LONG-TERM CONSOLIDATION TESTS ON CLAYS FROM THE CHEK LAP KOK FORMATION

GEO REPORT No. 72

D.O.K. Lo & J. Premchitt

GEOTECHNICAL ENGINEERING OFFICE
CIVIL ENGINEERING DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

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PREFACE

In keeping with our policy of releasing information which may be of general interest to the geotechnical profession and the public, we make available selected internal reports in a series of publications termed the GEO Report series. A charge is made to cover the cost of printing.

The Geotechnical Engineering Office also publishes guidance documents as GEO Publications. These publications and the GEO Reports may be obtained from the Government's Information Services Department. Information on how to purchase these documents is given on the last page of this report.

R.K.S. Chan
Principal Government Geotechnical Engineer
September 1998

FOREWORD

This report presents a documentation of a literature review on secondary compression, as well as the results and analysis of a series of long-term consolidation tests on firm to stiff clay samples obtained from the new airport site at Chek Lap Kok. The Airport Authority (AA) provided the samples and requested the consolidation tests to be conducted on them.

The work was carried out as a project under the GEO R&D Theme on Marine Geotechnology. Dr K.S. Ho planned and started the testing programme. The tests were carried out by the staff of the Public Works Central Laboratory (PWCL), under the general supervision of Mr P.W.K. Chung. On completion of the long-term tests, Dr D.O.K. Lo summarised and analysed the test results and conducted a literature review on related previous work. Dr J. Premchitt provided guidance throughout the project.

Dr A. Pickles and Mr C. Covil of the AA made useful technical suggestions during the testing programme. This report was reviewed by them as well as Mr P.W.K. Chung of the PWCL. All contributions are gratefully acknowledged.

P.L.R. Pang
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ABSTRACT

The settlement of a saturated clay layer consists of two main stages : primary consolidation settlement during which dissipation of pore water pressure occurs in the clay resulting in an increase in effective stress, and secondary compression under practically constant pore water pressure and effective stress over the long-term.

In Hong Kong, there are very few data on the compressibility characteristics of the firm to stiff clays from the Chek Lap Kok Formation, in particular the secondary compression characteristics. For this reason, the Airport Authority (AA) has requested the Geotechnical Engineering Office (GEO) to conduct two studies on the clay samples obtained from boreholes at the new airport site at Chek Lap Kok. The samples were taken at approximate elevations of -15 mPD to -29 mPD. The work has been carried out as a project under the GEO R&D Theme on Marine Geotechnology. The first study involved determination of the primary consolidation properties of the clays under constant rate of strain testing using a hydraulic consolidation cell. The results of that study are given in GEO Report No. 55.

The second study, as presented in this report, investigates the secondary compression behaviour of the clays experimentally using the oedometer. In this study, clay specimens were subjected to sustained effective vertical stresses at levels similar to those encountered in the field over various durations up to eighteen months. The tests carried out constitute some of the longest duration oedometer tests in Hong Kong and elsewhere. For comparison, the secondary compression parameters are commonly estimated from conventional oedometer tests over a 24-hour duration only. The tests in this study were designed to provide information on the variation of rate of secondary compression with time. This report presents a literature review on the previous studies on secondary compression, including factors affecting the secondary compression index and its determination, as well as the results of the tests carried out in this project.

The value of C_α/C_c for the clay samples tested is found to be about 0.044. This C_α/C_c value together with the e-log σ_v' curves from conventional oedometer tests may be used to estimate the secondary compression of firm to stiff clays from the Chek Lap Kok Formation at different levels of sustained effective vertical stress. The results also show that under the test conditions used in this study, the secondary compression index, C_α, decreases significantly with time in the initial period but the rate of decrease becomes smaller as the test continues. Due to this general decline with time, the C_α values estimated from data taken within the conventional 24-hour oedometer test duration are found to be typically considerably greater than the values derived from data taken over a period of testing of several months.

CONTENTS

1. INTRODUCTION

Major reclamation works have been undertaken in Hong Kong over the years to cope with its growth and development. The weight of the reclamation fill material imposes stresses in the soil strata under the seabed and these induce settlements. The seabed in Hong Kong generally comprises a very soft marine mud of the Hang Hau Formation underlain by firm to stiff clays or dense sands of the Chek Lap Kok Formation. Residual soil and weathered rock lie beneath these offshore deposits. The marine mud, which can generate large settlements under the applied load, is generally either preconsolidated with the use of vertical drains or dredged to reduce post-construction settlement. Although the underlying firm to stiff clays are rarely treated due to practical difficulties and the costs involved, the settlements in these materials often form a significant contribution to the long-term settlement of reclamations in Hong Kong regardless of whether the marine mud is treated insitu or dredged.

The settlement of a saturated clay layer comprises two main stages : primary consolidation during which dissipation of pore water pressure occurs in the clay resulting in an increase in effective stress, and secondary compression under practically constant pore water pressure and effective stress over the long-term. There are very few data on the compressibility characteristics of the clays of Hong Kong with regard to the strain rate effect on the determination of preconsolidation pressure and the long-term settlement performance. Limited long-term testing on firm to stiff clays has been carried out by the Airport Authority (AA). These tests have covered a period of up to 3 months. No longer period testing was conducted primarily due to the limitations of undertaking such tests in commercial laboratories. For this reason, the AA requested the Geotechnical Engineering Office (GEO) to conduct two studies on firm to stiff clay samples obtained from boreholes at the new airport site at Chek Lap Kok. The samples were taken at approximate elevations of -15 mPD to -29 mPD. The first study, reported by Premchitt et al (1996), describes the use of constant rate of strain tests to determine preconsolidation pressures and other compressibility parameters which are relevant to the primary consolidation settlement analysis.

The second study, reported in this document, investigates the secondary compression behaviour of the firm to stiff clays experimentally using the oedometer. In this study, the specimens were subjected to sustained effective vertical stresses at levels similar to those encountered in the field over various durations up to eighteen months. The tests carried out constitute some of the longest duration oedometer tests in Hong Kong and elsewhere. For comparison, the secondary compression parameters are commonly estimated from conventional oedometer tests over a 24-hour duration only. The tests in this study were designed to provide information on the variation of rate of secondary compression with time. This report presents a literature review on studies of secondary compression conducted by other investigators, including factors affecting the secondary compression index and its determination, as well as the results of the tests carried out under this project.

2. REVIEW OF PREVIOUS WORK

2.1 Primary and Secondary Consolidation

When a total vertical stress is applied to a saturated clay or silt layer, the pore water pressure in the soil increases. This increment of pore water pressure is generally referred to as the excess pore water pressure. With time, the excess pore water pressure will dissipate leading to an increase in effective stress. The period during which the excess pore water pressure dissipates (i.e. effective stress increases) resulting in settlement is known as the primary consolidation stage. The period that follows primary consolidation in which effective stress is constant but compression continues is known as the secondary compression stage. The end-of-primary (EOP) consolidation can be defined in terms of excess pore water pressure measurements or by means of graphical methods applied to the settlement data, such as Casagrande's method (Casagrande & Fadum, 1944) or Taylor's method (Taylor, 1948). The separation of the consolidation process into primary and secondary stages on the basis of the above interpretations of test results is not very well defined on the experimental settlement versus time plot but the procedure is useful for practical settlement calculations.

Different terms and symbols can be found in the literature for describing the controlling parameters of secondary compression of a soil. In this report, the following terms and symbols will be adopted throughout. The secondary compression index, C_α, defines the slope of the void ratio (e) versus log time (t) curve of a soil specimen in the secondary compression range of a loading test, under a given sustained effective vertical stress, as shown in Figure 1 :

$$C_\alpha = \frac{\Delta e}{\Delta \log t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

The coefficient of secondary compression, $C_{\alpha\epsilon}$, is defined as :

$$C_{\alpha\epsilon} = \frac{\Delta e}{1 + e_o} \frac{1}{\Delta \log t} = \frac{C_\alpha}{1 + e_o} \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

where e_o is the initial void ratio, often used to represent the natural, insitu value. If $C_{\alpha\epsilon}$ is to be used, account should be taken of the possible effects of sample disturbance, variation with depth and preloading on e_o values, as well as the loading stress levels with respect to the preconsolidation pressure as this can result in different C_α values as discussed in Section 2.2.4.

For a constant C_α between the time required to complete primary consolidation, t_p and any time t beyond primary consolidation, the secondary compression, s, of a soil element or a soil layer having uniform properties is given by :

$$s = \frac{C_\alpha}{1 + e_o} H_o \log\frac{t}{t_p} = C_{\alpha\epsilon} H_o \log\frac{t}{t_p} \quad \ldots\ldots\ldots\ldots \quad (3)$$

where H_o is the initial thickness of the soil element or layer which has an initial void ratio e_o. The void ratio at the end-of-primary consolidation is denoted as e_p in this report.

The magnitude of secondary compression depends on both the magnitude of $C_{\alpha\epsilon}$ as well as the ratio of t/t_p.

It is useful to define here the other common term, the compression index, C_c, which is closely related to C_α as described in Section 2 :

$$C_c = \frac{\Delta e}{\Delta \log \sigma_v'} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

where σ_v' is the effective vertical stress.

The compression ratio, CR, is defined as :

$$CR = \frac{\Delta e}{1 + e_o} \frac{1}{\Delta \log \sigma_v'} = \frac{C_c}{1 + e_o} \quad \ldots\ldots\ldots\ldots\ldots \quad (5)$$

where C_c and CR are commonly taken to be the values at EOP conditions.

Secondary compression is generally believed to be a continuation of the mechanisms of soil structure changes initiated during the primary consolidation stage. The mechanisms responsible for changes in the secondary compression stage, although not known completely in detail, are commonly accepted to be similar to those for primary consolidation (Walker, 1969; Ladd, 1971; Mesri, 1973, Mitchell, 1993). These include deformation of individual or groups of particles (e.g. compression of domains or packets in clays, expulsion of water from micro-fabric elements and rearrangement of adsorbed water molecules) and relative movements of individual particles with respect to each other (i.e. changes in average spacings due to net positive or negative normal stresses or due to shear displacements at particle contacts caused by shear stresses exceeding shear resistance bonds) (Mesri, 1973; Mitchell, 1993). A small excess pore water pressure may also exist (Walker, 1969; Mitchell, 1993).

The rate of secondary compression is believed to be largely controlled by the rate at which the soil structure can deform, while the rate of primary consolidation is principally controlled by water seepage rate and hence depends on how rapid water can escape from the pores (Mitchell, 1993). Analytical theories have been developed for the prediction of secondary compression effects. These theories commonly treated the processes of soil structure changes in primary and secondary stages as occurring in parallel. Some of the adopted processes involve a fluid flow mechanism coupled with a visco-elastic effective stress-strain relationship (Gibson & Lo, 1961; Schiffman et al, 1964; Barden, 1969).

The following Sections provide a review of the various factors that can affect the rate of secondary compression as derived from previous experimental studies. Sections 2.2.1 to 2.2.3 describe the effects due to mainly the intrinsic properties of the soil while the subsequent sections deal with the effects observed from tests under various experimental conditions.

2.2 Previous Experimental Studies on Secondary Compression

2.2.1 Index Properties

A number of correlations between C_α and index properties of soils have been established. Walker (1969) and Yasuhara et al (1983) reported data which showed that C_α increased with the liquidity index. Wahls (1962) and Kapp et al (1966) correlated C_α with void ratio for different soils. Mesri (1973) compiled the C_α data for different natural soil deposits and showed that $C_{\alpha\epsilon}$ increased with the natural moisture content of the soil, as shown in Figure 2.

2.2.2 Compression Index

It was found that soils with a large compressibility (i.e. a large compression index, C_c, see Section 2.1) also had a large secondary compression index, C_α (Walker, 1969; Ladd, 1971; Mesri, 1973). Walker (1969) suggested that highly sensitive clays with a high compressibility would exhibit relatively high rates of secondary compression. Ladd (1971) reported that for soils with the same compression ratio (i.e. CR, see Section 2.1), those falling below the A-line on Casagrande's plasticity chart (i.e. organic soils) generally have a larger coefficient of secondary compression, $C_{\alpha\epsilon}$.

Mesri & Godlewski (1977) showed that C_α was related to the compression/recompression index. They used the same symbol C_c to represent both the compression index and the recompression index. The same designation is also adopted in this report. It was found that the value of C_α obtained from the 'linear slope' of the e-log t curve beyond the transition from primary to secondary compression at any consolidation pressure is uniquely related to the value of C_c obtained from the slope of the e-log σ_v' curve corresponding to the end of primary consolidation at the same consolidation pressure. Mesri & Castro (1987) proposed a graphical procedure, shown in Figure 3, for determining the relationship between C_α and C_c. The C_α and C_c data pairs should be plotted on a C_α versus C_c diagram. The slope of the best-fit line through the origin defines the C_α/C_c ratio of the soil. It has been found that for each soil a constant value of C_α/C_c holds at all combinations of consolidation pressure (i.e. both the recompression and compression ranges) and time (Mesri et al, 1994) and this value is unaffected by the magnitude of the load increment ratio (Mesri & Godlewski, 1979; Mesri & Choi, 1980).

Table 1 summarises the C_α/C_c values for a large number of natural soil deposits from different parts of the world. Table 2 shows the general range of C_α/C_c values for different types of soils and soft rocks. It can be seen that for the wide variety of materials covered, the C_α/C_c values are in a relatively narrow range of 0.01 to 0.07, with an average of 0.04, which is the value commonly found for inorganic clays and silts.

2.2.3 Pore Fluid

It was previously postulated that secondary compression of soils was due to the structural viscosity of adsorbed water films (Terzaghi, 1941; Barden, 1968). Leonards & Girault (1961) conducted a series of oedometer tests on the Mexico City clay with the pore water replaced by carbon tetrachloride. They noted that the secondary compression developed was of the same order of magnitude as when the pore fluid was water. Leonards & Altschaeffl (1964) conducted some one-dimensional consolidation oedometer tests on freeze-dried (dehydrated) clay specimens to eliminate time lag effects due to consolidation. They noted that the compression in response to the applied load occurred essentially simultaneously with load application, followed by secondary compression.

Figure 4 shows the oedometer test results obtained by Mesri (1973) for different clay minerals in various pore fluids. The symbol e_p in Figure 4 denotes the void ratio at the end-of-primary consolidation under each load increment. It is apparent that even in inert fluids such as carbon tetrachloride and benzene, clays undergo secondary compression. Figure 4 also indicates that mineralogical and physio-chemical environment have important influences on the secondary compression index. Based on his test results, Mesri (1973) concluded that even if adsorbed water did influence and contribute to the rate of secondary compression, its presence was not necessary in order for secondary compression to occur.

2.2.4 Consolidation Pressure

A number of researchers had reported that the secondary compression index was independent of consolidation pressure (Haefeli & Schaad, 1948; Newland & Allely, 1960; Horn & Lambe, 1964; Berry & Poskitt, 1972). However, Wahls (1962) presented contrary C_α data for a calcareous organic silt. For this soil under vertical stresses in excess of the preconsolidation pressure, C_α decreased with vertical stress. Adams (1965) reported that $C_\alpha/(1+e_p)$ of a muskeg increased with consolidation pressure. Walker (1969) presented C_α data for three sensitive clays obtained from laboratory tests and from back-analysis of field settlement records. Walker's data suggested that C_α increased with effective stress and reached a peak value at the stress level beyond the preconsolidation pressure. Ladd & Preston (1965) reported that for one soil C_α increased slightly with consolidation pressure while for another soil C_α decreased substantially with consolidation pressure.

Based on laboratory test results, Ladd (1971), Mesri (1973) and Mesri & Godlewski (1977) showed that for overconsolidated soils, C_α was small in the range of stresses less than the preconsolidation pressure, it increased with recompression stress and reached a maximum at a stress level of 1.5 to 2 times the preconsolidation pressure. For normally consolidated clays with no previous sustained loading, C_α continuously decreased or remained constant with consolidation pressure.

The apparent increase or decrease of C_α with effective stress reported by different investigators was probably due to the limited stress range used in their test series, which was not broad enough to fully encompass both the recompression and compression behaviour.

2.2.5 Time

Based on laboratory and field measurements, most early investigators considered that the secondary compression was essentially a linear function of logarithm of time (e.g. Buisman, 1936; Adam, 1965; Bjerrum, 1964; Haefeli & Schaad, 1948). However, on the basis of laboratory tests on undisturbed and remoulded soils, Lo (1961) reported that C_α decreased with time. Bjerrum (1967), using the evidence obtained from a detailed analysis of field and laboratory settlement results of a Norwegian soft clay, concluded that the plot of settlement versus logarithm of time did not fall on a straight line but levelled off.

More recent work suggests that C_α is not necessarily constant with time (Mesri & Choi, 1980; Mesri & Godlewski, 1979, Mesri & Castro, 1987). Mesri & Choi (1980) performed one-dimensional consolidation tests on two natural clays. The soil specimens were back-pressured saturated, and pore water pressure measurements were made at the bottom of the specimens. In this investigation, the end-of-primary consolidation could be defined in terms of observed dissipation of pore water pressure as well as graphical solutions based on settlement data. The specimens were allowed to undergo varying amounts of secondary compression up to 375 days. The compression-log time curves at various consolidating pressures are shown in Figure 5. It can be seen that C_α can increase, decrease or remain constant with time depending on the level of sustained effective stress applied to the specimen. The increase in C_α with time at effective stresses close to the preconsolidation pressure was also observed in the oedometer test results by other investigators (e.g. Leonards & Altschaeffl, 1964; Akai et al, 1991).

In general, soft clays can exhibit a preconsolidation pressure because of a high immediate past pressure or a sustained secondary compression. Therefore, the e-log σ_v' curves for soft clays are generally nonlinear and the corresponding e-log t curves are also expected to be nonlinear in the secondary compression range. Mesri & Godlewski (1977) developed an approach to estimate secondary compression settlement with time at various effective stresses, using the C_α/C_c ratio and the EOP e-log σ_v' curve. The procedure, illustrated in Figure 6, involves constructing the e-log σ_v' curves corresponding to different times, say $10t_p$, on the basis of the EOP e-log σ_v' curve. This is done by estimating C_c from the gradient of the EOP e-log σ_v' curve at a number of selected points, and computing C_α at these points from the known values of C_α/C_c ratio and C_c. These C_α values, assumed to be constant between t_p and $10t_p$, are used to compute the void ratio changes in the period up to $10t_p$. The computed void ratios are then employed to construct another e-log σ_v' curve, which corresponds to a sustained loading time of $10t_p$. Using this curve (at $10t_p$), e-log σ_v' curves for subsequent times can be obtained in the same manner. The relationships between C_α and time at various effective vertical stresses can then be determined from a series of such curves. This procedure has been applied to estimate the variation of C_α with time for undisturbed laboratory soil specimens (Mesri & Godlewski, 1977) and for a diluvial clay layer in Osaka Bay (Mesri & Shahien, 1993).

2.2.6 Load Increment Ratio

Ohmaki (1978) and Murakami (1979) reported that C_α was dependent on load increment ratio. Ohmaki suggested that C_α increased to a peak and then decreased gradually with an increase in load increment ratio. However, Leonards & Altschaeffl (1964), Mesri & Godlewski (1977), Yasuhara et al (1993) and Katagiri (1993) showed that C_α was independent of load increment.

According to Mesri & Godlewski (1977), the apparent dependency of C_α with load increment ratio can be explained by the different final effective vertical stresses, σ_{vf}', due to the different load increments used. The difference in applied stress between tests resulted in different C_α values observed. Furthermore, experimental problems and interpretation difficulties can arise when a small load increment ratio is used. With a small load increment ratio, the changes in volume and excess pore water pressure under constant effective stress become significant, while similar changes due to the increase in effective stress become relatively small. Therefore, under this condition, it is difficult to separate the 'primary' and 'secondary' compression stages in the test data and C_α cannot be determined reliably.

2.2.7 Precompression

It is well recognised that precompression can reduce the subsequent secondary compression and large reduction can be obtained if a sufficient degree of overconsolidation is achieved (Schiffman et al, 1964; Johnson, 1970; Ladd, 1971; Mesri, 1973). The variation of C_α with level of applied stress relative to the preconsolidation pressure is discussed earlier in Section 2.2.4.

Surcharging is a precompression technique which has been used to improve the ground and substantially reduce post-construction settlements. Based on an extensive testing programme on a variety of natural soft clay deposits, Mesri and his co-workers showed that the amount of reduction in C_α is dependent on the effective surcharge ratio which, in turn, depends on the surcharging period and drainage conditions. Mesri & Feng (1991) and Mesri et al (1994) developed an approach to estimate post-surcharge secondary compression. This procedure has been used successfully in the estimation of the post-surcharge settlements of a sensitive clay in Sweden (Mesri et al, 1994).

2.2.8 Remoulding

Remoulding of a soil can change the soil structure. Ladd (1971) and Mesri (1973) reported that generally remoulding would reduce C_α. Larger secondary compression would occur in an undisturbed sample than in a remoulded sample when both are subjected to the same effective vertical stress. When a remoulded specimen is loaded, C_α will increase as effective stress increases, and finally at a certain stress level (determined by the composition of the soil and remoulding water content) C_α will reach a maximum and merge with the values in the virgin compression range.

Although the C_α and C_c values determined from remoulded and undisturbed samples at the same effective stress are different, Mesri & Godlewski (1977) and Katagiri (1993) showed that the values of the C_α/C_c ratio for remoulded and undisturbed samples are practically the same.

2.2.9 Shear Stress

Secondary compression was initially believed to be caused by the existence of shear stresses in soil. De Jong & Verruijt (1965) performed consolidation tests on spherical soil samples in an attempt to eliminate external shear stresses, but they still measured considerable secondary compression. Mesri & Choi (1980) and Mesri & Castro (1987) performed isotropic compression tests on undisturbed natural soils using a triaxial cell and observed primary consolidation followed by secondary compression. These test results indicated that secondary compression was not an effect caused by shear stresses in soil.

Although derivation of the parameter C_α is based on a one-dimensional compression test set-up, occasionally the C_α values are used to calculate settlement of the ground in two-dimensional and three-dimensional stress conditions. Taylor (1942) postulated that larger secondary compression would occur in one-dimensional compression than that in three-dimensional compression where the shear distortion of soil structure was less. Yasuhara et al (1983) reported that C_α values determined from one-dimensional compression tests were larger than those from isotropic compression tests.

Since natural clays were formed under a one-dimensional deposition and compression condition, they are expected to exhibit more resistance to one-dimensional compression than isotropic compression. Figure 7a shows the EOP e-log σ_v' curves for the one-dimensional and isotropic loading of a natural clay reported by Mesri & Choi (1985). According to the C_α/C_c concept, at a given consolidation pressure, C_α may have different values for isotropic and one-dimensional compression because of the differences in C_c. However, Mesri & Choi (1984) and Mesri & Castro (1987) showed that when the corresponding pairs of C_α and C_c from one-dimensional and isotropic compression tests were plotted, the value of C_α/C_c was constant irrespective of the types of test as shown in Figure 7b.

2.2.10 Sample Thickness

Berry & Poskitt (1972) conducted one-dimensional consolidation tests using the Rowe consolidation cell on remoulded fibrous peat and amorphous granular peat specimens of a thickness ranging from 18 mm to 64 mm. Their tests results indicated that C_α was the same for specimens of different thickness under the same applied pressure.

