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LAPORAN PENYELIDIKAN TANAH

U N T U K

PROYEK APARTEMEN GATOT SUBROTO (T TOWER)

PANCORAN - JL. GATOT SUBROTO

JAKARTA SELATAN

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FEBRUARI 2013

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LAPORAN PENYELIDIKAN TANAH
UNTUK PROYEK APARTEMEN GATOT SUBROTO (T TOWER)
PANCORAN - JL. GATOT SUBROTO, JAKARTA SELATAN

PEBRUARI 2013

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Appendix A Cross Sections of Boreholes
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LAPORAN PENYELIDIKAN TANAH
UNTUK PROYEK APARTEMEN GATOT SUBROTO (T TOWER)
PANCORAN - JL. GATOT SUBROTO, JAKARTA SELATAN

I. PENDAHULUAN

P.T. SADINI ARIANDA telah menugaskan **P.T. SOFOCO** untuk melaksanakan suatu penyelidikan tanah di lahan yang terletak di jalan Gatot Subroto, Kelurahan Pancoran, Jakarta Selatan.

Tujuan dari penyelidikan tanah tersebut adalah untuk mendapatkan informasi lapisan tanah sampai kedalaman 80 m untuk dapat menentukan jenis pondasi yang paling memadai untuk mendukung gedung menara 29 lantai dan dilengkapi dengan 3 lantai besemen.

Lingkup kerja

Pekerjaan lapangan di lokasi ini dilaksanakan dengan lingkup kerja sebagai berikut:

a. Pemboran di 6 titik Bor dengan kedalaman 80m (BH1 dan BH2)), dan bor dengan kedalaman 50m (BH3, BH4, BH5 dan BH6).
b. Uji SPT pada tiap interval kedalaman 1.5m di semua titik bor
c. Pengambilan undisturbed sample
d. Downhole Seismic Test di 2 titik
e. Uji Sondir 2.5 Ton di 6 titik
f. Pengujian Laboratorium terhadap semua tanah undisturbed yang diambil
g. Analisa tanah dan Rekomendasi Pondasi
h. Site Specific Response Spectra Analysis

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Laporan ini memberikan hasil dari pekerjaan lapangan dan laboratorium serta analisa kami mengenai lapisan tanah dan pondasi, disamping downhole seismic, dan analisa seismik serta pumping test untuk penentuan sifat geo-hidrologi tanah yang digunakan untuk dewatering pada waktu penggalian tanah untuk besemen.

Laporan untuk analisa Site Specific Response Spectra akan dimuat dalam laporan terpisah.

II. PEKERJAAN PENYELIDIKAN TANAH

Pekerjaan dilapangan dilaksanakan berupa pemboran di 6 titik dan sondir di 9 titik seperti dapat dilihat pada Gambar 1. –Appendix A

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- **Pekerjaan Pemboran**

Pemboran dilakukan dengan dua bor mesin rotary yang menggunakan pembilasan air/ lumpur untuk mengeluarkan hasil pemboran keluar dari lubang bor.

Diameter lubang bor adalah 100 mm dan pada setiap interval kedalaman 1.5 m dilakukan test SPT (Standard Penetration Test). Pada setiap interval kedalaman 3 m dilapisan tanah lempung lunak sampai sedang diambil contoh tanah tidak terganggu (undisturbed sampling) dengan tabung thin wall sampler.

Hasil pemboran di enam titik bor disajikan dalam bentuk profil bor yang meng-klasifikasi setiap lapisan tanah yang dijumpai sampai kedalaman maksimum 50m dan 80m, berikut konsistensinya dalam nilai N-SPT, seperti dapat dilihat dalam profil bor dalam lampiran laporan ini.

Stratifikasi Tanah

Dari profil bor,dan profil konsistensi lapisan tanah hingga kedalaman 50 dan 80m dilahan ini dapat di-klasifikasi dalam 3 strata tanah spesifik, yang masing-masing terbagi dalam beberapa sub-lapisan yang berbeda. Gambaran yang lebih jelas mengenai konsistensi tanah dilokasi ini disampaikan dalam bentuk konsisensi tanah berupa grafik antara nilai SPT dan kedalaman tanah seperti dapat dilihat dalam Gambar 2 dibawah ini:

Stratum 1 - Lapisan ke 1 : Tanah endapan resen (Recent Alluvial Sediments)

Terdiri dari Lempung berlanau - tufa (Volcanic Tuff) yang ber- konsistensi dari sedang (medium stiff sampai padat (Stiff) dan dengan nilai N_{SPT} = 4 ~ 16 dan terdapat sampai kedalaman: 6 ~ 8 m Muka air tanah hidrostatik terdapat mulai kedalaman antara 8.3 sampai 9.5 m dari permukaan tanah.

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Stratum 2 : Endapan sungai Lama (Intermediate River Alluvium)

Terdiri dari empat sublapisan yaitu:

Lapisan ke- 2

Terdiri dari sisipan endapan pasir berlanau yang sebagian tersementasi dan mempunyai konsistensi padat hingga sangat padat (Very Dense), dengan nilai N_{SPT} = 28 ~>60

Tebal dari sublapisan pasir ini adalah 3 sampai 6m. Lapisan ini merupakan akifer air karena air tanah hidrostatis berada didalam lapisan ini yaitu pada kedalaman antara 8.5 sampai 9.5m dari muka tanah.

Lapisan-3

Sublapisan dari endapan aluvial berupa Lanau berlempung dan sebagian ter-sementasi hingga mempunyai konsistensi sangat padat sampai keras (very stiff to very hard) dan dengan Nilai N_{SPT}= 33 ~ >60. Tebal lapisan ini adalah 8m (BH5) sampai 16m (BH.6), dan merupakan lapisan tanah yang kompeten untuk mendukung beban berat dari bangunan bertingkat banyak.

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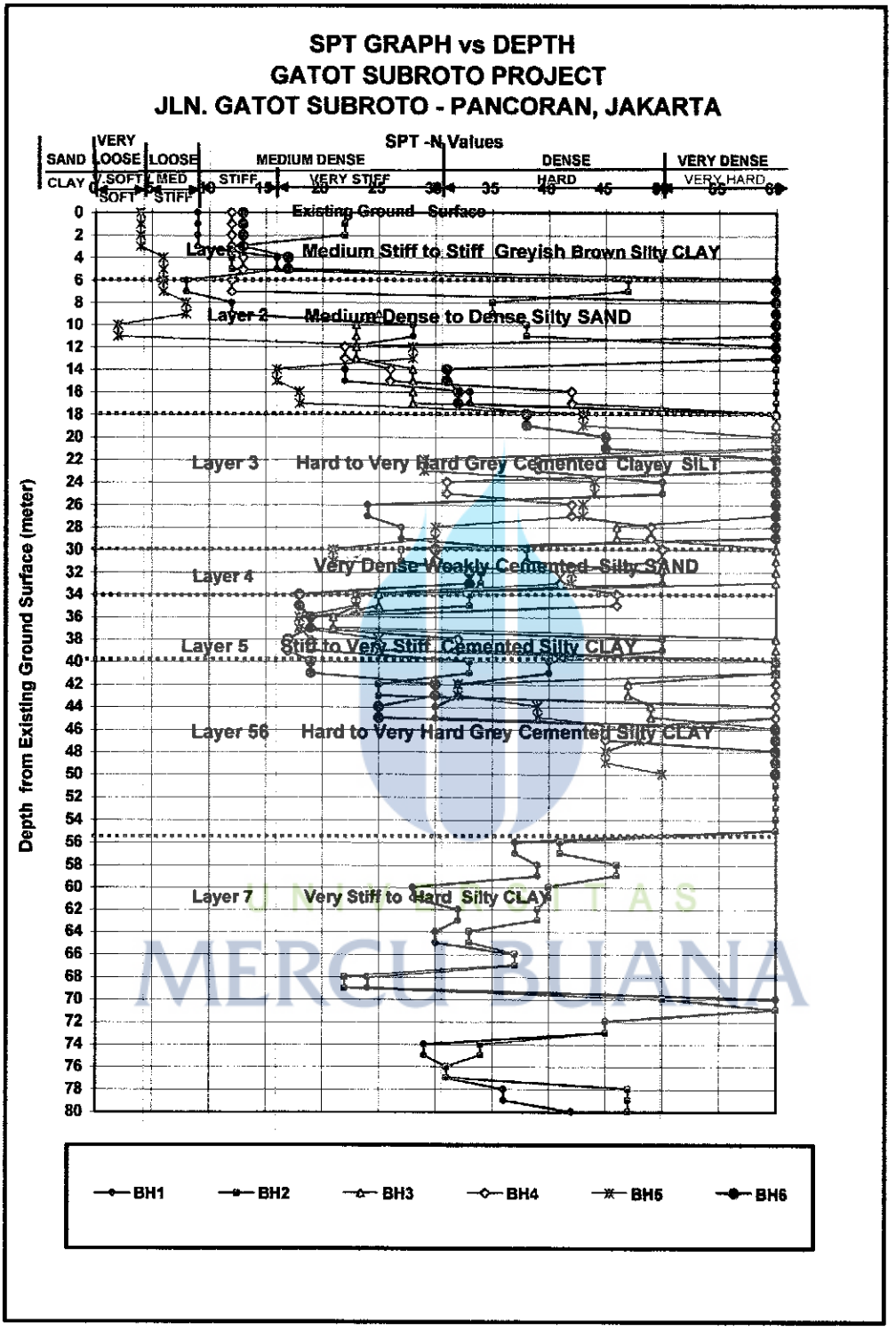

Gambar 2. Grafik antara nilai N-SPT dan kedalaman Bor

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Lapisan-4

Sublapisan Pasir berlanau yang mempunyai tebal 3 sampai 6m dan berkonsistensi padat sampai sangat padat. (dense to very dense) dengan N-SPT = 22 sampai 45.

Lapisan -5

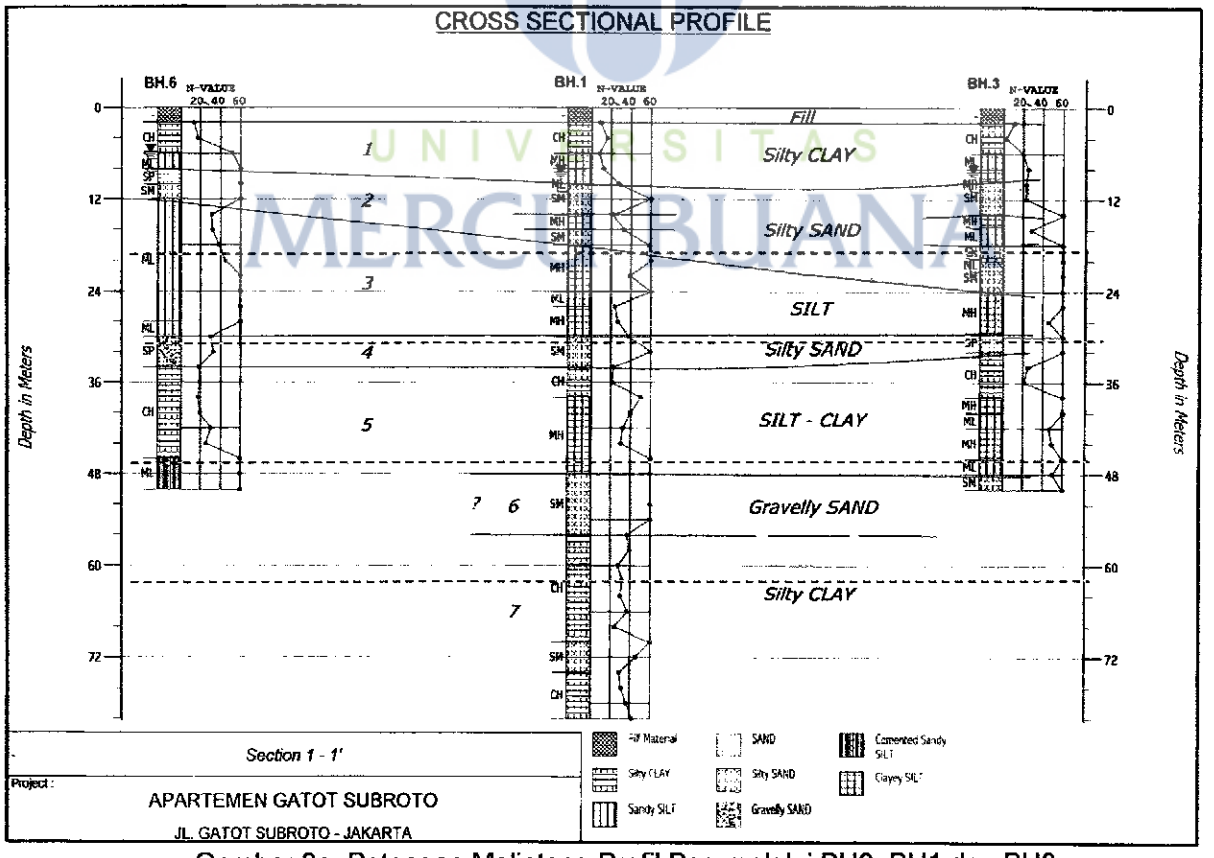
Sublapisan Lempung berlanau berkonsistensi padat sampai sangat padat (Stiff to very stiff), dan dengan nilai N-SPT = 16 ~ 30. Lapisan tanah ini diperkirakan masih dapat berdeformasi apabila mendapat beban tambahan baru dari bangunan.

Stratum 3 : Endapan Sungai Lama (Old River Alluvium) dan terdiri dari sublapisan :

Lapisan 6 Lapisan Pasir berkerikil dan lanau tersementasi. Tebal pasir berkerikil bervariasi dari 2m sampai 10m. dan selebihnya terdiri dari lapisan lanau tersementasi yang sangat keras.

Lapisan 7 (Sampai 80m) tanah lempung berlanau berkonsistensi padat sampai sangat padat dan dengan nilai SPT= 25 – 45. diperkirakan lapisan tanah ini telah terkonsolidasi lebih.

Dari gambar potongan melintang melalui titik-titik bor seperti pada Gambar 3a sampai 3c, dapat dilihat bahwa lapisan tanah yang memadai untuk menjadi lapisan pendukung beban bangunan yang kompeten (competent bearing layer) untuk gaya ujung tiang (end bearing pile) adalah lapisan 2 yang terdapat pada kedalamn 20m sampai 30m dari permukaan tanah (tebal = 10m), dan lapisan 6 yang terdapat pada kedalaman 42m sampai 62m(tebal =20m).



Gambar 3a. Potongan Melintang Profil Bor melalui BH6, BH1 dan BH3

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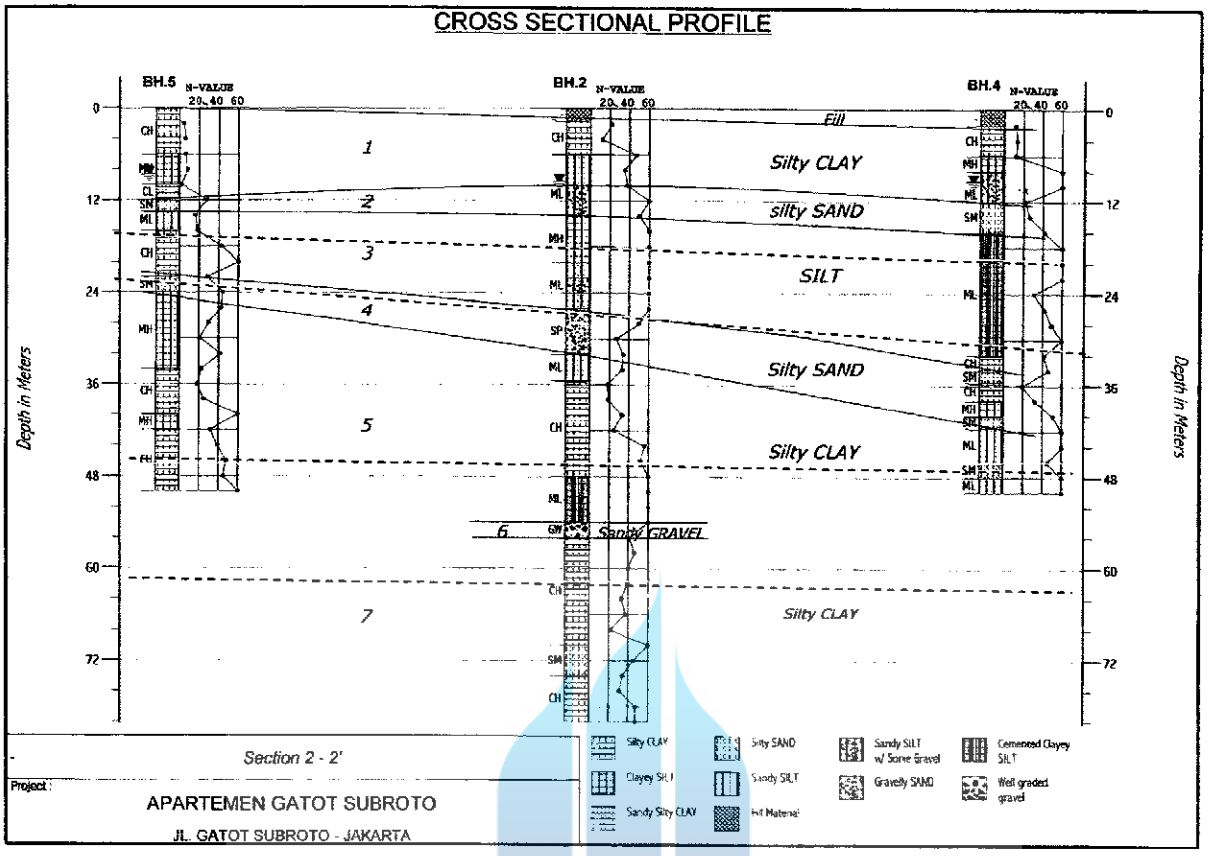

Gambar 3b. Potongan Melintang Profil Bor melalui BH5, BH2 dan BH4

- **Sondir**

Uji sondir dilaksanakan dengan alat sondir tipe Gouda dan berkapasitas tekanan maksimum 2.5Ton, dan menggunakan konus tipe Begemann .

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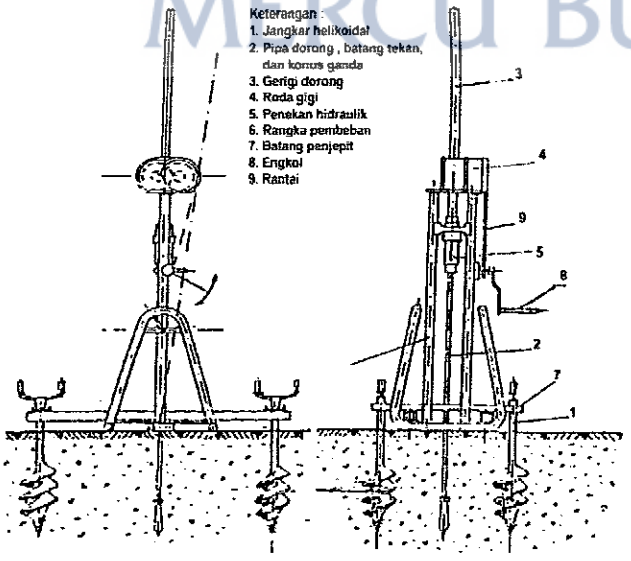

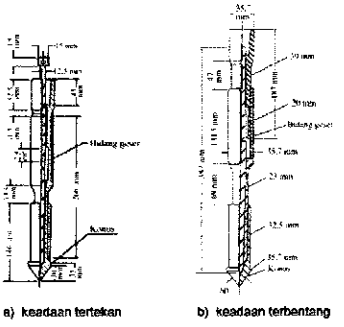

Gambar4a. Alat Sondir 2.5 -Ton

Gambar 4b. Double Cone (Tipe Begemann)

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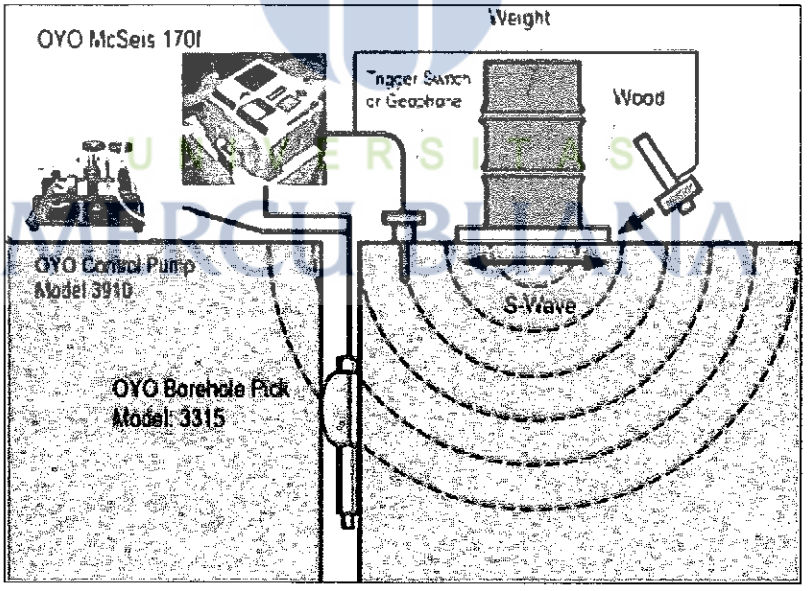
Tahanan yang dialami konus pada waktu ditekan melalui lapisan tanah dikenal sebagai tahanan konus sondir (q_c) Bacaan dilakukan pada tiap interval kedalaman 20cm hingga tahanan konus mencapai maksimum 250 kg/cm2, yaitu batas maksimum tekanan sondir, atau dimana dianggap mencapai tahanan maksimum penetrasi tiang pancang,

Hasil dari sondir dipresentasikan dalam bentuk grafik yaitu antara tahanan konus, (qc), tahanan local (fs) dan ratio gesekan (friction ratio) seperti dapat dilihat dalam lampiran Laporan ini .

Dari grafik profil sondir dapat dilihat bhawa lapisn tanah dengan tahanankonus qc < 20kg/cm2 da termasuk tanah lunak-sedang, mempunyai ketebalan dari 2 ~6m. dan selanjutnya tahanan konus naik secara gradual hingga mencapai tekanan maksimum 250 kg/cm2 pada kedalaman antara 5m sampai 12m.

- **Uji Downhole Seismik**

Uji Downhole seismic dilakukan dengan borehole pick yang terdiri dari tiga komponen geophone. Yang berarah x, y dan z. Geophone terbungkus didalam selubung karet atau yang dikenal sebagai Borehole Pick, dan dimasukkan ke dalam lubang bor yang telah disiapkan. Di permukaan tanah pada jarak 1- 2 meter dari lubang bor dilakukan pukulan (impact). Gelombang seismik merambat ke kedalaman dan signal ini akan direspons oleh geophone-geophone pada lubang bor yang diteruskan ke seismograph untuk direkam.



Gambar 5
Gambar skematik Uji Downhole Seismic

Peralatan yang digunakan adalah seismograph OyO MCSeis 170f (24 channel)..

Pengukuran gelombang dilakukan dua kali. Gelombang yang pertama kali datang pada geophone adalah P Wave baru kemudian disusul oleh S Wave.. Agar supaya kemunculan S Wave lebih jelas, maka dalam pengamatan kedatangan S Wave, pemukulan yang

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menerbitkan impact getaran dilakukan dalam arah horizontal, sedang untuk P wave pemukulan impact dilakukan vertikal ke tanah.

Hasil yang didapat dari pengukuran gelombang P dan S adalah seperti dirangkum dalam tabel 1a dan 1b dibawah ini.

Tabel 1a. Kecepatan Rambat P Wave dan S Wave BH-1

P WAVE					S WAVE				
Lap. ke	Kedalaman (m)		Tebal (m)	Vp (m/s)	Lap. Ke	Kedalaman (m)		Tebal (m)	Vs (m/s)
1	0.0	1.0	1.0	381.0	1	0.0	1.0	1.0	147.1
2	1.0	5.0	4.0	1097.0	2	1.0	8.0	7.0	162.7
3	5.0	10.0	5.0	1904.1	3	8.0	14.0	6.0	287.9
					4	14.0	30.0	16.0	317.9
								Vs RATA-RATA	***248.0***

Tabel 1b. Kecepatan Rambat P Wave dan S Wave BH-2

P WAVE					S WAVE				
Lap. ke	Kedalaman (m)		Tebal (m)	Vp (m/s)	Lap. Ke	Kedalaman (m)		Tebal (m)	Vs (m/s)
1	0.0	1.0	1.0	376.5	1	0.0	1.0	1.0	112.5
2	1.0	9.0	8.0	1055.9	2	1.0	6.0	5.0	154.6
3	9.0	30.0	21.0	1930.6	3	6.0	12.0	6.0	293.3
					4	12.0	30.0	18.0	346.7
								Vs RATA-RATA	***264.1***

Menurut SNI 1726-2002 klasifikasi tanah diperlukan unuk besar asselerasi yang dianggap berlaku untuk tiap zona kegempaan dan penentuan response gempa rencana untuk analisa dinamik struktur bangunan.

Dari hasil pengukuran kecepatan rambat gelombang geser Vs berdasarkan uji Seismik Downhole Test hingga kedalaman 30m seperti yang dapat dilihat dalam table 1a dan 1b diperoleh nilai rata-rata Vs = 248 m/detik di BH1, dan 264m/detik di titik bor BH2, dan berdasarkan klasifikasi SNI 1726-2002, tanah dilokasi ini dapat klasifikasi sebagai tanah **Sedang**.

Hasil yang didapat seperti diatas, masih harus dikaji lebih lanjut dengan analisa Site Specific Response Spectra, dan yang masih sedang dilakukan dan akan disampaikan dalam laporan terpisah.

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- **Uji Laboratorium**

Contoh tanah asli yang dapat diambil untuk pengujian di laboratorium adalah dalam tanah lempung yang terdapat sampai kedalaman 4~8m. Selebihnya merupakan tanah lanau yang padat dan mempunyai konsistensi relatip besar (N> 15).

Rangkuman dari hasil test dapat dilihat dalam Tabel 1 dibawah ini, sedang hasil detail dapat dilihat dalam Apendix B laporan ini

Tabel 2 . Parameter Tanah untuk lapisan tanah atas (1.0m sampai 6.0m)

Paramater Tanah	**Soft to Medium Stiff Silty Clay (CH) (1 ~ 6m)**
Berat Volume (kN/m^3)	15.8 – 17.3
Kadar Air (%)	32 – 55
Specific Gravity	2.61 – 2.67
Void Ratio	1.03 ~ 1.57
Limit Plastis	32 ~ 49
Limit Cair	60 ~ 82
Index Plastisitas	22 - 30
Undrained Shear Strength (kN/m^2) –cu'	25 ~ 59
Internal Friction (ϕ ')	21 ~ 24

Dari tabel diatas dapat disimpulkan bahwa tanah bagian atas, merupakan tanah lempung sedang yang mempunyai plastisitas dan gaya geser (undrained shear strength) yang relatip tinggi (=abu volkanik).

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III. RENCANA PONDASI

Melihat dari keadaan lapisan tanah dilokasi sebagaimana dapat dilihat dari profil bor BH1 sampai BH6 diketahui bahwa lapisan tanah teratas (=Stratum ke-1) merupakan tanah lempung =(abu volkanik dan dengan daya dukung rata-rata (allowable) = 10 ton/m2, dan kurang memadai sebagai pendukung bangunan dengan beban besar.

Gedung ini direncanakan mempunyai 29 lantai dan 2~3 lantai besemen, dan oleh karena itu pondasi baru dimulai pada kedalaman kurang lebih 10m dari muka tanah. Untuk ini, maka sistim pondasi yang memadai untuk keadaan ini adalah pondasi bor berdiameter besar.

Daya dukung yang diharapkan dari jenis pondasi ini adalah merupakan kombinasi dari daya dukung gesekan selubung tiang dan daya dukung ujung tiang.

Dari profil tanah dilokasi ini (seperti dapat dilihat pada Gambar3) maka terdapat dua lapisan tanah keras yang dapat dijadikan lapisan pendukung yaitu lapisan 3 berupa tanah lanau tersementasi atau lapisan 6 yang merupakan lapisan pasir padat.

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Kedua lapisan pendukung mempunyai konstrain yang membatasi daya dukung tiang.
Untuk lapisan 3, yang mempunyai ketebalan 10m, di landasi oleh tanah lempung (lapisan 5) yang masih dapat bereformasi, sehingga kemungkinan terjadinya penurunan(Settlement) tanah terutama untuk tiang berkelompok masih dapat terjadi. Kendala ke-2 adalah untuk tiag bor sedapat mungkin menghindarkan tiang berhenti di dalam lapisan pasir, dan dalam hal ini pasir halus, yang karena adanya soil heave/ soil boiling pada waktu instalasi tiang bor, maka akan sangat meredusir daya dukung ujung tiang. Akibatnya, ujung tiang sebaiknya berada di tengah dari lapisan -3, dan akibatnya tiang menjadi relatip pendek, dan daya ukung menjadi rendah.
Dalam keadaan tiang bor duduk dilapisan 6 yaitu dipasir kasar pada kedalaman kurang lebih 48m, pembuatan tiang ini memerlukan selubung (casing) untuk pemboran dapat melalui lapisan pasir halus pada kedalaman 30m. Dan menghindarkan lubang bor gugur.

Pemilihan Pondasi Dalam

Untuk beban atau tekanan ke tanah yang lebih besar dan memerlukan lapisan pendukung dengan daya dukung lebih besar, maka diperlukan pondasi tiang yang mencapai ke lapisan tanah yang lebih kokoh dan dengan konsistensi SPT>60 (lihat Gambar 2.).
Dari gambaran keadaan tanah seperti diatas, maka jelas Stratum -2 merupakan lapisan tanah pendukung (= Soil Bearing Layer) yang paling memadai untuk bangunan menara dilokasi ini. Lapisan ini dominan terdiri dari lanau tersementasi yang sangat kokoh (very stiff to very hard) yang mulai dijumpai mulai kedalaman 12m sampai 32 ~36m dari muka tanah.

Pondasi Bore Pile

Tiang Pondasi Bor (Bored Pile) dapat disesuaikan panjang/kedalamannya dengan daya dukung yang diperlukan. Misalnya Tiang Bor dengan diameter 800, 1000mm atau 1200mm, dapat dibor hingga menembus lapisan lanau tersementasi atau pasir sangat padat, di kedalaman 25~30m atau hingga kedalaman 40 ~50m.

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Mengacu pada keadaan sublapisan tanah seperti diuraikan diatas dan seperti dapat dilihat dalam gambar cross section profil bor, maka tiang dianjurkan tidak terlalu panjang. Dari perhitungan untuk tiang bor dengan diameter 800m dan kedalaman 26m ~ 28m, mempunyai variasi daya dukung allowable dari 200 ~ 350 Ton, atau rata-rata = 275 ton.
Untuk tiang bor dengan diameter 1000mm daya dukung nya adalah dari 250 sampai 500 ton, atau rata-rata = 375 ton, dan , daya dukung aman 400 ~ 800 Ton untuk tiang bor dengan diameter 1200mm dan rata2 = 600 ton.
Daya dukung tiang seperti ditunjukan dalam Gambar 8, 9 dan 10 berikut, adalah dihitung berdasarkan sifat soil properties tanah saja. Daya dukung tiang bor juga sangat tergantung dari cara pemboran dan instalasi tiang bor, yang memungkinkan untuk dapat reduksi penurunan daya dukung tiang bor, karena melewati lapisan pasir lepas, atau terjadinya kelongsoran dalam lubang bor.

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Jika daya dukung diperlukan lebih besar daripada yang ditentukan seperti diatas, maka tiang bor perlu mencapai ke lapisan pendukung kedua yang terdapat mulai kedalaman 42 - 45m.

Jakarta, 26 Pebruari 2013

Ir. Benny Kumara

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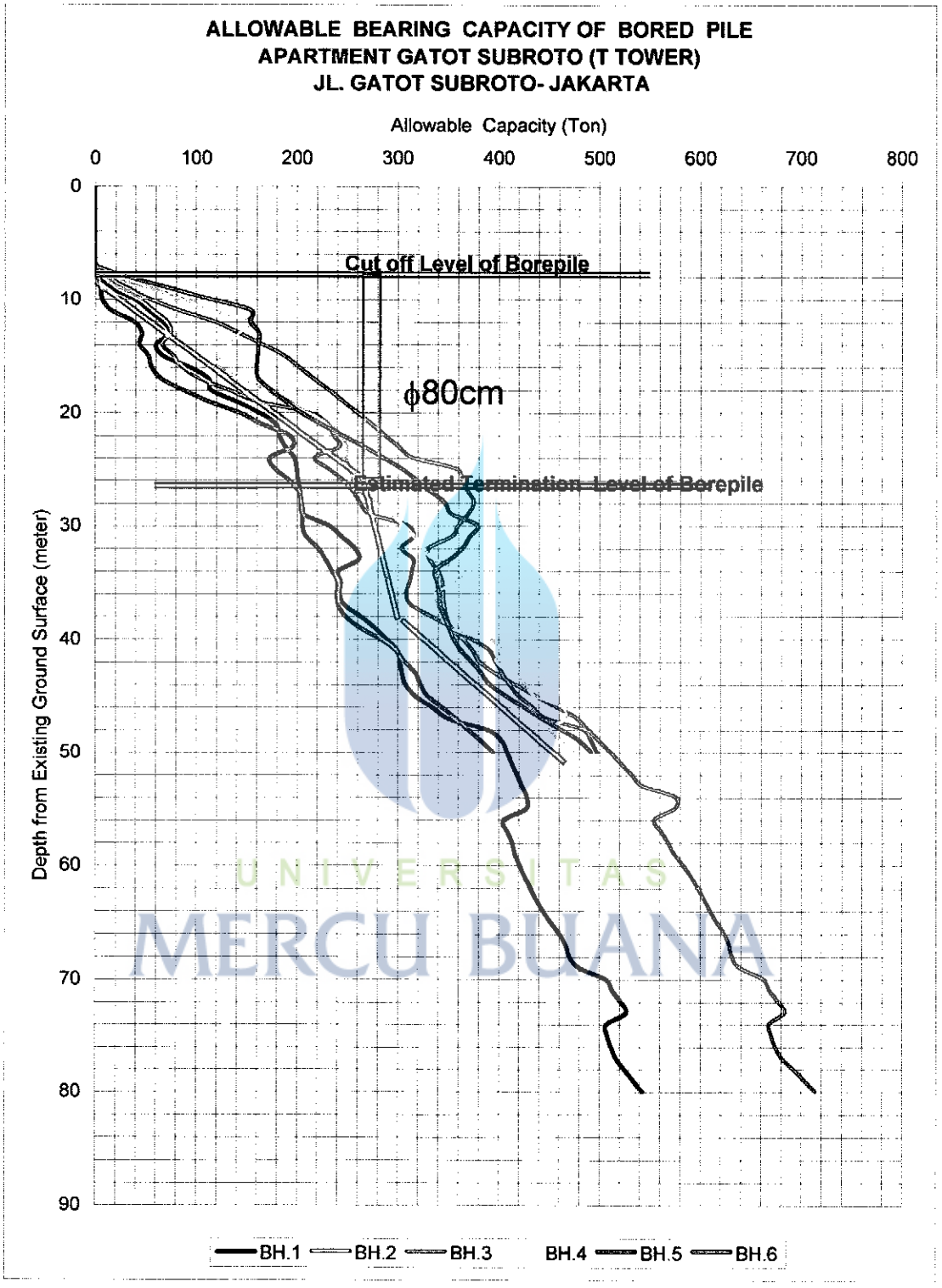

Gambar 6

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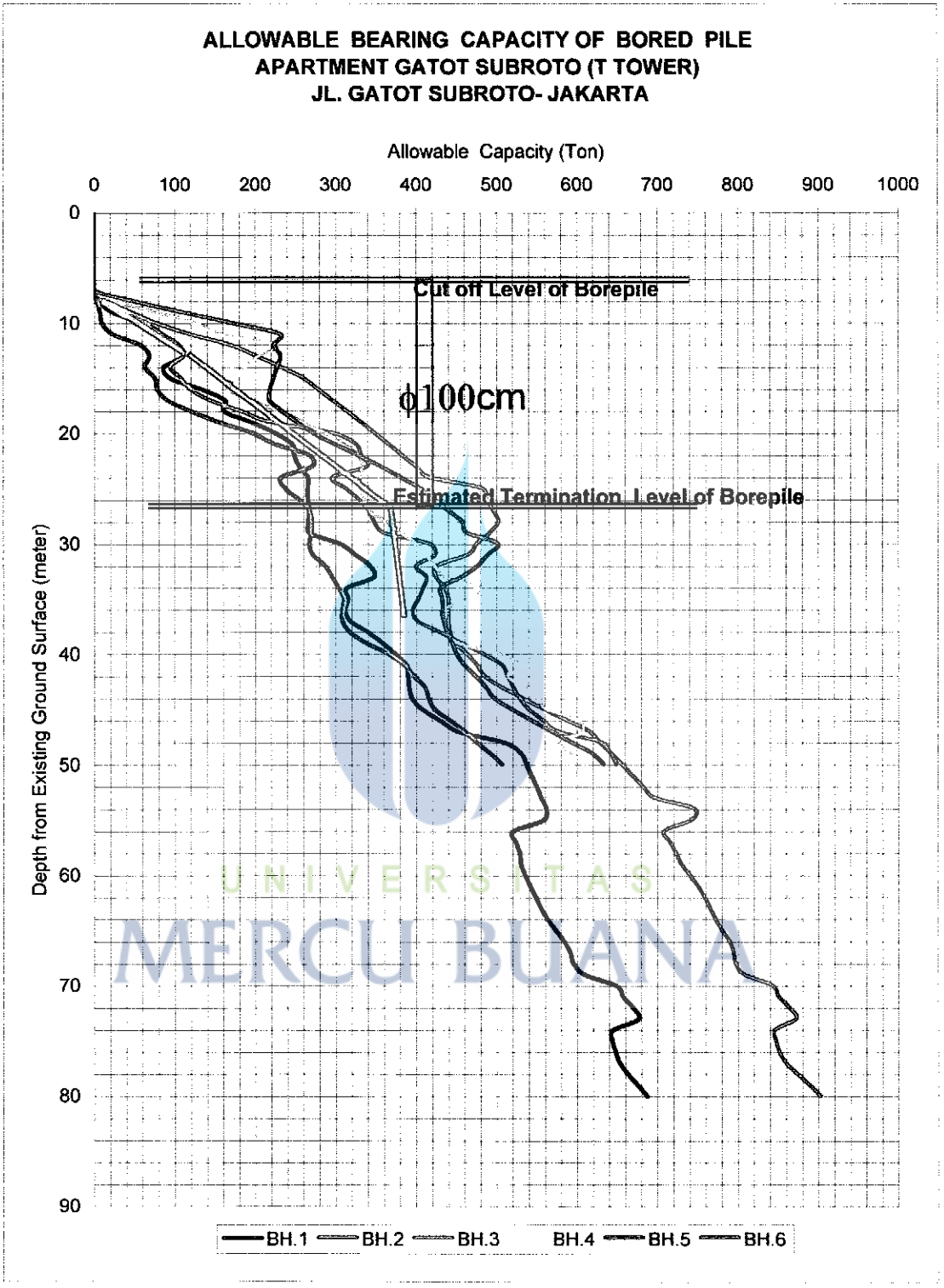

Gambar 7

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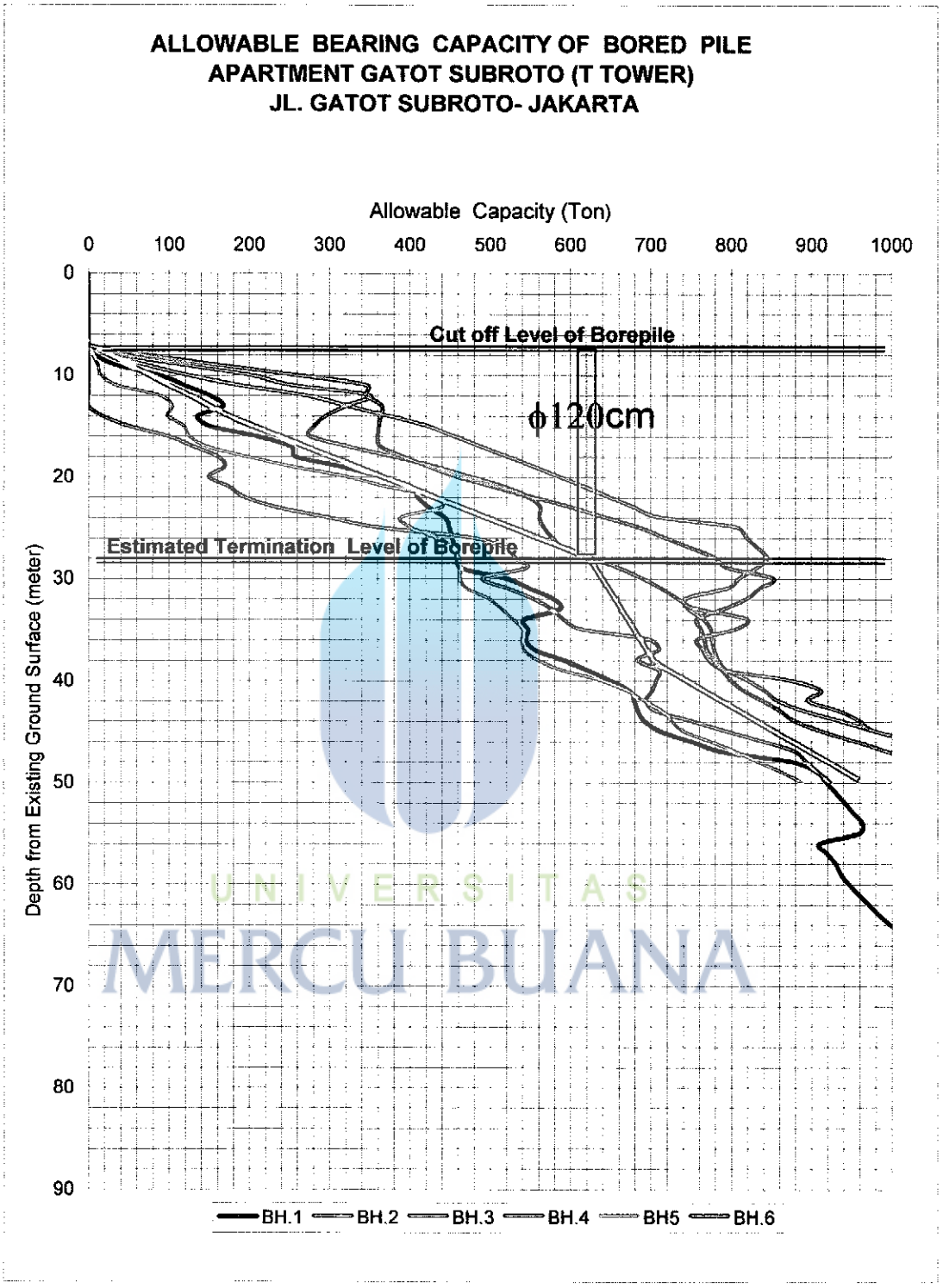

Gambar 8

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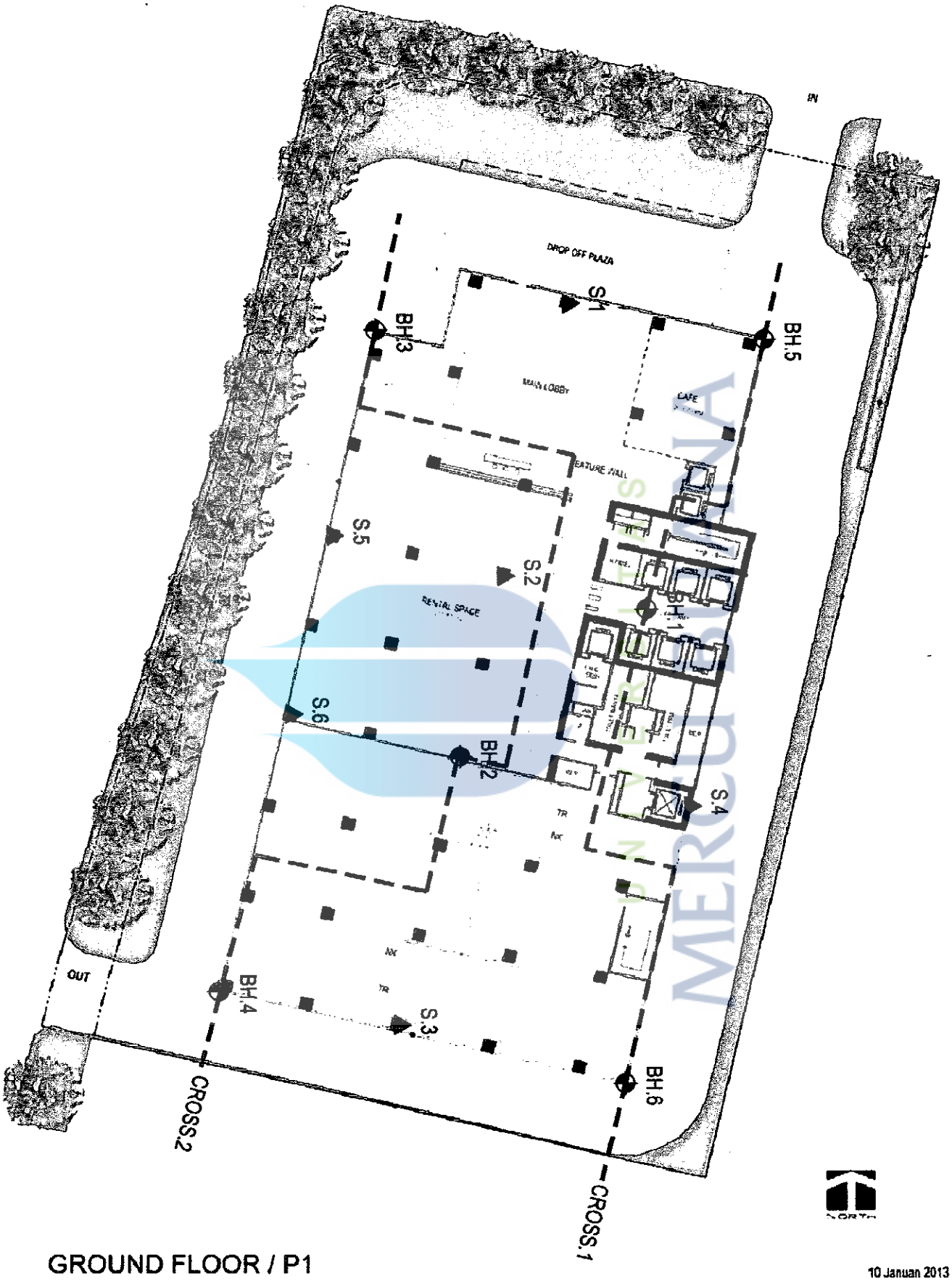

GROUND FLOOR / P1

10 Januari 2013

THE T TOWER	Owner: PT. SADINI ARIANDA	Lead Consultant: PT Design Global Indonesia

Gambar - 1

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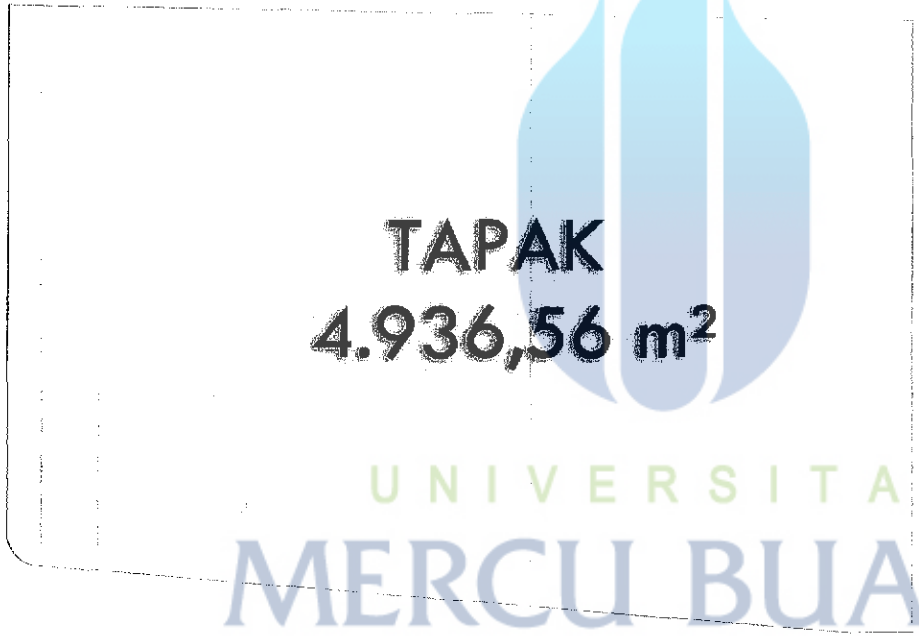
LUAS LANTAI DASAR BANGUNAN	:	2.553 m²		
LUAS SELURUH LT. BANGUNAN	:			
* LUAS LT. G	:	2.553 m²		
* LUAS LT. MEZZANINE	:	2.072 m²		
* LUAS LT. P1	:	2.553 m²		
* LUAS LT. P2	:	2.553 m²		
* LUAS LT. P3	:	2.553 m²		
* LUAS LT.PODIUM	:	2.553 m²		
* LUAS LT.6	:	1.633.36 m²		
* LUAS TOWER TIPIKAL LT 07-10	:	1.370,07 m² x 4	:	5.480,28 m²
* LUAS TOWER TIPIKAL LT 11-27	:	1.394,63 m²x17	:	23.708,71 m²
TOTAL LUAS LT	:	45.659,35 m²		

LUAS LT. SEMIBASEMENT	:	2.553 m²
LUAS LT. BASEMENT 1	:	3.234 m²
LUAS LT. BASEMENT 2	:	3.234 m²



RENCANA PELEBARAN LAHAN

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SOFOCO

TAPAK
skala 1: 500

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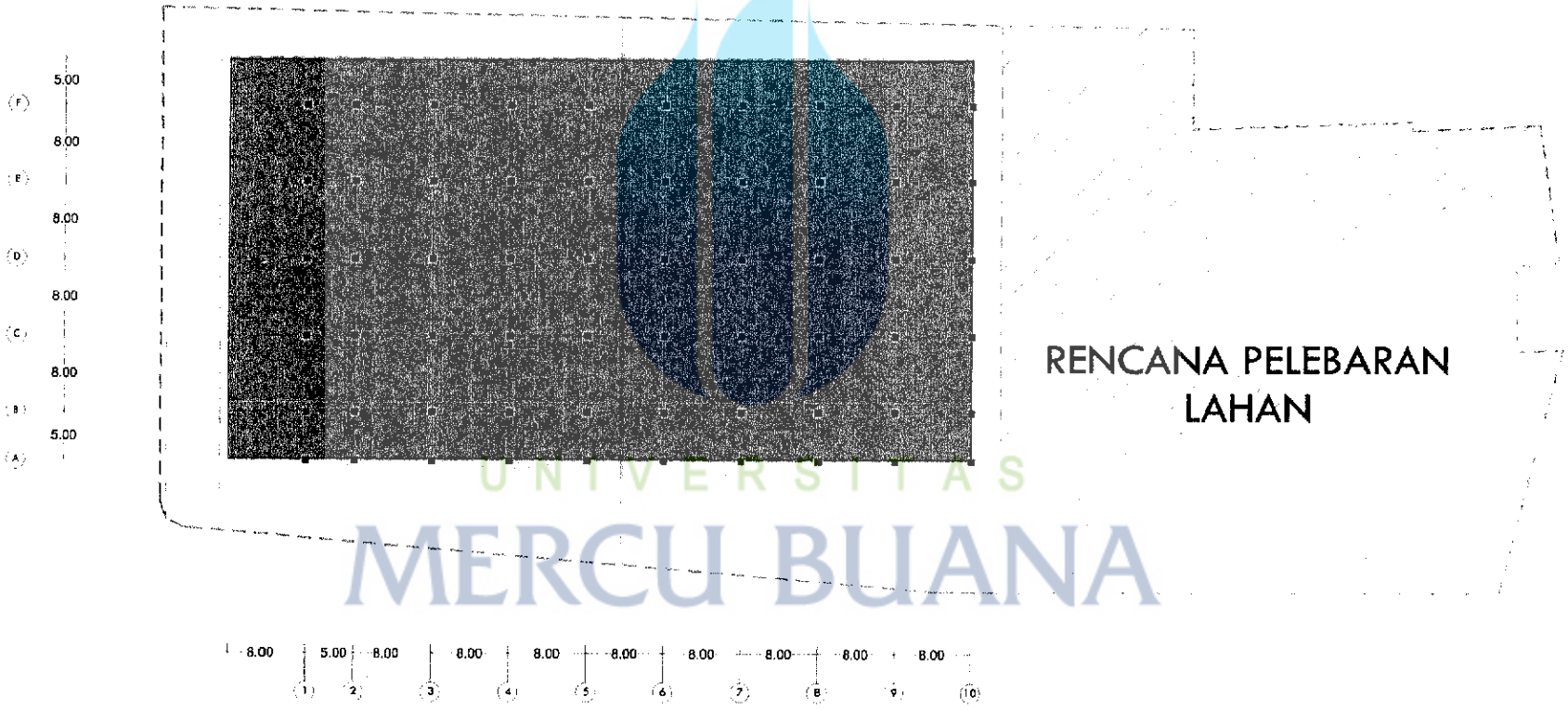

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MODULAR KOLOM
skala 1: 500

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Cross Sectional Profiles

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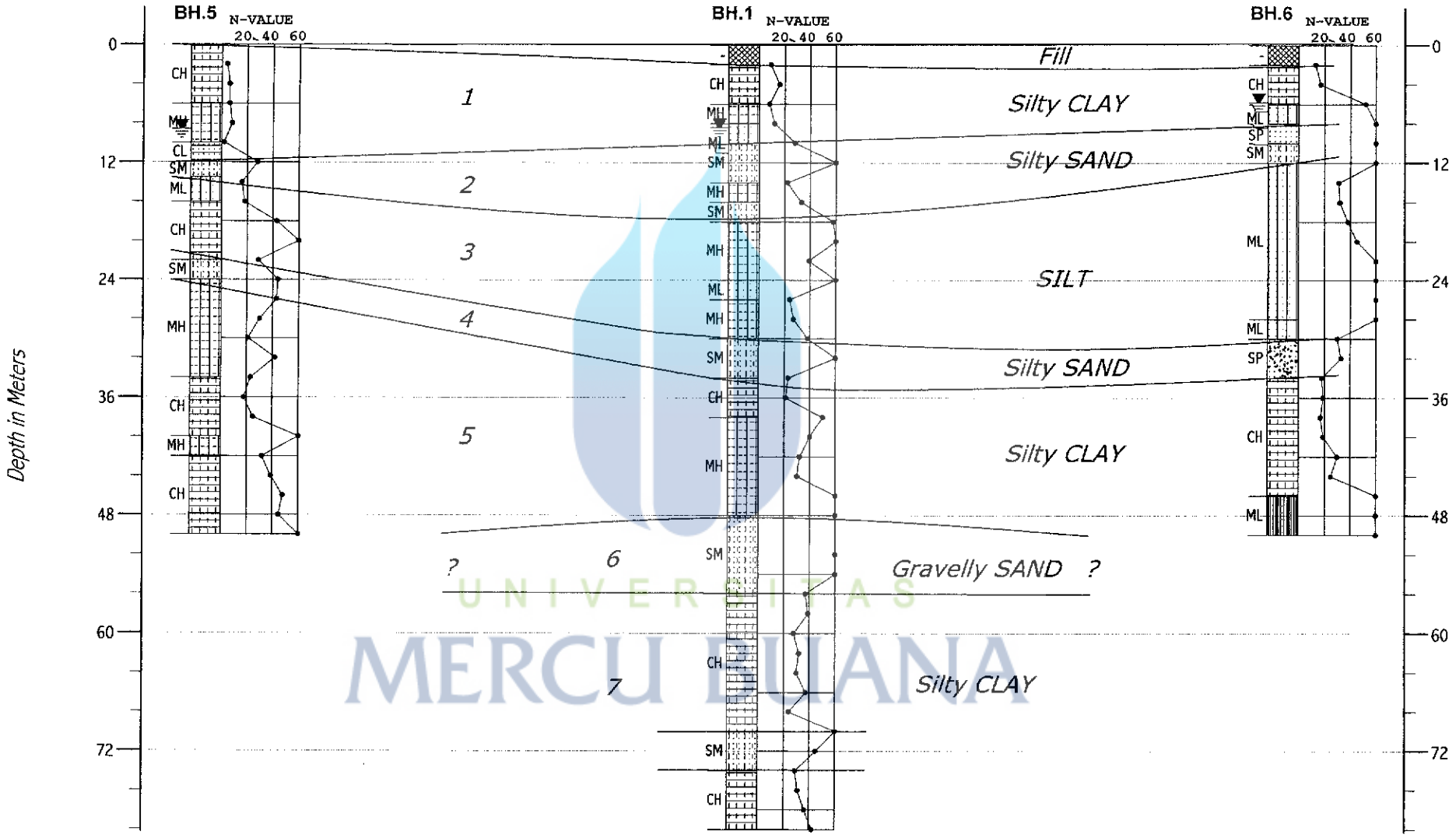
CROSS SECTIONAL PROFILE



Section 1 - 1'

Project :

APARTEMEN GATOT SUBROTO

JL. GATOT SUBROTO - JAKARTA

Silty CLAY	Silty SAND	SAND
Clayey SILT	Sandy SILT	Gravelly SAND
Sandy Silty CLAY	Fill Material	Cemented Sandy SILT

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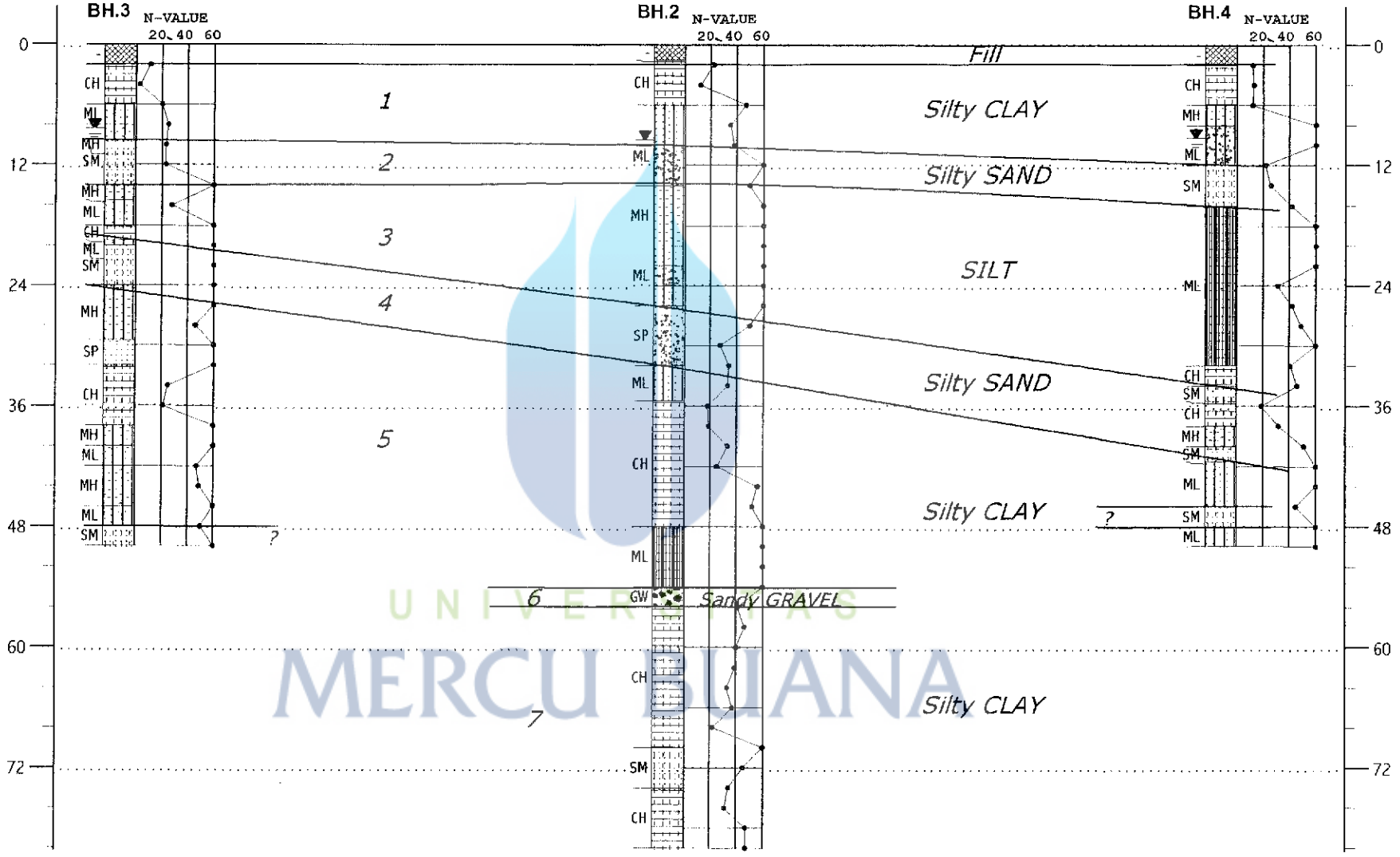
CROSS SECTIONAL PROFILE



Section 2 - 2'

Project :

APARTEMEN GATOT SUBROTO

JL. GATOT SUBROTO - JAKARTA

Fill Material
Silty CLAY
Sandy SILT
Clayey SILT
Silty SAND
SAND
Sandy SILT w/ Some Gravel
Gravelly SAND
Cemented Clayey SILT
Well graded gravel

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Log of Borings

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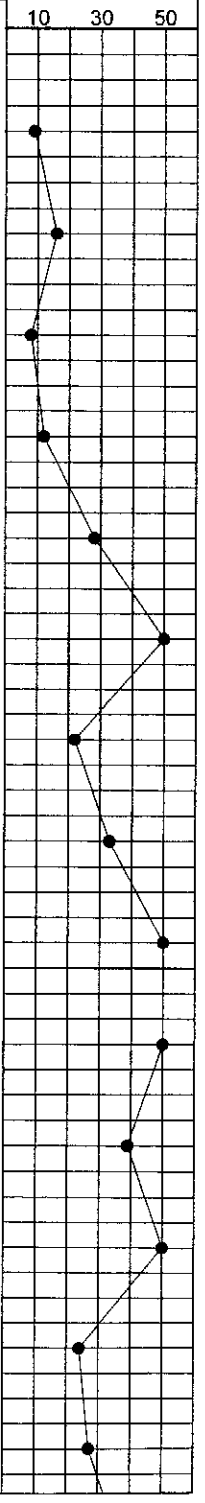
BORING PROFILE

PROJECT : APARTEMENT GATOT SUBROTO
LOCATION : JL. GATOT SUBROTO - JAKARTA
BORING No. : BH - 1
ELEVATION :
G.W.L. : 8.40 M BELOW GROUND SURFACE

COORDINATE
N =
E =

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
0	0.00	Ruin material		
	3/15 4/15 5/15 — 2.00 CH	Stiff, reddish brown silty clay	2.00-2.45	9
3	4/15 6/15 10/15	brown greyish silty clay	3.50-4.00	UDS
		Very stiff, greyish brown silty clay	4.00-4.45	16
6	3/15 3/15 5/15 — 6.00 MH	Medium stiff, brown clayey silt	6.00-6.45	8
		Ditto	7.50-8.00	UDS
9	4/15 5/15 7/15 — 8.00 ML	Stiff, brown fine sandy silt with trace clay	8.00-8.45	12
	6/15 13/15 15/15 — 10.00 SM	Medium dense, brown silty fine sand with trace cemented fine sand	10.00-10.45	28
12	20/15 34/15 16/8	Dense, black silty sand with trace gravel	12.00-12.38	50/23
	7/15 9/15 13/15 — 14.00 MH	Very stiff, brown clayey silt	14.00-14.45	22
15		Greyish brown clayey silt with fine sand	15.50-16.00	UDS
	8/15 14/15 19/15 — 16.00 SM	Dense, blackish dark grey silty fine sand	16.00-16.45	33
18	16/16 22/15 28/11 — 18.00	Hard, dark grey clayey silt with trace cemented silt	18.00-18.42	50/26
	20/15 30/15 20/10 — MH	Hard, dark grey cemented clayey silt with trace fine sand	20.00-20.40	50/25
21		Ditto	21.50-22.00	UDS
	11/15 17/15 22/15	Hard, dark grey clayey silt with trace fine sand	22.00-22.45	39
24	8/15 23/15 27/8 — 24.00 ML	Hard, blackish dark grey fine sandy silt	24.00-24.38	50/23
	7/15 10/15 14/15 — 26.00	Very stiff, blackish dark grey clayey silt	26.00-26.45	24
27		Ditto	27.50-28.00	UDS
	8/15 12/15 — MH	Ditto, very stiff	28.00-28.45	27

CURVE



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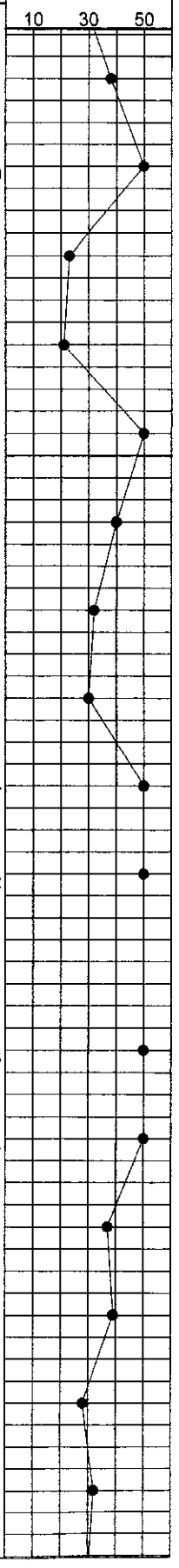
SOFOCO

PROJECT : APARTEMENT GATOT SUBROTO BORING No. : BH - 1

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
	15/15				
30	13/15 18/15 20/15	30.00	Hard, black silty sand with gravel	30.00-30.45	38
	15/15 33/15 17/15	SM	Hard, grey silty sand	32.00-32.45	50/20
33	5/15 8/15 15/15	34.00	Very stiff, grey silty clay	34.00-34.45	23
36	7/15 9/15 12/15	CH	Ditto, brown mixed grey Very stiff, brown mixed grey silty clay	35.50-36.00 36.00-36.45	UDS 21
39	8/15 19/15 31/15	38.00	Hard, grey clayey silt with trace cemented silt	38.00-38.45	50
	12/15 17/15 23/15		Hard, brown greyish clayey silt with trace cemented silt	40.00-40.45	40
42	9/15 13/15 19/15	MH	Hard, brown clayey silt	42.00-42.45	32
45	7/15 13/15 17/15		Ditto, very stiff	44.00-44.45	30
	12/15 37/15 13/2		Hard, grey brownish fine sandy silt with trace clay	46.00-46.32	50/17
48	50/12	48.00	Dense, grey cemented silty fine sand	48.00-48.12	50/12
51	16/15 40/15 10/1	SM	Dense, dark grey silty fine sand with some gravel	52.00-52.31	50/16
54	50/13		Dense, dark grey silty fine sand with some gravel	54.00-54.13	50/13
57	13/15 17/15 20/15	56.00	Hard, greenish grey silty clay	56.00-56.45	37
	11/15 16/15 23/15		Hard, grey and brownish yellow silty clay	58.00-58.45	39
60	9/15 13/15 15/15		Very stiff, light grey and brownish yellow silty clay	60.00-60.45	28
63	9/15 14/15 18/15	CH	Hard, grey anr yellowish brown silty clay	62.00-62.45	32

CURVE



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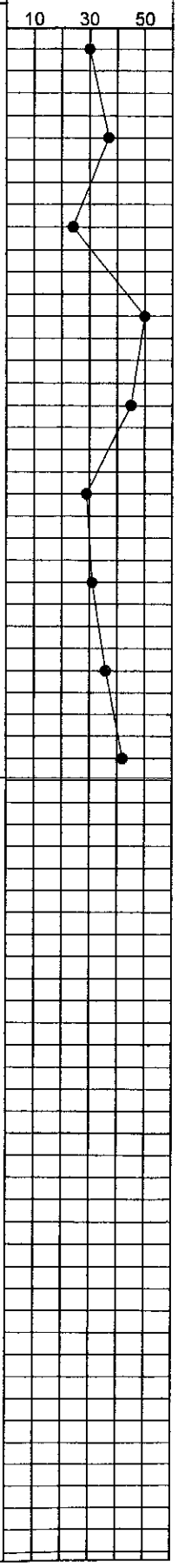
SOFOCO

http://digilib.mercubuana.ac.id/

PROJECT : APARTEMENT GATOT SUBROTO BORING No. : BH - 1

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
	9/15 13/15 17/15	Ditto, very stiff	64.00-64.45	30
66	11/15 18/15 19/15	Ditto, hard	66.00-66.45	37
	7/15 10/15 14/15	Ditto, very stiff	68.00-68.45	24
69	15/15 29/15 21/6	70.00 Dense, dark grey silty fine sand	70.00-70.36	50/21
72	15/15 19/15 26/15	SM Ditto, dense	72.00-72.45	45
	8/15 13/15 16/15	74.00 Very stiff, grey and brownish yellow silty clay	74.00-74.45	29
75	9/15 12/15 19/31	Ditto, very stiff	76.00-76.61	31
78	11/15 16/15 20/15	CH Ditto, hard	78.00-78.45	36
	13/15 18/15 24/15	Ditto, hard	80.00-80.45	42
81		Boring terminated at a depth of 80.45 m On Dec 18 - Jan 1,2012 Note UDS : Undisturbed sample		
84				
87				
90				
93				
96				

CURVE



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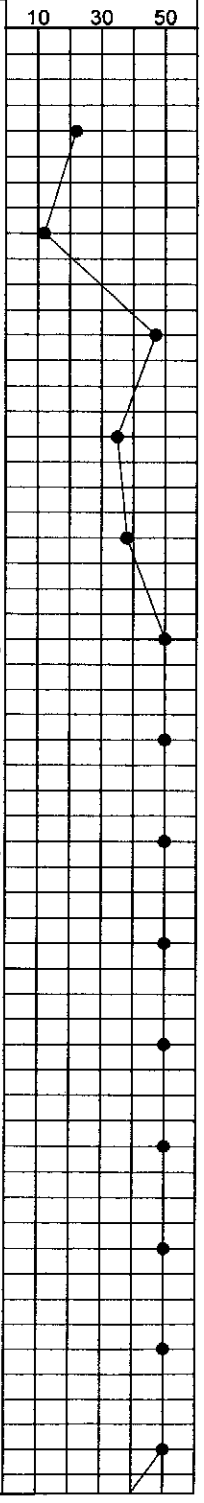
BORING PROFILE

PROJECT : APARTEMENT GATOT SUBROTO
LOCATION : JL. GATOT SUBROTO - JAKARTA
BORING No. : BH-2
ELEVATION :
G.W.L. : 9.50 M BELOW GROUND SURFACE

COORDINATE
N =
E =

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
0		0.00	Ruin material		
	5/15 7/15 15/15	1.50	Yellow and grey silty clay Very stiff, brownish red, grey and yellow silty clay	1.50-2.00 2.00-2.45	UDS 22
3	3/15 5/15 7/15	CH	Stiff, greyish whith, brown and yellow	4.00-4.45	12
6	14/15 20/15 27/15	6.00	Hard, yellowish brown fine sandy silt with trace gravel	6.00-6.45	47
	9/15 15/15 20/15		Hard, yellowish brown fine sandy silt	8.00-8.45	35
9	11/15 16/15 22/15	ML	Ditto Hard, grey, yellowish brown fine sandy silt with some gravel	9.50-10.00 10.00-10.45	UDS 38
12	50/15		Hard, grey cemented fine sandy silt	12.00-12.15	50/15
	11/15 27/15 23/15	14.00	Hard, grey cemented clayey silt	14.00-14.45	50
15	14/15 25/15 25/10	MH	Dark grey clayey silt Hard, greenish grey cemented clayey silt	15.50-16.00 16.00-16.40	UDS 50/25
18	24/15 30/15 20/8		Hard, grey cemnted clayey silt	18.00-18.38	50/23
	26/15 35/15 15/4	20.00	Hard, dark grey fine sandy silt	20.00-20.34	50/19
21	16/15 23/15 27/8	ML	Dense, dark grey silty fine sand with trace gravel	22.00-22.38	50/23
24	18/15 25/15 25/7		Dark grey silty fine sand Ditto, dense	23.50-24.00 24.00-24.37	UDS 50/22
	35/15 15/7	26.00	Dense, dark grey coarse sand mixed gravel	26.00-26.22	50/22
27	14/15 20/15		Ditto	28.00-28.45	50

CURVE



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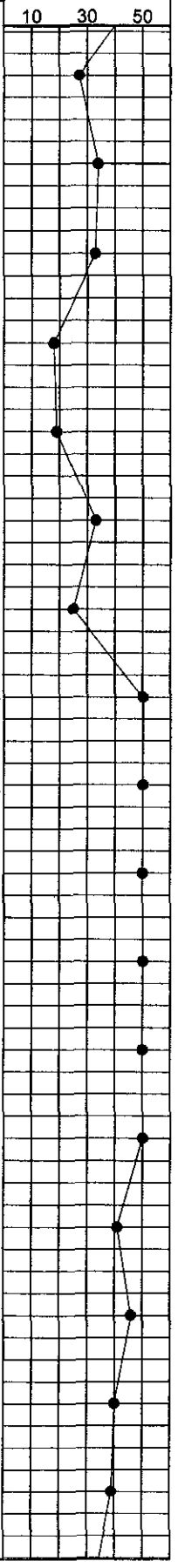
PROJECT : APARTEMENT GATOT SUBROTO BORING No. : BH-2

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
	30/15 SP			
30	7/15 11/15 16/15	Ditto	30.00-30.45	27
	7/15 11/15 23/15 32.00	Hard, dark grey clayey silt	32.00-32.45	34
33	ML 6/15 11/15 22/15	Ditto	34.00-34.45	33
36	35.50 5/15 7/15 11/15	Light grey and yellowish brown silty clay Ditto, very stiff	35.50-36.00 36.00-36.45	UDS 18
39	7/15 8/15 11/15	Ditto, brownish yellow	38.00-38.45	19
	9/15 14/15 19/15	Hard, dark grey and brown cemented silty clay	40.00-40.45	33
42	CH 7/15 11/15 14/15	Very stiff, dark grey and brown silty clay	42.00-42.45	25
45	17/15 25/15 25/12	Hard, light grey and yellowish brown silty clay	44.00-44.42	50/27
	17/15 23/15 27/15	Ditto	46.00-46.45	50/29
48	39/15 11/5 48.00	Hard, dark grey cemented clayey silt	48.00-48.20	50/20
51	50/15 ML	Ditto	50.00-50.15	50/15
	35/15 15/8	Ditto	52.00-52.23	50/23
54	50/15 54.00 GW	Dense, blackish dark grey boulder	54.00-54.15	50/15
57	12/15 17/15 24/15 56.00	Hard, light grey and brownish yellow cemented silty clay	56.00-56.45	41
	13/15 19/15 27/15	Ditto	58.00-58.45	46
60	10/15 17/15 23/15	Ditto	60.00-60.45	40
63	11/15 16/15 23/15 CH	Ditto	62.00-62.45	39

CURVE



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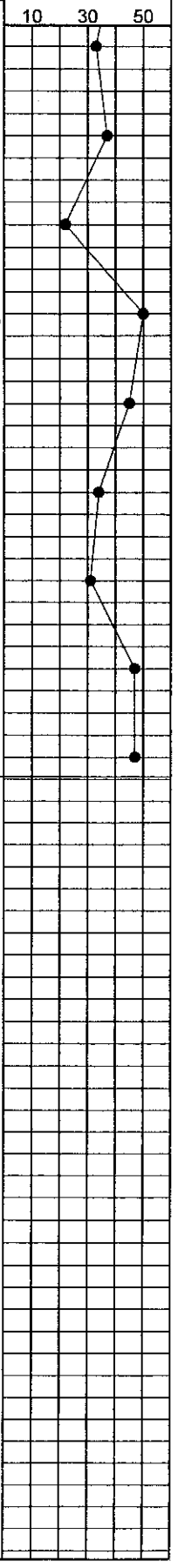
PROJECT : APARTEMENT GATOT SUBROTO BORING No. : BH-2

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
	9/15 14/15 19/15	Ditto, dark grey	64.00-64.45	33
66	11/15 17/15 20/15	Hard, grey and yellowish brown silty clay	66.00-66.45	37
	7/15 9/15 13/15	Ditto, very stiff	68.00-68.45	22
69	13/15 29/15 21/5 70.00	Dense, greenish grey silty fine sand	70.00-70.35	50/20
72	13/15 20/15 25/15 SM	Ditto, dark grey	72.00-72.45	45
	10/15 14/15 20/15 74.00	Hard, grey and yellowish brown silty clay	74.00-74.45	34
75	11/15 13/15 18/15 CH	Ditto	76.00-76.45	31
78	12/15 22/15 25/15	Ditto, cemented	78.00-78.45	47
	14/15 23/15 24/15	Ditto	80.00-80.45	47
81		Boring terminated at a depth of 80.45 m On Dec 19 - Jan 1,2013 Note UDS : Undisturbed sample		
84				
87				
90				
93				
96				

CURVE



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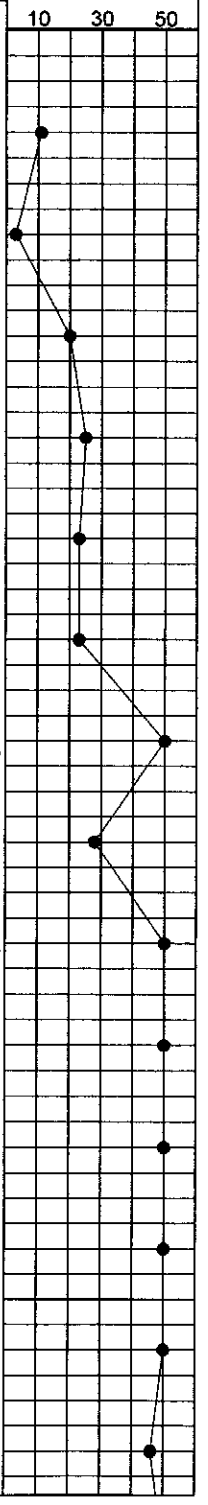
BORING PROFILE

PROJECT : APARTEMENT GATOT SUBROTO
LOCATION : JL. GATOT SUBROTO - JAKARTA
BORING No. : BH - 3
ELEVATION :
G.W.L. : 8.35 M BELOW GROUND SURFACE

COORDINATE
N =
E =

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
0		0.00	Ruin material		
	4/15 4/15 7/15	2.00	Stiff, reddish brown silty clay	2.00-2.45	11
3	1/15 1/15 2/15	CH	Ditto, brown Ditto, stiff	3.50-4.00 4.00-4.45	UDS 3
6	6/15 8/15 12/15	6.00 ML	Very stiff, brown fine sandy silt with trace clay	6.00-6.45	20
9	7/15 18/15 7/15	8.00 MH	Very stiff, greyish brown clayey silt	8.00-8.45	25
	6/15 11/15 12/15	9.50	Black cemented silty sand Ditto, medium dense	9.50-10.00 10.00-10.45	UDS 23
12	11/15 8/15 15/15	SM	Ditto	12.00-12.45	23
15	13/15 32/15 18/3	14.00 MH	Hard, brown clayey silt with trace cemented silt	14.00-14.33	50/18
	7/15 10/15 18/15	15.50 CL 16.00 ML	Greyish brown silty clay with fine sand Very stiff, blackish brown fine sandy silt with trace clay	15.50-16.00 16.00-16.45	UDS 28
18	18/15 25/15 25/5	18.00 CH	Hard, dark grey cemented silty clay	18.00-18.35	50/20
21	27/15 23/3	19.50 ML 20.00	Dark grey fine sandy silt with trace clay Dense, dark grey cemented silty fine sand	19.50-20.00 20.00-20.18	UDS 50/18
	30/15 20/4	SM	Ditto, dense	22.00-22.19	50/19
24	20/15 31/15 19/2	23.50 24.00	Grey fine sandy silt Hard, grey cemented clayey silt	23.50-24.00 24.00-24.32	UDS 50/17
27	12/15 35/15 15/5	MH	Hard, grey clayey silt with trace cemented silt	26.00-26.35	50/20
	18/15 20/15		Hard, grey clayey silt with fine sand	28.00-28.45	46

CURVE



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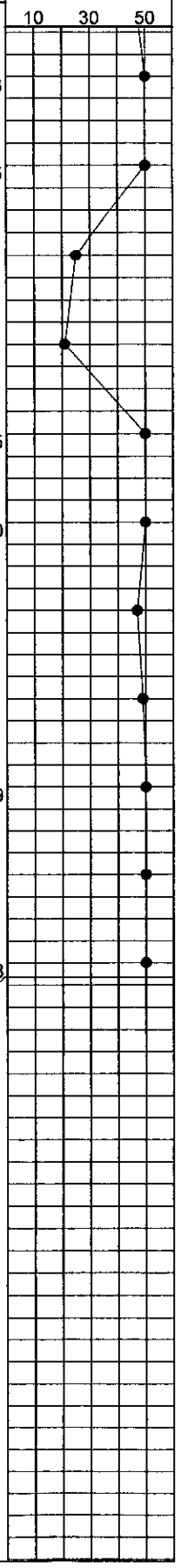
PROJECT : APARTEMENT GATOT SUBROTO

BORING No. : BH - 3

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
30	26/15, 15/15, 30/15, 20/3 — 29.50 ML, 30.00 SP	Dark grey fine sandy silt with clay Dense, black sand with trace silt	29.50-30.00 30.00-30.33	UDS 50/18
33	18/15, 24/15, 26/10 — 32.00	Hard, grey silty clay with trace cemented silt	32.00-32.40	50/25
	6/15, 10/15, 15/15 — CH	Very stiff, grey silty clay	34.00-34.45	25
36	7/15, 9/15, 12/15	Ditto	36.00-36.45	21
39	27/15, 23/10 — 38.00 MH	Hard, dark grey clayey silt	38.00-38.25	50/25
	35/15, 15/5 — 40.00 ML	Hard, dark grey fine sandy silt with trace clay and cemented silty sand	40.00-40.20	50/20
42	10/15, 19/15, 28/15 — 42.00 MH	Hard, yellowish brown clayey silt	42.00-42.45	47
45	12/15, 20/15, 29/15	Ditto, brown	44.00-44.45	49
	12/15, 32/15, 18/4 — 46.00 ML	Hard, grey sandy silt with trace clay	46.00-46.34	50/19
48	18/15, 25/15, 25/15 — 48.00 SM	Dense, blackish dark grey silty fine sand with trace gravel	48.00-48.45	50
51	18/15, 23/15, 22/3	Ditto Boring terminated at a depth of 50.33 m On Dec 18 - 22,2012	50.00-50.33	50/18
54		Note UDS : Undisturbed sample		
57				
60				
63				

CURVE



SOFOCO

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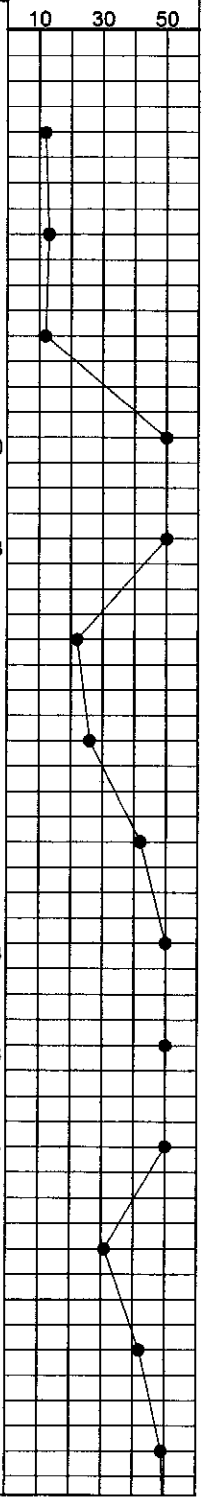
BORING PROFILE

PROJECT : APARTEMENT GATOT SUBROTO
LOCATION : JL. GATOT SUBROTO - JAKARTA
BORING No. : BH-4
ELEVATION :
G.W.L. : 9.30 M BELOW GROUND SURFACE

COORDINATE
N =
E =

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
0		0.00	Ruin material		
	3/15 4/15 8/15	2.00	Stiff, brownish red silty clay	2.00-2.45	12
3	3/15 6/15 7/15	CH	Ditto, yellowish brown Ditto, stiff	3.50-4.00 4.00-4.45	UDS 13
6	5/15 8/15 4/15	6.00 MH	Stiff, yellowish brown clayey silt	6.00-6.45	12
	17/15 30/15 20/5	8.00	Hard, dark grey cemented fine sandy silt	8.00-8.35	50/20
9	37/15 13/3	ML	Ditto Hard, dark grey sandy silt with gravel	9.50-10.00 10.00-10.18	UDS 50/18
12	7/15 9/15 13/15	12.00	Medium dense, dark grey silty fine sand	12.00-12.45	22
15	7/15 11/15 15/15	SM	Medium stiff, dark grey silty fine sand with gravel	14.00-14.45	26
	7/15 18/15 24/15	16.00	Hard, dark grey cemented clayey silt	16.00-16.45	42
18	40/15 10/3		Ditto Ditto, hard	17.50-18.00 18.00-18.18	UDS 50/18
21	17/15 36/15 14/3		Ditto	20.00-20.33	50/18
	39/15 11/2		Ditto	22.00-22.17	50/17
24	8/15 13/15 18/15	ML	Ditto, hard	24.00-24.45	31
27	10/15 16/15 26/15		Ditto Ditto, hard	25.50-26.00 26.00-26.45	UDS 42
	15/15 22/15		Ditto, hard	28.00-28.45	49

CURVE



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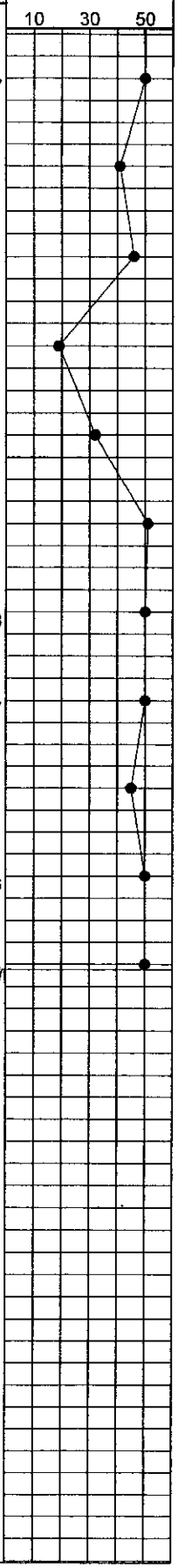
PROJECT : APARTEMENT GATOT SUBROTO BORING No. : BH-4

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
30	27/15 12/15 35/15 15/2	Ditto, hard	30.00-30.32	50/17
33	10/15 18/15 23/15 32.00 CH	Hard, light grey, brown and yellow silty clay	32.00-32.45	41
	13/15 19/15 27/15 34.00 SM	Dense, grey silty coarse sand	34.00-34.45	46
36	6/15 8/15 11/15 35.50 CH	Light grey silty clay Very stiff, light grey and brownish yellow silty clay	35.50-36.00 36.00-36.45	UDS 19
39	9/15 14/15 18/15 38.00 MH	Hard, yellowish brown and grey clayey silt with some gravel	38.00-38.45	32
	17/15 22/15 29/15 40.00 SM	Very dense, dark grey silty fine sand	40.00-40.45	51
42	11/15 36/15 14/3 41.50 ML	Grey and brown fine sandy silt with trace gravel Hard, grey and brown fine sandy silt with some gravel	41.50-42.00 42.00-42.33	UDS 50/18
45	37/15 13/2	Hard, dark grey cemented fine sandy silt	44.00-44.17	50/17
	14/15 18/15 27/15 46.00 SM	Dense, Dark grey silty fine sand	46.00-46.45	45
48	33/15 17/3 48.00 ML	Hard, dark grey cemented sandy silt	48.00-48.18	50/18
	50/13	Ditto	50.00-50.13	50/13

Boring terminated at a depth of 50.13 m
On Dec 19 - 26,2012

Note
UDS : Undisturbed sample

CURVE



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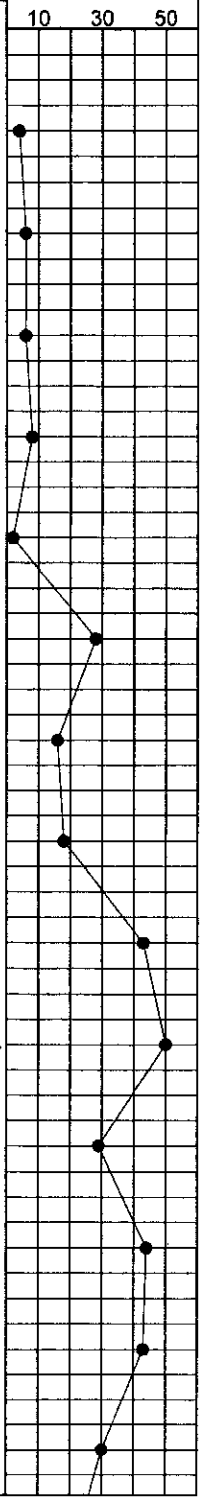
BORING PROFILE

PROJECT : APARTEMENT GATOT SUBROTO
LOCATION : JL. GATOT SUBROTO - JAKARTA
BORING No. : BH - 5
ELEVATION :
G.W.L. : 8.60 M BELOW GROUND SURFACE

COORDINATE
N =
E =

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
0	0.00	Reddish brown silty clay		
	1/15 2/15 2/15 CH	Ditto, soft	2.00-2.45	4
3	2/15 2/15 4/15	Medium stiff, brown clayey silt	4.00-4.45	6
		Brown silty clay	5.50-6.00	UDS
6	2/15 3/15 3/15	6.00 Medium stiff, brown clayey silt	6.00-6.45	6
9	3/15 4/15 4/15 MH	Ditto	8.00-8.45	8
	1/30 1/15	10.00 Very soft, brown silty clay with fine sand CL	10.00-10.45	2
12	12/15 13/15 15/15	12.00 SM Medium dense, black brownish silty fine sand with trace clay	12.00-12.45	28
		13.50 Blackish, clayey fine sand	13.50-14.00	UDS
15	3/15 6/15 10/15	SC 14.00 ML Very stiff, brown fine sandy silt	14.00-14.45	16
	7/15 7/15 11/15	16.00 Very stiff, grey silty clay	16.00-16.45	18
18	8/15 17/15 26/15 CH	Ditto Ditto, hard	17.50-18.00 18.00-18.45	UDS 43
21	16/15 37/15 13/2	Hard, dark grey fine sandy silt mixed cemented silt	20.00-20.32	50/17
	16/15 17/15 12/15	22.00 SM Medium dense, black silty fine sand with trace cemented sand	22.00-22.45	29
24	11/15 13/15 33/15	24.00 Hard, datk grey clayey silt	24.00-24.45	44
27	11/15 22/15 21/15	Ditto	26.00-26.45	43
	16/15 15/15	Grey, clayey silt with sand Medium dense, blackish dark grey silty sand with	27.50-28.00 28.00-28.45	UDS 30

CURVE



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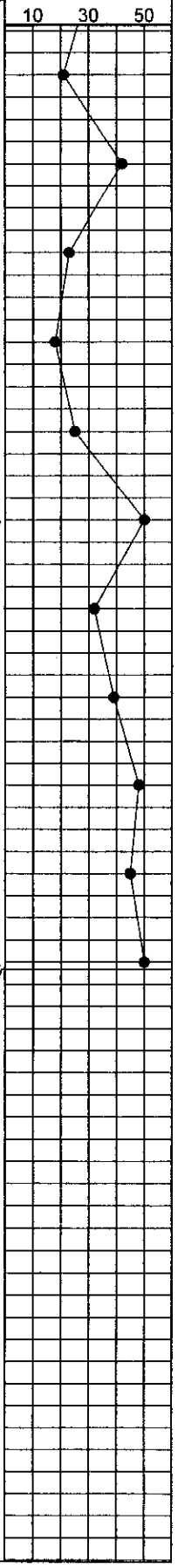
PROJECT : APARTEMENT GATOT SUBROTO

BORING No. : BH - 5

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
	15/15 MH	trace gravel		
30	16/15 26/15 24/15	Dense, black silty sand	30.00-30.45	21
	19/15 25/15 17/15	Dense, black silty sand with trace gravel	32.00-32.45	42
33	8/15 11/15 12/15 34.00	Very stiff, grey yellowish silty clay	34.00-34.45	23
		Ditto, brown greyish	35.50-36.00	UDS
36	7/15 8/15 10/15 CH	Ditto, very stiff	36.00-36.45	18
	7/15 10/15 15/15	Very stiff, light grey brownish silty clay	38.00-38.45	25
39	19/15 33/15 17/2 40.00 MH	Hard, grey cemented clayey silt with trace cemented sand	40.00-40.32	50/17
		Grey, clayey silt with fine sand	41.50-42.00	UDS
42	14/15 14/15 18/15 42.00	Hard,grey mixed brown silty clay	42.00-42.45	32
	15/15 17/15 22/15	Hard, grey brownish silty clay	44.00-44.45	39
45	11/15 17/15 31/15 CH	Hard, brown silty clay	46.00-46.45	48
48	12/15 15/15 30/15	Ditto	48.00-48.45	45
	39/15 11/1	Hard, greyish brown cemented clayey silt	50.00-50.16	50/16
51		Boring terminated at a depth of 50.16 m On Dec 19 - 23,2012 Note UDS : Undisturbed sample		
54				
57				
60				
63				

CURVE



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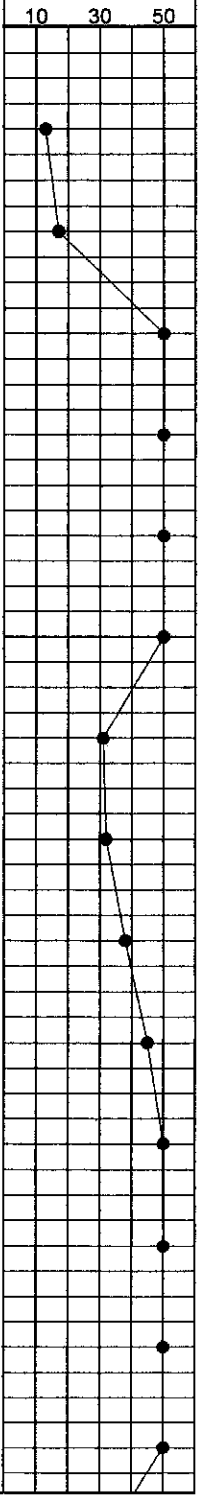
BORING PROFILE

PROJECT : APARTEMENT GATOT SUBROTO
LOCATION : JL. GATOT SUBROTO - JAKARTA
BORING No. : BH - 6
ELEVATION :
G.W.L. : 5.80 M BELOW GROUND SURFACE

COORDINATE
N =
E =

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
0		0.00	Ruin material		
	3/15 6/15 7/15	2.00	Stiff, brownish red silty clay	2.00-2.45	13
3	5/15 6/15 11/15	CH	Yellowish brown silty clay Very stiff, yellowish brown silty clay	3.50-4.00 4.00-4.45	UDS 17
6	8/15 17/15 33/14	6.00 ML	Hard, yellowish brown gravely silt	6.00-6.44	50/29
	36/15 14/2	8.00 SP	Dense, dark grey coarse sand mixed gravel	8.00-8.17	50/17
9	50/13	10.00 SM	Dense, dark grey silty sand mixed gravel	10.00-10.13	50/13
12	38/15 12/1	12.00	Hard, dark grey cemented sandy silt	12.00-12.16	50/16
	8/15 11/15 20/15		Hard, yellowish brown cemented clayey silt	14.00-14.45	31
15	7/15 10/15 22/15		Ditto Ditto, hard	15.50-16.00 16.00-16.45	UDS 32
18	8/15 13/15 25/15		Ditto	18.00-18.45	38
	10/15 16/15 29/15	ML	Ditto Ditto	19.50-20.00 20.00-20.45	UDS 45
21	14/15 32/15 18/2		Ditto	22.00-22.32	50/17
24	17/15 50/13		Ditto	24.00-24.28	50/13
	21/15 35/15 15/1		Ditto	26.00-26.31	50/16
27	31/15 19/2	28.00	Hard, dark grey cemented sandy clay	28.00-28.17	50/17

CURVE



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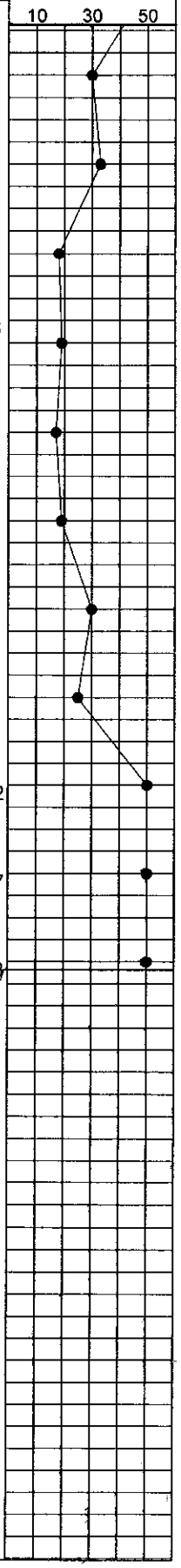
PROJECT : APARTEMENT GATOT SUBROTO BORING No. : BH - 6

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
	ML			
30	11/15 13/15 17/15 — 30.00	Dense, dark grey coarse sand mixed gravel	30.00-30.45	30
	SP			
	12/15 14/15 19/15	Ditto	32.00-32.45	33
33				
	6/15 7/15 11/15 — 34.00	Very stiff, light grey and brownish yellow silty clay	34.00-34.45	18
		Ditto	35.50-36.00	UDS
36	7/15 7/15 12/15	Ditto	36.00-36.45	19
	5/15 7/15 10/15	Ditto	38.00-38.45	17
39				
	CH			
	6/15 8/15 11/15	Ditto	40.00-40.45	19
42	9/15 13/15 17/15	Ditto	42.00-42.45	30
	7/15 10/15 15/15	Very stiff, dark grey silty clay	44.00-44.45	25
45				
	17/15 30/15 20/7 — 46.00	Hard, dark grey cemented sandy silt	46.00-46.37	50/22
48	ML			
	32/15 18/2	Ditto	48.00-48.17	50/17
	30/15 20/3	Ditto	50.00-50.18	50/18
51		Boring terminated at a depth of 50.18 m On Dec 25 - 30,2012		
		Note UDS : Undisturbed sample		
54				
57				
60				
63				

CURVE



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Dutch Cone Penetration Test

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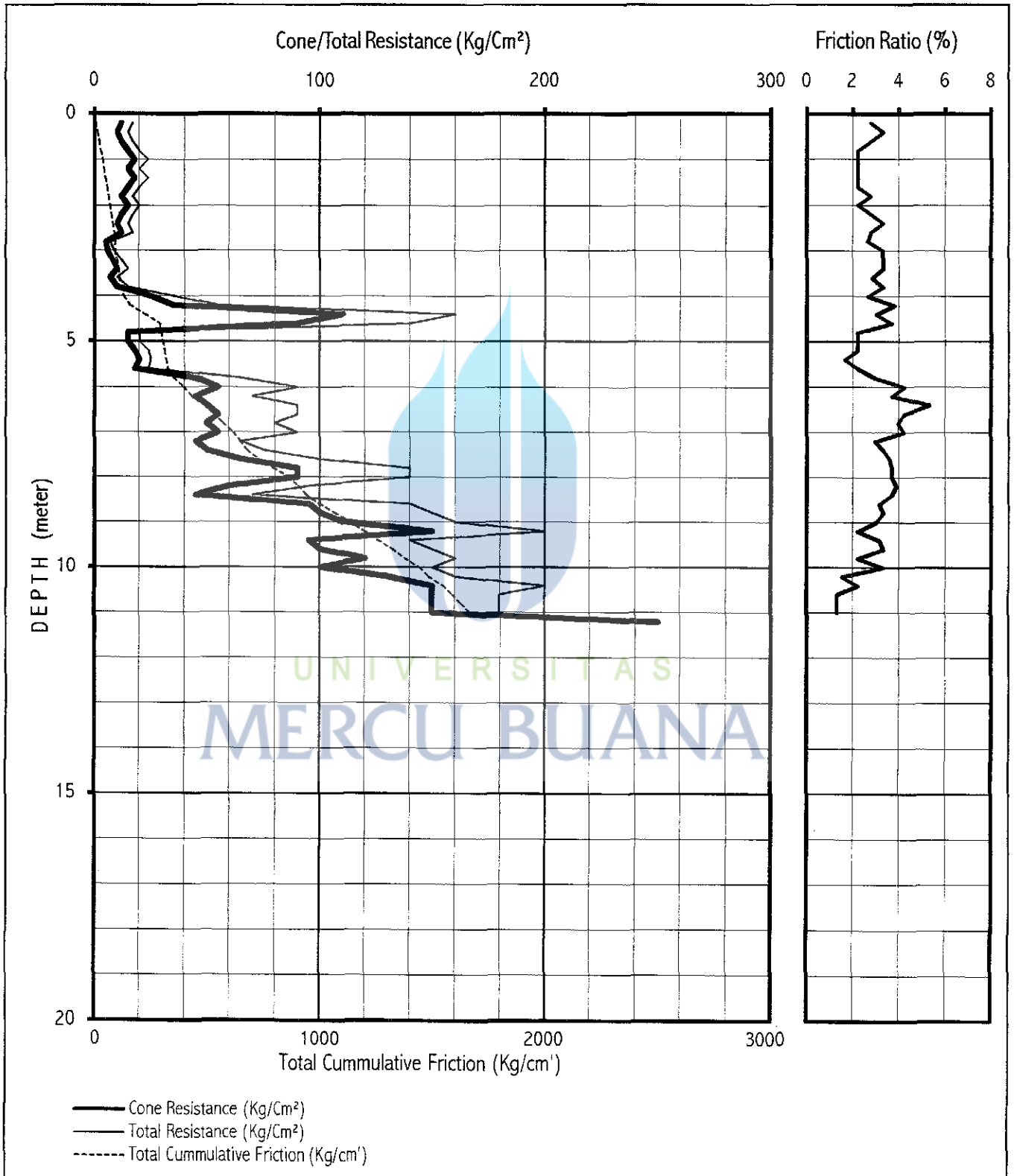
DUTCH CONE PENETRATION TEST

Project	:	APARTEMEN GATOT SUBROTO			
Location	:	JL. GATOT SUBROTO - JAKARTA			
Test No.	:	S-1	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	December 19, 2012	Elevation		: -



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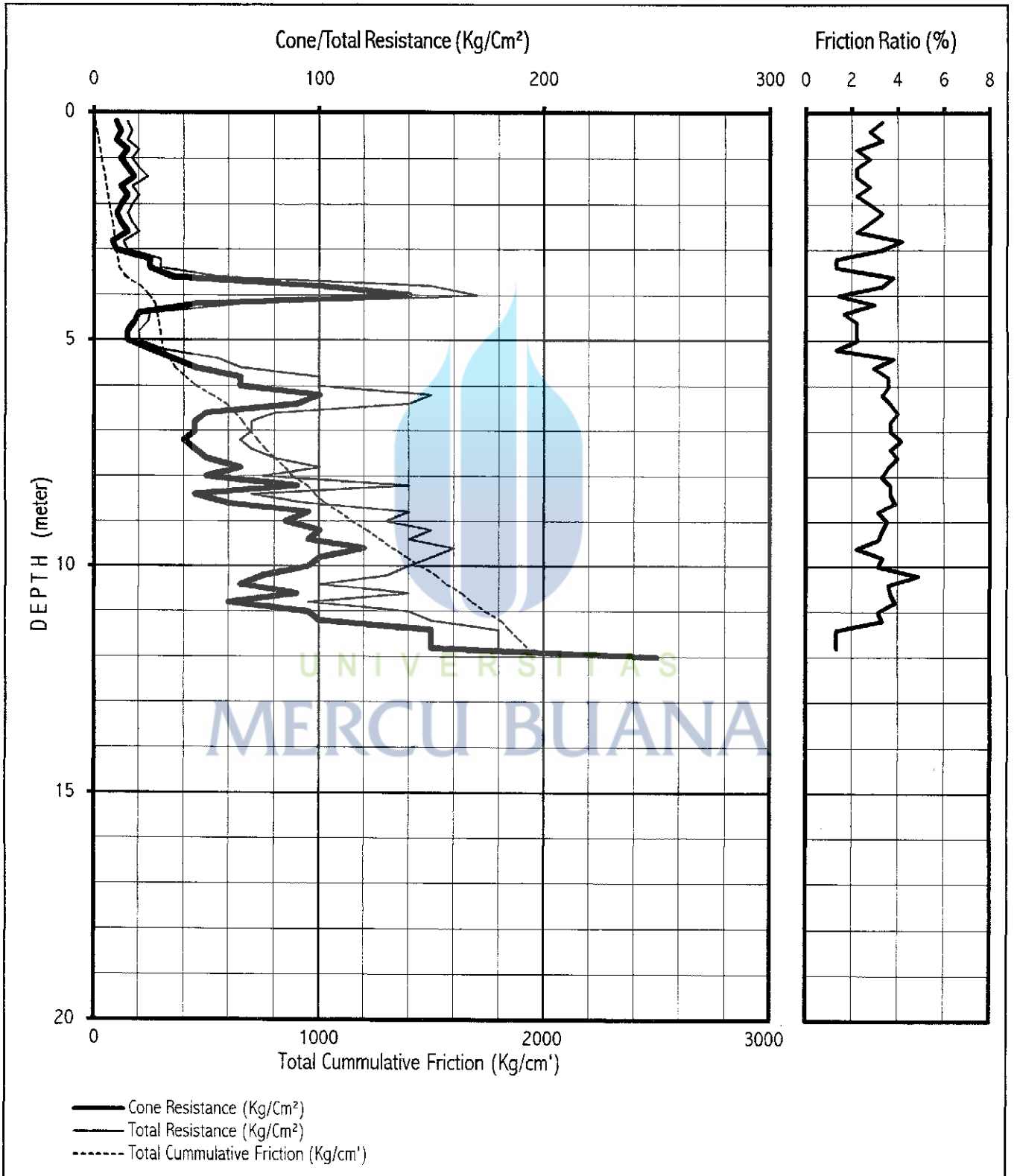
DUTCH CONE PENETRATION TEST

Project	:	APARTEMEN GATOT SUBROTO		
Location	:	JL. GATOT SUBROTO - JAKARTA		
Test No.	:	S-2	Coordinate E	: -
G.W.L.	:	-	N	: -
Date tested	:	December 18, 2012	Elevation	: -



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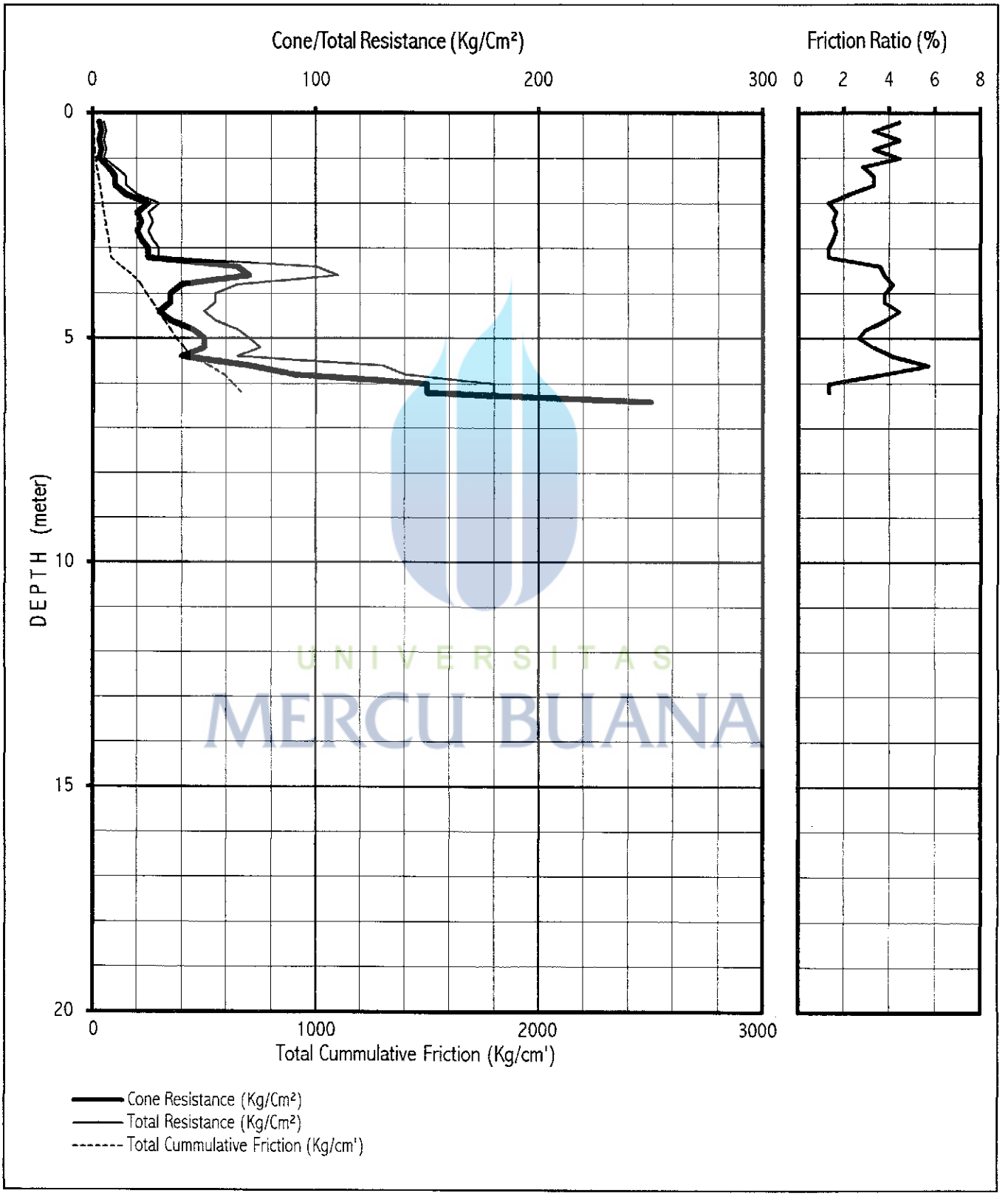
DUTCH CONE PENETRATION TEST

Project	:	APARTEMEN GATOT SUBROTO			
Location	:	JL. GATOT SUBROTO - JAKARTA			
Test No.	:	S-3	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	December 19, 2012	Elevation		: -



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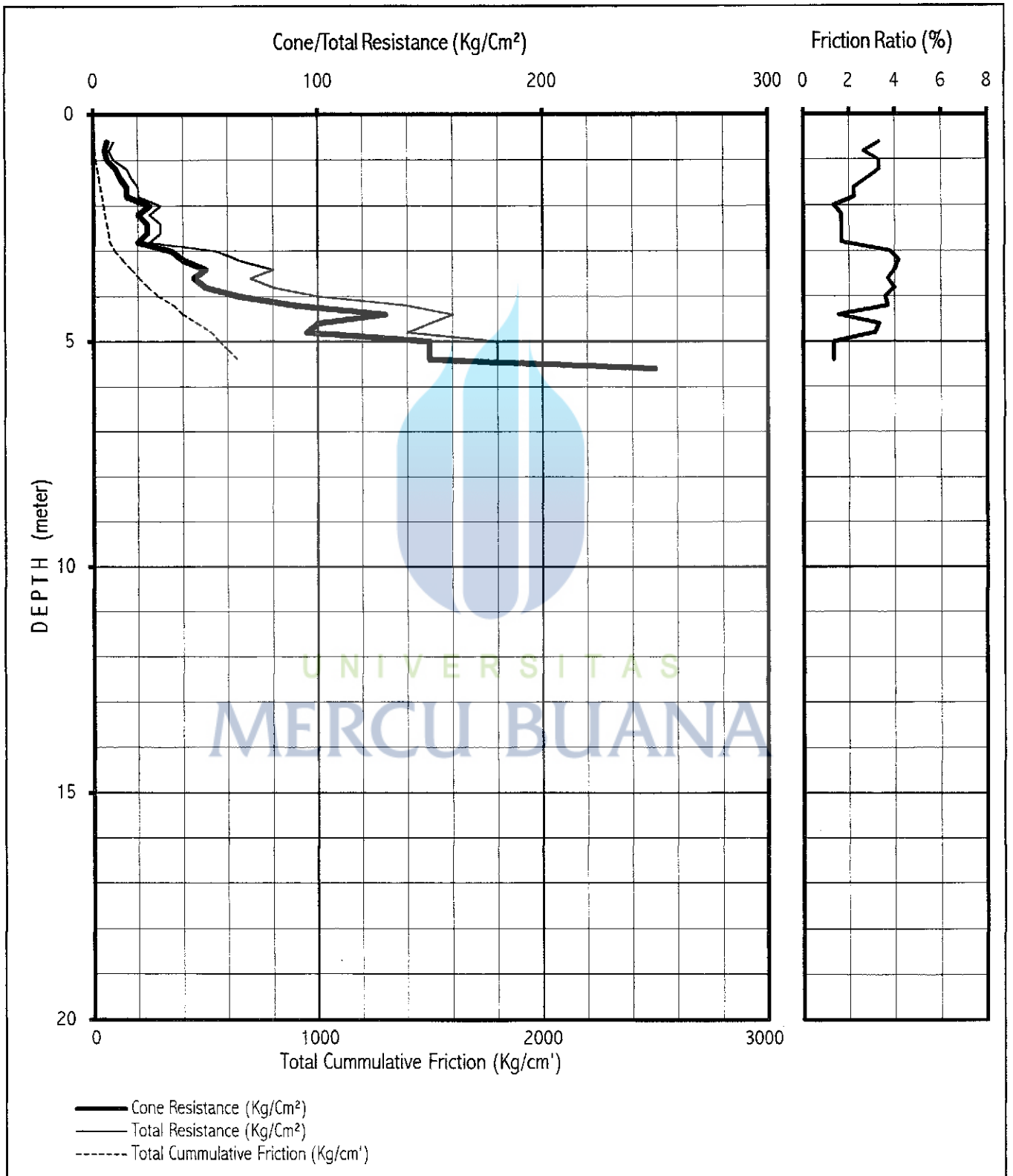
DUTCH CONE PENETRATION TEST

Project	:	APARTEMEN GATOT SUBROTO			
Location	:	JL. GATOT SUBROTO - JAKARTA			
Test No.	:	S-4	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	December 21, 2012	Elevation		: -



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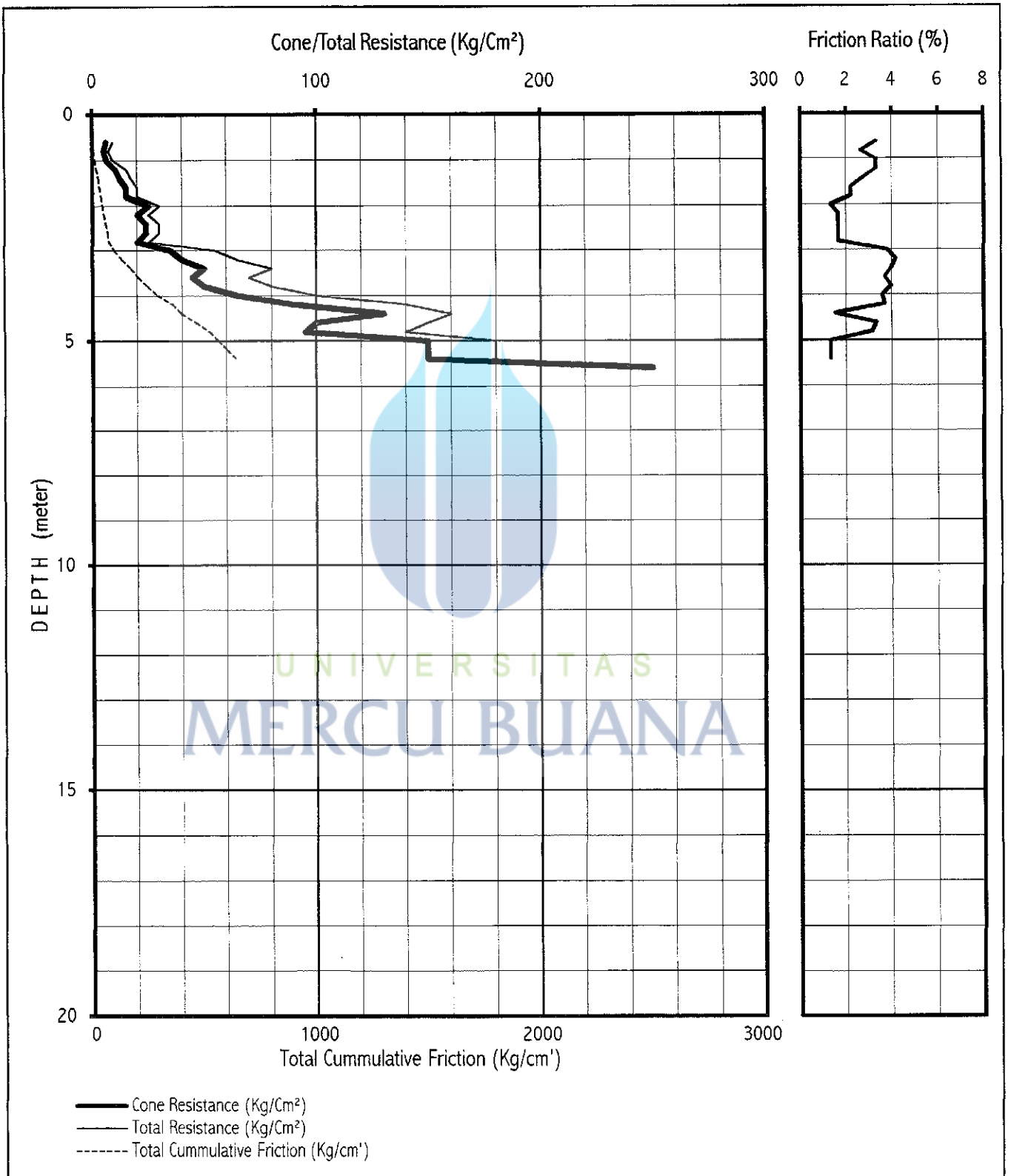
DUTCH CONE PENETRATION TEST

Project	:	APARTEMEN GATOT SUBROTO			
Location	:	JL. GATOT SUBROTO - JAKARTA			
Test No.	:	S-4	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	December 21, 2012	Elevation		: -



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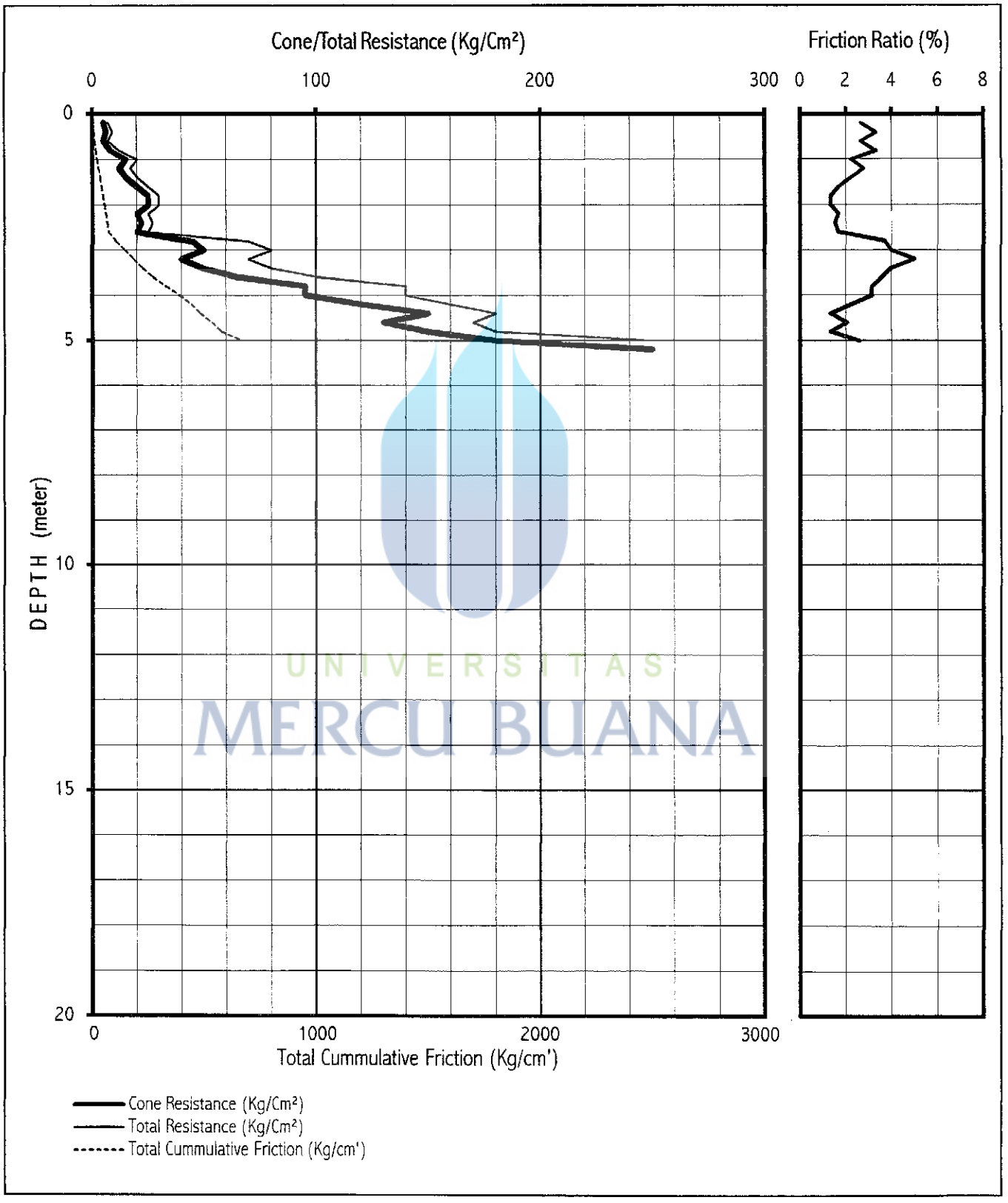
DUTCH CONE PENETRATION TEST

Project	:	APARTEMEN GATOT SUBROTO			
Location	:	JL. GATOT SUBROTO - JAKARTA			
Test No.	:	S-5	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	December 20, 2012	Elevation		: -



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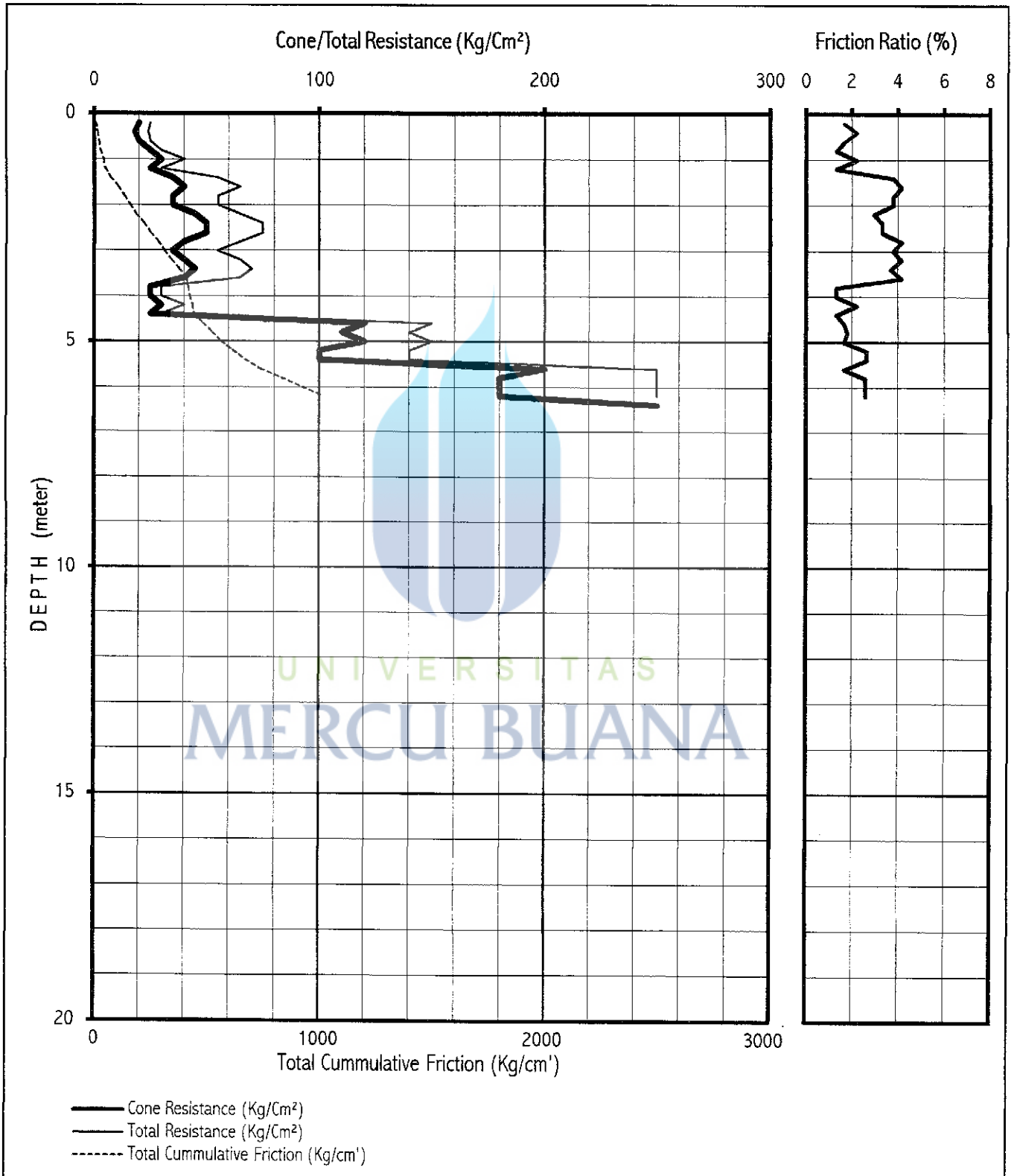
DUTCH CONE PENETRATION TEST

Project	:	APARTEMEN GATOT SUBROTO			
Location	:	JL. GATOT SUBROTO - JAKARTA			
Test No.	:	S-6	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	December 20, 2012	Elevation		: -



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Laboratory Test Results

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SUMMARY OF LABORATORY TEST RESULTS

PROJECT : APARTEMEN GATOT SUBROTO
LOCATION : JL. JEND. GATOT SUBROTO - JAKARTA

BOREHOLE	DEPTH	SAMPLE (UDS)	SAMPLE (SPT)	Specific Gravity, Grain Size Distribution, Density & Moisture						Atterberg Limits			Grain Size Fraction				Triaxial Compression: TX-UU / CU / CD; Unconfined Compression: UC						Consolidation			Field Vane Test qv	N-SPT
																	UC-UU		TX-UU		TX-CU						
				Moisture content, ω	Specific Gravity	Wet Density, γ t	Dry Density, γ d	Void Ratio, e0	Degree of Saturation	LL	PL	PI	Gravel Size Fraction	Sand Size Fraction	Silt Size Fraction	Clay Zize Fraction	Unconfined compressive strength, q_u	Strain at Failure	Cohesion, c	Angle of Internal Friction, Ø	Effective Cohesion, c'	Effective Angle of internal friction, Ø'	Compression Index, Cc	Recompression Index, Cr	Effective Preconsolidation Pressure, Pc		
No.	(M)	No.	No.	%	Gs	kN/m³	kN/m³	e	Sr %	%	%	%	%	%	%	%	kN/m²	%	kN/m²	(°)	kN/m²	(°)			kN/m²	kN/m²	
BH-1	3.50-4.00			50.90	2.57	16.43	10.888	1.360	96.16	67.5	36.7	30.8	2.0	28.0	53.0	17.0					59.0	21.8					
	7.50-8.00			44.47	2.56	16.53	11.442	1.237	92.00	60.2	33.9	26.3	2.0	36.0	49.0	13.0											
	15.50-16.00			47.97	2.63	16.90	11.421	1.303	96.84	70.0	35.3	34.7	-	10.0	68.0	22.0	27.45	6.10									
	21.50-22.00			32.56	2.5	17.97	13.556	0.844	96.42	-	-	-	47.0	33.0	20.0	-											
	35.50-36.00			33.01	2.55	17.61	13.240	0.926	90.90	50.1	30.4	19.7	4.0	43.0	43.0	10.0	73.15	8.65									
BH-2	1.50-2.00			37.31	2.54	17.26	12.570	1.021	92.85	53.8	32.2	21.6	21.0	49.0	26.0	4.0											
	9.50-10.00			31.98	2.48	17.93	13.585	0.825	96.08	-	-	-	25.0	64.0	11.0	-											
	23.50-24.00			47.01	2.58	16.79	11.421	1.259	96.34	65.0	35.6	29.4	-	32.0	54.0	14.0											
	39.50-40.00			34.69	2.69	18.04	13.394	1.008	92.54	63.1	30.4	32.7	-	1.0	73.0	26.0	84.06	8.13									

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SUMMARY OF LABORATORY TEST RESULTS

PROJECT : APARTEMEN GATOT SUBROTO
LOCATION : JL. JEND. GATOT SUBROTO - JAKARTA

BOREHOLE	DEPTH	SAMPLE (UDS)	SAMPLE (SPT)	Specific Gravity, Grain Size Distribution , Density & Moisture						Atterberg Limits			Grain Size Fraction				Triaxial Compression: TX-UU / CU / CD; Unconfined Compression: UC						Consolidation			Field Vane Test qv	N-SPT
																	UC-UU		TX-UU		TX-CU						
				Moisture content, ω	Specific Gravity	Wet Density, γ t	Dry Density, γ d	Void Ratio, e0	Degree of Saturation	LL	PL	PI	Gravel Size Fraction	Sand Size Fraction	Silt Size Fraction	Clay Size Fraction	Unconfined compressive strength, q_u	Strain at Failure	Cohesion, c	Angle of Internal Friction, Ø	Effective Cohesion, c'	Effective Angle of internal friction, Ø'	Compression Index, Cc	Recompression Index, Cr	Effective Preconsolidation Pressure, Pc		
No.	(M)	No.	No.	%	Gs	kN/m³	kN/m³	e	Sr %	%	%	%	%	%	%	%	kN/m²	%	kN/m²	(°)	kN/m²	(°)			kN/m²	kN/m²	
BH-3	3.50-4.00			53.89	2.68	16.07	10.443	1.566	92.20	81.6	36.1	45.5	-	1.0	70.0	29.0					25.0	24.4					
	9.50-10.00			30.50	2.48	18.13	13.893	0.785	96.34	-	-	-	-	93.0	7.0	-											
	15.50-16.00			60.17	2.67	16.02	10.002	1.670	96.23	87.5	39.8	47.7	-	2.0	73.0	25.0			150.0	32.0							
	19.50-20.00			38.80	2.58	17.57	12.659	1.038	96.42	56.2	33.4	22.8	-	25.0	58.0	17.0											
	23.50-24.00			43.92	2.55	16.56	11.506	1.216	92.09	60.6	34.5	26.1	28.0	32.0	34.0	6.0	101.44	6.10									
	29.50-30.00			43.57	2.56	16.99	11.834	1.163	95.88	60.3	34.3	26.0	-	42.0	46.0	12.0											
BH-4	3.50-4.00			90.99	2.61	14.02	7.341	2.556	92.93	110.4	48.9	61.5	-	15.0	66.0	19.0											
	9.50-10.00			36.62	2.54	17.68	12.941	0.963	96.61	53.0	33.4	19.6	30.0	37.0	28.0	5.0											
	17.50-18.00			14.53	2.49	20.51	17.908	0.390	92.66	-	-	-	30.0	56.0	14.0	-											
	25.50-26.00			55.40	2.58	16.13	10.380	1.486	96.21	72.1	38.9	33.2	-	24.0	60.0	16.0											
	31.50-32.00			40.84	2.61	17.02	12.085	1.160	91.91	61.3	33.6	27.7	3.0	12.0	66.0	19.0	305.36	8.65									
	35.50-36.00			41.05	2.67	17.24	12.223	1.184	92.53	69.0	33.8	35.2	-	2.0	68.0	30.0											

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SUMMARY OF LABORATORY TEST RESULTS

PROJECT : APARTEMEN GATOT SUBROTO
LOCATION : JL. JEND. GATOT SUBROTO - JAKARTA

BOREHOLE	DEPTH	SAMPLE (UDS)	SAMPLE (SPT)	Specific Gravity, Grain Size Distribution , Density & Moisture						Atterberg Limits			Grain Size Fraction				Triaxial Compression: TX-UU / CU / CD; Unconfined Compression: UC						Consolidation			Field Vane Test qv	N-SPT
																	UC-UU		TX-UU		TX-CU						
				Moisture content, ω	Specific Gravity	Wet Density, γ t	Dry Density, γ d	Void Ratio, e0	Degree of Saturation	LL	PL	PI	Gravel Size Fraction	Sand Size Fraction	Silt Size Fraction	Clay Zize Fraction	Unconfined compressive strength, q_u	Strain at Failure	Cohesion, c	Angle of Internal Friction, Ø	Effective Cohesion, c'	Effective Angle of internal friction, Ø'	Compression Index, Cc	Recompression Index, Cr	Effective Preconsolidation Pressure, Pc		
No.	(M)	No.	No.	%	Gs	kN/m³	kN/m³	e	Sr %	%	%	%	%	%	%	%	kN/m²	%	kN/m²	(°)	kN/m²	(°)			kN/m²	kN/m²	
BH-5	5.50-6.00			52.69	2.57	15.81	10.354	1.482	91.37	68.5	38.1	30.4	-	32.0	54.0	14.0											
	13.50-14.00			58.68	2.55	15.32	9.655	1.641	91.17	74.2	39.5	34.7	4.0	54.0	35.0	7.0	64.21	8.13									
	17.50-18.00			69.18	2.52	14.56	8.606	1.928	90.42	-	-	-	8.0	65.0	27.0	-											
	27.50-28.00			31.93	2.52	18.14	13.750	0.833	96.62	48.2	27.8	20.4	21.0	54.0	20.0	5.0											
	35.50-36.00			39.41	2.62	17.24	12.366	1.119	92.30	61.0	32.8	28.2	-	12.0	66.0	22.0											
	41.50-42.00			39.50	2.56	17.40	12.473	1.052	96.08	55.1	32.6	22.5	2.0	43.0	44.0	11.0											
BH-6	3.50-4.00			36.37	2.67	17.77	13.031	1.049	92.57	63.6	32.5	31.1	-	2.0	68.0	30.0											
	15.50-16.00			55.11	2.56	16.11	10.386	1.465	96.31	71.9	38.0	33.9	4.0	36.0	48.0	12.0	36.59	7.10									
	19.50-20.00			65.13	2.57	15.48	9.374	1.741	96.11	81.8	41.2	40.6	1.0	32.0	52.0	15.0											
	23.50-24.00			24.26	2.52	19.17	15.427	0.633	96.51	-	-	-	2.0	71.0	27.0	-											
	35.50-36.00			29.10	2.69	18.89	14.632	0.838	93.36	58.0	28.2	29.8	-	1.0	70.0	29.0											

