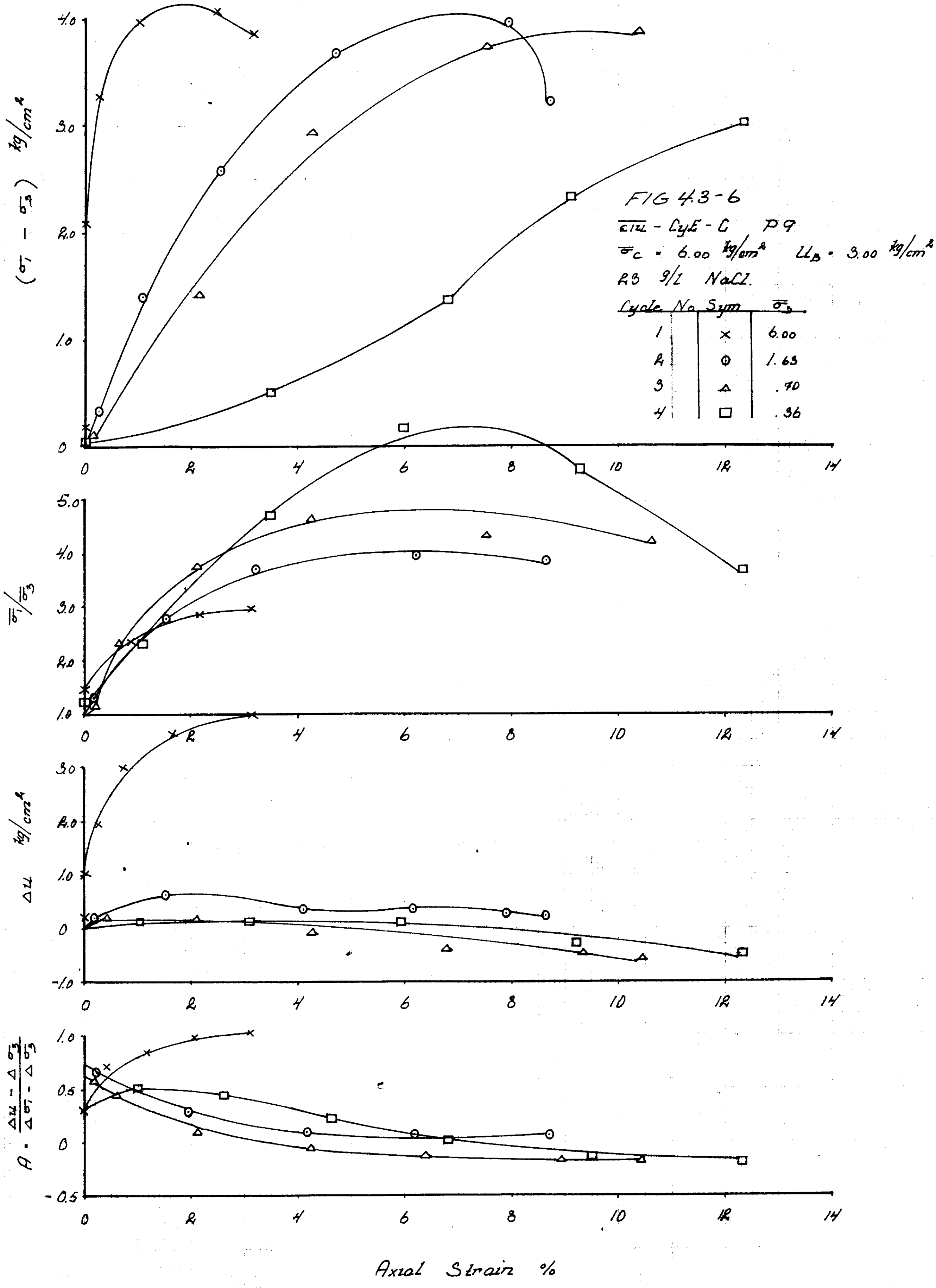


FIG 4.3-6
CIU - CyE - C P9
σc = 6.00 kg/cm² uB = 3.00 kg/cm²
23 g/l NaCl.
Cycle No. Sym σ3
1 × 6.00
2 ⊙ 1.63
3 △ .70
4 □ .36
(σ1 - σ3) kg/cm²
σ1/σ3
Δu kg/cm²
A = (Δu - Δσ3)/(Δσ1 - Δσ3)
Axial Strain %

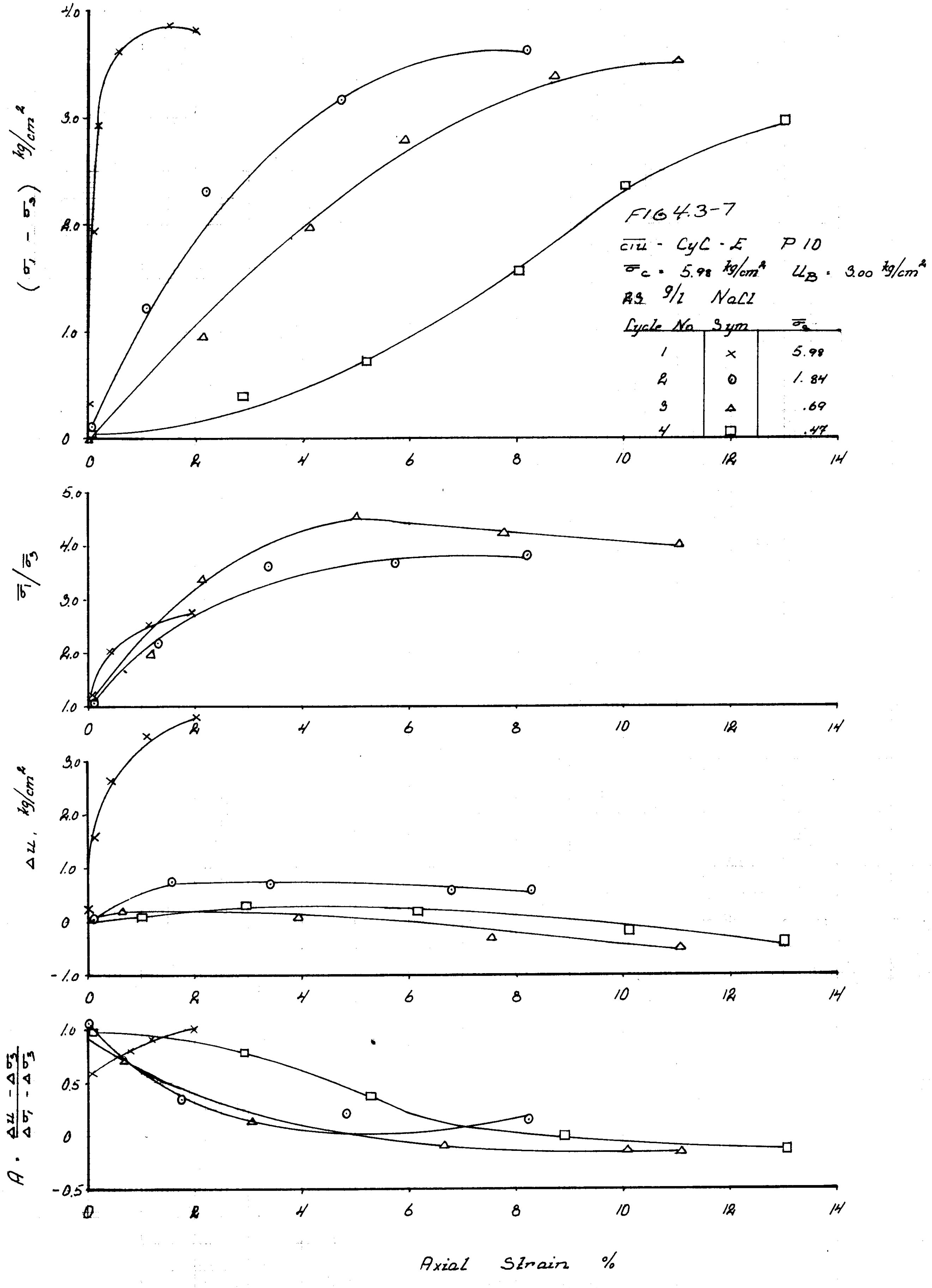


FIG 4.3-7
CIU - CyC - E P 10
$\bar{\sigma}_c$ = 5.98 kg/cm² u_B = 3.00 kg/cm²
RS 9/l NaCl
Cycle No. Sym $\bar{\sigma}_3$
1 × 5.98
2 ⊙ 1.84
3 △ .69
4 □ .47
($\bar{\sigma}_1$ - $\bar{\sigma}_3$) kg/cm²
$\bar{\sigma}_1$/$\bar{\sigma}_3$
Δu, kg/cm²
A = $\frac{\Delta u - \Delta \bar{\sigma}_3}{\Delta \bar{\sigma}_1 - \Delta \bar{\sigma}_3}$
Axial Strain %

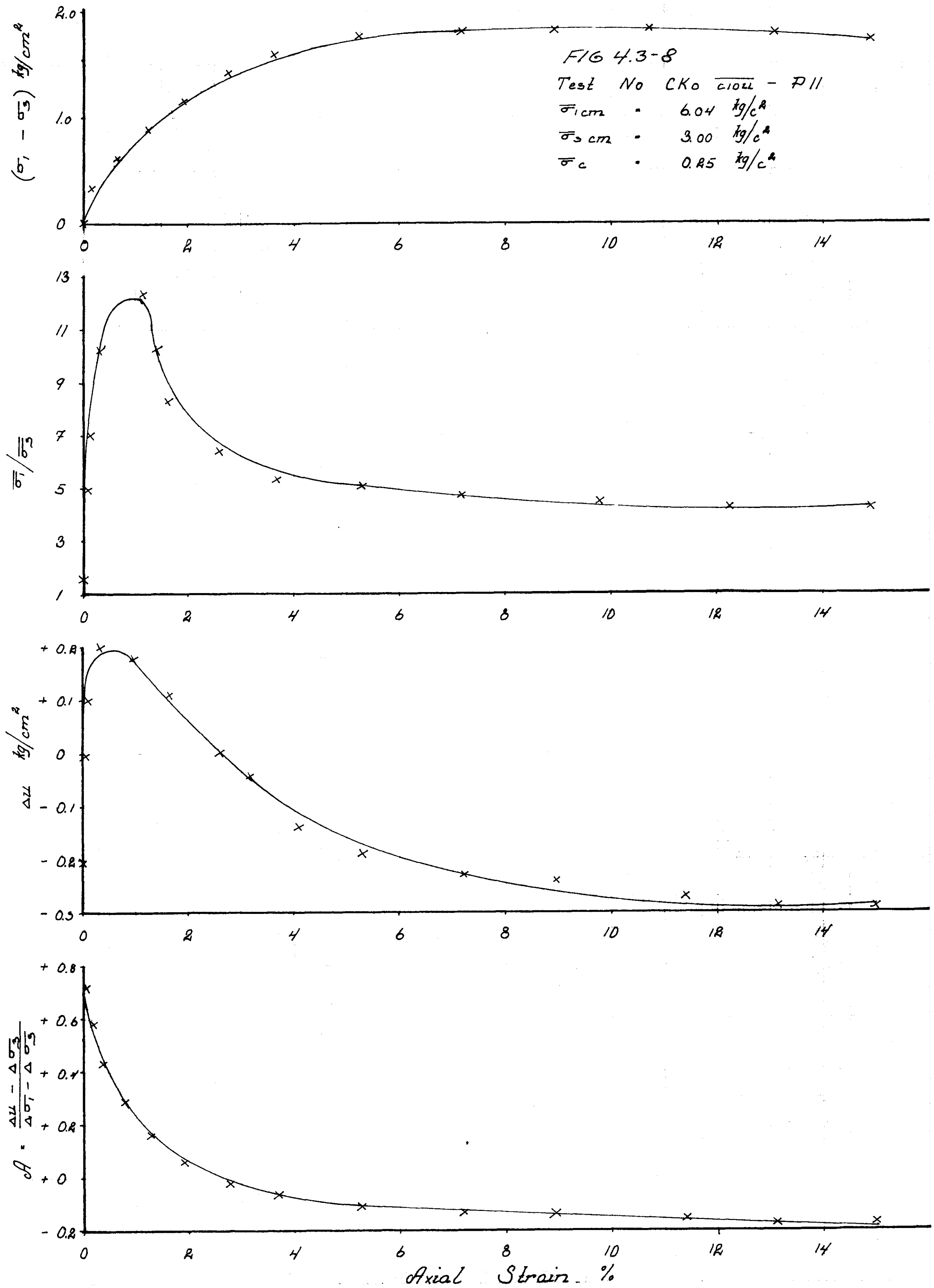


FIG 4.3-8
Test No CKo C10U - P11
$\bar{\sigma}_{1cm}$ = 6.04 kg/c²
$\bar{\sigma}_{3cm}$ = 3.00 kg/c²
$\bar{\sigma}_{c}$ = 0.25 kg/c²
$(\bar{\sigma}_1 - \bar{\sigma}_3)$ kg/cm²
$\bar{\sigma}_1 / \bar{\sigma}_3$
Δu kg/cm²
$A = \frac{\Delta u - \Delta \sigma_3}{\Delta \sigma_1 - \Delta \sigma_3}$
Axial Strain %

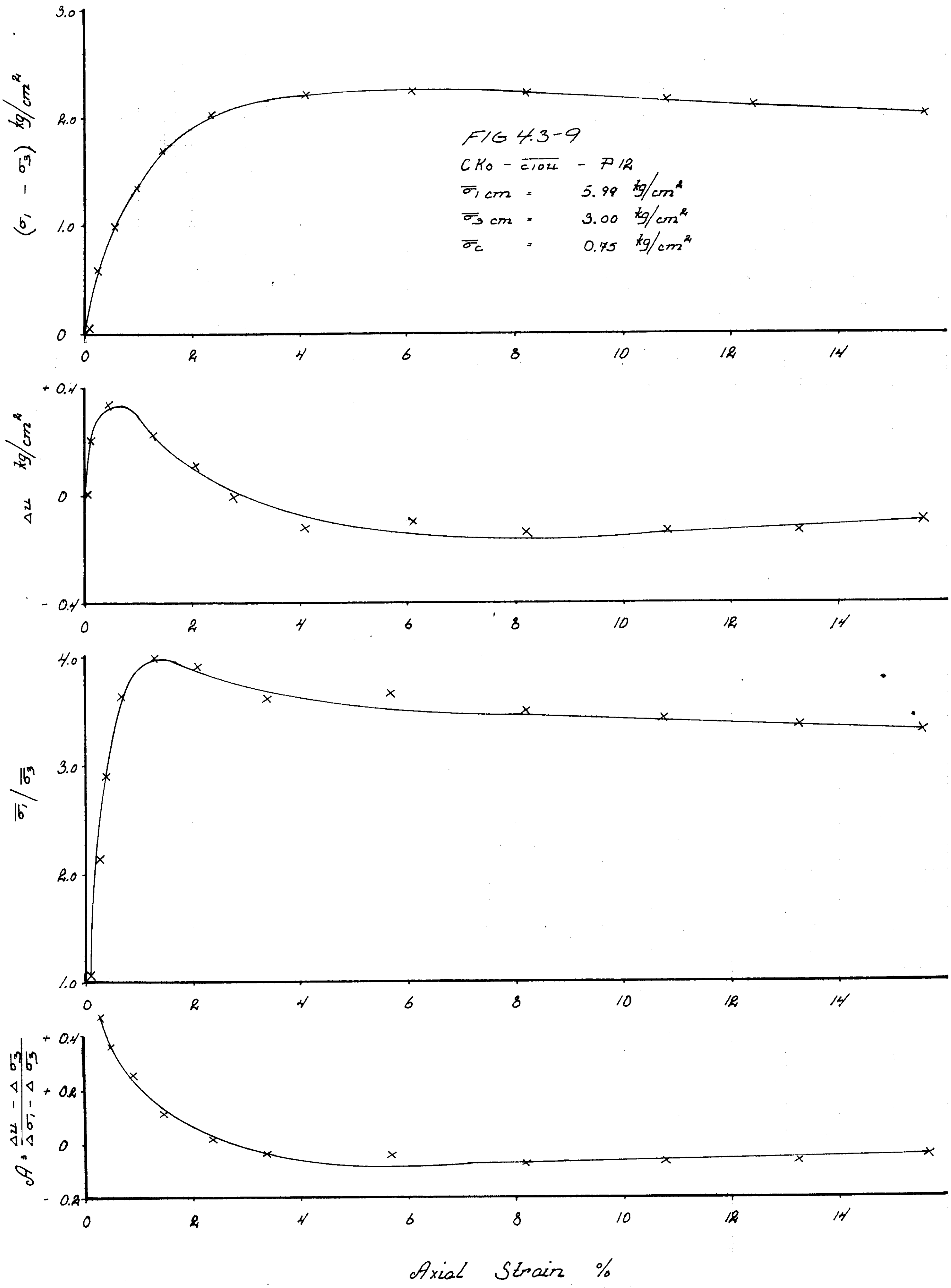


FIG 4.3-9
CKo - C̄IOU - P12
σ̄1 cm = 5.99 kg/cm²
σ̄3 cm = 3.00 kg/cm²
σ̄c = 0.75 kg/cm²
(σ1 - σ3) kg/cm²
Δu kg/cm²
σ̄1/σ̄3
A = (Δu - Δσ3)/(Δσ1 - Δσ3)
Axial Strain %

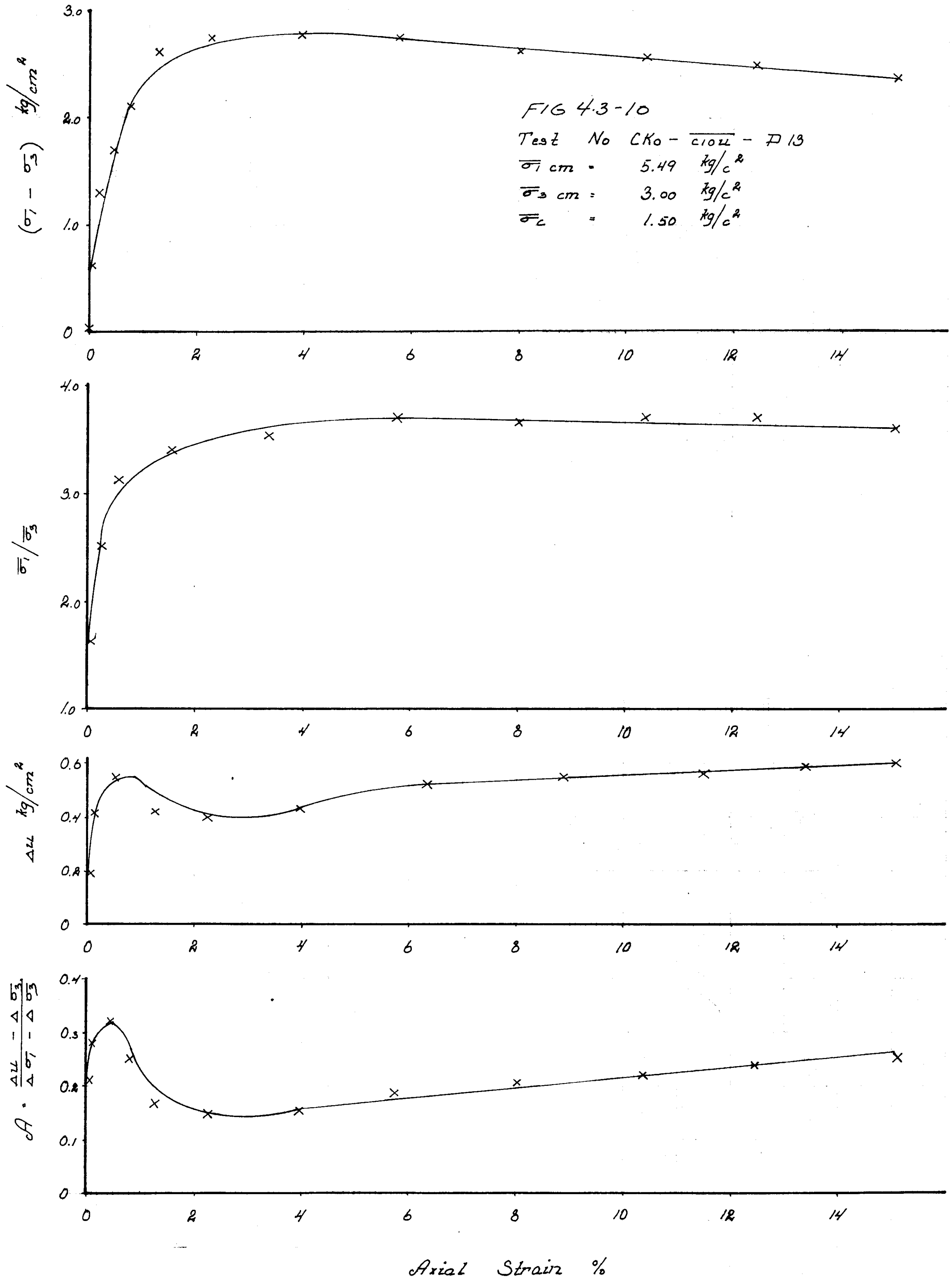


FIG 4.3-10
Test No CKo - $\overline{c10u}$ - D13
$\bar{\sigma}_1$ cm = 5.49 kg/c²
$\bar{\sigma}_3$ cm = 3.00 kg/c²
$\bar{\sigma}_c$ = 1.50 kg/c²
$(\bar{\sigma}_1 - \bar{\sigma}_3)$ kg/cm²
$\bar{\sigma}_1 / \bar{\sigma}_3$
Δu kg/cm²
$A = \frac{\Delta u - \Delta \bar{\sigma}_3}{\Delta \bar{\sigma}_1 - \Delta \bar{\sigma}_3}$
Axial Strain %