Aboshi (1991, 1995) performed one-dimensional consolidation tests on remoulded marine clay specimens with a thickness varying from 2 cm to 100 cm. Aboshi applied a single pressure increment from 20 kPa to 80 kPa to all specimens. The same final effective stress was used. Figure 8 shows the compressive strain-log time curves for the specimens tested. The estimated coefficients of secondary compression immediately after the end-of-primary consolidation for these specimens were practically the same despite very different times required to complete primary consolidation, from about 27 min to 58100 min (about 40 days) for the thinnest and thickest specimens respectively. The results of this series of tests suggest that C_α measured at EOP is independent of the thickness of the specimens.

2.3 Field Observations

Walker (1969), after carrying out a review of the field settlement records of embankments constructed on Canadian sensitive clays and the relevant laboratory oedometer test results, concluded that C_α values obtained from field measurements and laboratory tests were roughly in agreement. Walker further suggested that C_α values obtained from oedometer tests could be applied to predict the field settlements provided that the applied laboratory pressures closely reflected the stresses actually existed in the field.

Crawford & Sutherland (1971) reported sixty-five years of foundation settlement measurements carried out at the Empress Hotel in Victoria, British Columbia in Canada. The hotel was founded on soft clays. By comparing the field measurements and laboratory oedometer test results, they concluded that the observed rates of secondary settlement in the field correlated well with the laboratory C_α values. Leonards (1973) and Mesri & Godlewski (1977) reinterpreted the settlement data of the Empress Hotel and showed that the observed C_α values decreased with time.

A number of settlement observations at Osaka Bay showed that large secondary compression was occurring in the thick diluvial layers when the reclamation load produced final effective vertical stresses, σ_{vf}', in the soil close to the preconsolidation pressure, σ_p'. Mesri (1991) reinterpreted Kiyama's (1991) long-term field settlement measurements in a reclamation over diluvial clay in Osaka Bay. They showed that the values of C_α increase with time and the values were large where the insitu effective vertical stress was nearly the same as the preconsolidation pressure.

2.4 Past Data on Coefficient of Secondary Compression for Clays at Chek Lap Kok

During the study on the test embankment at Chek Lap Kok in the early 1980s, a comprehensive laboratory testing programme of the clays at the site was undertaken using standard 24-hour incremental loading procedures (RMP ENCON, 1982; Koutsoftas et al, 1987). Figure 2 summarises the $C_{\alpha\epsilon}$ data in the compression range of firm to stiff clays from the Chek Lap Kok Formation (referred to as the lower alluvium by RMP ENCON and Koutsoftas et al) generated from that testing programme and shows that the $C_{\alpha\epsilon}$ data are in the range of 0.001 to 0.04.

The $C_{\alpha\epsilon}$ data and the e-log σ_v' curve of a clay specimen in that testing programme are replotted as a part of this study in Figure 9. It can be seen that $C_{\alpha\epsilon}$ is small in the recompression range and reaches a peak at an effective stress of about $2\sigma_p'$. Thereafter it decreases with the consolidation pressure. Figure 9 also shows that the variation of $C_{\alpha\epsilon}$ with consolidation pressure is very similar to that for $C_c/1+e_o$ (i.e. CR).

3. LONG-TERM CONSOLIDATION TESTS

3.1 Geology of the Site and Ground Investigation

The seabed at the new airport at Chek Lap Kok consists of soft clay (marine mud) layer mostly belonging to the Hang Hau Formation with small localised areas pertaining to the Sham Wat Formation. These are underlain by firm to stiff clays and dense sands of the Chek Lap Kok Formation.

The oldest offshore Quaternary sediments in Hong Kong are those of the Chek Lap Kok Formation, which occurs in virtually all of Hong Kong's seabed and overlies bedrock in various states of decomposition. The formation includes a range of lithologies from gravel, coarse to fine sand, to silts and clays, and varies in colour from dark grey to bright reds and yellows. Sediment types vary extensively both laterally and vertically. A number of erosion surfaces and channel systems were identified within the formation (Fyfe & Shaw, in press; Langford et al, 1995; Newman et al, 1995). The formation is considered to have been deposited in a variety of sedimentary environments. Although most of the sediments are considered to be terrestrial, small amounts of intertidal and estuarine sediments may also present in the formation (Fyfe & Shaw, in press).

Six 100 mm diameter piston samples of firm to stiff clays from Chek Lap Kok Formation were obtained from boreholes at the new airport site. Boreholes 519B08, 520ME211 and 520ME214 were located west of Lam Chau while boreholes 532B25 and

532B32 were located along the southern runway. These boreholes were drilled by IP Foundations Ltd, under the supervision of the Airport Authority, and were sunk after completion of dredging of the overlying marine mud and placement of the fill. The depths at which the samples were obtained are given in Table 3. Copies of logs for the boreholes are given in Appendix A.

3.2 Characteristics of Samples and Specimens

The clays are firm to stiff, light to dark grey silty clay with occasional organic inclusions. The sample from borehole 520ME211 contains relatively rare clayey silty medium to coarse sand pockets. A range of classification and index tests were carried out, including determination of particle size distribution, Atterberg limits, natural moisture content and specific gravity (particle density). The results obtained from these tests are summarised in Table 3. The clays have a clay content varying from 24% to 51%, a silt content of 49% to 73% and a sand content of 0 to 3%. The clays have a liquid limit of 39% to 68%, plastic limit of 18% to 33%, natural moisture content of 21% to 56% and a bulk density of 1.67 Mg/m^3 to 2.06 Mg/m^3.

3.3 Testing Programme

Six small load increment, one-dimensional consolidation tests were carried out by the staff at the PWCL using conventional oedometers. One test specimen was taken from each piston sampling tube. A section of about 100 mm long was first cut off from the tube. The tube section was then placed onto an extruder. The soil sample was gradually pushed out of the tube section and directly into an oedometer ring. The excess soil was trimmed off. The oedometer specimen was prepared from the piston sample following the procedures in BS 1377:1990:Part 1 (BSI, 1990). The oedometer rings used in the tests were 100 mm in diameter and 19 mm high.

The general loading sequence for each specimen was 15, 30, 45, 60, 75, 90, 105, 120, 135, 150, 200 and 400 kPa. For the specimen from 519B08, the final pressure was 450 kPa instead of 400 kPa. The final pressure in the range of 400 to 450 kPa represents the insitu effective vertical stress of the specimens after the completion of the airport platform. For the specimen from borehole 532B25, it was unloaded from 400 kPa to 30 kPa in steps and reloaded to 800 kPa. Filter paper was used and drainage was allowed from both the top and bottom of the specimen. The testing procedures generally followed those given in BS 1377:1975 (BSI, 1975).

Except for the specimen from borehole 532B25, the final load (between 400 kPa and 450 kPa) for the other five specimens was maintained for various durations of up to 18 months. The test series is one of the longest duration for sustained load tests in Hong Kong and elsewhere. The long-term tests were designed to obtain soil parameters which represent more closely the actual long-term field situation than those from the conventional 24-hour duration tests.

3.4 Test Results

Taylor's method was used to determine the EOP void ratio and the coefficient of consolidation, c_v, at each load increment. The EOP e-log σ_v' curve and variation of c_v with effective vertical stress for each specimen are shown in Appendix B.

The relatively flat e-log σ_v' curves of the firm to stiff clays rendered the interpretation of preconsolidation pressure for each specimen rather difficult. Nevertheless, Casagrande's method was used to provide a rough estimate of the preconsolidation pressures. The clay specimens were found to be overconsolidated with an overconsolidation ratio of about 1.4 to 2.9.

The dial gauge readings for the settlements under the sustained pressure (400 to 450 kPa) for the long-term consolidation tests are summarised in Appendix C. The e-log t curves for the specimens under the final pressures are shown in Figure 10. It can be seen that the slope of the e-log t curves (C_α) during the secondary compression stage decreases with time although the rate of decrease tends to be less after a long time. Figure 11 shows the variation of C_α with time under the sustained loading for each specimen. The C_α value was estimated for each log cycle of the testing time, i.e. one value each for the periods t_p to $10t_p$, $10t_p$ to $100t_p$, etc. The C_α values range from 0.0024 to 0.025 for these specimens. As an indication of the variation of C_α with time, values of C_α were also estimated using the data obtained during the conventional, initial 24-hour duration for these specimens, and these were compared with the values estimated using test records over several months. The values obtained from the conventional 24-hour duration are typically 25% to 35 % greater than those determined from the long-term tests.

The $C_{\alpha\epsilon}$ data of the tested clay specimens in the virgin compression range are plotted in Figure 2. They fall within the range of values previously reported by RMP ENCON (1982) and Koutsoftas et al (1987). Mesri & Castro's method was followed to obtain C_c and C_α from the EOP e-log σ_v' curve and the e-log t curves respectively for the specimens as shown in Figure 12. Pairs of C_α and C_c obtained are plotted in Figure 13. This figure indicates that the value of C_α/C_c for the firm to stiff clays from the Chek Lap Kok Formation is about 0.044.

4. DISCUSSION AND CONCLUSIONS

A review of factors that affect the secondary compression index is presented. It is generally accepted that C_α is dependent on both the effective vertical stress and time. C_α is small in the recompression range, it increases with stress and reaches a maximum at a stress level of about 1.5 to 2 times the preconsolidation pressure. C_α generally varies with time depending on the magnitude of sustained effective vertical stress and shape of the EOP e-log σ_v' curve. The assumption of constant C_α with time in the estimation of secondary compression may be adequate for stresses in the virgin compression range and over a relatively short period after completion of primary consolidation.

The value of the C_α/C_c ratio for the clays from the Chek Lap Kok Formation is found to be about 0.044. This C_α/C_c value together with the EOP e-log σ_v' curve can be used to estimate secondary compression of the clays subjected to different sustained effective vertical stresses. In general, three to four pairs of C_α and C_c are sufficient for evaluating the C_α/C_c ratio for any one soil (Mesri & Castro, 1987). To facilitate the determination of C_α , the load increment must be large enough to produce an 'S-shaped' e-log t curve and one log cycle of secondary compression should be allowed for prior to the application of an additional load increment.

The long-term consolidation tests conducted in this study provide useful data on the secondary compression behaviour of the firm to stiff clays from the Chek Lap Kok Formation. The results show that for the clay specimens under the test conditions adopted, the secondary compression index, C_α, decreases significantly with time in the initial period but the rate of decrease becomes smaller as the test continues after this period. Due to this general decline with time, the C_α values estimated from data taken within the conventional 24-hour test duration were found to be typically considerably greater than the values derived from data taken over a period of testing of several months.

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Table 1 - Values of C_α/C_c for Some Natural Soil Deposits

Soil Grouping	Soil Type	C_α/C_c	Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)
Inorganic Clays and Silts	Atchafalaya clay	0.022	60 - 70	80	30
	Batiscan clay	0.03	71 - 88	49	22
	Berthierville clay	0.044	57 - 70	46	24
	Boston Blue clay	0.026	24 - 29	33	18
	Broadback clay	0.04	42 - 48	36	25
	Diluvial clay in Osaka Bay	0.035	60	96	40
	Ellingsrud marine silty clay	0.044	30 - 40	22 - 28	17 - 20
	Hayakita clay	0.03	-	-	-
	Hudson River silt	0.03 - 0.06	-	-	-
	Keelung River clay	0.037	46	56	23
	La Grande clay	0.055	55 - 59	62 - 64	26
	Leda clay	0.025 - 0.06	83 - 90	57 - 60	22 - 27
	Louiseville clay	0.03	64 - 71	65	28
	Brown Mexico City clay	0.046	313 - 340	361	91
	Nearshore clays and silts of Canso Strait	0.055 - 0.075	42 - 68	40 - 65	24 - 37
	New Liskeard varved clay	0.03 - 0.06	60 - 70	73	26
	Olga clay	0.033	85 - 94	67	29
	Ottawa clay	0.03	85 - 94	67	29
	Portland sensitive clay	0.025 - 0.055	-	-	-
	Saint Alban clay	0.25	58 - 64	43	21
	Saint Espirit clay	0.038	74 - 91	75	27
	Saint Hilaire clay	0.031	62 - 71	55	23
	San Francisco Bay mud	0.04 - 0.06	86 - 98	89	37
	Singapore marine clay	0.035	30 - 65	56 - 97	22 - 30
	Skå-Edeby varved clay	0.05	65 - 130	38 - 150	15 - 62
	Victoria clay	0.026	29 - 52	34 - 58	16 - 26
	Whangamarino clay	0.03 - 0.04	180 - 200	136	61
Organic Clays and Silts	Calcareous organic silt	0.035 - 0.06	100 - 135	132 - 138	75
	New Haven organic clayey silt	0.04 - 0.075	60 - 118	79 - 98	39 - 50
	Norfolk organic silt	0.05	-	-	-
	Organic clays and silts	0.05 - 0.07	-	-	-
	Postglacial organic clay	0.05 - 0.07	112 - 114	122	41
Peats	Amorphous and fibrous peat	0.035 - 0.083	240 - 1200	-	-
	Canadian muskeg	0.09 - 0.10	200 - 600	-	-
	Fibrous peat	0.06 - 0.085	613 - 866	-	-
	Peat	0.05 - 0.085	605 - 1290	-	-

Note : Data taken from Mesri & Godlewski (1977); Mesri & Choi (1984); Mesri & Castro (1987); Lo (1991); Mesri & Shahien (1992) and Feng (1993).

Table 2 - Values of C_α/C_c for Different Types of Soils and Soft Rocks

Material	C_α/C_c
Granular soils including rockfill	0.02 ± 0.01
Shale and mudstone	0.03 ± 0.01
Inorganic clays and silts	0.04 ± 0.01
Organic clays and silts	0.05 ± 0.01
Peat and muskeg	0.06 ± 0.01
Note : Data taken from Mesri et al (1994).	

Table 3 - Summary of Basic Soil Properties of the Samples Tested

Borehole Number	Sample Number	Material Description	Specimen Location		Particle Size Distribution			Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Specific Gravity	Initial Moisture Content (%)	Initial Void Ratio	Initial Degree of Saturation (%)	Bulk Density (Mg/m^3)
			Depth (m)	Reduced Level (mPD)	Sand (%)	Silt (%)	Clay (%)								
520ME211	4	Firm, dark grey SILT/CLAY	24.03 to 24.28	-15.39 to -15.64	3	73	24	33	68	35	2.68	35	0.942	99.9	1.86
532B32	6	Firm, dark grey silty CLAY	24.25 to 24.38	-18.04 to -18.17	2	55	43	20	39	19	2.66	55	1.457	99.9	1.67
520ME214	6	Firm, dark grey silty CLAY	26.75 to 26.88	-18.9 to -19.03	2	54	44	30	63	33	2.66	56	1.491	99.9	1.67
532B25	7	Firm, dark grey silty CLAY	25.26 to 25.32	-19.05 to -19.11	0	49	51	26	53	27	2.65	45	1.187	99.9	1.75
532B32	10	Firm, dark grey silty CLAY	28.25 to 28.38	-22.26 to -22.39	1	56	43	22	59	37	2.64	52	1.371	99.9	1.69
519B08	24	Firm, light grey CLAY	34.22 to 34.32	-26.55 to -26.65	-	-	-	18	40	22	2.67	21	0.565	96.8	2.06

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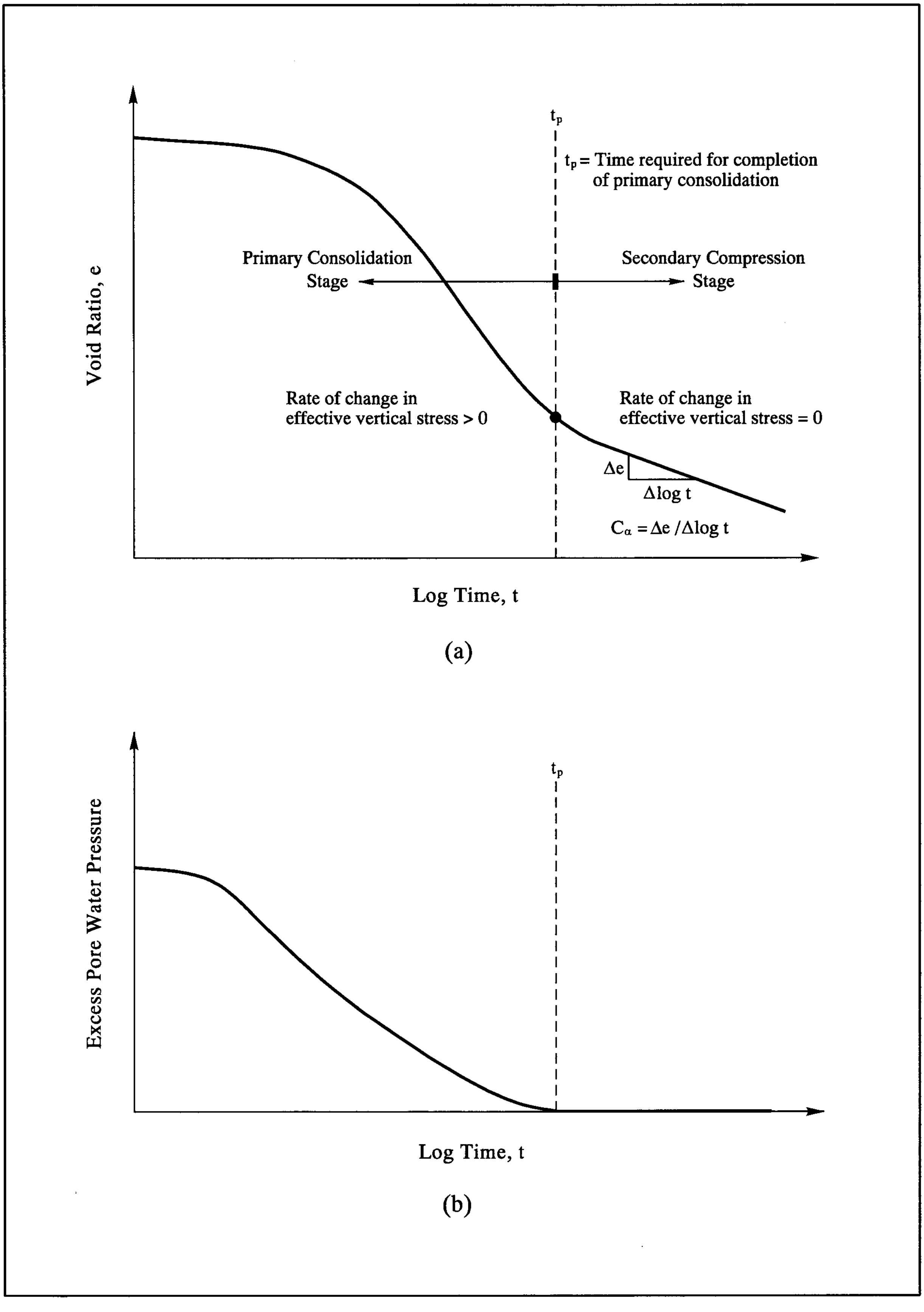
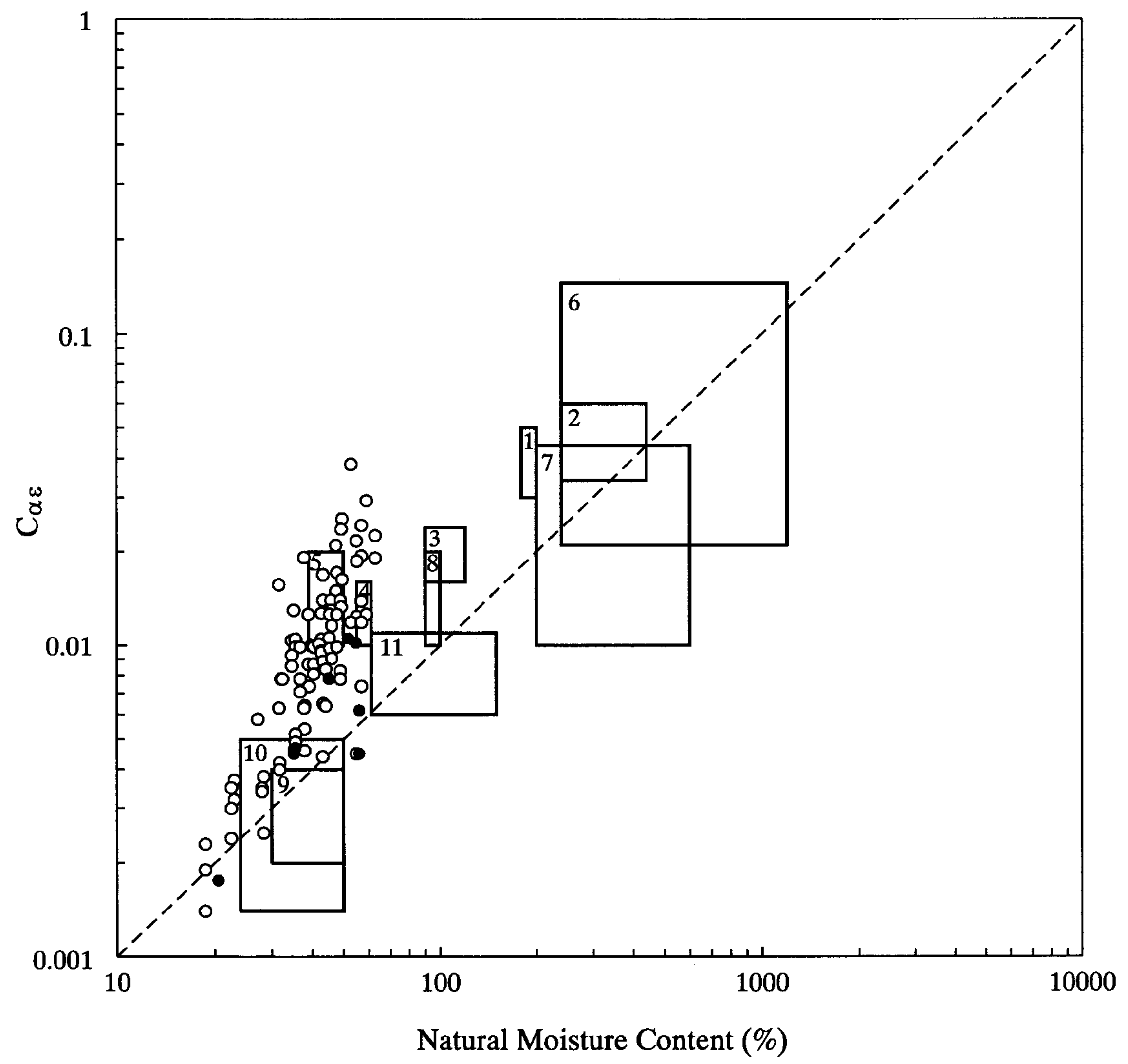


Figure 1 - Separation of Primary Consolidation and Secondary Compression Based on Variation of Void Ratio and Excess Pore Water Pressure with Logarithm of Time