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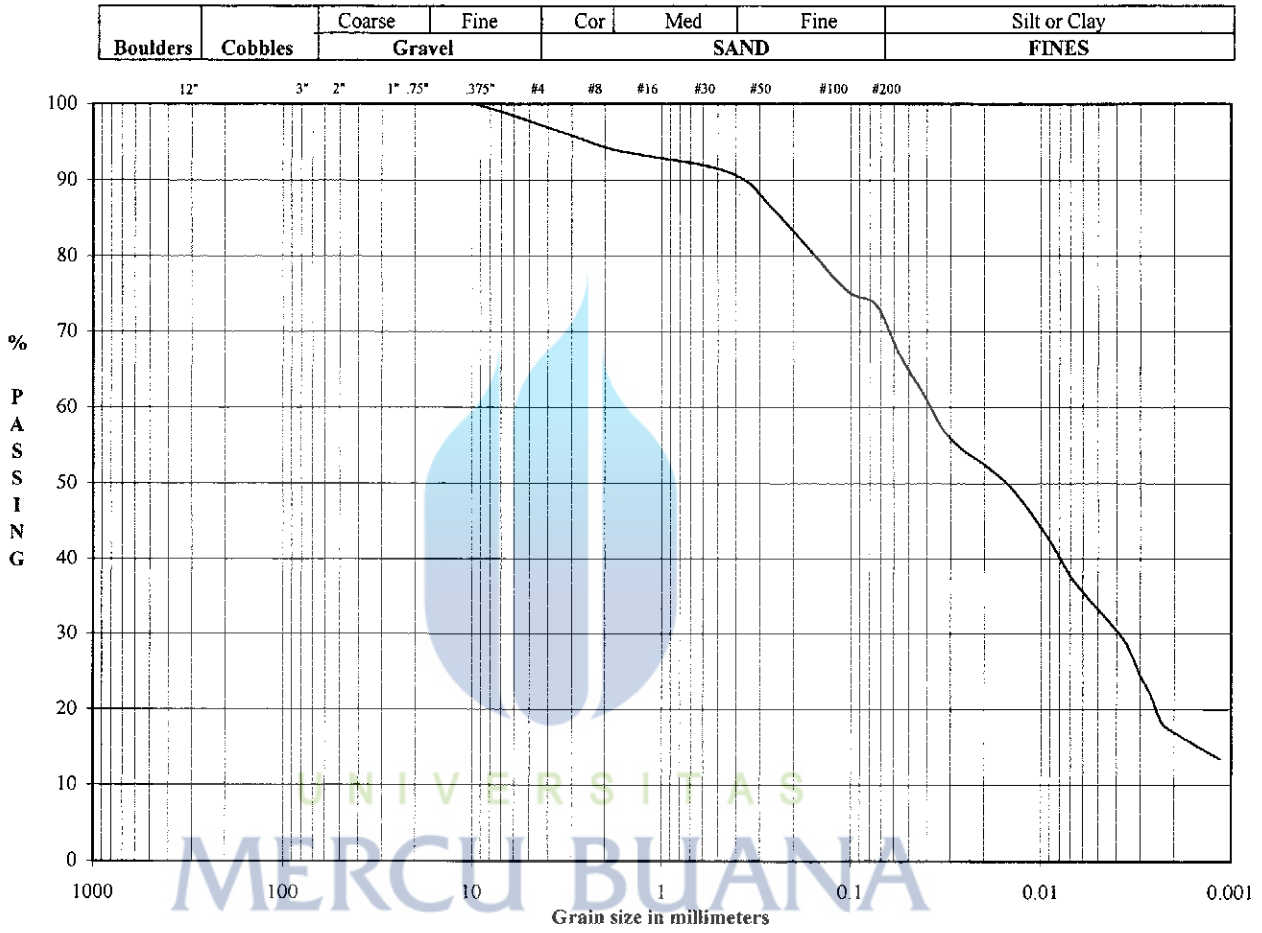
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-1
Sample Depth	:	3.50-4.00 M

Soil Description :



REMARKS :

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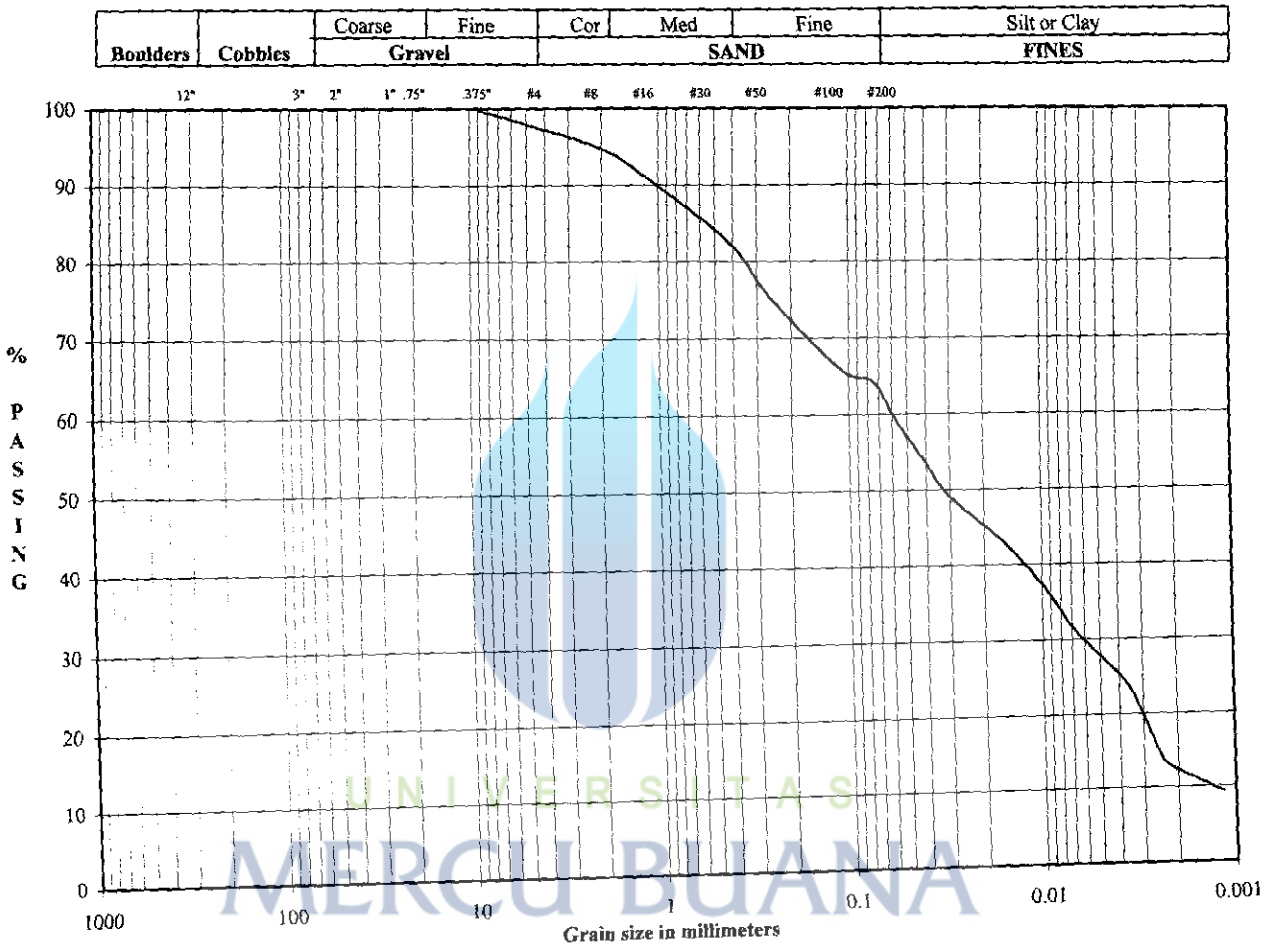
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-1
Sample Depth	:	7.50-8.00 M

Soil Description :



REMARKS :

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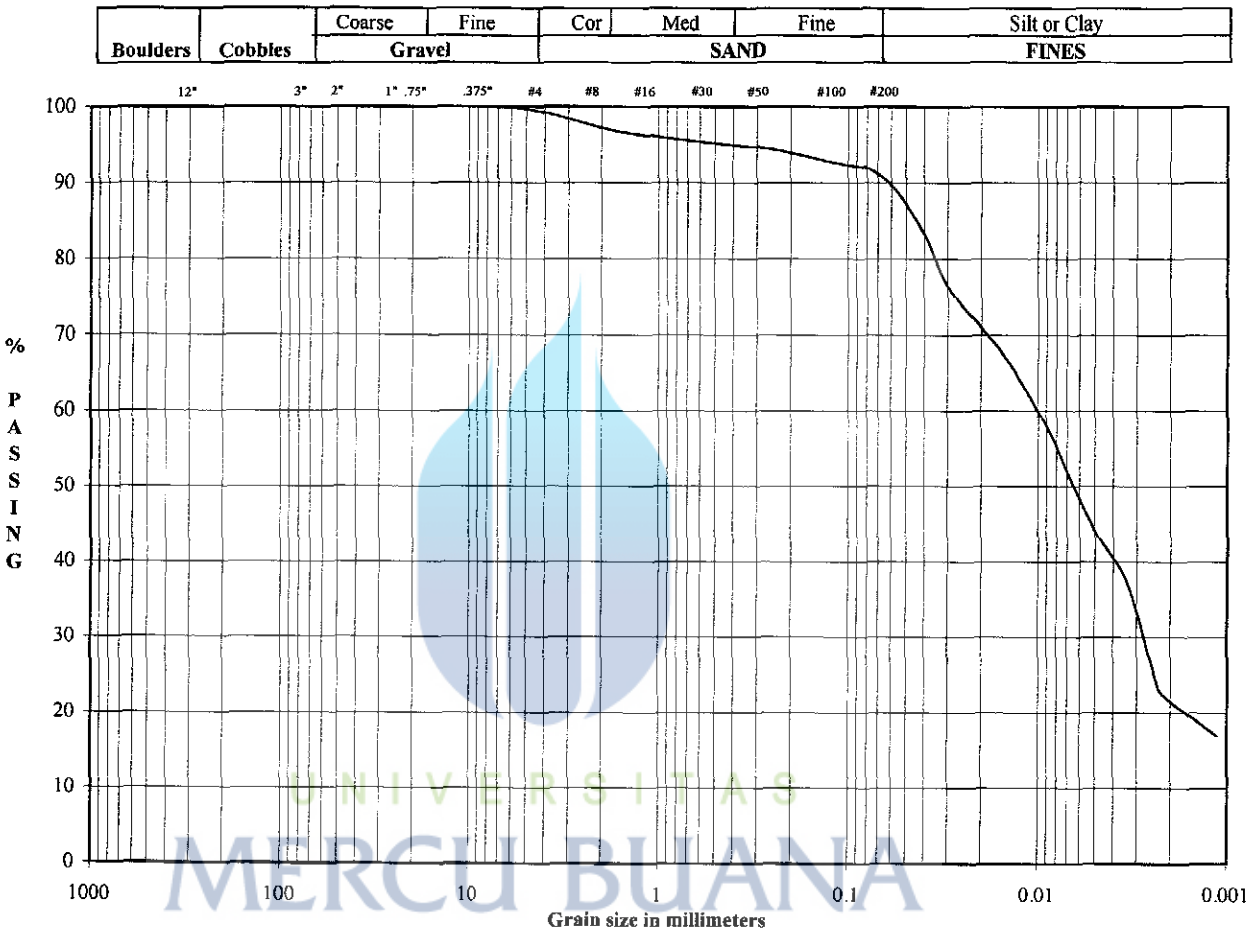
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-1
Sample Depth	:	15.50-16.00 M

Soil Description :



REMARKS :

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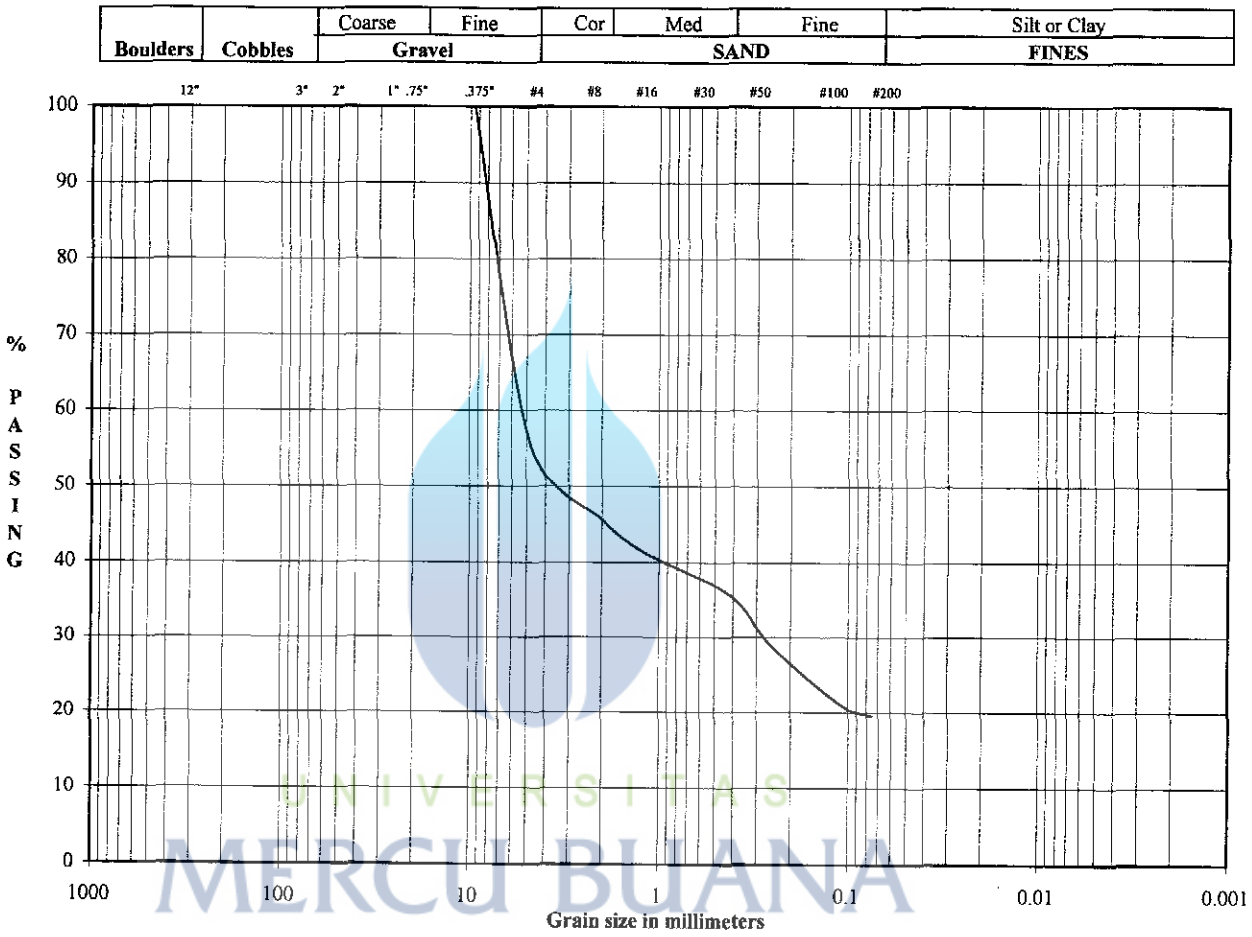
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-1
Sample Depth	:	21.50-22.00 M

Soil Description :



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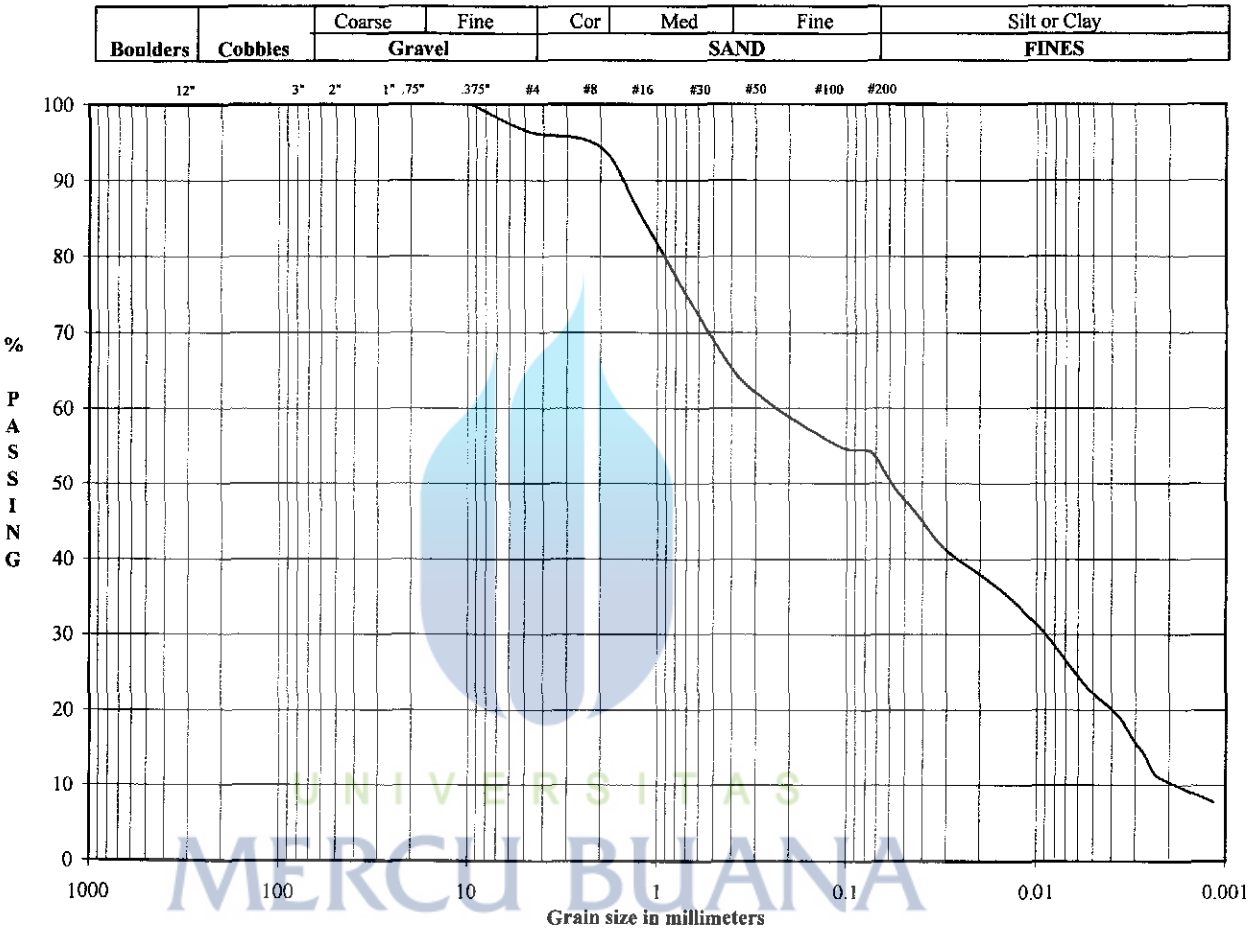
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-1
Sample Depth	:	35.50-36.00 M

Soil Description :



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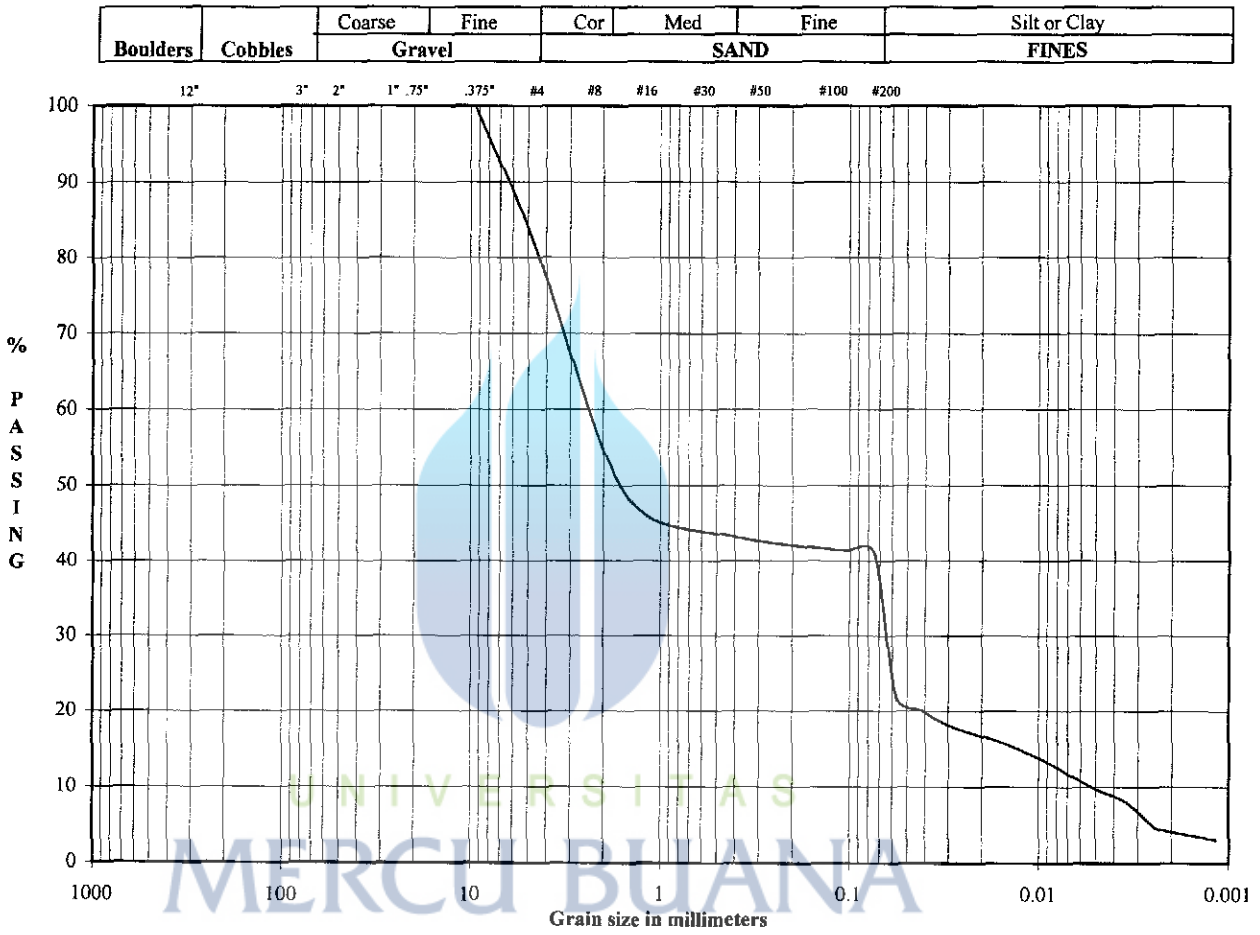
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-2
Sample Depth	:	1.50-2.00 M

Soil Description :



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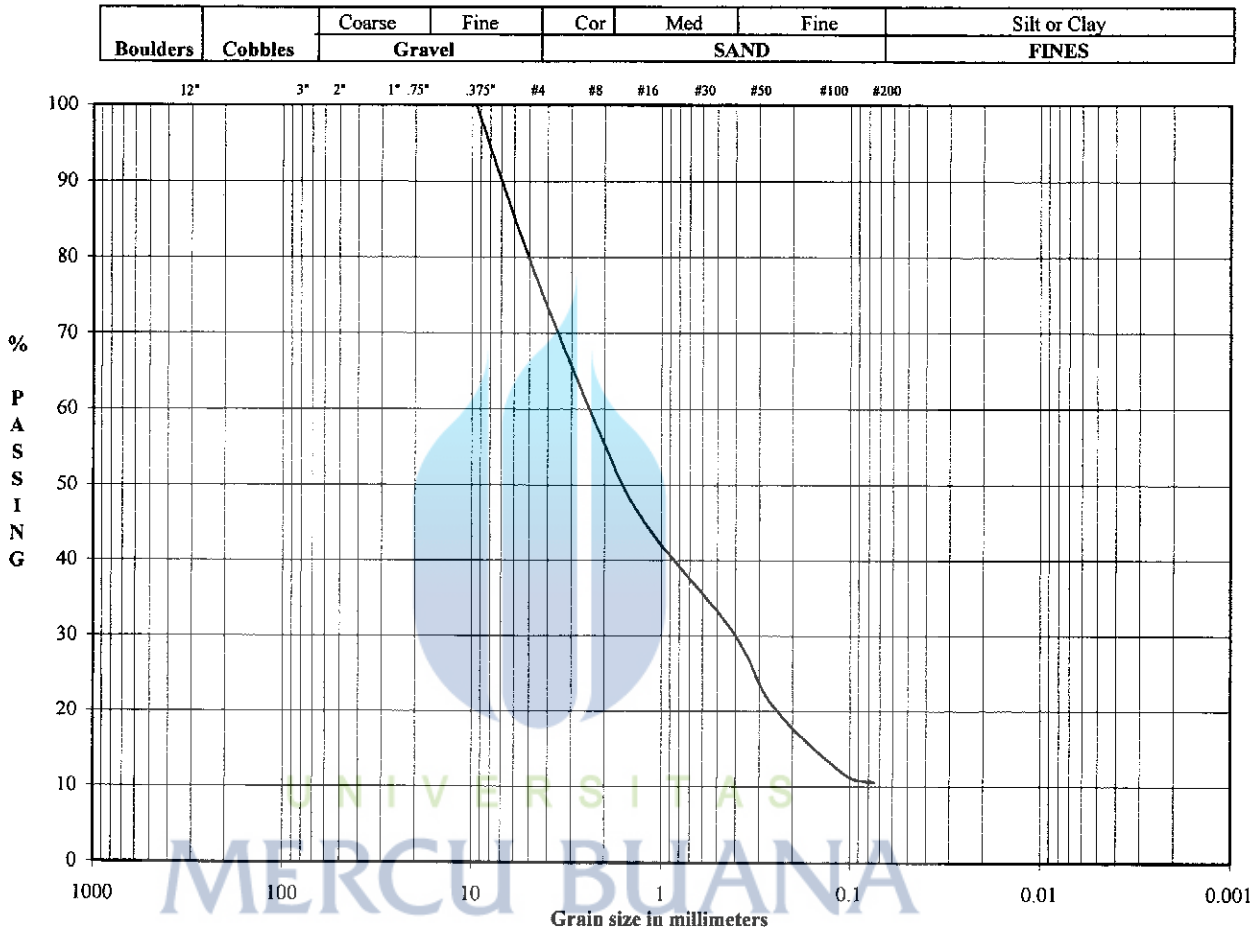
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-2
Sample Depth	:	9.50-10.00 M

Soil Description :



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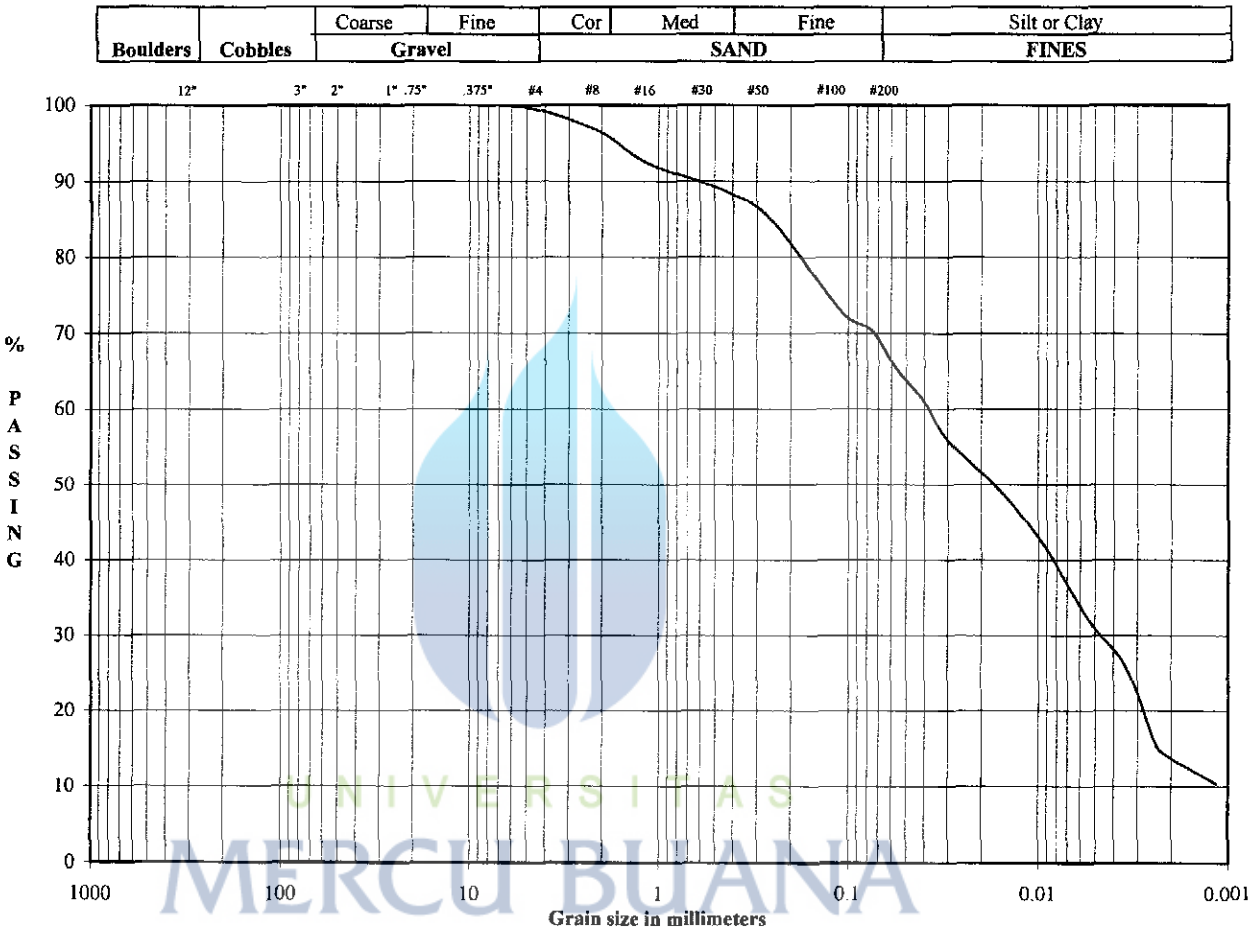
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-2
Sample Depth	:	23.50-24.00 M

Soil Description :



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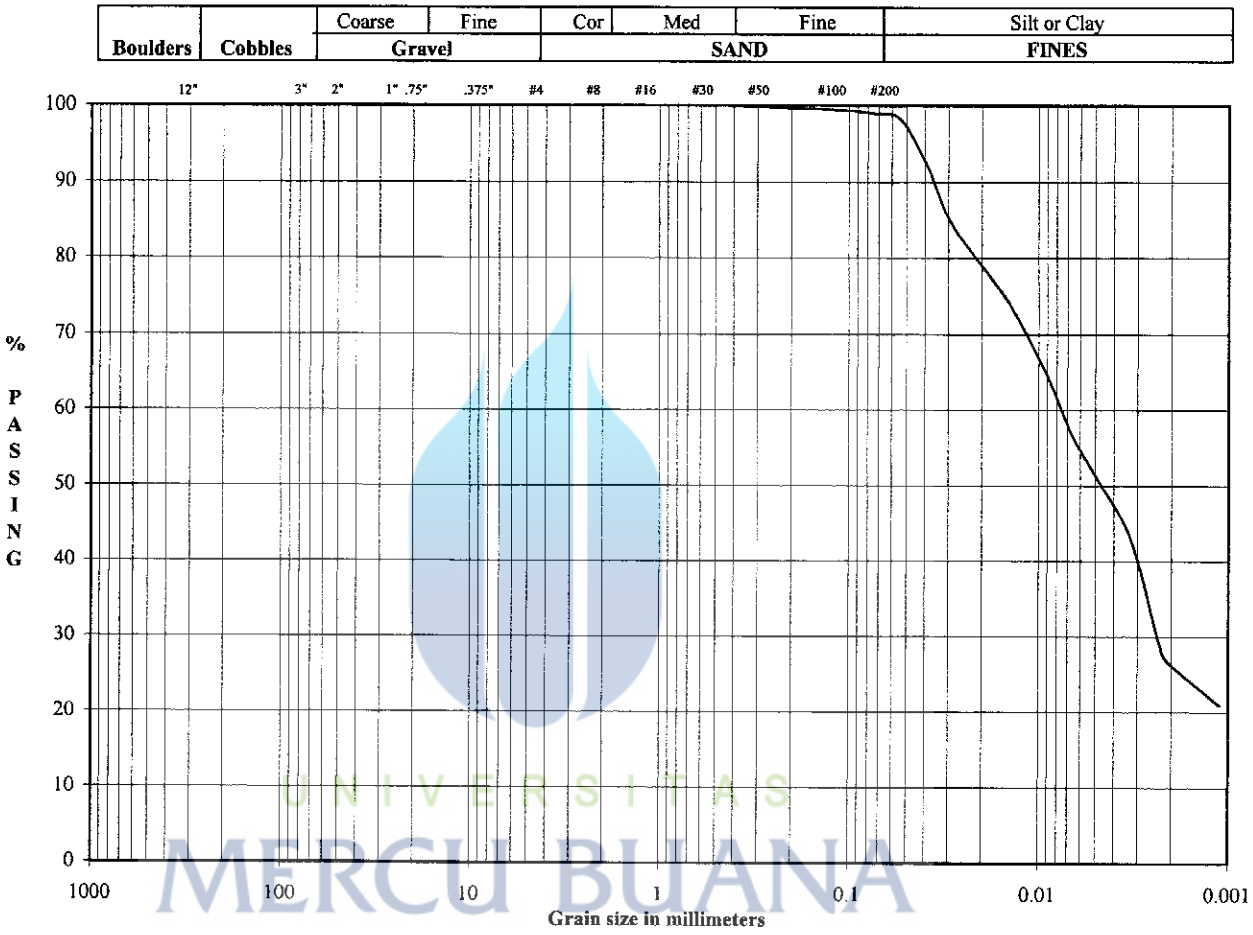
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-2
Sample Depth	:	39.50-40.00 M

Soil Description :



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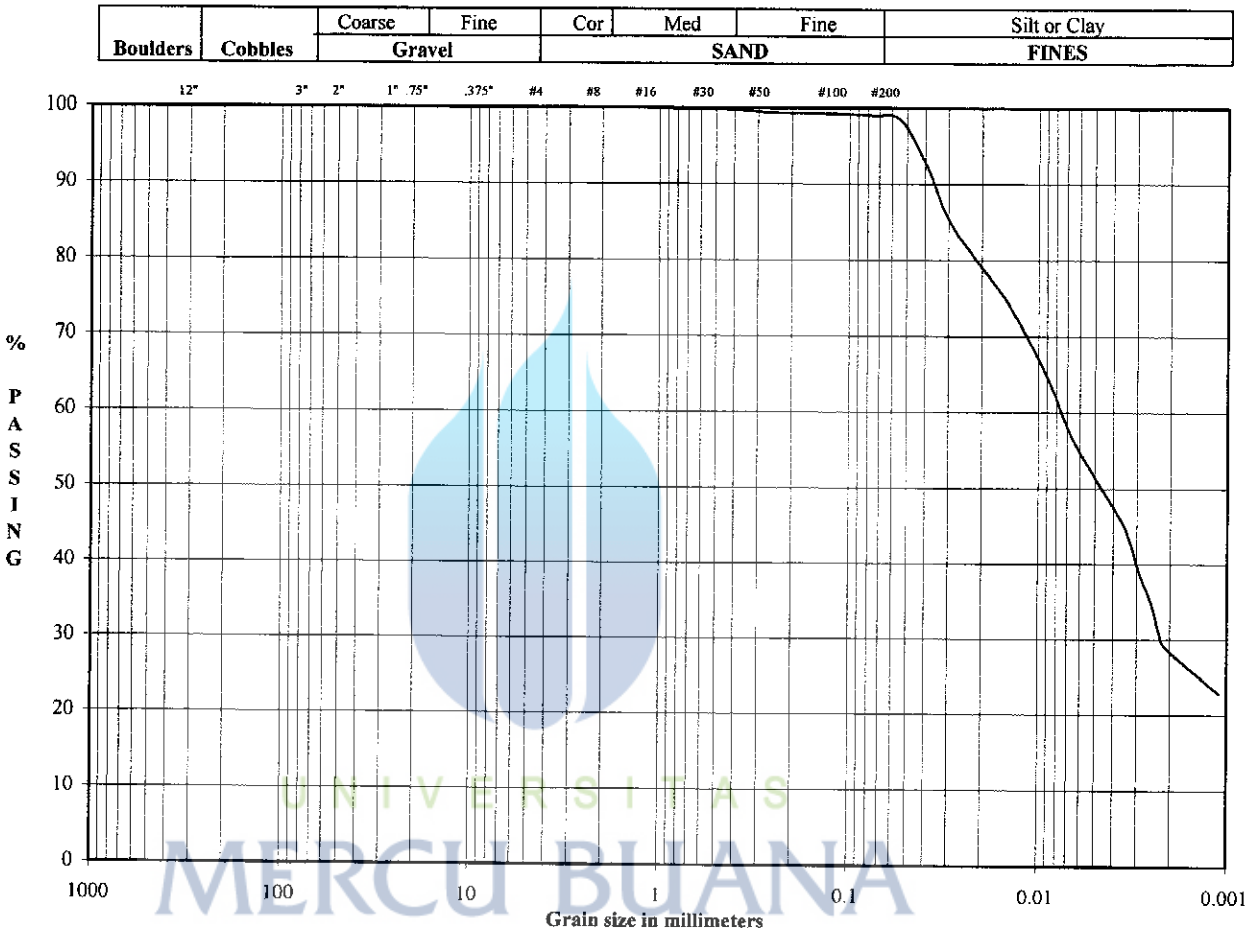
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-3
Sample Depth	:	3.50-4.00 M

Soil Description :



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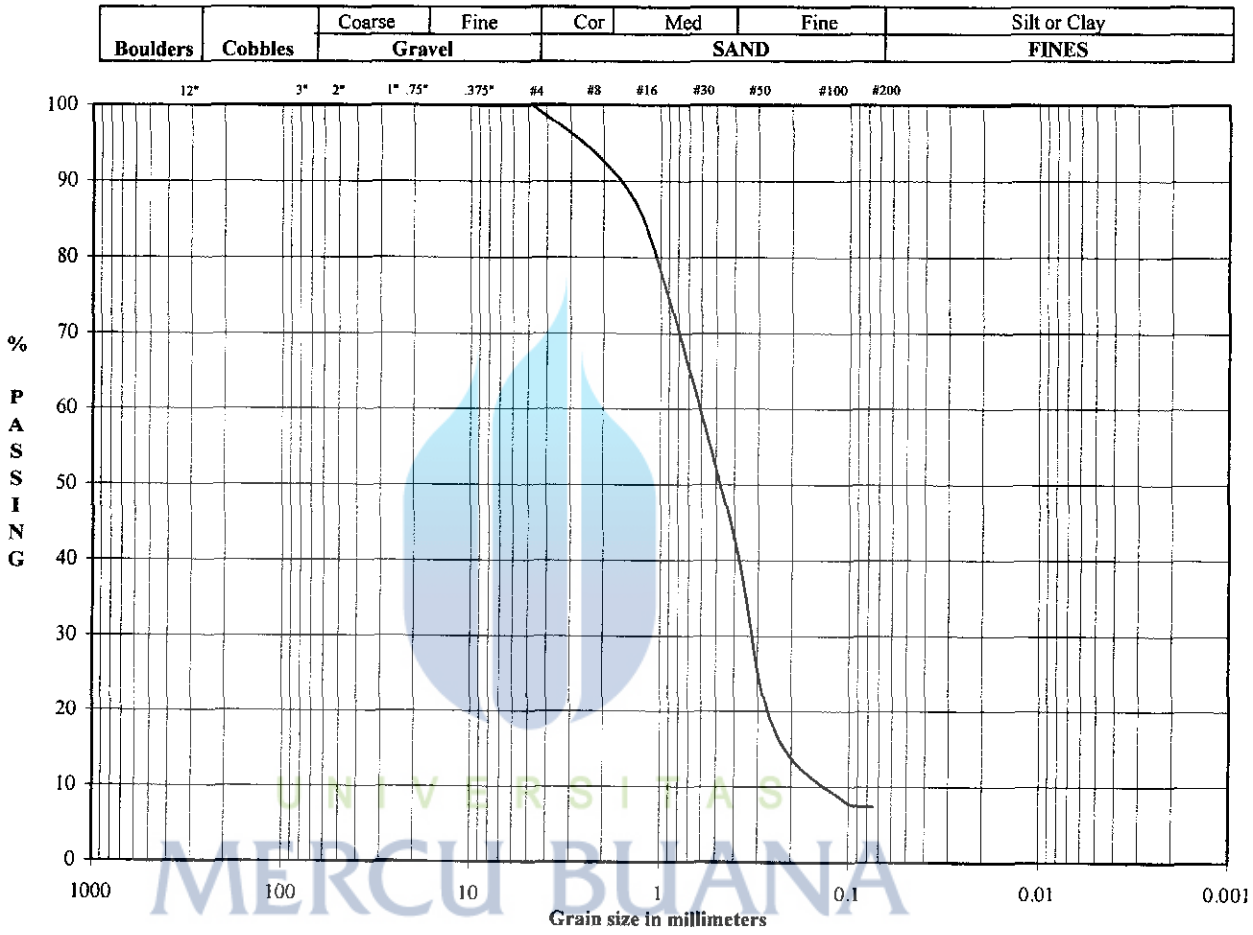
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-3
Sample Depth	:	9.50-10.00 M

Soil Description :



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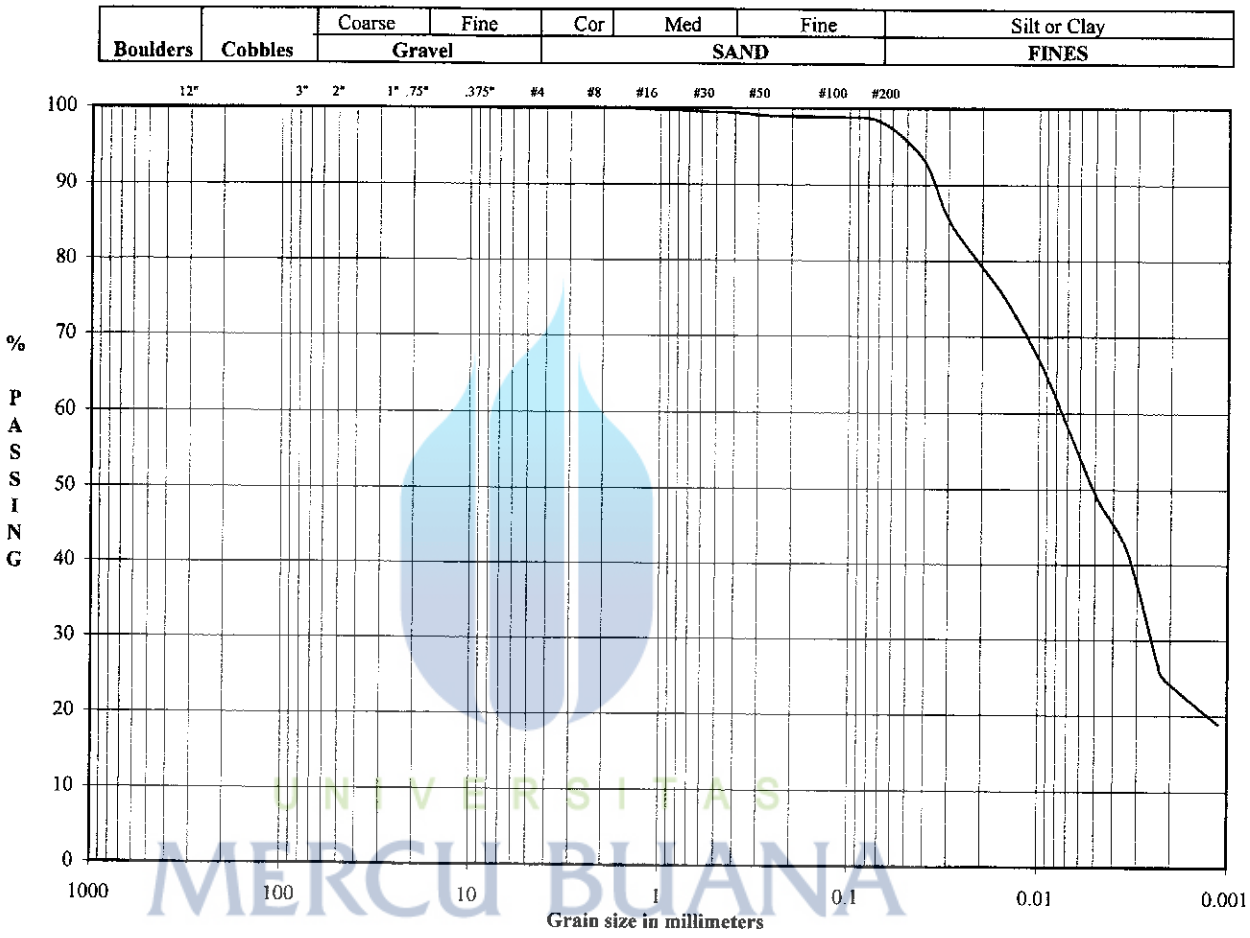
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-3
Sample Depth	:	15.50-16.00 M

Soil Description :



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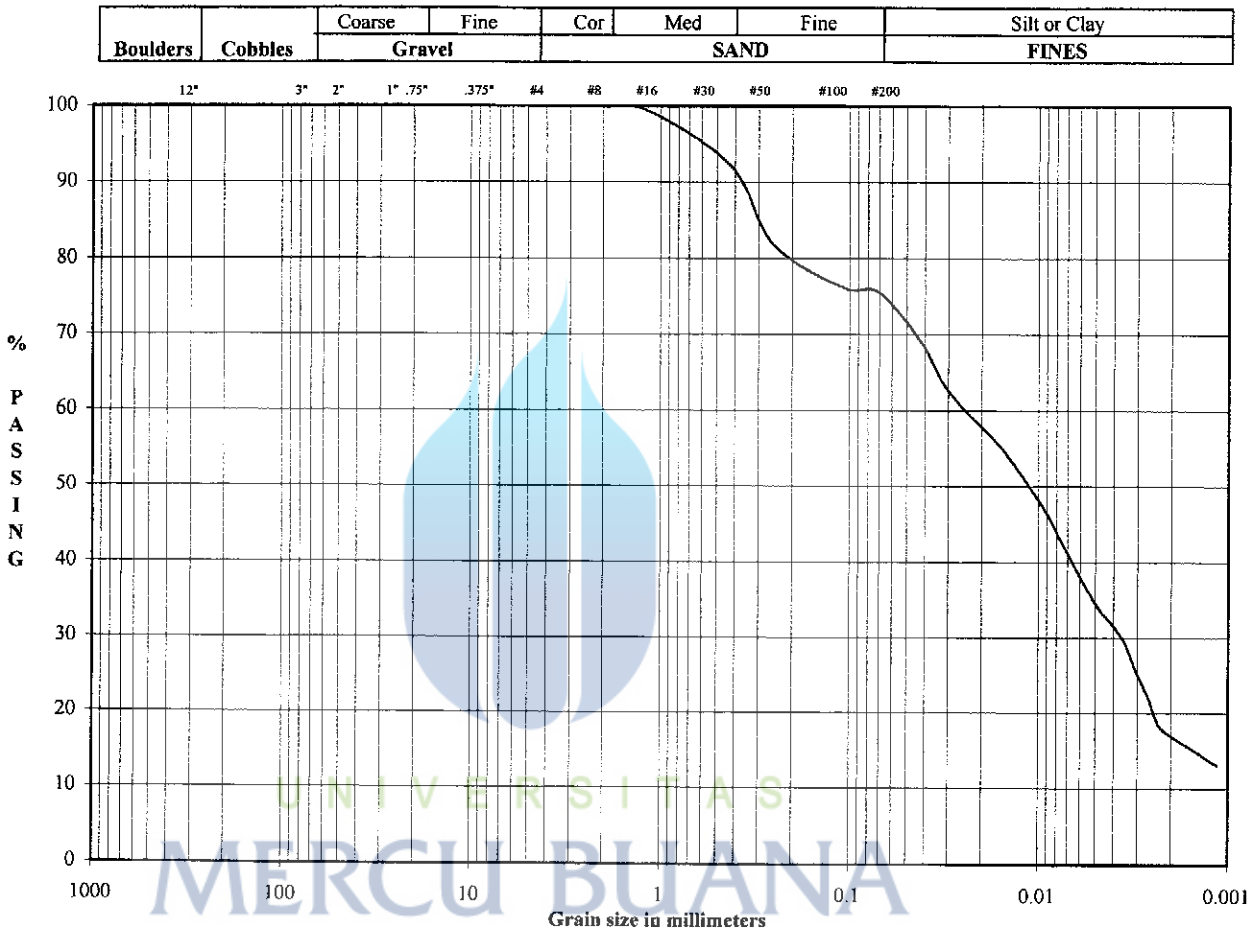
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-3
Sample Depth	:	19.50-20.00 M

Soil Description :



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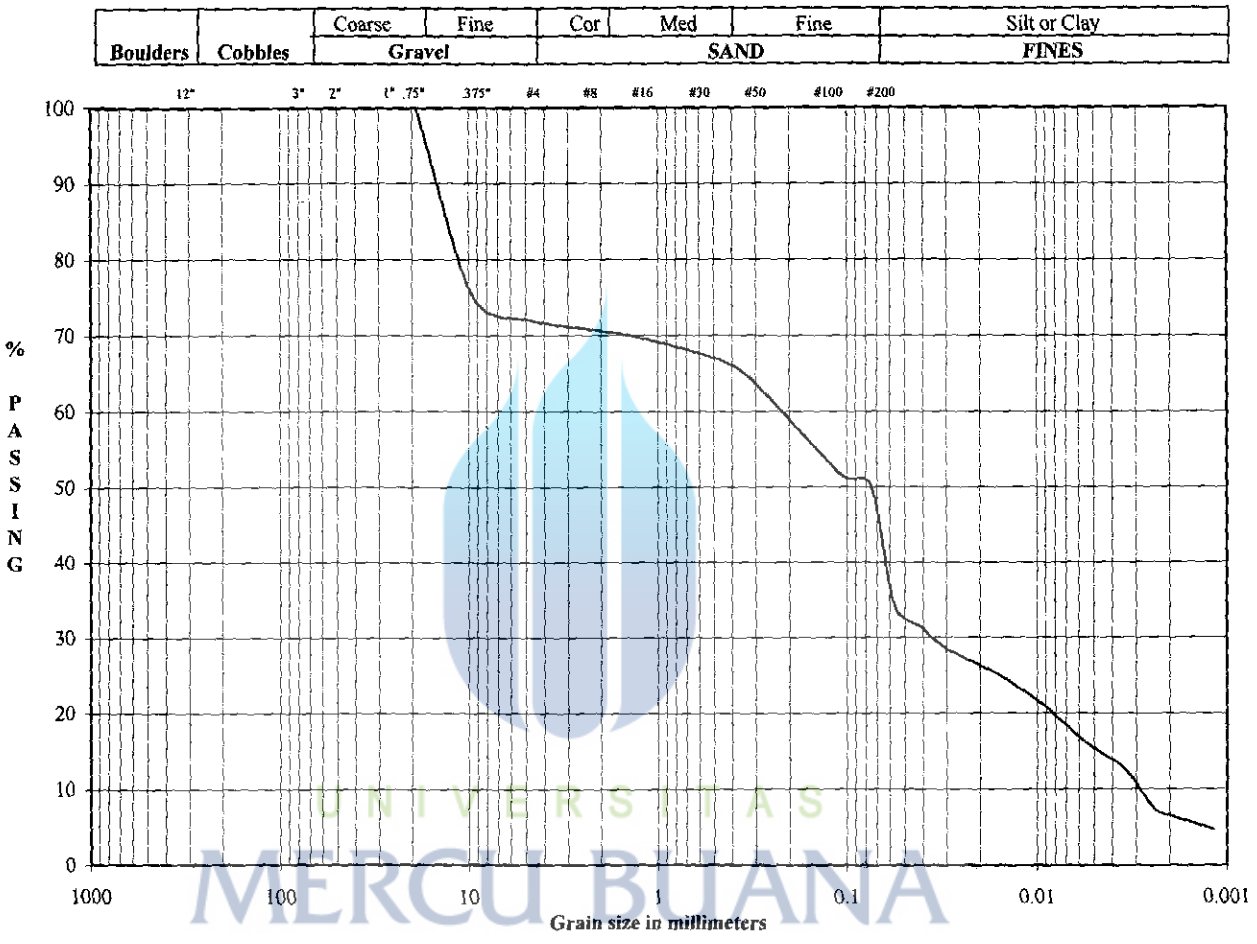
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-3
Sample Depth	:	23.50-24.00 M

Soil Description :



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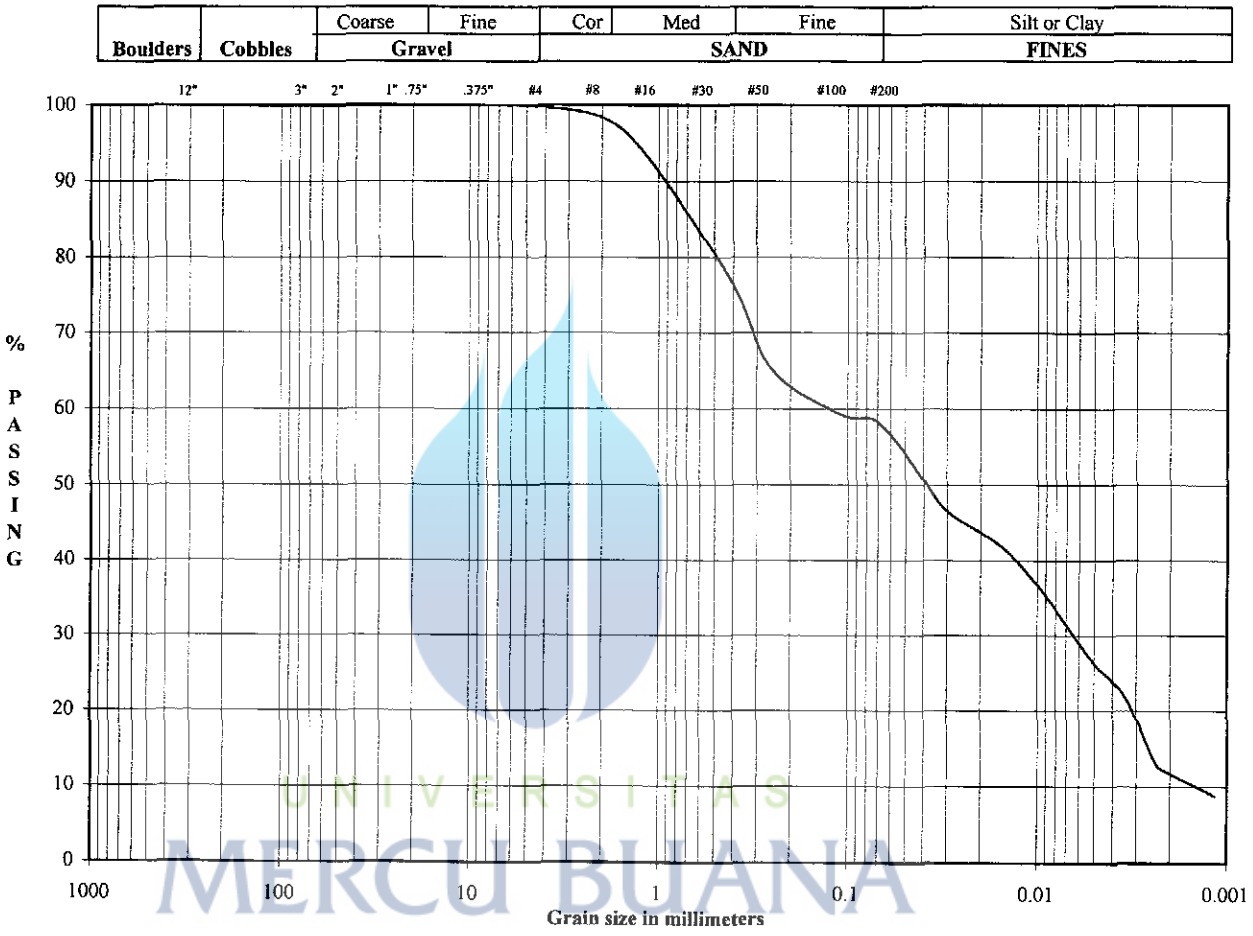
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-3
Sample Depth	:	29.50-30.00 M

Soil Description :



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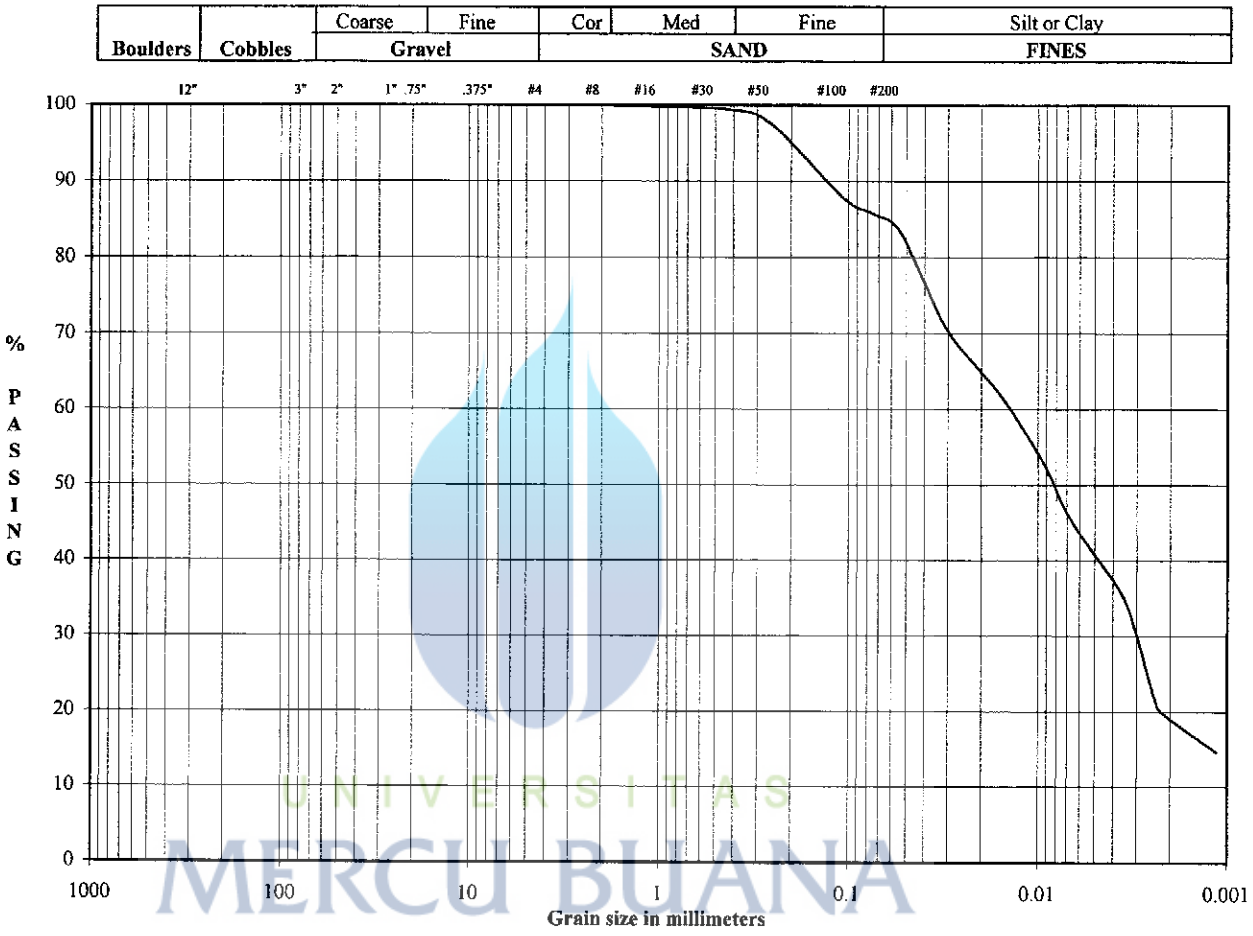
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-4
Sample Depth	:	3.50-4.00 M

Soil Description :



REMARKS :

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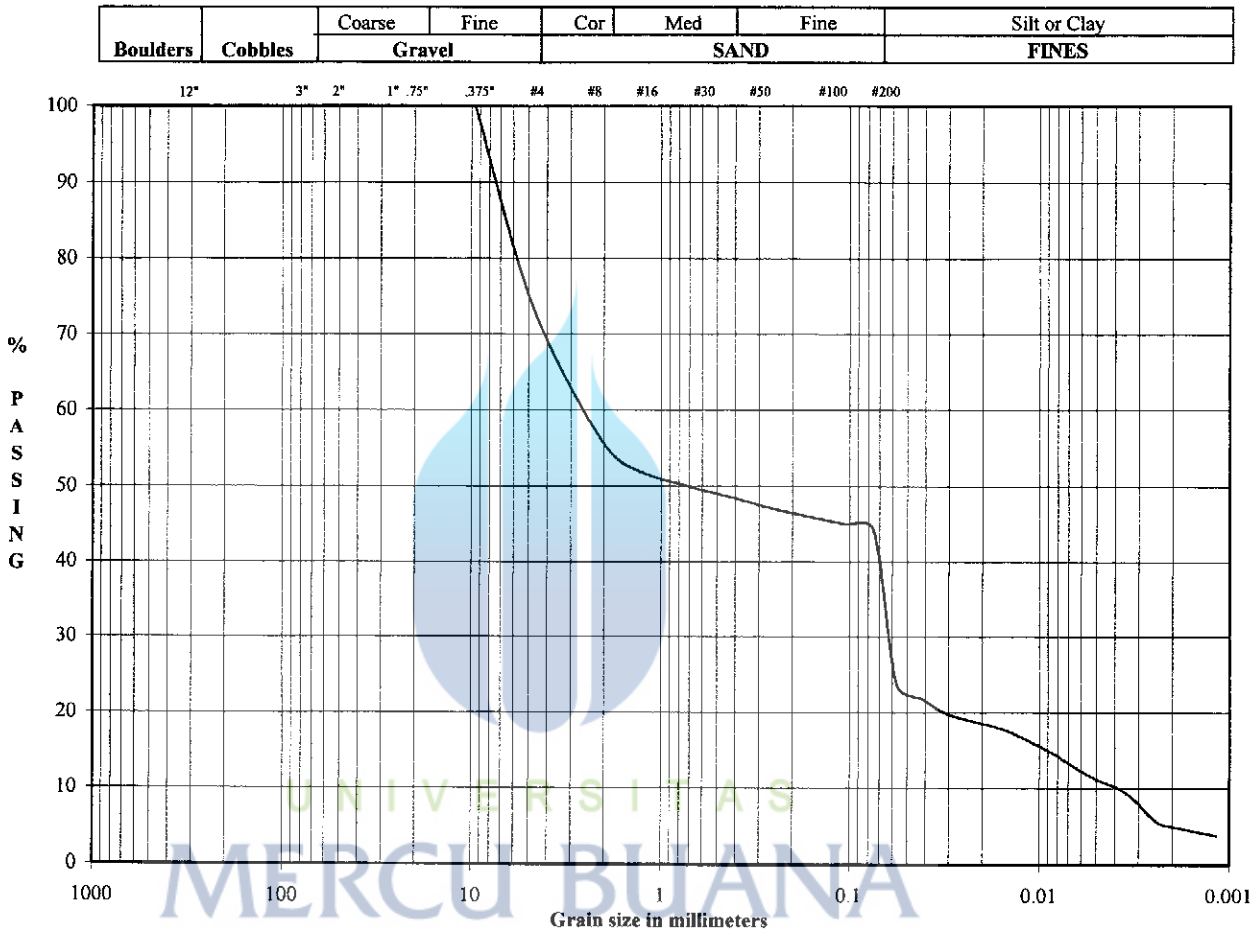
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-4
Sample Depth	:	9.50-10.00 M

Soil Description :



REMARKS :

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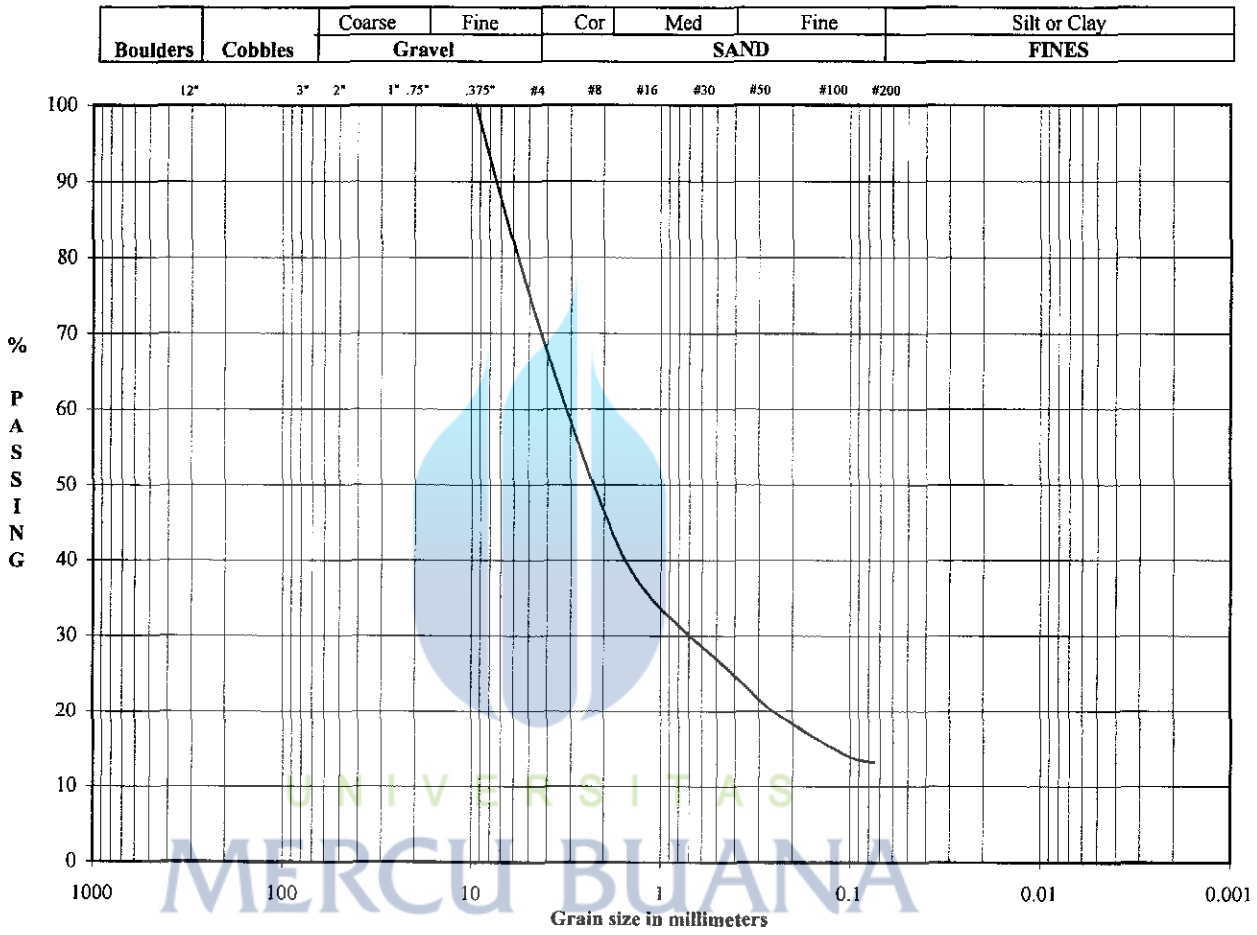
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-4
Sample Depth	:	17.50-18.00 M

Soil Description :



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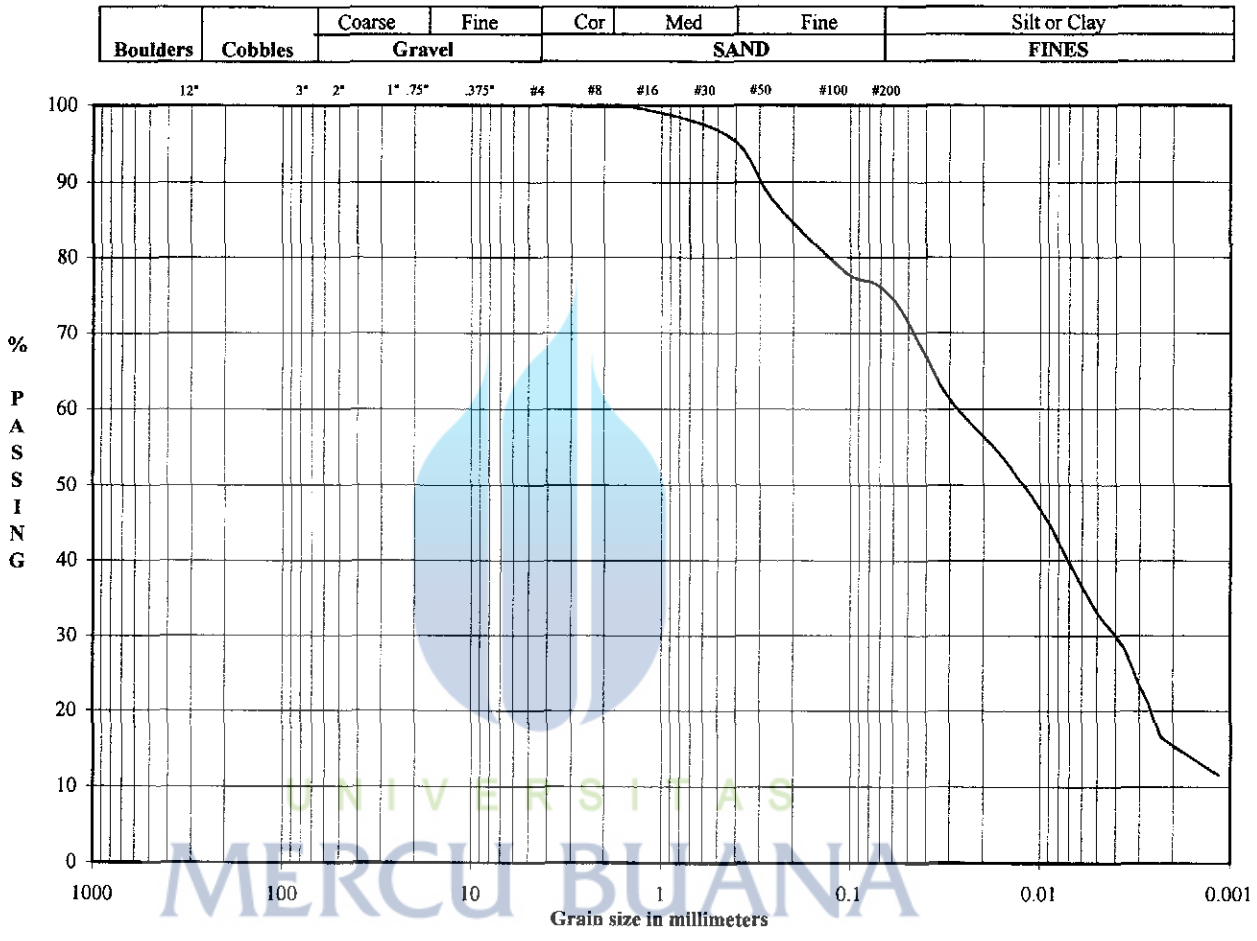
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-4
Sample Depth	:	25.50-26.00 M

Soil Description :



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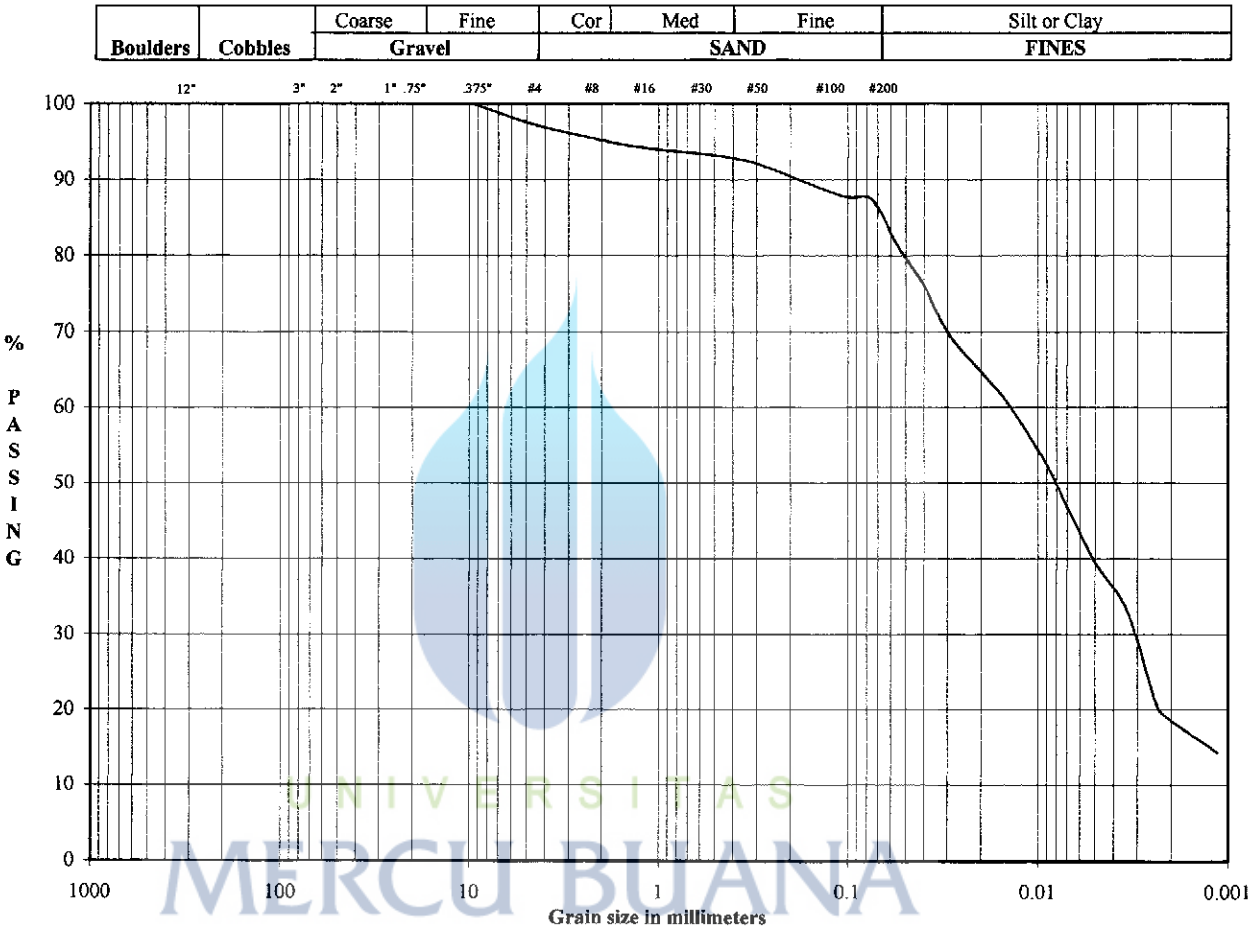
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-4
Sample Depth	:	31.50-32.00 M

Soil Description :



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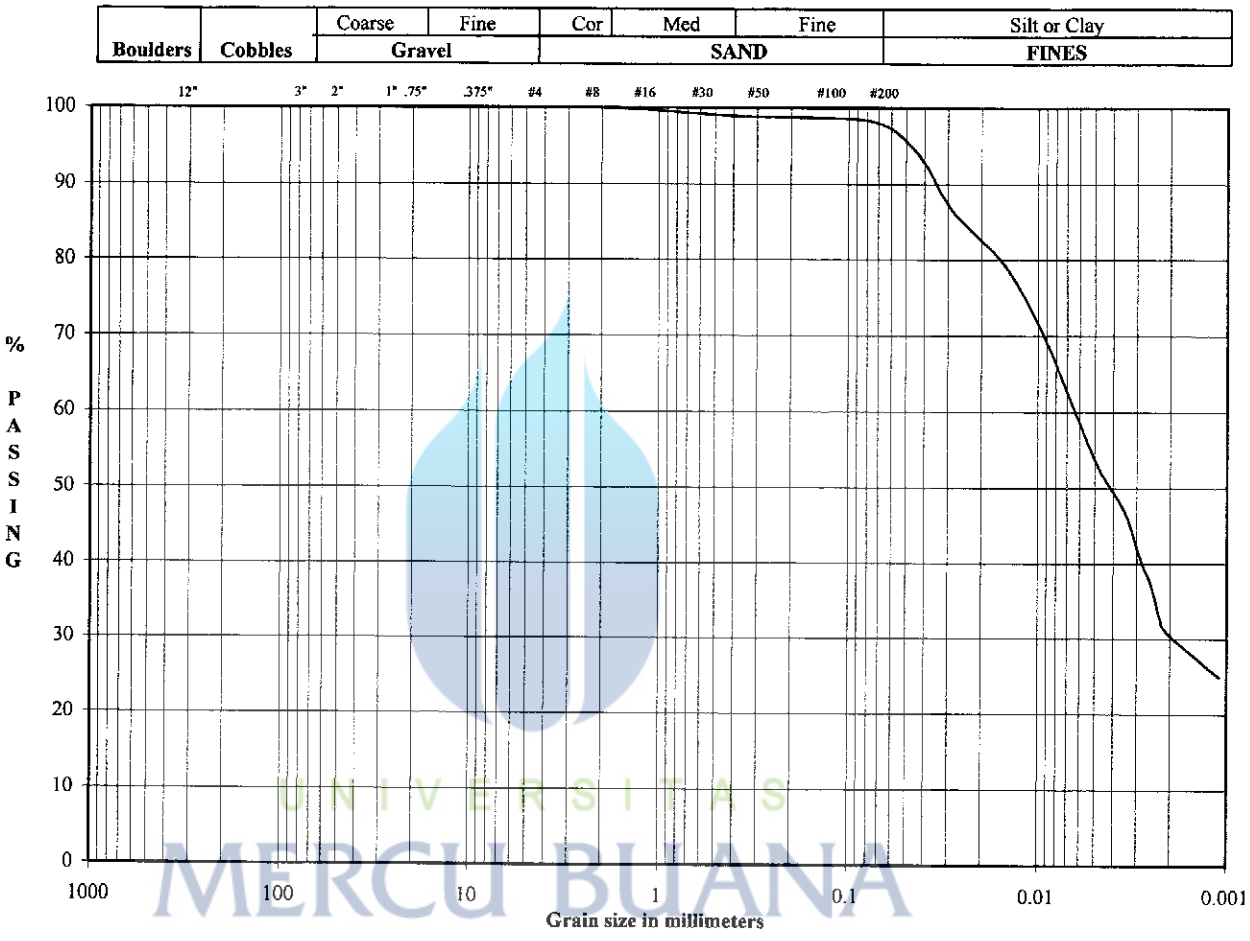
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-4
Sample Depth	:	35.50-36.00 M

Soil Description :



REMARKS :

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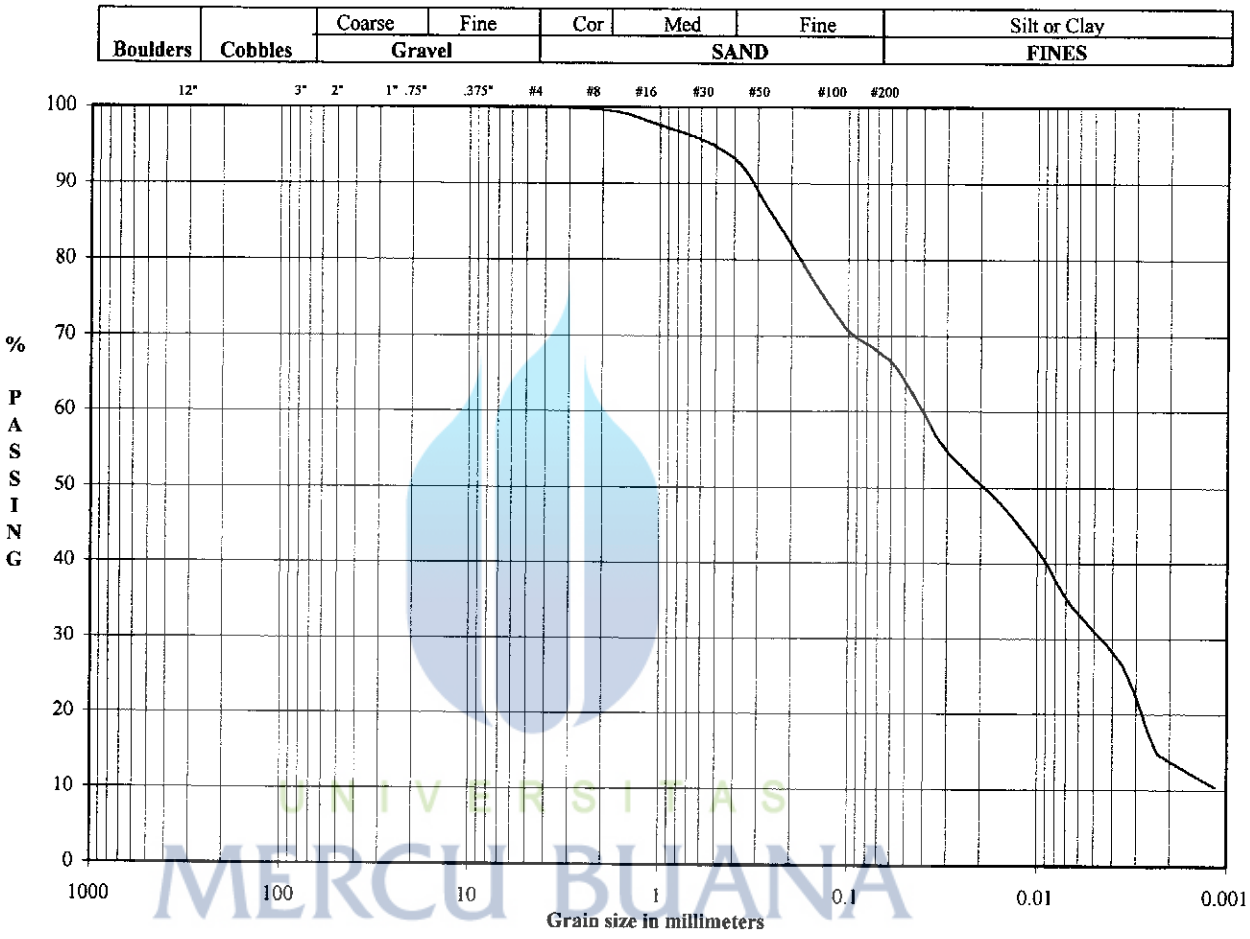
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-5
Sample Depth	:	5.50-6.00 M

Soil Description :



REMARKS :

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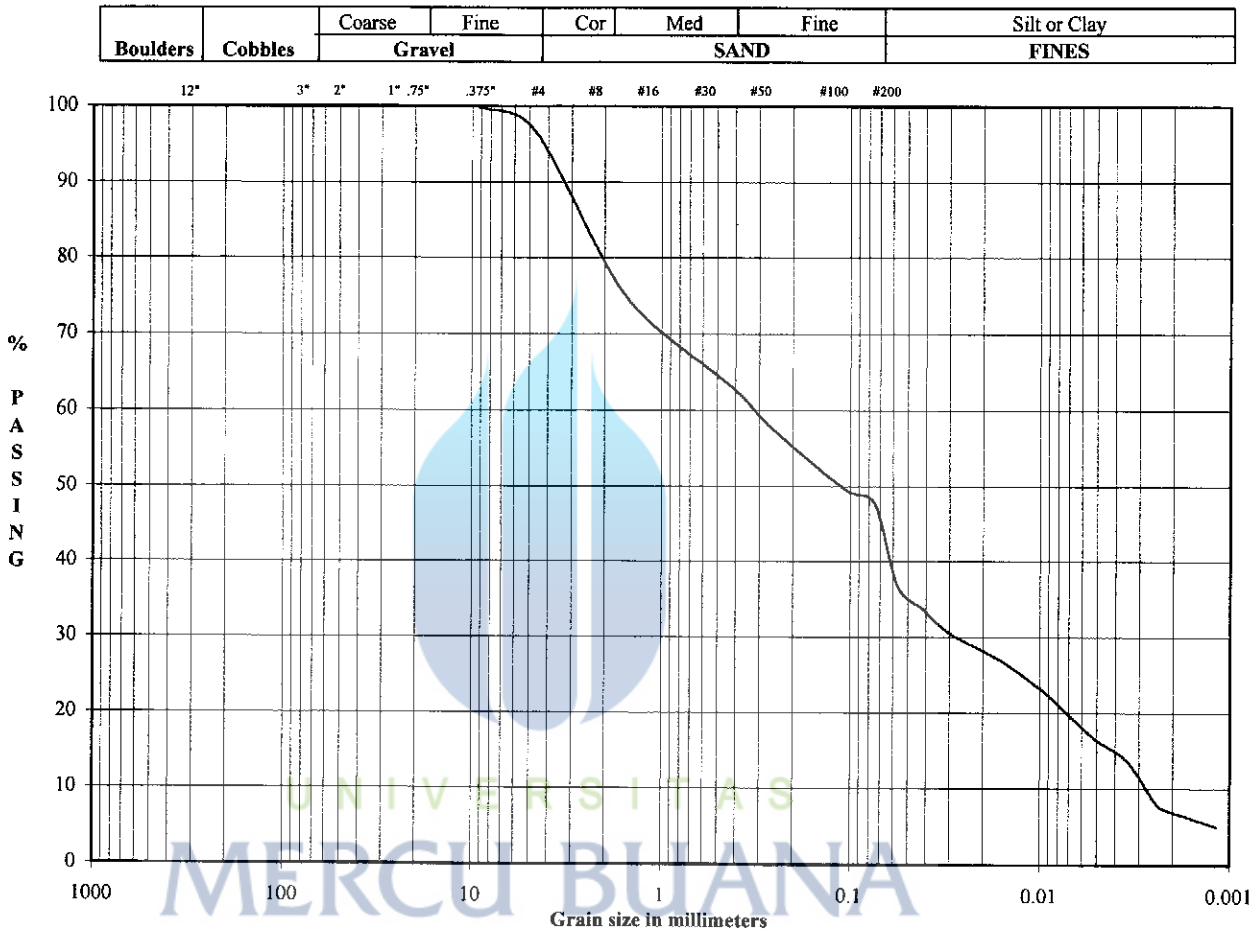
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-5
Sample Depth	:	13.50-14.00 M

Soil Description :



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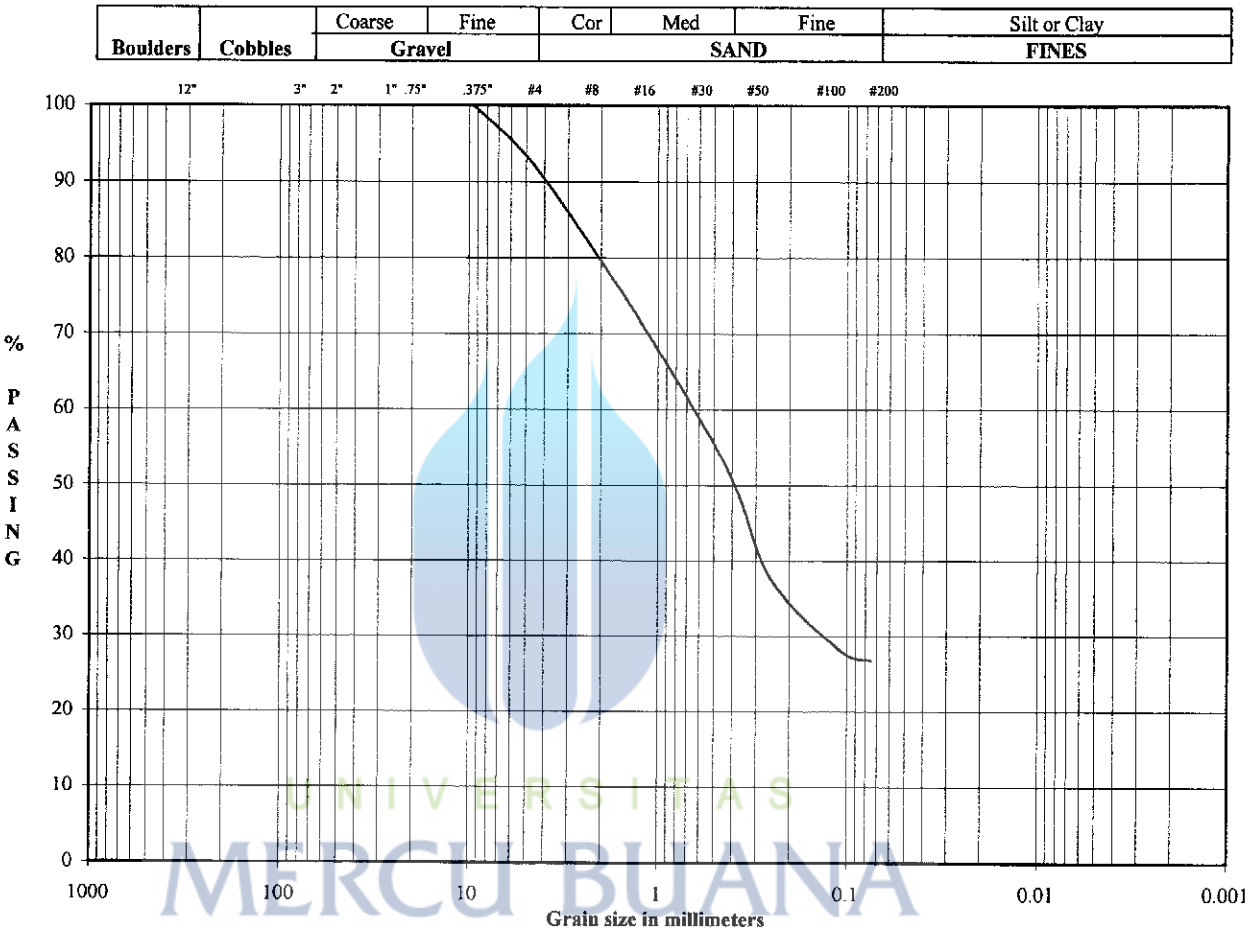
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-5
Sample Depth	:	17.50-18.00 M

Soil Description :



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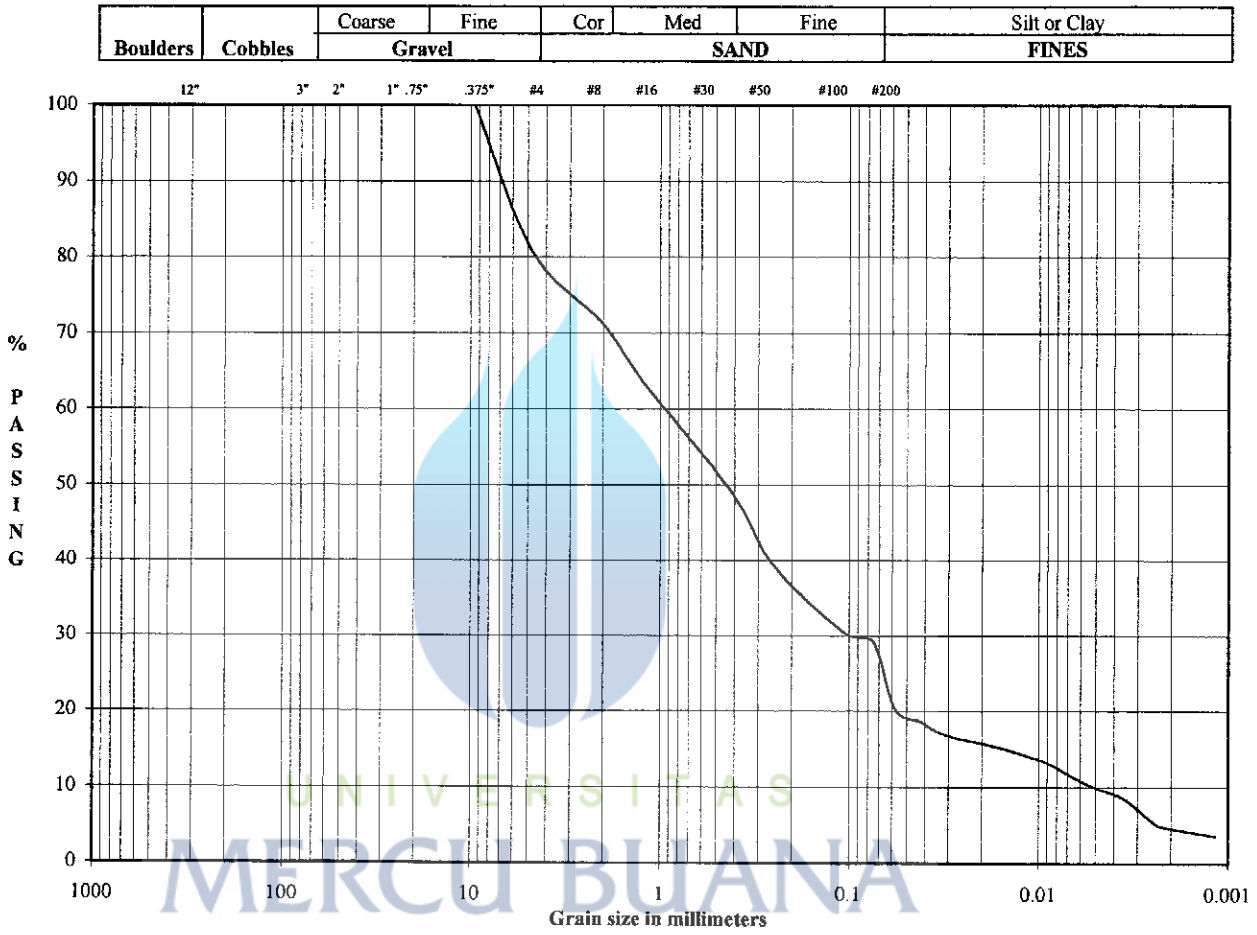
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-5
Sample Depth	:	27.50-28.00 M

Soil Description :



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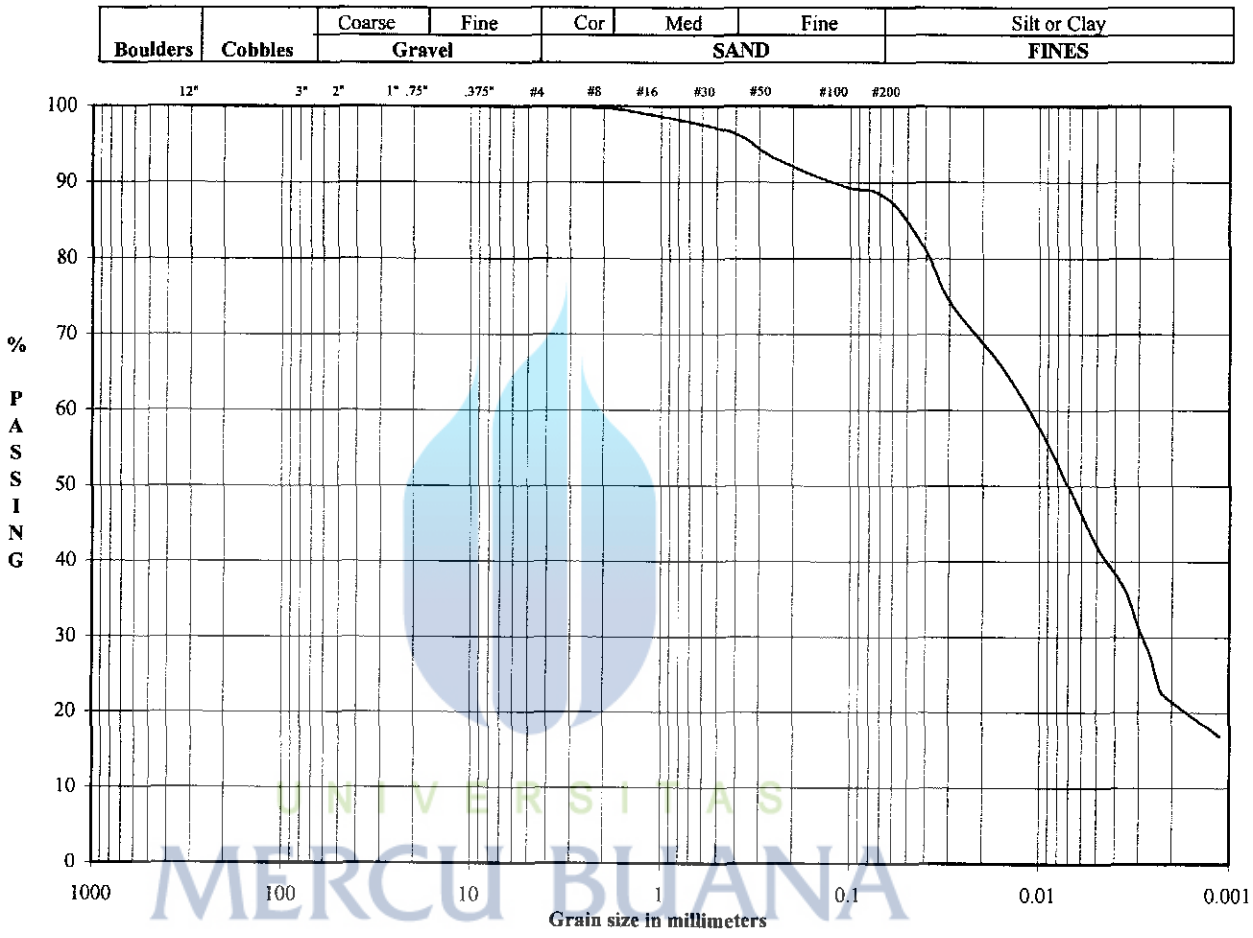
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-5
Sample Depth	:	35.50-36.00 M

Soil Description :



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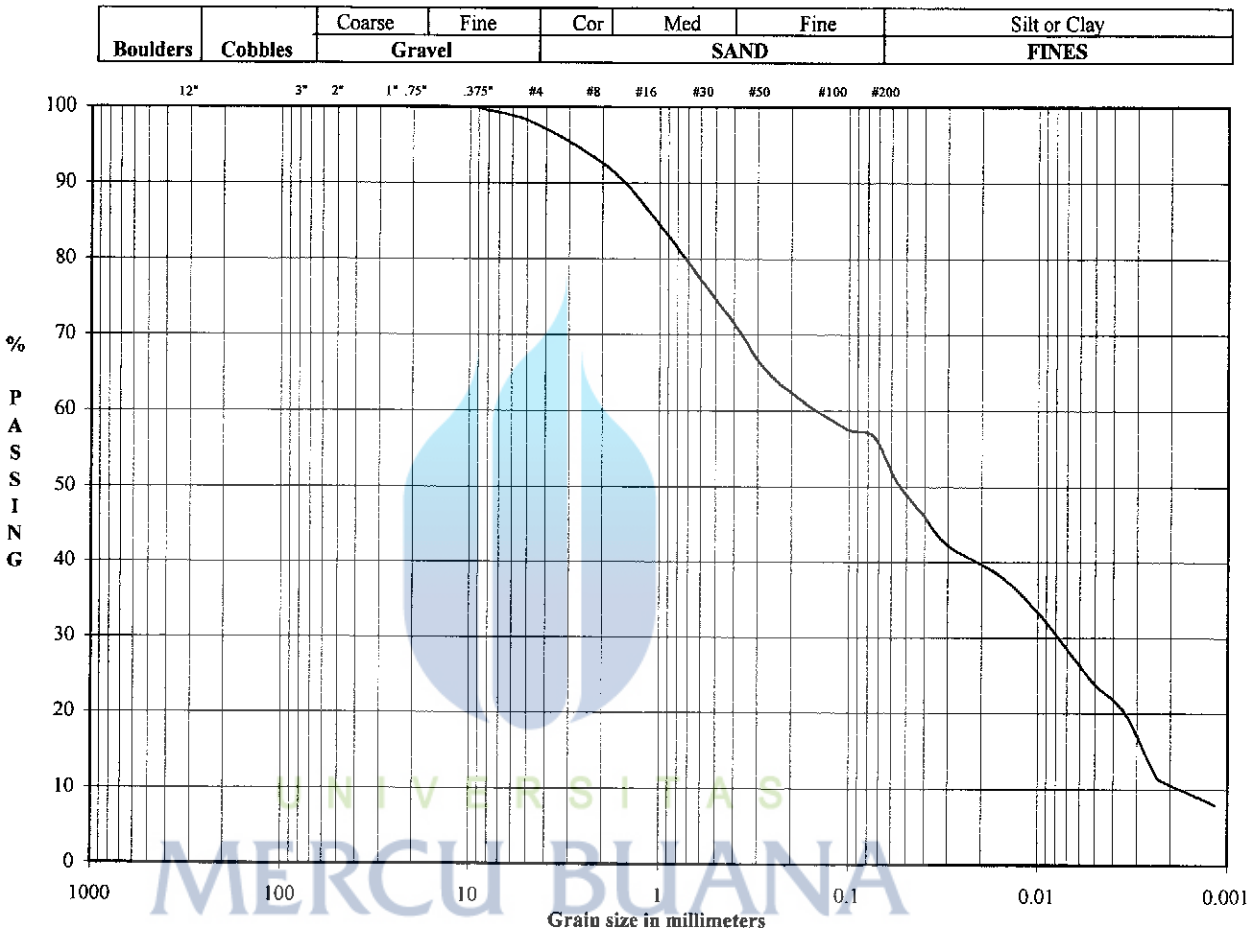
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-5
Sample Depth	:	41.50-42.00 M

Soil Description :



REMARKS :

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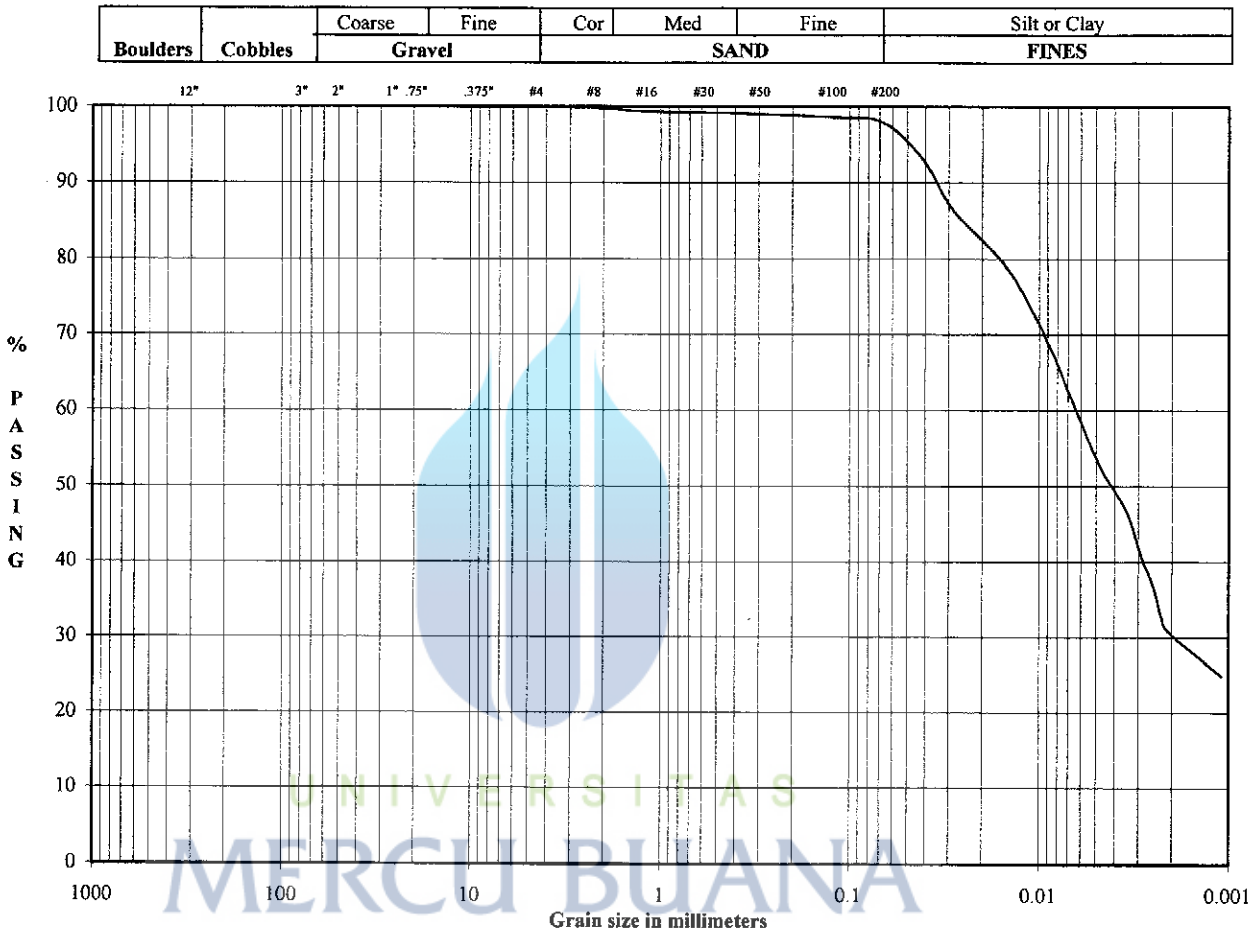
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-6
Sample Depth	:	3.50-4.00 M

Soil Description :



REMARKS :

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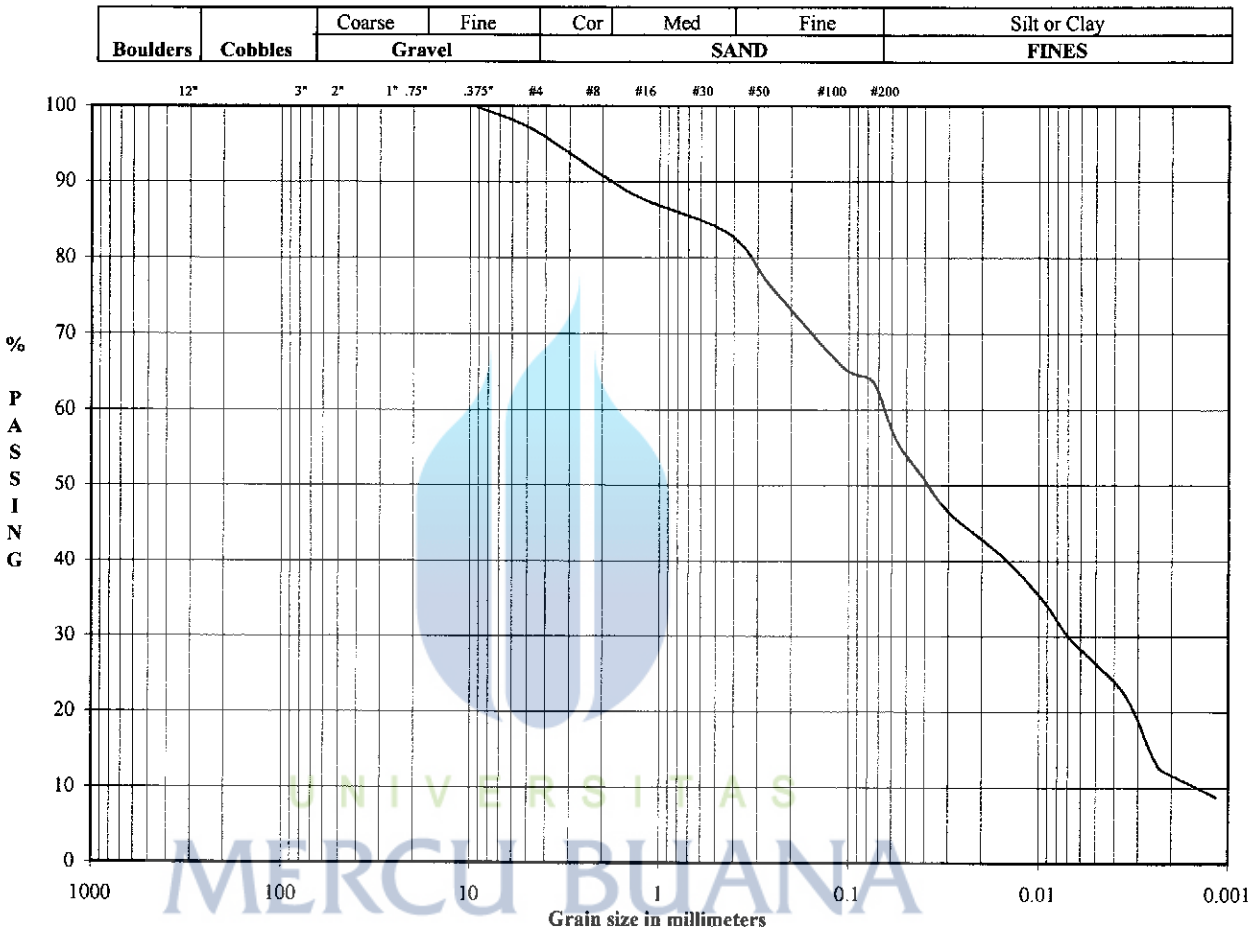
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-6
Sample Depth	:	15.50-16.00 M

Soil Description :



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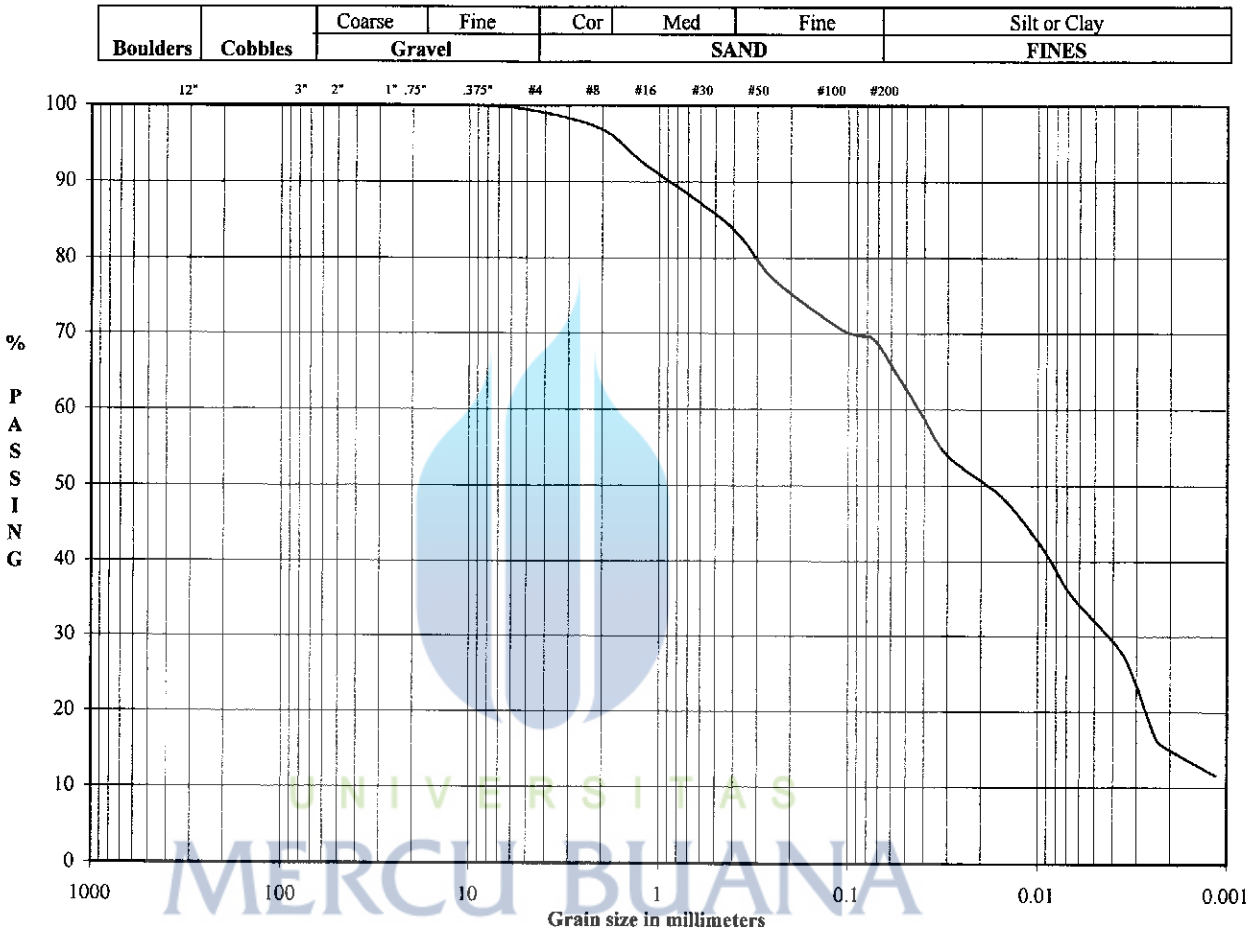
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-6
Sample Depth	:	19.50-20.00 M

Soil Description :



REMARKS :

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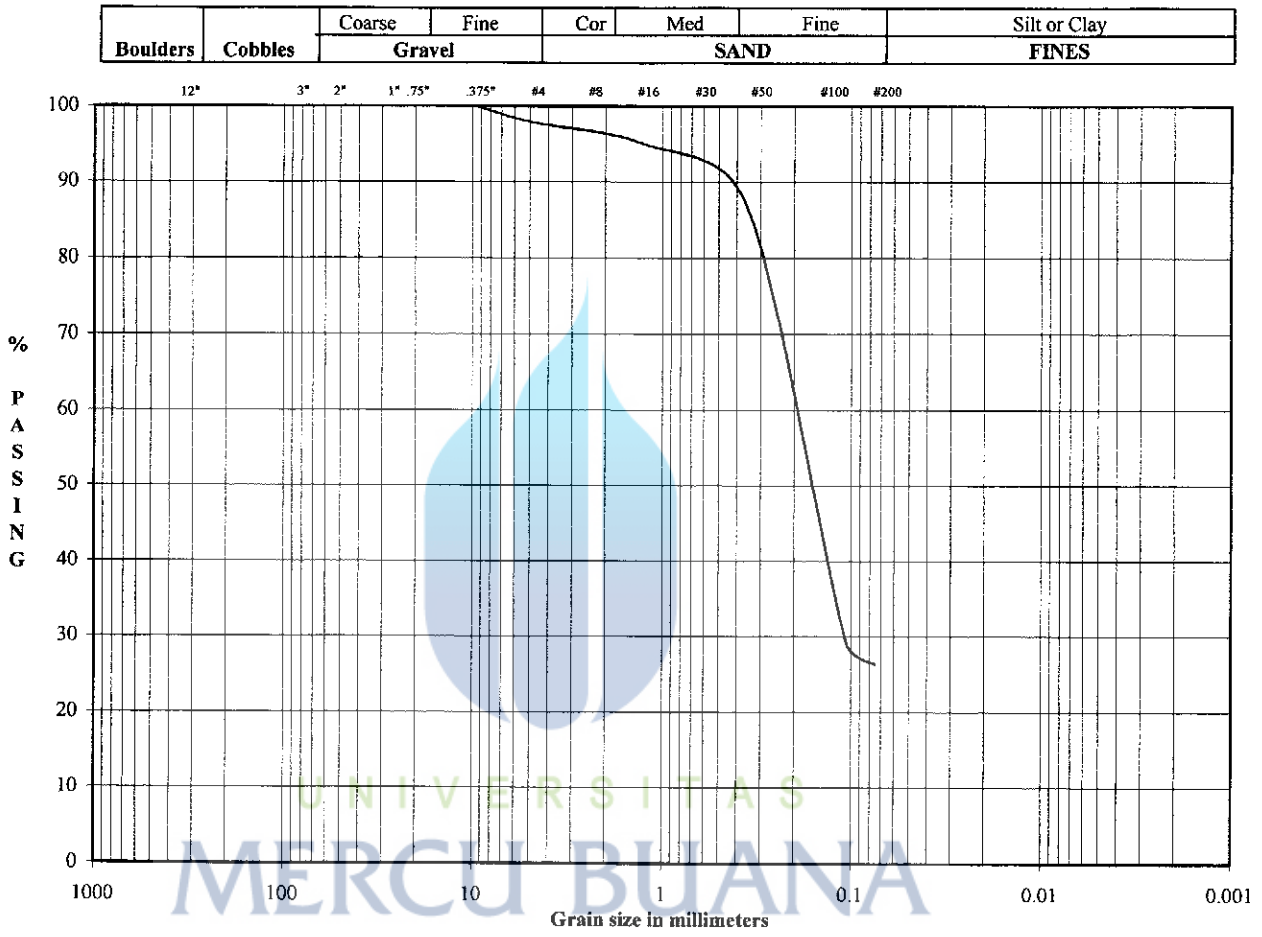
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-6
Sample Depth	:	23.50-24.0 M

Soil Description :



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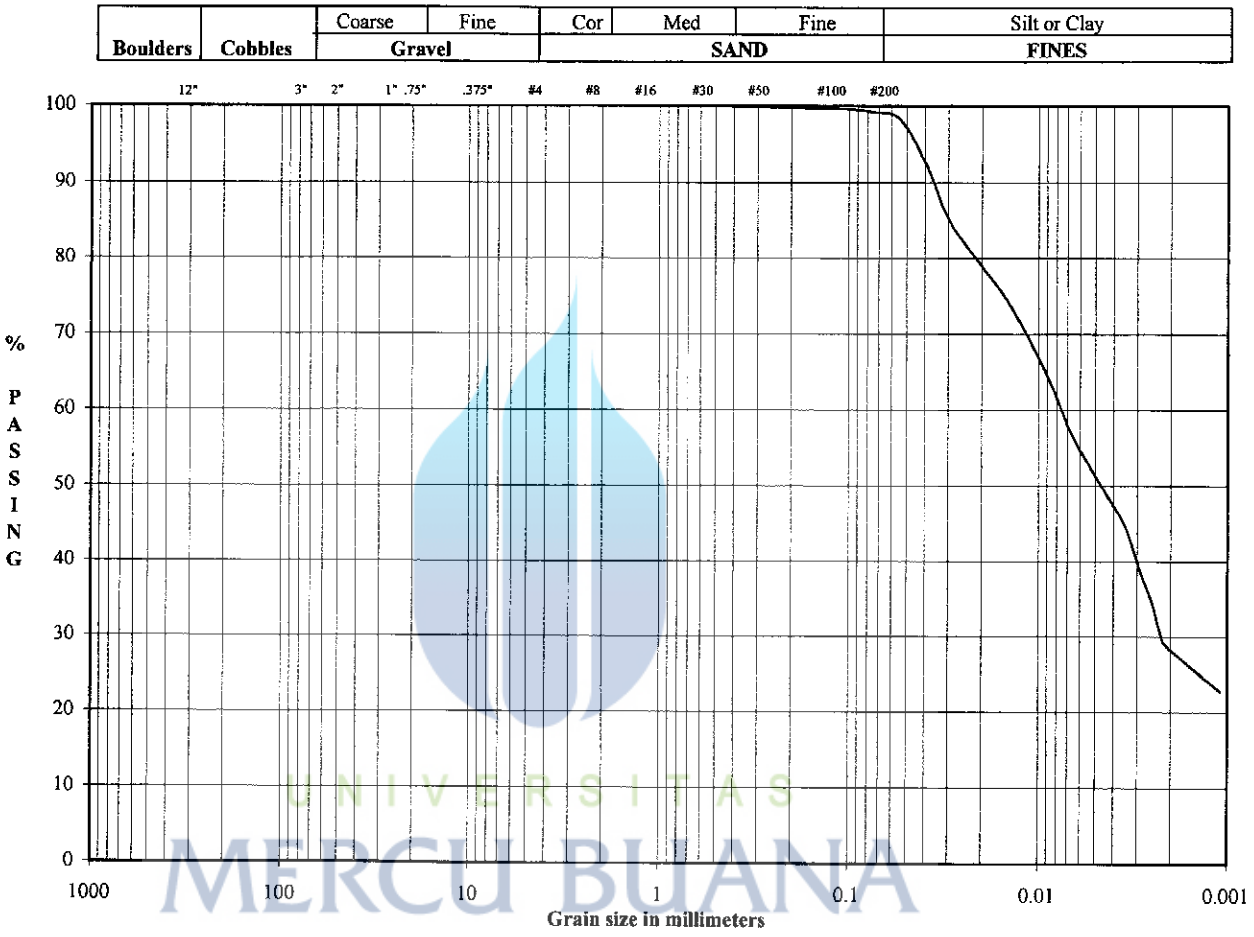
GRAIN SIZE DISTRIBUTION

Project	:	APARTEMEN GATOT SUBROTO
Location	:	JL. JEND. GATOT SUBROTO - JAKARTA
Boring No.	:	BH-6
Sample Depth	:	35.50-36.00 M

Soil Description :



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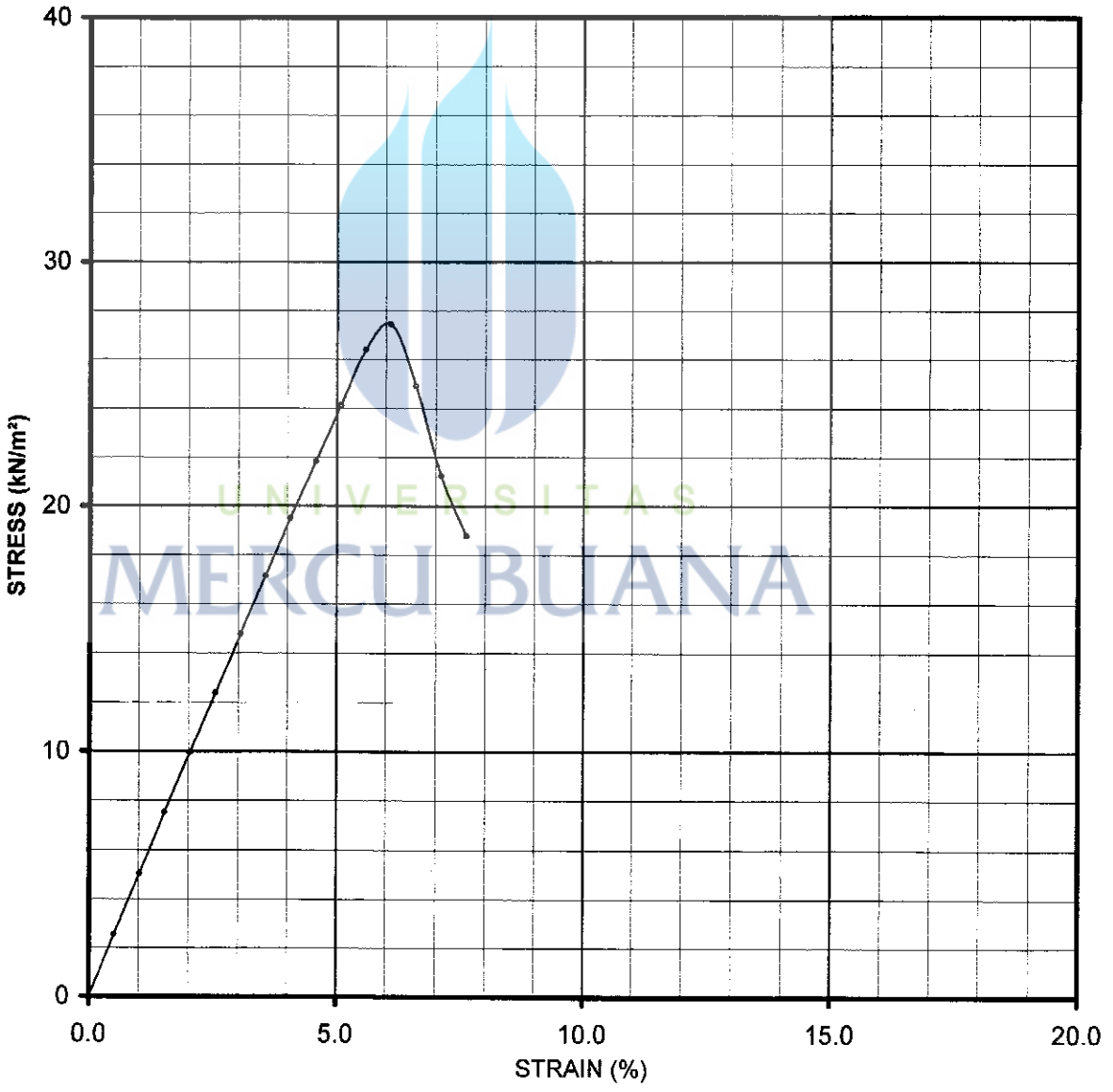
UNCONFINED COMPRESSION TEST

Project	: APARTEMENT GATOT SUBROTO	Lab. Ref.	: 002-01-0113	
Location	: JL. JEND. GATOT SUBROTO - JAK	Date Tested	: 29-May-12	
Boring No.	: BH-1	Moisture Conter	: 47.97	%
Depth	: 15.50-16.00 M	Wet Density	: 16.290	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	27.45
STRAIN AT FAILURE (%)	6.10



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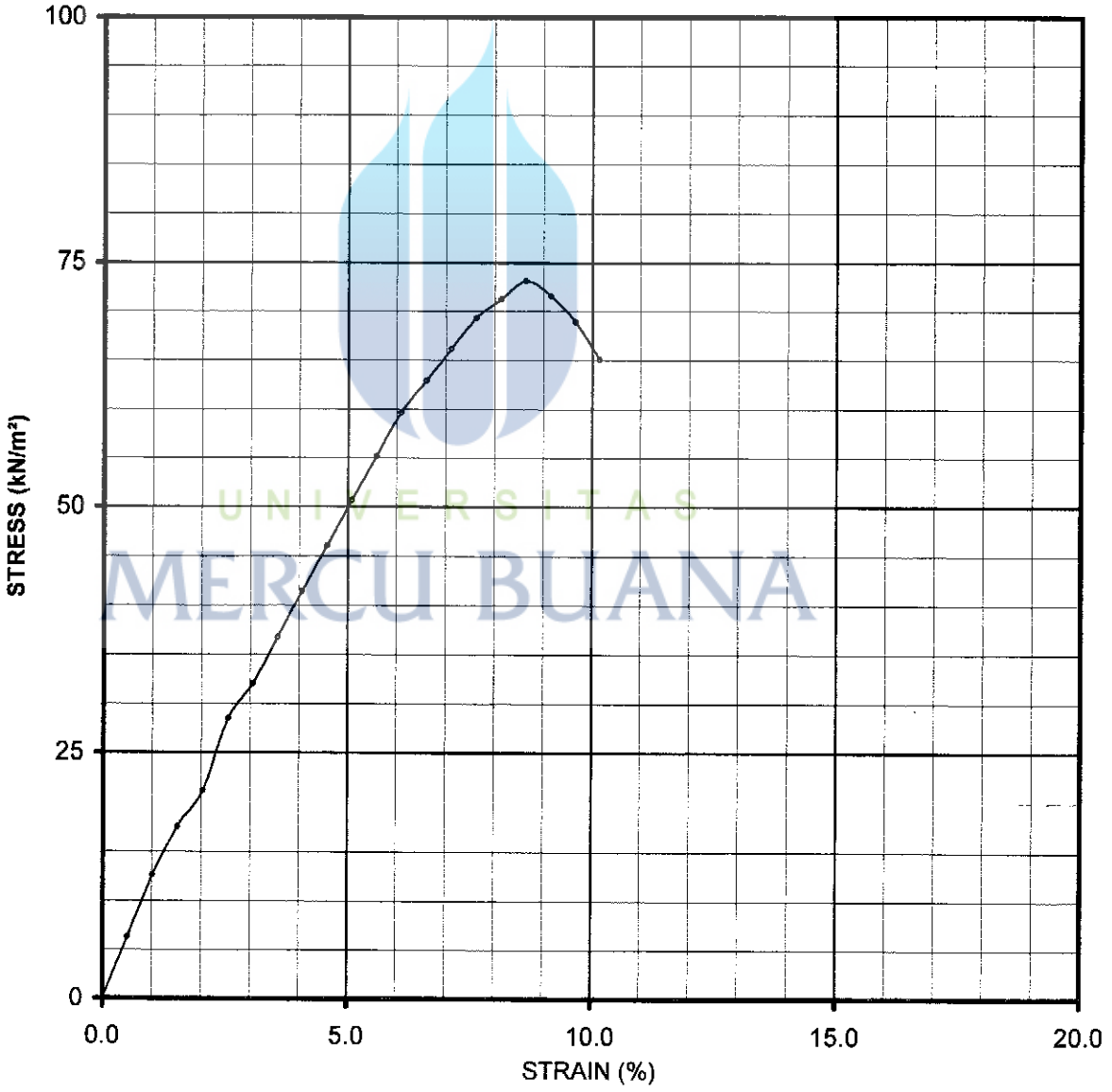
UNCONFINED COMPRESSION TEST

Project	: APARTEMENT GATOT SUBROTO	Lab. Ref.	: 002-01-0113	
Location	: JL. JEND. GATOT SUBROTO - JAK	Date Tested	: 29-May-12	
Boring No.	: BH-1	Moisture Conter	: 33.01	%
Depth	: 35.50-36.00 M	Wet Density	: 19.261	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	73.15
STRAIN AT FAILURE (%)	8.65



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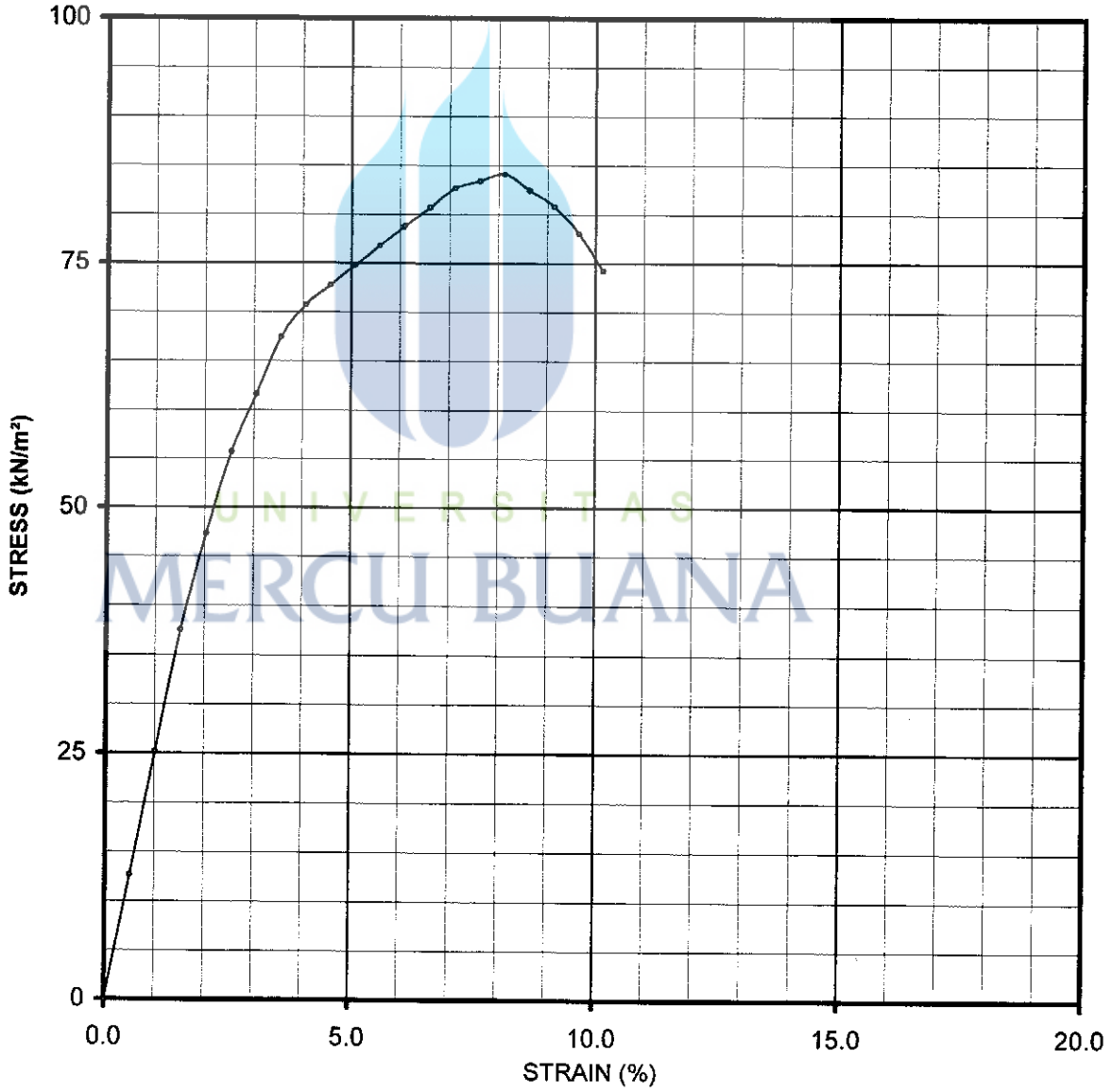
UNCONFINED COMPRESSION TEST

Project	: APARTEMENT GATOT SUBROTO	Lab. Ref.	: 002-01-0113	
Location	: JL. JEND. GATOT SUBROTO - JAK	Date Tested	: 29-May-12	
Boring No.	: BH-2	Moisture Conter	: 34.69	%
Depth	: 39.50-40.00 M	Wet Density	: 17.671	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	84.06
STRAIN AT FAILURE (%)	8.13