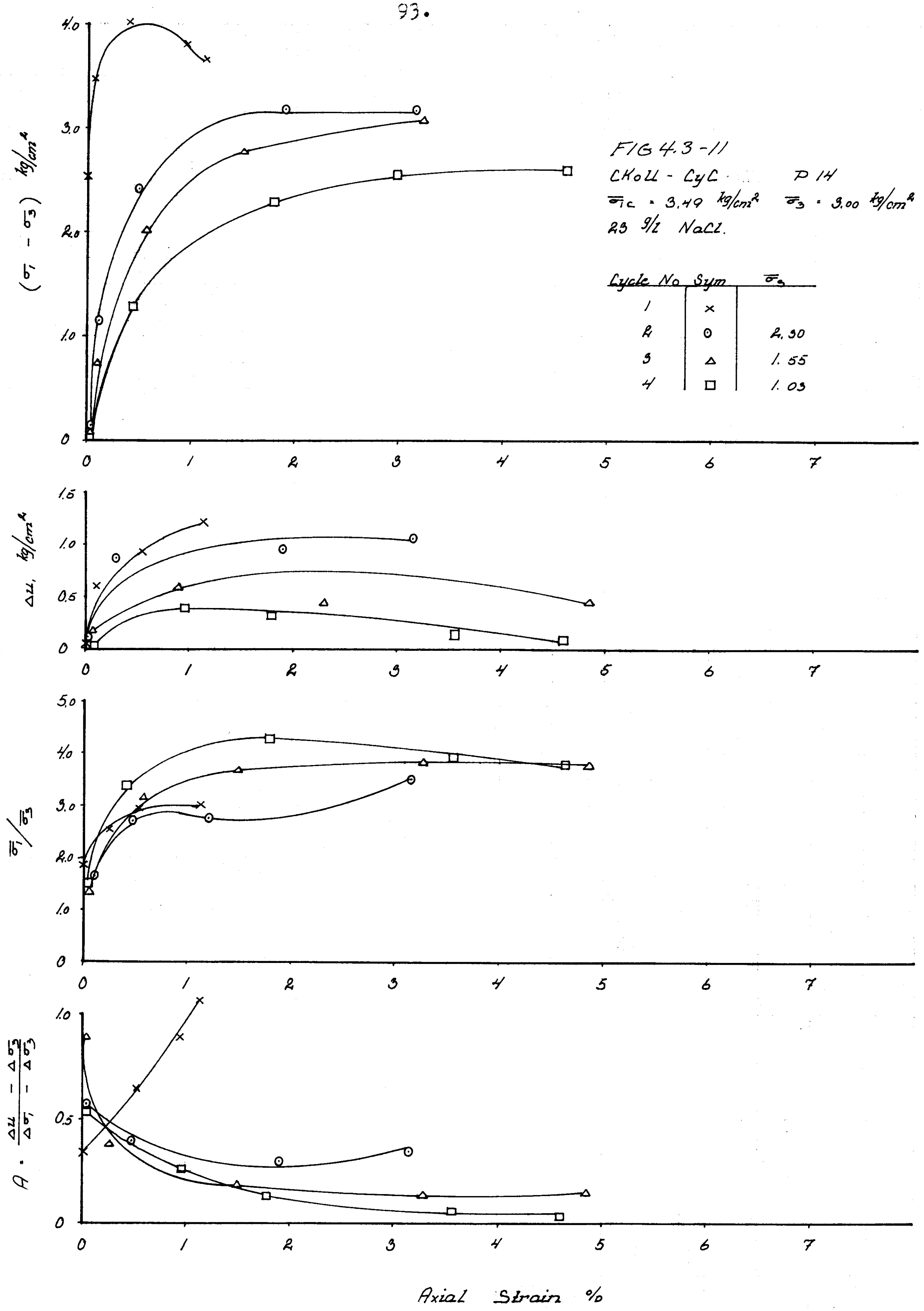


FIG 4.3-11
CKoU - CyC P 14
$\bar{\sigma}_{1c}$ = 3.49 kg/cm² $\bar{\sigma}_3$ = 3.00 kg/cm²
23 g/l NaCl.
Cycle No | Sym | $\bar{\sigma}_3$
1 | × |
2 | ⊙ | 2.30
3 | △ | 1.55
4 | □ | 1.03
$(\sigma_1 - \sigma_3)$ kg/cm²
Δu, kg/cm²
$\bar{\sigma}_1/\bar{\sigma}_3$
$A = \frac{\Delta u - \Delta \sigma_3}{\Delta \sigma_1 - \Delta \sigma_3}$
Axial Strain %

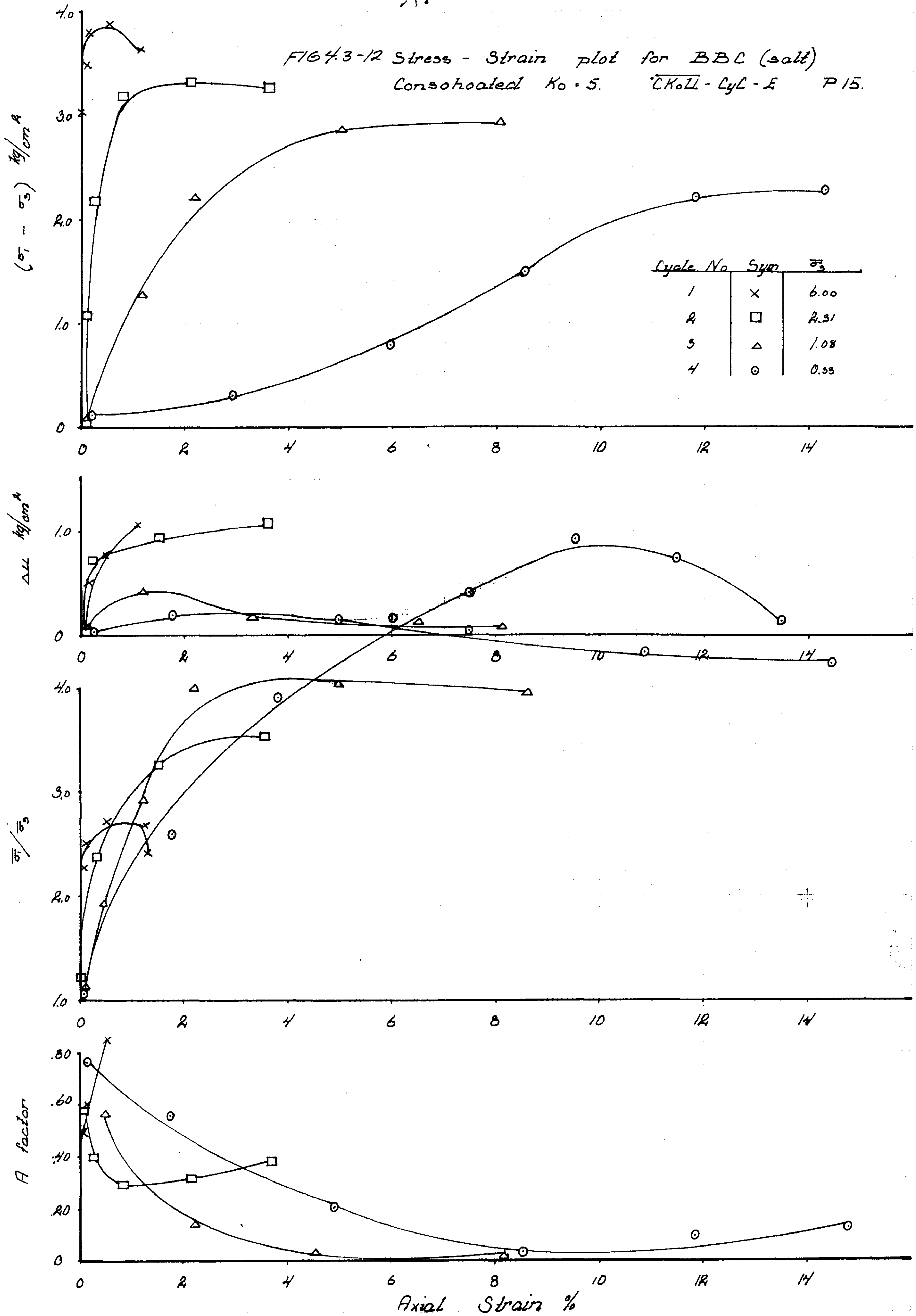
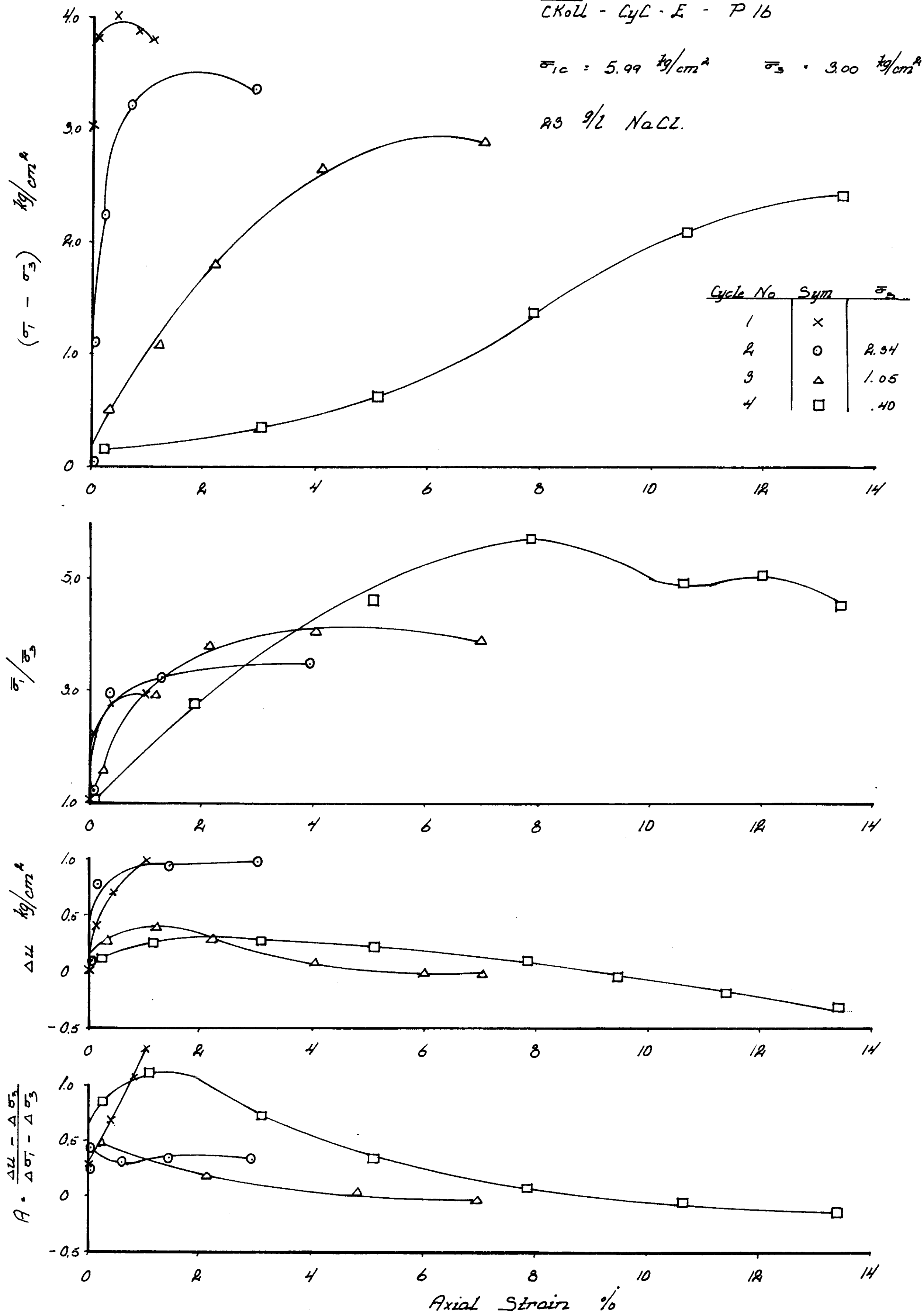


FIG 4.3-12 Stress - Strain plot for BBC (salt)
Consolidated Ko = .5. $\overline{CK_oU}$ - CyC - E P 15.

FIG 4.3-13
CKoU - CyC - E - P 16

σ_{1c} = 5.99 kg/cm² σ_3 = 3.00 kg/cm²

23 g/l NaCl.



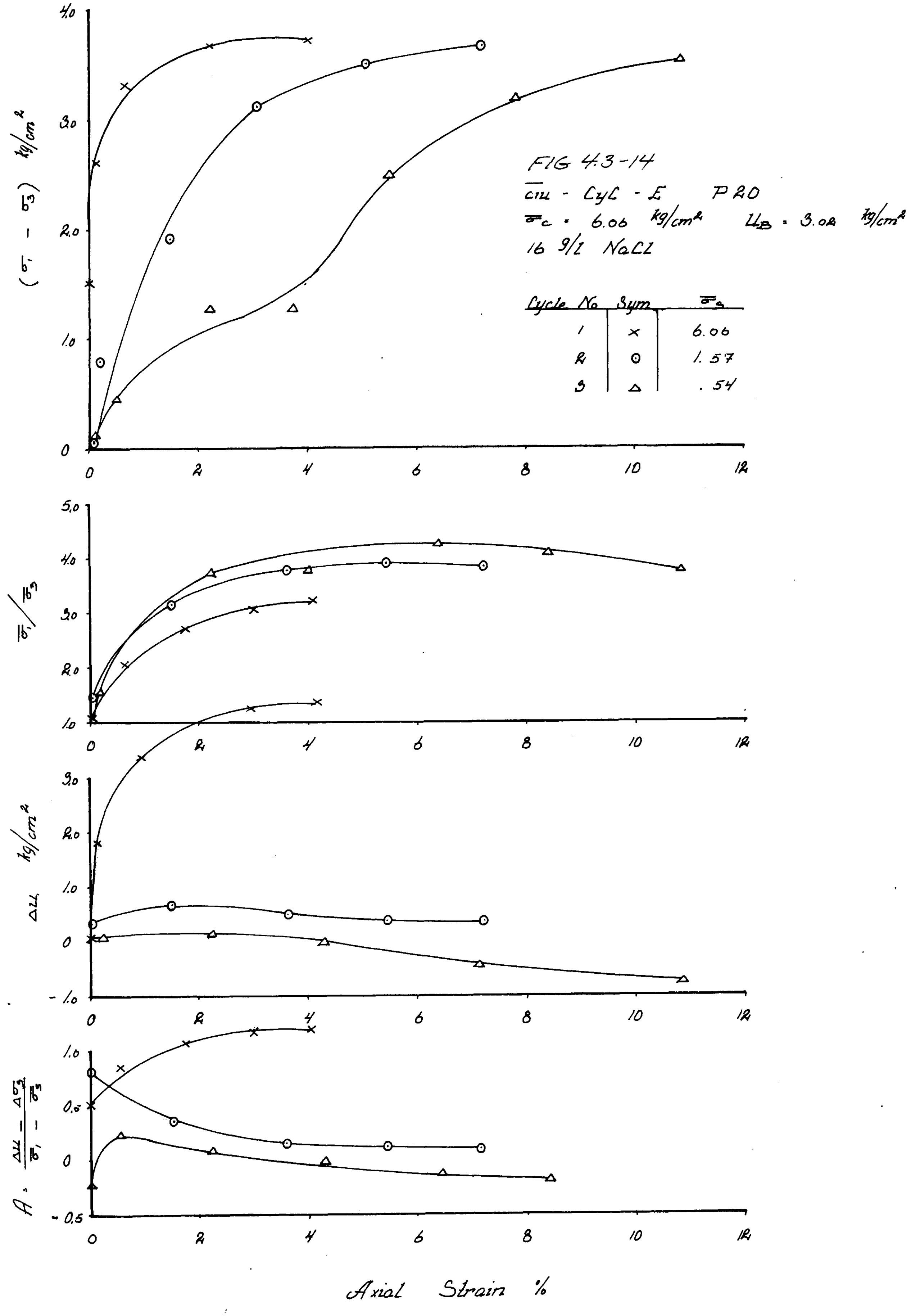


FIG 4.3-14
CIU - CYC - E P20
σ̄c = 6.06 kg/cm² UB = 3.02 kg/cm²
16 g/l NaCl
Cycle No. Sym. σ̄a
1 × 6.06
2 ⊙ 1.57
3 △ .54
(σ1 - σ3) kg/cm²
σ̄1/σ̄3
Δu kg/cm²
A = (Δu - Δσ3)/(σ̄1 - σ̄3)
Axial Strain %

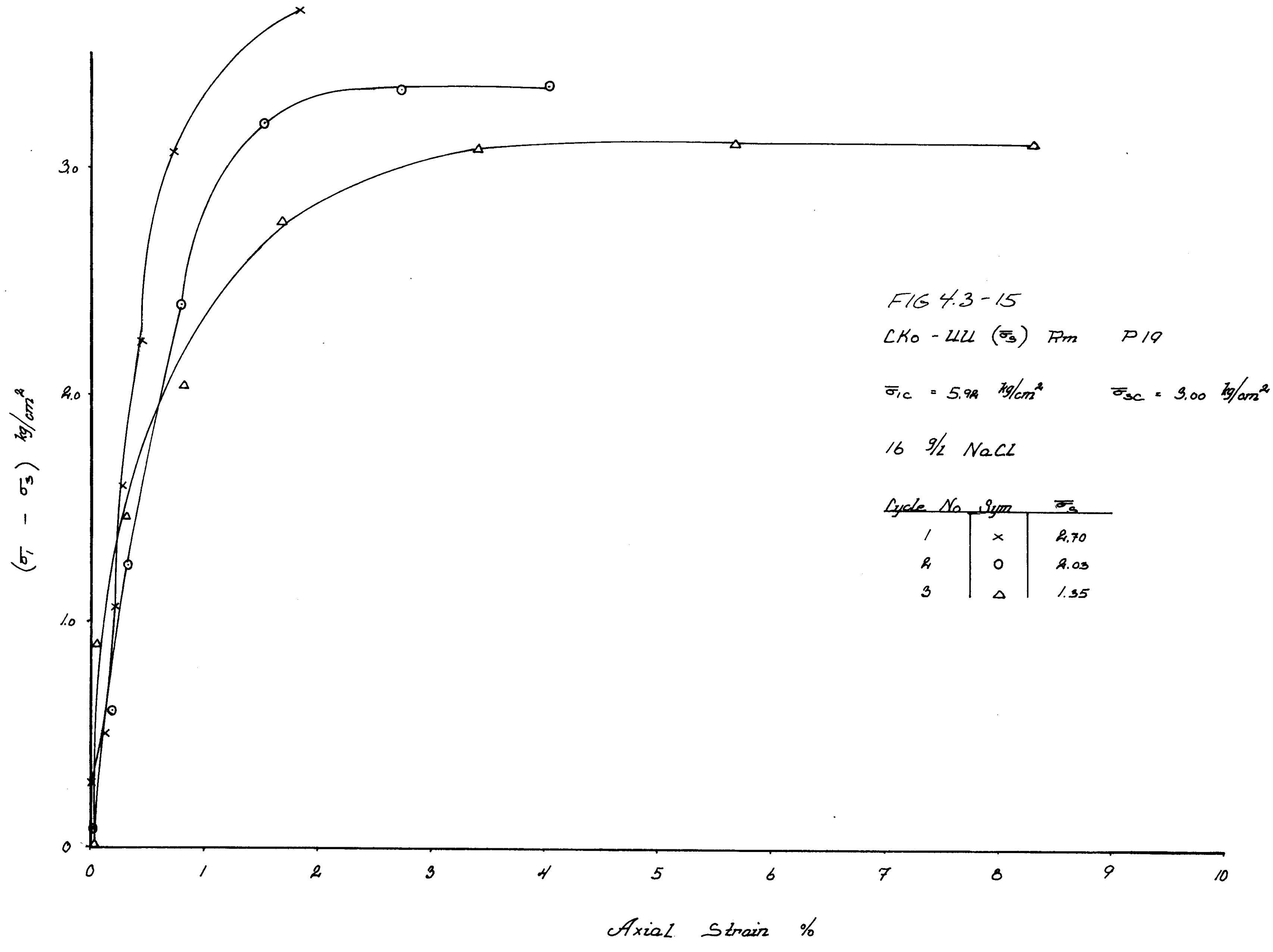


FIG 4.3-15

CKo - UU ($\bar\sigma_3$) Rm P19

$\bar\sigma_{1c}$ = 5.92 kg/cm² $\bar\sigma_{3c}$ = 3.00 kg/cm²

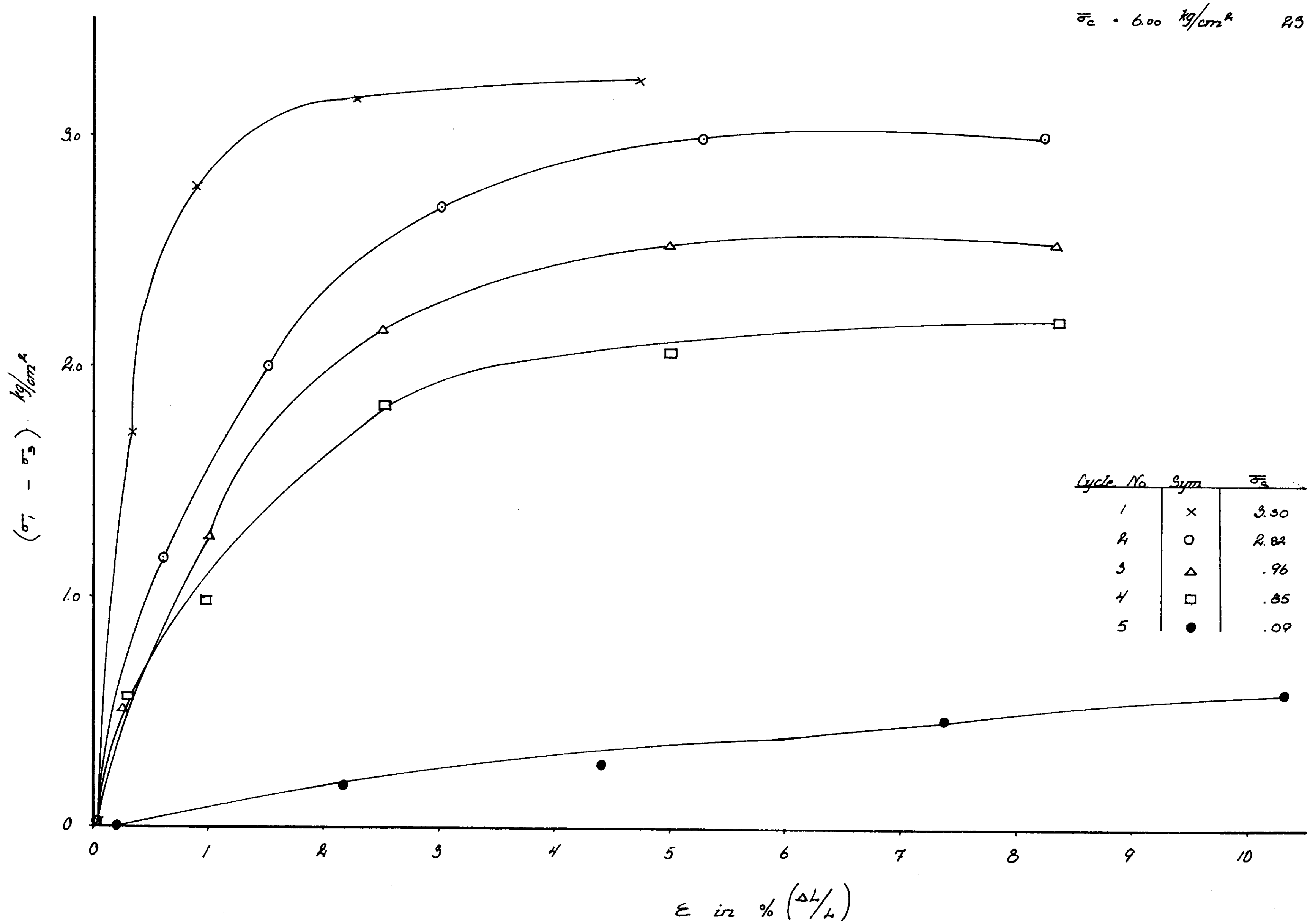
16 g/l NaCl

Cycle No	Sym	$\bar\sigma_3$
1	×	2.70
2	O	2.03
3	△	1.35

FIG 4.3-16

Cl - UU ($\bar{\sigma}_3$) Rm P 17

$\bar{\sigma}_c$ · 6.00 kg/cm² 23 g/l NaCl.