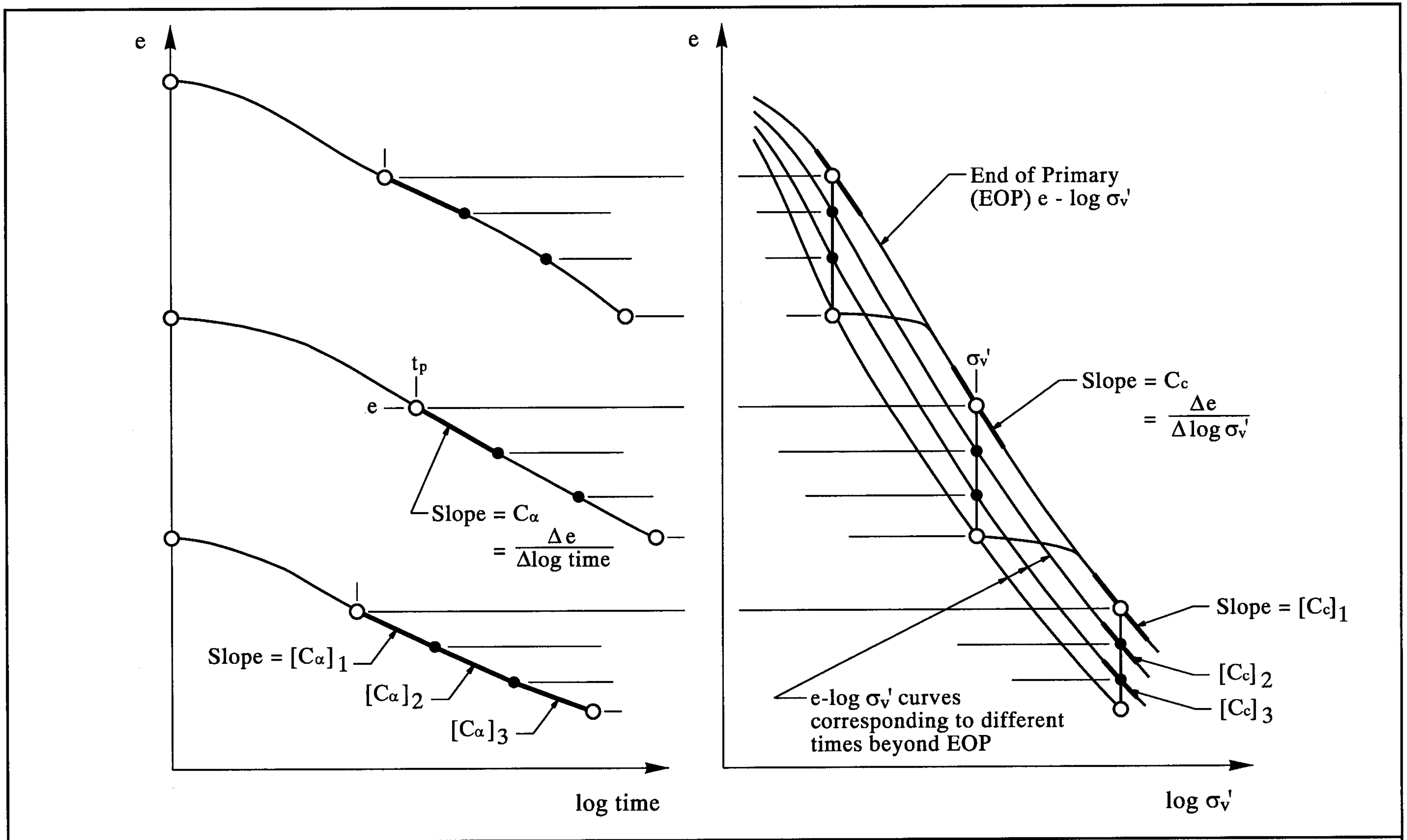


Legend :

1	Whangamarino Clay	8	Organic Marine Deposits
2	Mexico City Clay	9	Boston Blue Clay
3	Calcareous Organic Silt	10	Chicago Blue Clay
4	Leda Clay	11	Organic Silty Clay
5	Norwegian Plastic Clay	○	Alluvial Clay (RMP ENCON, 1982)
6	Amorphous and Fibrous Peat	●	Clays from Chek Lap Kok Formation obtained in this study
7	Canadian Muskeg		

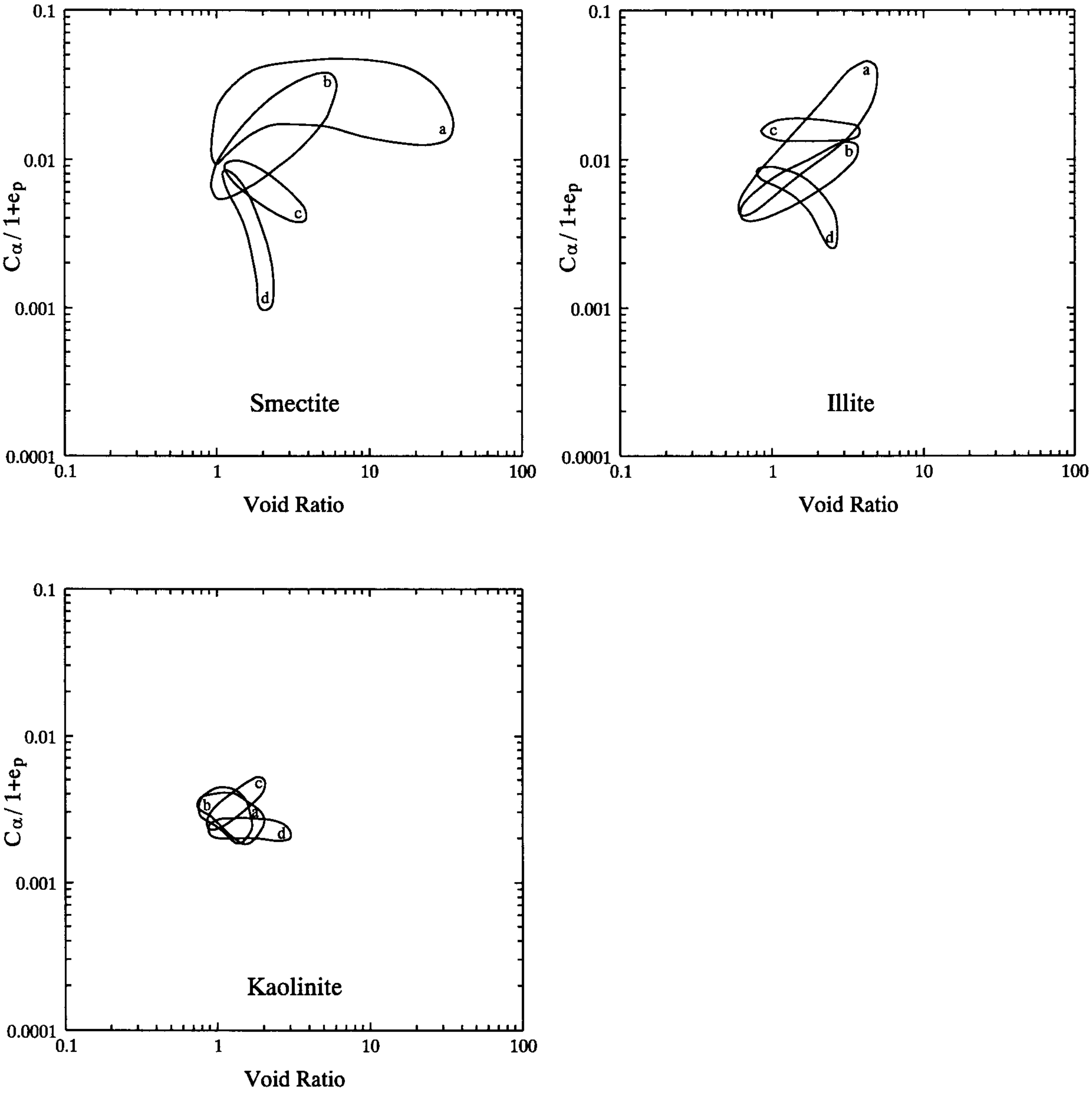
Note : Figure based on Mesri (1973), with Hong Kong data added.

Figure 2 - Coefficient of Secondary Compression for Some Natural Soil Deposits Including Results from This Study



Note : Figure based on Mesri & Castro (1987).

Figure 3 - Corresponding Values of C_α and C_c at Any Instant (e, σ_v', t) during Secondary Compression



Legend :

Pore fluid

ⓐ Water (Sodium Clay)

ⓑ Water (Calcium Clay)

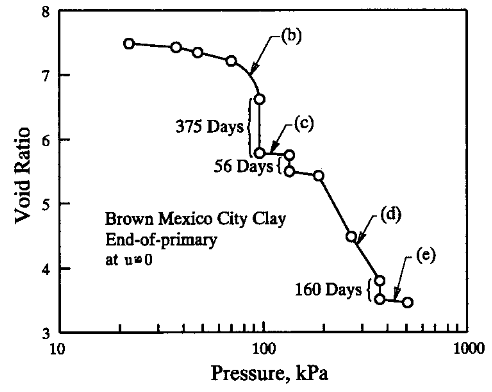
ⓒ Ethyl Alcohol and Methyl Alcohol

ⓓ Carbon Tetrachloride and Benzene

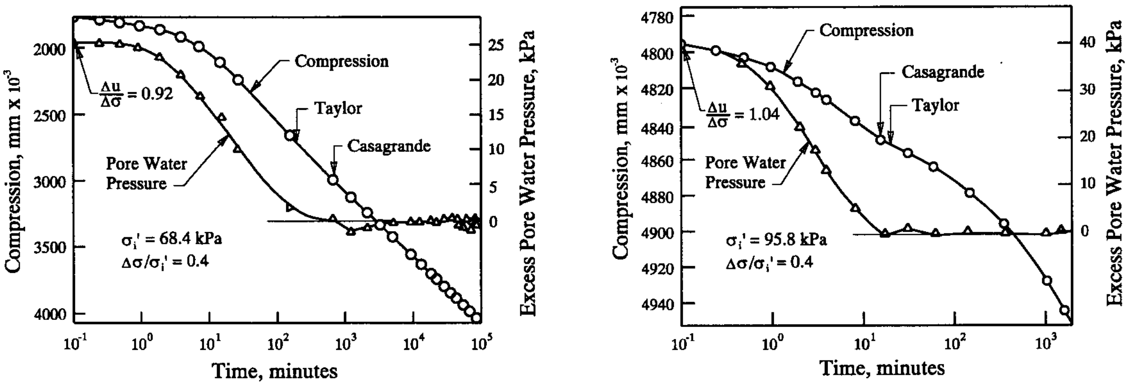
e_p Void ratio at end-of-primary consolidation

Note : Figure based on Mesri (1973).

Figure 4 - Coefficient of Secondary Compression of Different Clay Minerals in Various Pore Fluids

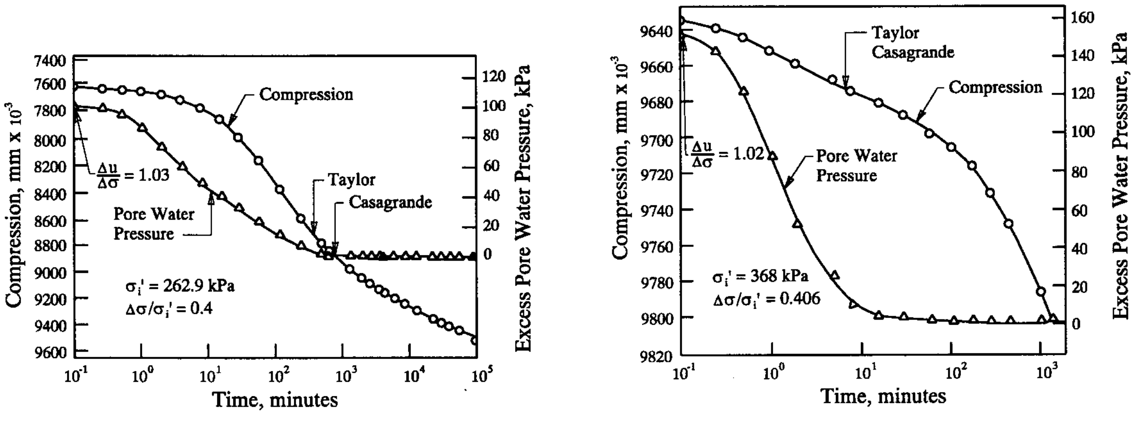


(a) Void Ratio - Consolidation Pressure History of Mexico City Clay Specimen



(b) A Pressure Increment near the Natural Critical Pressure

(c) A Pressure Increment on the Recompression Curve



(d) A Pressure Increment on the Compression Curve

(e) A Pressure Increment on the Recompression Cruve

Note : Figure based on Mesri & Choi (1980).

Figure 5 - Void Ratio - Effective Vertical Stress Relationship and Compression - Time Curves under Different Pressures for a Brown Mexico City Clay Specimen

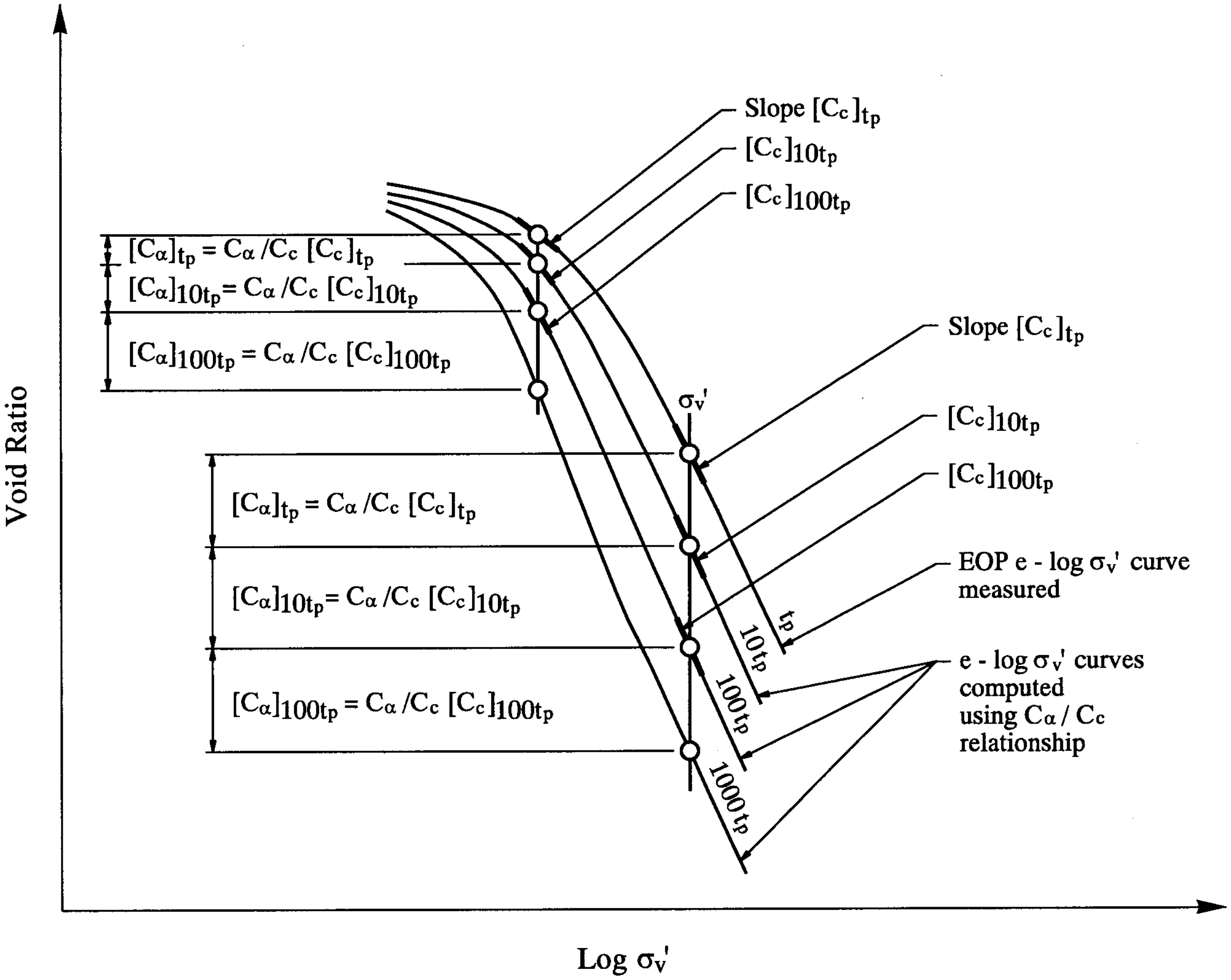
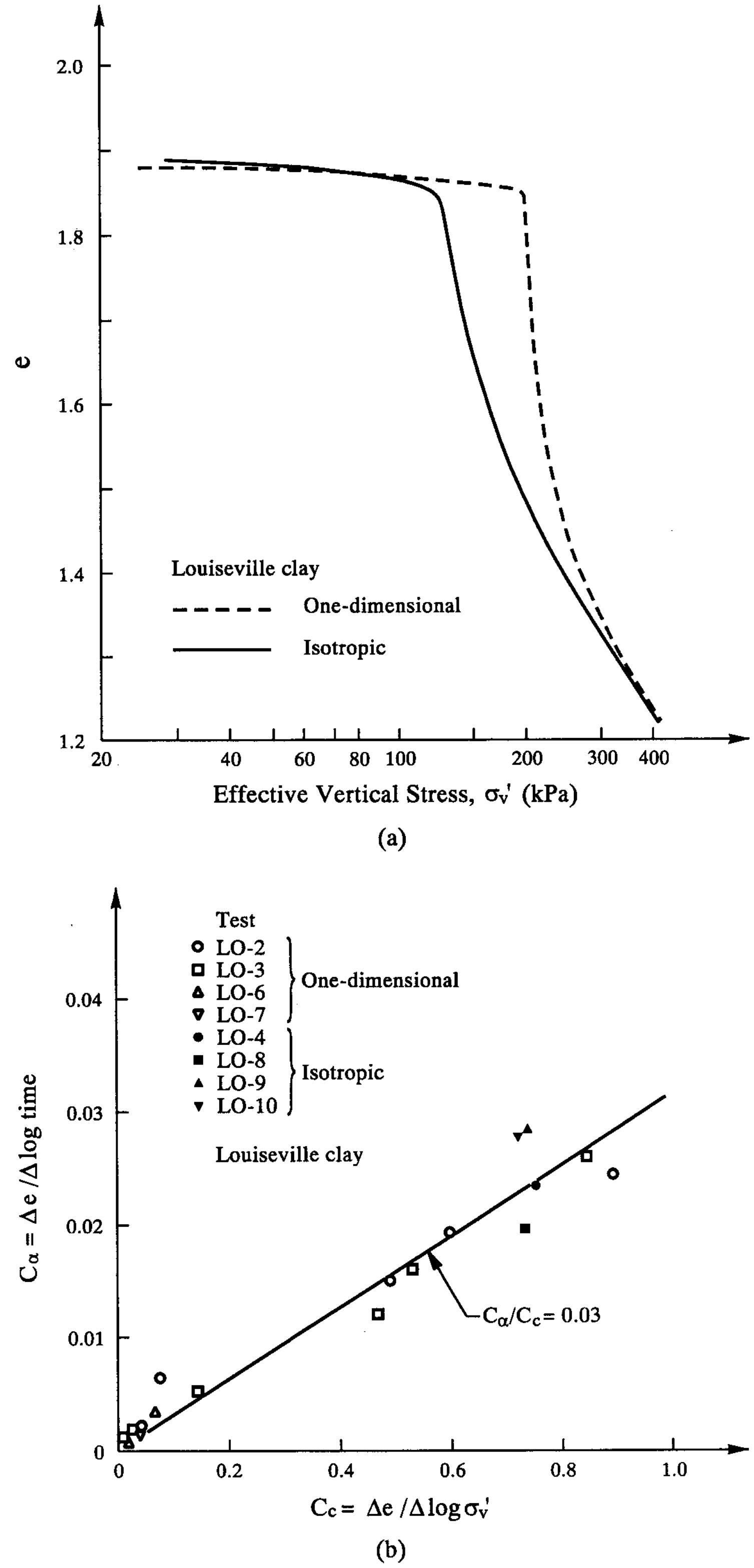
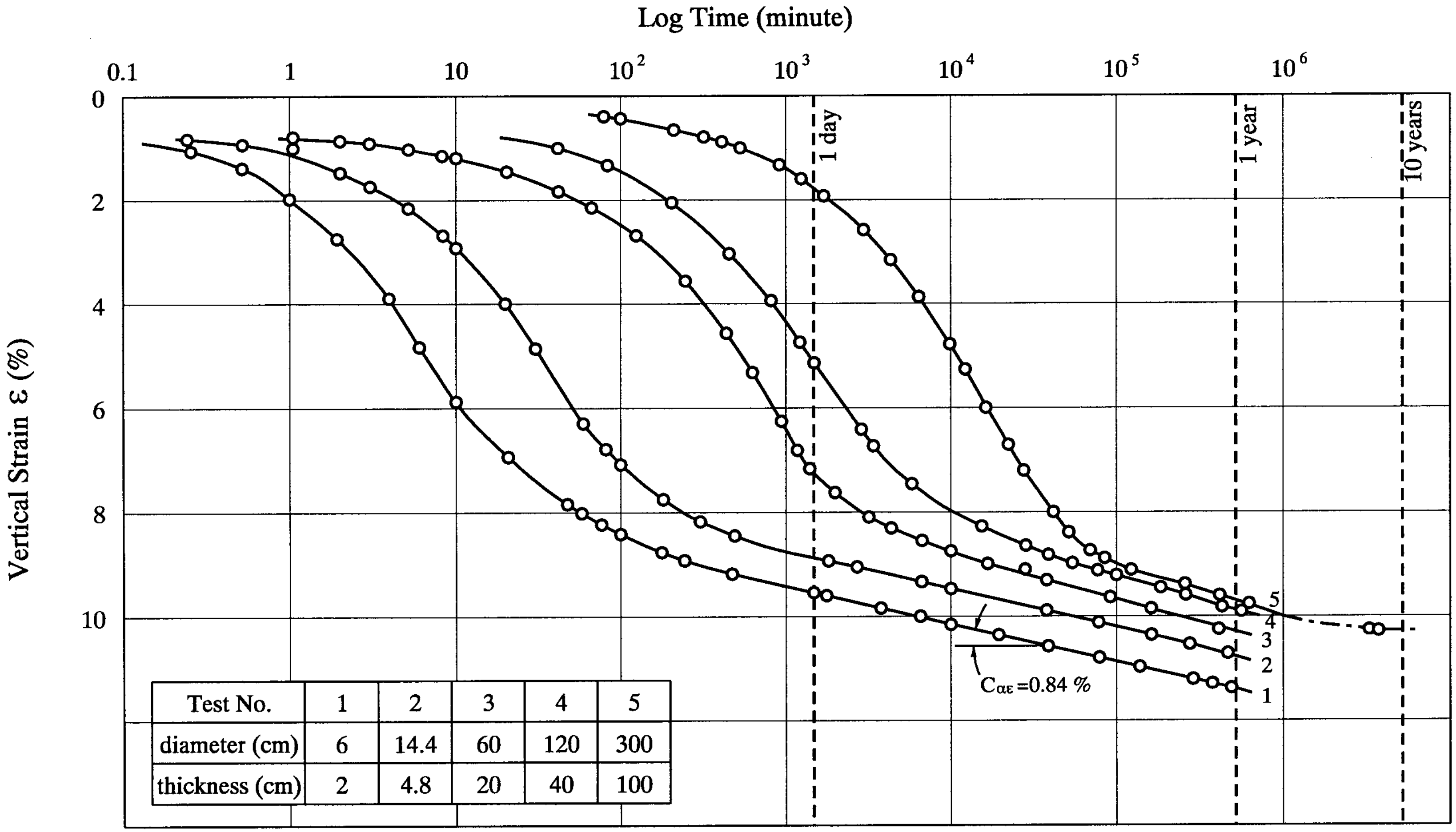


Figure 6 - Procedure Used to Compute the Relationships between C_α and Time at Various Effective Stresses



Note : Figure based on Mesri & Choi (1984, 1985).