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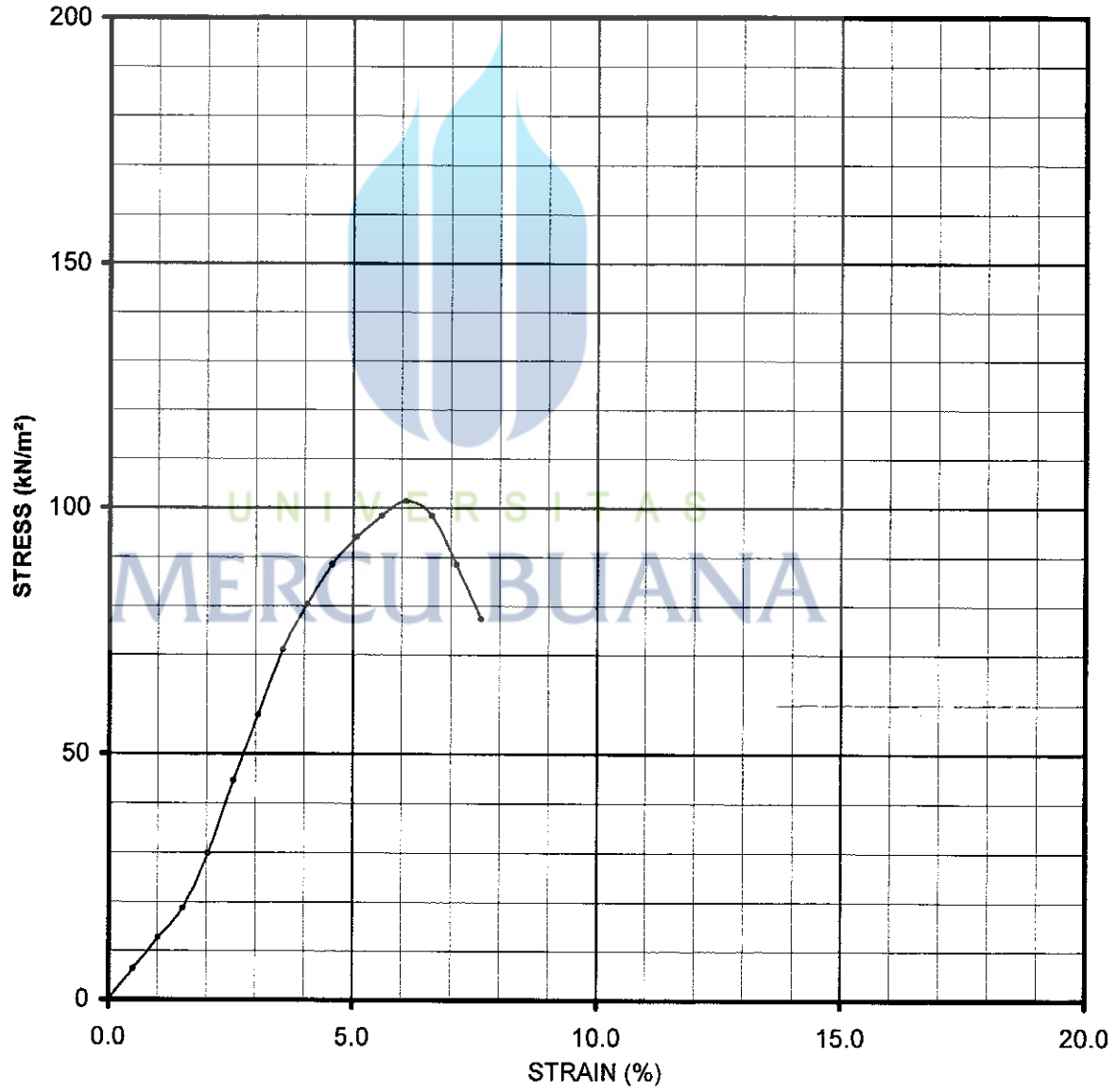
UNCONFINED COMPRESSION TEST

Project	: APARTEMENT GATOT SUBROTO	Lab. Ref.	: 002-01-0113	
Location	: JL. JEND. GATOT SUBROTO - JAK	Date Tested	: 29-May-12	
Boring No.	: BH-3	Moisture Conter	: 43.92	%
Depth	: 23.50-24.00 M	Wet Density	: 15.363	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	101.44
STRAIN AT FAILURE (%)	6.10



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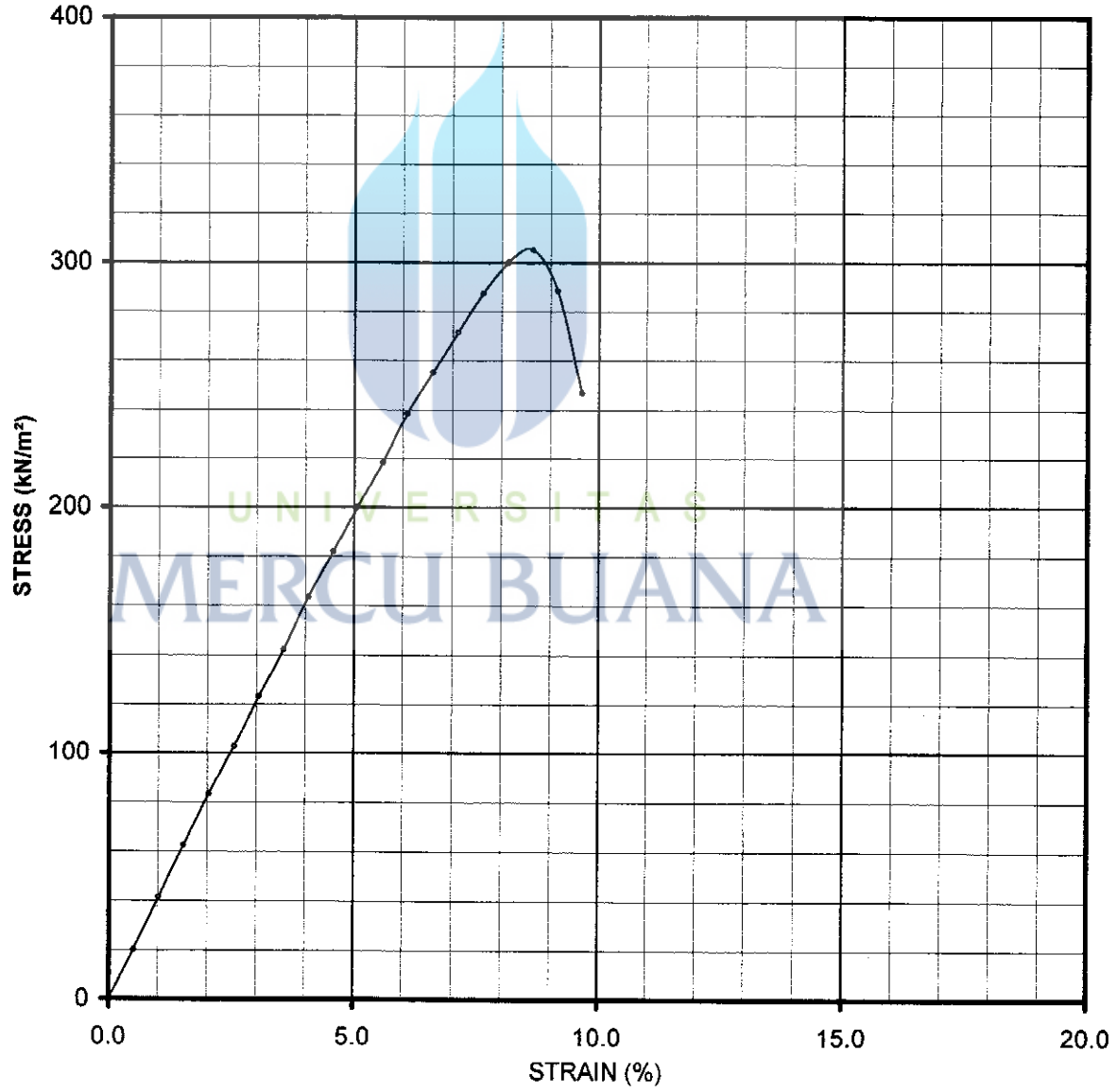
UNCONFINED COMPRESSION TEST

Project	: APARTEMENT GATOT SUBROTO	Lab. Ref.	: 002-01-0113	
Location	: JL. JEND. GATOT SUBROTO - JAK	Date Tested	: 29-May-12	
Boring No.	: BH-4	Moisture Conter	: 40.84	%
Depth	: 31.50-32.00 M	Wet Density	: 19.154	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	305.36
STRAIN AT FAILURE (%)	8.65



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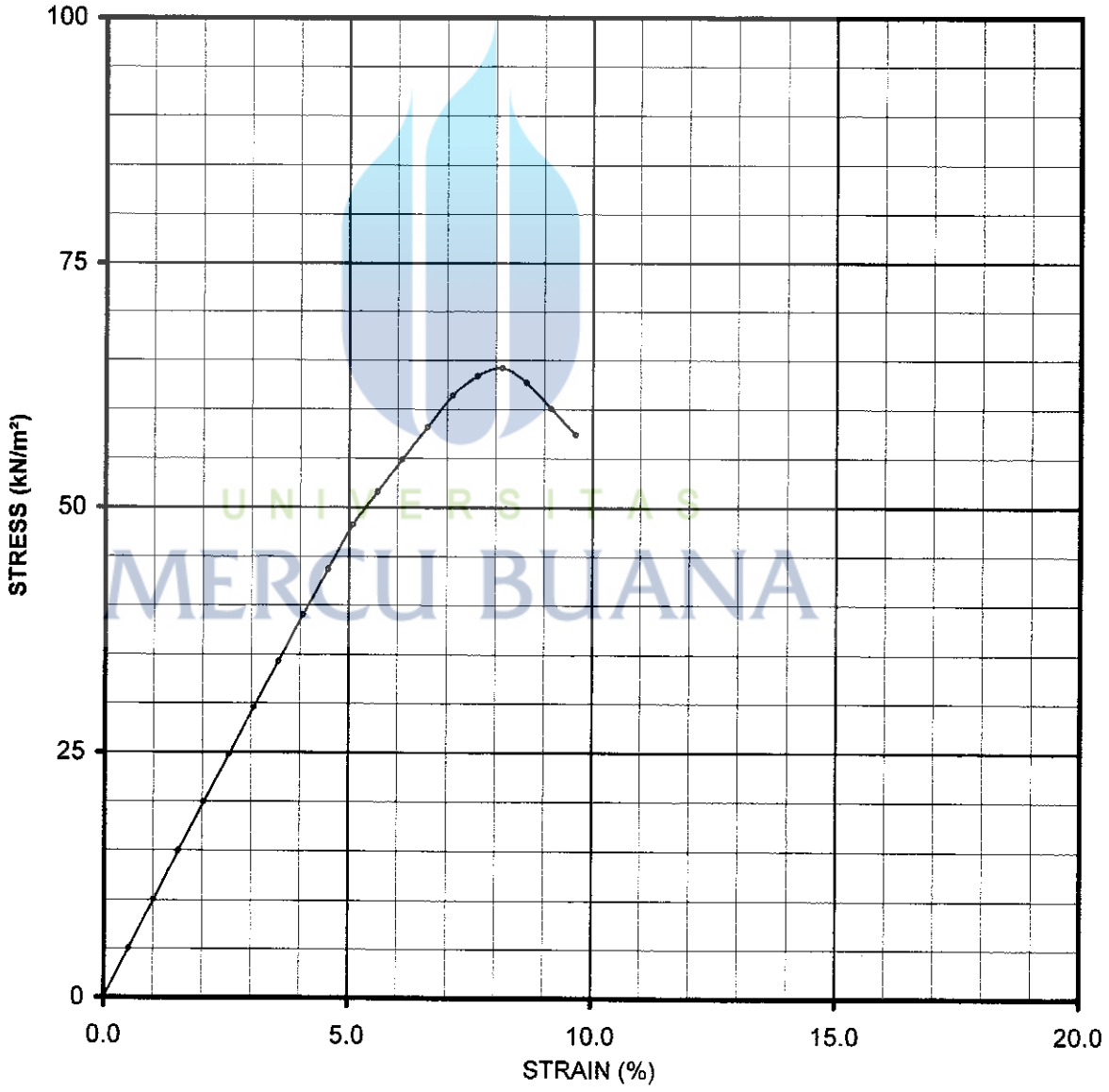
UNCONFINED COMPRESSION TEST

Project	: APARTEMENT GATOT SUBROTO	Lab. Ref.	: 002-01-0113	
Location	: JL. JEND. GATOT SUBROTO - JAK	Date Tested	: 29-May-12	
Boring No.	: BH-5	Moisture Conter	: 58.68	%
Depth	: 13.50-14.00 M	Wet Density	: 17.391	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	64.21
STRAIN AT FAILURE (%)	8.13



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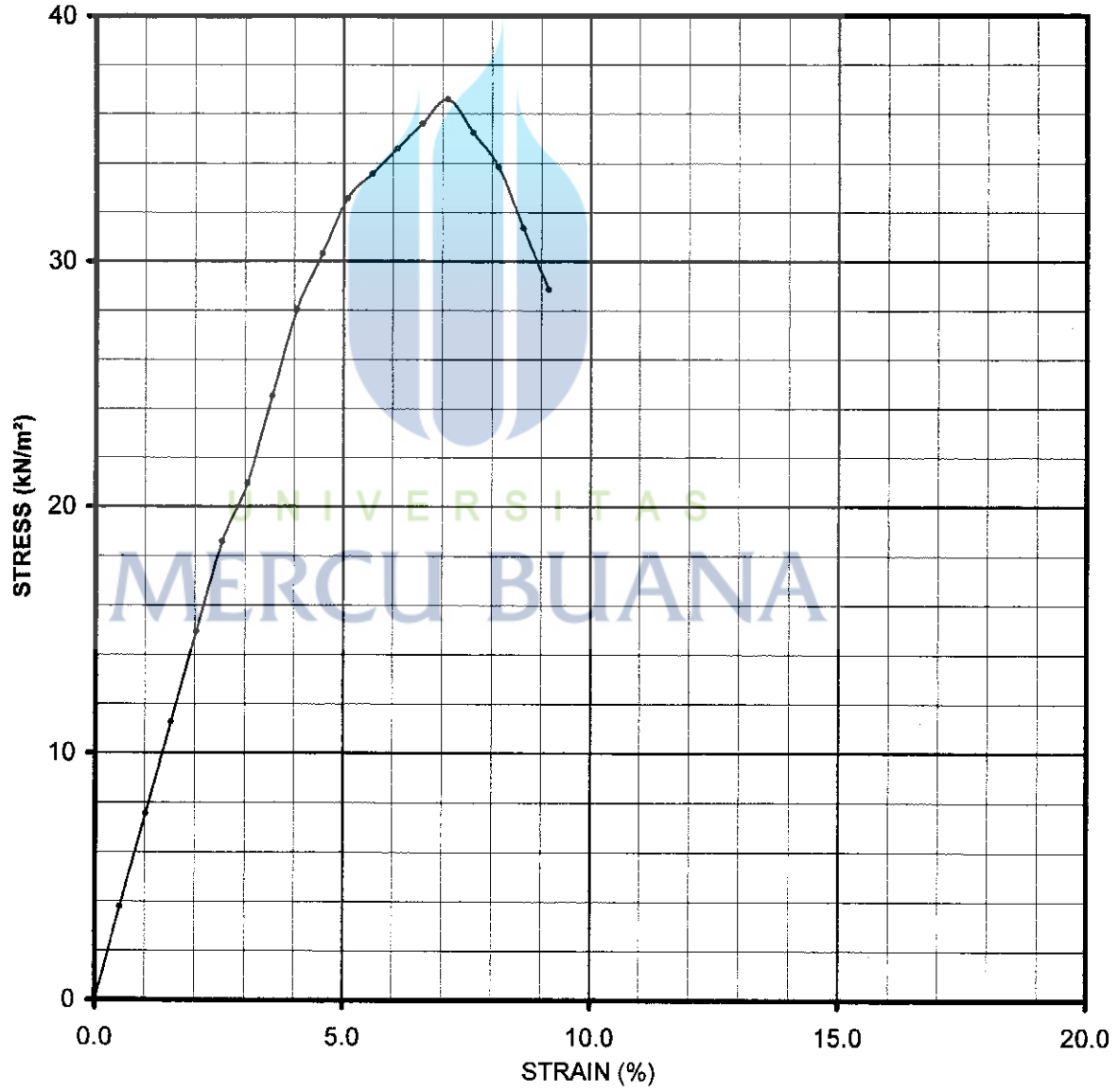
UNCONFINED COMPRESSION TEST

Project	: APARTEMENT GATOT SUBROTO	Lab. Ref.	: 002-01-0113	
Location	: JL. JEND. GATOT SUBROTO - JAK	Date Tested	: 29-May-12	
Boring No.	: BH-6	Moisture Conter	: 55.11	%
Depth	: 15.50-16.00 M	Wet Density	: 16.820	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	36.59
STRAIN AT FAILURE (%)	7.10



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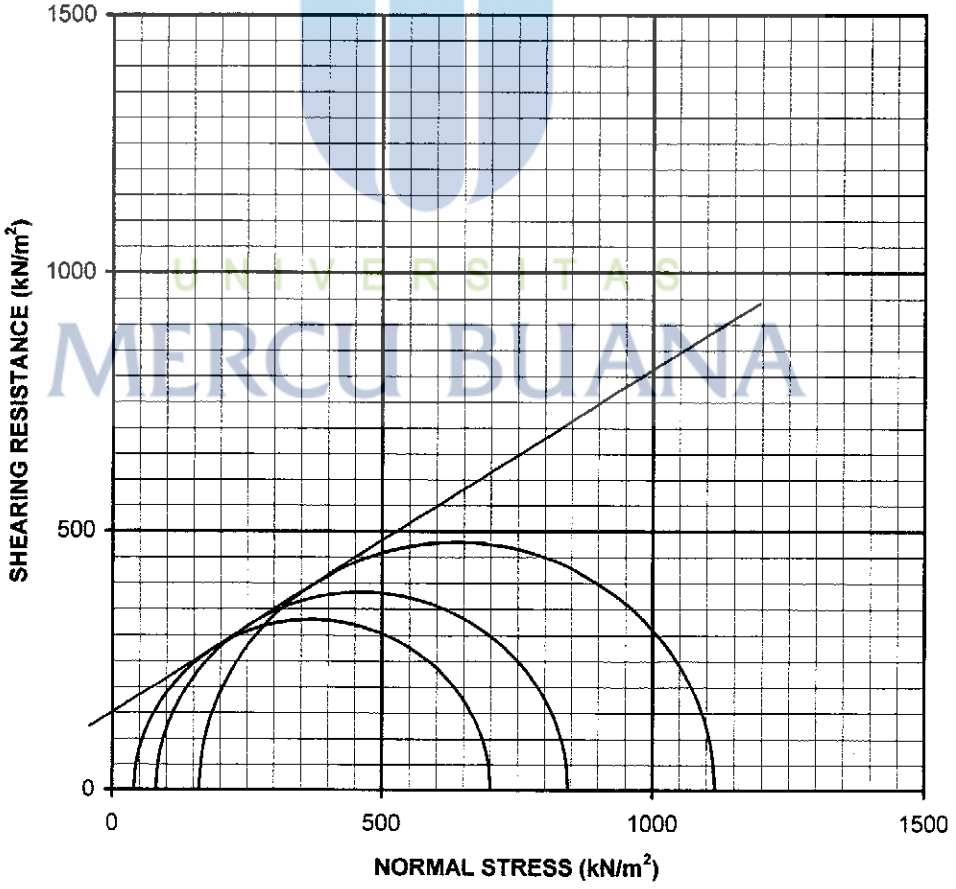
TRIAXIAL COMPRESSION TEST

Projevt	: **APARTEMENT GATOT SUBROTO**	Lab Reference	: **002-01-0113**
Location	: **JL. JEND. GATOT SUBROTO - JAKARTA**	Date Received	: **-**
Sample No.	: **BH-3**	Dete Tested	: **13-Feb-13**
Depth	: **15.50-16.00 M**		

IMMIDIATE TESTS, RATE OF STRAIN 2.00 MM/MIN					
Normal Stress at failure	(kN/m^2)	**660.3**	**763.9**	**955.7**	
Lateral Pressure	(kN/m^2)	**40.0**	**80.0**	**160.0**	
Total Normal Stress	(kN/m^2)	**700.3**	**843.9**	**1115.7**	

Apparent Cohesion	:	**150.0**	(kN/m^2)
Angle of Shearing Resistance	:	**32.0**	(°)
Type of Failure	:		
Moisture Content	:	**60.17**	**%**
Wet Density	:	**15.475**	**kN/m^3**
Dry Density	:	**9.662**	**kN/m^3**



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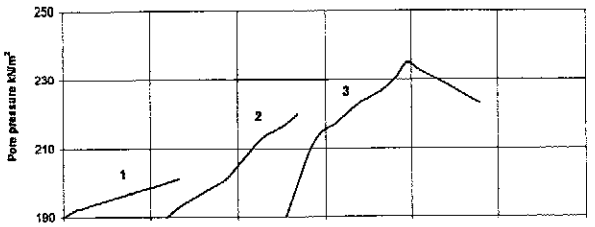
Client	SADINI ARIANDA		
Project	Apartemen Gatot Subroto (T Tower)		
Job No.	-	Date	-
Tested By	Hadi	Checked By	Ir. Benny Kumara

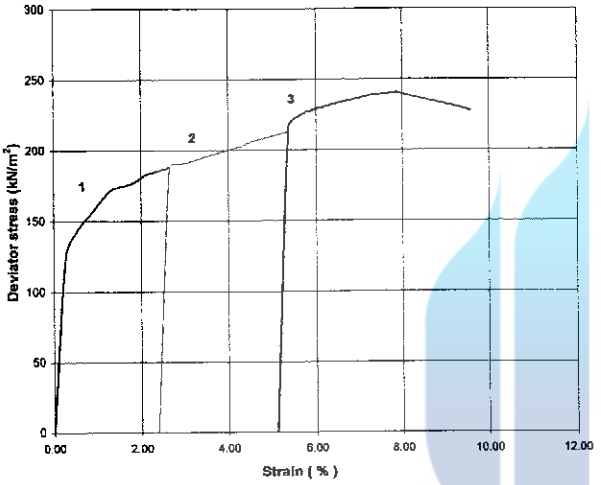
CU - TRIAXIAL COMPRESSION TEST

BS 1377 : Part 8 : 1990

Location : jl. Gatot Subroto - Pancoran, Jakarta Selatan
Boring no : BH.1
Depth : 3.50 -4.0m

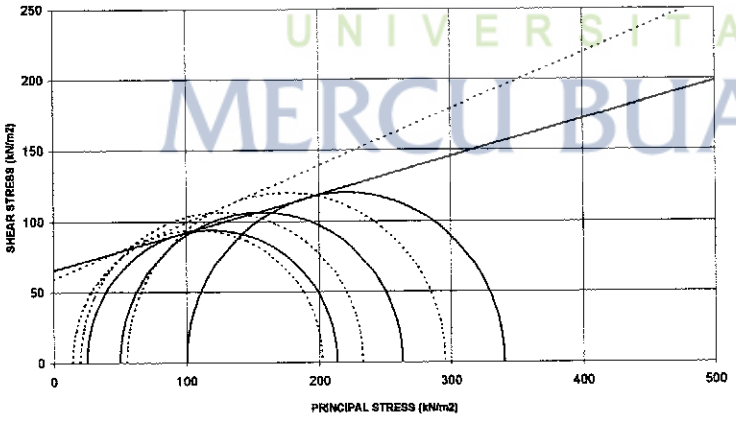
Sample type : USD
Soil description : Brown Geyish Silty Clay
Sample no. : 1



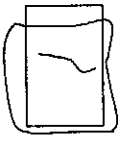


SPECIMEN			1	2	3
INITIAL	Wet density	Mg/m³	1.64		
	Moisture content	%	59		
	Dry density	Mg/m³	1.04		
AFTER CONSOLIDATION	Wet density	Mg/m³	1.61	1.59	1.59
	Moisture content	%	51		
	Dry density	Mg/m³	1.07	1.05	1.05
SATURATION STAGE	Initial pwp	kN/m²	0	0	0
	Saturated pwp	kN/m²	205	230	280
	Final cell presure	kN/m²	215	240	290
	B value		1.00	0.96	0.97
CONDSOLIDATION STAGE	Cell pressure	kN/m²	215	240	290
	Back pressure	kN/m²	190	190	190
	Initial pwp	kN/m²	205	230	280
	Final pwp	kN/m²	190	190	190
COMPRESSION STAGE	Cell pressure	kN/m²	215	240	290
	Initial pwp	kN/m²	190	190	190
	Initial σ'3	kN/m²	25	50	100
	Rate of strain	% / hour	4.1	4.1	4.1
FAILURE CONDITION	Strain	%	2.64	5.37	7.90
	σ1 - σ3	kN/m²	188	213	240
	U	kN/m²	201	220	235
	σ'3	kN/m²	14	20	55
	σ'1	kN/m²	202	233	295
CONDSOLIDATION PARAMETERS	c_v	m²/year	33.22	36.58	42.67
	m_v	m²/MN	0.77	0.29	0.13
	k	m/s	4.2E-08		

MOHR CIRCLES



MODE OF FAILURE :



STRENGTH PARAMETERS

C	kN/m²	66
ϕ	°	14.9
C'	kN/m²	59
ϕ'	°	21.8

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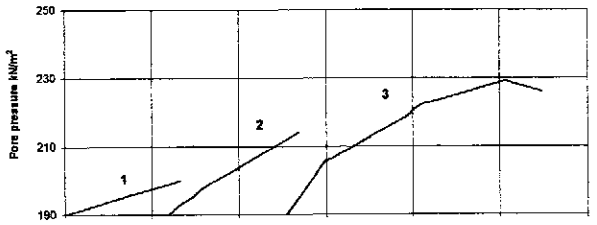
Client	SADINI ARIANDA		
Project	Apartemen Gatot Subroto (T Tower)		
Job No.	-	Date	-
Tested By	Hadi	Checked By	Ir. Benny Kumara

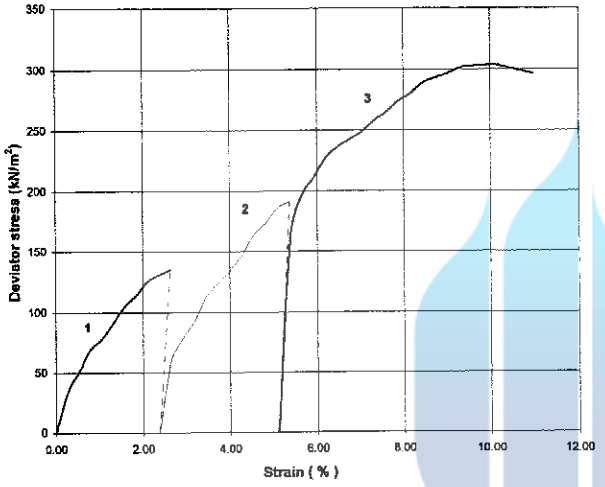
CU - TRIAXIAL COMPRESSION TEST

BS 1377 : Part 8 : 1990

Location : jl. Gatot Subroto - Pancoran, Jakarta Selatan
Boring no : BH.3
Depth : 3.50 -4.0m m

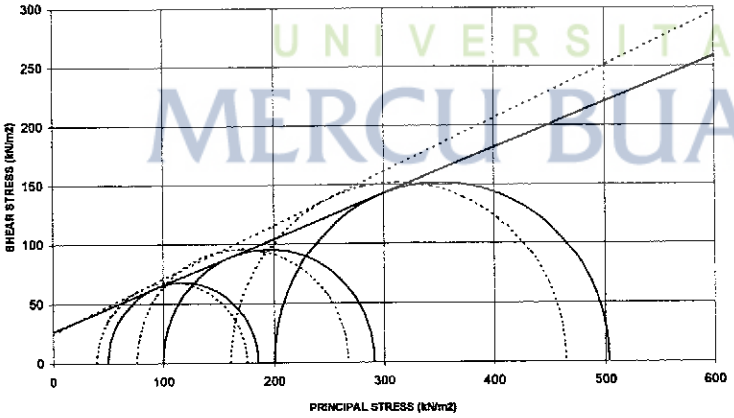
Sample type : USD
Soil description : Reddish Brown Silty Clay
Sample no. : 1





SPECIMEN			1	2	3
INITIAL	Wet density	Mg/m³	1.61		
	Moisture content	%	55		
	Dry density	Mg/m³	1.06		
AFTER CONSOLIDATION	Wet density	Mg/m³	1.81	1.63	1.63
	Moisture content	%	51		
	Dry density	Mg/m³	1.07	1.08	1.08
SATURATION STAGE	Initial pwp	kN/m²	0	0	0
	Saturated pwp	kN/m²	230	280	380
	Final cell presure	kN/m²	240	290	390
	B value		1.00	0.97	0.97
CONDSOLIDATION STAGE	Cell pressure	kN/m²	240	290	390
	Back pressure	kN/m²	190	190	190
	Initial pwp	kN/m²	230	280	380
	Final pwp	kN/m²	190	190	190
COMPRESSION STAGE	Cell pressure	kN/m²	240	290	390
	Initial pwp	kN/m²	190	190	190
	Initial σ'3	kN/m²	50	100	200
	Rate of strain	% / hour	4.1	4.1	4.1
FAILURE CONDITION	Strain	%	2.64	5.36	10.13
	σ1 - σ3	kN/m²	135	191	303
	U	kN/m²	200	214	229
	σ'3	kN/m²	40	76	161
	σ'1	kN/m²	175	267	464
CONDSOLIDATION PARAMETERS	c_v	m²/year	48.98	46.30	66.67
	m_v	m²/MN	0.23	0.13	0.05
	k	m/s	2.1E-08		

MOHR CIRCLES



MODE OF FAILURE :

STRENGTH PARAMETERS

c	kN/m²	27
ϕ	°	21.1
c'	kN/m²	25
ϕ'	°	24.4

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Downhole Seismic Test

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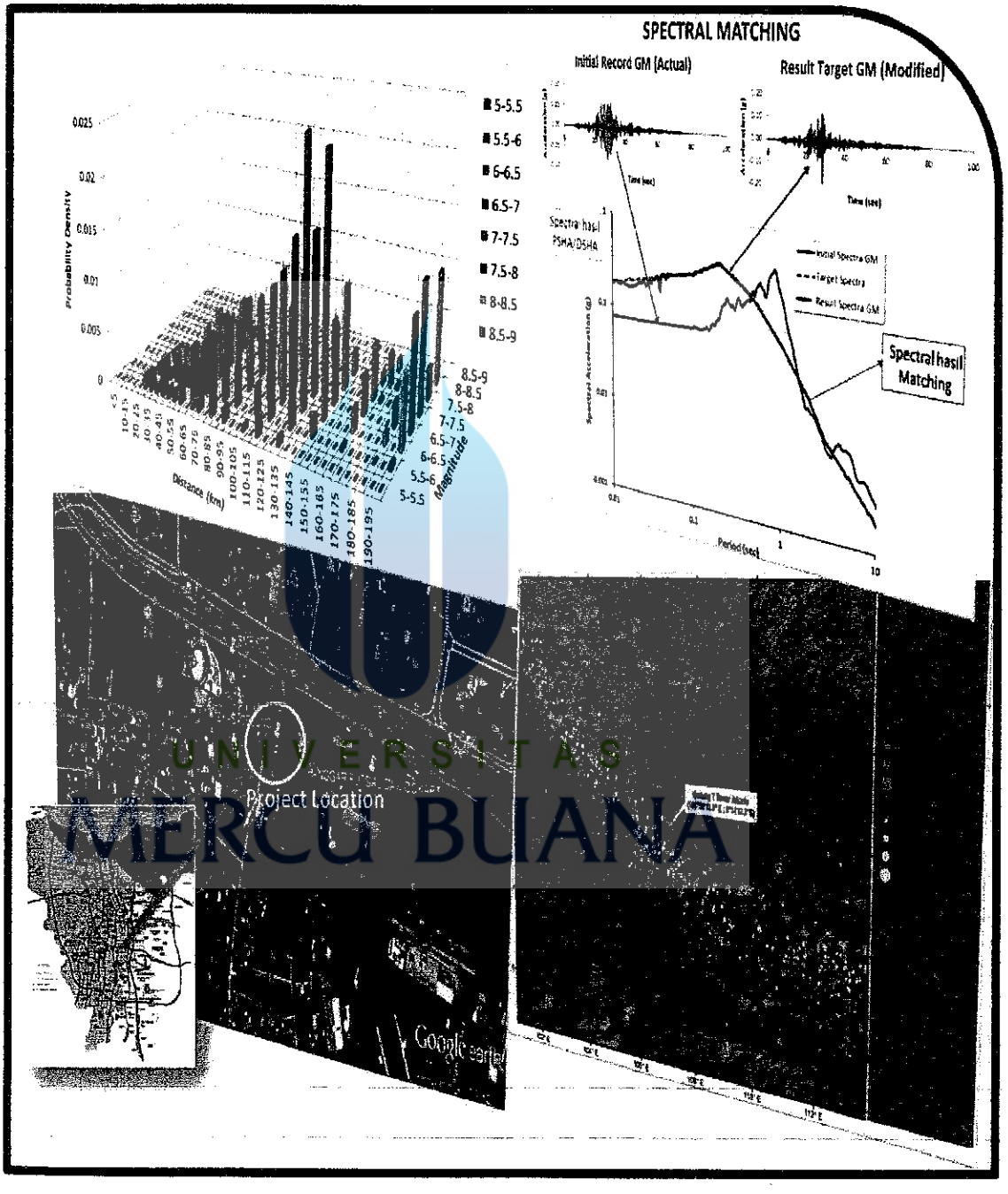
LAPORAN

ANALISIS SITE SPECIFIC RESPON SPEKTRA
PROYEK GEDUNG T TOWER
Jl. GATOT SUBROTO JAKARTA



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Februari 2013

LAPORAN

ANALISIS SITE SPECIFIC RESPON SPEKTRA
PROYEK GEDUNG T TOWER
Jl. GATOT SUBROTO JAKARTA

Februari 2013

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MERCU BUANA

Disiapkan oleh:

Ir. Pintor T. Simatupang, MT. Dr-Eng
Ahli Geoteknik Utama

Dr. Ir. M. Asrurifak, MT
Ahli Geoteknik Kegempaan

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REFERENSI **5-1**

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BAB 1
PENDAHULUAN

1.1. UMUM

Indonesia menempati zona tektonik yang sangat aktif karena tiga lempeng besar dunia dan sembilan lempeng kecil lainnya saling bertemu di wilayah Indonesia dan membentuk jalur-jalur pertemuan lempeng yang kompleks (Bird, 2003). Keberadaan interaksi antar lempeng-lempeng ini menempatkan wilayah Indonesia sebagai wilayah yang sangat rawan terhadap gempa bumi (Milson et al., 1992).

Pengalaman membuktikan bahwa sebagian besar korban dan kerugian yang terjadi akibat gempa disebabkan oleh kerusakan dan kegagalan infrastruktur/bangunan. Kerusakan akibat gempa dapat dibagi dalam 2 jenis: (1) kerusakan tidak langsung pada tanah menyebabkan terjadinya likuifaksi, cyclic mobility, lateral spreading, kelongsoran lereng, keretakan tanah, subsidence, dan deformasi yang berlebihan, serta (2) kerusakan struktur sebagai akibat langsung dari gaya inertia yang diterima bangunan selama goncangan.

Kerusakan pada infrastruktur/bangunan gedung akibat gempa secara langsung sangat bervariasi dan ditentukan oleh: (1) parameter bangunan dan (2) parameter pergerakan tanah. Parameter bangunan terdiri dari: disain dasar, tipe bangunan, bentuk bangunan, sistem struktur, elemen-elemen bangunan, dan material penyusunnya, sedangkan parameter pergerakan tanah tergantung dari magnituda, jarak, dan kondisi tanah lokal. Oleh karena itu, dalam perencanaan infrastruktur tahan gempa, analisis dan pemilihan parameter pergerakan tanah mutlak diperlukan untuk mendapatkan beban gempa rencana.

Laporan ini berisi hasil analisis perambatan gelombang gempa dari batuan dasar ke permukaan tanah pada lokasi proyek ***Gedung T Tower, Jl. Gatot Subroto Jakarta*** sebagaimana dapat dilihat dalam **Gambar 1.1**.

1.2. TUJUAN

Tujuan dari studi ini adalah untuk mendapatkan respons spektra desain di permukaan tanah dengan memperhitungkan pengaruh kondisi tanah lokal. Dalam studi ini nilai percepatan gempa (PGA) dan data ground motion (*time histories*) di batuan dasar untuk periode ulang 500 dan 2500 tahun didasarkan pada hasil studi yang pernah dilakukan untuk wilayah Jakarta dan sekitarnya.

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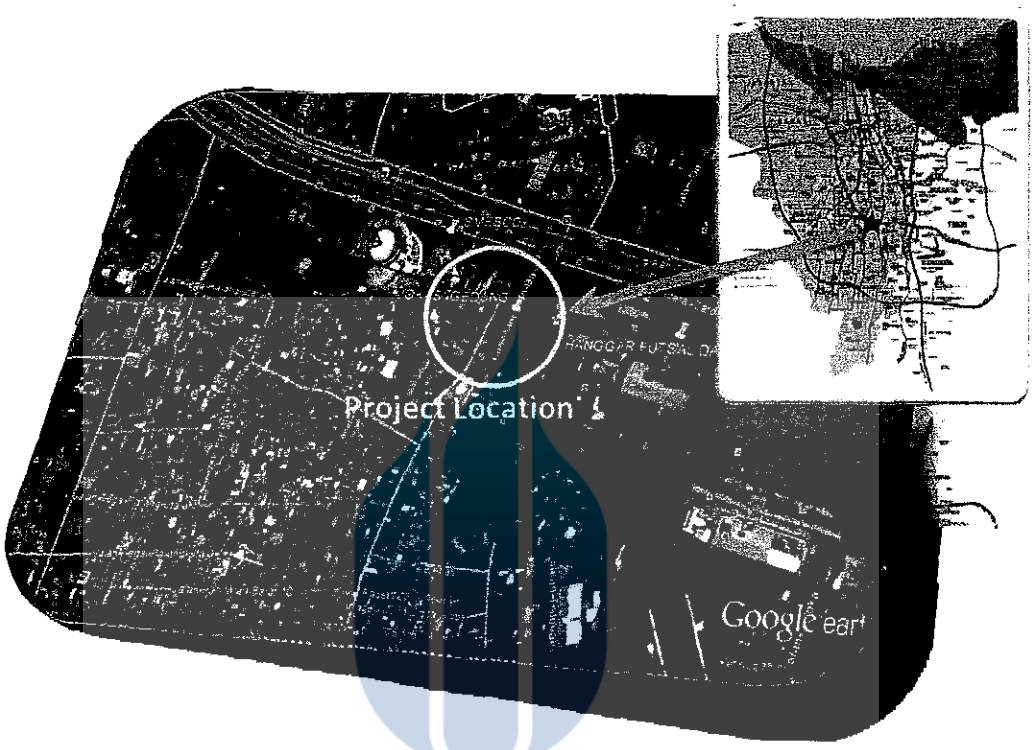
Beberapa hasil studi yang digunakan antara lain adalah studi dari Irsyam & Firmansjah (1999), Irsyam dkk (2001), Irsyam dkk (2008a, b) dan hasil studi Tim Revisi Peta Gempa Indonesia 2010 yang dikeluarkan oleh Kementrian Pekerjaan Umum (Juli, 2010).



Gambar 1.1. Lokasi Proyek

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1.3. METODOLOGI

Secara umum, langkah-langkah yang dilakukan pada studi ini adalah:

1. Review dari studi-studi yang pernah dilakukan untuk wilayah sekitar Jakarta.
   a. Studi literatur tentang kondisi geologi dan tektonik untuk mengidentifikasi aktifitas gempa regional dan menyiapkan zona-zona sumber gempa yang dipergunakan dalam seismic hazard analysis.
   b. Evaluasi data gempa historis regional untuk memperoleh parameter seismik untuk zona-zona sumber gempa yang mempengaruhi Jakarta.
2. *Seismic hazard analysis* dengan menggunakan pendekatan probabilistik. Tujuan dari analisis ini adalah untuk mendapatkan:

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a. Spektra percepatan di batuan dasar untuk periode ulang 500 dan 2500 tahun

b. Mendapatkan hubungan magnituda dan jarak (M-R) yang memberikan kontribusi terbesar pada nilai spektra di lokasi studi melalui analisis de-aggregasi di lokasi proyek.

3. Pemilihan input ground motion berdasarkan hasil *seismic hazard analysis*.

4. Penentuan profil parameter dinamik tanah.

5. Analisis perambatan gelombang geser satu dimensi dengan menggunakan beberapa *input ground motion* untuk merepresentasikan karakteristik gempa yang mempengaruhi kota Jakarta.

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BAB 2
KONDISI SEISMOTEKTONIK

2.1. TINJAUAN SEISMOTEKTONIK DI INDONESIA

Indonesia merupakan salah satu wilayah di dunia yang memiliki aktivitas gempa yang tinggi. Dalam enam tahun terakhir saja telah tercatat berbagai aktifitas gempa besar di Indonesia: Gempa Aceh disertai tsunami tahun 2004 (Mw=9,2), Gempa Nias tahun 2005 (Mw=8,7), Gempa Jogya tahun 2006 (Mw=6,3), Gempa Tasik tahun 2009 (Mw=7,4) dan terakhir Gempa Padang tahun 2009 (Mw=7,6). Gempa-gempa tersebut telah menyebabkan hilangnya ribuan jiwa, runtuh dan rusaknya ribuan infrastruktur dan bangunan, serta keluarnya dana trilyunan rupiah untuk rehabilitasi dan rekonstruksi.

Berdasarkan data-data geologi dan geofisika, Wilayah Indonesia dapat dibagi dalam lima elemen crustal yang terdiri dari :

1. Sunda Shield (SE Eurasian Craton), di bagian barat laut (northwest)
2. Lempeng Samudera Hindia Indian di bagian barat daya (southwest)
3. Australian Craton, di bagian tenggara (southeast)
4. Lempeng Pacific, di bagian timur laut (northeast), dan
5. Transitional Complex di bagian tengah Wilayah Indonesia.

Elemen-elemen crustal tersebut saling dibatasi secara tektonik satu sama lain oleh zona subduksi dan/atau thrust fault yang aktif maupun zona telah aktif kembali. Sehingga Wilayah Indonesia menjadi wilayah pertemuan dari interaksi tiga lempeng besar, yaitu Lempen Indo-Ausralia yang bergerak ke utara, Lempeng Pacific yang bergerak ke barat dan Lempeng Eurasia yang bergerak ke selatan dan barat daya sebagaimana dapat dilihat dalam **Gambar 2.1**.

Berdasarkan lokasi dan sifatnya, tatanan tektonik di Indonesia dikelompokkan menjadi beberapa kelompok. Tektonik Indonesia bagian Barat didominasi oleh konvergensi Lempeng India-Australia dengan Lempeng Eurasia. Pada sepanjang barat Sumatra, arah konvergensi membentuk penunjaman yang relatif menyerong terhadap arah kelurusan palung, sedangkan di sepanjang selatan Jawa, arah penunjaman lempeng hapir tegak lurus.

Sementara itu, tektonik Indonesia bagian Timur tampak lebih rumit, seperti adanya dua lempeng yang menunjam di bawah Laut Banda yaitu dari selatan di Palung Timor dan Aru dan dari utara di Palung Seram. Keduanya dipisahkan oleh

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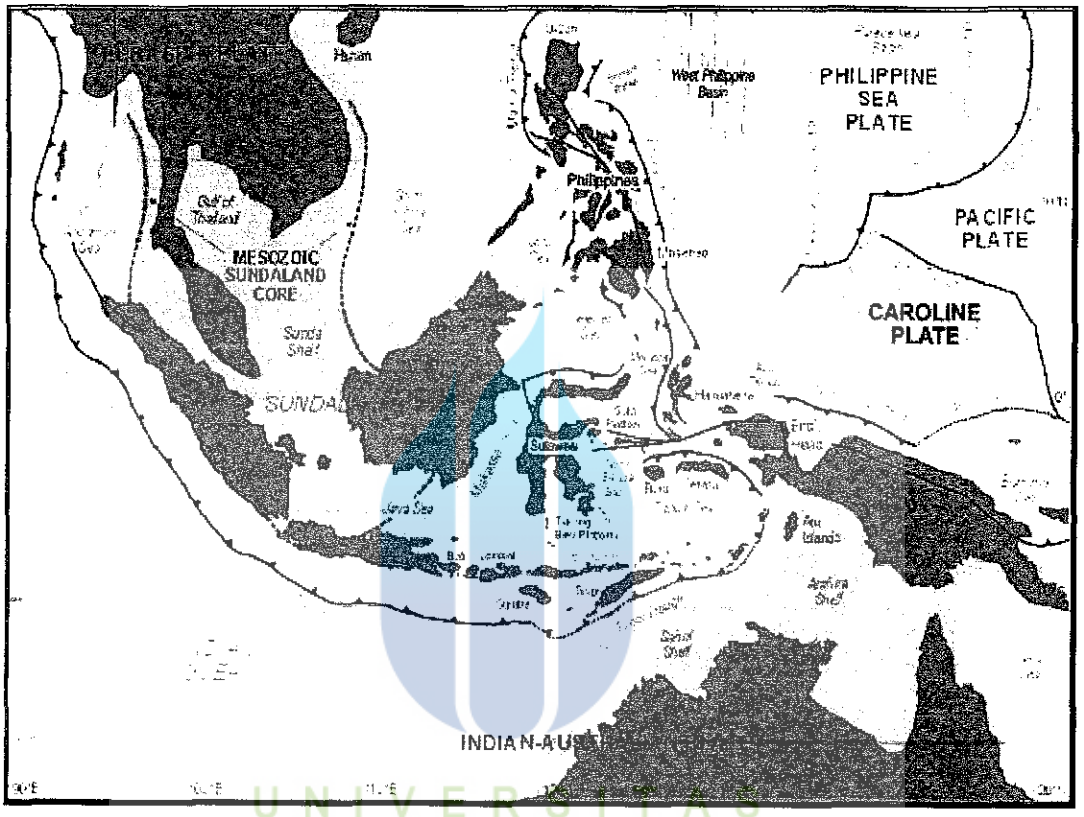
Sesar Tarera-Aiduna (Bock et al., 2003). Model tektonik yang rumit di Indonesia bagian Timur juga terbentuk oleh jalur tubrukan (*collision*) antara Lempeng Benua Australia dan Lempeng Samudra Pasifik yang menghasilkan persesaran yang sangat intensif dan meluas di Pulau Papua.



Gambar 2.1. Kondisi seismotektonik Wilayah Indonesia (Hall et al., 1995)

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Kegempaan Indonesia juga dipengaruhi oleh adanya beberapa sesar yang berpotensi aktif sebagai sumber gempa-gempa dangkal dan tersebar di wilayah Indonesia sebagaimana terlihat dalam **Gambar 2.2**.

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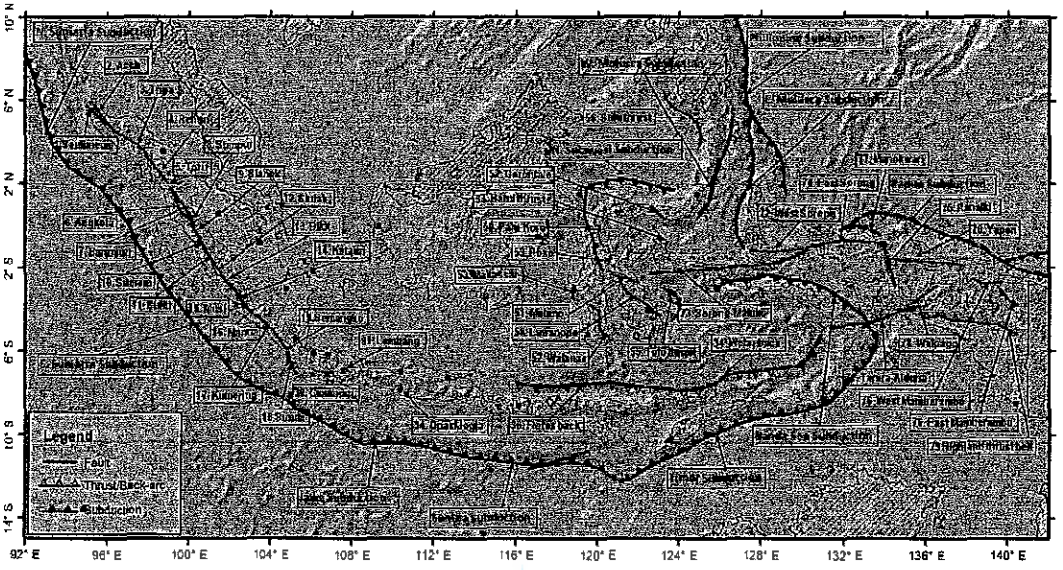

Gambar 2.2. Tatanan Tektonik Utama di Indonesia (Tim Revisi Peta Gempa Indonesia 2010)

2.2. TINJAUAN SEISMOTEKTONIK SEKITAR LOKASI STUDI

Kondisi Seismotektonik kota Jakarta, secara umum dipengaruhi oleh zona Subduksi Sunda Arc, dan zona patahan pada kerak dangkal (*shallow crustal fault*).

2.2.1. SUNDA ARC ZONA SUBDUKSI JAWA-SUMBA

Segmen subduksi Jawa-Sumba pada Busur Sunda terbentang mulai dari Selat Sunda dibagian barat sampai sekitar Bali Basin dibagian timur dan merupakan *oceanic* crust yang relative tua (150 juta tahun). Segmen ini konvergen ke arah normal terhadap busur dengan kecepatan 60±3 mm/th (Bock dkk, 2003) di *trench* Jawa Barat dan 49 mm/th di *trench* Jawa Timur (Katili, 1973) sehingga di Pulau Jawa berkembang pola sesar-sesar normal dan naik yang sejajar dengan busur pulau. Semakin ke arah timur (Nusa Tenggara Timur) sudut penukikkan semakin tajam (**Gambar 2.3**).

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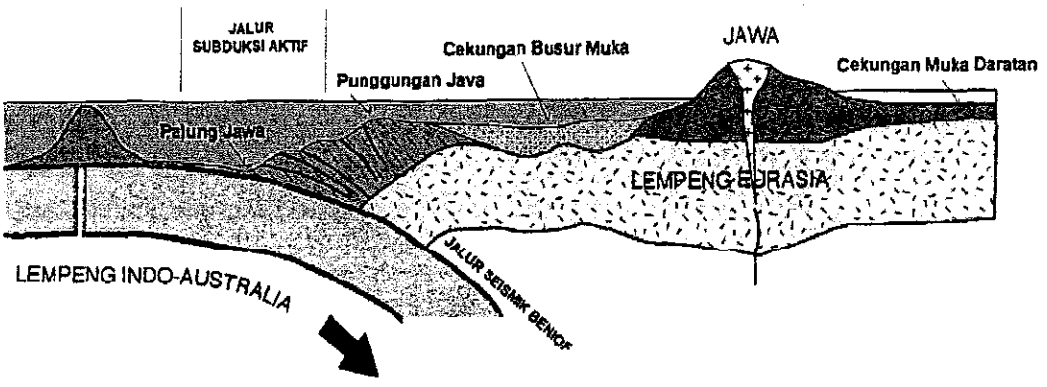
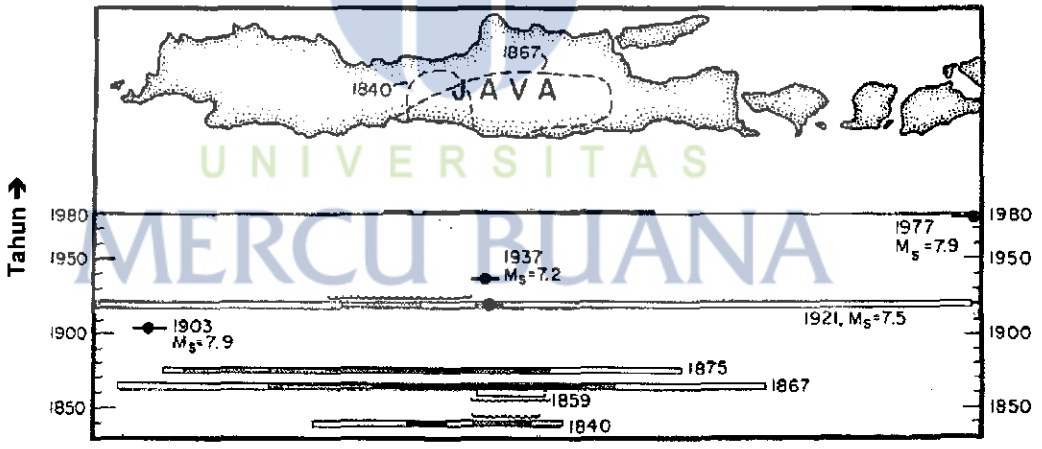


Gambar 2.3. Penampang melintang kondisi geologi pulau jawa (Katili J.A., 1963)

Kurangnya kejadian gempa besar dengan slip yang besar pada segmen ini menunjukkan bahwa perbedaan pergerakan antara Lempeng Indo-Australia dan Eurasia diakomodasi secara aseismik atau bisa jadi merupakan seismik gap yang suatu saat bila tiba waktunya akan terjadi gempa besar. Perbedaan magnitude dan frekuensi seismisitas sepanjang segmen busur ini menunjukkan bahwa derajat *seismic coupling* dipengaruhi oleh umur subduksi dan sifat-sifat geologi lempeng-lempeng yang bertumbukan.



Gambar 2.4. Zone-zone *rupture* dari gempa sepanjang Segmen Jawa (Newcomb & McCann, 1987)

Tiga gempa besar dilaporkan dalam catatan historik sebelum pemakaian instrumen pencatatan (Newcomb & McCann, 1987). Sebagaimana ditunjukkan pada **Gambar 2.4**, kejadian-kejadian ini terjadi dalam tahun 1840, 1867 dan 1875. Sejumlah gempa besar juga tercatat sejak tahun 1903. Catatan gempa

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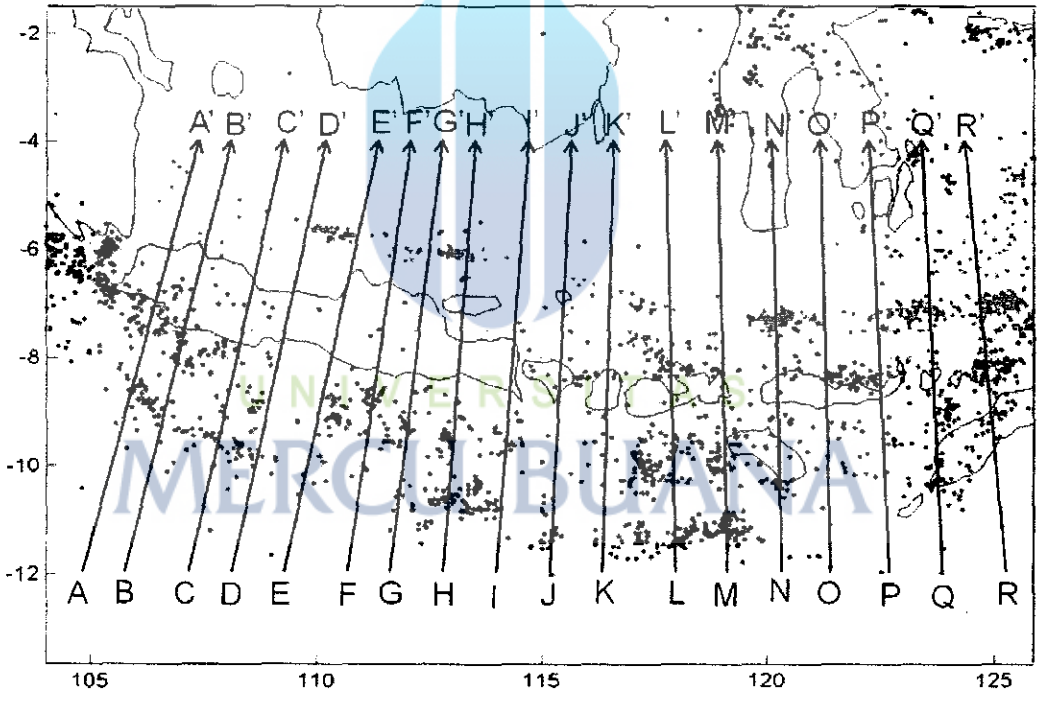
sepanjang dip pada Segmen Jawa mengindikasikan bahwa dalam periode 300 tahun, tidak ada kejadian gempa besar (M > 8) pada interface yang terjadi sebagaimana gempa pada Segmen Sumatera yang terjadi pada tahun 1833 dan 1861.

Newcomb & McCann (1987) menyatakan bahwa lempeng samudera yang lebih tua dan lebih padat sepanjang Segmen Jawa menambah komponen vertikal dari gerakan subduksi sehingga mengurangi besarnya *seismic coupling* dan kemungkinan terjadinya gempa sangat besar. Perbesaran dip dan kedalaman penetrasi dari zona seismik Benioff sepanjang Segmen Jawa kemungkinan juga merupakan akibat lempeng yang menunjam lebih tua dan lebih padat (Newcomb & McCann, 1987). Hasil tomografi untuk mengetahui besarnya dip yang dilakukan oleh Widiyantoro (2008) pada segmen Subduksi Jawa-Sumba dengan data gempa yang sudah rilokasi bisa dilihat pada **Gambar 2.5** untuk lokasi potongan melintang, **Gambar 2.6** untuk model tomografinya.



Gambar 2.5. Potongan melintang segmen subduksi Jawa-Sumba dengan data gempa yang sudah direlokasi.

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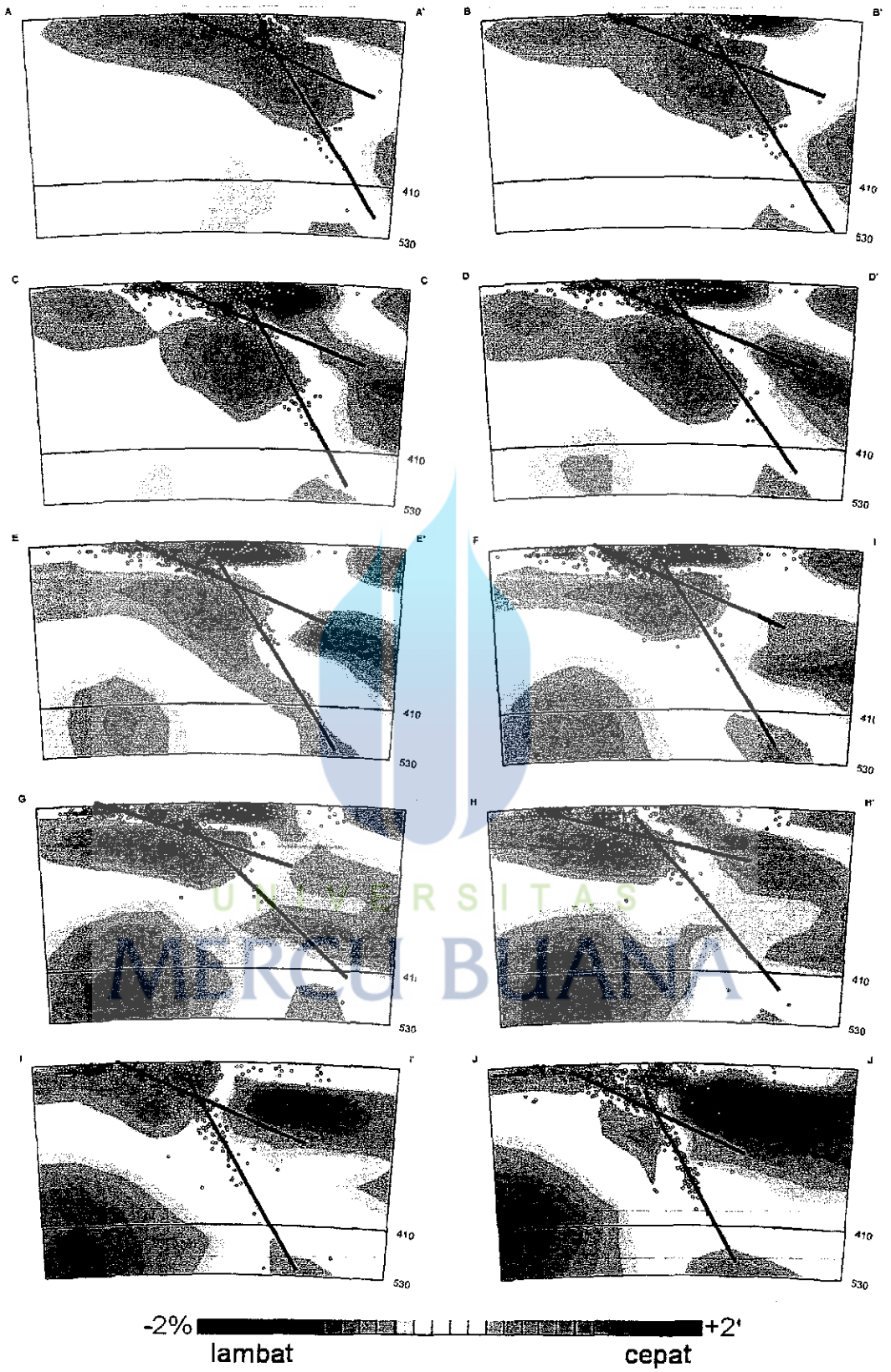

Gambar 2.6. Interpretasi sudut subduksi Jawa (Widiyantoro, 2009) dari data hiposenter hasil relokasi (Engdahl dkk, 2007).

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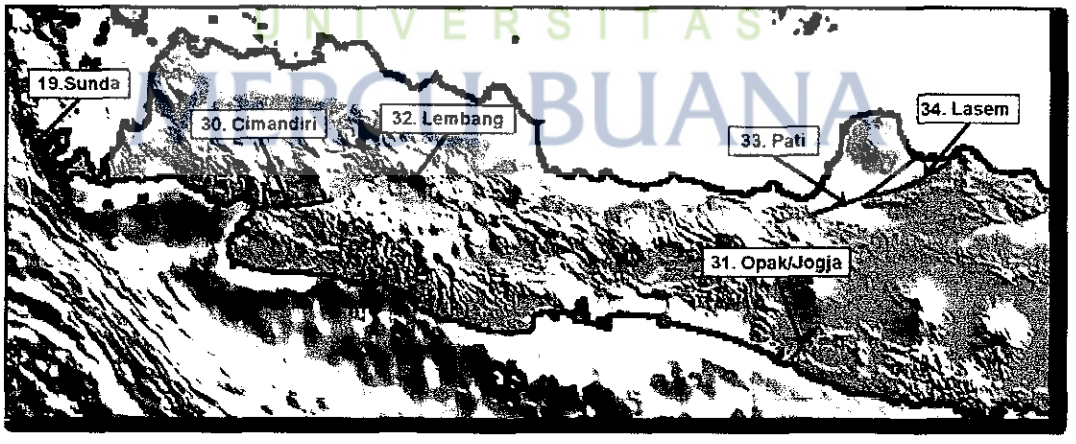
Untuk keperluan analisis hazard, zona subduksi Jawa-Sumba dibagi menjadi dua segmen sumber gempa, pembagian zona ini didasarkan pada kondisi seismotektoniknya, zona-zona ini meliputi segmen subduksi Jawa dan Subduksi Sumba.

2.2.2. SHALLOW CRUSTAL FAULT SEKITAR JAKARTA

Besar dan arah slip antara Lempeng Indo-Australia dan Eurasia di sepanjang Sunda Arc adalah konstan. Meskipun demikian, perubahan orientasi busur di dekat Selat Sunda memberikan perubahan rasio paralel yang besar terhadap normal slip. Menurut Hamilton (1979), dan Newcomb & McCann (1987), tidak adanya sesar pada daerah regional seperti pada Sesar Sumatera juga terdapat di Jawa. Meskipun demikian, sejumlah peneliti lain telah melaporkan bukti adanya deformasi *right-lateral strike-slip* di Jawa (Beca Carter Hollings & Ferner, 1978). Derajat kegempaan Jawa sangat lebih rendah bila dibandingkan dengan zona sesar sumatra (Lasitha dkk, 2006), kejadian pergerakan strike-slip perlu diperhitungkan yang relatif dekat dengan Kota Jakarta (**Gambar 2.7**). adalah akibat dari sesar Cimandiri, Lembang, Bumiayu, Pati, Lasem dan Opak (Jogja), sedangkan pergerakan sesar naik daerah timur Jawa ada Flores back-arc dan Wetar back-arc yang mempunyai keaktifan yang lebih besar.



Gambar 2.7. Shallow crustal di daerah Selat Sunda

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BAB 3
ANALISIS *SEISMIC HAZARD*

3.1. PENDAHULUAN

Pendekatan-pendekatan yang digunakan dalam studi-studi seismic hazard analysis yang pernah dilakukan sebelumnya akan dijelaskan pada bagian ini. Dalam studi ini analisis *seismic hazard* akan dilakukan dengan menggunakan pendekatan probabilistik. Analisis seismic hazard dengan metoda probabilistik (*Probabilistic seismic hazard analysis* /PSHA) yang dikembangkan oleh Cornell (1968) dan EERI Committee on Seismic Risk (EERI, 1989) memiliki empat tahap (Finn et al., 2004) yaitu: (a) identifikasi sumber gempa, (b) karakterisasi sumber gempa, (b) pemilihan fungsi atenuasi dan (d) perhitungan hazard gempa.

Tahap pertama dalam PSHA adalah identifikasi sumber-sumber gempa. Identifikasi tersebut didasarkan atas data-data seismologi, geologi, dan sejarah kegempaan di sekitar lokasi yang akan dianalisis. Dalam tahap identifikasi data gempa ini dilakukan pengumpulan dan pengolahan data gempa termasuk analisis pemisahan gempa utama dan gempa ikutan, analisis kelengkapan data gempa. Pada tahap karakterisasi dilakukan pemodelan sumber gempa dan penentuan parameter kegempaan seperti *b-value, annual rate,* magnitude maksimum dan *slip rate.* Tahap selanjutnya adalah pemilihan atenuasi yang didasarkan atas kondisi geologi, seismologi dan mekanisme kegempaan. Tahap terakhir adalah perhitungan hazard gempa untuk mendapatkan nilai percepatan untuk suatu periode ulang gempa yang telah ditentukan.

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3.2. PENGUMPULAN DAN PENGOLAHAN DATA

Seismic hazard analysis pada suatu lokasi memerlukan seluruh data yang mencatat kejadian gempa yang terjadi di sekitar lokasi tersebut untuk suatu periode pengamatan tertentu. Data-data kejadian gempa dikumpulkan dalam suatu katalog gempa yang disusun oleh lembaga-lembaga nasional maupun internasional, seperti:

1. Badan Meteorologi, Klimatologi dan Geofisika (BMKG), Jakarta, Indonesia
2. National Earthquake Information Service U.S. Geological Survey (NEIS-USGS) yang merupakan kompilasi dari berbagai katalog, yaitu Bureau Central International de Séismologie (BCIS), International Seismological

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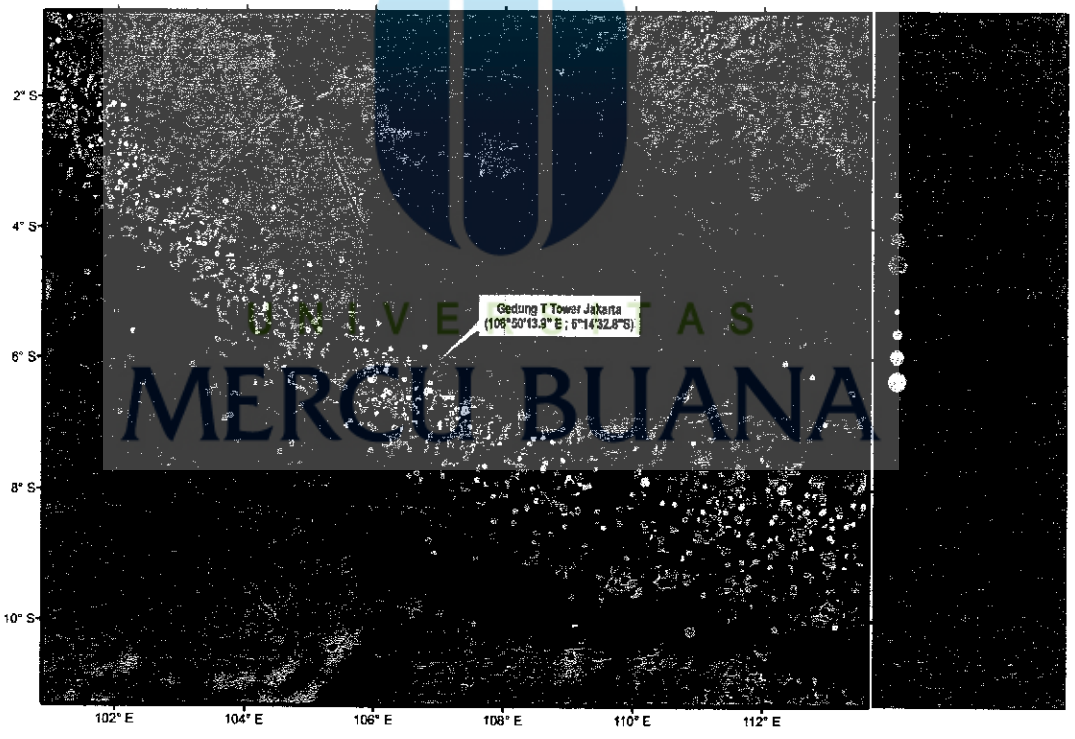
Summaries (ISS), International Seismological Center (ISC), Preliminary Determination of Epicenters (PDE), dan Advanced National Seismic System (ANSS).

3. Centennial Catalog yang dikompilasi dari data Abe (1981, 1984), Abe dan Noguchi (1983a, b), dan Newcomb and McCann (Newcomb and McCann, 1987). Katalog ini telah direlokasi oleh Pacheco and Sykes (Pacheco and Sykes, 1992).
4. Katalog gempa yang sudah direlokasi oleh Engdahl (Engdahl et al., 2007)

Katalog gempa gabungan yang dikumpulkan mencakup area dari 102.0^0 BT sampai 112.0^0 BT dan dari 1.0^0 LS sampai 10.0^0 LS. Magnituda minimum sebesar 5.0 dan kedalaman maksimum sebesar 300 km. Data pecatatan pertama adalah pada tahun 1900 dan yang paling akhir pada tahun 2009. Katalog gempa hasil penggabungan katalog dari berbagai institusi tersebut dapat dilihat dalam **Gambar 3.1**.



Gambar 3.1. Distribusi episenter kejadian gempa sebelum disortir (*all shock*) sejak tahun 1900 sampai tahun 2009 untuk magnitude minimum 5.0

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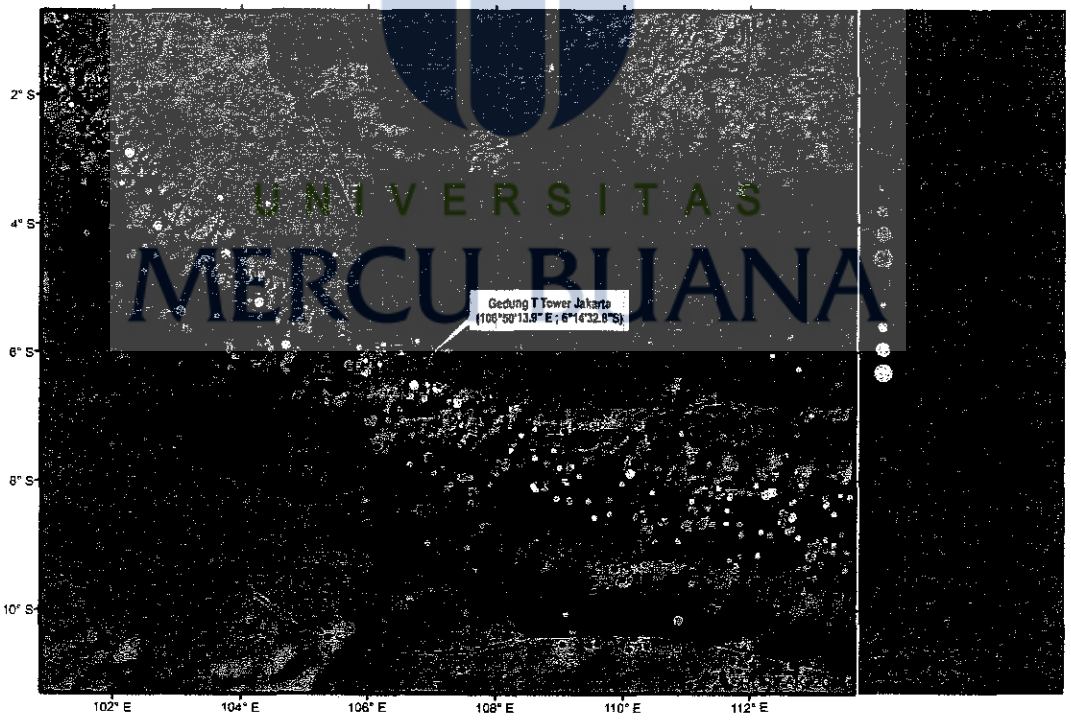
Seluruh data dari katalog gempa harus diproses dengan menggunakan prinsip-prinsip statistik sebelum digunakan untuk seismic hazard analysis. Prosedur ini dilakukan untuk meminimalisasi deviasi atau kesalahan yang sistematis dan untuk mendapatkan hasil yang baik. Prosedur ini mencakup (1) analisis pemisahan gempa utama dan gempa ikutan dan (2) analisis kelengkapan data gempa.

Kejadian-kejadian gempa dependent atau gempa ikutan (*foreshock* dan *aftershock*), harus diidentifikasi sebelum data-data kejadian gempa digunakan untuk menentukan tingkat hazard gempa. Beberapa kriteria empiris untuk mengidentifikasi kejadian gempa dependent telah dilakukan oleh beberapa peneliti, seperti Arabasz dan Robinson (1976), Gardner dan Knopoff (1974) dan Uhrhammer (1986). Kriteria ini dikembangkan berdasarkan suatu rentang waktu dan jarak tertentu dari satu kejadian gempa besar.

Dalam studi ini digunakan model Gardner dan Knopoff (1974) untuk memisahkan gempa utama dan gempa ikutannya. Hal ini sesuai dengan berbagai analisis yang dilakukan oleh peneliti dengan menggunakan model-model diatas dan diketahui model Gardner dan Knopoff (1974) memiliki hasil yang cukup baik (**Gambar 3.2**).



Gambar 3.2. Distribusi episenter kejadian gempa setelah disortir (*main shock*) sejak tahun 1900 sampai tahun 2009 untuk magnitude minimum 5.0.

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Proses analisis kelengkapan (*completeness*) data gempa juga dilakukan untuk mengetahui kelengkapan suatu katalog data gempa. Ketidaklengkapan data gempa akan mengakibatkan parameter resiko gempa yang dihasilkan menjadi overestimated atau underestimated. Metode analisis kelengkapan data gempa yang digunakan pada studi ini mengikuti prosedur yang diusulkan oleh Stepp (1973). Hasil analisis kelengkapan data untuk wilayah Indonesia untuk setiap rentang magnituda bisa dilihat dalam **Tabel 3.1**.

Tabel 3.1. Interval completeness dari data gempa wilayah Indonesia.

Rentang Magnitude	Interval Completeness (tahun dari 2009)
5.0 – 6.0	44
6.0 – 7.0	54
≥ 7.0	108

3.3. PEMODELAN ZONA SUMBER GEMPA

Berdasarkan kondisi tektonik di sekitar lokasi proyek, secara umum zona sumber gempa yang mempengaruhi kota Jakarta dapat dibagi menjadi tiga (3) model sumber gempa fault, subduksi, dan *background*. Parameter-parameter kegempaan seperti *slip-rate*, *dip*, geometri dan magnituda maksimum yang digunakan dalam analisis didasarkan pada hasil-hasil penelitian yang pernah dilakukan sebelumnya. Model sumber gempa yang digunakan dalam studi ini dapat dilihat dalam Gambar 3.3.

Model sumber gempa fault ini juga disebut sebagai sumber gempa tiga dimensi karena dalam perhitungan probabilitas jarak, yang dilibatkan adalah jarak dari site ke hypocenter. Jarak ini memerlukan data dip dari fault yang akan dipakai sebagai perhitungan probabilitas tersebut. Parameter-parameter yang diperlukan untuk analisis probabilitas dengan model sumber gempa fault adalah *fault trace*, mekanisme pergerakan, slip-rate, dip, panjang dan lebar fault. Penentuan lokasi sesar (fault trace) ini berdasarnya dari data-data peneliti yang sudah dipublikasi.

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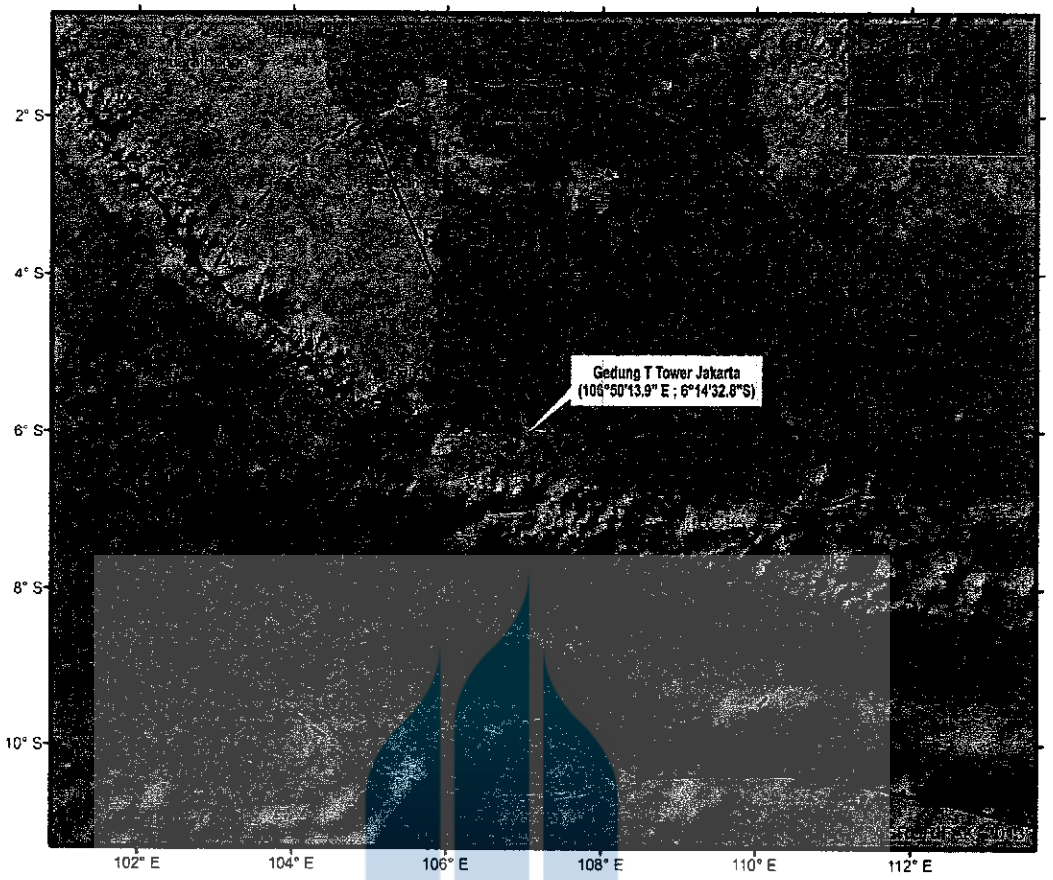

Gambar 3.3. Model zona sumber gempa

Sumber gempa fault terjadi pada patahan-patahan dangkal (*shallow crustal faults*) yang terdefinisi dengan jelas seperti Sesar Semangko di Sumatra dan sesar-sesar di Jawa seperti sesar Cimandiri, Lembang, Lasem, dan Pati.

Sumber gempa subduksi adalah model yang didapat dari data seismotektonik yang sudah teridentifikasi dengan baik. Parameter dari model ini meliputi lokasi subduksi yang dituangkan dalam koordinat latitude dan longitude, kemiringan bidang subduksi (dip), rate, dan b-value dari areal subduksi yang bisa didapatkan dari data gempa historis, serta batas kedalaman area subduksi. Perhitungan nilai a & *b* (*a & b-value*) untuk sumber gempa subduksi dilakukan dengan cara mengambil data-data gempa historis yang ada di daerah *Megathrust* tersebut, kemudian dilakukan analisis statistik dengan model Maximum Likelihood (Aki, 1965). Zona subduksi yang mempengaruhi sekitar lokasi studi meliputi zona subduksi Sumatra dan Jawa yang terbentuk akibat pergerakan lempeng tektonik Australia yang menunjam lempeng tektonik Eurasia.

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Zona background dalam model ini digunakan untuk memperhitungkan sumber-sumber gempa yang belum teridentifikasi namun memiliki sejarah kegempaan di sekitar lokasi studi. Dalam studi ini digunakan model gridded yang didasarkan atas studi yang dilakukan oleh Frankel, et al (1996).

3.4. PEMILIHAN FUNGSI ATENUASI

Fungsi atenuasi merupakan persamaan matematika sederhana yang menghubungkan antara parameter kegempaan di lokasi sumber gempa (Magnituda M dan jarak R) dengan parameter pergerakan tanah (spektra percepatan) di lokasi yang ditinjau (Campbell, 2001). Fungsi atenuasi cenderung spesifik untuk setiap wilayah dan untuk suatu tipe patahan, misalnya atenuasi untuk strike-slip berbeda dengan untuk reverse atau thrust faults. (Finn et al., 2004). Salah satu data yang digunakan untuk menurunkan fungsi tersebut adalah data time histories yang didapatkan dari hasil pencatatan alat accelerograph saat berlangsungnya kejadian gempa. Karena minimnya data pencatatan time histories untuk keperluan pembuatan fungsi atenuasi untuk Indonesia, maka pemakaian fungsi atenuasi yang diturunkan dari negara lain tidak dapat dihindari. Pemilihan fungsi atenuasi didasarkan pada kesamaan kondisi geologi dan tektonik dari wilayah dimana rumus atenuasi itu dibuat.

Dalam studi ini digunakan pula fungsi atenuasi dari publikasi-publikasi terkini seperti NGA (Next Generation Attenuation) dari Boore dan Atkinson (2008), Campbell dan Bozorgnia (2008), and Chiou dan Young (2008). Model NGA ini dikembangkan menggunakan basis data yang meliputi 1557 catatan dari 143 gempa sejak tahun 1935 di beberapa wilayah tektonik aktif, seperti Turki, Taiwan, Mexico, Yunani, Iran, Italia, dan Amerika Serikat dan dengan memperhitungkan detil kondisi geologi/seismologinya.

Dalam studi ini, rumus atenuasi yang digunakan untuk masing-masing model sumber gempa yaitu:

1. Sumber gempa shallow crustal, untuk model sumber gempa fault dan shallow background:
   a. Boore-Atkinson NGA. (Boore dan Atkinson, 2008)
   b. Campbell-Bozorgnia NGA. (Campbell dan Bozorgnia, 2008)
   c. Chiou-Youngs NGA. (Chiou dan Youngs, 2008)
2. Sumber gempa subduksi interface (Megathrust), untuk model sumber gempa subduksi:
   a. Geomatrix subduction (Youngs et al., SRL, 1997)

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b. Atkinson-Boore BC (Atkinson dan Boore, 2003)
c. Zhao et al (Zhao et al., 2006)

3. Sumber gempa Benioff (deep intraslab), untuk model sumber gempa intraslab:
   a. Atkinson-Boor (Atkinson-Boore, Cascadia 2003)
   b. Geomatrix slab seismicity rock (Youngs et al., 1997)
   c. Atkinson-Boore (Atkinson-Boore, Wordwide 2003)

3.4. LOGIC TREE

Ketidakpastian (*uncertainties*) didalam disain beban akibat gempa umumnya menjadi sesuatu masalah yang harus di cari penyelesaiannya. Ketidak-pastian itu mulai dari saat kejadian gempa, tempat gempa akan terjadi, ukuran atau besar kecilnya gempa, karakter gempa dan berapa kali suatu gempa akan terjadi pada lokasi yang sama pada rentang waktu tertentu. Studi yang sangat intensif perlu dilakukan sehingga ketidak pastian tersebut dapat dikurangi derajatnya atau dicari metoda-metoda baru yang dapat dipakai untuk mengatasi persoalan ketidak pastian tersebut.

Pendekatan *logic tree* menyediakan penggunaan model alternatif. Salah satunya adalah memberikan faktor pembobot yang diinterpretasikan sebagai kemungkinan relatif dari model untuk menjadi betul. Model ini terdiri dari satu seri nodal (*node*) yang merepresentasikan titik dimana model dispesifikkan dan cabang yang merepresentasikan model yang berbeda yang dispesifikasikan pada tiap nodal. Penjumlahan probabilitas dari semua cabang yang dihubungkan dengan satu nodal tertentu nilainya harus sama dengan 1.

Untuk menggunakan *logic tree*, satu analisis resiko gempa diselesaikan untuk kombinasi model dan atau parameter yang berkaitan dengan tiap ujung cabang. Hasil tiap analisis diberikan oleh nilai bobot kemungkinan relatif dari kombinasi cabang, dengan hasil akhir diambil sebagai penjumlahan dari nilai bobot masing-masing.

Model *logic tree* yang digunakan untuk *Probalistic Sesismic Hazard Analysis* disesuaikan dengan model sumber gempa yang digunakan. Model untuk sumber gempa sesar, subduksi dan background seperti yang terlihat pada **Gambar 3.4** s/d **Gambar 3.6**.

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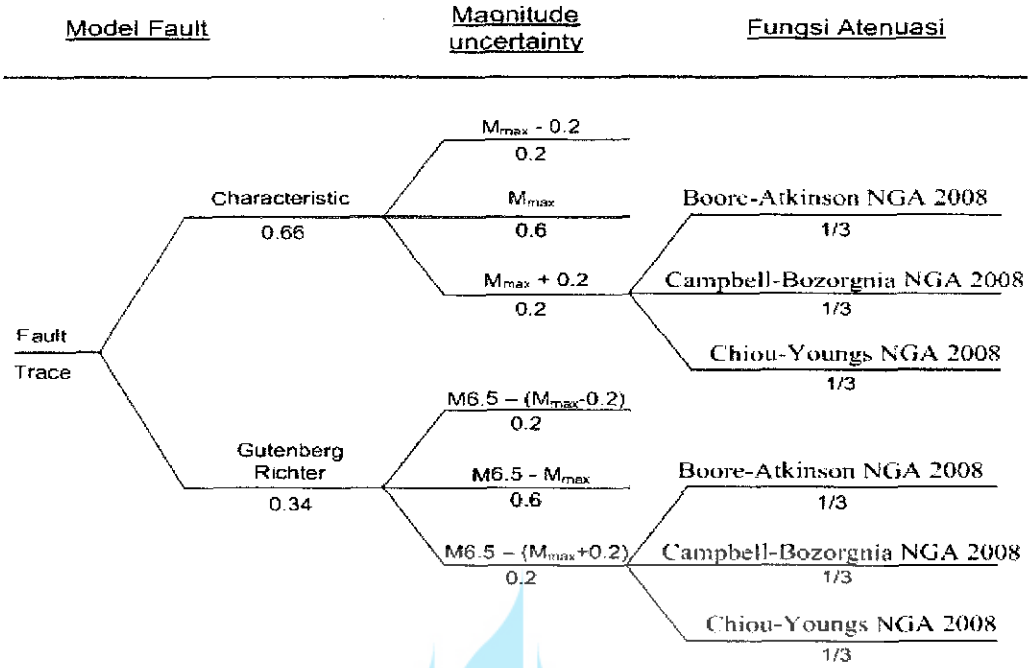
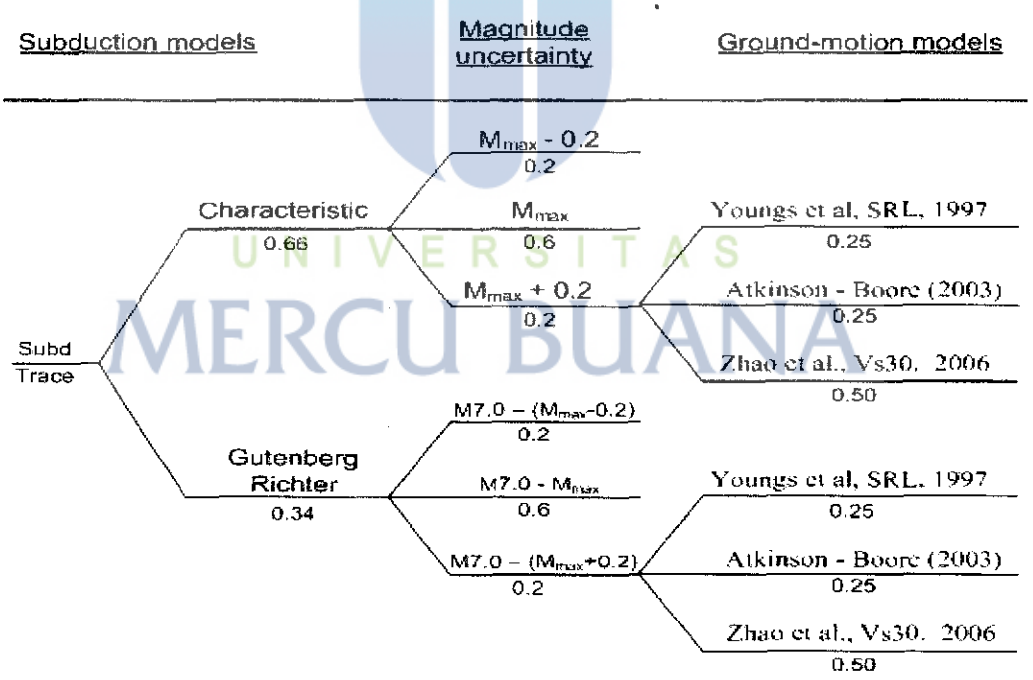


Gambar 3.4. Model *logic tree* untuk Sumber Gempa Sesar (*Fault*)



Gambar 3.5. Model *logic tree* untuk Sumber Gempa Subduksi (*Megathrust*)

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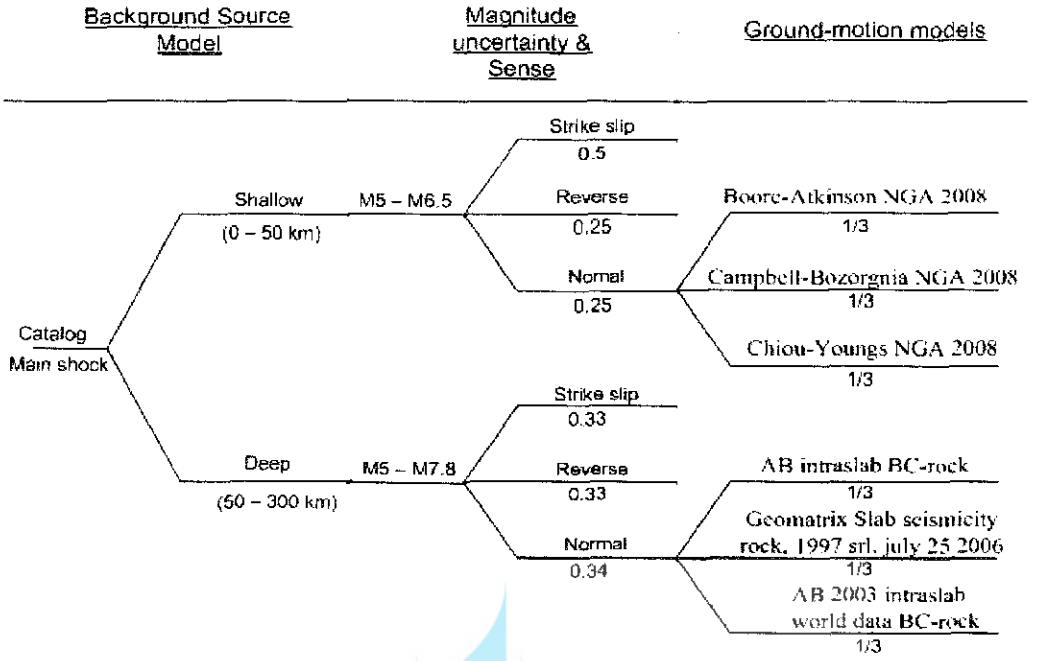

Gambar 3.6. Model *logic tree* untuk Sumber Gempa Background.

3.5. KONSEP PROBABILITAS

Penentuan besar pergerakan tanah (*ground shaking*) merupakan hal yang penting dalam analisis dinamik struktur. Besar pergerakan tanah dinyatakan dalam bentuk *peak ground acceleration* (PGA), *uniform hazard spectra* (UHS) dan *time histories. Seismic hazard analysis* digunakan untuk menentukan besarnya PGA dan UHS di lokasi tertentu untuk suatu periode ulang gempa.

Teori probabilitas total yang dikembangkan oleh McGuire (1976) didasarkan pada konsep probabilitas yang dikembangkan oleh Cornell (1968), dengan asumsi bahwa magnitude gempa M dan jarak hiposenter R sebagai random variable independen yang menerus.

Teori probabilitas total dapat dinyatakan dalam bentuk dasar sebagai berikut,

$$P[I \geq i] = \int_r \int_m P[I \geq i \mid m \text{ and } r] \cdot f_M(m) \cdot f_R(r)\, dm\, dr \qquad (3\text{-}1)$$

dimana,

f_M = fungsi densitas mangitude, M

f_R = fungsi densitas jarak hiposenter, R

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P [I ≥ i |M dan R] = probabilitas dari intensitas I yang sama atau lebih besar dari i pada suatu lokasi dengan magnitude, M dan jarak hiposenter, R

Untuk sumber patahan, formula yang sering digunakan untuk menghitung P [I ≥ i |M dan R] adalah sebagai berikut:

$$\ln I = C_1 + C_2M + C_3\ln R + C_4R + \varepsilon;\ \varepsilon \approx N(0,\sigma_I^2) \quad (3\text{-}2)$$

dimana R merupakan jarak ke fault rupture, C1, C2, C3, C4 dan σ_I merupakan konstanta. Persamaan di atas dapat dirubah menjadi

$$P[I \geq i \mid m \text{ and } r] = \phi * \left(\frac{\ln i - \overline{\ln I(m,r)}}{\sigma_I} \right) \quad (3\text{-}3)$$

dimana ϕ adalah fungsi distribusi normal complementary cumulative dan ln I (m,r) merupakan nilai ln I yang didapatklan dari persamaan di atas dengan mengambil nilai $\varepsilon = 0$.

Distribusi magnitude umumnya diasumsikan sebagai doubly truncated exponential, seperti,

$$f_M(m) = k_i(-\beta_i(m-M_{oi})),\quad M_{oi} < m < M_{maxi} \quad (3\text{-}4)$$

dimana $k_i = (1-\exp(\beta_i(m-M_{oi})))^{-1}$ adalah konstanta normal, M_{oi} adalah magnitude minimum dan M_{maxi} adalah magnitude maksimum yang dapat terjadi pada suatu sumber gempa.

Sebagai alternatif distribusi magnitude eksponensial adalah model karakteristik yang diajukan oleh Youngs & Coppersmith (1985), yang dijelaskan dalam persamaan:

$$\begin{aligned} f_M(m) &= k_i' \exp(-\beta(m-M_{oi}) && ;\ M_{oi} < m < M_{maxi}1/2 \\ &= k_i' \exp(-\beta(M_{maxi}-3/2)-M_{oi})) && ;\ M_{maxi}1/2 < m < M_{maxi} \end{aligned} \quad (3\text{-}5)$$

dimana ki' adalah konstanta normal yang membuat persamaan di atas mendekati 1.

Distribusi jarak ditentukan oleh dimensi sumber dan jarak serta arah relatifnya terhadap lokasi. Jika ukuran retakan diperhitungkan dalam perhitungan jarak, maka distribusi jarak bergantung pada magnitude.

Perhitungan jarak memperhitungkan dimensi batas dari retakan dan ketergantungan ukuran retakan pada magnitude gempa. Kedalaman dan lokasi

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horisontal retakan gempa diasumsikan terdistribusi merata. Panjang retakan L_R dan lebar retakan W_R diasumsikan bervariasi berdasarkan magnitude sesuai persamaan:

$$\text{Log } L_R = \text{Log } W_R = A_L + B_L + \delta \qquad \delta \approx N(0, SIG_L) \qquad (3\text{-}6)$$

Koefisien A_L dan B_L diperoleh melalui analisis regresi magnitude pada ukuran retakan; SIG_L menunjukkan sebaran data dalam analisis ini. Jika untuk nilai δ tertentu, nilai L_R yang diberikan pada persamaan di atas lebih besar daripada panjang patahan, L_R dianggap sama dengan panjang patahan. Begitu pula jika W_R lebih besar daripada lebar patahan, W_R dianggap sama dengan lebar patahan.

Perhitungan lokasi horisontal dan vertikal retakan dipisahkan untuk penyederhanaan. Konsekuensi dari pemisahan ini adalah, ketika retakan terjadi diantara dua segmen dalam patahan dipping fault, panjang retakan pada kedalaman berbeda dengan L_R, dimana L_R menunjukkan panjang retakan seperti pengukuran di permukaan. Perbedaan umumnya kecil karena perubahan strike pada patahan kecil diantara segmen.

Terdapat tiga definisi jarak R (Gambar 3.7), yaitu:

- R_0: jarak terdekat dengan retakan.
- R_1: berdasarkan jarak terdekat dengan proyeksi horisontal retakan:

  $R_1 = R_{horizontal}$
- R_2: berdasarkan jarak terdekat dengan proyeksi retakan dipermukaan (misalnya., jarak terdekat dengan bidang runtuh dari jalur patahan, jika retakan memanjang ke permukaan); termasuk fixed "depth" didefinisikan sebagai R_{ZERO}; misalnya.,

  $R_2 = R_{to\ surface\ expression}$

Catatan: R_1 identik dengan R_2 untuk patahan vertikal.

Jarak umumnya didefinisikan sebagai R_0, namun definisi lainnya dapat digunakan agar konsisten dengan definisi jarak yang digunakan dalam fungsi atenuasi tertentu.

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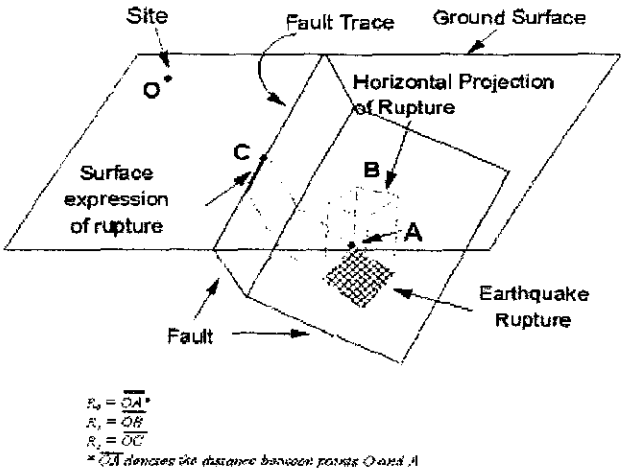

Gambar 3.7. Model patahan 3-dimensi.

Dengan definisi di atas, urutan perhitungan seismic hazard untuk sumber patahan dapat ditunjukkan dengan formula yang dimodifikasi dari persamaan sebelumnya sebagai berikut:

$$P[I \geq i] = \int f_M(m) \int f_{LR}(l) \int P[I \geq i : m, r].f_{R;M,LR}(r, m, l) dr.dl.dm \qquad (3\text{-}7)$$

Jumlah gempa n_M dengan megnitude sama atau lebih besar daripada M yang terjadi pada lokasi tertentu diasumsikan mengikuti hubungan di bawah ini (Gutenberg dan Richter, 1954),

$$\log_{10} n_M = a - b\,M \qquad (3\text{-}8)$$

dimana a dan b merupakan konstanta karakteristik dari area sumber yang dipelajari. Konstanta b menggambarkan distribusi relatif dari magnitude kecil dan besar, dimana nilai b yang lebih besar menggambarkan bahwa guncangan yang besar relatif lebih sedikit, dan begitu pula kebalikannya.

Probabilitas total gempa tahunan dengan intensitas I yang sama atau lebih besar dari i pada lokasi tertentu ditentukan dengan menjumlahkan seluruh probabilitas dari tiap sumber gempa. Dalam formula matematika dapat ditulis sebagai berikut:

$$N_A = \sum_{i=1}^{n} N_1 (M \geq m_o)_1 P[I \geq i] \qquad (3\text{-}9)$$

dimana,

N_A = total gempa tahunan yang terjadi dengan intensitas I yang sama atau lebih besar sama dengan i dari seluruh sumber gempa.

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$P[I \geq i]$ = probabilitas dari satu kejadian dengan intensitas I yang sama atau lebih besar dari i dari satu sumber gempa.

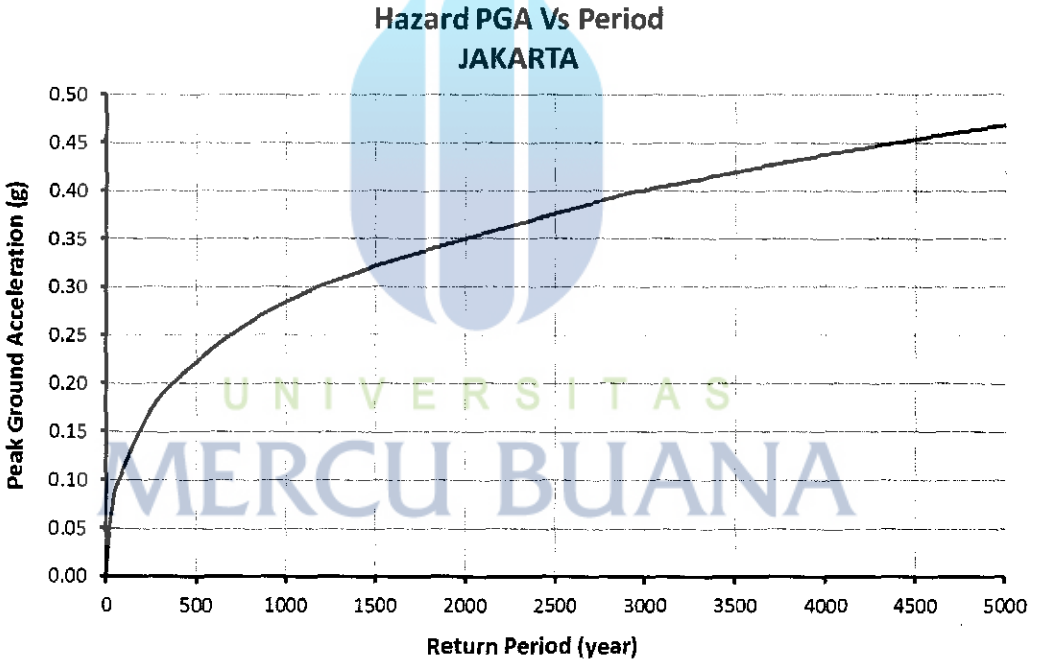
$N_l(M \geq m_o)$ = gempa tahunan yang terjadi dengan magnitude M yang sama dengan atau lebih besar dari magnitude m dari satu sumber gempa.

Resiko gempa tahunan diasumsikan tersebar menurut Distribusi Poisson sebagai berikut,

$$R_A = 1 - e^{(-NA)} \quad (3\text{-}10)$$

3.6. HASIL ANALISIS PROBABILISTIK

Gambar 3.8 dibawah memperlihatkan hasil analisis hazard PGA Vs Periode ulang di batuan dasar di wilayah Jakarta.



Gambar 3.8. Hazard PGA Vs Periode ulang untuk wilayah Jakarta

Berdasarkan hasil-hasil studi PSHA tersebut didapat percepatan gempa di batuan dasar (PGA) Jakarta untuk periode ulang 500 dan 2500 tahun masing-masing adalah **0.211g dan 0.369g.**

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Selain nilai PGA, analisis PSHA juga menghasilkan nilai-nilai spektra seragam (Uniform hazard spectrum/UHS) untuk periode ulang 500 dan 2500 tahun. Nilai spektra yang umum digunakan sebagai titik kontrol dalam merepresentasikan respons spektra untuk periode pendek (*short period*) dan period panjang (*long period*) berturut-turut adalah nilai spektra di periode, T=0.2 detik dan T=1.0 detik. Nilai spektra percepatan di Jakarta untuk 500 tahun pada periode 0.2 detik dan 1.0 detik berturut-turut adalah **0.39g** dan **0.15g**. Sedangkan nilai spektra untuk periode ulang 2500 tahun pada periode 0.2 detik dan 1.0 detik berturut-turut adalah **0.69g** dan **0.29g**, nilai ini sudah memperhitungkan *direction factor* dengan faktor pengali 1,05 pada periode 0,2 detik dan faktor pengali 1,15 pada perioda 1 detik untuk memperhitungkan arah percepatan maksimum dan koefisien risiko C_{RS} & C_{R1} masing-masing 0.995 dan 0.939 yang diterapkan terhadap nilai rata-rata geometrik hasil analisis hazard gempa. Nilai faktor pengali ini sesuai dengan RSNI-03-1726-201x dan sudah disepakati bersama oleh Tim SNI kegempaan.

3.7. INPUT GROUND MOTION

Pemilihan data *ground motion* (GM) yang akan digunakan dalam analisis perambatan gelombang dari batuan dasar ke permukaan tanah merupakan faktor yang cukup penting. Data *ground motion* yang dimaksud adalah data digitasi riwayat waktu percepatan (*acceleration time histories*). Hal yang paling penting untuk mendapatkan hasil yang akurat adalah pemilihan data riwayat waktu yang sesuai dengan kondisi spesifik geologi dan seismologi lokasi yang ditinjau. Apabila pada lokasi yang ditinjau tidak memiliki data *time-histories* sendiri, maka dapat digunakan tiga metode alternatif untuk mendapatkan data digitasi riwayat waktu (*time histories*) di batuan dasar, yaitu:

(1) Menggunakan data *time-histories* pada suatu lokasi yang kondisi geologi dan seismologinya sesuai atau mirip dengan kondisi lokasi yang ditinjau.

(2) Menggunakan data *time-histories* dari lokasi lain yang telah diskalakan sesuai dengan target spektra dari lokasi yang ditinjau.

(3) Membuat *synthetic time-histories* yang disesuaikan dengan kondisi geologi dan seismologi setempat.

Metode pemilihan data *time-histories* yang banyak digunakan di Indonesia adalah metode pada poin (2) dan (3), karena di Indonesia belum memiliki data *time histories* sendiri. Dalam memilih data *time-histories* dari lokasi lain yang akan

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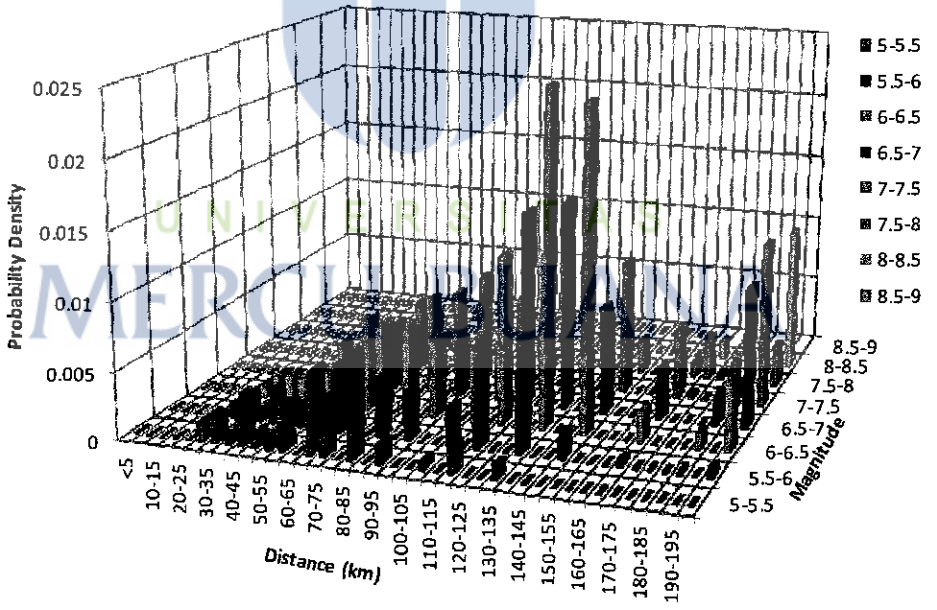
diskalakan, pemilihan dilakukan berdasarkan magnitude (M) dan jarak (R) yang paling berpengaruh dari hasil dari analisis deagregasi,

Rangkuman *recorded ground motion* yang dipilih berdasarkan hasil deagregasi dapat dilihat pada **Tabel 3.2**. Hasil deagregasi untuk wilayah Jakarta ditunjukkan dalam **Gambar 3.9** s/d **Gambar 3.22** untuk gempa dengan periode ulang 500 dan 2500 tahun.

Tabel 3.2. Rangkuman hasil deagregasi

Periode Ulang (tahun)	Spectral (detik)	All Sources		Megathrust		Shallow Crustal		Benioff	
		Magn. (Mw)	Jarak (km)	Magn. (Mw)	Jarak (km)	Magn. (Mw)	Jarak (km)	Magn. (Mw)	Jarak (km)
500	0.2	6.65	115.38	8.05	191.44	5.94	58.07	6.71	122.79
	1.0	7.22	148.85	8.05	202.32	6.47	70.62	6.96	134.01
2500	0.2	6.79	102.83	8.09	189.51	5.97	47.38	6.91	111.07
	1.0	7.44	141.60	8.11	199.80	6.41	49.56	7.16	117.38



Gambar 3.9. Grafik hasil deagregasi Wilayah Jakarta untuk periode ulang gempa 500 Tahun.

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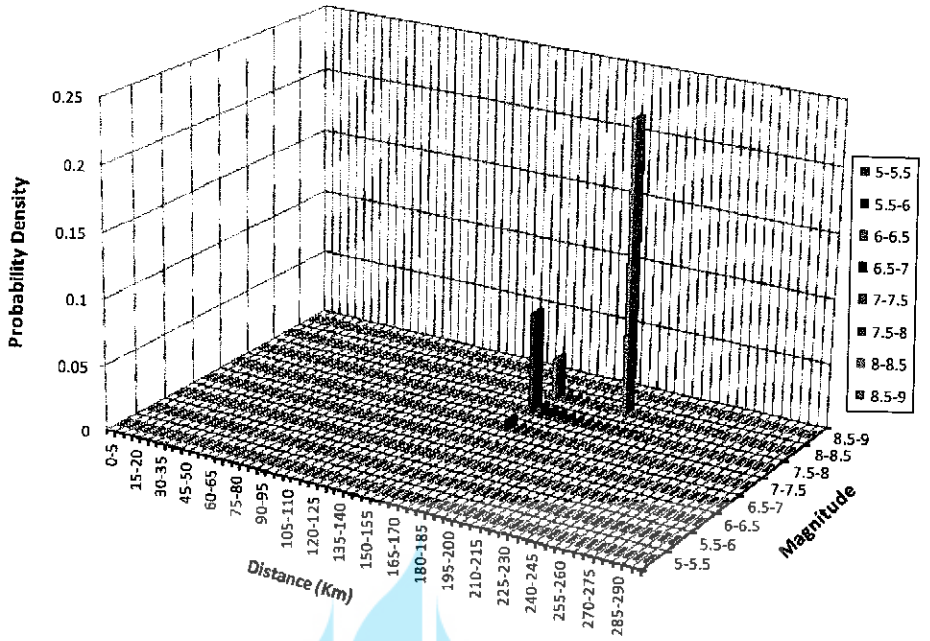
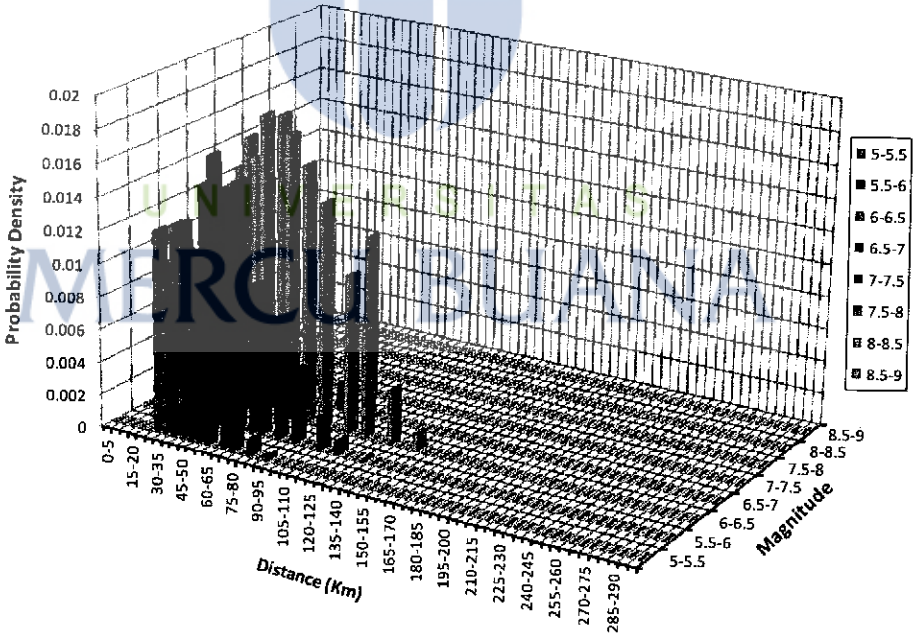


Gambar 3.10. Grafik hasil deagregasi Jakarta untuk perioda ulang gempa 500 tahun dari sumber gempa Megathrust pada spektra T = 0.2 sec.



Gambar 3.11. Grafik hasil deagregasi Jakarta untuk perioda ulang 500 tahun dari sumber gempa shallow crustal pada spektra T = 0.2 sec.

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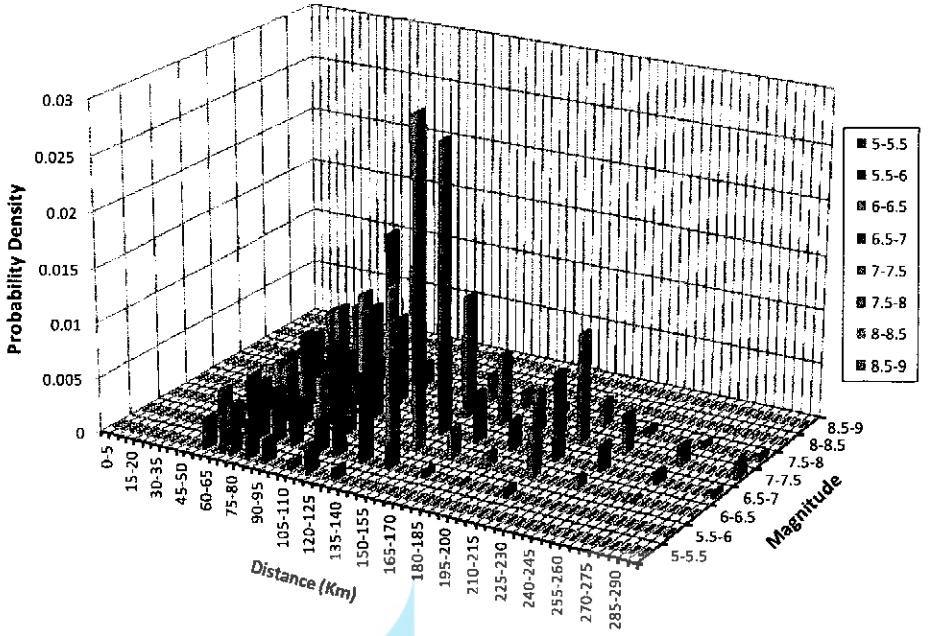
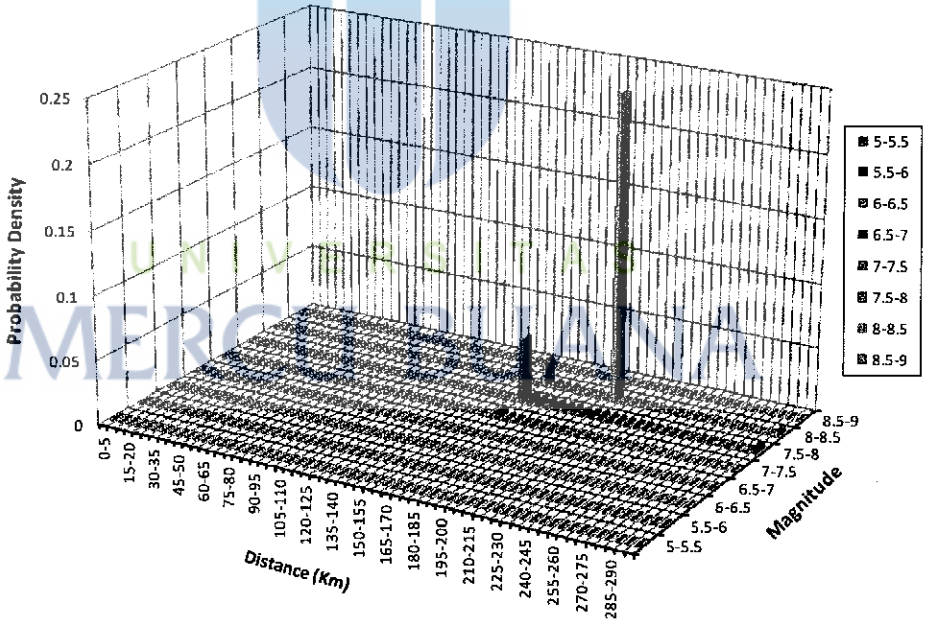


Gambar 3.12. Grafik hasil deagregasi Jakarta untuk perioda ulang 500 tahun dari sumber gempa Benioff pada spektra T = 0.2 sec.



Gambar 3.13. Grafik hasil deagregasi Jakarta untuk perioda ulang 500 tahun dari sumber gempa Megathrust pada spektra T = 1 sec.

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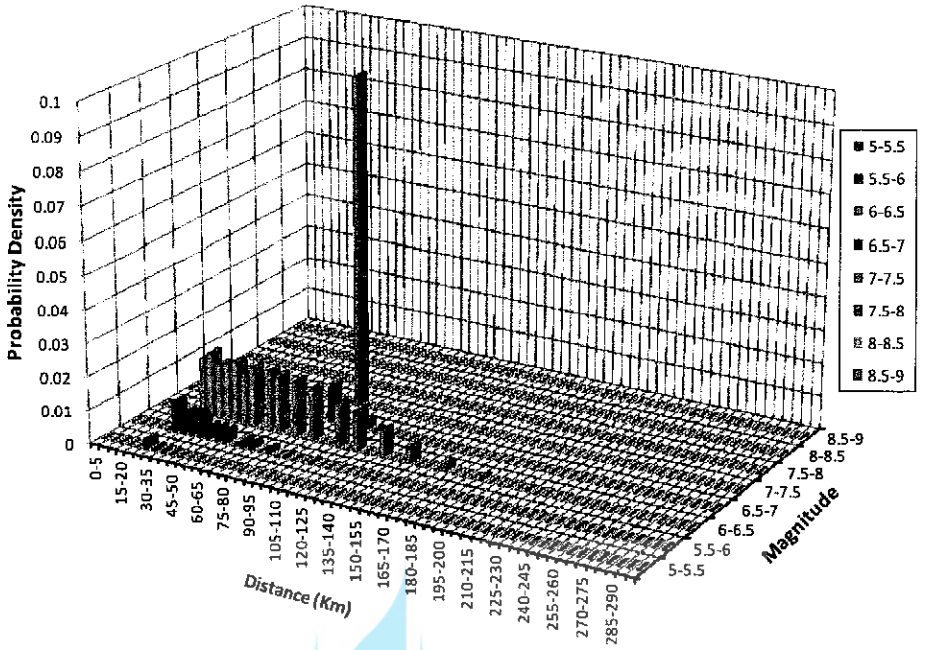
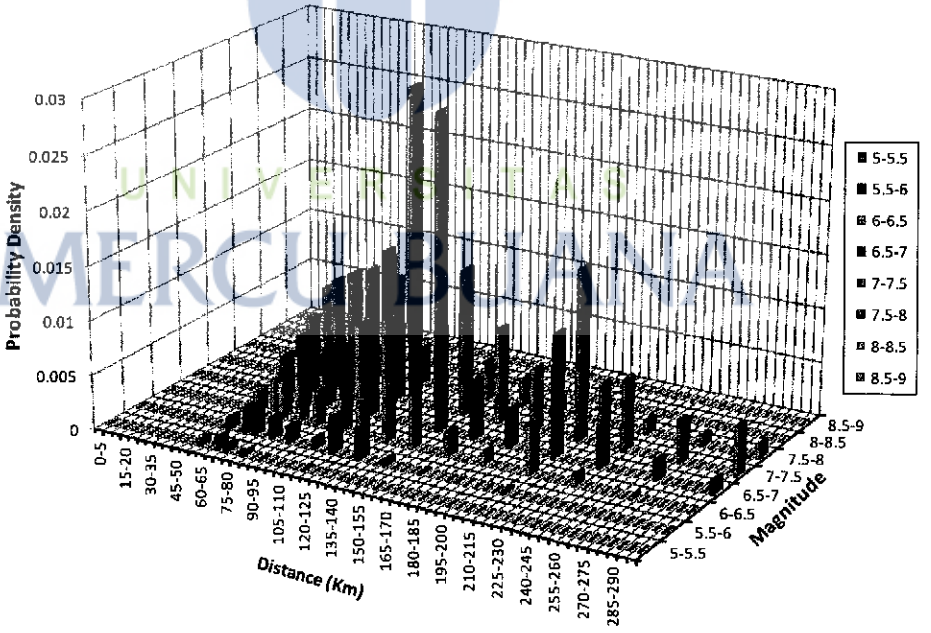


Gambar 3.14. Grafik hasil deagregasi Jakarta untuk perioda ulang 500 tahun dari sumber gempa shallow crustal pada spektra T = 1 sec.



Gambar 3.15. Grafik hasil deagregasi Jakarta untuk perioda ulang 500 tahun dari sumber gempa Benioff pada spektra T = 1 sec.

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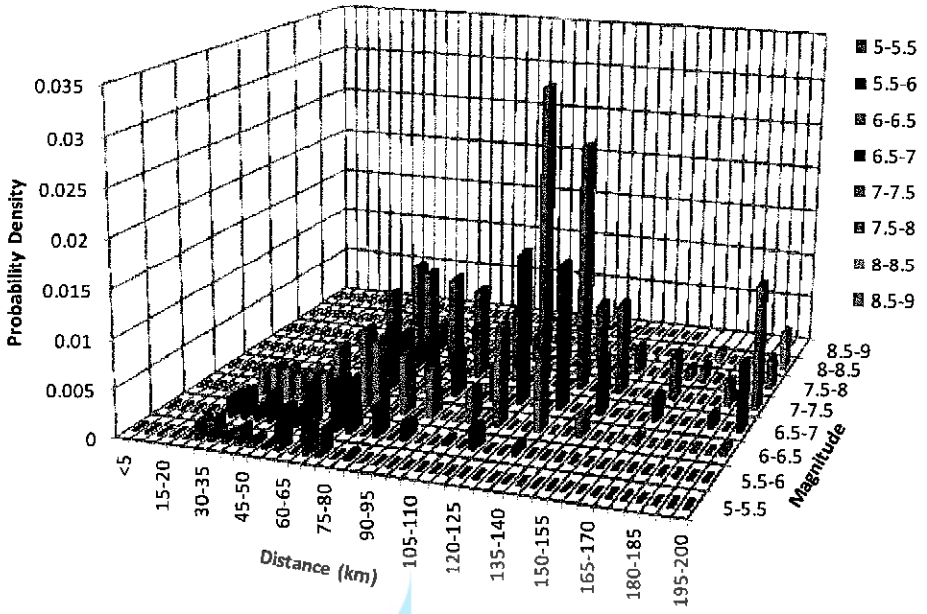
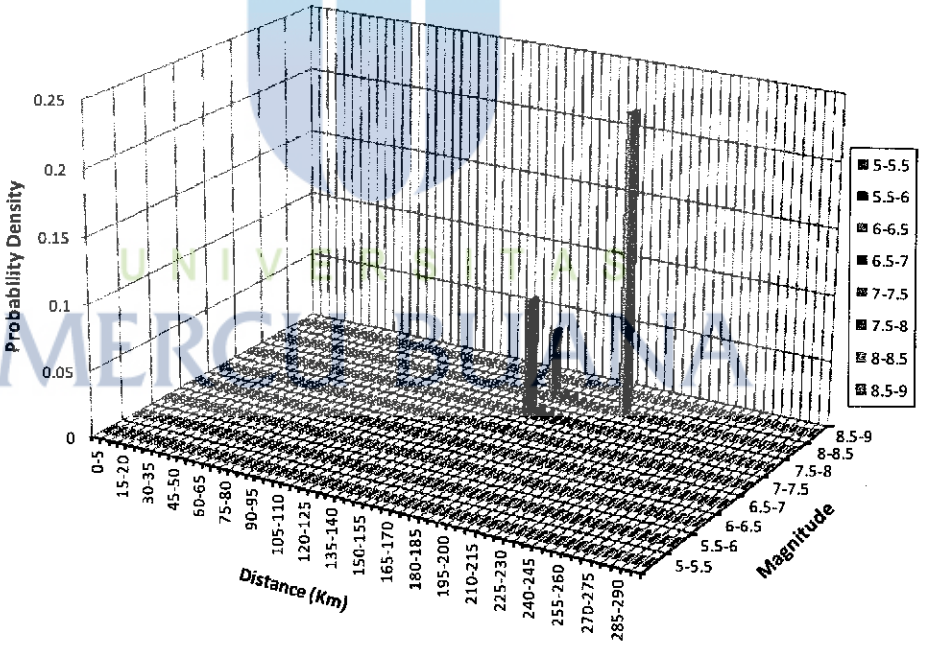


Gambar 3.16. Grafik hasil deagregasi Wilayah Jakarta untuk periode ulang gempa 2500 Tahun.



Gambar 3.17. Grafik hasil deagregasi Jakarta untuk perioda ulang 2500 tahun dari sumber gempa Megathrust pada spektra T = 0.2 sec.

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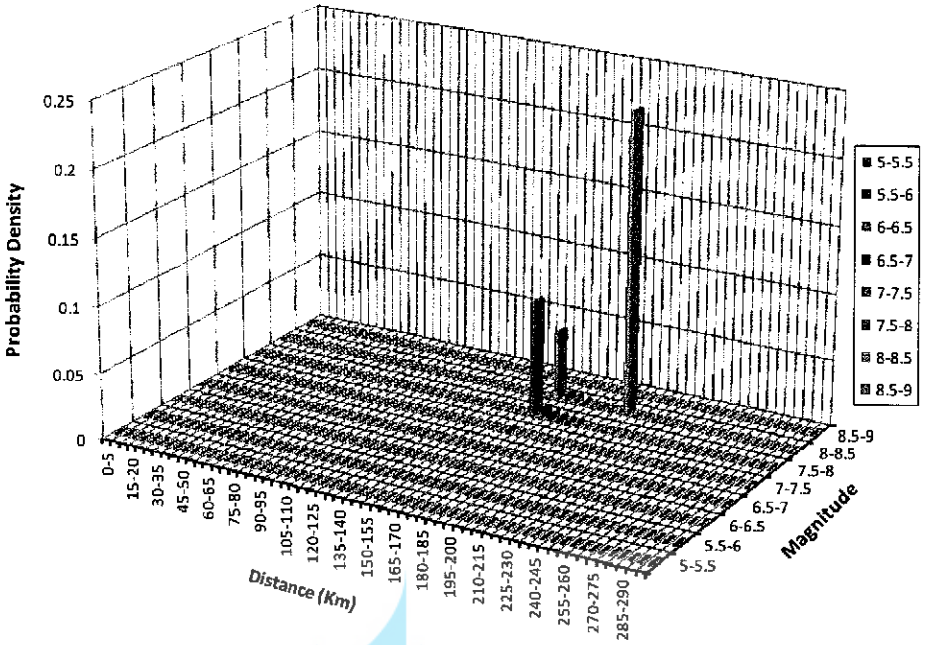
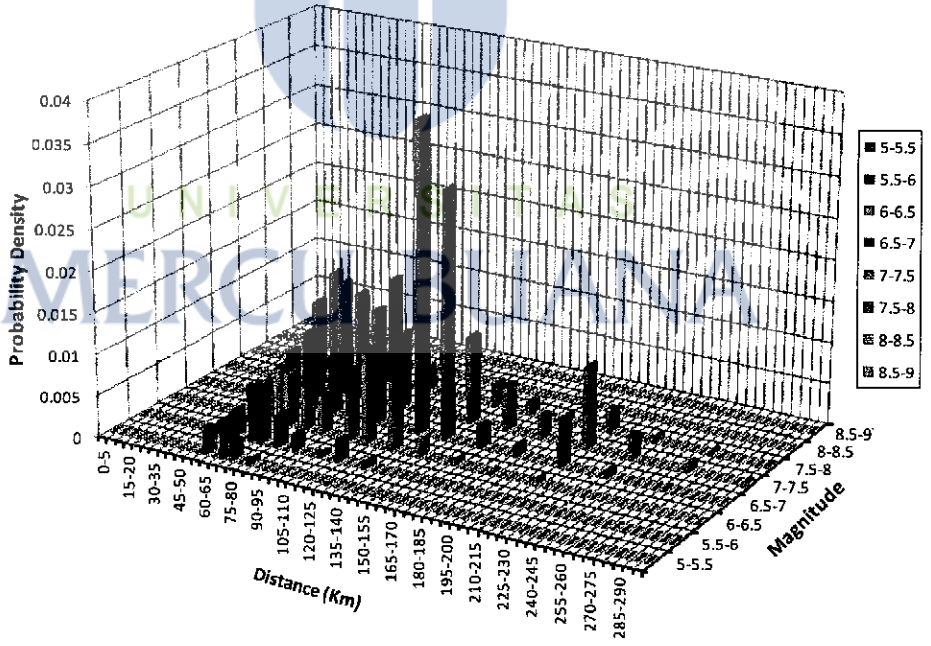


Gambar 3.18. Grafik hasil deagregasi Jakarta untuk perioda ulang 2500 tahun dari sumber gempa shallow crustal pada spektra T = 0.2 sec.



Gambar 3.19. Grafik hasil deagregasi Jakarta untuk perioda ulang 2500 tahun dari sumber gempa Benioff pada spektra T = 0.2 sec.

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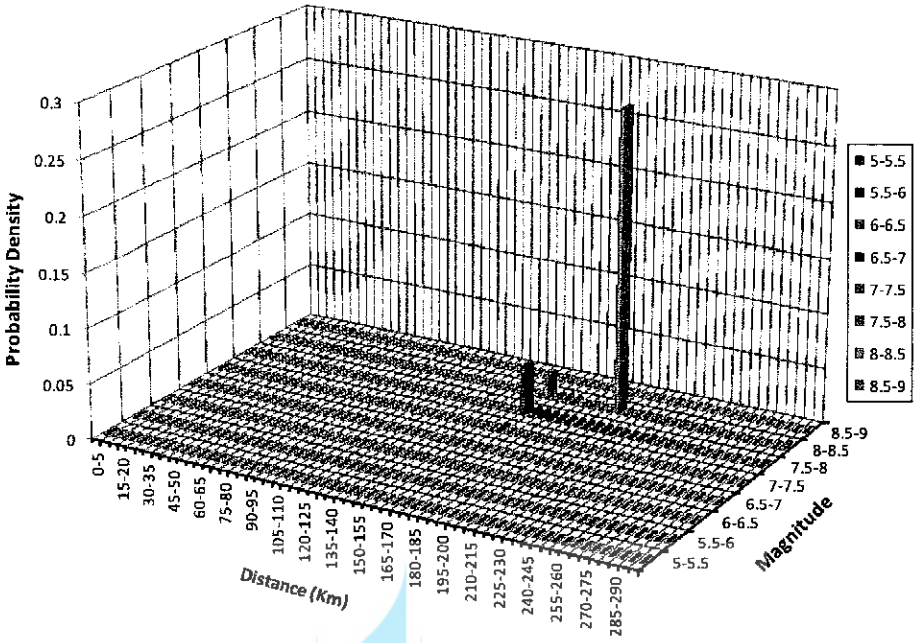
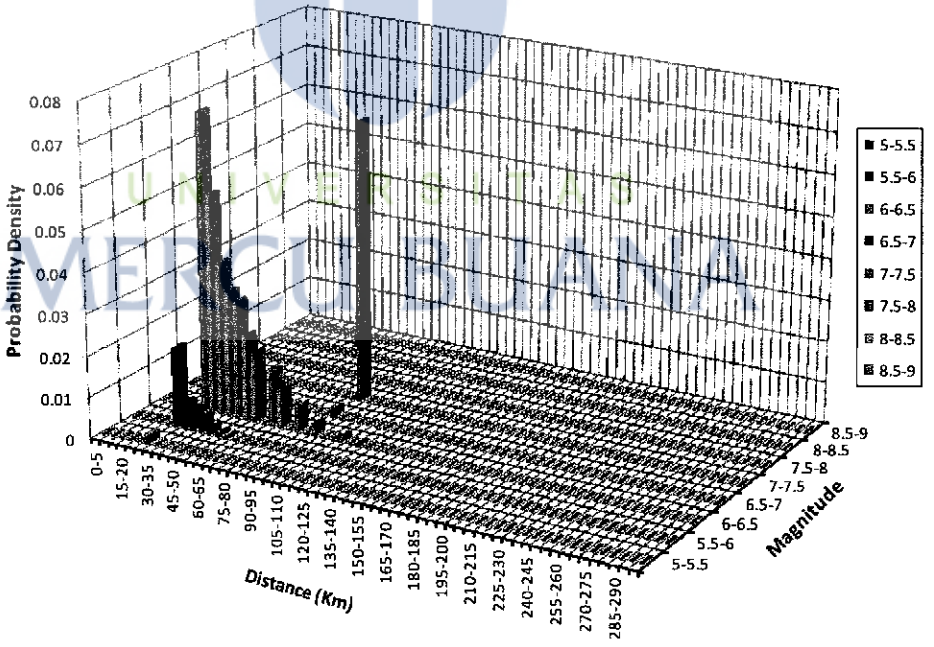


Gambar 3.20. Grafik hasil deagregasi Jakarta untuk perioda ulang 2500 tahun dari sumber gempa Megathrust pada spektra T = 1 sec.



Gambar 3.21. Grafik hasil deagregasi Jakarta untuk perioda ulang 2500 tahun dari sumber gempa shallow crustal pada spektra T = 1 sec.

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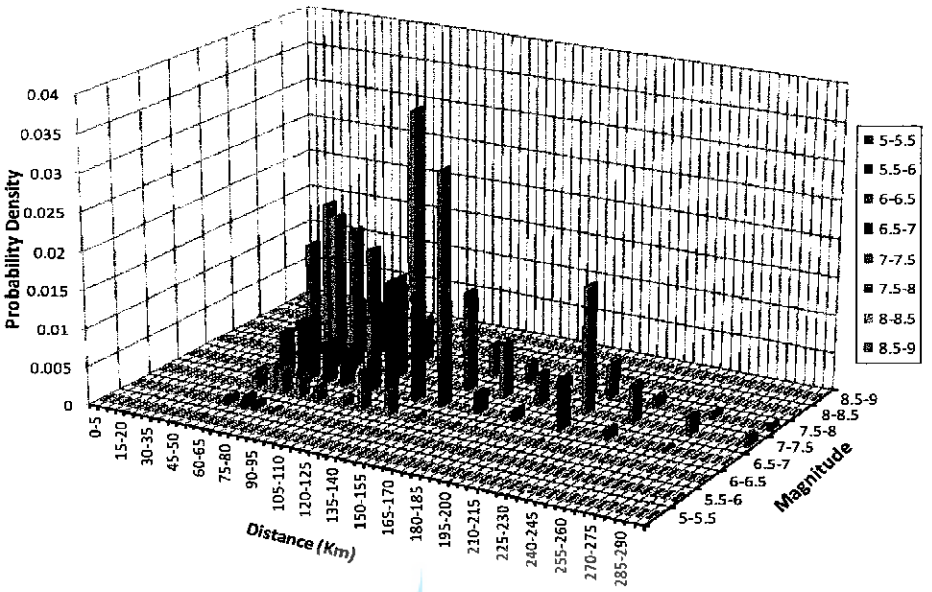

Gambar 3.22. Grafik hasil deagregasi Jakarta untuk perioda ulang 2500 tahun dari sumber gempa Benioff pada spektra T = 1 sec.