4.4 SUMMARIES OF INDIVIDUAL TESTS.

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU - P1

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY WP DATE 2/3 65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.0	1.17	99	80.8	8.00	10.10
PRESHEAR	31.6	.88	100	68.90	7.41	9.30

G_s = 2.77 TYPE CELL C.H.

PRESHEAR STRESS HISTORY 1-D to 1.5 kg/cm², isotropic 3-D to 6.0 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.00 t_c =

$\bar{\sigma}_{3c}$ = 6.00 P.P.R. = 100 %

$\bar{\sigma}_{ac}$ = 6.00 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .0006 "/min

PATH undrained loading

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	0	0		6.00	6.00	1.00	0		—	0	6.00						
	.016	.09		6.02	6.11	1.02	−.02		—	.045	6.065						
	.066	.28		5.95	6.23	1.05	+.05		.179	.14	6.09						
	.100	.76		5.71	6.47	1.13	.29		.382	.38	6.09						
	.133	1.15		5.50	6.65	1.21	.50		.435	.575	6.075						
	.167	1.49		5.35	6.84	1.28	.65		.437	.745	6.095						
	.200	1.67		4.92	6.59	1.34	1.08		.647	.835	5.755						
	.233	2.01		4.80	6.81	1.42	1.20		.597	1.005	5.805						
	.300	2.19		4.59	6.82	1.51	1.50		.647	1.16	5.685						
	.333	2.32		4.50	7.02	1.61	1.64		617	1.33	5.69						
	.417	2.66		4.36	6.64	1.68	2.04		.762	1.34	5.30						
	.500	2.68		3.96	6.59	1.74	2.22		.790	1.405	5.185						
	.69	3.01		3.98	6.42	1.88	2.59		.861	1.505	4.915						
	.86	3.12		3.13	6.25	2.00	2.87		.921	1.56	4.69						
	1.03	3.20		2.97	6.17	2.08	3.07		.961	1.60	4.57						
	1.20	3.25		2.78	6.03	2.17	3.22		.992	1.625	4.405						
	1.36	3.27		2.65	5.92	2.23	3.35		1.023	1.635	4.285						
	1.53	3.27		2.52	5.79	2.30	3.48		1.042	1.635	4.155						
	1.70	3.27		2.46	5.73	2.33	3.54		1.082	1.635	4.095						
	2.04	3.28		2.28	5.56	2.48	3.72		1.100	1.64	3.92						
	2.38	3.30		2.17	5.47	2.52	3.83		1.160	1.65	3.82						
	2.73	3.31		2.03	5.34	2.63	3.97		1.200	1.655	3.685						
	3.07	3.34		1.95	5.29	2.71	4.05		1.213	1.67	3.62						
	3.41	3.35		1.86	5.21	2.80	4.14		1.238	1.675	3.535						
	4.08	3.36		1.79	5.15	2.88	4.21		1.253	1.68	3.47						
	4.77	3.36		1.68	5.04	3.00	4.32		1.287	1.68	3.36						
	5.46	3.36		1.63	4.99	3.06	4.37		1.300	1.68	3.31						
	6.13	3.33		1.58	4.91	3.11	4.42		1.327	1.665	3.245						
	6.82	3.34		1.55	4.89	3.16	4.45		1.332	1.67	3.22						
	7.50	3.36		1.50	4.86	3.24	4.50		1.340	1.68	3.13						
	8.17	3.35		1.48	4.83	3.27	4.52		1.348	1.675	3.155						
	8.86	3.37		1.46	4.83	3.31	4.54		1.348	1.685	3.145						
	9.54	3.39		1.44	4.83	3.36	4.56		1.347	1.695	3.135						
	10.21	3.34		1.42	4.76	3.35	4.58		1.372	1.67	3.09						
	10.91	3.36		1.40	4.76	3.40	4.66		1.370	1.68	3.08						

(1) CORRECTED FOR P.F. & F.S.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU - P1

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY WP DATE 2/3 65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.0	1.17	99	80.8	8.00	10.1
PRESHEAR	31.6	.88	100	68.9	68.4	9.30

G_s = 2.77 TYPE CELL C. H.

PRESHEAR STRESS HISTORY 1-D to 1.5 kg/cm², isotropic 3-D to 6.00 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.00 t_c =

$\bar{\sigma}_{3c}$ = 6.00 P.P.R. = 100 %

$\bar{\sigma}_{ac}$ = 6.00 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .0006 "/min

PATH undrained loading

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$
	11.58	3.38		1.39	4.77	3.43	4.61		1.362	1.69	3.08		
	12.24	3.37		1.38	4.75	3.44	4.62		1.370	1.685	3.065		

(1) CORRECTED FOR R.F. & F.S.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. E10U - P2
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY W.P. DATE 2/3 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.1	1.172	99.2	80.72	8.00	10.09
PRESHEAR	32.0	.914	100	71.15	7.65	9.29

G_S = 2.77   TYPE CELL C.H.

PRESHEAR STRESS HISTORY $\bar{\sigma}_{cm}$ = 6.00 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 3.00 t_c =

$\bar{\sigma}_{3c}$ = 3.00   P.P.R. = 97 %

$\bar{\sigma}_{ac}$ = 3.00 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .0006 "/min

PATH undrained loading

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	0	0		3.00	3.00	1.00	0		—	0	3.00						
	.098	.017		2.92	2.94	1.005	.08		8.00	.009	2.93						
	.164	.40		2.74	3.14	1.144	.26		.650	.20	2.94						
	.229	.75		2.59	3.34	1.288	.41		.546	.375	2.965						
	.293	.83		2.52	3.35	1.330	.48		.578	.415	2.925						
	.427	.95		2.49	3.44	1.382	.51		.537	.475	2.965						
	.573	1.03		2.45	3.48	1.42	.55		.534	.515	2.965						
	.741	1.04		2.38	3.42	1.44	.62		.596	.52	2.90						
	.902	1.26		2.34	3.60	1.54	.66		.524	.63	2.97						
	1.068	1.35		2.32	3.67	1.58	.68		.504	.675	2.995						
	1.230	1.38		2.31	3.69	1.60	.69		.500	.69	3.00						
	1.393	1.37		2.31	3.68	1.60	.69		.502	.685	2.995						
	1.558	1.34		2.31	3.65	1.59	.69		.515	.67	2.98						
	1.805	1.29		2.33	3.62	1.56	.67		.520	.645	2.975						
	2.130	1.26		2.32	3.58	1.54	.68		.540	.63	2.95						
	2.460	1.19		2.33	3.52	1.51	.67		.563	.595	2.925						
	2.790	1.22		2.34	3.56	1.52	.66		.541	.61	2.95						
	3.12	1.23		2.33	3.56	1.53	.67		.545	.615	2.945						
	3.61	1.27		2.26	3.53	1.56	.74		.583	.635	2.895						
	3.94	1.58		2.14	3.72	1.74	.86		.545	.79	2.93						
	5.25	1.79		2.07	3.86	1.87	.93		.520	.895	2.965						
	5.58	2.16		1.94	4.10	2.12	1.06		.491	1.08	3.02						
	5.90	2.32		1.86	4.18	2.25	1.14		.472	1.16	3.02						
	6.56	2.48		1.69	4.17	2.47	1.31		.528	1.24	2.93						
	7.22	2.57		1.58	4.15	2.63	1.42		.553	1.285	2.865						
	7.87	2.63		1.50	4.13	2.76	1.50		.571	1.315	2.815						
	8.53	2.64		1.41	4.05	2.88	1.59		.602	1.32	2.73						
	9.18	2.69		1.33	4.02	3.02	1.67		.622	1.345	2.675						
	9.85	2.71		1.29	4.00	3.10	1.71		.631	1.355	2.645						
	10.60	2.74		1.28	4.02	3.14	1.78		.650	1.37	2.65						
	11.20	2.77		1.20	3.97	3.31	1.80		.650	1.385	2.585						
	11.80	2.78		1.15	3.93	3.42	1.85		.665	1.39	2.54						
	12.48	2.77		1.15	3.92	3.41	1.85		.668	1.385	2.535						
	13.12	2.79		1.14	3.93	3.45	1.86		.667	1.39	2.535						
	13.78	2.82		1.12	3.94	3.52	1.88		.667	1.41	2.53						
	14.42	2.82		1.11	4.03	3.64	1.89		.672	1.41	2.57						

(1) CORRECTED FOR DF & F.S.

(2) Δu FOR $\Delta \sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta \sigma_r}{\Delta \sigma_a - \Delta \sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta \sigma_a}{\Delta \sigma_r - \Delta \sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIOU - P3
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY W.P. DATE 3/12 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	41.2	1.168	97.3	80.5	8.00	10.07
PRESHEAR	32.7	.904	100	71.2	7.82	9.11

G_s = 2.77 TYPE CELL C.H.

PRESHEAR STRESS HISTORY $\bar{\sigma}_{cm}$ = 6.00 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 1.50 t_c =
$\bar{\sigma}_{3c}$ = 1.50 P.P.R. = 100 %
$\bar{\sigma}_{ac}$ = 1.50 u_B = 3.00 kg/cc

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .0006 "/min
PATH undrained loading

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	0	0		1.50	1.50	1.00	0	0	—	0	1.50						
	.033	.027		1.48	1.51	1.02	.02		1.095	.014	1.49						
	.098	.538		1.28	1.82	1.42	.22		.613	.269	1.55						
	.163	.844		1.14	1.98	1.74	.36		.603	.422	1.56						
	.227	1.041		1.08	2.13	1.98	.42		.573	.503	1.58						
	.292	1.181		1.03	2.21	2.15	.47		.567	.598	1.62						
	.426	1.396		.98	2.38	2.43	.52		.528	.698	1.68						
	.574	1.557		.97	2.53	2.61	.53		.482	.779	1.75						
	.738	1.722		.98	2.70	2.76	.52		.432	.861	1.84						
	.883	1.844		.98	2.82	2.88	.52		.402	.922	1.90						
	1.07	2.05		.96	3.01	3.14	.56		.391	1.025	1.99						
	1.27	2.03		.99	3.02	3.05	.51		.355	1.015	2.005						
	1.38	2.07		.98	3.05	3.12	.52		.382	1.035	2.015						
	1.54	2.13		1.00	3.13	3.13	.50		.333	1.065	2.065						
	1.78	2.20		1.01	3.21	3.18	.49		.314	1.10	2.11						
	2.11	2.25		1.01	3.26	3.23	.49		.307	1.135	2.135						
	2.46	2.29		1.01	3.30	3.27	.49		.301	1.145	2.155						
	2.78	2.31		1.02	3.33	3.27	.48		.294	1.156	2.176						
	3.09	2.36		1.02	3.38	3.32	.48		.288	1.18	2.200						
	3.32	2.39		1.02	3.41	3.33	.48		.285	1.20	2.20						
	3.90	2.45		1.00	3.45	3.45	.50		.290	1.225	2.225						
	4.54	2.57		.99	3.51	3.55	.51		.286	1.26	2.25						
	5.28	2.56		.97	3.53	3.64	.53		.293	1.28	2.25						
	5.87	2.56		.98	3.54	3.65	.52		.285	1.28	2.26						
	6.48	2.55		.97	3.52	3.67	.53		.294	1.275	2.245						
	7.15	2.60		.98	3.58	3.66	.52		.281	1.30	2.28						
	7.85	2.64		.97	3.61	3.73	.53		.284	1.32	2.29						
	8.45	2.64		.97	3.61	3.75	.53		.284	1.32	2.29						
	9.08	2.66		.97	3.63	3.72	.53		.282	1.33	2.30						
	9.86	2.66		.98	3.64	3.72	.52		.286	1.33	2.31						
	10.40	2.63		.97	3.60	3.75	.53		.285	1.32	2.285						
	11.05	2.66		.97	3.63	3.75	.53		.282	1.33	2.30						
	11.75	2.67		.97	3.64	3.76	.53		.281	1.335	2.305						
	12.33	2.65		.97	3.63	3.71	.52		.281	1.325	2.305						
	13.65	2.64		.98	3.62	3.70	.52		.278	1.32	2.30						

(1) CORRECTED FOR P.F. & F.S.

(2) Δu FOR $\Delta \sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta \sigma_r}{\Delta \sigma_a - \Delta \sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta \sigma_a}{\Delta \sigma_r - \Delta \sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIOU - P4
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY W.P. DATE 2/3 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.5	1.172	100	80.8	8.00	10.1
PRESHEAR	33.0	.905	100	70.9	7.79	9.11

G_s = 2.77 TYPE CELL C.H.

PRESHEAR STRESS HISTORY $\bar{\sigma}_{vm}$ = 6.00 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = .74 t_c =
$\bar{\sigma}_{3c}$ = .74 P.P.R. = 100 %
$\bar{\sigma}_{ac}$ = .74 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .0006 "/min
PATH undrained loading

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	0	0		.74	.74	1.00	0		—	0	.74						
	.032	.076		.69	.77	1.11	.06		.72	.039	.73						
	.0714	.269		.61	.88	1.44	.14		.52	.134	.744						
	.129	.473		.53	1.00	1.90	.22		.46	.237	.767						
	.195	.612		.47	1.16	2.31	.28		.46	.306	.776						
	.26	.692		.47	1.24	2.47	.28		.41	.346	.816						
	.32	.767		.47	1.38	2.63	.28		.37	.389	.859						
	.49	.901		.48	1.51	2.88	.27		.30	.451	.931						
	.65	1.02		.49	1.64	3.08	.26		.26	.510	1.06						
	.81	1.13		.51	1.75	3.21	.24		.21	.564	1.04						
	.97	1.22		.53	1.84	3.30	.22		.18	.610	1.14						
	1.13	1.30		.53	1.97	3.46	.22		.17	.651	1.18						
	1.30	1.39		.58	2.07	3.39	.17		.12	.693	1.17						
	1.46	1.46		.61	2.13	3.38	.14		.096	.728	1.34						
	1.63	1.51		.62	2.22	3.43	.13		.086	.754	1.37						
	1.95	1.57		.65	2.41	3.43	.10		.063	.787	1.44						
	2.27	1.71		.70	2.49	3.44	.05		.029	.853	1.55						
	2.60	1.77		.72	2.49	3.46	.03		.017	.883	1.60						
	2.92	1.83		.73	2.57	3.52	.02		.011	.919	1.65						
	3.08	1.858		.73	2.59	3.55	.02		.010	.929	1.66						
	3.57	1.910		.75	2.66	3.55	0		0	.955	1.71						
	4.22	1.95		.76	2.71	3.55	-.01		-.005	.97	1.73						
	4.87	2.03		.77	2.80	3.64	-.02		-.010	1.01	1.78						
	5.52	2.08		.81	2.89	3.57	-.06		-.029	1.04	1.85						
	6.17	2.15		.81	2.96	3.65	-.06		-.029	1.07	1.88						
	6.82	2.22		.81	3.03	3.74	-.06		-.028	1.11	1.92						
	7.47	2.21		.81	3.02	3.73	-.06		-.027	1.10	1.91						
	8.12	2.25		.81	3.02	3.73	-.06		-.027	1.10	1.91						
	8.77	2.28		.83	3.08	3.73	-.08		-.036	1.13	1.96						
	9.42	2.29		.83	3.11	3.71	-.08		-.035	1.14	1.97						
	10.07	2.32		.84	3.13	3.75	-.09		-.039	1.15	1.99						
	11.36	2.31		.84	3.16	3.73	-.09		-.038	1.16	2.01						
	12.02	2.30		.83	3.14	3.76	-.08		-.035	1.15	1.98						
	12.66	2.31		.83	3.14	3.79	-.08		-.035	1.15	1.98						
	13.31	2.31		.83	3.13	3.79	-.08		-.035	1.15	1.98						

(1) CORRECTED FOR P.F. & F.S.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. C10U - P4
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY W.P. DATE 3/3 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.5	1.172	100	808	8.00	10.1
PRESHEAR	33.0	.905	100	709	7.79	9.11

G_s = 2.77 TYPE CELL C.H.

PRESHEAR STRESS HISTORY $\bar{\sigma}_{vm}$ = 6.00 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = .74 t_c =
$\bar{\sigma}_{3c}$ = .74 P.P.R. = 100 %
$\bar{\sigma}_{ac}$ = .74 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .0006 "/min
PATH undrained loading

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	13.32	2.31		.83	3.14	3.79	-.08		-.035	1.15	1.98						
	13.97	2.36		.83	3.19	3.84	-.08		-.034	1.18	1.98						
	14.61	2.34		.88	3.22	3.66	-.13		-.056	1.17	2.05						

(1) CORRECTED FOR P.F. & F.S.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK₀-UU-P7
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY W.P. DATE 3/9 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.0	1.192	97.5	809	8.00	10.1
PRESHEAR	32.7	.904	100	70.3	7.07	9.95

G_s = 2.77 TYPE CELL C.H.

PRESHEAR STRESS HISTORY anisotropic consolidation with loading K=0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.98 t_c =
$\bar{\sigma}_{3c}$ = 3.00 P.P.R. = 95 %
$\bar{\sigma}_{ac}$ = 5.98 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .0006 "/min
PATH undrained

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$(\bar{\sigma}_1 / \bar{\sigma}_3) / \bar{\sigma}_{1c}$ ($\bar{\sigma}_3$)	$\bar{\sigma}_1$	~~$\bar{\sigma}_f$~~	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\Delta u / \bar{\sigma}_{1c}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	0	2.98	3.08	5.98		2.00	0		—	4.49	4.49						
	0	2.35	3.28	5.63		1.72	-.28		.431	1.18	4.46						
	0	1.16	3.69	4.85		1.31	-.69		.375	.58	4.27						
	-.007	.531	3.73	4.26		1.14	-.73		.296	.266	4.06						
	-.038	.113	3.70	3.81		1.03	-.70		.242	.056	3.76						
	-.078	-.086	3.68	3.59		.97	-.68		.228	-.043	3.64						
					Reloading												
	-.078	.068	3.50	3.57		1.02	.18		2.64	.034	3.53						
	-.078	.63	3.30	3.93		1.19	.38		.604	.34	3.61						
	-.078	1.59	2.89	4.44		1.54	.81		.509	.78	3.67						
	-.078	2.30	2.65	4.95		1.87	1.32		.573	1.15	3.80						
	+.156	3.37	2.38	5.75		2.42	1.44		.427	1.69	4.07						
	.295	3.71	2.26	5.97		2.65	1.55		.418	1.86	4.12						
	.58	3.87	2.15	6.02		2.80	1.71		.442	1.88	4.09						
	1.12	3.76	2.00	5.76		2.88	1.84		.489	1.84	3.88						
	1.54	3.67	1.87	5.54		2.96	1.97		.537	1.76	3.71						
	2.43	3.51	1.71	5.22		3.05	2.09		.595	1.72	3.47						
	3.09	3.43	1.59	5.02		3.16	2.16		.630	1.68	3.31						
	3.79	3.36	1.52	4.88		3.21	2.21		.658	1.66	3.20						
	4.51	3.31	1.47	4.78		3.26	2.23		.674	1.64	3.13						
	5.24	3.28	1.45	4.73		3.26	2.31		.704	1.63	3.09						
	6.11	3.26	1.39	4.63		3.38	2.35		.722	1.59	3.00						
	6.98	3.17	1.33	4.50		3.38	2.39		.754	1.57	2.92						
	7.67	3.14	1.29	4.43		3.43	2.39		.762	1.57	2.86						
	8.58	3.10	1.29	4.39		3.40	2.40		.774	1.55	2.84						
	9.48	3.08	1.28	4.36		3.41	2.40		.778	1.54	2.82						
	10.37	3.06	1.27	4.33		3.41	2.41		.787	1.53	2.80						
	11.05	3.02	1.26	4.28		3.40	2.42		.802	1.51	2.77						

(1) CORRECTED FOR

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

First Cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. *CIU-CyC-E P9*

SOIL *Remolded BBC*

PROJECT *Earth Science*

TESTED BY *W.P.* DATE *4/23 65*

ALL STRESSES IN *kg/cm*

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.6	1.200	98.3	80.9	8.00	10.11
PRESHEAR	31.1	.861	100	68.5	7.62	9.00

G_s = *2.77* TYPE CELL *Geonor*

PRESHEAR STRESS HISTORY *Isotropically cons. to 6.00 kg/cm²*

PRESHEAR

$\bar{\sigma}_{1c}$ = *6.00* t_c = ______

$\bar{\sigma}_{3c}$ = *6.00* P.P.R. = *95* %

$\bar{\sigma}_{ac}$ = *6.00* u_B = *3.00*

DURING SHEAR

CONTROLLED STRAIN *✓* STRESS ______

RATE *606 min/cm*

PATH *Cyclic compression & extension*

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q (4)	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	0	.01		6.00	6.01	1.00	0		0	.005	6.00						
	.01	.17		6.00	6.17	1.03	0		0	.09	6.09						
	.03	.63		5.79	6.42	1.11	.21		.33	.32	6.11						
	.09	2.09		4.91	7.00	1.43	1.09		.52	1.05	5.96						
	.17	2.87		4.42	7.29	1.65	1.58		.55	1.44	5.86						
	.25	3.25		4.08	7.33	1.80	1.92		.59	1.63	5.71						
	.42	3.63		3.54	7.17	2.03	2.46		.68	1.82	5.37						
	.58	3.77		3.28	7.05	2.15	2.72		.72	1.89	5.26						
	.79	3.88		2.98	6.86	2.30	3.08		.78	1.94	4.92						
	.98	3.95		2.83	6.78	2.40	3.17		.81	1.98	4.71						
	1.14	3.96		2.66	6.62	2.49	3.34		.84	1.98	4.64						
	1.57	4.00		2.46	6.46	2.63	3.54		.89	2.00	4.46						
	1.67	4.02		2.33	6.35	2.72	3.64		.90	2.01	4.34						
	1.93	4.03		2.20	6.23	2.83	3.80		.94	2.02	4.22						
	2.08	4.01		2.17	6.18	2.85	3.83		.98	2.01	4.18						
	2.44	4.05		2.04	6.09	2.99	3.96		.98	2.03	4.07						
	2.66	4.05		2.00	6.05	3.03	4.00		.99	2.04	4.03						
	3.04	4.08		1.91	5.99	3.14	4.09		1.00	2.04	3.95						
	3.10	3.82		1.94	5.76	2.97	4.06		1.06	1.91	3.85						
	3.11	3.37		1.95	5.32	2.73	4.05			1.69	3.64						
	3.11	2.75		2.05	4.80	2.34	3.95			1.38	3.43						
	3.07	2.69		2.05	4.74	2.31	3.95			1.35	3.40						
	3.04	2.17		2.11	4.28	2.03	3.89			1.09	3.20						
	2.97	1.55		2.26	3.81	1.69	3.74			.78	3.04						
	2.87	1.04		2.35	3.39	1.41	3.65			.52	2.87						
	2.68	.37		2.39	2.76	1.16	3.61			.19	2.58						
	2.60	.26		2.34	2.60	1.11	3.66			.13	2.47						
	2.47	-.21		2.54	2.33	.92	3.46			-.11	2.43						
	2.29	-.38		2.56	2.28	.89	3.44			-.19	2.37						
	2.11	-.50		2.54	2.04	.81	3.46			-.25	2.29						
	1.95	-.62		2.49	1.87	.75	3.51			-.31	2.18						
	1.30	-.72		2.45	1.73	.71	3.55			-.36	2.09						
	1.16	-.93		2.59	1.66	.64	3.41			-.47	2.12						
	.94	-1.09		2.54	1.45	.57	3.46			-.55	1.99						
	.59	-1.33		2.59	1.26	.49	3.41			-.67	1.92						