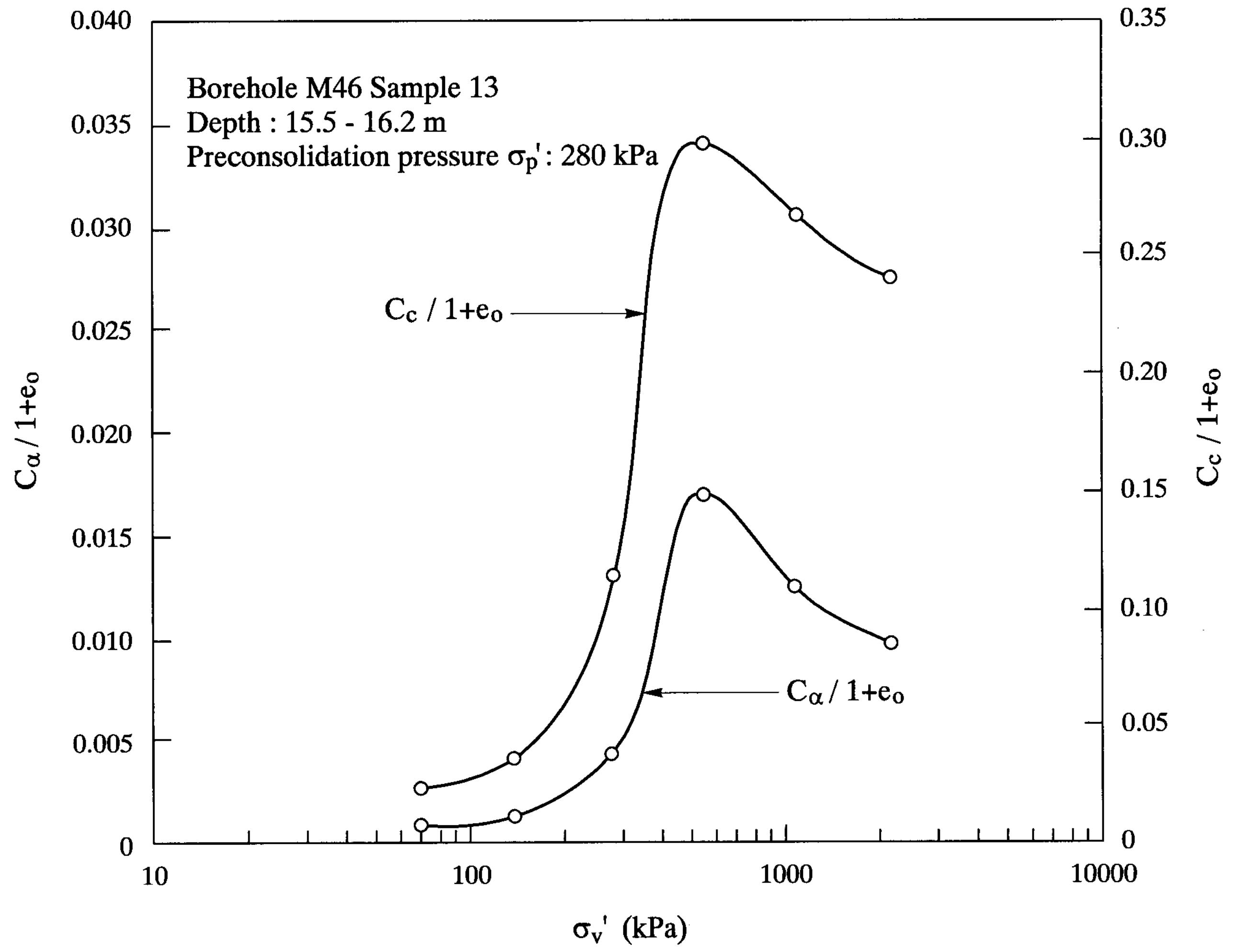
Figure 7 - Void Ratio - Effective Vertical Stress Relationships and C_α/C_c Data of a Natural Soft Clay Obtained from One-dimensional Compression Tests and Isotropic Compression Tests



Test No.	1	2	3	4	5
diameter (cm)	6	14.4	60	120	300
thickness (cm)	2	4.8	20	40	100

Note : Figure based on Aboshi (1995).

Figure 8 - Vertical Strain - Log Time Curves for Remoulded Clay Specimens of Varying Thicknesses (Diameter/Thickness Ratio of 3)



Note : Raw data obtained from RMP ENCON (1982).

Figure 9 - Relationship between C_α , C_c and Consolidation Pressure for a Firm to Stiff Clay Specimen

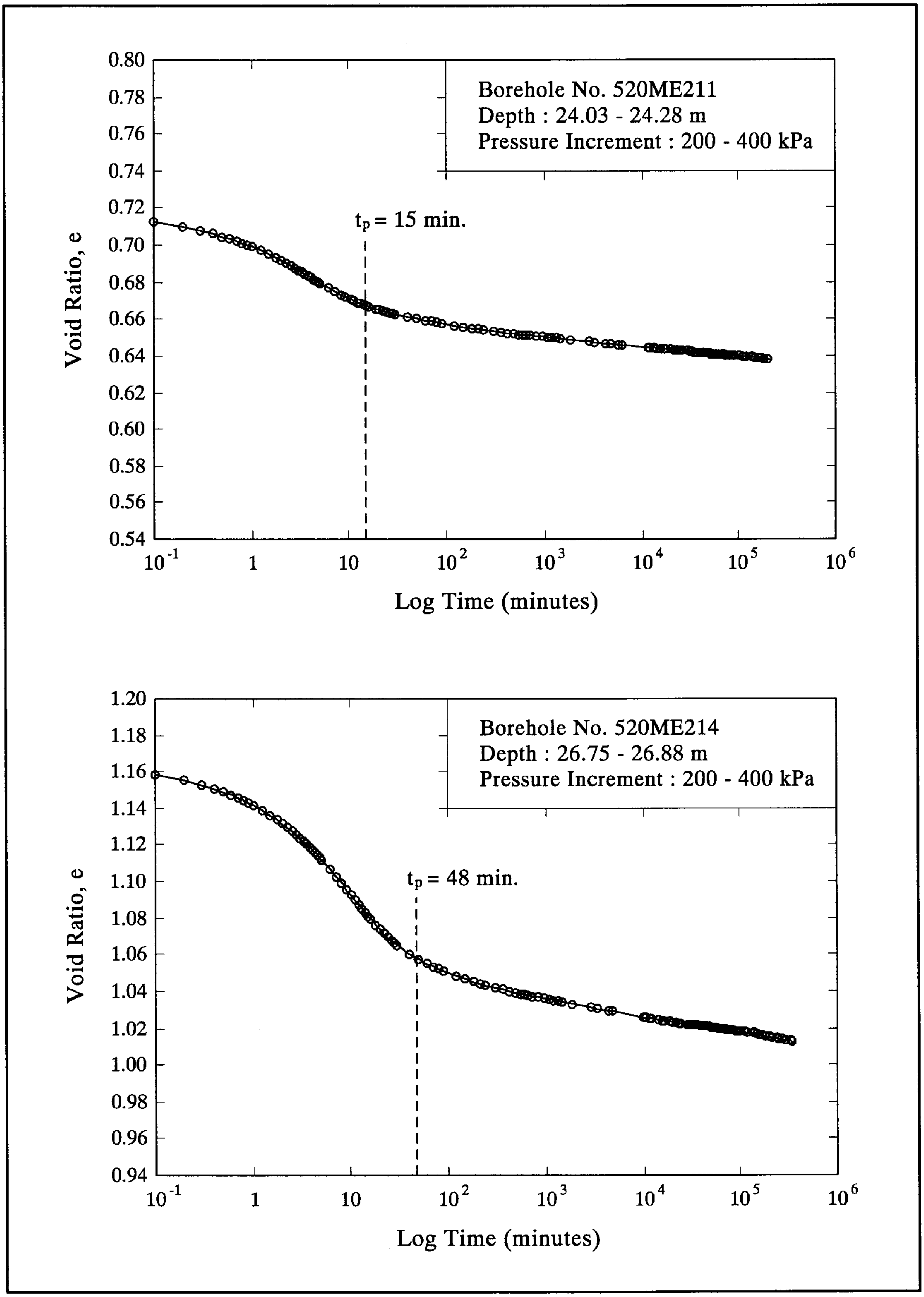


Figure 10 - Void Ratio - Time Curves for Specimens under Sustained Loading
(Sheet 1 of 3)

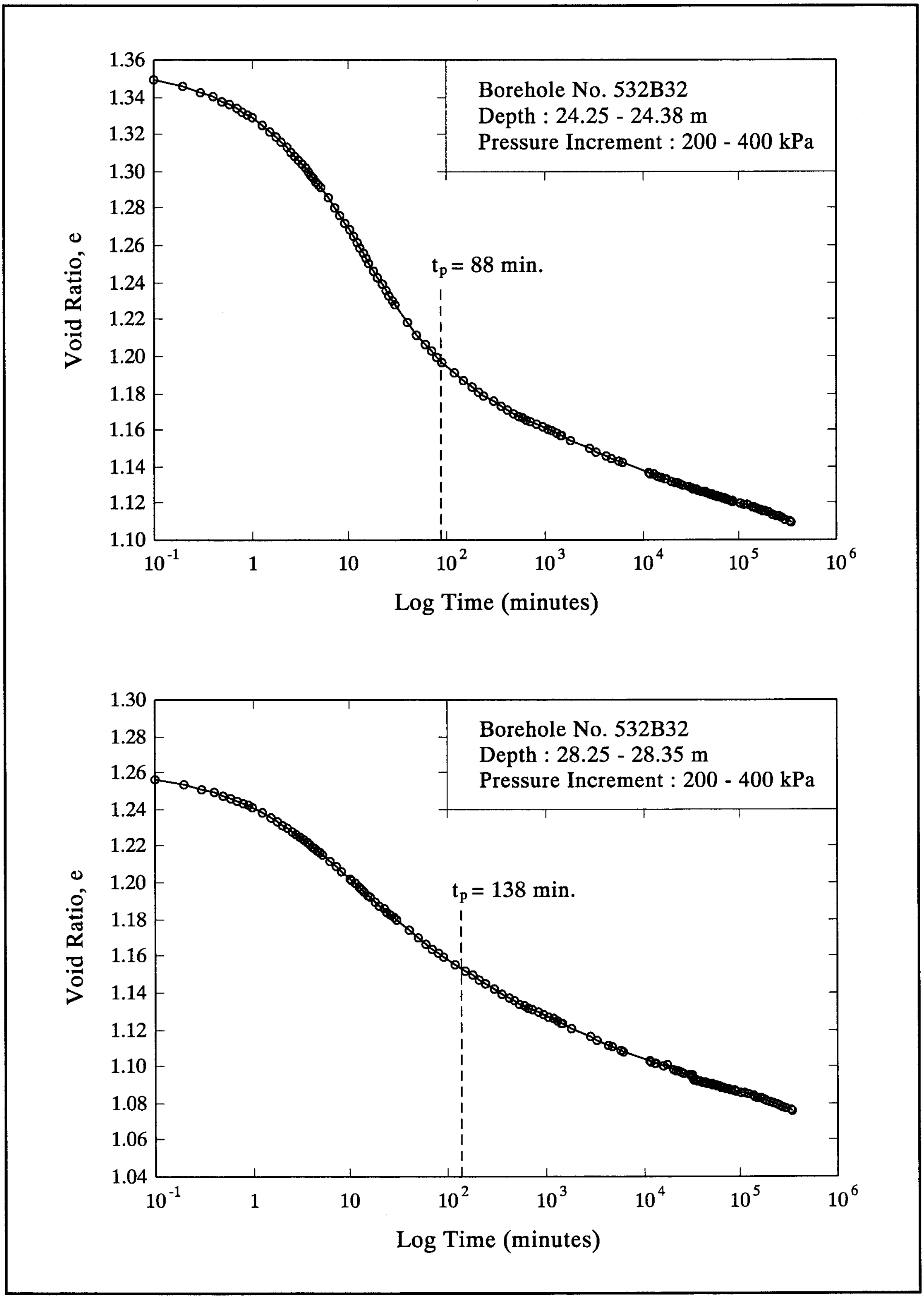


Figure 10 - Void Ratio - Time Curves for Specimens under Sustained Loading (Sheet 2 of 3)

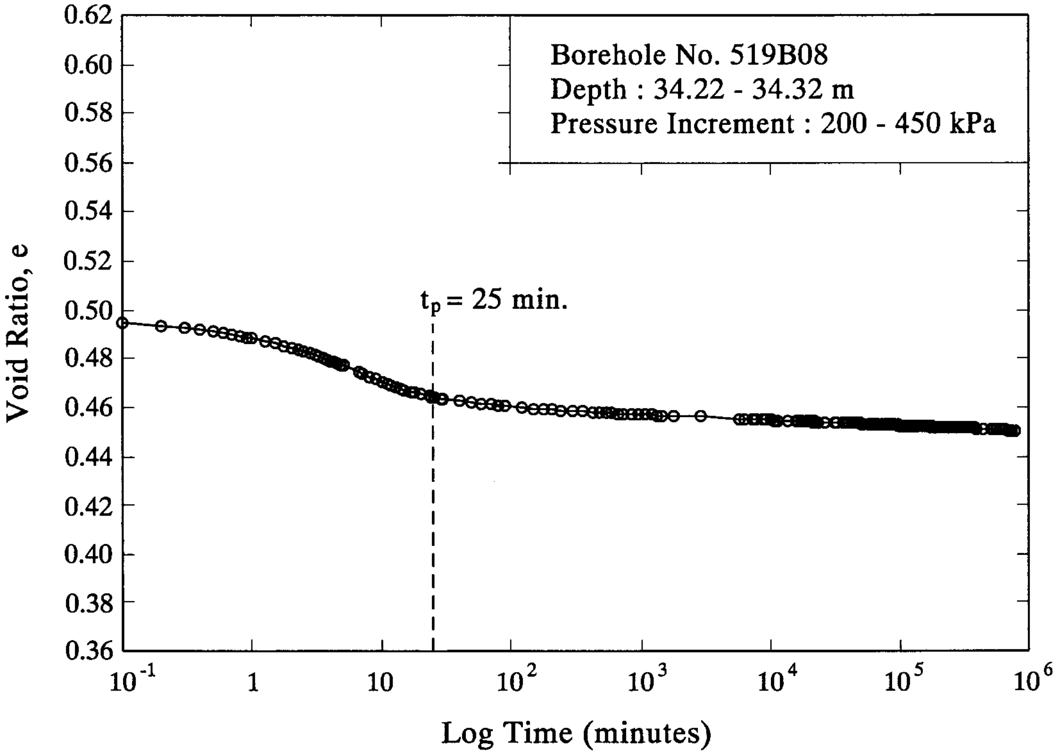


Figure 10 - Void Ratio - Time Curves for Specimens under Sustained Loading (Sheet 3 of 3)