Dari hasil deaggregasi diatas, maka didapatkan nilai mean magnitude dan jarak yang dominan untuk berbagai periode dan sumber gempa sehingga bisa dipilih *Recorded ground motion* yang sesuai untuk kondisi tersebut.

Resume hasil deaggregasi dan ground motion yang dipilih bisa dilihat pada **Tabel 3.3** dibawah ini.

Tabel 3.3. Resume hasil deagregasi dan pemilihan *Recorded ground motion*.

NO	DEAG	SOURCE	M	R (km)	Record ground motion (PEER-NGA)	M	R (km)
1	PGA 500 yrs	All sources	6.68	113.04	Kobe, Jepang, STA-TOT, 1995	6.90	119.0
2	PGA 2500 yrs	All sources	6.90	104.60	Nenana Mountain, Alaska, STA-TAPS PUMP, 2002	6.70	104.7
3	SA 0.2-sec 500 yrs	Megathrust	8.05	191.44	Chi-chi, Taiwan, STA-KAU082, 1999	7.62	168.7
4		Shallow crustal	5.94	58.07	Morgan Hill, Santa Crus Mine, STA-HWA011, 1984	6.19	45.5
5		Benioff	6.71	122.79	Loma Prita, Santa Crus, STA-OLEMA-POINT REYES RANGER, 1989	6.90	117.0
6	SA 1-sec 500 yrs	Megathrust	8.05	202.32	Chi-chi, Taiwan, STA-KAU082, 1999	7.62	168.7
7		Shallow crustal	6.47	70.62	Hector Mine, STA-Anza, SS, 1999	7.13	90.0
8		Benioff	6.96	134.01	Loma Prita, Santa Crus, STA-OLEMA-POINT REYES RANGER, 1989	6.90	117.0

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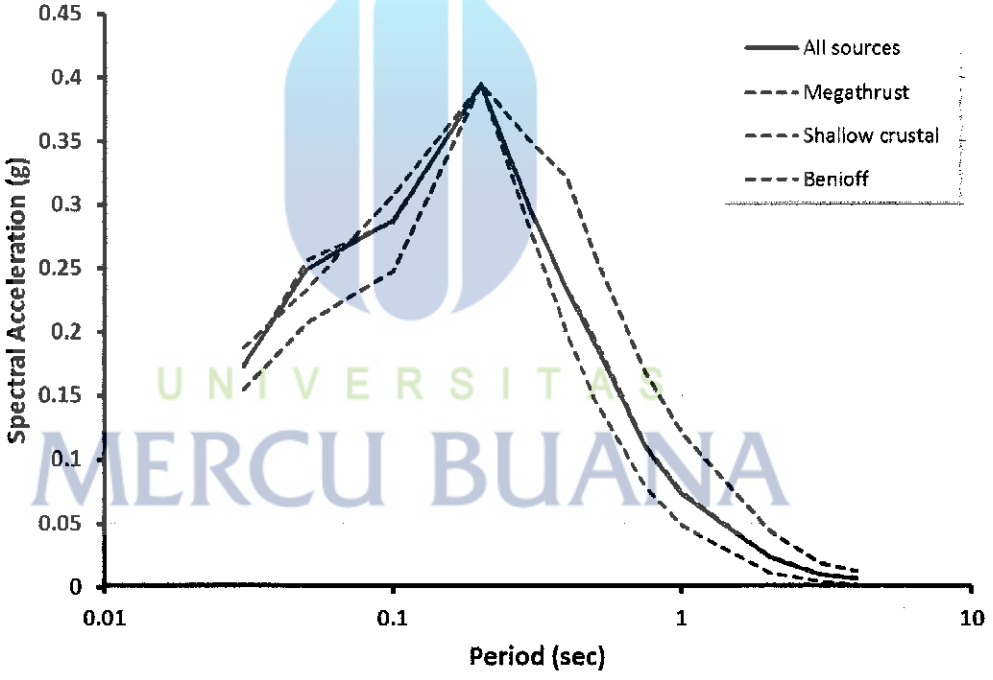
9	SA 0.2-sec 2500 yrs	Megathrust	8.09	189.51	Chi-chi, Taiwan, STA-KAU082, 1999	7.62	168.7
10		Shallow crustal	5.97	47.38	Morgan Hill, Santa Crus Mine, STA-HWA011, 1984	6.19	45.5
11		Benioff	6.91	111.07	Loma Prita, Santa Crus, STA-OLEMA-POINT REYES RANGER, 1989	6.90	117.0
12	SA 1-sec 2500 yrs	Megathrust	8.11	199.80	Chi-chi, Taiwan, STA-KAU082, 1999	7.62	168.7
13		Shallow crustal	6.41	49.56	Morgan Hill, Santa Crus Mine, STA-HWA011, 1984	6.19	45.5
14		Benioff	7.16	117.38	Loma Prita, Santa Crus, STA-OLEMA-POINT REYES RANGER, 1989	6.90	117.0

Spektrum respons untuk peristiwa diatas diskalakan ke periode getar T = 0.2 dan T = 1.0 detik dengan menggunakan *Conditional Means Spectrum* (CMS) seperti yang diusulkan oleh Baker, dkk (2011). Spektrum terskala untuk periode ulang 500 dan 2500 tahun ditunjukkan pada **Gambar 3.23** s/d **Gambar 3.26.**



Gambar 3.23. Spectrum terskala ke T = 0.2 detik daerah Jakarta untuk periode ulang 500 tahun.

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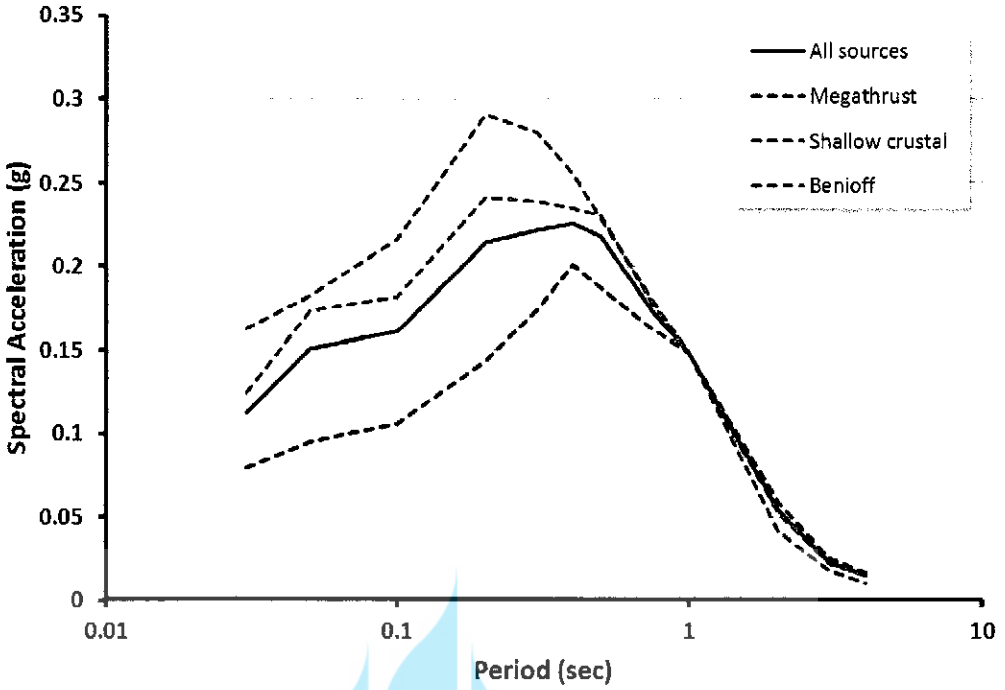
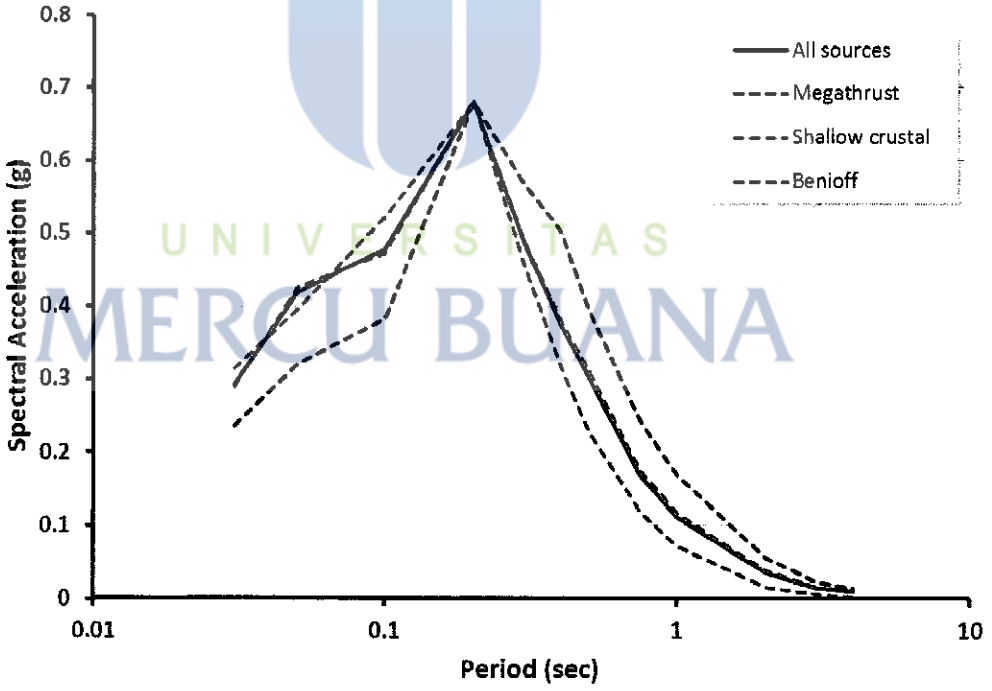


Gambar 3.24. Spectrum terskala ke T = 1 detik daerah Jakarta untuk periode ulang 500 tahun.



Gambar 3.25. Spectrum terskala ke T = 0.2 detik daerah Jakarta untuk periode ulang 2500 tahun

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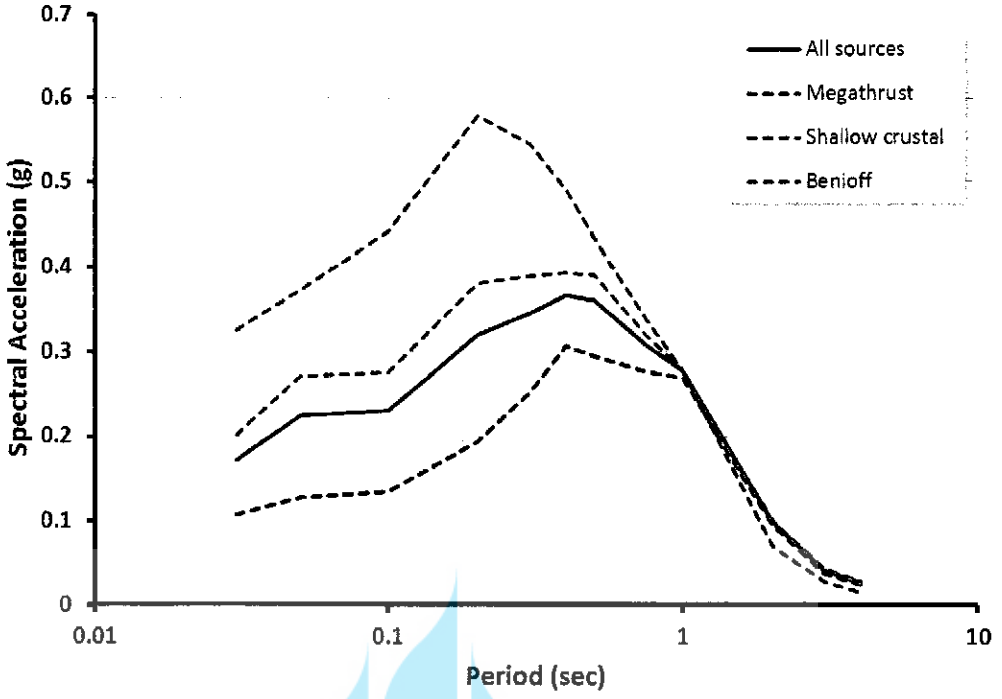

Gambar 3.26. Spectrum terskala ke T = 1.0 detik daerah Jakarta untuk periode ulang 2500 tahun

Recorded ground motion yang dipilih tersebut kemudian dimodifikasi sehingga spektra dari gelombang gempa tersebut mendekati dengan target spektra. Meroda ini dinamakan *spectrum matching analysis* (SMA). Dalam studi ini SMA dilakukan dengan menggunakan bantuan perangkat lunak (*software*) EZ-FRISK™ (Risk Engineering, 2005). Software ini sudah mengadopsi metoda time-dependent spectral matching yang dibuat oleh Norm Abrahamson (Abrahamson, 1998). Metoda ini merupakan hasil modifikasi dari riset sebelumnya yang telah dilakukan oleh Lilhanand dan Tseng (1987, 1988). Proses SMA bisa dilihat pada **Gambar 3.27**.

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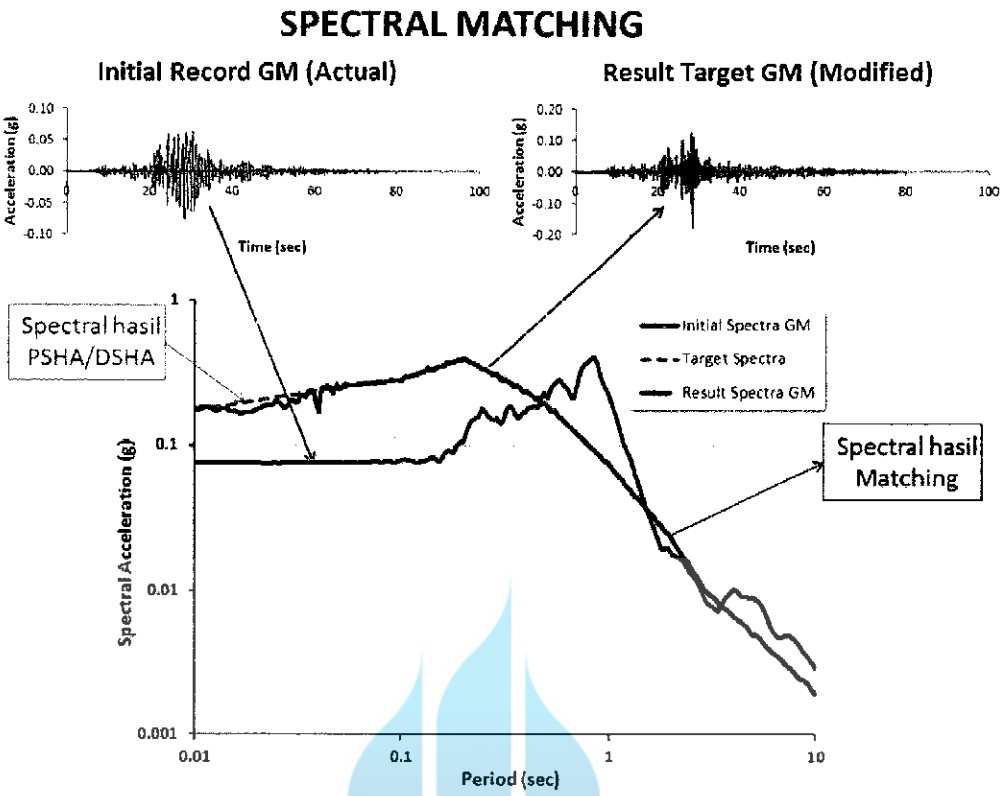

Gambar 3.27. Proses spectral matching dari data *initial record GM* berdasarkan hasil deagregasi, modifikasi spectra dari GM tersebut mendekati spectra target hasil PSHA yang sesuai dan khas untuk setiap site yang ditinjau.

Ground motion yang telah diskalakan dan digunakan sebagai input motion pada analisis perambatan gelombang geser dari batuan dasar ke permukaan tanah ditunjukkan pada **Gambar 3.28** s/d **Gambar 3.41** yang mewakili semua model sumber gempa pada periode ulang 500 dan 2500 tahun.

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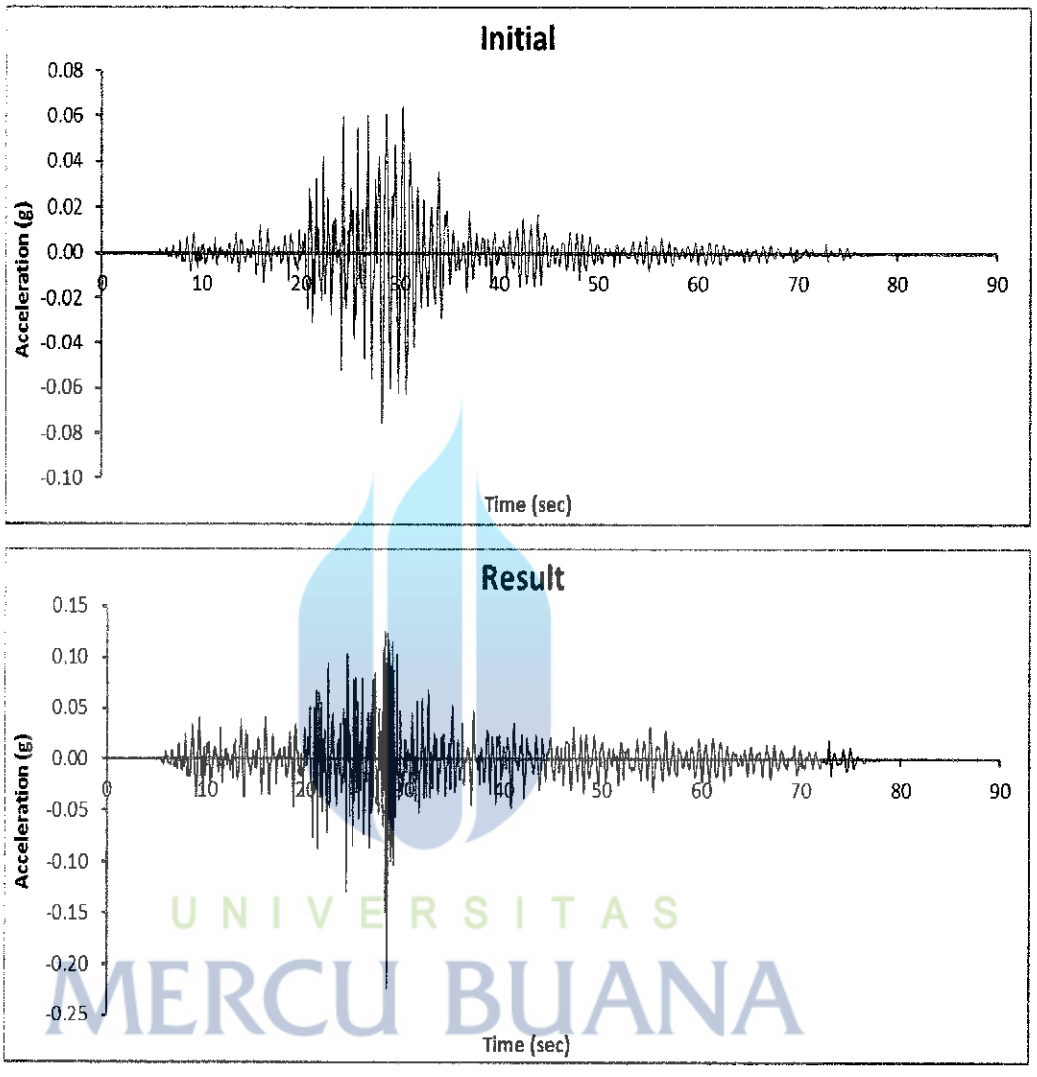

Gambar 3.28. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili semua sumber gempa pada periode ulang 500 tahun.

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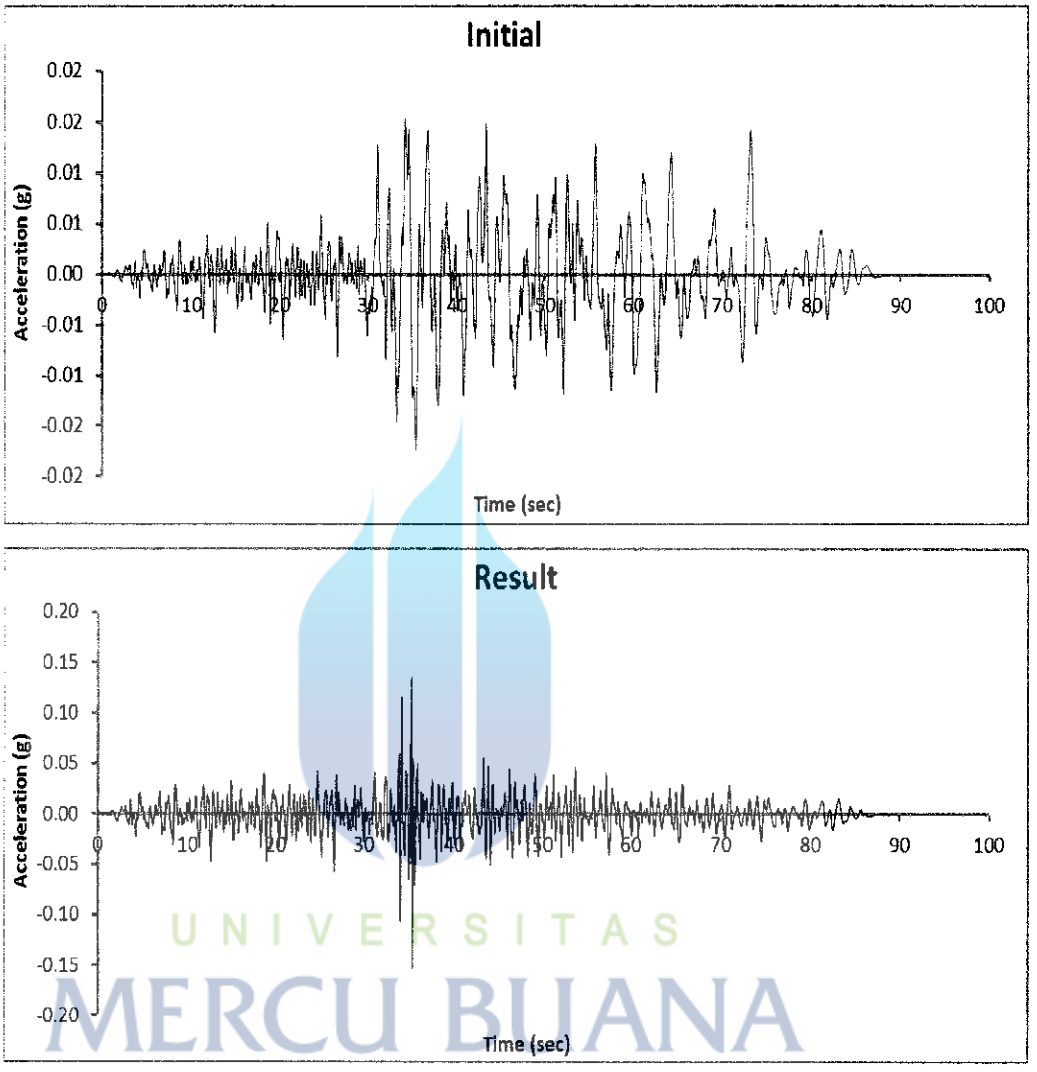

Gambar 3.29. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili sumber gempa *Megathrust* pada periode ulang 500 tahun (T = 0.2 detik).

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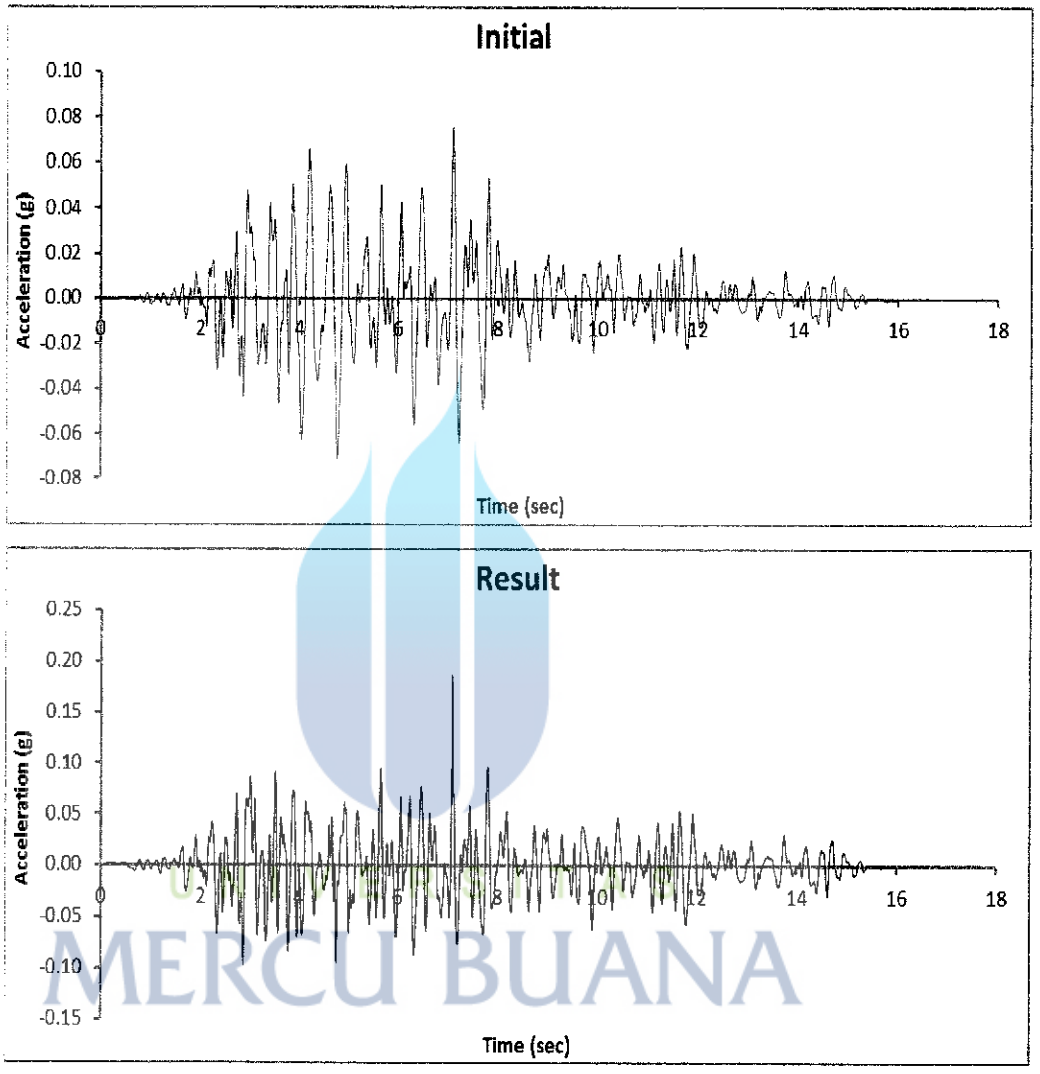

Gambar 3.30. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili sumber gempa *Shallow crustal* pada periode ulang 500 tahun (T = 0.2 detik).

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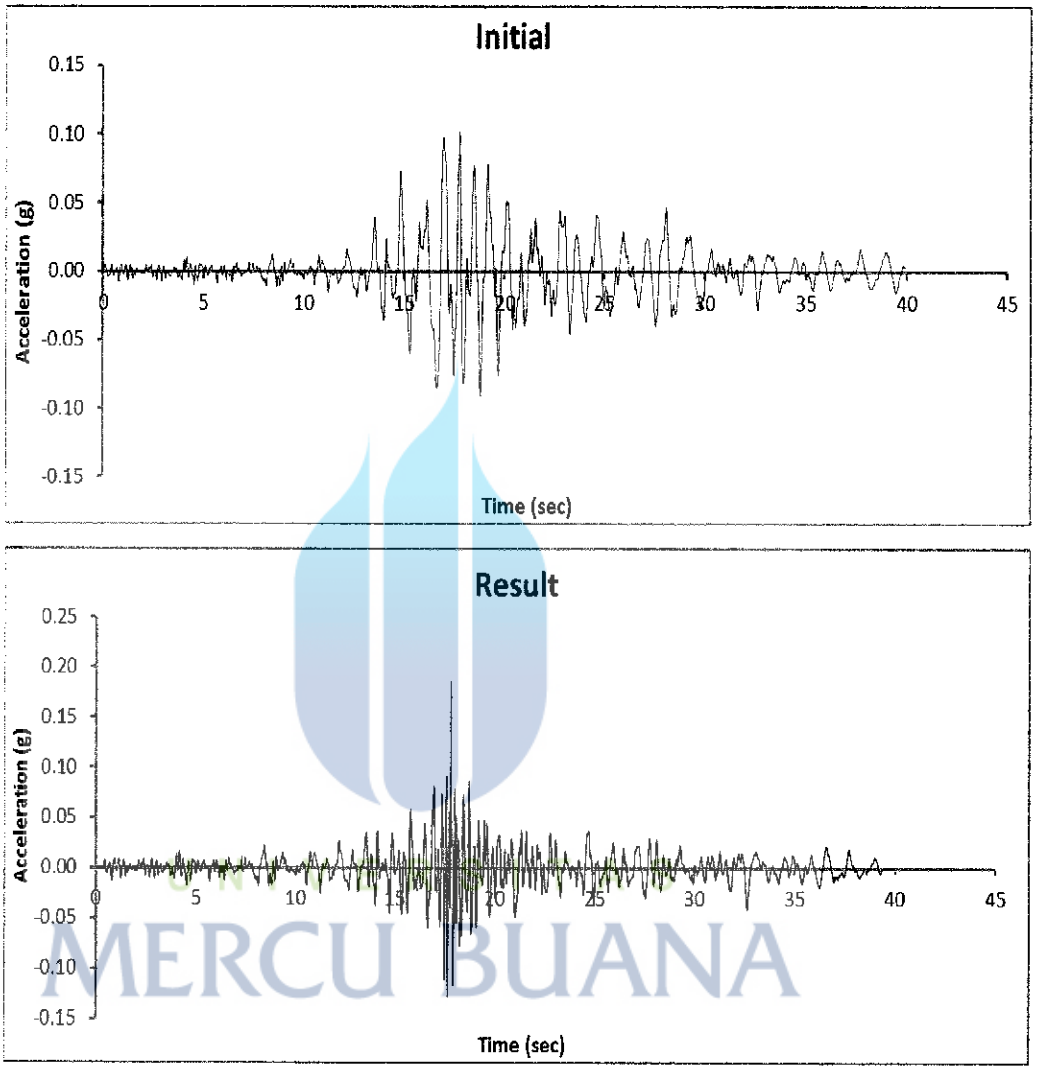

Gambar 3.31. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili sumber gempa *Benioff* pada periode ulang 500 tahun (T = 0.2 detik).

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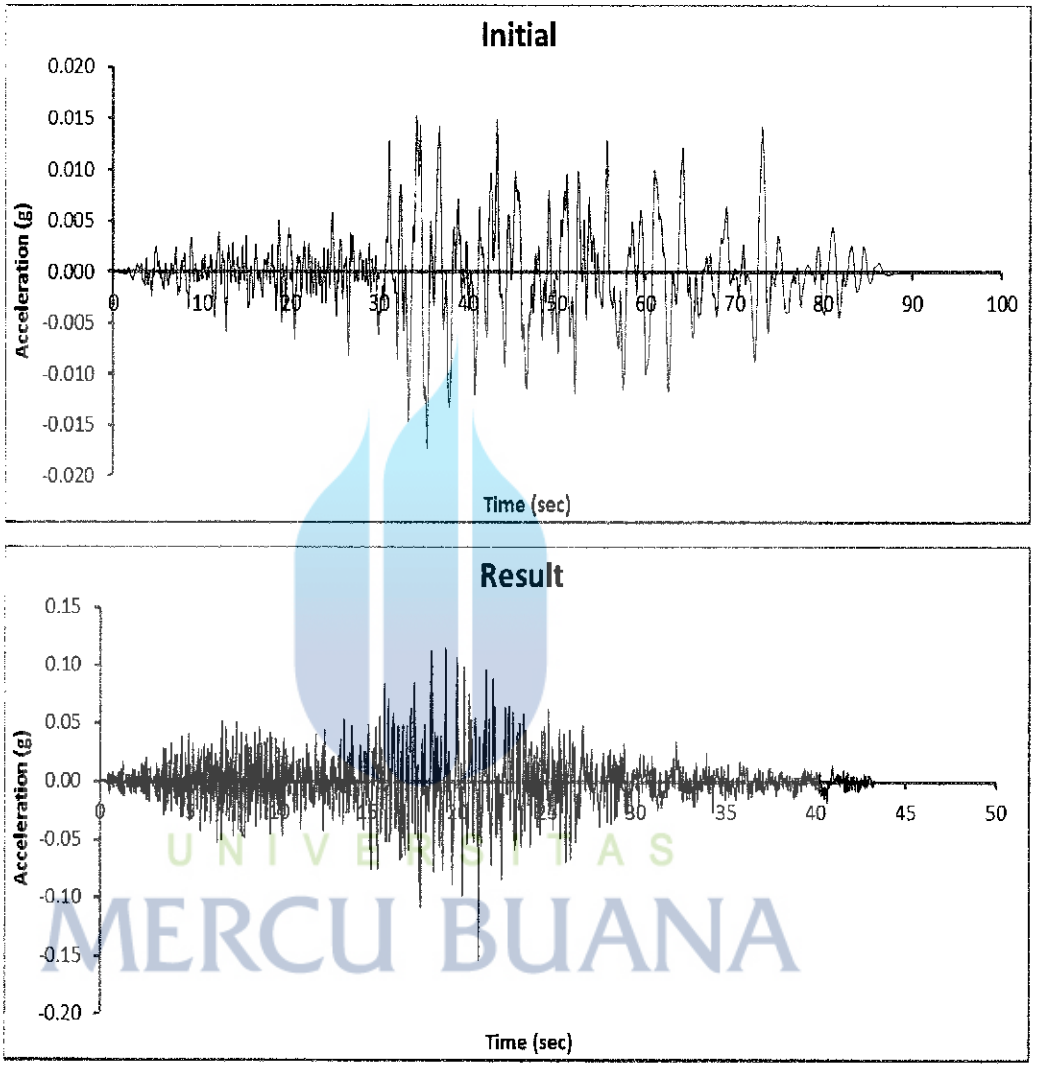

Gambar 3.32. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili sumber gempa *Megathrust* pada periode ulang 500 tahun (T = 1.0 detik).

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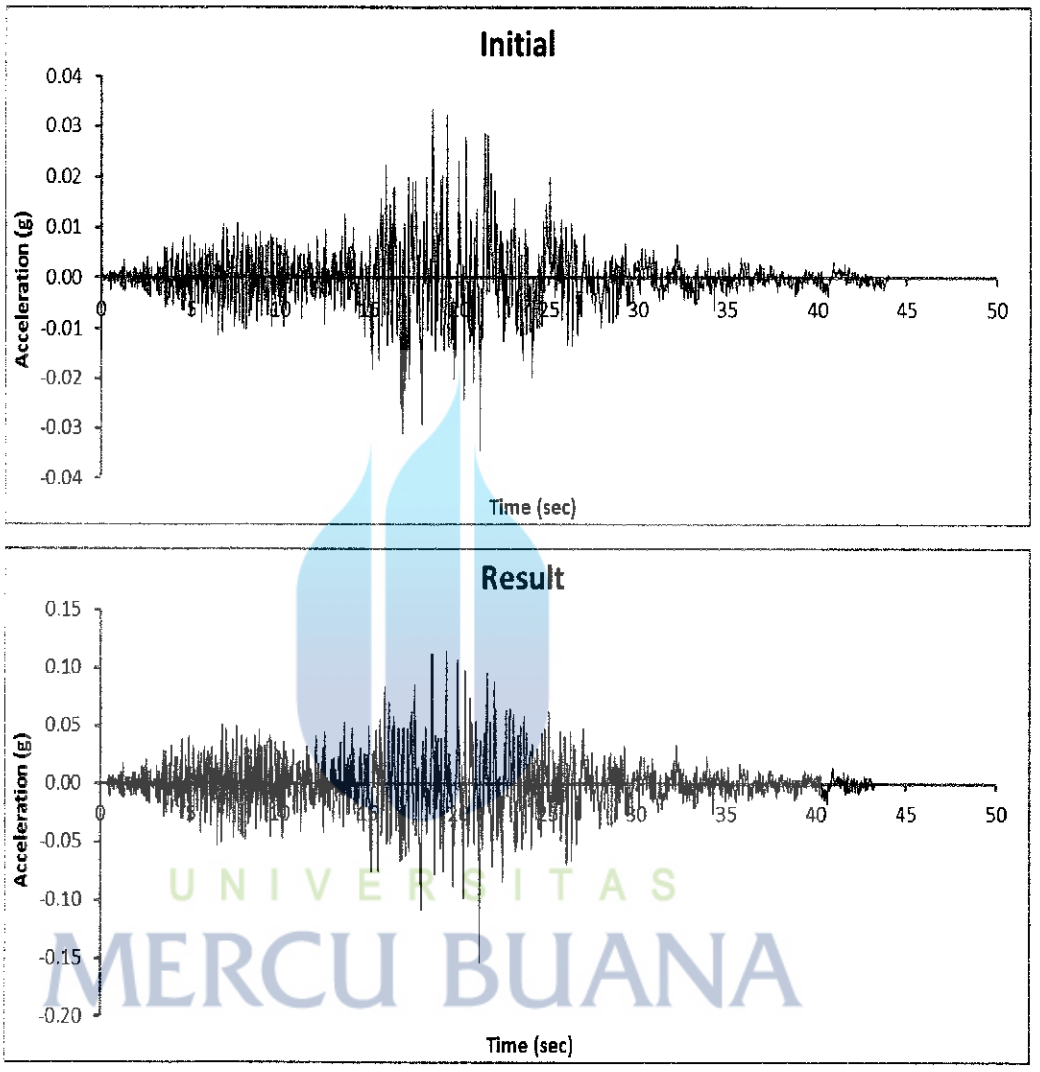

Gambar 3.33. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili sumber gempa *Shallow crustal* pada periode ulang 500 tahun (T = 1.0 detik).

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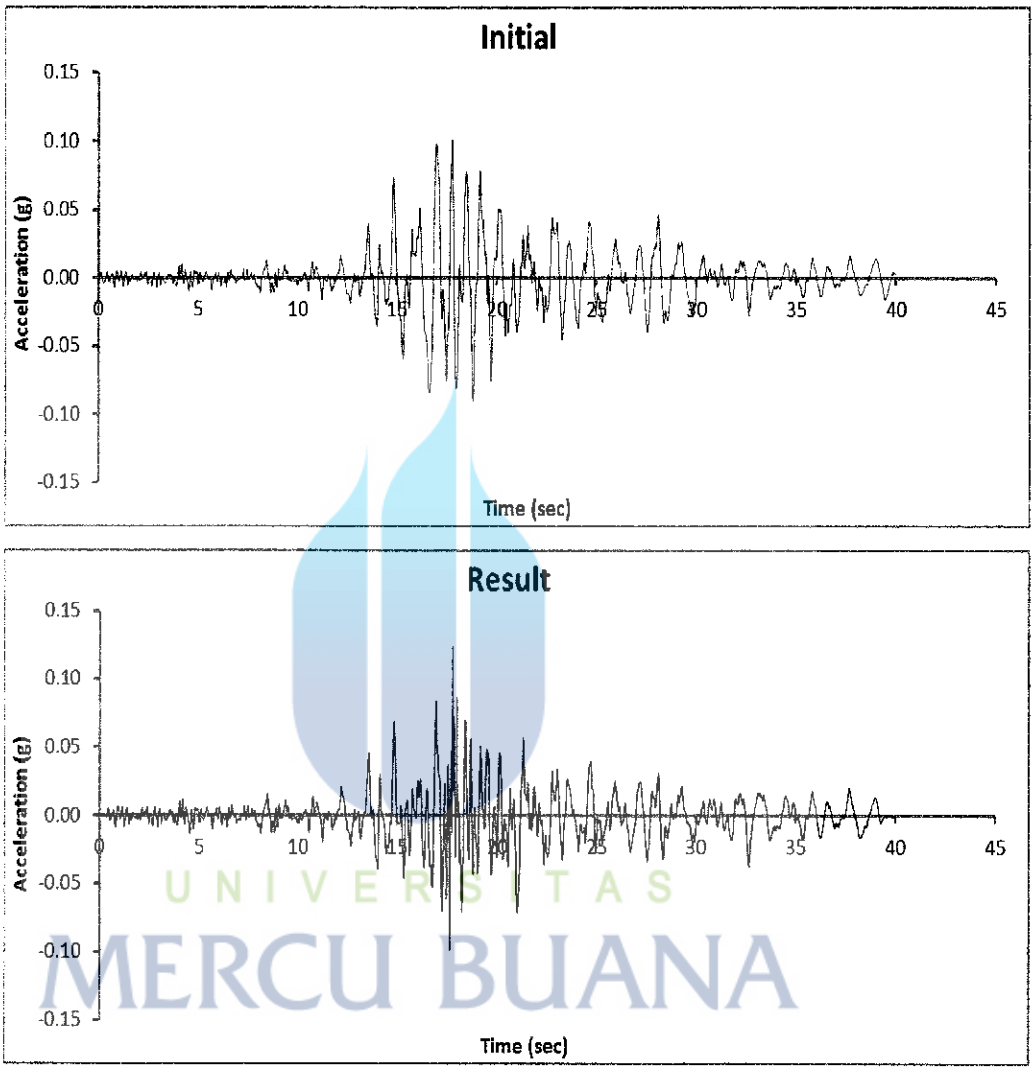

Gambar 3.34. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili sumber gempa *Benioff* pada periode ulang 500 tahun (T = 1.0 detik).

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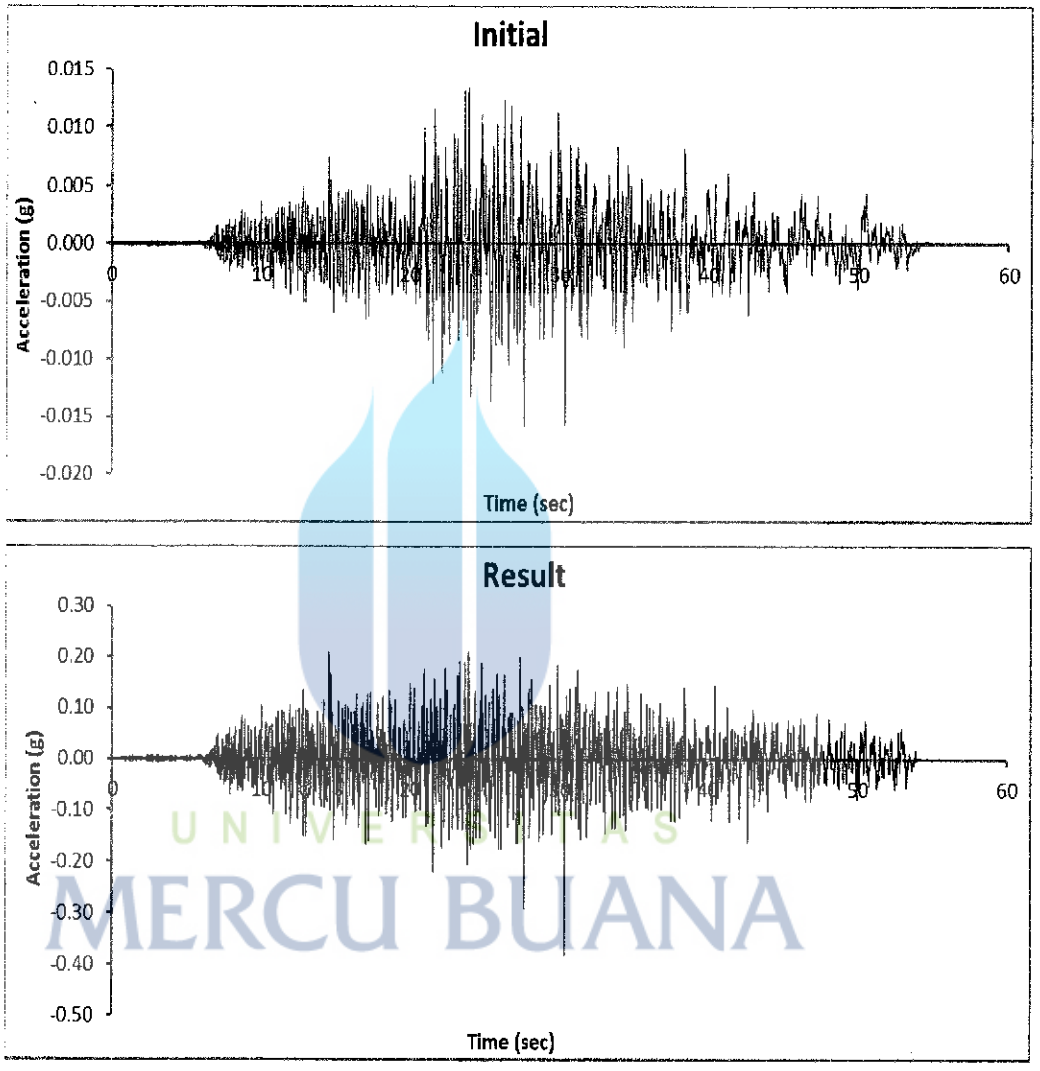

Gambar 3.35. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili semua sumber gempa pada periode ulang 2500 tahun.

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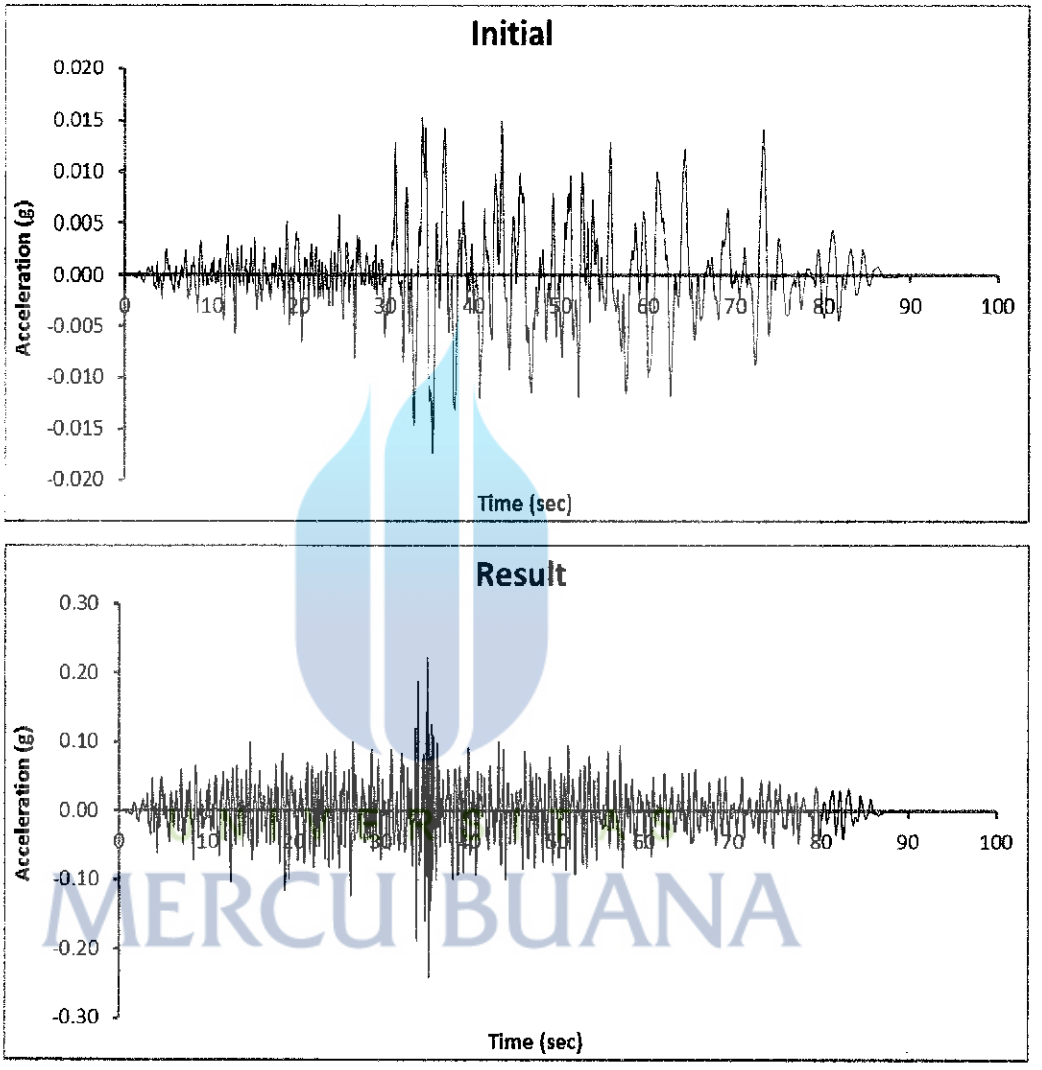

Gambar 3.36. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili sumber gempa *Megathrust* pada periode ulang 2500 tahun (T = 0.2 detik).

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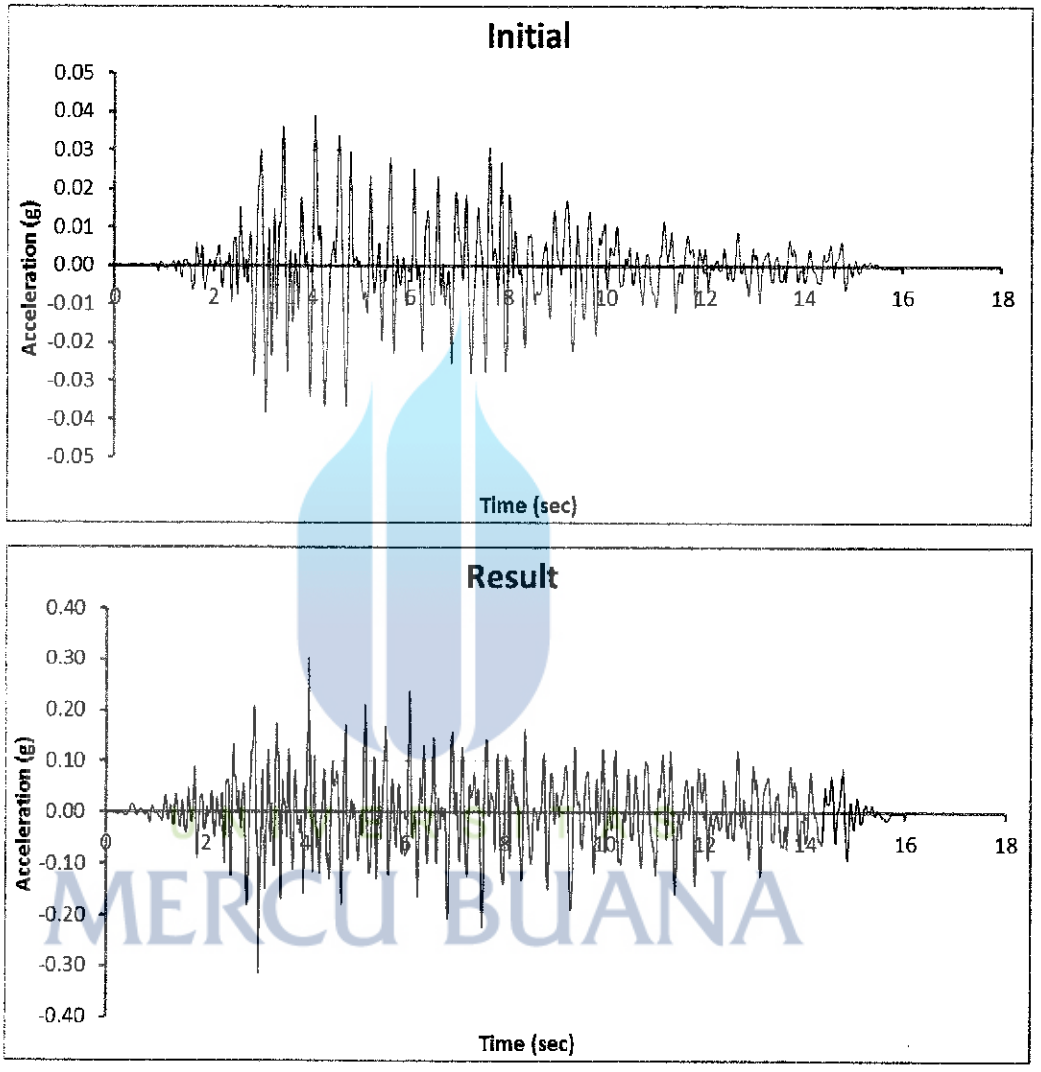

Gambar 3.37. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili sumber gempa *Shallow Crustal* pada periode ulang 2500 tahun (T = 0.2 detik).

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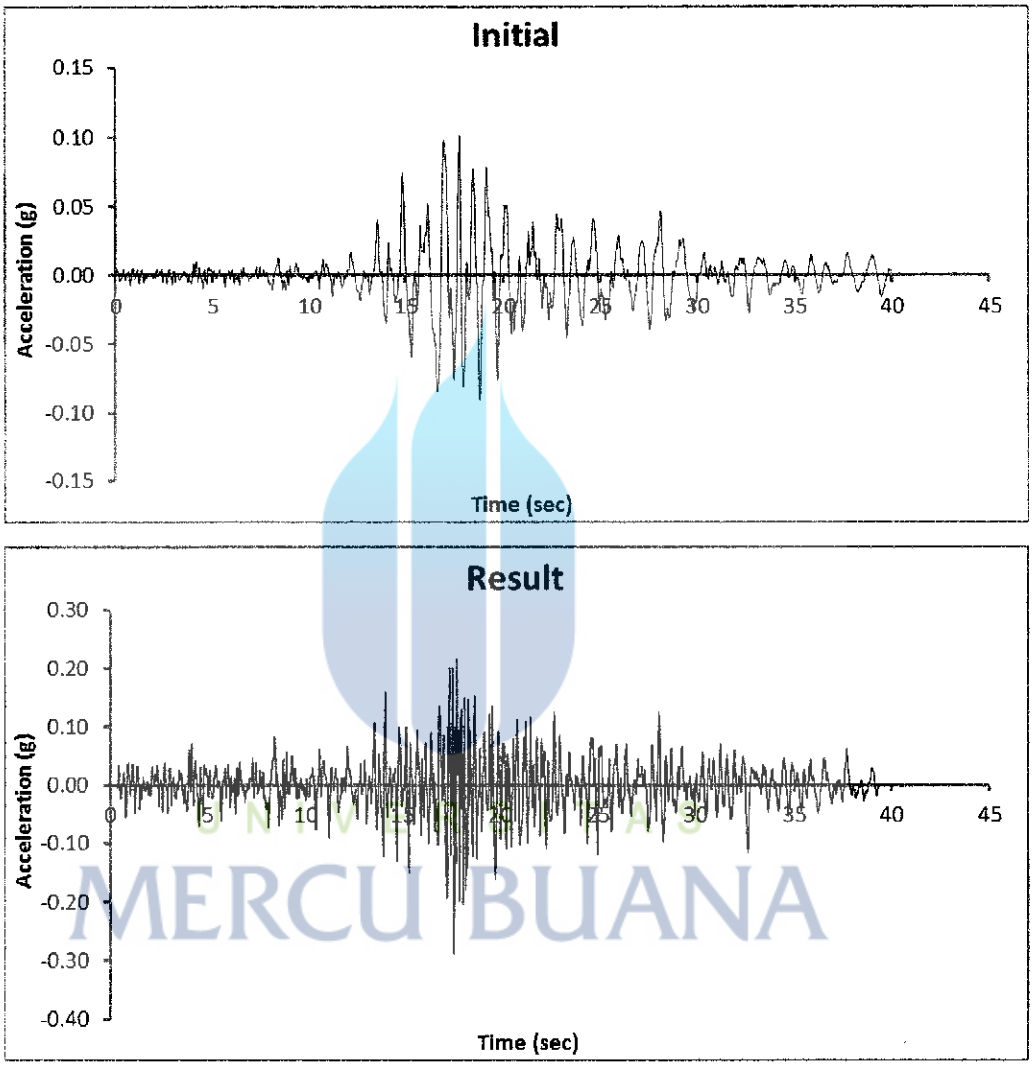

Gambar 3.38. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili sumber gempa *Benioff* pada periode ulang 2500 tahun (T = 0.2 detik).

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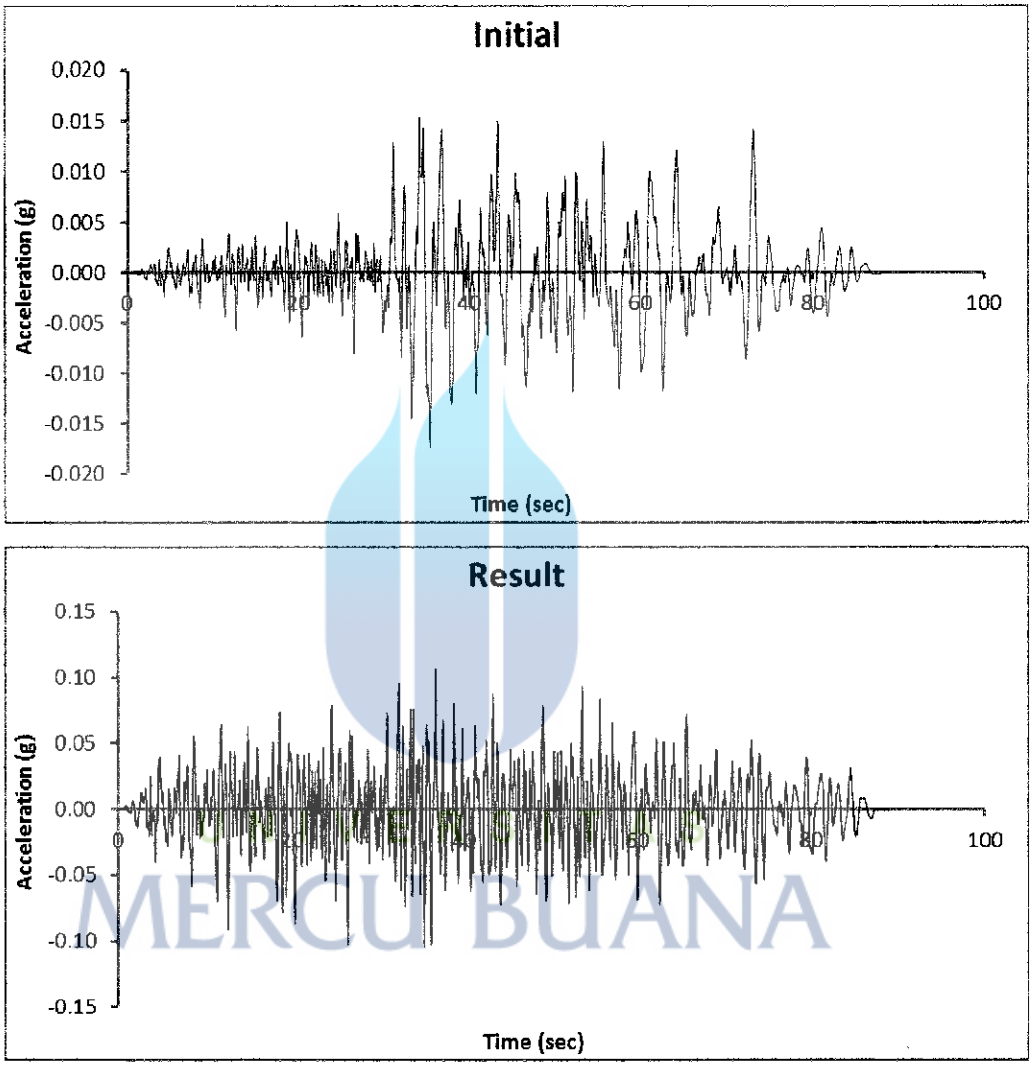

Gambar 3.39. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili sumber gempa *Megathrust* pada periode ulang 2500 tahun (T = detik).

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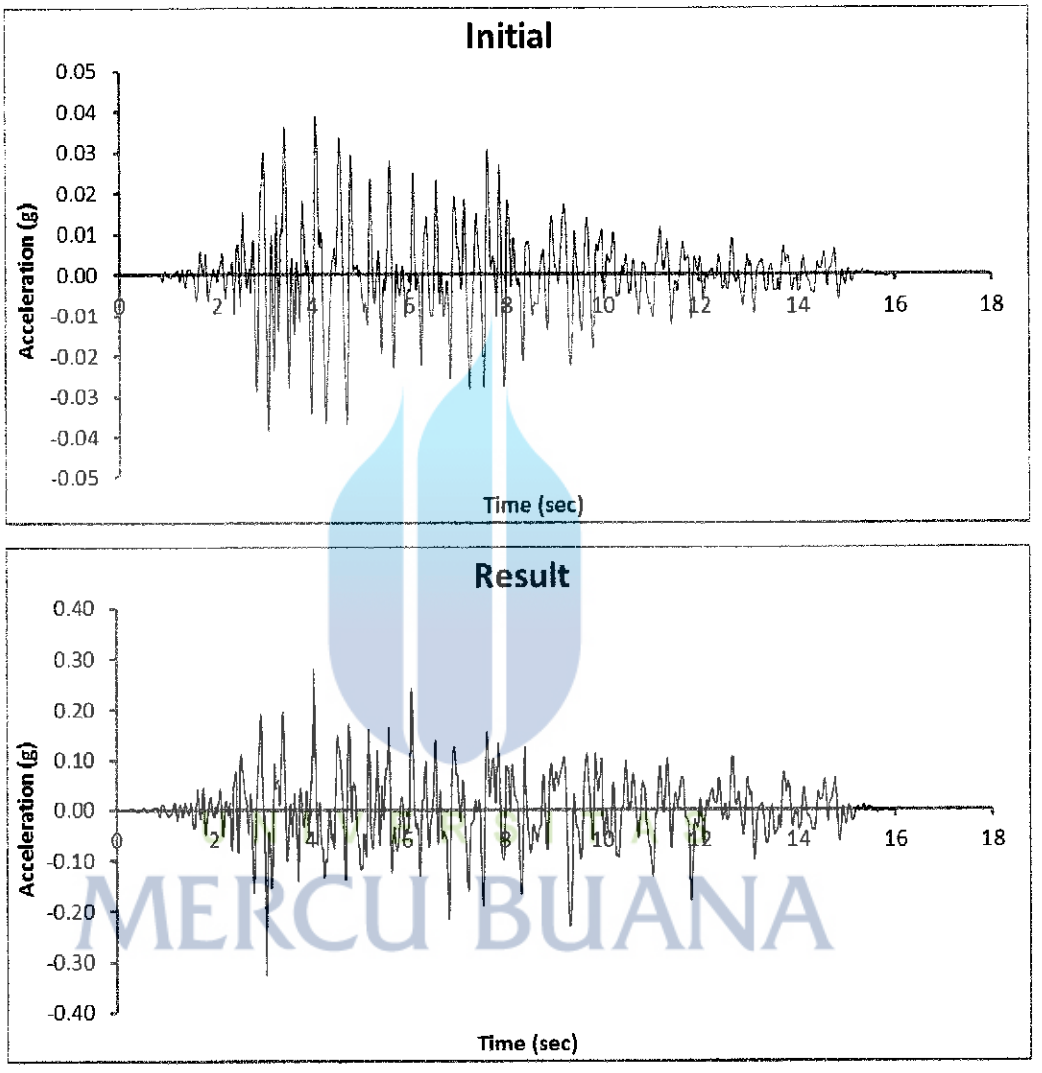

Gambar 3.40. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili sumber gempa *Shallow Crustal* pada periode ulang 2500 tahun (T = 1 detik).

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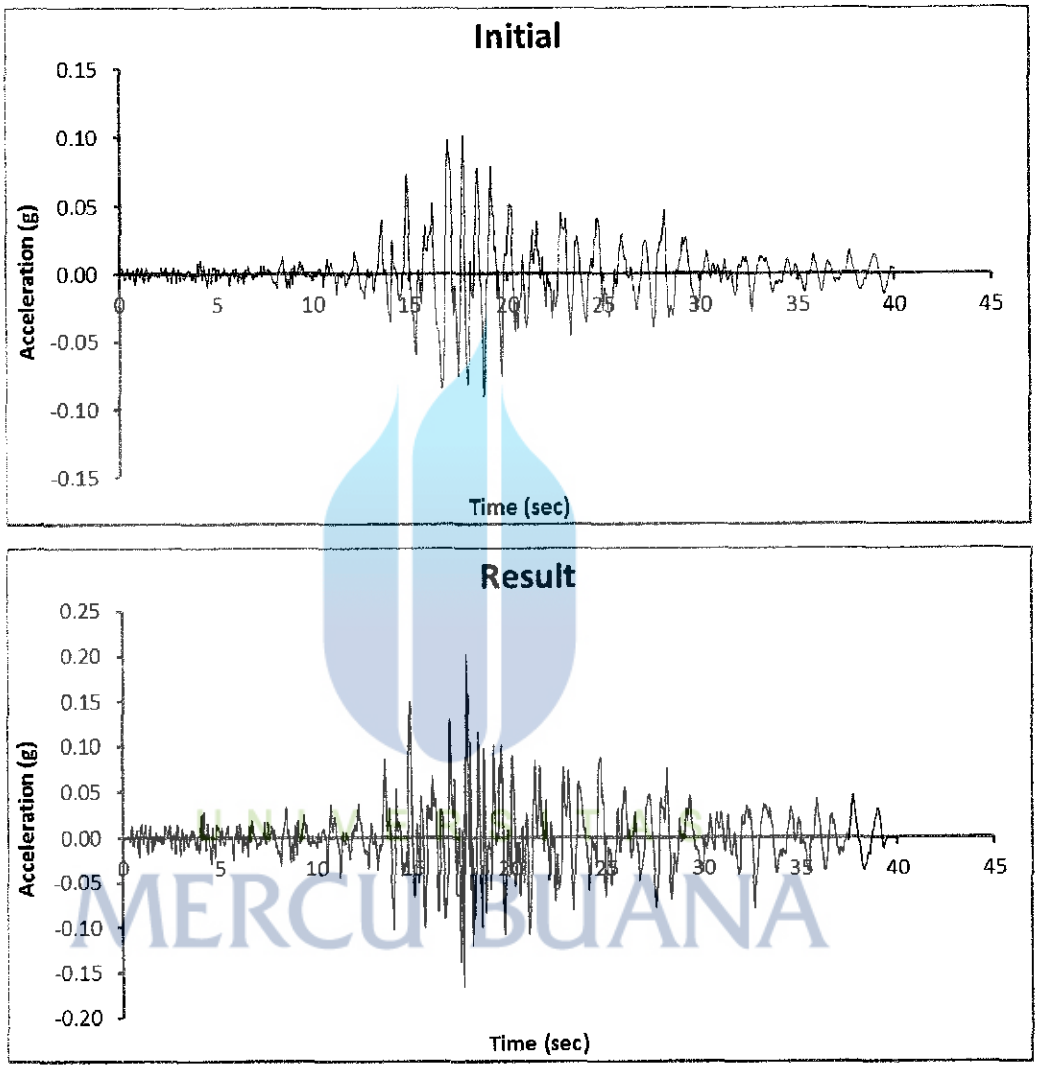

Gambar 3.41. Time History sebelum dan setelah diskalakan di Batuan dasar mewakili sumber gempa *Benioff* pada periode ulang 2500 tahun (T = 1 detik).

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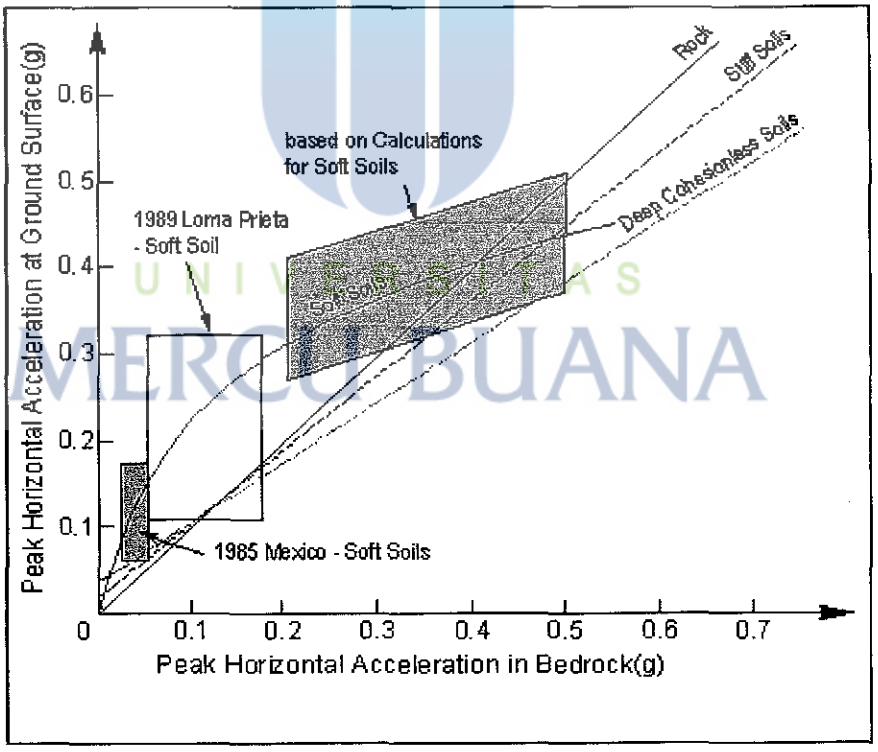
BAB 4
PENGARUH KONDISI TANAH LOKAL

4.1. PENDAHULUAN

Analisis pengaruh kondisi tanah lokal dilakukan untuk mengevaluasi respon kondisi tanah lokal terhadap motion di batuan dasar yang berada di bawahnya. Hal ini sangat mempengaruhi karakteristik motion di permukaan tanah yaitu, amplitude percepatan dan bentuk respon spektra. Perbandingan antara atenuasi percepatan maksimum di suatu lokasi dengan kondisi tanah yang berbeda menunjukkan kecenderungan yang jelas dalam perilaku amplifikasi (Seed et al. 1976). **Gambar 4.1** menunjukkan bahwa percepatan maksimum di permukaan tanah lebih besar daripada percepatan maksimum di batuan pada percepatan rendah dan sebaliknya pada percepatan tinggi. Untuk percepatan yang tinggi, kekakuan yang rendah dan nonlinieritas tanah lunak seringkali menyebabkan percepatan maksimum tidak bertambah sebesar yang terjadi di batuan dasar.



Gambar 4.1. Perkiraan hubungan antara peak acceleration di batuan dan beberapa jenis tanah lainnya (Idriss, 1990)

Sebagai tambahan, Dorbry dkk (2000) telah mempelajari pengaruh tanah lokal berdasarkan data Gempa Loma Prieta. Risetnya menghasilkan nilai faktor

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amplifikasi berdasarkan pengaruh kondisi tanah lokal. Klasifikasi tanah yang digunakan pada **Tabel 4.1** konsisten dengan Uniform Building Code (UBC) 1997. Tipe tanah SC-1a, SC-1b, SC-II, SC-III dan SC-IV adalah masing-masing dapat disamakan dengan tanah tipe S_A, S_B, S_C, S_D and S_E (**Tabel 4.2**). **Tabel 4.1** merangkum faktor amplifikasi untuk tipe tanah sebagai fungsi dari kecepatan gelombang geser dengan *ground motion* tertentu pada kondisi tanah batuan (tipe S_B). Patut dicatat bahwa faktor amplifikasi untuk suatu tipe tanah sangat tergantung dari magnitude *ground motion.*

Tabel 4.1. Faktor amplifikasi untuk periode rendah dengan kondisi tanah SC-1a Firm to Hard Rocks (Dorbry dkk, 2000)

	Site Classes – shear wave velocity (m/s)				
Ground Motion (g)	SC-1a	SC-1b	SC-II	SC-III	SC-IV
	1620	1050	540	290	150
0.1	0.9	1.0	1.3	1.6	2.0
0.2	0.9	1.0	1.2	1.4	1.6
0.3	1.0	1.0	1.1	1.1	1.2
0.4	1.0	1.0	1.0	0.9	0.9
Average	1.0	1.0	1.2	1.3	1.4

Pada studi kali ini, analisis akan dilakukan dengan menggunakan teori perambatan gelombang geser satu dimensi yang menghasilkan parameter ground motion, antara lain *surface spectral acceleration* dan *time histories.* Analisis dilakukan dengan program komputer Nonlinier Earthquake Response Analysis (NERA) yang dikembangkan oleh Bardet & Tobita (2001).

Tabel 4.2. Klasifikasi Tanah Berdasarkan UBC - 1997

Site Class	Description	$\overline{v_s}$ (m/s)	$\overline{N} - SPT$	$\overline{Su}(kPa)$
S_A	Hard Rock	>1500	-	-
S_B	Rock	$760 < \overline{v_s} \leq 1500$	-	-
S_C	Hard Soil and Soft rock	$360 < \overline{v_s} \leq 760$	>50	>200
S_D	Medium Soil	$180 < \overline{v_s} \leq 360$	$15 < \overline{N} \leq 50$	$100 < \overline{S_u} \leq 200$
S_E	Soft Soil	≤ 180	<15	<100

Dalam studi ini pengaruh basin tidak diperhitungkan karena analisis yang dilakukan hanya dalam arah satu dimensi (1-D) saja. Namun menurut King and

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Tucker (1984), 1-D analysis dapat digunakan memprediksi respons rata-rata dari sedimen yang berada di tengah lembah. Bard and Gariel (1986) dengan menggunakan pendekatan analitis untuk melihat pengaruh efek dua dimensi akibat basin menyimpulkan bahwa analisis 1-D dan 2-D relatif menghasilkan pola dan besaran yang sama (Kramer, 1996). Sehingga dalam studi ini diperkirakan hasil yang diperoleh dapat mendekati hasil analisis 2-D.

4.2. METODE ANALISIS PERAMBATAN GELOMBANG

Teori yang dipergunakan dalam analisis perambatan gelombang geser 1-D ini memperhitungkan respons yang berhubungan dengan perambatan vertikal dari gelombang geser melewati suatu sistem viskoelastik linear seperti terlihat pada **Gambar 4.2**.

Sistem tersebut terdiri dari N lapisan horizontal, yang memanjang tidak terhingga dalam arah horisontal dan lapisan dasar dianggap sebagai sebuah sistem *half space*. Masing-masing lapisan adalah homogen dan isotropik dengan parameter ketebalan, h, *mass density*, ρ, *shear modulus*, G atau kecepatan gelombang geser, V_S, dan faktor damping, β. Perambatan gelombang vertikal melalui sistem ini seperti terlihat seperti pada Gambar 4.2 hanya menyebabkan perpindahan dalam arah horizontal,

$$u = u(x,t) \tag{4.1}$$

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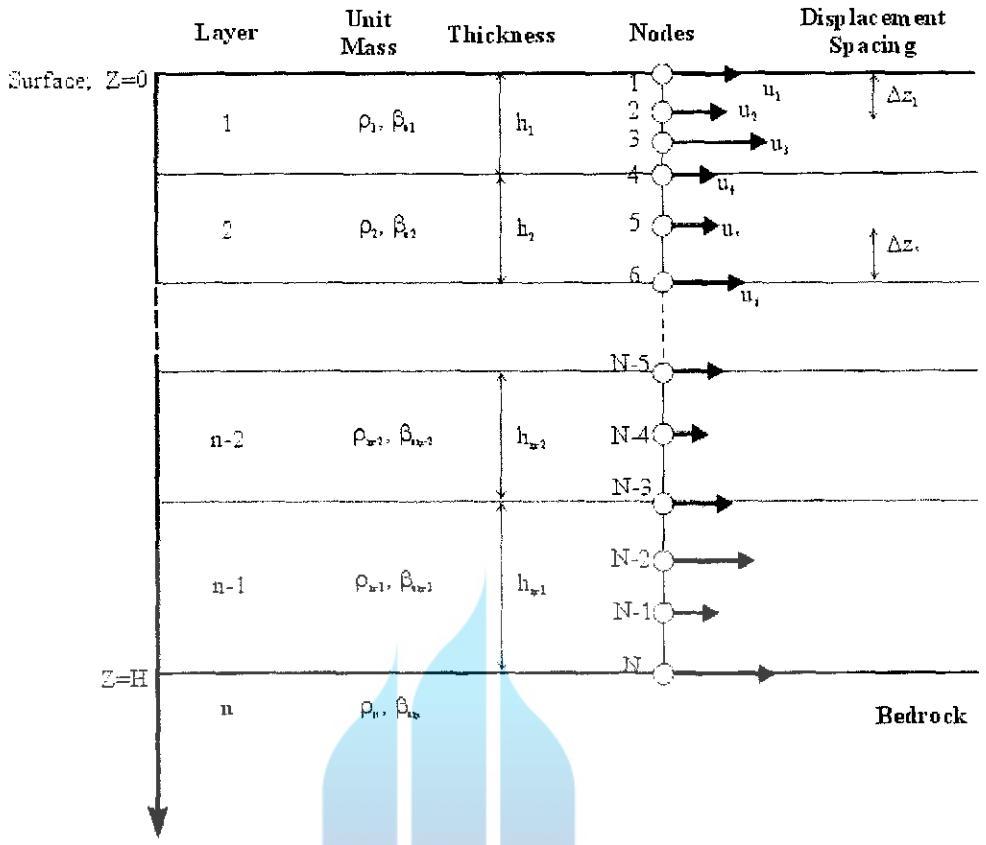

Gambar 4.2. Sistem satu dimensi

yang harus memenuhi persamaan gelombang :

$$\rho\frac{\partial^2 u}{\partial t^2}+\eta\frac{\partial u}{\partial t}=\frac{\partial \tau}{\partial z} \qquad (4.2)$$

ρ: mass density

η : koefisien damping tanah

Analisis perambatan gelombang dapat dilakukan dengan dua cara, yaitu menggunakan pendekatan linier ekivalen atau menggunakan metode nonlinier. Pendekatan pertama dapat dianalisis dengan menggunakan program SHAKE (Schnabel et. al, 1972) atau EERA (Bardet et. al, 2000). Dalam studi ini, analisis dilakukan dengan metoda nonlinier menggunakan bantuan program NERA (Bardet & Tobita., 2001). Program ini merupakan pengembangan dari program SHAKE (Schnabel et. al, 1972) dan EERA (Bardet et. al, 2000). Program ini menggunakan model material yang dikembangkan oleh Iwan (1967) dan Mroz (1967) untuk memodelkan perilaku nonlinear dari tanah dan juga berdasarkan solusi menerus dari persamaan gelombang (Kanai, 1951) disesuaikan untuk

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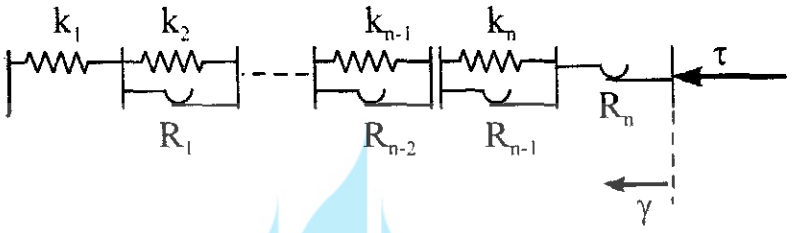
penggunaan *transient motions* dengan algoritma Fast Fourier Transform (Cooley dan Tukey, 1965). Model ini lazim juga disebut IM model.

Model IM ini menggunakan suatu deret elemen mekanik yang disebut *slider* dengan kekakuan dan tahanan geser (R_i) yang berlainan. Sliders memiliki tahanan meningkat antara satu slider ke slider yang berikutnya ($R_1 < R_2 < ... < R_n$). Gambaran skematik tentang model tegangan-regangan yang digunakan dalam model IM dapat dilihat dalam **Gambar 4.3**.



Gambar 4.3. Representasi skematik dari model IM (Bardet and Tobita, 2001)

Kelebihan model nonlinier ini dibandingkan pendekatan linier ekivalen adalah: (Kramer, 1966):

1. Kekakuan dari kondisi tanah yang aktual berubah sepanjang kejadian gempa, sehingga kondisi amplifikasi yang sangat tinggi yang terjadi jika digunakan pendekatan linier ekivalen tidak akan terjadi dalam kondisi sesungguhnya di lapangan.
2. Metoda nonlinier dapat digunakan untuk memodelkan redistribusi atau dissipasi ekses tegangan air tanah selama dan sesudah kejadian gempa.

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4.3. PARAMETER DINAMIK TANAH

Parameter dinamik tanah yang diperlukan untuk analisis perambatan gelombang geser adalah modulus geser dinamik, G_{max}, atau kecepatan gelombang geser, v_S, material damping dinamik, ξ, dan hubungan antara modulus geser dan damping ratio dengan regangan geser.

Modulus geser dinamik maksimum (G_{max}) biasanya dikorelasikan dengan kecepatan gelombang geser (v_S) pada regangan yang kecil ($\pm 10^{-4}\%$) sebagai:

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$$G_{max} = vs^2 \gamma / g \quad (4.3)$$

Dimana: γ = unit weight

g = percepatan gravitasi

Besarnya kecepatan gelombang geser atau modulus geser dinamik dapat ditentukan berdasarkan korelasi empiris dengan menggunakan data pengujian lapangan seperti N-SPT atau dari hasil pengujian lapangan. Salah satu metode pengujian lapangan yang sering digunakan untuk mendapatkan kecepatan gelombang geser adalah ***seismic downhole test*** (SDH).

Pada studi ini, parameter dinamik tanah yang digunakan adalah berdasarkan data hasil pengukuran kecepatan gelombang geser yang dilakukan pada lokasi BH-1 dan BH-2. Data hasil pengukuran tersebut kemudian dievaluasi kembali untuk keperluan analisis. Dalam analisis ini nilai V_S yang digunakan merupakan hasil pengukuran dari Seismic Downhole Test (SDH) dengan mempertimbangkan juga hasil korelasi empiris antara N-SPT dengan V_S sebagaimana dapat dilihat dalam Lampiran A. Berdasarkan hasil evaluasi nilai N-SPT rata-rata, dan V_S rata-rata hingga kedalaman 30 m didapat hasil sebagai berikut:

Tabel 4.3. Hasil perhitungan nilai N-SPT dan VS rata-rata hingga 30 m

Lokasi	N-SPT-30	Vs (m/dt) N-SPT	Vs (m/dt) SDH	V_S-used (m/dt)
BH-1	20	256	248	255
BH-2	35	298	264	287
BH-3	18	262	-	262
BH-4	26	276	-	276
BH-5	9	211	-	211
BH-6	32	292	-	291

Data hasil pengukuran tersebut kemudian digunakan sebagai data primer dalam analisis perambatan gelombang geser dari batuan dasar ke permukaan tanah. Pada studi ini, data kecepatan gelombang geser hasil pengukuran adalah hingga kedalaman 30m (**Gambar 4.4**). Sehingga besarnya kecepatan gelombang geser pada kedalaman lebih dari 30 m hingga batuan dasar (400 m) mengikuti prosedur yang dilakukan dalam studi *Seismic Design Criteria Jakarta Tower*

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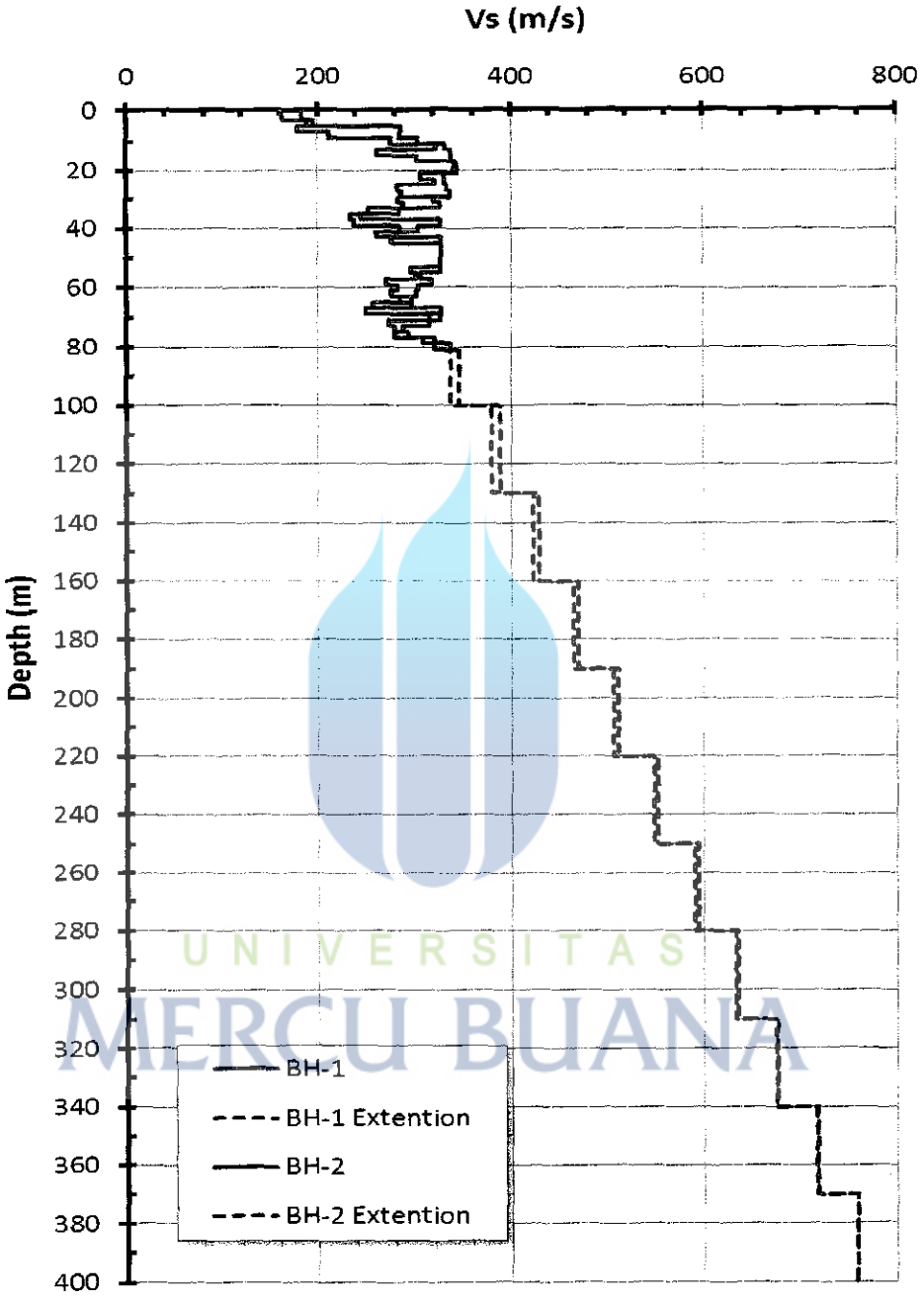
(1996) contoh grafik profil tanah pada BH-1 dan BH-2 terlihat seperti pada **Gambar 4.4.**



Gambar 4.4. Profil parameter dinamik tanah yang digunakan dalam analisis perambatan gelombang geser.

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4.4. HASIL ANALISIS

4.4.1. PGA DI PERMUKAAN TANAH BERDASARKAN PERATURAN GEMPA INDONESIA

Berdasarkan hasil pengukuran N-SPT dan harga kecepatan gelombang geser dari hasil seismic downhole test dan korelasi empiris pada Tabel 4.3, maka menurut Peraturan Gempa Indonesia (SNI 03-1726-2002) lokasi proyek dikategorikan sebagai tanah sedang (**Tabel 4.4**). Sehingga *peak ground acceleration* di permukaan adalah sekitar 0.23g atau faktor amplifikasi untuk tanah tersebut adalah sekitar 1.5 (**Tabel 4.5**).

Tabel 4.4. Site classification berdasarkan Peraturan Gempa Indonesia (SNI 03-1726, 2002)

Jenis tanah	Kecepatan rambat gelombang geser rata-rata, $\bar{v}_s$ (m/det)	Nilai hasil Test Penetrasi Standar rata-rata $\bar{N}$	Kuat geser niralir rata-rata $\bar{S}_u$ (kPa)
Tanah Keras	$\bar{v}_s \geq 350$	$\bar{N} \geq 50$	$\bar{S}_u \geq 100$
Tanah Sedang	$175 \leq \bar{v}_s < 350$	$15 \leq \bar{N} < 50$	$50 \leq \bar{S}_u < 100$
Tanah Lunak	$\bar{v}_s < 175$	$\bar{N} < 15$	$\bar{S}_u < 50$
	atau, setiap profil dengan tanah lunak yang tebal total lebih dari 3 m dengan PI > 20, $w_n \geq 40$ % dan $S_u < 25$ kPa		
Tanah Khusus	Diperlukan evaluasi khusus di setiap lokasi		

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Tabel 4.5. PGA di permukaan tanah berdasarkan Peraturan Gempa Indonesia (SNI 03-1726, 2002)

Wilayah Gempa	Percepatan puncak batuan dasar ('g')	Percepatan puncak muka tanah A_o ('g')			
		Tanah Keras	Tanah Sedang	Tanah Lunak	Tanah Khusus
1	0.03	0.04	0.05	0.08	Diperlukan evaluasi khusus di setiap lokasi
2	0.10	0.12	0.15	0.20	
3	0.15	0.18	0.23	0.30	
4	0.20	0.24	0.28	0.34	
5	0.25	0.28	0.32	0.36	
6	0.30	0.33	0.36	0.38	

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4.4.2. PGA DAN SITE SPECIFIC RESPON SPEKTRA BERDASARKAN ANALISIS PERAMBATAN GELOMBANG

Analisis dilakukan dengan menggunakan data kecepataan gelombang geser (Vs) hasil pengukuran SDH pada BH-1 dan BH-2 serta Vs hasil korelasi empirik dari data N-SPT semua data *bor hole* (BH). Respon spektra hasil analisis perambatan gelombang geser dari batuan dasar ke permukaan tanah dengan menggunakan data kecepatan gelombang geser hasil pengukuran dapat dilihat dalam **Gambar 4.5** dan **Gambar 4.6** untuk periode ulang 500 tahun dan Gambar 4.7 untuk periode ulang 2500 tahun. Respons Spektra yang direkomendasikan adalah selubung/envelope dari kurva Average+1 Standar deviasi (STD). Perbandingan respons spektra yang direkomendasikan dengan SNI 03-1726-2002 dan IBC 2000 untuk periode ulang 500 tahun dapat dilihat dalam **Gambar 4.6**. Respons spektra dalam format tripartite ditampilkan dalam **Gambar 4.8** dan **Gambar 4.9** untuk periode ulang 500 dan 2500 tahun. Nilai-nilai dari desain spektra yang direkomendasikan dapat dilihat dalam Error! Reference source not found. dan **abel 4.7** untuk periode ulang 500 dan 2500 tahun.

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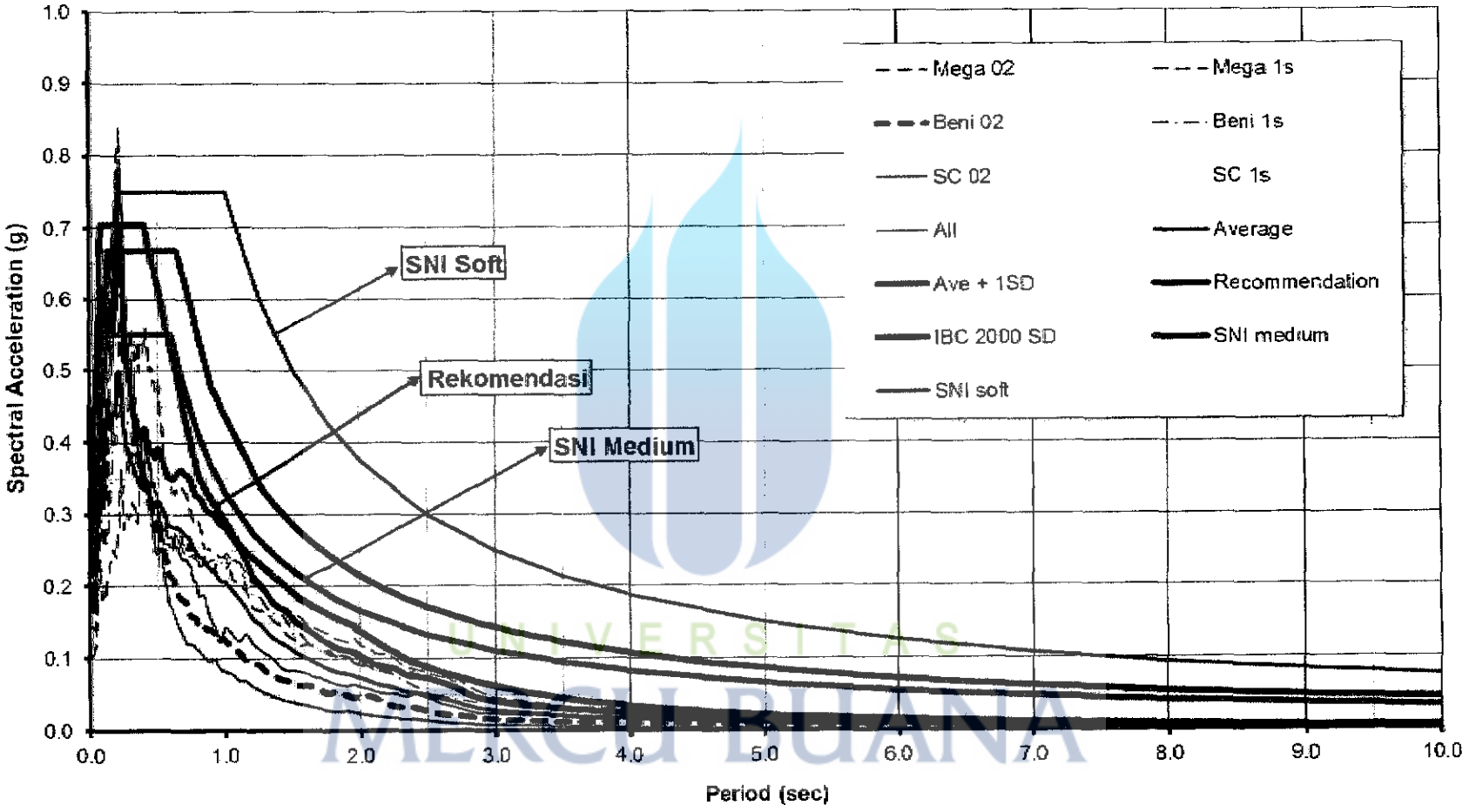

Gambar 4.5. Respon spektra dipermukaan tanah dengan menggunakan data kecepatan gelombang geser (Periode ulang 500 tahun)

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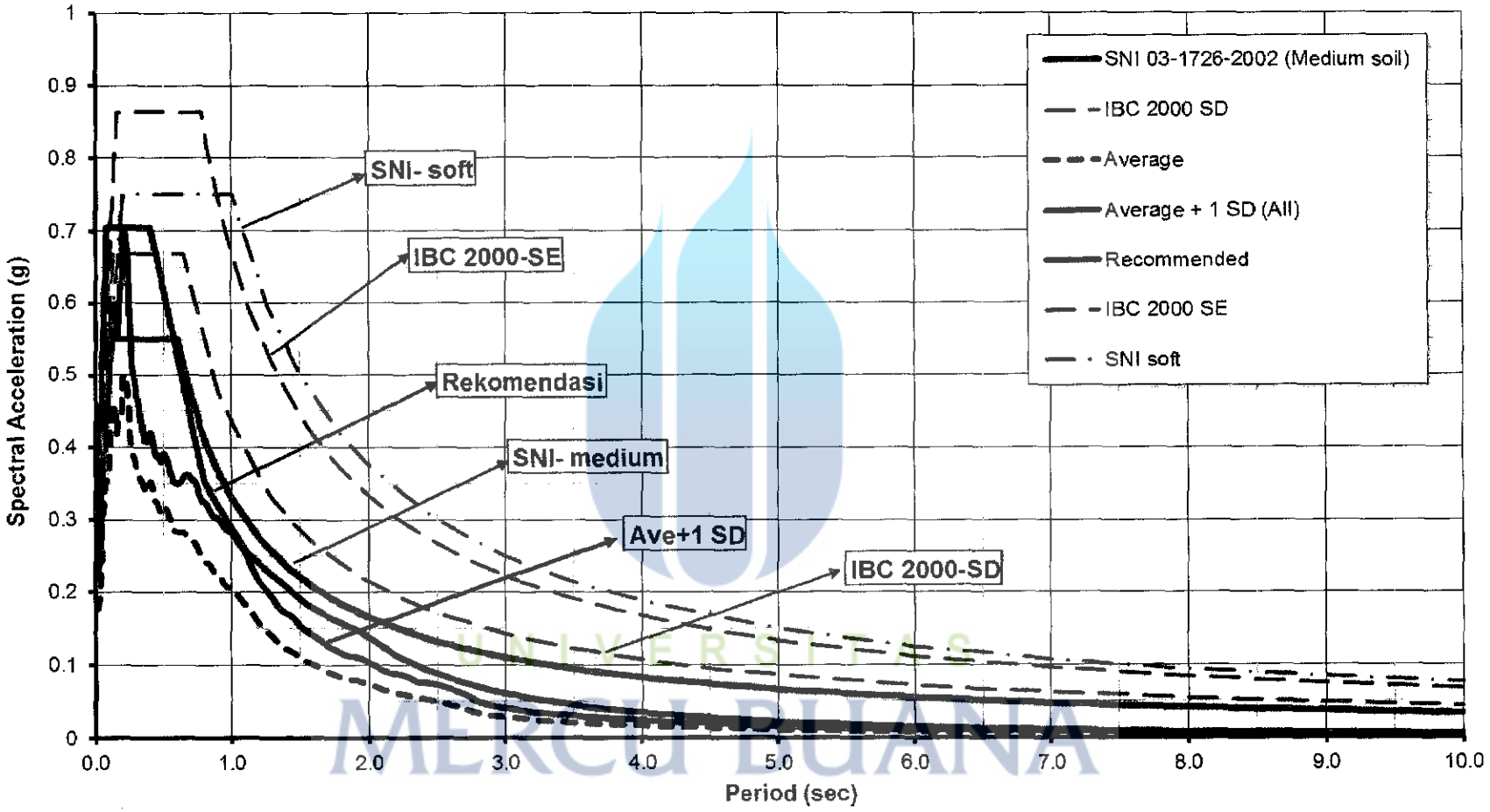

Gambar 4.6. Perbandingan Respon spektra dipermukaan tanah dengan SNI 2002, UBC 1997, dan IBC 2000 (Periode ulang 500 tahun)

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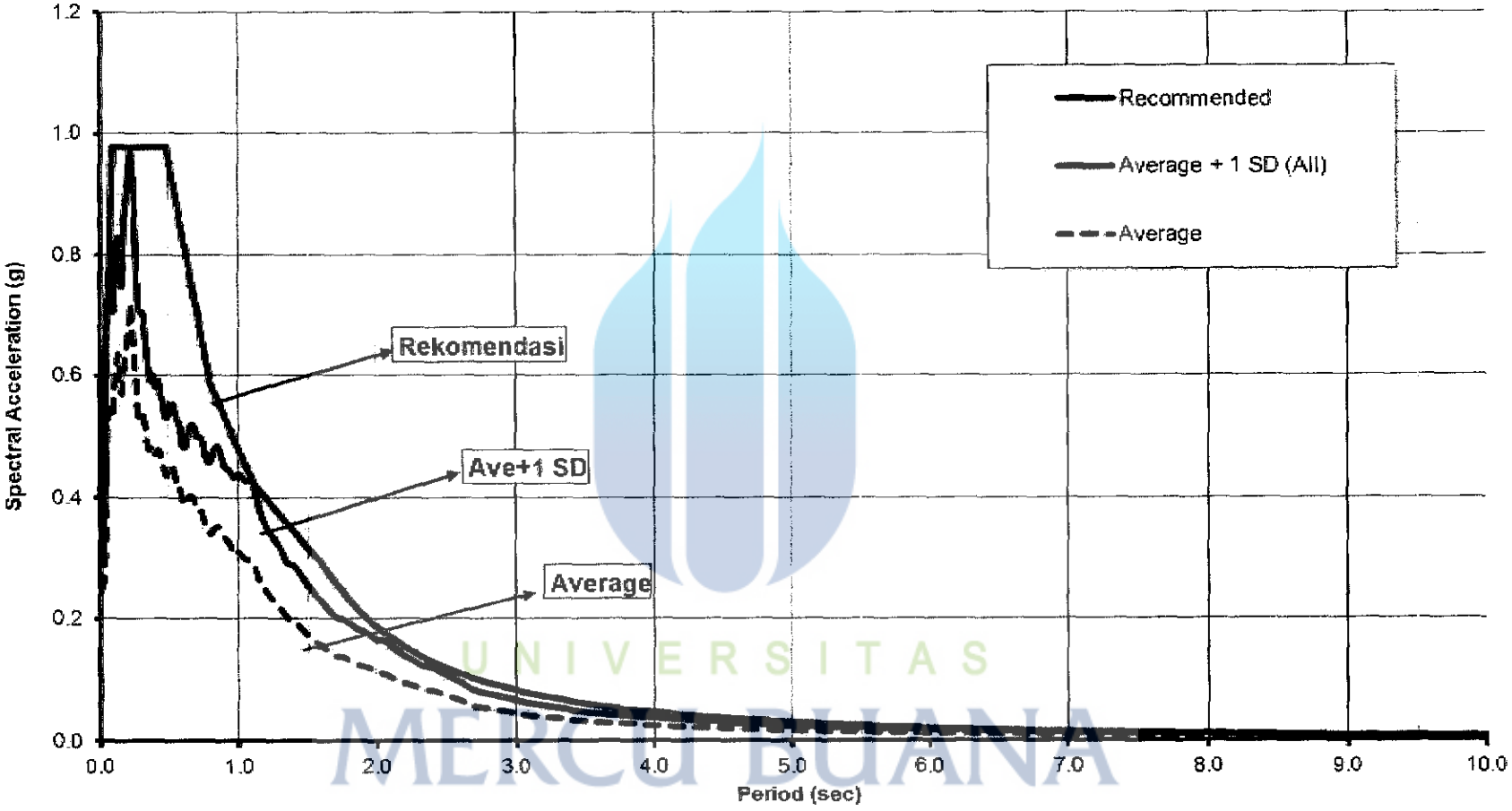

Gambar 4.7. Respon spektra dipermukaan tanah dengan menggunakan data kecepatan gelombang geser (Periode ulang 2500 tahun)

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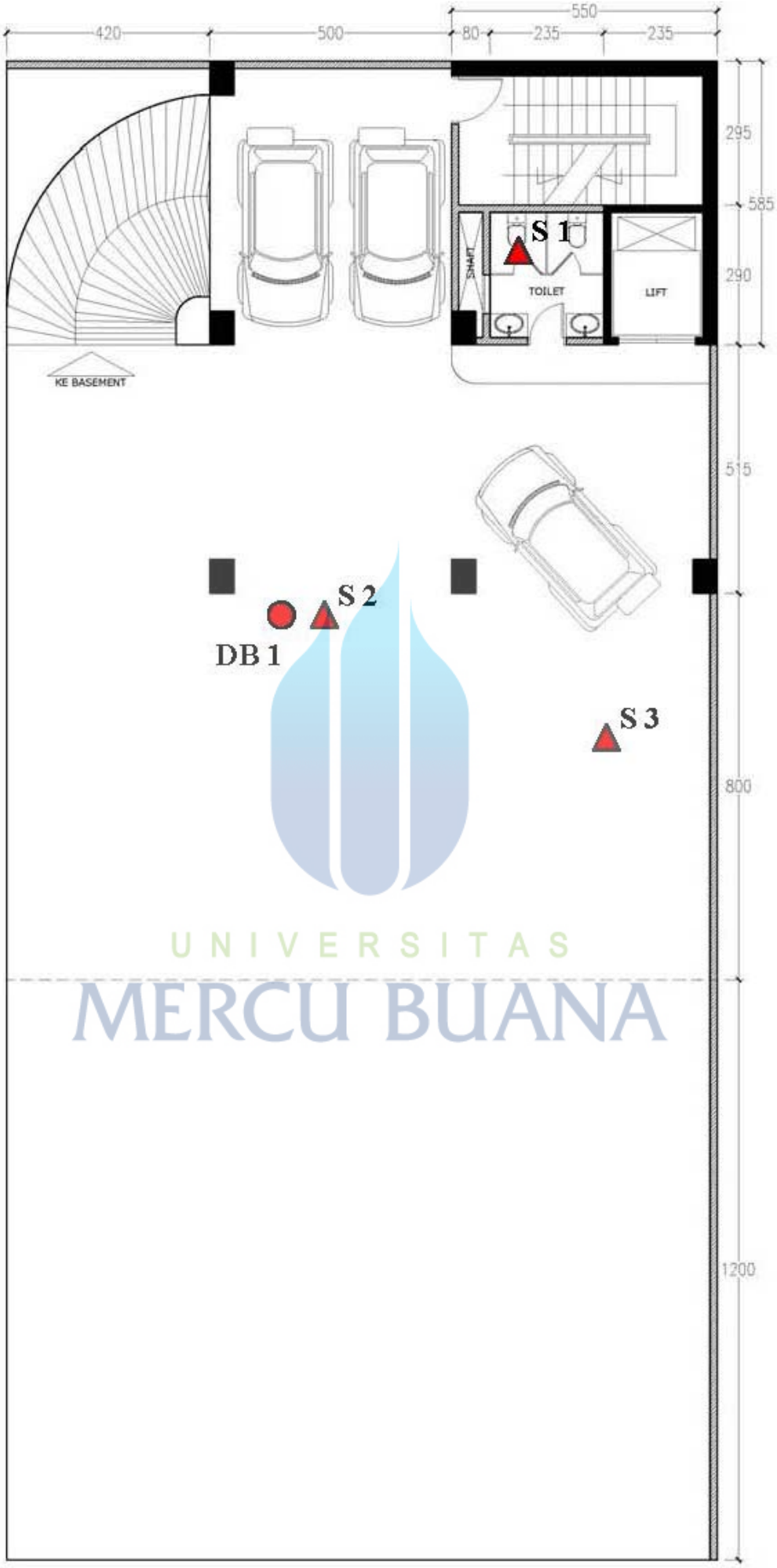

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BORING LOG

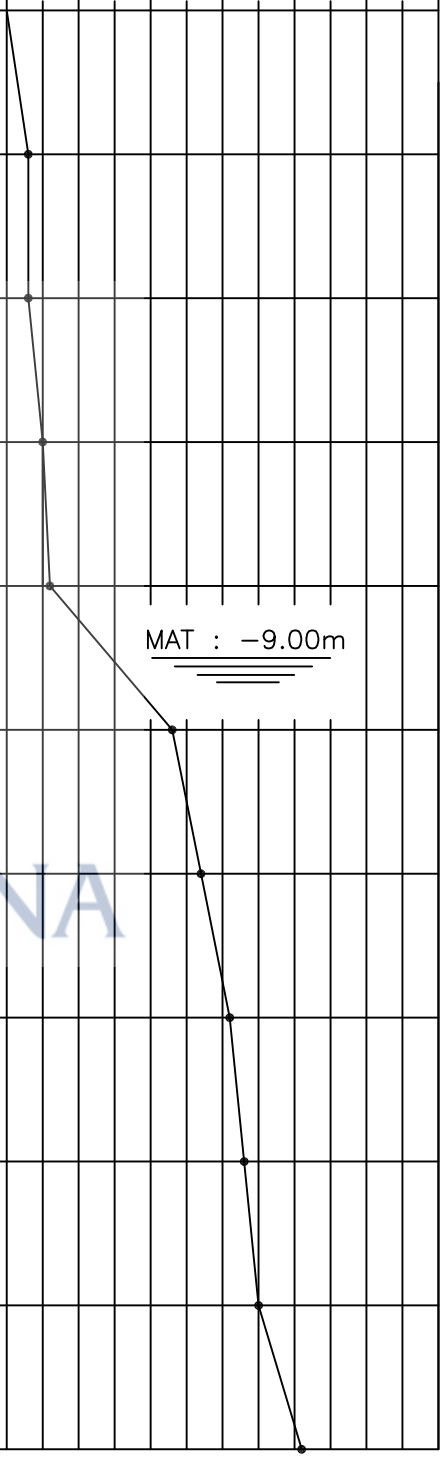
PROJECT : GEDUNG 8 LANTAI

LOCATION : JLN. GARUDA, KEMAYORAN

DATE : 22–24/12/2012

BORING : DB1

DEPTH (m)	INTERVAL	SYIMBOL	SOIL DESCRIPTION	150 mm	150 mm	150 mm	N BLOWS
1.00							
2.00			Lempung, Soft Hitam	1	1	2	3
3.00							
4.00				1	1	2	3
5.00							
6.00			Lempung, Medium Stiff Hitam	2	2	3	5
7.00							
8.00				2	3	3	6
9.00							
10.00			Lempung Kepasiran, Very Stiff Coklat	9	11	12	23
11.00							
12.00				10	12	15	27
13.00							
14.00			Pasir Halus, Dense Coklat Kehitaman	13	14	17	31
15.00							
16.00				13	15	18	33
17.00							
18.00				15	17	18	35
19.00							
20.00				17	20	21	41



LEGEND				
	UNDISTURBED SAMPLE	CLAY	CLAYEYSILT	ORGANIK
	SPT	SILT	SILTYCLAY	SAND

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BORING LOG

PROJECT : GEDUNG 8 LANTAI

LOCATION : JLN. GARUDA, KEMAYORAN

DATE : 22–24/12/2012

BORING : DB1

DEPTH (m)	INTERVAL	SYIMBOL	SOIL DESCRIPTION	150 mm	150 mm	150 mm	N BLOWS
21.00			Pasir Halus, Dense Coklat Kehitaman				
22.00				20	23	25	48
23.00							
24.00				21	25	26	51
25.00							
26.00			Pasir Kasar, Very Dense Hitam	45/10			60
27.00							
28.00				50/5			60
29.00							
30.00				55/5			60

SPT. CURVE

LEGEND				
	UNDISTURBED SAMPLE	CLAY	CLAYEYSILT	ORGANIK
	SPT	SILT	SILTYCLAY	SAND

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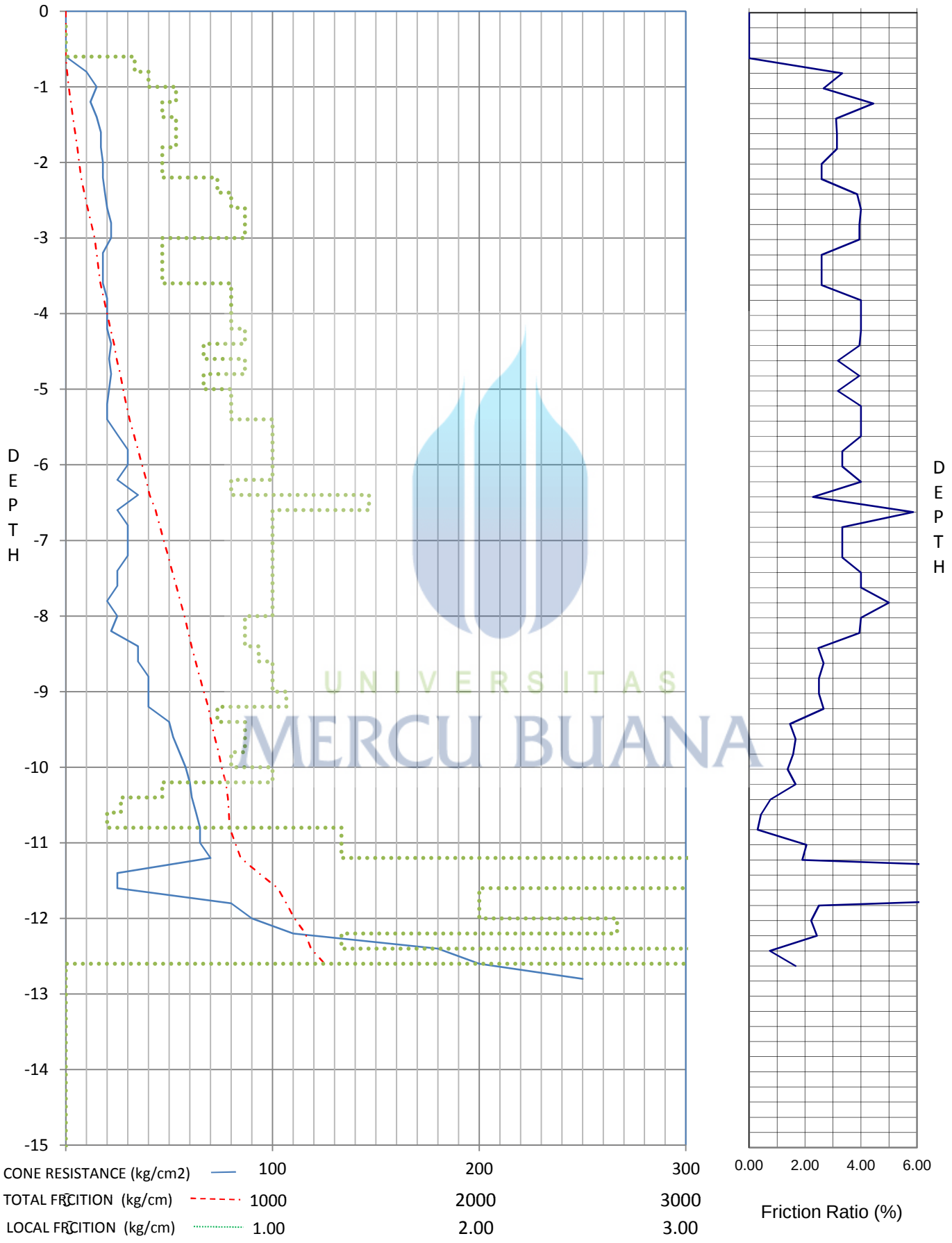
PUTRA DWI MANDIRI

CPT

Proyek : **BAGUNAN OFFICE 8 LANTAI**
Point : **S1**
Location : **PRJ - JALAN GARUDA**

Elev. :
Test by : **TRISNA**
Date : **24 DES 2012**



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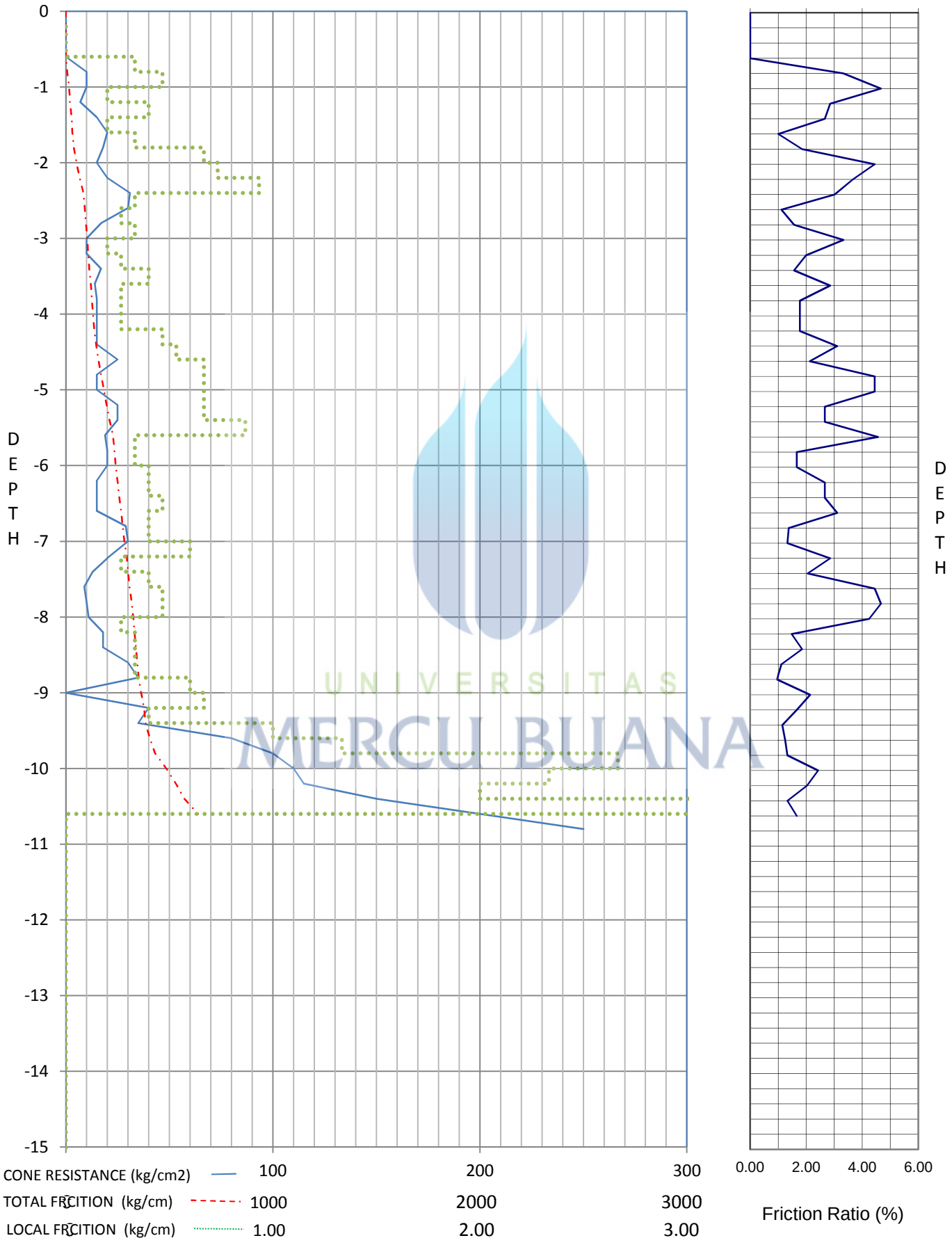
PUTRA DWI MANDIRI

CPT

Proyek : **BAGUNAN OFFICE 8 LANTAI**
Point : **S2**
Location : **PRJ - JALAN GARUDA**

Elev. :
Test by : **TRISNA**
Date : **24 DES 2012**



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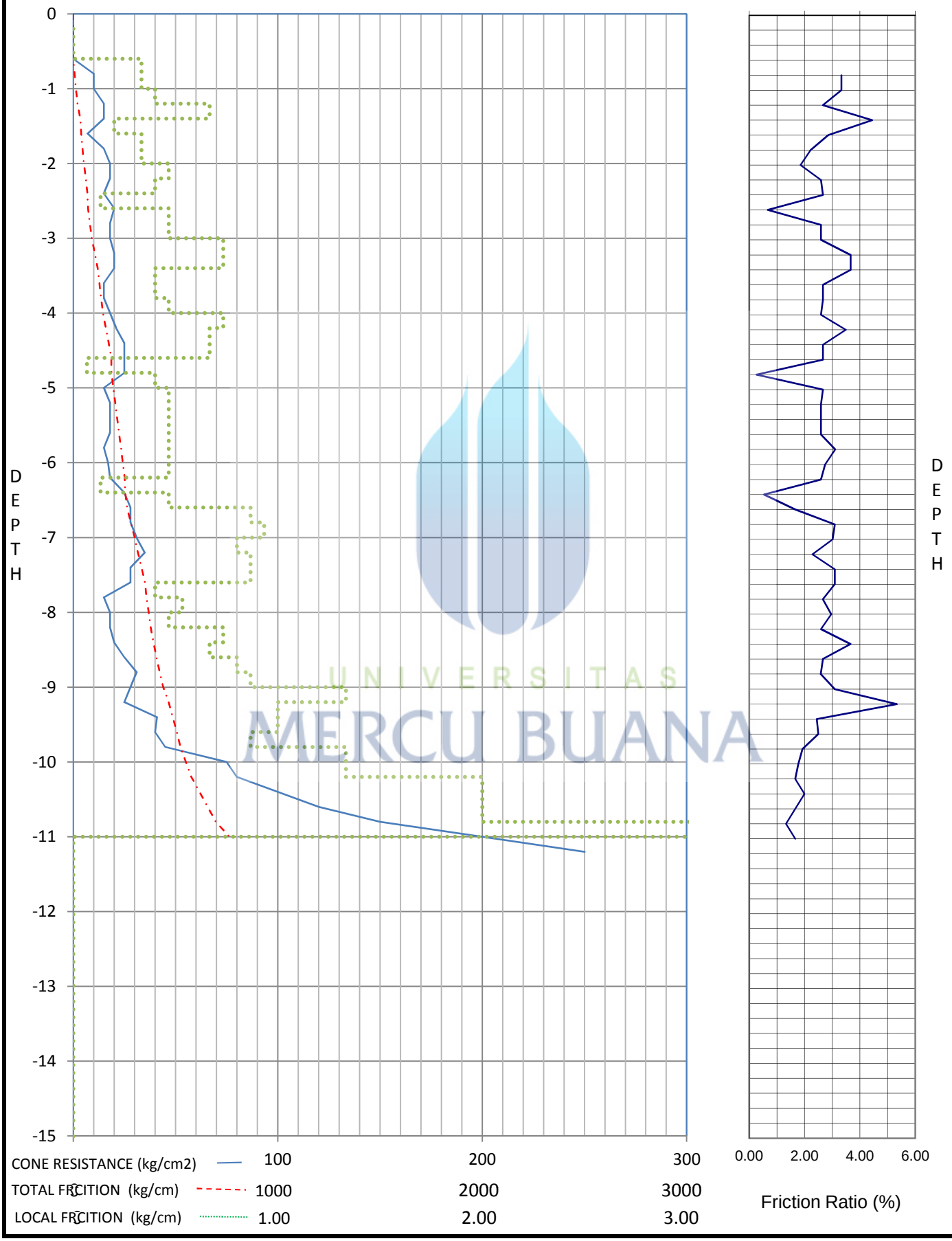
PUTRA DWI MANDIRI

CPT

Proyek : **BAGUNAN OFFICE 8 LANTAI**
Point : **S3**
Location : **PRJ - JALAN GARUDA**

Elev. :
Test by : **TRISNA**
Date : **24 DES 2012**



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DATA UJI LABORATORIUM

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SUMMARY OF LABORATORY TEST RESULT

PROJECT : GEDUNG 8 LANTAI
LOCATION : JL.GARUDA , KEMAYORAN

Sample No.							
Bore Hole No.			DB-1	DB-1	DB-1		
Sample Depth			1,50-2,00 M	3,50-4,00 M	5,50-6,00 M		
Gradition	Gravel	%	0	0	0		
	sand	%	3,77	6,74	10,35		
	Silt	%	58,73	56,26	49,15		
	Clay	%	37,50	37,00	40,50		
Liquit Limit		%	80,89	67,50	78,92		
Plastic Limit		%	35,27	27,85	33,60		
Plasticity indeks		%	45,62	39,65	45,32		
Shrinkage Limit		%					
Specific Grafity			2,599	2,611	2,623		
Dry Density		t/m^3	1,088	1,125	1,189		
Coefficient of Permeability		cm/sec					
Natural Strte	Water Content	%	40,29	43,19	36,65		
	Wet Density	t/m^3	1,526	1,611	1,625		
	Void Ratio		1,389	1,321	1,206		
	Porosity		0,581	0,569	0,547		
	Degree of Saturation		75,37	85,38	79,73		
unc. Comp	Compresssive strength	kg/cm^2					
	Sensivity						
Triaxial	Cohesion	kg/cm^2					
	Cohesion eff.	kg/cm^2					
	Angle of internal friction						
	Angle of internal friction eff.						
D.S	Cohesion	kg/cm^2	0,13	0,19	0,18		
	Angle of internal friction	°	13,3	12,4	15,2		
C.C	Coeff.of consolidation	cm/sec	5,656E-04	5,843E-04	6,396E-04		
	Compresssionindex		0,352	0,333	0,370		
Comp tion	Optimum Moisture Content						
	Max.Dry Density	t/m^3					
CBR	CBR	%					
	Dry density	t/m^3					
	Water Content	%					
	Test condition						
	Sample condition						
Swelling		kg/cm^2					

Remarks :

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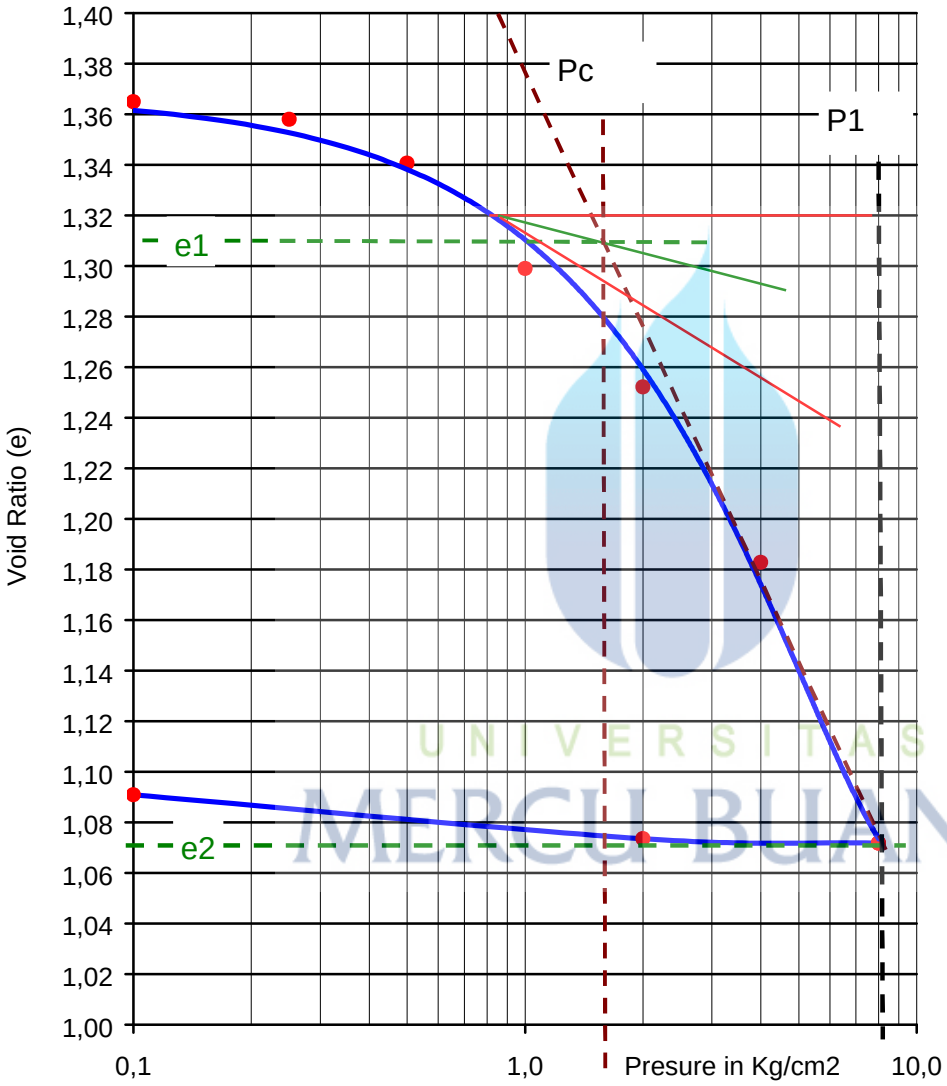
CONSOLIDATION TEST

Project	:	GEDUNG 8 LANTAI		Insitu Void ratio ,Eo	:	1,367	
Location	:	JL.GARUDA , KEMAYORAN		Sample Area	:	38,50	cm^2
Date	:	0		Sample Height	:	1,97	cm
Test by	:	0					
Drilling No.	:	DB-1					
Depth	:	1,50-2,00	m				



Pc (kg/cm2)	:	**1,7**
P1 (kg/cm2)	:	8,000
e1	:	**1,31**

Cc = (e1-e2)/log(p1/pc)

Cc	:	***0,352***
Cv	:	***5,656E-04***

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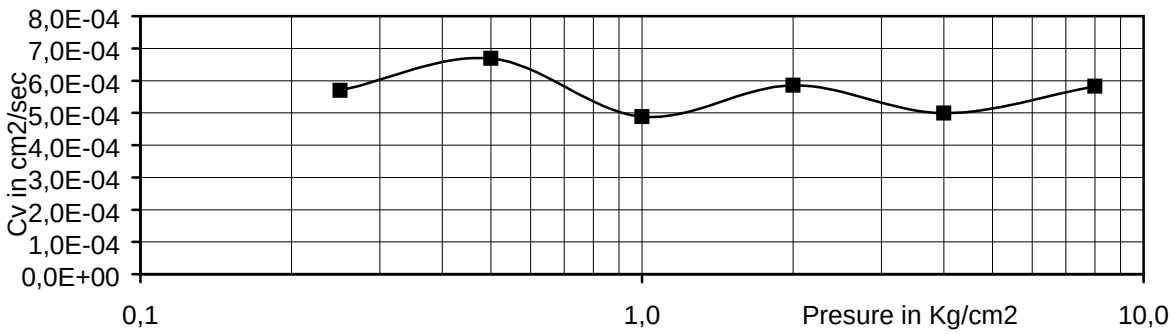
Compression Index ,Cc = 0,352



Coeff.Consolidation ,Cv = 5,656E-04 cm^2 / sec

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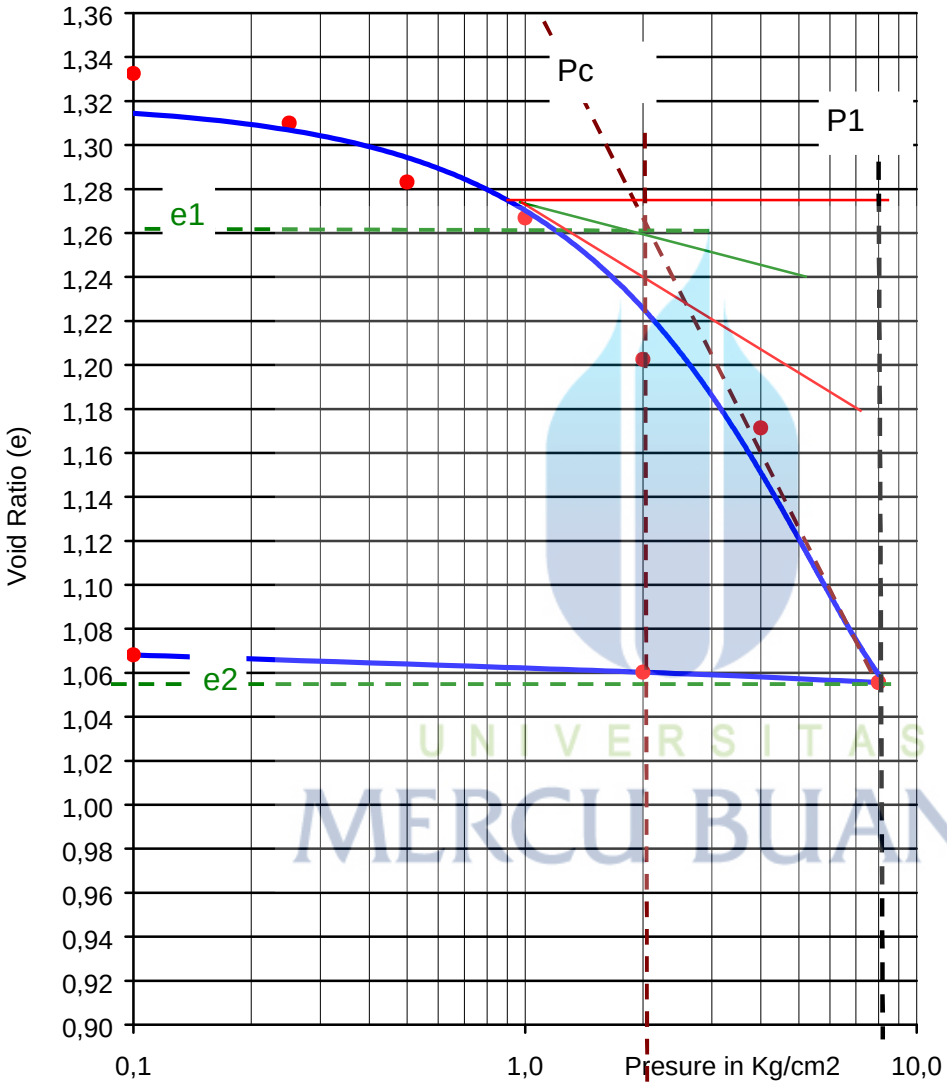
CONSOLIDATION TEST

Project	:	GEDUNG 8 LANTAI		Insitu Void ratio ,Eo	:	1,335	
Location	:	JL.GARUDA , KEMAYORAN		Sample Area	:	38,50	cm^2
Date	:	0		Sample Height	:	2	cm
Test by	:	0					
Drilling No.	:	DB-1					
Depth	:	3,50-4,00	m				

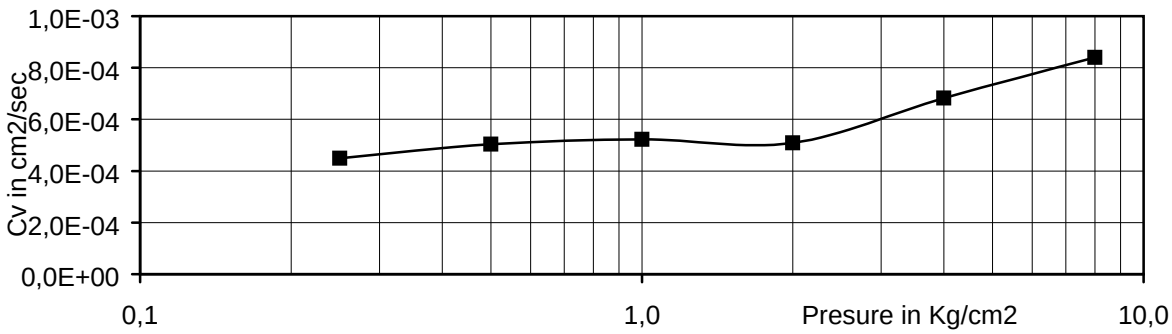


Pc (kg/cm2)	:	**2**
P1 (kg/cm2)	:	8,000
e1	:	**1,261**

Cc = (e1-e2)/log(p1/pc)