(1) CORRECTED FOR *P.F. & F.S.*

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS: *(4) q = ½ ($\bar{\sigma}_a - \bar{\sigma}_r$)*

First Cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU-CyC-E P9

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY W.P. DATE 2/23 65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.6	1.200	98.3	80.9	8.00	10.11
PRESHEAR	31.1	.861	100	68.5	7.62	9.00

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Cons. isotrop. to 6.00 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.00 t_c =

$\bar{\sigma}_{3c}$ = 6.00 P.P.R. = 95 %

$\bar{\sigma}_{oc}$ = 6.00 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE 606 min/cm

PATH Cyclic compression extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	A (3)	q (4)	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	.31	-1.51		2.66	1.15	.43	3.34			-.76	1.90						
	.17	-1.65		2.73	1.08	.40	3.27			-.83	1.90						
	-.57	-1.92		2.84	.92	.32	3.16			-.96	1.88						
	-.79	-1.57		2.55	.98	.38	3.45			-.79	1.76						

(1) CORRECTED FOR

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS: (4) $q = 1/2(\bar{\sigma}_a - \bar{\sigma}_r)$

Second Cycle ✓

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU-CyC-E P9
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY W.P.+NFB DATE 2/23 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.6	1.20	98.3	8.08	8.00	10.11
PRESHEAR	31.1	.861	100	68.5	7.62	9.00

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Isotropically cons. to 6.00 kg/cm² ✓

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.00 t_c = ______
$\bar{\sigma}_{3c}$ = 6.00 P.P.R. = 95 %
$\bar{\sigma}_{ac}$ = 6.00 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS ______
RATE 606 min/cm
PATH Cyclic compression ✓ - extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q (4)	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	-.52	-.75		1.92	1.17	.61	4.08			-.26	1.66						
	.04	.01		1.62	1.63	1.01	0		~~0~~	.008	1.63						
	.23	.34		1.39	1.73	1.24	.23		.68	.17	1.56						
	.38	.57		1.26	1.83	1.46	.36		.63	.29	1.55						
	.74	.97		1.08	2.05	1.90	.54		.57	.48	1.56						
	1.17	1.38		1.00	2.38	2.38	.62		.45	.69	1.69						
	1.51	1.70		.97	2.67	2.75	.65		.38	.85	1.82						
	2.00	2.07		.97	3.04	3.14	.65		.31	1.04	2.01						
	2.54	2.57		1.04	3.61	3.47	.58		.23	1.29	2.33						
	3.22	3.07		1.13	4.20	3.72	.49		.16	1.54	2.67						
	4.13	3.43		1.23	4.66	3.79	.39		.11	1.72	2.95						
	4.74	3.69		1.23	4.92	4.00	.39		.11	1.85	3.08						
	6.23	3.82		1.30	5.12	3.94	.32		.083	1.91	3.21						
	7.30	3.87		1.32	5.19	3.94	.30		.078	1.94	3.26						
	7.94	3.96		1.32	5.28	4.00	.30		.076	1.98	3.30						
	8.70	3.96		1.37	5.33	3.89	.25		.063	1.98	3.35						
	8.76	3.19		1.33	4.52	3.40	.29		.091	1.60	2.93						
	8.68	2.02		1.50	3.52	2.45	.12			1.02	2.52						
	8.51	1.33		1.53	2.86	1.89	.09			0.66	2.19						
	8.10	.43		1.45	1.88	1.30	.17			.22	1.67						
	7.93	-.20		1.50	1.30	.87	.12			-.10	1.40						
	6.66	-.40		1.24	.84	.69	.33			-.20	1.09						
	6.39	-.50		1.21	.71	.59	.41			-.25	.96						
	5.60	-.59		1.22	.63	.52	.40			-.30	.92						
	5.06	-.69		1.18	.49	.42	.40			-.34	.84						
	4.32	-.81		1.18	.37	.31	.44			-.40	.78						

(1) CORRECTED FOR P.F. & F.S.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS: (4) $q = 1/2(\bar{\sigma}_a - \bar{\sigma}_r)$

Third Cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU-CyC-E P9

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY WP, NFB DATE 3/23 65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.6	1.20	98.3	80.9	8.00	10.11
PRESHEAR	31.1	.861	100	68.5	7.62	9.00

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Isotrop. cons. to 6.00 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.00 t_c =

$\bar{\sigma}_{3c}$ = 6.00 P.P.R. = 95 %

$\bar{\sigma}_{ac}$ = 6.00 u_B = 300

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE 606 min/cm

PATH Cyclic Compression & extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a / \bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q (4)	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	ε relative		
	4.02	-.40		.97	.57	.59	-.65			-.20	.77			.+		
	4.75	.13		.63	.76	1.21	.08		.62	.06	.69			.18		
	5.14	.32		.43	.75	1.75	.23		.72	.16	.59			.47		
	5.34	.56		.45	1.01	2.35	.26		.47	.28	.73			.67		
	5.60	.82		.38	1.20	3.16	.33		.31	.41	.79			.93		
	5.98	1.02		.39	1.41	3.61	.32		.14	.51	.90			1.31		
	6.78	1.44		.51	1.92	3.77	.20		.085	.74	1.25			2.11		
	7.44	1.88		.55	2.43	4.42	.16		.035	.94	1.49			2.77		
	8.05	2.37		.62	2.99	4.82	.09		-.031	1.19	1.81			3.38		
	8.95	2.94		.80	3.74	4.67	-.09		-.073	1.47	2.27			4.28		
	10.2	3.44		.96	4.40	4.58	-.25		-.090	1.72	2.68			5.53		
	11.10	3.56		1.03	4.59	4.45	-.32		-.090	1.78	2.81			6.43		
	11.40	3.70		1.04	4.74	4.56	-.33		-.104	1.85	2.89			6.74		
	12.20	3.73		1.10	4.83	4.38	-.39		-.110	1.87	2.97			7.53		
	12.90	3.81		1.13	4.94	4.37	-.42		-.117	1.91	3.04			8.21		
	13.65	3.84		1.17	5.01	4.28	-.45		-.123	1.92	3.09			8.98		
	14.00	3.75		1.18	4.93	4.18	-.46		-.132	1.87	3.05			9.31		
	15.00	3.88		1.22	5.10	4.18	-.51		-.171	1.94	3.16			10.3		
	15.07	3.16		1.25	4.41	3.53	-.54			1.58	2.83			10.4		
	14.89	1.64		1.38	3.02	2.19	-.67			.82	2.20					
	14.7	1.14		1.38	2.52	1.83	-.67			.57	1.95					
	14.5	.61		1.31	1.92	1.46	-.60			.30	1.61					
	14.2	.53		1.12	1.65	1.47	-.41			.26	1.38					
	13.2	-.30		1.08	.78	.72	-.31			-.15	.83					
	12.0	-.43		.96	.53	.55	-.25			-.22	.74					
	11.5	-.52		.92	.44	.46	-.25			-.26	.70					
	10.8	-.58		.92	.34	.37	-.23			-.29	.68					
	10.1	-.64		.92	.28	.30	-.23			-.32	.60					
	9.55	-.71		.92	.21	.23	-.23			-.35	.57					
	8.58	-.79		1.01	.23	.22	-.30			-.39	.62					
	7.78	-.87		1.03	.16	.15	-.32			-.44	.54					
	6.83	-.97		1.12	.15	.14	-.41			-.48	.64					
	5.84	-1.08		1.23	.15	.12	-.52			-.54	.69					
	4.66	-1.22		1.36	.14	.10	-.65			-.61	.75					
	4.51	-.53		.83	.30	.36	-.12			-.27	.57					

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS: (4) $q = 1/2\,(\bar{\sigma}_a - \bar{\sigma}_r)$

Fourth Cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU-CyE-E P9

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY W.P. & N.F.B. DATE 2/23 65

ALL STRESSES IN Kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.6	1.20	98.3	80.9	8.00	10.11
PRESHEAR	31.1	.861	100	68.5	7.62	9.00

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Isotropically cons. to 6.00 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.00 t_c =

$\bar{\sigma}_{3c}$ = 6.00 P.P.R. = 95 %

$\bar{\sigma}_{ac}$ = 6.00 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE 606 min/cm

PATH Cyclic compression extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q (4)	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	5.28	-.23		.58	.35	.61	.13			-.11	.47						
	5.61	.07		.30	.37	1.23	.08		1.14	.04	.34						
	6.65	.24		.18	.42	2.33	.20		.83	.12	.30						
	7.30	.30		.14	.44	3.14	.24		.80	.15	.29						
	8.30	.38		.13	.51	3.92	.25		.66	.19	.32						
	9.10	.48		.13	.61	4.68	.25		.52	.24	.37						
	10.3	.68		.14	.82	5.92	.24		.35	.34	.48						
	10.7	.82		.18	1.00	5.56	.20		.24	.41	.59						
	11.5	1.06		.20	1.26	6.30	.18		.17	.53	.73						
	12.4	1.34		.27	1.61	5.98	.11		.082	.67	.94						
	13.1	1.60		.34	1.94	5.72	.04		.035	.80	1.14						
	13.7	1.99		.44	2.43	5.53	-.06		-.030	1.00	1.44						
	14.9	2.32		.51	2.83	5.55	-.13		-.056	1.16	1.67						
	16.1	2.73		.65	3.38	5.21	-.27		-.100	1.37	2.02						
	17.3	2.96		.78	3.74	4.79	-.40		-.135	1.48	2.26						
	18.0	3.04		.79	3.83	4.83	-.41		-.135	1.52	2.31						

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS: (4) $q = 1/2 (\bar{\sigma}_a - \bar{\sigma}_r)$

111

First Cycle ✓ CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. *CIU-CyC-E P10*

SOIL *Remolded BBC*

PROJECT *Earth Science*

TESTED BY *WP + NEB* DATE *3/23 65*

ALL STRESSES IN *kg/cm²*

	W, %	e	S, %	V, cc	L, cm	A, cm^2
INITIAL	42.4	1.192	98.3	80.6	8.00	10.08
PRESHEAR	31.1	.860	100	68.5	7.62	9.00

G_s = *2.77* TYPE CELL *Geonor*

PRESHEAR STRESS HISTORY *Isotrop. cons. to 6.00 kg/cm²*

PRESHEAR

$\bar{\sigma}_{1c}$ = *6.00* t_c = ____

$\bar{\sigma}_{3c}$ = *6.00* P.P.R. = *96* %

$\bar{\sigma}_{ac}$ = *6.00* u_B = *3.00*

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS ____

RATE *606 min/cm*

PATH *Cyclic compression & extension*

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q (4)	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	0	0		5.98	5.98	1.00	0		—	0	5.98						
	.01	.31		5.68	5.99	1.06	.30		1.00	.15	5.83						
	.03	.50		5.29	5.79	1.10	.69		1.40	.25	5.54						
	.09	1.95		4.76	5.71	1.20	1.22		.063	.98	5.74						
	.13	2.46		4.42	6.88	1.56	1.56		.64	1.23	5.65						
	.17	2.92		4.01	6.93	1.73	1.97		.68	1.46	5.47						
	.30	3.18		3.66	6.84	1.87	2.32		.73	1.59	5.25						
	.44	3.46		3.36	6.82	2.03	2.62		.76	1.73	5.09						
	.52	3.62		3.17	6.79	2.14	2.81		.78	1.81	4.98						
	.78	3.73		2.92	6.65	2.28	3.06		.82	1.87	4.79						
	.97	3.82		2.76	6.58	2.39	3.22		.84	1.91	4.67						
	1.09	3.86		2.48	6.34	2.56	3.50		.91	1.93	4.31						
	1.50	3.85		2.38	6.23	2.62	3.60		.94	1.93	4.14						
	1.78	3.87		2.20	6.07	2.76	3.78		.97	1.94	4.17						
	1.90	3.87		2.23	6.10	2.74	3.75		1.00	1.94	4.04						
	1.97	3.79		2.17	5.96	2.75	3.81			1.90	3.99						
	1.99	3.55		2.21	5.76	2.61	3.77			1.78	3.88						
	1.98	3.24		2.26	5.50		3.72			1.62	3.60						
	1.95	2.37		2.41	4.78		3.57			1.19	3.56						
	1.92	2.07		2.52	4.59		3.46			1.04	3.33						
	1.83	1.26		2.70	5.96		3.28			.63	3.19						
	1.71	.67		2.85	6.52		3.13			.34	3.09						
	1.56	.37		2.90	6.27		3.08			.19	2.09						
	1.40	-.39		3.17	5.78		2.81			-.20	2.97						
	1.30	-.63		3.18	5.55		2.80			-.32	2.86						
	1.16	-.84		3.18	5.34		2.80			-.42	2.76						
	1.02	-1.09		3.24	5.15		2.74			-.55	2.69						
	.82	-1.35		3.31	4.96		2.67			-.68	2.63						
	.63	-1.55		3.38	4.83		2.60			-.78	2.60						
	.51	-1.69		3.45	4.76		2.53			-.85	2.60						
	.18	-1.82		3.52	4.70		2.46			-.91	2.61						
	-.17	-2.18		3.60	5.78		2.38			-1.09	2.51						
	-.32	-2.25		3.63	5.88		2.35			-1.13	2.50						
	-.74	-2.40		3.67	6.07		2.31			-1.20	2.47						
	-1.13	-2.37		3.68	6.05		2.30			-1.28	2.40						

(1) CORRECTED FOR *RF.*

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS: (4) = $\frac{1}{2}(\bar{\sigma}_a - \bar{\sigma}_r)$

First Cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU-CyC-E P10

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY WP & NFB DATE 2/23 65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.4	1.192	98.3	80.6	8.00	10.1
PRESHEAR	31.1	.860	100	68.5	7.62	9.00

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Isotropic cons. to 6.00 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.98 t_c =

$\bar{\sigma}_{3c}$ = 5.98 P.P.R. = 96 %

$\bar{\sigma}_{ac}$ = 5.98 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE 606 min/cm

PATH Cyclic compression extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q (4)	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	-1.33	-2.52		3.72	6.24		2.26			-1.26	2.46						
	-1.37	-2.11		3.43	4.32		2.55			-1.06	2.37						
	-1.30	.85		2.49	4.64		3.49			-.43	2.06						

(1) CORRECTED FOR

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS: (4) $q = 1/2(\bar{\sigma}_a - \bar{\sigma}_r)$

113.

Second Cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU-CyC-E P10

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY W.P. & NFB DATE 2/23 65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.1	1.192	98.3	80.6	8.06	10.1
PRESHEAR	31.1	.860	100	68.5	[illegible]	9.00

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Isotropic cons. to 6.00 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.98 t_c =

$\bar{\sigma}_{3c}$ = 5.98 P.P.R. = 96 %

$\bar{\sigma}_{ac}$ = 5.98 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE 606 min/cm

PATH Cyclic compression extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	(4) q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	-1.23	-.56		2.30	1.74		3.68			-.28	2.02						
	-1.00	.08		1.78	1.86	1.05	.10		1.03	.04	1.82						
	-.67	.57		1.46	2.03	1.39	.42		.74	.29	1.75						
	-.21	1.03		1.25	2.28	1.83	.63		.61	.52	1.82						
	.03	1.24		1.20	2.44	2.03	.68		.51	.62	1.85						
	.21	1.40		1.15	2.55	2.22	.73		.50	.70	1.96						
	.59	1.72		1.10	2.82	2.56	.78		.50	.86	2.16						
	.68	2.13		1.09	3.22	2.96	.79		.37	1.07	2.57						
	1.81	2.81		1.16	3.97	3.42	.72		.26	1.41	2.70						
	2.39	3.05		1.17	4.22	3.61	.71		.23	1.53	2.80						
	3.78	3.17		1.21	4.38	3.67	.67		.21	1.59	2.89						
	4.68	3.39		1.19	4.58	3.85	.69		.20	1.70	3.02						
	5.75	3.43		1.30	4.73	3.63	.58		.17	1.72	3.09						
	6.75	3.58		1.30	4.88	3.75	.58		.16	1.79	3.08						
	7.17	3.61		1.28	4.89	3.82	.60		.17	1.80	2.88						
	7.16	2.83		1.46	4.29	2.96	.42		.15	1.42	2.90						
	6.96	1.85		1.47	3.32		.41			1.43	2.90						
	6.28	.74		1.40	2.14		.48			.37	1.77						
	5.72	-.06		1.25	1.18		.63			-.03	1.22						
	4.20	-.66		1.24	.58		.64			-.33	.91						
	3.46	-.79		1.27	.48		.61			-.40	.87						
	2.53	-.94		1.34	.40		.54			-.47	.87						
	1.70	-1.08		1.48	.40		.40			-.54	.94						

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS: (4) = 1/2 ($\bar{\sigma}_a - \bar{\sigma}_r$)

Third Cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. *CIU-CyC-E P10*
SOIL *Remolded BBC*
PROJECT *Earth Science*
TESTED BY *W.P. & N.B.* DATE *3/23/65*
ALL STRESSES IN *kg/cm²*

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.1	1.192	98.3	80.6	8.00	10.1
PRESHEAR	31.1	.860	100	68.5	7.62	9.00

G_s = *2.77* TYPE CELL *Geonor*

PRESHEAR STRESS HISTORY *Isotropic cons to 6.00 kg/cm²*

PRESHEAR

$\bar{\sigma}_{1c}$ = *5.98* t_c =
$\bar{\sigma}_{3c}$ = *5.98* P.P.R. = *96* %
$\bar{\sigma}_{ac}$ = *5.98* u_B = *3.00*

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE *606 min/cm*
PATH *Cyclic compression & extension*

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	ε rel.			
	1.76	-.40		.94	.54		.94			-.20	.74						
	2.66	.34		.47	.81	1.73	.24		.71	.17	.64			.36			
	3.40	.46		.46	.92	2.00	.23		.50	.23	.69			1.20			
	4.23	.98		.40	1.38	3.45	.31		.32	.49	.89			2.03			
	5.23	1.45		.49	1.94	3.97	.22		.15	.73	1.22			3.08			
	6.17	1.97		.58	2.55	4.40	.13		.07	.99	1.57			3.97			
	7.05	2.40		.67	3.07	4.58	.04		.02	1.20	1.87			4.85			
	7.96	2.79		.79	3.58	4.54	-.08		-.03	1.39	2.18			5.76			
	8.87	3.06		.87	3.93	4.52	-.16		-.05	1.53	2.40			6.67			
	9.75	3.13		.97	4.10	4.22	-.26		-.08	1.57	2.54			7.55			
	10.8	3.39		1.04	4.43	4.26	-.33		-.10	1.70	2.74			8.62			
	11.3	3.55		1.06	4.61	4.35	-.35		-.10	1.78	2.84			9.12			
	12.1	3.49		1.11	4.60	4.14	-.40		-.11	1.75	2.86			9.92			
	13.1	3.55		1.16	4.71	4.06	-.45		-.13	1.78	2.93			10.9			
	13.1	2.96		1.20	4.16	3.46	-.49		-.16	1.48	2.68			10.9			
	12.9	1.51		1.34	2.85		.76			2.10	2.10						
	12.5	.73		1.28	2.01		.37			1.65	1.65						
	12.3	.43		1.22	1.65		.22			1.44	1.44						
	11.8	-.11		1.30	1.19		-.06			1.25	1.25						
	11.2	-.30		1.13	.83		-.15			.98	.98						
	10.5	-.44		.98	.54		-.22			.76	.76						
	9.86	-.49		.93	.44		-.25			.69	.69						
	9.10	-.57		.93	.36		-.29			.65	.65						
	8.11	-.65		.93	.28		-.33			.61	.61						
	6.66	-.81		1.04	.25		-.41			.65	.65						
	5.72	-.91		1.08	.17		-.46			.63	.63						
	4.84	-1.01		1.25	.24		-.51			.75	.75						
	3.60	-1.16		1.30	.14		-.58			.72	.72						
	2.89	-1.26		1.51	.25		-.63			.88	.88						
	3.06	-.38		.83	.45		-.19			.64	.64						

(1) CORRECTED FOR *P.F.*

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

Fourth Cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU-CyC-E P10
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY WP & NB DATE 2/23 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.1	1.192	98.3	80.6	8.00	10.1
PRESHEAR	31.1	.860	100	68.5	7.62	9.00

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Isotropic cons. to 6.00 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.98 t_c =
$\bar{\sigma}_{3c}$ = 5.98 P.P.R. = 96 %
$\bar{\sigma}_{ac}$ = 5.98 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE 606 min/cm
PATH Cyclic compression extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q (4)	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	3.15	-.23		.67	0.44					-.12	.56						
	3.39	.01		.46	.47	1.02	.01		1.00	.01	.47						
	4.42	.20		.32	.52	1.62	.15		.75	.10	.42						
	5.14	.27		.18	.45	2.50	.29		1.02	.135	.32						
	6.25	.39		.16	.55	3.44	.31		.80	.20	.36						
	7.03	.47		.17	.64	3.76	.30		.64	.24	.41						
	7.88	.59		.18	.77	4.28	.29		.49	.30	.48						
	8.53	.71		.21	.92	4.38	.26		.37	.36	.57						
	9.49	.93		.27	1.20	4.45	.20		.22	.47	.74						
	10.4	1.25		.32	1.57	4.92	.15		.12	.63	.95						
	11.4	1.55		.41	1.96	4.79	.06		.04	.78	1.18						
	12.2	1.86		.47	2.33	4.96	0		0	.93	1.40						
	13.4	2.33		.61	2.94	4.83	-.14		-.06	1.17	1.78						
	14.3	2.60		.70	3.30	4.72	-.23		-.09	1.30	2.00						
	15.3	2.84		.79	3.63	4.60	-.32		-.11	1.42	2.21						
	16.1	2.94		.86	3.80	4.43	-.39		-.13	1.47	2.33						
	16.3	2.98		.86	3.84	4.47	-.39		-.13	1.49	2.35						

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS: (4) = ½ $(\bar{\sigma}_a - \bar{\sigma}_r)$

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK_o - $\overline{C}$IOU - P11
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY WP, NFB DATE 8/9 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.8	1.182	100	80.2	8.00	10.01
PRESHEAR	35.3	.978	100	70.5	7.21	9.82

G_s = 2.77 TYPE CELL C.H.

