Cyclic Triaxial Tests on Eastern Scheldt Sand

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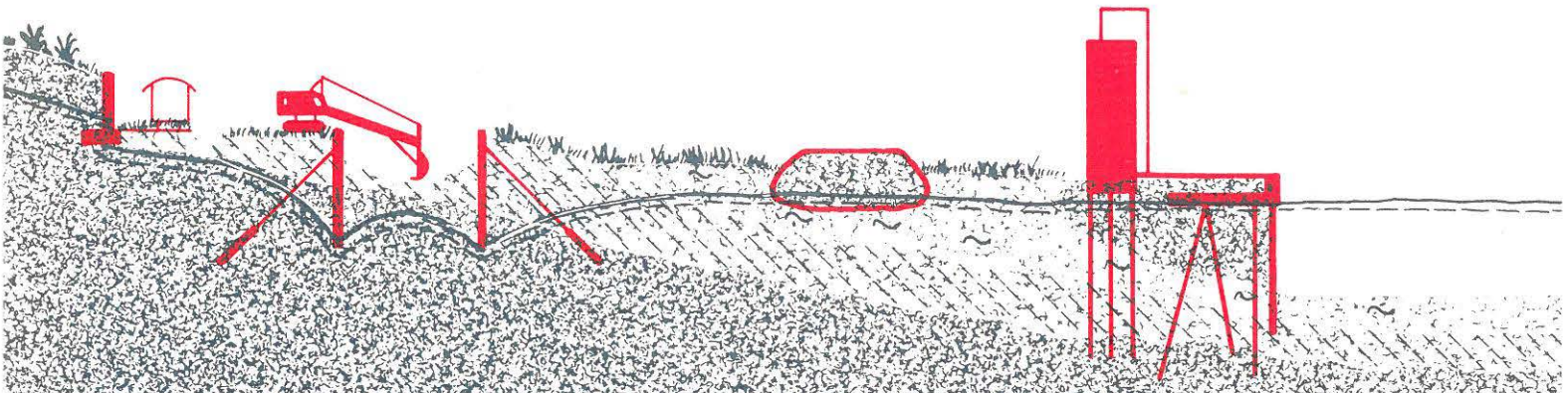

Cyclic Triaxial Tests on Eastern Scheldt Sand

Report

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Cyclic Triaxial Tests on Eastern Scheldt Sand Report

Cyclic Triaxial Tests on Eastern Scheldt Sand

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1 INTRODUCTION

For prediction of the behaviour of foundations subjected to cyclic loading, for instance earthquakes and repetitive environmental loading, it is common practice to perform numerous laboratory studies. During cyclic loading the pore pressure in the soil mass evidently changes and under disadvantageous conditions the pore pressure build-up will exceed a characteristic value and the soil may liquefy. In the absence of liquefaction excessive settlements may occur. In both cases the damage on foundations and structures can be far-reaching.

Various factors affect the liquefaction potential and settlements of soil (Seed and Lee, 1966; Lee and Seed, 1967):

- Grain size and grading
- Initial density
- Initial state of stress
- Overconsolidation and preshearing
- Load amplitude
- Number of cycles
- Drainage characteristic of the deposit

In the present study the effects of initial state of stress, load amplitude and number of cycles have been considered with special reference to the development of pore pressure build-up. The study is accomplished by performing several undrained cyclic triaxial tests, starting from different initial states of stress and applying various load amplitudes.

All tests are performed on reconstituted medium dense specimens of Eastern Scheldt Sand. Soil properties, applied equipment and test procedures are described in the succeeding sections, concluding with a summary of the performed triaxial tests.

Information about hydraulic properties and static loading response of Eastern Scheldt Sand under drained and undrained condition can be found in Jakobsen (1998a), Jakobsen and Praastrup (1998) and Jakobsen (1998b), respectively.

2 EASTERN SCHELDT SAND

Eastern Scheldt Sand is a fine, well-sorted line shore quartz sand, with sub-rounded to rounded grains. The classification properties are summarised in Table 1. For information about grain size distributions refer to Jakobsen (1998a).

Table 1. Classification properties for Eastern Scheldt Sand.

Property	Value
Specific gravity, G_s	2.650
Maximum void ratio, e_{max}	0.886
Minimum void ratio, e_{min}	0.591
Maximum grain size, d_{100}	0.500 mm
Mean grain size, d_{50}	0.166 mm
Fines content	1.3 %
Uniformity coefficient, $C_U = \frac{d_{60}}{d_{10}}$	1.52
Curvature coefficient, $C = \frac{d_{30}^2}{d_{10}d_{60}}$	0.99

3 EQUIPMENT FOR CYCLIC TRIAXIAL TESTING

The cyclic tests are performed in a device based on the measuring principle of the Danish triaxial apparatus developed in the late sixties (Jacobsen, 1970). The measuring and control system have recently been brought up-to-date. This renovation gives full digital control over the hydraulic actuator, allowing adjustment of axial load or displacement to be executed from the computer. In both cases the axial load and deformation are redirected to the comparator for fast and accurate control of the hydraulic system, generating any prescribed load or deformation. A schematic set-up of the cyclic triaxial apparatus is shown in Figure 1.

During the cyclic test axial load and deformation as well as pore and cell pressure are measured and transmitted to the computer for data processing. If drainage is allowed the volumetric changes can be measured by use of the backpressure system. A summary of the capabilities of the cyclic triaxial apparatus is given in Table 2.

Even though the measuring and control system are up-to-date it is important to avoid measuring errors due to false deformations of the devices. The problem is avoided by performing all the measurements as close to the specimen as possible. Thus, displacement transducers are mounted on the top and bottom pressure heads, the axial load is measured

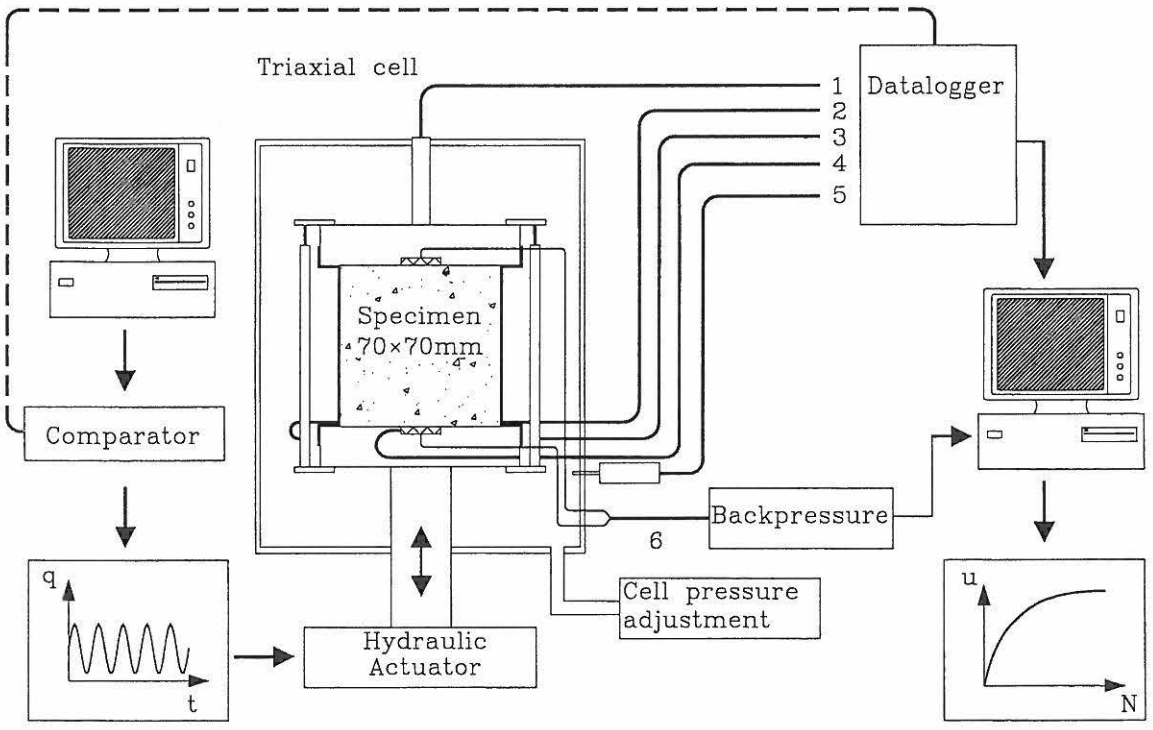

Figure 1. Schematic set-up of the cyclic triaxial apparatus. 1) axial load, 2-3) axial deformation, 4) pore pressure, 5) cell pressure and 6) volumetric change/backpressure.

inside the cell and the pore pressure is measured in the bottom pressure head beneath the porous filter.

Table 2. Capabilities of the cyclic triaxial apparatus.

Subject	Value
Specimen height	70-140 mm
Specimen diameter	70 mm
Maximum axial deformation	40 mm
Deformation rate	6-10000 %ph.
Cyclic loading frequency	0.01-10 Hz
Maximum confining pressure	700 kPa
Maximum axial load	20 kN
Maximum backpressure	500 kPa

4 SPECIMEN PREPARATION

In order to obtain homogeneous stress and strain states in the specimen during testing, all tests are performed on 70×70 mm specimens using lubricated end plates (Jacobsen, 1970; Rowe and Barden, 1964; Kirkpatrick, 1974).

The specimens are prepared by air pluviation in a split mould with an initial void ratio of 0.672 and a tolerance of ± 0.001.

All the specimens are saturated by use of the backpressure technique, as a high degree of saturation is necessary for the achievement of reliable pore pressure measurements (see Jakobsen, 1998b). The degree of saturation is checked by measuring the pore pressure coefficient, B, expressing the ratio between the resulting change in pore pressure and the imposed change in the cell pressure (Skempton, 1954). The degree of saturation is found to be acceptable if B-values above 0.975 are obtained.

5 PERFORMED TRIAXIAL TESTS

After saturation the specimen is isotropically consolidated at a maximum loading rate of 5 kPa per minute to a predefined isotropic stress state, followed by an anisotropic drained consolidation until the desired initial state of stress is reached. A sinusoidal loading with a period of 10 seconds and constant load amplitude is afterwards applied. The confining pressure is kept constant throughout the test.

The test conditions in terms of initial void ratio, initial stress state and load amplitude for the performed tests are summarised in Table 3.

Table 3. Test conditions for performed cyclic triaxial tests.

Test No.	e_0 [-]	p'_0 [kPa]	q_0 [kPa]	q_{cyc} [kPa]
9802.01	0.669	100.0	75.0	25.0
9802.02	0.673	100.0	75.0	50.0
9802.03	0.674	200.0	75.0	50.0
9802.04	0.672	100.0	43.3	28.6
9802.05	0.672	100.0	75.0	67.5
9802.06	0.670	200.0	75.0	67.5
9802.07	0.671	50.0	75.0	25.0
9802.08	0.674	200.0	75.0	100.0
9802.09	0.665	100.0	75.0	82.5
9802.10	0.669	99.5	150.0	22.5
9802.11	0.672	200.3	75.9	82.5
9802.14	0.673	50.0	75.0	11.3
9802.15	0.672	100.0	75.0	25.0
9802.16	0.671	50.0	75.0	25.0
9802.17	0.673	100.0	151.5	100.0
9802.18	0.671	30.0	55.0	36.3

Graphical presentations of the performed tests are furthermore given in Figures 2 and 3. Figure 2 shows the initial states of stress and the corresponding test numbers. To give an idea of the soil response upon loading the drained failure envelope (see Section 7), is also included. Figure 3 shows the cyclic load amplitude relative to the initial deviator stress (q_{cyc}/q_0) plotted as function of the initial deviatoric stress ratio (q_0/p'_0). For amplitude ratios above unity the tests progress into the extension region.

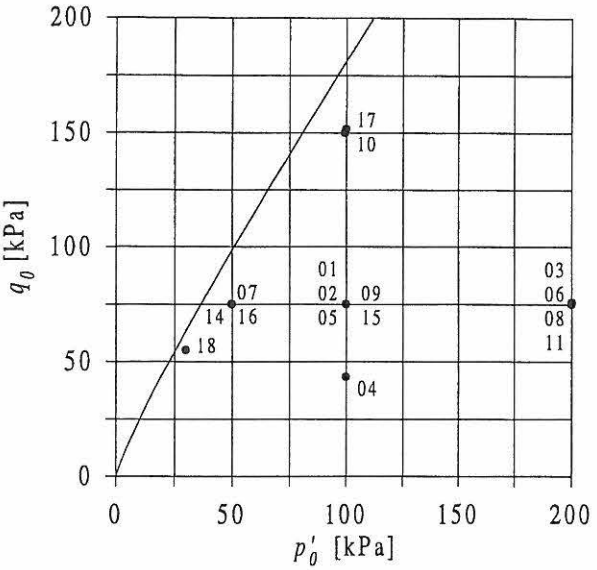

Figure 2. Initial stress states for performed cyclic triaxial tests.

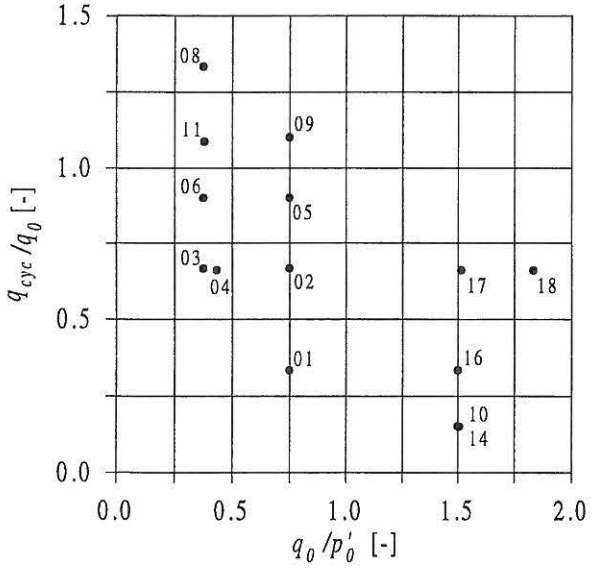

Figure 3. Cyclic load amplitude relative to initial deviator stress for performed cyclic triaxial tests.

6 PRESENTATION OF TEST RESULTS

The analysis of the test results is briefly discussed and parameters used for description of characteristic stress and strain states are defined.

During the triaxial test simultaneous values of axial displacement, volumetric change, confining pressure, pore pressure and axial load are measured by the principles outlined in Section 3. As both the measured loads and displacements coincide with the principal axes of stresses and strains the analysis is straight forward.

The exact displacement field is established from the measured axial displacements and the volumetric change. From these quantities the radial displacement, u_2 is determined by the relation:

$$u_2 = \frac{D_0}{2} - \sqrt{\frac{V_0 - \Delta V}{\pi(H_0 - u_1)}} \tag{1}$$

u_1 being the average value of the measured axial displacements and $V_0 - \Delta V$ the current volume of the specimen. The relative deformation can afterwards be expressed by any suitable strain measure. In geotechnical engineering or geomechanics it is common practice to use the simple and linear engineering strain measure. This measure is, however found to be inconsistent with the used measuring techniques and may lead to erroneous results (Praastrup et al. 1998). It is therefore chosen to use the non-linear natural strain measure instead:

$$\varepsilon_1 = \ln\left(\frac{H_0}{H_0 - u_1}\right) \tag{2}$$

$$\varepsilon_2 = \varepsilon_3 = \ln\left(\frac{D_0}{D_0 - 2u_2}\right) \tag{3}$$

$$\varepsilon_v = \varepsilon_1 + 2\varepsilon_3 = \ln\left(\frac{V_0}{V_0 - \Delta V}\right) \tag{4}$$

The stresses are given as true stresses, expressing the ratio between current load and current area. The cross sectional area of the specimen is continuously corrected by:

$$A = \tfrac{\pi}{4}(D_0 - 2u_2)^2 = \frac{V_0 - \Delta V}{H_0 - u_1} \tag{5}$$

The test results are in general presented in terms of the deviatoric stress q and mean normal stress p':

$$p' = \tfrac{1}{3}(\sigma_1' + 2\sigma_3') = \tfrac{1}{3}((\sigma_1 - u) + 2(\sigma_3 - u)) \quad (6)$$

$$q = (\sigma_1' - \sigma_3') \quad (7)$$

in which primes denote effective stresses.

Associated with these stress quantities are the volumetric and shear strain, ε_v and ε_q:

$$\varepsilon_v = \varepsilon_1 + 2\varepsilon_3 \quad (8)$$

$$\varepsilon_q = \tfrac{2}{3}(\varepsilon_1 - \varepsilon_3) = \varepsilon_1 - \tfrac{1}{3}\varepsilon_v \quad (9)$$

For description of the cyclic load and the development in stresses and strains during the cyclic loading step the following quantities are defined:

$$q_{cyc}(N) = \tfrac{1}{2}(q_{\max} - q_{\min}) \quad (10)$$

$$q_m(N) = \tfrac{1}{2}(q_{\max} + q_{\min}) \quad (11)$$

$$p_m'(N) = (\sigma_3 - u_p) + \tfrac{1}{3}q_m \quad (12)$$

The permanent pore pressure, u_p, is determined for $q = q_m$ after each load cycle. The development in pore pressure is furthermore described in term of the cyclic pore pressure given by:

$$u_{cyc}(N) = \tfrac{1}{2}(u_{\max} - u_{\min}) \quad (13)$$

The developments in strains are given in terms of cyclic axial strain, ε_{cyc}, and permanent or irrecoverable axial strain, ε_p, within each load cycle. The cyclic axial strain is calculated by:

$$\varepsilon_{cyc}(N) = \tfrac{1}{2}(\varepsilon_{\max} - \varepsilon_{\min}) \quad (14)$$

The permanent axial strain is taken at the same time as the permanent pore pressure.

7 SUMMARY OF TEST RESULTS

Results from the tests, outlined in Table 2, are shown in Enclosures 1-16 consisting of four pages each.

Page 1: Test conditions, test programme and results of isotropic and anisotropic consolidation.

Page 2: Results from undrained cyclic loading, including mean normal stress, mean deviator stress, permanent and cyclic pore pressure and permanent and cyclic axial strain for chosen cycles.

Page 3: Cyclic stress response in the $p' - q$ plane. The development in stresses are bounded by the drained failure envelopes in compression and extension (Jacobsen, 1989):

$$q_f = \frac{6\sin\varphi_a}{3 - \sin\varphi_a} p' \left(1 + \frac{c_a \cot\varphi_a}{mp'}\right)^m \quad (15)$$

$$q_f = \frac{-6\sin\varphi_a}{3 + \sin\varphi_a} p' \left(1 + \frac{c_a \cot\varphi_a}{mp'}\right)^m \quad (16)$$

The parameters $\varphi_a = 35.0°$, $c_a = 46.2$ kPa and $m = 0.143$ are derived from static triaxial tests reported by Jakobsen and Praastrup (1998b). As no extension tests have been performed the friction angle is increased by 10 percent in the extension region.

Page 4: Development of deviator stress, pore pressure and axial strain quantities with number of cycles applied.

8 REFERENCES

Jacobsen, M. (1970). New Odeometer and New Triaxial Apparatus for Firm Soil. *Danish Geotechnical Institute Bulletin No. 27.*

Jacobsen, M. (1989). Dilatancy and Cohesion in Frictional Materials. *Proceedings of the 12th. International Conference on Soil*

Mechanics and Foundation Engineering. Rio de Janiero.

Jakobsen, K.P. (1998a). Permeability Tests on Eastern Scheldt Sand. *AAU Geotechnical Engineering Papers*, ISSN 1398-6465 R9821.

Jakobsen, K.P. (1998b). Undrained Triaxial Tests on Eastern Scheldt Sand. *AAU Geotechnical Engineering Papers*, ISSN 1398-6465 R9823.

Jakobsen, K.P., Praastrup, U. (1998b). Drained Triaxial Tests on Eastern Scheldt Sand. *AAU Geotechnical Engineering Papers*, ISSN 1398-6465 R9821.

Kirkpatrick, W.M., Seals, R.K., Newman, F.B. (1974). Stress Distributions in Triaxial Compression Samples. *Journal of the Geotechnical Engineering Division*, ASCE, Vol. 100, No. GT2, February, pp. 190-196.

Lee, L., Seed, H. (1967). Cyclic Stress Conditions Causing Liquefaction of Sand. *Journal of the Soil Mechanics and Foundations Division*, ASCE, Vol. 93, No. SM1, January, pp. 47-70.

Praastrup, U., Jakobsen, K.P., Ibsen L.B. (1998). On the Choice of Strain Measures in Geomechanics. *12th. Young Geotechnical Engineers Conference*, Tallinn, Estonia.

Rowe, P.W., Barden, L. (1964). Importance of Free Ends in Triaxial Testing. *Journal of the Soil Mechanics and Foundations Division*, ASCE, Vol. 90, No. SM1, January, pp. 1-27.

Seed, H., Lee, L. (1966). Liquefaction of Saturated Sand During Cyclic Loading. *Journal of the Soil Mechanics and Foundations Division*, ASCE, Vol. 92, No. SM6, November, pp. 105-134.

Skempton, A.W. (1954). The Pore Pressure Coefficients A and B. *Géotechnique*, Vol. 4, January, pp. 143-147.