Cc	:	***0,333***
Cv	:	***5,843E-04***

Compression Index ,Cc = 0,333



Coeff.Consolidation ,Cv = 5,843E-04 cm^2 / sec

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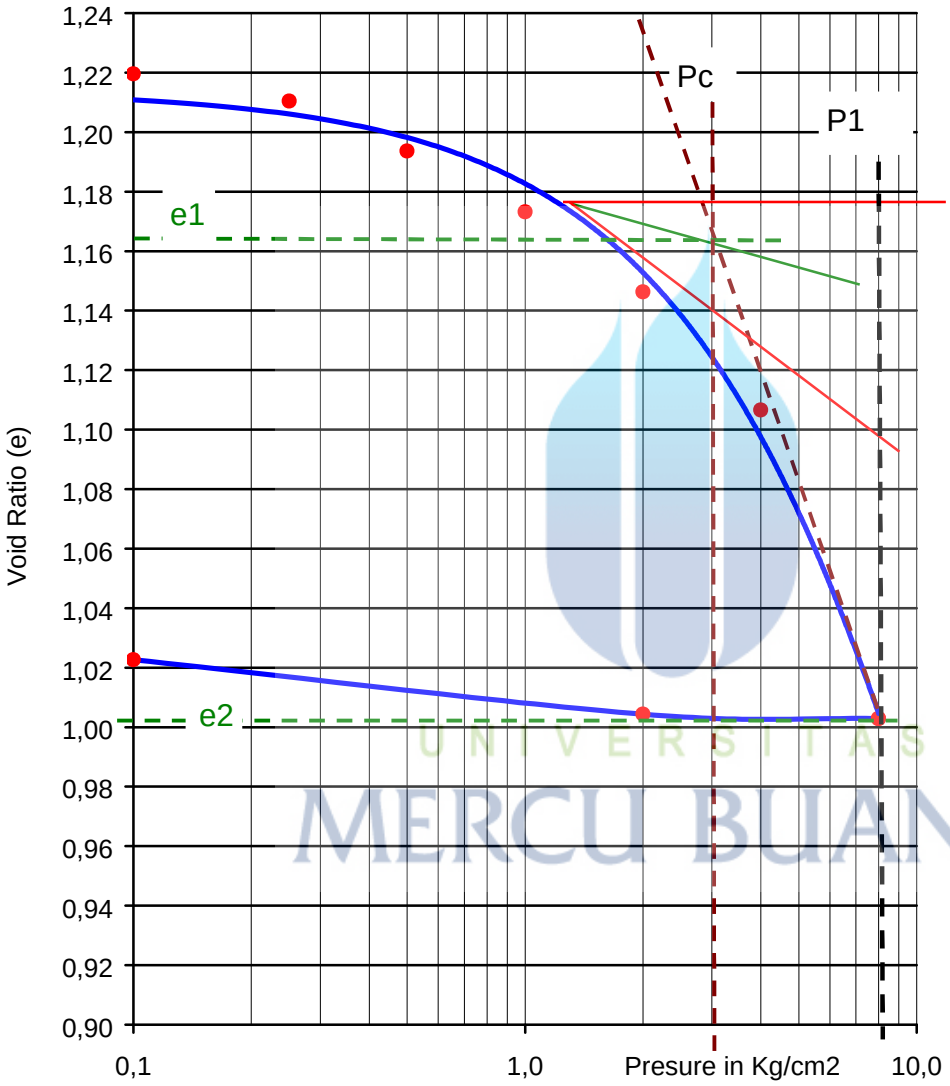
CONSOLIDATION TEST

Project	:	GEDUNG 8 LANTAI		Insitu Void ratio ,Eo	:	1,221	
Location	:	JL.GARUDA , KEMAYORAN		Sample Area	:	38,50	cm^2
Date	:	0		Sample Height	:	2	cm
Test by	:	0					
Drilling No.	:	DB-1					
Depth	:	5,50-6,00	m				

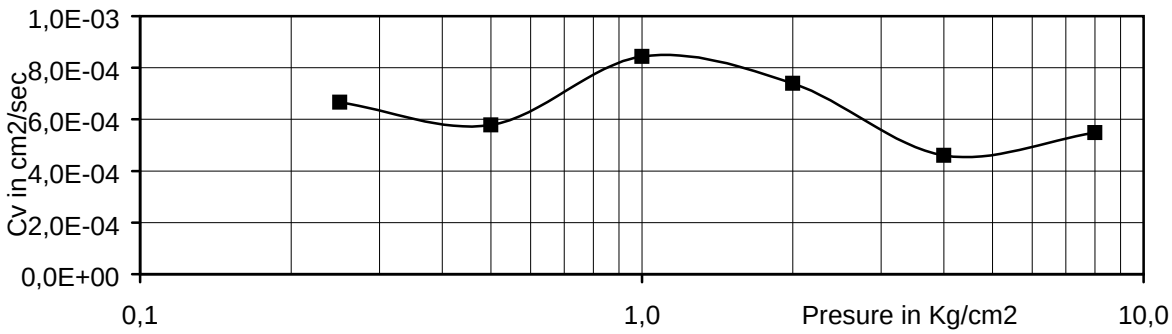


Pc (kg/cm2)	:	**3**
P1 (kg/cm2)	:	8,000
e1	:	**1,162**

Cc = (e1-e2)/log(p1/pc)

Cc	:	***0,370***
Cv	:	***6,396E-04***

Compression Index ,Cc = 0,370



Coeff.Consolidation ,Cv = 6,396E-04 cm^2 / sec

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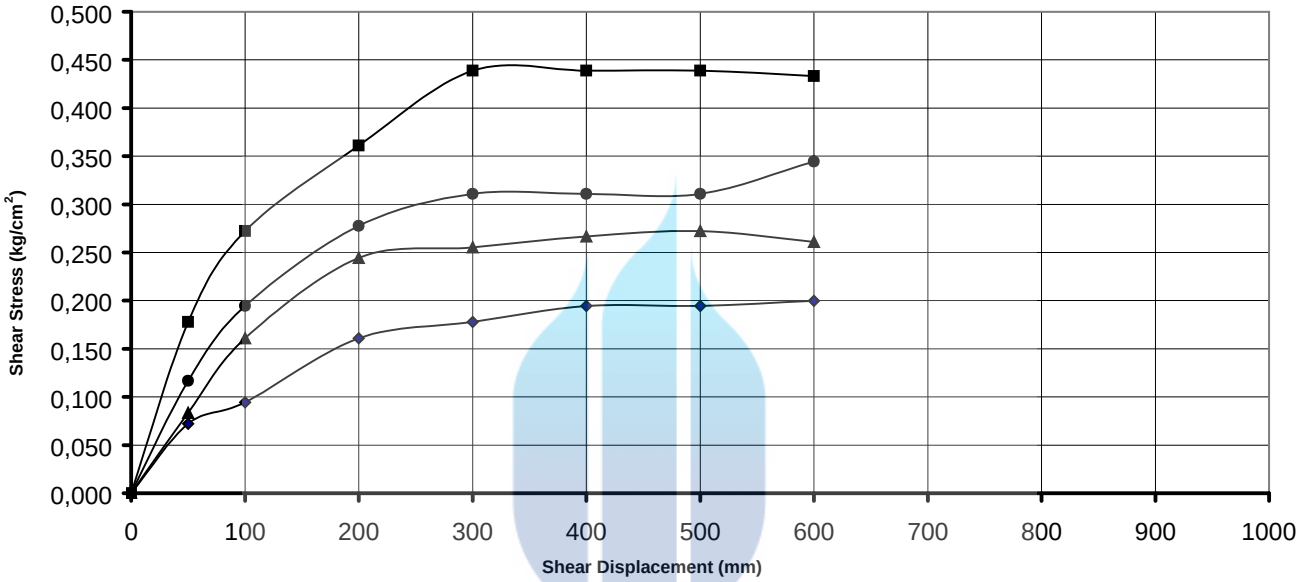
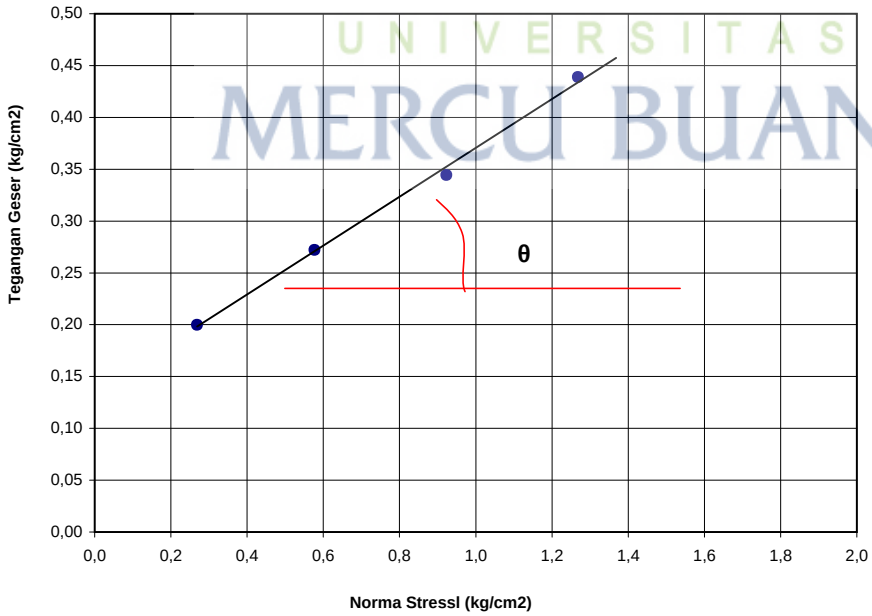
DIRECT SHEAR TEST

Project	: GEDUNG 8 LANTAI		**Drilling No.**	: DB-1	
Location	: JL.GARUDA , KEMAYORAN		**Depth**	: 1,50-2,00	m
Date	: 0		**LCR**	: 0,1444	
Tested by	: JHON		**Sample**	: 0	

Grafik Shear Displacement VS Shear Stress





Teg.Geser Max. kg/cm2		Teg.Normal kg/cm2	
A =	0,200	A =	0,269
B =	0,272	B =	0,577
C =	0,344	C =	0,923
D =	0,439	D =	1,269

Slope 0,2359

C = 0,13 kg/cm^2

θ = 13,3

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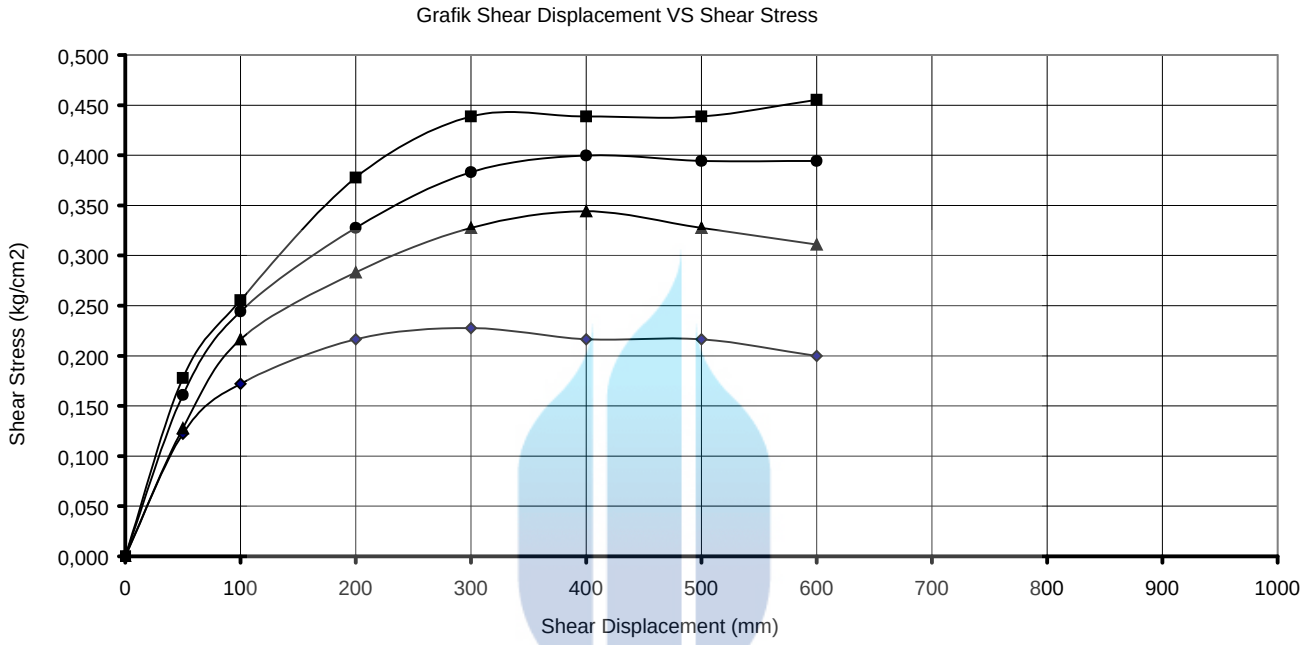
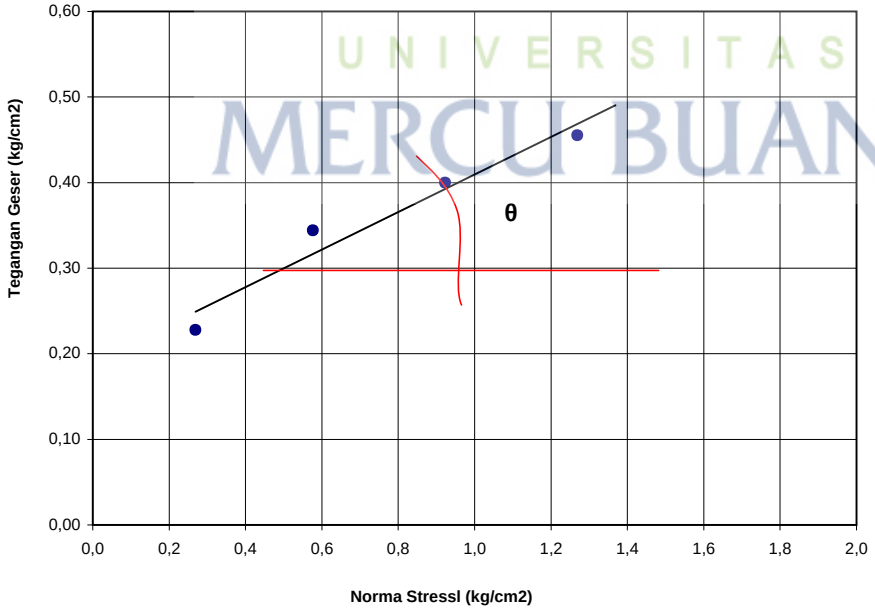
DIRECT SHEAR TEST

Project	: GEDUNG 8 LANTAI		**Drilling No.**	: DB-1	
Location	: JL.GARUDA , KEMAYORAN		**Depth**	: 3,50-4,00	m
Date	: 0		**LCR**	: 0,1444	
Tested by	: JHON		**Sample**	: 0	





Teg.Geser Max. kg/cm2		Teg.Normal kg/cm2	
A =	0,228	A =	0,269
B =	0,344	B =	0,577
C =	0,400	C =	0,923
D =	0,455	D =	1,269

Slope 0,2194

C = 0,19 kg/cm2

θ = 12,4

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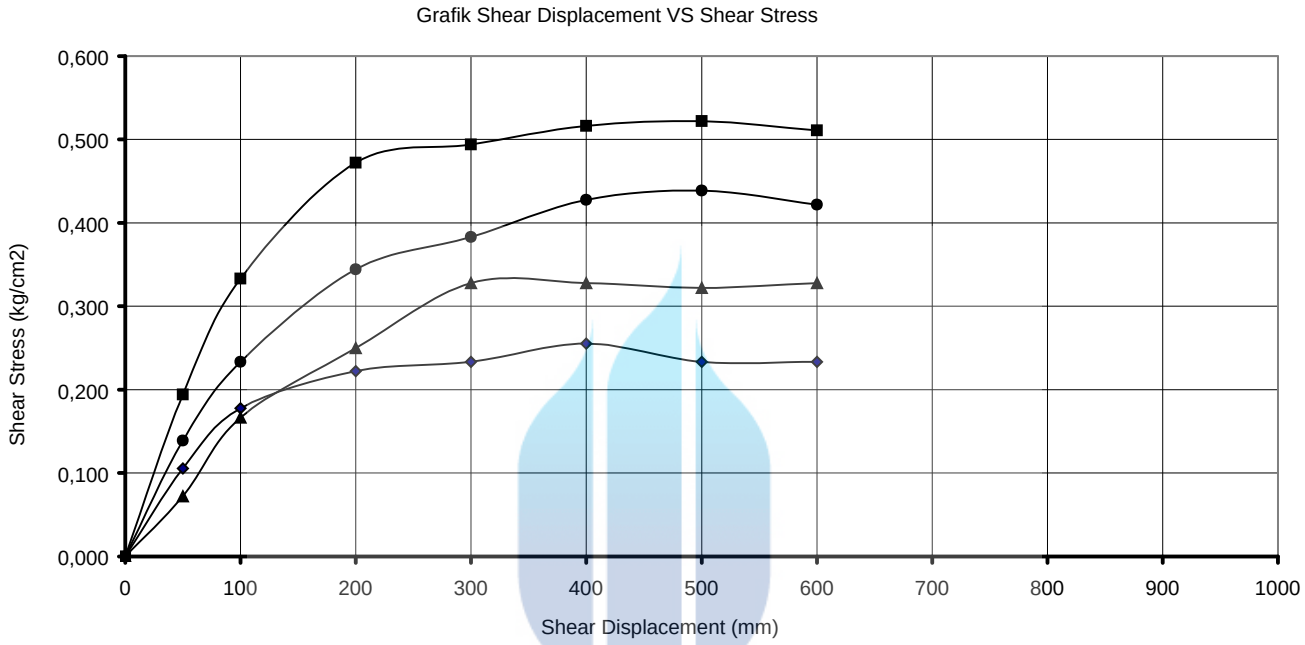
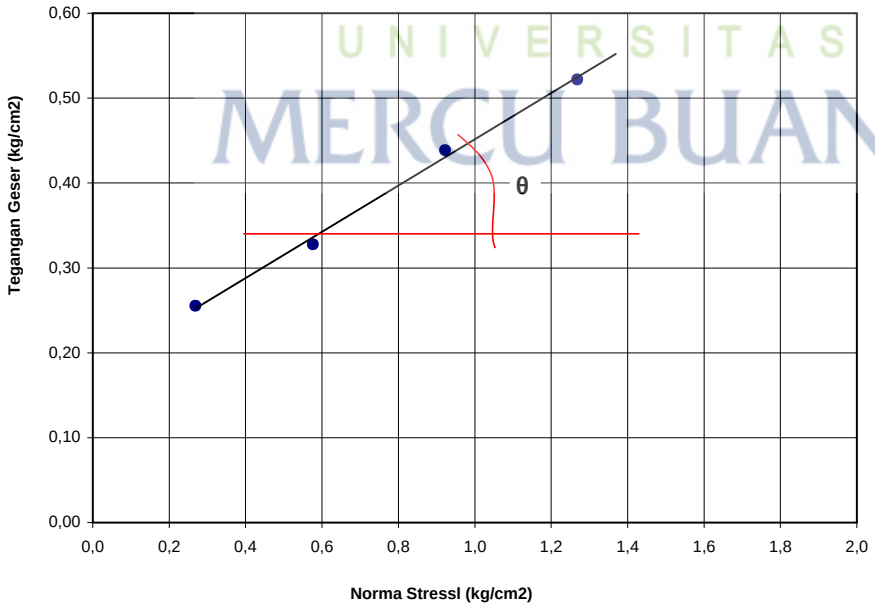
DIRECT SHEAR TEST

Project	: GEDUNG 8 LANTAI		**Drilling No.**	: DB-1	
Location	: JL.GARUDA , KEMAYORAN		**Depth**	: 5,50-6,00	m
Date	: 0		**LCR**	: 0,1444	
Tested by	: JHON		**Sample**	: 0	





Teg.Geser Max. kg/cm2		Teg.Normal kg/cm2
A =	0,255	A = 0,269
B =	0,328	B = 0,577
C =	0,439	C = 0,923
D =	0,522	D = 1,269

Slope 0,2725
C = 0,18 kg/cm2
θ = 15,2

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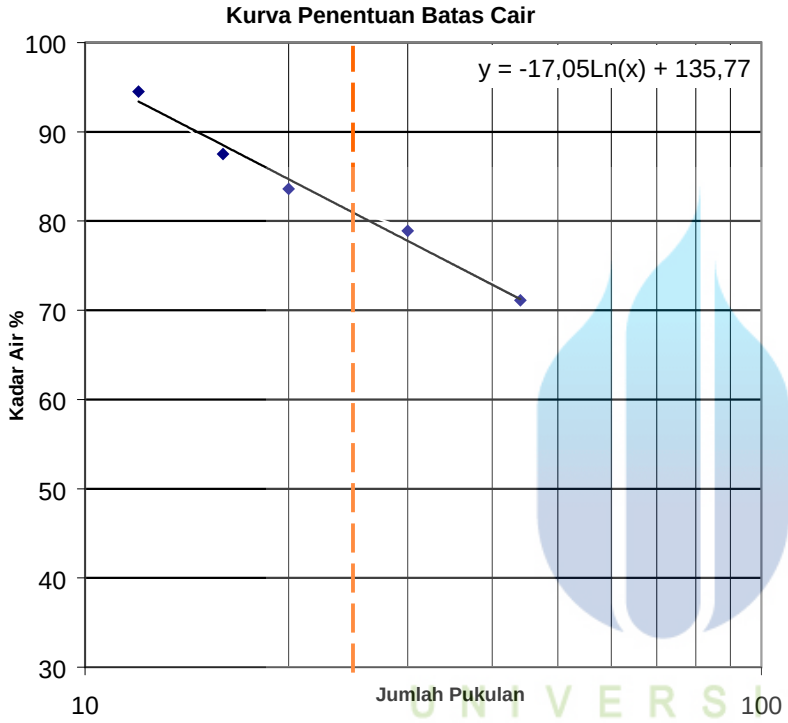
ATTERBERG LIMITS

PROJECT : GEDUNG 8 LANTAI
LOCATION : JL.GARUDA , KEMAYORAN
DATE 0
TESTED BY 0
Drilling No. : DB-1
Depth : 1,50-2,00 M



DARI GRFIK DIDAPAT :

LIQUIT LIMIT (LL)	: 80,89	%
PLATIC LIMIT (PL)	: 35,27	%
PLASTICITY INDEX (IP)	: 45,62	%

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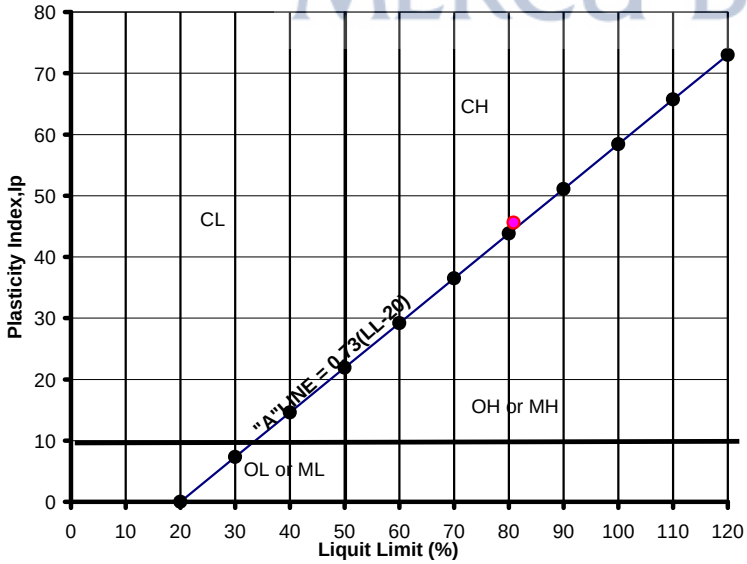
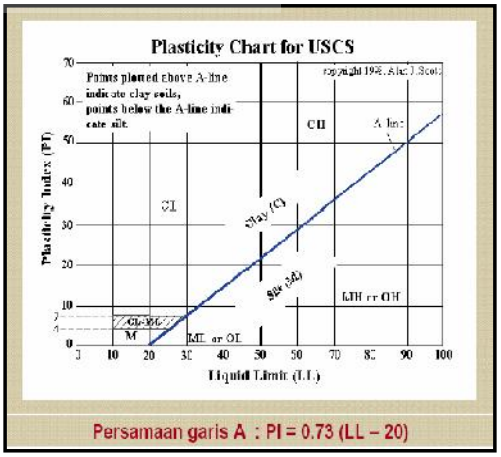
Clasification : CH





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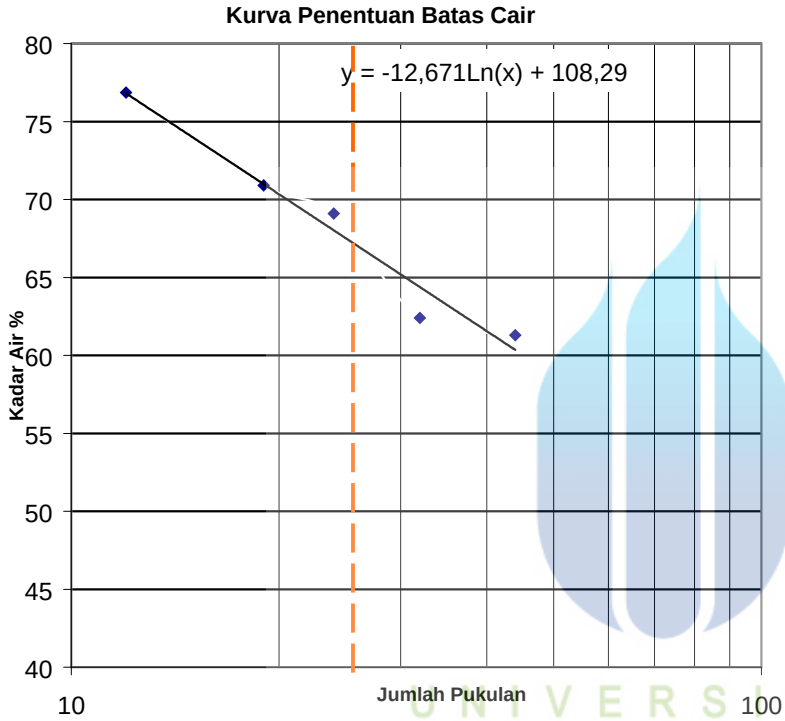
ATTERBERG LIMITS

PROJECT : GEDUNG 8 LANTAI
LOCATION : JL.GARUDA , KEMAYORAN
DATE 0
TESTED BY 0
Drilling No. : DB-1
Depth : 3,50-4,00 M



DARI GRFIK DIDAPAT :

LIQUIT LIMIT (LL)	: 67,50	%
PLATIC LIMIT (PL)	: 27,85	%
PLASTICITY INDEX (IP)	: 39,65	%

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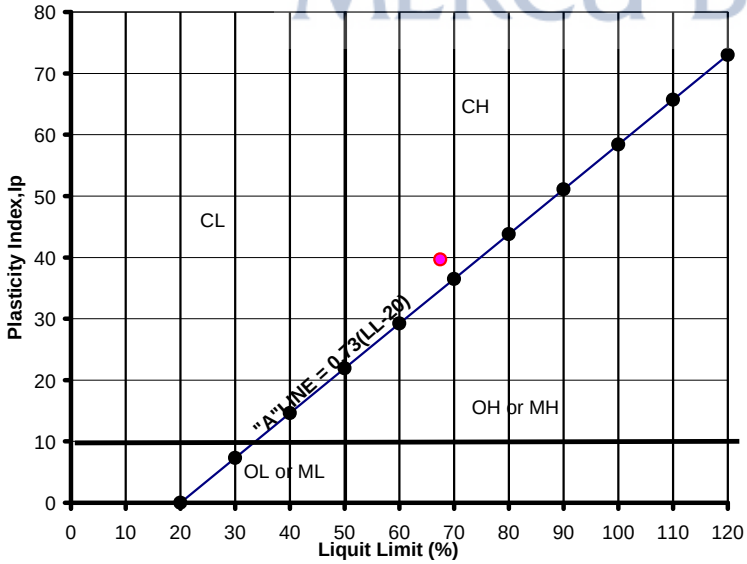
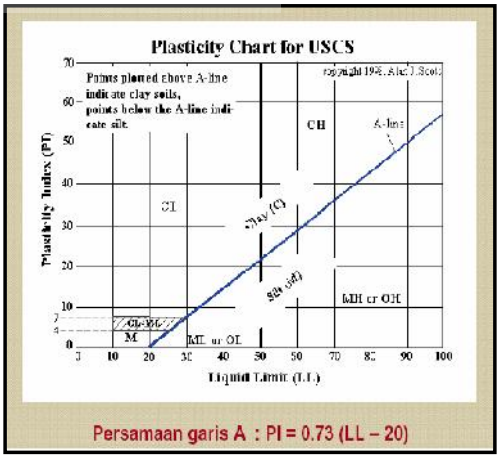
Clasification : CH





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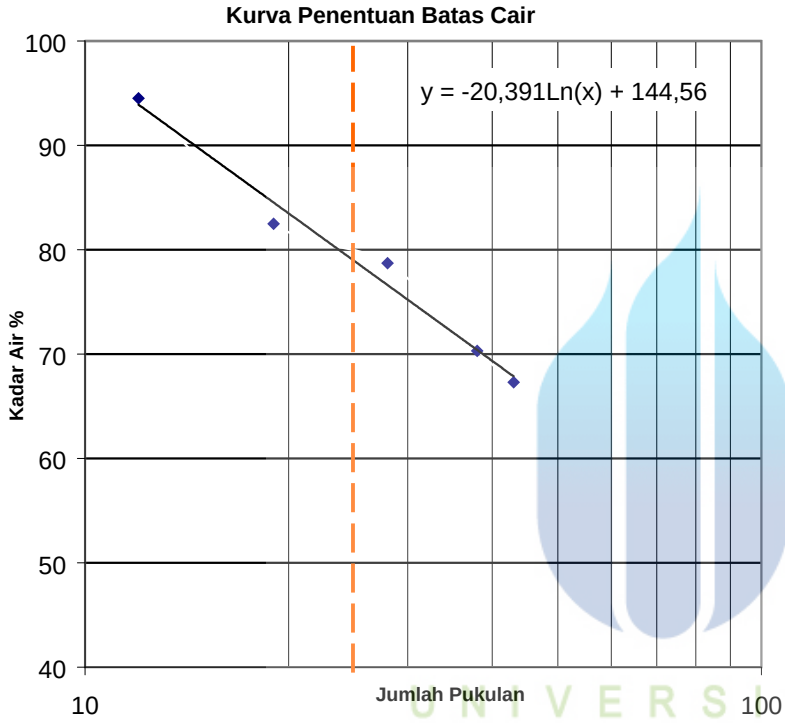
ATTERBERG LIMITS

PROJECT : GEDUNG 8 LANTAI
LOCATION : JL.GARUDA , KEMAYORAN
DATE 0
TESTED BY 0
Drilling No. : DB-1
Depth : 5,50-6,00 M



DARI GRFIK DIDAPAT :

LIQUIT LIMIT (LL)	: 78,92	%
PLATIC LIMIT (PL)	: 33,60	%
PLASTICITY INDEX (IP)	: 45,32	%

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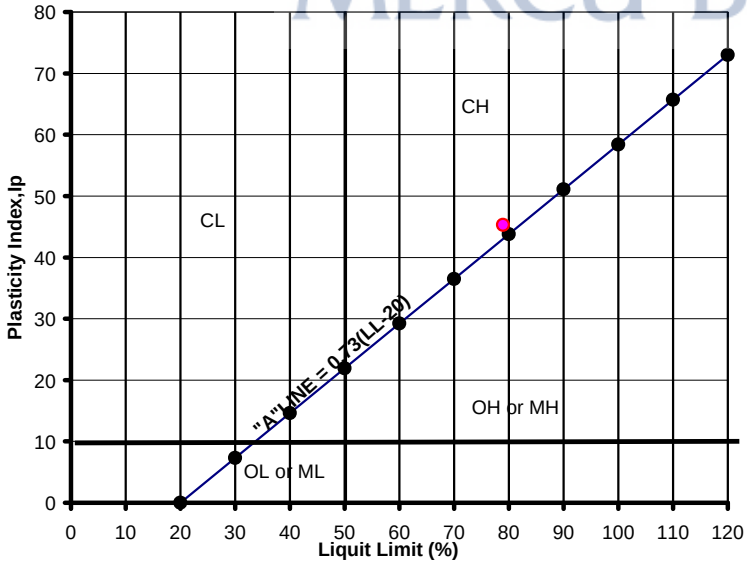
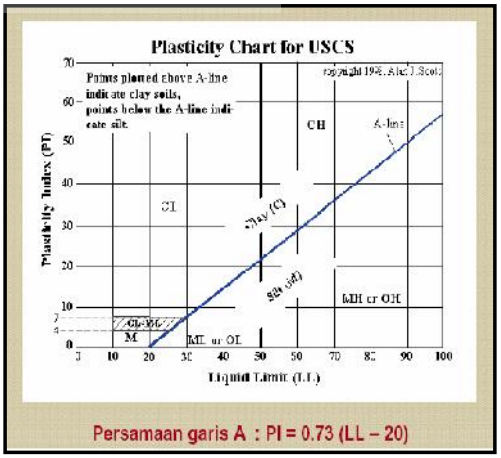
Clasification : CH





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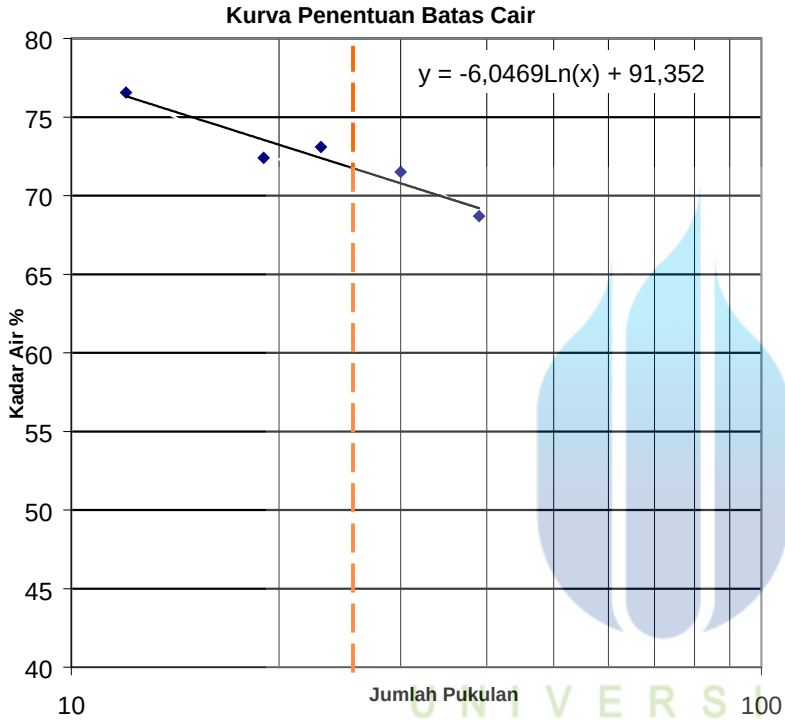
ATTERBERG LIMITS

PROJECT : GEDUNG 8 LANTAI
LOCATION : JL.GARUDA , KEMAYORAN
DATE 0
TESTED BY 0
Drilling No. : BH-1
Depth : 3,50-4,00 M



DARI GRFIK DIDAPAT :

LIQUIT LIMIT (LL)	: 71,89	%
PLATIC LIMIT (PL)	: 32,27	%
PLASTICITY INDEX (IP)	: 39,62	%

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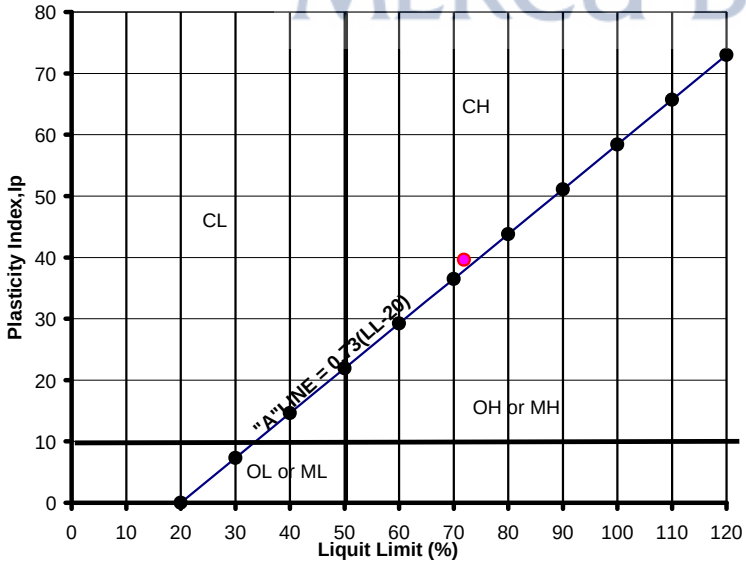
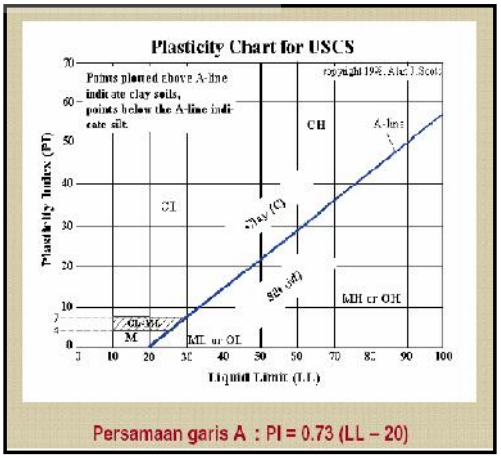
Clasification : CH

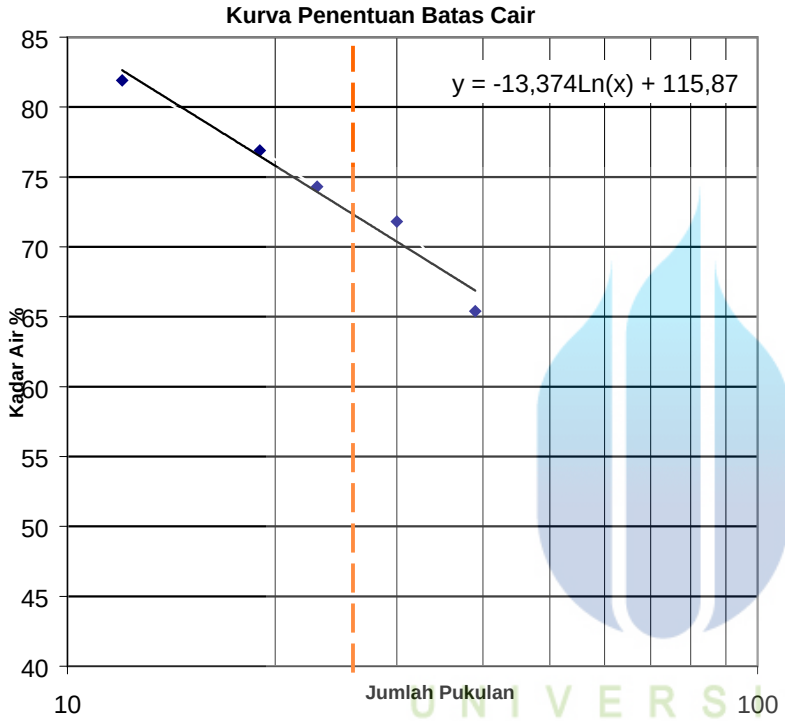




http://digilib.mercubuana.ac.id/

ATTERBERG LIMITS

PROJECT : GEDUNG 8 LANTAI
LOCATION : JL.GARUDA , KEMAYORAN
DATE 0
TESTED BY 0
Drilling No. : BH-1
Depth : 5,50-6,00 M



DARI GRFIK DIDAPAT :

LIQUIT LIMIT (LL)	: 72,82	%
PLATIC LIMIT (PL)	: 33,17	%
PLASTICITY INDEX (IP)	: 39,65	%

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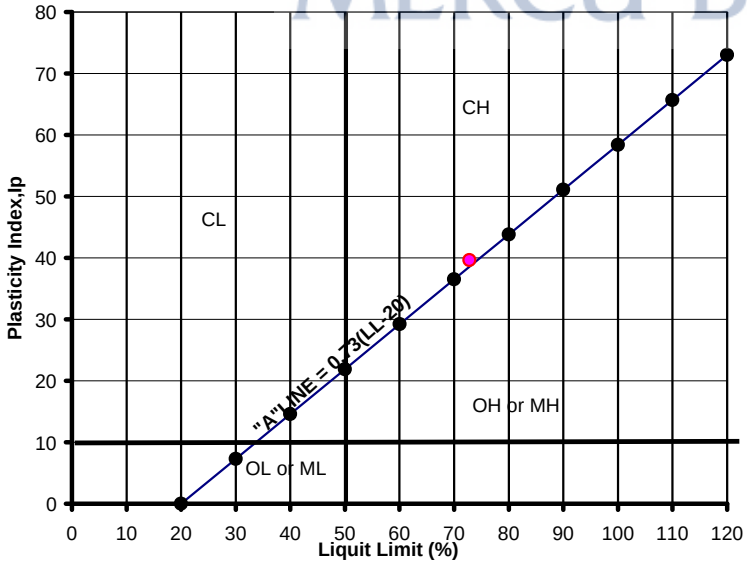
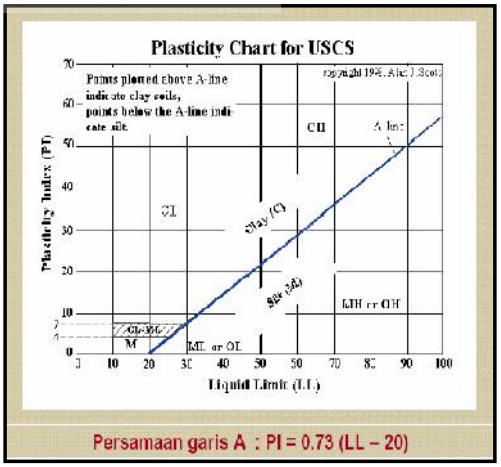
Clasification : CH





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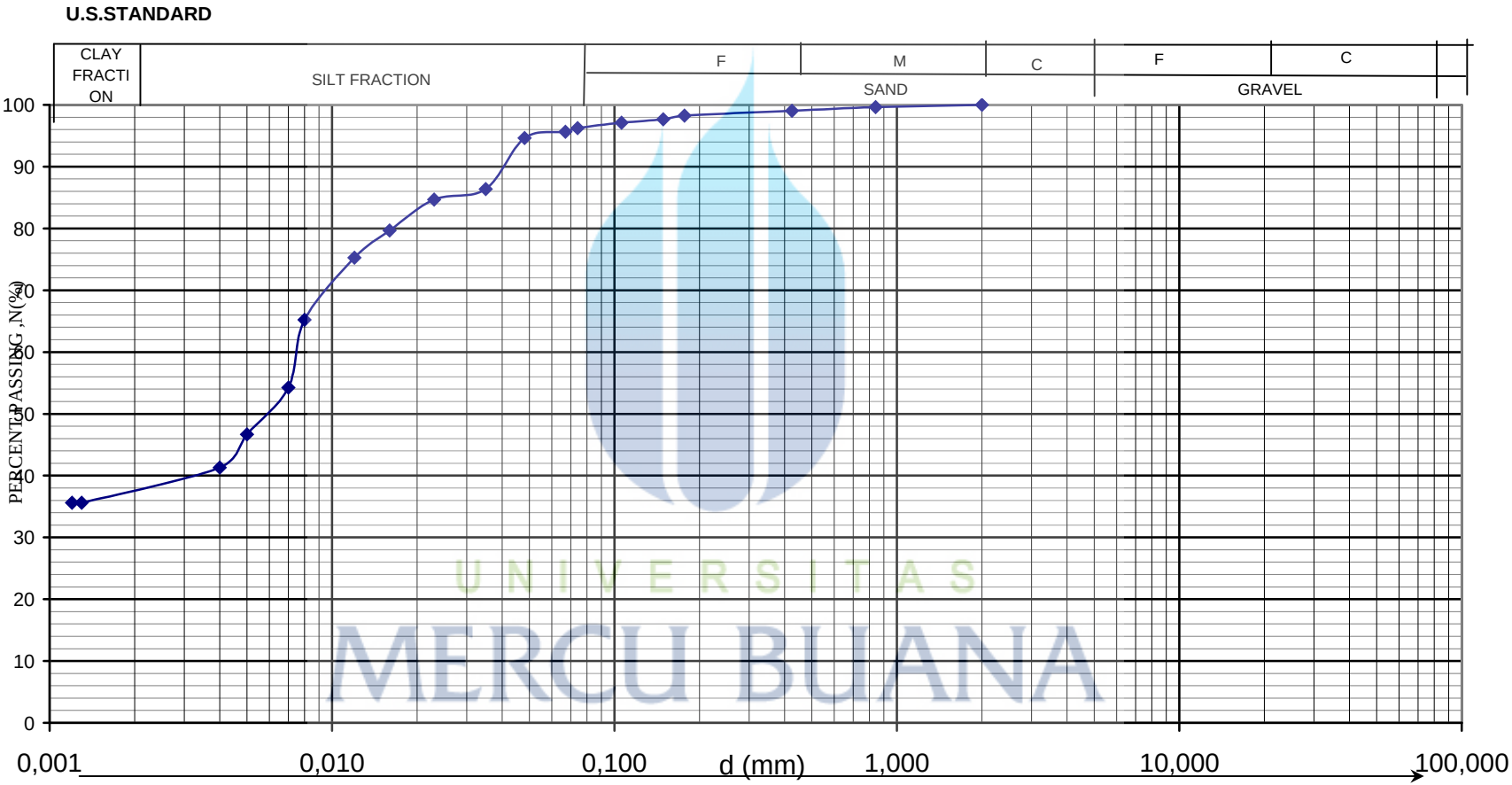
GRAINSIZE DISTRIBUTION CURVE

Project	:	GEDUNG 8 LANTAI	Drilling No.	DB-1	
Location	:	JL.GARUDA , KEMAYORAN	Depth	1,50-2,00	m



Gravel	% = 0,00	Silt	% = 58,73	d60 =	mm
Sand	% = 3,77	Clay	% = 37,50	d10 =	mm
Fines	% = 96,23			Cu =	

petrus marpaung

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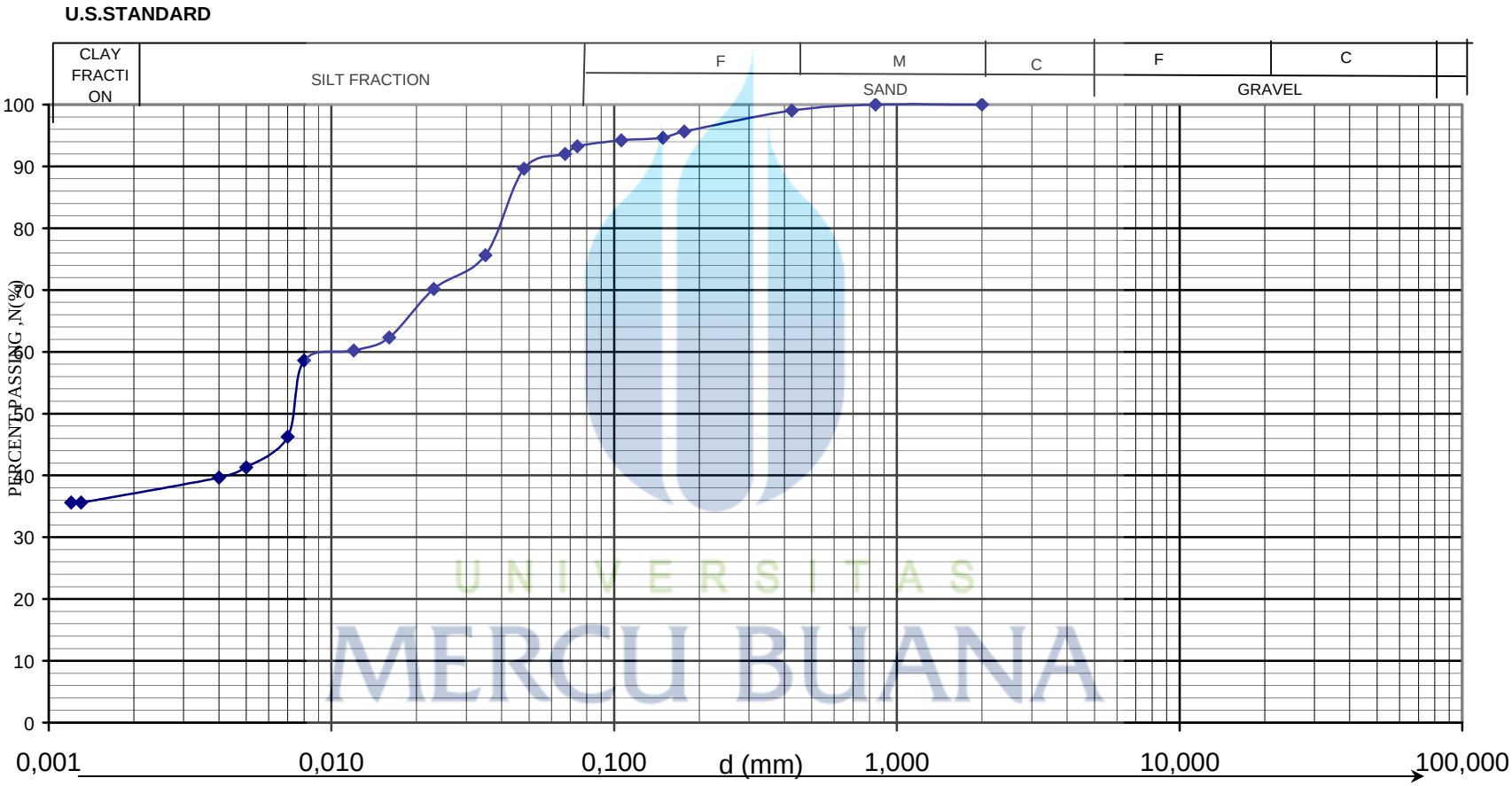
GRAINSIZE DISTRIBUTION CURVE

Project	:	GEDUNG 8 LANTAI	Drilling No.	DB-1	
Location	:	JL.GARUDA , KEMAYORAN	Depth	3,50-4,00	m



Gravel	% = 0,00	Silt	% = 56,26	d60 =	mm
Sand	% = 6,74	Clay	% = 37,00	d10 =	mm
Fines	% = 93,26			Cu =	

petrus marpaung

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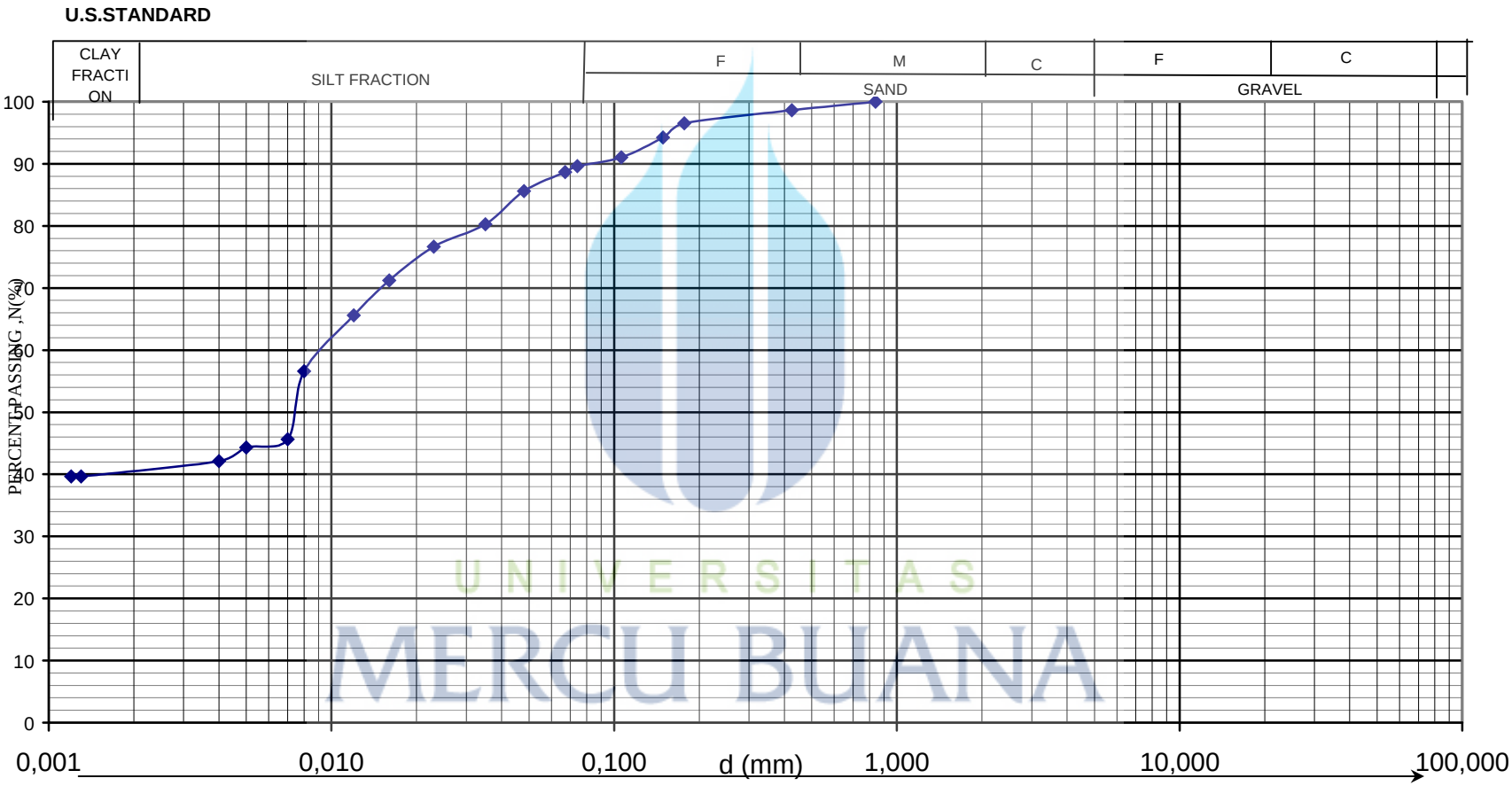
GRAINSIZE DISTRIBUTION CURVE

Project	:	GEDUNG 8 LANTAI	Drilling No.	DB-1	
Location	:	JL.GARUDA , KEMAYORAN	Depth	5,50-6,00	m



Gravel	% = 0,00	Silt	% = 49,15	d60 =	mm
Sand	% = 10,35	Clay	% = 40,50	d10 =	mm
Fines	% = 89,65			Cu =	

petrus marpaung

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BORING LOG

PROJECT	: PEMBANGUNAN HOTEL	DATE	: 7/8/2012
CLIENT	:	BORING METHOD	:
LOCATION	: JL. RAJAWALI SELATAN NO.1 JAK-PUS	SAMPLING METHOD	:
BORE HOLE NO.	: BH1	SPT	:
ELEVATION	:	DRILLER	:
COORDINATES	:	LOGGER	:
DEPTH	:	REVIEWED BY	:
WATER DEPTH	: -2.0M	DRAWN BY	:

DEPTH M	DEPTH LWS	SYMBOL	ROCK / SOIL DESCRIPTION	N1 VALUE	N2 VALUE	N3 VALUE	BLOWWS
			Urugan puing-puing material				
2.0			Lempung lanau kepasiran, soft, berwarna coklat	1	1	1	2
4.0				1	1	1	2
6.0			Lempung kelanauan, soft, berwarna abu-abu	1	1	1	2
8.0			Pasir kasar, medium dense, berwarna coklat	3	5	8	13
10			Pasir kelanauan, very dense, berwarna hitam	10	20	35	55
12			Batu, hard, berwarna hitam keabuan	60 / 5			>60
14			Pasir kelanauan, very dense, berwarna coklat keabuan	7	11	20	31
16				7	13	20	33
18			Pasir kelanauan, very dense, berwarna hitam keabuan	11	16	34	50
20				10	20	40	60
22				9	26	34	60
24			Pasir kelanauan, very dense, berwarna abu-abu	4	22	38	60
26				10	26	34	60
28				11	16	35	51
30				10	20	35	55
32			Stop bor 30.50m				
34							
36							

SPT N-VALUE

Keterangan :

Undisturbed Sample

Disturbed Sample

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BORING LOG

PROJECT	: PEMBANGUNAN HOTEL	DATE	: 14/8/2012
CLIENT	:	BORING METHOD	:
LOCATION	: JL. RAJAWALI SELATAN NO.1 JAK–PUS	SAMPLING METHOD	:
BORE HOLE NO.	: BH2	SPT	:
ELEVATION	:	DRILLER	:
COORDINATES	:	LOGGER	:
DEPTH	:	REVIEWED BY	:
WATER DEPTH	: –2.10M	DRAWN BY	:

DEPTH LWS	SYMBOL	ROCK / SOIL DESCRIPTION	N1 VALUE	N2 VALUE	N3 VALUE	BLOWWS
		Urugan puing–puing material				
		Lempung lanau kepasiran, soft, berwarna coklat	1	1	1	2
			1	1	1	2
		Lempung kelanauan, soft, berwarna abu–abu	1	1	2	3
		Lempung kelanauan, medium stiff, berwarna coklat keabuan	1	2	3	5
		Pasir kelanauan, dense, berwarna hitam	7	14	20	34
		Batu, hard, berwarna hitam keabuan	60/5			>60
		Pasir kelanauan, very dense, berwarna abu–abu	7	12	16	28
			6	10	22	32
		Batu, koral hard, berwarna hitam keabuan	60/10			>60
		Pasir, dense to very dense, berwarna hitam keabuan	11	21	33	54
			11	22	33	55
			10	20	31	51
			10	20	30	50
			8	16	24	40
			8	18	28	46
		Stop bor 30.50m				

SPT N–VALUE

Keterangan :

Undisturbed Sample

Disturbed Sample

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LAPORAN PENYELIDIKAN TANAH
UNTUK GEDUNG HOTEL & OFFICE TOWER
JL. M.T. HARYONO - CAWANG, JAKARTA TIMUR

MEI 2013

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LAPORAN PENYELIDIKAN TANAH
UNTUK GEDUNG HOTEL & OFFICE TOWER
JL. M.T. HARYONO - CAWANG, JAKARTA TIMUR

MEI 2013

I. PENDAHULUAN

P.T. Waskita Karya (Persero) Divisi Realty telah meminta **PT. SOFOCO** untuk melaksanakan suatu penyelidikan tanah di lokasi rencana di jalan M.T. Haryono Cawang , Jakarta Timur.

Penyelidikan tanah terdiri dari pemboran di empat titik dan yang meliputi seluruh tapak rencana bangunan yang akan terdiri dari bangunan tower dengan 16 lantai berikut dengan besemen 3 level.

Maksud dari penyelidikan ini adalah untuk mendapatkan data dari lapisan tanah dan menentukan jenis pondasi yang paling memadai untuk mendukung bangunan menara ini.

Penyelidikan Tanah dilokasi ini direncanakan akan terdiri dari :

- Pemboran di 4 titik dengan kedalaman 40m di B1/BH1, B2 /BH2, B3/BH3 dan 60m di DB1
- Uji SPT pada interval kedalaman 1,0m atau 1,5m
- Pengambilan contoh tanah tak terganggu (undisturbed samples)
- 9 titik sondir kapasitas 2.5Ton.
- Pengujian tanah dalam laboratorium untuk sifat fisik maupun tekniknya.
- Analisa tanah dan rekomendasi pondasi

Laporan ini memberikan hasil dari penyelidikan tanah yang telah diselesaikan berupa profil bor, grafik sondir, data test laboratorium dan analisa tanah serta rekomendasi kami mengenai pondasi untuk bangunan.

II. PEKERJAAN PENYELIDIKAN TANAH

- **Keadaan Lokasi Penyelidikan Tanah**

  Lokasi tapak proyek ini berada di Cawang Jl. MT Haryono, Cawang- Jakarta Timur. dapat dilihat pada gambar 1. Pada saat dilakukan penyelidikan tanah, keadaan lapangan adalah datar dan sbagian digunakan sebagai lahan parker dan bangunan lantai .

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Gambar 1. Gambar situasi (Vicinity Map) Google dari lokasi Hotel & Office Tower di Cawang

- **Pekerjaan Pemboran dan Pengambilan Contoh Tanah**

Pemboran dilakukan dengan dua unit bor mesin rotary yang menggunakan pembilasan dengan air/ lumpur untuk mengeluarkan tanah pemboran keluar. Diameter lubang bor adalah 100 mm dan pada interval kedalaman 1.0 m dan 1,5 m, dilakukan test SPT (Standard Penetration Test). Pada setiap interval kedalaman 3 m direncanakan pengambilan contoh tanah tidak terganggu (undisturbed sampling) dengan tabung thin wall sampler dalam tanah lempung lunak sampai sedang.

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- **Hasil Dari Pemboran**

Hasil dari pemboran di 4 titik dapat dilihat dalam profil bor dimana tiap lapisan tanah di deskripsi dilihat dari jenis tanah, kepadatan maupun konsistensi dalam nilai SPT. (Lihat Profil bor B1~B3 dan DB1 dalam Lampiran laporan ini.

Gambaran secara menyeluruh mengenai keadaan pelapisan tanah ditapak ini dapat dilihat dalam gambar penampang melintang (cross sectional profile) seperti dapat dilihat pada Gambar 2 dibawah.

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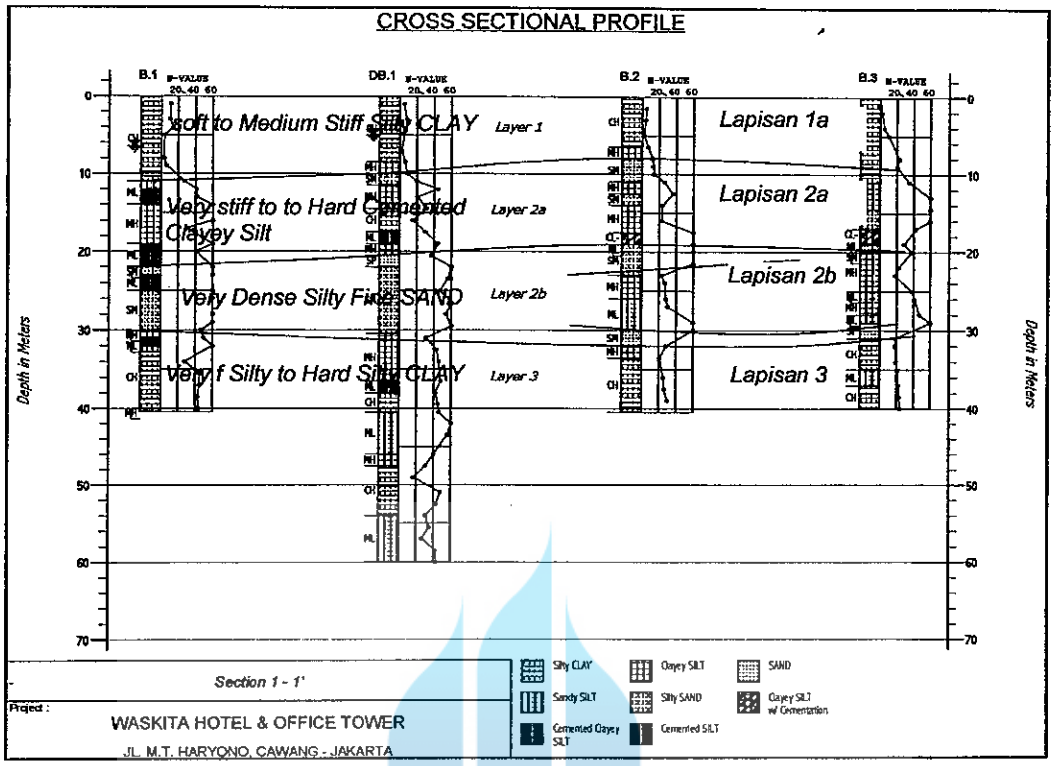

Gambar 2. Potongan melintang dari profil bor melalui B1, DB1, B2 dan B3

Dapat dilihat bahwa terdapat tiga lapisan (strata) tanah spesifik, mulai dari permukaan tanah hingga kedalaman 40m.

Lapisan ke-1 adalah tanah lempung berlanau yang merupakan tanah alluvial (endapan) abu volkanik (tufa) yang terdiri dari dua sub-lapisan 1a dan 1b. Lapisan teratas 1a mulai dari permukaan tanah sampai kedalaman 8~9m merupakan lempung yang mempuyai konsistensi lunak sampai sedang (soft to medium stiff) dan dengan nilai N-SPT = 2 ~9. Tanah yang lunak terutama yang berada dalam level fluktuasi ketinggian air tanah yang pada waktu pengeboran diakukan, air tanah berada pada kedalaman antara 3 sampai 5m dari muka tanah.
Sub-lapisan 1b adalah jenis tanah lempung yang sama seperti Lapisan-1a, tetapi telah mengalami sementasi/oksidasi sehingga menjadi lebih keras dan diklasifikasikan sebagai tanah sedang sampai padat (medium stiff to very stiff Clay) dan dengan nilai N-SPT = 12 ~35
Pada umumnya uji sondir 2,5Ton terhenti dalam sub-lapisan 1b ini.

Lapisan ke-2 merupakan endapan aluvial sungai, dan juga terdiri dari dua sub-lapisan tanah, yaitu pada bagian atas terdiri dari Lanau keras yang telah tersementasi, dan mempunyai konsistensi N-SPT=15 ~ >60. Pada beberapa titik bor dimana tanah kurang tesementasi(di DB1 dan BH2) maka terlihat nilai SPT lebih kecil yaitu N-SPT 15 ~24, Sub-lapisan 2a ini dijumpai pada kedalaman antara 12m hingga 20m.

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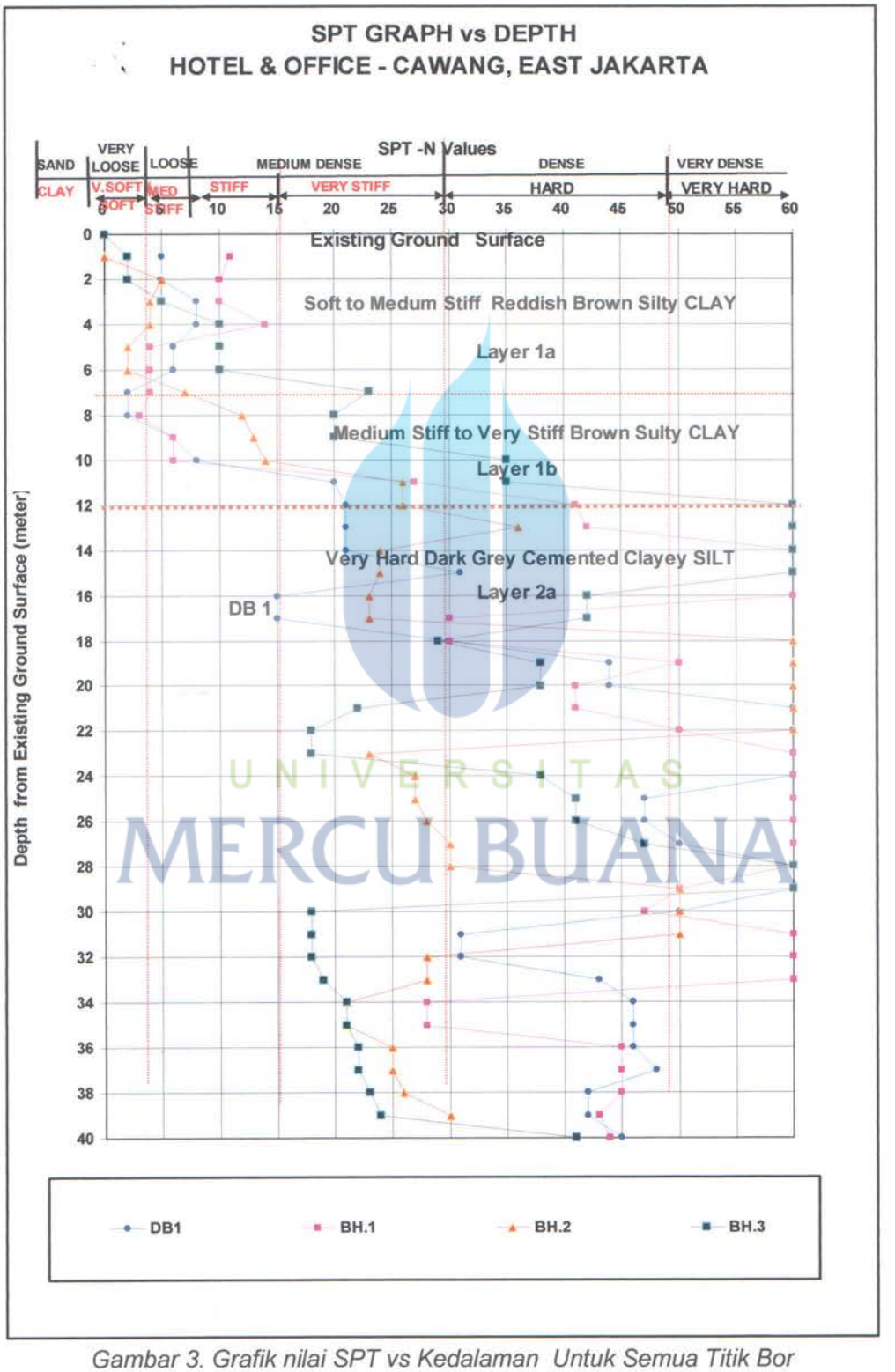
Sub-Lapisan 2-b merupakan tanah endapan sungai, tetapi terdiri dari pasir berlanau yang padat sampai sangat padat (dense to very dense sand) dan sebagian tersementasi dan mempunyai konsistensi N-SPT = 25 ~ >60. Lapisan ini mempunyai tebal kurang lebih 10m, dan terdapat mulai kedalaman 20m sampai 30m dari muka tanah.



Gambar 3. Grafik nilai SPT vs Kedalaman Untuk Semua Titik Bor

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Lapisan ke-3 terdiri dari aluvium sungai (lama) dan telah tersementasi sebagian dan terkonsolidasi berlebih, dan mempunyai konsistensi dengan nilai N-SPT= 20 ~ 45.Lapisan tanah ini mulai kedalaman 30m hingga lebih dari 40m.

- **Uji Pemompaan (Pumping Test)**

Uji pemompaan dilakukan untuk mendapatkan parameter hidrolik air tanah, dilaksanakan dengan membuat sumur pompa sedalam kurang lebih 25m, dan enam sumur pantau sedalam 15m dilokasi ini.

Pemompaan dilakukan selama 2 x 24 jam secara kontinu hingga mendapatkan debit air tanah konstan dan mencapai level kedalaman muka air yang maksimum, baik dilokasi sumur pompa maupun dalam sumur uji.

Hasil dari pemompaan dan pengukuran muka air tanah dapat dilihat dalam lampiran laporan ini, dan dapat disimpulkan mempunyai karaketeristik hidro-geologis sebagai berikut:

Transmisivitas:		304 m2/hari
Storage Coefficient	:	0.06
Permeabilitas	:	7.0×10^{-4} m/detik (medium permeability)
Radius influence	:	40m

Dari data uji pemompaan dapat diketahui bahwa pengaruh dari pemompaan untuk menurunkan air tanah dari level kedalaman kurang lebh 4.0m hingga stabil pada kedalaman 9m setelah pemompaan kontinue selama 48 jam, dan dengan kapasitas 350 ~ 400L/menit.

Jadi untuk dewatering suatu galian sedalam 10m untuk pembuatan besement, di perkirakan dibutuhkan empat buah pompa submersible yang dipasang pada kedalaman 18 -20 m dari muka tanah.

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- **Uji Laboratorium**

Contoh tanah asli yang dapat diambil untuk pengujian di laboratorium adalah dalam tanah lempung yang terdapat sampai kedalaman 6~8m. Selebihnya merupakan tanah lanau yang padat dan mempunyai konsistensi relatip besar (N> 15).

Rangkuman dari hasil test dapat dilihat dalam Tabel 1 dibawah ini, sedang hasil detail dapat dilihat dalam Lampiran laporan ini

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Tabel 1. Parameter Tanah untuk lapisan tanah atas (1.0m sampai 6.0m)

Paramater Tanah	**Soft to MediumStiff Silty Clay (CH) (1 ~ 6m)**
Berat Voluma (kN/m^3)	15.4 – 16.3
Kadar Air (%)	47 – 64
Specific Gravity	2.64 – 2.66
Void Ratio	1.34 ~ 1.82
Limit Plastis	34 ~ 41
Limit Cair	67 ~ 88
Index Plastisitas	32 – 41
Undrained Shear Strength (kN/m^2) –cu	8 ~ 24
Internal Friction (°)	11 ~ 17

Dari tabel diatas dapat disimpulkan bahwa tanah bagian atas, merupakan tanah lempung sedang yang mempunyai plastisitas dan gaya geser (undrained shear strength) yang relatip tinggi (=abu volkanik).

Untuk mengetahui sifat konsolidasi dari lapisan tanah dalam dibawah level rencana pondasi, yaitu dikedalaman 30m dan 50m telah dilakukan uji konsolidasi dengan menggunakan CRS Consolidation, dapat dilihat dalam lampiran laporan ini.

III. ANALISA DAN REKOMENDASI

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. **Rencana Bangunan**

Di tapak ini direncanakan akan dibangun satu tower 16 lantai dan besemen dengan 3 level.

. **Daya Dukung Tanah Dekat Permukaan**

Dari hasil penyelidikan tanah yang dilakukan didapat keadaan lapisan tanah mulai 1m sampai 8m dari muka tanah adalah lunak sampai sedang, dan mempunyai daya dukung tanah izin maksimal = 10 Ton/m^2.

Dengan daya dukung pada lapisan tanah atas dan beban dari bangunan yang besar, maka lapisan tanah atas tidak memadai untuk mendukung bangunan misalnya dengan pondasi mat/raft karena kemungkinan terjadinya penurunan differensial akan besar. Karena itu diperlukan pondasi dalam hingga mencapai tanah keras.

Air tanah selama pengeboran geoteknik dijumpai pada kedalaman 3.0 sampai 4.0m dari muka tanah yang ada.

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- **Pondasi Dalam**

Bangunan Hotel & Office tower dengan 16 lantai akan mempunyai beban yang terkonsentrasi cukup besar sedang lapisan tanah ditapak ini mempunyai konsistensi yang sangat bervariasi dari lunak hingga keras, sehingga pemilihan lapisan tanah pendukung (competent soil bearing layer) dan alternatip pemilihan pondasi dalam perlu dipertimbangkan dengan baik agar memadai dalam pelaksanaannya.

Dapat diketahui bahwa lapisan tanah dengan konsistensi sangat padat dan dengan N-SPT>60 ditapak ini dijumpai pada dua lapisan yaitu lapisan 2a dan lapisan 2b, dan mulai dijumpai pada kedalaman 10~12m dari muka tanah. Tebal lapisan keras 2a dan 2b adalah kurang lebih 20m hingga kedalaman kurang lebh 30m dari permukaaan tanah.
Direncanakan bangunan akan mempunyai besemen 3 lapis, sehingga cut-off level pondasi berada pada kedalaman ~9m dari muka tanah.
Jika akan menggunakan pondasi tiang pancang, maka tiang tidak dapat menembus lapisan 2a, sehingga panjang tiang hanya 2~4m dari cut off level, yang mana pondasi menjadi terlalu pendek.
Jenis pondasi dalam yang dapat menembus tanah cemented adalah jenis pondasi bor berdiameter besar (Bored Pile). Karena itu maka untuk pendukung bangunan 16 lantai ini dianjurkan untuk menggunakan pondasi Tiang Bor.

Lapisan pasir juga dapat menjadi hambatan/ kesulitan pada penggunaan tiang bor terutama untuk lokasi dimana pasir tidak tersementasi, sehingga diperlukan casing atau stabilizing mud untuk mencegah keruntuhan dinding bor pada waktu pengecoran tiang bor.

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Untuk tiang Bor, dapat dipilih variasi ukuran penampang dari 800mm hingga 1200mm dan dapat diperoleh daya dukung aman dengan panjang tiang efektip 20m, yaitu sebesar 200 Ton, 300Ton dan 380 Ton. (Lihat Plate A1, A2 dan A3).

- **Galian untuk Besemen**

Untuk besemen 3 level diperlukan galian hingga kedalaman 9~10m dari muka tanah yang ada.
Karena dilokasi bangunan rencana ini terdapat lempung yang lunak terutama antara kedalaman 3 sampai 7m (lihat data sondir dan profil bor) dan permukaan air tanah terdapat pada kedalaman 3 ~4m dari permukaan tanah, maka diperlukan tindakan khusus untuk kestabilan dan mencegah heave (mumbulnya) dasar galian karena uplift dari tekanan air tanah.
Untuk ini diperlukan penurunan air tanah dalam daerah galian, yaitu dengan dewatering.
Dari test pemompaan yang dilakukan, didapat bahwa rembesan air tanah termasuk sedang sampai besar, yaitu dengan debit 300 sampai 400 liter/menit, untuk sumur submersibel

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dengan diameter 150mm.

Disamping itu pula karena sebagian rencana besemen berada dekat dengan bangunan yang ada, maka kemungkinan terjadi pegerakan tanah lateral, dan dapat men-destabilisasi lereng galian (jika menggunakan open cut method), sehingga dalam hal ini dianjurkan untuk menggunakan dinding penahan tanah, berupa contigous atau secant pile.

Jakarta, 20 Mei 2013

Benny Kumara
Ahli Geoteknik Utama G-2

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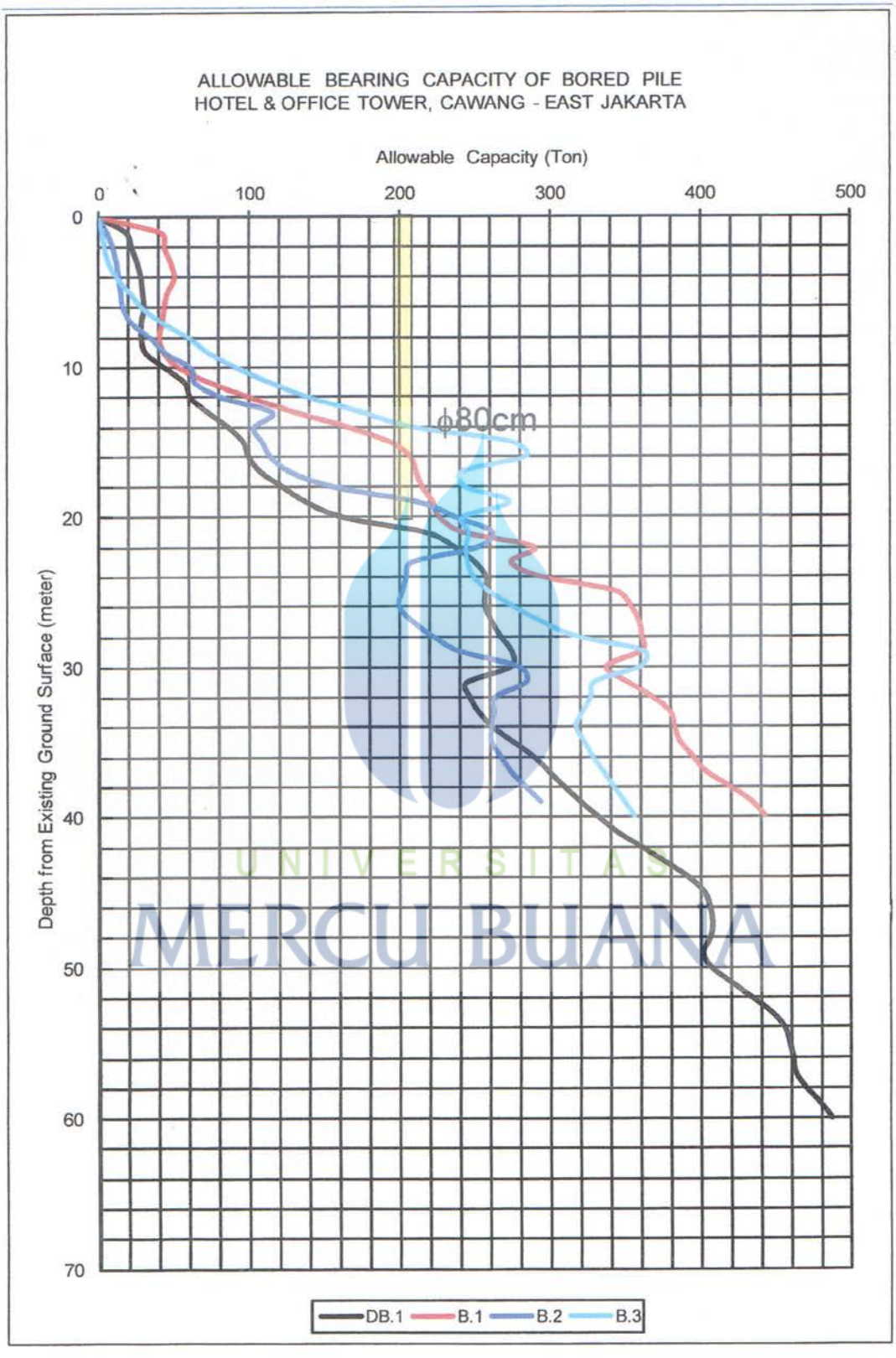

PLATE A1

SOFOCO

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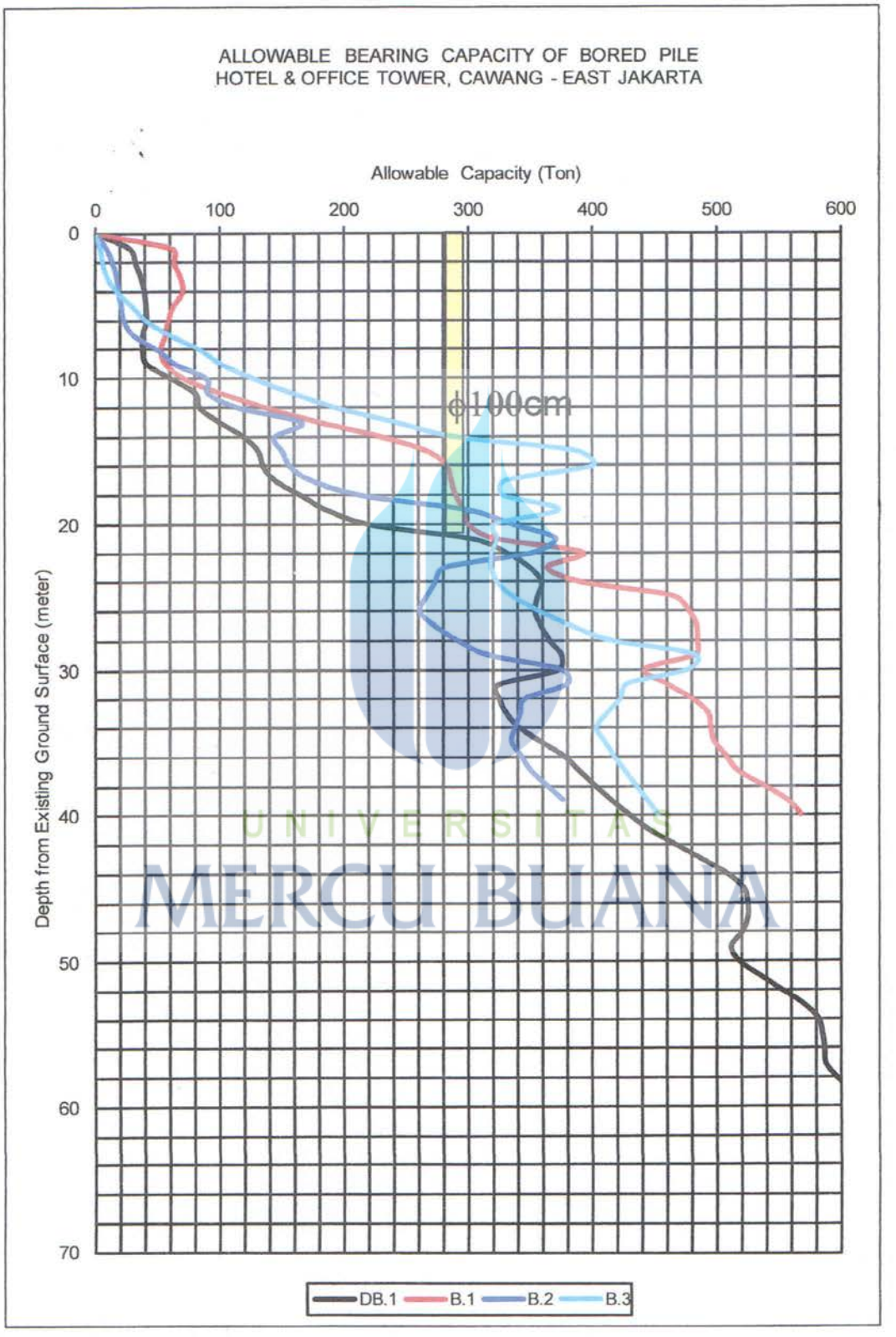

PLATE A2

SOFOCO

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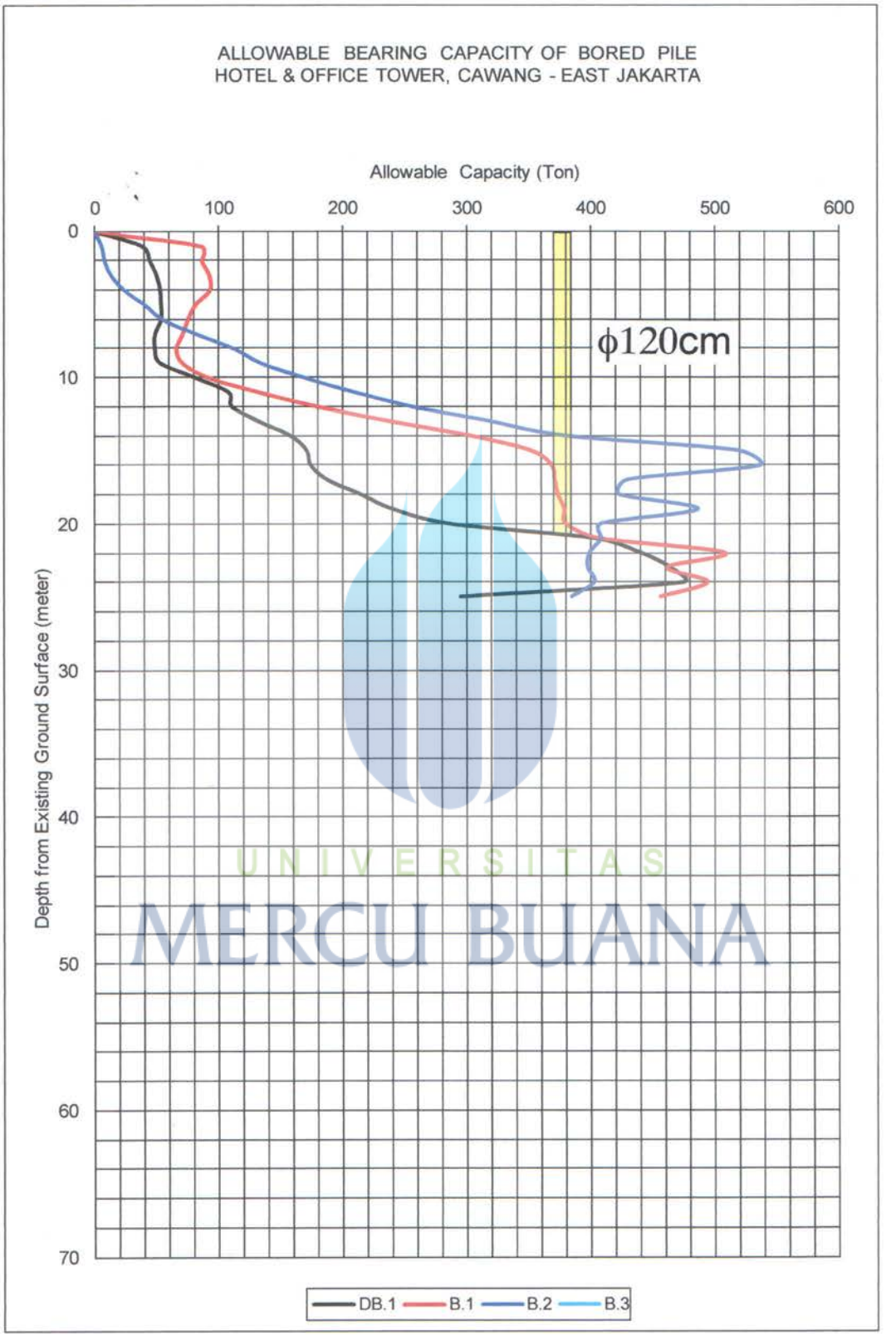
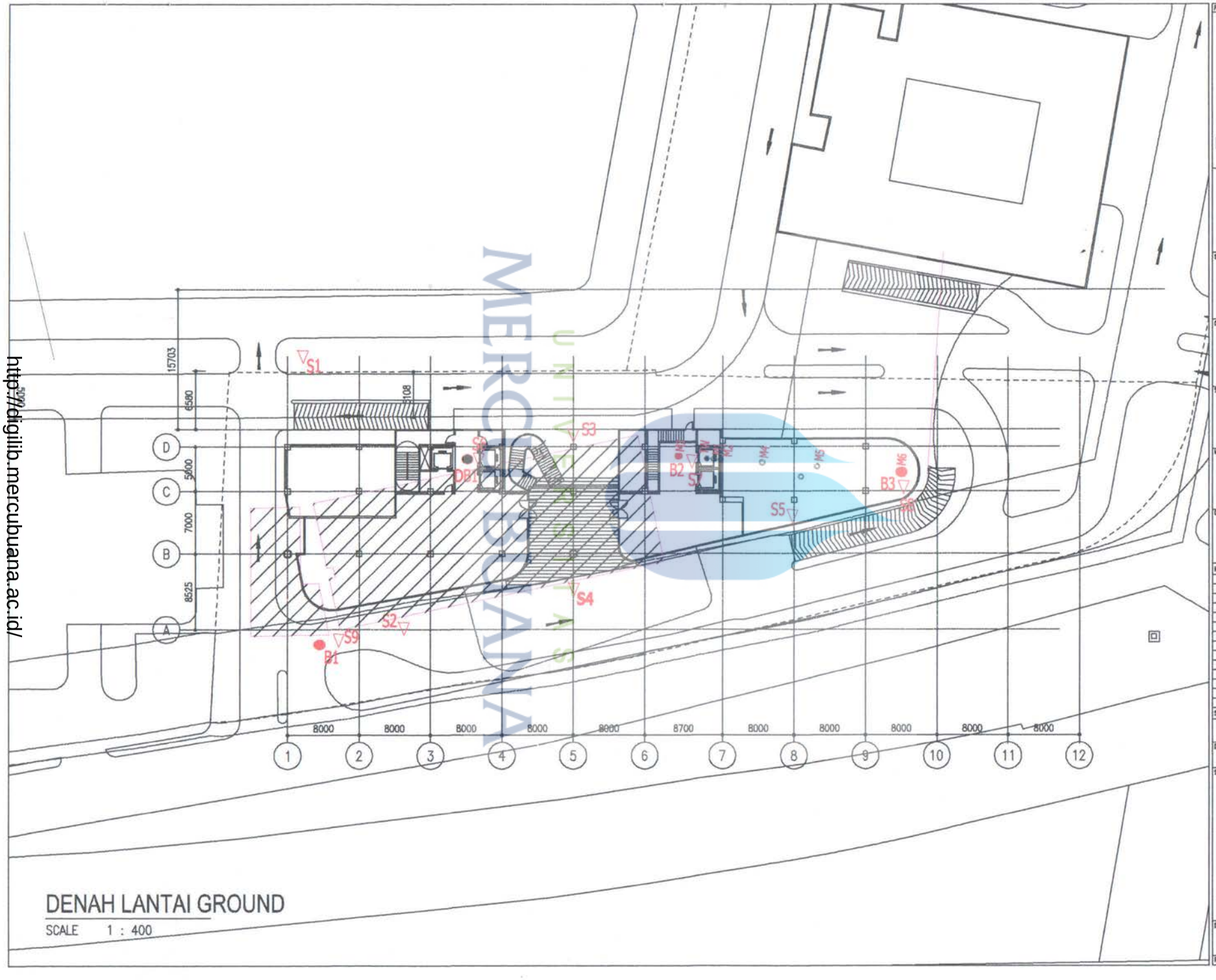


PLATE A3

http://digilib.mercubuana.ac.id/



DENAH LANTAI GROUND

SCALE 1 : 400

PROJECT :

WASKITA
HOTEL & OFFICE TOWER

SHOP ARCHITECT STAMP

OWNER / DEVELOPER :

STRUCTURAL ENGINEER :

MEP ENGINEER :

QUANTITY SURVEYORS :

NO	REVISIONS	DATE

SCALE : A1 A3

DATE :

SHEET TITLE :

DRAWING NO :

FILE NAME :

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Cross Sectional Profile

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MERCU BUANA

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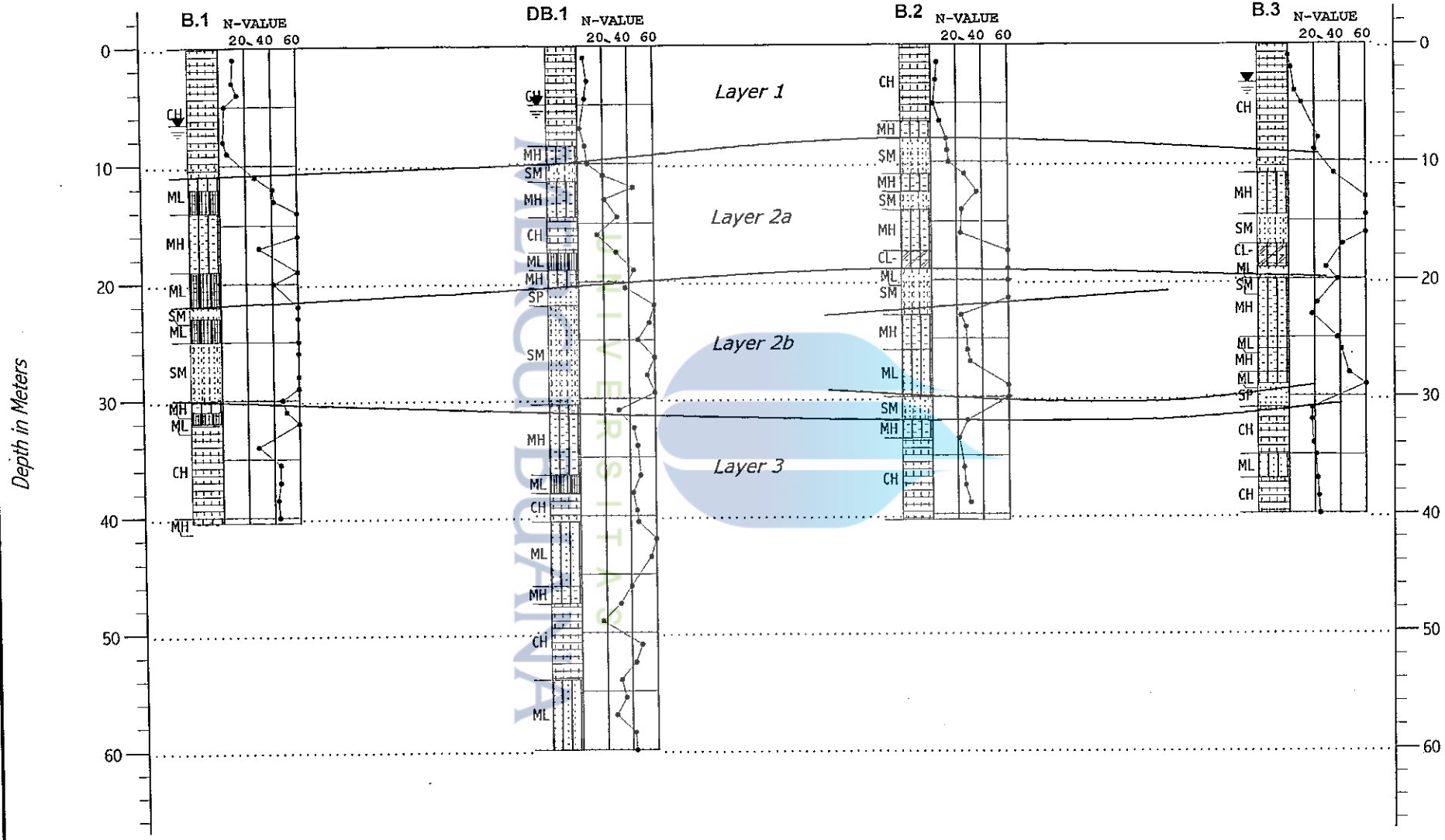
CROSS SECTIONAL PROFILE



Section 1 - 1'

Project :

WASKITA HOTEL & OFFICE TOWER

JL. M.T. HARYONO, CAWANG - JAKARTA

Silty CLAY
Clayey SILT
SAND
Sandy SILT
Silty SAND
Clayey SILT w/ Cementation
Cemented Clayey SILT
Cemented SILT

SOFOCO

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Log of Borings

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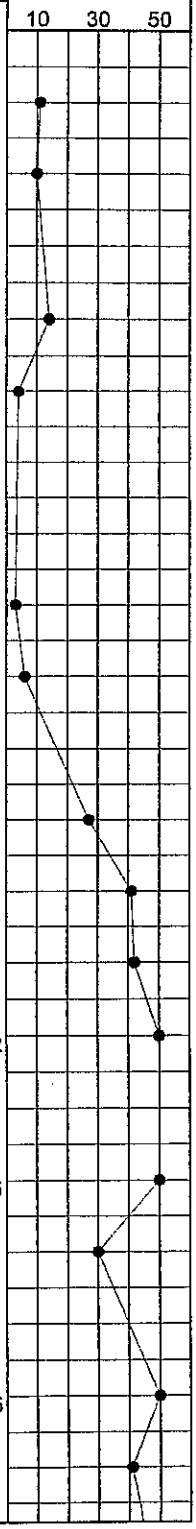
BORING PROFILE

PROJECT : HOTEL & OFFICE TOWER
LOCATION : CAWANG - EAST JAKARTA
BORING No. : B.1
ELEVATION :
G.W.L. : - 6.50 M BELOW GROUND SURFACE

COORDINATE
N =
E =

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
0		0.00			
	4/15 5/15 6/15		Stiff, reddish brown silty clay.	1.00-1.45	11
2	3/15 4/15 6/15		Stiff, brown silty clay.	2.00-2.45	10
				3.00-3.50	UDS
4	4/15 6/15 8/15		Stiff, reddish brown silty clay.	4.00-4.45	14
	2/15 2/15 2/15	CH	Soft, greyish brown silty clay.	5.00-5.45	4
6					
				7.00-7.50	UDS
8	1/15 1/15 2/15		Soft, brown silty clay.	8.00-8.45	3
	1/15 2/15 4/15		Medium stiff, brown silty clay.	9.00-9.45	6
10					
	4/15 8/15 19/15	11.00	Very stiff, brown fine sand clayey silt.	11.00-11.45	27
12	8/15 15/15 26/15	ML	Hard, grey cemented clayey silt.	12.00-12.45	41
	8/15 16/15 26/15		Ditto.	13.00-13.45	42
14	12/15 28/15 22/7	14.00	Very hard, dark grey clayey silt.	14.00-14.37	50/22
				15.50-16.00	UDS
16	15/15 50/15	MH	Very hard, dark grey clayey silt.	16.00-16.30	50/15
	9/15 15/15 15/15		Very stiff, greyish brown clayey silt.	17.00-17.45	30
18				18.00-18.50	UDS
	50/15	19.00	Very hard, blackish dark grey cemented clayey silt.	19.00-19.15	50/15
20	15/15 18/15 23/15	ML	Hard, blackis dark grey clayey silt.	20.00-20.45	41

CURVE



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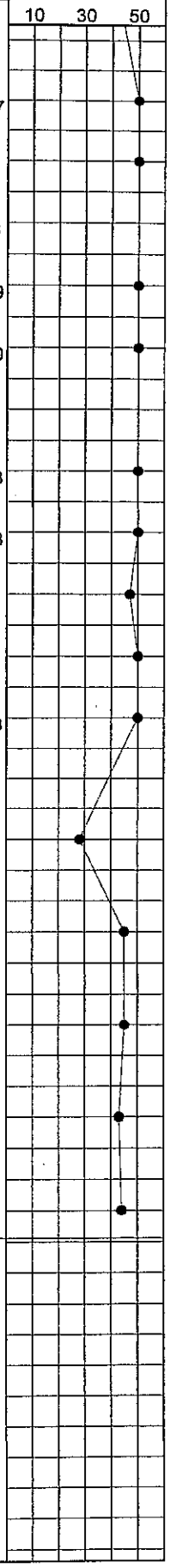
PROJECT :HOTEL & OFFICE TOWER

BORING No. : B.1

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
22	32/15 18/2	22.00 SM	Very dense, black silty sand.	22.00-22.17	50/17
	21/15 50/7	23.00 ML	Very hard, dark grey fine sand cemented clayey silt.	23.00-23.22	50/7
24				24.00-24.50	UDS
	35/15 15/4	25.00	Very dense, black silty fine sand.	25.00-25.19	50/19
26	30/15 20/5	SM	Ditto.	26.00-26.20	50/20
28	40/15 10/3		Very dense, black silty sand.	28.00-28.18	50/18
	38/15 12/3		Ditto.	29.00-29.18	50/18
30	17/15 20/15 27/15	30.00 MH	Hard, dark grey clayey silt.	30.00-30.45	47
	19/15 24/15 26/15	31.00 ML	Very hard, dark grey cemented clayey silt.	31.00-31.45	50
32	19/15 30/15 20/9	32.00	Very hard, grey silty clay.	32.00-32.39	50/18
				33.50-34.00	UDS
34	9/15 12/15 16/15		Very stiff, greyish brown silty clay.	34.00-34.45	28
36	12/15 18/15 27/15	CH	Hard, greyish light brown silty clay.	35.50-35.95	45
	9/15 12/15 24/15		Ditto.	37.00-37.45	45
38	13/15 19/15 24/15		Ditto.	38.50-38.95	43
40	15/15 19/15 25/15	40.00 MH	Hard, greyish brown clayey silt.	40.00-40.45	44
		40.45	Boring terminated at a depth of 40.45 m, on March 01-06, 2013.		
42					
44					

CURVE



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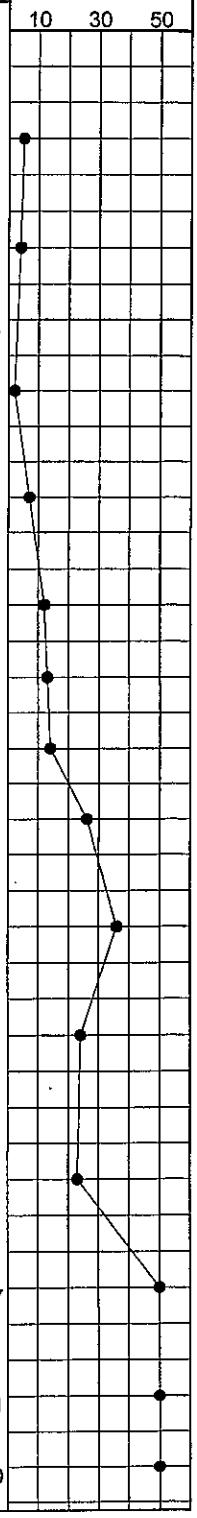
BORING PROFILE

PROJECT : HOTEL & OFFICE TOWER
LOCATION : CAWANG - EAST JAKARTA
BORING No. : B.2
ELEVATION :
G.W.L. : - 3.82 M BELOW GROUND SURFACE

COORDINATE
N =
E =

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
0	0.00			
2	2/15 2/15 3/15	Medium stiff, reddish brown silty clay.	1.50-1.95	5
	1/15 1/15 3/15 CH	Soft, reddish brown silty clay.	3.00-3.45	4
4			4.00-4.50	UDS
	1/15 1/15 1/15	Soft, greyishbrown silty clay.	5.00-5.45	2
6	2/15 3/15 4/15 6.50 MH	Medium stiff, brown clayey silt.	6.50-6.95	7
8	4/15 5/15 7/15 8.00	Medium dense, whitish brown silty sand.	8.00-8.45	12
	5/15 6/15 7/15 SM	Ditto.	9.00-9.45	13
10	5/15 6/15 8/15	Ditto.	10.00-10.45	14
	6/15 7/15 19/15 11.00 MH	Very stiff, dark grey clayey silt.	11.00-11.45	26
12	8/15 18/15 18/15 12.50 SM	Dense, dark grey silty fine sand.	12.50-12.95	36
14	6/15 10/15 14/15 14.00	Very stiff, dark grey clayey silt.	14.00-14.45	24
			15.00-15.50	UDS
16	7/15 10/15 13/15 MH	Ditto.	16.00-16.45	23
18	15/15 36/15 14/2 17.50 CL-ML	Very hard, blackish grey clayey silt with cementation.	17.50-17.82	50/17
	15/15 28/15 22/6 19.00	Very dense, black silty fine sand.	19.00-19.36	50/21
20	16/15 28/15	Very dense, black silty fine sand.	20.00-20.35	50/20



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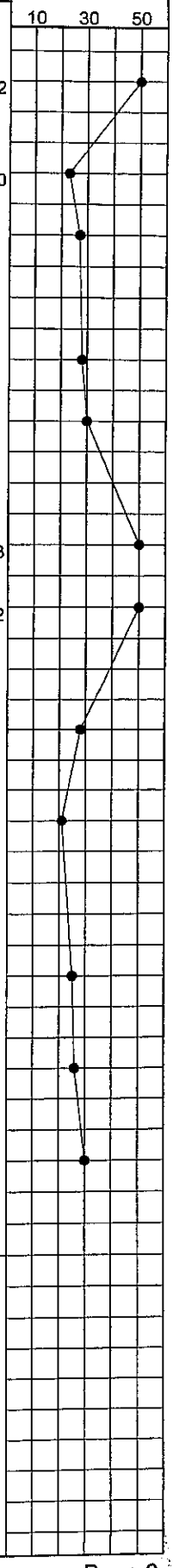
PROJECT : HOTEL & OFFICE TOWER

BORING No. : B.2

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
	22/5 SM			
22	15/15 27/15 23/7	Ditto.	21.50-21.87	50/22
	7/15 9/15 14/15 — 23.00	Very stiff, black dark grey clayey silt.	23.00-23.45	23/30
24	7/15 10/15 17/15 MH	Ditto.	24.00-24.45	27
26	10/15 12/15 16/15 — 26.00	Very stiff, blackish dark grey sandy silt.	26.00-26.45	28
	11/15 14/15 16/15	Ditto.	27.00-27.45	30
28	ML			
	50/13	Very hard, black sandy silt.	29.00-29.13	50/13
30	50/12 — 30.00 SM	Very dense, black silty coarsa sand.	30.00-30.12	50/12
32	9/15 13/15 15/15 — 32.00 MH	Very stiff, yellowish brown clayey silt.	32.00-32.45	28
			33.00-33.50	UDS
34	5/15 9/15 12/15 — 33.50	Very stiff, greyish brown silty clay.	33.50-33.95	21
			35.00-35.50	UDS
36	6/15 10/15 15/15 CH	Ditto.	36.00-36.45	25
38	8/15 11/15 20/15	Ditto.	37.50-37.95	26
	8/15 10/15 20/15	Ditto.	39.00-39.45	30
40			40.00-40.50	UDS
	40.50	Boring terminated at a depth of 40.50 m, on February 23-26, 2013.		
42				
44				

CURVE



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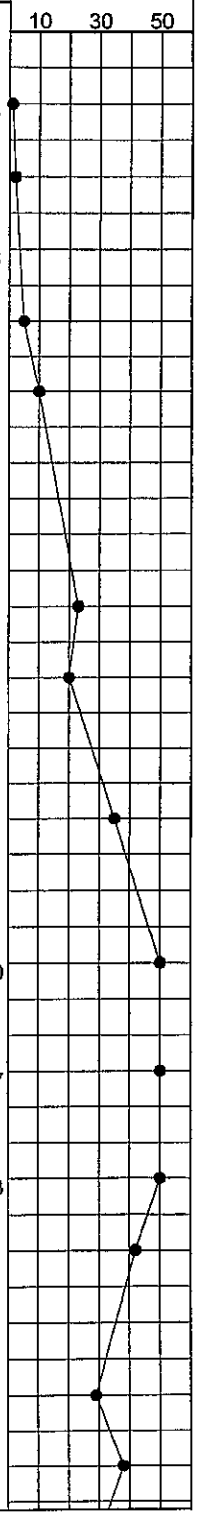
BORING PROFILE

PROJECT : HOTEL & OFFICE TOWER
LOCATION : CAWANG - EAST JAKARTA
BORING No. : B.3
ELEVATION :
G.W.L. : - 3.30 M BELOW GROUND SURFACE

COORDINATE
N =
E =

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
0		0.00			
	1/45		Very soft, brown silty clay.	1.00-1.45	1/45
2	1/30 1/15		Soft, brown silty clay.	2.00-2.45	2
				3.00-3.50	UDS
4	2/15 2/15 3/15		Medium stiff, grey silty clay.	4.00-4.45	5
	1/15 3/15 7/15	CH	Stiff, greyish brown silty clay.	5.00-5.45	10
6				7.00-7.50	UDS
8	9/15 10/15 13/15		Very stiff,brown silty clay.	8.00-8.45	23
	15/15 12/15 8/15		Very stiff, blackish grey silty clay.	9.00-9.45	20
10					
	7/15 15/15 20/15	11.00	Hard, ddark grey clayey silt.	11.00-11.45	35
12				12.00-12.50	UDS
	14/15 30/15 20/5	MH	Very hard, blackish dark grey clayey silt.	13.00-13.35	50/20
14	50/17	14.50	Very dense, black cemented silty fine sand.	14.50-14.67	50/17
16	15/15 27/15 23/8	SM	Ditto.	16.00-16.38	50/23
	10/15 15/15 27/15	17.00	Hard, blackish grey clayey silt with cementantion.	17.00-17.45	42
18		CL-ML		18.00-18.50	UDS
	11/15 14/15 15/15	19.00 SM	Medium dense, blackish grey silty sand.	19.00-19.45	29
20	15/15 18/15	20.00	Hard, blackish dark grey clayey silt.	20.00-20.45	38

CURVE



SOFOCO

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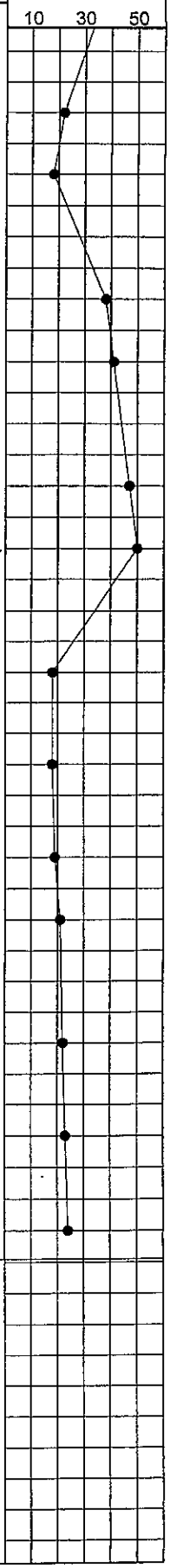
PROJECT : HOTEL & OFFICE TOWER

BORING No. : B.3

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
	20/15			
22	9/15 9/15 13/15 MH	Ditto, very stiff.	22.00-22.45	22
	5/15 7/15 11/15	Very stiff, grey silty clay.	23.00-23.45	18
24			24.00-24.50	UDS
	12/15 18/15 20/15 25.00 ML	Dense, dark grey fine sandy silt.	25.00-25.45	38
26	15/15 18/15 23/15 26.00 MH	Hard, black clayey silt.	26.00-26.45	41
28	14/15 20/15 27/15 28.00 ML	Hard, black cemented fine sandy silt.	28.00-28.45	47
	19/15 37/15 13/2 29.00 SP	Very dense, black sand.	29.00-29.32	50/17
30			30.00-30.50	UDS
	5/15 8/15 10/15 31.00 CH	Very stiff, grey silty clay.	31.00-31.45	18
32	6/15 8/15 10/15	Very stiff, brownish grey silty clay.	32.50-32.95	18
34	7/15 9/15 10/15	Very stiff, grey silty clay.	34.00-34.45	19
	7/15 9/15 12/15 35.00 ML	Very stiff, greyish brown fine sandy silt.	35.00-35.45	21
36	6/15 9/15 13/15 37.00 CH	Very stiff, greyish brown silty clay.	37.00-37.45	22
38	7/15 10/15 13/15	Ditto.	38.50-38.95	23
40	3/15 11/15 13/15 40.45	Ditto.	40.00-40.45	24
42		Boring terminated at a depth of 40.45 m, on February 23-28, 2013.		
44				

CURVE



SOFOCO

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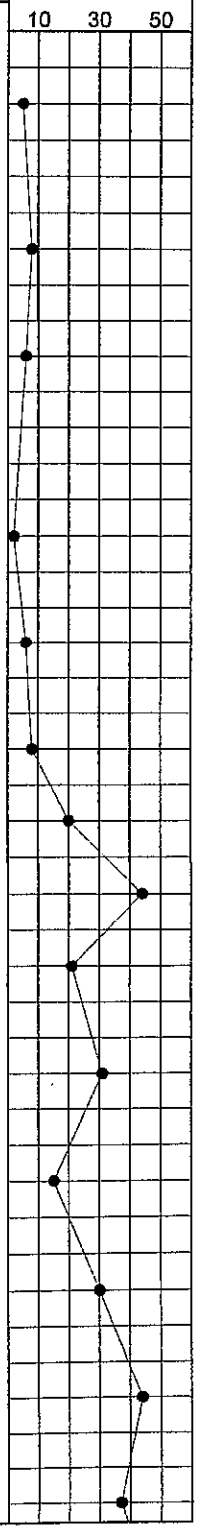
BORING PROFILE

PROJECT : HOTEL & OFFICE TOWER
LOCATION : CAWANG - EAST JAKARTA
BORING No. : DB.1
ELEVATION :
G.W.L. : -5.00 M BELOW GROUND SURFACE

COORDINATE
N =
E =

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
0		0.00			
	1/15 2/15 1/5		Medium stiff, reddish brown silty clay.	1.00-1.35	5
2				2.00-2.50	UDS
	2/15 4/15 4/15		Medium stiff, yellowish brown silty clay.	3.00-3.45	8
4		CH			
	2/15 3/15 3/15		Medium stiff, greyish brown silty clay.	4.50-4.95	6
6				6.00-6.50	UDS
	1/15 1/15 1/15		Soft, brown silty clay.	7.00-7.45	2
8					
	1/15 2/15 4/15	8.50 MH	Medium stiff, brown clayey silt.	8.50-8.95	6
10	2/15 3/15 5/15	10.00 SM	Loose, whitish brown silty fine sand.	10.00-10.45	8
	15/15 9/15 11/15	11.50	Medium dense, dark grey silty sand.	11.00-11.45	20
12	8/15 13/15 31/15		Hard, dark grey clayey silt.	12.00-12.45	44
	2/15 8/15 13/15	MH	Ditto, very stiff.	13.00-13.45	21
14	8/15 13/15 18/15	14.50	Hard, dark grey silty clay.	14.50-14.95	31
16	3/15 6/15 9/15	CH	Stiff, balckish brown silty clay.	16.00-16.45	15
				17.00-17.50	UDS
18	5/15 8/15 22/15	17.50 ML	Very stiff, dark grey cemented silt.	17.50-17.95	30
	11/15 17/15 27/15	19.00 MH	Hard, dark grey clayey silt.	19.00-19.45	44
20	12/15	20.50		20.50-20.95	37

CURVE



SOFOCO

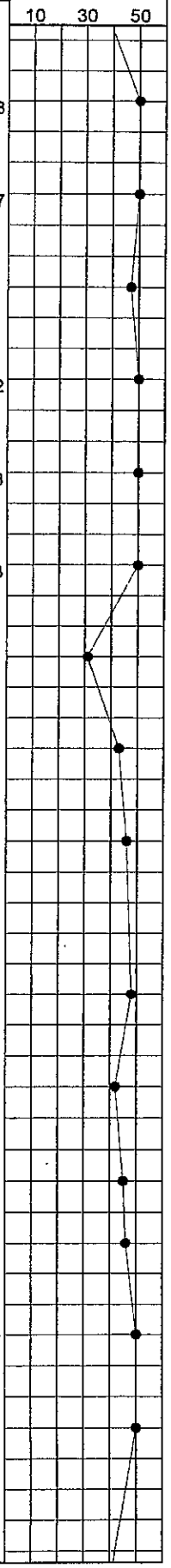
UNIVERSITAS MERCU BUANA
http://digilib.mercubuana.ac.id/

PROJECT :HOTEL & OFFICE TOWER

BORING No. : DB.1

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
	15/15 22/15 SP	Dense, black fine sand.		
22	24/15 33/15 17/3 22.00	Very dense, black silty sand.	22.00-22.33	50/18
24	32/15 18/12	Ditto.	23.50-23.77	50/27
	14/15 18/15 29/15	Dense, black silty fine sand.	25.00-25.45	47
26	SM 16/15 26/15 24/7	Very dense, black silty fine sand.	26.50-26.87	50/22
28	24/15 25/15 25/13	Ditto.	28.00-28.43	50/28
30	34/15 16/8	Ditto.	29.50-29.73	50/23
	30.50 8/15 9/15 22/15	Hard, dark grey clayey silt.	31.00-31.45	31
32	15/15 18/15 25/15 MH	Hard, grey clayey silt.	32.50-32.95	43
34	13/15 18/15 28/15	Hard, light grey clayey silt.	34.00-34.45	46
36			35.50-36.00	UDS
	12/15 19/15 29/15 36.50 ML	Hard, light grey cemented silty clay.	36.50-36.95	48
38	12/15 16/15 26/15 38.00	Hard, light brown silty clay.	38.00-38.45	42
40	CH 13/15 18/15 27/15	Ditto.	39.50-39.95	45
	10/15 17/15 29/15 40.50	Hard, greyish brown fine sandy clayey silt.	40.50-40.95	46
42	20/15 38/15 12/2	Very hard, grey fine sandy clayey silt.	42.00-42.32	50/17
44	ML 13/15 26/15 14/12	Very hard, grey fine sandy silt.	43.50-43.92	50/27
			45.00-45.50	UDS

CURVE



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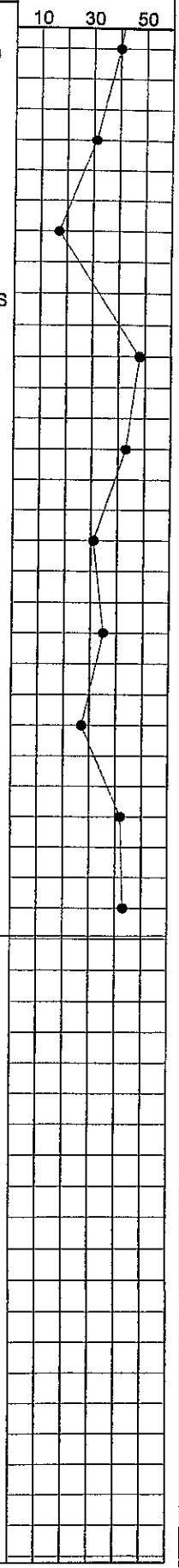
PROJECT :HOTEL & OFFICE TOWER

BORING No. : DB.1

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
46	12/15 15/15 25/15 — 46.00 MH	Hard, greyish brown silty clay.	46.00-46.45	40
48	5/15 12/15 19/15 — 47.50	Hard, dark grey silty clay.	47.50-47.95	31
	5/15 7/15 10/15	Very stiff, dark grey silty clay.	49.00-49.45	17
50	CH		50.00-50.50	UDS
	8/15 15/15 33/15	Herd, dark grey silty clay.	51.00-51.45	48
52	14/15 20/15 23/15	Hat\rd, whitish grey silty clay.	52.50-52.95	43
54	10/15 13/15 18/15 — 54.00	Hard, grey fine sandy silty clay.	54.00-54.45	31
56	11/15 14/15 21/15	Ditto.	55.50-55.95	35
58	8/15 12/15 15/15 — ML	Ditto, Very stiff.	57.00-57.45	27
	10/15 18/15 25/15	Hard, yellowish brown fine sandy silty clay.	58.50-58.95	42
60	11/15 17/15 26/15 — 60.45	Hard, grey fine sandy silty clay.	60.00-60.45	43
		Boring terminated at depth of 60.45 m, on February 28 - March 06, 2013.		
62				
64				
66				
68				
70				

CURVE



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Dutch Cone Penetration Test

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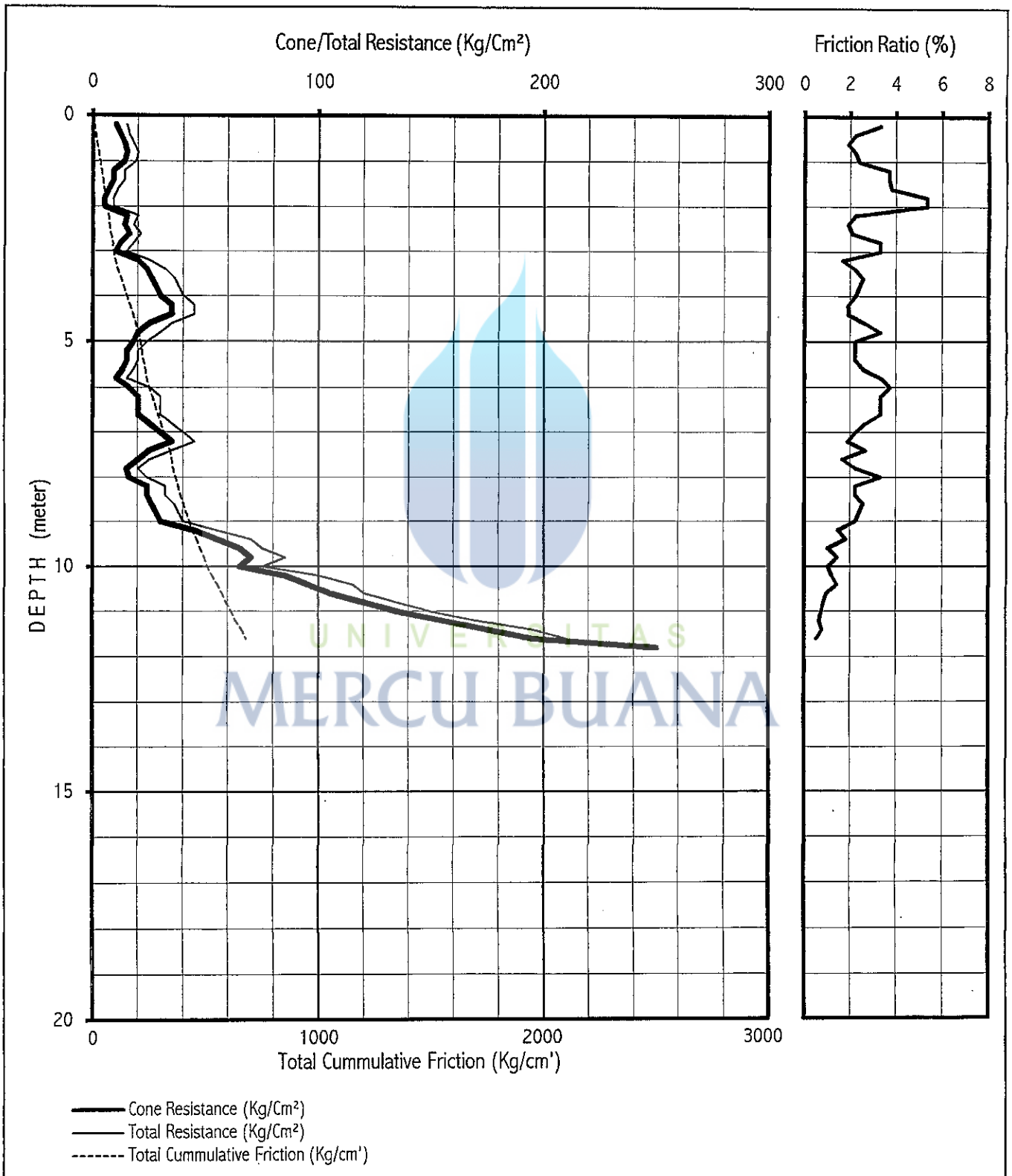
SOFOCO

DUTCH CONE PENETRATION TEST

Project	:	THE WASKITA HOTEL & OFFICE TOWER			
Location	:	JL. M.T. HARYONO, CAWANG - JAKARTA			
Test No.	:	S-1	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	February 23, 2013	Elevation		: -



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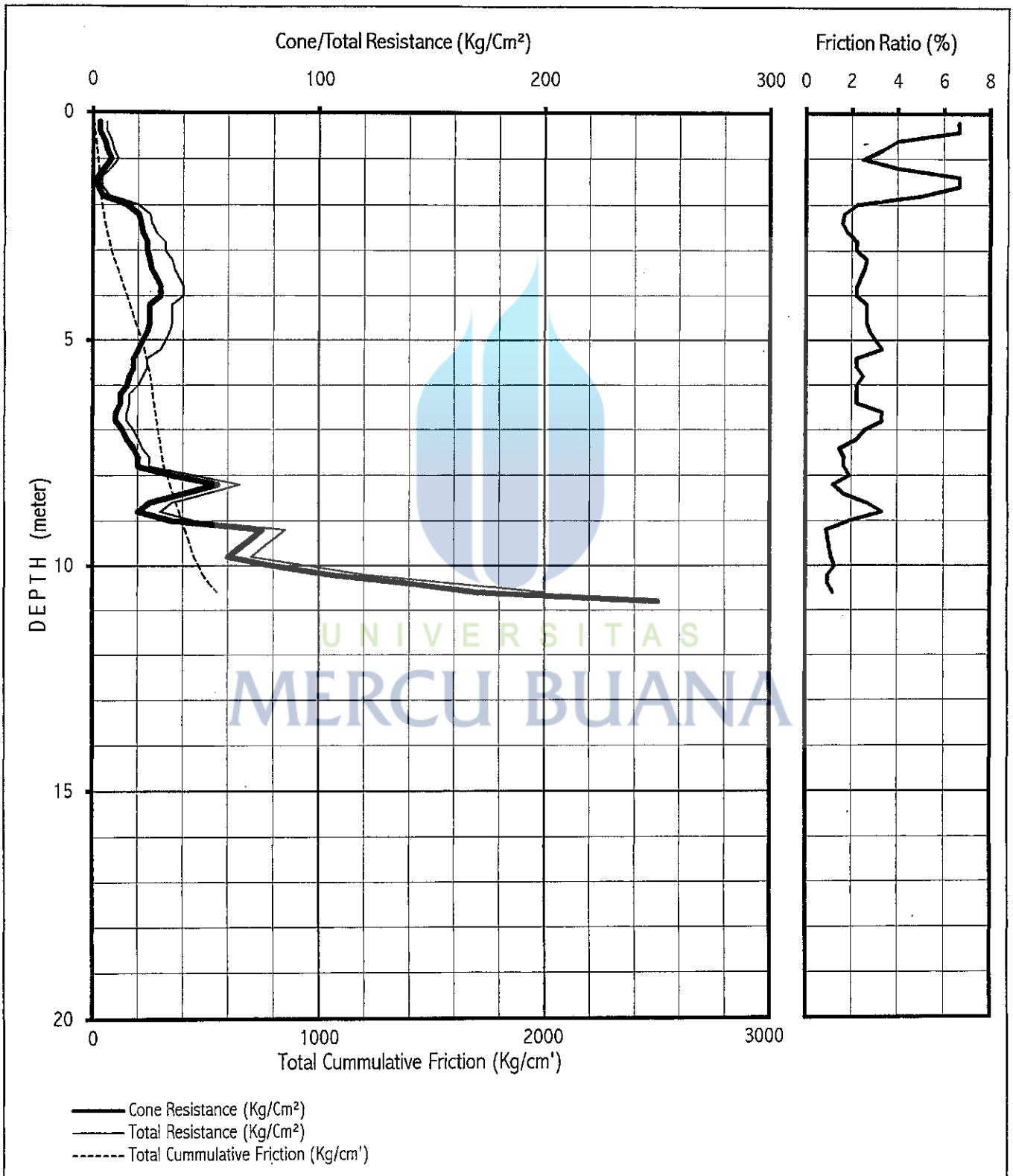
DUTCH CONE PENETRATION TEST

Project	:	THE WASKITA HOTEL & OFFICE TOWER			
Location	:	JL. M.T. HARYONO, CAWANG - JAKARTA			
Test No.	:	S-2	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	February 24, 2013	Elevation		: -



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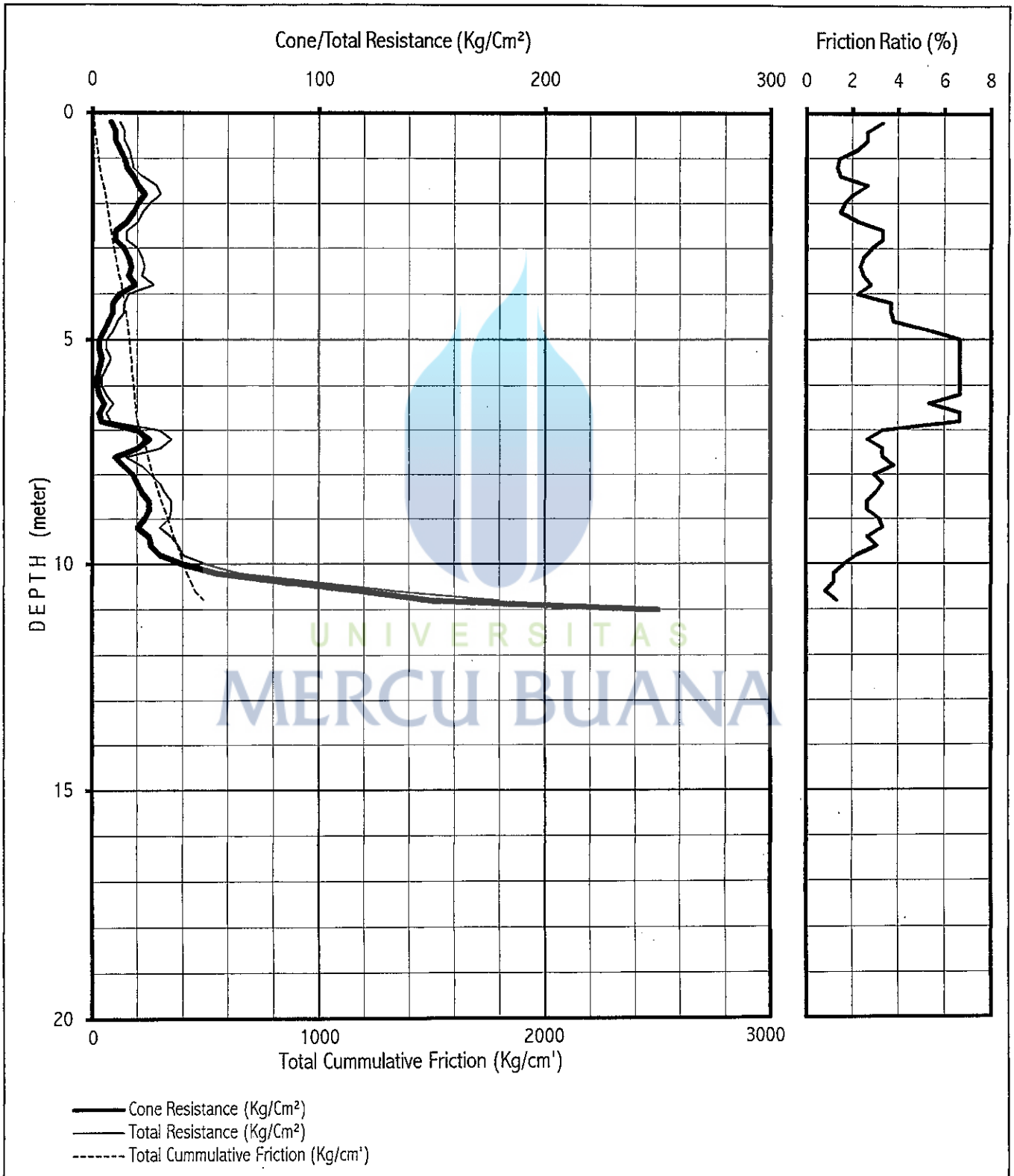
DUTCH CONE PENETRATION TEST

Project	:	THE WASKITA HOTEL & OFFICE TOWER			
Location	:	JL. M.T. HARYONO, CAWANG - JAKARTA			
Test No.	:	S-3	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	February 23, 2013	Elevation		: -



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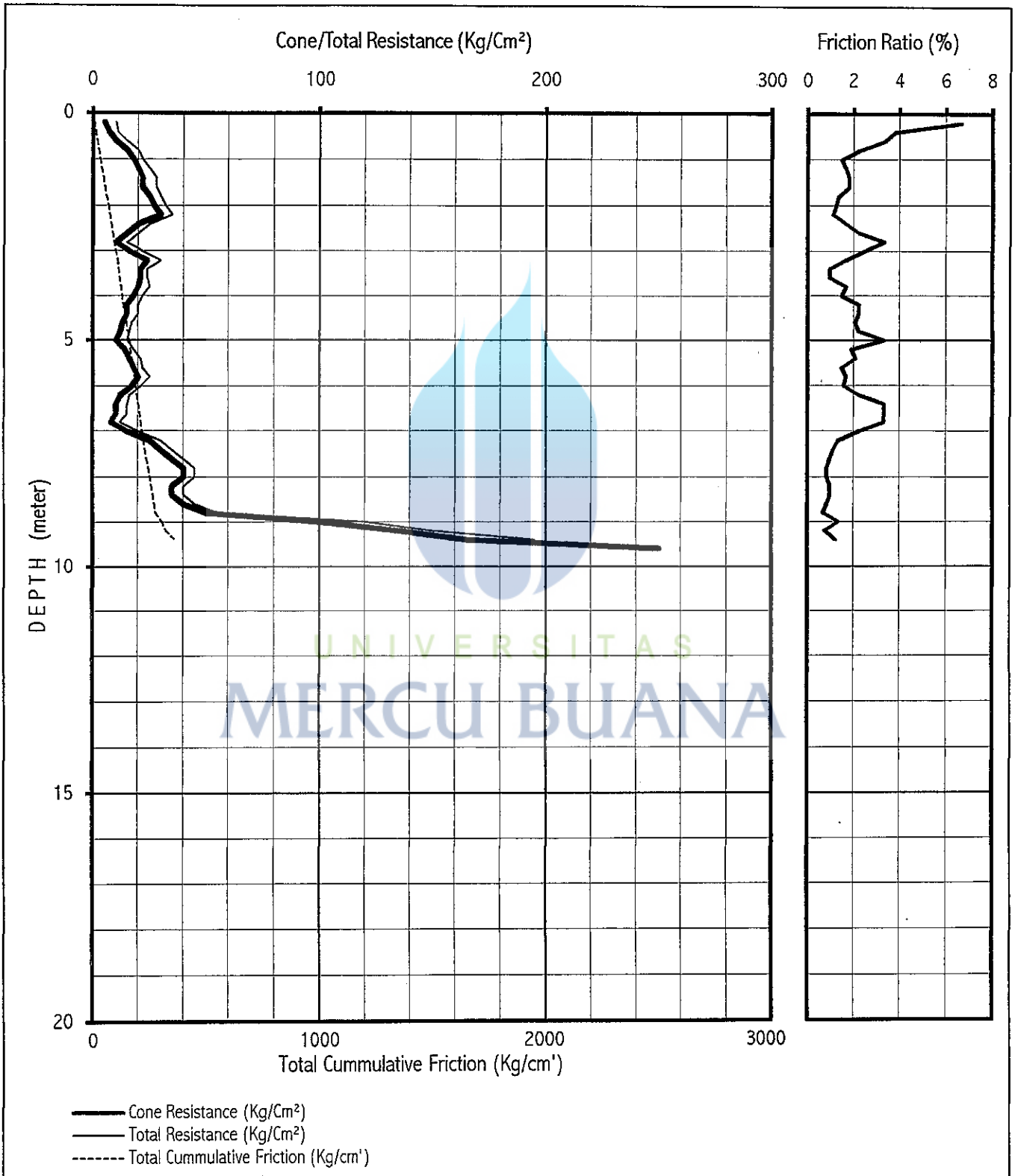
DUTCH CONE PENETRATION TEST