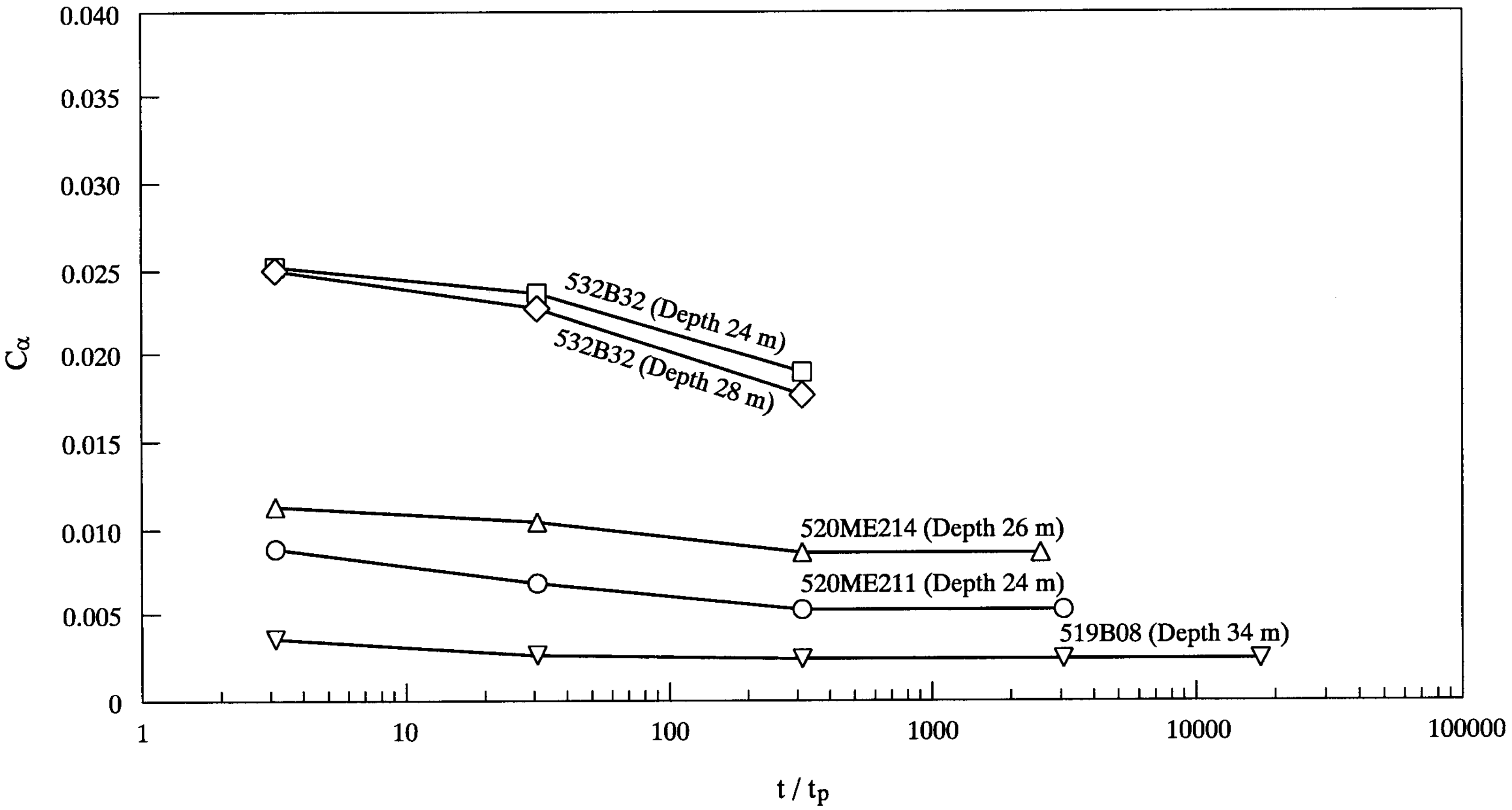


Figure 11 - Variation of C_α with Time during Secondary Compression

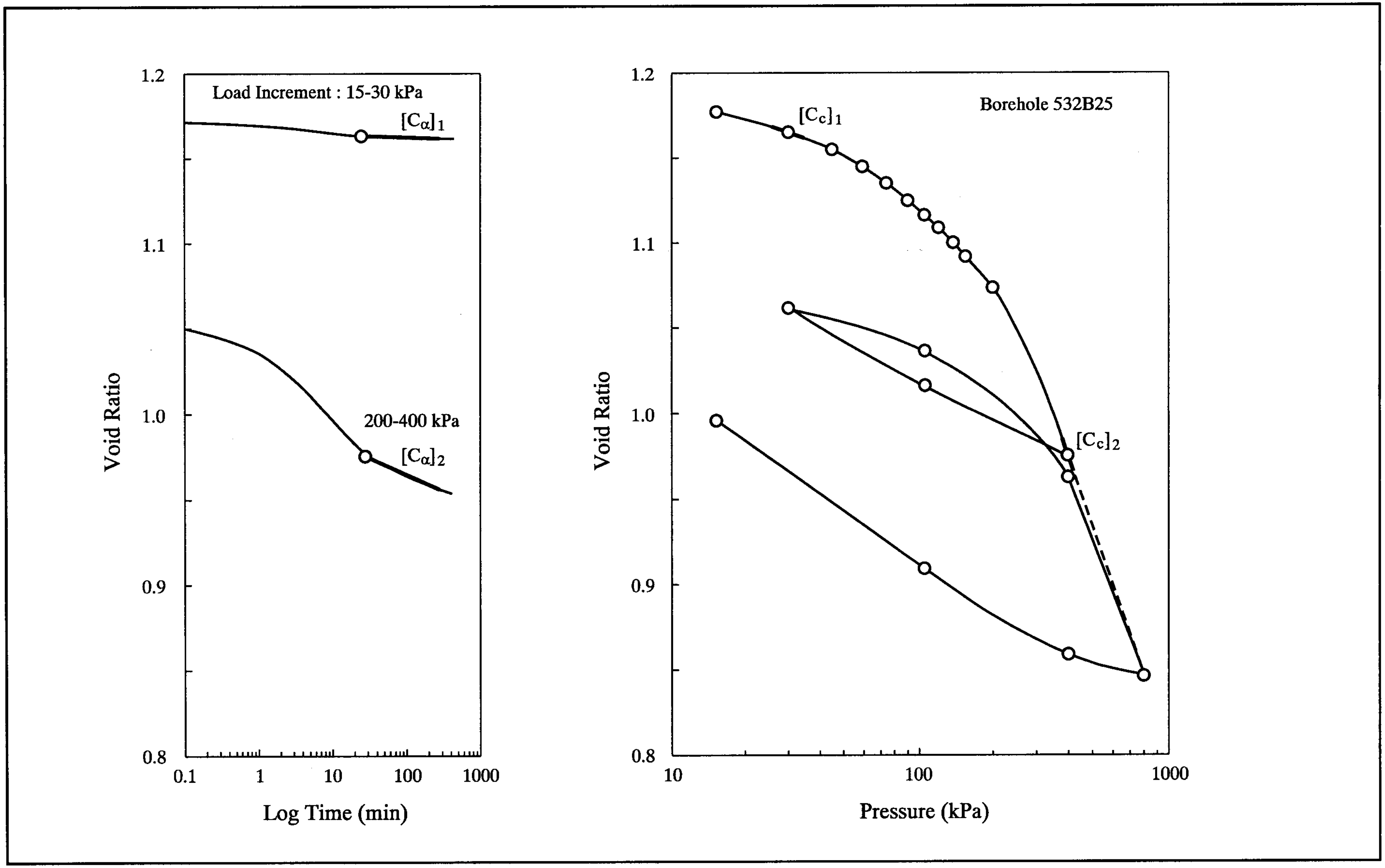
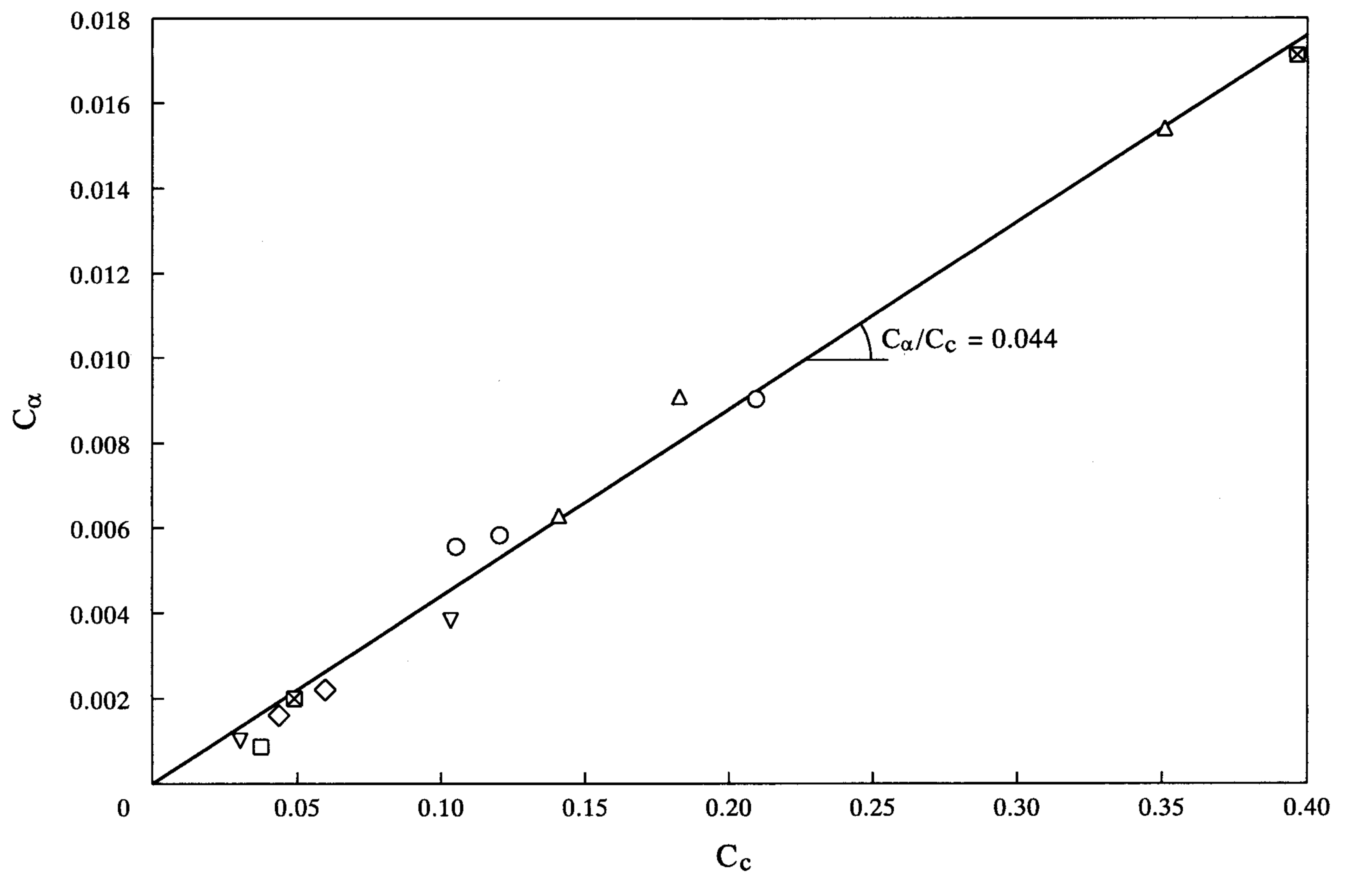


Figure 12 - Procedure Used to Obtain Corresponding Pairs of C_α and C_c from e-log t and EOP e-log σ_v' Curves



Notes : (1) C_α is the slope of the e-log t curve in the secondary compression stage between t_p and $10t_p$.

(2) C_c represents the slope of the EOP e-log σ_v' curve. The data points include C_c values in both the recompression and compression ranges.

Legend :

□	532B32 (Depth 24 m)	△	520ME214	▽	519B08	t_p	Time required to complete primary consolidation
◇	532B32 (Depth 28 m)	○	520ME211	⊠	532B25		

Figure 13 - Relationship between C_α and C_c for Firm to Stiff Clays

APPENDIX A

LOGS OF BOREHOLES

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

HOLE NO. 519B08

PEG REPORT SIR179

SHEET 1 of 5

METHOD

SPC WORKS AREA D3/3

PROJECT The New Hong Kong Airport

CO-ORDINATES
E 808174.15
N 817722.95

CONTRACTOR IP Foundations Ltd.

MACHINE & No. ACKER D90 /ACKER 20

DATE from 16/7/94 **to** 30/7/94

FLUSHING MEDIUM AIR / WATER

ORIENTATION Vertical

GROUND LEVEL 7.67 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
	PX											FILLA	Rock (FILL)
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	□	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
█	U100 UNDISTURBED SAMPLE	I	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YKY

DATE 01/08/94

CHECKED CBT

DATE 02/08/94

REMARKS

In situ vane shear tests at 31.00m (61.40kPa) 32.50m (78.39kPa), 34.00m (56.73kPa), 35.50m (61.40kPa), 37.00m (41.91kPa) and at 38.50m (75.54kPa)

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

	DRILLHOLE RECORD	**HOLE NO.** 519B08
	PEG REPORT SIR179	**SHEET** 2 of 5
	METHOD	**SPC WORKS AREA** D3/3
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 808174.15 N 817722.95	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. ACKER D90 /ACKER 20		**DATE from** 16/7/94 **to** 30/7/94
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 7.67 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
11 12 13 14 15 16 17 18 19									-11.33	19.00			
20			13					19.00 T2101				FILLA	Yellowish brown coarse angular GRAVEL and COBBLES of granite with a matrix of fine to medium sand (FILL)

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	▼ □	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	▽	
■	U100 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
▨	MAZIER SAMPLE	⌶	PERMEABILITY TEST
▤	PISTON SAMPLE	V	IN-SITU VANE SHEAR TEST

LOGGED YKY

DATE 01/08/94

CHECKED CBT

DATE 02/08/94

REMARKS

In situ vane shear tests at 31.00m (61.40kPa) 32.50m (78.39kPa), 34.00m (56.73kPa), 35.50m (61.40kPa), 37.00m (41.91kPa) and at 38.50m (75.54kPa)

Date Printed 16 September 1996

香港機場管理局 AIRPORT AUTHORITY HONG KONG	**DRILLHOLE RECORD**	**HOLE NO.** 519B08
	PEG REPORT SIR179	**SHEET** 3 of 5
	METHOD	**SPC WORKS AREA** D3/3
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 808174.15 N 817722.95	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. ACKER D90 /ACKER 20		**DATE from** 16/7/94 to 30/7/94
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 7.67 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
21									-13.33	21.00			
	HX						49	■ 1 21.00				QSWAMP	Firm to very stiff, light grey mottled reddish brown streaked yellowish brown sandy clayey SILT (ALLUVIUM)
								▯ 1 21.45					
							42	42 2 21.50					
22								■ 2 21.95					
							34	3 22.00					
								▯ 3 22.45					
							25	25 4 22.50					
23								■ 4 22.95					
							35	5 23.00	-15.83	23.50			
								▯ 5 23.45				QCK30	Very stiff, grey slightly sandy very clayey SILT with occasional black organic fragments (ALLUVIUM) S20
							27	27 6 23.50	-16.33	24.00			
24								■ 6 23.95				QCK3	Firm to stiff, light grey silty CLAY (ALLUVIUM)
							43	7 24.00	-16.83	24.50			
								▯ 7 24.45				QCK3	Firm to stiff, yellowish brown streaked dark brown slightly clayey to clayey SILT with occasional dark brown silt nodules (<4mm) (ALLUVIUM)
							17	17 8 24.50					
25								■ 8 24.95					
							41	9 25.00					
								▯ 9 25.45					
							22	22 10 25.50					
26								■ 10 25.95					
							35	11 26.00	-18.83	26.50			
								▯ 11 26.45				QCK1CO	Soft to firm, dark grey silty CLAY (ALLUVIUM) S25
							14	14 12 26.50					
27								■ 12 26.95					
							46	13 27.00					
								▯ 13 27.45					
							13	13 14 27.50					
28								■ 14 27.95					
							23	15 28.00					
								▯ 15 28.45					28.50-31.00: very silty
							12	12 16 28.50					
29								■ 16 28.95					
							33	17 29.00					
								▤ 17 29.45					
								18 29.50					
30													

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	□	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	▽	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	⌶	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YKY

DATE 01/08/94

CHECKED CBT

DATE 02/08/94

REMARKS
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Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

	DRILLHOLE RECORD	**HOLE NO.** 519B08
	PEG REPORT SIR179	**SHEET** 4 of 5
	METHOD	**SPC WORKS AREA** D3/3
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 808174.15 N 817722.95	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. ACKER D90 /ACKER 20		**DATE from** 16/7/94 **to** 30/7/94
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 7.67 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
								18 30.45 18 30.50					
31								19 30.95 19 31.00	-23.33	31.00		QCK1C	Firm, yellowish brown streaked light grey clayey SILT (ALLUVIUM)
32								20 31.95 20 32.00					32.00-33.50: stiff
								21 32.45 20 32.50					
33													
								22 33.45 22 33.50					
34								23 33.95 21 34.00					
35								24 34.95 24 35.00					
								25 35.45 22 35.50					35.50-35.00: slightly clayey slightly sandy
36													
								26 36.45 26 36.50					
37								27 36.95 23 37.00	-29.33	37.00		QCK1	Firm, light grey clayey SILT (ALLUVIUM) S44
38								28 37.95 28 38.00					
							171	29 38.45 24 38.50	-30.83	38.50		QCK1G	Grey and whitish grey, slightly clayey silty sandy subangular locally subrounded coarse GRAVEL of granite and dolerite (COLLUVIUM)
39							51	30 38.95 25 39.00					
40							270	31 39.45 26 39.50					

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	▼	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	▽	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	Ⅰ	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YKY

DATE 01/08/94

CHECKED CBT

DATE 02/08/94

REMARKS

In situ vane shear tests at 31.00m (61.40kPa) 32.50m (78.39kPa), 34.00m (56.73kPa), 35.50m (61.40kPa), 37.00m (41.91kPa) and at 38.50m (75.54kPa)

Date Printed 16 September 1996

香港機場管理局
AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

	DRILLHOLE RECORD	**HOLE NO.** 519B08
	PEG REPORT SIR179	**SHEET** 5 of 5
	METHOD	**SPC WORKS AREA** D3/3
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 808174.15 N 817722.95	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. ACKER D90 /ACKER 20		**DATE from** 16/7/94 to 30/7/94
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 7.67 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
41			75				193	32 39.95 27 40.00 33 40.45 T2101 40.50					40.50-41.80: gravel and cobbles
42			85					41.80 T2101	-34.68	42.35			
43 44			100	100	100	1.3		42.35 T2101	-36.28	43.95		CDG	SR Strong, greyish pink spotted black slightly decomposed coarse grained slightly chloritised GRANITE with medium spaced rough undulating rough stepped clean joints, dipping at 10° and 75°
45 46 47 48 49 50													

- ● SMALL DISTURBED SAMPLE
- ↕ LARGE DISTURBED SAMPLE
- ▯ SPT LINER SAMPLE
- ▨ U76 UNDISTURBED SAMPLE
- ■ U100 UNDISTURBED SAMPLE
- ▧ MAZIER SAMPLE
- ▤ PISTON SAMPLE
- △ WATER SAMPLE
- ■ PIEZOMETER TIP
- ▼▽□ STANDPIPE
- ↓ STANDARD PENETRATION TEST
- ⌶ PERMEABILITY TEST
- V IN-SITU VANE SHEAR TEST

LOGGED YKY

DATE 01/08/94

CHECKED CBT

DATE 02/08/94

REMARKS
In situ vane shear tests at 31.00m (61.40kPa) 32.50m (78.39kPa), 34.00m (56.73kPa), 35.50m (61.40kPa), 37.00m (41.91kPa) and at 38.50m (75.54kPa)

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

HOLE NO. 532B25	**PEG REPORT** SIR255	**SHEET** 1 of 6
	METHOD RC+RP	**SPC WORKS AREA** D2/1
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 809975.18 N 818176.00	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. CMC / HONDRILL HD70		**DATE from** 18/3/95 to 21/4/95
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 6.21 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
	ODEX										▨	FILLC	SAND (FILL)
1											▨		
2									3.71	2.50	▨		
											◇	FILLA	ROCK (FILL)
3											◇		
4											◇		
5											◇		
6											◇		
7											◇		
8											◇		
9											◇		
10											◇		

● SMALL DISTURBED SAMPLE
↕ LARGE DISTURBED SAMPLE
▯ SPT LINER SAMPLE
▨ U76 UNDISTURBED SAMPLE
■ U100 UNDISTURBED SAMPLE
▨ MAZIER SAMPLE
☰ PISTON SAMPLE
△ WATER SAMPLE
■ PIEZOMETER TIP
□ STANDPIPE
↓ STANDARD PENETRATION TEST
⊥ PERMEABILITY TEST
V IN-SITU VANE SHEAR TEST

LOGGED KYK
DATE 21/04/95
CHECKED BS
DATE 02/05/95

REMARKS
Percussive drilling from 0.00m-13.10mDesignated fill type C placed above 3.71mPDand fill type A/B above -10.79mPDDesignated fill type A/B placed above -10.79mPD

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

PROJECT The New Hong Kong Airport	**PEG REPORT** SIR255	**HOLE NO.** 532B25
MACHINE & No. CMC / HONDRILL HD70	**METHOD** RC+RP	**SHEET** 2 of 6
FLUSHING MEDIUM AIR / WATER	**CO-ORDINATES** E 809975.18 N 818176.00	**SPC WORKS AREA** D2/1
	ORIENTATION Vertical	**CONTRACTOR** IP Foundations Ltd.
		DATE from 18/3/95 **to** 21/4/95
		GROUND LEVEL 6.21 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
11													
12													
13									-6.89	13.10			
	PX		100					T2101 13.10				FILLA	Greyish pink spotted black, subangular coarse, occasionally medium GRAVEL and COBBLES (FILL)
			94					T2101 13.70					
14			91					T2101 14.05					
			95					T2101 14.40					
15			100					T2101 15.06					
			80					T2101 15.40					
16			100					T2101 16.19					
17									-10.79	17.00			
			100				60	■ 2 17.00				QSWBP	Firm to stiff, reddish brown, dappled light grey silty CLAY (ALLUVIUM)
								● 1 17.45					
18							↓ 6 21 21	▯ 3 18.00					
								● 2 18.45					
19									-12.79	19.00			
			100					▤ 4 19.00				QCK3	Firm, light grey, occasionally medium brown very sandy SILT (ALLUVIUM) S20
20													

- ● SMALL DISTURBED SAMPLE
- ↕ LARGE DISTURBED SAMPLE
- ▯ SPT LINER SAMPLE
- ◪ U76 UNDISTURBED SAMPLE
- ■ U100 UNDISTURBED SAMPLE
- ▨ MAZIER SAMPLE
- ▤ PISTON SAMPLE
- △ WATER SAMPLE
- ▼ PIEZOMETER TIP
- ▽ STANDPIPE
- ↓ STANDARD PENETRATION TEST
- I PERMEABILITY TEST
- V IN-SITU VANE SHEAR TEST

LOGGED KYK

DATE 21/04/95

CHECKED BS

DATE 02/05/95

REMARKS
Percussive drilling from 0.00m-13.10mDesignated fill type C placed above 3.71mPDand fill type A/B above -10.79mPDDesignated fill type A/B placed above -10.79mPD

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

HOLE NO. 532B25	**PEG REPORT** SIR255	**SHEET** 3 of 6	
METHOD RC+RP	**SPC WORKS AREA** D2/1		
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 809975.18 N 818176.00	**CONTRACTOR** IP Foundations Ltd.	
MACHINE & No. CMC / HONDRILL HD70		**DATE from** 18/3/95 **to** 21/4/95	
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 6.21 mPD	

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
								● 3 20.00					
21									-14.79	21.00			
							↓ 23 71 71	▯ 5 21.00				QCK3S	Very dense, light brownish yellow, fine to medium SAND (ALLUVIUM)
								● 4 21.45					
22													
									-16.29	22.50			
			100				41	■ 6 22.50				QCK2A	Firm to stiff, medium grey, silty CLAY (ALLUVIUM) S25
23								● 5 22.95					
							↓ 4 16 16	▯ 7 23.50					
24								● 6 23.95					
			100					▤ 7 24.50					
25									-19.29	25.50			
							↓ 6 15 15	● 8 25.50 ▯ 7 25.51 ● 8 25.95				QCK2AO	Firm, medium to dark grey, mottled black clayey SILT with traces to some organic matter (ALLUVIUM)
26									-20.29	26.50			
			100					▤ 9 26.50				QCK2A	Firm, dark grey, occasionally dappled medium brown clayey SILT (ALLUVIUM)
27													
							↓ 7 13 13	● 10 27.50 ▯ 9 27.51 ● 10 27.95					
28									-22.29	28.50			
			100					▤ 11 28.50				QCK1S	Medium dense, grey, slightly silty fine to medium SAND (ALLUVIUM) S30
29													
							↓ 8 26 26	● 12 29.50 ▯ 11 29.51					29.50-31.00m: very silty
30													

● SMALL DISTURBED SAMPLE
↕ LARGE DISTURBED SAMPLE
▯ SPT LINER SAMPLE
▨ U76 UNDISTURBED SAMPLE
■ U100 UNDISTURBED SAMPLE
▨ MAZIER SAMPLE
▤ PISTON SAMPLE
△ WATER SAMPLE
■ PIEZOMETER TIP
▼ □ ▽ STANDPIPE
↓ STANDARD PENETRATION TEST
I PERMEABILITY TEST
V IN-SITU VANE SHEAR TEST

LOGGED KYK

DATE 21/04/95

CHECKED BS

DATE 02/05/95

REMARKS

Percussive drilling from 0.00m-13.10mDesignated fill type C placed above 3.71mPDand fill type A/B above -10.79mPDDesignated fill type A/B placed above -10.79mPD

Date Printed 16 September 1996

香港機場管理局 AIRPORT AUTHORITY HONG KONG	**DRILLHOLE RECORD**	**HOLE NO.** 532B25
	PEG REPORT SIR255	**SHEET** 4 of 6
	METHOD RC+RP	**SPC WORKS AREA** D2/1
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 809975.18 N 818176.00	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. CMC / HONDRILL HD70		**DATE from** 18/3/95 **to** 21/4/95
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 6.21 mPD

Drilling Progress	Casing size	Water level (m) Shift start/end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
								12 29.95			∴		
31			0				170	■ 13 31.00			∴		31.00-33.50m: fine to coarse SAND
								● 13 31.45			∴		
32											∴		
							↓ 12 49 49	▯ 14 32.50			∴		
33								● 14 32.95			∴		
			24					T2101 33.50	-27.29	33.50	○	QCK1G	Light grey and dark grey, subrounded medium to coarse GRAVEL and COBBLES (COLLUVIUM)
34											○		
35			28					T2101 35.00			○		
36			28					T2101 36.00			○		
37			38					T2101 37.00			○		
38											○		
			17					T2101 38.20			○		
39											○		
			16					T2101 39.70			○		
40											○		

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	□	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	⌶	PERMEABILITY TEST
▧	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
⌸	PISTON SAMPLE		

LOGGED KYK

DATE 21/04/95

CHECKED BS

DATE 02/05/95

REMARKS

Percussive drilling from 0.00m-13.10mDesignated fill type C placed above 3.71mPDand fill type A/B above -10.79mPDDesignated fill type A/B placed above -10.79mPD

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香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

HOLE NO. **532B25**	PEG REPORT SIR255	SHEET 5 of 6
METHOD RC+RP	SPC WORKS AREA D2/1	
PROJECT The New Hong Kong Airport	CO-ORDINATES E 809975.18 N 818176.00	CONTRACTOR IP Foundations Ltd.
MACHINE & No. CMC / HONDRILL HD70		DATE from 18/3/95 to 21/4/95
FLUSHING MEDIUM AIR / WATER	ORIENTATION Vertical	GROUND LEVEL 6.21 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
41									-34.99	41.20	○ ○ ○		
42 43							↓ 30 95 95	● 15 41.95	-37.09	43.30		QCK1S	Very dense, grey, fine to coarse SAND with some rounded fine to medium gravel (COLLUVIUM)
44									-38.09	44.30	○ ○ ○	QCK1G	Light grey, subrounded COBBLES (COLLUVIUM)
45 46							↓ 86 186 86 186	▯ 16 44.50 ● 16 44.95	-39.79	46.00		QCK1L	Very stiff, greyish brown, sandy SILT with occasionally subrounded fine gravel (COLLUVIUM)
47 48 49			0				177 ↓ 22 112 112	■ 17 46.00 ● 17 46.45 ● 18 47.95	-42.79	49.00		QCK1S	Very dense, pinkish brown mottled yellowish brown, slightly silty fine to coarse SAND with some subrounded fine to coarse gravel (COLLUVIUM)
50			0				157	■ 19 49.00 ● 19 49.45				QCK1G	Light grey and brownish grey clayey silty sandy subrounded medium to coarse GRAVEL (COLLUVIUM)

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	▼	PIEZOMETER TIP
▯	SPT LINER SAMPLE	▼ □	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	▽	
■	U100 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
▨	MAZIER SAMPLE	I	PERMEABILITY TEST
▤	PISTON SAMPLE	V	IN-SITU VANE SHEAR TEST

LOGGED KYK

DATE 21/04/95

CHECKED BS

DATE 02/05/95

REMARKS

Percussive drilling from 0.00m-13.10mDesignated fill type C placed above 3.71mPDand fill type A/B above -10.79mPDDesignated fill type A/B placed above -10.79mPD

Date Printed 16 September 1996

香港機場管理局 AIRPORT AUTHORITY HONG KONG	**DRILLHOLE RECORD**	**HOLE NO.** 532B25
	PEG REPORT SIR255	**SHEET** 6 of 6
	METHOD RC+RP	**SPC WORKS AREA** D2/1
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 809975.18 N 818176.00	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. CMC / HONDRILL HD70		**DATE from** 18/3/95 **to** 21/4/95
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 6.21 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
									-44.29	50.50			
							22 123 23 123	20 50.50 20 50.95				HDG	Extremely weak to very weak, light pinkish grey mottled light green, completely to highly decomposed medium grained GRANITE (Very dense, silty fine to coarse SAND) SR
51	HX												
52			40					21 52.00 21 53.00					
53							50 200 200	22 53.70					
54													
55			85					23 55.00 23 56.00					
56							200 200	24 56.47	-50.32	56.53			
57													
58													
59													
60													

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	▼	PIEZOMETER TIP
▯	SPT LINER SAMPLE	□ ▽	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	I	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED KYK

DATE 21/04/95

CHECKED BS

DATE 02/05/95

REMARKS
Percussive drilling from 0.00m-13.10mDesignated fill type C placed above 3.71mPDand fill type A/B above -10.79mPDDesignated fill type A/B placed above -10.79mPD

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

HOLE NO. 532B32

PEG REPORT SIR255

SHEET 1 of 5

METHOD RC+RP

SPC WORKS AREA D2/2

PROJECT The New Hong Kong Airport

CO-ORDINATES
E 809581.97
N 818261.03

CONTRACTOR IP Foundations Ltd.