9 NOTATION

A [mm^2] : area of specimen
B [-] : Skemptons pore pressure parameter
C [-] : curvature coefficient
C_U [-] : uniformity coefficient
c_a [kPa] : asymptotic cohesion for curved failure criteria
d [mm] : grain size
D_0 [mm] : initial diameter of specimen
e [-] : void ratio
e_0 [-] : initial void ratio
e_{max} [-] : maximum void ratio
e_{min} [-] : minimum void ratio
G_s [-] : specific gravity
H_0 [mm] : initial height of specimen
m [-] : curvature parameter for failure criteria
N [-] : number of cycles
p' [kPa] : mean normal stress (effective)
p'_0 [kPa] : initial mean normal stress (effective)
p'_m [kPa] : mean normal stress (effective) after N cycles
q [kPa] : deviator stress
q_m [kPa] : mean deviator stress
q_{cyc} [kPa] : cyclic deviator stress
u [kPa] : pore pressure
u_p [kPa] : permanent pore pressure after N cycles
u_{cyc} [kPa] : cyclic pore pressure after N cycles
u_i [mm] : principal displacements, i=1..3
V_0 [mm^3] : initial volume of specimen

ε_{cyc} [%] : cyclic axial strain after N cycles
ε_p [%] : permanent axial strain after N cycles
ε_q [%] : triaxial shear strain
ε_v [%] : triaxial volumetric strain
ε_i [%] : principal strains, i=1..3
σ'_3 [kPa] : confining pressure (effective)
σ'_i [kPa] : principal stresses (effective), i=1..3
φ_a [°] : asymptotic friction angle for curved failure criteria

Enclosures

Enclosure 1	Cyclic Triaxial Test 9802.01	4 pages
Enclosure 2	Cyclic Triaxial Test 9802.02	4 pages
Enclosure 3	Cyclic Triaxial Test 9802.03	4 pages
Enclosure 4	Cyclic Triaxial Test 9802.04	4 pages
Enclosure 5	Cyclic Triaxial Test 9802.05	4 pages
Enclosure 6	Cyclic Triaxial Test 9802.06	4 pages
Enclosure 7	Cyclic Triaxial Test 9802.07	4 pages
Enclosure 8	Cyclic Triaxial Test 9802.08	4 pages
Enclosure 9	Cyclic Triaxial Test 9802.09	4 pages
Enclosure 10	Cyclic Triaxial Test 9802.10	4 pages
Enclosure 11	Cyclic Triaxial Test 9802.11	4 pages
Enclosure 12	Cyclic Triaxial Test 9802.14	4 pages
Enclosure 13	Cyclic Triaxial Test 9802.15	4 pages
Enclosure 14	Cyclic Triaxial Test 9802.16	4 pages
Enclosure 15	Cyclic Triaxial Test 9802.17	4 pages
Enclosure 16	Cyclic Triaxial Test 9802.18	4 pages

CCU Triaxial Test No. 9802.01

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal9802.dat	Height Diameter	71.50 mm 69.70 mm
Saturation procedure CO_2 / Backpressure	Date 1998-01-29	Void ratio B-value	0.669 0.996

Test program			
	Isotropic compression, σ'_3 :	10.0 - 75.0	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	75.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained		
	☐ Applied undrained		
	Cyclic loading, q_{cyc} :	25.0	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	75.3	kPa
Pore pressure	u	199.8	kPa
Axial strain	ε_1	0.12	%
Volumetric strain	ε_v	0.38	%
Void ratio	e	0.663	

Anisotropic compression			
Confining pressure	σ'_3	75.0	kPa
Axial pressure	σ'_1	149.9	kPa
Deviator stress	q	74.9	kPa
Mean normal stress	p'	100.0	kPa
Pore pressure	u	199.8	kPa
Axial strain	ε_1	0.39	%
Volumetric strain	ε_v	0.52	%
Void ratio	e	0.660	

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 1
Evaluated: KPJ	Approved: KPJ

Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	93.9	74.0	5.9	3.9	0.11	0.06
3	91.4	74.0	8.1	4.8	0.14	0.01
5	90.4	74.0	9.2	5.0	0.15	0.01
10	88.4	74.0	11.2	5.0	0.17	0.01
25	86.2	73.9	13.6	5.1	0.21	0.01
50	83.9	73.9	15.8	5.0	0.24	0.01
75	82.6	73.9	17.0	4.9	0.27	0.01
100	82.1	73.9	17.7	4.9	0.29	0.01
150	80.2	73.9	19.5	4.6	0.30	0.01
200	80.8	73.9	18.9	5.2	0.31	0.01
300	79.7	73.8	20.1	4.7	0.35	0.00
400	79.5	73.8	20.2	4.7	0.36	0.00
500	79.8	73.8	20.0	4.7	0.37	0.00
750	81.0	73.8	18.6	5.1	0.38	0.00
1000	83.3	73.8	16.4	4.9	0.39	0.00
1250	86.1	73.8	13.5	5.1	0.40	0.00
1500	88.3	73.8	11.5	5.1	0.40	0.00
1750	90.0	73.8	9.8	5.1	0.41	0.00
2000	92.1	73.8	7.6	5.3	0.41	0.00
2250	95.4	73.8	4.6	5.6	0.42	0.00
2500	97.1	73.8	2.8	5.5	0.42	0.00
3000	100.5	73.8	-0.9	5.6	0.43	0.00
3500	104.3	73.8	-4.7	5.7	0.43	0.00
3900	108.1	73.8	-8.8	5.8	0.43	0.00

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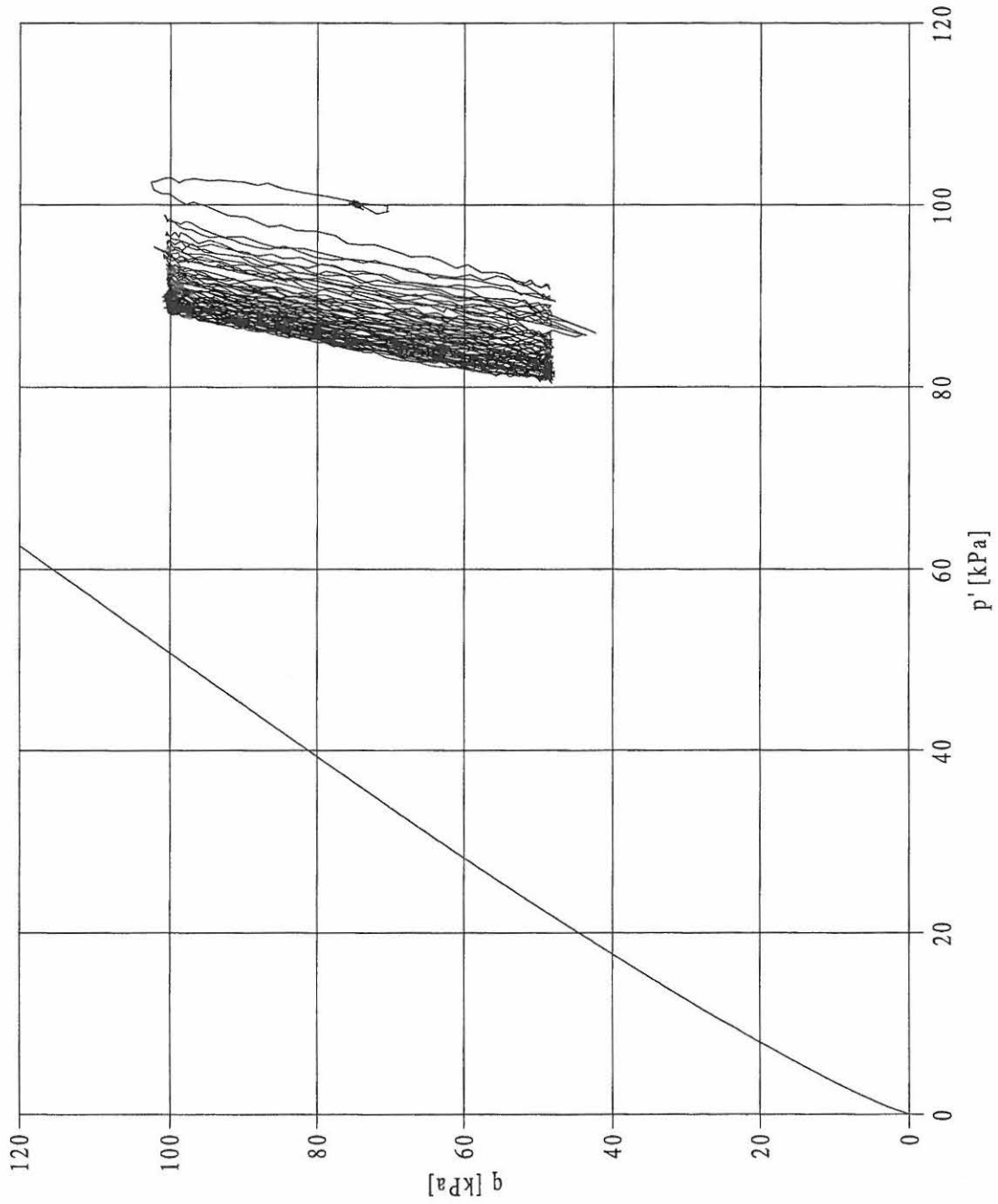

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Noise on load signal
Only cycle 1-500 plotted.

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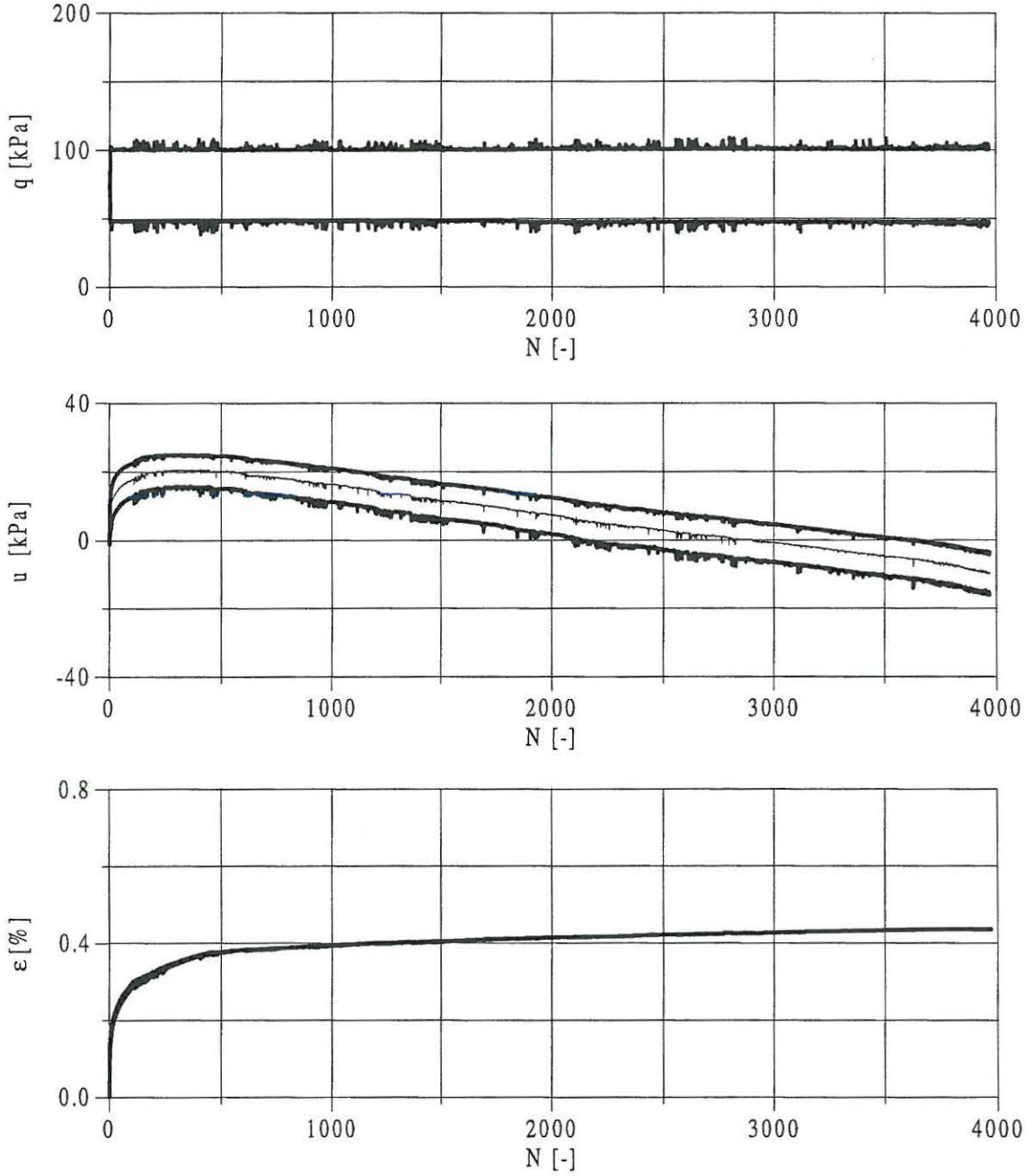

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CCU Triaxial Test No. 9802.02

Description of soil	Cyclic Triaxial Apparatus	Sample properties	
Eastern Scheldt Sand			
Specimen preparation	Calibration file	Height	71.50 mm
Air pluviation	Cal9802.dat	Diameter	69.70 mm
Saturation procedure	Date	Void ratio	0.673
CO_2 / Backpressure	1998-01-30	B-value	0.980

Test program			
	Isotropic compression, σ'_3 :	10.0 - 75.0	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	75.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained		
	☐ Applied undrained		
	Cyclic loading, q_{cyc} :	50.0	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	75.1	kPa
Pore pressure	u	300.0	kPa
Axial strain	ε_1	0.15	%
Volumetric strain	ε_v	0.42	%
Void ratio	e	0.666	

Anisotropic compression			
Confining pressure	σ'_3	75.0	kPa
Axial pressure	σ'_1	149.7	kPa
Deviator stress	q	74.7	kPa
Mean normal stress	p'	99.9	kPa
Pore pressure	u	199.8	kPa
Axial strain	ε_1	0.39	%
Volumetric strain	ε_v	0.57	%
Void ratio	e	0.664	

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Evaluated: KPJ	Approved: KPJ

Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	86.3	74.6	13.4	6.7	0.20	0.11
3	82.8	74.5	17.0	7.6	0.26	0.03
5	81.1	74.5	18.6	7.7	0.30	0.02
10	78.6	74.4	21.2	7.8	0.36	0.02
25	75.9	74.3	23.9	7.7	0.47	0.02
50	73.8	74.3	26.0	7.6	0.58	0.02
75	73.0	74.2	26.9	7.4	0.65	0.01
100	72.1	74.2	27.6	7.3	0.70	0.01
150	71.2	74.1	28.6	7.3	0.78	0.01
200	70.7	74.1	29.1	7.2	0.83	0.01
300	70.0	74.0	30.0	7.2	0.91	0.01
400	69.5	74.0	30.4	7.0	0.97	0.01
500	69.9	73.9	30.3	7.0	1.01	0.01
750	69.0	73.8	31.1	7.0	1.08	0.00
1000	69.0	73.8	31.1	7.1	1.13	0.00
1250	69.1	73.8	31.2	6.9	1.17	0.00
1500	69.0	73.7	31.4	6.9	1.20	0.00
1750	67.9	73.7	32.6	6.9	1.23	0.00
2000	67.9	73.7	32.6	6.9	1.25	0.00

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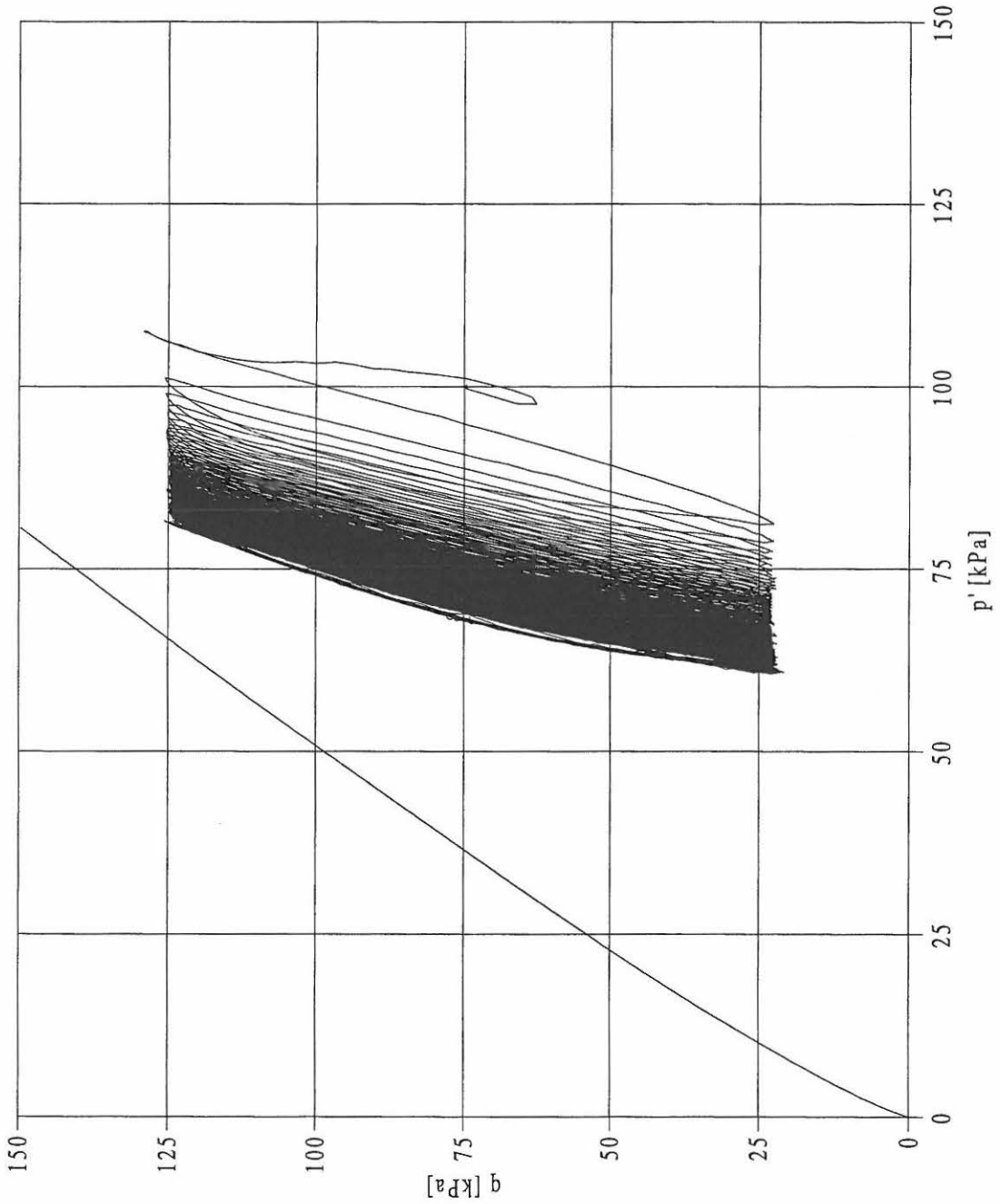

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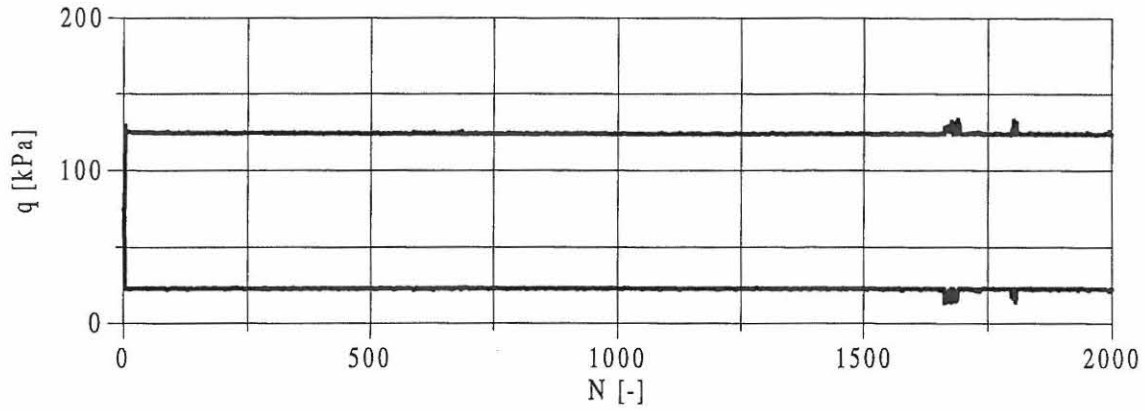
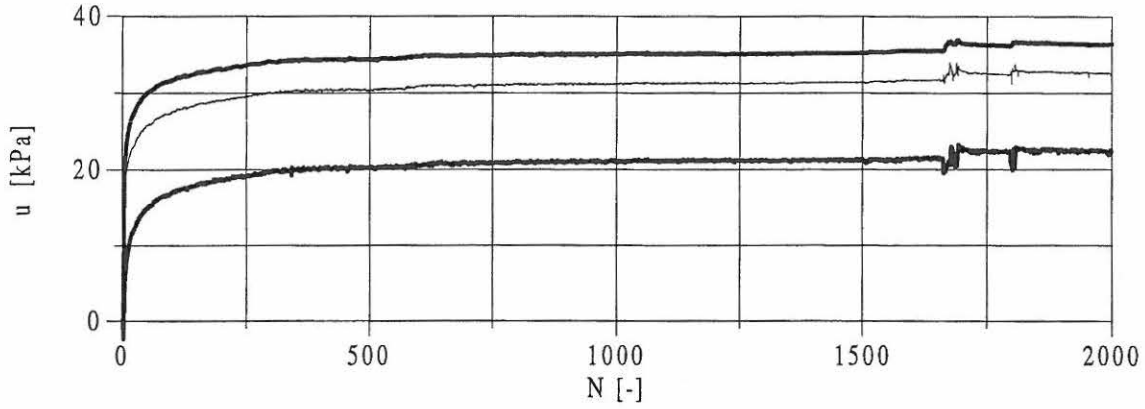
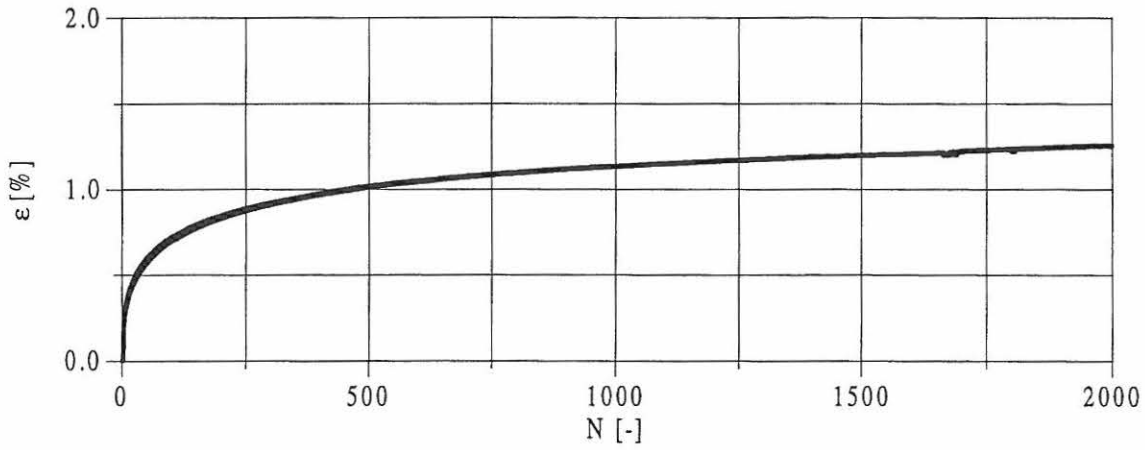
Executed: KPJ	Enclosure No. 2
Evaluated: KPJ	Approved: KPJ







Remarks

Job:	Aalborg University
Executed: KPJ	Enclosure No. 2
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.03

Description of soil	Cyclic Triaxial Apparatus	Sample properties	
Eastern Scheldt Sand			
Specimen preparation	Calibration file	Height	71.51 mm
Air pluviation	Cal9802.dat	Diameter	69.71 mm
Saturation procedure	Date	Void ratio	0.674
CO_2 / Backpressure	1998-01-31	B-value	0.983

Test program			
	Isotropic compression, σ'_3 :	10.0 - 175.0	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	75.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained		
	☐ Applied undrained		
	Cyclic loading, q_{cyc} :	50.0	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	175.2	kPa
Pore pressure	u	300.0	kPa
Axial strain	ε_1	0.27	%
Volumetric strain	ε_v	0.73	%
Void ratio	e	0.661	

Anisotropic compression			
Confining pressure	σ'_3	175.0	kPa
Axial pressure	σ'_1	249.9	kPa
Deviator stress	q	74.9	kPa
Mean normal stress	p'	200.0	kPa
Pore pressure	u	300.0	kPa
Axial strain	ε_1	0.40	%
Volumetric strain	ε_v	0.85	%
Void ratio	e	0.659	

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 3
Evaluated: KPJ	Approved: KPJ