PRESHEAR STRESS HISTORY Anisotropic cons to 6.00 kg/c² K_o = 0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.04 t_c =
$\bar{\sigma}_{3c}$ = 3.00 P.P.R. = 98 %
$\bar{\sigma}_{ac}$ = 6.04 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE 606 min/cm
PATH Unload, reconsolidate - compression

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$
	0	3.04		3.00	6.04	2.01	0		—	1.52	4.52		
	-.011	2.62		3.11	5.73	1.85	-.11		.262	1.31	4.42		
	-.021	2.34		3.16	5.50	1.74	-.16		.228	1.17	4.33		
	-.04	1.97		3.27	5.24	1.60	-.27		.252	.985	4.26		
	-.078	1.54		3.38	4.92	1.46	-.38		.253	.77	4.15		
	-.17	1.18		3.43	4.61	1.34	-.43		.231	.59	4.02		
	-.18	.765		3.47	4.24	1.22	-.47		.207	.38	3.85		
	-.25	.39		3.40	3.79	1.12	-.40		.103	.195	3.60		
	-.38	.002		3.32	3.32	1.00	-.32		.105	.001	3.32		
	Drainage lines opened and sample consolidated to $\bar{\sigma}_c$ = 0.25 kg/c²												
	New Area = 9.81 cm² Length = 7.42 cm S = 100 % e = 1.033												
	0	0		.25	.25	1.00	0		—	0	.25		
	0	.01		.23	.24	1.04	.02		2.06	.005	.23		
	.04	.11		.17	.28	1.65	.08		.727	.055	.22		
	.08	.20		.15	.35	2.33	.10		.500	.10	.25		
	.19	.31		.07	.38	5.43	.18		.582	.155	.22		
	.34	.46		.05	.51	10.21	.20		.435	.23	.29		
	.41	.53		.04	.59	14.8	.21		.397	.265	.32		
	.65	.62		.06	.68	11.3	.19		.307	.31	.38		
	.76	.65		.06	.71	11.8	.19		.292	.325	.41		
	.91	.71		.07	.78	11.1	.18		.254	.355	.45		
	1.11	.80		.07	.87	12.4	.18		.225	.40	.50		
	1.27	.88		.11	.99	9.0	.14		.159	.44	.58		
	1.40	.94		.10	1.04	10.4	.15		.160	.47	.57		
	1.61	1.03		.14	1.17	8.35	.11		.107	.52	.66		
	1.90	1.13		.17	1.30	7.65	.08		.071	.57	.74		
	2.14	1.22		.19	1.41	7.42	.06		.049	.61	.80		
	2.54	1.34		.25	1.59	6.36	0		0	.67	.92		
	2.74	1.40		.27	1.67	6.19	-.02		-.014	.70	.97		
	2.92	1.45		.28	1.73	6.18	-.03		-.021	.73	1.01		
	3.12	1.50		.29	1.79	6.17	-.04		-.025	.75	1.04		
	3.66	1.58		.36	1.94	5.39	-.11		-.070	.79	1.15		

(1) CORRECTED FOR P.F. & F.S.

(2) Δu FOR $\Delta \sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta \sigma_r}{\Delta \sigma_a - \Delta \sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta \sigma_a}{\Delta \sigma_r - \Delta \sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO CKo - CIOU - P11
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY W.P. NEB DATE 3/9/65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL						
PRESHEAR						

G_s = 2.77 TYPE CELL C. H.

PRESHEAR STRESS HISTORY

PRESHEAR

$\bar{\sigma}_{1c}$ = t_c =
$\bar{\sigma}_{3c}$ = P.P.R. = %
$\bar{\sigma}_{ac}$ = u_B =

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE 606 min/cm
PATH

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	4.07	1.62		.39	2.01	5.14	-.14	-	-.087	.81	1.20						
	4.60	1.68		.41	2.09	5.09	-.16		-.095	.84	1.25						
	5.26	1.75		.44	2.21	5.03	-.19		-.109	.88	1.32						
	5.92	1.78		.45	2.23	4.96	-.20		-.113	.89	1.34						
	6.45	1.79		.45	2.24	4.98	-.20		-.112	.90	1.35						
	7.19	1.80		.48	2.28	4.75	-.23		-.128	.90	1.38						
	8.26	1.82		.47	2.29	4.87	-.22		-.121	.91	1.38						
	8.93	1.82		.49	2.31	4.72	-.24		-.132	.91	1.40						
	9.76	1.84		.53	2.37	4.47	-.28		-.152	.92	1.45						
	10.71	1.82		.55	2.37	4.32	-.30		-.165	.91	1.46						
	11.39	1.81		.52	2.33	4.42	-.27		-.149	.91	1.43						
	12.22	1.79		.55	2.34	4.26	-.30		-.168	.90	1.45						
	13.10	1.78		.54	2.32	4.30	-.29		-.163	.89	1.43						
	13.78	1.77		.54	2.31	4.28	-.29		-.164	.89	1.43						
	14.90	1.74		.54	2.28	4.23	-.29		-.167	.87	1.41						
	16.19	1.71		.54	2.25	4.18	-.29		-.170	.86	1.40						

(1) CORRECTED FOR P.F. & F.S.

(2) Δu FOR $\Delta \sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta \sigma_r}{\Delta \sigma_a - \Delta \sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta \sigma_a}{\Delta \sigma_r - \Delta \sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK₀ - CIOU P12
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY WP & NFB DATE 3/9 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm^2
INITIAL	42.6	1.168	99	80.5	8.00	10.1
PRESHEAR	~~34.5~~	.916	100	71.12	7.16	9.93

G_s = 2.77 TYPE CELL C.H.

PRESHEAR STRESS HISTORY Anisotr. cons. to $\bar{\sigma}_{1c}$ = 6.0 kg/cm² K = 0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.99 t_c =
$\bar{\sigma}_{3c}$ = 3.00 P.P.R. = 98 %
$\bar{\sigma}_{ac}$ = 5.99 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE 606 min/cm
PATH unloading, recons, compression.

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$
	0	2.99		3.00	5.99	2.00	0		—	1.50	4.50		
	-.003	2.89		3.06	5.95	1.95	-.06		.600	1.45	4.51		
	-.014	2.64		3.11	5.75	1.85	-.11		.314	1.32	4.43		
	-.039	2.25		3.23	5.48	1.70	-.23		.311	1.13	4.36		
	-.074	1.80		3.36	5.16	1.54	-.36		.302	.90	4.26		
	-.116	1.46		3.40	4.86	1.43	-.40		.261	.73	4.13		
	-.175	.91		3.42	4.33	1.27	-.42		.202	.46	3.88		
	-.270	.61		3.38	3.99	1.18	-.38		.160	.31	3.69		
	-.407	.156		3.31	3.47	1.05	-.31		.110	.08	3.39		
	-.487	.003		3.28	3.28		-.28		.094	.002	3.28		

Drainage lines opened and sample cons. isotropically to $\bar{\sigma}_c$ = 0.75 kg/cm²
New area 9.94 cm² New length 7.27 cm e_f = .948 w = 34.5%

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu	$\frac{\Delta u}{\bar{\sigma}_{1c}}$	A	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$
	0	0		.75	.75	1.00	0		—	0	.75		
	.06	0		.74	.74	1.00	.01		—	0	.74		
	.13	.34		.55	.89	1.62	.20		.588	.17	.72		
	.203	.57		.51	1.08	2.12	.24		.422	.29	.80		
	.269	.69		.43	1.12	2.61	.32		.464	.35	.78		
	.339	.79		.42	1.21	2.88	.33		.418	.40	.82		
	.409	.85		.41	1.26	3.07	.34		.400	.43	.84		
	.478	.93		.42	1.35	3.22	.33		.355	.47	.89		
	.553	.98		.43	1.41	3.28	.32		.317	.49	.92		
	.688	1.13		.43	1.56	3.63	.32		.276	.57	1.00		
	.827	1.25		.43	1.68	3.91	.32		.248	.63	1.06		
	.968	1.34		.45	1.79	3.97	.30		.224	.67	1.12		
	1.11	1.45		.51	1.96	3.84	.24		.116	.73	1.24		
	1.28	1.58		.53	2.11	3.98	.22		.139	.79	1.32		
	1.47	1.68		.57	2.25	3.95	.18		.107	.84	1.41		
	1.77	1.83		.62	2.45	3.95	.13		.071	.92	1.54		
	2.01	1.87		.64	2.51	3.92	.11		.059	.94	1.58		
	2.34	2.02		.73	2.75	3.77	.02		.010	1.01	1.74		
	2.56	2.07		.73	2.80	3.84	.02		.009	1.04	1.77		
	2.77	2.11		.76	2.87	3.78	-.01		-.005	1.06	1.82		

(1) CORRECTED FOR P.F. & F.S.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK₀-C̄IOU P12
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY WP & NFB DATE 3/9 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm^2
INITIAL						
PRESHEAR	34.5	.948	100	72.30	7.27	9.94

G_s = 2.77 TYPE CELL C.H.

PRESHEAR STRESS HISTORY

PRESHEAR

$\bar{\sigma}_{1c}$ = t_c =
$\bar{\sigma}_{3c}$ = P.P.R. = %
$\bar{\sigma}_{ac}$ = u_B =

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE 606 min/cm
PATH

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	3.34	2.16		.83	2.99	3.60	-.08		-.035	1.08	1.91						
	4.05	2.20		.87	3.07	3.53	-.12		-.052	1.10	1.97						
	4.48	2.25		.87	3.12	3.59	-.12		-.050	1.13	2.00						
	5.65	2.25		.85	3.10	3.65	-.10		-.042	1.13	1.98						
	6.04	2.24		.85	3.09	3.64	-.10		-.042	1.12	1.97						
	6.73	2.23		.93	3.16	3.40	-.18		-.081	1.12	2.05						
	7.54	2.22		.91	3.13	3.44	-.16		-.072	1.11	2.02						
	8.18	2.21		.89	3.10	3.49	-.14		-.066	1.11	2.00						
	8.98	2.19		.88	3.07	3.49	-.13		-.059	1.10	1.98						
	9.50	2.18		.89	3.07	3.46	-.14		-.064	1.09	1.98						
	10.80	2.15		.88	3.03	3.44	-.13		-.061	1.08	1.96						
	11.50	2.13		.86	2.99	3.48	-.11		-.052	1.07	1.93						
	12.39	2.10		.88	2.98	3.39	-.13		-.062	1.05	1.93						
	13.27	2.08		.88	2.96	3.37	-.13		-.063	1.04	1.92						
	14.39	2.05		.87	2.92	3.38	-.12		-.059	1.03	1.90						
	15.53	2.02		.85	2.87	3.31	-.10		-.050	1.01	1.86						

(1) CORRECTED FOR P.F. & F.S.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK₀ - C̄IOU - P13
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY WP & NFB DATE 3/12 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.8	1.201	98.8	80.22	8.00	10.03
PRESHEAR	34.0	.942	100	70.67	7.05	10.02

G_s = 2.77 TYPE CELL C.H.

PRESHEAR STRESS HISTORY Anisotr. cons to 6.0 kg/cm² = $\bar{\sigma}_{1c}$ K=0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.49 t_c =

$\bar{\sigma}_{3c}$ = 3.00 P.P.R. = 98 %

$\bar{\sigma}_{ac}$ = 5.49 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .0006 in/min

PATH unloading, cons, compression

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$
	0	2.49		3.00	5.49	1.83	0		—	1.25	4.25		
	0	2.13		3.12	5.25	1.68	-.12		.333	1.07	4.19		
	-.007	1.79		3.20	4.99	1.56	-.20		.286	.90	4.10		
	-.039	1.26		3.36	4.62	1.38	-.36		.293	.63	3.99		
	-.088	.82		3.44	4.36	1.27	-.44		.263	.41	3.85		
	-.166	.38		3.46	3.84	1.11	-.46		.218	.19	3.65		
	-.29	0		3.43	3.43	1.00	-.43		.173	0	3.43		
	-.33	0		3.22	3.22	1.00	-.22		.088	0	2.22		
		Drainage line opened and sample cons. isotropically to $\bar{\sigma}_c$ = 1.50 kg/cm²											
		New area = 9.96 cm² L = 7.15 cm, e = .957 ω = 35.8%											
	0	0		1.50	1.50	1.00	0		—	0	1.50		
	0	.178		1.48	1.66	1.12	.02		.112	.089	1.57		
	.007	.335		1.42	1.75	1.23	.08		.239	.168	1.59		
	.032	.593		1.40	1.99	1.42	.10		.168	.297	1.70		
	.068	.820		1.33	2.15	1.62	.17		.207	.410	1.74		
	.122	1.16		1.18	2.34	1.98	.32		.286	.558	1.76		
	.183	1.26		1.09	2.35	2.16	.41		.325	.63	1.72		
	.279	1.53		1.05	2.56	2.48	.47		.307	.765	1.795		
	.405	1.66		.97	2.63	2.71	.53		.316	.83	1.80		
	.558	2.02		.96	2.98	3.10	.54		.268	1.01	1.97		
	.785	2.06		1.00	3.03	3.03	.50		.243	1.03	2.015		
	1.00	2.44		1.03	3.47	3.37	.47		.193	1.22	2.25		
	1.29	2.60		1.08	3.68	3.41	.42		.162	1.30	2.38		
	1.56	2.65		1.11	3.76	3.39	.39		.147	1.325	2.435		
	1.96	2.65		1.11	3.76	3.39	.39		.147	1.325	2.435		
	2.13	2.69		1.11	3.80	3.42	.39		.145	1.325	2.455		
	2.28	2.71		1.11	3.82	3.44	.39		.144	1.355	2.465		
	2.55	2.73		1.11	3.84	3.46	.39		.143	1.365	2.475		
	3.37	2.76		1.10	3.86	3.51	.40		.145	1.38	2.48		
	3.96	2.76		1.08	3.84	3.55	.42		.147	1.38	2.46		
	4.52	2.75		1.07	3.82	3.57	.42		.156	1.375	2.445		
	5.76	2.72		1.01	3.73	3.69	.49		.180	1.36	2.37		

(1) CORRECTED FOR F.S. & P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. Ck_0-$\overline{C}$IOU-P13

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY WP & NFB DATE 3/12 65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.8	1.201	98	80.22	8.00	10.05
PRESHEAR	35.8	.957	100	71.22	7.15	9.96

G_s = 2.77 TYPE CELL C.H.

PRESHEAR STRESS HISTORY

PRESHEAR

$\bar{\sigma}_{1c}$ = t_c =

$\bar{\sigma}_{3c}$ = P.P.R. = %

$\bar{\sigma}_{ac}$ = u_B =

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .0006 in/min

PATH

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	6.35	2.70		.99	3.69	3.76	.51		.189	1.35	2.34						
	7.15	2.62		.99	3.61	3.65	.51		.195	1.31	2.30						
	8.01	2.59		.98	3.57	3.64	.52		.201	1.295	2.375						
	8.83	2.58		.96	3.54	3.68	.54		.210	1.29	2.25						
	9.41	2.58		.95	3.53	3.72	.55		.213	1.29	2.24						
	10.37	2.55		.95	3.50	3.69	.55		.216	1.275	2.225						
	11.50	2.49		.95	3.44	3.62	.55		.221	1.245	2.195						
	12.42	2.47		.92	3.39	3.68	.58		.235	1.235	2.155						
	13.28	2.46		.92	3.38	3.68	.58		.236	1.23	2.15						
	14.14	2.43		.91	3.34	3.67	.59		.243	1.215	2.125						
	15.04	2.36		.91	3.27	3.60	.59		.250	1.18	2.09						

(1) CORRECTED FOR F.S. & P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

1st cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CKoU-CyC P14
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY WP & NFB DATE 3/16 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.8	1.203	98	80.0	8.00	10.0
PRESHEAR	33.7	.948	100	70.67	7.16	9.88

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Anisotropic cons to $\bar{\sigma}_{1c}$ = 6.0 kg/cm² K≈0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.58 t_c =
$\bar{\sigma}_{3c}$ = 3.00 P.P.R. = 100 %
$\bar{\sigma}_{ac}$ = 5.58 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .0006 "/min
PATH Cyclic compression

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	0	2.53		3.05	5.58	1.83	0		–	1.27	4.32						
	.02	2.92		2.91	5.81	2.00	.14		.360	1.45	4.37						
	.05	3.46		2.67	6.13	2.30	.38		.404	1.73	4.40						
	.12	3.90		2.45	6.35	2.59	.60		.438	1.95	4.40						
	.25	3.95		2.26	6.21	2.54	.79		.556	1.97	4.23						
	.37	4.00		2.27	6.27	2.76	.78		.530	2.00	4.27						
	.51	3.97		2.13	6.10	2.87	.92		.640	1.99	4.12						
	.95	3.79		1.92	5.71	2.98	1.13		.898	1.90	3.82						
	1.04	3.75		1.90	5.65	2.98	1.15		.943	1.87	3.77						
	1.11	3.65		1.85	5.50	2.98	1.20		1.07	1.83	3.68						
	1.13	3.22		1.88	5.10	2.68	1.17		1.70	1.61	3.49						
	1.12	2.70		1.95	4.65	2.38	1.10		.648	1.35	3.30						
	1.09	2.47		2.03	4.50	2.22	1.02		–17.0	1.23	3.27						
	.99	1.62		2.22	3.84	1.73	.83		–.912	.81	3.03						
	.89	1.15		2.27	3.42	1.51	.78		–.565	.38	2.85						
	.73	.57		2.34	2.91	1.24	.71		–.357	[illegible]	2.63						
	.47	.04		2.37	2.41	1.02	.68		–.273	.02	2.39						
	.31	0		2.33	2.33	1.06	.72		–.285	0	2.33						

(1) CORRECTED FOR PF & F.S.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

2nd cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK₀U - CyE P14
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY WP & NFB DATE 3/16 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.8	1.203	98	80.0	8.00	10.0
PRESHEAR	33.7	.948	100	70.67	7.16	9.88

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Anisotropic cons to $\bar{\sigma}_{1c}$ = 6.0 kg/c² K = 0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.58 t_c =

$\bar{\sigma}_{3c}$ = 3.00 P.P.R. = 100 %

$\bar{\sigma}_{ac}$ = 5.58 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .0006 in/min

PATH Cyclic compression

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	ε relative			
	.31	0		2.33	2.33	1.00	0		—	0	2.33			0			
	.31	.04		2.47	2.51	1.02	-.16		—	.02	2.49			0			
	.38	.74		1.93	2.67	1.38	.40		.541	.37	2.30			.07			
	.43	1.10		1.68	2.78	1.66	.35		.318	.55	2.23			.13			
	.61	1.87		1.47	3.34	2.27	.86		.460	.94	2.41			.31			
	.79	2.41		1.37	3.78	2.76	.96		.383	1.21	2.58			.48			
	1.56	2.43		1.41	3.84	2.72	.92		.379	1.22	2.63			1.25			
	2.65	3.20		1.33	4.53	3.41	1.00		.313	1.60	2.93			2.34			
	3.47	3.16		1.28	4.44	3.47	1.05		.333	1.58	2.86			3.16			
	3.52	2.88		1.32	4.20	3.18	1.01		.349	1.44	2.76			3.21			
	3.49	2.27		1.42	3.69	2.60	.91		.402	1.14	2.55			3.18			
	3.40	1.67		1.51	3.18	2.10	.82		.492	.84	2.35			3.09			
	3.16	.83		1.59	2.42	1.52	.74		.893	.42	2.01			2.85			
	2.94	.39		1.59	1.98	1.25	.74		1.90	.20	1.79			2.63			
	2.17	0		1.54	1.54	1.00	.79		—	0	1.54			1.86			

(1) CORRECTED FOR P.F. & F.S.

(2) Δu FOR $\Delta \sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta \sigma_r}{\Delta \sigma_a - \Delta \sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta \sigma_a}{\Delta \sigma_r - \Delta \sigma_a}$ FOR EXTENSION TESTS

REMARKS:

3rd cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. $\overline{CK_oU}$ - CyC P14

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY WD & NFB DATE 3/16/65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.8	1.203	98	80.0	8.00	10.0
PRESHEAR	33.7	.948	100	70.67	7.16	9.88

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Anisotropic cons. to $\bar{\sigma}_{1c}$ = 6.0 kg/cm² K = 0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.58 t_c = ______

$\bar{\sigma}_{3c}$ = 3.00 P.P.R. = 100 %

$\bar{\sigma}_{ac}$ = 5.58 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS ______

RATE .0006 in/min

PATH Cyclic compression

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	ε relative			
	2.17	0		1.54	1.54	1.00	0		–	0	1.54						
	2.08	.04		1.54	1.58	1.03	0		0	.02	1.56			0			
	2.12	.50		1.36	1.86	1.37	.18		.900	.25	1.61			.04			
	2.16	.74		1.22	1.96	1.61	.32		.432	.37	1.59			.08			
	2.22	1.08		1.08	2.16	2.00	.46		.426	.54	1.62			.14			
	2.37	1.52		.95	2.47	2.60	.59		.388	.76	1.71			.29			
	2.64	2.01		.93	2.94	3.16	.61		.303	1.01	1.94			.56			
	2.98	2.49		.97	3.46	3.57	.57		.229	1.25	2.22			.90			
	3.58	2.77		1.03	3.80	3.69	.51		.184	1.39	2.42			1.50			
	4.37	2.99		1.09	4.08	3.75	.45		.150	1.50	2.59			2.29			
	5.28	3.07		1.09	4.16	3.82	.45		.147	1.54	2.63			3.28			
	6.93	2.96		1.08	4.04	3.74	.46		.156	1.48	2.56			4.85			
	8.60	2.91		1.05	3.96	3.77	.49		.168	1.46	2.51			6.52			
	9.57	2.15		1.09	3.24	2.97	.45		.210	1.08	2.17			7.49			
	9.31	1.02		1.18	2.20	2.71	.36		.353	.51	1.69			7.23			
	8.69	.17		1.07	1.24	1.16	.47		2.77	.09	1.16			6.61			
	8.25	0		1.02	1.02	1.00	.52		–	6	1.02			6.17			

(1) CORRECTED FOR P.F. & F.S.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

4th cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK₀U-CyC P14

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY WP & NFB DATE 3/16 65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.8	1.203	98	80.0	8.00	10.0
PRESHEAR	33.7	.948	100	70.67	7.16	9.88

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Anistropic cons to $\bar{\sigma}_{1c}$ = 6.0 kg/c² K = 0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.58 t_c =

$\bar{\sigma}_{3c}$ = 3.00 P.P.R. = 100 %

$\bar{\sigma}_{ac}$ = 5.58 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .0006 in/min

PATH Cyclic compression

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	8.25	0		1.02	1.02	1.00	0		—	0	1.02						
	8.16	.03		1.02	1.05	1.03	0		0	.02	1.04						
	8.19	.43		.78	1.21	1.55	.24		.56	.22	1.00						
	8.31	.86		.61	1.47	2.41	.41		.477	.43	1.04						
	8.60	1.28		.54	1.82	3.37	.48		.375	.64	1.18						
	9.13	1.62		.64	2.26	3.53	.48		.234	.81	1.45						
	9.95	2.28		.70	2.98	4.25	.38		.140	1.14	1.84						
	11.1	2.53		.85	3.38	3.98	.32		.067	1.27	2.12						
	11.7	2.58		.89	3.47	3.90	.17		.051	1.29	2.18						
	12.2	2.58		.93	3.51	3.77	.13		.035	1.29	2.22						
	12.5	2.70		.93	3.65	3.92	.09		.033	1.35	2.28						
	12.8	2.58		.93	3.51	3.77	.09		.035	1.29	2.22						
	13.4	2.56		.92	3.48	3.78	.09		.039	1.28	2.20						
	14.4	2.42		.91	3.40	3.74	.11		.046	1.25	2.15						

(1) CORRECTED FOR F.S. & P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

1st cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. $\overline{CK_oU}$-CyC-E P15

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY WP & NFB DATE 3/16/65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.9	1.173	100	80.0	8.00	10.0
PRESHEAR	33.3	.924	100	70.4	7.06	9.98

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Anisotropic cons to $\bar{\sigma}_{1c}$ = 6.00 kg/cm² K_o = 0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.99 t_c =

$\bar{\sigma}_{3c}$ = 3.01 P.P.R. = 100 %

$\bar{\sigma}_{ac}$ = 5.99 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE 606 min/cm

PATH Cyclic compression & extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$
	0	2.98		3.01	5.99	1.99	0		—	1.49	4.50		
	.002	3.48		2.72	6.20	2.28	.29		.58	1.79	4.50		
	.097	3.78		2.53	6.31	2.50	.48		.60	1.89	4.42		
	.431	3.86		2.26	6.12	2.71	.75		.85	1.93	4.19		
	1.08	3.65		1.94	5.59	2.88	1.07		1.60	1.83	3.77		
	1.14	3.23		1.93	5.16	2.68	1.08			1.62	3.55		
	1.14	2.74		1.94	4.68	2.41	1.07			1.37	3.31		
	1.11	2.52		2.06	4.58	2.23	.97			1.26	3.32		
	1.07	2.17		2.13	4.30	2.02	.88			1.09	3.22		
	1.04	1.57		2.25	3.82	1.69	.76			.79	3.04		
	.82	.90		2.35	3.25	1.38	.66			.45	2.80		
	.60	.36		2.38	2.74	1.15	.63			.18	2.56		
	.43	.07		2.38	2.45	1.07	.63			.04	2.41		

(1) CORRECTED FOR RF.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

127.