MACHINE & No. HONDRILL HD90 / D86

DATE from 16/12/94 **to** 28/12/94

FLUSHING MEDIUM AIR / WATER

ORIENTATION Vertical

GROUND LEVEL 5.99 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
	ODEX										▨	FILLC	Sand (FILL)
									-0.01	6.00			
												FILLA	Rock (FILL)

Drilling Progress scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	□	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	I	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 28/12/94

CHECKED CBT

DATE 11/01/95

REMARKS

Percussive drilling from 0.00m-15.00mDesignated fill type C placed above -0.01mPD andfill type A placed above -12.51mPDDesignate d fill type A placed above -12.51mPDF = Fractured zone

Date Printed 16 September 1996

香港機場管理局 AIRPORT AUTHORITY HONG KONG	**DRILLHOLE RECORD**	HOLE NO. **532B32**
	PEG REPORT SIR255	SHEET 2 of 5
	METHOD RC+RP	SPC WORKS AREA D2/2
PROJECT The New Hong Kong Airport	CO-ORDINATES E 809581.97 N 818261.03	CONTRACTOR IP Foundations Ltd.
MACHINE & No. HONDRILL HD90 / D86		DATE from 16/12/94 to 28/12/94
FLUSHING MEDIUM AIR / WATER	ORIENTATION Vertical	GROUND LEVEL 5.99 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
11													
12													
13													
14													
15									-9.01	15.00			
	PX		32					T2101 15.00				FILLA	Pinkish grey spotted black coarse GRAVEL, COBBLES and BOULDERS of granite and dolerite (FILL)
16													
			38					T2101 16.20					
17													
			45					T2101 17.50					
18									-12.51	18.50			
			100				41	■ 1 18.50 ● 1 18.95				QCK2CP	Firm to stiff, light yellowish brown mottled light grey and reddish brown clayey SILT (ALLUVIUM)
19													
			76					▤ 2 19.50					19.50-21.50m: very stiff, bluish grey mottled yellowish brown in colour
20													

● SMALL DISTURBED SAMPLE	△ WATER SAMPLE	LOGGED YHL	**REMARKS** Percussive drilling from 0.00m-15.00mDesignated fill type C placed above -0.01mPD andfill type A placed above -12.51mPDDesignate d fill type A placed above -12.51mPDF = Fractured zone
↕ LARGE DISTURBED SAMPLE	■ PIEZOMETER TIP	DATE 28/12/94	
▯ SPT LINER SAMPLE	▼ □ STANDPIPE	CHECKED CBT	
▨ U76 UNDISTURBED SAMPLE	▽ ↓ STANDARD PENETRATION TEST	DATE 11/01/95	Date Printed 16 September 1996
■ U100 UNDISTURBED SAMPLE	⌶ PERMEABILITY TEST		
▨ MAZIER SAMPLE	V IN-SITU VANE SHEAR TEST		
▤ PISTON SAMPLE			

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

		HOLE NO. 532B32
	PEG REPORT SIR255	**SHEET** 3 of 5
	METHOD RC+RP	**SPC WORKS AREA** D2/2
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 809581.97 N 818261.03	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. HONDRILL HD90 / D86		**DATE from** 16/12/94 **to** 28/12/94
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 5.99 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
							4 12 12	3 20.50 2 20.51 3 20.95					
21													
									-15.51	21.50			
			100					4 21.50				QCK2CO	Firm, dark grey clayey SILT (ALLUVIUM)
22													
							3 9 9	5 22.50 4 22.51 5 22.95					
23													
			100					6 23.50					23.50-29.50m: with occasional black organic fragments
24													
							3 10 10	7 24.50 6 24.51 7 24.95					
25													
			100					8 25.50					
26													
							3 14 14	9 26.50 8 26.51 9 26.95					
27													
			100					10 27.50					27.50-29.50m: greenish grey in colour with occasional brown wood fragments
28													
							4 11 11	11 28.50 10 28.51 11 28.95					
29													
									-23.51	29.50			
			70					12 29.50				QCK1SO	Dense, dark grey slightly clayey silty coarse SAND with occasional black S40
30													

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	□	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	I	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
☰	PISTON SAMPLE		

LOGGED YHL

DATE 28/12/94

CHECKED CBT

DATE 11/01/95

REMARKS

Percussive drilling from 0.00m-15.00mDesignated fill type C placed above -0.01mPD andfill type A placed above -12.51mPDDesignate d fill type A placed above -12.51mPDF = Fractured zone

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD		**HOLE NO.** 532B32
PEG REPORT SIR255		**SHEET** 4 of 5
METHOD RC+RP		**SPC WORKS AREA** D2/2
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 809581.97 N 818261.03	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. HONDRILL HD90 / D86		**DATE from** 16/12/94 **to** 28/12/94
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 5.99 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description
31							8 38 38	13 30.50 12 30.51 13 30.95	-25.51	31.50			organic fragments and occasional subangular fine gravel (ALLUVIUM)
32 33			0				240 250 250	14 31.50 14 31.65 15 32.63	-27.31	33.30		QCK1M	Very dense, light grey very clayey silty fine SAND with some subrounded fine to coarse gravel sized rock fragments (COLLUVIUM)
34			17					33.30 T2101	-28.21	34.20		QCK1DG	Dark grey, speckled white and grey subangular to subrounded fine to coarse GRAVEL of granite (COLLUVIUM) S45
35 36			0 0				238 49 31 31 92	16 34.50 16 34.63 17 35.00 17 35.45 18 36.00 18 36.45	-30.51	36.50		QCK1DS	Very dense to dense, whitish grey speckled black and black silty fine to coarse SAND with some to many subrounded fine to medium gravel sized rock fragments (COLLUVIUM) 36.00-36.50m: with many fine to coarse gravel sized rock fragments
37 38 39 40			60 18 39 88 63					T2101 36.51 37.00 T2101 38.10 T2101 39.00 T2101 39.80				QCK1DG	Light grey spotted black subrounded coarse GRAVEL and COBBLES of granite and dolerite (COLLUVIUM)

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	▼ □	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	▽ ↓	STANDARD PENETRATION TEST
█	U100 UNDISTURBED SAMPLE	I	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 28/12/94

CHECKED CBT

DATE 11/01/95

REMARKS

Percussive drilling from 0.00m-15.00mDesignated fill type C placed above -0.01mPD andfill type A placed above -12.51mPDDesignate d fill type A placed above -12.51mPDF = Fractured zone

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

HOLE NO. 532B32

PEG REPORT SIR255

SHEET 5 of 5

METHOD RC+RP

SPC WORKS AREA D2/2

PROJECT The New Hong Kong Airport

CO-ORDINATES
E 809581.97
N 818261.03

CONTRACTOR IP Foundations Ltd.

MACHINE & No. HONDRILL HD90 / D86

DATE from 16/12/94 **to** 28/12/94

FLUSHING MEDIUM AIR / WATER

ORIENTATION Vertical

GROUND LEVEL 5.99 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Layer Code	Description
								T2101				
			32					40.25 T2101				
41												
			27					41.50 T2101				
42												
43									-37.01	43.00		
			90				↓ 246 246	19 43.15 20 43.20			CDG	Extremely weak, pinkish grey speckled green completely decomposed GRANITE (Very dense silty fine to medium SAND with some angular fine to coarse gravel sized rock fragments) SR
44								20 44.20				
45							↓ 245 245	● 21 45.13				
46									-39.98	45.97		
			80	0	0	>20		45.97 T2101			MDG	Moderately strong to strong, light pinkish grey speckled green and spotted black, moderately to slightly decomposed, fine to medium chloritised GRANITE, highly fractured where intact with rough undulating kaolinit e stained joints, dipping at 45°- 50° R10
									-40.74	46.73		
47												
48												
49												
50												

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	▼ ■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	□	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	▽ ↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	Ⅰ	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 28/12/94

CHECKED CBT

DATE 11/01/95

REMARKS
Percussive drilling from 0.00m-15.00mDesignated fill type C placed above -0.01mPD andfill type A placed above -12.51mPDDesignate d fill type A placed above -12.51mPDF = Fractured zone

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

HOLE NO.	ME211
PEG REPORT	SIR222
SHEET	1 of 5
METHOD	
SPC WORKS AREA	D3/6
PROJECT	The New Hong Kong Airport
CO-ORDINATES	E 807788.39 N 817501.81
CONTRACTOR	IP Foundations Ltd.
MACHINE & No.	HD90
DATE from	8/2/95 to 16/2/95
FLUSHING MEDIUM	AIR / WATER
ORIENTATION	Vertical
GROUND LEVEL	8.64 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description	Installation	Details
									4.64	4.00	▨	FILLC	Sand (FILL)		
											◇	FILLA	Rock (FILL)		

Drilling Progress scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	▼	PIEZOMETER TIP
▯	SPT LINER SAMPLE	□	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	▽	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	⌶	PERMEABILITY TEST
▧	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 17/02/95

CHECKED CBT

DATE 23/02/95

REMARKS

Designated fill type A placed above -11.86mPDwith designated fill type C capping placed above 4.64mPDPercussive drilling from 0.00m-20.50mSpider magnet extensometer installedAll samples extruded and logged

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

	DRILLHOLE RECORD	**HOLE NO.** ME211
	PEG REPORT SIR222	**SHEET** 2 of 5
	METHOD	**SPC WORKS AREA** D3/6
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 807788.39 N 817501.81	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. HD90		**DATE from** 8/2/95 to 16/2/95
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 8.64 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description	Installation	Details
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	▼ □	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	▽ ↓	STANDARD PENETRATION TEST
█	U100 UNDISTURBED SAMPLE	⌶	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 17/02/95

CHECKED CBT

DATE 23/02/95

REMARKS
Designated fill type A placed above -11.86mPDwith designated fill type C capping placed above 4.64mPDPercussive drilling from 0.00m-20.50mSpider magnet extensometer installedAll samples extruded and logged

Date Printed 16 September 1996

香港機場管理局 AIRPORT AUTHORITY HONG KONG	**DRILLHOLE RECORD**	**HOLE NO.** ME211
	PEG REPORT SIR222	**SHEET** 3 of 5
	METHOD	**SPC WORKS AREA** D3/6
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 807788.39 N 817501.81	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. HD90		**DATE from** 8/2/95 **to** 16/2/95
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 8.64 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description	Installation	Details
									-11.86	20.50		QSWAS	Loose light grey slightly silty fine to medium SAND (ALLUVIUM)		
21							4 9 9	9 1 21.00 1 21.45							
22									-13.36	22.00		QSWAO	Firm, dark grey clayey SILT with occasional black organic fragments (ALLUVIUM)	M7	-13.74
							2 6 6	6 2 22.50							
23							16	2 22.95 3 23.00					23.00-24.50: With occasional clayey silty medium to coarse sand pockets. (<30mm)		
								3 23.45 4 23.50							
24							18	4 24.45 5 24.50					24.50-26.00: Slightly sandy		
25							15	5 24.95 6 25.00							
							3 8 8	8 6 25.45 7 25.50							
26							17	7 25.95 8 26.00	-17.36	26.00		QSWAM	Grey, sandy clayey SILT with occasional subangular to subrounded gravel (ALLUVIUM)		
									-17.61	26.25		QSWAS	Grey, silty clayey medium to coarse SAND (ALLUVIUM)		
							20	8 26.45 9 26.50	-17.86	26.50		QCK1CS	Medium dense, yellowish grey, slightly silty medium to coarse SAND with occasional to some subangular fine to medium gravel (ALLUVIUM) 27.50-29.00: With occasional subangular fine gravel.	M6	-17.94
27							5 12 12	12 9 26.95 10 27.00							
							8 17 17	17 10 27.45 11 27.50							
28								11 27.95							
29							7 15 15	15 12 29.00	-20.36	29.00		QCK1CO	Soft to firm, dark grey clayey SILT with occasional black organic fragments (ALLUVIUM) 29.50-29.70: A yellowish brown mottled black cobble.	M5	-20.84
							20	12 29.45 13 29.50							
30															

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	▼ □ ▽	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	I	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 17/02/95

CHECKED CBT

DATE 23/02/95

REMARKS

Designated fill type A placed above -11.86mPDwith designated fill type C capping placed above 4.64mPDPercussive drilling from 0.00m-20.50mSpider magnet extensometer installedAll samples extruded and logged

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

HOLE NO. ME211	**PEG REPORT** SIR222	**SHEET** 4 of 5
METHOD	**SPC WORKS AREA** D3/6	
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 807788.39 N 817501.81	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. HD90		**DATE from** 8/2/95 **to** 16/2/95
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 8.64 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Layer Code	Description	Installation	Details
							16	13 29.95 14 30.00						
							4 11 11	14 30.45 15 30.50						
31							18	15 30.95 16 31.00						
							18	16 31.45 17 31.50						
32							3 9 9	17 31.95 18 32.00					M4	-23.34
							19	18 32.45 19 32.50	-24.01	32.65		32.50-32.65: Slightly sandy.		
33							21	19 32.95 20 33.00			QCK1S	Medium dense to dense, light grey mottled yellowish brown, clayey silty fine to medium SAND (ALLUVIUM) 33.00-33.45: With occasional dark brown fragments.		
34							5 11 11	20 33.45 21 33.50 21 33.95						
35							9 35 35	22 35.00 22 35.45					M3	-26.94
36									-27.86	36.50				
37							9 29 29	23 36.50 23 36.95			QCK1	Very stiff, whitish grey slightly clayey SILT with occasional angular fine gravel sized rock fragments (ALLUVIUM)	M2	-29.14
38									-29.36	38.00				
							11 41 41	24 38.00	-29.86	38.50	QCK1S	Dense, yellowish brown mottled white silty fine to medium SAND with occasional subangular medium gravel sized rock fragments (ALLUVIUM)		
39								24 38.45 25 38.50 25 38.70			QCK1G	Dark greenish brown, angular fine to medium GRAVEL sized rock fragments with a matrix of yellowish brown silty fine to medium sand (COLLUVIUM)		
40							6 72 72	26 39.50						

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	□	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	⌶	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 17/02/95

CHECKED CBT

DATE 23/02/95

REMARKS
Designated fill type A placed above -11.86mPDwith designated fill type C capping placed above 4.64mPDPercussive drilling from 0.00m-20.50mSpider magnet extensometer installedAll samples extruded and logged

Date Printed 16 September 1996

香港機場管理局 AIRPORT AUTHORITY HONG KONG	**DRILLHOLE RECORD**	HOLE NO. **ME211**
	PEG REPORT SIR222	SHEET 5 of 5
	METHOD	SPC WORKS AREA D3/6
PROJECT The New Hong Kong Airport	CO-ORDINATES E 807788.39 N 817501.81	CONTRACTOR IP Foundations Ltd.
MACHINE & No. HD90		DATE from 8/2/95 to 16/2/95
FLUSHING MEDIUM AIR / WATER	ORIENTATION Vertical	GROUND LEVEL 8.64 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description	Installation	Details
								▨ 26 39.95 27 40.00 27 40.15	-32.36	41.00	○				
41							↓ 99 178 178	▯ 178 28 41.00	-32.86	41.50	⁞	QCK1S	Very dense, orangish brown mottled white fine to medium locally coarse SAND (COLLUVIUM)	M1	-32.34
42								▨ 28 41.45 29 41.50 29 41.65	-34.08	42.72	○	QCK1G	Dark brown mottled reddish brown and white subangular medium GRAVEL sized rock fragments (COLLUVIUM)		
43 44 45 46							↓ 47 154 154	30 42.72	-37.76	46.40	+	MDG	Very strong, grey mottled white and black slightly decomposed medium to coarse grained locally slightly chloritised GRANITE, with closely to medium spaced smooth stepped smooth undulating iron and manganese stai ned joints, dipping at 15°-25°, locally s¯ 44.40-44.64: A 35mm pegmatitic vein with macro quartz crystals. 45.90-46.17: Joints dipping at 75.	DTM	-36.04
47 48 49 50															

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	▼ □	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	▽ ↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	Ⅰ	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 17/02/95

CHECKED CBT

DATE 23/02/95

REMARKS
Designated fill type A placed above -11.86mPDwith designated fill type C capping placed above 4.64mPDPercussive drilling from 0.00m-20.50mSpider magnet extensometer installedAll samples extruded and logged

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

HOLE NO. ME214	**PEG REPORT** SIR222	**SHEET** 1 of 5
METHOD		**SPC WORKS AREA** D3/4
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 808364.85 N 817490.02	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. HD90		**DATE from** 6/12/94 **to** 15/12/94
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 7.85 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description	Installation	Details
									2.85	5.00	▨	FILLC	Sand (FILL)		
											⬡	FILLAB	Rock (FILL)		

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	□	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	I	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 14/12/94

CHECKED CBT

DATE 06/03/95

REMARKS
Designated fill type A/B placed above -13.15mPD with designated fill type C capping placed above 2.85mPDPercussive drilli ng from 0.00m-21.00mSpider magnetic extensometer installed

Date Printed 16 September 1996

香港機場管理局
AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

	DRILLHOLE RECORD	HOLE NO. ME214
	PEG REPORT SIR222	SHEET 2 of 5
	METHOD	SPC WORKS AREA D3/4
PROJECT The New Hong Kong Airport	CO-ORDINATES E 808364.85 N 817490.02	CONTRACTOR IP Foundations Ltd.
MACHINE & No. HD90		DATE from 6/12/94 to 15/12/94
FLUSHING MEDIUM AIR / WATER	ORIENTATION Vertical	GROUND LEVEL 7.85 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description	Installation	Details
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	▼ ◻	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	▽ ↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	⌶	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 14/12/94

CHECKED CBT

DATE 06/03/95

REMARKS
Designated fill type A/B placed above -13.15mPD with designated fill type C capping placed above 2.85mPDPercussive drilli ng from 0.00m-21.00mSpider magnetic extensometer installed

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

		HOLE NO. ME214
	PEG REPORT SIR222	**SHEET** 3 of 5
	METHOD	**SPC WORKS AREA** D3/4
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 808364.85 N 817490.02	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. HD90		**DATE from** 6/12/94 **to** 15/12/94
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 7.85 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description	Installation	Details
21									-13.15	21.00					
							2 6 6	6 1 21.00 1 21.45				QCK1C	Soft to firm, light grey mottled yellowish brown clayey SILT (ALLUVIUM)		
														M6	-13.85
22															
							2 5 5	5 2 22.50 2 22.95							
23															
24							2 7 7	7 3 24.00 3 24.45							
25															
														M5	-17.45
							1 5 5	5 4 25.50							
26									-18.15	26.00					
							30	4 25.95 5 26.00	-18.30	26.15		QCK1CO	Soft to firm, dark grey slightly sandy clayey SILT with much black organic fragments		
								5 26.45 6 26.50				QCK1CO	Firm, dark grey clayey SILT with some black and brown organic matter (ALLUVIUM)		
27															
							1 5 5	6 27.45 5 7 27.50							
28							23	7 27.95 8 28.00							
							23	8 28.45 9 28.50							
29							2 9 9	9 28.95 9 10 29.00							
							16	10 29.45 11 29.50							
30															

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	□	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	I	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 14/12/94

CHECKED CBT

DATE 06/03/95

REMARKS

Designated fill type A/B placed above -13.15mPD with designated fill type C capping placed above 2.85mPDPercussive drilli ng from 0.00m-21.00mSpider magnetic extensometer installed

Date Printed 16 September 1996

香港機場管理局

AIRPORT AUTHORITY HONG KONG

DRILLHOLE RECORD

		HOLE NO. ME214
	PEG REPORT SIR222	**SHEET** 4 of 5
	METHOD	**SPC WORKS AREA** D3/4
PROJECT The New Hong Kong Airport	**CO-ORDINATES** E 808364.85 N 817490.02	**CONTRACTOR** IP Foundations Ltd.
MACHINE & No. HD90		**DATE from** 6/12/94 **to** 15/12/94
FLUSHING MEDIUM AIR / WATER	**ORIENTATION** Vertical	**GROUND LEVEL** 7.85 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description	Installation	Details
							16	■ 11 29.95 12 30.00	-22.50	30.35					
31							↓ 1 6 6	▯ 12 30.45 13 30.50	-23.15	31.00		QCK1C	Firm, dark grey mottled yellowish brown clayey SILT with much sand nodules (<3mm)		
							14	■ 13 30.95 14 31.00	-23.65	31.50		QCK1C	Firm, light grey mottled yellowish and reddish brown clayey SILT with occasional black and brown organic matter	M4	-23.53
							18	■ 14 31.45 15 31.50				QCK1CO	Firm, light grey mottled yellowish and reddish brown clayey SILT with some sand nodules (<2mm) and occasional brown organic matter (ALLUVIUM) 32.50-34.00: Slightly clayey.		
32							↓ 2 9 9	▯ 15 31.95 16 32.00							
							19	■ 16 32.45 17 32.50							
33							17	■ 17 32.95 18 33.00							
							↓ 1 6 6	▯ 18 33.45 19 33.50							
34							14	■ 19 33.95 20 34.00	-26.65	34.50			34.00-34.10: A brown colour sand band (10mm).		
							15	■ 20 34.45 21 34.50	-26.83	34.68		QCK1C QCK1O	Medium dense, dark grey clayey silty fine to medium SAND with occasional black organic matter	M3	-27.04
35							↓ 2 9 9	▯ 21 34.95 22 35.00					Firm to stiff, dark grey clayey SILT with some black organic fragments (ALLUVIUM) 35.65-35.70: With occasional sand nodules (2mm) 35.75-35.80: With occasional sand nodules (<2mm) and rounded fine to medium gravel. 36.00-38.00: Light grey mottled yellowish brown in colour. 36.35-36.50: Slightly sandy. 36.50-37.30: Light grey in colour, no sand to medium and slightly clayey.		
							16	■ 22 35.45 23 35.50							
36							19	■ 23 35.95 24 36.00							
							↓ 2 8 8	▯ 24 36.45 25 36.50							
37							16	■ 25 36.95 26 37.00	-29.45 -29.65	37.30 37.50		QCK1M QCK1	Medium dense, dark grey clayey silty fine to medium SAND	M2	-30.04
							20	■ 26 37.45 27 37.50	-30.15	38.00			Stiff, light grey slightly clayey SILT with much sand nodules (<3mm)		
38							↓ 2 9 9	▯ 27 37.95 28 38.00	-30.65	38.50		QCK1			
							21	■ 28 38.45 29 38.50				QCK1MO	Firm, light grey mottled yellowish brown slightly sandy clayey SILT		
39							14	■ 29 38.95 30 39.00	-31.20 -31.30	39.05 39.15		QCK1 QCK1MO	Medium dense, dark grey clayey silty fine to coarse SAND with		
40							↓ 3 11 11	▯ 30 39.45 31 39.50							