Project	:	THE WASKITA HOTEL & OFFICE TOWER			
Location	:	JL. M.T. HARYONO, CAWANG - JAKARTA			
Test No.	:	S-4	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	February 24, 2013	Elevation		: -



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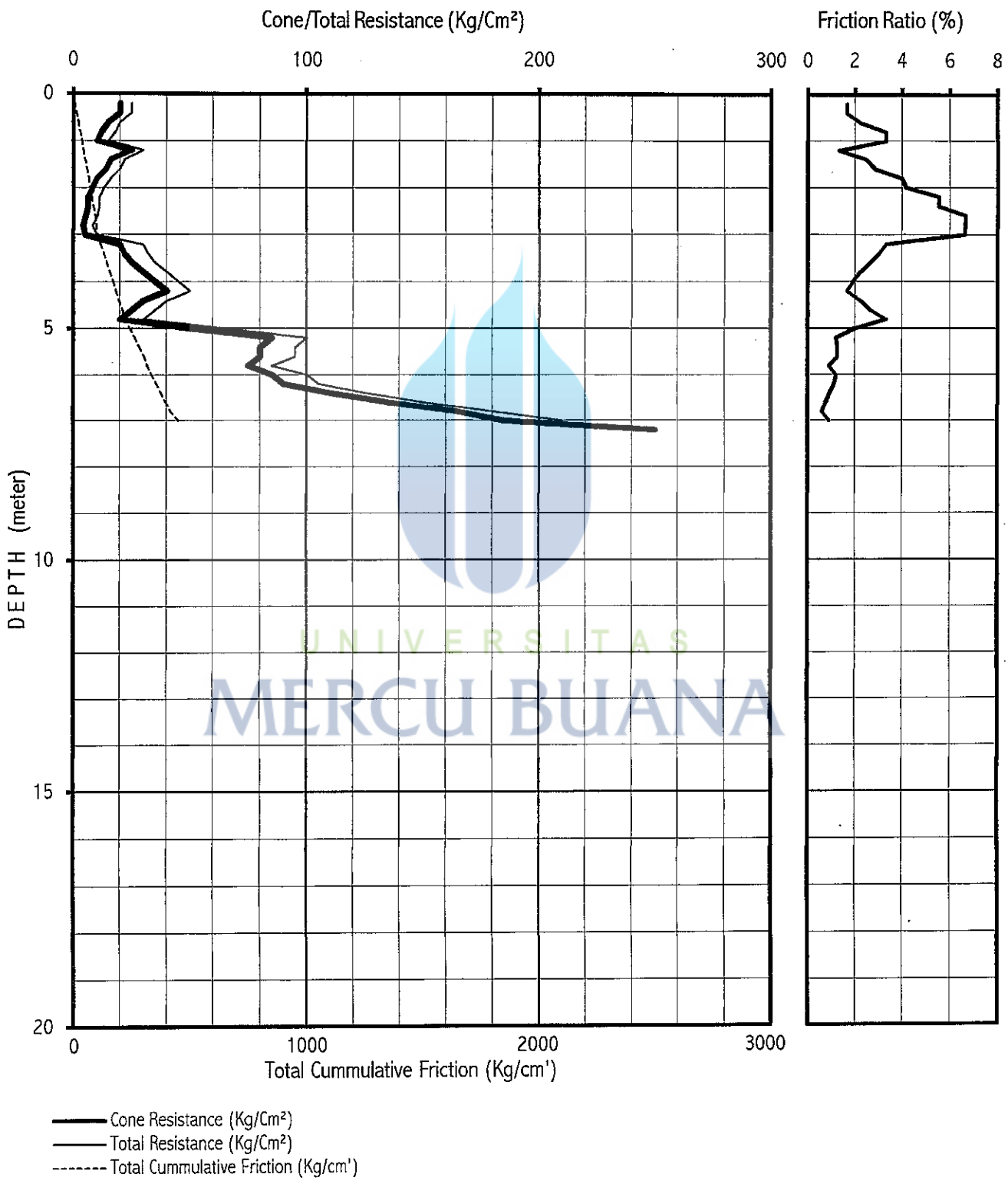
DUTCH CONE PENETRATION TEST

Project	:	THE WASKITA HOTEL & OFFICE TOWER			
Location	:	JL. M.T. HARYONO, CAWANG - JAKARTA			
Test No.	:	S-5	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	March 22, 2013	Elevation		: -



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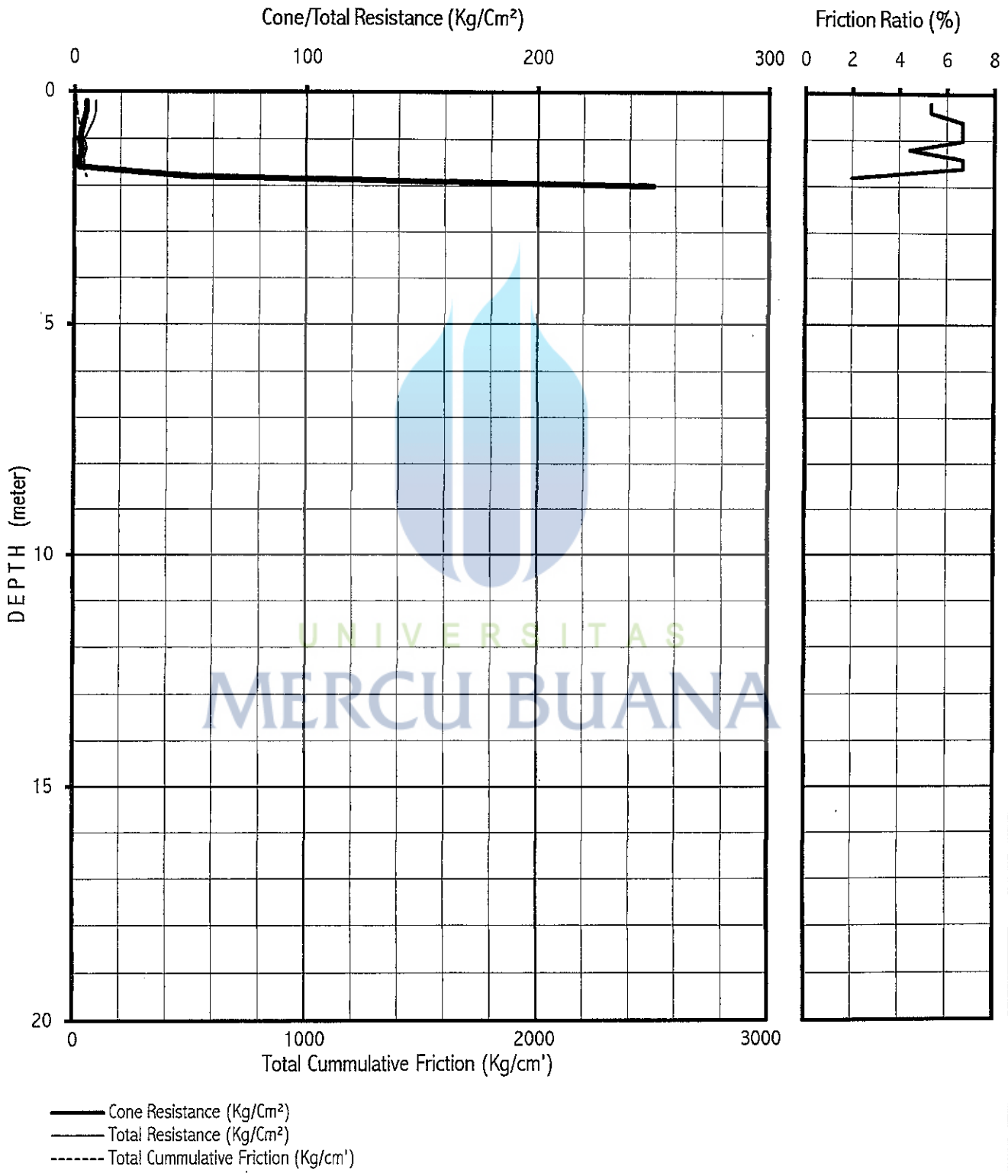
DUTCH CONE PENETRATION TEST

Project	:	THE WASKITA HOTEL & OFFICE TOWER			
Location	:	JL. M.T. HARYONO, CAWANG - JAKARTA			
Test No.	:	S.6/DB.1	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	March 15, 2013	Elevation		: -



SOFOCO

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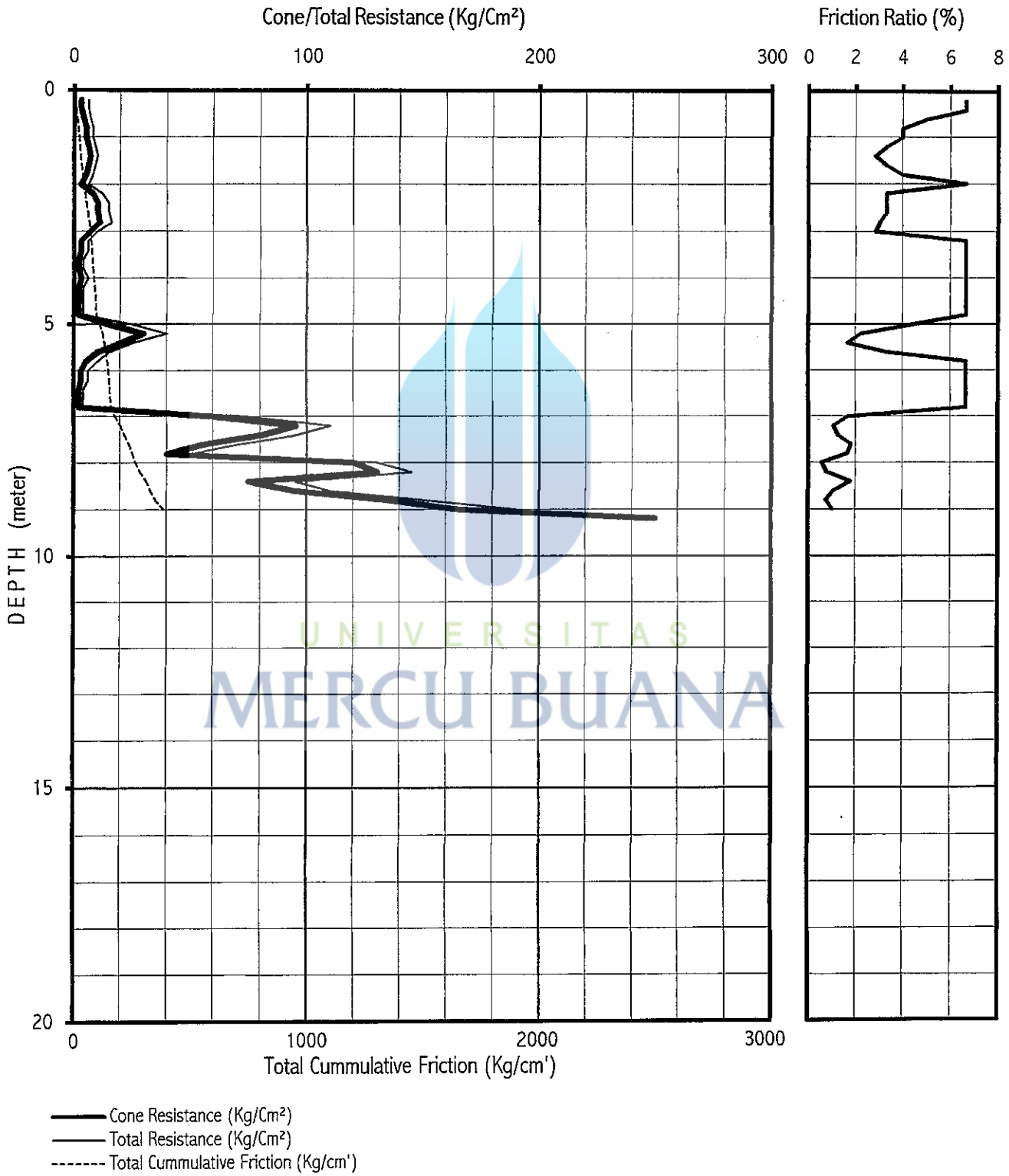
DUTCH CONE PENETRATION TEST

Project	:	THE WASKITA HOTEL & OFFICE TOWER			
Location	:	JL. M.T. HARYONO, CAWANG - JAKARTA			
Test No.	:	S.7/BH.2	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	March 15, 2013	Elevation		: -



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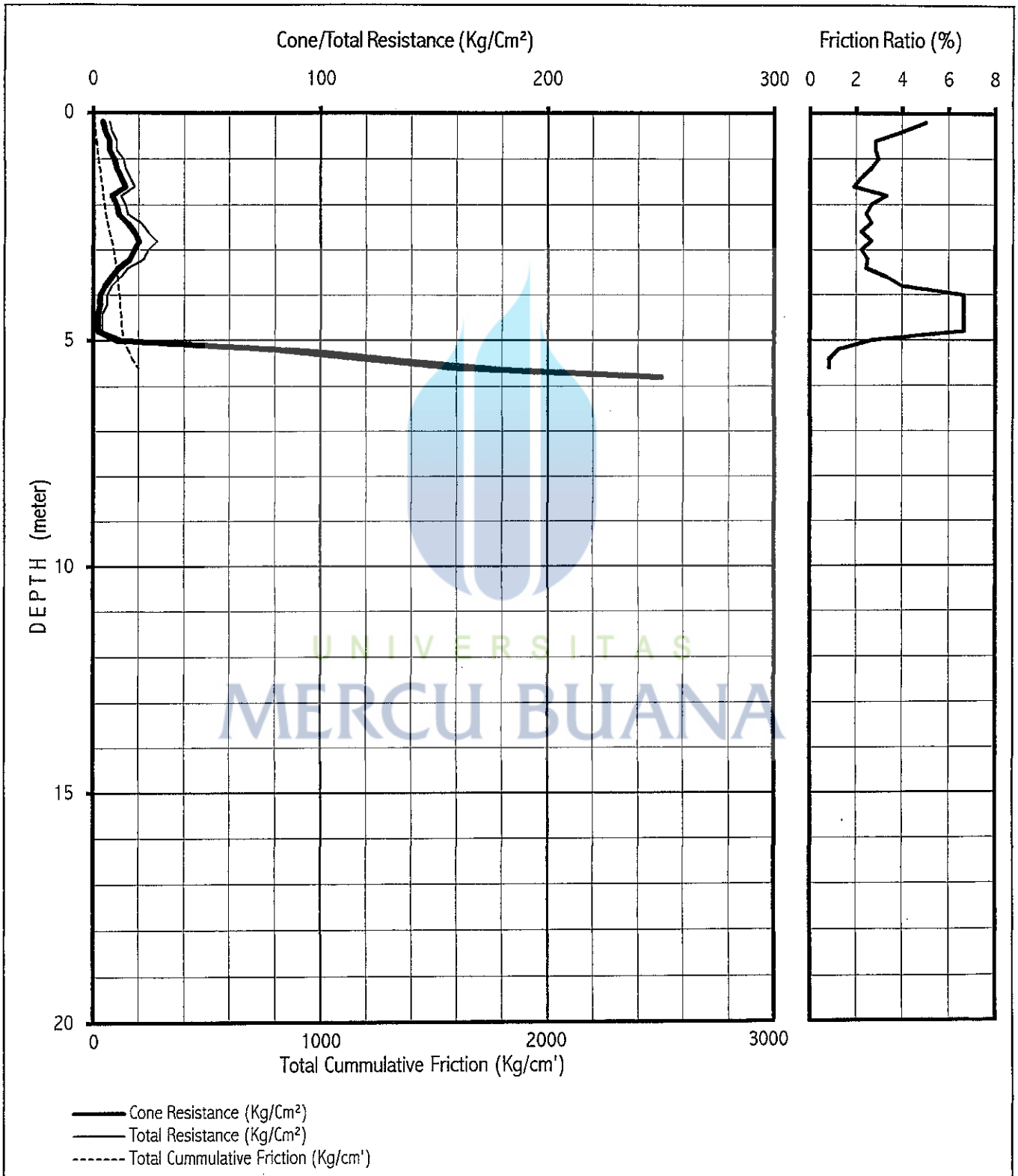
DUTCH CONE PENETRATION TEST

Project	:	THE WASKITA HOTEL & OFFICE TOWER			
Location	:	JL. M.T. HARYONO, CAWANG - JAKARTA			
Test No.	:	S.8/BH.3	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	March 16, 2013	Elevation		: -



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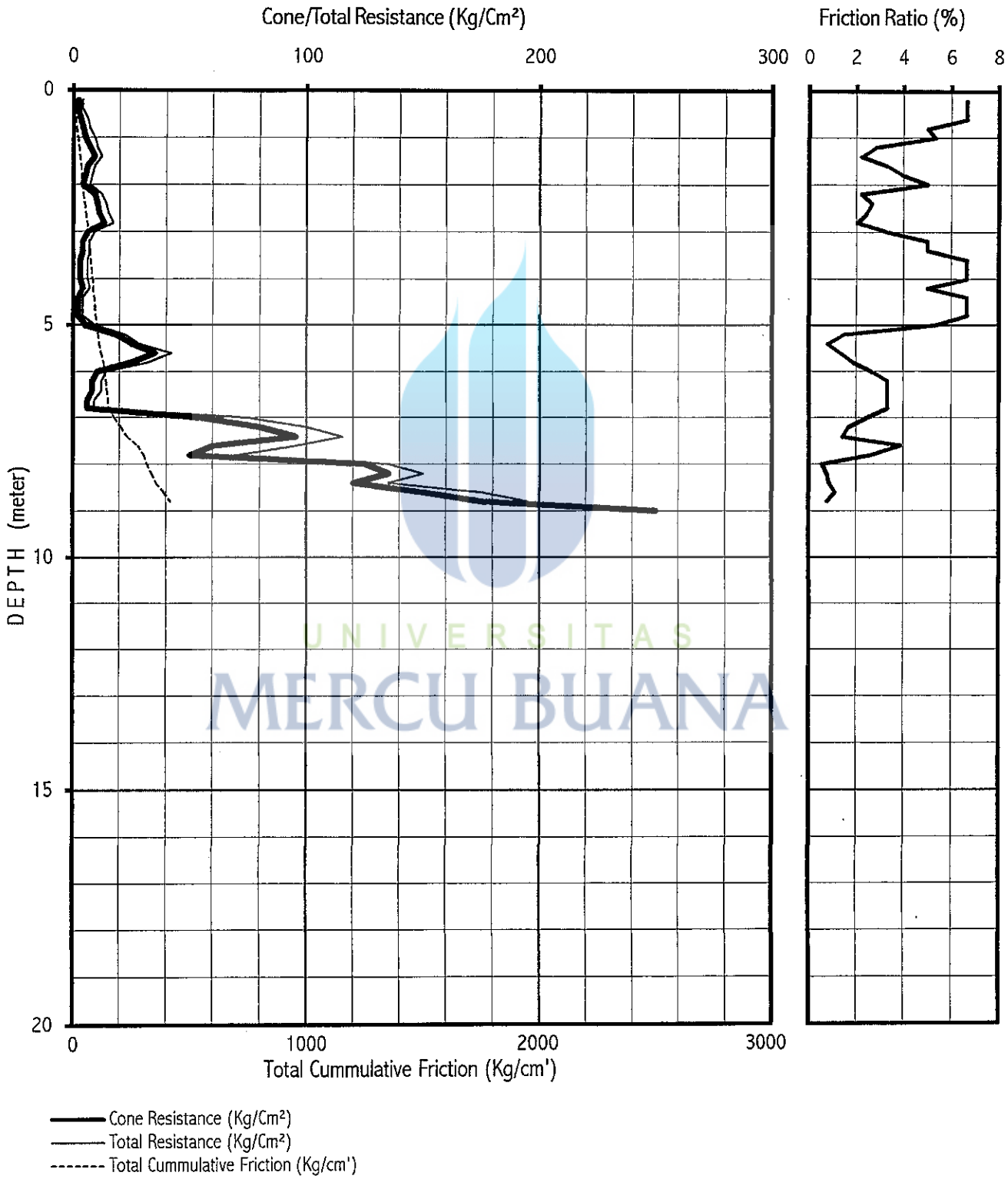
DUTCH CONE PENETRATION TEST

Project	:	THE WASKITA HOTEL & OFFICE TOWER			
Location	:	JL. M.T. HARYONO, CAWANG - JAKARTA			
Test No.	:	S.9/BH.1	Coordinate	E	: -
G.W.L.	:	-		N	: -
Date tested	:	March 16, 2013	Elevation		: -



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Pumping Test

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SOFOCO

PROJECT : WASKITA KARYA HOTEL & OFFICE TOWER
LOCATION : JL. M.T. HARYONO KAV.10 - JAKARTA
PUMPING RATE : 360.00 Litre / minute

TABLE 1. PUMPING TEST DATA

DATE	TIME	ELAPSED TIME (min)	TW	OW.1 1.85 (m)	OW.2 3.66 (m)	OW.3 7.87 (m)	OW.4 15.82 (m)	OW.5 43.52 (m)	OW.6 52.00 (m)
12-Mar	08:00	0.0	4.33	4.00	4.34	4.41	4.04	3.12	5.00
	08:05	5.0	8.68	4.05	4.40	4.43	4.05	3.12	5.00
	08:10	10.0	8.74	4.12	4.43	4.44	4.06	3.12	5.00
	08:15	15.0	8.82	4.21	4.48	4.45	4.07	3.12	5.00
	08:30	30.0	9.03	4.39	4.52	4.49	4.09	3.12	5.00
	08:45	45.0	9.20	4.45	4.59	4.51	4.09	3.12	5.00
	09:00	60.0	9.31	4.52	4.64	4.55	4.09	3.12	5.01
	09:15	75.0	9.34	4.57	4.67	4.57	4.10	3.13	5.01
	09:30	90.0	9.36	4.61	4.69	4.59	4.11	3.13	5.02
	09:45	105.0	9.37	4.65	4.71	4.62	4.11	3.13	5.02
	10:00	120.0	9.38	4.69	4.72	4.63	4.12	3.13	5.02
	10:30	150.0	9.39	4.76	4.75	4.65	4.12	3.14	5.02
	11:00	180.0	9.41	4.81	4.77	4.67	4.14	3.15	5.02
	12:00	240.0	9.41	4.86	4.81	4.70	4.16	3.15	5.02
	13:00	300.0	9.42	4.90	4.85	4.73	4.18	3.15	5.03
	14:00	360.0	9.43	4.94	4.90	4.75	4.19	3.15	5.03
	15:00	420.0	9.44	4.99	4.94	4.76	4.20	3.15	5.04
	16:00	480.0	9.45	5.02	4.99	4.77	4.20	3.15	5.04
	17:00	540.0	9.45	5.04	5.00	4.78	4.21	3.15	5.04
	18:00	600.0	9.45	5.05	5.02	4.78	4.22	3.16	5.04
	19:00	660.0	9.45	5.06	5.05	4.79	4.22	3.16	5.04
	20:00	720.0	9.46	5.07	5.06	4.79	4.23	3.16	5.05
	21:00	780.0	9.46	5.08	5.06	4.79	4.23	3.16	5.05
	22:00	840.0	9.47	5.08	5.07	4.80	4.23	3.16	5.05
	23:00	900.0	9.47	5.08	5.08	4.80	4.24	3.17	5.05
13-Mar	00:00	960.0	9.47	5.08	5.08	4.80	4.24	3.17	5.05
	01:00	1020.0	9.47	5.09	5.08	4.80	4.24	3.17	5.05
	02:00	1080.0	9.47	5.11	5.08	4.80	4.24	3.17	5.05
	03:00	1140.0	9.47	5.12	5.08	4.80	4.25	3.17	5.05
	04:00	1200.0	9.47	5.13	5.08	4.81	4.25	3.17	5.06
	05:00	1260.0	9.47	5.14	5.08	4.82	4.26	3.17	5.06
	06:00	1320.0	9.47	5.15	5.08	4.82	4.26	3.17	5.06
	07:00	1380.0	9.47	5.16	5.09	4.82	4.28	3.17	5.06
	08:00	1440.0	9.47	5.17	5.10	4.83	4.29	3.17	5.07
	09:00	1500.0	9.49	5.19	5.11	4.83	4.29	3.17	5.07
	10:00	1560.0	9.51	5.20	5.11	4.83	4.29	3.17	5.07
	11:00	1620.0	9.52	5.21	5.12	4.84	4.30	3.17	5.07
	12:00	1680.0	9.54	5.22	5.13	4.85	4.30	3.17	5.07
	13:00	1740.0	9.56	5.24	5.16	4.85	4.30	3.17	5.07
	14:00	1800.0	9.57	5.25	5.18	4.87	4.31	3.17	5.08
	15:00	1860.0	9.58	5.27	5.21	4.89	4.32	3.18	5.08
	16:00	1920.0	9.59	5.29	5.23	4.91	4.33	3.18	5.09
	17:00	1980.0	9.60	5.31	5.25	4.93	4.33	3.18	5.09
	18:00	2040.0	9.61	5.32	5.27	4.94	4.34	3.19	5.09
	19:00	2100.0	9.62	5.33	5.29	4.95	4.35	3.19	5.09
	20:00	2160.0	9.63	5.34	5.30	4.96	4.36	3.20	5.09
	21:00	2220.0	9.63	5.35	5.31	4.97	4.36	3.20	5.09
	22:00	2280.0	9.63	5.36	5.32	4.98	4.36	3.20	5.09
	23:00	2340.0	9.63	5.36	5.32	4.99	4.36	3.20	5.09
14-Mar	00:00	2400.0	9.63	5.36	5.32	4.99	4.36	3.20	5.09
	01:00	2460.0	9.64	5.36	5.32	4.99	4.36	3.20	5.09
	02:00	2520.0	9.64	5.37	5.33	4.99	4.37	3.20	5.10
	03:00	2580.0	9.64	5.39	5.34	5.02	4.37	3.20	5.10
	04:00	2640.0	9.64	5.41	5.36	5.03	4.38	3.20	5.10
	05:00	2700.0	9.64	5.43	5.38	5.04	4.39	3.21	5.10
	06:00	2760.0	9.64	5.45	5.40	5.05	4.40	3.21	5.11
	07:00	2820.0	9.64	5.47	5.42	5.05	4.41	3.21	5.11
	08:00	2880.0	9.64	5.49	5.44	5.06	4.41	3.21	5.11
14-Mar	09:00	2940.0	9.64	5.50	5.46	5.07	4.42	3.21	5.11

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PROJECT : WASKITA KARYA HOTEL & OFFICE TOWER
LOCATION : JL. M.T. HARYONO KAV.10 - JAKARTA
PUMPING RATE : 360.00 Litre / minute

TABLE 2. ANALYSIS OF PUMPING TEST DATA (1)

ELAPSED TIME (min)	DRAWDOWN (M)						
	TW	OW.1	OW.2	OW.3	OW.4	OW.5	OW.6
	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.0	4.350	0.050	0.060	0.020	0.010	0.000	0.000
10.0	4.410	0.120	0.090	0.030	0.020	0.000	0.000
15.0	4.490	0.210	0.140	0.040	0.030	0.000	0.000
30.0	4.700	0.390	0.180	0.080	0.050	0.000	0.000
45.0	4.870	0.450	0.250	0.100	0.050	0.000	0.000
60.0	4.980	0.520	0.300	0.140	0.050	0.000	0.010
75.0	5.010	0.570	0.330	0.160	0.060	0.010	0.010
90.0	5.030	0.610	0.350	0.180	0.070	0.010	0.020
105.0	5.040	0.650	0.370	0.210	0.070	0.010	0.020
120.0	5.050	0.690	0.380	0.220	0.080	0.010	0.020
150.0	5.060	0.760	0.410	0.240	0.080	0.020	0.020
180.0	5.080	0.810	0.430	0.260	0.100	0.030	0.020
240.0	5.080	0.860	0.470	0.290	0.120	0.030	0.020
300.0	5.090	0.900	0.510	0.320	0.140	0.030	0.030
360.0	5.100	0.940	0.560	0.340	0.150	0.030	0.030
420.0	5.110	0.990	0.600	0.350	0.160	0.030	0.040
480.0	5.120	1.020	0.650	0.360	0.160	0.030	0.040
540.0	5.120	1.040	0.660	0.370	0.170	0.030	0.040
600.0	5.120	1.050	0.680	0.370	0.180	0.040	0.040
660.0	5.120	1.060	0.710	0.380	0.180	0.040	0.040
720.0	5.130	1.070	0.720	0.380	0.190	0.040	0.050
780.0	5.130	1.080	0.720	0.380	0.190	0.040	0.050
840.0	5.140	1.080	0.730	0.390	0.190	0.040	0.050
900.0	5.140	1.080	0.740	0.390	0.200	0.050	0.050
960.0	5.140	1.080	0.740	0.390	0.200	0.050	0.050
1020.0	5.140	1.090	0.740	0.390	0.200	0.050	0.050
1080.0	5.140	1.110	0.740	0.390	0.200	0.050	0.050
1140.0	5.140	1.120	0.740	0.390	0.210	0.050	0.050
1200.0	5.140	1.130	0.740	0.400	0.210	0.050	0.060
1260.0	5.140	1.140	0.740	0.410	0.220	0.050	0.060
1320.0	5.140	1.150	0.740	0.410	0.220	0.050	0.060
1380.0	5.140	1.160	0.750	0.410	0.240	0.050	0.060
1440.0	5.140	1.170	0.760	0.420	0.250	0.050	0.070
1500.0	5.160	1.190	0.770	0.420	0.250	0.050	0.070
1560.0	5.180	1.200	0.770	0.420	0.250	0.050	0.070
1620.0	5.190	1.210	0.780	0.430	0.260	0.050	0.070
1680.0	5.210	1.220	0.790	0.440	0.260	0.050	0.070
1740.0	5.230	1.240	0.820	0.440	0.260	0.050	0.070
1800.0	5.240	1.250	0.840	0.460	0.270	0.050	0.080
1860.0	5.250	1.270	0.870	0.480	0.280	0.060	0.080
1920.0	5.260	1.290	0.890	0.500	0.290	0.060	0.090
1980.0	5.270	1.310	0.910	0.520	0.290	0.060	0.090
2040.0	5.280	1.320	0.930	0.530	0.300	0.070	0.090
2100.0	5.290	1.330	0.950	0.540	0.310	0.070	0.090
2160.0	5.300	1.340	0.960	0.550	0.320	0.080	0.090
2220.0	5.300	1.350	0.970	0.560	0.320	0.080	0.090
2280.0	5.300	1.360	0.980	0.570	0.320	0.080	0.090
2340.0	5.300	1.360	0.980	0.580	0.320	0.080	0.090
2400.0	5.300	1.360	0.980	0.580	0.320	0.080	0.090
2460.0	5.310	1.360	0.980	0.580	0.320	0.080	0.090
2520.0	5.310	1.370	0.990	0.580	0.330	0.080	0.100
2580.0	5.310	1.390	1.000	0.610	0.330	0.080	0.100
2640.0	5.310	1.410	1.020	0.620	0.340	0.080	0.100
2700.0	5.310	1.430	1.040	0.630	0.350	0.090	0.100
2760.0	5.310	1.450	1.060	0.640	0.360	0.090	0.110
2820.0	5.310	1.470	1.080	0.640	0.370	0.090	0.110
2880.0	5.310	1.490	1.100	0.650	0.370	0.090	0.110
2940.0	5.310	1.500	1.120	0.660	0.380	0.090	0.110

TABLE 3. ANALYSIS OF PUMPING TEST DATA (2)

ELAPSED TIME (min)	R^2/t (m^2/min)					
	OW.1	OW.2	OW.3	OW.4	OW.5	OW.6
5.0	0.685	2.679	12.387	50.054	378.798	540.80
10.0	0.342	1.340	6.194	25.027	189.399	270.400
15.0	0.228	0.893	4.129	16.685	126.266	180.267
30.0	0.114	0.447	2.065	8.342	63.133	90.133
45.0	0.076	0.298	1.376	5.562	42.089	60.089
60.0	0.057	0.223	1.032	4.171	31.567	45.067
75.0	0.046	0.179	0.826	3.337	25.253	36.053
90.0	0.038	0.149	0.688	2.781	21.044	30.044
105.0	0.033	0.128	0.590	2.384	18.038	25.752
120.0	0.029	0.112	0.516	2.086	15.783	22.533
150.0	0.023	0.089	0.413	1.668	12.627	18.027
180.0	0.019	0.074	0.344	1.390	10.522	15.022
240.0	0.014	0.056	0.258	1.043	7.892	11.267
300.0	0.011	0.045	0.206	0.834	6.313	9.013
360.0	0.010	0.037	0.172	0.695	5.261	7.511
420.0	0.008	0.032	0.147	0.596	4.510	6.438
480.0	0.007	0.028	0.129	0.521	3.946	5.633
540.0	0.006	0.025	0.115	0.463	3.507	5.007
600.0	0.006	0.022	0.103	0.417	3.157	4.507
660.0	0.005	0.020	0.094	0.379	2.870	4.097
720.0	0.005	0.019	0.086	0.348	2.631	3.756
780.0	0.004	0.017	0.079	0.321	2.428	3.467
840.0	0.004	0.016	0.074	0.298	2.255	3.219
900.0	0.004	0.015	0.069	0.278	2.104	3.004
960.0	0.004	0.014	0.065	0.261	1.973	2.817
1020.0	0.003	0.013	0.061	0.245	1.857	2.651
1080.0	0.003	0.012	0.057	0.232	1.754	2.504
1140.0	0.003	0.012	0.054	0.220	1.661	2.372
1200.0	0.003	0.011	0.052	0.209	1.578	2.253
1260.0	0.003	0.011	0.049	0.199	1.503	2.146
1320.0	0.003	0.010	0.047	0.190	1.435	2.048
1380.0	0.002	0.010	0.045	0.181	1.372	1.959
1440.0	0.002	0.009	0.043	0.174	1.315	1.878
1500.0	0.002	0.009	0.041	0.167	1.263	1.803
1560.0	0.002	0.009	0.040	0.160	1.214	1.733
1620.0	0.002	0.008	0.038	0.154	1.169	1.669
1680.0	0.002	0.008	0.037	0.149	1.127	1.610
1740.0	0.002	0.008	0.036	0.144	1.089	1.554
1800.0	0.002	0.007	0.034	0.139	1.052	1.502
1860.0	0.002	0.007	0.033	0.135	1.018	1.454
1920.0	0.002	0.007	0.032	0.130	0.986	1.408
1980.0	0.002	0.007	0.031	0.126	0.957	1.366
2040.0	0.002	0.007	0.030	0.123	0.928	1.325
2100.0	0.002	0.006	0.029	0.119	0.902	1.288
2160.0	0.002	0.006	0.029	0.116	0.877	1.252
2220.0	0.002	0.006	0.028	0.113	0.853	1.218
2280.0	0.002	0.006	0.027	0.110	0.831	1.186
2340.0	0.001	0.006	0.026	0.107	0.809	1.156
2400.0	0.001	0.006	0.026	0.104	0.789	1.127
2460.0	0.001	0.005	0.025	0.102	0.770	1.099
2520.0	0.001	0.005	0.025	0.099	0.752	1.073
2580.0	0.001	0.005	0.024	0.097	0.734	1.048
2640.0	0.001	0.005	0.023	0.095	0.717	1.024
2700.0	0.001	0.005	0.023	0.093	0.701	1.001
2760.0	0.001	0.005	0.022	0.091	0.686	0.980
2820.0	0.001	0.005	0.022	0.089	0.672	0.959
2880.0	0.001	0.005	0.022	0.087	0.658	0.939
2940.0	0.001	0.005	0.021	0.085	0.644	0.920

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PROJECT : WASKITA KARYA HOTEL & OFFICE TOWER
LOCATION : JL. M.T. HARYONO KAV.10 - JAKARTA
PUMPING RATE : 360.00 Litre / minute

TABLE 4. RECOVERY TEST DATA

DATE	CUMMU-LATIVE (min)	ELAPSED TIME (min)	TW	OW.1	OW.2	OW.3	OW.4	OW.5	OW.6
14-Mar	2940.0	0.0	9.64	5.50	5.46	5.07	4.42	3.21	5.11
	2945.0	5.0	5.32	4.87	4.87	4.79	4.29	3.21	5.11
	2950.0	10.0	5.22	4.76	4.78	4.75	4.25	3.19	5.11
	2955.0	15.0	5.10	4.63	4.64	4.70	4.22	3.17	5.11
	2970.0	30.0	4.97	4.49	4.51	4.63	4.18	3.15	5.11
	2985.0	45.0	4.89	4.45	4.44	4.59	4.16	3.15	5.11
	3000.0	60.0	4.78	4.40	4.41	4.56	4.16	3.15	5.10
	3015.0	75.0	4.75	4.34	4.36	4.54	4.14	3.15	5.10
	3030.0	90.0	4.71	4.31	4.33	4.52	4.13	3.15	5.09
	3045.0	105.0	4.67	4.28	4.30	4.50	4.12	3.15	5.08
	3060.0	120.0	4.64	4.25	4.27	4.49	4.11	3.15	5.08
	3090.0	150.0	4.60	4.20	4.27	4.47	4.11	3.15	5.08
	3120.0	180.0	4.54	4.18	4.27	4.45	4.10	3.15	5.08
	3150.0	210.0	4.50	4.16	4.27	4.45	4.09	3.15	5.08
	3180.0	240.0	4.48	4.15	4.27	4.45	4.09	3.15	5.08
	3210.0	270.0	4.46	4.12	4.27	4.44	4.09	3.15	5.08
	3240.0	300.0	4.43	4.10	4.27	4.44	4.09	3.15	5.08
	3270.0	330.0	4.40	4.08	4.27	4.44	4.09	3.15	5.08
	3300.0	360.0	4.38	4.06	4.27	4.44	4.09	3.15	5.07
	3330.0	390.0	4.37	4.05	4.27	4.44	4.09	3.15	5.07
	3360.0	420.0	4.37	4.05	4.27	4.44	4.09	3.15	5.07
	3390.0	450.0	4.37	4.05	4.27	4.44	4.09	3.15	5.07
	3420.0	480.0	4.37	4.05	4.27	4.44	4.09	3.15	5.07

TABLE 5. ANALYSIS OF RECOVERY TEST DATA

TIME ELAPSED FROM PUMPING t(min)	STOPPED t'(min)	t/t'	RESIDUAL DRAWDOWN (m) TW	OW.1	OW.2	OW.3	OW.4	OW.5	OW.6
2940.0			5.310	1.500	1.120	0.660	0.380	0.090	0.110
2945.0	5.0	589.00	0.990	0.870	0.530	0.380	0.250	0.090	0.110
2950.0	10.0	295.00	0.890	0.760	0.440	0.340	0.210	0.070	0.110
2955.0	15.0	197.00	0.770	0.630	0.300	0.290	0.180	0.050	0.110
2970.0	30.0	99.00	0.640	0.490	0.170	0.220	0.140	0.030	0.110
2985.0	45.0	66.33	0.560	0.450	0.100	0.180	0.120	0.030	0.110
3000.0	60.0	50.00	0.450	0.400	0.070	0.150	0.120	0.030	0.100
3015.0	75.0	40.20	0.420	0.340	0.020	0.130	0.100	0.030	0.100
3030.0	90.0	33.67	0.380	0.310	-0.010	0.110	0.090	0.030	0.090
3045.0	105.0	29.00	0.340	0.280	-0.040	0.090	0.080	0.030	0.080
3060.0	120.0	25.50	0.310	0.250	-0.070	0.080	0.070	0.030	0.080
3090.0	150.0	20.60	0.270	0.200	-0.070	0.060	0.070	0.030	0.080
3120.0	180.0	17.33	0.210	0.180	-0.070	0.040	0.060	0.030	0.080
3150.0	210.0	15.00	0.170	0.160	-0.070	0.040	0.050	0.030	0.080
3180.0	240.0	13.25	0.150	0.150	-0.070	0.040	0.050	0.030	0.080
3210.0	270.0	11.89	0.130	0.120	-0.070	0.030	0.050	0.030	0.080
3240.0	300.0	10.80	0.100	0.100	-0.070	0.030	0.050	0.030	0.080
3270.0	330.0	9.91	0.070	0.080	-0.070	0.030	0.050	0.030	0.080
3300.0	360.0	9.17	0.050	0.060	-0.070	0.030	0.050	0.030	0.070
3330.0	390.0	8.54	0.044	0.050	-0.070	0.030	0.050	0.030	0.070
3360.0	420.0	8.00	0.040	0.050	-0.070	0.030	0.050	0.030	0.070
3390.0	450.0	7.53	0.040	0.050	-0.070	0.030	0.050	0.030	0.070
3420.0	480.0	7.13	0.040	0.050	-0.070	0.030	0.050	0.030	0.070

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PROJECT	:	WASKITA KARYA HOTEL & OFFICE TOWER
LOCATION	:	JL. M.T. HARYONO KAV.10 - JAKARTA
PUMPING RATE	:	360.00 Litre / minute

TABLE 6. HYDRAULIC PARAMETERS

INFLUENCE RADIUS		
OBS.WELL	DISTANCE FROM WELL (M)	DRAWDOWN (M)
OW.1	1.85	1.50
OW.2	3.66	1.12
OW.3	7.87	0.66
OW.4	15.82	0.38
OW.5	43.52	0.09
OW.6	52.00	0.11

Q= 0.360 M3/minute.
D= 5.00 M

	Sd(0) (m)	T (m2/min)	t (minute)	r (m)	Cs	k (m/sec)
OW.1	0.5000	0.131784	6.00	3.66	0.13281	4.4E-04
OW.2	0.4000	0.164730	10.00	7.87	0.05984	5.5E-04
OW.3	0.3000	0.219640	20.00	15.82	0.03949	7.3E-04
OW.4	0.2000	0.329460	30.00	43.52	0.01174	1.1E-03
OW.5	0.1000	0.658921	45.00	52.00	0.02467	2.2E-03

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METHOD OF ANALYSIS:

The Modified THEIS METHOD, by Jacob (1950)

$$Sd = \frac{2.3\,Q}{4 \times 3.14 \times T} \log \frac{2.25\,T.t}{r2.\,Cs}$$

$$k = \frac{T}{D}$$

Sd= Drawdown at radius r and time t
Q= Pumping rate (debit)
T= Transmissivity of the aquifer
Cs= Storage coefficient
k= Permeability
D= Thickness of aquifer

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PUMPING TEST

Project : WASKITA KARYA HOTEL & OFFICE TOWER
Location : JL. M.T. HARYONO KAV.10 - JAKARTA

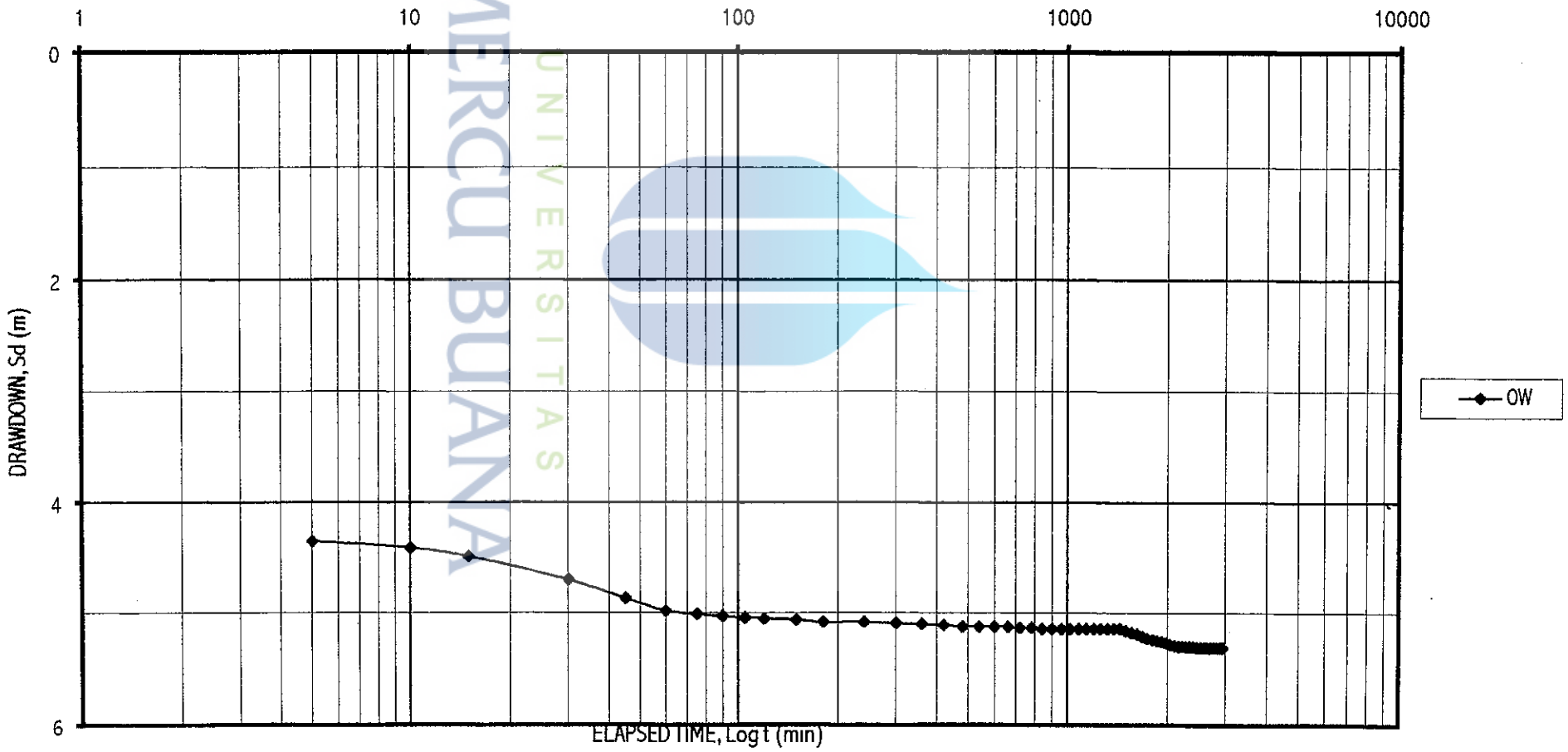

Fig 1. DRAWDOWN OF PUMPING WELL

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PUMPING TEST

Project : WASKITA KARYA HOTEL & OFFICE TOWER
Location : JL. M.T. HARYONO KAV.10 - JAKARTA

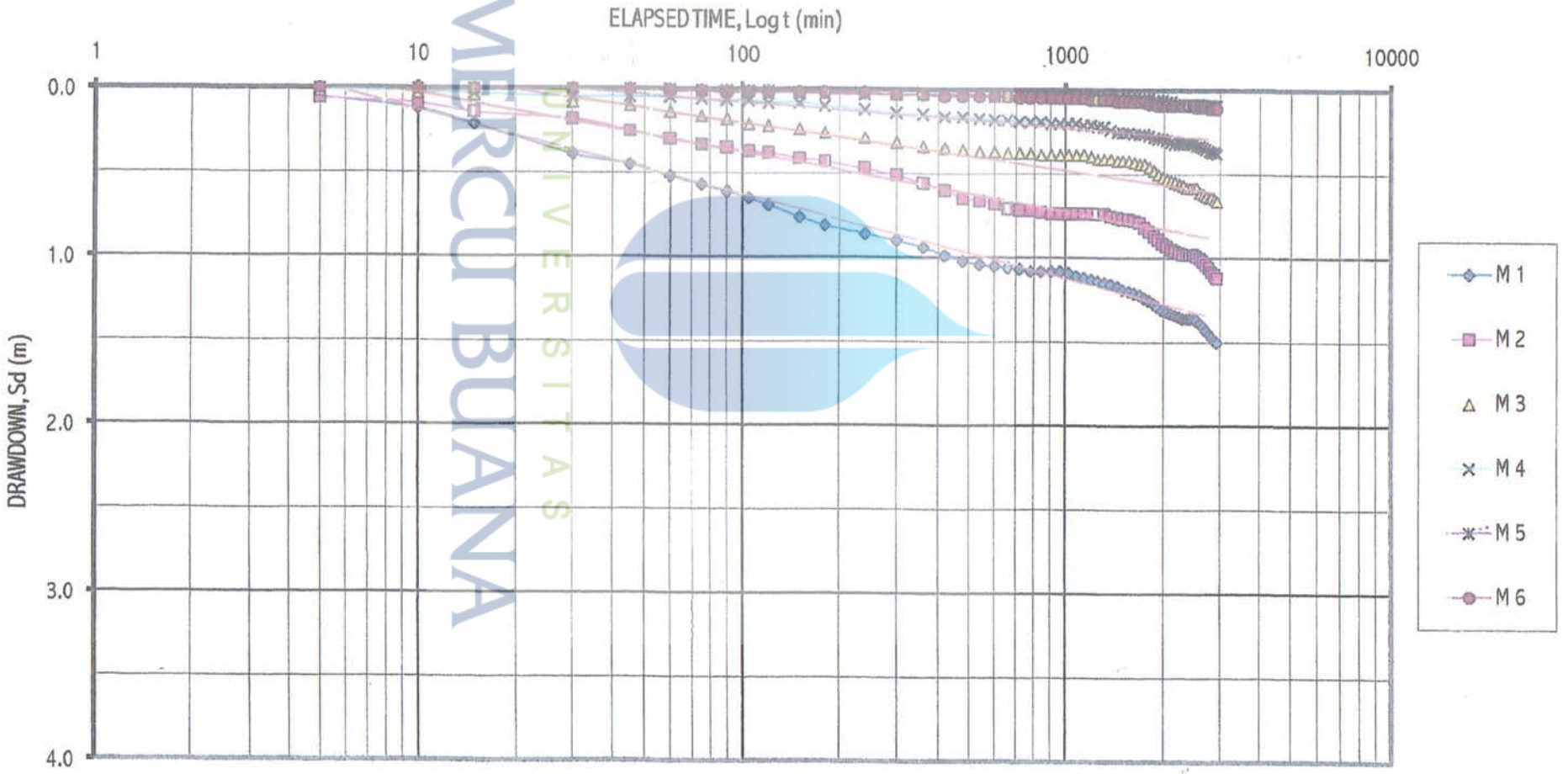

Fig 2. DRAWDOWN OF OBSERVATION WELL

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PUMPING TEST

Project : WASKITA KARYA HOTEL & OFFICE TOWER
Location : JL. M.T. HARYONO KAV.10 - JAKARTA

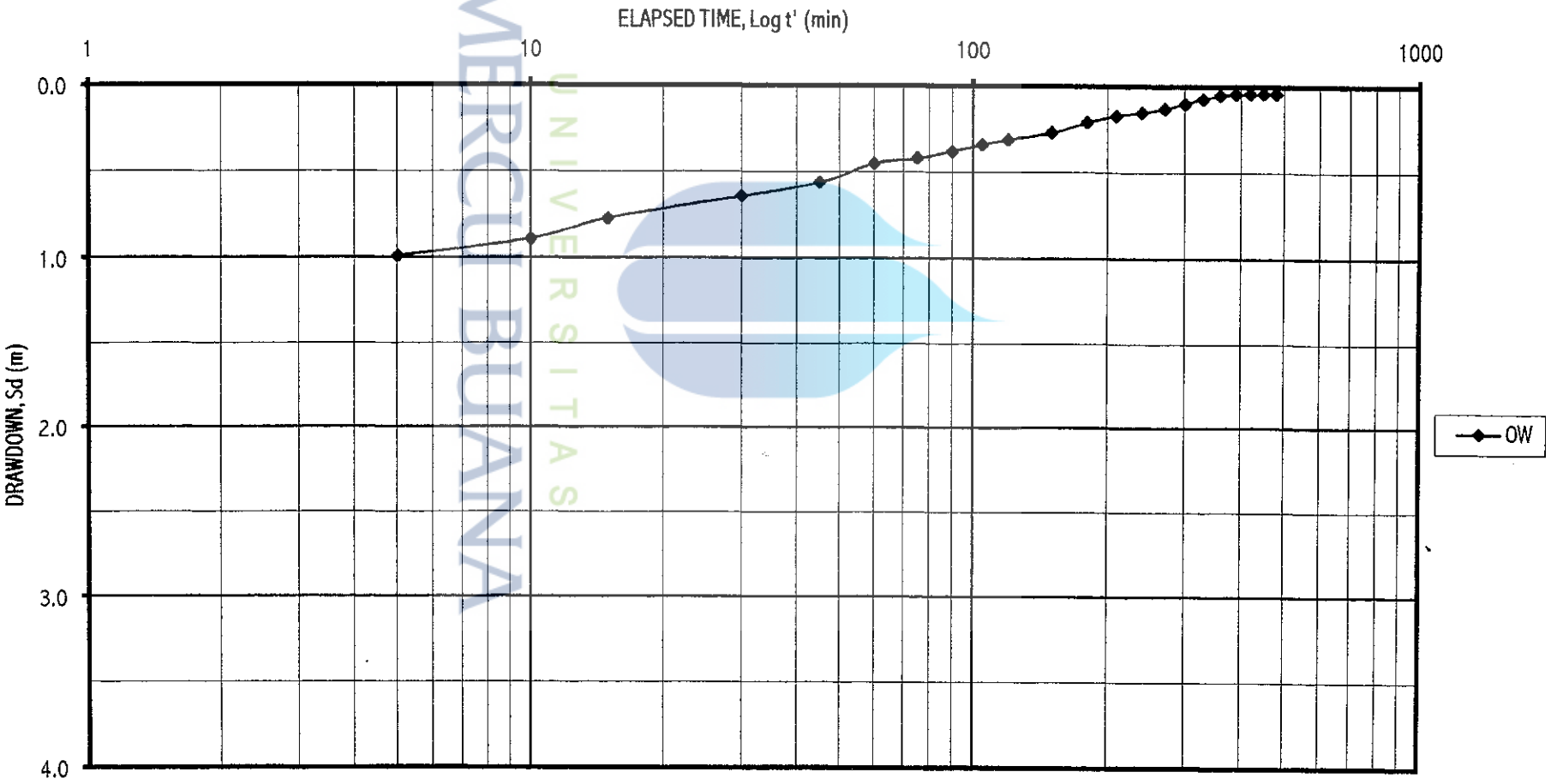

Fig 3. RECOVERY OF PUMPING WELL

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PUMPING TEST

Project : WASKITA KARYA HOTEL & OFFICE TOWER
Location : JL. M.T. HARYONO KAV.10 - JAKARTA

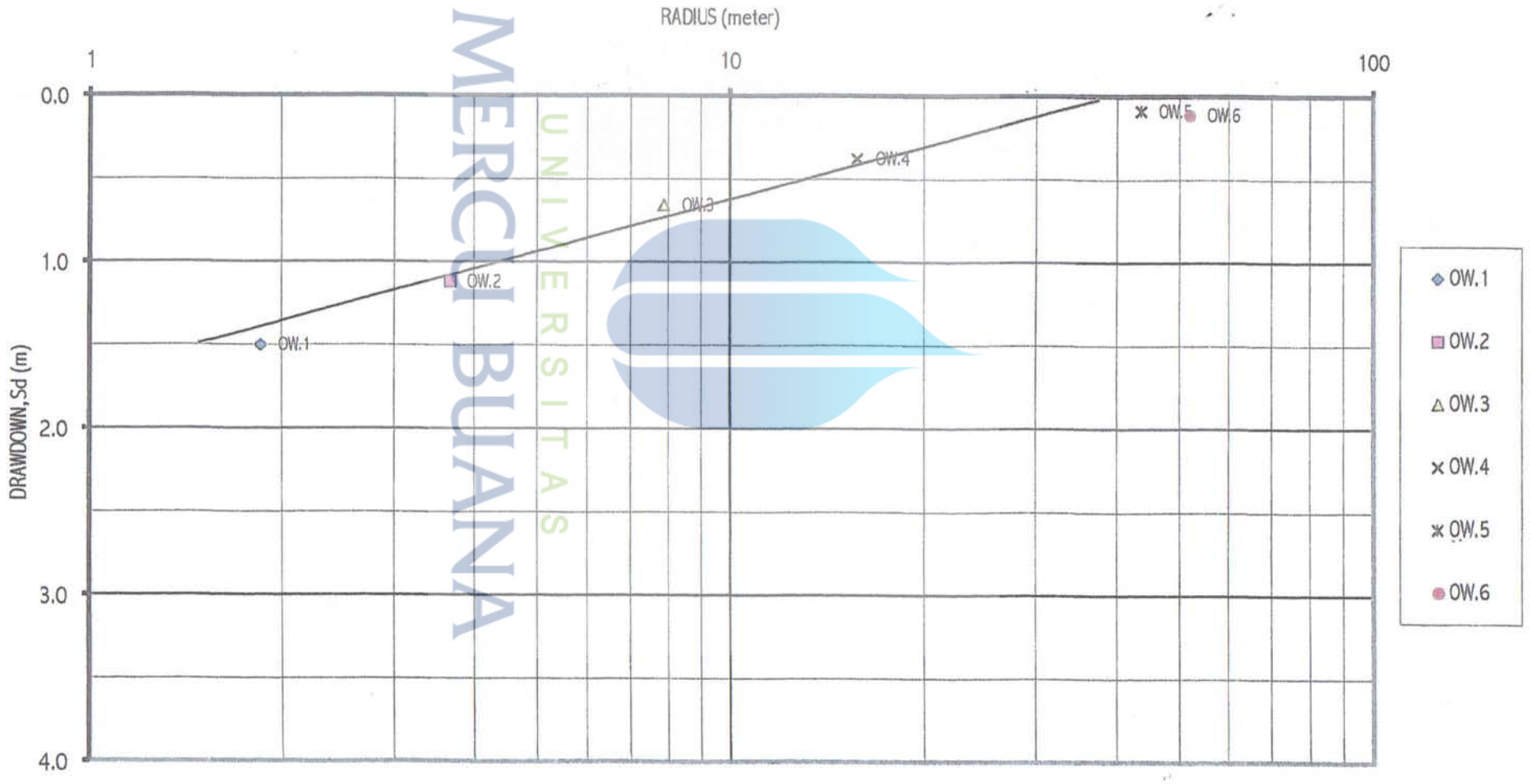

Fig 4. INFLUENCE RADIUS OF OBSERVATION WELL

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Laboratory Test Results

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SUMMARY OF LABORATORY TEST RESULTS

PROJECT : HOTEL & OFFICE TOWER
LOCATION : JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA

BOREHOLE	DEPTH	SAMPLE (UDS)	SAMPLE (SPT)	Specific Gravity, Grain Size Distribution, Density & Moisture						Atterberg Limits			Grain Size Fraction				Triaxial Compression: TX-UU / CU / CD; Unconfined Compression: UC						Consolidation			Field Vane Test qv	N-SPT
																	UC-UU		TX-UU		TX-CU						
				Moisture content, ω	Specific Gravity	Wet Density, γ t	Dry Density, γ d	Void Ratio, e0	Degree of Saturation	LL	PL	PI	Gravel Size Fraction	Sand Size Fraction	Silt Size Fraction	Clay Size Fraction	Unconfined compressive strength, q_u	Strain at Failure	Cohesion, c	Angle of Internal Friction, Ø	Effective Cohesion, c'	Effective Angle of internal friction, Ø'	Compression Index, Cc	Recompression Index, Cr	Effective Preconsolidation Pressure, Pc		
No.	(M)	No.	No.	%	Gs	kN/m³	kN/m³	e	Sr %	%	%	%	%	%	%	%	kN/m²	%	kN/m²	(°)	kN/m²	(°)			kN/m²	kN/m²	
BH-1	3.00-3.50			49.43	2.65	16.80	11.243	1.357	96.52	74.2	36.8	37.4	-	5.0	70.0	25.0					23.0	26.7					
	7.00-7.50			66.20	2.65	15.24	9.170	1.890	92.82	91.0	41.8	49.2	-	6.0	68.0	26.0					13.0	22.0					
	15.50-16.00			40.11	2.54	16.82	12.005	1.116	91.31	55.7	32.4	23.3	20.0	48.0	26.0	6.0			10.0	15.0							
	18.00-18.50			48.31	2.48	16.35	11.024	1.250	95.88	-	-	-	5.0	87.0	8.0	-											
	24.00-24.50			70.53	2.56	15.25	8.943	1.863	96.93	87.5	42.6	44.9	-	45.0	44.0	11.0											
	33.50-34.00			33.49	2.65	18.44	13.814	0.918	96.64	58.0	30.9	27.1	-	6.0	71.0	23.0	115.76	6.10					0.26		150		
BH-2	4.00-4.50			63.81	2.65	15.42	9.413	1.815	93.16	88.2	41.2	47.0	-	3.0	71.0	26.0			8.0	11.0							
	15.00-15.50			75.76	2.59	14.99	8.529	2.037	96.34	93.9	43.0	50.9	-	23.0	61.0	16.0	42.03	8.13									
	33.00-33.50			27.25	2.64	19.03	14.955	0.765	94.00	51.0	29.9	21.1	-	10.0	71.0	19.0	126.73	10.15									
	35.00-35.50			25.32	2.63	19.15	15.281	0.721	92.35	50.9	29.8	21.1	1.0	7.0	69.0	23.0	87.75	9.15									
	40.00-40.50			45.38	2.67	17.14	11.790	1.265	95.81	72.5	34.0	38.5	-	2.0	68.0	30.0	56.69	5.08					0.26		140		

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SUMMARY OF LABORATORY TEST RESULTS

PROJECT : HOTEL & OFFICE TOWER
LOCATION : JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA

BOREHOLE	DEPTH	SAMPLE (UDS)	SAMPLE (SPT)	Specific Gravity, Grain Size Distribution, Density & Moisture						Atterberg Limits			Grain Size Fraction				Triaxial Compression: TX-UU / CU / CD; Unconfined Compression: UC						Consolidation			Field Vane Test qv	N-SPT
																	UC-UU		TX-UU		TX-CU						
				Moisture content, ω	Specific Gravity	Wet Density, γ t	Dry Density, γ d	Void Ratio, e0	Degree of Saturation	LL	PL	PI	Gravel Size Fraction	Sand Size Fraction	Silt Size Fraction	Clay Zize Fraction	Unconfined compressive strength, q_u	Strain at Failure	Cohesion, c	Angle of Internal Friction, Ø	Effective Cohesion, c'	Effective Angle of internal friction, Ø'	Compression Index, Cc	Recompression Index, Cr	Effective Preconsolidation Pressure, Pc		
No.	(M)	No.	No.	%	Gs	kN/m³	kN/m³	e	Sr %	%	%	%	%	%	%	%	kN/m²	%	kN/m²	(°)	kN/m²	(°)			kN/m²	kN/m²	
BH-3	3.00-3.50			47.33	2.6	16.34	11.091	1.344	91.54	67.0	34.6	32.4	7.0	18.0	59.0	16.0			24.0	17.0							
	7.00-7.50			44.00	2.54	16.37	11.368	1.234	90.54	61.3	33.9	27.4	-	56.0	34.0	10.0											
	12.00-12.50			34.84	2.48	17.65	13.090	0.895	96.58	-	-	-	33.0	62.0	5.0	-											
	18.00-18.50			32.55	2.47	17.88	13.489	0.831	96.74	-	-	-	2.0	95.0	3.0	-											
	24.00-24.50			69.71	2.55	15.16	8.933	1.855	95.85	83.2	42.0	41.2	1.0	55.0	35.0	9.0											
	30.00-30.50			30.21	2.65	18.52	14.223	0.863	92.75	55.0	30.6	24.4	-	4.0	67.0	29.0	112.62	8.65					0.23		130		
DB-1	2.00-2.50			52.59	2.64	16.06	10.525	1.508	92.05	76.4	37.2	39.2	2.0	5.0	73.0	20.0											
	6.00-6.50			56.62	2.67	16.19	10.337	1.583	95.50	83.8	37.9	45.9	-	1.0	73.0	26.0											
	17.00-17.50			88.01	2.68	14.22	7.563	2.543	92.74	116.0	44.6	71.4	-	1.0	70.0	29.0			10.0	6.5							
	35.50-36.00			44.01	2.63	16.98	11.791	1.231	94.06	67.2	33.8	33.4	2.0	10.0	68.0	20.0	140.77	10.67									
	45.00-45.50			50.37	2.56	15.97	10.620	1.410	91.42	67.9	37.1	30.8	-	36.0	50.0	14.0	121.71	9.65									
	50.00-50.50			91.10	2.62	14.02	7.336	2.571	92.83	113.2	47.0	66.2	-	11.0	69.0	20.0	103.18	5.60					0.52		180		

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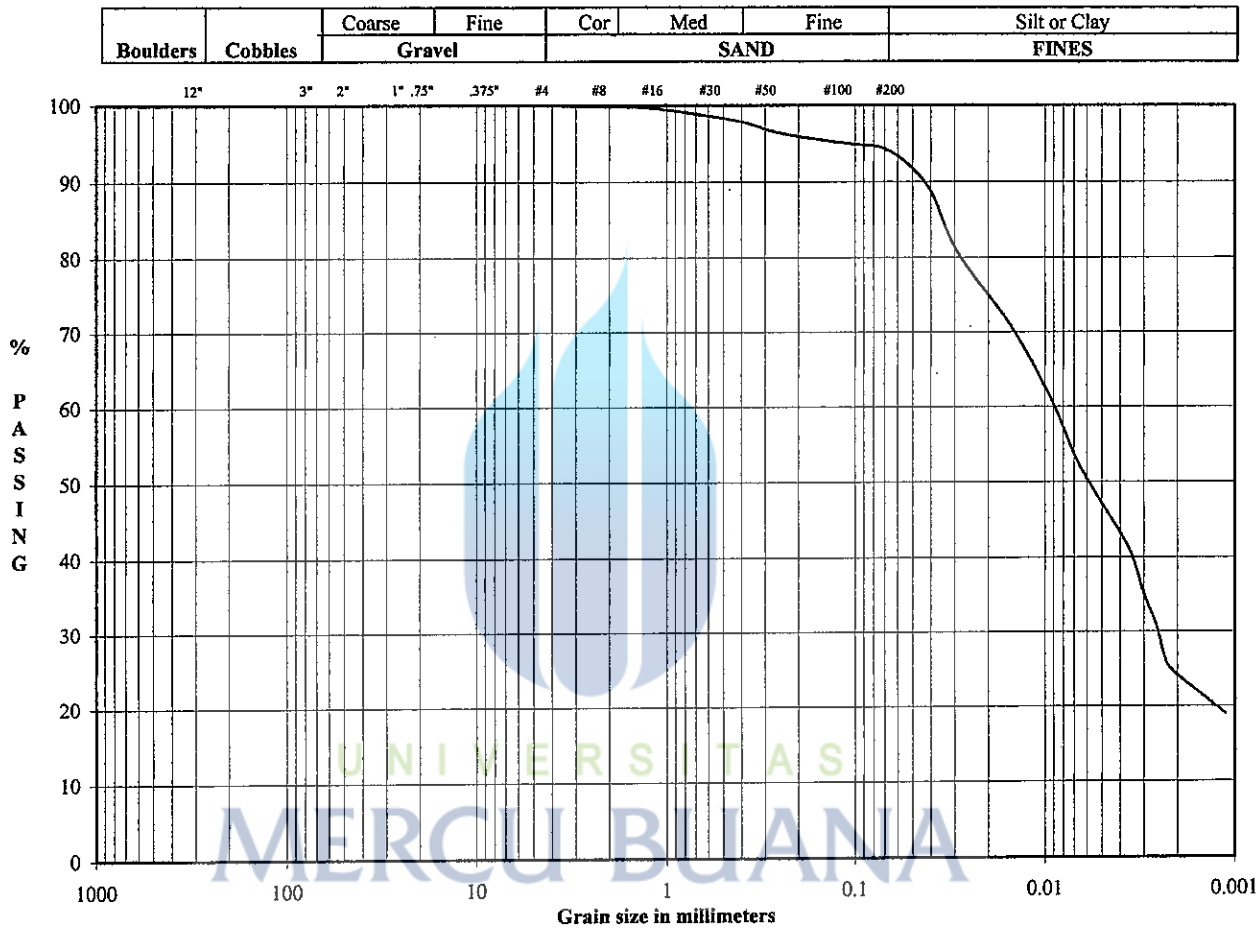
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-1
Sample Depth	:	3.00-3.50 M

Soil Description :



REMARKS :

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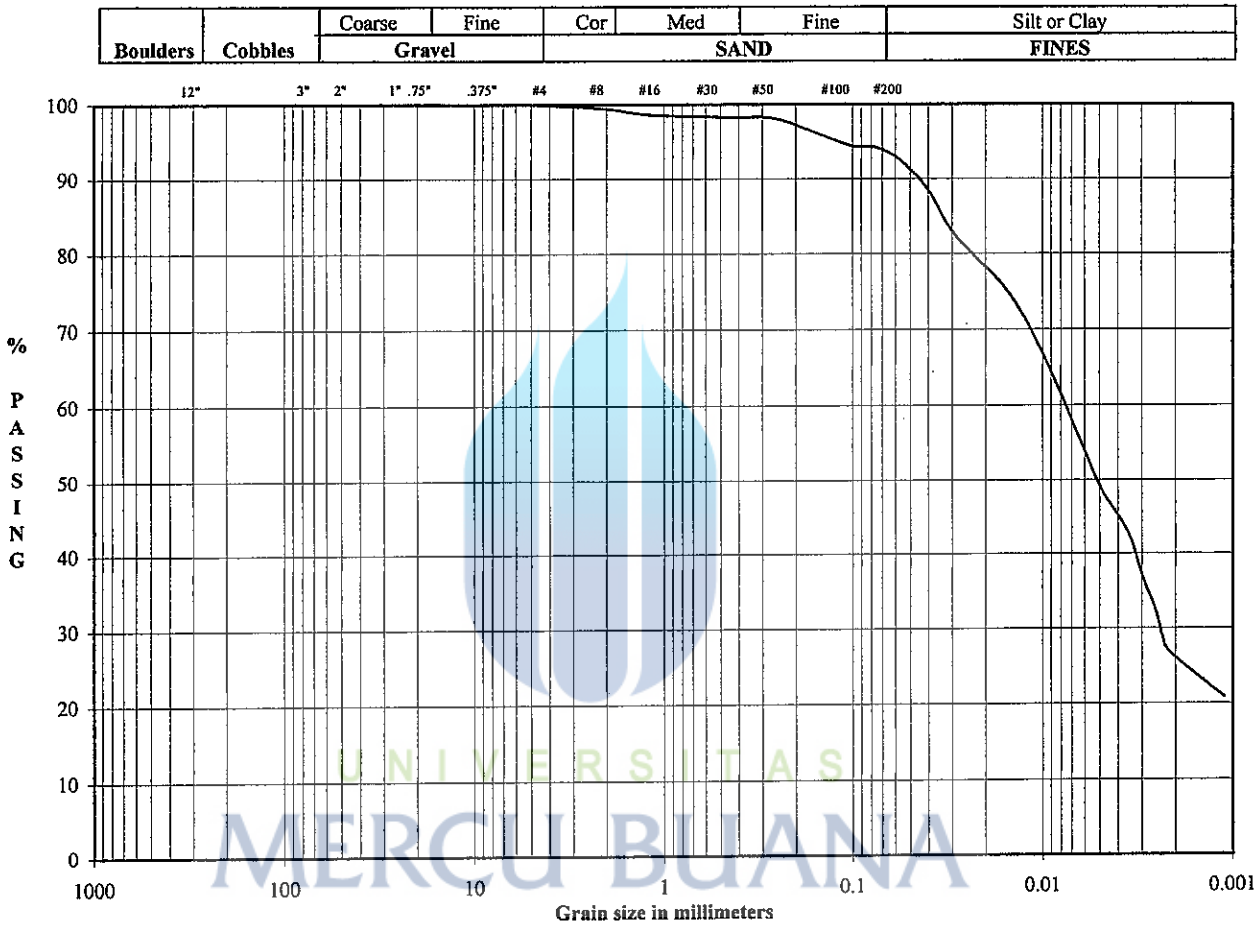
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-1
Sample Depth	:	7.00-7.50 M

Soil Description :



REMARKS :

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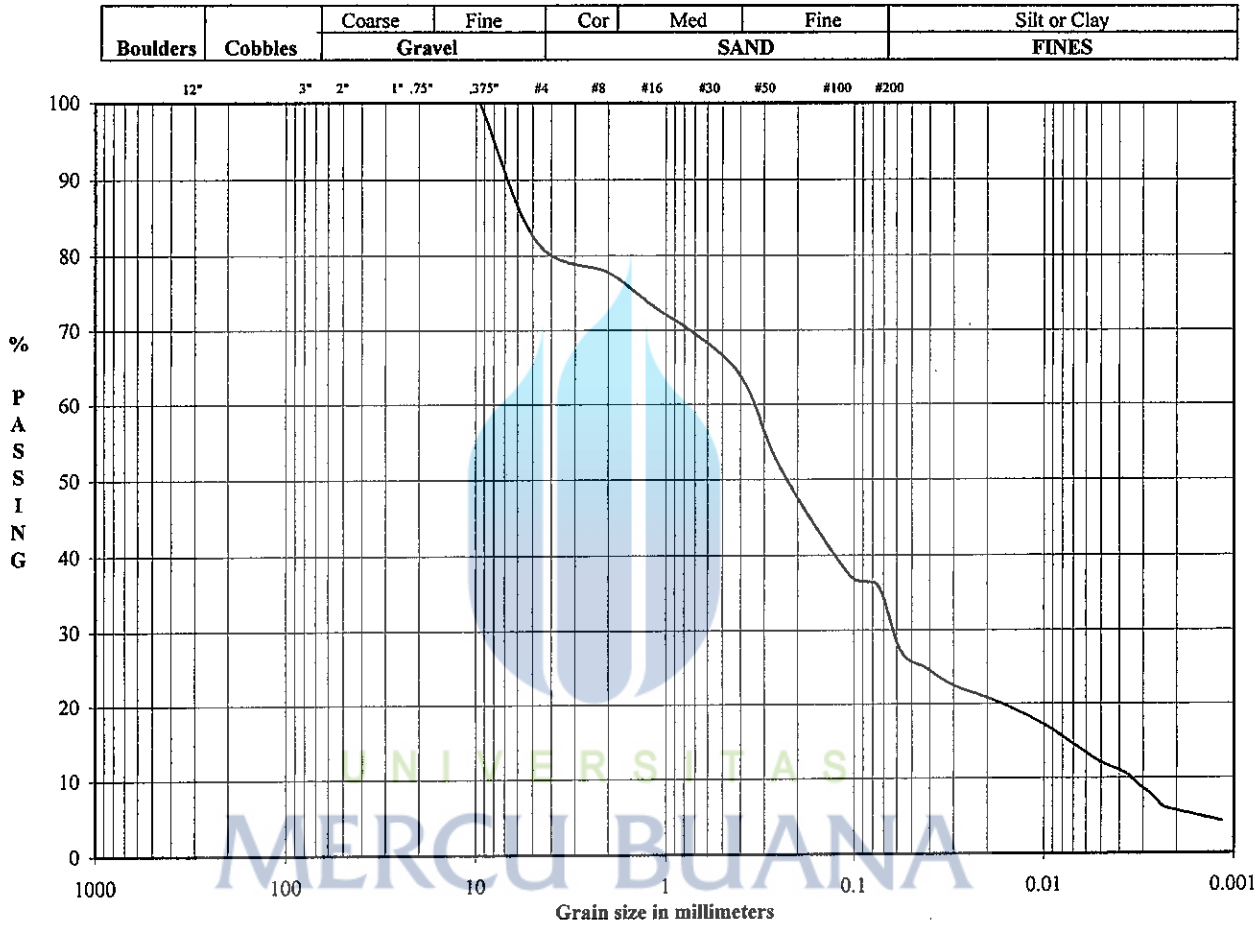
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-1
Sample Depth	:	15.50-16.00 M

Soil Description :



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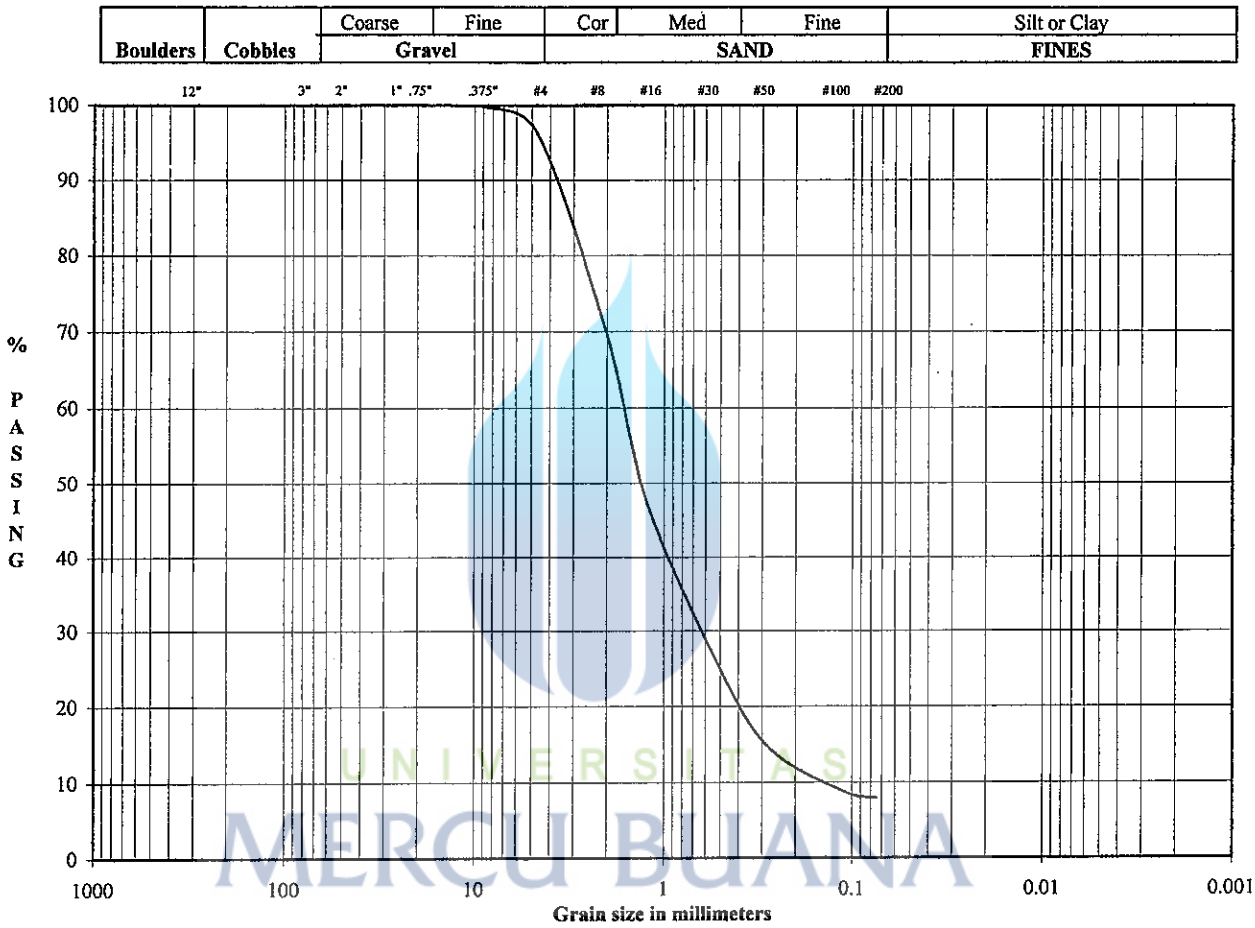
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-1
Sample Depth	:	18.00-18.50 M

Soil Description :



REMARKS :

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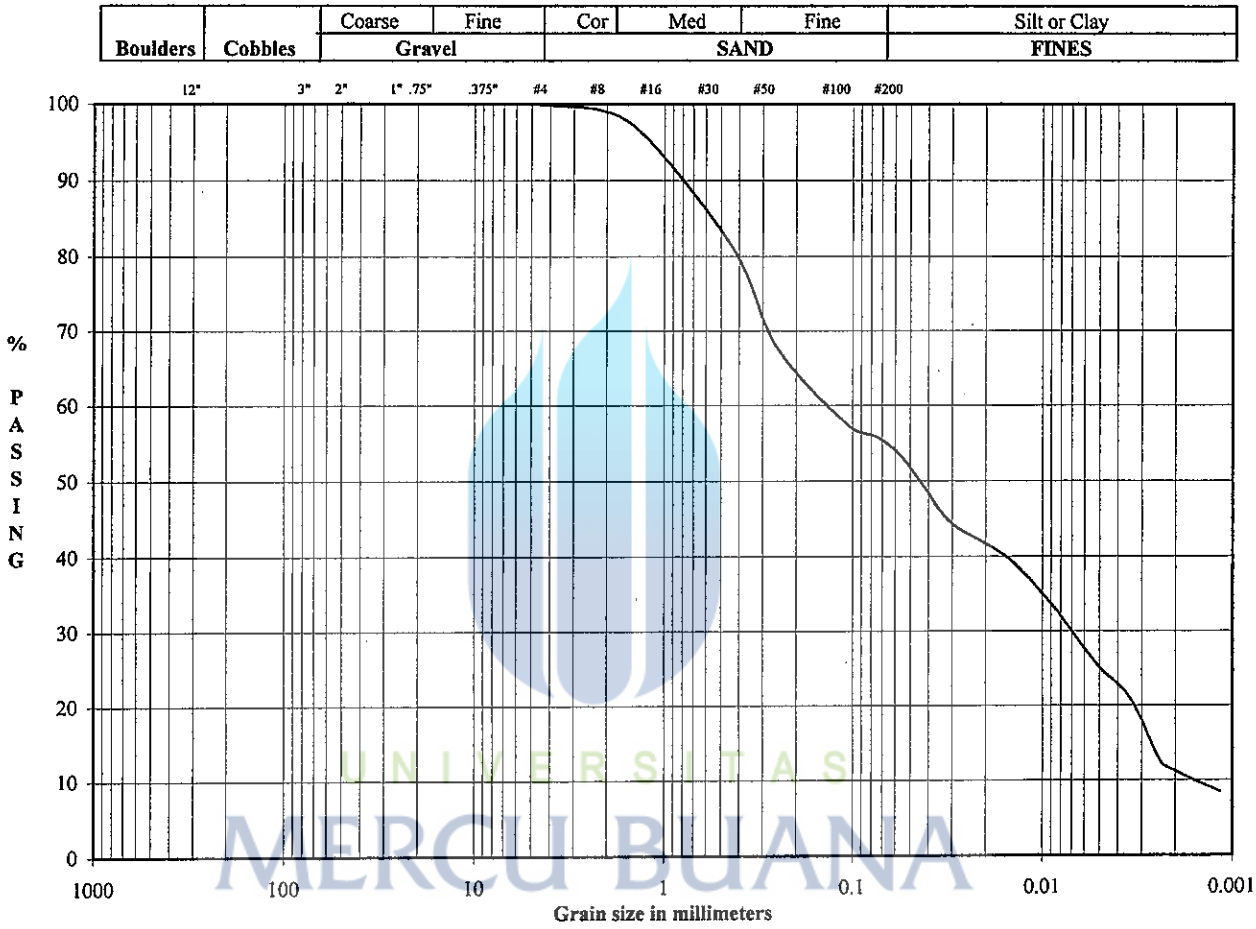
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-1
Sample Depth	:	24.00-24.50 M

Soil Description :



REMARKS :

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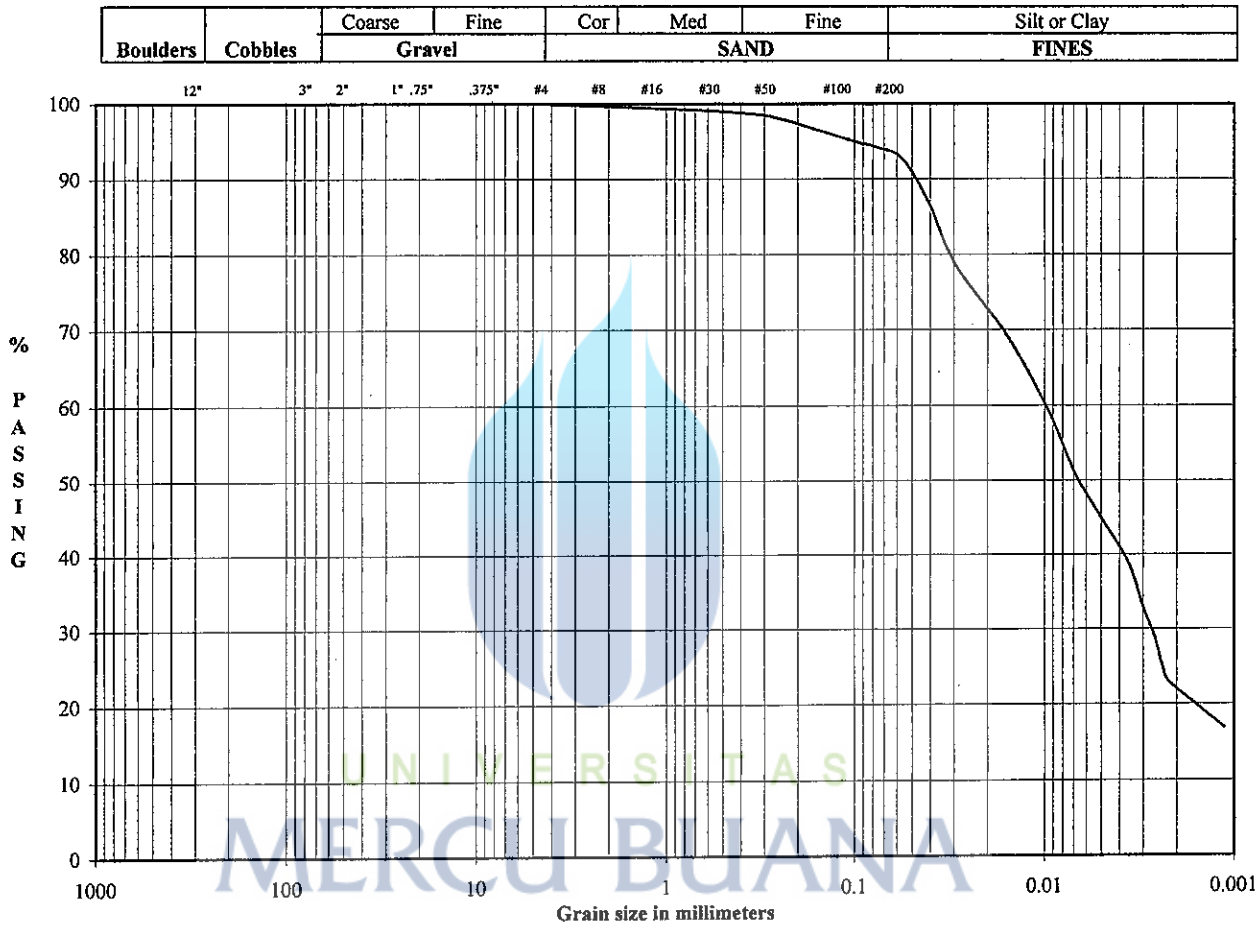
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-1
Sample Depth	:	33.50-34.00 M

Soil Description :



REMARKS :

SOFOCO

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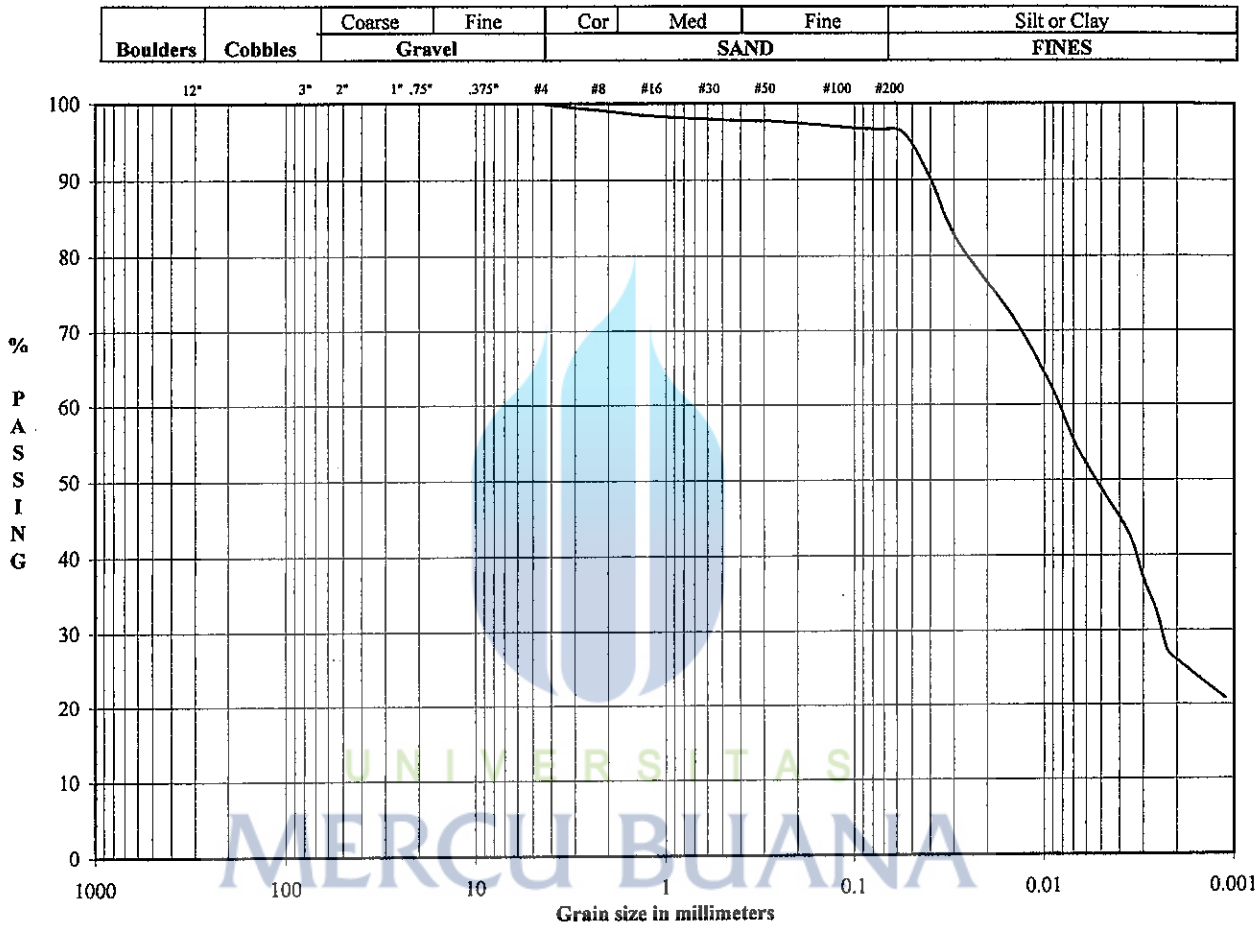
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-2
Sample Depth	:	4.00-4.50 M

Soil Description :



REMARKS :

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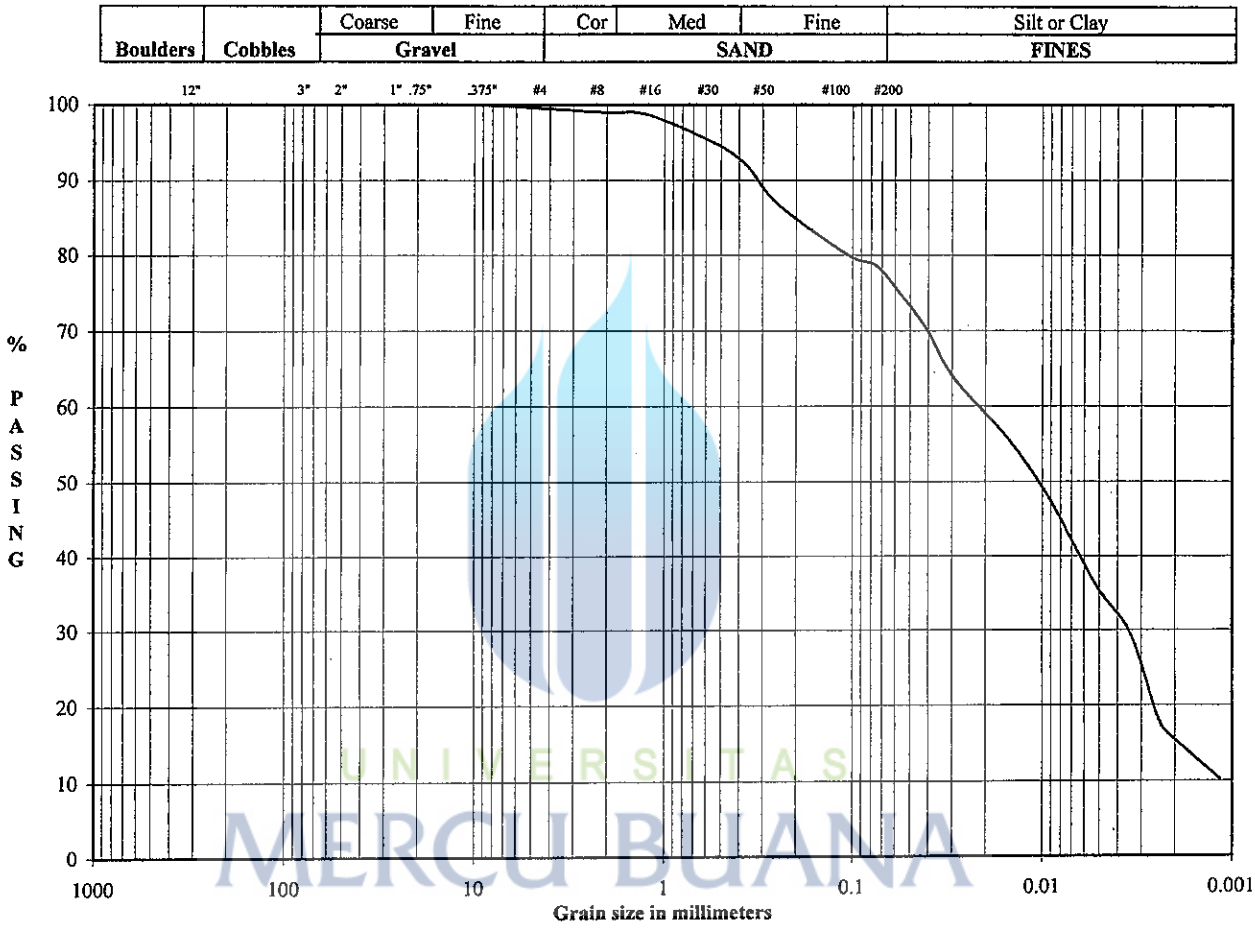
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-2
Sample Depth	:	15.00-15.50 M

Soil Description :



REMARKS :

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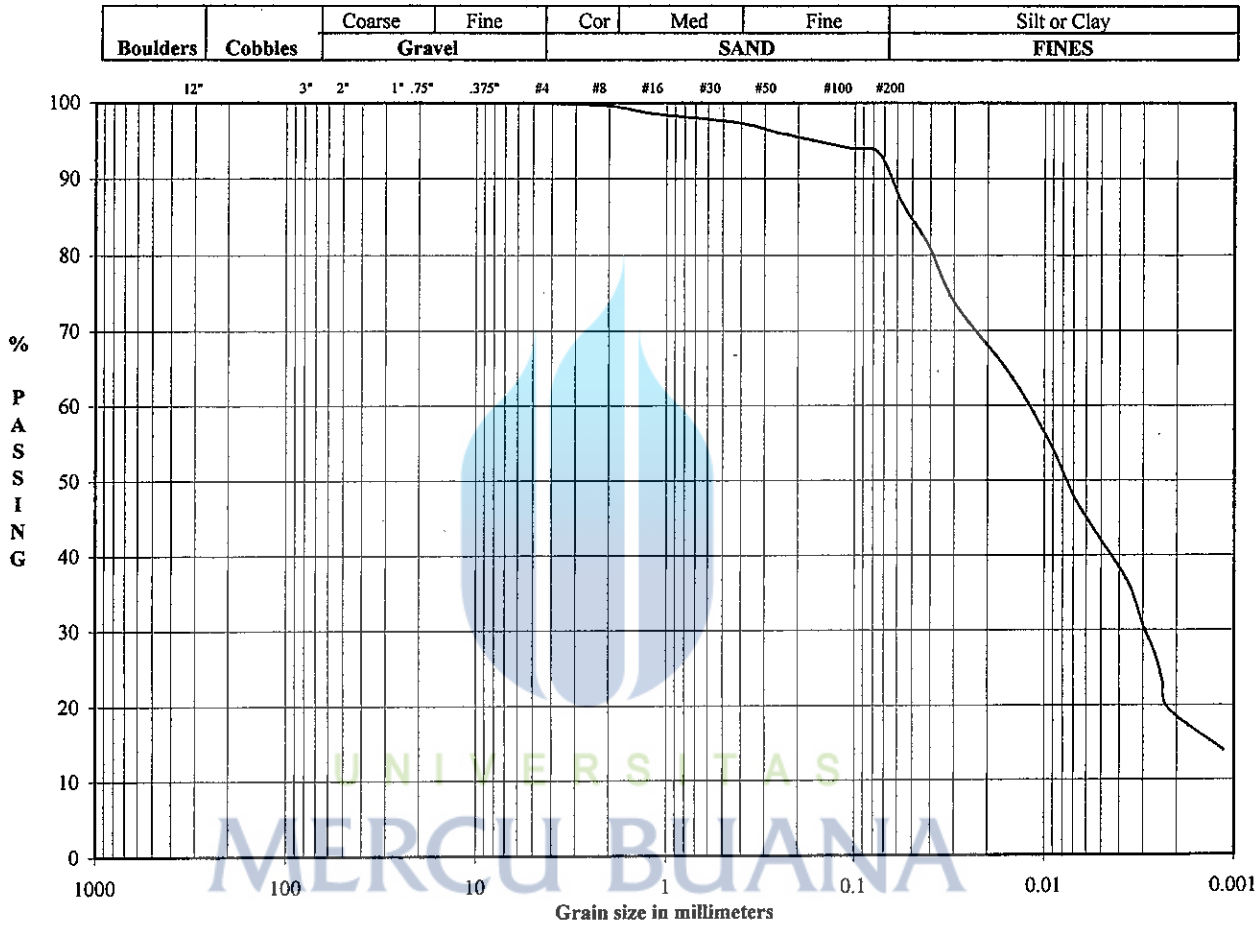
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-2
Sample Depth	:	33.00-33.50 M

Soil Description :



REMARKS :

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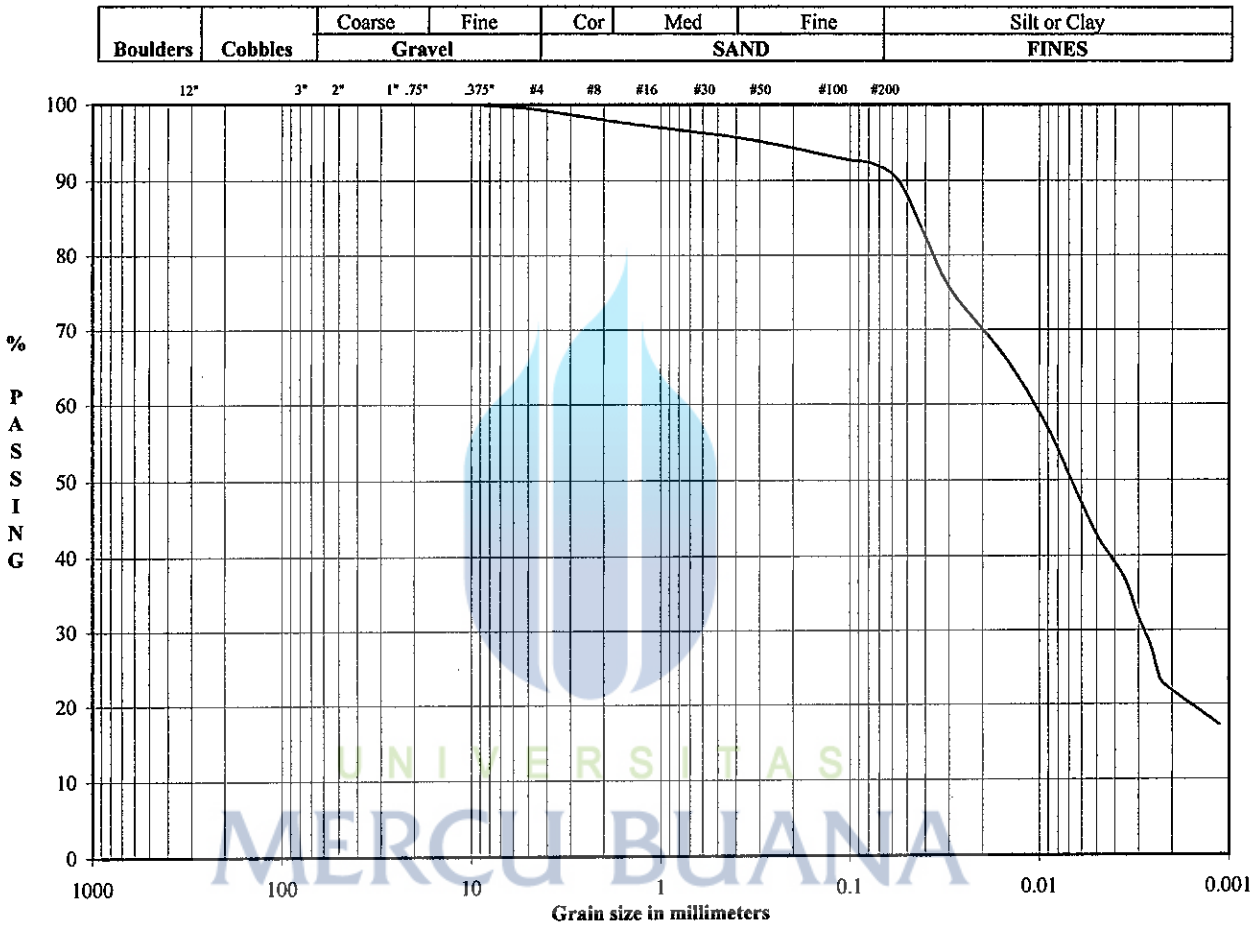
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-2
Sample Depth	:	35.00-35.50 M

Soil Description :



REMARKS :

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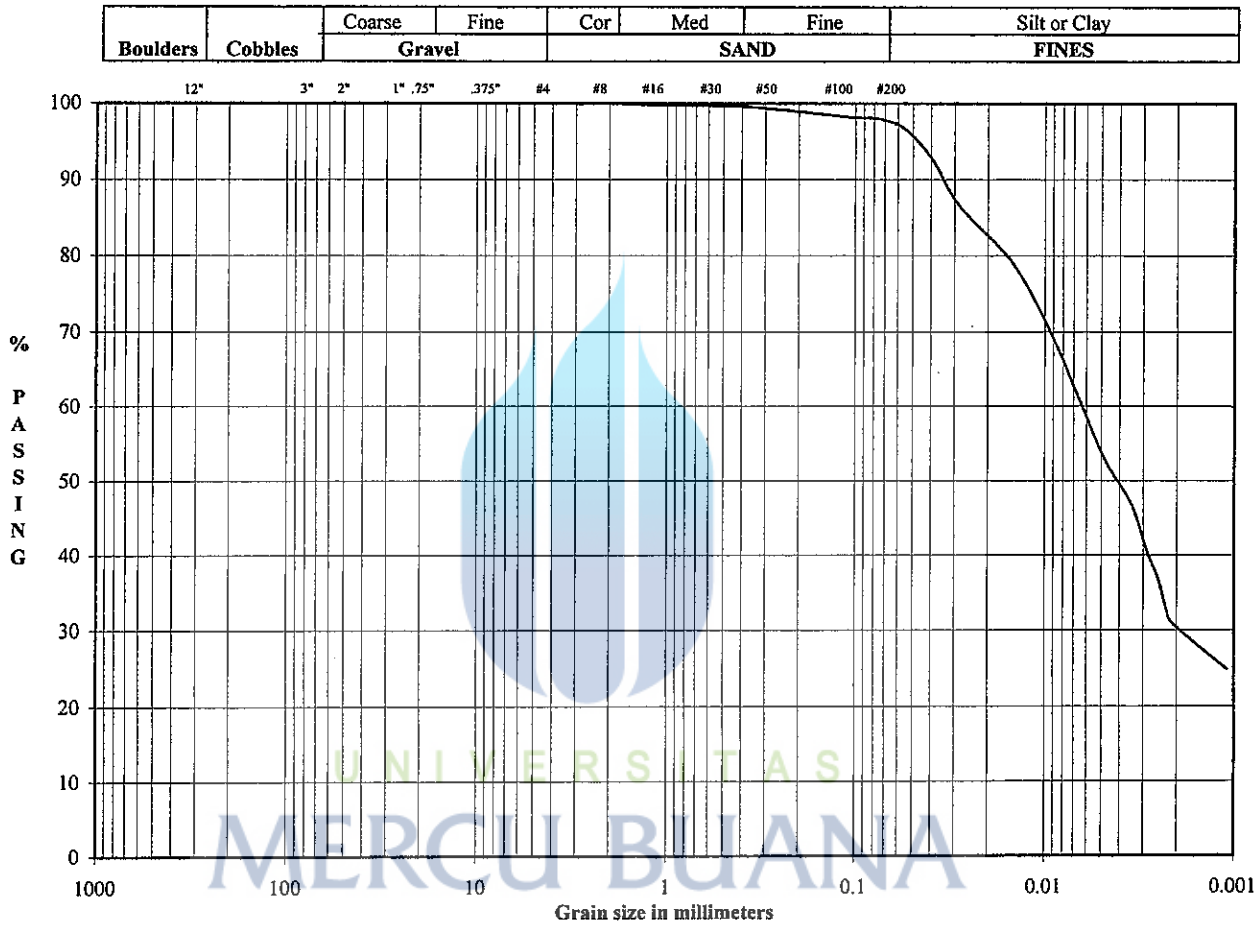
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-2
Sample Depth	:	40.00-40.50 M

Soil Description :



REMARKS :

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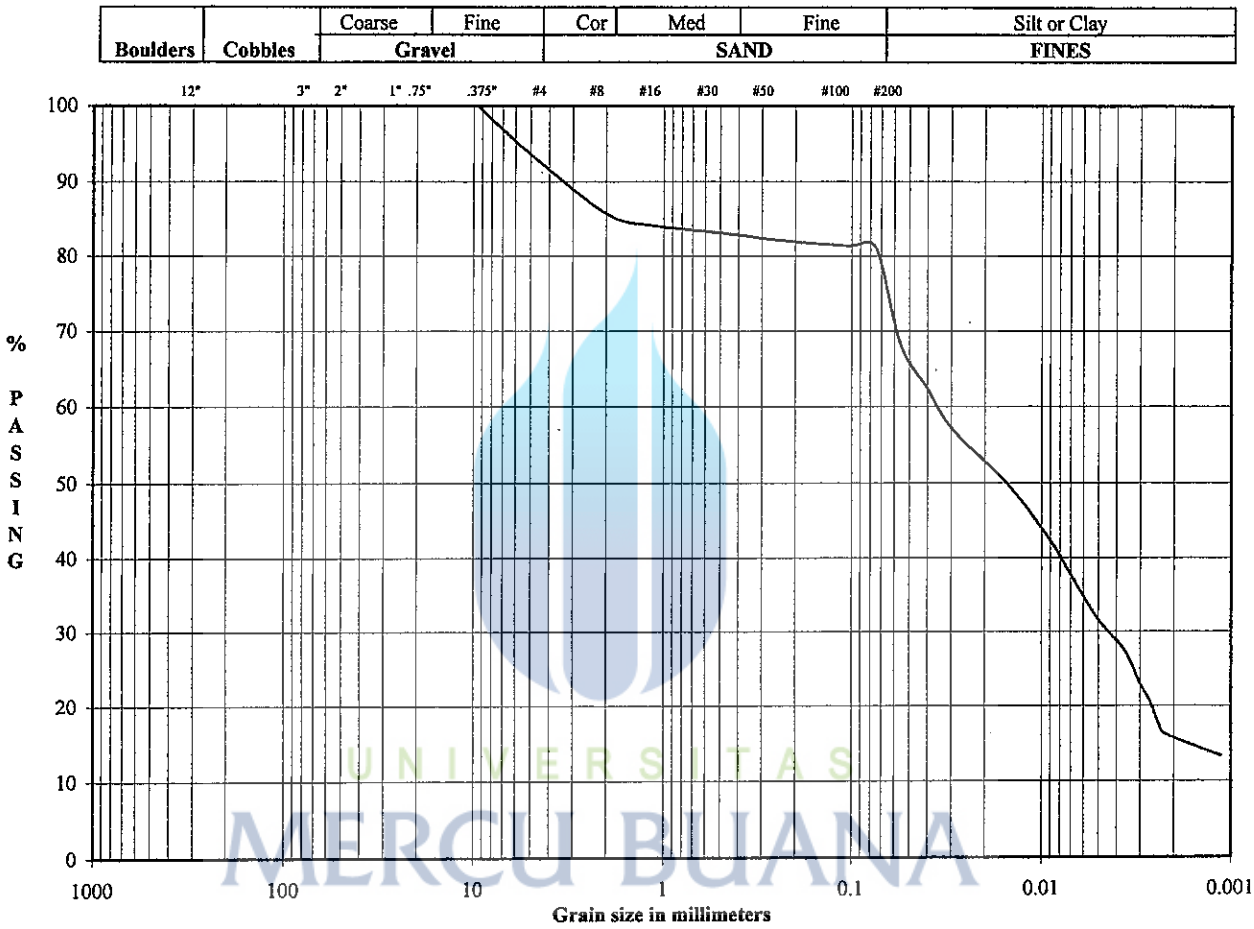
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-3
Sample Depth	:	3.00-3.50 M

Soil Description :



REMARKS :

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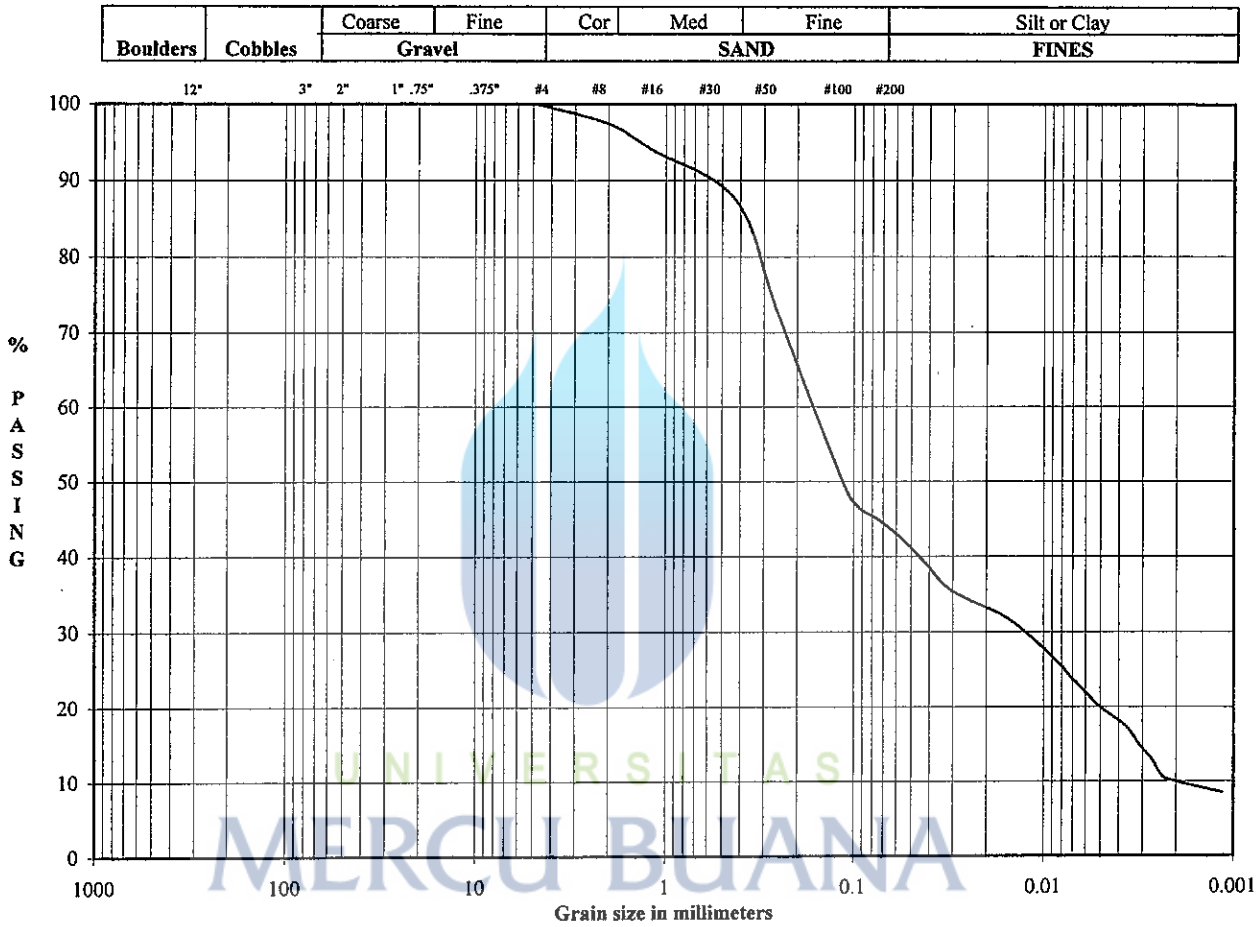
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-3
Sample Depth	:	7.00-7.50 M

Soil Description :



REMARKS :

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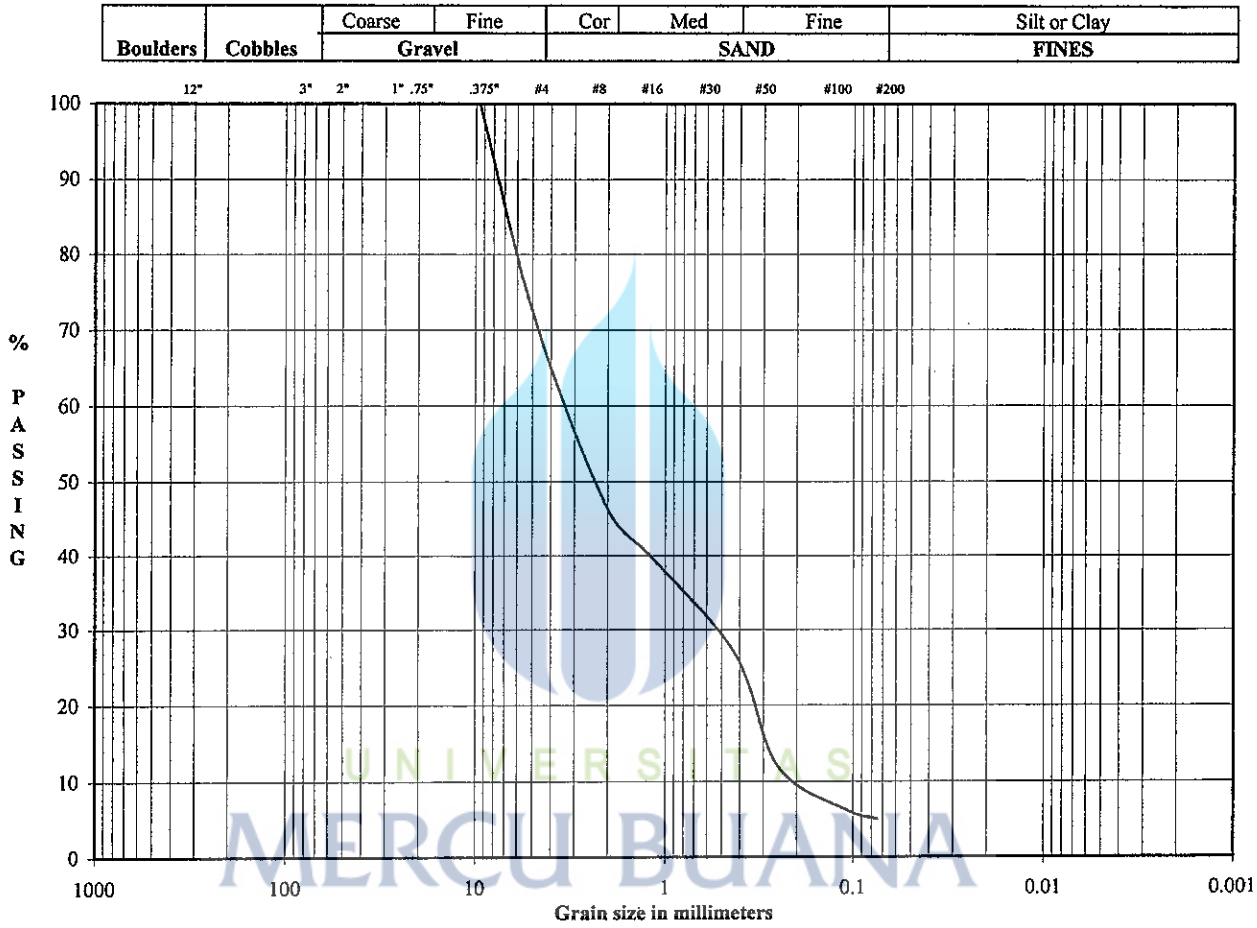
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-3
Sample Depth	:	12.00-12.50 M

Soil Description :



REMARKS :

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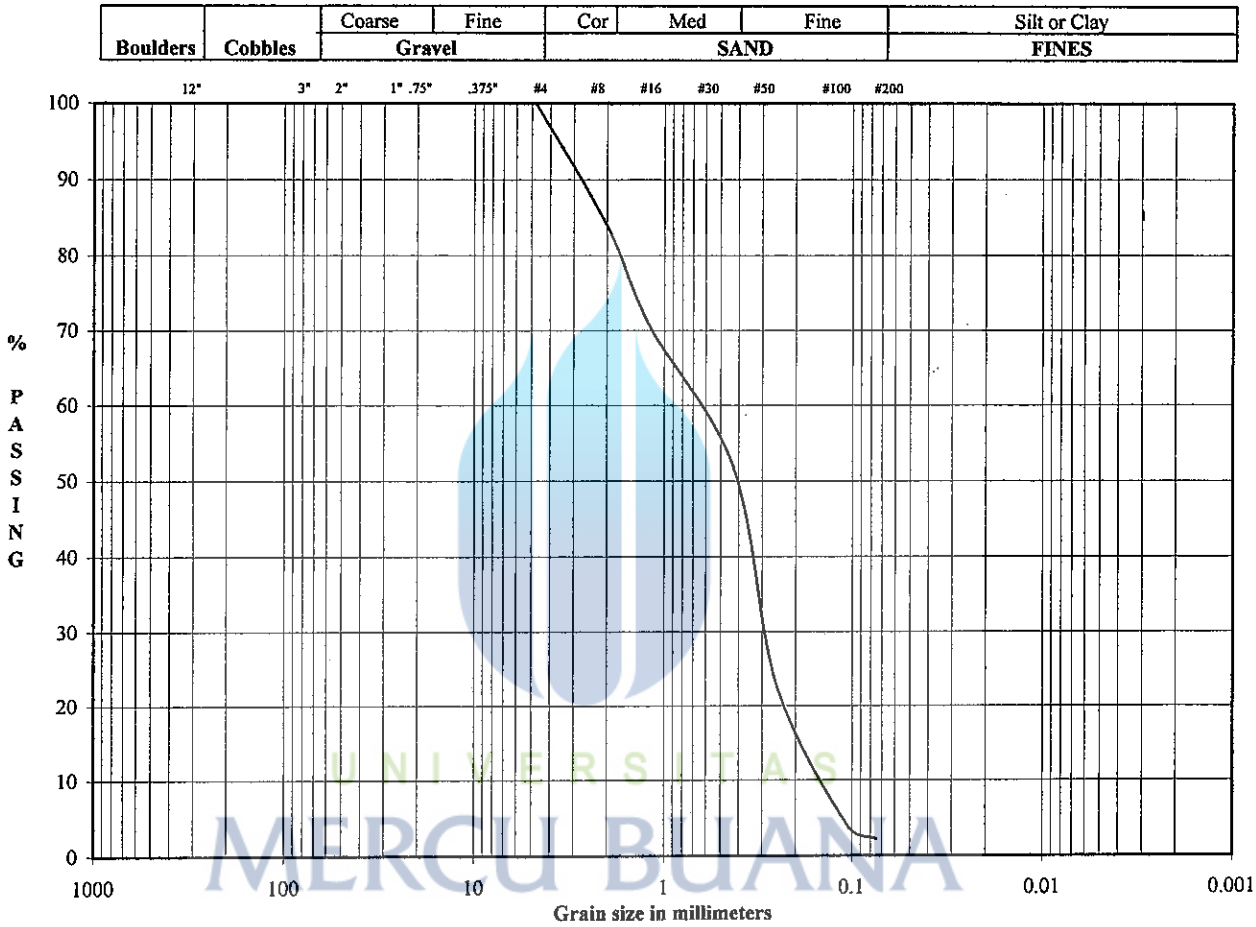
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-3
Sample Depth	:	18.00-18.50 M

Soil Description :



REMARKS :

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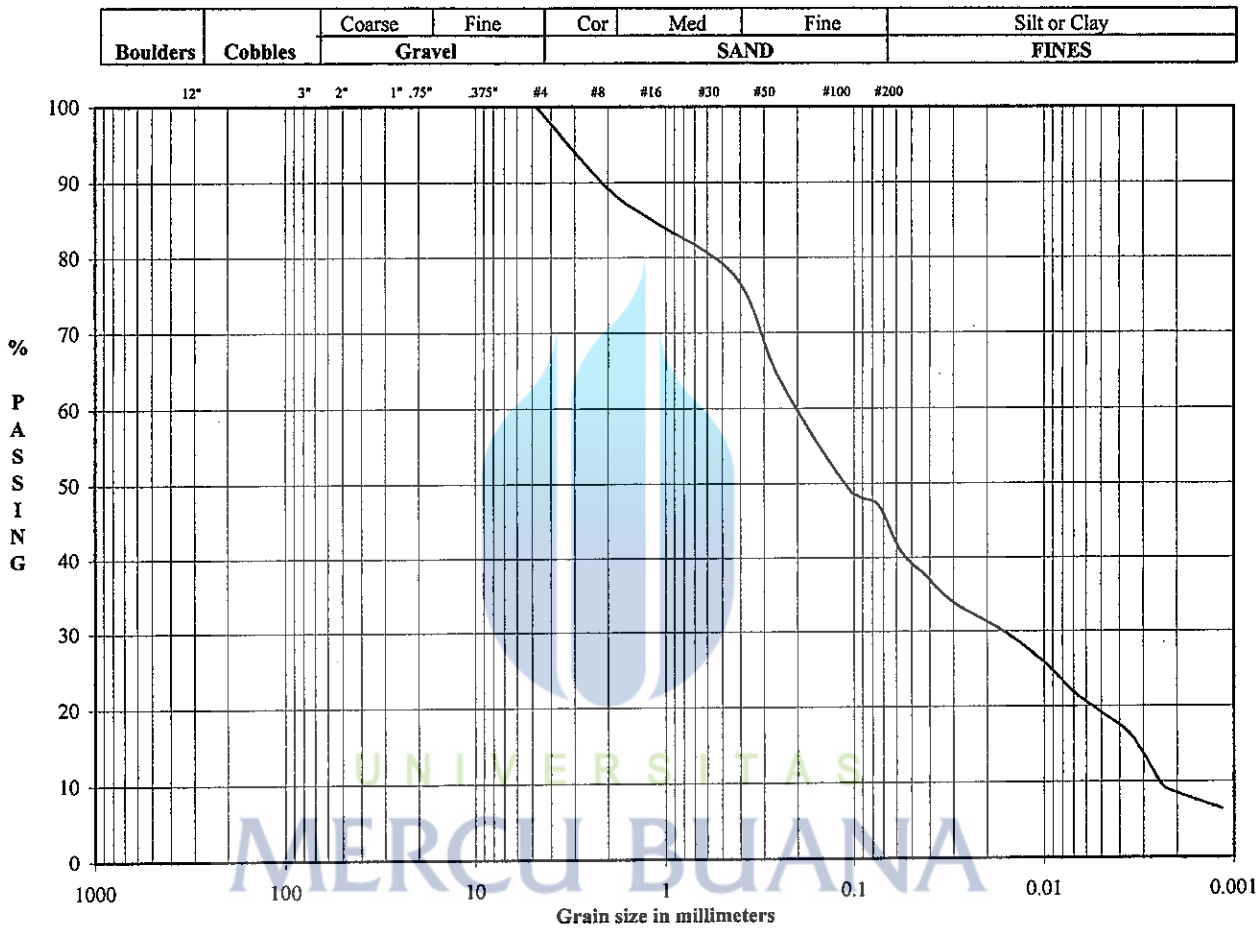
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-3
Sample Depth	:	24.00-24.50 M

Soil Description :



REMARKS :

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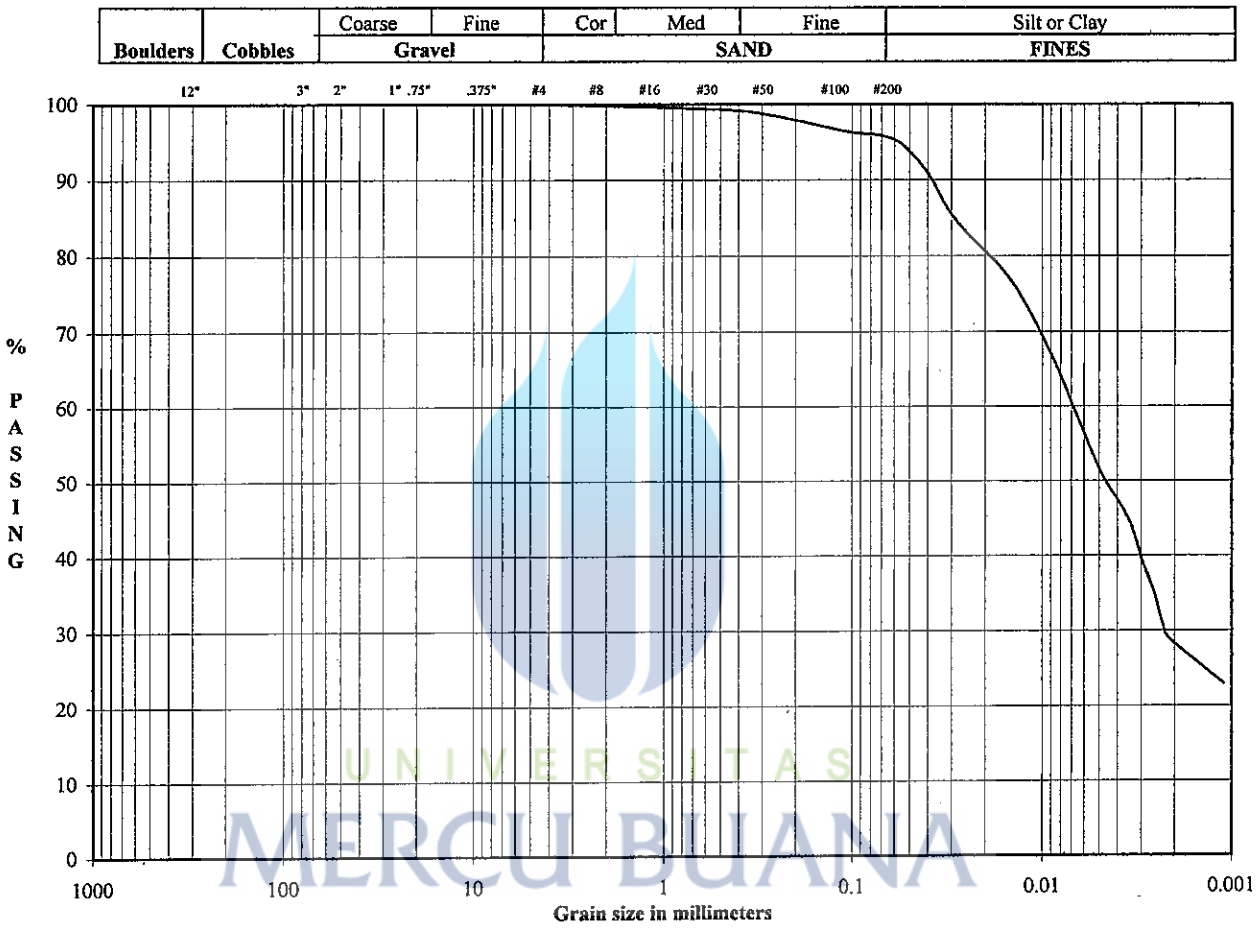
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	BH-3
Sample Depth	:	30.00-30.50 M

Soil Description :



REMARKS :

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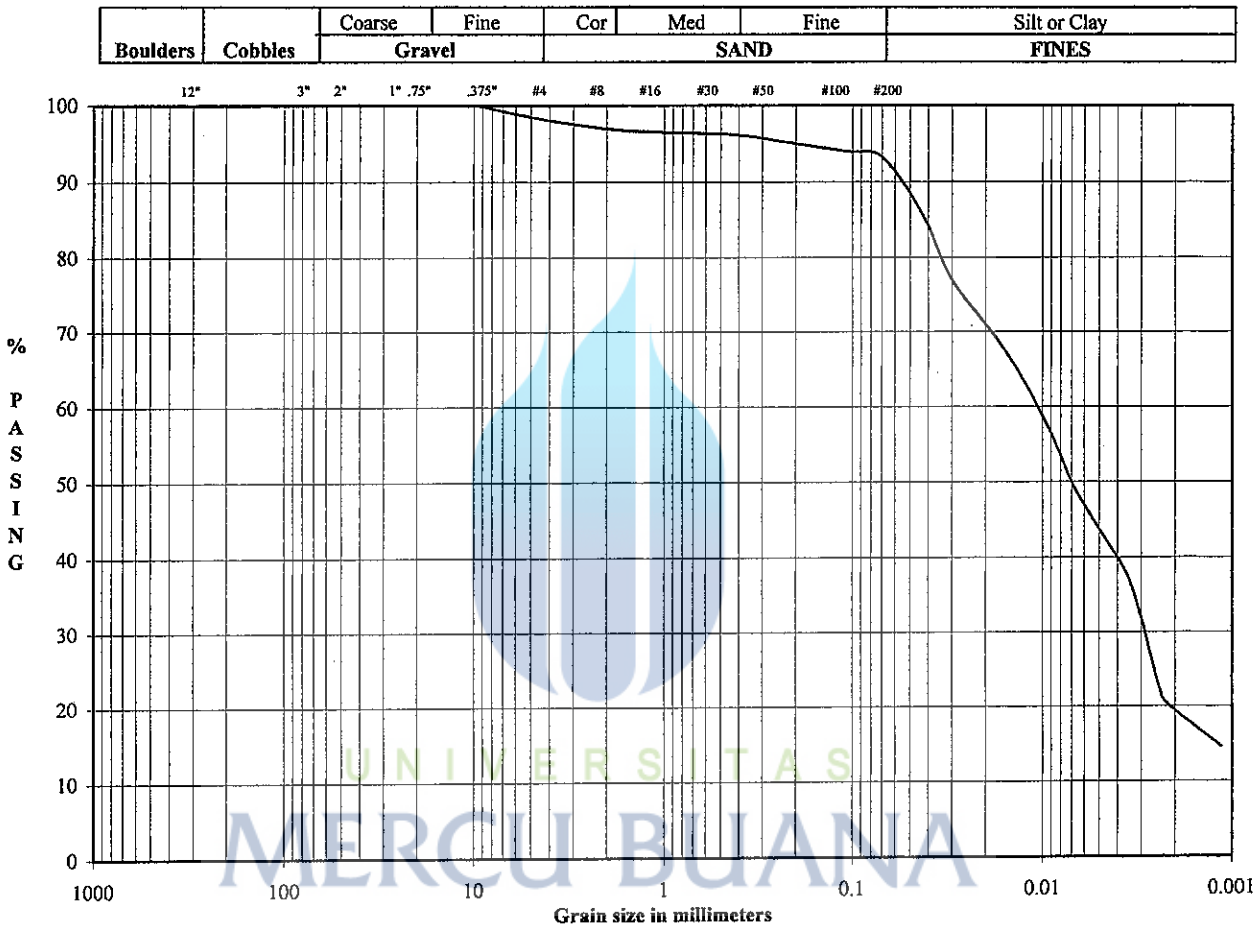
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	DB-1
Sample Depth	:	2.00-2.50 M

Soil Description :



REMARKS :