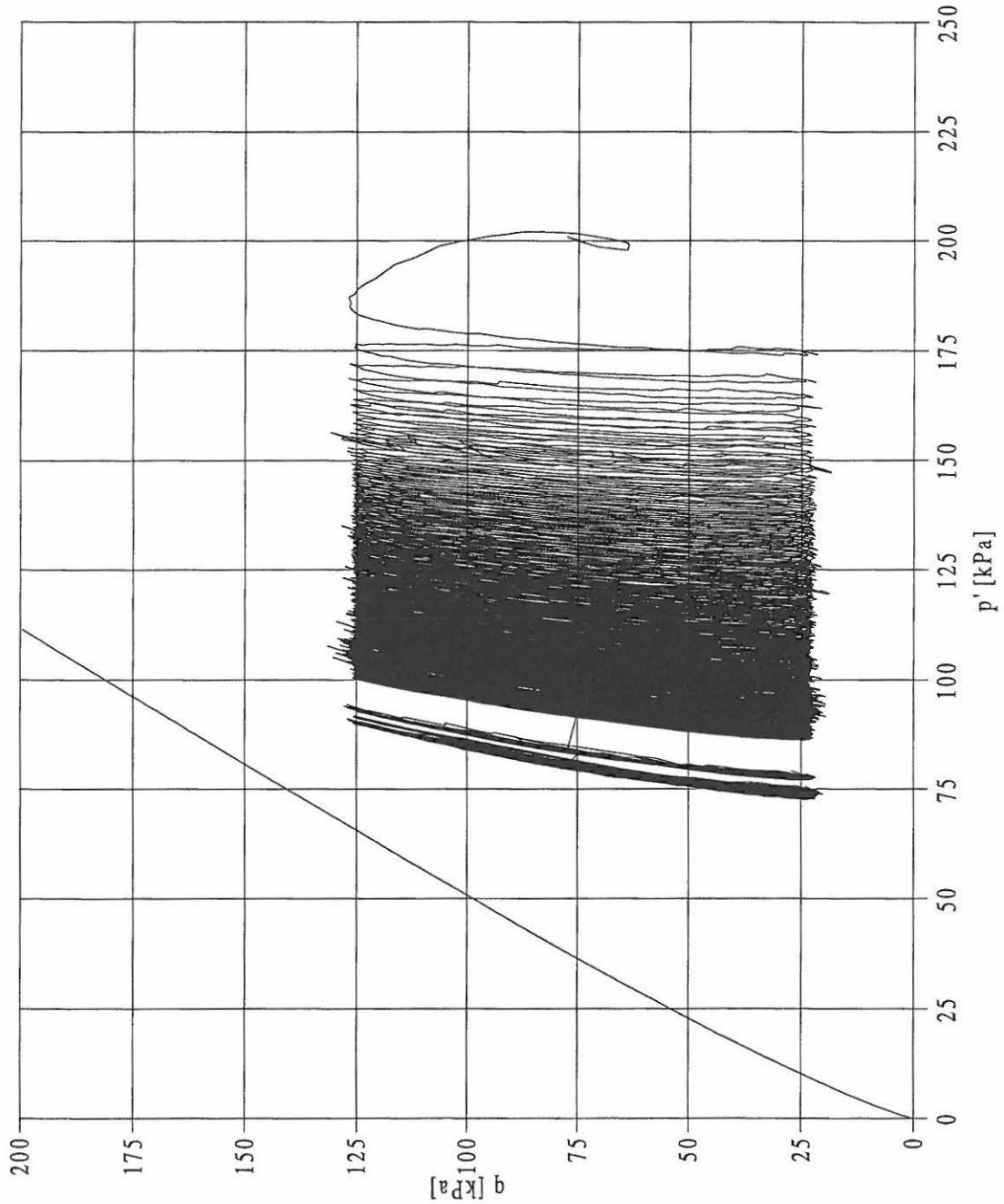
Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	175.4	75.4	24.7	16.6	0.05	0.04
3	166.5	75.4	33.6	13.7	0.07	0.01
5	161.7	75.4	38.4	13.8	0.08	0.01
10	154.3	75.4	45.8	13.9	0.09	0.01
25	142.4	75.4	57.7	13.9	0.13	0.01
50	132.6	75.4	67.5	13.6	0.16	0.01
75	125.8	75.4	74.1	12.8	0.18	0.01
100	120.9	75.3	79.1	12.5	0.20	0.00
150	113.4	75.3	86.5	12.2	0.23	0.00
200	108.1	75.3	91.8	11.6	0.25	0.00
300	100.4	75.3	99.5	11.8	0.29	0.00
400	95.0	75.2	104.9	10.7	0.34	0.00
500	91.3	75.2	108.5	10.1	0.37	0.00
750	85.7	75.2	114.2	9.6	0.43	0.00
1000	82.8	75.1	117.2	9.2	0.49	0.00
1250	80.8	75.1	119.3	9.1	0.55	0.00
1500	80.0	75.0	120.2	8.9	0.58	0.00
1750	79.4	75.0	120.8	8.8	0.62	0.00
2000	79.3	75.0	121.0	8.6	0.64	0.00
2250	79.4	74.9	121.0	8.7	0.66	0.00
2500	79.4	74.9	121.0	8.6	0.67	0.00
3000	79.9	74.9	120.6	8.6	0.70	0.00
3500	80.3	74.9	120.2	8.7	0.71	0.00
4000	80.9	74.9	119.7	8.7	0.73	0.00

Remarks:

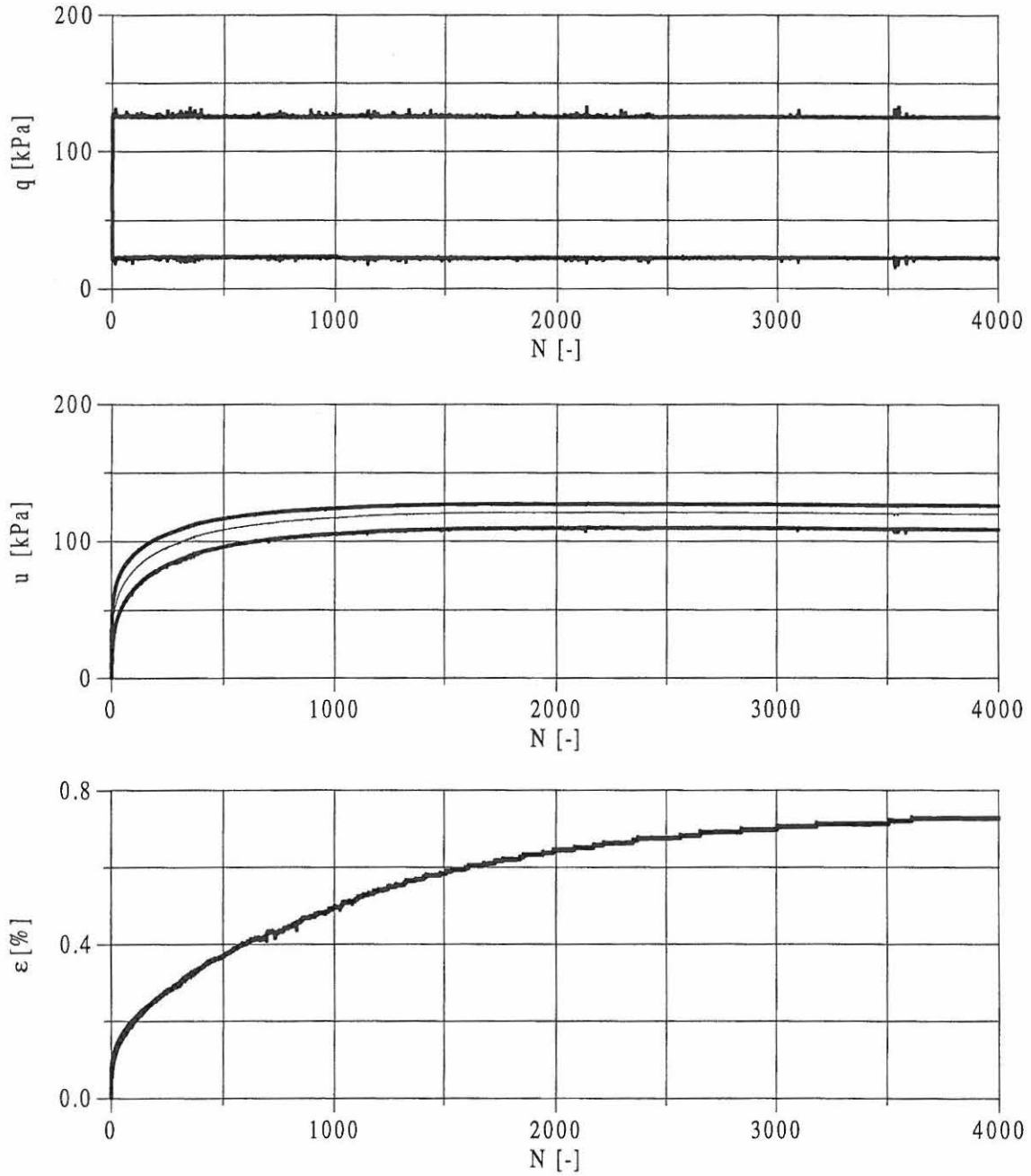
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 3
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.03



Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 3
Evaluated: KPJ	Approved: KPJ



Remarks

Job:	Aalborg University
Executed: KPJ	Enclosure No. 3
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.04

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal9802.dat	Height Diameter	71.50 mm 69.70 mm
Saturation procedure CO_2 / Backpressure	Date 1998-02-01	Void ratio B-value	0.672 0.990

Test program			
	Isotropic compression, σ'_3 :	10.0 - 85.6	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	43.3	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained		
	☐ Applied undrained		
	Cyclic loading, q_{cyc} :	28.6	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	85.6	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.13	%
Volumetric strain	ε_v	0.42	%
Void ratio	e	0.665	

Anisotropic compression			
Confining pressure	σ'_3	85.5	kPa
Axial pressure	σ'_1	128.9	kPa
Deviator stress	q	43.4	kPa
Mean normal stress	p'	100.0	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.21	%
Volumetric strain	ε_v	0.47	%
Void ratio	e	0.665	

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 4
Evaluated: KPJ	Approved: KPJ

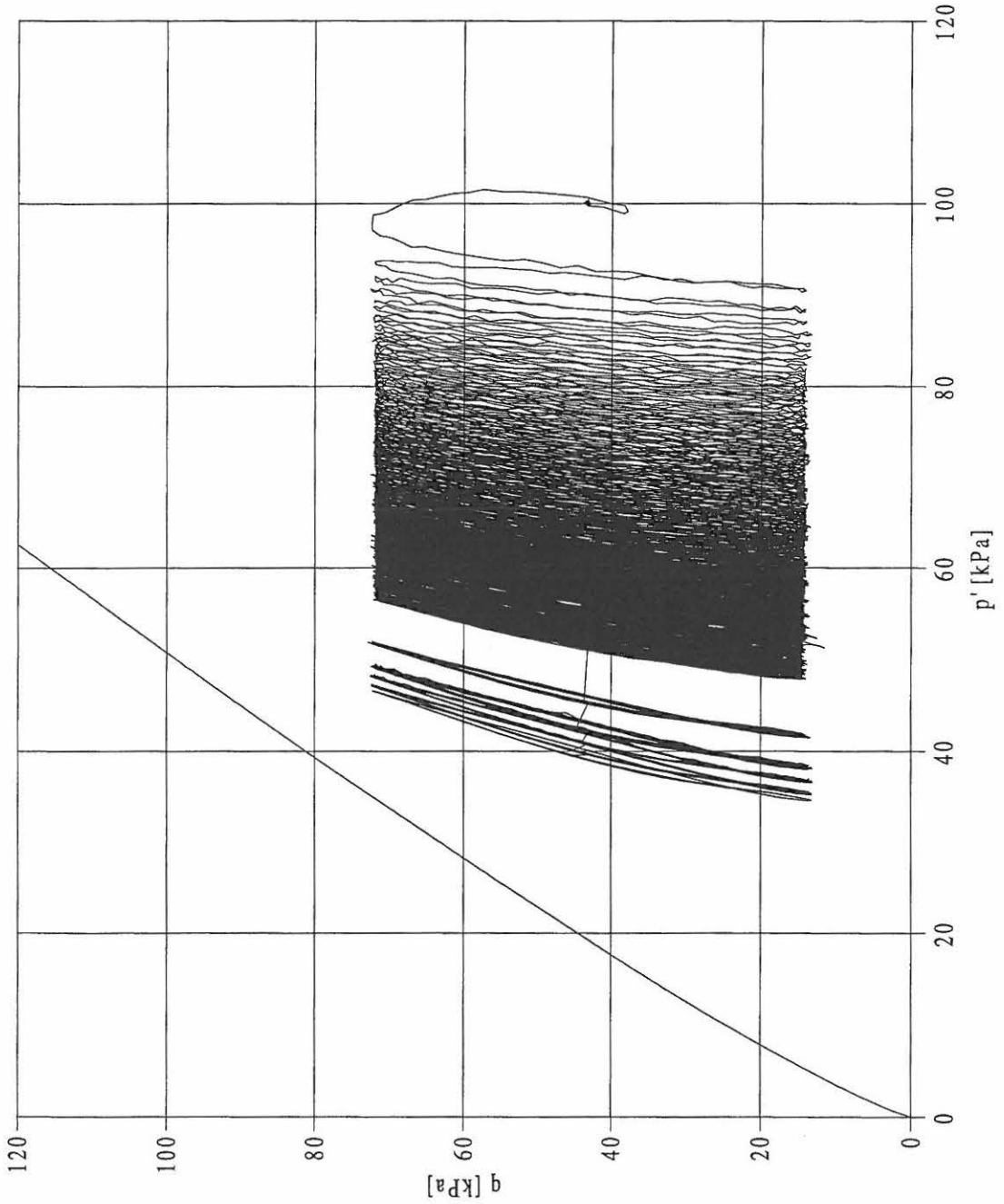
Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	92.1	43.2	7.8	6.6	0.03	0.02
3	88.4	43.3	11.5	7.4	0.04	0.01
5	86.5	43.3	13.4	7.5	0.04	0.01
10	83.1	43.3	16.7	7.4	0.05	0.01
25	77.7	43.3	22.0	7.3	0.07	0.02
50	72.9	43.3	26.9	7.1	0.09	0.02
75	69.6	43.3	30.1	6.9	0.10	0.01
100	67.1	43.3	32.6	6.8	0.12	0.02
150	63.4	43.3	36.4	6.5	0.14	0.02
200	60.3	43.3	39.1	6.3	0.17	0.02
300	56.5	43.3	43.0	6.0	0.20	0.02
400	53.3	43.3	46.2	5.6	0.24	0.02
500	50.8	43.3	48.8	5.4	0.27	0.02
750	46.9	43.2	52.5	5.0	0.34	0.02
1000	45.2	43.2	54.4	4.7	0.40	0.02
1250	43.4	43.2	56.2	4.4	0.45	0.02
1500	41.9	43.1	57.6	4.3	0.49	0.02
1750	41.1	43.1	58.5	4.2	0.53	0.02
2000	40.7	43.1	58.9	4.2	0.56	0.02
2250	40.0	43.1	59.4	4.1	0.58	0.02
2500	39.5	43.1	59.9	4.0	0.61	0.02
3000	38.9	43.1	60.5	3.9	0.64	0.02
3500	39.1	43.1	60.2	3.9	0.67	0.02
4000	39.0	43.1	59.9	3.8	0.69	0.02

Remarks:

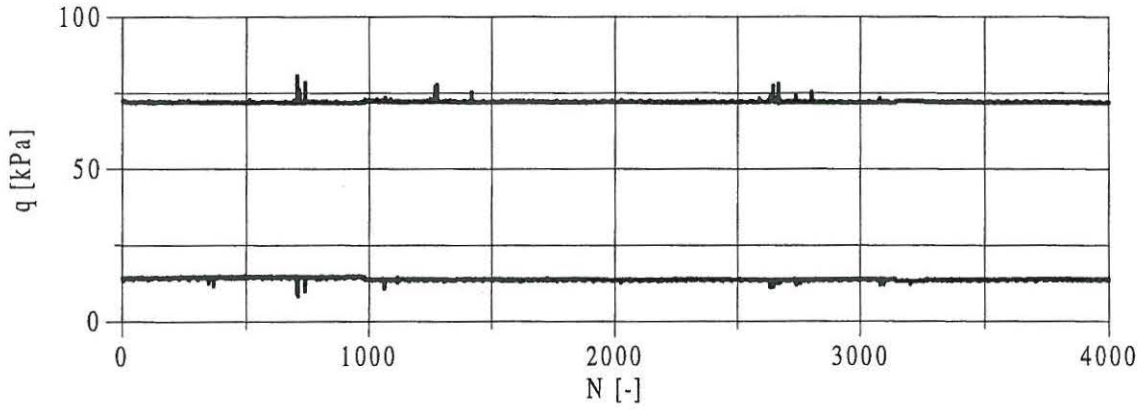
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 4
Evaluated: KPJ	Approved: KPJ

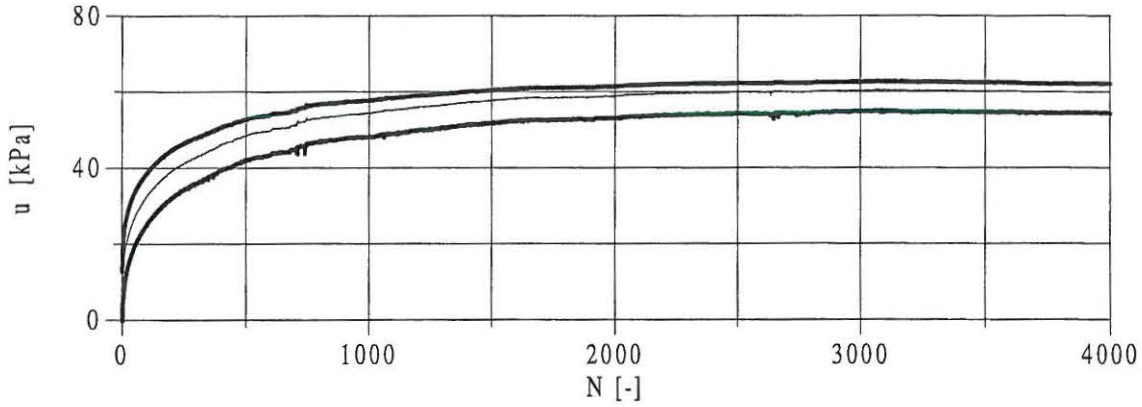
CCU Triaxial Test No. 9802.04

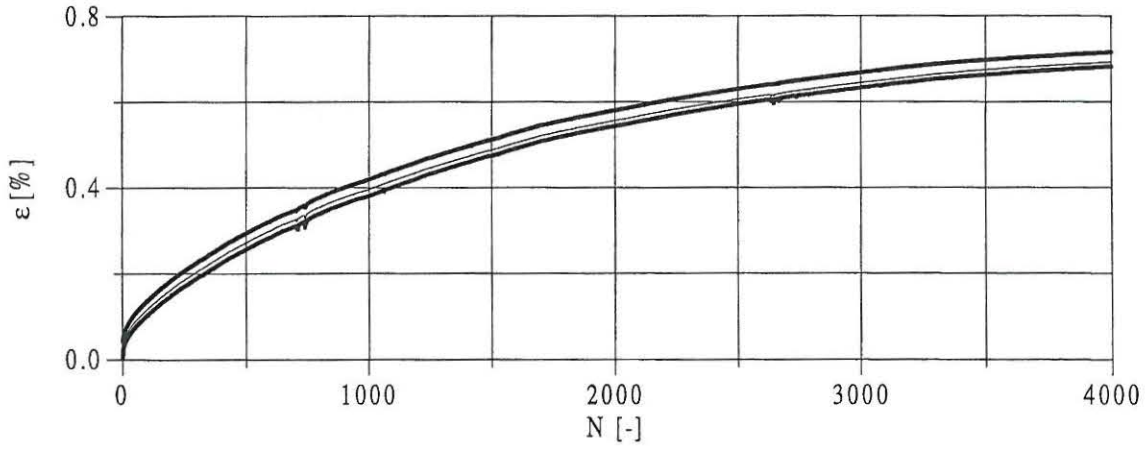


Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 4
Evaluated: KPJ	Approved: KPJ







Remarks

Job:	Aalborg University
Executed: KPJ	Enclosure No. 4
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.05

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal9802.dat	Height Diameter	71.50 mm 69.70 mm
Saturation procedure CO_2 / Backpressure	Date 1998-02-02	Void ratio B-value	0.672 0.977

Test program			
	Isotropic compression, σ'_3 :	10.0 - 75.0	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	75.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained ☐ Applied undrained		
	Cyclic loading, q_{cyc} :	67.5	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	75.2	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.11	%
Volumetric strain	ε_v	0.37	%
Void ratio	e	0.666	

Anisotropic compression			
Confining pressure	σ'_3	74.9	kPa
Axial pressure	σ'_1	150.0	kPa
Deviator stress	q	75.1	kPa
Mean normal stress	p'	100.0	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.26	%
Volumetric strain	ε_v	0.47	%
Void ratio	e	0.664	

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 5
Evaluated: KPJ	Approved: KPJ

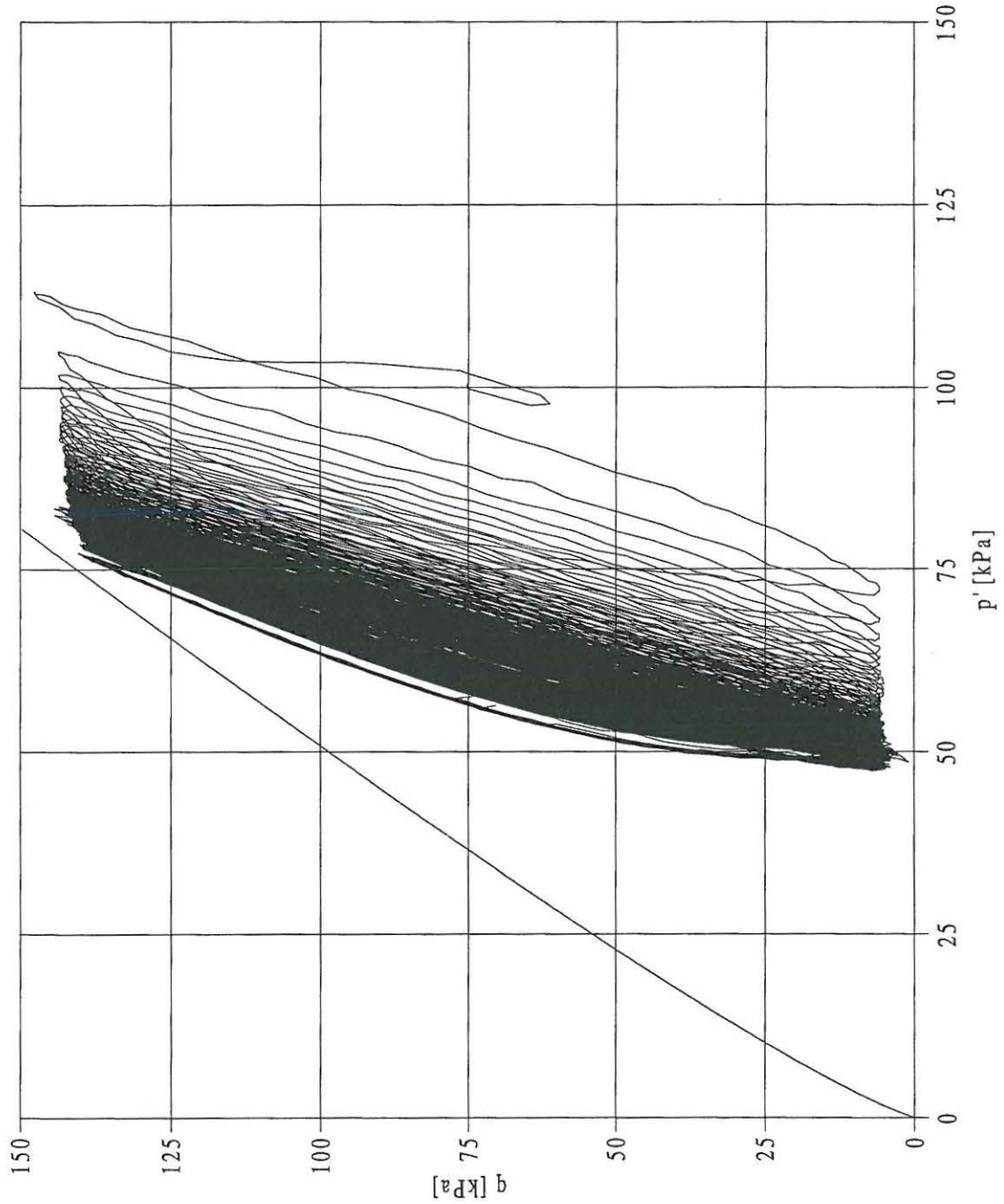
Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	78.6	75.0	21.1	11.4	0.23	0.14
3	73.0	74.9	26.7	8.8	0.32	0.05
5	70.7	74.8	29.3	8.8	0.39	0.05
10	66.9	74.8	32.8	8.5	0.50	0.05
25	63.8	74.6	36.0	8.1	0.71	0.05
50	62.5	74.4	37.3	8.0	0.92	0.04
75	61.3	74.4	38.4	7.9	1.06	0.04
100	61.0	74.3	38.7	7.8	1.17	0.04
150	59.3	74.1	40.4	7.8	1.33	0.04
200	60.1	74.0	39.7	7.8	1.46	0.04
300	57.9	73.9	41.8	8.1	1.65	0.05
400	59.0	73.8	40.6	7.7	1.81	0.04
500	58.6	73.7	41.0	7.7	1.93	0.04
750	58.2	73.5	41.3	7.7	2.15	0.04
1000	58.8	73.4	41.1	7.8	2.31	0.04
1250	58.4	73.3	41.4	7.9	2.43	0.04
1500	58.6	73.2	41.2	7.7	2.52	0.04
1750	58.4	73.2	41.3	7.9	2.60	0.04
2000	59.1	73.1	40.9	8.0	2.67	0.04
2250	58.8	73.0	41.1	7.8	2.72	0.04
2500	58.4	73.0	41.6	8.0	2.79	0.04
3000	57.8	72.9	41.8	8.1	2.89	0.04
3500	58.4	72.9	41.5	8.0	2.97	0.04
4000	57.6	72.8	41.9	8.1	3.04	0.04
4500	58.1	72.8	41.8	8.3	3.09	0.04
5000	57.7	72.7	42.3	8.1	3.16	0.04
5500	58.0	72.7	42.1	8.0	3.20	0.04
6000	55.9	72.6	44.3	8.2	3.25	0.04