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	▼	PIEZOMETER TIP
▯	SPT LINER SAMPLE	□	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	⌶	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 14/12/94

CHECKED CBT

DATE 06/03/95

REMARKS

Designated fill type A/B placed above -13.15mPD with designated fill type C capping placed above 2.85mPDPercussive drilling from 0.00m-21.00mSpider magnetic extensometer installed

Date Printed 16 September 1996

香港機場管理局 AIRPORT AUTHORITY HONG KONG	**DRILLHOLE RECORD**	HOLE NO. **ME214**
	PEG REPORT SIR222	SHEET 5 of 5
	METHOD	SPC WORKS AREA D3/4
PROJECT The New Hong Kong Airport	CO-ORDINATES E 808364.85 N 817490.02	CONTRACTOR IP Foundations Ltd.
MACHINE & No. HD90		DATE from 6/12/94 to 15/12/94
FLUSHING MEDIUM AIR / WATER	ORIENTATION Vertical	GROUND LEVEL 7.85 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Layer Code	Description	Installation	Details
								31 39.95					some black organic matter		
													Firm to stiff, dark grey slightly sandy clayey SILT	M1	-32.63
41									-33.15	41.00			Medium dense, dark grey clayey silty fine to coarse SAND with some black organic fragments		
							21 55 55					QCK1G	Very dense, dark brown mottled white slightly clayey silty sandy subangular to subrounded fine to medium GRAVEL (ALLUVIUM)		
								32 41.45							
42															
									-34.65	42.50					
							207 207	33 42.65				CDG	Extremely weak, light yellowish and orangish brown speckled green and white completely decomposed GRANITE (Very dense, sandy subangular to subrounded fine to medium GRAVEL)		
43						6.7			-35.15	43.00		MDG			
						1.0									
44													Moderately strong to strong, light pinkish grey speckled green and black moderately decomposed chloritised fine to medium GRANITE, with medium to closely spaced smooth planar smooth undulating kaolinite (1mm) an d chlorite (1mm) infilled joints, dipping ˜		
						1.7									
45						3.7								DTM	-37.59
46						3.3									
47									-39.20	47.05					
48															
49															
50															

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	▼ □	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	▽ ↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	I	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED YHL

DATE 14/12/94

CHECKED CBT

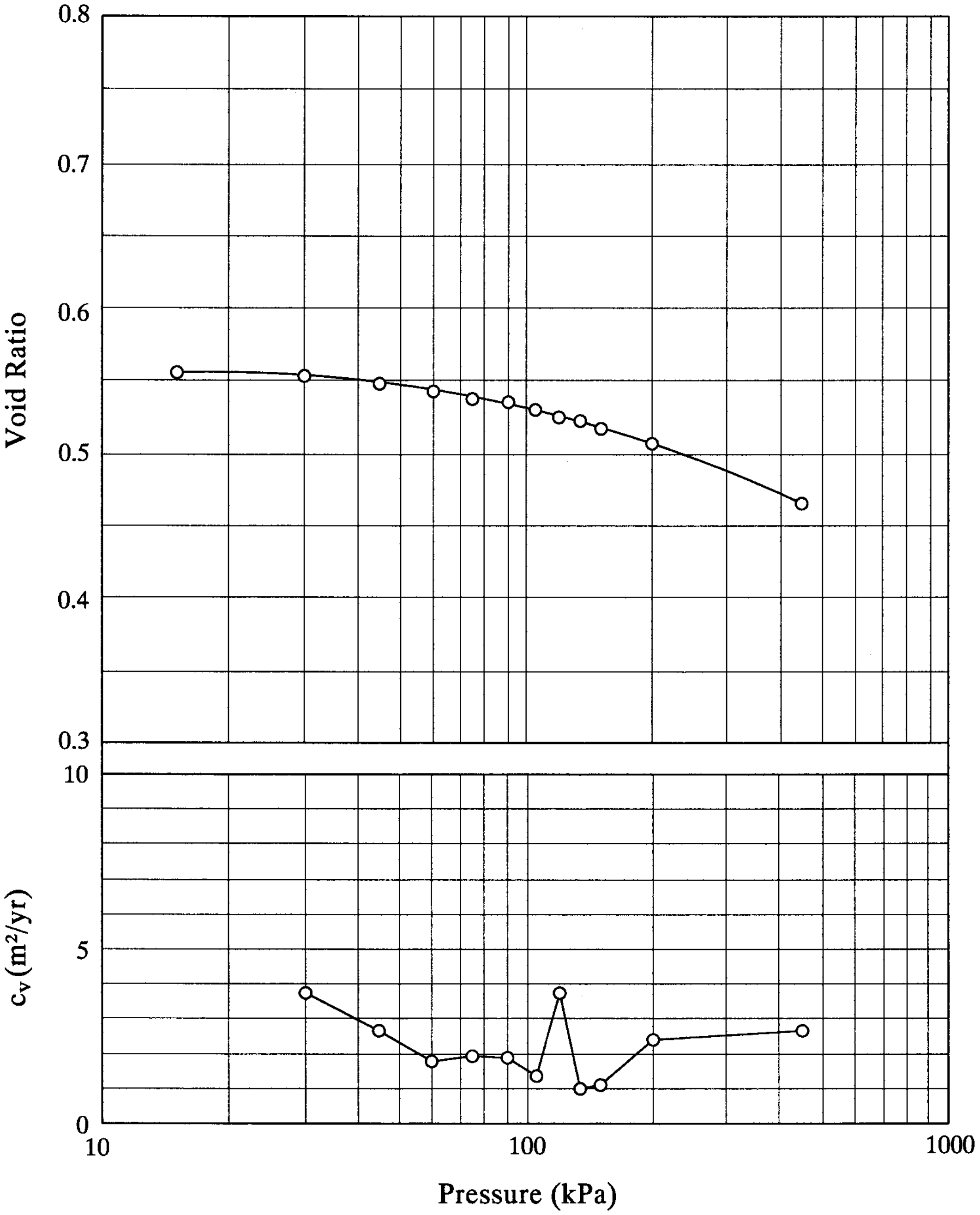
DATE 06/03/95

REMARKS
Designated fill type A/B placed above -13.15mPD with designated fill type C capping placed above 2.85mPDPercussive drilli ng from 0.00m-21.00mSpider magnetic extensometer installed

Date Printed 16 September 1996

APPENDIX B

END-OF-PRIMARY VOID RATIO - EFFECTIVE VERTICAL STRESS RELATIONSHIPS



Description Light grey clayey SILT

Initial bulk density 2.06 Mg/m^3

Borehole no. 519B08

Initial moisture content 21 %

Depth 34.22 - 34.32 m

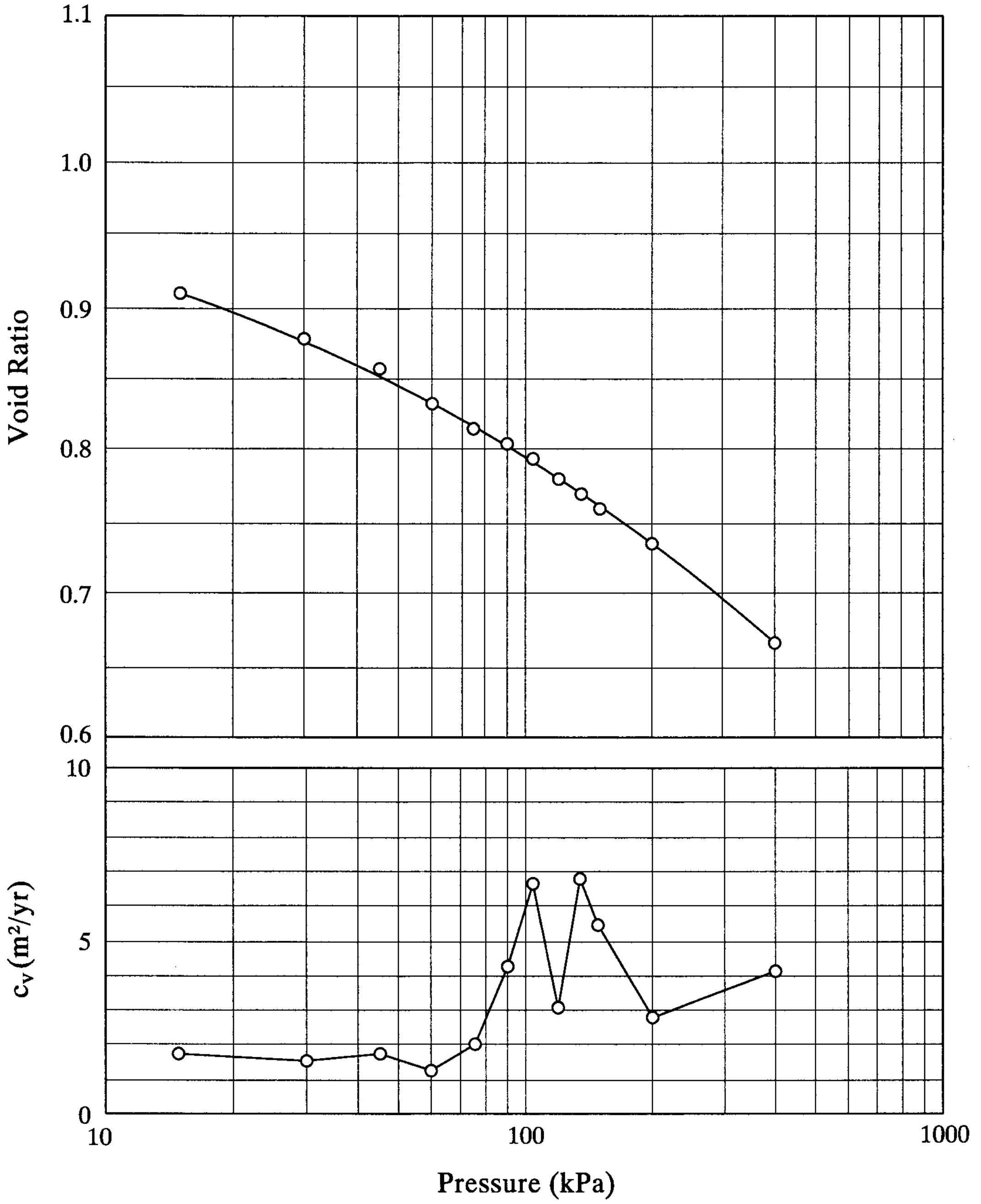
Initial dry density 1.71 Mg/m^3

Initial saturation 96.8 %

Specific gravity 2.67 Measured

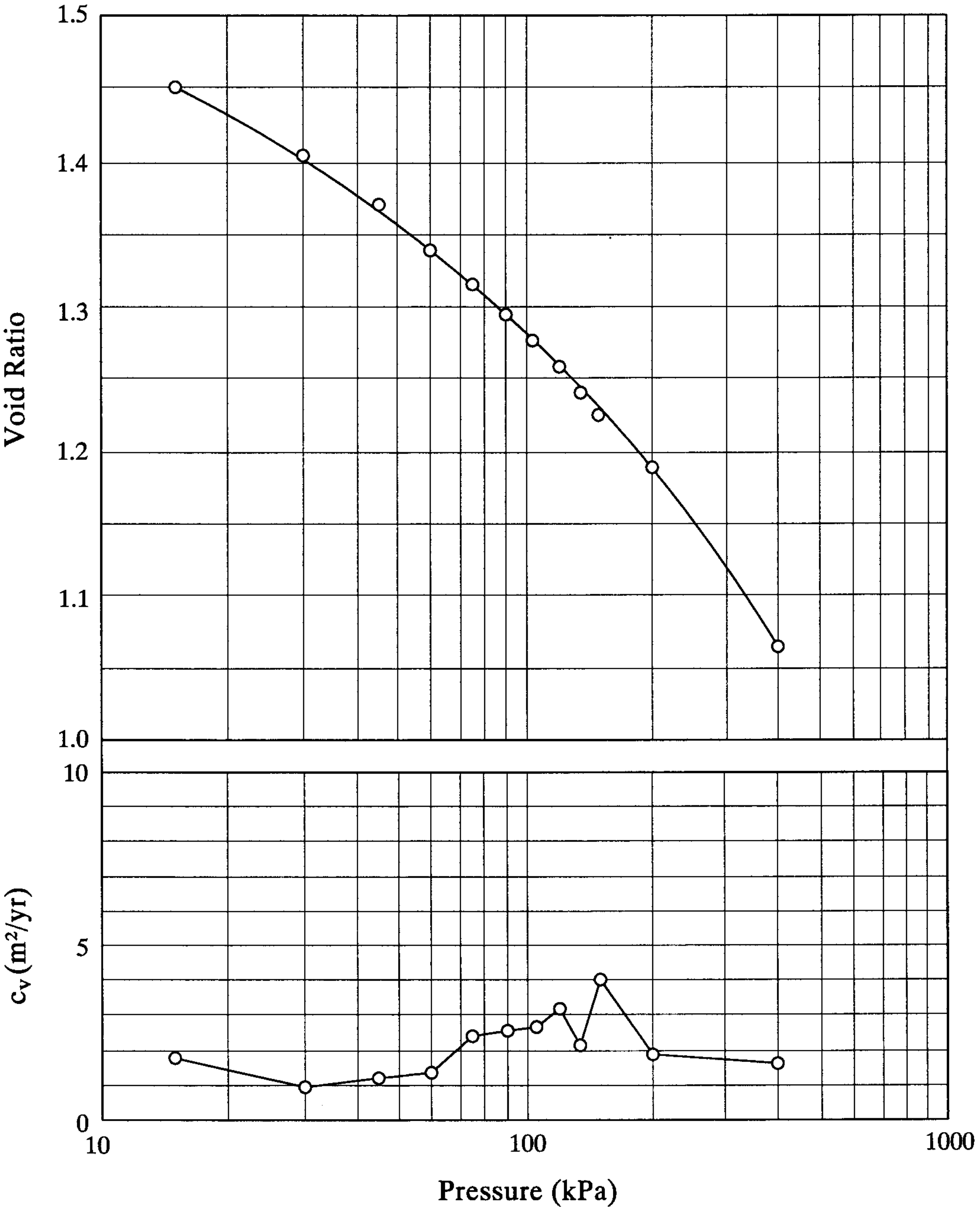
Initial void ratio 0.565

Figure B1 - Void Ratio - Effective Vertical Stress Relationship for Sample from Borehole 519B08



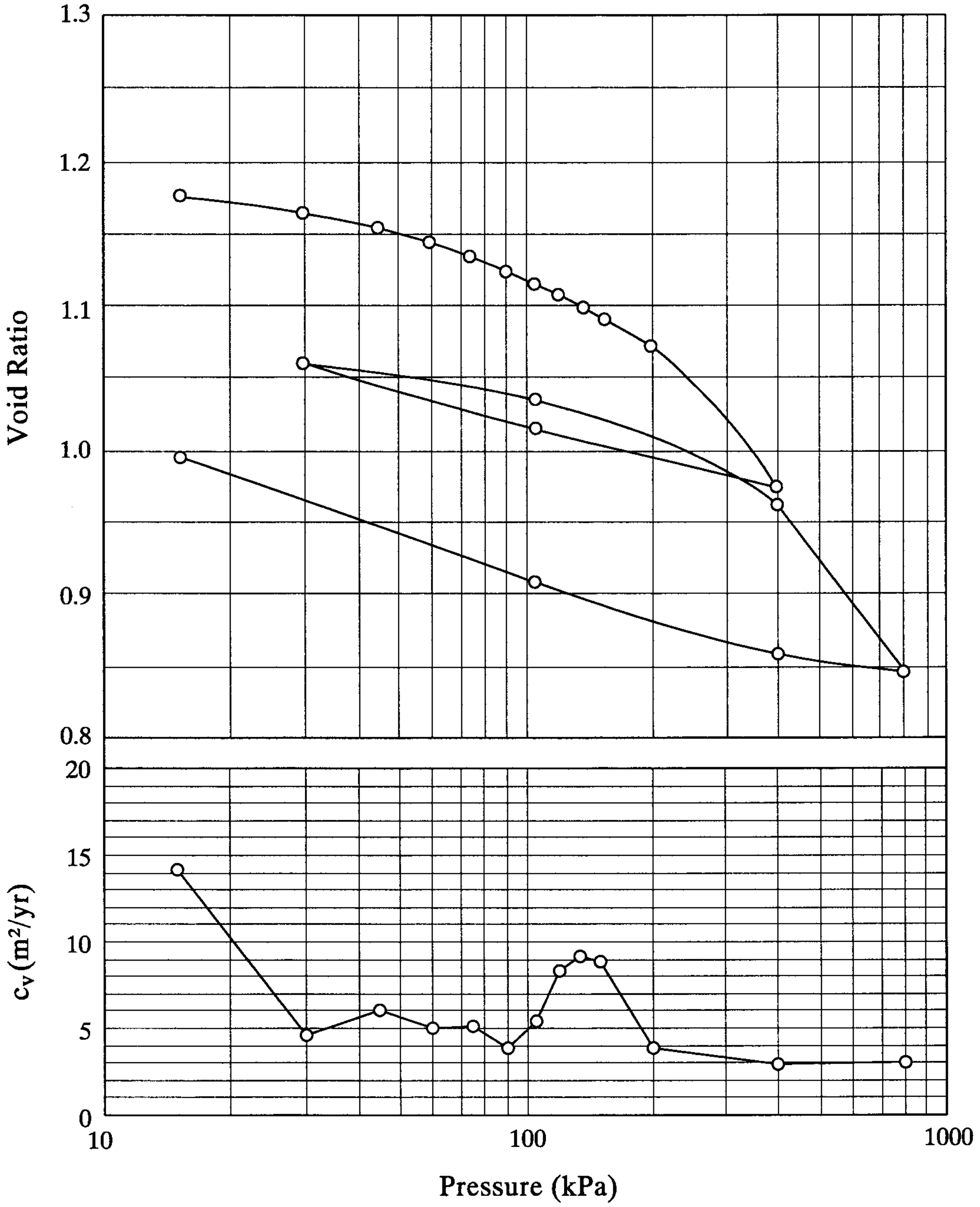
Description	Dark grey, silghtly sandly SILT				
Initial bulk density	1.86	Mg/m^3	Borehole no.	520ME211	
Initial moisture content	35	%	Depth	24.03 - 24.28	m
Initial dry density	1.38	Mg/m^3	Initial saturation	99.9	%
Specific gravity	2.68	Measured	Initial void ratio	0.942	

Figure B2 - Void Ratio - Effective Vertical Stress Relationship for Sample from Borehole 520ME211



Description	Dark grey, slightly sandly SILT		
Initial bulk density	1.67 Mg/m³	Borehole no.	520ME214
Initial moisture content	56 %	Depth	26.75 - 26.88 m
Initial dry density	1.07 Mg/m³	Initial saturation	99.9 %
Specific gravity	2.66 Measured	Initial void ratio	1.491

Figure B3 - Void Ratio - Effective Vertical Stress Relationship for Sample from Borehole 520ME214



Description Dark grey SILT/CLAY

Initial bulk density 1.75 Mg/m³

Borehole no. 532B25

Initial moisture content 45 %

Depth 25.26 - 25.32 m

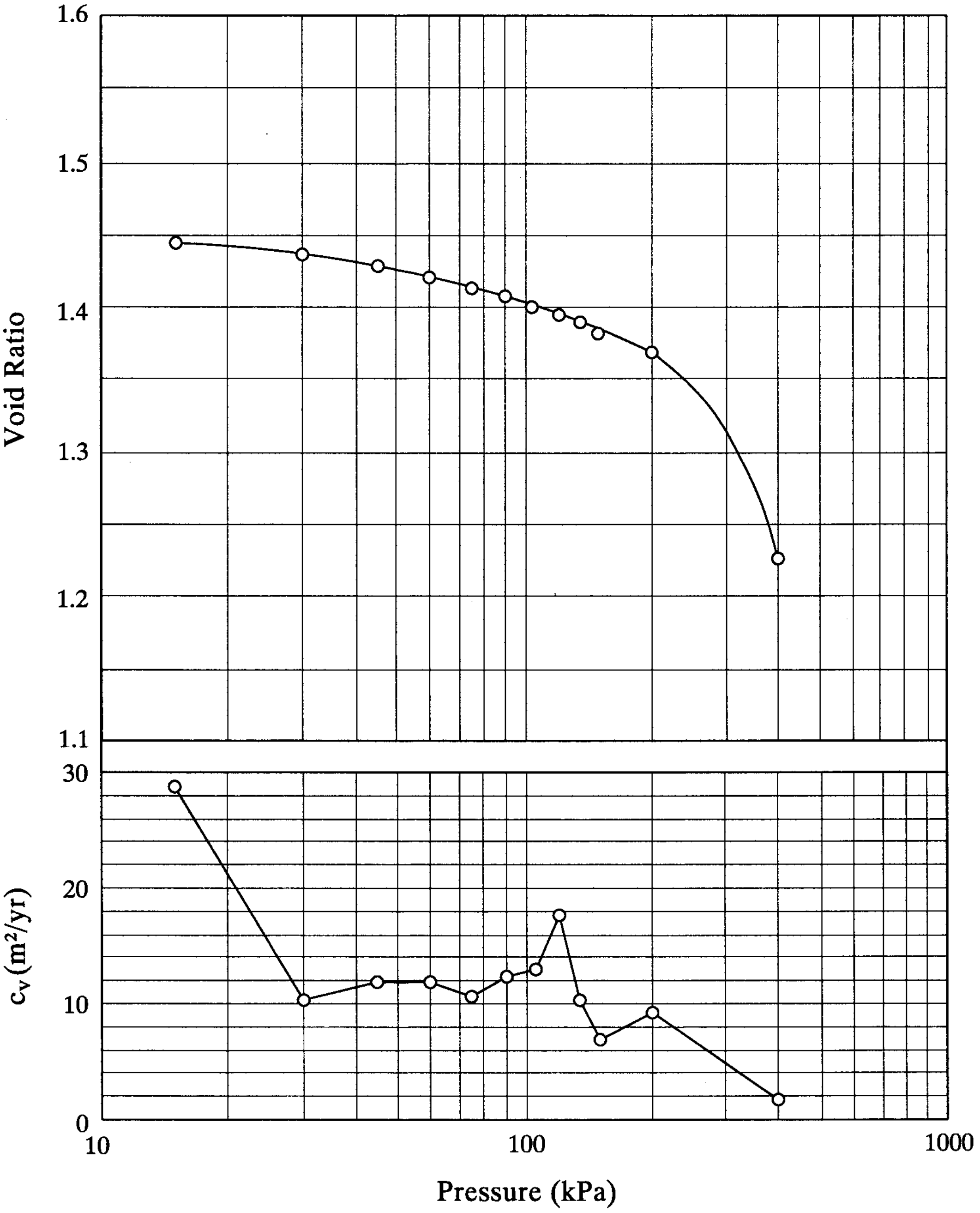
Initial dry density 1.21 Mg/m³

Initial saturation 99.9 %

Specific gravity 2.65 Measured

Initial void ratio 1.187

Figure B4 - Void Ratio - Effective Vertical Stress Relationship for Sample from Borehole 532B25