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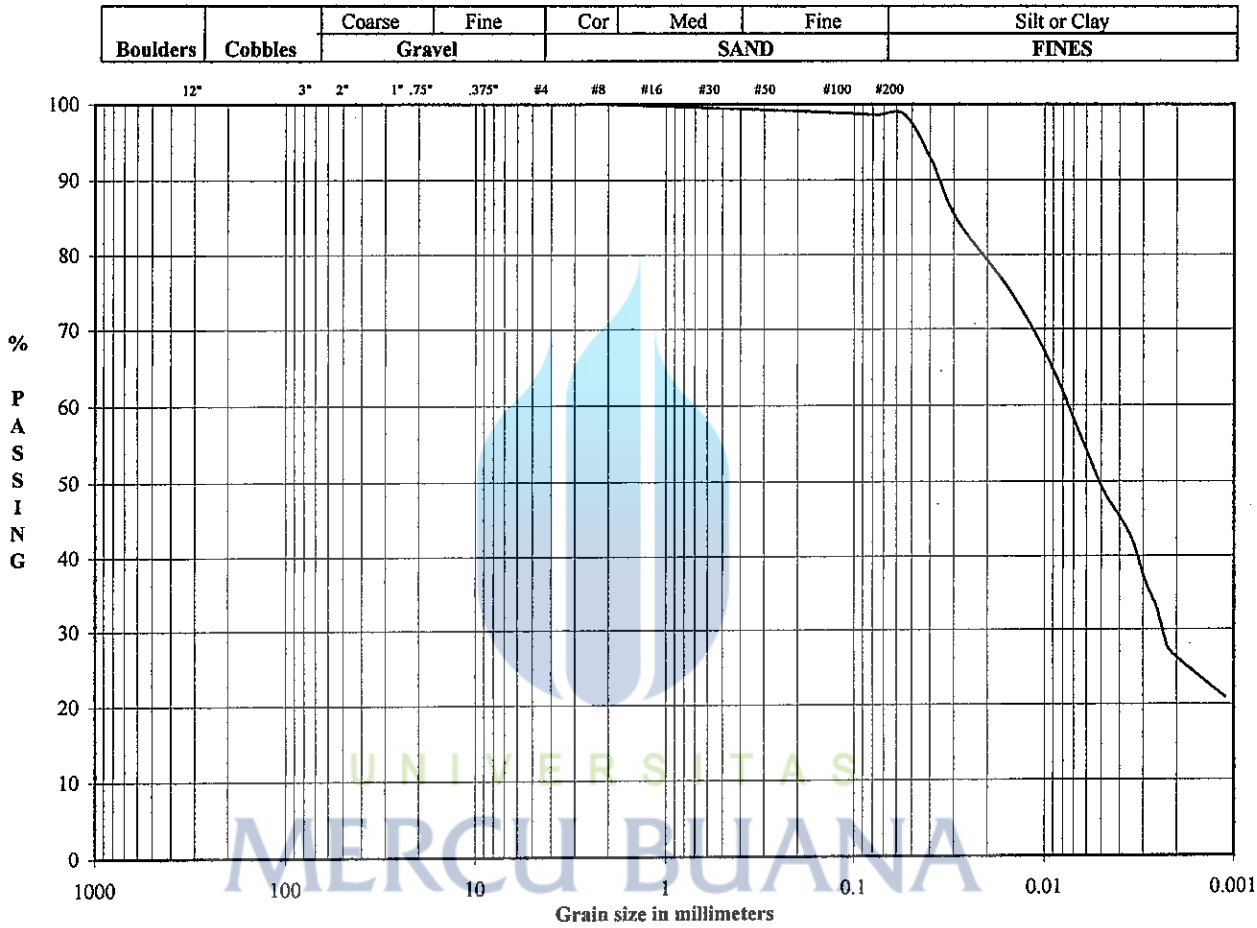
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	DB-1
Sample Depth	:	6.00-6.50 M

Soil Description :



REMARKS :

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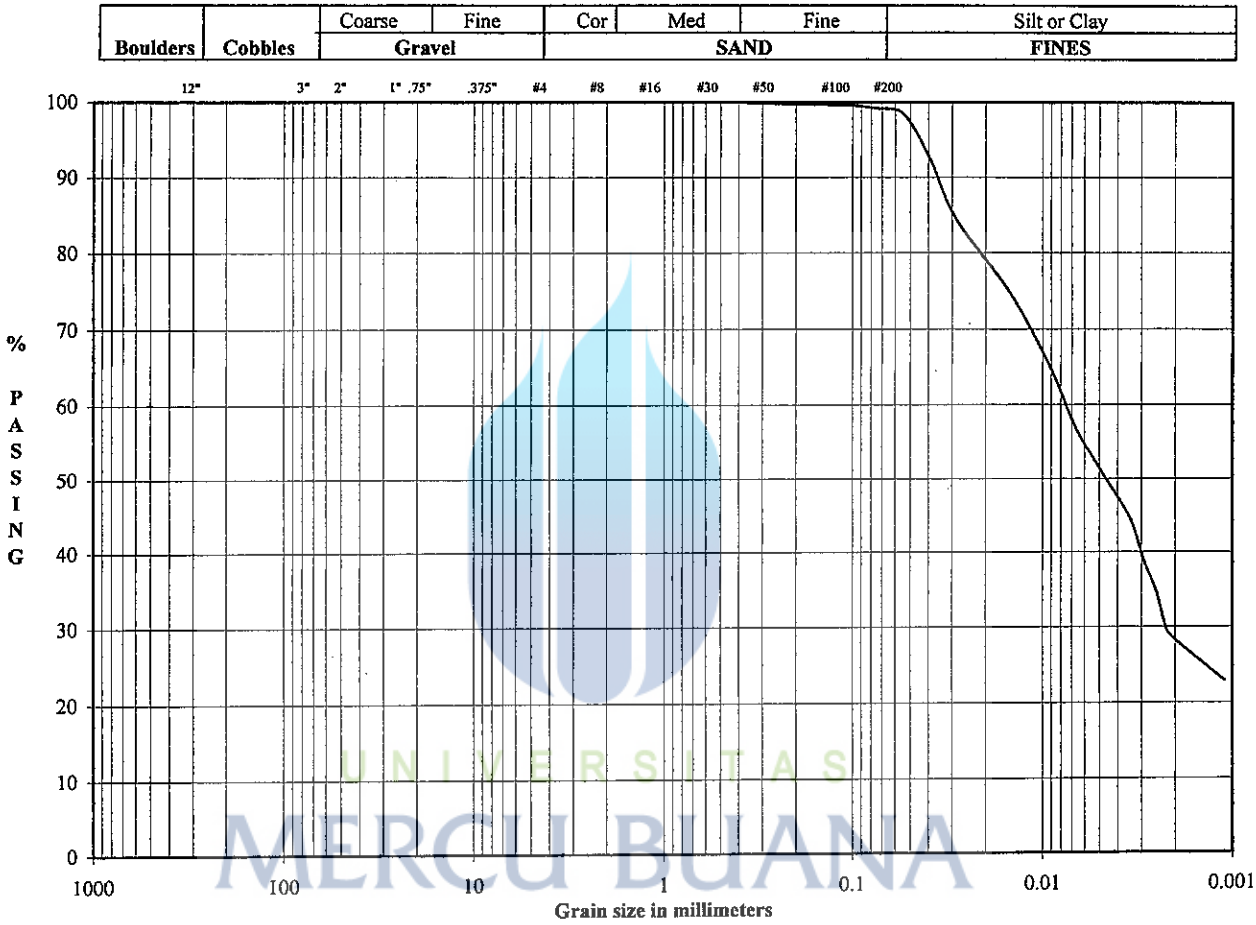
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	DB-1
Sample Depth	:	17.00-17.50 M

Soil Description :



REMARKS :

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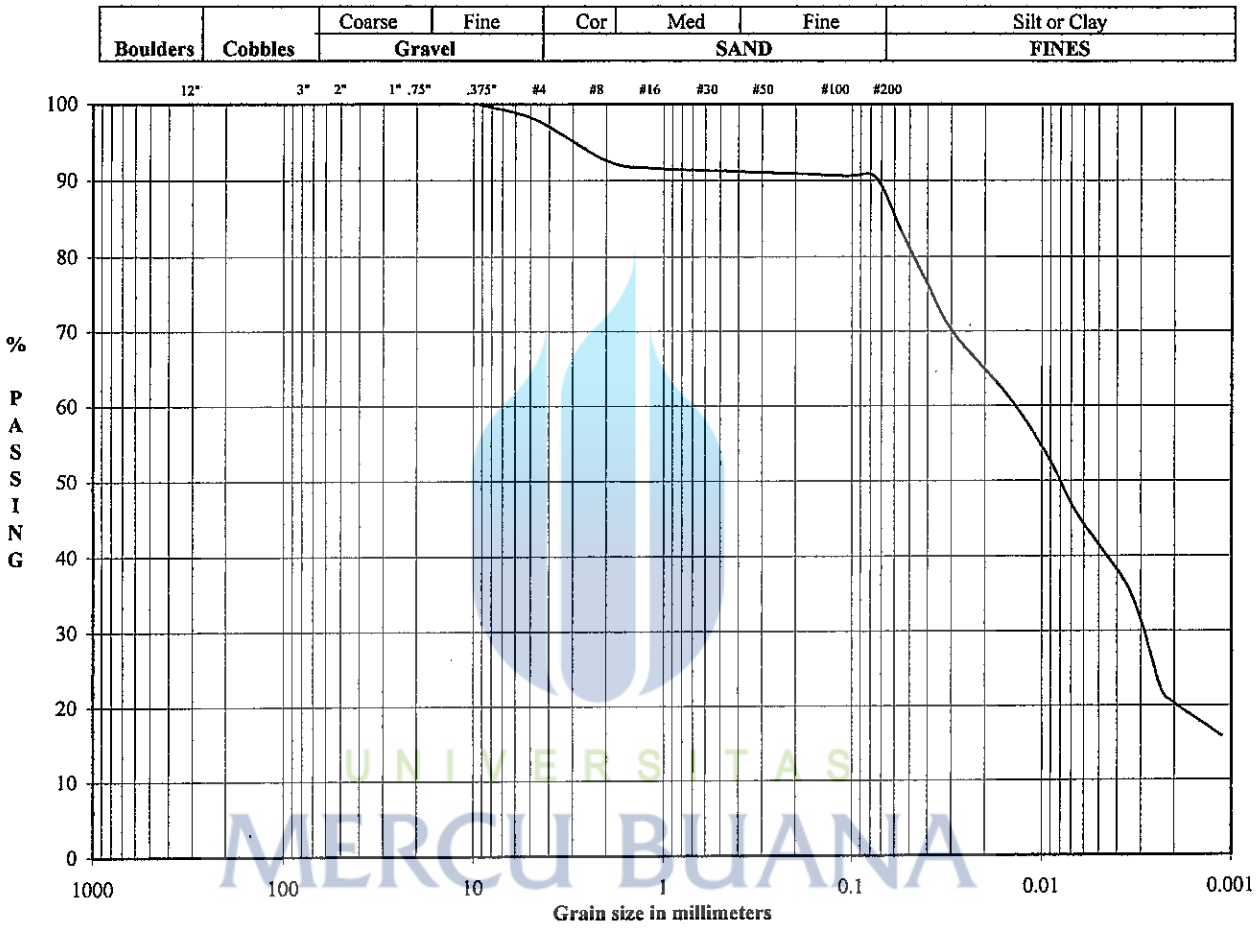
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	DB-1
Sample Depth	:	35.50-36.00 M

Soil Description :



REMARKS :

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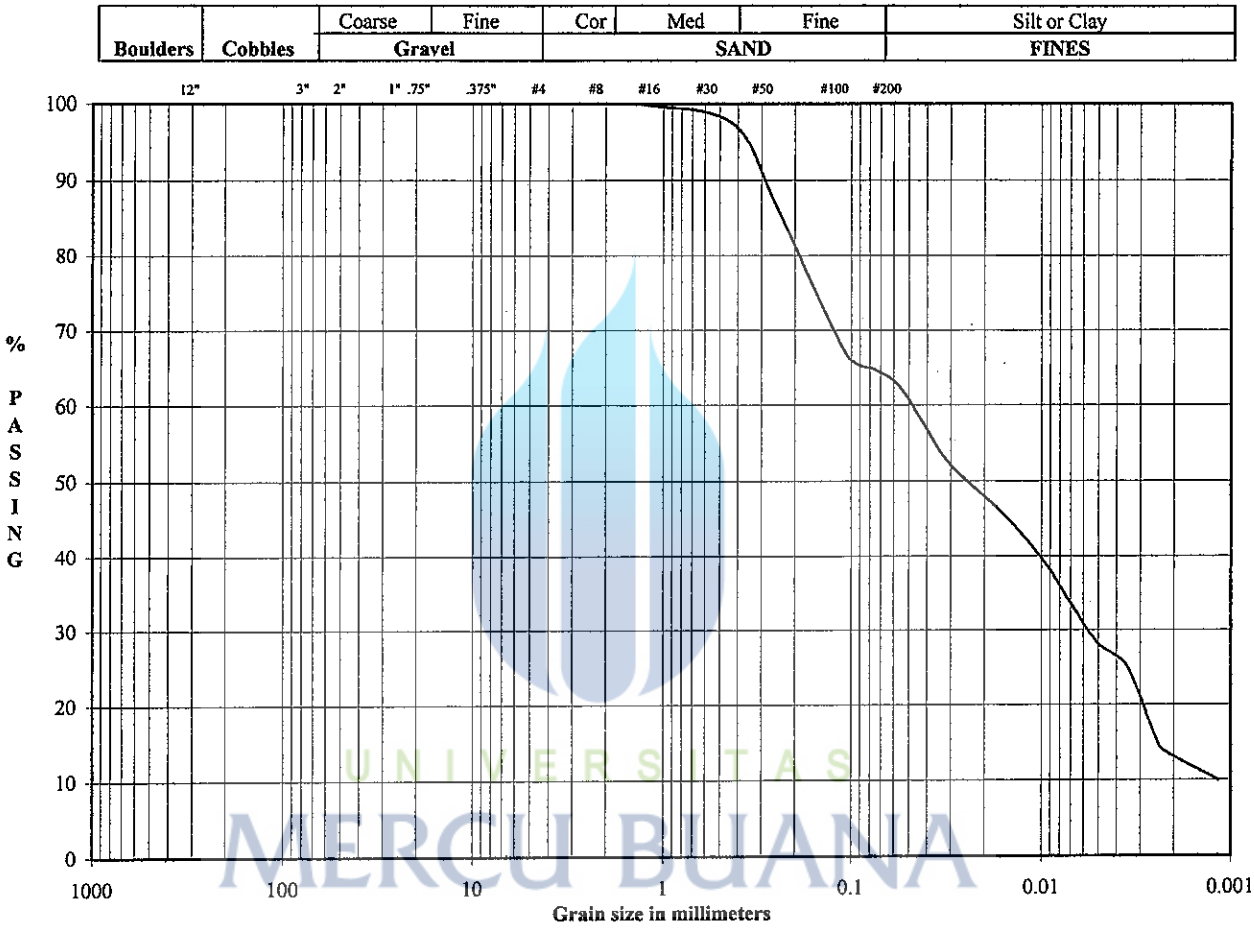
GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	DB-1
Sample Depth	:	45.00-45.50 M

Soil Description :



REMARKS :

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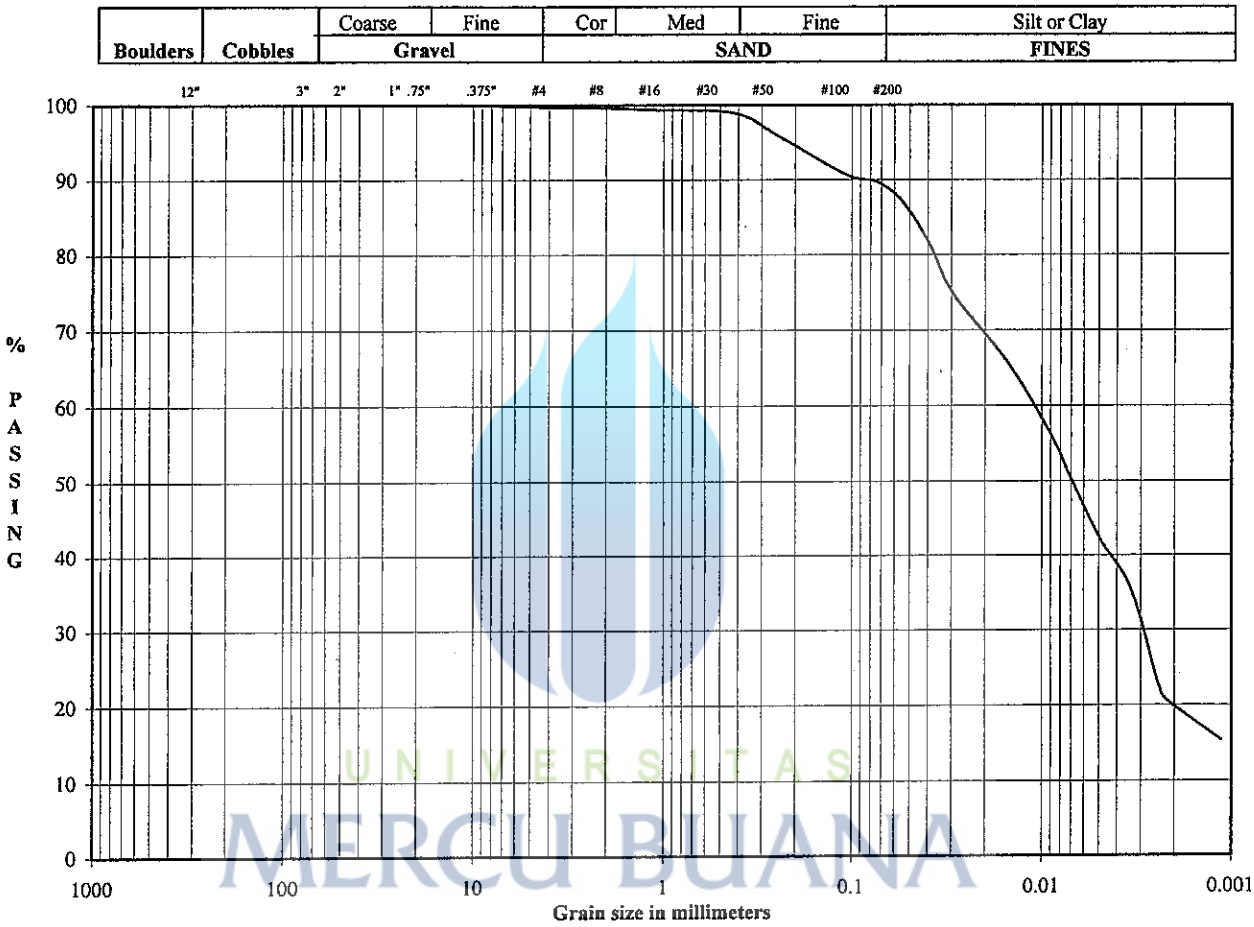
http://digilib.mercubuana.ac.id/

GRAIN SIZE DISTRIBUTION

Project	:	HOTEL & OFFICE TOWER
Location	:	JL. MT. HARYONO KAV. 10, CAWANG - JAKARTA
Boring No.	:	DB-1
Sample Depth	:	50.00-50.50 M

Soil Description :



REMARKS :

SOFOCO

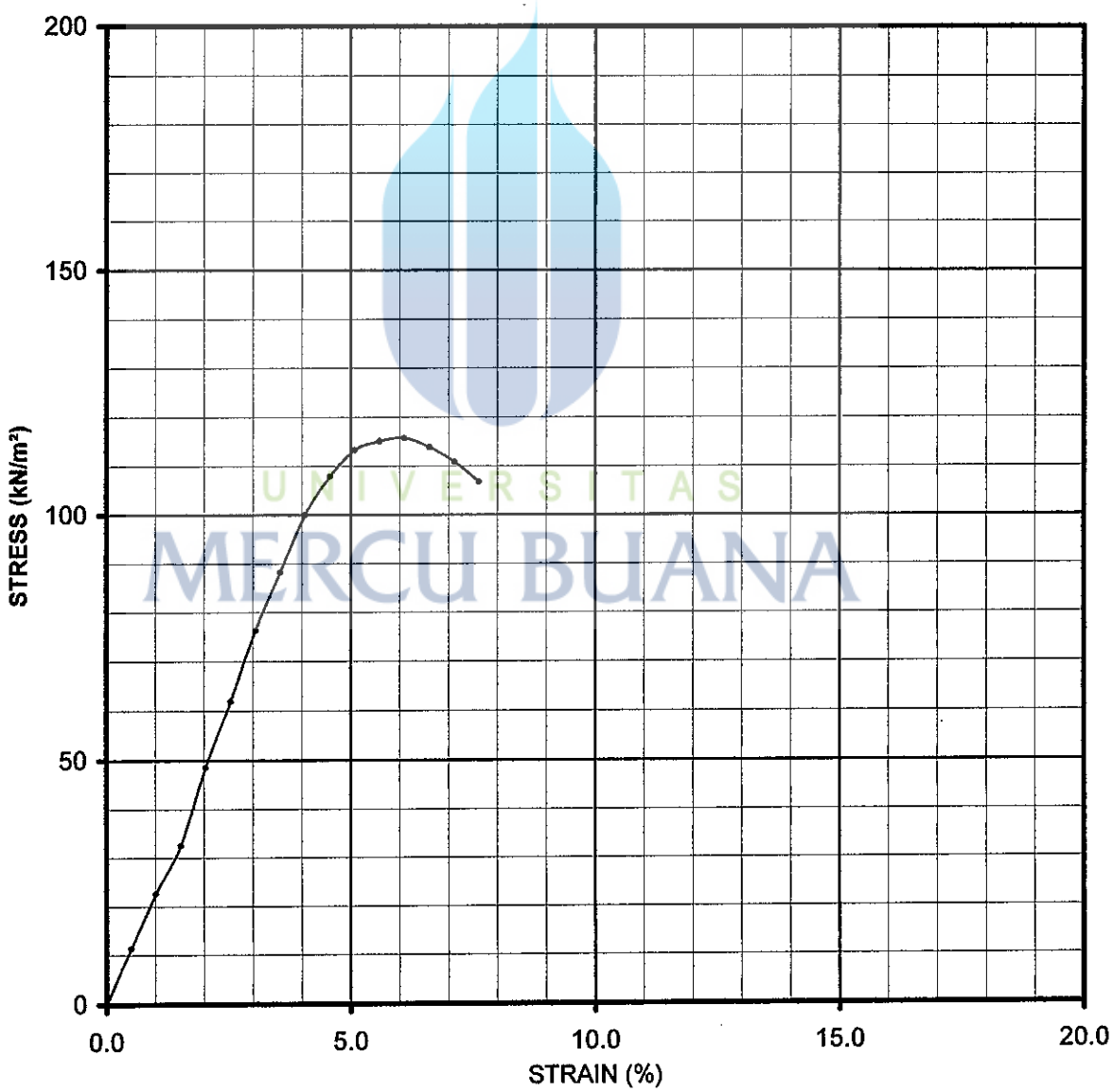
http://digilib.mercubuana.ac.id/

UNCONFINED COMPRESSION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313	
Location	: JL. MT. HARYONO KAV. 10, CAW/	Date Tested	: 23-Apr-13	
Boring No.	: BH-1	Moisture Conter	: 33.49	%
Depth	: 33.50-34.00 M	Wet Density	: 18.675	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	115.76
STRAIN AT FAILURE (%)	6.10



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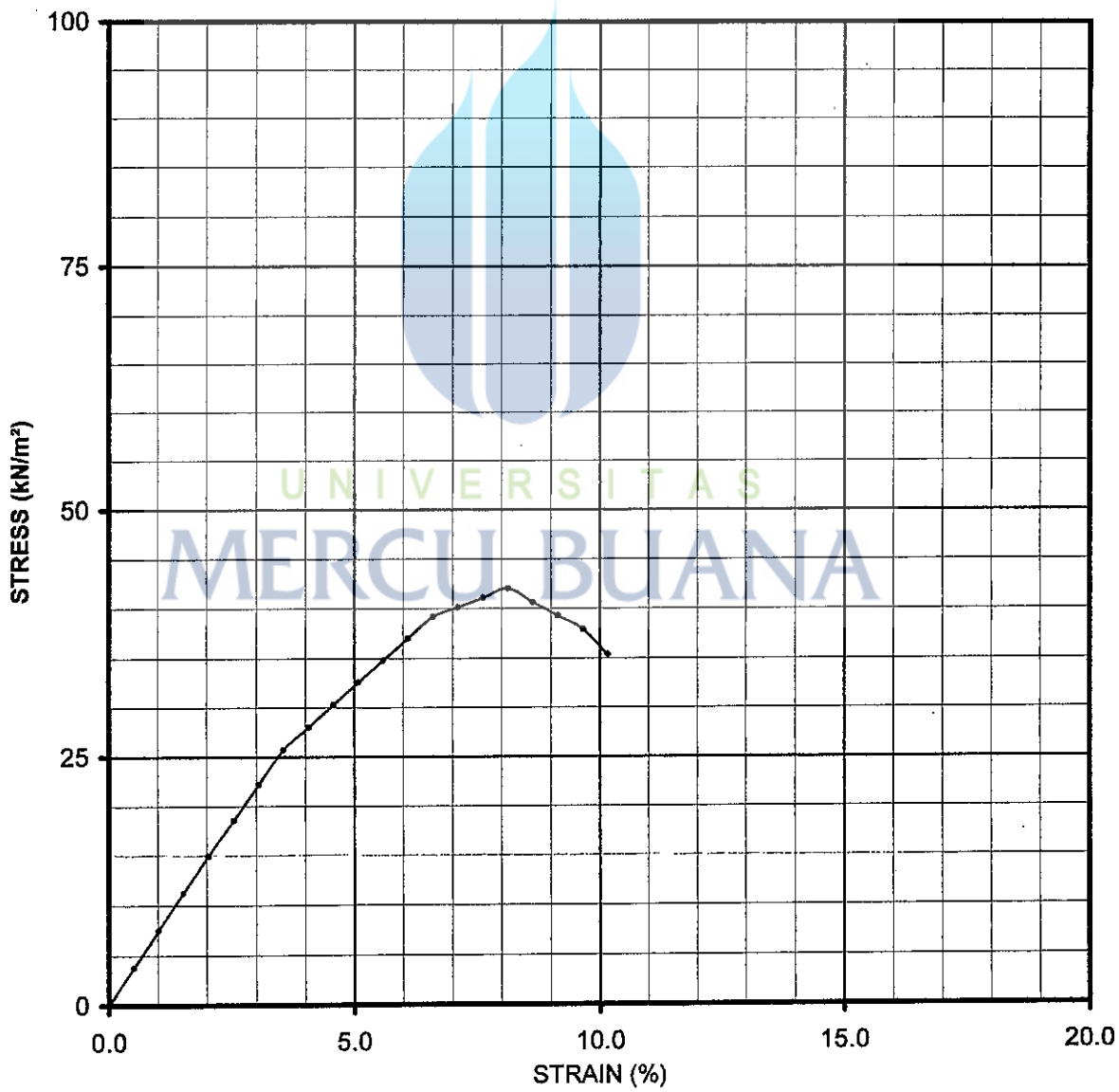
UNCONFINED COMPRESSION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313	
Location	: JL. MT. HARYONO KAV. 10, CAW/	Date Tested	: 23-Apr-13	
Boring No.	: BH-2	Moisture Conter	: 75.76	%
Depth	: 15.00-15.50 M	Wet Density	: 16.443	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	42.03
STRAIN AT FAILURE (%)	8.13



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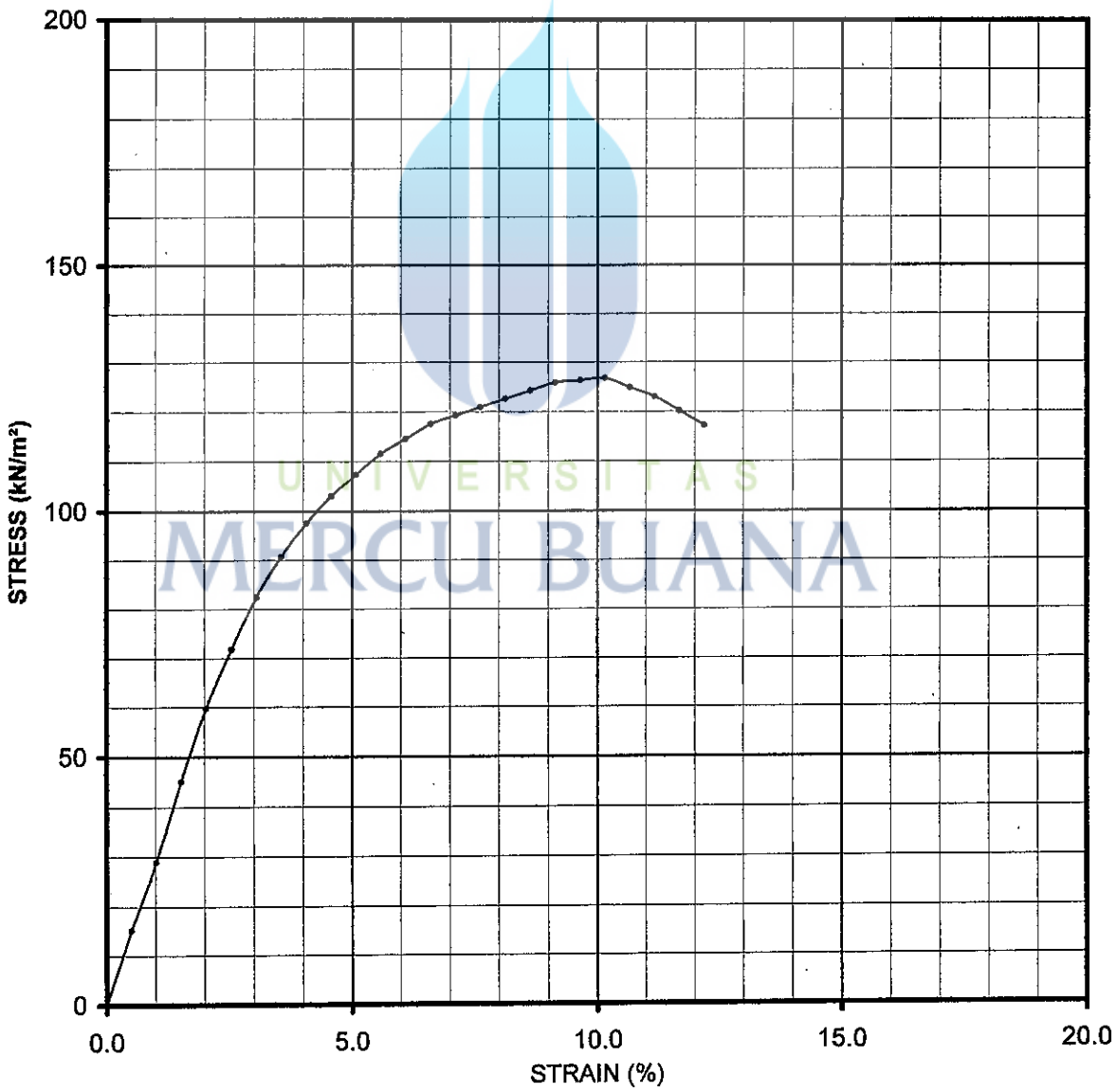
UNCONFINED COMPRESSION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313	
Location	: JL. MT. HARYONO KAV. 10, CAW/	Date Tested	: 23-Apr-13	
Boring No.	: BH-2	Moisture Conter	: 27.25	%
Depth	: 33.00-33.50 M	Wet Density	: 19.169	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	126.73
STRAIN AT FAILURE (%)	10.15



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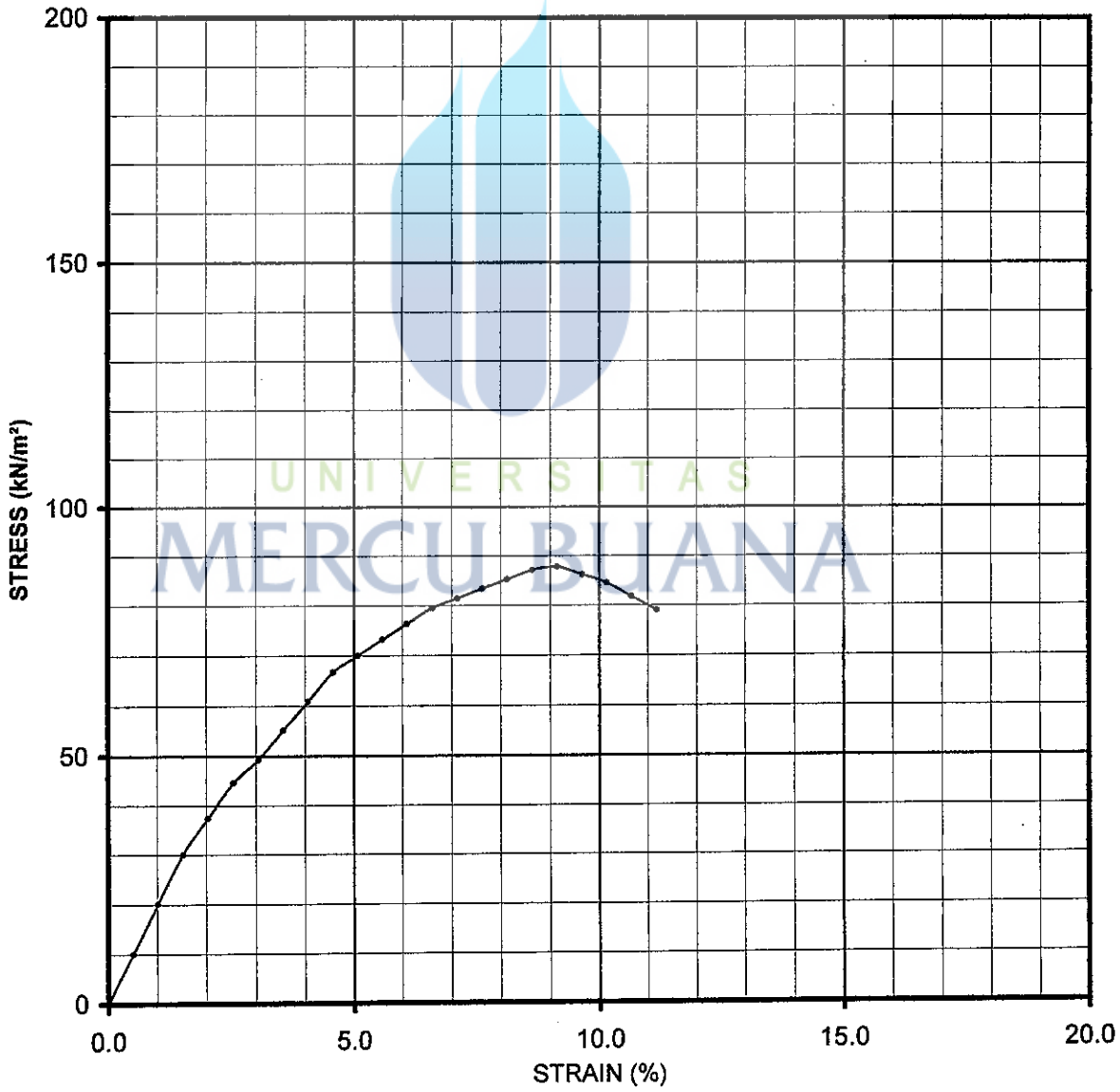
UNCONFINED COMPRESSION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313	
Location	: JL. MT. HARYONO KAV. 10, CAW/	Date Tested	: 23-Apr-13	
Boring No.	: BH-2	Moisture Conter	: 25.32	%
Depth	: 35.00-35.50 M	Wet Density	: 19.368	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	87.75
STRAIN AT FAILURE (%)	9.15



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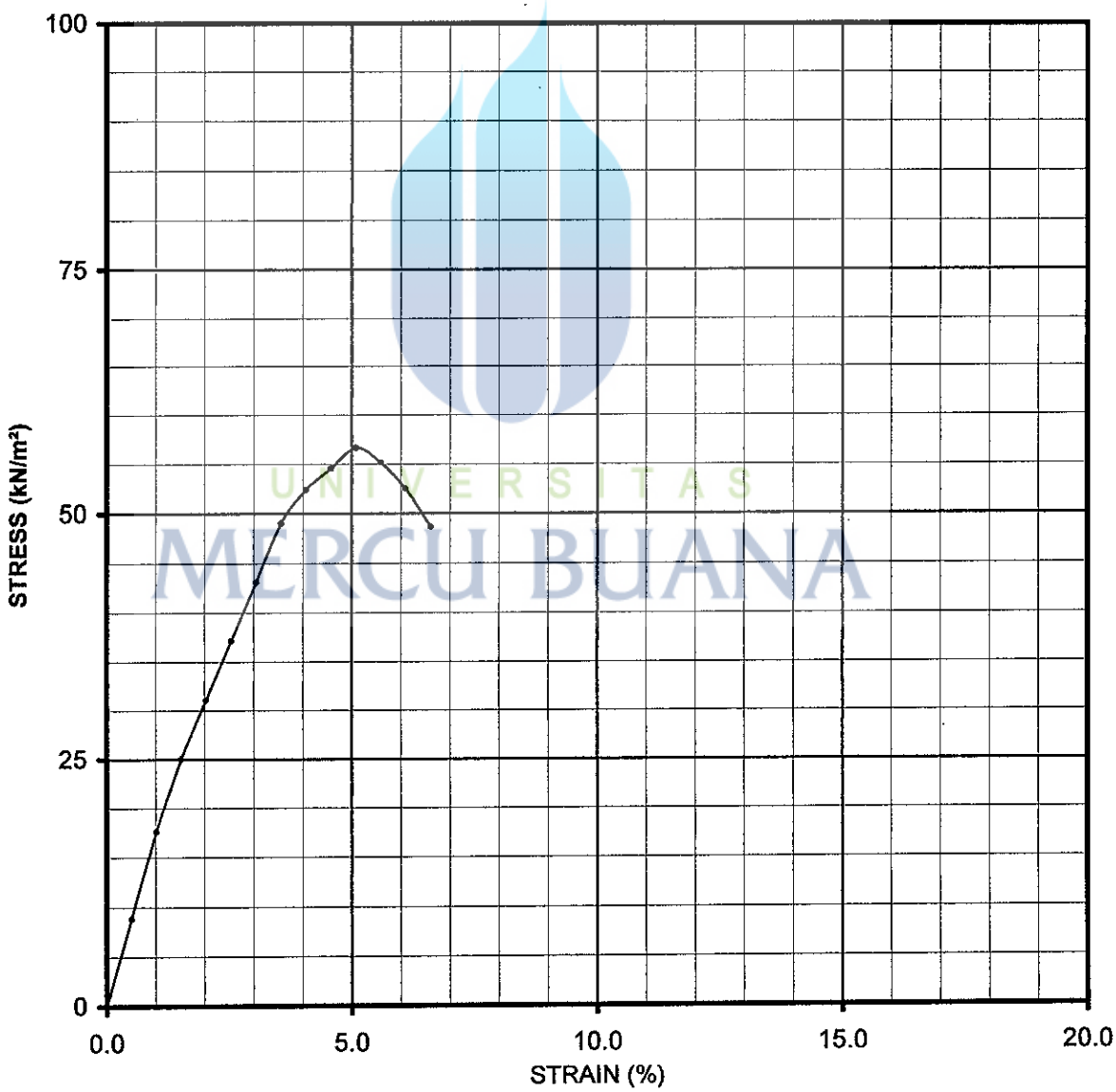
UNCONFINED COMPRESSION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313	
Location	: JL. MT. HARYONO KAV. 10, CAW/	Date Tested	: 23-Apr-13	
Boring No.	: BH-2	Moisture Conter	: 45.38	%
Depth	: 40.00-40.50 M	Wet Density	: 17.732	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	56.69
STRAIN AT FAILURE (%)	5.08



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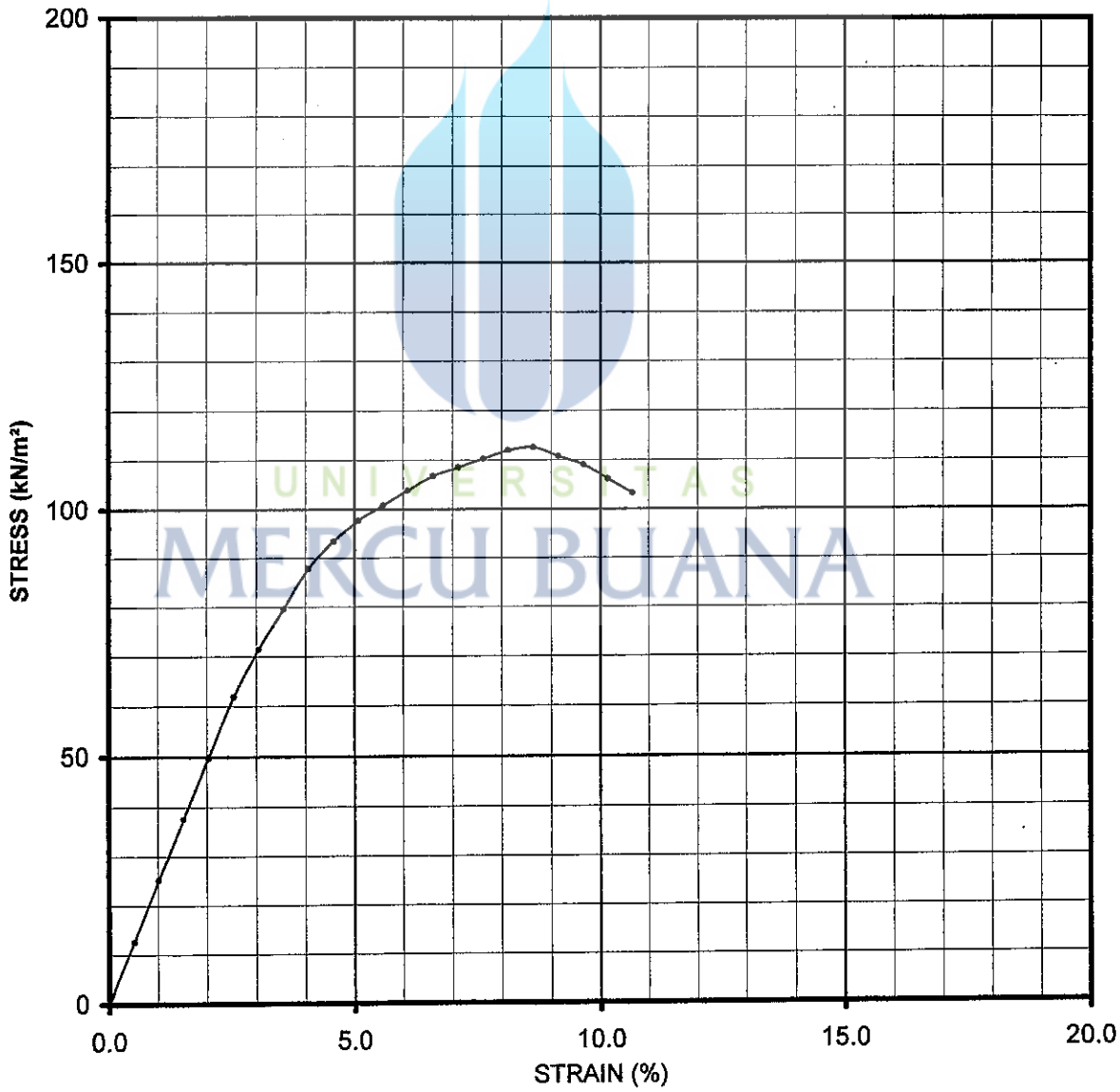
UNCONFINED COMPRESSION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313	
Location	: JL. MT. HARYONO KAV. 10, CAW/	Date Tested	: 23-Apr-13	
Boring No.	: BH-3	Moisture Conter	: 30.21	%
Depth	: 30.00-30.50 M	Wet Density	: 18.589	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	112.62
STRAIN AT FAILURE (%)	8.65



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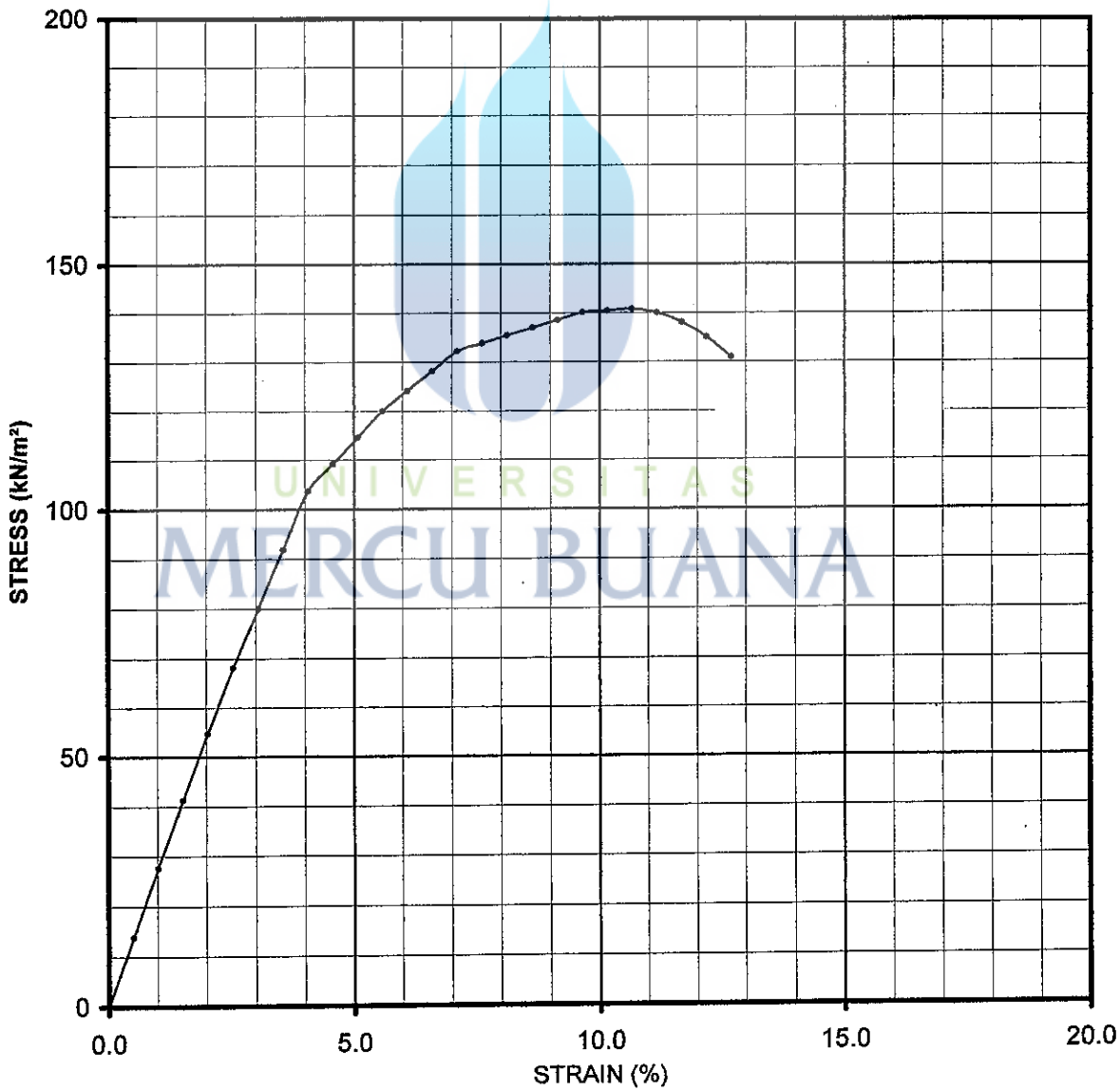
UNCONFINED COMPRESSION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313	
Location	: JL. MT. HARYONO KAV. 10, CAW/	Date Tested	: 23-Apr-13	
Boring No.	: DB-1	Moisture Conter	: 44.01	%
Depth	: 35.50-36.00 M	Wet Density	: 17.631	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	140.77
STRAIN AT FAILURE (%)	10.67



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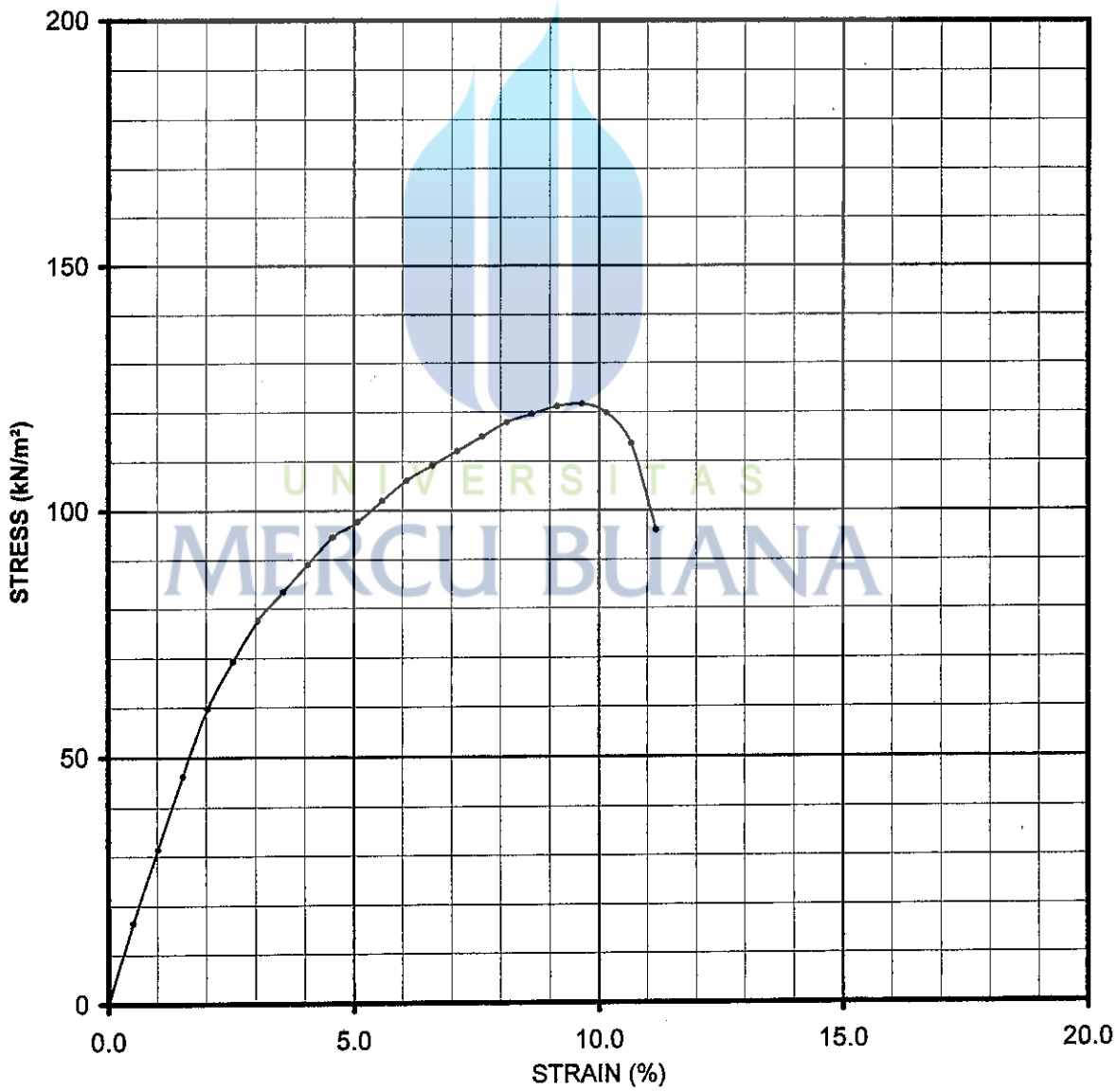
UNCONFINED COMPRESSION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313	
Location	: JL. MT. HARYONO KAV. 10, CAW/	Date Tested	: 23-Apr-13	
Boring No.	: DB-1	Moisture Conter	: 50.37	%
Depth	: 45.00-45.50 M	Wet Density	: 16.693	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	121.71
STRAIN AT FAILURE (%)	9.65



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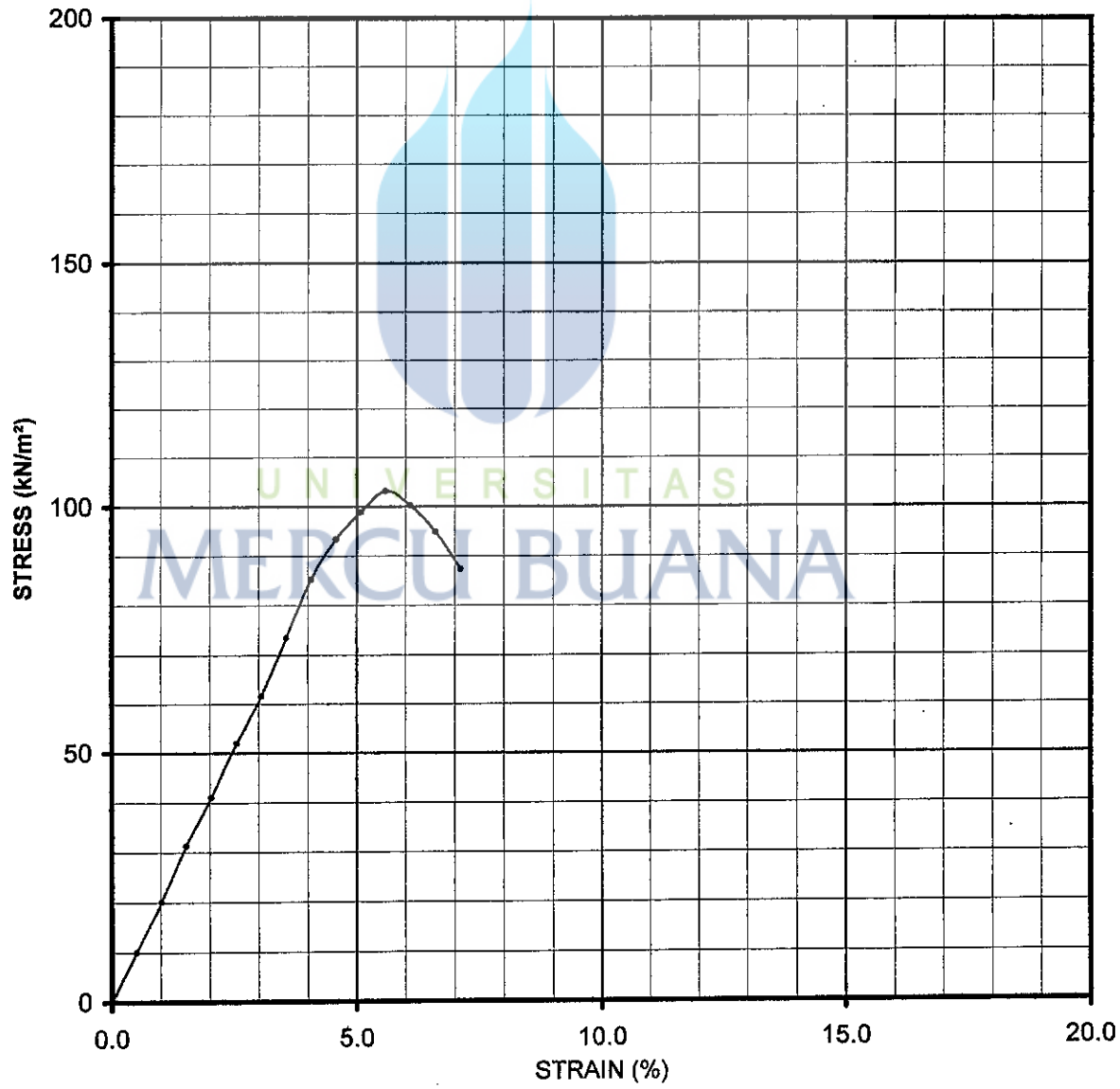
UNCONFINED COMPRESSION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313	
Location	: JL. MT. HARYONO KAV. 10, CAW/	Date Tested	: 23-Apr-13	
Boring No.	: DB-1	Moisture Conter	: 91.10	%
Depth	: 50.00-50.50 M	Wet Density	: 15.628	KN/m^3

Soil Description :

	UNDISTURBED
UNCONFINED COMPRESSIVE STRENGTH (kN/m^2)	103.18
STRAIN AT FAILURE (%)	5.60



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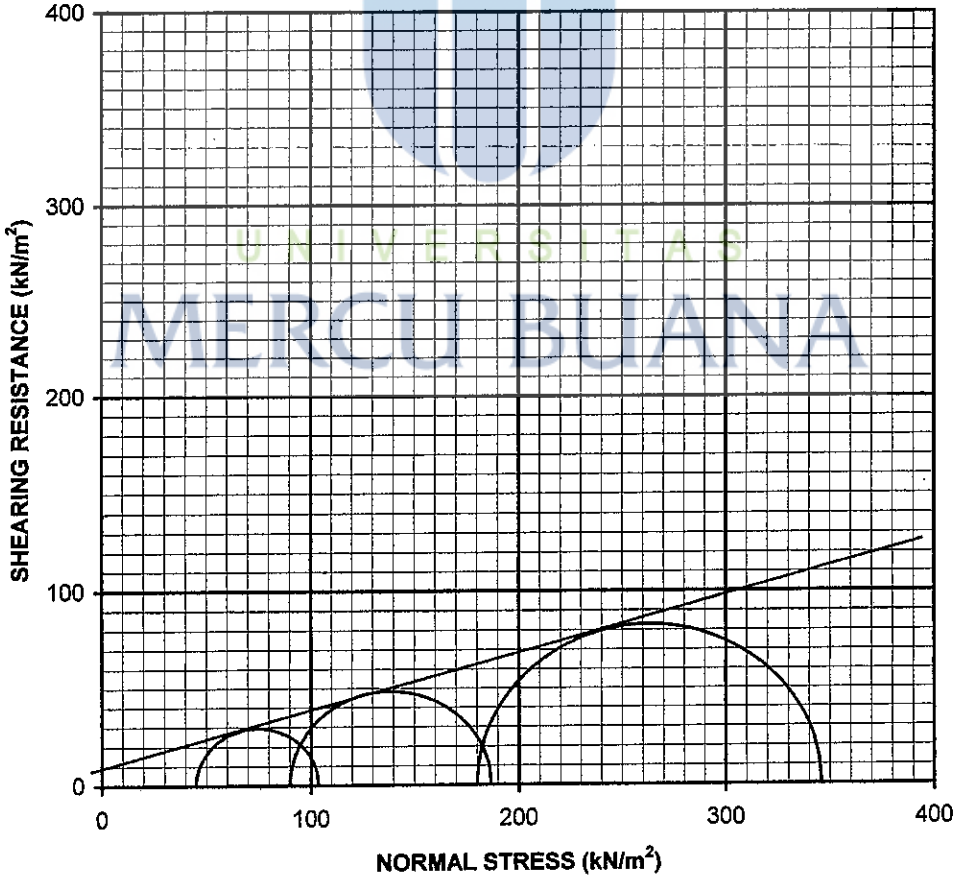
TRIAXIAL COMPRESSION TEST

Projevt	: HOTEL & OFFICE TOWER	Lab Reference	: 024-01-0313
Location	: JL. MT. HARYONO KAV. 10, CAWANG -	Date Received	: -
Sample No.	: BH-1	Dete Tested	: 23-Apr-13
Depth	: 15.50-16.00 M		

IMMIDIATE TESTS, RATE OF STRAIN 2.00 MM/MIN					
Normal Stress at failure	(kN/m^2)	58.8	96.8	166.0	
Lateral Pressure	(kN/m^2)	45.0	90.0	180.0	
Total Normal Stress	(kN/m^2)	103.8	186.8	346.0	

Apparent Cohesion	:	10.0	(kN/m^2)
Angle of Shearing Resistance	:	15.0	(°)
Type of Failure	:		
Moisture Content	:	40.11	%
Wet Density	:	15.597	kN/m^3
Dry Density	:	11.132	kN/m^3



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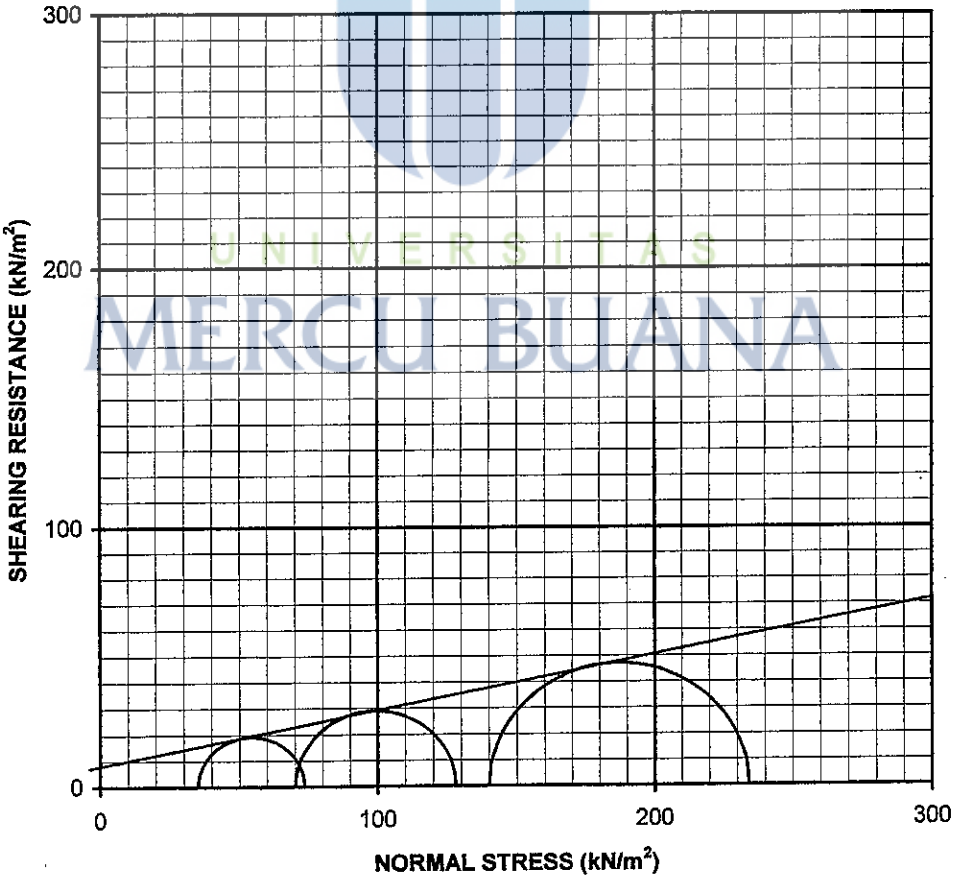
TRIAXIAL COMPRESSION TEST

Projevt	: HOTEL & OFFICE TOWER	Lab Reference	: 024-01-0313
Location	: JL. MT. HARYONO KAV. 10, CAWANG -	Date Received	: -
Sample No.	: BH-2	Dete Tested	: 23-Apr-13
Depth	: 4.00-4.50 M		

IMMIDIATE TESTS, RATE OF STRAIN 2.00 MM/MIN					
Normal Stress at failure	(kN/m^2)	38.4	58.1	94.2	
Lateral Pressure	(kN/m^2)	35.0	70.0	140.0	
Total Normal Stress	(kN/m^2)	73.4	128.1	234.2	

Apparent Cohesion	:	8.0	(kN/m^2)
Angle of Shearing Resistance	:	11.0	(°)
Type of Failure	:		
Moisture Content	:	63.81	%
Wet Density	:	15.817	kN/m^3
Dry Density	:	9.655	kN/m^3



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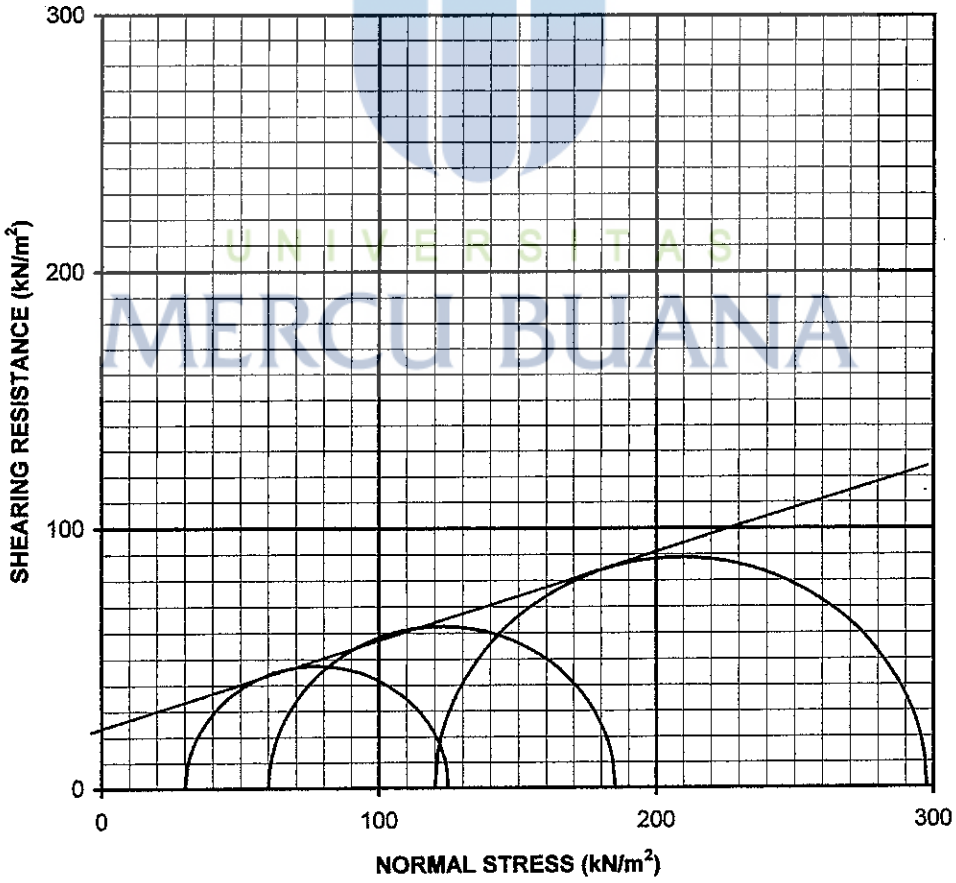
TRIAXIAL COMPRESSION TEST

Projevt	: **HOTEL & OFFICE TOWER**	Lab Reference	: **024-01-0313**
Location	: **JL. MT. HARYONO KAV. 10, CAWANG -**	Date Received	: -
Sample No.	: **BH-3**	Dete Tested	: **23-Apr-13**
Depth	: **3.00-3.50 M**		

IMMIDIATE TESTS, RATE OF STRAIN 2.00 MM/MIN					
Normal Stress at failure	(kN/m^2)	**94.9**	**125.1**	**177.6**	
Lateral Pressure	(kN/m^2)	**30.0**	**60.0**	**120.0**	
Total Normal Stress	(kN/m^2)	**124.9**	**185.1**	**297.6**	

Apparent Cohesion	:	**24.0**	(kN/m^2)
Angle of Shearing Resistance	:	**17.0**	(°)
Type of Failure	:		
Moisture Content	:	**47.33**	%
Wet Density	:	**16.693**	kN/m^3
Dry Density	:	**11.330**	kN/m^3



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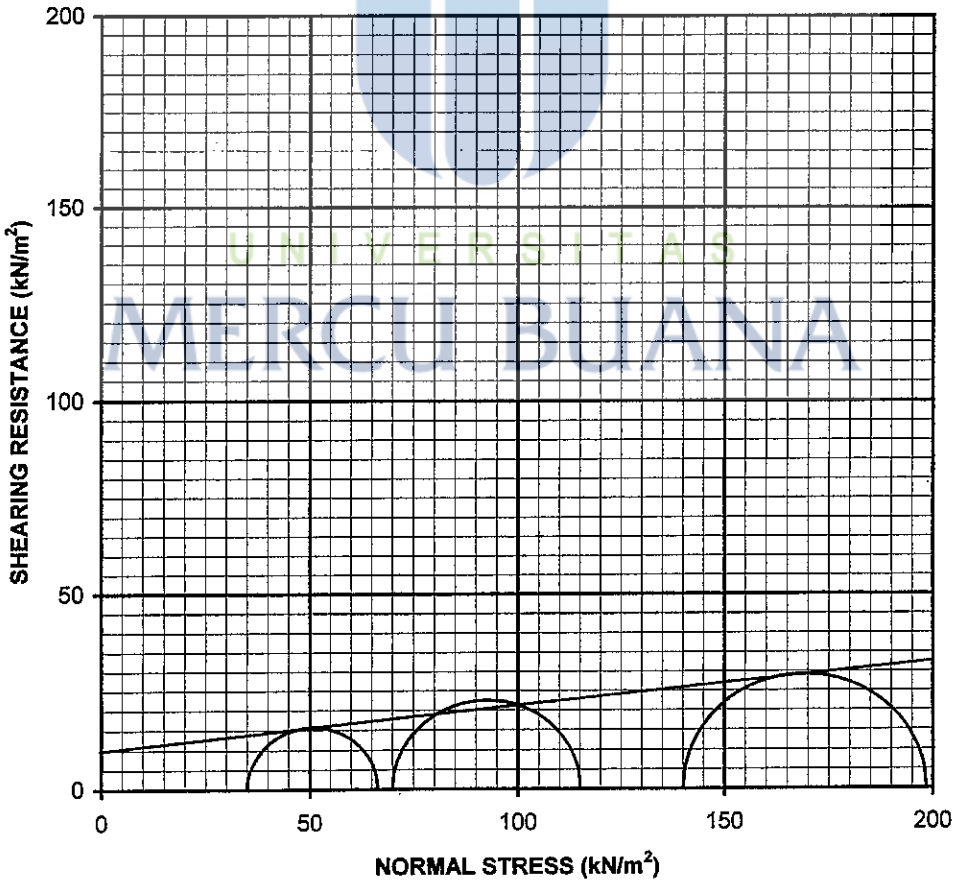
TRIAXIAL COMPRESSION TEST

Projevt	: HOTEL & OFFICE TOWER	Lab Reference	: 024-01-0313
Location	: JL. MT. HARYONO KAV. 10, CAWANG -	Date Received	: -
Sample No.	: DB-1	Dete Tested	: 23-Apr-13
Depth	: 17.00-17.50 M		

IMMIDIATE TESTS, RATE OF STRAIN 2.00 MM/MIN					
Normal Stress at failure	(kN/m^2)	31.5	45.1	58.4	
Lateral Pressure	(kN/m^2)	35.0	70.0	140.0	
Total Normal Stress	(kN/m^2)	66.5	115.1	198.4	

Apparent Cohesion	:	10.0	(kN/m^2)
Angle of Shearing Resistance	:	6.5	(°)
Type of Failure	:		
Moisture Content	:	88.01	%
Wet Density	:	13.926	kN/m^3
Dry Density	:	7.407	kN/m^3



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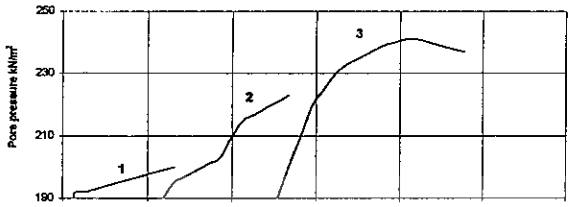
Client			
Project	Hotel -Office Waskita		
Job No.	-	Date	15052013
Tested By	Hadi	Checked By	PBK

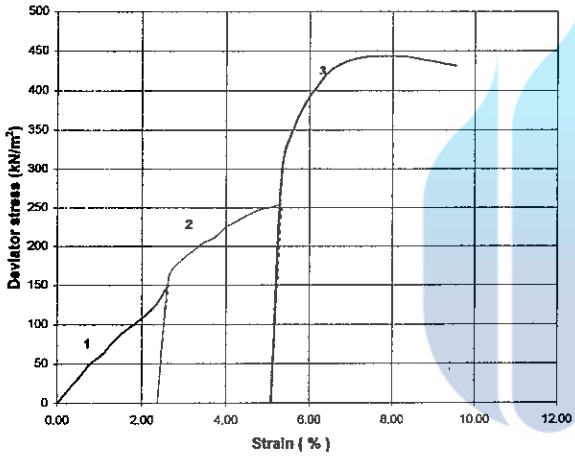
CU - TRIAXIAL COMPRESSION TEST

BS 1377 : Part 8 : 1990

Location :
Boring no : B.1
Depth : 3.00- 3.50 m

Sample type : UDS
Soil description : Soft Greyish Brown Silty CLAY
Sample no. : 1





SPECIMEN			1	2	3
INITIAL	Wet density	Mg/m³	1.68		
	Moisture content	%	49		
	Dry density	Mg/m³	0.79		
AFTER CONSOLIDATION	Wet density	Mg/m³	1.68	1.67	1.69
	Moisture content	%	47		
	Dry density	Mg/m³	1.14	1.14	1.15
SATURATION STAGE	Initial pwp	kN/m²	0	0	0
	Saturated pwp	kN/m²	240	300	420
	Final cell presure	kN/m²	250	310	430
	B value		1.00	0.97	0.98
CONDSOLIDATION STAGE	Cell pressure	kN/m²	250	310	430
	Back pressure	kN/m²	190	190	190
	Initial pwp	kN/m²	240	300	420
	Final pwp	kN/m²	0	190	190
COMPRESSION STAGE	Cell pressure	kN/m²	250	310	430
	Initial pwp	kN/m²	0	190	190
	Initial σ'3	kN/m²	250	115	240
	Rate of strain	% / hour	4.1	4.1	241
FAILURE CONDITION	Strain	%	2.63	5.34	8.14
	σ1 - σ3	kN/m²	130	197	300
	U	kN/m²	180	223	
	σ'3	kN/m²	50	87	189
	σ'1	kN/m²	199	305	570
CONDSOLIDATION PARAMETERS	c_v	m²/year	48.98	46.30	66.67
	m_v	m²/MN	0.00	0.09	0.04
	k	m/s	6.8E-09		

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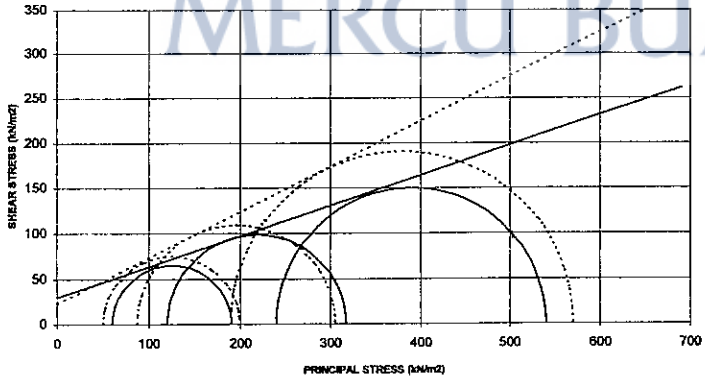
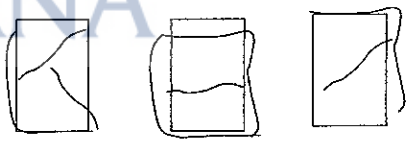
MOHR CIRCLES



MODE OF FAILURE :



STRENGTH PARAMETERS

C	kN/m²	30
ϕ	°	18.6
C'	kN/m²	23
ϕ'	°	26.7

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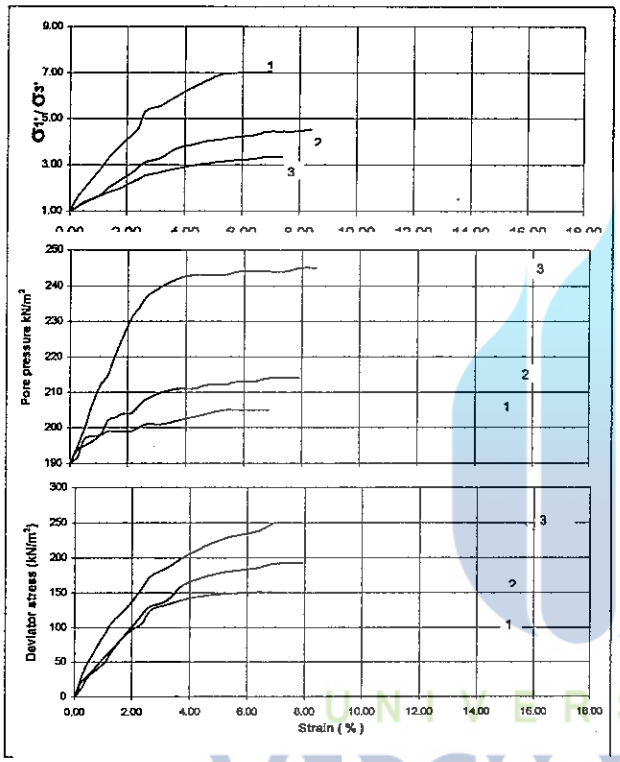
Client			
Project	Hotel -Office Waskita		
Job No.	-	Date	15052013
Tested By	Hadi	Checked By	PBK

CU - TRIAXIAL COMPRESSION TEST

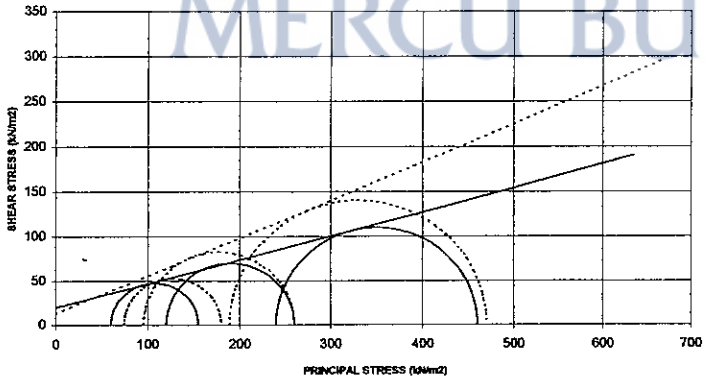
BS 1377 : Part 8 : 1990

Location :
Boring no : B.1
Depth : 7.00-7.50 m

Sample type : UDS
Soil description : Soft Greyish Brown Silty CLAY
Sample no. : 1



SPECIMEN			1	2	3
INITIAL	Wet density	Mg/m³	1.52		
	Moisture content	%	66		
	Dry density	Mg/m³	0.79		
AFTER CONSOLIDATION	Wet density	Mg/m³	1.53	1.55	1.57
	Moisture content	%	78		
	Dry density	Mg/m³	0.86	0.87	0.88
SATURATION STAGE	Initial pwp	kN/m²	0	0	0
	Saturated pwp	kN/m²	205	300	420
	Final cell presure	kN/m²	250	215	245
	B value		1.00	0.97	0.98
CONDSOLIDATION STAGE	Cell pressure	kN/m²	250	310	430
	Back pressure	kN/m²	190	190	190
	Initial pwp	kN/m²	240	300	420
	Final pwp	kN/m²	0	190	190
COMPRESSION STAGE	Cell pressure	kN/m²	250	310	430
	Initial pwp	kN/m²	0	190	190
	Initial σ'3	kN/m²	250	115	240
	Rate of strain	% / hour	4.1	4.1	241
FAILURE CONDITION	Strain	%	2.63	5.34	8.14
	σ1 - σ3	kN/m²	95	140	220
	U	kN/m²	180	223	
	σ'3	kN/m²	74	95	189
	σ'1	kN/m²	180	280	470
CONDSOLIDATION PARAMETERS	c_v	m²/year	48.98	46.30	66.67
	m_v	m²/MN	0.00	0.09	0.04
	k	m/s	6.8E-09		



MODE OF FAILURE :

STRENGTH PARAMETERS

C	kN/m²	20
ϕ	°	15.0
C'	kN/m²	13
ϕ'	°	22.9

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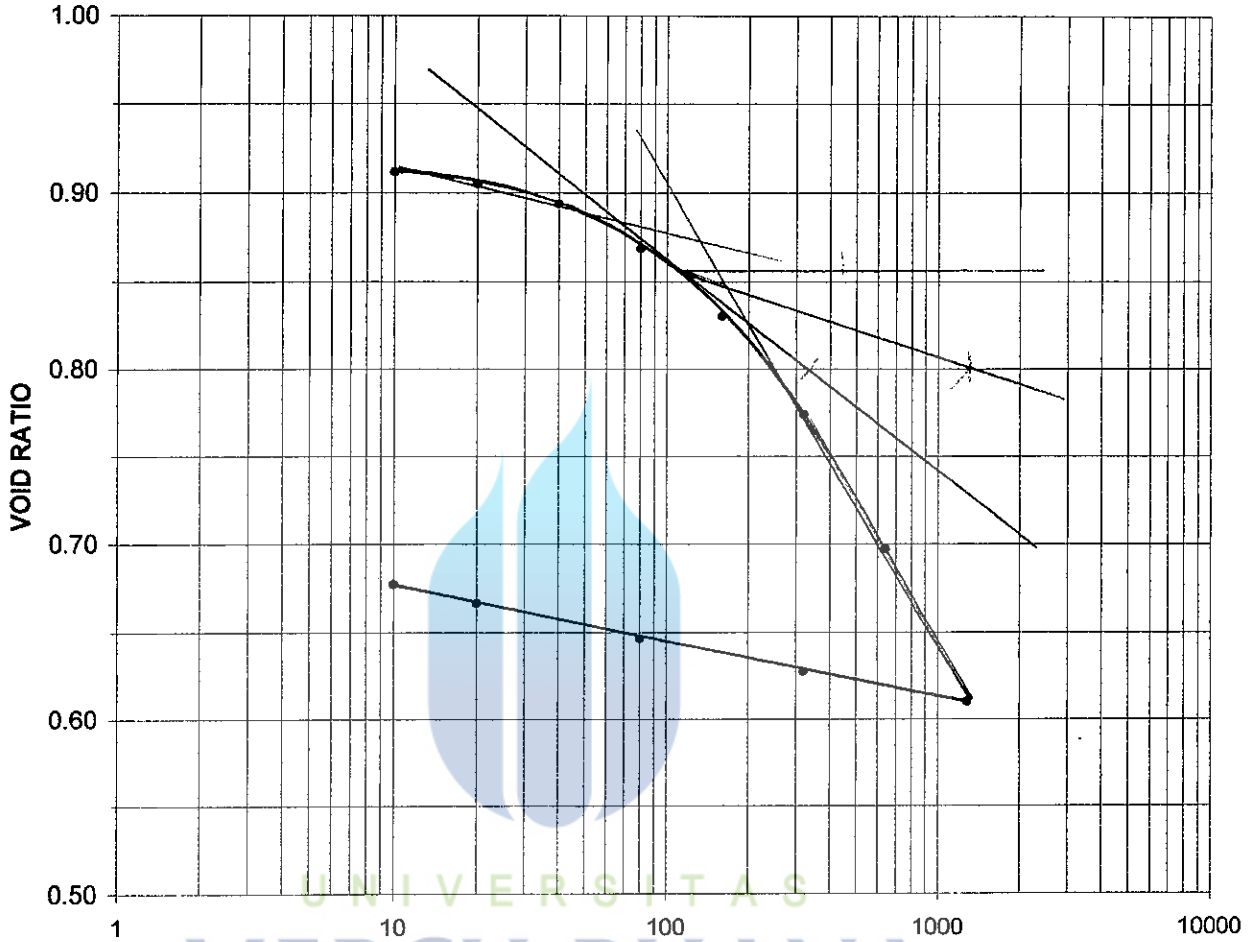
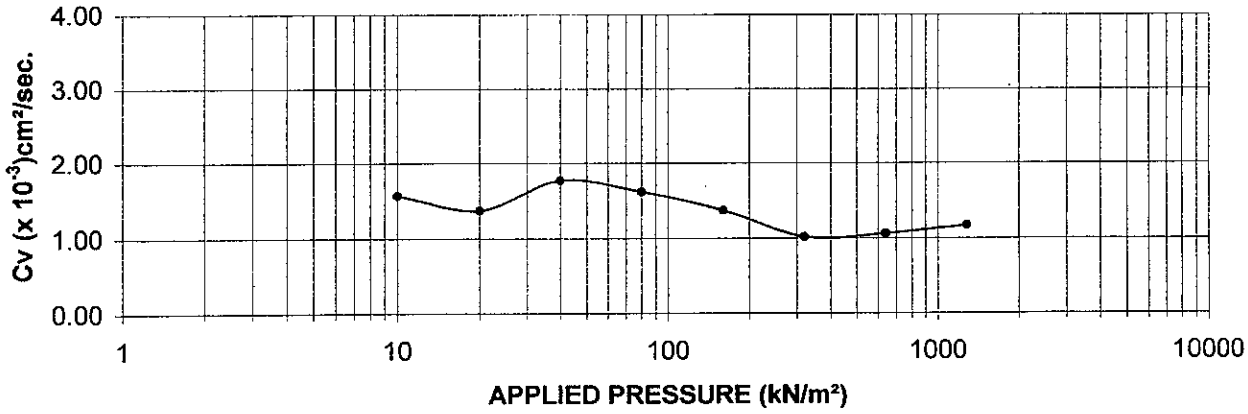
CONSOLIDATION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313		
Location	: JL.MT. HARYONO KAV.10, CAWAN(	Date Tested	:		
Boring No.	: BH-1	Cc	:	0.26	
Depth	: 33.50-34.00 M	Pc	:	150	kN/m²





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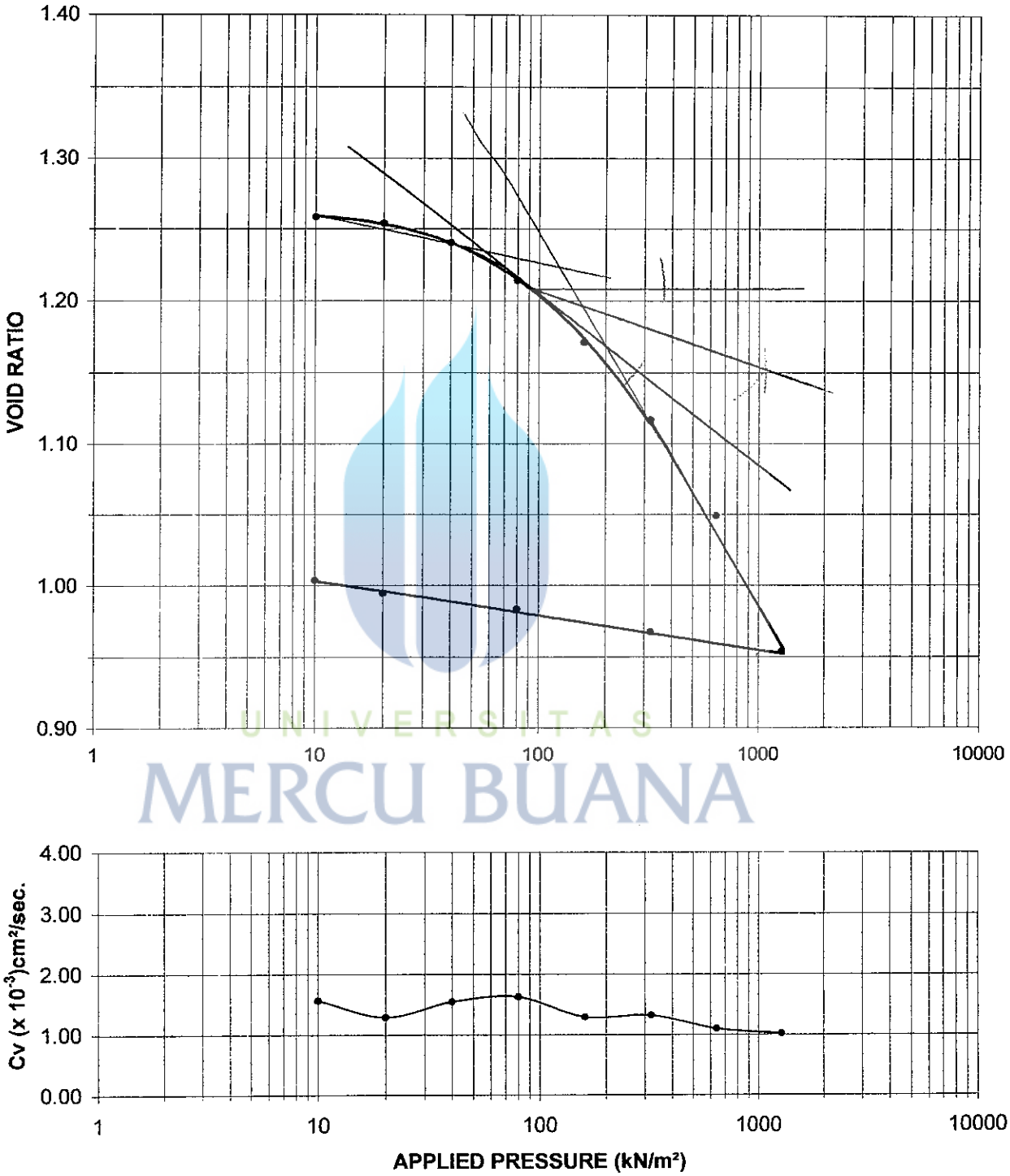
CONSOLIDATION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313		
Location	: JL.MT. HARYONO KAV.10, CAWAN(	Date Tested	:		
Boring No.	: BH-2	**Cc**	:	**0.26**	
Depth	: 40.00-40.50 M	**Pc**	:	**140**	**kN/m²**



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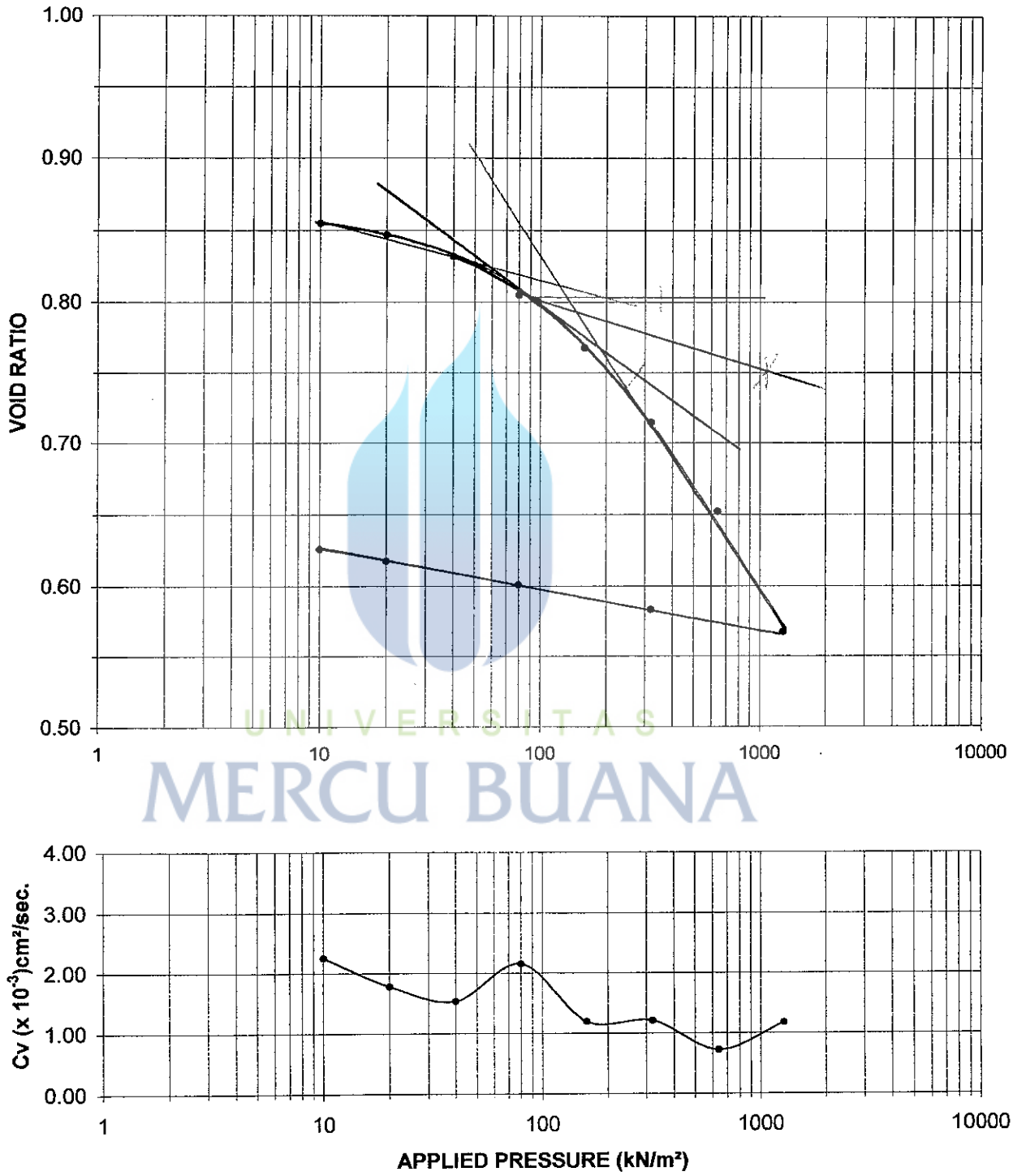
CONSOLIDATION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313		
Location	: JL.MT. HARYONO KAV.10, CAWAN(	Date Tested	:		
Boring No.	: BH-3	**Cc**	:	**0.23**	
Depth	: 30.00-30.50 M	**Pc**	:	**130**	**kN/m²**



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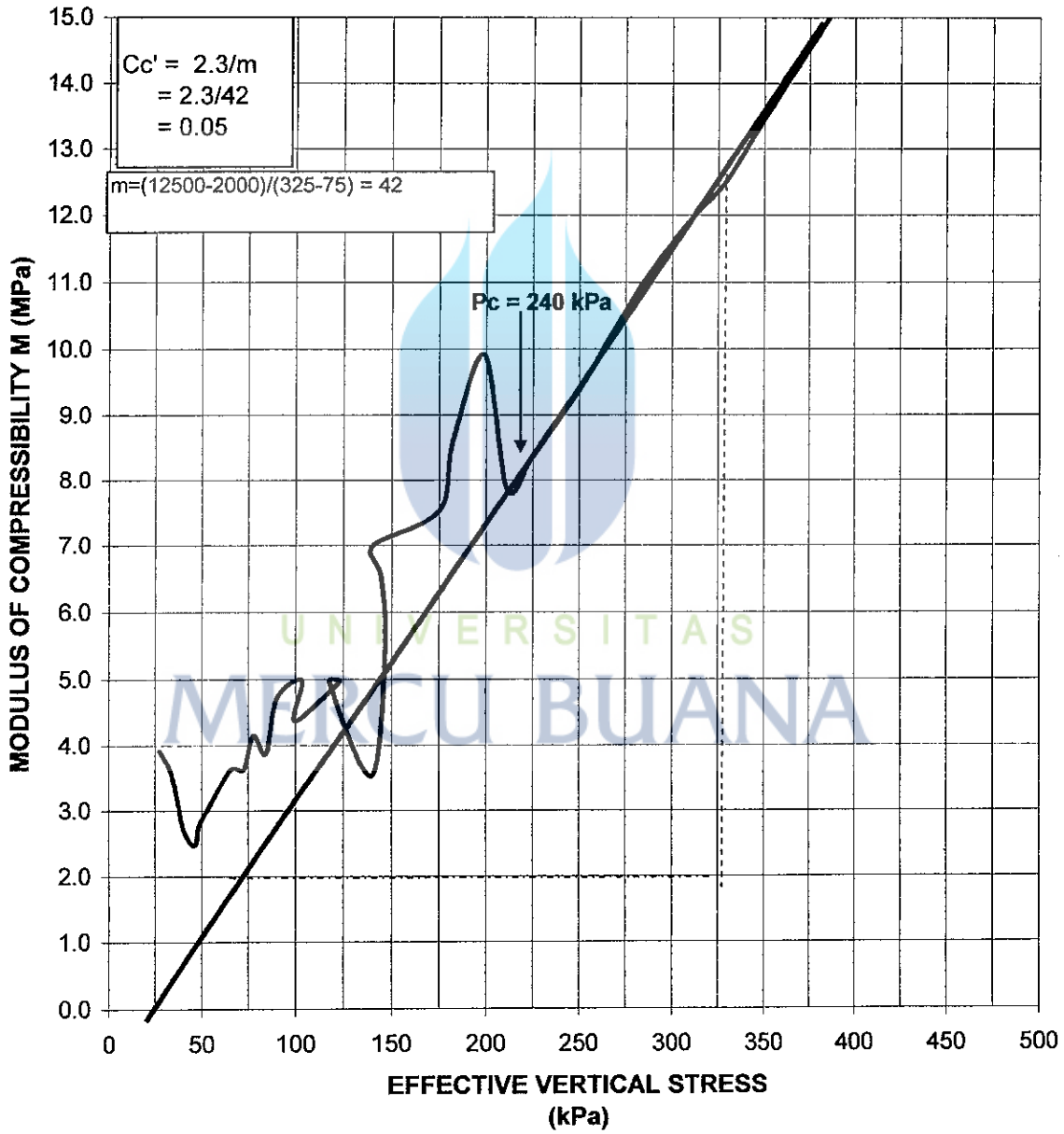
CSR CONSOLIDATION TEST - TANGENT MODULUS METHOD

Project	: HOTEL WASKITA	Lab. Ref.	:	153-01 -0812	
Location	:	Date Tested	:	28-Mar-13	
Boring No.	: BH-3	Cc'	:	0.05	
Depth	: 30.0 - 30.5.m	Pc'	:	240	kPa



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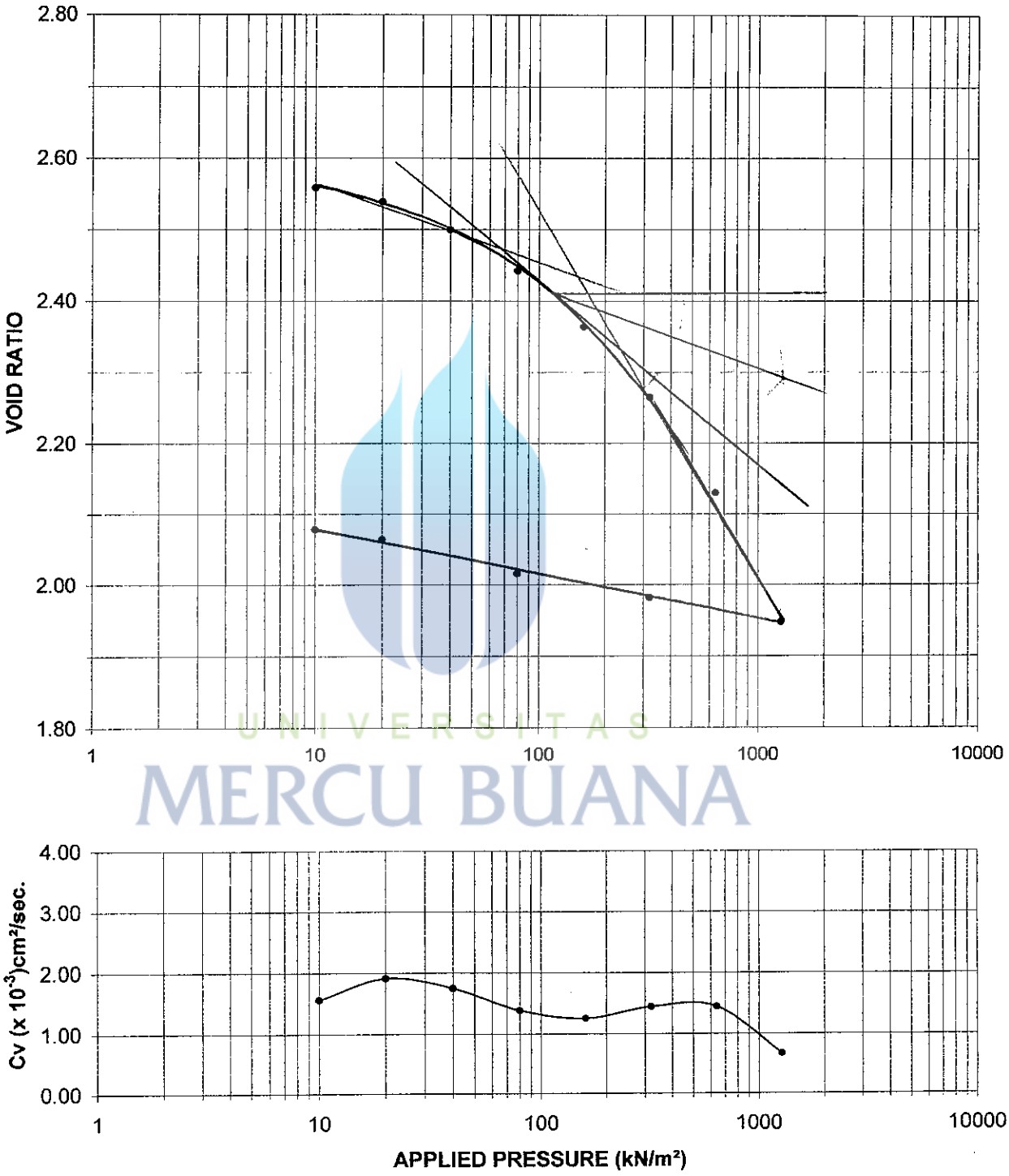
CONSOLIDATION TEST

Project	: HOTEL & OFFICE TOWER	Lab. Ref.	: 024-01-0313		
Location	: JL.MT. HARYONO KAV.10, CAWAN(	Date Tested	:		
Boring No.	: DB-1	**Cc**	:	**0.52**	
Depth	: 50.00-50.50 M	**Pc**	:	**180**	**kN/m²**



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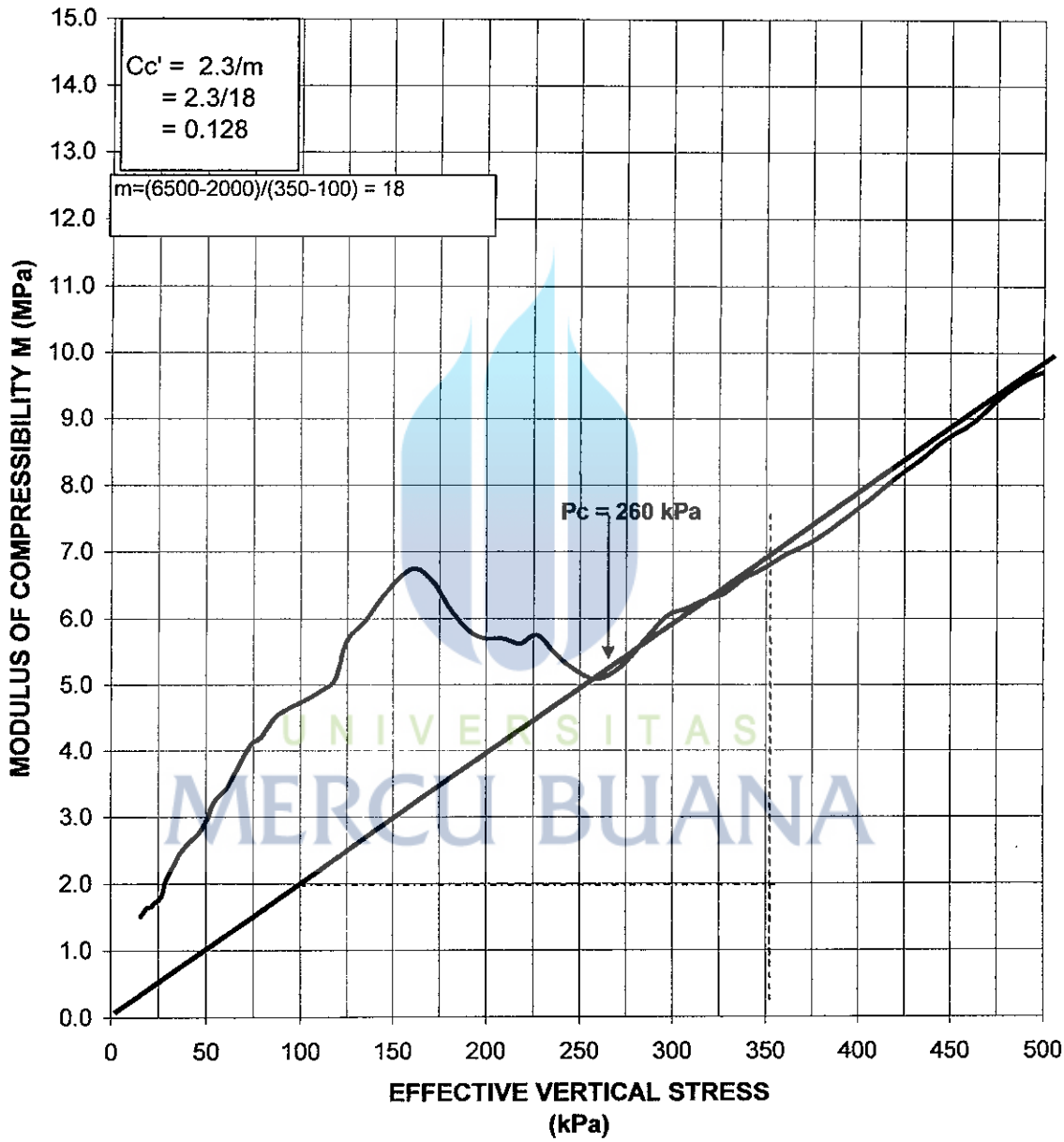
CSR CONSOLIDATION TEST - TANGENT MODULUS METHOD

Project	: HOTEL WASKITA	Lab. Ref.	:	153-01 -0812	
Location	:	Date Tested	:	28-Mar-13	
Boring No.	: DB-1	Cc'	:	0.13	
Depth	: 50.00-50.50 M	Pc'	:	260	kPa



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CRS CONS Waskita BH1-33 &50

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Photographs

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B-1

B-2

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B-3

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DB-1

S-1

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S-2

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S-3

S-4

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S-5

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S-8

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S-9

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DW

M-1

M-2

M-3

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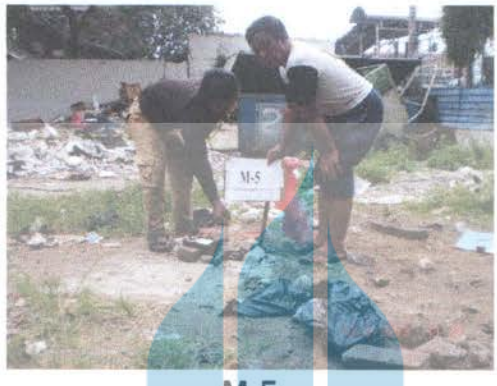
M-4



M-5

M-6

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BORING PROFILE

PROJECT : BANGUNAN
LOCATION : KOM.PERTAMBANGAN, JL.KEMANGGISAN
PERFORMED BY :
GROUND WATER LEVEL : meter
DATE : 9-11 MARET 2013
BORING NO. : DB - 1

Depth (m)	DESCRIPTION	UDS (m)	STANDARD PENETRATION TEST DEPTH (m)	Number of Blows	N / Cm		
					15	15	15
0,00			0,00				
-1,00			-1,00				
-2,00	Silty CLAY, high plasticity, Yellow Brown		-2,00	6	2	2	4
-3,00			-3,00				
-4,00			-4,00	8	3	3	5
-5,00			-5,00				
-6,00	Silty CLAY, high plasticity, Yellow Brown		-6,00	10	5	5	5
-7,00			-7,00				
-8,00			-8,00	13	6	6	7
-9,00			-9,00				
-10,00			-10,00	19	8	9	10
-11,00	Silty CLAY, high plasticity, Yellow Brown		-11,00				
-12,00			-12,00	21	9	9	12
-13,00			-13,00				
-14,00			-14,00	28	12	13	15
-15,00	Silty CLAY, high plasticity, Pale Grey		-15,00				
-16,00			-16,00	60	11	26	36
-17,00			-17,00				
-18,00	Silty CLAY, high plasticity, Dark Grey fine to medium sand		-18,00	60	26	32	39
-19,00	Silty CLAY, high plasticity, Dark Grey fine to medium sand		-19,00				
-20,00			-20,00	60	28	32	36
	STOP BORE						

Petrus,Marpaung,ST

LEGENDS SYMBOLS AND RANGE OF VALUE

Legend :

- Silt
- Clay
- Sand
- Ground Water Level (GWL)
- Undisturbed Sample (UDS)
- Disturbed Sample (DS)
- Gravel

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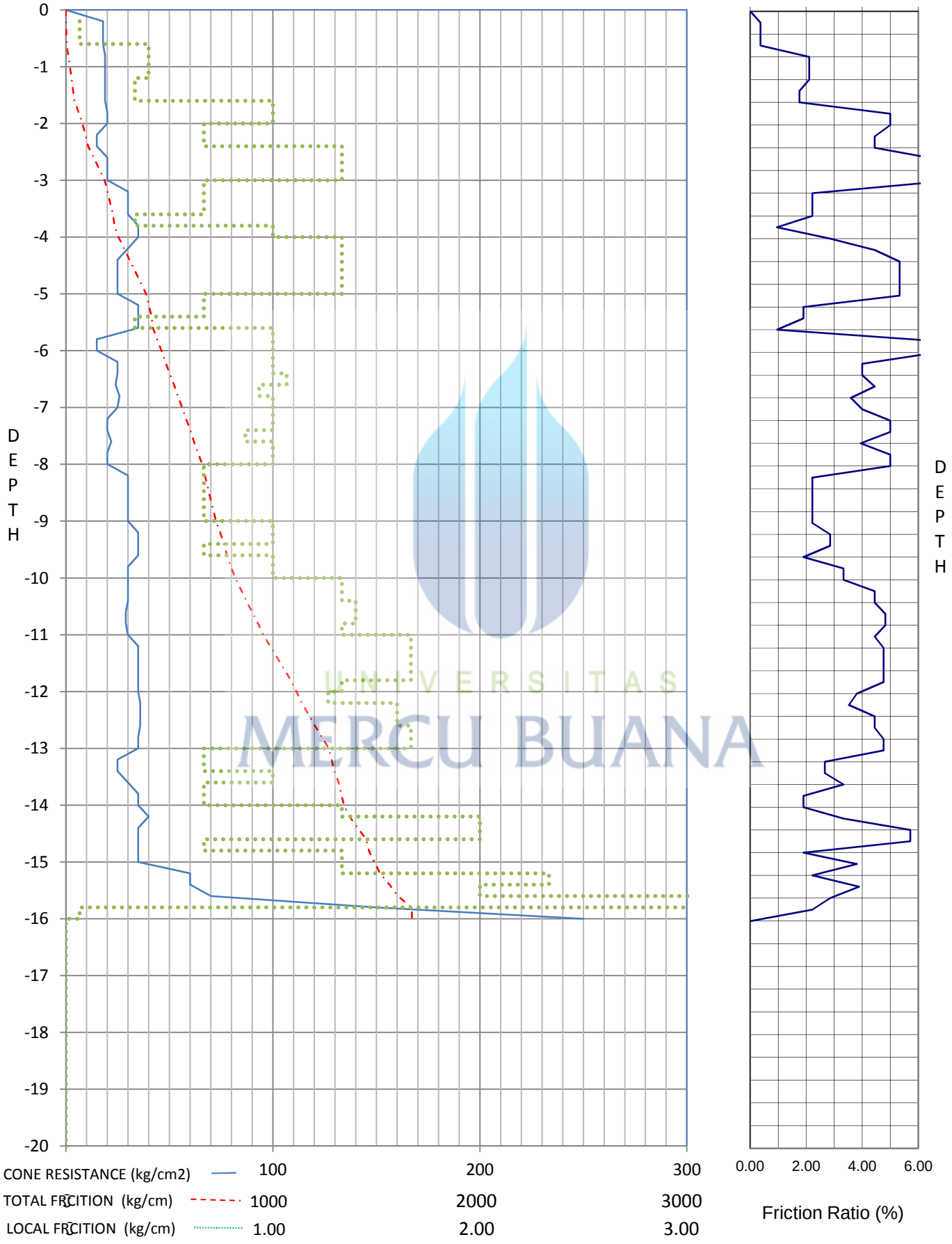
PUTRA DWI MANDIRI

CPT

Proyek : **BANGUNAN**
Point : **S1**
Location : **KEMANGGISAN - JAKARTA BARAT**

Elev. :
Test by : **PETRUS**
Date : **09/03/2013**



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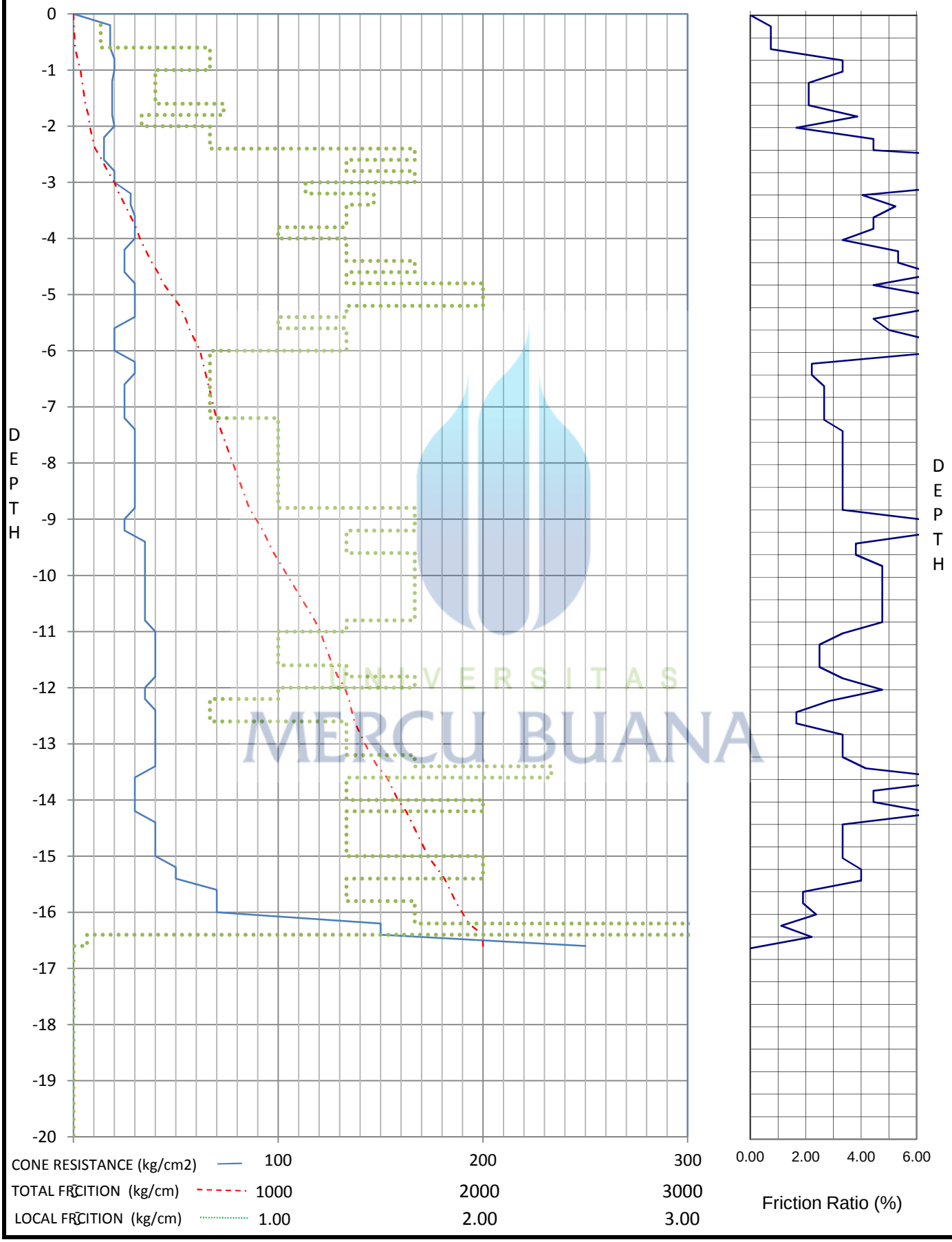
PUTRA DWI MANDIRI

CPT

Proyek : **BANGUNAN**
Point : **S2**
Location : **KEMANGGISAN - JAKARTA BARAT**

Elev. :
Test by : **PETRUS**
Date : **09/03/2013**



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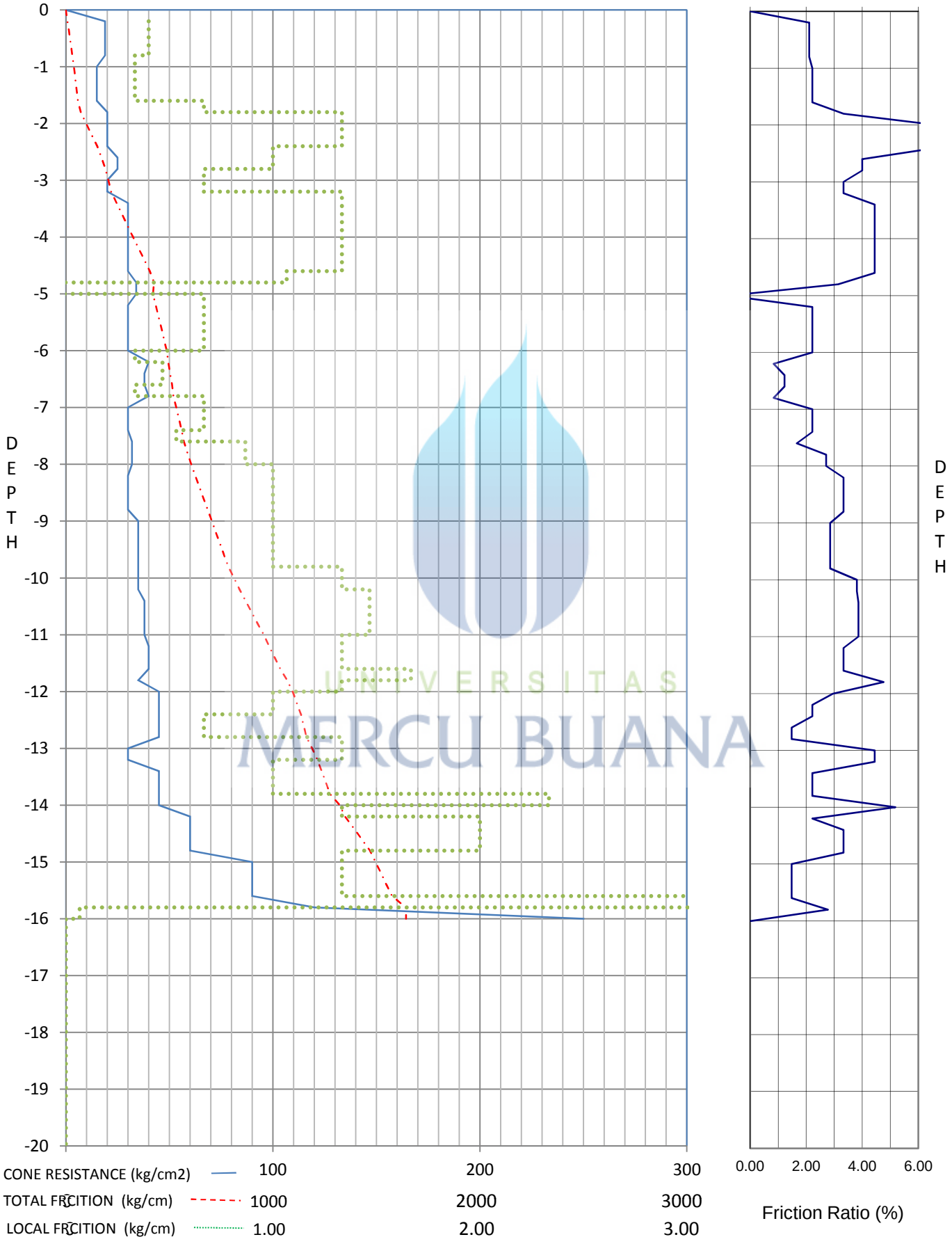
PUTRA DWI MANDIRI

CPT

Proyek : **BANGUNAN**
Point : **S3**
Location : **KEMANGGISAN - JAKARTA BARAT**

Elev. :
Test by : **PETRUS**
Date : **09/03/2013**



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SUMMARY OF LABORATORY TEST RESULT

PROJECT : BANGUAN
LOCATION : KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - JAKARTA

Sample No.								
Bore Hole No.			DB - 1	DB - 1	DB - 1			
Sample Depth			1,50-2,00 M	3,50-4,00 M	5,50-6,00 M			
Gradition	Gravel	%	0	0	0			
	sand	%	9,77	7,64	5,74			
	Silt	%	47,73	50,36	56,76			
	Clay	%	42,50	42,00	37,50			
Liquit Limit		%	64,65	70,71	73,01			
Plastic Limit		%	35,43	31,73	30,90			
Plasticity indeks		%	29,22	38,98	42,11			
Shrinkage Limit		%						
Specific Grafity			2,612	2,618	2,622			
Dry Density		t/m^3	1,141	1,156	1,237			
Coefficient of Permeability		cm/sec						
Natural Strte	Water Content	%	41,26	40,26	39,36			
	Wet Density	t/m^3	1,612	1,622	1,724			
	Void Ratio		1,289	1,264	1,120			
	Porosity		0,563	0,558	0,528			
	Degree of Saturation		83,61	83,39	92,19			
unc. Comp	Compresssive strength	kg/cm^2						
	Sensivity							
Triaxial	Cohesion	kg/cm^2						
	Cohesion eff.	kg/cm^2						
	Angle of internal friction							
	Angle of internal friction eff.							
D.S	Cohesion	kg/cm^2	0,16	0,17	0,16			
	Angle of internal friction	°	13,23	13,3	13,9			
C.C	Coeff.of consolidation	cm/sec	6,109E-04	6,666E-04	6,102E-04			
	Compresssionindex		0,262	0,491	0,565			
Compaction	Optimum Moisture Content							
	Max.Dry Density	t/m^3						
CBR	CBR	%						
	Dry density	t/m^3						
	Water Content	%						
	Test condition							
	Sample condition							
Swelling		kg/cm^2						

Remarks :

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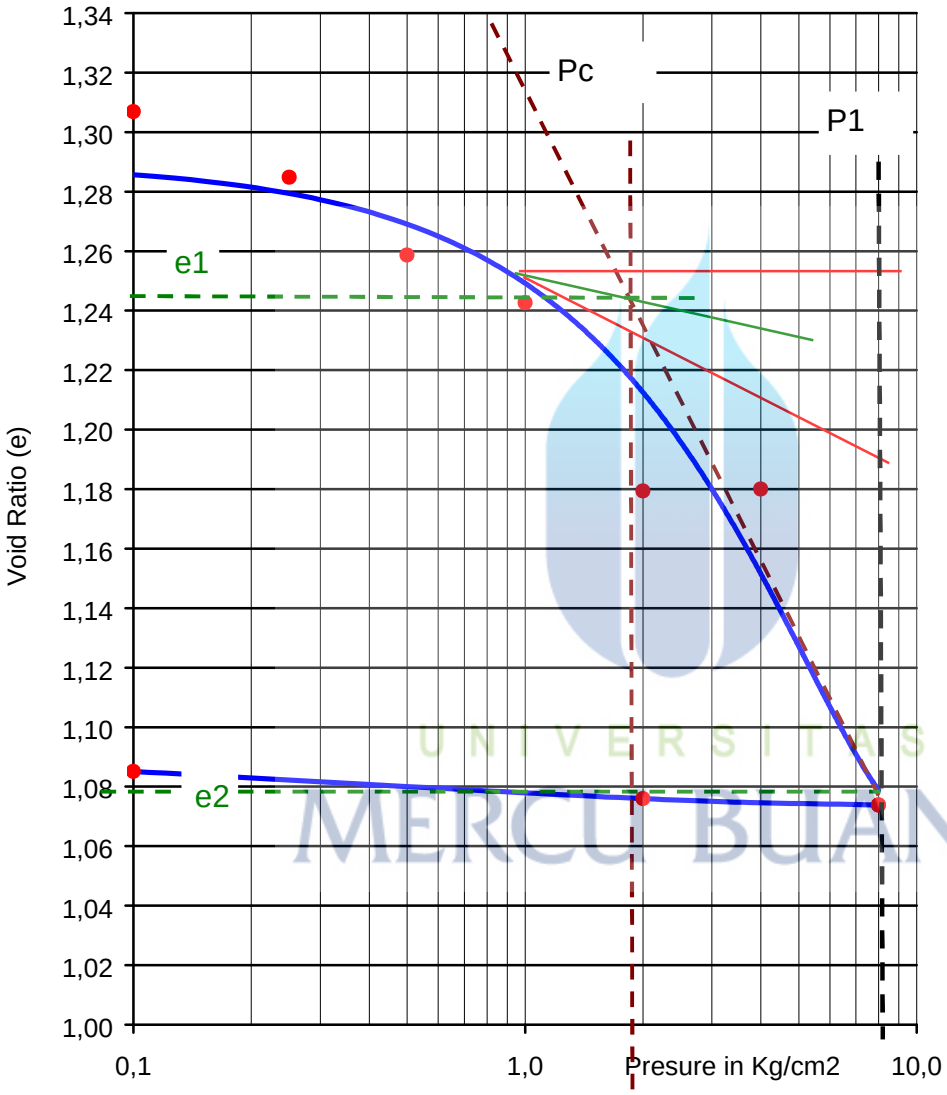
CONSOLIDATION TEST

Project	:	BANGUAN	Insitu Void ratio ,Eo	:	1,309	
Location	:	KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - J	Sample Area	:	38,50	cm^2
Date	:	0	Sample Height	:	2	cm
Test by	:	0				
Drilling No.	:	DB - 1				
Depth	:	1,50-2,00 m				

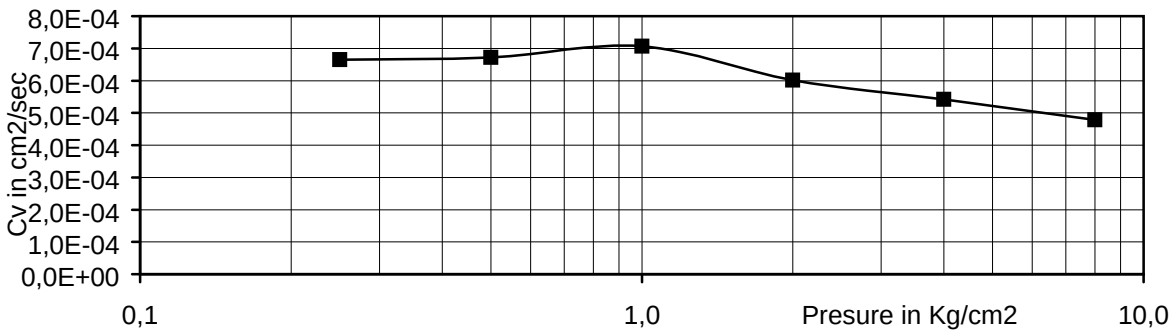


Pc (kg/cm2)	:	**1,8**
P1 (kg/cm2)	:	8,000
e1	:	**1,246**

Cc = (e1-e2)/log(p1/pc)

Cc	:	***0,262***
Cv	:	***6,109E-04***

Compression Index ,Cc = 0,262



Coeff.Consolidation ,Cv = 6,109E-04 cm^2 / sec

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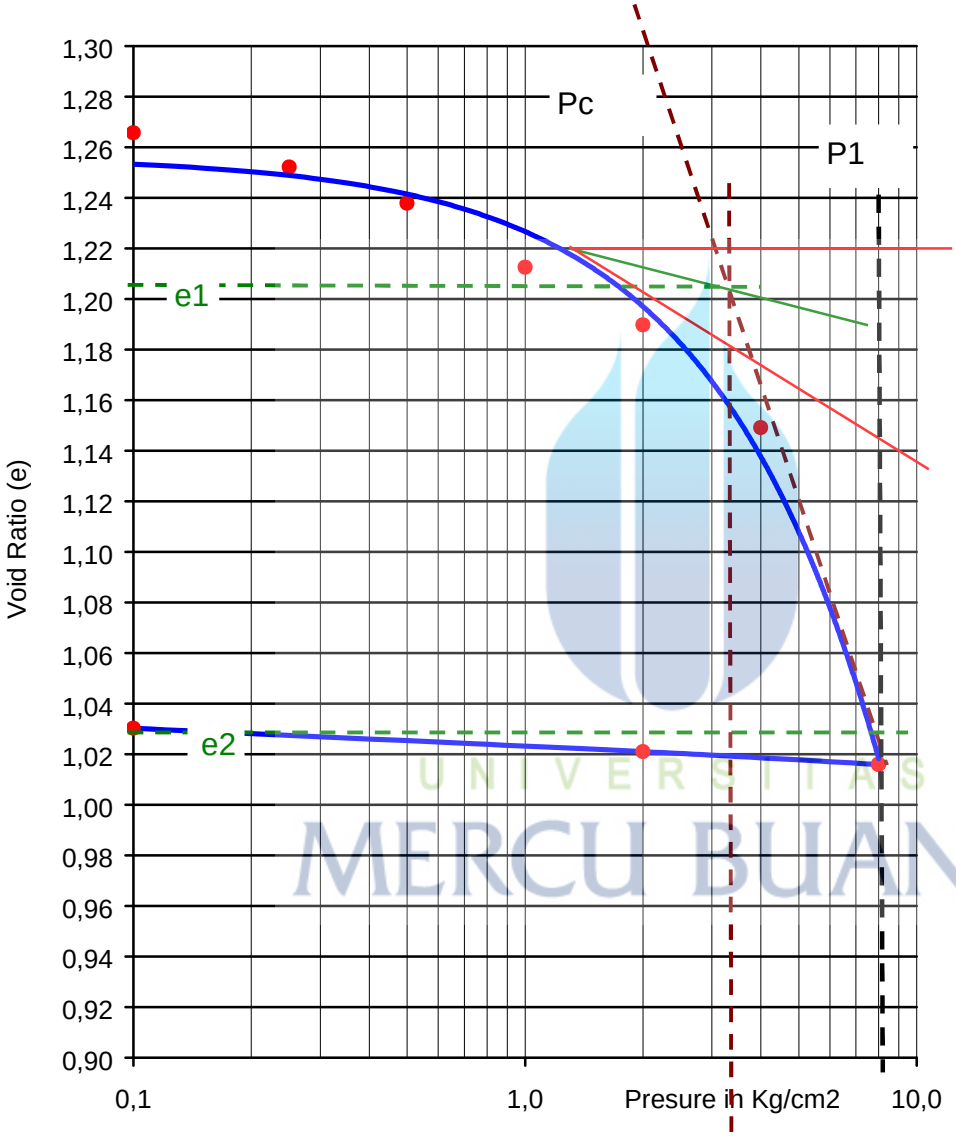
CONSOLIDATION TEST

Project	:	BANGUAN	Insitu Void ratio ,Eo	:	1,268	
Location	:	KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - J	Sample Area	:	38,50	cm^2
Date	:	0	Sample Height	:	2	cm
Test by	:	0				
Drilling No.	:	DB - 1				
Depth	:	3,50-4,00 m				

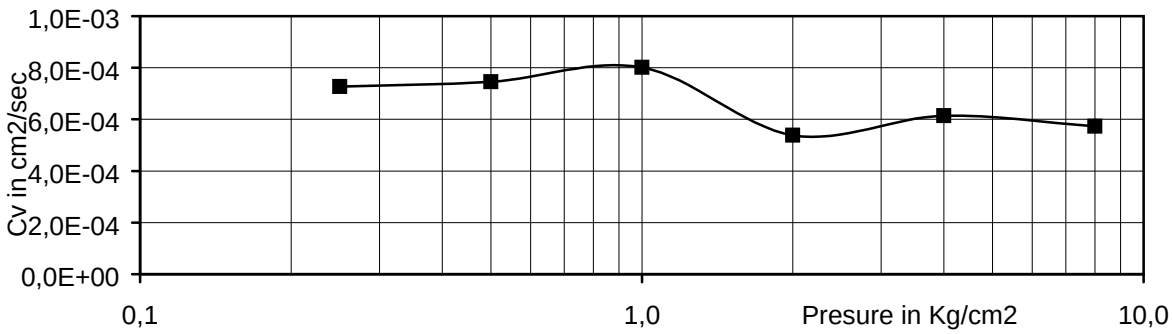


Pc (kg/cm2)	:	**3,3**
P1 (kg/cm2)	:	8,000
e1	:	**1,21**

Cc = (e1-e2)/log(p1/pc)

Cc	:	***0,491***
Cv	:	***6,666E-04***

Compression Index ,Cc = 0,491



Coeff.Consolidation ,Cv = 6,666E-04 cm^2 / sec

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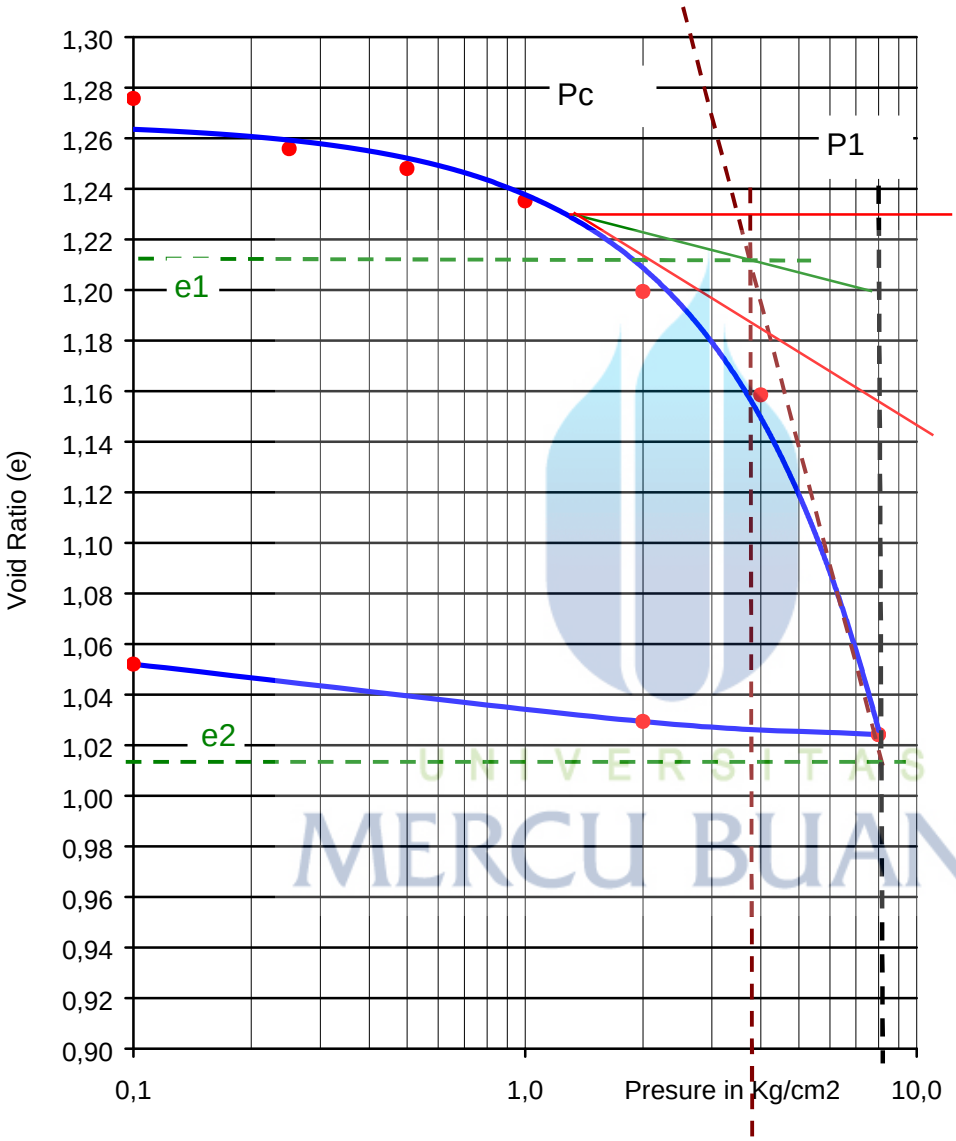
CONSOLIDATION TEST

Project	:	BANGUAN	Insitu Void ratio ,Eo	:	1,278	
Location	:	KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - J	Sample Area	:	38,50	cm^2
Date	:	0	Sample Height	:	2	cm
Test by	:	0				
Drilling No.	:	DB - 1				
Depth	:	5,50-6,00 m				