2nd Cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK₀U-CyC-E P15
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY WP & NFB DATE 3/16 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.9	1.173	100	80.0	8.00	10.0
PRESHEAR	33.3	.924	100	70.4	7.06	9.98

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Anisotropic cons. to $\bar\sigma_{1c}$ 6.00 kg/cm² Kco

PRESHEAR: $\bar\sigma_{1c}$ = 5.99 t_c = ____ $\bar\sigma_{3c}$ = 3.01 P.P.R. = 100 % $\bar\sigma_{ac}$ = 5.99 u_B = 3.00

DURING SHEAR: CONTROLLED STRAIN ✓ STRESS ____ RATE 606 min/cm PATH Cyclic compression - extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar\sigma_a - \bar\sigma_r)$ (1)	$\frac{(\bar\sigma_1 - \bar\sigma_3)}{\bar\sigma_{1c}}$	$\bar\sigma_r$	$\bar\sigma_a$	$\bar\sigma_a/\bar\sigma_r$	Δu (2)	$\frac{\Delta u}{\bar\sigma_{1c}}$ (2)	A (3)	q	$\bar p$	$\bar\sigma_r$	$\bar\sigma_a$	ε rel.			
	.43	.07		2.38	2.45	1.07	0		0	.04	2.41			0			
	.41	.26		2.23	2.49	1.12	.15		.578	.13	2.36			0			
	.41	.46		2.19	2.65	1.21	.19		.414	.23	2.42			0			
	.45	.104		1.90	2.94	1.55	.48		.462	.52	2.42			.043			
	.56	1.73		1.64	3.37	2.06	.74		.427	.87	2.51			.16			
	.67	2.14		1.54	3.68	2.39	.84		.393	1.07	2.61			.26			
	1.21	3.13		1.50	4.63	3.09	.88		.282	1.57	3.07			.80			
	1.89	3.29		1.46	4.75	3.25	.92		.280	1.65	3.11			1.47			
	2.43	3.29		1.36	4.65	3.42	1.02		.310	1.65	3.01			2.03			
	3.42	3.26		1.28	4.54	3.54	1.10		.337	1.63	2.91			3.01			
	3.95	3.23		1.29	4.52	3.50	1.09		.338	1.62	2.91			3.55			
	4.01	2.78		1.32	4.10	3.11	1.06		.382	1.39	2.71			3.60			
	3.97	2.22		1.44	3.66	2.54	.94		.424	1.11	2.55			3.56			
	3.86	1.54		1.54	3.08	2.00	.84		.546	.77	2.31			3.45			
	3.63	.91		1.57	2.48	1.58	.81		.890	.46	2.03			3.22			
	2.94	.10		1.50	1.60	1.07	.88			.05	1.55			2.53			
	2.52	-.42		1.57	1.15	.73	.81			-.21	1.36			2.11			
	2.01	-.46		1.47	1.01	.69	.91			-.23	1.24			1.60			
	.79	-.66		1.44	.78	.54	.94			-.33	1.11			.38			
	1.43	-.31		1.27	.96	.76	1.11			-.16	1.11			1.02			

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

3rd cycle ✓

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU-CyC-E P15
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY KIP & NFB DATE 3/16 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.9	1.173	100	80.0	8.00	10.0
PRESHEAR	33.3	.924	100	70.4	7.06	9.98

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Anisotropic cons $\bar{\sigma}_{1cm}$ = 6.00 kg/cm² K_0 ≈ .5

PRESHEAR: $\bar{\sigma}_{1c}$ = 5.99 t_c = ______ $\bar{\sigma}_{3c}$ = 3.01 P.P.R. = 100 % $\bar{\sigma}_{ac}$ = 5.99 u_B = 3.00

DURING SHEAR: CONTROLLED STRAIN ✓ STRESS ______ RATE 606 min/cm PATH Cyclic compression & extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q (4)	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	ε rel.
	1.43	0		1.08	1.08	1.00	0		—	0	1.08			
	1.90	.60		.71	1.39	1.96	.37		.544	.34	1.05			.47
	2.57	1.30		.66	1.96	2.97	.42		.322	.63	1.31			1.16
	3.70	2.23		.74	2.97	4.02	.34		.152	1.12	1.86			2.17
	4.67	2.65		.89	3.54	3.98	.19		.072	1.33	2.22			3.24
	5.68	2.81		.97	3.78	3.90	.11		.039	1.41	2.38			4.25
	6.41	2.86		.93	3.79	4.07	.15		.052	1.43	2.36			4.98
	7.29	2.88		.99	3.87	3.91	.09		.031	1.44	2.43			5.86
	7.67	2.93		.96	3.89	4.05	.12		.041	1.47	2.43			6.24
	8.45	2.91		.98	3.89	3.97	.10		.033	1.46	2.44			7.02
	9.47	2.91		.98	3.89	3.97	.10		.033	1.46	2.27			8.04
	9.72	2.55		.99	3.54	3.58	.09			1.28	2.02			8.29
	9.67	1.88		1.08	2.96	2.74	0			.94	1.84			8.24
	9.47	1.42		1.13	2.55	2.26	-.05			.71	1.49			8.04
	9.46	.77		1.10	1.87	1.70	-.02			.39	1.28			8.03
	8.75	.49		1.03	1.52	1.48	.05			.25	.94			7.32
	8.29	.43		.87	1.00	1.15	.21			.07	.92			6.8
	7.99	-.23		1.04	.81	.78	.04			-.12	.71			6.56
	7.18	-.42		.92	.50	.54	.16			-.21	.61			5.85
	5.70	-.49		.86	.40	.46	.22			-.25	.59			4.27
	3.97	-.62		.90	.32	.36	.18			-.31	.57			2.54
	2.70	-.70		.92	.22	.24	.16			-.35	.60			-1.27
	1.59	-.78		.99	.21	.21	.09			-.39	.60			-.16
	.587	-.86		1.09	.23	.21	-.01			-.43	.66			-.84
	-.658	-.91		1.12	.21	.19	-.04			-.46	.66			-1.49
	-.601	-.96		1.18	.22	.19	-.10			-.48	.70			-2.03
	-1.414	-.79		1.06	.27	.25	.02			-.40	.66			-2.85
	-1.34	-.52		.83	.31	.37	.25			-.26	.57			-2.77
	-.98	-.31		.61	.30	.49	.47			-.16	.45			-2.41
	-.79	-.12		.44	.32	.73	.64			-.06	.38			-2.22

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS: (4) = $\frac{1}{2}(\bar{\sigma}_a - \bar{\sigma}_r)$

4th cycle

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SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU-CyC-E P15
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY WP & NFB DATE 3/16/65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.9	1.173	100	80.0	8.00	10.0
PRESHEAR	33.3	.924	100	70.4	7.06	9.98

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Anisotropic cons. $\bar{\sigma}_{1m}$ = 6.00 kg/cm² K_0 = 0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.99 t_c =
$\bar{\sigma}_{3c}$ = 3.01 P.P.R. = 100 %
$\bar{\sigma}_{ac}$ = 5.99 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE 606 min/cm
PATH Cyclic compression & extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	ε rel.			
	.255	.01		.32	.33	1.03	0		—	.005	.33			0			
	.442	.13		.22	.35	1.59	.10		.77	.07	.29			.187			
	1.29	.21		.16	.37	2.31	.16		.76	.11	.27			1.04			
	2.05	.27		.17	.44	2.59	.15		.56	.14	.31			1.79			
	3.10	.31		.16	.47	2.94	.16		.52	.16	.32			2.84			
	4.06	.47		.16	.63	3.94	.16		.34	.24	.40			3.80			
	5.20	.64		.19	.83	4.37	.13		.20	.32	.51			4.94			
	6.22	.79		.22	1.01	4.60	.10		.13	.40	.62			5.96			
	7.72	1.20		.31	1.51	4.87	.01		.008	.60	.91			7.46			
	8.99	1.48		.35	1.83	5.24	-.03		-.02	.74	1.09			8.53			
	9.84	1.75		.40	2.15	5.38	-.08		-.046	.88	1.28			9.58			
	11.1	1.94		.49	2.43	4.96	-.17		-.088	.97	1.46			10.8			
	11.7	2.08		.49	2.57	5.25	-.17		-.082	1.04	1.53			11.4			
	12.1	2.15		.53	2.68	5.06	-.21		-.098	1.08	1.61			11.8			
	12.8	2.22		.54	2.76	5.11	-.22		-.099	1.11	1.65			12.6			
	13.6	2.26		.62	2.88	4.64	-.30		-.133	1.13	1.75			13.3			
	14.6	2.26		.62	2.88	4.64	-.30		-.133	1.13	1.75			14.4			

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta \sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta \sigma_r}{\Delta \sigma_a - \Delta \sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta \sigma_a}{\Delta \sigma_r - \Delta \sigma_a}$ FOR EXTENSION TESTS

REMARKS:

1st cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK_oU-CyC-E P16

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY WP & NFB DATE 3/16 65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	41.6	1.162	100	81.2	8.00	10.14
PRESHEAR	32.2	.903	100	71.3	7.18	9.94

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Anistropically cons to $\bar{\sigma}_{1c}$ = 6.0 kg/cm² K=0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.99 t_c =

$\bar{\sigma}_{3c}$ = 2.98 P.P.R. = 100 %

$\bar{\sigma}_{ac}$ = 5.99 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE 606 min/cm

PATH Cyclic compression & extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	0	3.01		2.98	5.99	2.01	.00		—	1.50	4.49						
	.004	3.27		2.83	6.10	2.16	.17		.66	1.64	4.47						
	.01	3.52		2.82	6.34	2.25	.18		.35	1.76	4.58						
	.05	3.81		2.64	6.45	2.45	.36		.44	1.91	4.55						
	.18	3.99		2.48	6.47	2.61	.52		.53	2.06	4.48						
	.35	4.00		2.33	6.33	2.72	.67		.67	2.00	4.33						
	.54	3.93		2.21	6.14	2.78	.79		.85	1.97	4.18						
	.77	3.84		2.12	5.96	2.81	.88		1.05	1.92	4.04						
	.97	3.80		1.98	5.78	2.92	1.02		1.25	1.90	3.88						
	1.12	3.64		1.93	5.57	2.89	1.07			1.82	3.75						
	1.15	3.50		1.93	5.43	2.81	1.07			1.75	3.68						
	1.15	3.03		1.94	4.97	2.57	1.06			1.52	3.46						
	1.15	2.78		2.00	4.78	2.39	1.00			1.39	3.39						
	1.13	2.34		2.11	4.45	2.11	.89			1.17	3.28						
	1.06	1.67		2.21	3.88	1.76	.79			.84	3.05						
	1.02	1.37		2.26	3.63	1.61	.74			.69	2.95						
	.88	.66		2.31	2.97	1.29	.69			.33	2.64						
	.77	.31		2.31	2.62	1.13	.69			.16	2.47						

(1) CORRECTED FOR

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

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REMARKS:

2nd cycle

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SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK_0U-CyC-E P16
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY WP & NFB DATE 3/16 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	41.6	1.162	100	81.2	8.00	10.14
PRESHEAR	32.2	.903	100	71.3	7.18	9.94

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Anisotropic cons to $\bar{\sigma}_{1c}$= 6.0 kg/cm² K=0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.99 t_c = ____
$\bar{\sigma}_{3c}$ = 2.98 P.P.R. = 100 %
$\bar{\sigma}_{ac}$ = 5.99 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS ____
RATE 606 min/cm
PATH Cyclic compression extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	ε rel.			
	.622	.08		2.31	2.39	1.05	0		—	.04	2.35			.00			
	.61	.12		2.28	2.40	1.13	.03		.25	.06	2.34			.01			
	.61	.28		2.22	2.50	1.26	.09		.32	.14	2.36			.01			
	.61	.55		2.11	2.66	1.59	.20		.36	.28	2.39			.01			
	.65	1.09		1.84	2.93	2.11	.47		.43	.55	2.39			.05			
	.71	1.86		1.59	3.35	2.41	.72		.39	.93	2.52			.11			
	.80	2.22		1.58	3.80	2.91	.73		.33	1.11	2.69			.20			
	.97	2.82		1.48	4.30	3.11	.83		.29	1.41	2.89			.37			
	1.24	3.20		1.52	4.72	3.26	.79		.25	1.60	3.12			.64			
	1.85	3.39		1.50	4.89	3.39	.81		.24	1.70	3.20			1.25			
	3.02	3.35		1.40	4.75	3.47	.91		.27	1.68	3.08			1.42			
	3.53	3.35		1.36	4.71	3.17	.95		.28	1.68	3.04			2.93			
	3.59	2.95		1.36	4.31	2.49	.95		.32	1.48	2.84			2.99			
	3.57	2.21		1.48	3.69	1.93	.83			1.11	2.59			2.97			
	3.48	1.45		1.57	3.02	1.41	.74			.73	2.30						
	3.24	.65		1.58	2.23	1.19	.78			.33	1.91						
	3.03	.29		1.58	1.87	1.01	.73			.15	1.73						
	2.80	.02		1.51	1.53	.88	.80			.01	1.52						
	2.69	-.20		1.59	1.39	.74	.72			-.10	1.49						
	2.53	-.42		1.61	1.19	.68	.70			-.21	1.40						
	2.29	-.50		1.54	1.04	.65	.75			-.25	1.39						
	1.98	-.60		1.52	.98	.48	.79			-.30	1.22						
	1.30	-.82		1.44	.62	.39	.87			-.42	1.02						
	.65	-.87		1.43	.50	39	.88			-.44	.99						
	.63	-.43		1.20	.77	.64	1.11			-.22	.98						

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

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REMARKS:

3rd cycle

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TEST NO. CK₀U-CyC-E P16

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY WP & NFB DATE 3/16 65

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PRESHEAR

$\bar{\sigma}_{1c}$ = 5.99 t_c =

$\bar{\sigma}_{3c}$ = 2.98 P.P.R. = 100 %

$\bar{\sigma}_{ac}$ = 5.99 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE 606 min/cm

PATH Cyclic compression & extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ [1]	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu [2]	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ [2]	A [3]	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	ε rel.			
	.80	.188		.92	1.11	1.21	0		–	.094	1.01						
	1.08	.50		.68	1.18	1.[illegible]	.24		.48	.25	.92			.22			
	1.99	1.11		.57	1.68	2.[illegible]	.35		.32	.56	.93			1.13			
	2.97	1.82		.80	2.47	3.80	.27		.15	.91	1.13			2.11			
	3.90	2.38		.87	3.18	3.97	.12		.05	1.19	1.56			3.04			
	4.86	2.65		.93	3.52	4.05	.05		.02	1.38	1.99			4.00			
	5.70	2.77		.96	3.70	3.98	-.01		-.004	1.39	2.25			4.84			
	6.80	2.85		.97	3.81	3.93	-.04		-.014	1.43	2.32			5.94			
	7.82	2.90		1.02	3.87	3.99	-.05		-.017	1.45	2.39			6.96			
	8.16	2.61		1.08	3.63	3.56	-.10		-.034	1.31	2.42			7.30			
	8.14	1.89		1.06	2.[illegible]	2.75	-.16			.95	2.33			7.28			
	8.02	1.28		1.06	2.34	2.21	-.14			.64	2.03						
	7.70	.52		.97	1.58	1.49	-.14			.26	1.70						
	7.17	.20		1.01	1.17	1.21	-.05			.10	1.32						
	7.04	-.15		.90	.86	.85	-.09			-.08	1.07						
	6.45	-.38		.87	.52	.58	.02			-.19	.93						
	6.17	-.41		.86	.46	.53	.05			-.21	.71						
	5.81	-.48		.85	.38	.44	.06			-.24	.66						
	5.24	-.53		.85	.32	.38	.07			-.27	.62						
	4.54	-.63		.85	.22	.26	.07			-.32	.58						
	3.42	-.71		.88	.14	.17	.07			-.36	.53						
	2.64	-.77		.88	.11	.13	.04			-.39	.49						
	1.61	-.86		.97	.11	.11	.05			-.43	.[illegible]						
	.94	-.91		1.01	.10	.10	.09			-.46	.55						
	.10	-.95		1.07	.12	.11	-.15			-.48	.55						
	-.55	-1.03		1.12	.09	.08	-.20			-.52	.60						
	-1.38	-1.09		1.18	.09	.08	-.26			-.55	.63						
	-1.83	-.49		.93	.44	.47	-.01			-.25	.68						
	-1.77	-.42		.80	.38	.48	.12			-.21	.59						
	-1.67	-.29		.64	.35	.55	.28			-.15	.49						
	-1.37	-.09		.45	.36	.80	.47			-.05	.40						

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

4th cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK0U-CyC-E P16

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY WP/WFB DATE 3/16 65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	41.6	1.162	100	81.2	8.06	10.14
PRESHEAR	32.2	.903	100	71.3	7.18	9.94

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Anisotropic cons. $\bar{\sigma}_{1cm}$ = 6.0 kg/cm² K=0.5

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.99 t_c =

$\bar{\sigma}_{3c}$ = 2.98 P.P.R. = 100 %

$\bar{\sigma}_{ac}$ = 5.99 u_B = 3.06

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE 606 min/cm

PATH Cyclic compression & extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	-1.00	-.09		.39	.30	.77	[illegible]		—	-.05	.34						
	-.63	.15		.24	.39	1.63	.12		.80	.07	.31						
	.15	.19		.16	.35	2.19	.20		1.05	.09	.25						
	.98	.24		.14	.38	2.71	.22		.916	.12	.26						
	2.12	.33		.13	.36	2.77	.23		.697	.16	.29						
	3.07	.45		.13	.58	4.47	.23		.512	.23	.36						
	4.19	.61		.17	.78	4.58	.19		.312	.31	.48						
	5.57	.96		.22	1.18	5.36	.14		.146	.48	.70						
	6.90	1.36		.29	1.65	5.69	.07		.051	.68	.97						
	7.66	1.59		.35	1.94	5.54	.01		.006	.80	1.15						
	8.50	1.82		.43	2.25	5.23	-.07		-.038	.91	1.34						
	9.67	2.10		.55	2.65	4.83	-.19		-.091	1.05	1.60						
	10.4	2.22		.56	2.78	4.97	-.20		-.090	1.11	1.67						
	11.0	2.29		.57	2.86	5.03	-.21		-.092	1.15	1.72						
	11.8	2.38		.60	2.98	4.97	-.24		-.101	1.19	1.79						
	12.4	2.42		.67	3.09	4.62	-.31		-.128	1.21	1.88						

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. C1-UU($\bar{\sigma}_3$) RmC-P17
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY NFB DATE 4/15 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	44	1.165	98.2	81.60	8.00	10.2
PRESHEAR	31.5	.873	108	70.6	7.55	9.28

G_s = 2.77 TYPE CELL C.H. with $\bar{\sigma}_3$ eq.