Remarks:

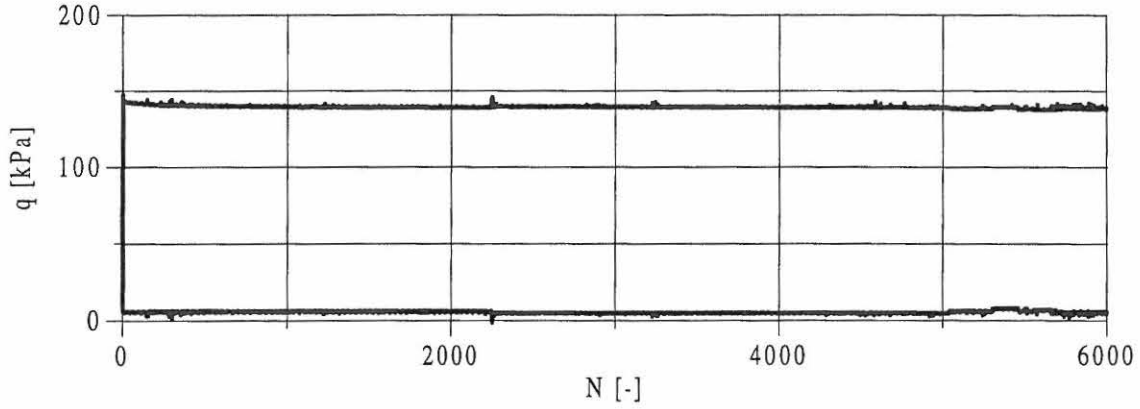
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 5
Evaluated: KPJ	Approved: KPJ

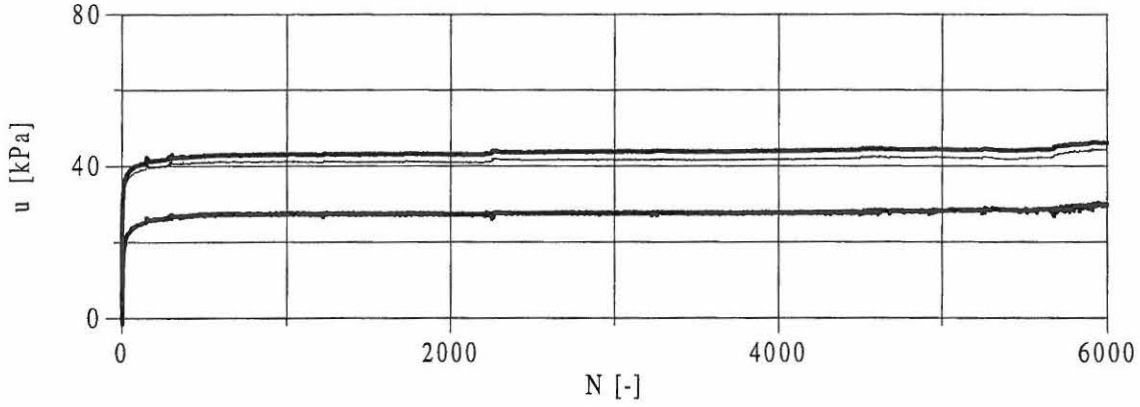
CCU Triaxial Test No. 9802.05

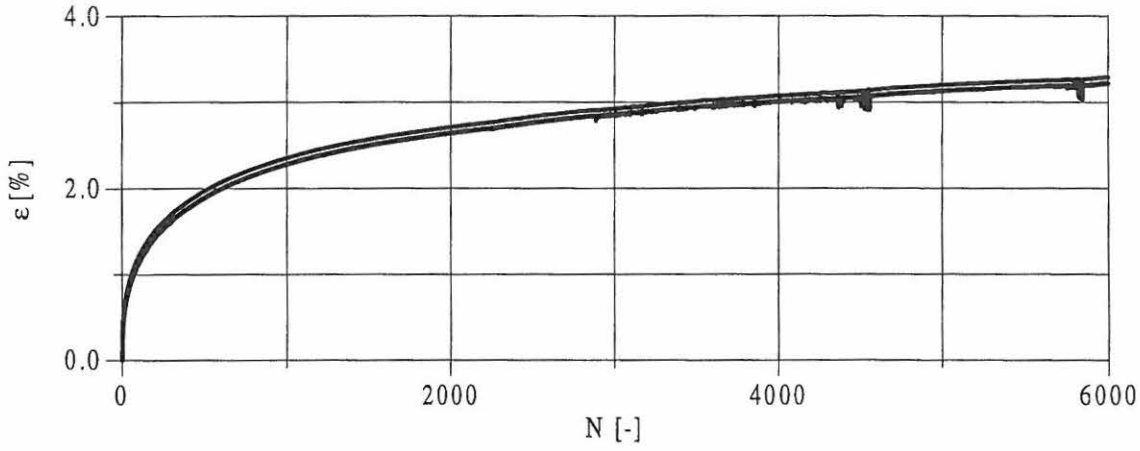


Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 5
Evaluated: KPJ	Approved: KPJ







Remarks

Job:	Aalborg University
Executed: KPJ	Enclosure No. 5
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.06

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal9802.dat	Height Diameter	71.47 mm 69.67 mm
Saturation procedure CO_2 / Backpressure	Date 1998-02-03	Void ratio B-value	0.670 0.986

Test program			
	Isotropic compression, σ'_3 :	10.0 - 175.0	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	75.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained ☐ Applied undrained		
	Cyclic loading, q_{cyc} :	67.5	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	175.3	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.18	%
Volumetric strain	ε_v	0.60	%
Void ratio	e	0.660	

Anisotropic compression			
Confining pressure	σ'_3	175.0	kPa
Axial pressure	σ'_1	250.4	kPa
Deviator stress	q	75.4	kPa
Mean normal stress	p'	200.1	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.27	%
Volumetric strain	ε_v	0.67	%
Void ratio	e	0.659	

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 6
Evaluated: KPJ	Approved: KPJ

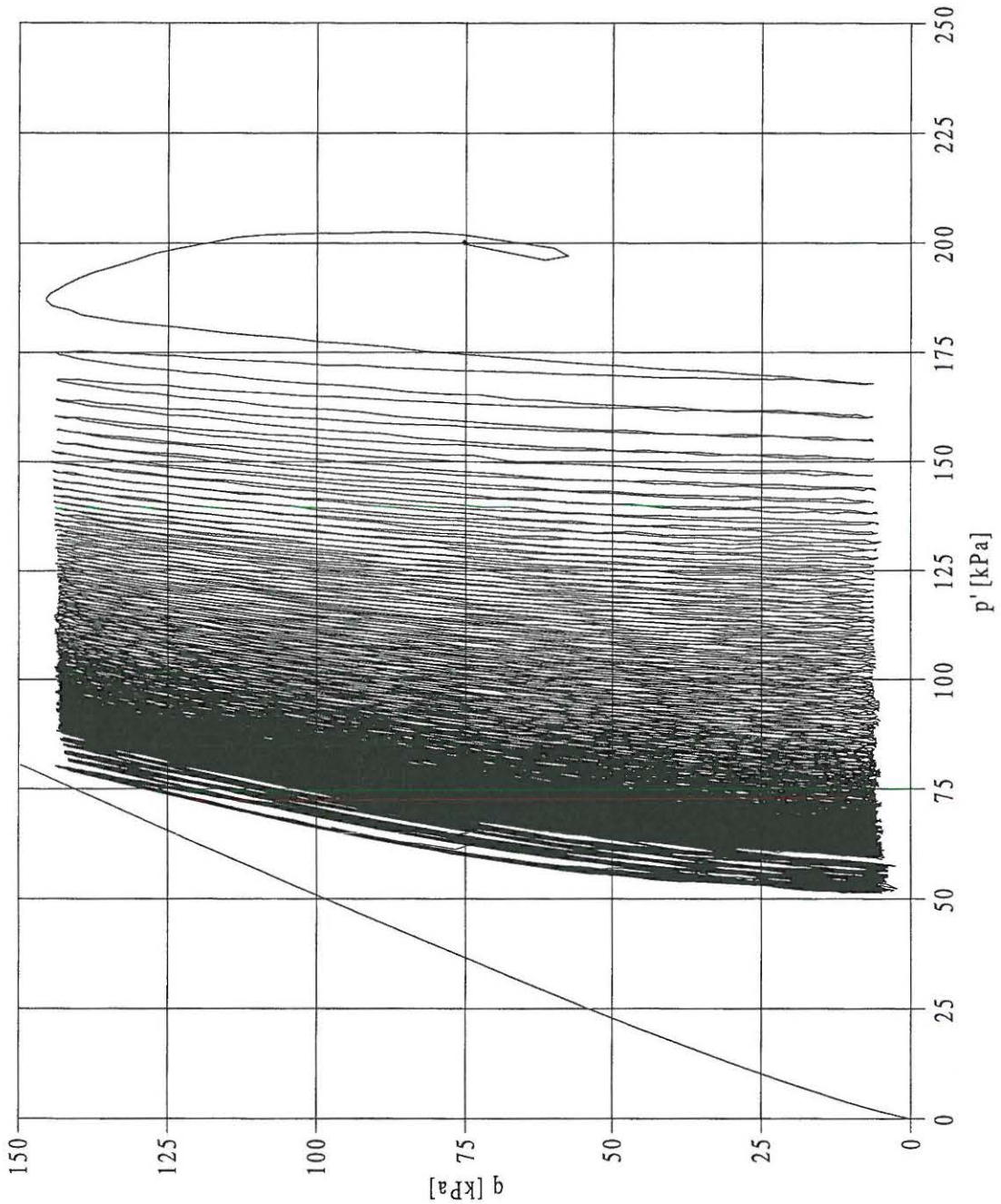
Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	170.8	75.1	29.3	19.9	0.06	0.04
3	158.0	75.1	42.1	16.0	0.08	0.02
5	150.0	75.1	50.0	16.1	0.09	0.02
10	137.0	75.1	62.8	16.0	0.12	0.03
25	116.2	75.1	83.7	14.7	0.17	0.03
50	98.1	75.0	102.0	13.1	0.26	0.03
75	88.4	74.9	111.8	11.8	0.36	0.03
100	82.6	74.8	117.6	11.0	0.44	0.03
150	76.5	74.7	123.8	10.2	0.59	0.03
200	73.1	74.6	127.0	9.8	0.71	0.03
300	70.4	74.5	129.9	9.2	0.89	0.03
400	68.5	74.4	131.6	9.0	1.02	0.03
500	67.9	74.3	132.4	9.0	1.13	0.03
750	67.1	74.1	133.4	8.7	1.32	0.03
1000	66.6	74.0	133.9	8.6	1.44	0.02
1250	66.1	73.9	134.5	8.7	1.55	0.02
1500	66.1	73.9	134.5	8.6	1.63	0.02
1750	66.2	73.8	134.6	8.8	1.69	0.02
2000	66.4	73.8	134.6	8.7	1.74	0.02
2250	65.5	73.8	135.1	8.7	1.78	0.02
2500	65.3	73.7	135.2	8.7	1.82	0.02
3000	64.9	73.7	135.4	8.8	1.87	0.02
3500	64.7	73.7	135.7	8.9	1.91	0.02
4000	63.8	73.7	136.2	9.0	1.95	0.02
4500	63.1	73.7	136.8	9.0	1.98	0.02
5000	62.5	73.7	137.3	9.1	2.00	0.02
5500	61.3	73.7	138.2	9.0	2.03	0.02
6000	59.4	73.6	140.2	9.1	2.05	0.02

Remarks:

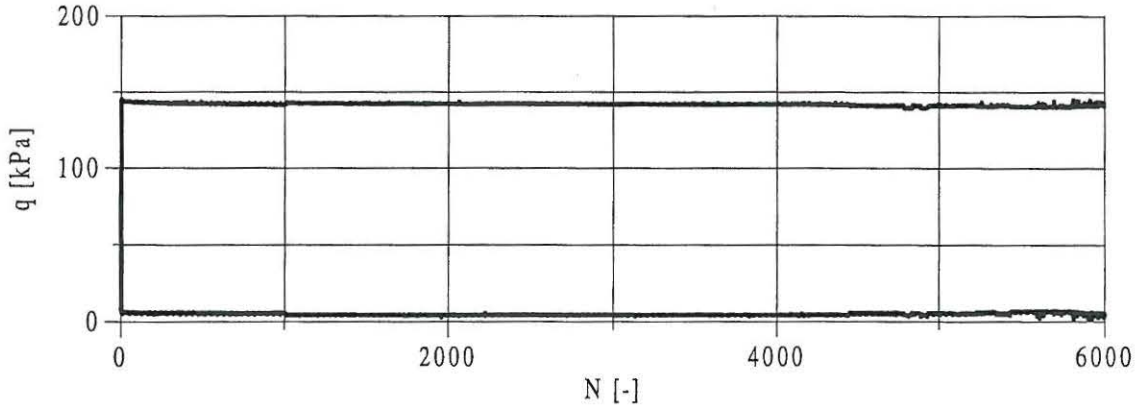
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 6
Evaluated: KPJ	Approved: KPJ

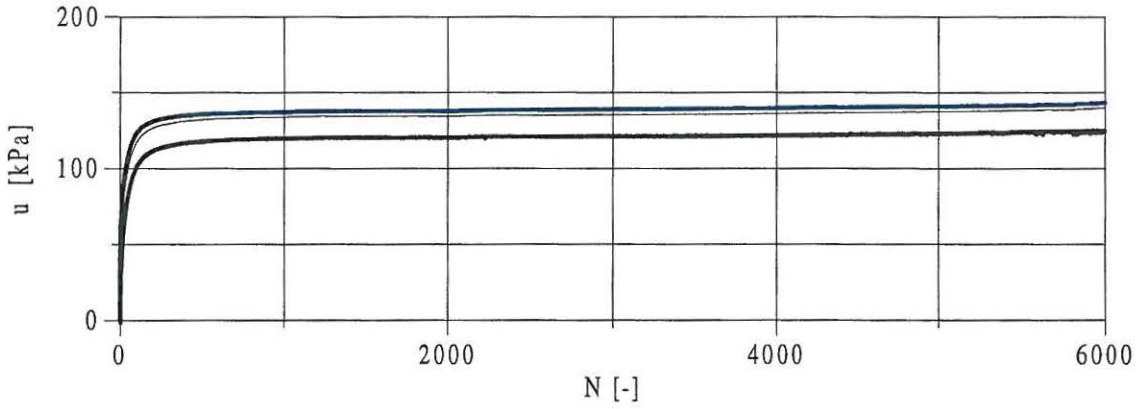
CCU Triaxial Test No. 9802.06

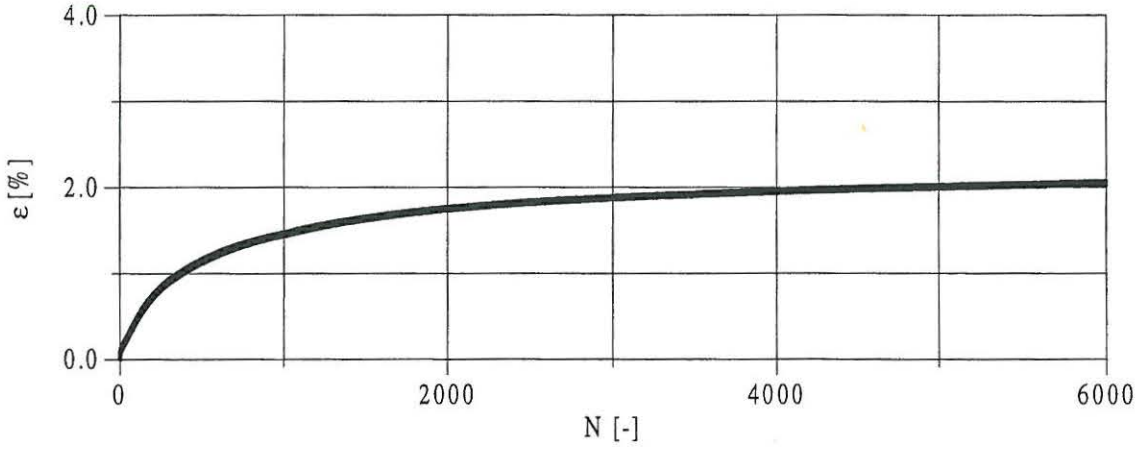


Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ Evaluated: KPJ	Enclosure No. 6 Approved: KPJ







Remarks

Job:	Aalborg University
Executed: KPJ Evaluated: KPJ	Enclosure No. 6 Approved: KPJ

CCU Triaxial Test No. 9802.07

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal9802.dat	Height Diameter	71.48 mm 69.68 mm
Saturation procedure CO_2 / Backpressure	Date 1998-02-04	Void ratio B-value	0.671 0.980

Test program			
	Isotropic compression, σ'_3 :	10.0 - 25.0	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	75.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained ☐ Applied undrained		
	Cyclic loading, q_{cyc} :	25.0	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	25.1	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.06	%
Volumetric strain	ε_v	0.11	%
Void ratio	e	0.670	

Anisotropic compression			
Confining pressure	σ'_3	25.0	kPa
Axial pressure	σ'_1	100.4	kPa
Deviator stress	q	75.4	kPa
Mean normal stress	p'	50.1	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.82	%
Volumetric strain	ε_v	0.18	%
Void ratio	e	0.668	

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 7
Evaluated: KPJ	Approved: KPJ

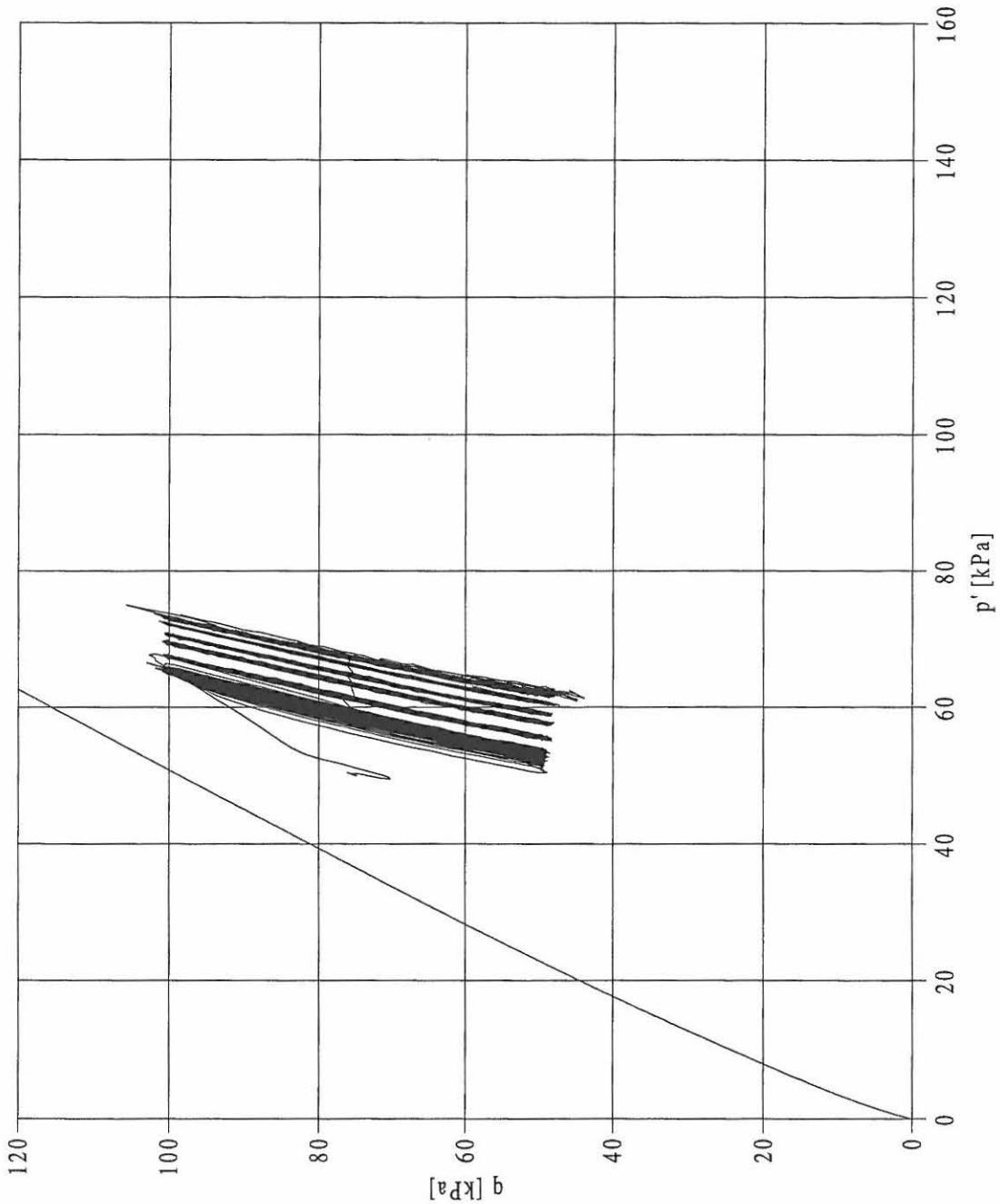
Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	56.0	75.3	-6.0	4.5	0.11	0.06
3	57.0	75.3	-7.0	2.2	0.14	0.01
5	57.3	75.2	-7.2	2.2	0.16	0.01
10	57.7	75.2	-7.7	2.2	0.20	0.01
25	58.0	75.1	-8.0	2.3	0.25	0.01
50	58.1	75.1	-8.2	2.4	0.29	0.01
75	58.1	75.1	-8.1	2.4	0.31	0.01
100	58.1	75.1	-8.1	2.4	0.33	0.01
150	58.3	75.0	-8.3	2.4	0.36	0.01
200	58.4	74.9	-8.4	2.4	0.38	0.01
300	58.6	74.9	-8.6	2.4	0.40	0.01
400	58.8	74.9	-8.8	2.5	0.41	0.01
500	59.2	74.9	-9.0	2.5	0.42	0.01
750	60.2	74.9	-9.8	2.6	0.44	0.01
1000	61.1	74.9	-10.5	2.6	0.46	0.01
1250	62.4	74.9	-11.6	2.7	0.47	0.01
1500	63.3	74.9	-12.4	2.7	0.47	0.01
1750	63.7	74.9	-12.6	2.7	0.48	0.01
2000	64.5	74.9	-13.4	2.8	0.49	0.01
2250	65.3	74.9	-14.0	2.8	0.49	0.01
2500	66.0	74.9	-14.6	2.8	0.49	0.01
3000	65.7	74.9	-15.0	2.9	0.50	0.01
3500	66.7	74.9	-15.9	3.0	0.50	0.01
4000	66.9	74.9	-16.2	3.0	0.50	0.01

Remarks:

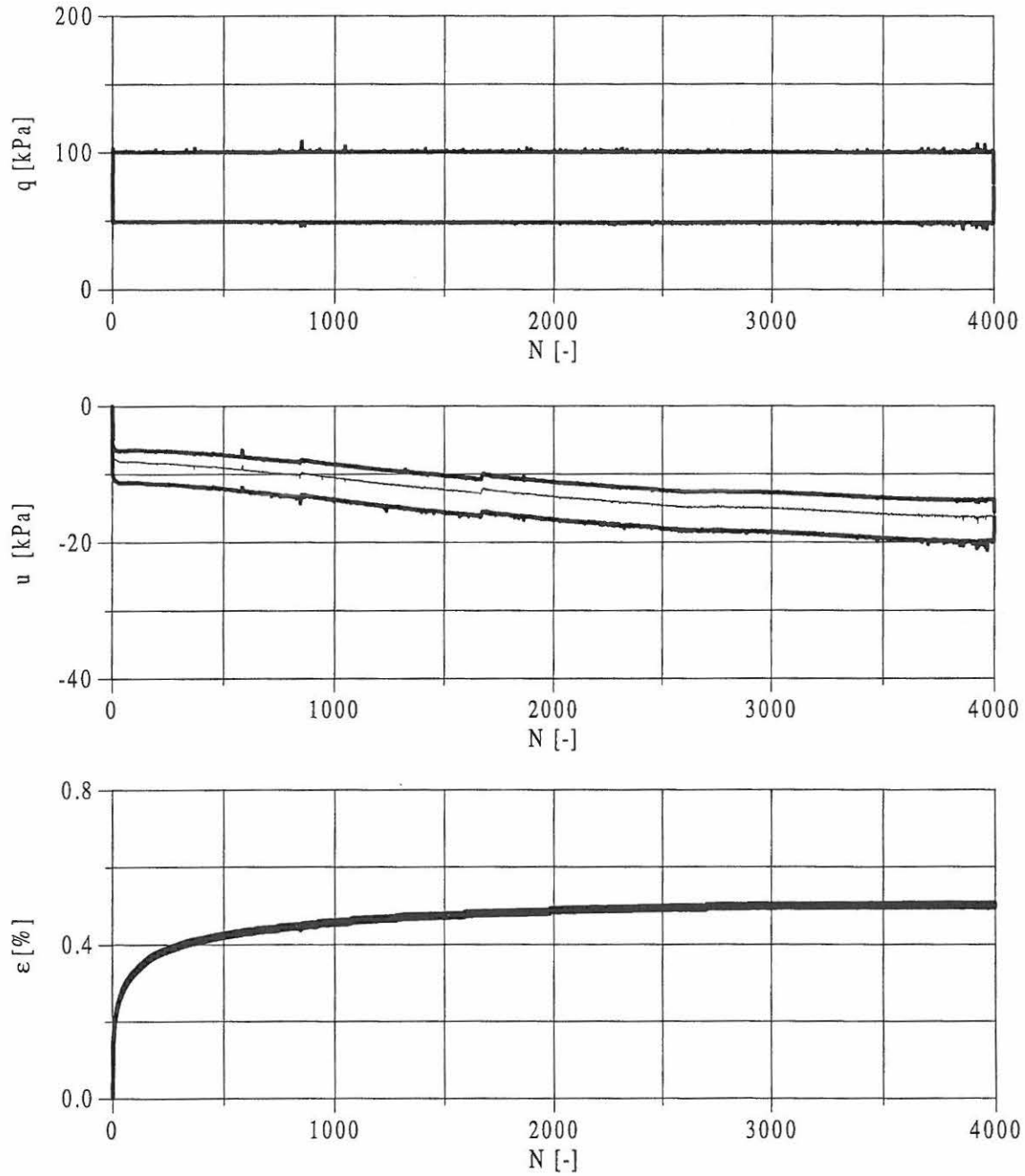
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 7
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.07



Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 7
Evaluated: KPJ	Approved: KPJ



Remarks

Job:	Aalborg University
Executed: KPJ	Enclosure No. 7
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.08

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal9802.dat	Height Diameter	71.52 mm 69.72 mm
Saturation procedure CO_2 / Backpressure	Date 1998-02-05	Void ratio B-value	0.674 0.990

Test program			
	Isotropic compression, σ'_3 :	10.0 - 175.0	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	75.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained ☐ Applied undrained		
	Cyclic loading, q_{cyc} :	100.0	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	175.1	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.20	%
Volumetric strain	ε_v	0.66	%
Void ratio	e	0.663	

Anisotropic compression			
Confining pressure	σ'_3	175.0	kPa
Axial pressure	σ'_1	249.7	kPa
Deviator stress	q	74.7	kPa
Mean normal stress	p'	199.9	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.31	%
Volumetric strain	ε_v	0.75	%
Void ratio	e	0.662	

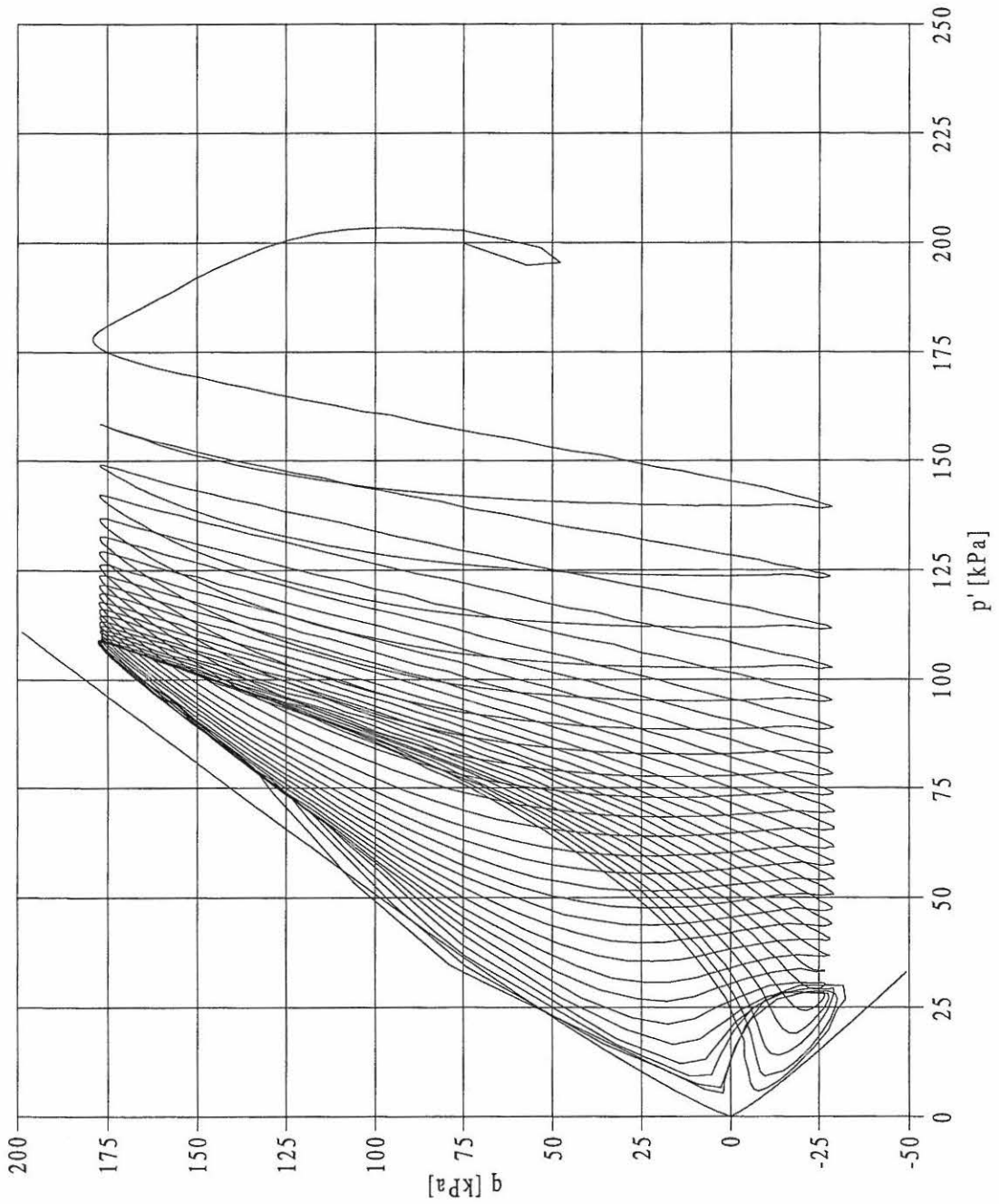
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 8
Evaluated: KPJ	Approved: KPJ

Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	141.8	74.7	58.0	30.6	0.11	0.09
3	114.8	74.6	84.9	16.6	0.19	0.05
5	98.6	74.6	101.2	16.2	0.26	0.06
10	73.8	74.4	125.9	15.3	0.42	0.08
25	34.2	73.9	165.5	24.7	1.13	0.82
50	29.2	68.9	173.0	29.6	7.39	3.66

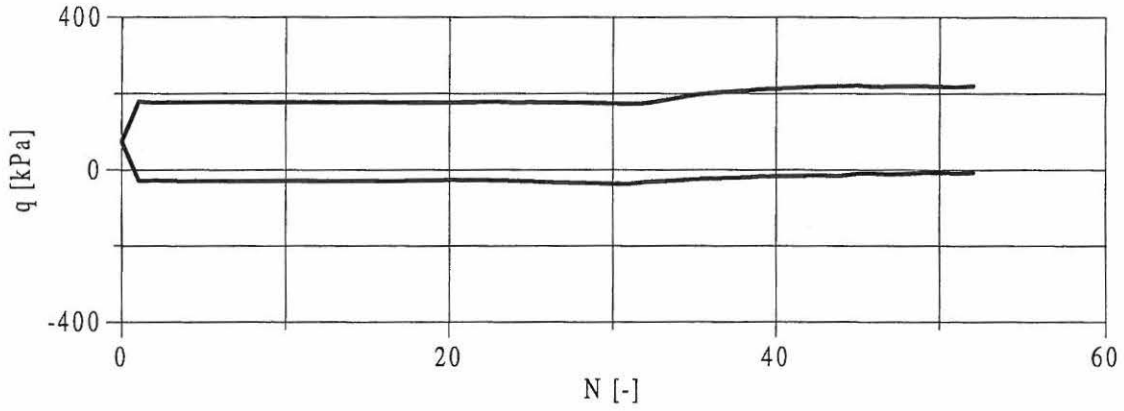
Remarks:

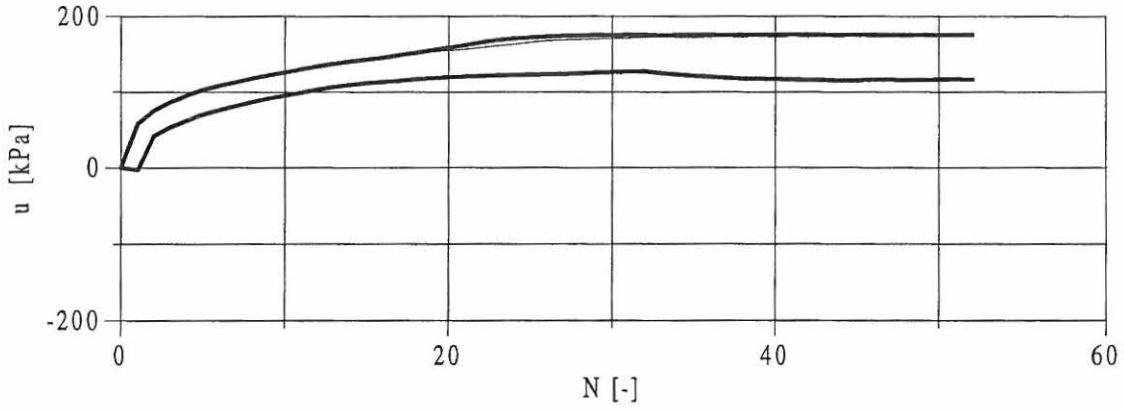
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 8
Evaluated: KPJ	Approved: KPJ

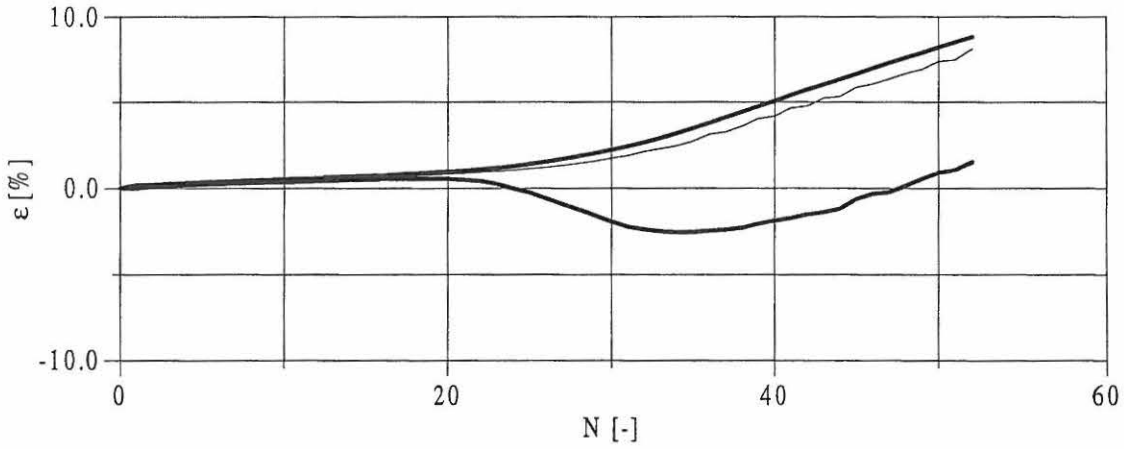


Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ Evaluated: KPJ	Enclosure No. 8 Approved: KPJ







Remarks

Job:	Aalborg University
Executed: KPJ Evaluated: KPJ	Enclosure No. 8 Approved: KPJ

CCU Triaxial Test No. 9802.09

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal9802.dat	Height Diameter	71.43 mm 69.63 mm
Saturation procedure CO_2 / Backpressure	Date 1998-02-05	Void ratio B-value	0.666 0.993

Test program			
	Isotropic compression, σ'_3 :	10.0 - 75.0	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	75.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained ☐ Applied undrained		
	Cyclic loading, q_{cyc} :	82.5	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	74.2	kPa
Pore pressure	u	201.3	kPa
Axial strain	ε_1	0.01	%
Volumetric strain	ε_v	0.01	%
Void ratio	e	0.666	

Anisotropic compression			
Confining pressure	σ'_3	73.6	kPa
Axial pressure	σ'_1	149.1	kPa
Deviator stress	q	75.5	kPa
Mean normal stress	p'	98.8	kPa
Pore pressure	u	201.3	kPa
Axial strain	ε_1	0.08	%
Volumetric strain	ε_v	0.06	%
Void ratio	e	0.665	

Remarks: Sample preconsolidated before test ($\sigma'_3 \approx 75$ kPa, $\sigma'_1 \approx 110$ kPa)

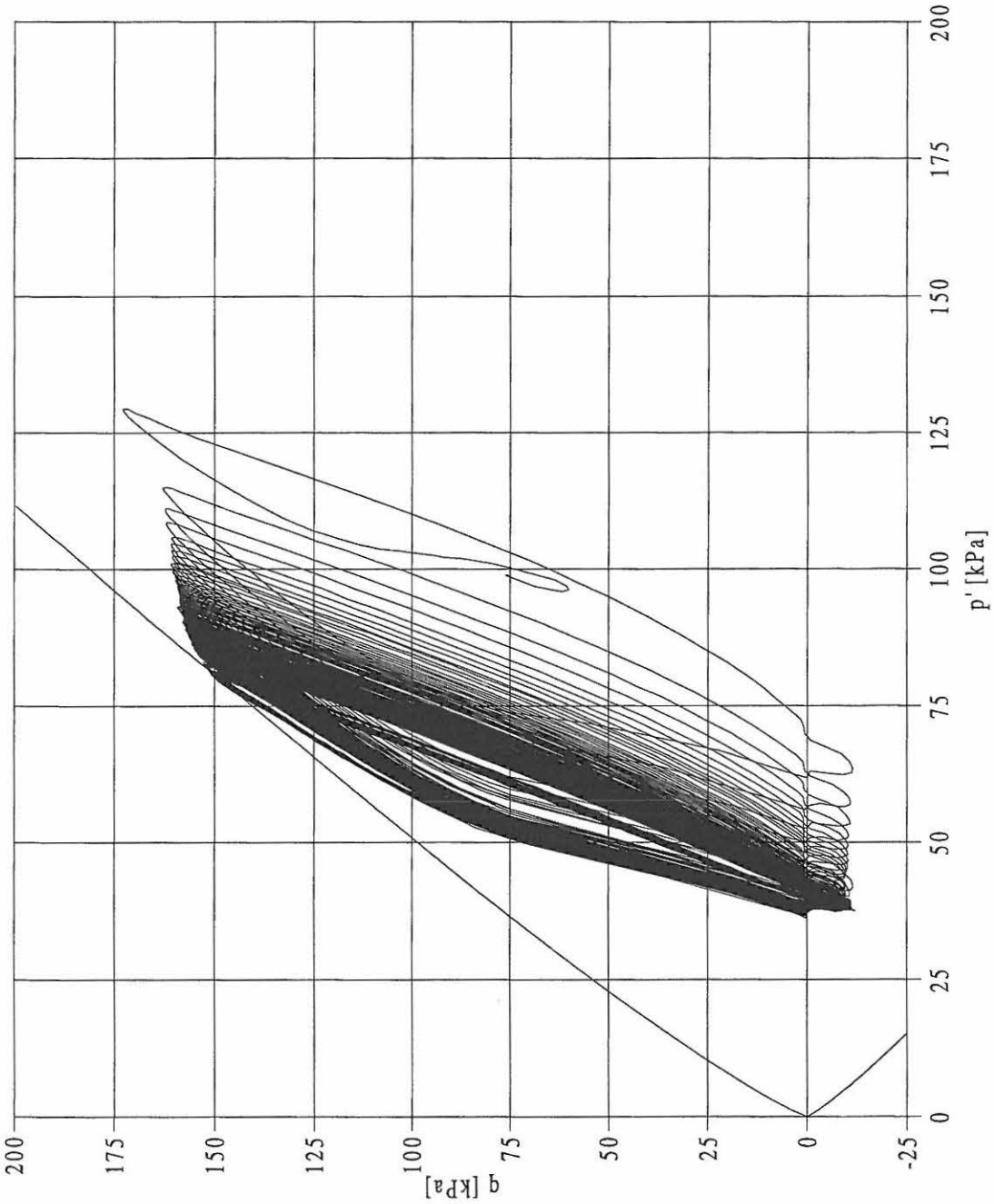
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 9
Evaluated: KPJ	Approved: KPJ

Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	73.8	75.2	24.7	14.7	0.32	0.21
3	65.8	75.1	32.6	11.7	0.47	0.08
5	62.0	75.0	36.5	11.1	0.58	0.08
10	58.2	74.9	40.2	10.6	0.74	0.09
25	54.1	74.6	44.1	9.5	1.15	0.09
50	52.9	74.3	45.4	8.6	1.58	0.08
75	52.2	74.0	45.9	8.2	1.89	0.08
100	52.1	73.9	46.0	7.9	2.14	0.08
150	52.5	73.6	45.6	7.4	2.51	0.08
200	52.1	73.3	45.9	7.5	2.80	0.07
300	51.8	73.0	46.2	7.6	3.28	0.07
400	51.8	72.7	46.0	7.7	3.65	0.07
500	51.5	72.5	46.3	7.8	3.97	0.07
750	50.6	71.9	47.1	7.9	4.68	0.07
1000	50.1	71.5	47.6	8.1	5.23	0.07
1250	50.7	71.1	47.0	8.3	5.68	0.06
1500	50.7	70.8	47.0	8.5	6.08	0.06
1750	51.0	70.6	46.8	8.5	6.41	0.06
2000	51.0	70.3	46.8	8.8	6.70	0.06

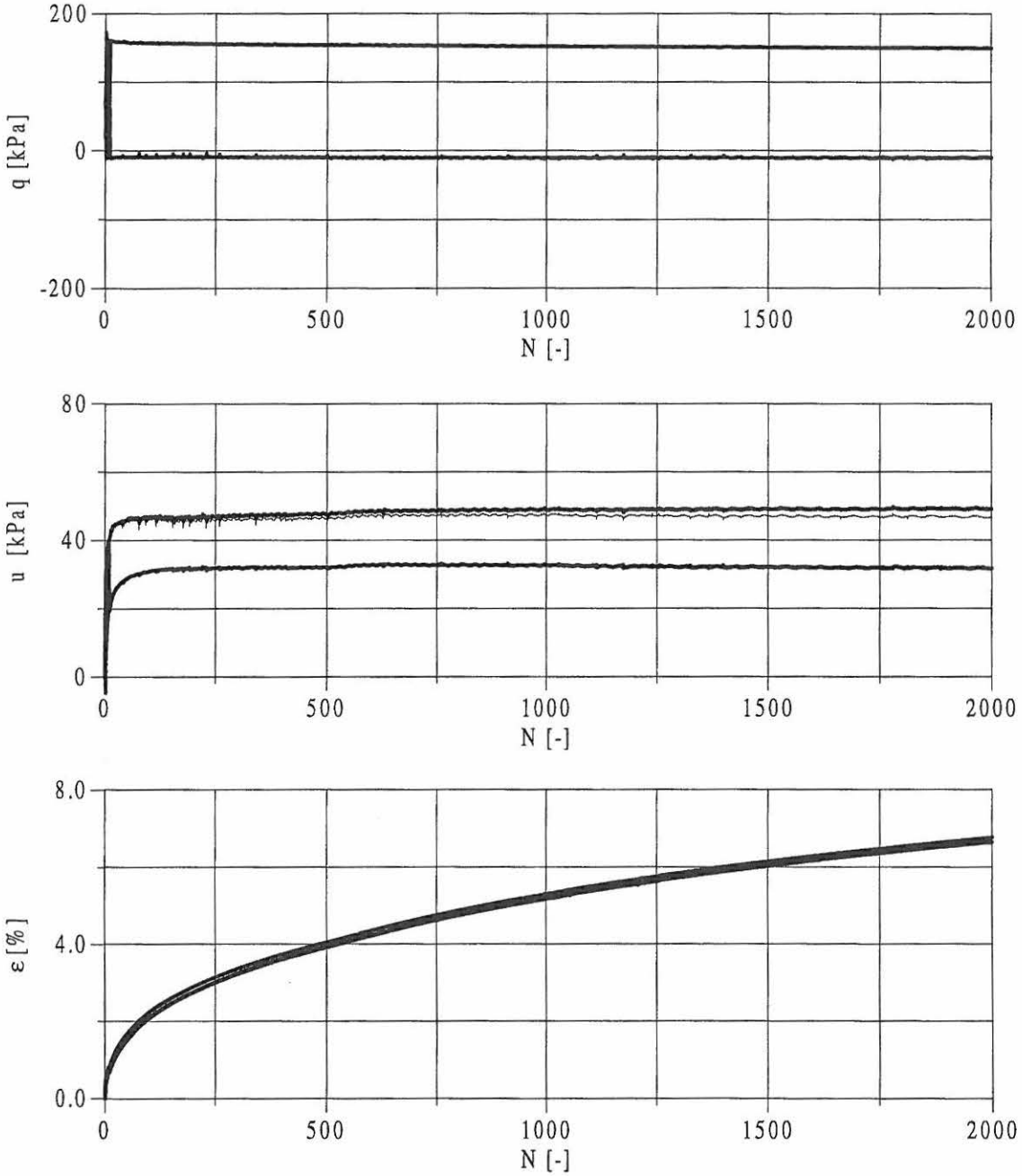
Remarks:

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 9
Evaluated: KPJ	Approved: KPJ



Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 9
Evaluated: KPJ	Approved: KPJ



Remarks

Job:	Aalborg University
Executed: KPJ	Enclosure No. 9
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.10

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal98021.dat	Height Diameter	71.45 mm 69.65 mm
Saturation procedure CO_2 / Backpressure	Date 1998-02-06	Void ratio B-value	0.669 0.990

Test program			
	Isotropic compression, σ'_3 :	10.0 - 49.5	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	150.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained ☐ Applied undrained		
	Cyclic loading, q_{cyc} :	22.5	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	49.4	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.09	%
Volumetric strain	ε_v	0.26	%
Void ratio	e	0.665	

Anisotropic compression			
Confining pressure	σ'_3	49.4	kPa
Axial pressure	σ'_1	199.7	kPa
Deviator stress	q	150.3	kPa
Mean normal stress	p'	99.6	kPa
Pore pressure	u	199.9	kPa
Axial strain	ε_1	1.22	%
Volumetric strain	ε_v	0.26	%
Void ratio	e	0.665	

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 10
Evaluated: KPJ	Approved: KPJ