Description Dark grey SILT/CLAY

Initial bulk density 1.67 Mg/m³

Initial moisture content 55 %

Initial dry density 1.08 Mg/m³

Specific gravity 2.66 Measured

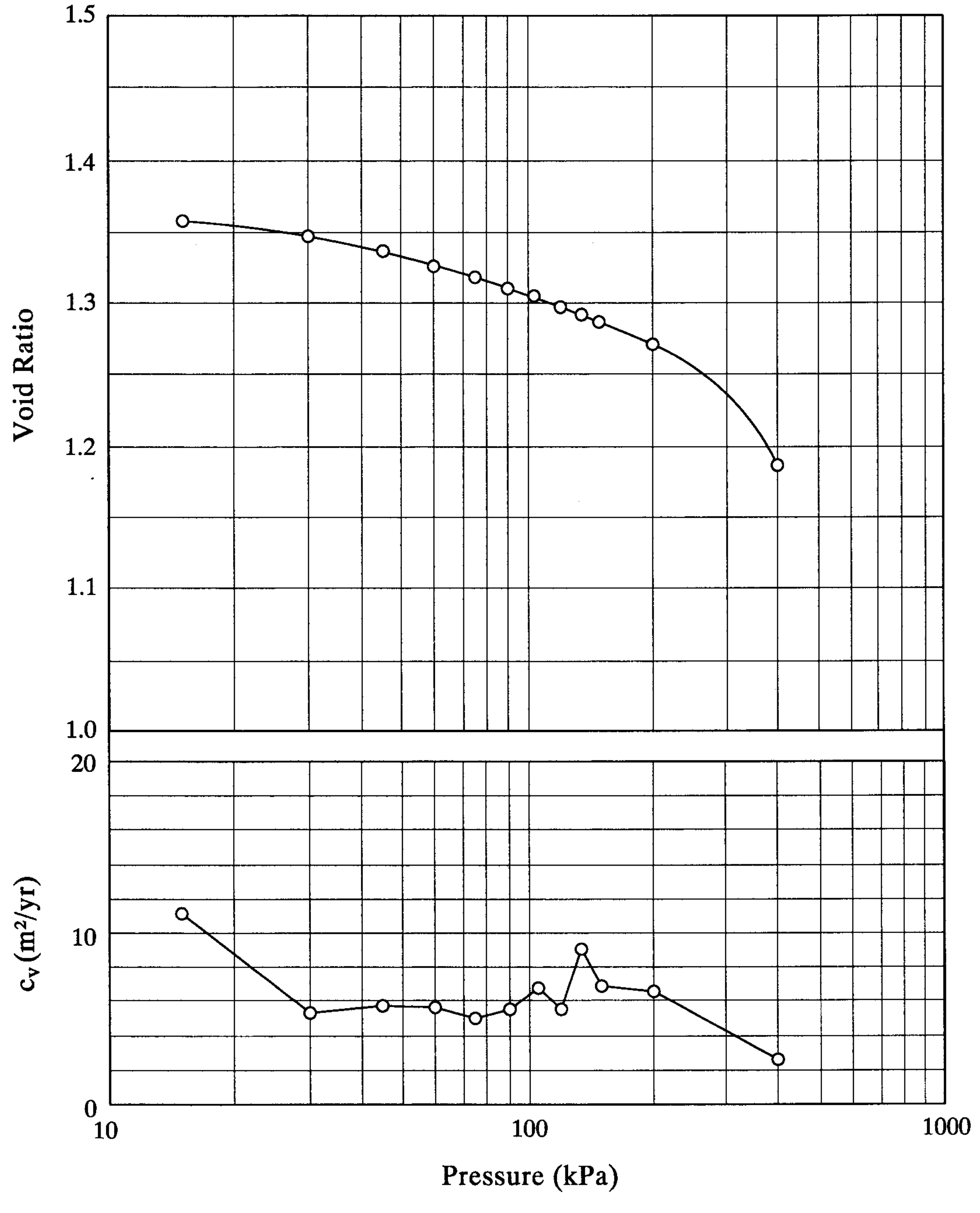
Borehole no. 532B32

Depth 24.25 - 24.38 m

Initial saturation 99.9 %

Initial void ratio 1.457

Figure B5 - Void Ratio - Effective Vertical Stress Relationship for Sample from Borehole 532B32 (with Depth 24.25 - 24.38 m)



Description Dark grey SILT/CLAY

Initial bulk density 1.69 Mg/m³

Borehole no. 532B32

Initial moisture content 52 %

Depth 28.25 - 28.38 m

Initial dry density 1.11 Mg/m³

Initial saturation 99.9 %

Specific gravity 2.64 Measured

Initial void ratio 1.371

Figure B6 - Void Ratio - Effective Vertical Stress Relationship for Sample from Borehole 532B32 (with Depth 28.25 - 28.38 m)

APPENDIX C

TIME - SETTLEMENT READINGS

Borehole No. : 519B08
Sample No. : 24

Depth (m) : 34.22 - 34.32
Pressure Increment (kPa) : 200 - 450

Initial Void Ratio, e_o = 0.565
Height, H_o (mm) = 19.000
Solid Height, H_s (mm) = 12.137
Initial Dial Gauge Reading (mm) = 11.779

Dial Gauge Reading (mm)	Time (minutes)
10.920	0.10
10.904	0.20
10.892	0.30
10.882	0.40
10.873	0.50
10.865	0.60
10.858	0.70
10.852	0.80
10.845	0.90
10.839	1.00
10.826	1.25
10.813	1.50
10.802	1.77
10.792	2.02
10.782	2.28
10.773	2.53
10.764	2.80
10.756	3.05
10.749	3.30
10.741	3.57
10.734	3.82
10.727	4.08
10.721	4.33
10.714	4.60
10.708	4.85
10.703	5.10
10.670	6.82
10.665	7.08
10.649	8.13
10.635	9.17
10.623	10.22
10.612	11.23
10.605	12.00
10.597	13.02
10.590	14.03
10.583	15.03
10.573	16.97
10.569	18.03
10.560	20.13
10.551	23.43

Dial Gauge Reading (mm)	Time (minutes)
10.549	24.25
10.545	26.10
10.538	29.42
10.537	30.23
10.525	40.63
10.518	50.25
10.512	60.03
10.508	70.20
10.505	80.20
10.502	90.08
10.495	120.2
10.490	150.0
10.487	180.1
10.484	210.1
10.481	240.2
10.477	300.0
10.474	360.0
10.471	420.1
10.469	480.1
10.468	540.2
10.466	600.2
10.465	660.2
10.464	720.0
10.462	840.0
10.460	960.1
10.459	1080
10.458	1200
10.457	1320
10.456	1441
10.452	1766
10.450	2886
10.440	5751
10.437	6241
10.436	7191
10.435	7676
10.435	8631
10.434	9121
10.434	10071
10.431	10561
10.431	11519

Borehole No. : 519B08

Sample No. : 24

Depth (m) : 34.22 - 34.32

Pressure Increment (kPa) : 200 - 450

Initial Void Ratio, e_o = 0.565

Height, H_o (mm) = 19.000

Solid Height, H_s (mm) = 12.137

Initial Dial Gauge Reading (mm) = 11.779

Dial Gauge Reading (mm)	Time (minutes)
10.430	11511
10.429	13441
10.428	15831
10.427	16311
10.426	17271
10.425	17751
10.425	18711
10.424	19196
10.424	20151
10.424	20641
10.424	21636
10.422	21583
10.422	23411
10.422	25901
10.422	26406
10.421	31701
10.419	32166
10.419	35986
10.419	36471
10.418	37431
10.418	37921
10.418	38871
10.418	38871
10.418	40326
10.417	41751
10.417	43681
10.416	46071
10.415	46071
10.415	47511
10.415	48971
10.414	50391
10.414	51831
10.412	56151
10.412	57591
10.412	59031
10.412	60486
10.412	61911
10.412	63351
10.411	66231
10.411	67671

Dial Gauge Reading (mm)	Time (minutes)
10.411	69126
10.411	71991
10.410	77751
10.410	79191
10.409	80646
10.409	82106
10.409	83511
10.408	86391
10.408	87831
10.408	89271
10.408	90711
10.407	92151
10.407	96471
10.406	97926
10.406	100791
10.406	103671
10.406	106551
10.406	107991
10.405	109431
10.405	110871
10.405	112311
10.404	116631
10.404	120951
10.404	122391
10.404	126711
10.404	128151
10.404	129591
10.403	131031
10.402	138231
10.402	141111
10.401	142551
10.401	146871
10.400	149766
10.400	152631
10.400	154086
10.399	156966
10.399	158391
10.399	159831
10.399	162711
10.399	167046

Borehole No. : 519B08
Sample No. : 24

Depth (m) : 34.22 - 34.32
Pressure Increment (kPa) : 200 - 450

Initial Void Ratio, e_o = 0.565
Height, H_o (mm) = 19.000
Solid Height, H_s (mm) = 12.137
Initial Dial Gauge Reading (mm) = 11.779

Dial Gauge Reading (mm)	Time (minutes)
10.398	169911
10.398	171366
10.398	172926
10.398	174666
10.397	177126
10.397	178566
10.397	179991
10.397	181806
10.397	187191
10.396	188631
10.396	192006
10.396	192966
10.396	199166
10.396	200291
10.395	201636
10.395	207396
10.395	211716
10.394	213126
10.394	215016
10.394	217491
10.394	219336
10.394	221766
10.394	223206
10.394	229566
10.393	232026
10.393	236346
10.393	240486
10.392	245336
10.392	247986
10.392	252036
10.392	257766
10.392	267876
10.392	273606
10.392	279366
10.391	292326
10.391	301076
10.391	309606
10.390	332916
10.390	341661
10.390	349926
10.390	364326
10.390	388840
10.389	394566
10.388	449326
10.387	519886
10.387	525676
10.387	525786
10.387	529926
10.385	535693
10.382	560226
10.382	570561
10.382	603436
10.381	615046
10.381	652326
10.381	662596
10.380	696986
10.380	702876
10.379	723256
10.379	752586
10.377	792906

Borehole No. : 520ME214
Sample No. : 6

Depth (m) : 26.75 - 26.88
Pressure Increment (kPa) : 200 - 400

Initial Void Ratio, e_o = 1.491
Height, H_o (mm) = 19.54
Solid Height, H_s (mm) = 7.843
Initial Dial Gauge Reading (mm) = 10.556

Dial Gauge Reading (mm)	Time (minutes)
7.984	0.00
7.944	0.10
7.920	0.20
7.900	0.30
7.884	0.40
7.870	0.50
7.857	0.60
7.845	0.70
7.834	0.80
7.823	0.90
7.813	1.00
7.790	1.25
7.770	1.50
7.750	1.77
7.733	2.02
7.716	2.28
7.700	2.53
7.685	2.80
7.671	3.05
7.658	3.30
7.645	3.57
7.632	3.82
7.620	4.08
7.609	4.33
7.598	4.60
7.587	4.85
7.577	5.10
7.540	6.12
7.507	7.12
7.478	8.13
7.452	9.13
7.428	10.15
7.406	11.15
7.387	12.15

Dial Gauge Reading (mm)	Time (minutes)
7.369	13.17
7.352	14.17
7.338	15.18
7.324	16.18
7.300	18.18
7.279	20.20
7.262	22.22
7.246	24.22
7.233	26.22
7.221	28.23
7.212	30.00
7.174	40.00
7.149	50.00
7.131	60.08
7.118	70.10
7.109	80.10
7.099	90.10
7.080	120.1
7.066	150.1
7.056	180.1
7.047	210.1
7.040	240.1
7.030	300.1
7.022	360.1
7.015	420.0
7.009	480.0
7.004	540.0
7.001	600.0
6.997	660.2
6.994	720.2
6.989	840.2
6.985	960.2
6.981	1080
6.977	1200

Borehole No. : 520ME214
Sample No. : 6

Depth (m) : 26.75 - 26.88
Pressure Increment (kPa) : 200 - 400

Initial Void Ratio, e_o = 1.491
Height, H_o (mm) = 19.54
Solid Height, H_s (mm) = 7.843
Initial Dial Gauge Reading (mm) = 10.556

Dial Gauge Reading (mm)	Time (minutes)
6.974	1320
6.971	1440
6.971	1442
6.959	1876
6.946	2876
6.940	3314
6.932	4342
6.929	4775
6.904	10078
6.902	10519
6.901	11515
6.899	11963
6.894	14393
6.890	15883
6.888	16003
6.886	18713
6.883	20153
6.881	21593
6.879	23033
6.877	24473
6.873	28793
6.871	30233
6.871	30233
6.871	31673
6.870	33113
6.870	34553
6.869	35993
6.868	38873
6.867	40313
6.866	41753
6.866	43193
6.865	44633
6.864	46073

Dial Gauge Reading (mm)	Time (minutes)
6.863	48953
6.862	50393
6.861	51833
6.860	53273
6.859	54713
6.858	56153
6.857	59033
6.856	61913
6.854	64793
6.853	69113
6.851	71993
6.851	74873
6.849	79193
6.848	84953
6.846	89273
6.844	99353
6.841	110873
6.840	119513
6.836	135353
6.836	139673
6.832	149753
6.830	159833
6.826	169913
6.824	182873
6.822	200153
6.818	216143
6.814	240473
6.812	250561
6.809	267953
6.806	295508
6.804	332703
6.802	342873

Borehole No. : 520ME211

Sample No. : 4

Depth (m) : 24.03 - 24.28

Pressure Increment (kPa) : 200 - 400

Initial Void Ratio, e_o = 0.942

Height, H_o (mm) = 19.33

Solid Height, H_s (mm) = 9.954

Initial Dial Gauge Reading (mm) = 10.341

Dial Gauge Reading (mm)	Time (minutes)
8.139	0.00
8.058	0.10
8.032	0.20
8.011	0.30
7.995	0.40
7.981	0.50
7.968	0.60
7.957	0.70
7.946	0.80
7.937	0.90
7.927	1.00
7.906	1.25
7.886	1.50
7.868	1.77
7.852	2.02
7.837	2.28
7.824	2.53
7.811	2.80
7.800	3.05
7.789	3.30
7.778	3.57
7.769	3.82
7.760	4.08
7.751	4.33
7.743	4.60
7.736	4.85
7.729	5.10
7.705	6.12
7.686	7.12
7.668	8.25
7.658	9.02
7.643	10.42
7.635	11.20
7.627	12.23
7.621	13.03
7.615	14.07
7.609	15.08
7.604	16.10
7.591	19.27
7.588	20.07
7.581	22.18
7.576	24.05
7.571	26.13
7.567	28.18
7.563	30.22
7.549	40.08
7.538	50.12
7.530	60.13
7.524	70.15
7.517	80.17
7.513	90.18
7.502	120.2
7.494	150.2
7.487	180.2
7.482	210.0
7.476	240.0
7.470	300.0
7.465	360.0
7.460	420.0
7.456	480.0
7.453	540.0
7.452	600.0
7.450	660.0
7.448	720.0
7.445	840.2
7.442	960.2
7.439	1080
7.437	1200

Borehole No. : 520ME211

Sample No. : 4

Depth (m) : 24.03 - 24.28

Pressure Increment (kPa) : 200 - 400

Initial Void Ratio, e_o = 0.942

Height, H_o (mm) = 19.33

Solid Height, H_s (mm) = 9.954

Initial Dial Gauge Reading (mm) = 10.341

Dial Gauge Reading (mm)	Time (minutes)
7.434	1320
7.430	1440
7.429	1479
7.429	1479
7.422	1866
7.413	2856
7.408	3299
7.403	4299
7.399	4736
7.396	5764
7.395	6195
7.382	11500
7.380	11941
7.380	12937
7.378	13385
7.377	14379
7.375	15814
7.372	17304
7.372	17434
7.371	20134
7.367	21574
7.367	23014
7.365	24454
7.364	25894
7.364	30214
7.360	31654
7.360	31654
7.358	33094
7.356	34534
7.356	35974
7.355	37414
7.353	40294
7.352	41734
7.352	43174
7.351	44614
7.350	46054
7.350	47494
7.350	50374
7.349	51814
7.348	53254
7.348	54694
7.348	56134
7.347	57574
7.346	60454
7.345	63334
7.345	66214
7.343	70534
7.341	73414
7.341	76294
7.339	80614
7.338	86374
7.337	90694
7.336	100774
7.334	112294
7.332	120934
7.329	136774
7.329	141094
7.328	151174
7.325	161254
7.323	171334
7.319	184294
7.318	201574

Borehole No. : 532B32
Sample No. : 6

Depth (m) : 24.25 - 24.38
Pressure Increment (kPa) : 200 - 400

Initial Void Ratio, e_o = 1.457
Height, H_o (mm) = 19.39
Solid Height, H_s (mm) = 7.892
Initial Dial Gauge Reading (mm) = 11.693

Dial Gauge Reading (mm)	Time (minutes)
10.921	0.00
10.841	0.10
10.810	0.20
10.786	0.30
10.766	0.40
10.748	0.50
10.733	0.60
10.717	0.70
10.703	0.80
10.690	0.90
10.678	1.00
10.647	1.27
10.620	1.53
10.596	1.78
10.574	2.03
10.554	2.30
10.533	2.57
10.515	2.82
10.497	3.07
10.481	3.33
10.465	3.60
10.450	3.85
10.435	4.10
10.422	4.37
10.408	4.63
10.395	4.88
10.383	5.13
10.338	6.15
10.298	7.15
10.262	8.17
10.230	9.17
10.200	10.18
10.172	11.18
10.147	12.18
10.123	13.20

Dial Gauge Reading (mm)	Time (minutes)
10.101	14.20
10.081	15.22
10.061	16.22
10.026	18.23
9.999	20.00
9.971	22.00
9.945	24.00
9.922	26.00
9.901	28.02
9.881	30.02
9.806	40.03
9.753	50.03
9.714	60.05
9.683	70.05
9.658	80.07
9.636	90.07
9.590	120.1
9.557	150.1
9.532	180.1
9.511	210.1
9.494	240.1
9.468	300.1
9.448	360.1
9.431	420.0
9.417	480.2
9.406	540.2
9.397	600.2
9.389	660.2
9.382	720.1
9.370	840.1
9.360	960.1
9.351	1080
9.342	1200
9.334	1320
9.324	1440

Borehole No. : 532B32
Sample No. : 6

Depth (m) : 24.25 - 24.38
Pressure Increment (kPa) : 200 - 400

Initial Void Ratio, e_o = 1.457
Height, H_o (mm) = 19.39
Solid Height, H_s (mm) = 7.892
Initial Dial Gauge Reading (mm) = 11.693

Dial Gauge Reading (mm)	Time (minutes)
9.320	1491
9.320	1491
9.300	1875
9.267	2865
9.252	3308
9.232	4308
9.224	4745
9.210	5772
9.205	6207
9.164	11509
9.159	11949
9.156	12945
9.148	14387
9.143	15822
9.135	17312
9.135	17442
9.126	20142
9.121	21582
9.117	23022
9.113	24462
9.109	25902
9.100	30222
9.096	31662
9.093	33102
9.090	34542
9.088	35982
9.086	37422
9.082	40302
9.080	41742
9.079	43182
9.077	44622
9.076	46062
9.073	47502

Dial Gauge Reading (mm)	Time (minutes)
9.071	50382
9.069	51822
9.067	53262
9.065	54702
9.063	56142
9.061	57582
9.058	60462
9.055	63342
9.052	66222
9.050	70542
9.047	73422
9.045	76302
9.043	80622
9.040	84942
9.036	86382
9.031	100782
9.027	112302
9.024	120942
9.015	136782
9.015	141102
9.009	151182
9.005	161262
8.999	171342
8.995	184302
8.989	201582
8.983	217572
8.976	241902
8.974	251992
8.968	269382
8.960	296937
8.954	334132
8.950	344302

Borehole No. : 532B32
Sample No. : 10

Depth (m) : 28.25-28.35
Pressure Increment (kPa) : 200 - 400

Initial Void Ratio, e_o = 1.371
Initial Height, H_o (mm) = 19.6
Solid Height, H_s (mm) = 8.266
Initial Dial Gauge Reading (mm) = 10.14

Dial gauge Reading (mm)	Time (minutes)
9.252	0.00
9.188	0.10
9.164	0.20
9.145	0.30
9.129	0.40
9.115	0.50
9.103	0.60
9.092	0.70
9.081	0.80
9.071	0.90
9.061	1.00
9.039	1.25
9.018	1.52
9.000	1.78
8.984	2.03
8.968	2.30
8.954	2.57
8.941	2.82
8.929	3.08
8.917	3.35
8.906	3.60
8.895	3.87
8.885	4.13
8.876	4.38
8.867	4.65
8.858	4.90
8.850	5.18
8.821	6.18
8.795	7.20
8.773	8.22
8.737	10.12
8.732	10.40
8.720	11.20
8.705	12.23
8.694	13.02

Dial gauge Reading (mm)	Time (minutes)
8.680	14.07
8.667	15.20
8.656	16.22
8.638	18.02
8.620	20.05
8.604	22.10
8.590	24.12
8.577	26.13
8.566	28.15
8.555	30.15
8.509	40.22
8.474	50.23
8.447	60.00
8.424	70.02
8.407	80.03
8.390	90.05
8.353	120.1
8.327	150.1
8.305	180.1
8.284	210.1
8.267	240.1
8.241	300.1
8.222	360.1
8.204	420.2
8.190	480.1
8.177	540.1
8.168	600.1
8.159	660.1
8.152	720.1
8.139	840.1
8.128	960.1
8.118	1080
8.109	1200
8.100	1320
8.091	1440

Borehole No. : 532B32
Sample No. : 10

Depth (m) : 28.25-28.35
Pressure Increment (kPa) : 200 - 400

Initial Void Ratio, e_o = 1.371
Initial Height, H_o (mm) = 19.6
Solid Height, H_s (mm) = 8.266
Initial Dial Gauge Reading (mm) = 10.14

Dial gauge Reading (mm)	Time (minutes)
8.089	1468
8.063	1855
8.028	2846
8.013	3289
7.992	4289
7.983	4727
7.969	5754
7.963	6190
7.919	11490
7.914	11931
7.911	12927
7.909	13375
7.898	15805
7.904	17295
7.904	17425
7.882	20125
7.877	21565
7.873	23005
7.869	24445
7.866	25885
7.858	30205
7.855	31645
7.845	31661
7.837	33085
7.833	34525
7.831	35965
7.829	37405
7.825	40285
7.824	41725
7.822	43165
7.821	44605
7.820	46045
7.818	47485
7.816	50365
7.814	51805
7.813	53245
7.811	54685
7.809	56125
7.808	57565
7.805	60445
7.802	63325
7.800	66205
7.797	70525
7.794	73405
7.792	76285
7.789	80605
7.787	86365
7.784	90685
7.779	100765
7.775	112285
7.772	120925
7.763	136765
7.762	141085
7.756	151165
7.752	161245
7.746	171325
7.741	184285
7.737	201565
7.731	217555
7.723	241885
7.720	251974
7.713	269365
7.708	296920
7.701	334115
7.699	344285