PRESHEAR STRESS HISTORY Isotropic cons. to $\bar{\sigma}_{1c}$ = 6.04 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.04 t_c =
$\bar{\sigma}_{3c}$ = 6.04 P.P.R. = B=1.00
$\bar{\sigma}_{ac}$ = 6.04 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .015 in/min
PATH undrained loading

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_3$	Area cm²	Lo cm	Cycle No
	0	0												3.30	9.88	7.55	1
	.303	1.70					First shear										
	.54	2.40															
	.87	2.77															
	1.21	2.92															
	1.55	3.03															
	1.95	3.10															
	2.29	3.15															
	3.50	3.17															
	4.72	3.22															
	6.05	3.19															
	0	0					Second shear							2.82	10.43	6.75	2
	.23	.72															
	.60	1.16															
	.98	1.54															
	1.50	1.98															
	2.03	2.33															
	2.48	2.48															
	3.01	2.68															
	3.95	2.84															
	5.26	2.98															
	6.40	3.02															
	8.27	3.02															
	0	0					Third shear							.96	11.52	6.10	3
	.25	.61															
	.58	.95															
	1.00	1.27															
	1.50	1.64															
	2.00	1.94															
	2.50	2.16															
	2.92	2.27															
	3.96	2.35															
	5.00	2.54															

(1) CORRECTED FOR

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. 51-UU($\bar{\sigma}_s$)RmC-P17
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY NFB DATE 4/15/65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	41.4	1.165	98.2	81.6	8.00	10.2
PRESHEAR	31.5	.873	100	70.6	7.55	9.28

G_s = 2.77 TYPE CELL C.H. with $\bar{\sigma}_s$ eq

PRESHEAR STRESS HISTORY Isotropic cons. to 6.04 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.04 t_c =
$\bar{\sigma}_{3c}$ = 6.04 P.P.R. = B=1.00
$\bar{\sigma}_{ac}$ = 6.04 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .015 in/min
PATH undrained loading

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_s$	Area cm²	Lo cm	Cycle No.
	6.33	2.58												.96	11.52	6.10	3
	8.34	2.55															
						Fourth shear											
	0	0												.85	12.42	5.65	4
	.27	.58															
	.54	.93															
	.99	.95															
	1.53	1.49															
	1.98	1.69															
	2.52	1.81															
	3.06	1.90															
	4.05	2.02															
	4.95	2.06															
	6.75	2.22															
	8.37	2.20															
	0	0				Sample remolded, sheared								.09	10.00	6.86	1
	.0	0															
	.22	0															
	.55	.03															
	1.11	.09															
	2.22	.11															
	3.32	.18															
	4.44	.20															
	5.54	.27															
	6.65	.33															
	7.38	.40															
	9.25	.44															
	10.32	.52															
	12.20	.57															
	13.30	.63															
	14.78	68															

(1) CORRECTED FOR

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK₀-UU($\bar{\sigma}_3$) Rw P19

SOIL Remolded BBC

PROJECT Earth Science

TESTED BY NFB DATE 12/22 65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL				81.2	8.00	10.15
PRESHEAR	37.2	1.00	100	76.0	7.39	10.29

G_s = 2.77 TYPE CELL CH. with $\bar{\sigma}_3$

PRESHEAR

$\bar{\sigma}_{1c}$ = 5.92 t_c =

$\bar{\sigma}_{3c}$ = 3.00 P.P.R. = B = 99%

$\bar{\sigma}_{ac}$ = 5.92 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .015 in/min

PATH ~~undrained~~ loading

PRESHEAR STRESS HISTORY Anisotropically cons. to 5.92 ($\bar{\sigma}_{1c}$) & 3.00 ($\bar{\sigma}_{3c}$)

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	~~A~~	σ_3	$\bar{\sigma}_3$	Lo cm	Ao cm²	Cycle No
	0	0											6.11	2.70	6.98	10.29	1
	.004	.283				First shear											
	.018	.332															
	.036	.382															
	.073	.432															
	.145	.498															
	.218	1.068															
	.292	1.585															
	.364	1.93															
	.437	2.22															
	.51	2.44															
	.62	2.60															
	.73	3.06															
	.84	3.26															
	.95	3.40															
	1.09	3.44															
	1.27	3.54															
	1.46	3.68															
	1.82	3.69															
						Second shear											
	0	0											6.11	2.03	6.92	10.39	2
	.018	.061															
	.074	.107															
	.147	.141															
	.220	.594															
	.294	.984															
	.368	1.248															
	.478	1.56															
	.588	1.85															
	.698	2.08															
	.845	2.40															
	1.065	2.53															
	1.211	2.96															
	1.396	3.11															

(1) CORRECTED FOR ____

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK₀-UU(G) Rm P19
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY NFB DATE 12/22 65
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL						
PRESHEAR						

G_s = ________ TYPE CELL ________

PRESHEAR STRESS HISTORY ________

PRESHEAR

$\bar{\sigma}_{1c}$ = ________ t_c = ________

$\bar{\sigma}_{3c}$ = ________ P.P.R. = ________ %

$\bar{\sigma}_{ac}$ = ________ u_B = ________

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS ________

RATE .015 in/min

PATH undrained loading

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	σ_3	σ_s	Lo cm	Ao cm²	Cycle No
	1.54	3.19															
	1.76	3.26															
	2.06	3.30															
	2.39	3.33															
	2.76	3.35															
	3.12	3.36															
	3.49	3.36															
	4.04	3.36															
						Third shear							6.11	1.35	6.73	10.67	3
	0	0															
	.038	.90															
	.076	1.081															
	.151	1.199															
	.226	1.21															
	.340	1.45															
	.492	1.61															
	.680	1.84															
	.830	2.04															
	1.057	2.31															
	1.321	2.54															
	1.70	2.77															
	2.08	2.91															
	2.64	3.02															
	3.02	3.06															
	3.40	3.08															
	4.16	3.13															
	4.92	3.13															
	5.66	3.13															
	7.65	3.14															
	8.31	3.11															
					Remolded fourth shear								6.11	.11	?	?	4
		Ff = 11.30			Suf = 1.185 kg/cm²												

(1) CORRECTED FOR ________

(2) Δu FOR $\Delta \sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta \sigma_r}{\Delta \sigma_a - \Delta \sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta \sigma_a}{\Delta \sigma_r - \Delta \sigma_a}$ FOR EXTENSION TESTS

REMARKS:

1st cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CID-CyC-E P20
SOIL Remolded BBC 16 g/l NaCl
PROJECT Earth Science
TESTED BY NFB DATE 8/23 66
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	38.4	1.080	100	80.34	8.00	10.08
PRESHEAR	30.7	.843	100	71.24	7.80	9.14

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Isotropic cons to 6.06 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.06 t_c =
$\bar{\sigma}_{3c}$ = 6.06 P.P.R. = 100 %
$\bar{\sigma}_{ac}$ = 6.06 u_B = 3.02

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE 600.01 min/cm
PATH Cyclic compression / extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q (4)	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$
	0	0		6.06	6.06	1.00	0		—	0	6.06		
	.0026	.167		5.97	6.14	1.03	.09		.540	.083	6.05		
	.004	.919		5.52	6.44	1.16	.54		.588	.46	5.98		
	.005	1.55		5.16	6.71	1.30	.90		.581	.775	5.935		
	.018	1.86		4.85	6.71	1.39	1.28		.652	.93	5.78		
	.042	2.07		4.75	6.82	1.43	1.31		.632	1.035	5.785		
	.145	2.58		4.27	6.85	1.61	1.79		.694	1.29	5.56		
	.255	2.79		3.85	6.64	1.73	2.21		.794	1.395	5.245		
	.41	3.08		3.54	6.62	1.87	2.52		.819	1.54	5.08		
	.64	3.31		3.09	6.40	2.07	2.97		.898	1.665	4.755		
	.92	3.46		2.76	6.22	2.25	3.30		.955	1.73	4.49		
	.99	3.49		2.73	6.22	2.28	3.33		.955	1.745	4.475		
	1.25	3.56		2.52	6.08	2.42	3.54		.994	1.78	4.30		
	1.74	3.64		2.21	5.85	2.64	3.85		1.058	1.82	4.03		
	2.18	3.65		2.00	5.65	2.83	4.06		1.112	1.825	3.825		
	2.92	3.70		1.83	5.53	3.02	4.23		1.142	1.85	3.68		
	3.60	3.73		1.70	5.43	3.20	4.36		1.169	1.865	3.565		
	4.08	3.73		1.71	5.44	3.18	4.35		1.192	1.865	3.575		
	4.12	3.30		1.71	5.01					1.65	3.36		
	3.97	1.84		1.93	3.77					.92	2.85		
	3.36	.086		2.02	2.11					.043	2.06		
	2.27	-.86		2.00	1.14					-.43	1.57		
	1.57	-1.08		2.15	1.07					-.54	1.61		

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS: (4) $q = 1/2(\bar{\sigma}_a - \bar{\sigma}_r)$

2nd cycle ✓

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU-CyC-E P20
SOIL Remolded BBC 16g/l NaCl
PROJECT Earth Science
TESTED BY NFB DATE 3/23 66
ALL STRESSES IN kg/cm² ✓

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	38.4	1.080	100	80.34	8.00	10.08
PRESHEAR	30.7	.843	100	71.24	7.80	9.14

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Isotropic cons. to 6.06 kg/cm² ✓

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.06 t_c =
$\bar{\sigma}_{3c}$ = 6.06 P.P.R. = 100 %
$\bar{\sigma}_{ac}$ = 6.06 u_B = 3.02

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE 600.01 min/cm
PATH Cyclic compression - extension ✓

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_a - \bar{\sigma}_r)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_a/\bar{\sigma}_r$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q (4)	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	1.570	.003		1.57	1.57	1.00	0		—	.0015	1.57						
	1.576	.281		1.33	1.61	1.21	.24		.852	.14	1.47						
	1.578	.306		1.32	1.63	1.23	.25		.817	.153	1.47						
	1.619	.427		1.25	1.68	1.34	.31		.725	.213	1.46						
	1.659	.526		1.20	1.73	1.44	.37		.702	.26	1.46						
	1.72	.625		1.15	1.78	1.55	.43		.687	.31	1.46						
	1.84	.778		1.05	1.83	1.76	.52		.668	.39	1.44						
	1.97	.925		.98	1.91	1.95	.59		.638	.46	1.44						
	2.14	1.08		.95	2.03	2.14	.62		.576	.54	1.49						
	2.28	1.20		.95	2.15	2.26	.62		.516	.60	1.55						
	2.64	1.53		.91	2.44	2.68	.66		.432	.765	1.675						
	3.08	1.91		.93	2.84	3.06	.64		.334	.955	1.885						
	3.54	2.33		.94	3.27	3.48	.59		.253	1.165	2.105						
	4.04	3.04		1.05	4.09	3.90	.52		.171	1.52	2.57						
	4.67	3.10		1.15	4.25	3.70	.42		.135	1.55	2.70						
	5.20	3.22		1.17	4.39	3.75	.40		.124	1.61	2.78						
	5.59	3.31		1.21	4.52	3.73	.36		.108	1.855	2.865						
	6.25	3.45		1.30	4.75	3.66	.37		.107	1.725	3.025						
	6.72	3.50		1.27	4.77	3.75	.30		.086	1.75	3.02						
	7.06	3.56		1.25	4.81	3.85	.32		.090	1.78	3.03						
	7.77	3.59		1.31	4.90	3.74	.36		.100	1.795	3.105						
	8.36	3.64		1.31	4.95	3.78	.36		.099	1.82	3.13						
	8.79	3.63		1.32	4.95	3.75	.35		.097	1.815	3.14						
	8.79	3.46		1.32	4.78					1.73	3.05						
	8.79	2.47		1.45	4.92					1.235	2.685						
	8.44	-.31		1.17	1.01					-.15	1.17						
	6.60	-.43		1.22	.74					-.22	.95						
	5.53	-.73		1.24	.47					-.375	.74						
	4.93	-.79		1.24	.45					-.395	.84						

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS: (4) $q = \frac{1}{2}(\bar{\sigma}_a - \bar{\sigma}_r)$

3rd Cycle

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. $\overline{CIU}$-CyC-E P20
SOIL Remolded BBC 16 g/l NaCl
PROJECT Earth Science
TESTED BY NFB DATE 3/23 66
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	38.4	1.080	100	80.34	8.00	10.08
PRESHEAR	30.7	.845	100	71.24	7.80	9.14

G_s = 2.77 TYPE CELL Geonor

PRESHEAR STRESS HISTORY Isotropic cons. to 6.06 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.06 t_c = ______
$\bar{\sigma}_{3c}$ = 6.06 P.P.R. = 100 %
$\bar{\sigma}_{ac}$ = 6.06 u_B = 3.02

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS ______
RATE 600.01 min/cm
PATH Cyclic compression extension

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	5.10	.004		.54	.54	1.00	0		—	.002	.54						
	5.11	.015		.72	.74	1.03	-.18		-12.0	.0075	.73						
	5.11	.10		.70	.80	1.14	-.16		-1.60	.05	.75						
	5.13	.22		.60	.82	1.37	-.06		-.273	.11	.71						
	5.36	.33		.46	.77	1.68	+.08		+.242	.168	.625						
	5.64	.45		.44	.89	2.02	+.10		+.222	.225	.665						
	7.34	1.25		.46	1.71	3.72	+.08		+.064	.625	1.085						
	8.96	1.28		.47	1.75	3.72	+.07		+.055	.64	1.11						
	9.40	1.71		.59	2.30	3.90	-.05		-.029	.855	1.445						
	10.69	2.95		.82	3.30	4.02	-.37		-.113	1.24	2.16						
	11.53	3.02		.91	3.86	4.24	-.41		-.125	1.475	2.385						
	12.20	3.20		.95	3.97	4.18	-.49		-.136	1.51	2.46						
	12.93	3.29		1.03	4.23	4.12	-.54		-.153	1.60	2.63						
	13.52	3.46		1.08	4.37	4.04	-.70		-.164	1.645	2.725						
	15.60	3.55		1.24	4.64	3.74	-.68		-.206	1.70	2.94						
	15.82	3.55		1.22	4.77	3.91	-.74		-.192	1.775	2.995						
	15.90	3.55		1.28	4.83	3.78	-.74		-.208	1.775	3.055						
	15.96	3.54		1.28	4.82	3.76	-.74		-.209	1.70	3.05						

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU - P21
SOIL Remolded BBC
PROJECT Earth Science
TESTED BY NFB DATE 3/22 66
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	38.5	1.10	96.3	77.1	7.54	10.22
PRESHEAR	30.0	.88	100	67.0	7.42	9.03

G_s = 2.77 TYPE CELL WF

PRESHEAR STRESS HISTORY 1-D to 1.5 kg/cm² 3-D .375, .75, 1.5, 5.1, 6.06

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.06 t_c =
$\bar{\sigma}_{3c}$ = 6.06 P.P.R. = 100 %
$\bar{\sigma}_{ac}$ = 6.06 u_B = 3.0

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .00048 "/min
PATH Loading

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$
8:12	0	0	0	6.06	6.06	1.00	0	0	—	0	6.06		
	.05	.28	.046	6.21	6.21	1.05	.03	.021	.47	.14	6.07		
	.10	.44	.073	5.92	6.36	1.08	.14	.023	.32	.22	6.14		
	.22	.75	.124	5.72	6.47	1.13	.34	.056	.45	.375	6.10		
	.39	.81	.134	5.63	6.44	1.14	.43	.071	.53	.41	6.04		
	.43	.85	.140	5.41	6.26	1.16	.65	.107	.77	.43	5.84		
	.44	1.48	.244	5.15	6.63	1.29	.91	.150	.62	.74	5.89		
	.47	1.69	.279	4.87	6.56	1.35	1.19	.197	.71	.85	5.72		
	.52	2.48	.410	4.52	7.00	1.50	1.54	.254	.62	1.24	5.76		
	.56	2.70	.446	4.35	7.05	1.62	1.71	.282	.64	1.35	5.70		
	.67	3.16	.522	3.89	7.05	1.81	2.17	.358	.69	1.58	5.47		
	.705	3.22	.532	3.87	7.09	1.83	2.19	.361	.68	1.61	5.48		
	.89	3.51	.580	3.39	6.90	2.04	2.67	.442	.76	1.76	5.15		
	1.15	3.68	.607	3.07	6.75	2.20	3.00	.495	.82	1.84	4.91		
	1.31	3.72	.614	2.87	6.59	2.30	3.19	.526	.86	1.86	4.73		
	1.55	3.77	.622	2.54	6.31	2.48	3.40	.562	.90	1.89	4.43		
	1.73	3.82	.630	2.41	6.23	2.59	3.53	.582	.92	1.91	4.32		
	2.14	3.84	.633	2.28	6.12	2.68	3.78	.623	.98	1.92	4.20		
	2.76	3.95	.652	2.09	6.04	2.89	3.98	.658	1.01	1.98	4.07		
	3.64	3.97	.656	1.89	5.86	3.10	4.17	.688	1.05	1.99	3.88		
	4.45	4.01	.661	1.77	5.78	3.27	4.29	.709	1.07	2.005	3.78		
	4.98	4.01	.661	1.69	5.70	3.37	4.33	.716	1.08	2.005	3.70		
	5.52	4.01	.661	1.68	5.69	3.38	4.38	.725	1.10	2.005	3.69		
15:26	6.45	4.00	.660	1.66	5.66	3.41	4.40	.726	1.10	2.00	3.66		

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CIU - P21
SOIL Remolded BBC 16g/l NaCl
PROJECT Earth Science
TESTED BY NFB DATE 3/22 66
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	38.4	1.098	96.3	71.1	7.53	10.22
PRESHEAR	30.0	.822	100	67.0	7.42	9.03

G_s = 2.77 TYPE CELL W.F.

PRESHEAR STRESS HISTORY Isotropic cons. to 6.06 kg/cm²

PRESHEAR

$\bar{\sigma}_{1c}$ = 6.06 t_c =
$\bar{\sigma}_{3c}$ = 6.06 P.P.R. = 100 %
$\bar{\sigma}_{ac}$ = 6.06 u_B = 3.02

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .00048 in/min
PATH undrained comp.

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)$ (1)	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	Δu (2)	$\frac{\Delta u}{\bar{\sigma}_{1c}}$ (2)	A (3)	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$				
	0	0		6.06	6.06	1.00	0		—	0	6.06						
	.05	.28		5.93	6.21	1.05	.13		.47	.14	6.07						
	.10	.44		5.92	6.36	1.08	.14		.32	.22	6.14						
	.22	.75		5.72	6.47	1.13	.34		.45	.375	6.10						
	.39	.81		5.63	6.44	1.14	.43		.53	.41	6.04						
	.43	.85		5.41	6.26	1.16	.65		.77	.43	5.84						
	.44	1.48		5.15	6.63	1.29	.91		.62	.74	5.89						
	.47	1.69		4.87	6.56	1.35	1.19		.71	.85	5.72						
	.475	2.01		4.81	6.82	1.42	1.25		.62	1.01	5.82						
	.52	2.48		4.52	7.00	1.50	1.54		.62	1.24	5.76						
	.56	2.70		4.35	7.05	1.62	1.71		.64	1.35	5.70						
	.67	3.16		3.89	7.05	1.81	2.17		.69	1.58	5.47						
	.705	3.22		3.87	7.09	1.83	2.19		.68	1.61	5.48						
	.89	3.51		3.39	6.90	2.04	2.67		.76	1.76	5.15						
	1.15	3.68		3.07	6.75	2.20	3.00		.82	1.84	4.91						
	1.31	3.72		2.87	6.59	2.30	3.19		.86	1.86	4.73						
	2.14	3.84		2.28	6.12	2.68	3.78		.98	1.92	4.20						
	2.76	3.95		2.09	6.04	2.89	3.98		1.01	1.98	4.07						
	3.64	3.97		1.89	5.86	3.10	4.17		1.05	1.99	3.88						
	4.45	4.01		1.77	5.78	3.27	4.29		1.07	2.005	3.78						
	4.98	4.01		1.69	5.70	3.37	4.33		1.08	2.005	3.70						
	5.52	4.01		1.68	5.69	3.38	4.38		1.10	2.005	3.69						
	6.45	4.00		1.66	5.66	3.41	4.40		1.10	2.00	3.66						

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK₀O-UU($\bar{\sigma}_3$) Rm P22

SOIL Remolded BBC 16 g/L NaCl

PROJECT Earth Science

TESTED BY NFB DATE 2/12 66

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	39.8	1.112	99	80.8	8.00	10.1
PRESHEAR	32.8	.888	100	72.3	7.23	10.0

G_s = 2.77 TYPE CELL C.H. with $\bar{\sigma}_3$

PRESHEAR STRESS HISTORY Anisotropic cons, K₀. $\bar{\sigma}_{1cm}$ = 6.0, $\bar{\sigma}_{3cm}$ = 3.0

PRESHEAR

$\bar{\sigma}_{1c}$ = 3.00 t_c =

$\bar{\sigma}_{3c}$ = 2.10 P.P.R. = B=1.00

$\bar{\sigma}_{ac}$ = 3.00 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .015 in/min

PATH undrained compression

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_3$	σ_3	A cm²	Lo cm
	0	0					First shear							2.07	3.97	10.00	7.23
	.07	.168															
	.175	.269															
	.244	.390															
	.455	.489															
	.629	.522															
	.675	.602															
	.682	.845															
	.699	.972															
	.716	.982															
	.734	1.199															
	.77	1.382															
	.84	1.74															
	.91	2.04															
	.98	2.31															
	1.12	2.56															
	1.15	2.78															
	1.19	2.94															
	1.26	3.09															
	1.36	3.25															
	1.57	3.44															
	1.92	3.47															
	2.10	3.51															
	2.45	3.50															
	0	0					Second Shear							1.63	3.97	10.19	7.14
	.07	.165															
	.11	.253															
	.14	.450															
	.16	.606															
	.18	.692															
	.21	1.005															
	.28	1.185															
	.36	1.379															
	.43	1.68															

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CKoO-UU($\bar{\sigma}_s$)Rm-P22
SOIL Remolded BBC 16 g/l NaCl
PROJECT Earth Science
TESTED BY NFB DATE 3/12 66
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	39.8	1.112	99	80.8	8.00	10.1
PRESHEAR	32.8	.888	100	72.3	7.23	10.0

G_s = 2.77 TYPE CELL C.H. with $\bar{\sigma}_s$

PRESHEAR STRESS HISTORY Ko consolidation, $\bar{\sigma}_{1cm}$ = 6.0, $\bar{\sigma}_{3cm}$ = 3.0

PRESHEAR

$\bar{\sigma}_{1c}$ = 3.00 t_c =
$\bar{\sigma}_{3c}$ = 2.10 P.P.R. = B = 1.00
$\bar{\sigma}_{ac}$ = 3.00 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .015 in/min
PATH undrained comp

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_s$	σ_3	A cm²	L cm
	.50	1.78															
	.57	1.94															
	.64	2.10															
	.71	2.25															
	.89	2.58															
	1.07	2.83															
	1.25	3.00															
	1.42	3.10															
	1.77	3.22															
	2.14	3.24															
	2.49	3.26															
	3.20	3.28															
	0	0					Third Shear							1.09	3.97	10.58	6.88
	.04	.096															
	.07	.33															
	.111	.50															
	.15	.635															
	.19	.72															
	.26	.86															
	.33	.97															
	.41	1.071															
	.52	1.21															
	.63	1.33															
	.70	1.46															
	.92	1.69															
	1.20	1.97															
	1.48	2.26															
	1.85	2.46															
	2.03	2.59															
	2.40	2.71															
	2.77	2.79															
	3.33	2.90															
	4.07	2.89															
	4.80	2.97															

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

145.

CONSOLIDATED - UNDRAINED TRIAXIAL TEST - DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. CK₀O-UU($\bar{\sigma}_3$) Rm P22
SOIL Remolded BBC 16 g/l NaCl
PROJECT Earth Science
TESTED BY NFB DATE 2/12 66
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	39.8	1.112	99	80.8	8.00	10.1
PRESHEAR	32.8	.888	100	72.3	7.23	10.0

G_s = 2.77 TYPE CELL C.H. with $\bar{\sigma}_3$

PRESHEAR STRESS HISTORY Ko consolidation, $\bar{\sigma}_{1cm}$ = 6.0 $\bar{\sigma}_{3cm}$ = 3.0

PRESHEAR

$\bar{\sigma}_{1c}$ = 3.00 t_c =
$\bar{\sigma}_{3c}$ = 2.10 P.P.R. B = 1.00
$\bar{\sigma}_{ac}$ = 3.00 u_B = 3.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .015 in/min
PATH undrained comp.

ELAPSED TIME	AXIAL STRAIN, %	$(\bar{\sigma}_1 - \bar{\sigma}_3)^{(1)}$	$\frac{(\bar{\sigma}_1 - \bar{\sigma}_3)}{\bar{\sigma}_{1c}}$	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1 / \bar{\sigma}_3$	$\Delta u^{(2)}$	$\frac{\Delta u}{\bar{\sigma}_{1c}}^{(2)}$	$A^{(3)}$	q	$\bar{p}$	$\bar{\sigma}_r$	$\bar{\sigma}_a$	$\bar{\sigma}_s$	$\bar{\sigma}_3$	A cm²	Lo cm
	5.54	2.98															
	6.28	2.96															
	7.39	2.94															
							Fourth Shear							0.85	3.97	11.23	6.48
	0	0															
	.039	.230															
	.079	.369															
	.12	.468															
	.16	.537															
	.20	.597															
	.28	.696															
	.39	.823															
	.51	1.03															
	.71	1.10															
	.88	1.25															
	1.08	1.43															
	1.27	1.61															
	1.47	1.78															
	1.67	1.94															
	1.86	2.07															
	2.16	2.25															
	2.55	2.41															
	2.94	2.52															
	3.34	2.59															
	3.73	2.63															
	4.32	2.68															
	4.72	2.71															
	5.49	2.75															
	6.67	2.72															

(1) CORRECTED FOR P.F.