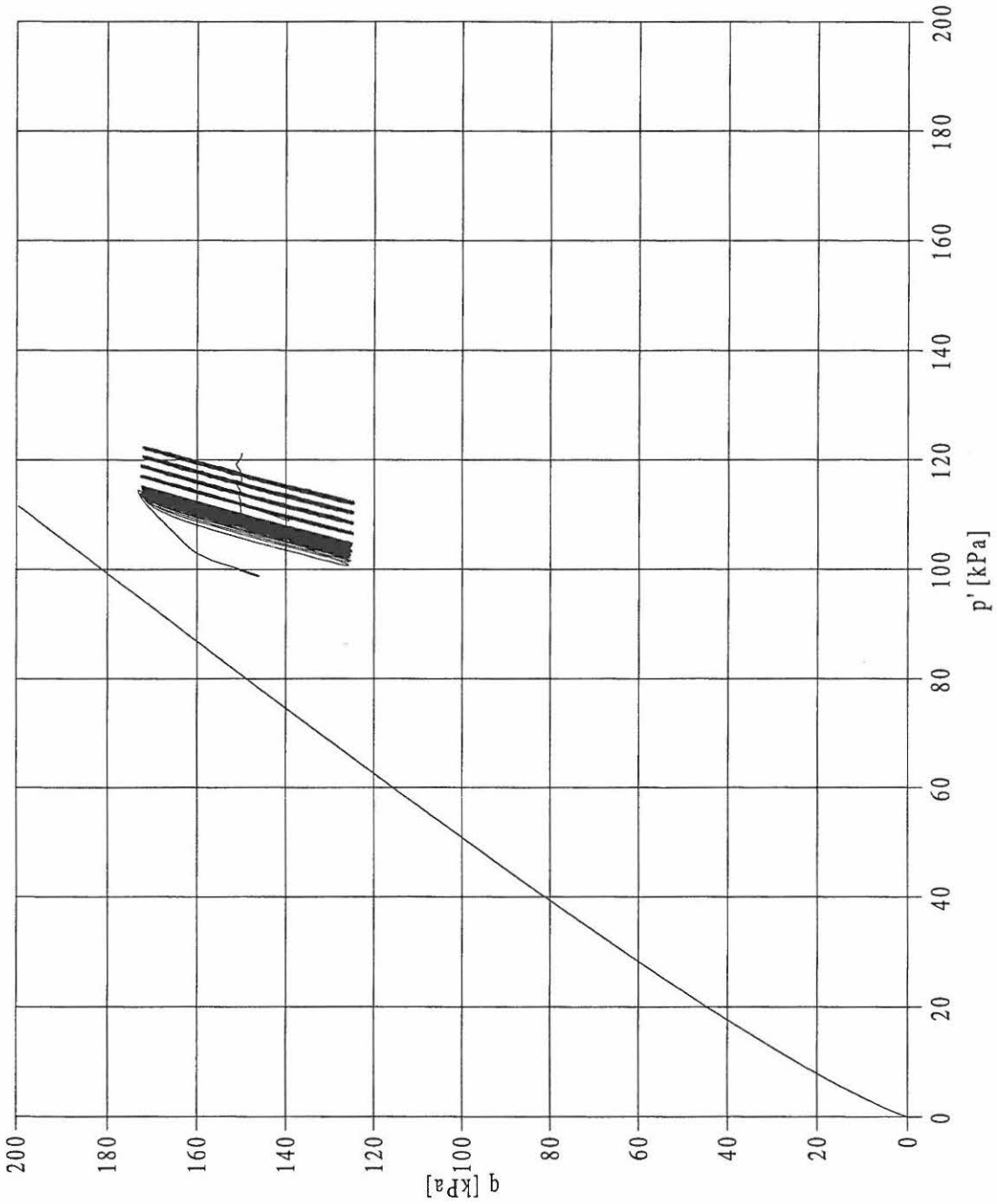
Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	105.7	150.3	-6.1	4.8	0.04	0.02
3	106.8	150.3	-7.3	2.5	0.06	0.01
5	107.3	150.2	-7.6	2.5	0.07	0.01
10	108.0	150.2	-8.3	2.6	0.09	0.00
25	108.2	150.2	-8.6	2.6	0.11	0.00
50	108.6	150.2	-9.1	2.6	0.13	0.00
75	108.6	150.1	-8.9	2.6	0.14	0.00
100	108.6	150.1	-9.0	2.6	0.15	0.00
150	108.7	150.1	-9.2	2.6	0.16	0.00
200	109.1	150.1	-9.3	2.6	0.17	0.00
300	109.5	150.1	-9.7	2.6	0.19	0.00
400	109.7	150.1	-9.9	2.6	0.19	0.00
500	110.1	150.0	-10.3	2.7	0.20	0.00
750	111.0	150.0	-11.2	2.7	0.21	0.00
1000	112.0	150.0	-12.0	2.7	0.22	0.00
1250	113.1	150.0	-12.9	2.7	0.23	0.00
1500	113.9	149.9	-13.7	2.8	0.23	0.00
1750	114.8	149.9	-14.4	2.7	0.24	0.00
2000	115.7	149.9	-15.2	2.8	0.24	0.00
2250	116.6	149.9	-16.0	2.8	0.24	0.00
2500	117.4	149.9	-16.8	2.8	0.24	0.00
3000	118.9	149.9	-18.1	2.9	0.25	0.00
3500	120.4	149.9	-19.6	2.9	0.25	0.00

Remarks:

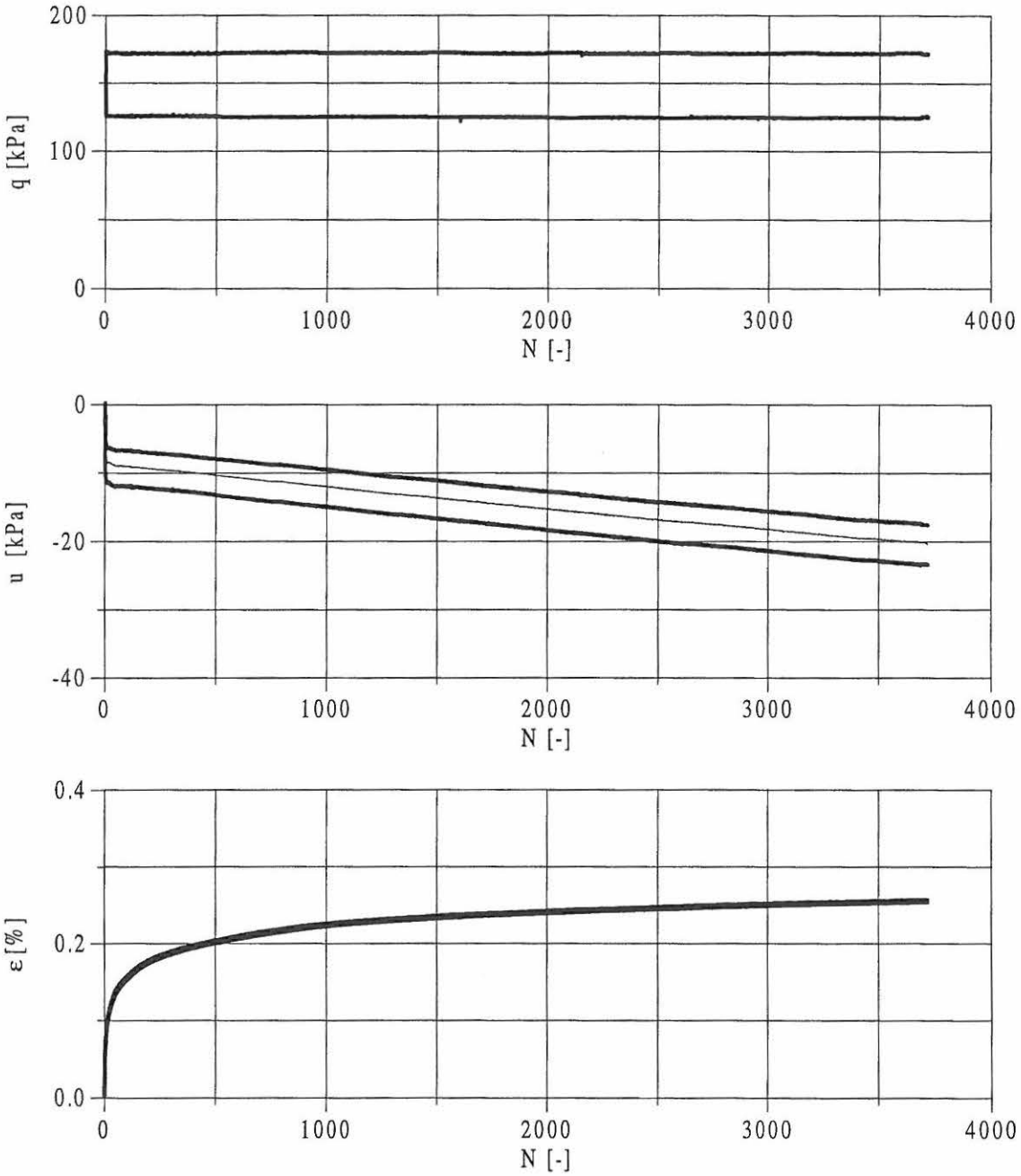
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 10
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.10



Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ Evaluated: KPJ	Enclosure No. 10 Approved: KPJ



Remarks

Job:	Aalborg University
Executed: KPJ	Enclosure No. 10
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.11

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal98022.dat	Height Diameter	71.50 mm 69.70 mm
Saturation procedure CO_2 / Backpressure	Date 1998-02-08	Void ratio B-value	0.672 0.997

Test program			
	Isotropic compression, σ'_3 :	10.0 - 175.0	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	75.9	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained ☐ Applied undrained		
	Cyclic loading, q_{cyc} :	82.5	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	175.0	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.19	%
Volumetric strain	ε_v	0.68	%
Void ratio	e	0.661	

Anisotropic compression			
Confining pressure	σ'_3	175.0	kPa
Axial pressure	σ'_1	250.8	kPa
Deviator stress	q	75.8	kPa
Mean normal stress	p'	200.3	kPa
Pore pressure	u	200.0	kPa
Axial strain	ε_1	0.28	%
Volumetric strain	ε_v	0.76	%
Void ratio	e	0.659	

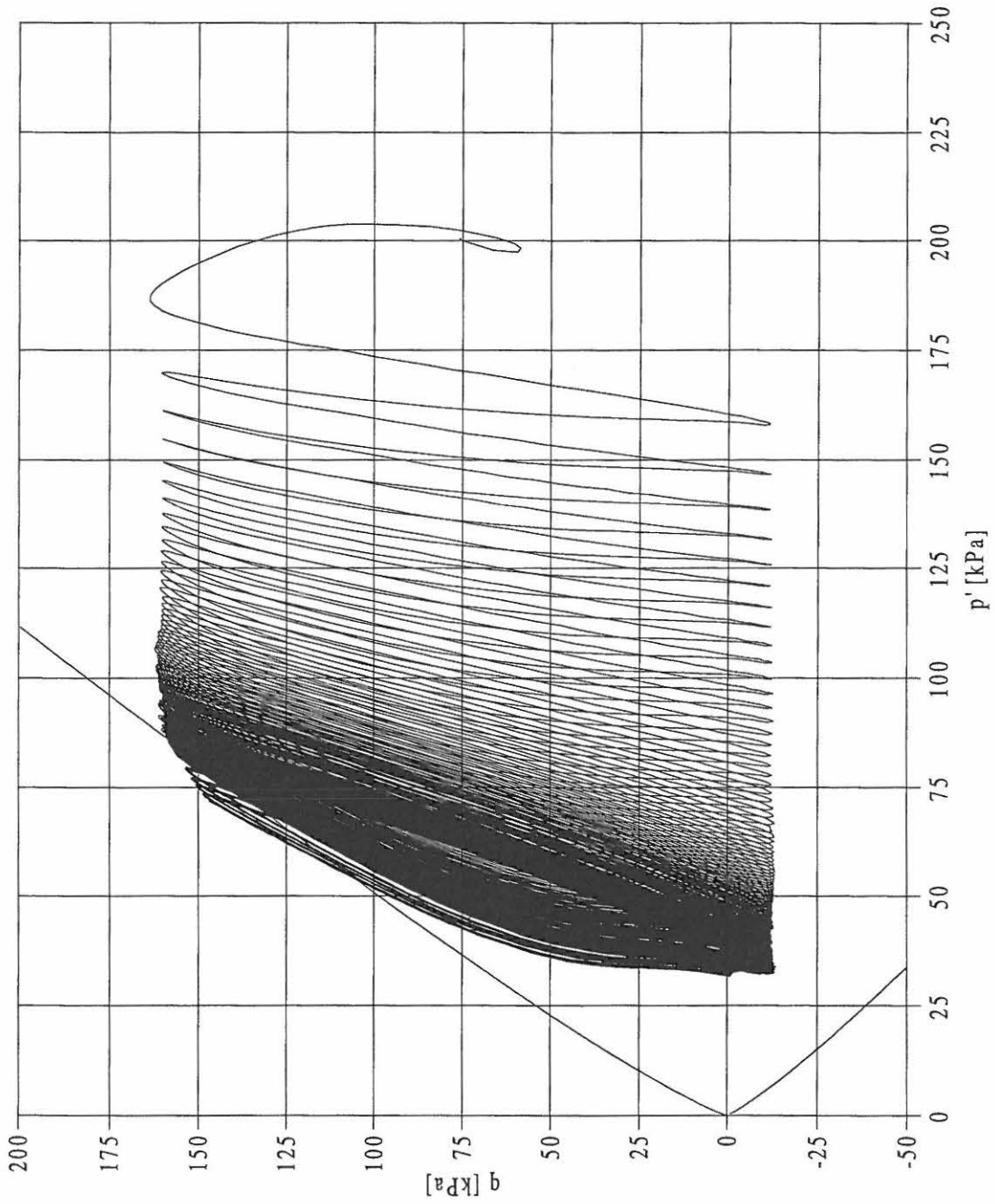
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 11
Evaluated: KPJ	Approved: KPJ

Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	161.6	75.7	38.5	22.4	0.07	0.06
3	142.6	75.6	57.6	17.3	0.11	0.04
5	130.3	75.6	69.9	16.8	0.14	0.04
10	108.5	75.6	91.6	15.4	0.21	0.05
25	74.0	75.3	126.1	11.8	0.50	0.06
50	58.0	75.0	142.0	10.0	0.99	0.07
75	53.5	74.7	146.3	9.7	1.36	0.08
100	51.6	74.5	148.3	9.2	1.66	0.08
150	49.7	74.1	150.0	8.9	2.15	0.08
200	47.7	73.8	152.0	8.8	2.57	0.08
300	46.1	73.2	153.4	8.5	3.26	0.08
400	45.7	72.8	153.8	8.7	3.81	0.08
500	45.4	72.5	154.1	8.7	4.26	0.08
750	44.2	71.7	155.0	8.9	5.20	0.08
1000	43.8	71.2	155.3	9.0	5.93	0.07
1250	43.4	70.7	155.5	9.2	6.53	0.07
1500	42.7	70.3	156.0	9.3	7.07	0.07
1750	42.2	70.0	156.4	9.4	7.53	0.07
2000	41.8	69.7	156.6	9.5	7.95	0.07
2250	41.0	69.4	157.2	9.5	8.36	0.07
2500	40.6	69.1	157.5	9.6	8.73	0.07

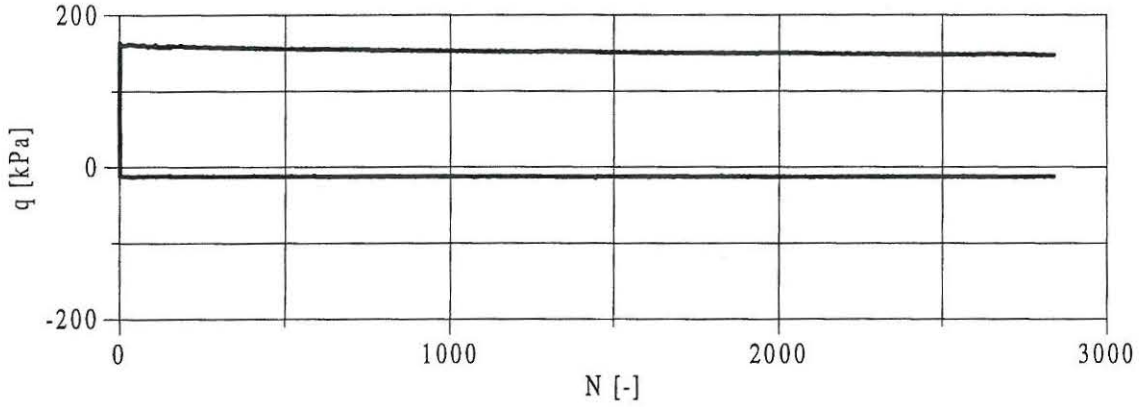
Remarks:

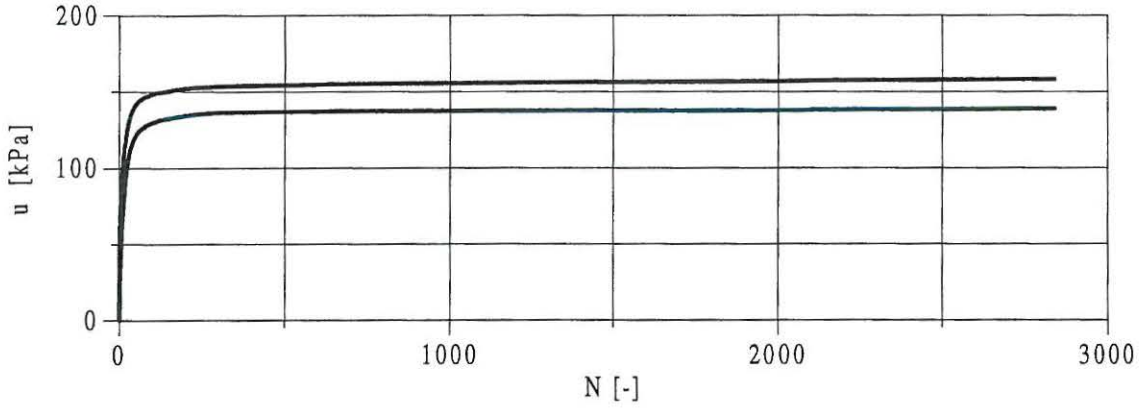
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 11
Evaluated: KPJ	Approved: KPJ

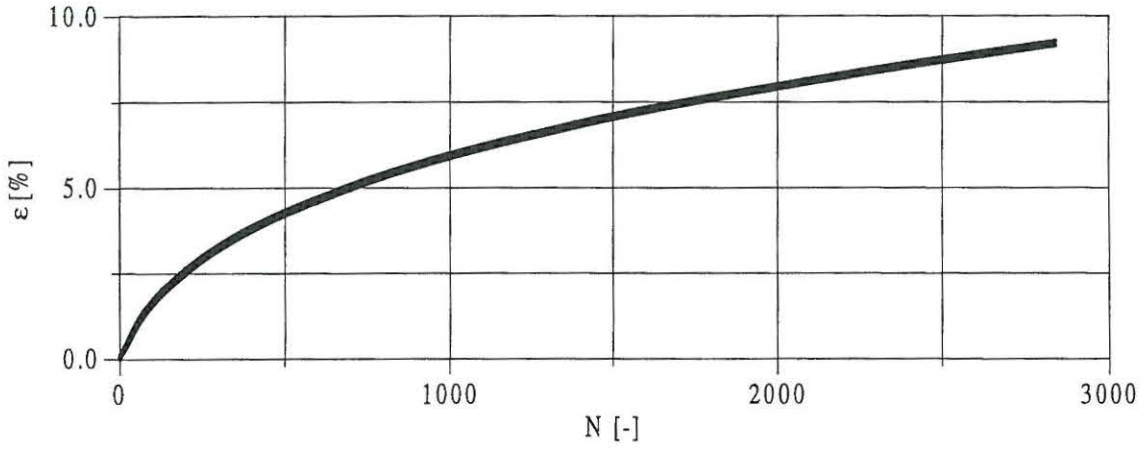


Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 11
Evaluated: KPJ	Approved: KPJ







Remarks

Job:	Aalborg University
Executed: KPJ Evaluated: KPJ	Enclosure No. 11 Approved: KPJ

CCU Triaxial Test No. 9802.14

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal98023.dat	Height Diameter	71.50 mm 69.70 mm
Saturation procedure CO_2 / Backpressure	Date 1998-02-09	Void ratio B-value	0.673 0.990

Test program			
	Isotropic compression, σ'_3 :	10.0 - 25.0	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	75.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained ☐ Applied undrained		
	Cyclic loading, q_{cyc} :	11.3	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	25.0	kPa
Pore pressure	u	300.3	kPa
Axial strain	ε_1	0.03	%
Volumetric strain	ε_v	0.11	%
Void ratio	e	0.671	

Anisotropic compression			
Confining pressure	σ'_3	25.0	kPa
Axial pressure	σ'_1	99.9	kPa
Deviator stress	q	74.9	kPa
Mean normal stress	p'	50.0	kPa
Pore pressure	u	300.0	kPa
Axial strain	ε_1	0.72	%
Volumetric strain	ε_v	0.16	%
Void ratio	e	0.670	

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 12
Evaluated: KPJ	Approved: KPJ

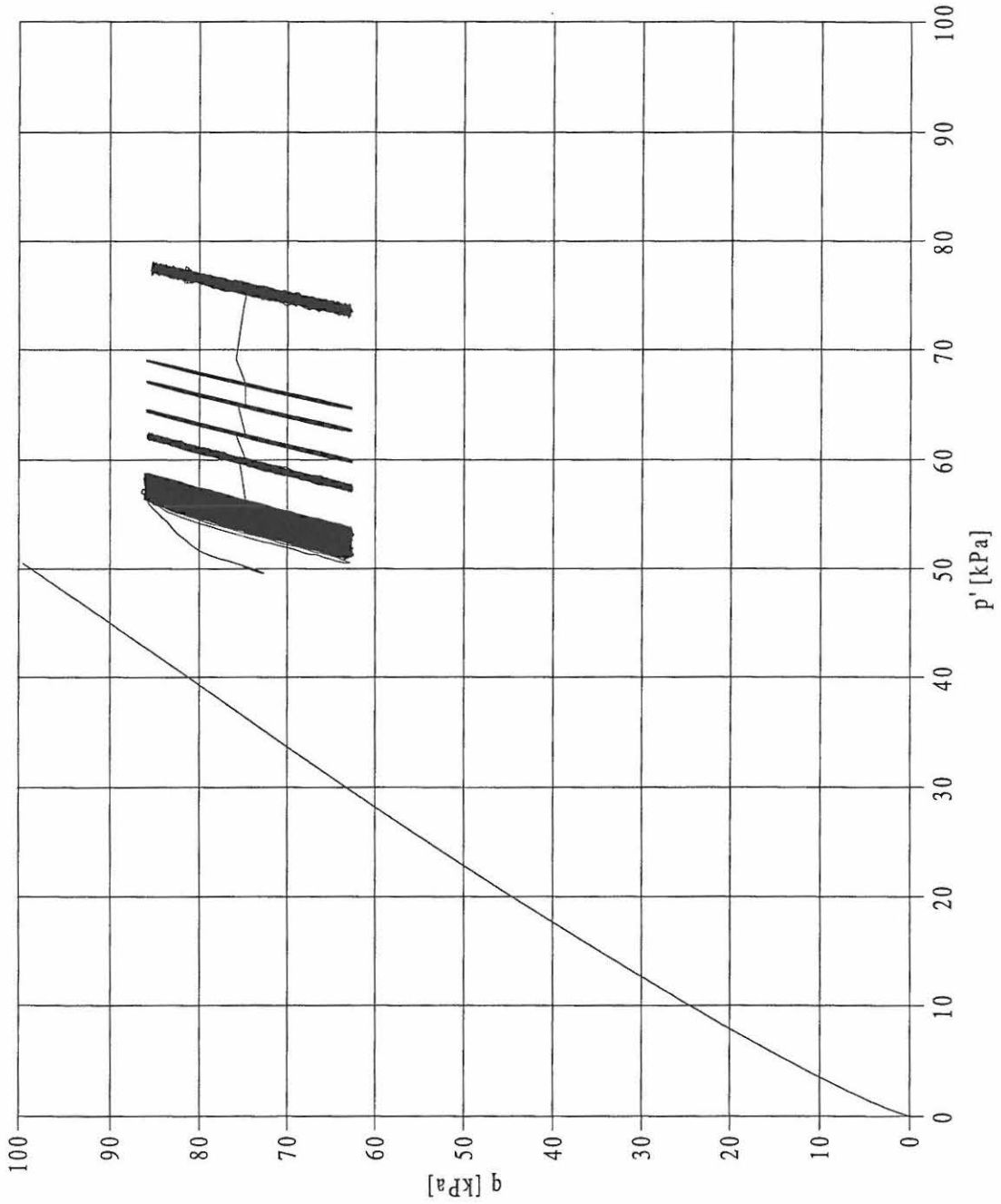
Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	53.0	74.9	-2.9	2.3	0.04	0.02
3	53.4	74.9	-3.3	1.3	0.05	0.00
5	53.5	74.9	-3.4	1.2	0.06	0.00
10	53.5	74.9	-3.6	1.2	0.07	0.00
25	53.7	74.9	-3.6	1.3	0.10	0.00
50	53.7	74.8	-3.7	1.3	0.11	0.00
75	53.8	74.8	-3.7	1.3	0.12	0.00
100	53.8	74.8	-3.8	1.3	0.13	0.00
150	54.2	74.8	-4.0	1.4	0.14	0.00
200	54.6	74.8	-4.3	1.3	0.15	0.00
300	55.1	74.8	-4.8	1.3	0.16	0.00
400	55.8	74.8	-5.4	1.4	0.17	0.00
500	56.3	74.8	-6.0	1.4	0.17	0.00
750	58.1	74.8	-7.7	0.0	0.18	0.00
1000	60.0	74.8	-9.6	1.5	0.19	0.00
1250	61.0	74.8	-11.3	1.7	0.19	0.00
1500	62.4	74.8	-12.7	1.7	0.19	0.00
1750	63.8	74.8	-14.5	1.8	0.20	0.00
2000	65.0	74.8	-15.5	1.7	0.20	0.00
2250	66.0	74.8	-16.6	1.8	0.20	0.00
2500	67.0	74.8	-17.7	1.8	0.20	0.00
3000	72.6	74.4	-18.4	1.9	0.21	0.00
3500	73.7	74.4	-20.0	1.8	0.21	0.00
4000	76.0	74.4	-21.8	1.9	0.21	0.00

Remarks:

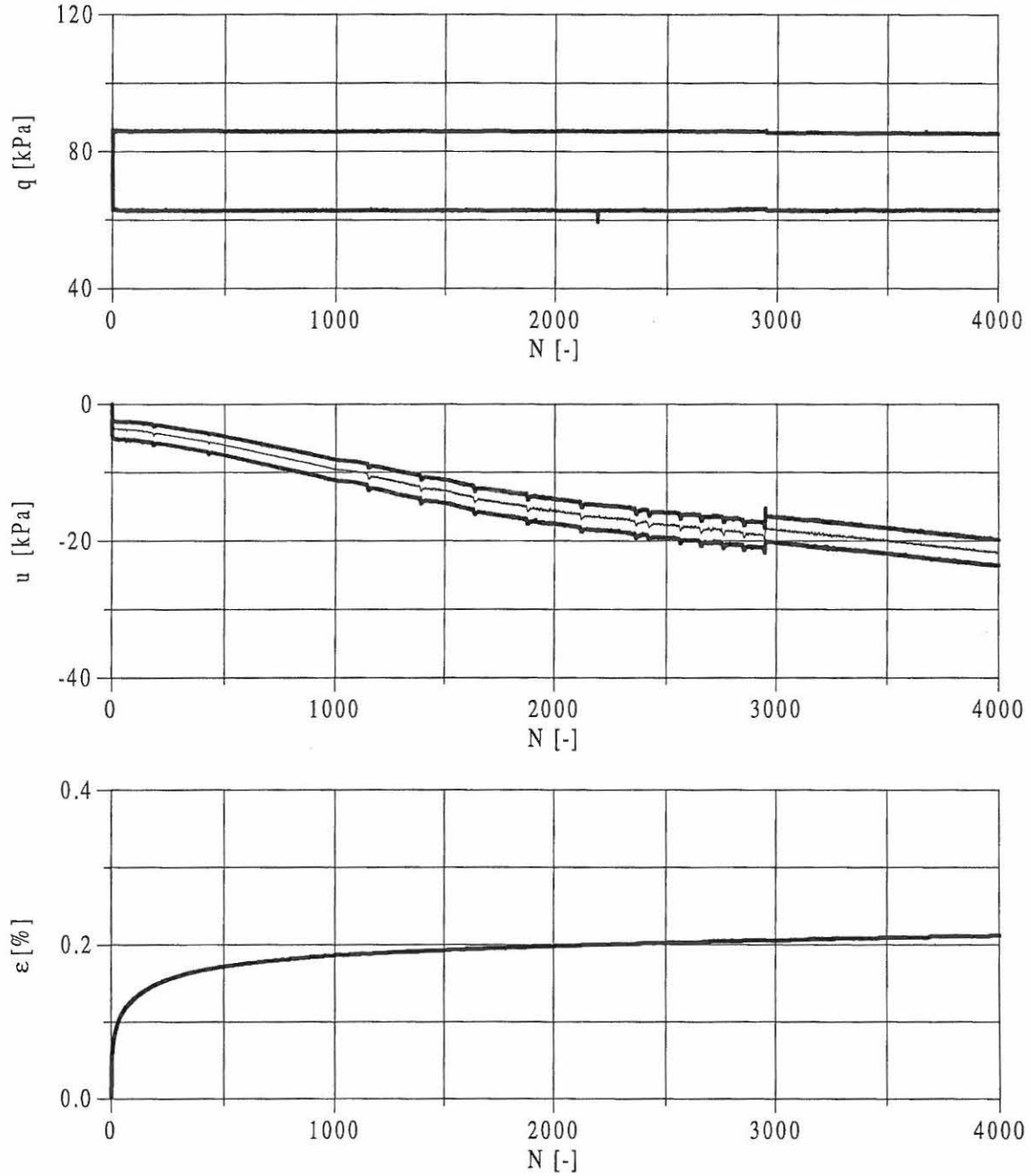
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 12
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.14



Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ Evaluated: KPJ	Enclosure No. 12 Approved: KPJ



Remarks

Job:	Aalborg University
Executed: KPJ	Enclosure No. 12
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.15

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal98023.dat	Height Diameter	71.50 mm 69.70 mm
Saturation procedure CO_2 / Backpressure	Date 1998-03-05	Void ratio B-value	0.672 0.983

Test program			
	Isotropic compression, σ'_3 :	10.0 - 75.0	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	75.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained ☐ Applied undrained		
	Cyclic loading, q_{cyc} :	25.0	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	75.0	kPa
Pore pressure	u	299.6	kPa
Axial strain	ε_1	0.14	%
Volumetric strain	ε_v	0.30	%
Void ratio	e	0.667	

Anisotropic compression			
Confining pressure	σ'_3	75.0	kPa
Axial pressure	σ'_1	150.4	kPa
Deviator stress	q	75.4	kPa
Mean normal stress	p'	100.1	kPa
Pore pressure	u	299.6	kPa
Axial strain	ε_1	0.35	%
Volumetric strain	ε_v	0.40	%
Void ratio	e	0.665	

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 13
Evaluated: KPJ	Approved: KPJ

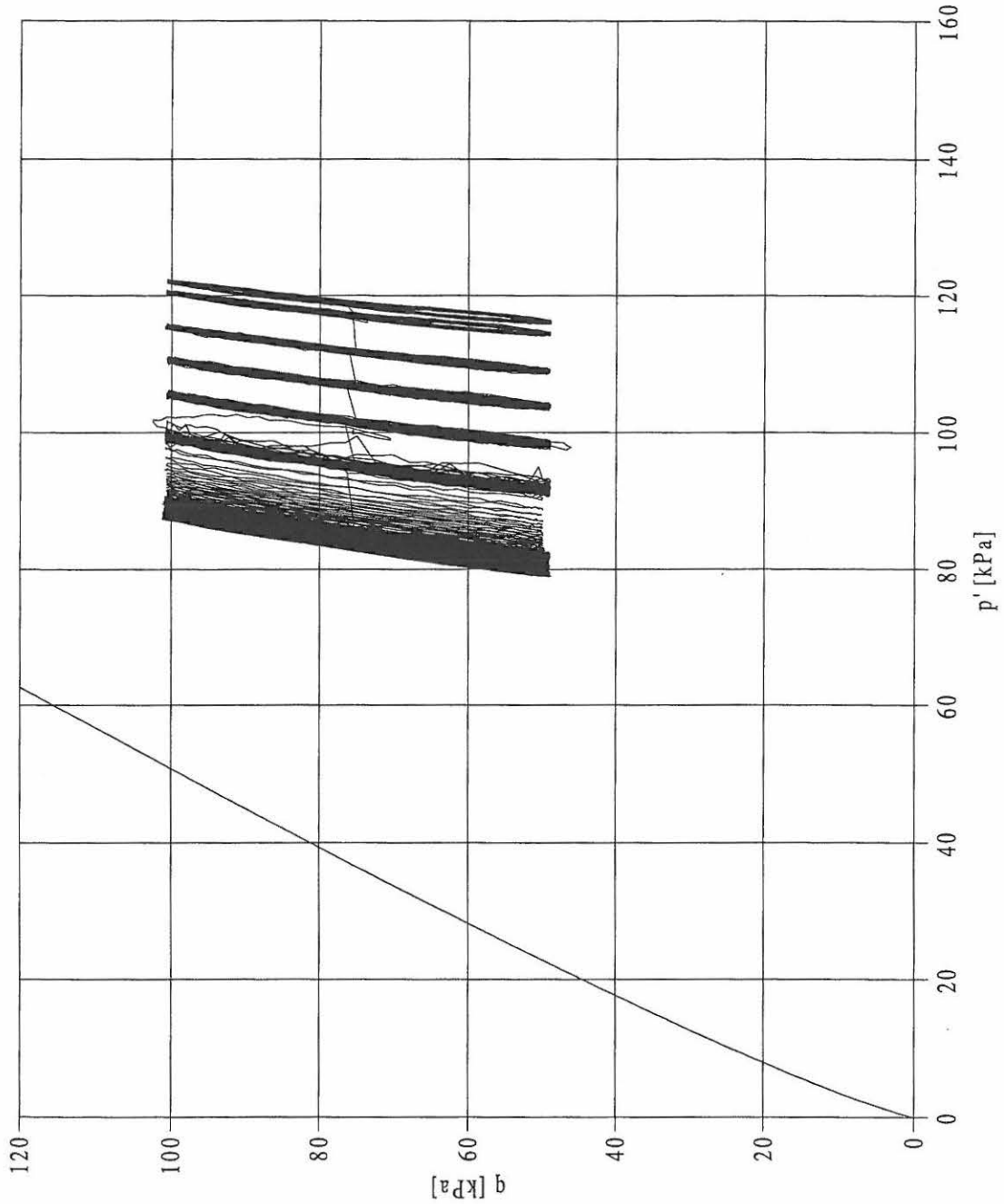
Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	93.0	75.5	6.9	4.2	0.09	0.05
3	90.9	75.4	9.1	4.3	0.11	0.01
5	89.7	75.4	10.3	4.4	0.13	0.01
10	88.4	75.4	11.6	4.6	0.15	0.01
25	86.1	75.4	14.1	4.6	0.18	0.01
50	84.3	75.4	15.6	4.5	0.20	0.01
75	83.6	75.4	16.4	4.5	0.22	0.00
100	83.4	75.3	16.8	4.4	0.23	0.00
150	83.2	75.3	16.9	4.5	0.25	0.00
200	82.8	75.3	17.1	4.5	0.27	0.00
300	83.6	75.3	16.4	4.5	0.30	0.00
400	84.6	75.3	15.4	4.5	0.31	0.00
500	86.1	75.3	14.1	4.5	0.32	0.00
750	91.0	75.2	9.8	4.6	0.34	0.00
1000	95.3	75.1	5.9	4.8	0.36	0.00
1250	97.9	75.2	2.9	5.0	0.37	0.00
1500	102.0	75.1	-0.8	5.0	0.38	0.00
1750	104.5	75.1	-3.5	5.2	0.38	0.00
2000	107.2	75.1	-6.2	5.2	0.39	0.00
2250	109.9	75.1	-8.7	5.4	0.39	0.00
2500	112.1	75.1	-10.9	5.3	0.40	0.00
3000	113.8	75.2	-13.3	5.5	0.40	0.00
3500	116.3	75.2	-15.9	5.6	0.41	0.00
4000	117.2	75.2	-17.2	5.6	0.42	0.00
4500	118.2	75.2	-18.2	5.6	0.42	0.00
5000	119.1	75.2	-19.0	5.7	0.43	0.00

Remarks:

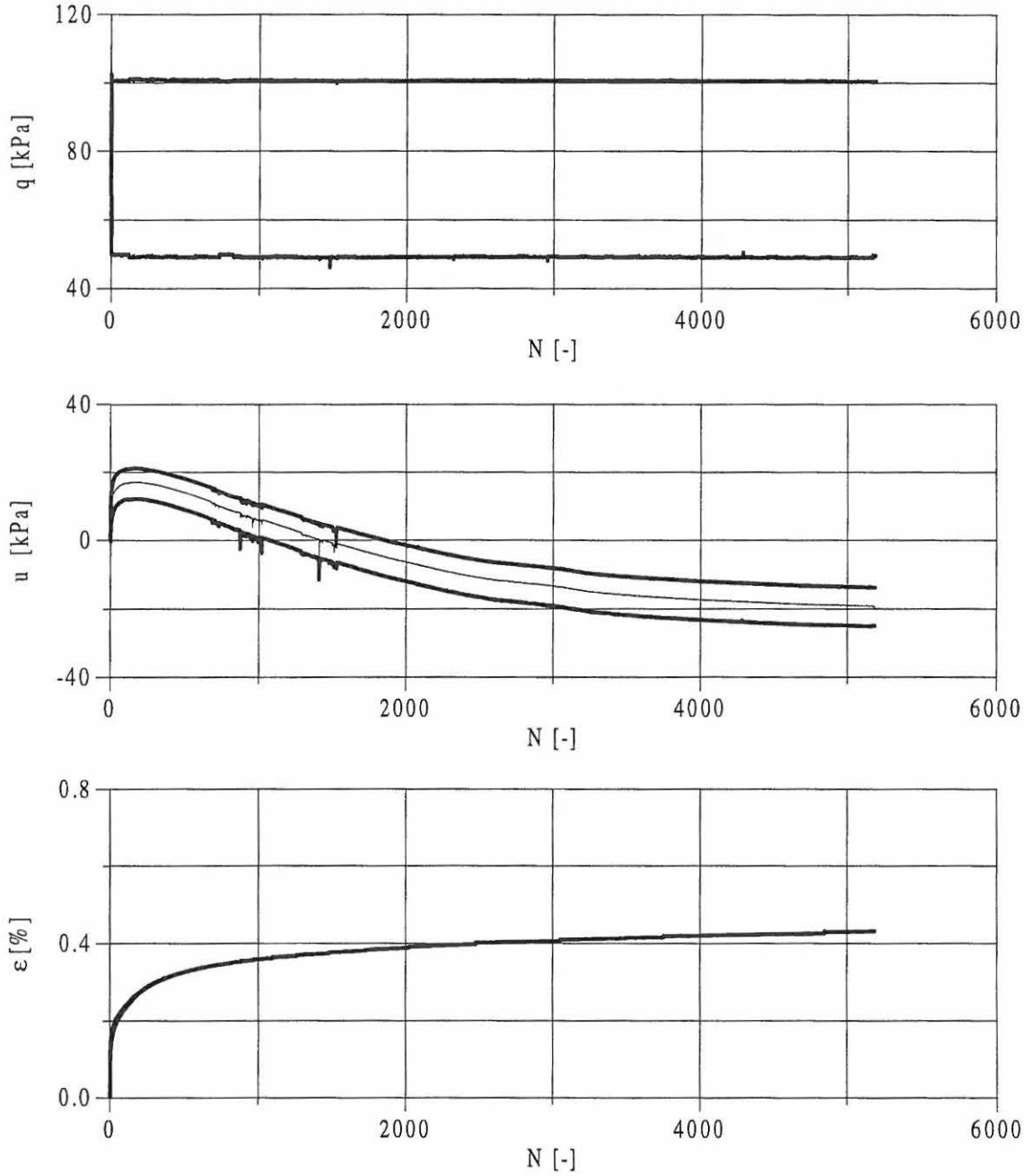
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 13
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.15



Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ Evaluated: KPJ	Enclosure No. 13 Approved: KPJ



Remarks

Job:	Aalborg University
Executed: KPJ	Enclosure No. 13
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.16

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal98023.dat	Height Diameter	71.47 mm 69.67 mm
Saturation procedure CO_2 / Backpressure	Date 1998-03-06	Void ratio B-value	0.671 0.977

Test program			
	Isotropic compression, σ'_3 :	10.0 - 25.0	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	75.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained ☐ Applied undrained		
	Cyclic loading, q_{cyc} :	25.0	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	24.9	kPa
Pore pressure	u	299.9	kPa
Axial strain	ε_1	0.00	%
Volumetric strain	ε_v	0.01	%
Void ratio	e	0.671	

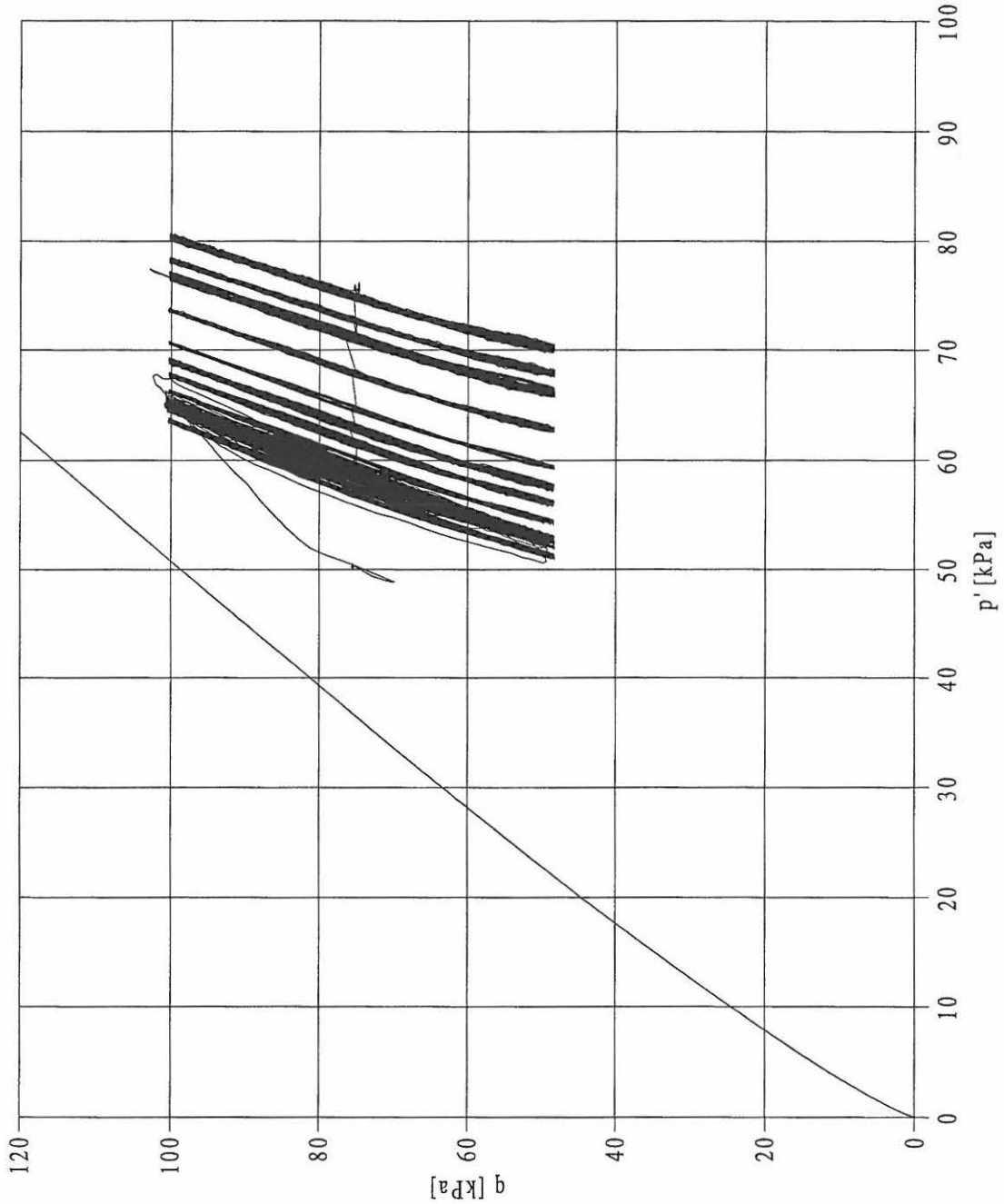
Anisotropic compression			
Confining pressure	σ'_3	25.0	kPa
Axial pressure	σ'_1	100.4	kPa
Deviator stress	q	75.4	kPa
Mean normal stress	p'	50.1	kPa
Pore pressure	u	299.9	kPa
Axial strain	ε_1	0.59	%
Volumetric strain	ε_v	-0.05	%
Void ratio	e	0.672	

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 14
Evaluated: KPJ	Approved: KPJ

Cyclic loading						
N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	56.0	75.4	-5.8	5.0	0.10	0.05
3	57.1	75.4	-6.9	2.5	0.13	0.01
5	57.4	75.4	-7.3	2.5	0.15	0.01
10	57.8	75.4	-7.7	2.5	0.18	0.01
25	58.2	75.3	-8.1	2.6	0.22	0.01
50	58.3	75.3	-8.2	2.6	0.26	0.01
75	58.2	75.3	-8.1	2.6	0.28	0.01
100	58.3	75.3	-8.1	2.6	0.29	0.01
150	58.2	75.2	-8.2	2.7	0.32	0.01
200	58.2	75.2	-8.2	2.6	0.34	0.01
300	58.2	75.2	-8.1	2.7	0.36	0.01
400	58.1	75.2	-8.0	2.7	0.38	0.01
500	58.3	75.2	-8.1	2.7	0.40	0.01
750	58.2	75.2	-8.0	2.7	0.42	0.01
1000	58.3	75.1	-7.9	2.6	0.45	0.01
1250	58.4	75.1	-7.8	2.6	0.46	0.01
1500	58.4	75.1	-7.6	2.6	0.48	0.01
1750	58.3	75.0	-7.3	2.6	0.50	0.01
2000	58.0	75.0	-7.0	2.5	0.51	0.01
2250	57.9	75.0	-6.8	2.5	0.52	0.01
2500	57.7	75.0	-6.5	2.5	0.54	0.01
3000	56.9	75.0	-6.0	2.5	0.56	0.01
3500	56.5	75.0	-5.6	2.5	0.58	0.01
4000	56.7	74.9	-5.7	2.5	0.60	0.01
4500	56.6	75.0	-5.7	2.6	0.61	0.01
5000	56.9	74.9	-6.0	2.6	0.62	0.01
5500	57.3	74.9	-6.4	2.6	0.62	0.01
6000	58.1	74.9	-7.2	2.6	0.63	0.01
7000	59.5	74.9	-8.8	2.8	0.63	0.01
8000	61.3	74.9	-10.5	2.9	0.64	0.01
9000	62.6	74.9	-11.9	3.0	0.64	0.01
10000	64.5	74.9	-13.5	3.1	0.64	0.01
12000	67.7	74.9	-16.5	3.3	0.64	0.01
14000	70.8	74.9	-19.3	3.4	0.65	0.01
16000	72.3	74.9	-21.1	3.6	0.65	0.01
18000	71.3	74.9	-20.4	3.4	0.64	0.01
20000	74.9	74.9	-23.4	3.7	0.64	0.01