(2) Δu FOR $\Delta\sigma_3 = 0$

(3) $A = \frac{\Delta u - \Delta\sigma_r}{\Delta\sigma_a - \Delta\sigma_r}$ FOR COMPRESSION TESTS

$A = \frac{\Delta u - \Delta\sigma_a}{\Delta\sigma_r - \Delta\sigma_a}$ FOR EXTENSION TESTS

REMARKS:

UNCONSOLIDATED - UNDRAINED TRIAXIAL TEST — DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. UU($\bar{\sigma}_3$) U7-16-1

SOIL BBC undisturbed

PROJECT CAES

TESTED BY NFB DATE 5/13 64

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	36.4	1.022	100	80.0	8.0	10.0
FINAL					8.0	10.0

G_s 2.78 TYPE CELL C.H. with $\bar{\sigma}_3$

PRESHEAR

u	σ_c
-.10	0
+.40	.50
+.90	1.00

PRESHEAR σ_c 1.00

PRESHEAR B 1.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .03 "/min

PATH loading

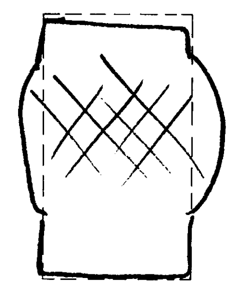
ELAPSED TIME	AXIAL STRAIN, %	$(\sigma_1 - \sigma_3)$ (1)	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	Δu (2)	A	q	$\bar{p}$
15:49	0	0							
	.318	.203							
	637	.303							
	.955	.367							
	1.27	.424							
	1.59	.468							
	1.91	.512							
	2.23	.559							
	2.55	.602							
	2.86	.637							
	3.14	.668							
	3.50	.668							
	4.14	.718							
	4.77	.742							
	5.41	.770							
	6.05	.780							
	6.79	.796							
	7.31	.801							
	7.95	.803							
16:02	8.60	.796							

SAMPLE DESCRIPTION

AFTER TRIMMING

Med. stiff blue clay

AT FAILURE



(1) CORRECTED FOR

(2) Δu FOR $\Delta\sigma_3 = 0$

REMARKS:

UNCONSOLIDATED - UNDRAINED TRIAXIAL TEST — DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. UU($\bar{\sigma}_3$) U7-2-1

SOIL BBC undisturbed

PROJECT CHES

TESTED BY NFB DATE 5/19 64

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	39.5	1.118		80.0	8.00	10.0
FINAL	39.5	1.118	100			12.55

G_s 2.78 TYPE CELL C.H. $\bar{\sigma}_3$

PRESHEAR

u	σ_c
-.32	0
.16	.50
.67	1.00

PRESHEAR σ_c 1.00

PRESHEAR B 1.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .03 "/min

PATH

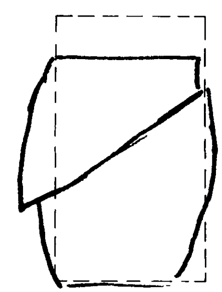
ELAPSED TIME	AXIAL STRAIN, %	$(\sigma_1-\sigma_3)$ (1)	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	Δu (2)	A	q	$\bar{p}$				
9:42	0	0											
	.318	.371											
	.637	.478											
	.955	.570											
	1.27	.643											
	1.59	.692											
	1.91	.735											
	2.55	.815											
	3.14	.854											
	3.82	.876											
	4.45	.903											
	5.09	.920											
	5.74	.918											
	6.36	.934											
	7.00	.955											
	7.64	.966											
	8.28	.966											
	8.91	.966											
	9.55	.960											
	10.2	.967											
	10.8	.980											
	11.5	.980											
	12.1	.982											
	12.7	.985											

SAMPLE DESCRIPTION

AFTER TRIMMING

stiff clay

AT FAILURE



p. 152

(1) CORRECTED FOR

(2) Δu FOR $\Delta\sigma_3 = 0$

REMARKS:

UNCONSOLIDATED - UNDRAINED TRIAXIAL TEST — DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. UU($\bar{\sigma}_3$) - U7-3-1

SOIL BBC undisturbed

PROJECT CAES

TESTED BY NFB DATE 5/21 64

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	38.7	1.100	100	80.0	8.00	10.00
FINAL	38.7	1.10	100			

G_s 2.78 TYPE CELL C.H. with $\bar{\sigma}_3$

PRESHEAR

u	σ_c
-.265	0
.255	0.50
.745	1.00

PRESHEAR σ_c 1.00

PRESHEAR B .98

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS ___

RATE .03"/min

PATH ___

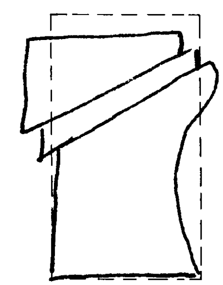
ELAPSED TIME	AXIAL STRAIN, %	$(\sigma_1 - \sigma_3)$ (1)	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	Δu (2)	A	q	$\bar{p}$				
	0	0											
	.318	.291											
	.955	.576											
	1.27	.684											
	1.91	.862											
	2.55	.952											
	3.14	.968											
	3.82	.970											
	4.45	1.008											
	5.09	1.031											
	5.74	1.056											
	6.36	1.072											
	7.00	1.086											
	7.64	1.081											
	8.28	1.093											
	8.91	1.087											
	9.55	1.085											
	10.2	1.090											
	10.8	1.092											
	11.7	1.089											

SAMPLE DESCRIPTION

AFTER TRIMMING

Blue clay, cavities in sample may be disturbed

AT FAILURE



148.

(1) CORRECTED FOR ___

(2) Δu FOR $\Delta\sigma_3 = 0$

REMARKS:

UNCONSOLIDATED - UNDRAINED TRIAXIAL TEST — DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. UU($\bar{\sigma}_s$)-U7-4-1

SOIL BBC undisturbed

PROJECT CAES

TESTED BY NFB DATE 5/14 64

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	33.9	1.11	100	80.0	8.6	10.0
FINAL	33.9	1.11	100			11.48

G_s 2.78 TYPE CELL C.H. $\bar{\sigma}_s$

PRESHEAR

u	σ_c
−.21	0
+.29	.50
+.76	1.00

PRESHEAR σ_c 1.00

PRESHEAR B .94

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .03 "/min

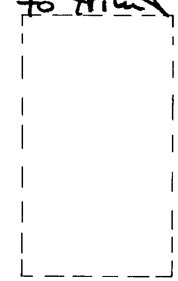
PATH

ELAPSED TIME	AXIAL STRAIN, %	$(\sigma_1 - \sigma_3)$ (1)	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	Δu (2)	A	q	$\bar{p}$					
	0	0												
	.318	.203												
	.637	.287												
	.955	.368												
	1.27	.384												
	1.59	.414												
	1.91	.457												
	2.23	.489												
	2.55	.521												
	2.86	.542												
	3.14	.563												
	3.50	.572												
	4.14	.613												
	4.77	.653												
	5.21	.698												
	6.05	.756												
	6.79	.838												
	7.31	.866												
	7.95	.896												
	8.60	.906												
	9.23	.931												
	9.86	.920												
	10.5	.912												

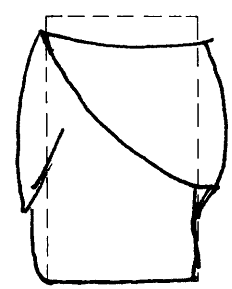
SAMPLE DESCRIPTION

AFTER TRIMMING

soft to medium stiff clay easy to trim



AT FAILURE



(1) CORRECTED FOR

(2) Δu FOR $\Delta\sigma_3 = 0$

REMARKS:

UNCONSOLIDATED - UNDRAINED TRIAXIAL TEST — DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. UU($\bar{\sigma}_3$)-U7-5-1

SOIL BBC - undisturbed

PROJECT CAES

TESTED BY NFB DATE 5/22 64

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	48.9	1.38	100	80.0	8.00	10.0
FINAL	48.9	1.38	100			10.31

G_s 2.78 TYPE CELL C.H. with ($\bar{\sigma}_3$)

PRESHEAR

u	σ_c
-.345	0
+.135	0.50
+.635	1.00

PRESHEAR σ_c 1.00

PRESHEAR B 1.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .03"/min

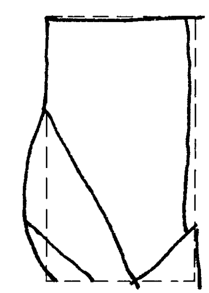
PATH

ELAPSED TIME	AXIAL STRAIN, %	$(\sigma_1 - \sigma_3)$ (1)	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	Δu (2)	A	q	$\bar{p}$				
	0	0											
	.318	.424											
	.637	.600											
	.955	.725											
	1.27	.815											
	1.91	.895											
	2.55	.827											
	3.14	.809											

SAMPLE DESCRIPTION

AFTER TRIMMING

AT FAILURE



(1) CORRECTED FOR

(2) Δu FOR $\Delta\sigma_3 = 0$

REMARKS:

150.

UNCONSOLIDATED - UNDRAINED TRIAXIAL TEST — DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. UU($\bar{\sigma}_3$) U7-6d-1
SOIL BBC undisturbed
PROJECT CAES
TESTED BY NFB DATE 5/18 64
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	35.3	.98	100	80.0	8.00	10.0
FINAL	35.3	.98	100			12.11

G_s 2.78 TYPE CELL C.H. ($\bar{\sigma}_3$)

PRESHEAR

u	σ_c
0	0
.50	.50
1.06	1.00

PRESHEAR σ_c 1.00
PRESHEAR B 1.06

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .03"/min
PATH

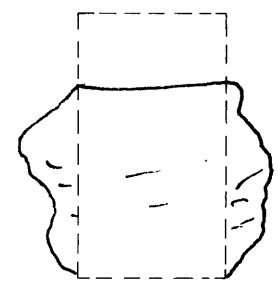
ELAPSED TIME	AXIAL STRAIN, %	$(\sigma_1 - \sigma_3)$ (1)	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	Δu (2)	A	q	$\bar{p}$				
	0	0											
	.318	.06											
	.637	.099											
	.955	.116											
	1.27	.131											
	1.91	.141											
	2.55	.158											
	3.14	.163											
	3.82	.175											
	4.45	.183											
	5.09	.187											
	5.74	.195											
	6.36	.204											
	7.00	.210											
	7.64	.216											
	8.28	.220											
	8.91	.223											
	9.55	.226											
	10.2	.233											
	10.8	.232											
	11.5	.233											
	12.1	.237											
	12.7	.241											
	13.4	.244											
	14.0	.247											
	14.7	.247											
	15.2	.250											
	15.9	.249											
	17.4	.249											

SAMPLE DESCRIPTION

AFTER TRIMMING

Very soft, disturbed?

AT FAILURE



(1) CORRECTED FOR

(2) Δu FOR $\Delta\sigma_3 = 0$

REMARKS:

UNCONSOLIDATED - UNDRAINED TRIAXIAL TEST — DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. UU($\bar{\sigma}_3$) U7-7-1

SOIL BBC-undisturbed

PROJECT CHES

TESTED BY NFB DATE 5/27 64

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	29.6	.82	100	80.0	8.00	10.0
FINAL	29.6	.82	100			10.50

G_s 2.78 TYPE CELL C.H with ($\bar{\sigma}_3$)

PRESHEAR

u	σ_c
-.06	0
+.445	.50
.93	1.00

PRESHEAR σ_c 1.00

PRESHEAR B .97

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .03 "/min

PATH

ELAPSED TIME	AXIAL STRAIN, %	$(\sigma_1 - \sigma_3)$ (1)	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	Δu (2)	A	q	$\bar{p}$				
	0	0											
	.079	.03											
	.159	.07											
	.238	.09											
	.318	.12											
	.476	.15											
	.637	.17											
	.955	.22											
	1.59	.30											
	2.23	.38											
	2.86	.43											
	3.50	.50											
	4.14	.55											
	4.77	.59											
	5.41	.62											
	6.05	.64											
	6.79	.68											
	7.31	.70											
	8.60	.72											
	9.86	.75											
	10.5	.76											
	11.8	.76											
	12.4	.77											
	13.7	.77											
	14.8	.77											
	16.2	.77											
	17.4	.77											
	18.1	.78											
	18.7	.78											
	19.6	.78											

SAMPLE DESCRIPTION

AFTER TRIMMING

AT FAILURE

(1) CORRECTED FOR

(2) Δu FOR $\Delta \sigma_3 = 0$

REMARKS:

UNCONSOLIDATED - UNDRAINED TRIAXIAL TEST — DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. UU($\overline{\sigma}_3$) U10-13-1

SOIL BBC undisturbed

PROJECT CAES

TESTED BY NFB DATE 6/22 64

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	41.6	1.072	100	80.0	8.00	10.0
FINAL	38.6	1.072	100			10.11

G_s 2.78 TYPE CELL C.H.($\overline{\sigma}_3$)

PRESHEAR

u	σ_c
-.23	0
+.735	1.00
+1.23	1.50

PRESHEAR σ_c 1.50

PRESHEAR B 1.06

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS

RATE .03 "/min

PATH

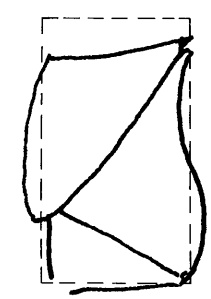
ELAPSED TIME	AXIAL STRAIN, %	$(\sigma_1 - \sigma_3)$ (1)	$\overline{\sigma}_3$	$\overline{\sigma}_1$	$\overline{\sigma}_1/\overline{\sigma}_3$	Δu (2)	A	q	$\bar{p}$				
	0	0											
	.079	.11											
	.159	.25											
	.318	.36											
	.476	.44											
	.637	.52											
	.955	.65											
	1.59	.76											
	2.23	.82											
	2.86	.88											
	3.50	.93											
	4.14	.98											
	4.77	.99											
	5.41	1.01											
	6.05	1.01											
	6.79	1.01											
	7.31	1.01											
	8.28	1.02											
	9.23	1.01											

SAMPLE DESCRIPTION

AFTER TRIMMING

Soft clay with fine sand layers

AT FAILURE



153.

(1) CORRECTED FOR

(2) Δu FOR $\Delta\sigma_3 = 0$

REMARKS:

UNCONSOLIDATED - UNDRAINED TRIAXIAL TEST — DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. UU($\bar{\sigma}_3$)010-15-1

SOIL BBC undisturbed

PROJECT CAES

TESTED BY NFB DATE 4/26 65

ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	42.8	1.19	100	80.0	8.00	100
FINAL	42.8	1.19	100			11.95

G_s 2.78 TYPE CELL C.H. ($\bar{\sigma}_3$)

PRESHEAR

u	σ_c
-.145	0
.875	1.00
1.375	1.50

PRESHEAR σ_c 1.50

PRESHEAR B 1.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS ____

RATE .03 "/min

PATH ____

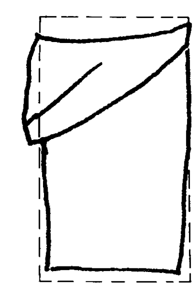
ELAPSED TIME	AXIAL STRAIN, %	$(\sigma_1 - \sigma_3)$ (1)	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	Δu (2)	A	q	$\bar{p}$					
	0	0												
	.079	.05												
	.159	.09												
	.318	.10												
	.476	.11												
	.637	.12												
	.955	.14												
	1.27	.15												
	1.91	.18												
	2.55	.20												
	3.14	.23												
	3.82	.26												
	4.45	.29												
	5.09	.33												
	5.74	.36												
	6.36	.39												
	7.00	.41												
	7.64	.42												
	8.28	.44												
	8.91	.45												
	9.55	.46												
	10.02	.47												
	10.8	.48												
	11.5	.48												
	12.1	.48												
	12.7	.49												
	13.4	.49												
	14.0	.50												
	14.7	.505												
	15.2	.51												
	15.9	.51												
	16.5	.50												

SAMPLE DESCRIPTION

AFTER TRIMMING

grey uniform clay

AT FAILURE



(1) CORRECTED FOR ____

(2) Δu FOR $\Delta\sigma_3 = 0$

REMARKS:

154.

UNCONSOLIDATED - UNDRAINED TRIAXIAL TEST — DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. UU($\bar{\sigma}_3$)-U10-16-1
SOIL BBC undisturbed
PROJECT CAES
TESTED BY NFB DATE 6/24 64
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	36.7	1.02	100	80.0	8.00	10.0
FINAL	36.7	1.02	100			11.53

G_s 2.78 TYPE CELL C.H. with $\bar{\sigma}_3$

PRESHEAR

u	σ_c
-.116	0
.886	1.00
1.38	1.50

PRESHEAR σ_c 1.50
PRESHEAR B 1.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .05 "/min
PATH

ELAPSED TIME	AXIAL STRAIN, %	$(\sigma_1-\sigma_3)$ (1)	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	Δu (2)	A	q	$\bar{p}$					
	0	0												
	.079	.01												
	.159	.05												
	.318	.07												
	.476	.10												
	.637	.12												
	.955	.15												
	1.27	.17												
	1.91	.21												
	2.55	.26												
	3.14	.30												
	3.82	.36												
	4.45	.42												
	5.09	.48												
	5.74	.53												
	6.36	.58												
	7.00	.61												
	7.64	.64												
	8.28	.66												
	8.91	.67												
	9.55	.68												
	10.2	.68												
	10.8	.68												
	11.5	.67												

SAMPLE DESCRIPTION

AFTER TRIMMING

Horizontal seams of fine sand in clay

AT FAILURE

(1) CORRECTED FOR
(2) Δu FOR $\Delta\sigma_3 = 0$

REMARKS:

155.

UNCONSOLIDATED - UNDRAINED TRIAXIAL TEST — DATA SUMMARY SHEET

SOIL MECHANICS LABORATORY, DEPT. OF CIVIL ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TEST NO. UU($\bar{\sigma}_3$) U10-19-1
SOIL BBC undisturbed
PROJECT CHES
TESTED BY NFB DATE 6/25 64
ALL STRESSES IN kg/cm²

	W, %	e	S, %	V, cc	L, cm	A, cm²
INITIAL	31.4	.87	100	800	8.00	10.0
FINAL	31.4	.87	100			11.64

G_s 2.78 TYPE CELL C.H($\bar{\sigma}_3$)

PRESHEAR

u	σ_c
-.08	0
.42	.50
.919	1.00

PRESHEAR σ_c 1.00
PRESHEAR B 1.00

DURING SHEAR

CONTROLLED STRAIN ✓ STRESS
RATE .03 "/min
PATH

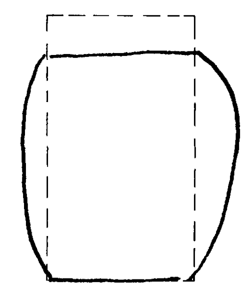
ELAPSED TIME	AXIAL STRAIN, %	$(\sigma_1 - \sigma_3)$ (1)	$\bar{\sigma}_3$	$\bar{\sigma}_1$	$\bar{\sigma}_1/\bar{\sigma}_3$	Δu (2)	A	q	$\bar{p}$					
	0	0												
	.079	0												
	.159	.04												
	.318	.07												
	.476	.07												
	.637	.09												
	.955	.13												
	1.59	.18												
	2.23	.22												
	2.86	.26												
	3.50	.30												
	4.14	.35												
	4.77	.41												
	5.41	.47												
	6.05	.53												
	6.79	.58												
	7.31	.64												
	7.95	.67												
	8.60	.70												
	9.23	.73												
	9.86	.74												
	10.5	.76												
	11.1	.77												
	11.8	.77												
	12.4	.77												
	13.1	.77												
	14.0	.76												

SAMPLE DESCRIPTION

AFTER TRIMMING

Soft grey clay one horizontal seam of fine sand

AT FAILURE



(1) CORRECTED FOR
(2) Δu FOR $\Delta\sigma_3 = 0$

REMARKS:

156.

Types of Triaxial Tests.

$\overline{}$	an elevated bar over letters denoting a type of shear test, indicates that pore pressures were measured during shear.
$\overline{CIU}$	compression test on isotropically normally consolidated sample..
$\overline{CIOU}$	compression test on isotropically overconsolidated sample.
$\overline{CK_oU}$	compression test on "perfect" sample after K_o consolidation. Perfect sampling denotes an undrained release of K_o stresses to attain an isotropic state of stress (Ladd and Lambe, 1963).
CK_o-$\overline{CIOU}$	compression test on isotropically consolidated sample after K_o consolidation, i.e. sample is consolidated to K_o, unloaded undrained to attain an isotropic state of stress ($\bar{\sigma}_{ps}$) and then consolidated isotropically to where $\bar{\sigma}_c < \bar{\sigma}_{ps}$
$\overline{CIU}$-CyC-E	cyclic compression-extension test on isotropically consolidated sample.
$\overline{CK_oU}$-CyC	cyclic compression test on K_o consolidated sample.
$\overline{CK_oU}$-CyC-E	cyclic compression-extension test on K_o consolidated sample.
CI-UU	compression test on isotropically consolidated sample rebound to zero total stress before shear.
CK_o-UU	compression test on K_o consolidated sample rebound to zero total stress before shear.

List of symbols.

σ_v, σ_h	vertical and horizontal total stress
$\bar{\sigma}_v$, $\bar{\sigma}_h$	vertical and horizontal effective stress
$\bar{\sigma}_1$, $\bar{\sigma}_3$	major and minor effective stress
$\bar{\sigma}_{cm}$	maximum past consolidation pressure
$\bar{\sigma}_c$	consolidation pressure (isotropic)
$\bar{\sigma}_{1c}$, $\bar{\sigma}_{3c}$	consolidation pressures (anisotropic)
$\bar{\sigma}_{ps}$	effective residual stress after perfect sampling
$\bar{\sigma}_s$	effective residual stress after actual sampling
e	void ratio
γ	unit weight
γ_t	total unit weight
γ_w	unit weight of water
K	ratio of horizontal to vertical effective stress
K_o	ratio of horizontal to vertical effective stress when no strain is taking place in the direction of minor stress
A	Skemtons A-factor = $\frac{\Delta u - \Delta\sigma_3}{\Delta\sigma_1 - \Delta\sigma_3}$
A_u	" " " during unloading = $\frac{\Delta u - \Delta\sigma_h}{\Delta\sigma_v - \Delta\sigma_h}$
A_f	Skemtons A-factor at failure
S_u	undrained shear strength
S_u @ $\bar{\sigma}_{ps}$	undrained shear strength at perfect sampling
S_u @ $\bar{\sigma}_s$	undrained shear strength at sampling
$\bar{c}_e$	Hvorslev's cohesion parameter
$\bar{\phi}_e$	Hvorslev's friction angle parameter
$\bar{\sigma}_e$	Hvorslev's equivalent pressure
O.C.R.	overconsolidation ratio = $\frac{\bar{\sigma}_{cm}}{\bar{\sigma}_c}$ or $\frac{\bar{\sigma}_{vm}}{\bar{\sigma}_{vc}}$

Equ."OCR"	Equivalent "overconsolidation" ratio = $\frac{\bar{\sigma}_{ps}}{\bar{\sigma}_s}$
ε_1, ε_3	strain in major and minor stress directions
u	pore pressure
u_s	residual pore pressure
w	water content
w_L	liquid limit
w_P	plastic limit
w_n	natural water content
z	depth
A_c	preshear crossectional area of triaxial sample
L_c	preshear length of triaxial sample
S	degree of saturation
P.F.	piston friction
F.S.	filter strips