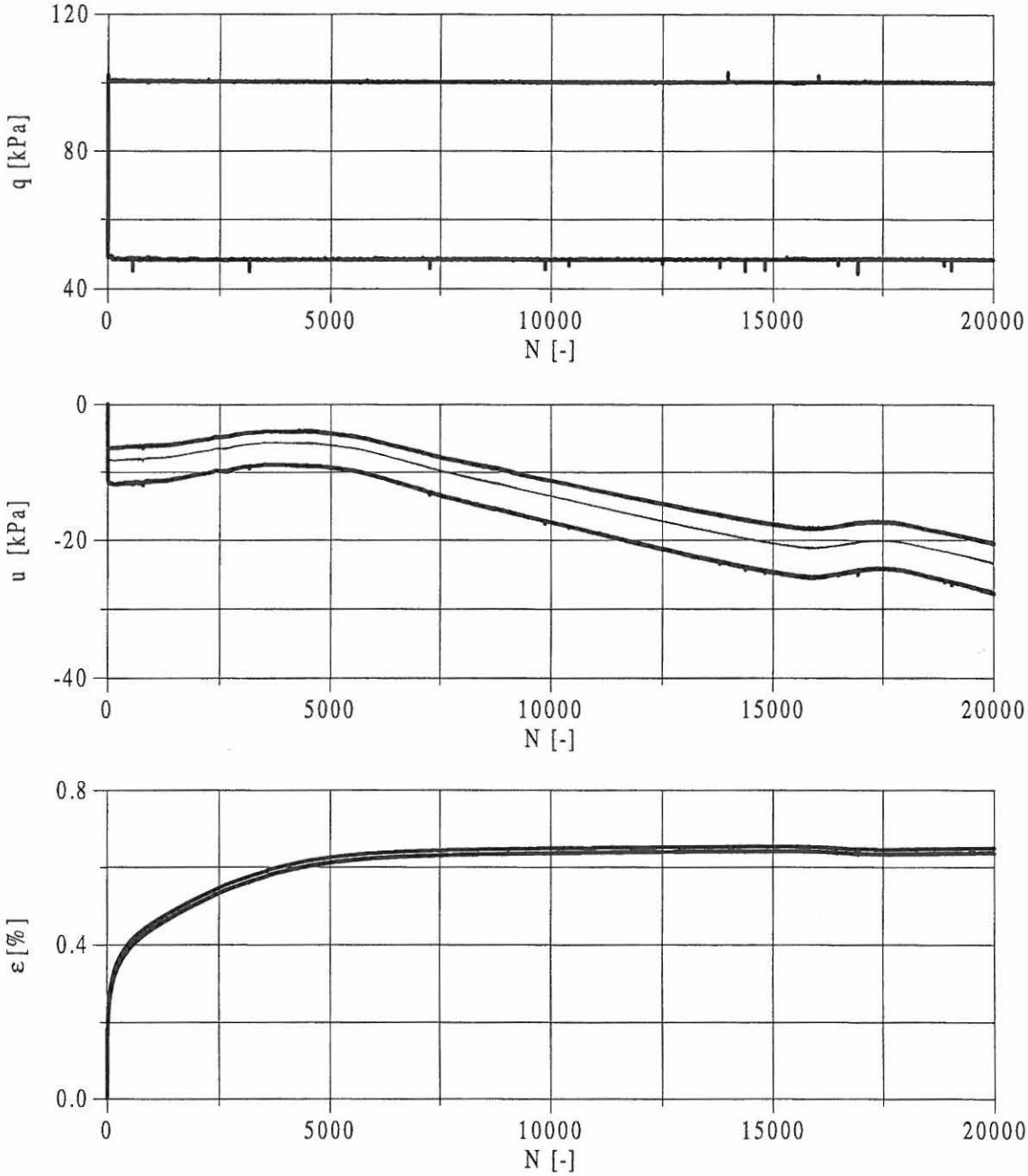
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 14
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.16



Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 14
Evaluated: KPJ	Approved: KPJ



Remarks

Job:	Aalborg University
Executed: KPJ	Enclosure No. 14
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.17

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal98023.dat	Height Diameter	71.50 mm 69.70 mm
Saturation procedure CO_2 / Backpressure	Date 1998-03-09	Void ratio B-value	0.673 0.997

Test program			
	Isotropic compression, σ'_3 :	10.0 - 49.5	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	151.5	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained ☐ Applied undrained		
	Cyclic loading, q_{cyc} :	100.0	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	49.4	kPa
Pore pressure	u	299.2	kPa
Axial strain	ε_1	0.06	%
Volumetric strain	ε_v	0.13	%
Void ratio	e	0.671	

Anisotropic compression			
Confining pressure	σ'_3	49.5	kPa
Axial pressure	σ'_1	200.6	kPa
Deviator stress	q	151.1	kPa
Mean normal stress	p'	99.9	kPa
Pore pressure	u	299.2	kPa
Axial strain	ε_1	1.11	%
Volumetric strain	ε_v	0.19	%
Void ratio	e	0.670	

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 15
Evaluated: KPJ	Approved: KPJ

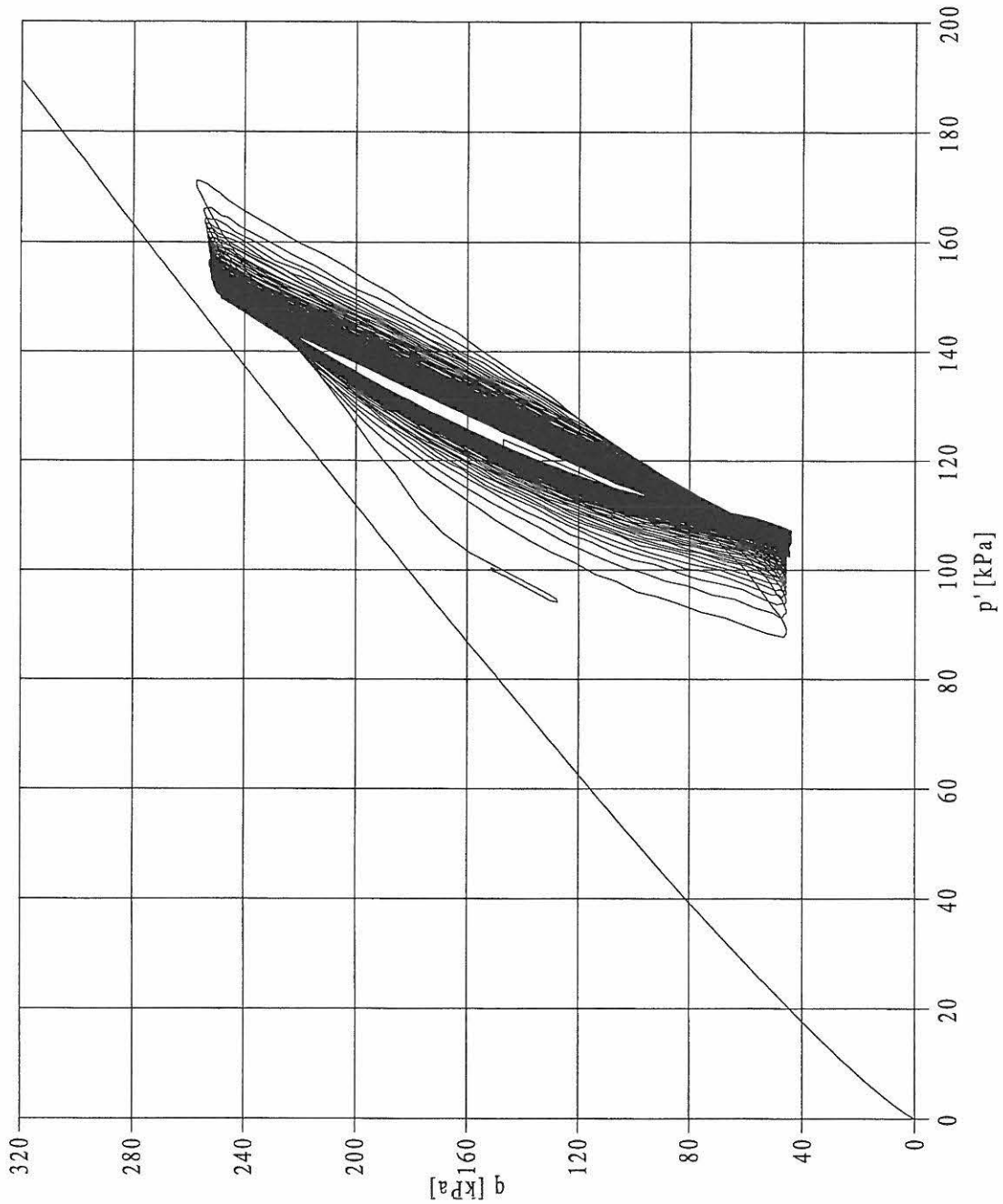
Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	109.2	150.4	-9.5	19.3	0.30	0.17
3	113.8	150.2	-14.1	13.0	0.45	0.06
5	115.3	150.1	-15.9	11.8	0.54	0.05
10	117.5	149.8	-18.0	10.9	0.69	0.04
25	119.7	149.5	-20.4	10.7	0.91	0.04
50	120.8	149.2	-21.4	11.0	1.11	0.04
75	121.1	149.0	-21.8	11.2	1.23	0.04
100	121.1	148.9	-22.0	11.3	1.33	0.04
150	121.4	148.6	-22.2	11.4	1.46	0.03
200	121.8	148.5	-22.4	11.5	1.55	0.03
300	121.5	148.3	-22.3	11.6	1.69	0.03
400	121.6	148.1	-22.3	11.6	1.78	0.03
500	121.5	148.0	-22.2	11.7	1.86	0.03
750	121.6	147.8	-22.2	11.8	1.99	0.03
1000	121.8	147.7	-22.4	11.8	2.08	0.03
1250	121.7	147.6	-22.3	11.9	2.14	0.03
1500	122.1	147.5	-22.6	11.9	2.19	0.02
1750	122.2	147.4	-22.8	12.0	2.23	0.02
2000	122.5	147.4	-23.0	12.1	2.26	0.02
2250	122.3	147.4	-23.0	12.1	2.29	0.02
2500	122.0	147.3	-22.9	12.3	2.31	0.02
3000	121.7	147.3	-22.9	12.3	2.34	0.02
3500	121.8	147.3	-23.0	12.4	2.37	0.02
4000	123.9	147.3	-25.4	12.4	2.40	0.02

Remarks:

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 15
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.17



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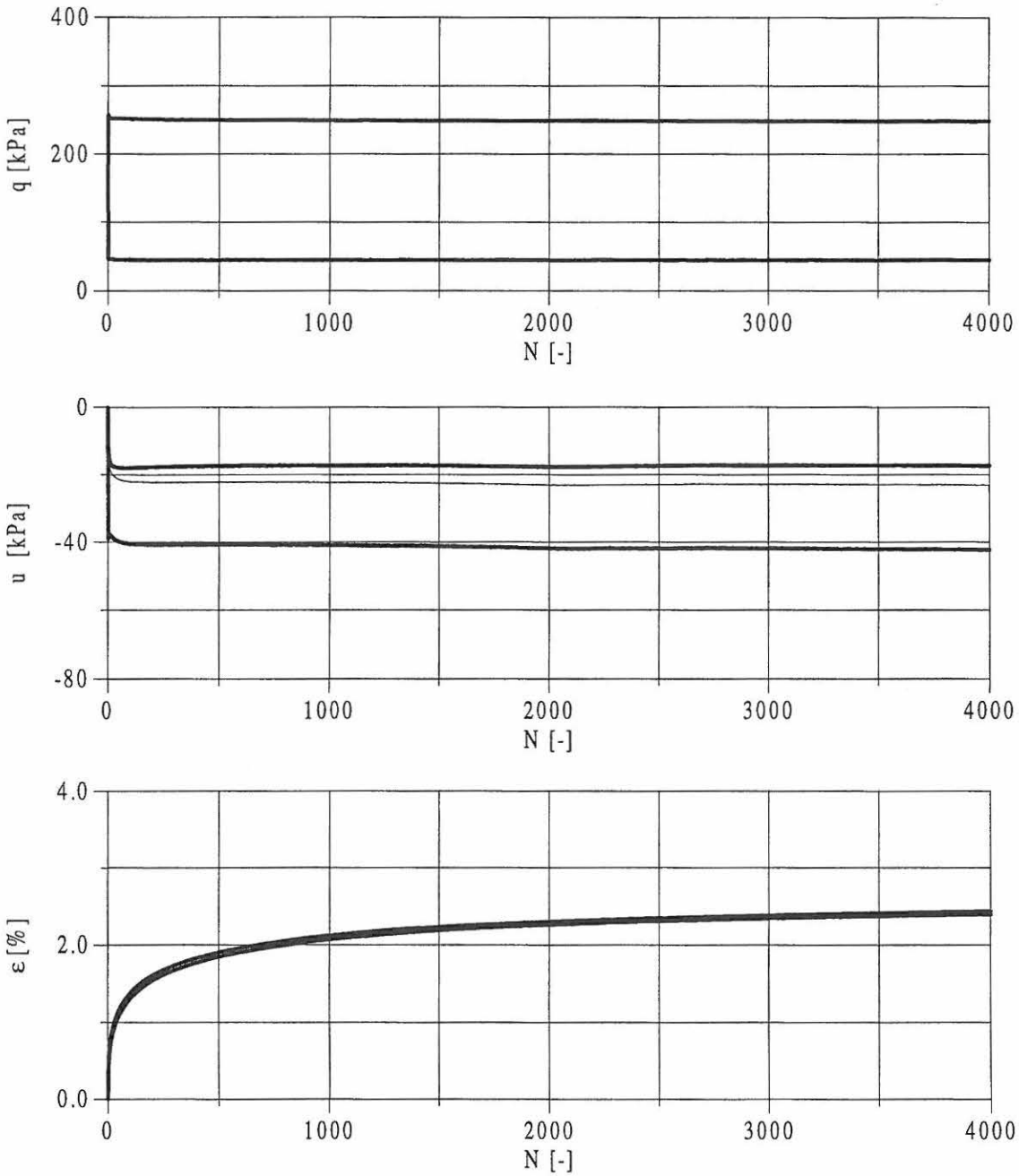
Job: Ph.D. Project	Aalborg University
Executed: KPJ Evaluated: KPJ	Enclosure No. 15 Approved: KPJ



Remarks

Job:	Aalborg University
Executed: KPJ	Enclosure No. 17
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.18

Description of soil Eastern Scheldt Sand	Cyclic Triaxial Apparatus	Sample properties	
Specimen preparation Air pluviation	Calibration file Cal98023.dat	Height Diameter	71.47 mm 69.67 mm
Saturation procedure CO_2 / Backpressure	Date 1998-03-10	Void ratio B-value	0.671 0.997

Test program			
	Isotropic compression, σ'_3 :	10.0 - 11.7	kPa
	Loading rate:	5.0	kPa/min
	Anisotropic compression, q_m :	55.0	kPa
	Loading rate:	3.0	kPa/min
	☒ Applied drained ☐ Applied undrained		
	Cyclic loading, q_{cyc} :	36.3	kPa
	Period:	10.0	s

Isotropic compression			
Confining pressure	σ'_3	11.7	kPa
Pore pressure	u	299.9	kPa
Axial strain	ε_1	0.00	%
Volumetric strain	ε_v	0.01	%
Void ratio	e	0.671	

Anisotropic compression			
Confining pressure	σ'_3	11.6	kPa
Axial pressure	σ'_1	66.3	kPa
Deviator stress	q	54.7	kPa
Mean normal stress	p'	29.8	kPa
Pore pressure	u	299.8	kPa
Axial strain	ε_1	1.22	%
Volumetric strain	ε_v	-0.35	%
Void ratio	e	0.677	

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 16
Evaluated: KPJ	Approved: KPJ

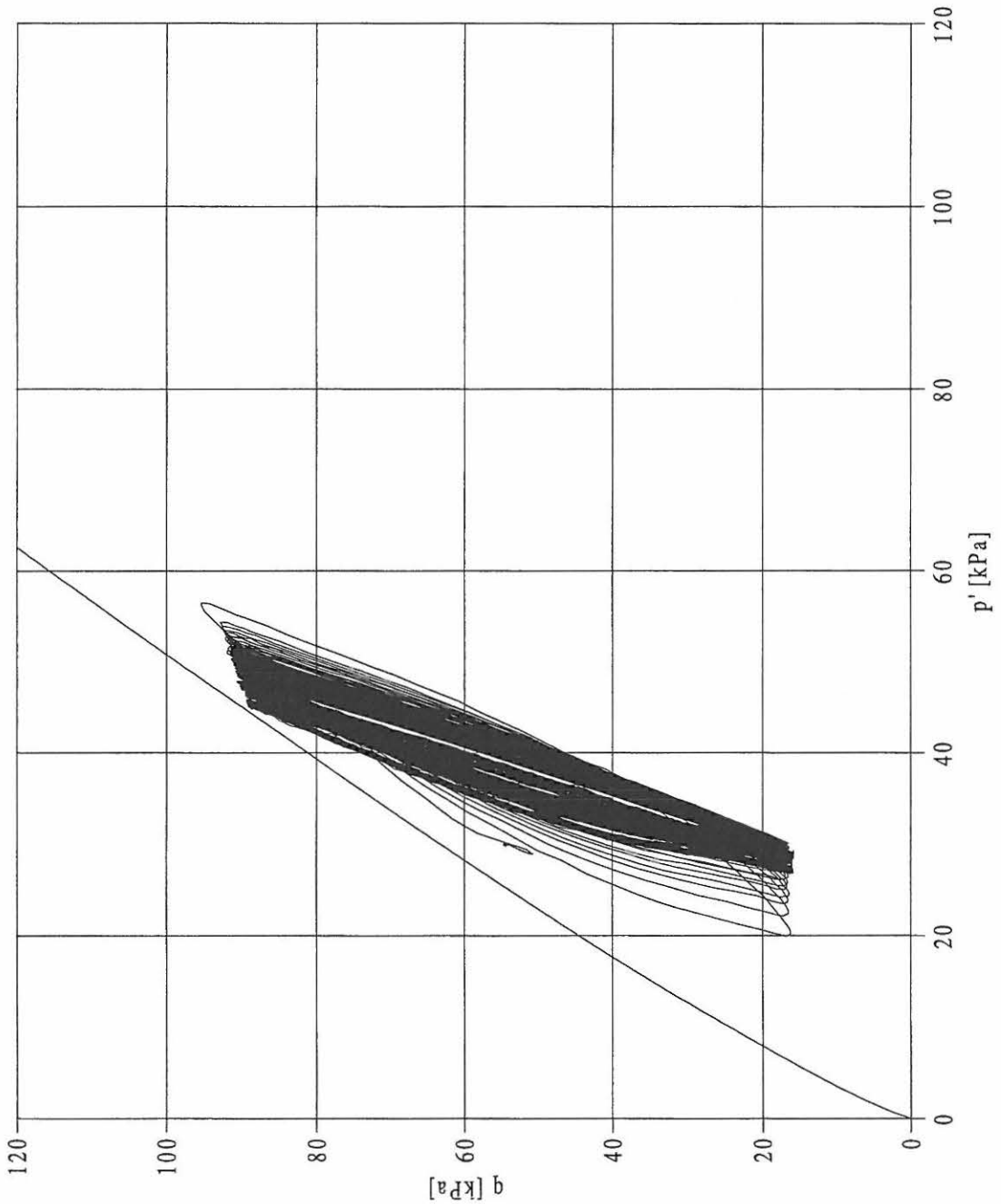
Cyclic loading

N	p'_m kPa	q_m kPa	u_p kPa	u_{cyc} kPa	ε_p %	ε_{cyc} %
1	31.3	54.6	-1.4	6.8	0.19	0.11
3	33.0	54.5	-3.2	5.2	0.32	0.04
5	33.7	54.5	-4.0	4.6	0.39	0.03
10	34.9	54.4	-5.2	3.8	0.51	0.03
25	36.0	54.3	-6.3	3.3	0.68	0.02
50	36.7	54.2	-7.0	3.2	0.83	0.02
75	36.8	54.2	-7.2	3.2	0.93	0.02
100	36.8	54.1	-7.3	3.2	1.00	0.01
150	36.7	54.1	-7.1	3.2	1.11	0.01
200	36.6	54.0	-7.1	3.1	1.20	0.01
300	36.0	53.9	-6.6	3.1	1.36	0.01
400	36.0	53.9	-6.8	3.1	1.48	0.01
500	35.9	53.8	-6.9	3.1	1.58	0.01
750	35.5	53.7	-6.6	3.0	1.79	0.01
1000	35.2	53.6	-6.1	3.1	1.99	0.01
1250	35.1	53.5	-6.0	3.2	2.16	0.01
1500	34.9	53.4	-5.7	3.2	2.30	0.01
1750	35.2	53.3	-5.6	3.2	2.40	0.01
2000	35.2	53.3	-5.6	3.2	2.49	0.00
2250	35.4	53.2	-5.7	3.2	2.56	0.00
2500	35.7	53.2	-5.7	3.3	2.63	0.00
3000	35.2	53.1	-5.4	3.3	2.73	0.00
3500	35.0	53.1	-5.2	3.2	2.82	0.00
4000	34.7	53.1	-5.0	3.3	2.89	0.00
4500	34.5	53.0	-4.9	3.2	2.96	0.00
5000	33.9	53.0	-4.5	3.2	3.02	0.00
5500	33.7	53.0	-4.3	3.2	3.08	0.00
6000	33.6	52.9	-4.2	3.2	3.13	0.00

Remarks:

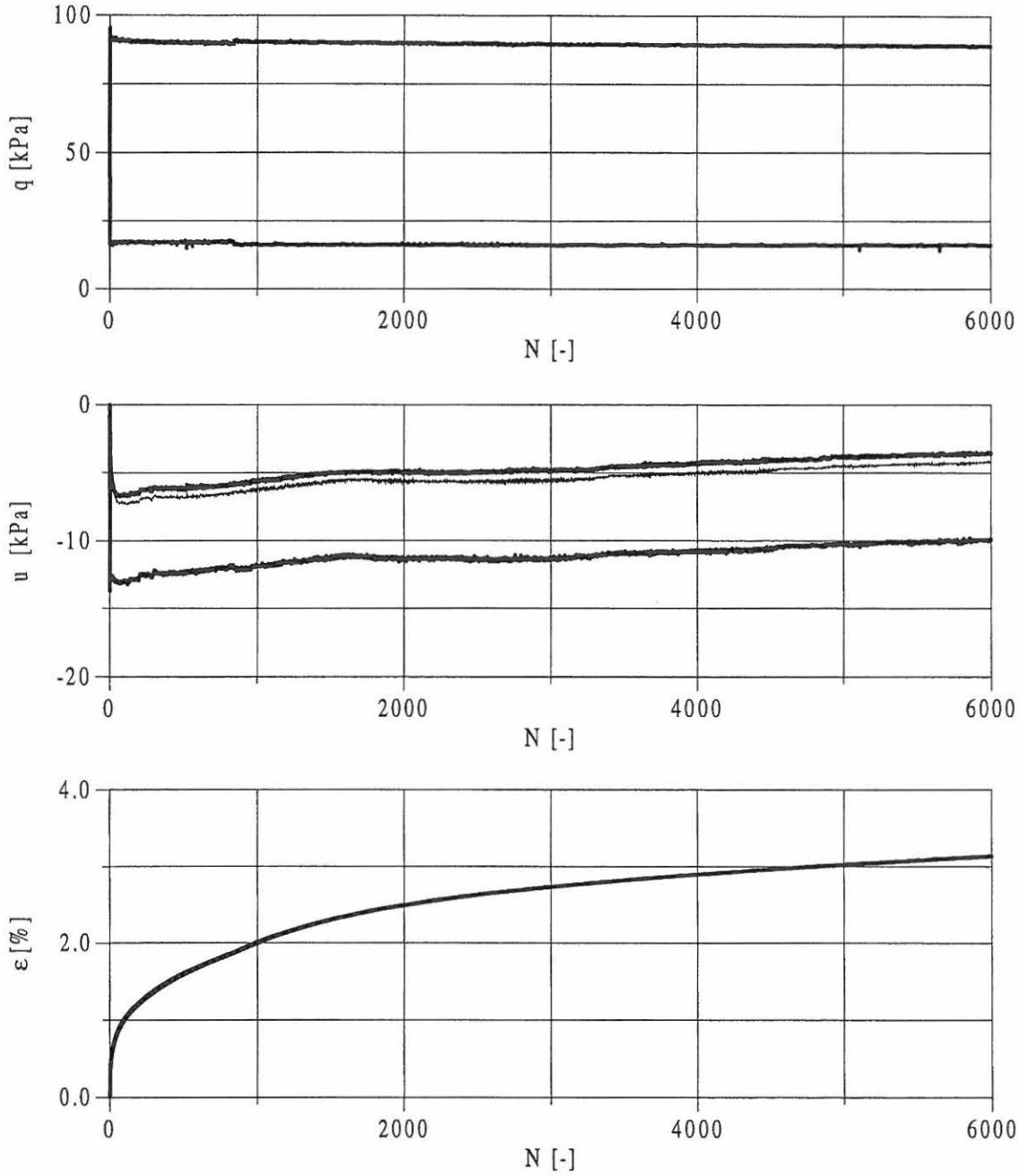
Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 16
Evaluated: KPJ	Approved: KPJ

CCU Triaxial Test No. 9802.18



Remarks

Job: Ph.D. Project	Aalborg University
Executed: KPJ	Enclosure No. 16
Evaluated: KPJ	Approved: KPJ



Remarks

Job:	Aalborg University
Executed: KPJ Evaluated: KPJ	Enclosure No. 16 Approved: KPJ