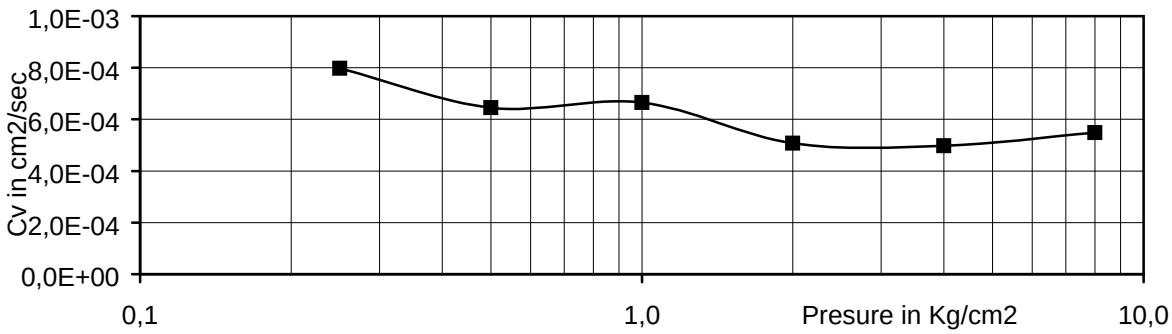


Pc (kg/cm2)	:	**3,8**
P1 (kg/cm2)	:	8,000
e1	:	**1,212**

Cc = (e1-e2)/log(p1/pc)

Cc	:	***0,565***
Cv	:	***6,102E-04***

Compression Index ,Cc = 0,565



Coeff.Consolidation ,Cv = 6,102E-04 cm^2 / sec

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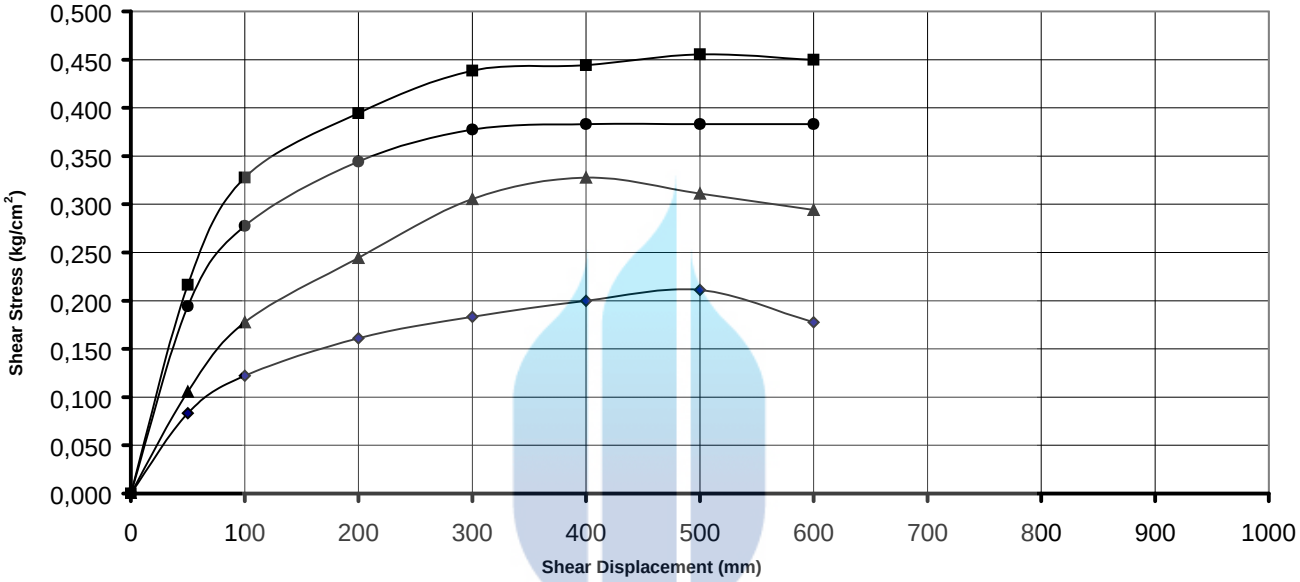
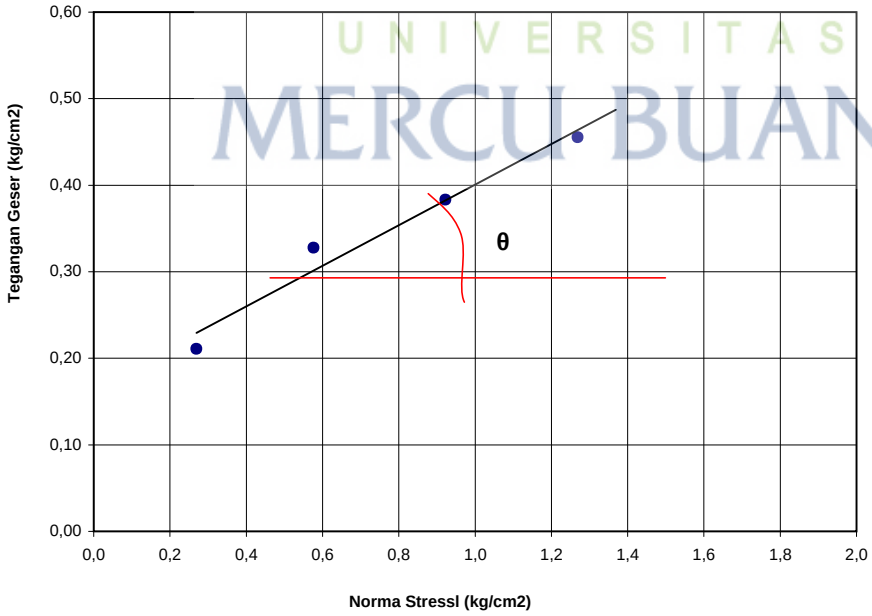
DIRECT SHEAR TEST

Project	: BANGUAN		**Drilling No.**	: DB - 1	
Location	: KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - JAKARTA		**Depth**	: 1,50 - 2,00	m
Date	: 0		**LCR**	: 0,1444	
Tested by	: JHON		**Sample**	: 0	

Grafik Shear Displacement VS Shear Stress





Teg.Geser Max. kg/cm2		Teg.Normal kg/cm2	
A =	0,211	A =	0,269
B =	0,328	B =	0,577
C =	0,383	C =	0,923
D =	0,455	D =	1,269

Slope 0,2345

C = 0,17 kg/cm^2

θ = 13,2

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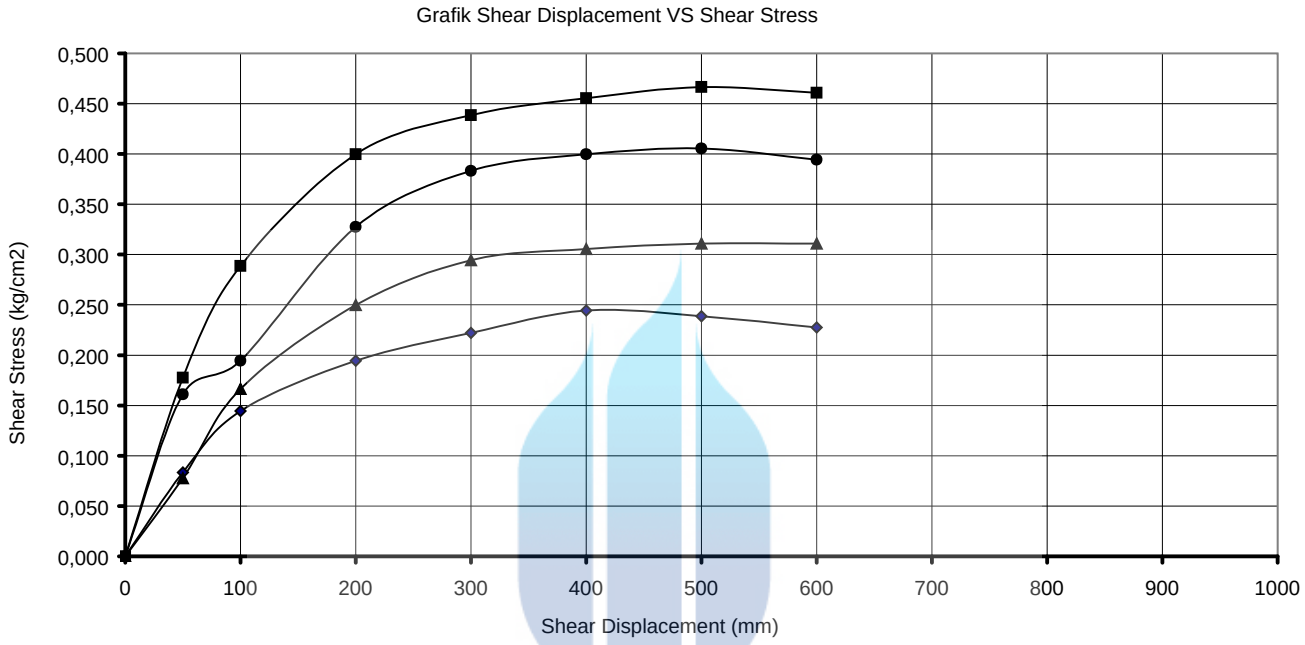
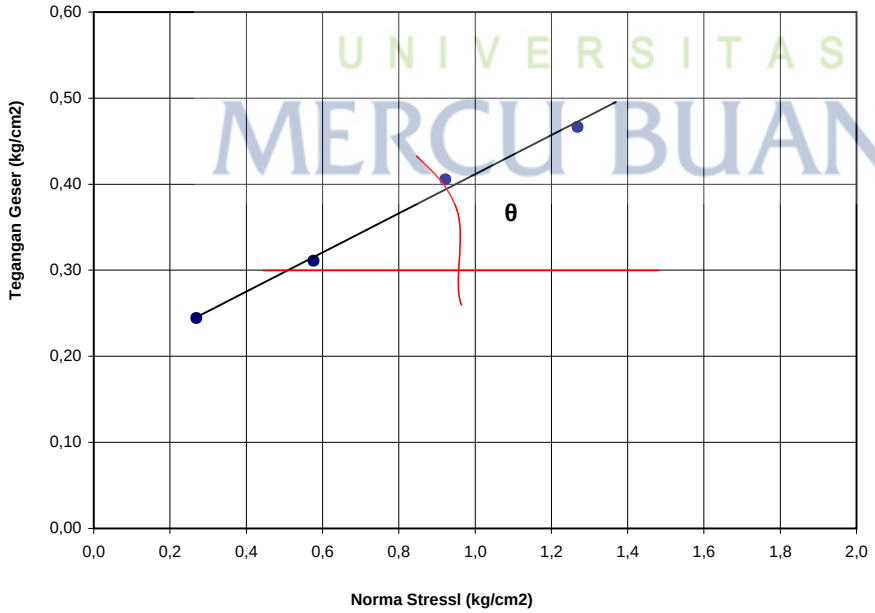
DIRECT SHEAR TEST

Project	: BANGUAN		**Drilling No.**	: DB - 1	
Location	: KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - JAKARTA		**Depth**	: 3,50 - 4,00	m
Date	: 0		**LCR**	: 0,1444	
Tested by	: JHON		**Sample**	: 0	





Teg.Geser Max. kg/cm2		Teg.Normal kg/cm2	
A =	0,244	A =	0,269
B =	0,311	B =	0,577
C =	0,405	C =	0,923
D =	0,466	D =	1,269

Slope 0,2274

C = 0,18 kg/cm2

θ = 12,8

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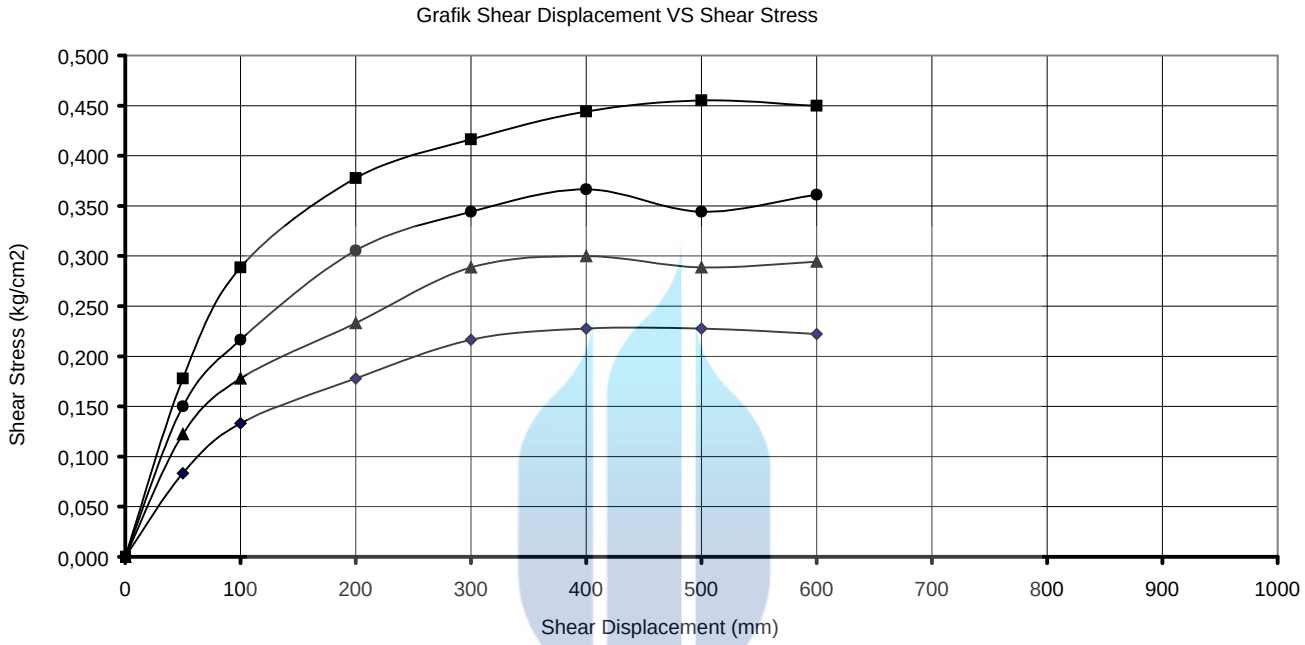
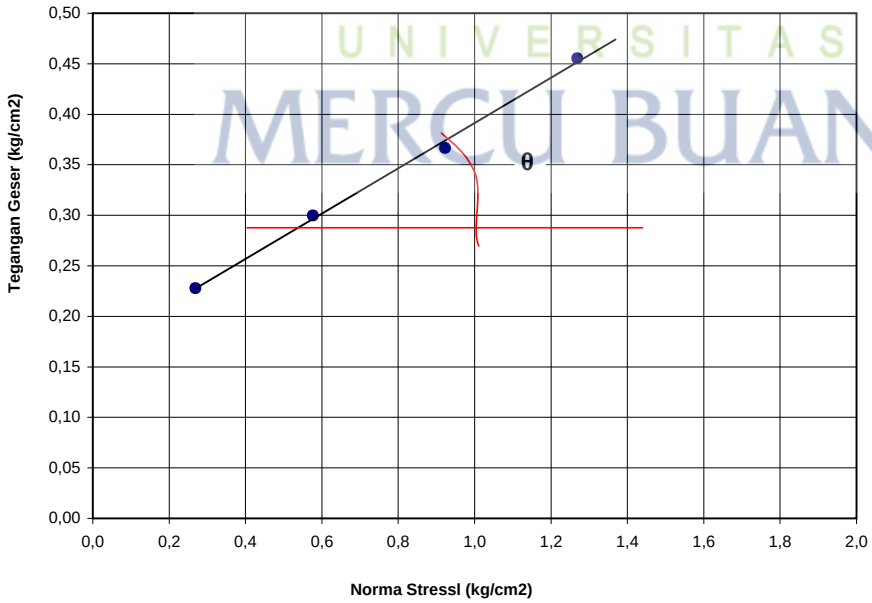
DIRECT SHEAR TEST

Project	: BANGUAN	**Drilling No.**	: DB - 1		
Location	: KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - JAKARTA	**Depth**	: 5,50-6,00	m	
Date	: 0	**LCR**	: 0,1444		
Tested by	: JHON	**Sample**	: 0		





Teg.Geser Max. kg/cm2		Teg.Normal kg/cm2
A =	0,228	A = 0,269
B =	0,300	B = 0,577
C =	0,367	C = 0,923
D =	0,455	D = 1,269

Slope 0,2241

C = 0,17 kg/cm2

θ = 12,6

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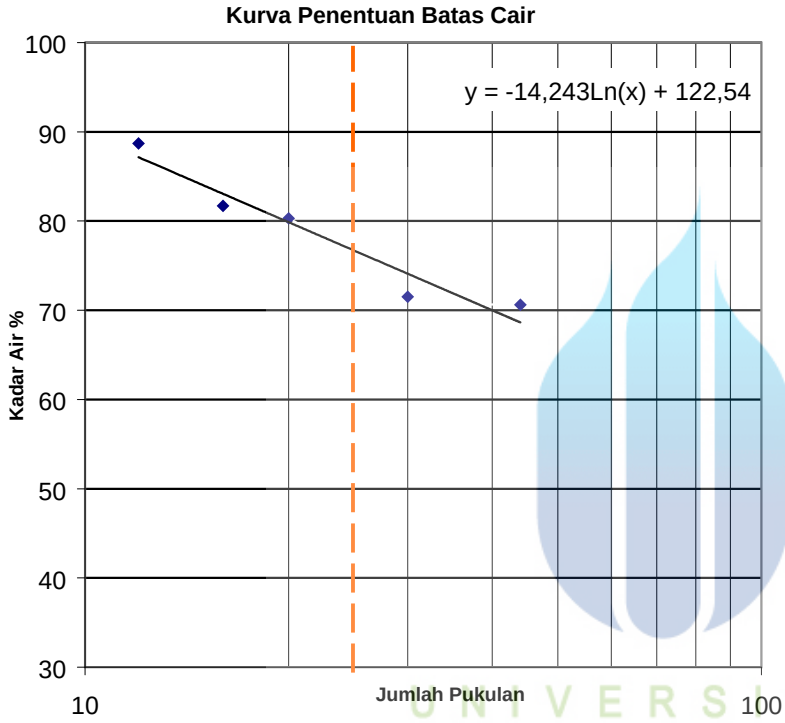
ATTERBERG LIMITS

PROJECT : BANGUAN
LOCATION : KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - JAKARTA
DATE 0
TESTED BY 0
Drilling No. : DB - 1
Depth : 1,50 - 2,0(M



DARI GRFIK DIDAPAT :

LIQUIT LIMIT (LL)	: 76,69	%
PLATIC LIMIT (PL)	: 31,43	%
PLASTICITY INDEX (IP)	: 45,26	%

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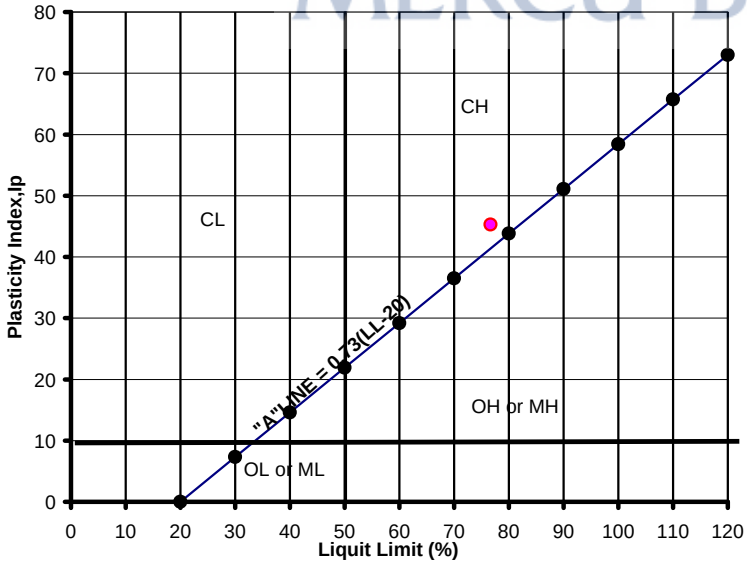
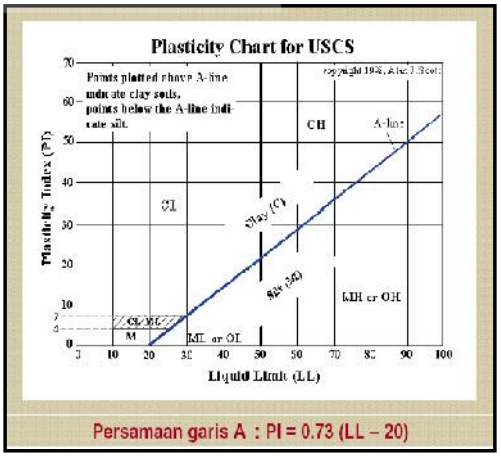
Clasification : CH





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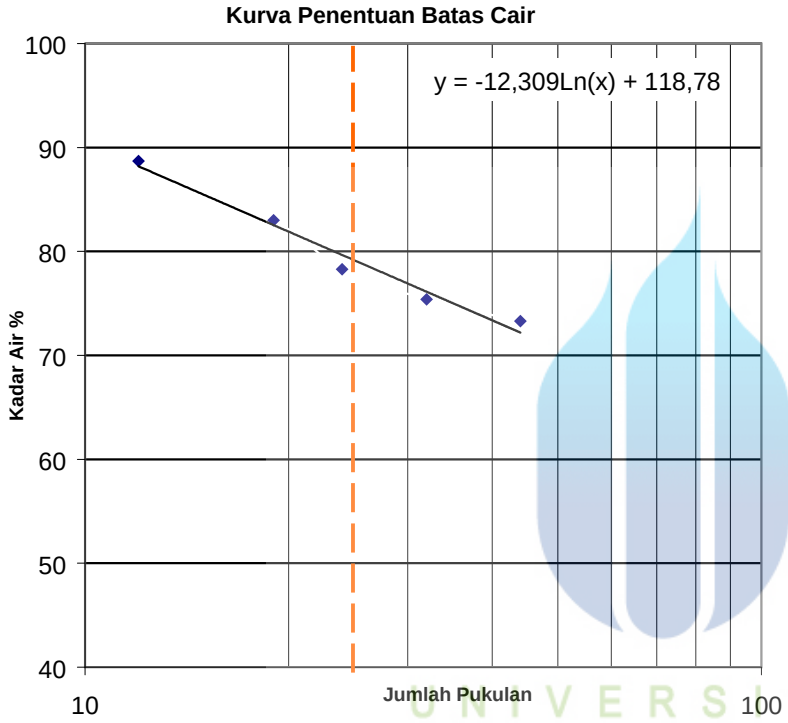
ATTERBERG LIMITS

PROJECT : BANGUAN
LOCATION : KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - JAKARTA
DATE 0
TESTED BY 0
Drilling No. : DB - 1
Depth : 3,50 - 4,0(M



DARI GRFIK DIDAPAT :

LIQUIT LIMIT (LL)	: 79,16	%
PLATIC LIMIT (PL)	: 34,91	%
PLASTICITY INDEX (IP)	: 44,25	%

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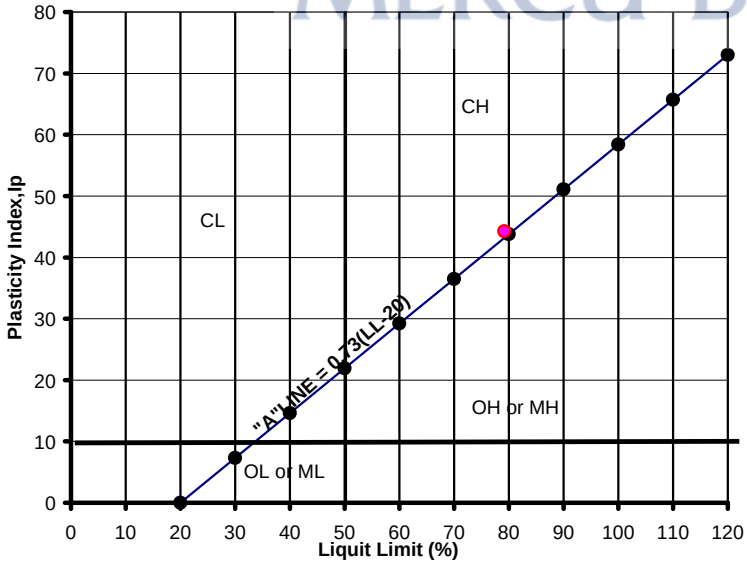
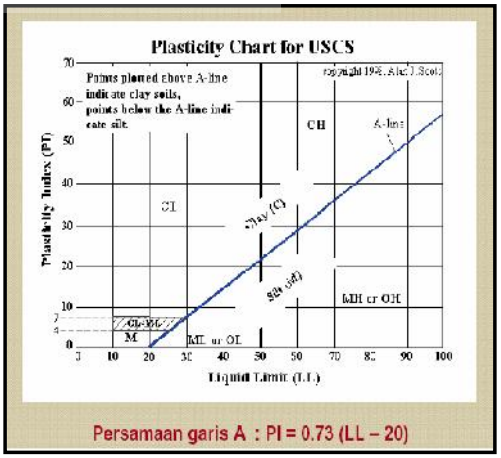
Clasification : CH

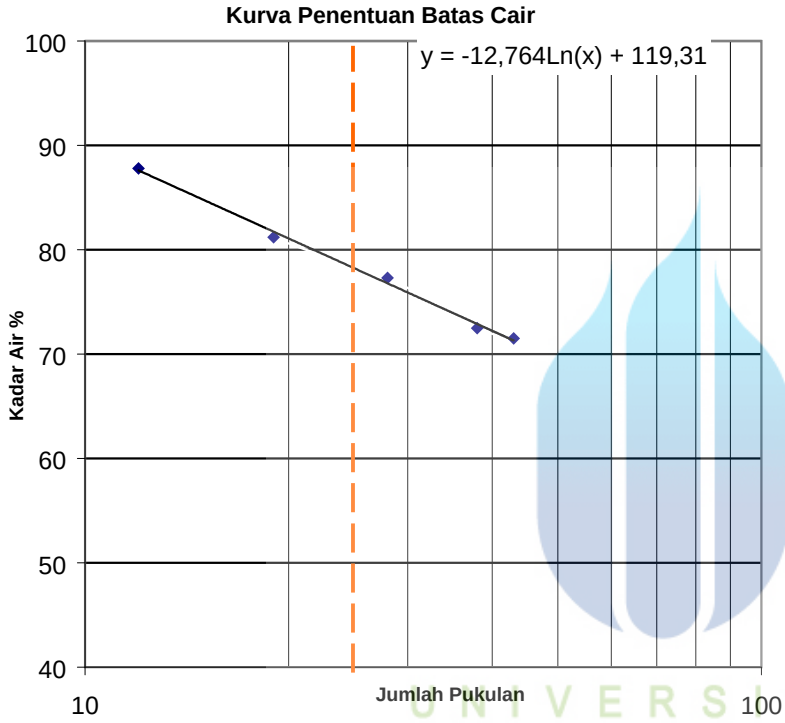




http://digilib.mercubuana.ac.id/

ATTERBERG LIMITS

PROJECT : BANGUAN
LOCATION : KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - JAKARTA
DATE 0
TESTED BY 0
Drilling No. : DB - 1
Depth : 5,50 - 6,0(M



DARI GRFIK DIDAPAT :

LIQUIT LIMIT (LL)	: 78,22	%
PLATIC LIMIT (PL)	: 36,11	%
PLASTICITY INDEX (IP)	: 42,11	%

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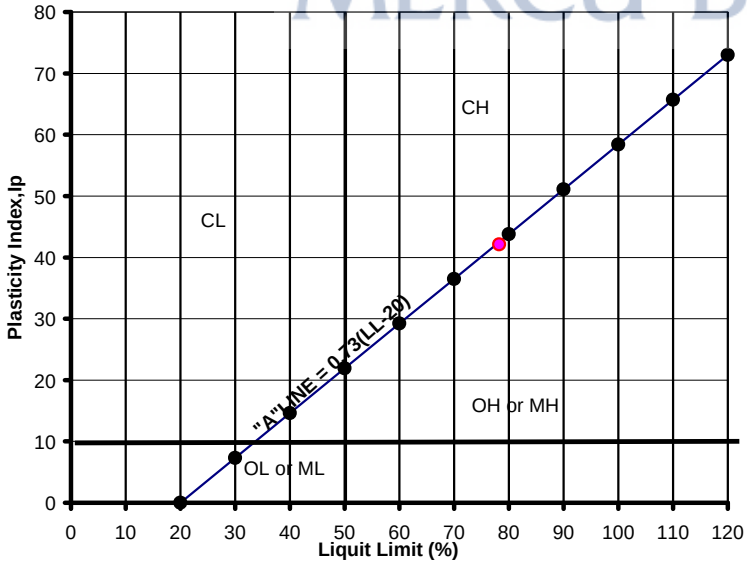
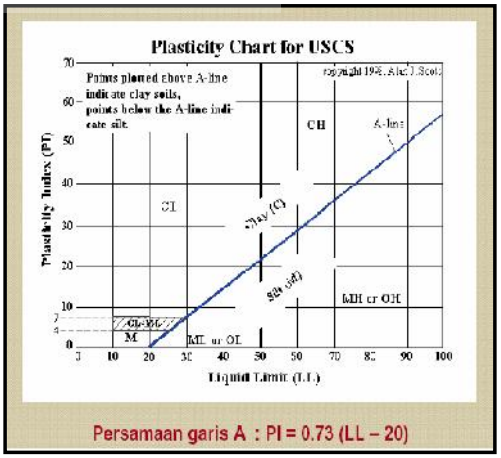
Clasification : CH





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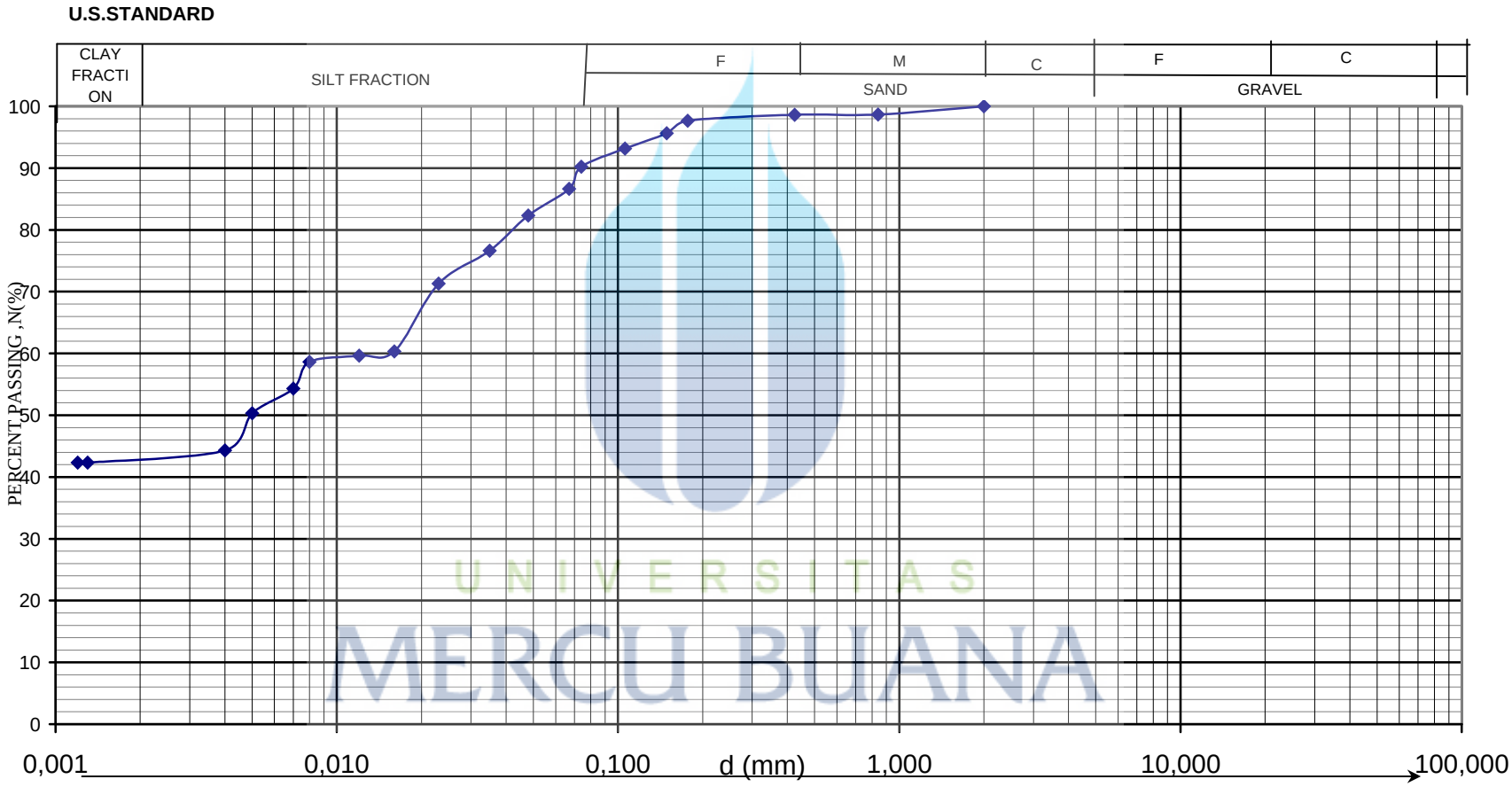
GRAINSIZE DISTRIBUTION CURVE

Project	:	BANGUAN	Drilling No.	DB - 1	
Location	:	KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - JAKARTA	Depth	1.50-2.00	m



Gravel	% = 0,00	Silt	% = 47,73	d60 =	mm
Sand	% = 9,77	Clay	% = 42,50	d10 =	mm
Fines	% = 90,23			Cu =	

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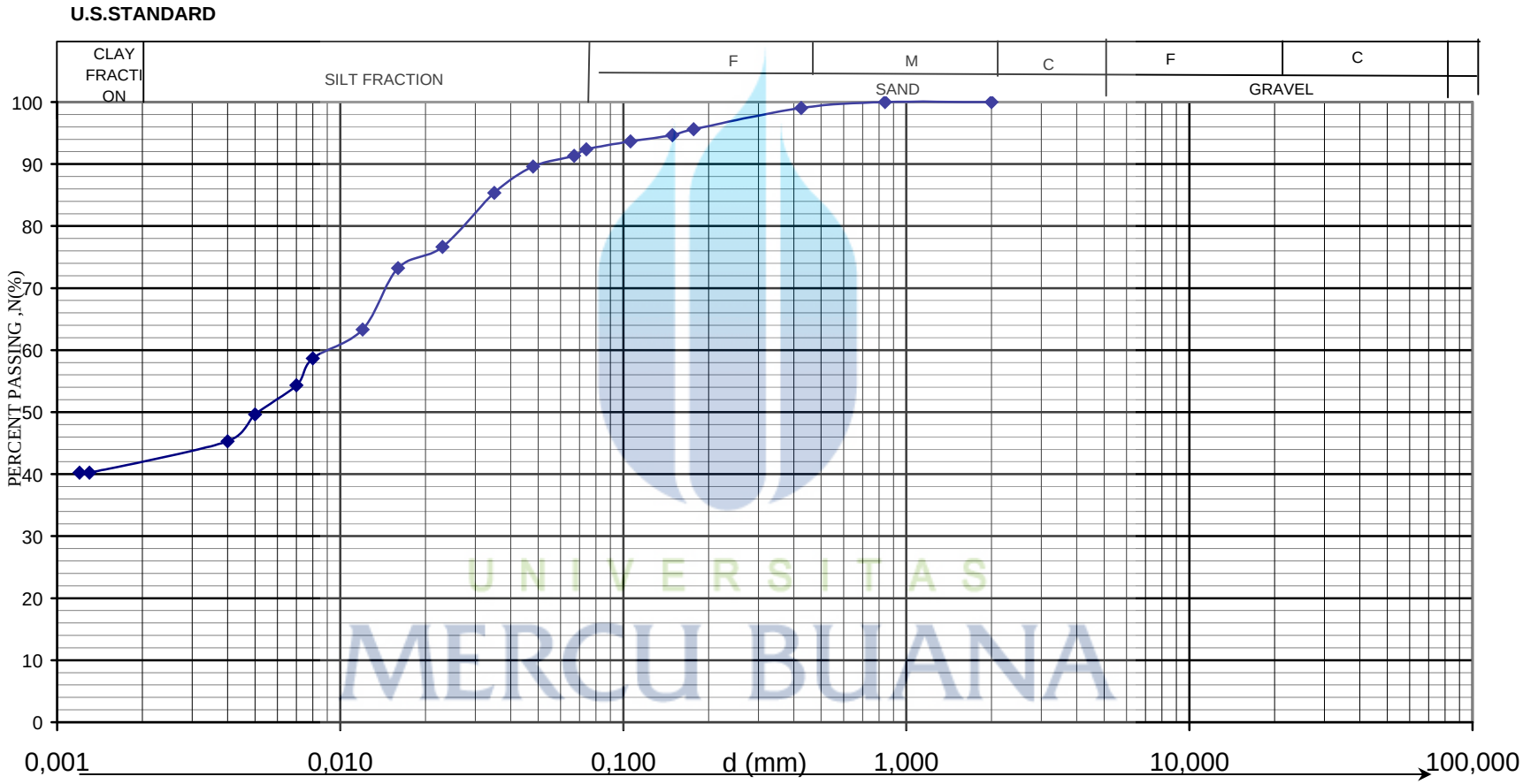
GRAINSIZE DISTRIBUTION CURVE

Project	:	BANGUAN	Drilling No.	DB - 1	
Location	:	KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - JAKARTA	Depth	3.50-4.00	m



Gravel	% = 0,00	Silt	% = 50,36	d60 =	mm
Sand	% = 7,64	Clay	% = 42,00	d10 =	mm
Fines	% = 92,36			Cu =	

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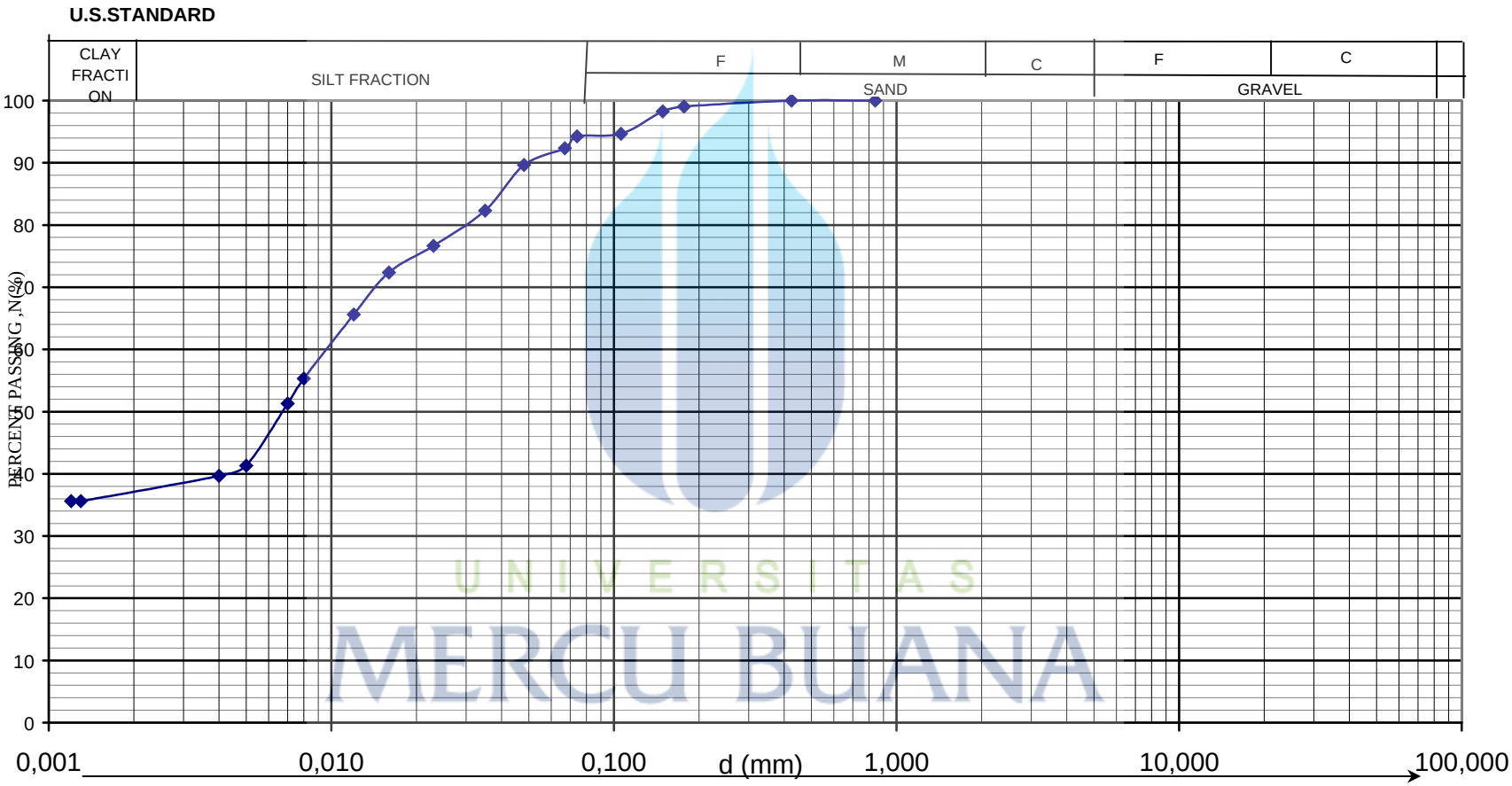
GRAINSIZE DISTRIBUTION CURVE

Project	:	BANGUAN	Drilling No.	DB - 1	
Location	:	KOMPLEK PERTAMBANGAN - JL.KEMANGGISAN - JAKARTA	Depth	5,50-6,00	m



Gravel	% = 0,00	Silt	% = 56,76	d60 =	mm
Sand	% = 5,74	Clay	% = 37,50	d10 =	mm
Fines	% = 94,26			Cu =	

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LAPORAN ENGINEERING GEOLOGY &

DATA FACTUAL HASIL PENYELIDIKAN TANAH

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Laporan Engineering Geology & Data Factual Hasil Penyelidikan Tanah untuk Proyek Danamon Head Quarter, Kuningan – Jakarta Selatan

(termasuk drilling logs, hasil pengujian in-situ dan pengujian laboratorium terhadap contoh – contoh tanah).

1. PENDAHULUAN

1.1. Kondisi Umum dan Daerah Proyek

Proyek Gedung Danamon Head Quarter, Kuningan - Jakarta Selatan terletak sekitar 5 km dari Pusat Kota Jakarta.

Daerah Jakarta dan sekitarnya termasuk lokasi Proyek Danamon Head Quarter Kuningan adalah merupakan bagian dari *dataran yang terletak diantara dataran pantai utara dengan daerah perbukitan diselatan Jakarta, dimana dikenal sebagai Dataran Rendah Jakarta,* dan berdasarkan peta dibatasi koordinat 106°30' - 107°00' BT dan 6°00' - 6°30' LS.

Menuju kearah selatan dari lokasi proyek terdapat Kipas Gunung Api Bogor dengan Bogor sebagai puncaknya dan daerah Perbukitan Bergelombang yang memisahkan dataran pantai di Utara dengan jajaran gunungapi di selatan berupa Satuan Pegunungan kerucut gunungapi seperti G. Salak & G. Gede (+2211 m & +2958 m diatas m.s.l.). Daerah Bogor tersebut merupakan sumber material tanah / butiran dari endapan tanah di Dataran Rendah Jakarta.

Lokasi rencana proyek terletak pada daerah dataran yang disekitarnya terdapat pula daerah dataran yang sedikit bergelombang halus dan merupakan daerah dengan ciri-ciri endapan tanah berkonsistensi lunak atau loose (untuk tanah non-cohesive) pada lapisan tanah paling atas.

Daerah rencana Proyek secara mudah dapat ditempuh dari berbagai lokasi-lokasi lain di bagian selatan, barat, timur dan utara melalui jalan kota. Layanan transport

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umum dan harian banyak sekali menuju lokasi sekitar proyek melalui jalan raya dan highway, termasuk jalan – jalan kecil diseluruh daerah tersebut yang bisa dilalui kendaraan bermotor.

Pada saat dilaksanakan penyelidikan tanah sedang berlangsung pada saat bersamaan *struktur bangunan lama sedang dibongkar sehingga peralatan penyelidikan tanah terpaksa dikembalikan ke workshop kami dan kemudian dilakukan mobilisasi kembali peralatan ke proyek setelah proses pembongkaran bangunan lam selesai (lebih kurang 2 minggu kemudian)*.

Lokasi proyek telah berkembang lama dimana terdapat tanah timbunan (lapisan 1) pada bagian atas yang merupakan campuran tanah berwarna coklat terdiri dari lempung, lanau, pasir, kerikil dan pecahan puing batuan / pecahan beton.

Perincian masalah yang dihadapi pada saat berlangsungnya pekerjaan pada bulan Oktober – November 2012 adalah sbb :

1. Kesulitan untuk memperoleh air pemboran
2. Bersamaan dengan pembongkaran bangunan lama sehingga pekerjaan terpaksa dihentikan sementara sekitar 2 - 3 minggu.
3. Puing & beton menutupi sebagian area proyek sehingga titik - titik uji CPT terpaksa dilakukan penggeseran dari titik - titik rencana namun masih tetap dapat mewakili kondisi tanah setempat.

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1.2. Jadwal Kerja

Persiapan kerja dan mobilisasi peralatan dilakukan pada akhir September 2012, dan penyelidikan tanah lapangan secara keseluruhan di Proyek Gedung Danamon Head Quarter dimulai pada tanggal 1 Oktober 2012 dan selesai pada sekitar tanggal 13 November 2012. Perpindahan mesin bor secara manual tidak sulit untuk dilakukan dan tidak mempengaruhi kemajuan pekerjaan selama penyelidikan tanah berlangsung.

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2. PERKIRAAN KEADAAN GEOLOGI

Peta Geologi Lembar Jakarta, dengan skala 1: 100.000 diterbitkan oleh Pusat Penelitian dan Pengembangan Geologi, Bandung (lihat Gambar - 1), dimana mencakup area pada batas garis bujur timur 106°30' - 107°00' dan garis lintang selatan 6°00' - 6°30', seperti daerah Propinsi Jakarta, Kabupaten Bogor, Kabupaten Tanggerang – Propinsi Jawa Barat.

Sebagian besar daerah Jakarta merupakan daerah terbuka untuk areal permukiman, gedung – gedung tinggi dan pembangunan industri, sedangkan area hutan hanya terdapat didaerah perbatasan dengan Bogor.

Musim kemarau di Jakarta pada umumnya berlangsung dari bulan Mei hingga September sedangkan musim hujan berlangsung dari bulan November hingga April. Pada sisi baratdaya yang berbatasan dengan Bogor pada umumnya mempunyai curah hujan yang agak tinggi dibanding dengan tempat lainnya.

Secara fisiograpi dan morfologi daerah Jakarta dan sekitarnya termasuk daerah sebelah selatan Jakarta, dapat dibagi secara luas menjadi satuan – satuan sebagai berikut:

1. Dataran / rendah pantai, yang dicirikan oleh permukaannya yang datar dengan ketinggian antara 0 – 15 meter diatas m.s.l. ; lebarnya antara 7 – 40 km, meliputi tanggul pematang pantai, daerah rawa dan dataran delta. *Dataran ini dikenal sebagai Dataran Rendah termasuk Pantai Jakarta.*
2. Kipas Gunungapi Bogor, yang menyebar dari selatan ke utara dengan Bogor sebagai puncaknya. Satuan ini terdiri tuf, konglomerat, dan breksi yang sebagian telah mengalami pelapukan kuat, berwarna merah kecoklatan. Hasil erosi tanah didaerah ini terbawa oleh air dan selama ribuan tahun berlangsung dan mengendap di Dataran Rendah Jakarta.
3. Daerah Perbukitan bergelombang memisahkan antara dataran pantai di utara dengan jajaran gunungapi di sebelah selatannya. Timbulan didaerah ini secara berangsur – angsur meninggi kearah selatan, dan dibeberapa tempat terdapat tonjolan – tonjolan bukit – bukit yang bersusunan batugamping dan batuan

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beku.

4. Satuan pegunungan menempati bagian selatan diluar Jakarta berupa Kerucut vulkanik / gunungapi seperti G. Salak dan G. Gede.

Lokasi rencana proyek tersebut terletak di tanah dataran rendah Jakarta tidak jauh dari tepi pantai Laut Jawa, dan nampaknya disekitarnya dan jauh menuju kearah selatan terdapat perbukitan yang bergelombang halus dimana tanah bagian paling atas terdiri dari endapan vulkanik dan alluvium (berumur *Kuarter*)

Sejarah tektonik menunjukkan bahwa daerah Jakarta dan Kepulauan Seribu terdapat struktur geologi berupa lipatan, sesar dan kelurusan (dapat dilihat pada Peta Geologi Lembar Jakarta dan Kepulauan Seribu, sebagai source map).
Lipatan, dijumpai dibagian tenggara peta berupa antklin dengan sumbu berarah barat laut – tenggara, yang melipat Formasi Klapanunggal. Sesar – sesar lain berupa sesar naik, sesar geser dan sesar turun dijumpai disebelah barat daya dan sebelah tenggara. Pola kelurusan – kelurusan yang mempunyai arah barat laut – tenggara dan timur laut – barat daya kemungkinan merupakan zona lemah yang berupa kekar atau sesar yang kemungkinan terjadi akibat gaya kompresi bumi dengan arah timur laut – barat daya.
Sejarah geologi Jakarta dimulai sejak awal Miosen yang kemudian beberapa kali mengalami pengangkatan dan penurunan sehingga menjadi daratan dan lautan berdasarkan ciri – ciri endapan tanah / batuan yang dijumpai. Selain itu daerah ini juga pernah mengalami keadaan dimana terjadi kegiatan gunungapi.
Proses geologi berjalan terus hingga sekarang termasuk didalamnya terjadi proses – proses erosi, pelapukan, dan pengendapan yang menghasilkan *endapan aluvium, endapan pantai dan endapan laut.*

Berdasarkan peta geologi regional (gambar 1); lapisan – lapisan tanah dan lapisan semi batuan yang disebut sebagai lapisan yang mempunyai daya dukung (dalam kondisi natural / terbentuk secara alamiah) di sekitar wilayah proyek dapat dibagi menjadi:

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1. Lapisan Tanah paling atas / top soil yang merupakan lapisan tanah timbunan atau lapisan puing - puing (merupakan campuran cohesive soil, sand, gravel & boulder).
2. Di bawah top soil disekeliling daerah proyek berdasarkan pengamatan secara keseluruhan terdiri dari endapan kipas aluvium dan endapan young volcanic product (dalam kondisi lunak / soft) terdiri dari lanau, lempung dan pasir atau percampuran antara mereka, dan diasumsikan mempunyai ketebalan sekitar sepuluh (10) meter hingga belasan meter.
3. Di bawah endapan lapisan tanah kedua terdapat *uncemented - weakly cemented soil* yang diperkirakan merupakan tanah yang termasuk kedalam lapisan *Formasi Genteng* yang terdiri dari tuf batuapung (sering dijumpai berongga – rongga kecil), batupasir tufan, konglomerat, dan sisipan lempung tufan / lempung lanauan, dalam keadaan tidak tersementasi hingga tersementasi lemah / weakly cemented. Formasi Genteng diperkirakan berumur Miosen - Pliosen Awal yang diendapkan dalam lingkungan litoral hingga darat, dengan ketebalan mulai puluhan meter hingga ratusan meter.

Bahan untuk pembangunan gedung dan jalan didaerah ini sangat mungkin dijumpai terdiri dari batugamping, lempung pasir, dan kerikil andesit basal (lihat Gambar 1, Peta Geologi Regional).
Minyak bumi telah diketemukan terdapat dilepas pantai Laut Jawa berdasarkan pemboran.

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Beberapa perihal penting yang perlu dipahami yang diperoleh berdasarkan pengalaman & pengamatan terhadap <u>lapisan tanah</u> yang terdapat dibawah lapisan tanah permukaan dan lapisan tanah dibawahnya pada kedalaman yang relatif dangkal didaerah Jakarta dan sekitarnya a.l. adalah :

1. *bahwa lapisan tanah tersebut didaerah Jakarta dan sekitarnya berupa "cemented atau uncemented clay, silt dan sand atau terkadang juga berupa gravel" seringkali dijumpai mempunyai kontak antar lapisan yang disebut sebagai "interfingering" atau "menjari jemari", sehingga meski pada jarak yang relatif cukup dekat (beberapa meter saja, berdasarkan bor penyelidikan*

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tanah) kondisi tanah dapat mempunyai ciri fisik yang berbeda baik pada arah vertikal maupun horizontal.

2. *pada arah horizontal seringkali menunjukkan perbedaan jenis tanah dan meski pada tanah yang sama seringkali menunjukkan sifat fisik dan jenis material penyusun tanah yang berbeda.*
3. *pada arah vertikal berdasarkan pengamatan dan hasil uji in-situ seringkali menunjukkan tingkat kekerasan dan sementasi yang berbeda dimana terkadang perbedaannya cukup menyolok.*
4. *kontak antar lapisan tanah secara "interfingering" juga seringkali dijumpai pada lapisan tanah sangat lunak dibawah tanah permukaan terutama didaerah dataran yang mendekati pantai utara Jakarta.*
5. *bahwa pada tanah sangat lunak dibawah tanah permukaan didaerah dataran Jakarta Utara ditepi pantai meskipun tidak terjadi dikeseluruhan tempat, terdapat indikasi kecenderungan mengalir kearah bolak – balik. Hal ini terjadi diduga ada hubungannya dengan pasang surut air laut.*

3. LINGKUP PEKERJAAN PENYELIDIKAN TANAH

Pekerjaan Penyelidikan Tanah dilaksanakan berdasarkan spesifikasi teknis yang berlaku secara umum, berdasarkan persetujuan Pemberi Tugas dan berdasarkan instruksi yang diberikan oleh Geo-technical Engineer serta berdasarkan atas kondisi sebenarnya dilapangan yang kemudian setelah dilakukan evaluasi diperlukan adanya penyesuaian pekerjaan.

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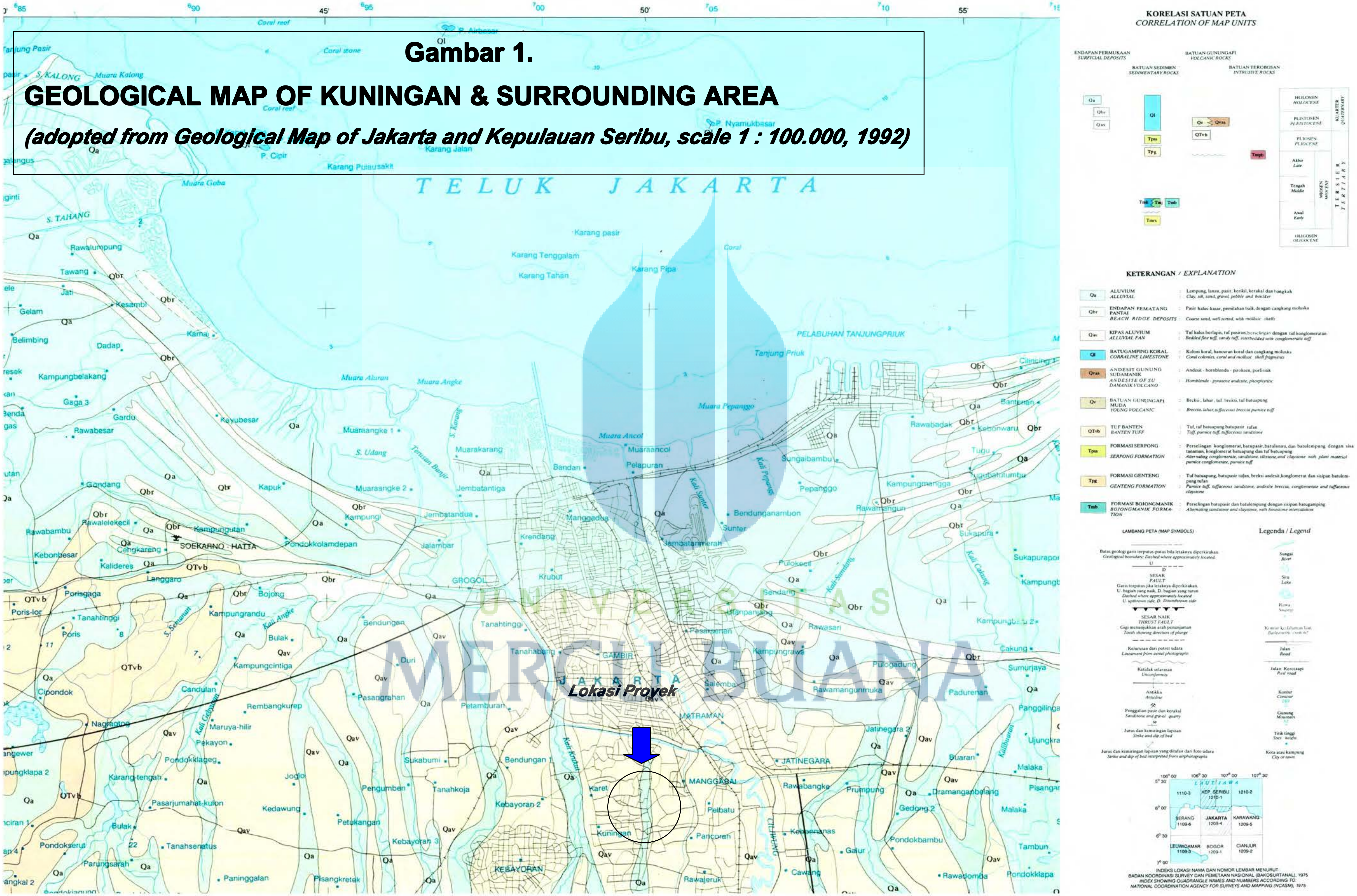
Gambar 1.

GEOLOGICAL MAP OF KUNINGAN & SURROUNDING AREA

(adopted from Geological Map of Jakarta and Kepulauan Seribu, scale 1 : 100.000, 1992)



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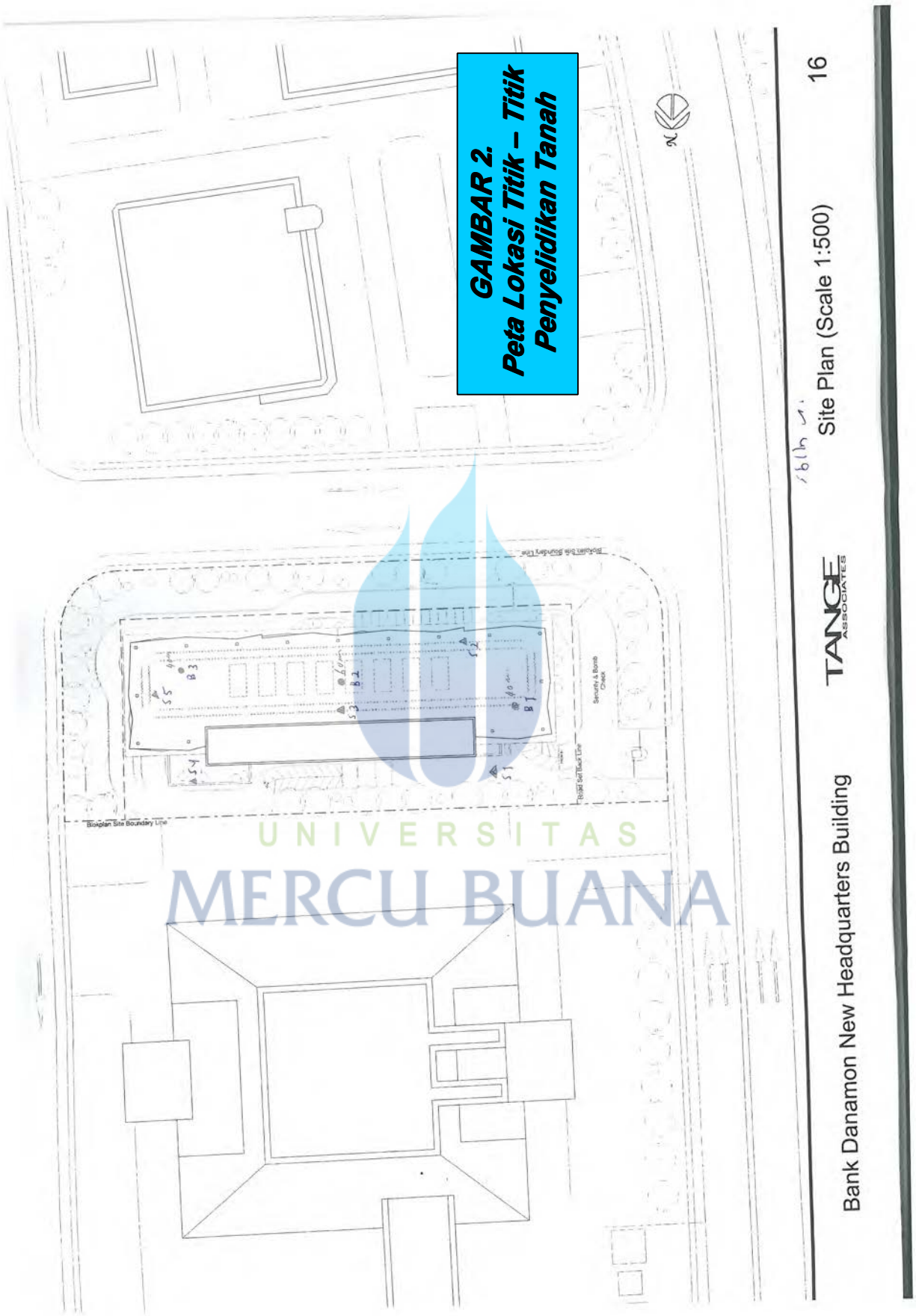

GAMBAR 2.
Peta Lokasi Titik – Titik Penyelidikan Tanah

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Pemboran yang dilakukan pada 3 titik dan pengujian in-situ dengan cara sondir ringan (2,5 ton) sebanyak 5 titik yang dipilih (lihat gambar – 2) dan ditentukan berdasarkan atas penyesuaiannya dengan rencana bangunan Proyek Danamon Head Quarter, Kuningan - Jakarta Selatan.

Ruang lingkup pekerjaan direncanakan berdasarkan usulan yang diajukan oleh Konsultan dapat diperinci sebagai berikut:

- Persiapan, mobilisasi & demobilisasi peralatan dan personil.
- 3 (tiga) titik pemboran inti dimulai dari permukaan tanah hingga mencapai kedalaman tertentu, dimana kedalaman pengeboran maksimum ditetapkan sedalam 40 dan 60 m.
- Uji Penetrasi Standar (SPT) dilaksanakan dalam lubang bor dengan interval 1,5 m
- Pengujian dengan cara sondir ringan (kapasitas 2,5 ton)
- Pengambilan contoh tanah tidak terganggu (UD) selama pengeboran berlangsung
- Pengukuran Muka Air Tanah
- Pengujian laboratorium atas sifat-sifat tanah, uji konsolidasi, dll terhadap contoh tanah UD yang diambil dari lubang bor.
- Penyajian Laporan Faktual Penyelidikan Tanah untuk memberikan informasi tentang lapisan – lapisan tanah bawah permukaan

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4. PEKERJAAN PENYELIDIKAN TANAH

Penyelidikan tanah dilaksanakan berdasarkan prosedur standar dari “The American Society of Testing and Material” (ASTM).

Tabel berikut menunjukan Nomor Referensi ASTM dan jenis – jenis pengujiannya yang biasanya dipergunakan dalam pekerjaan penyelidikan tanah :

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ASTM Ref.	TYPE OF INVESTIGATION WORKS
GENERAL	
D420	Standard guide for investigating and sampling soil and rock
EXPLORATORY BORING, CLASSIFICATION, LOGGING AND SAMPLING	
D1452	Standard practice for soil investigation by auger boring
D1587	Standard practice for thin-walled tube sampling of soils
D2113	Standard practice for diamond core drilling for site investigation
D2487	Standard classification of soils for engineering purposes (unified soil classification system)
D2488	Standard practice for description and identification of soils (visual—manual procedure)
D3550	Standard practice for ring-lined barrel sampling of soils
D4220	Standard practice for preserving and transporting soil samples
IN-SITU TESTING	
D1194	Standard test method for bearing capacity of soil for static load and spread footings
D1586	Standard test method for penetration test and split- barrel sampling of soils
D2573	Standard test method for field vane shear test in cohesive soil
D2922	Standard test method for density of soil and soil aggregate in place by nuclear methods (shallow depth)
D2937	Standard test method for density of soil in place by the drive-cylinder method
D3441	Standard test method for deep, quasi-static, cone and friction-cone penetration tests of soil
D4429	Standard test method for bearing ratio of soils in place
D4633	Standard test method for stress wave energy measurement for dynamic penetro-meter testing systems
D4719	Standard test method for pressure-meter testing in soils

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D422	Standard test method for particle-size analysis
D698	Test method for laboratory compaction characteristics of soil using standard effort (12,400 ft-lbs/ft3 (600 kN-m/m3)
D854	Standard test method for specific gravity of soils
D1556	Standard test method for density and unit weight of soil in place by the sand-core method
D1557	Test method for laboratory compaction characteristics of soil using modified effort (56,000 ft-lbs/ft3 (2,700 kN-m/m3))
D1883	Standard test method for CBR (California Bearing Ratio) at laboratory-compacted soils
D2166	Standard Test Method for Unconfined Compressive Strength of Cohesive
D2167	Standard test method for density and unit weight of soil in place by a rubber balloon method
D22l6	Standard test method for laboratory determination of water (moisture) content of soil and rock
D2217	Standard practice for wet preparation of soil samples for particle size analysis and determination of soil constants
D2434	Standard test method for permeability of granular soils (constant head)
D2435	Standard test method for one-dimensional consolidation properties of soils
D2850	Standard test method for unconsolidated un-drained compressive strength of cohesive soils in triaxial compression
D2974	Standard test method for moisture, ash, and organic matter of peat and other organic soils
D3080	Standard test method for direct shear test of soils under consolidated drained conditions
D43l8	Standard test method for liquid limit, plastic limit, and plasticity index of soils
D4373	Standard test method for calcium carbonate content of soils
D4643	Standard test method for determination of water (moisture) content of soil by the microwave oven method
D4647	Standard test method for identification and classification of dispersive clays

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	by the pinhole test

4.1. Pemboran Inti

Dari 3 log bor hasil pemboran penyelidikan tanah, dapat dibuat profil tanah secara sederhana yang menggambarkan kondisi lapisan - lapisan tanah yang dibuat berdasarkan asumsi dari keadaan Geologi dan Geo-teknik bawah permukaan di bawah Rencana Konstruksi Proyek Danamon Head Quarter , Kuningan.

Elevasi titik - titik bor diukur terhadap elevasi jalan aspal Rasuna Said yang dianggap mempunyai elevasi 0.00 m, dan masing - masing titik bor mampunyai elevasi sbb :

- BH-1 : - 40 cm terhadap jalan aspal
- BH-2 : - 55 cm terhadap jalan aspal
- BH-3 : - 55 cm terhadap jalan aspal

Pemboran dilakukan dengan menggunakan 1 (satu) unit mesin bor putar dengan sistem hidrolik, lengkap dengan pompa air untuk pencucian tanah & sirkulasi air, core barel, stang bor, contoh tanah tak terganggu dan terganggu, split soil sampler SPT dan peralatan bantu lainnya. Pemboran di daerah penyelidikan dilakukan sampai kedalaman hingga 40 - 60 m dengan mempertimbangkan berbagai aspek geoteknik.

Lokasi titik – titik lubang bor dan penyelidikan tanah lain ditentukan pada lokasi rencana bangunan di proyek Danamon Head Quarter.

Casing dengan diameter 89 mm dipasang ke dalam lubang bor ketika pengeboran telah menembus tanah lunak / lepas untuk mencegah keruntuhan tanah. Proteksi lubang dengan cara ini akan mengizinkan SPT dan pengambilan contoh tanah yang tidak terganggu dapat dilakukan dengan baik.

Contoh-contoh inti tanah diambil dengan mempergunakan core barel diameter 73 mm dengan metode pengeboran kering.

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Contoh inti tanah pada setiap panjang 1 meter dari lubang bor itu disimpan dalam kotak kayu penyimpan contoh inti tanah yang disusun berdasarkan kepada urutan kedalaman pemboran. Informasi tertulis tentang contoh inti, seperti tanggal pelaksanaan pemboran, nomor lubang bor dan total kedalaman pemboran juga ditulis dalam kotak kayu tersebut.

Posisi contoh inti tanah dan posisi pengambilan contoh tanah tak terganggu yang gagal terambil, dicatat dalam drilling log. Faktor – faktor penting lain dicatat dalam drilling log seperti nama proyek, lokasi, nomor lubang, kedalaman sampel, deskripsi detail tentang tanah, hasil pengujian in-situ dan data pengeboran lainnya yang diperlukan selain daripada yang disebutkan (lihat lampiran - 1, Drilling Log).

4.2. Uji Penetrasi Standar (SPT)

Uji Penetrasi Standar (SPT) dilaksanakan didalam lubang bor dengan interval kedalaman 1,5 m berdasarkan prosedur standar (ASTM No. D-1586).

Pengujian ini dilakukan untuk mendapatkan kepadatan relatif tanah granular (non kohesif) dan konsistensi tanah berbutir halus (kohesif). Tes dilakukan dengan menggunakan alat Hammer / palu SPT yang memiliki berat standar 63.5 kg dan "Split Spoon Sampler" yang mempunyai diameter luar 2 inci dipasang diujung bawah dari rangkaian stang bor. Palu dijatuhkan secara bebas dari ketinggian 76 cm di atas blok yang terpasang pada stang bor dan palu akan jatuh bebas meluncur mengikuti stang bor, gaya yang bekerja pada saat palu tertahan oleh blok, selanjutnya diteruskan oleh rangkaian stang bor hingga mencapai split spoon sampler, dan split spoon sampler menembus ke lapisan tanah di dasar lubang bor.

Nilai kepadatan dan konsistensi (sebagai nilai N SPT) dapat diperoleh dari jumlah pukulan palu SPT yang dihitung selama pelaksanaan tes untuk kedalaman penembusan split spoon sampler sepanjang total 45 cm. Penembusan 15 cm pertama tidak digunakan karena posisi ini dianggap sebagai kondisi setting. Jumlah pukulan pada panjang 15 cm kedua dan panjang 15 cm ketiga dihitung sebagai nilai N SPT. Grafik nilai N sebagai hasil dari pengujian dengan cara SPT digambar pada drilling log dimana menunjukkan tingkat kekakuan dan kekerasan lapisan tanah.

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Contoh tanah di dalam split spoon sampler dimasukkan ke dalam plastik transparan sebelum didiskripsi oleh Engineer.

4.3. Pengujian Vane Shear Test dalam Lubang Bor (tidak dilakukan)

Metode pengujian standard untuk field vane shear test pada cohesive soil yang sangat lunak dilaksanakan mengikuti / sesuai dengan ASTM. D2573.

4.4. Pengujian dengan Pocket Penetrometer pada Contoh Inti Tanah Lunak (tidak dilakukan)

Pengujian tanah dengan mempergunakan alat Pocket penetrometer menghasilkan klasifikasi yang cukup akurat untuk tanah kohesif yang berhubungan dengan penetapan konsistensi tanah. Ujung batang stainless steel dengan luas 31 cm² ditusukkan kepada contoh tanah yang diuji hingga masuk sedalam 6 mm sesuai batas berupa garis yang melingkar batang. Bacaan yang kemudian dicatat tertera pada skala yang terdapat pada batang pegangan dari alat tersebut yang mana telah dikalibrasi hingga 5 ton per sq.ft (mendekati sama dengan kg gaya per cm²).

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4.4. Contoh Tanah yang tidak Terganggu

Contoh tanah tidak terganggu dengan hati-hati diambil dari lubang bor di kedalaman di mana kondisi tanah memungkinkan untuk diambil dengan menggunakan Sampler Tabung Shelby (memiliki diameter luar 70 mm) dan maksimum 4 contoh untuk setiap lubang bor.

Sampler Tube Shelby dipasang diujung bawah dari rangkaian stang bor, lalu dengan hati-hati diturunkan ke bawah hingga mencapai dasar lubang bor. Sistem rangkaian alat tersebut perlahan-lahan ditekan ke bawah dengan gaya hidrolik hingga menembus lapisan tanah dimana contoh tanah berada didalam tabung

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shelby. Pengalaman menunjukkan bahwa contoh tanah tak terganggu tidak bisa diperoleh bila tanah mempunyai nilai N - SPT lebih besar dari sekitar 15. Penerapan tekanan secara berlebihan untuk memperoleh contoh tanah akan mengakibatkan contoh tanah tidak lagi sesuai dengan keadaan aslinya / rusak.

Kebanyakan dari hasil uji index properties dalam lampiran uji laboratorium merupakan hasil pengujian yang diterapkan atas contoh tanah terganggu yang diperoleh dari dalam lubang bor.

Setelah ditutupi dengan segel parafin pada kedua sisi tabung contoh tanah, untuk menjaga agar contoh tanah tetap dalam kondisi alamnya dan untuk mencegah hilangnya kandungan air alami yang terdapat dalam tanah, kemudian contoh tanah tak terganggu / terganggu dengan hati-hati dikirim ke laboratorium untuk pengujian mekanik tanah.

Contoh tanah tak terganggu di proyek ini diperoleh pada lapisan tanah yang umumnya berkomposisi lempung. Pada lapisan pasir dan kerikil yang dijumpai dibawah lapisan lempung (dibawah kedalaman 8 m) tidak dapat diperoleh contoh tanah yang tidak terganggu.

Setiap tabung contoh tanah telah ditandai dengan label yang menunjukkan Nama Proyek, Lokasi, No Bor Lubang, Kedalaman Pengeboran dan lain-lain informasi yang diperlukan.

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4.5. Pengujian Sondir

Pelaksanaan Sondir dilakukan sesuai dengan Standard ASTM D 3411 T 75, dengan memakai alat sondir ringan kapasitas 2,5 ton. Pekerjaan sondir dilakukan untuk mengetahui perlawanan tanah terhadap ujung konus yang dinyatakan dalam gaya geser persatuan luas. Sedangkan hambatan lekat adalah perlawanan geser terhadap selubung bikonus dalam gaya per satuan panjang. Alat yang digunakan untuk mengukur daya dukung tanah melalui sondir ini adalah penetrometer (Dutch Cone Penetration Test). Penyondiran ini dilakukan sampai mencapai kekuatan tanah keras dengan bacaan nilai konus CR $\geq$ 250 kg/cm² atau mencapai kedalaman max.

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30 meter, maka pekerjaan sudah dapat dihentikan. Dalam pekerjaan ini bila tidak dapat diperoleh keterangan tentang jenis tanah, maka untuk mengetahui diambil dari lobang bor yang berdampingan dengan titik sondir.

Dari penyondiran dengan memasukkan bikonus ke dalam tanah akan didapatkan Cone Resistance (CR) dan Total Resistance (TR) dalam satuan kg/cm² dari pembacaan manometer untuk tiap interval 10 cm.

Dengan didapatkannya CR dan TR, maka selanjutnya dari analisa akan didapatkan :

1. FR = TR – CR

   FR = Friction Resistance..... kg/cm²

   TR = Total Resistance..... kg/cm²

   CR = Cone Resistance..... kg/cm²

2. SF = FR x 20/10..... kg/cm

   SF = Skin Friction..... kg/cm

   20 = interval pembacaan..... (cm)

   10 = Faktor alat (Reduction Factor)

3. TSF = Total Skin Friction..... kg/cm

4. LSF = FR / 10

   LSF = Local Skin Friction..... kg/cm²

4.6. Pengukuran Muka Air Tanah

Muka Air tanah dalam lubang bor diukur dua kali sehari sebelum dan sesudah operasi pengeboran. Tabel air tanah dicatat setiap hari di catatan harian pelaksanaan pemboran dan muka air rata – rata ditulis dalam drilling log adalah antara 5 - 8,4 m diukur dari permukaan tanah pada setiap titik bor. Cuaca selama proses pemboran berlangsung adalah musim kemarau panjang.

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4.7. Pengujian Laboratorium

Parameter – parameter karakteristik dan teknis dari tanah bawah permukaan di daerah penyelidikan diperoleh dari serangkaian pengujian laboratorium terdiri dari "Index Properties" dan "Engineering Properties". Pengujian yang diterapkan kepada sampel tanah terganggu dan terganggu yang diambil di lubang bor.

Pengujian laboratorium terhadap semua contoh tanah terdiri dari uji fisik.

Pengujian fisik sebagaimana diuraikan berikut ini dilakukan berdasarkan pada prosedur standar ASTM:

Index Properties

1. Kandungan Air Alami (Wn)

   Tes ini dilakukan mengikuti prosedur standar ASTM D 2216 untuk mengetahui kandungan air alami dari sampel tanah.

2. Gravitasi Spesifik (Gs)

   Tes ini dilakukan mengikuti prosedur standar ASTM D 854

3. Analisis Ukuran Butir

   Tes ini dilakukan mengikuti prosedur standar ASTM D 422 dan D 1140 dalam rangka untuk menemukan persentase masing-masing ukuran butiran material tanah.

4. Uji Batas Atterberg

   Tes ini dilakukan mengikuti prosedur standar ASTM D 423 dan D 434 dalam rangka untuk mencari Batas Cair (LL), Batas Plastik (PL) dan Indeks Plastisitas (IP) dari sampel tanah.

5. Volume Satuan Berat

   Tes ini dilakukan dalam rangka untuk menemukan densitas (kepadatan basah & kering) dari contoh tanah mengikuti prosedur standar ASTM D1556.

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6. Rasio Void (e), Porositas (n) dan Derajat Saturasi (Sr)

   Tes ini dilakukan dalam rangka untuk menentukan e, n dan Sr dari contoh tanah sampel dengan cara mengikuti prosedur standar ASTM D 7263-09.

Engineering Properties

1. Tri-aksial Kompresi Test (Tx UU)

   Tes ini dilakukan mengikuti prosedur standar ASTM D 2850 dalam rangka untuk mendapatkan nilai Kohesi (C) dan sudut geser dalam (q) dari sampel tanah.

2. Uji Konsolidasi

   Tes ini dilakukan mengikuti prosedur standar ASTM D 2435 dalam rangka untuk memperoleh parameter – parameter Koefisien Konsolidasi (Cu), Indeks Kompresi (Cc) dan Re-kompresi Index (Cr) dari sampel tanah.

Ringkasan dan Hasil Uji Laboratorium lengkap disajikan dalam lampiran 3.

5. MORFOLOGI

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Proyek Danamon Head Quarter terletak di wilayah dataran yang tidak terlampau jauh dari pantai utara Jakarta dengan ketinggian diperkirakan sekitar 5 m di atas permukaan air laut pada kondisi pasang tertinggi.

Area Proyek sebagian besar telah terdapat bangunan gedung lama, dimana tanah permukaannya merupakan *tanah timbunan* yang terdiri dari campuran pasir berbutir halus hingga kasar, kerikil, cobble, boulder, lempung dan lanau dan puing – puing bangunan.

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Tanah timbunan tersebut tersebar di dalam dan sekitar wilayah Proyek menutupi lapisan lempung dengan silt dan pasiran yang lunak / soft atau loose untuk granular soil. Kedalaman tanah lunak bervariasi dibawah kedalaman 4 m hingga kedalaman 6 m. Perbaikan tanah pondasi untuk bangunan dengan pondasi dangkal diperlukan dalam kondisi tanah “loose” / lepas atau lunak.

6. KONDISI TANAH DI BAWAH PERMUKAAN

Kondisi geologi / lapisan tanah di bawah permukaan diperkirakan berdasarkan hasil inti pengeboran dan asumsi.

Table 6.1. Ringkasan Pengeboran dan Tes In-Situ

No	Bore Hole no	Location	Total Depth (m)	In-situ Testing		UD/D Sample	Execution Date (year 2011)		Remark
				SPT (nos)	VST (nos)		Start	Finish	Elevasi thd jalan aspal Rasuna Said
1	BH – 1	bld	40	20		2	1 Okt	7 Okt	- 40 cm
2	BH - 2	bld	60	29		0	1 Nov	7 Nov	- 55 cm
3	BH - 3	bld	40	19		3	9 Nov	12 Nov	- 55 cm
	Total		140	68					

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Tabel 6.2. Ringkasan hasil Pengujian dengan cara DCPT

No	*DCPT No*	*Penetration Depth until qc > 250*	*Date of Execution*	*Note*
1	S - 1	12.20 m	2 Okt 2012	Ujung konus diperkirakan mencapai lapisan sand (lapisan III)
2	S - 2	10.80 m	3 Okt 2012	Ujung konus diperkirakan mencapai lapisan sand (lapisan III)
3	S - 3	10.80 m	3 Okt 2012	Ujung konus diperkirakan mencapai lapisan sand (lapisan III)
4	S - 4	11.20 m	4 Okt 2012	Ujung konus diperkirakan mencapai lapisan sand (lapisan III)
5	S - 5	12.00 m	11 Nov 2012	Ujung konus diperkirakan mencapai lapisan sand (lapisan III)

Table 6.3. Ringkasan sample UD di setiap lubang pengeboran

No	*Bore Hole no*	*Location*	*Sampling no & depth in m*							
			S 1	*S 2*	*S 3*	*S 4*	*S 5*	*S 6*	*S 7*	*S 8*
	BH 1	bld	1 – 1.5	3 – 3.5	7 - 7.5					
	BH 2	bld	1 - 1.5	4 - 4.5	6 - 6.5	10 - 10.5				
	BH 3	bld	1.5 – 2	4 – 4.5	6.5 - 7					
		Total	10 UD samples							

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Berdasarkan 3 titik bor dan 5 titik sondir yang telah dilaksanakan, maka dapat digambarkan simplified soil profile (gambar 6.1) dan stratigrafi bawah permukaannya dengan uraian tersebut dibawah ini.

Lapisan - I: **Tanah Timbunan (dari permukaan tanah sekarang hingga kedalaman sekitar 0.5 - 2,75 m)**

Lapisan - I adalah tanah bagian paling atas yang merupakan tanah timbunan terdiri dari campuran pasir berbutir halus – kasar, kerikil, pecahan beton / puing bangunan, lanau, dan lempung.

Beberapa karakteristik tanah-tanah yang terekam oleh titik – titik bor tersebut dapat dijelaskan sebagai berikut:

(i) Konsistensi: lunak

(ii) Kepadatan: lepas

(iii) Kelembaban alami: kering sampai lembab

(iv) Plastisitas: non-plastis sampai plastisitas rendah

(v) Warna: coklat

(vi) Tebal: sekitar 0.5 sampai 2,75 m (dari pinggir jalan Rasuna Said menuju kebelakang rencana bangunan timbunan tanah semakin tebal)

Nilai Tahanan Konus dari hasil pengujian sondir S1 s/d S5 menunjukkan angka antara 15 – 35 kg/cm^2 dimana masing – masing titik sondir tersebut berdekatan dengan titik – titik bor BH-1 s/d BH-3.

Nilai tahanan konus ini dapat memberikan asumsi yang logic bahwa disekitar area tersebut menunjukkan tanah bagian paling atas secara keseluruhan dalam kondisi lunak / lepas hingga firm.

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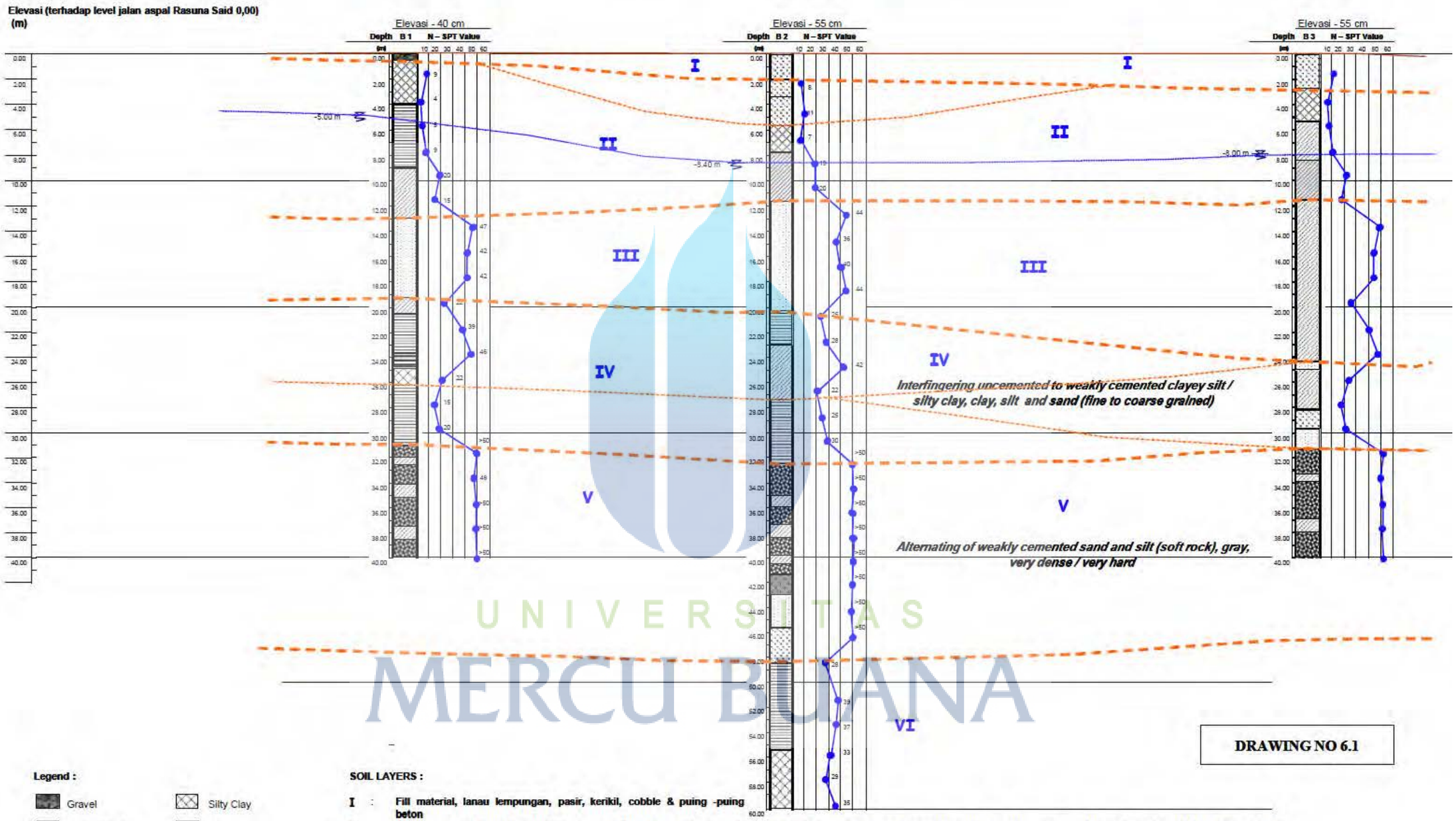

DRAWING NO 6.1

Legend :

- Gravel
- Gravelly Sand
- Sand
- Silt
- Silty Clay
- Clay
- Organic Clay
- Ground water level (GWL)

SOIL LAYERS :

I : Fill material, lanau lempungan, pasir, kerikil, cobble & puing -puing beton

II : Terutama terdiri dari silt, coklat, soft sampai firm. Lapisan lensa pasir terdapat pada cekungan tanah ini (lihat BH3)

III : Pasir kelanauan, coklat keabuan, sebagian besar weakly cemented, umumnya dense.

IV interfingering layers antara clayey silt / silty clay, clay, silt dan sand, abu2 - coklat keabuan, sebagian weakly cemented, very stiff - hard.

V Alternating weakly cemented sand & silt, abu - abu, very dense / very hard

VI Clay & clayey silt, abu kecoklatan, very stiff - hard (lihat bor no BH-3)

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Ada beberapa kemungkinan yang menyebabkan perbedaan – perbedaan kepadatan pada tanah timbunan yaitu :

- tanah timbunan memang tidak pernah bisa menjadi padat meski dengan mengikuti prosedur standar karena tanah pendukung dibawahnya lunak
- terjadi kesalahan cara pemadatan tanah pada saat penimbunan dilaksanakan
- kepadatan tanah berkurang karena tanah pendukungnya mengalami konsolidasi secara bertahap dan turun

Lapisan - II: didominasi oleh tanah Lanau mengandung lempung atau lempungan (terdapat dibawah tanah timbunan hingga kedalaman sekitar 11.6 sampai 13 m)

Lapisan kedua terutama terdiri dari *lanau lempungan atau lanau mengandung sedikit lempung, pada umumnya dengan konsistensi "firm"*. Pada titik bor BH-3 menunjukkan bukti bahwa pada masa lampau terdapat cekungan yang relatif kecil diarea proyek yang menghasilkan endapan *lensa pasir berbutir kasar dan kerikilan.* Lapisan lensa pasir ini tidak terlalu jelas apakah merupakan tanah original (terbentuk karena proses erosi dari daerah Selatan Jakarta dan diendapkan diarea proyek) atau fill material pada masa lampau.

Lapisan ini terdapat di bawah lapisan pertama berwarna coklat yang dapat diasumsikan bahwa lapisan lanau ini berasal dari daerah selatan wilayah Jakarta yang memang dominan berwarna coklat (material asal volkanik). Tanah lanau ini diperkirakan aslinya adalah sangat lunak (N-SPT =0), namun kemudian mengalami perubahan secara berangsur - angsur dimana terkonsolidasi secara perlahan, sehingga mempunyai tingkat konsistensi yang lebih tinggi mengacu kepada nilai N- SPT 4 – 20 (dari bagian atas kebawah semakin meningkat kepadatannya). Nilai Tahanan Konus dari hasil pengujian sondir menunjukkan angka antara 15 – 130 kg/cm^2. Nilai tahanan konus ini dapat memberikan asumsi yang logic bahwa telah terjadi proses konsolidasi yang *tidak secara merata* pada lapisan II dan secara berangsur - angsur dari tanah bagian atas kebagian bawahnya.

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Pengujian sondir yang dilakukan hingga qc atau total qc & friction > 250 kg/cm2 tidak dapat menembus lapisan ke 2 ini.

Lapisan - III: Pasir lanauan (dijumpai di bawah lapisan II hingga kedalaman sekitar 19,30 – 24.10 m)

Dibawah lapisan kedua dijumpai lapisan pasir lanauan, berbutir sedang hingga kasar, menunjukkan lingkungan pengendapan daratan, sebagian besar berwarna coklat keabu – abuan, umumnya "dense / very dense" (ditandai dengan nilai N-SPT 24 - 48). Berdasarkan diskripsi & pengamatan secara visual, lapisan ini menunjukkan *sebagian tersementasi lemah* (weakly cemented) dengan sifat utamanya adalah brittle (ditunjukkan juga oleh hasil pengujian nilai N-SPT yang naik turun). Ketebalan lapisan ini berdasarkan data pemboran adalah sekitar 6,3 - 12,4 m, dimana dijumpai di bawah lapisan ketiga sampai kedalaman 19,3 - 24.10 m.

Bergantung dari besarnya beban bangunan, maka lapisan III ini dapat dipergunakan sebagai lapisan tanah *pendukung / bearing layer*.

Pada penggunaan tiang pancang diperkirakan akan terjadi perbedaan kedalaman penembusan yang cukup bervariasi dan sulit diprediksi disebabkan oleh variasi nilai kekerasan tanah dan jenisnya

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Lapisan - IV: "interfingering layer" dari cemented / un-cemented Silty Clay / Clayey Silt, Silt dan Sand (terdapat dibawah Lapisan III hingga kedalaman sekitar 30 - 32 m)

Lapisan IV ini merupakan lapisan dengan kontak antar lapisan yang menjari jemari (interfingering) dimana batas – batas lapisannya menjadi tidak jelas dan berubah – ubah kearah horizontal. Lapisan ini terutama terdiri dari lanau & lempung atau campuran antara keduanya, dengan warna dominan adalah abu-abu kecoklatan.

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Terkadang lapisan ini terdapat pada kondisi tersementasi yang mendekati medium cemented.

Sifat perlapisan “interfingering” ditandai pula oleh nilai N-SPT yang sangat bervariasi / tidak seragam (dibuktikan dengan indikasi nilai N-SPT yang naik turun dengan selisih yang cukup besar antara 22 hingga > 50).

Pada proses pelaksanaan pemancangan tiang pancang (bila dipergunakan untuk pondasi) hingga kondisi “setting” diperkirakan akan terjadi perbedaan kedalaman penembusan yang cukup bervariasi dan sulit diprediksi disebabkan oleh variasi nilai kekerasan tanah dan jenisnya. Pada tanah jenis pasir yang mengandung kerikil cukup banyak, jelas akan lebih sulit lagi ditembus oleh tiang pancang dibandingkan dengan jenis lanau ataupun lempung.

Bergantung dari besarnya beban bangunan, maka lapisan IV ini dapat dipergunakan sebagai lapisan tanah *pendukung / bearing layer*.

Lapisan - V: Alternating Weakly cemented Sand & Silt (dapat digolongkan kedalam jenis "soft rock", dijumpai di bawah lapisan IV atau kedalaman 30 - 32 m hingga kedalaman 48.40 m)

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Dibawah lapisan keempat dijumpai lapisan tanah yang tersementasi cukup baik, terdiri dari perselingan pasir dengan lanau, berbutir halus hingga kasar, berwarna abu – abu, keras / sangat padat dapat diklasifikasikan sebagai "soft rock" / batuan lunak (ditandai dengan nilai N-SPT rata - rata > 50).

Terekam pada BH-3, menunjukkan bahwa secara berangsur terdapat perubahan besar butir pada lapisan pasir menjadi lebih kasar dan mengandung kerikil pada kedalaman dibawah 41.15 m dan dengan sisipan pasir halus.

Lapisan - VI: Lempung / Lanau (tercatat pada lubang bor BH-3, di bawah lapisan V hingga kedalaman dasar lubang bor)

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Dibawah lapisan kelima dijumpai lapisan lempung / lanau yang yang sangat keras, dengan nilai N-SPT rata -rata diatas 30 (>30). Lapisan tanah ini secara dominan berwarna kecoklatan, dijumpai sampai kedalaman akhir lubang bor pada kedalaman 60 m.

7. MUKA AIR TANAH

Berdasarkan drilling log BH - 1 hingga BH - 3 menunjukkan muka air tanah adalah antara 5 m pada bulan Oktober 2012 (atau pada saat dilaksanakan pemboran di BH-1) dan 8 - 8,40 m pada bulan November 2012 (atau pada saat dilaksanakan pemboran pada bulan November 2012). Rata – rata muka air tanah tersebut diukur selama pemboran tanah berlangsung, dimana keadaan *cuaca kering / tidak ada hujan*. Perbedaan kedalaman muka air tanah yang ditunjukkan pada titik bor adalah disebabkan karena adanya perbedaan level permukaan tanah dan kondisi tanpa hujan yang berkepanjangan pada bulan November 2012 dibandingkan dengan bulan Oktober 2012.

Apabila terdapat aliran air ketempat yang lebih rendah, didalam wilayah proyek diperkirakan mempunyai "hydraulic gradient" yang sangat kecil atau dengan kecepatan yang sangat lambat.

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8. INTERPRETASI BERDASARKAN KONDISI DAN VARIASI LAPISAN – LAPISAN TANAH

Berdasarkan drilling log, urutan lapisan tanah dan simplified soil profile diperkirakan telah terjadi beberapa kali proses pengendapan pada lingkungan darat dan kemungkinan juga pernah mengalami proses genangan air yang menghasilkan endapan lempung lapisan IV (lapisan tanah paling bawah).

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Secara keseluruhan proses tersebut terjadi diatas lapisan dasar (lapisan V & VI) yang merupakan lapisan yang berumur paling tua didaerah proyek.

Pertama, genangan air yang terjadi dengan lapisan dasar lapisan V & VI menghasilkan sedimen berupa interfingering weakly cemented silty clay / clayey silt, silt & clay dan sand. Lapisan tanah ini merupakan endapan dataran dekat ke pantai dan pasir berwarna abu – abu hingga coklat (percampuran antara endapan lingkungan air dan volkanik).

Proses selanjutnya kemudian terjadi penyusutan air genangan yang menghasilkan deposit lapisan II & III pada lingkungan daratan yang bersifat volkanik.

Berikutnya yaitu kedaan sekarang ini dimana terjadi proses pengerjaan oleh manusia yang melakukan penimbunan tanah (lapisan I).

9. RINGKASAN HASIL PENGUJIAN LABORATORIUM

Ringkasan hasil pengujian laboratorium diterapkan pada contoh tanah yang tidak terganggu / terganggu (lihat lampiran halaman berikut) yang diambil dari lubang bor di daerah proyek, dimana secara rinci ditampilkan dalam lampiran tes laboratorium (lampiran 3).

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Berdasarkan diskripsi tanah dan ringkasan hasil uji Distribusi Ukuran Butir di laboratorium menunjukkan bahwa contoh tanah yang diambil dari variasi kedalaman antara 1 hingga 10.5 m secara dominan dapat diklasifikasikan sebagai tanah *clayey silt / lanau kelempungan.*

Contoh – contoh tanah untuk diuji di laboratorium adalah secara dominan termasuk kedalam kelas MH, dan proporsi dari *Silt* dan *Clay* dianalisa berdasarkan analisa besar butir seperti ditampilkan dalam table dibawah ini.

No Bor	Silt (%)	Clay (%)	Klasifikasi Tanah
BH 1	55 - 65	35 - 45	MH

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BH 2	58 - 65	35 - 42	MH
BH 3	55 - 62	38 - 45	MH

Untuk jenis tanah dibawah 10 m, pengambilan contoh tanah dengan shelby tube sampler tidak dapat diperoleh karena tanah lempung dan pasir sudah cukup keras sehingga analisa lempung & pasir yang pada umumnya sudah tersementasi tidak tersedia.

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SUMMARY OF LABORATORY TESTS

BORING No. AND SAMPLE CODE	SAMPLE DEPTH (Meter)	Natural Water Content	Wet Density	Dry Density	Specific Grafity	Void Rasio	Porosity	Degree of Saturation	ATTERBERG LIMITS				GRAIN SIZE DISTRIBUTION (% by Weight)				Organic Content Test	Unconfined Compr. Test		Sensivity	TRIAXIAL **CU		Consl.	NOTES
																					Cohesion	Intr. Frict. Angle	Comp. Index	OTHER TEST
		W_N	γt	γd	Gs	e	n	Sr	W_L	W_P	I_P	Class	Gravel	Sand	Silt	Clay	Org.	qu	qur	St	c	ϕ	C_c	
		%	t/m^3		-			%	%				%				%	kg/cm^2		-	kg/cm^2	deg	-	
BH. 1																								
UDS. 1	1.00 ~ 1.50	39.196	1.758	1.263	2.638	1.088	0.521	94.98	50.30	31.09	19.21	MH	0.00	0.00	58.00	42.00	-	-	-	-	-	-	-	
UDS. 2	3.00 ~ 3.50	39.589	1.740	1.247	2.653	1.128	0.530	93.09	75.90	37.35	38.55	MH	0.00	0.00	65.00	35.00	-	-	-	-	-	-	0.57	
UDS. 3	7.00 ~ 7.50	39.883	1.717	1.227	2.641	1.152	0.535	91.46	75.90	37.31	38.59	MH	0.00	0.00	55.00	45.00	-	-	-	-	-	-	-	
																					**			

PROJECT : BANK DANAMON
LOCATION : KUNINGAN - JAKARTA SELATAN

Tested by : Lodang_Dd
Date of Test : OKT. 2012
Checked by : Djs

No.

Fig.

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SUMMARY OF LABORATORY TESTS

BORING No. AND SAMPLE CODE	SAMPLE DEPTH (Meter)	Natural Water Content	Wet Density	Dry Density	Specific Grafity	Void Rasio	Porosity	Degree of Saturation	ATTERBERG LIMITS				GRAIN SIZE DISTRIBUTION (% by Weight)				Organic Content Test	Unconfined Compr. Test		Sensivity	TRIAXIAL **CU		Consl.	NOTES
																					Cohe sion	Intr. Frict. Angle	Comp. Index	OTHER TEST
		W_N	γt	γd	Gs	e	n	Sr	W_L	W_p	I_p	Class	Gravel	Sand	Silt	Clay	Org.	qu	qur	St	c	ϕ	C_c	
		%	t/m^3		-			%	%				%				%	kg/cm^2		-	kg/cm^2	deg	-	
BH. 2																								
UDS. 1	1.50 ~ 2.00	54.378	1.620	1.049	2.640	1.516	0.602	94.71	83.50	47.17	36.33	MH	0.00	0.00	58.00	42.00	-	-	-	-	-	-	0.51	
UDS. 2	4.00 ~ 4.50	33.429	1.774	1.330	2.638	0.984	0.496	89.60	56.40	30.56	25.84	MH	0.00	0.00	65.00	35.00	-	-	-	-	-	-	-	
UDS. 3	6.00 ~ 6.50	42.867	1.667	1.167	2.643	1.265	0.559	89.55	74.20	37.56	36.64	MH	0.00	0.00	60.00	40.00	-	-	-	-	-	-	-	
UDS. 4	10.00 ~ 10.50	33.624	1.773	1.327	2.642	0.991	0.498	89.63	59.50	31.86	27.64	MH	0.00	0.00	64.00	36.00	-	-	-	-	-	-	-	
BH. 3																								
UDS. 1	1.50 ~ 2.00	37.639	1.770	1.286	2.660	1.069	0.517	93.69	58.10	34.55	23.55	MH	0.00	0.00	58.00	42.00	-	-	-	-	-	-	-	
UDS. 2	4.00 ~ 4.50	43.045	1.698	1.187	2.660	1.240	0.554	92.29	49.20	31.51	17.69	ML	0.00	0.00	62.00	38.00	-	-	-	-	-	-	0.36	
UDS. 3	6.50 ~ 7.00	64.253	1.550	0.944	2.633	1.791	0.642	94.50	80.80	45.03	35.77	MH	0.00	0.00	55.00	45.00	-	-	-	-	-	-	-	

PROJECT : BANK DANAMON
LOCATION : KUNINGAN - JAKARTA SELATAN

Tested by : Lodang - Dedi Cs.
Date of Test : NOP_DES.2012
Checked by : Djs

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Fig.

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Jenis tanah ini juga memiliki hubungan yang masuk akal dibandingkan dengan pengujian index properties lainnya seperti Wn, γt, γd, Gs, e, n dan Sr.

Ciri-ciri engineering dari sampel tanah ditunjukkan oleh hasil uji *konsolidasi* dimana menunjukkan hasil Cc untuk kedalaman yang dangkal sekitar 1.5 - 2 m adalah sekitar 0.51, pada kedalaman sekitar 3 - 3.5 m adalah sekitar 0.57, dan pada kedalaman sekitar 4 - 4.5 m adalah sekitar 0.36. Sedangkan hasil uji Triaxial CU dari contoh UD dari BH-1 hingga BH-3 menunjukkan nilai c antara 0.17 - 0.70 kg/cm2 dan nilai φ antara 15.92 - 21.75º.

Jenis-jenis tanah ini yang diperoleh dari hasil tes laboratorium menunjukan kesamaan dengan tanah yang tersebar pada umumnya didaerah rencana proyek seperti didiskripsi pada drilling log dan berdasarkan singkapan tanah, dimana sebagian besar terdiri dari tanah lanau dan lempung serta serta terkadang mengandung pasir dan sedikit kerikil. Hal ini juga sama dengan yang tertera pada Peta Geologi dimana menguraikan jenis – jenis tanah secara umum.

10. KESIMPULAN DAN SARAN

a) Dibawah permukaan area proyek dijumpai 6 (enam) lapisan tanah. Salah satunya yaitu lapisan II yang dapat dianggap sebagai tanah lunak mencapai kedalaman sekitar 12 m.

b) Lapisan II, terletak dibawah tanah timbunan sebagian besar terdiri dari *Endapan Volkanik Muda*. Tanah tersebut ditemukan dalam kondisi sebagian telah terkonsolidasi cukup baik dengan nilai N – SPT sekitar 7 - 11 (firm), sedangkan sebagian lagi telah mengalami konsolidasi yang lebih kuat hingga memberikan nilai N-SPT 14 hingga 20 (dominan stiff).

c) Terdapat 2 lapisan tanah yang dapat dipergunakan sebagai bearing layer dibawah permukaan tanah diproyek ini yaitu Lapisan III (ketebalan > 6m) dan Lapisan V (ketebalan > 10 m)

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d) Bila dikehendaki pondasi terdiri dari tiang pancang hingga kedalaman lapisan V, maka harus mempertimbangkan bahwa tiang tidak akan dapat menembus lapisan III, terkecuali dilakukan pre-boring.

e) Perbaikan tanah lunak untuk pondasi dangkal diperlukan sebelum pembangunan konstruksi diatasnya untuk memperkecil besarnya penurunan.

f) Muka air tanah pada musim hujan dengan curah hujan yang besar, kemungkinan akan naik sangat tinggi hingga sekitar 2 - 3 m, namun diperkirakan keadaan ini tidak akan terlampau lama berlangsung mengingat penyedotan air yang luar biasa diarea sekitar rencana proyek untuk kebutuhan sehari - hari.

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Hasil – Hasil Penyelidikan Tanah

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LAMPIRAN – 1

Drilling Log

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BORING LOG

HOLE No. : BH.-I

PROJECT	: BANK DANAMON	TOTAL DEPTH	: 40.00 m	DRILLING METHOD	: ROTARY DRILLING
LOCATION	: KUNINGAN – JAKARTA	COORDINATES N. –	E. –	ø OF CORE	: 60 mm
STARTED	: 05–10–2012	GROUND ELEVATION	: – m	ø OF CASING	: 89 mm
FINISHED	: 08–10–2012	GROUND WATER LEVEL	: + 0.50 m	LOGGED BY	: Syahrir

SCALE IN (m)	DEPTH (m)	ELEVATION (m)	SYMBOL	SOIL / ROCK DESCRIPTION	SAMPLING DEPTH (m)	SYMBOL	INSITU TEST: STANDARD PENETRATION TEST N VALUE (BLOWS PER 30 cm)	N – VALUE	RQD (%)
0									
	0.50			Beton. Gravel / Pasir					
					1.00				
					1.50				
2				Tanah Lempung warna coklat	1.95		N. 9	9	
	3.00				3.00				
					3.50				
4				Tanah Lempung Pasiran, berukuran sedang, warna kuning kecoklatan	3.95		N. 4	4	
6	6.00				6.00				
					6.45		N. 5	5	
				Lempung Pasiran, agak halus, warna kuning kecoklatan					
8					8.00				
					8.45		N. 9	9	
	9.00								
10					10.00				
					10.45		N. 20	20	
				Lempung warna kuning dan abu–abu, ada sedikit pasir					
12					12.00				
					12.45		N. 15	30	
	13.00								
14					14.00				
					14.45		N. 47	39	
				Lempung abu pasiran, dan ada sedikit Pasir, warna putih, sangat padat					
16									
					17.00				
					17.45		N. 42	42	
18	18.00				18.00				
					18.45		N. 42	42	
20				Lempung kuning, dan abu–abu pasiran	20.00				
					20.45		N. 22	22	
	21.50				21.50				
22					21.95		N. 39	39	
				Tuv warna kuning, kecoklatan dan abu–abu					
24	24.00				24.00				
					24.45		N. 46	46	
				Batu Pasir warna abu–abu					
26	26.00				26.00				
					26.45		N. 22	22	
28				Lempung warna kuning dan abu–abu	28.00				
					28.45		N. 15	15	
30									

REMARKS:

MODIFICATION 0 to 10 % TRACE
10 to 20 % SOME
20 to 35 % ADJECTIVE (CLAYEY/SILTY)
35 to 50 % AND

SAMPLES U.D. SAMPLE
SPT SAMPLE

SHEET 1 OF 2

UNIVERSITAS MERCU BUANA

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BORING LOG

HOLE No. : BH.-I

PROJECT	: BANK DANAMON	TOTAL DEPTH	: 40.00 m	DRILLING METHOD	: ROTARY DRILLING
LOCATION	: KUNINGAN – JAKARTA	COORDINATES N. –	E. –	ø OF CORE	: 60 mm
STARTED	: 05–10–2012	GROUND ELEVATION	: – m	ø OF CASING	: 89 mm
FINISHED	: 08–10–2012	GROUND WATER LEVEL	: + 0.50 m	LOGGED BY	: Syahrir

SCALE IN (m)	DEPTH (m)	ELEVATION (m)	SYMBOL	SOIL / ROCK DESCRIPTION	SAMPLING DEPTH (m)	SAMPLING SYMBOL	INSITU TEST: N VALUE (BLOWS PER 30 cm)	N – VALUE
30								
	30.50			Lempung warna kuning dan abu–abu	30.45	⊠	N. 20	20
32					32.00			
					32.45	⊠	N. 50	50
34				Batu Pasir warna abu–abu	34.00			
					34.45	⊠	N. 48	48
36					36.00			
					36.45	⊠	N. >50	>50
38					38.00			
					38.45	⊠	N. >50	>50
					39.55			
40	40.00				40.00	⊠	N. >50	>50
				End of Drilling				
42								
44								
46								
48								
50								
52								
54								
56								
58								
60								

INSITU TEST: STANDARD PENETRATION TEST; RQD (%); W (%), W_L, W_P

REMARKS:

MODIFICATION
0 to 10 % TRACE
10 to 20 % SOME
20 to 35 % ADJECTIVE (CLAYEY/SILTY)
35 to 50 % AND

SAMPLES
U.D. SAMPLE
SPT SAMPLE

SHEET 2 OF 2

UNIVERSITAS MERCU BUANA

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BORING LOG

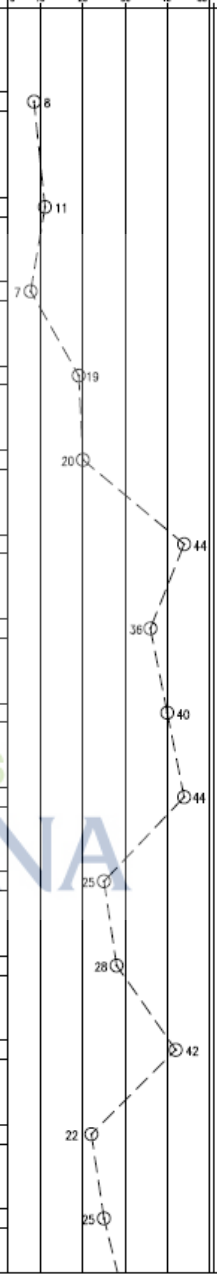
HOLE No. : BH. 2

PROJECT	: DANAMON NEW HEADQUARTER BUILDING	TOTAL DEPTH	: 60.00 m	DRILLING METHOD	: ROTARY DRILLING
LOCATION	: KUNINGAN – JAKARTA	COORDINATES N. –	E. –	ø OF CORE	: 60 mm
STARTED	: 11–01–2012	GROUND ELEVATION	: – m	ø OF CASING	: 89 mm
FINISHED	: 11–07–2012	GROUND WATER LEVEL	: + 8.40 m	LOGGED BY	: Syahrir

SCALE IN (m)	DEPTH (m)	ELEVATION (m)	SYMBOL	SOIL / ROCK DESCRIPTION
0				
2	2.00			Fill material, represent of mixed Sand, Silt and gravel of masonry (max ø 10cm angular) brown
	3.30			Sandy gravel with some Silt, brown, (max ø4cm, angular) poorly graded, loose
4				Medium to coarse grain Sand with some subrounded gravel (max ø2cm) brown, poorly graded, loose to medium dense
6	5.80			Clayey Silt, with some fine grain Sand, brown, firm
8	7.80			Silt trace Clay, light brown friable, very stiff
12	11.70			Silty Sand, medium to coarse grain, poorly graded, dense, greyish brown. at some place weakly cemented, brittle
20	20.15			Silt with some Clay trace Sand, non plastic, friable, brown, very stiff. at some place intercalated by thin sand layer
24	23.00			Silt, brownish grey to black, friable to brittle, very stiff to hard soil
28	27.40			Clay, grey and brownish grey, very stiff to hard, friable
30	30.00			

SAMPLING DEPTH (m)	SYMBOL	N VALUE (BLOWS PER 30 cm)
1.50		
2.00		
2.45	SPT	N. 8
4.00		
4.50		
4.95	SPT	N. 11
6.00		
6.50		
6.95	SPT	N. 7
8.50		
8.95	SPT	N. 19
10.00		
10.50		
10.95	SPT	N. 20
12.50		
12.95	SPT	N. 44
14.50		
14.95	SPT	N. 36
16.50		
16.95	SPT	N. 40
18.50		
18.95	SPT	N. 44
20.50		
20.95	SPT	N. 25
22.50		
22.95	SPT	N. 28
24.50		
24.95	SPT	N. 42
26.50		
26.95	SPT	N. 22
28.50		
28.95	SPT	N. 25

INSITU TEST — STANDARD PENETRATION TEST — N – VALUE (0, 10, 20, 30, 40, 50)



RQD (%) (0, 50, 100)

W (%) (50, 100)

REMARKS:

MODIFICATION
0 to 10 % TRACE
10 to 20 % SOME
20 to 35 % ADJECTIVE (CLAYEY/SILTY)
35 to 50 % AND

SAMPLES
U.D. SAMPLE
SPT SAMPLE

SHEET 1 OF 2

UNIVERSITAS MERCU BUANA

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BORING LOG

HOLE No. : BH. 2

PROJECT	: DANAMON NEW HEADQUARTER BUILDING	TOTAL DEPTH	: 60.00 m	DRILLING METHOD	: ROTARY DRILLING
LOCATION	: KUNINGAN – JAKARTA	COORDINATES N. –	E. –	ø OF CORE	: 60 mm
STARTED	: 11–01–2012	GROUND ELEVATION	: – m	ø OF CASING	: 89 mm
FINISHED	: 11–07–2012	GROUND WATER LEVEL	: + 8.40 m	LOGGED BY	: Syahrir

SCALE IN (m)	DEPTH (m)	ELEVATION (m)	SYMBOL	SOIL / ROCK DESCRIPTION	SAMPLING DEPTH (m)	SAMPLING SYMBOL	INSITU TEST: N VALUE (BLOWS PER 30 cm)	N-VALUE
30								
32	32.40			As above. CLAY, grey and brownish grey, very stiff to hard, friable	30.50 30.95 32.50		N. 30 N. >50	50 >50
34 36 38 40	41.15			Alternation of Siltstone and medium grain Sandstone, weakly cemented, brittle, grey, soft rock	32.55 34.50 34.60 36.50 36.55 38.50 38.58 40.50 40.60		N. >50 N. >50 N. >50 N. >50 N. >50	>50 >50 >50 >50 >50
42	43.00			Coarse grain Sand, weakly cemented, poorly graded, dark grey, soft rock	42.50 42.62		N. >50	>50
44	45.70			Fine grain Sand with some Silt, black, poorly graded, very dense	44.50 44.90		N. >50	>50
46 48	48.40			Gravelly Sand, coarse grain, poorly graded (gravel max ø 4cm sub rounded), brownish grey, very dense	46.50 46.70 48.50		N. >50	>50
50 52 54	55.30			Clay with some Silt, grey and brownish grey, friable, very stiff to hard soil. – at 52.10–52.50 m : intercalated with brown fine grain Sandy Silt	48.95 51.50 51.95 53.50 53.95		N. 28 N. 39 N. 37	28 39 37
56 58 60	60.00			Clayey Silt, light brown and brown spotted white, friable very stiff to hard soil – at 57.10–57.60 m : intercalated with silty Clay, brownish grey	55.50 55.90 57.50 57.95 59.50 59.95		N. 33 N. 29 N. 35	33 29 35

End of Drilling

REMARKS:

MODIFICATION
0 to 10 % TRACE
10 to 20 % SOME
20 to 35 % ADJECTIVE (CLAYEY/SILTY)
35 to 50 % AND

SAMPLES
U.D. SAMPLE
SPT SAMPLE

SHEET 2 OF 2

UNIVERSITAS MERCU BUANA

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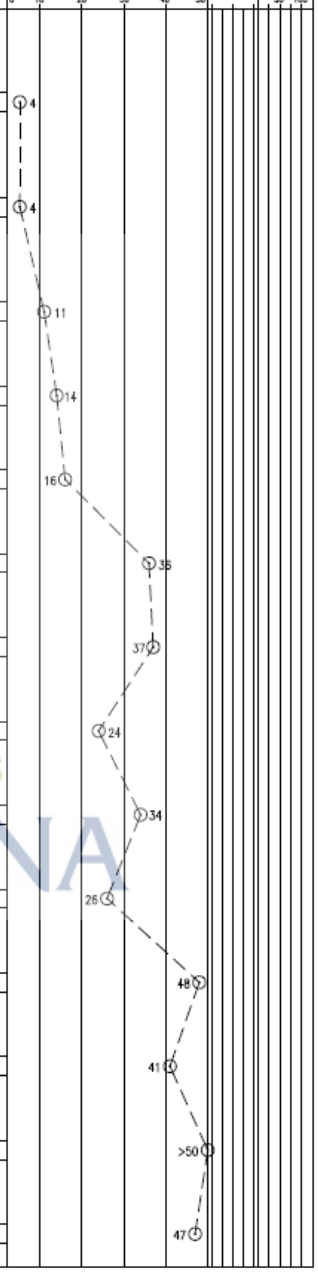
BORING LOG

HOLE No. : BH.3

PROJECT	: DANAMON NEW HEADQUARTER BUILDING	TOTAL DEPTH	: 40.00 m	DRILLING METHOD	: ROTARY DRILLING
LOCATION	: KUNINGAN – JAKARTA	COORDINATES N. –	E. –	ø OF CORE	: 60 mm
STARTED	: 11–09–2012	GROUND ELEVATION	: – m	ø OF CASING	: 89 mm
FINISHED	: 11–12–2012	GROUND WATER LEVEL	: + 8.00 m	LOGGED BY	: Syahrir

SCALE IN (m)	DEPTH (m)	ELEVATION (m)	SYMBOL	SOIL / ROCK DESCRIPTION	SAMPLING DEPTH (m)	SAMPLING SYMBOL	INSITU TEST: N VALUE (BLOWS PER 30 cm)
				Fill material, represent of Silt, Clay, and gravel of masonry mixtures, (max ø5cm, angular) brown, soft	1.50 2.00 2.45		N. 4
	2.75			Clayey Silt, trace fine grain Sand, yellowish brown, soft	4.00 4.50 4.95		N. 4
	5.20			Silt some Clay, light brown, friable, stiff	6.50 7.00 7.45		N. 11
	8.50			Silt trace Clay, light brown, friable, stiff	9.00 9.45		N. 14
	11.60			Silty Sand, medium to coarse grain, poorly graded, greyish brown, friable, medium dense to dense. at some place, weakly cemented, brittle	11.00 11.45		N. 16
					13.00 13.45		N. 36
					15.00 15.45		N. 37
					17.00 17.45		N. 24
					19.00 19.45		N. 34
					21.00 21.45		N. 26
					23.00 23.45		N. 48
	24.10			Fine grain Sand with some Silt, brown, dense	25.00 25.45		N. 41
	25.00			Weakly cemented medium to coarse grain silty Sand, brown very dense/ soft rock	27.00 27.45		N. >50
	28.25			Medium to coarse grain Sand with some sub rounded gravel of neous rock (max ø4cm), dark grey to black, dense to very dense	29.00 29.45		N. 47
	29.75						



REMARKS:

MODIFICATION
0 to 10 % TRACE
10 to 20 % SOME
20 to 35 % ADJECTIVE (CLAYEY/SILTY)
35 to 50 % AND

SAMPLES
U.D. SAMPLE
SPT SAMPLE

SHEET 1 OF 2

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BORING LOG

HOLE No. : BH.3

PROJECT	: DANAMON NEW HEADQUARTER BUILDING	TOTAL DEPTH	: 40.00 m	DRILLING METHOD	: ROTARY DRILLING
LOCATION	: KUNINGAN – JAKARTA	COORDINATES N. –	E. –	ø OF CORE	: 60 mm
STARTED	: 11–09–2012	GROUND ELEVATION	: – m	ø OF CASING	: 89 mm
FINISHED	: 11–12–2012	GROUND WATER LEVEL	: + 8.00 m	LOGGED BY	: Syahrir

SCALE IN (m)	DEPTH (m)	ELEVATION (m)	SYMBOL	SOIL / ROCK DESCRIPTION	SAMPLING DEPTH (m)	SAMPLING SYMBOL	N VALUE (BLOWS PER 30 cm)	STANDARD PENETRATION TEST N – VALUE	RQD (%)
30									
	31.30			29.75–31.30m medium to coarse grain Sand, dark grey, poorly graded, dense to very dense	31.00				
32					31.40		N. >50	50	
					33.00		N. >50	48	
34				Alternation of Siltstone and medium to coarse grain Sandstone weakly cemented, brittle, grey, soft rock	33.05				
					35.00		N. >50	>50	
36					35.10				
					37.00		N. >50	>50	
38					37.12				
					39.00		N. >50	>50	
40	40.00			End of Drilling	39.05				
42									
44									
46									
48									
50									
52									
54									
56									
58									
60									

REMARKS:

MODIFICATION 0 to 10 % TRACE
10 to 20 % SOME
20 to 35 % ADJECTIVE (CLAYEY/SILTY)
35 to 50 % AND

SAMPLES U.D. SAMPLE
SPT SAMPLE

SHEET 2 OF 2

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LAMPIRAN – 2

Hasil Pengujian Sondir

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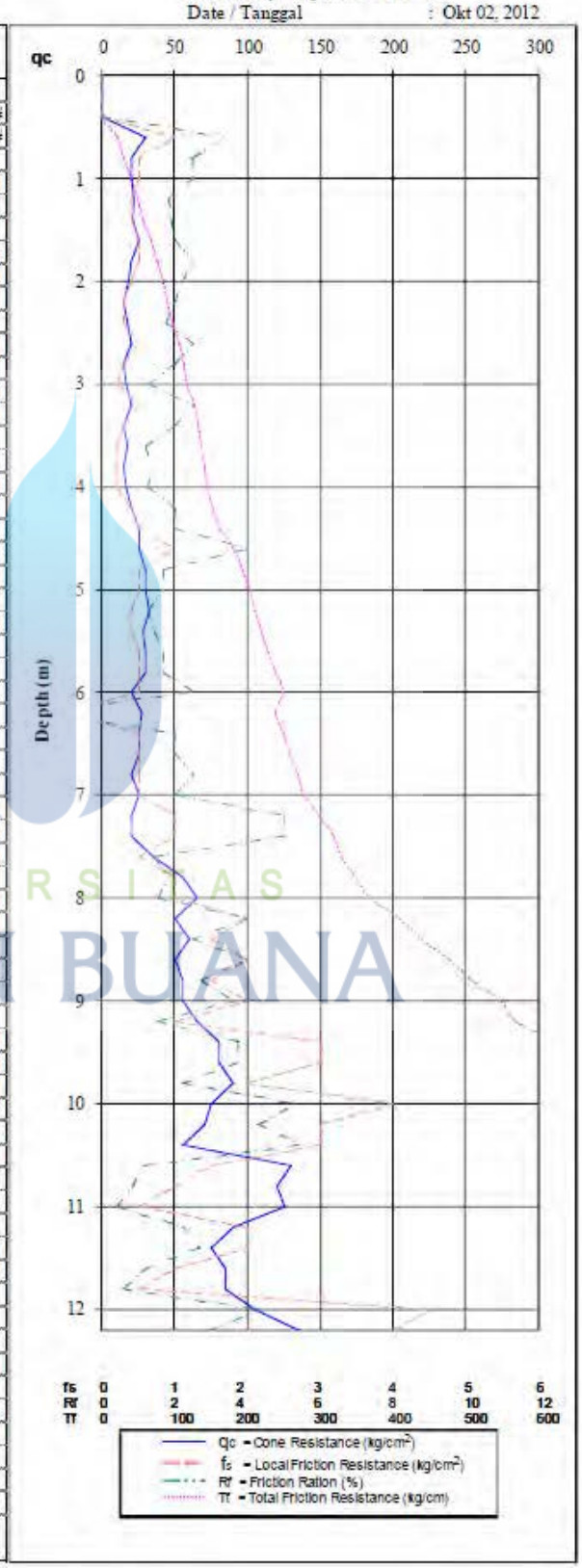
DATA & DIAGRAM
OF DUCTH CONE PENETRATION TEST

Project : BANK DANAMON, KUNINGAN-JAKARTA
Elevation/Elevasi : - m
Coordinate/Koordinat : X= -
Y= -

Point Number / Titik No. : DCPT-S.01
Operator / Juru Sondir : Aip Mulyono
Checked by / Diperiksa Oleh : -
Date / Tanggal : Okt 02, 2012

Depth m	C_w kg/cm²	T_w kg/cm²	K_w kg/cm²	q_c kg/cm²	f_s kg/cm²	T_f kg/cm	R_f %
0.00	0	0	0	0	0	0	0
0.20	0	0	0	0	0.000	0.00	#####
0.40	0	0	0	0	0.000	0.00	#####
0.60	30	40	10	30	1.000	20.00	3.33
0.80	20	25	5	20	0.500	30.00	2.50
1.00	20	25	5	20	0.500	40.00	2.50
1.20	22	26	4	22	0.400	48.00	1.82
1.40	21	25	4	21	0.400	56.00	1.90
1.60	25	30	5	25	0.500	66.00	2.00
1.80	20	25	5	20	0.500	76.00	2.50
2.00	18	22	4	18	0.400	84.00	2.22
2.20	15	18	3	15	0.300	90.00	2.00
2.40	17	20	3	17	0.300	96.00	1.76
2.60	20	25	5	20	0.500	106.00	2.50
2.80	15	18	3	15	0.300	112.00	2.00
3.00	16	18	2	16	0.200	116.00	1.25
3.20	20	25	5	20	0.500	126.00	2.50
3.40	15	18	3	15	0.300	132.00	2.00
3.60	17	19	2	17	0.200	136.00	1.18
3.80	15	17	2	15	0.200	140.00	1.33
4.00	16	18	2	16	0.200	144.00	1.25
4.20	20	24	4	20	0.400	152.00	2.00
4.40	25	30	5	25	0.500	162.00	2.00
4.60	25	35	10	25	1.000	182.00	4.00
4.80	30	35	5	30	0.500	192.00	1.67
5.00	30	35	5	30	0.500	202.00	1.67
5.20	32	36	4	32	0.400	210.00	1.25
5.40	28	32	4	28	0.400	218.00	1.43
5.60	30	35	5	30	0.500	228.00	1.67
5.80	30	35	5	30	0.500	238.00	1.67
6.00	20	25	5	20	0.500	248.00	2.50
6.20	27	22	-5	27	-0.500	238.00	-1.85
6.40	25	30	5	25	0.500	248.00	2.00
6.60	25	30	5	25	0.500	258.00	2.00
6.80	20	25	5	20	0.500	268.00	2.50
7.00	25	30	5	25	0.500	278.00	2.00
7.20	20	30	10	20	1.000	298.00	5.00
7.40	20	30	10	20	1.000	318.00	5.00
7.60	35	40	5	35	0.500	328.00	1.43
7.80	55	65	10	55	1.000	348.00	1.82
8.00	65	75	10	65	1.000	368.00	1.54
8.20	50	70	20	50	2.000	408.00	4.00
8.40	60	75	15	60	1.500	438.00	2.50
8.60	50	70	20	50	2.000	478.00	4.00
8.80	55	70	15	55	1.500	508.00	2.73
9.00	55	75	20	55	2.000	548.00	3.64
9.20	65	75	10	65	1.000	568.00	1.54
9.40	80	110	30	80	3.000	628.00	3.75
9.60	80	110	30	80	3.000	688.00	3.75
9.80	90	110	20	90	2.000	728.00	2.22
10.00	75	115	40	75	4.000	808.00	5.33
10.20	70	100	30	70	3.000	868.00	4.29
10.40	55	85	30	55	3.000	928.00	5.45
10.60	130	145	15	130	1.500	958.00	1.15
10.80	120	130	10	120	1.000	978.00	0.83
11.00	125	130	5	125	0.500	988.00	0.40
11.20	90	110	20	90	2.000	1028.00	2.22
11.40	75	95	20	75	2.000	1068.00	2.67
11.60	85	95	10	85	1.000	1088.00	1.18
11.80	85	90	5	85	0.500	1098.00	0.59
12.00	105	150	45	105	4.500	1188.00	4.29
12.20	135	175	40	135	4.000	1268.00	2.96



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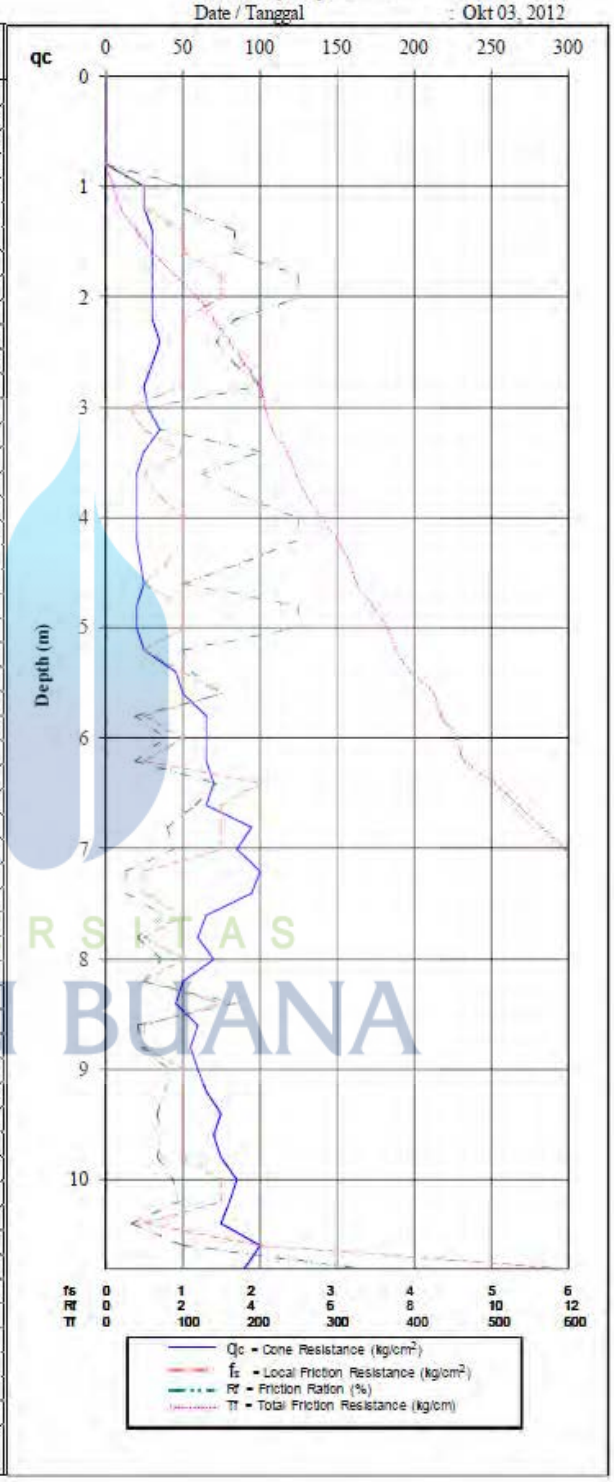
DATA & DIAGRAM
OF DUCTH CONE PENETRATION TEST

Project : BANK DANAMON, KUNINGAN-JAKARTA
Elevation/Elevasi : - m
Coordinate/Koordinat : X= -
Y= -

Point Number / Titik No. : DCPT-S.02
Operator / Juru Sondir : Aip Mulyono
Checked by / Diperiksa Oleh : -
Date / Tanggal : Okt 03, 2012

Depth m	C_w kg/cm^2	T_w kg/cm^2	K_w kg/cm^2	q_c kg/cm^2	f_s kg/cm^2	T_f kg/cm	R_f %
0.00	0	0	0	0	0	0	0
0.20	0	0	0	0	0.000	0.00	#####
0.40	0	0	0	0	0.000	0.00	#####
0.60	0	0	0	0	0.000	0.00	#####
0.80	0	0	0	0	0.000	0.00	#####
1.00	25	30	5	25	0.500	10.00	2.00
1.20	25	30	5	25	0.500	20.00	2.00
1.40	30	40	10	30	1.000	40.00	3.33
1.60	30	40	10	30	1.000	60.00	3.33
1.80	30	45	15	30	1.500	90.00	5.00
2.00	30	45	15	30	1.500	120.00	5.00
2.20	30	40	10	30	1.000	140.00	3.33
2.40	35	45	10	35	1.000	160.00	2.86
2.60	30	40	10	30	1.000	180.00	3.33
2.80	25	35	10	25	1.000	200.00	4.00
3.00	27	30	3	27	0.300	206.00	1.11
3.20	35	40	5	35	0.500	216.00	1.43
3.40	25	35	10	25	1.000	236.00	4.00
3.60	20	25	5	20	0.500	246.00	2.50
3.80	20	27	7	20	0.700	260.00	3.50
4.00	20	30	10	20	1.000	280.00	5.00
4.20	20	30	10	20	1.000	300.00	5.00
4.40	22	30	8	22	0.800	316.00	3.64
4.60	25	30	5	25	0.500	326.00	2.00
4.80	20	30	10	20	1.000	346.00	5.00
5.00	20	30	10	20	1.000	366.00	5.00
5.20	25	30	5	25	0.500	376.00	2.00
5.40	45	55	10	45	1.000	396.00	2.22
5.60	50	65	15	50	1.500	426.00	3.00
5.80	65	70	5	65	0.500	436.00	0.77
6.00	65	75	10	65	1.000	456.00	1.54
6.20	65	70	5	65	0.500	466.00	0.77
6.40	70	90	20	70	2.000	506.00	2.86
6.60	65	80	15	65	1.500	536.00	2.31
6.80	95	110	15	95	1.500	566.00	1.58
7.00	85	100	15	85	1.500	596.00	1.76
7.20	100	105	5	100	0.500	606.00	0.50
7.40	95	100	5	95	0.500	616.00	0.53
7.60	65	75	10	65	1.000	636.00	1.54
7.80	60	65	5	60	0.500	646.00	0.83
8.00	70	80	10	70	1.000	666.00	1.43
8.20	50	55	5	50	0.500	676.00	1.00
8.40	45	60	15	45	1.500	706.00	3.33
8.60	60	65	5	60	0.500	716.00	0.83
8.80	55	60	5	55	0.500	726.00	0.91
9.00	60	70	10	60	1.000	746.00	1.67
9.20	65	75	10	65	1.000	766.00	1.54
9.40	75	85	10	75	1.000	786.00	1.33
9.60	70	80	10	70	1.000	806.00	1.43
9.80	75	85	10	75	1.000	826.00	1.33
10.00	85	100	15	85	1.500	856.00	1.76
10.20	80	95	15	80	1.500	886.00	1.88
10.40	75	80	5	75	0.500	896.00	0.67
10.60	100	120	20	100	2.000	936.00	2.00
10.80	90	150	60	90	6.000	1056.00	6.67



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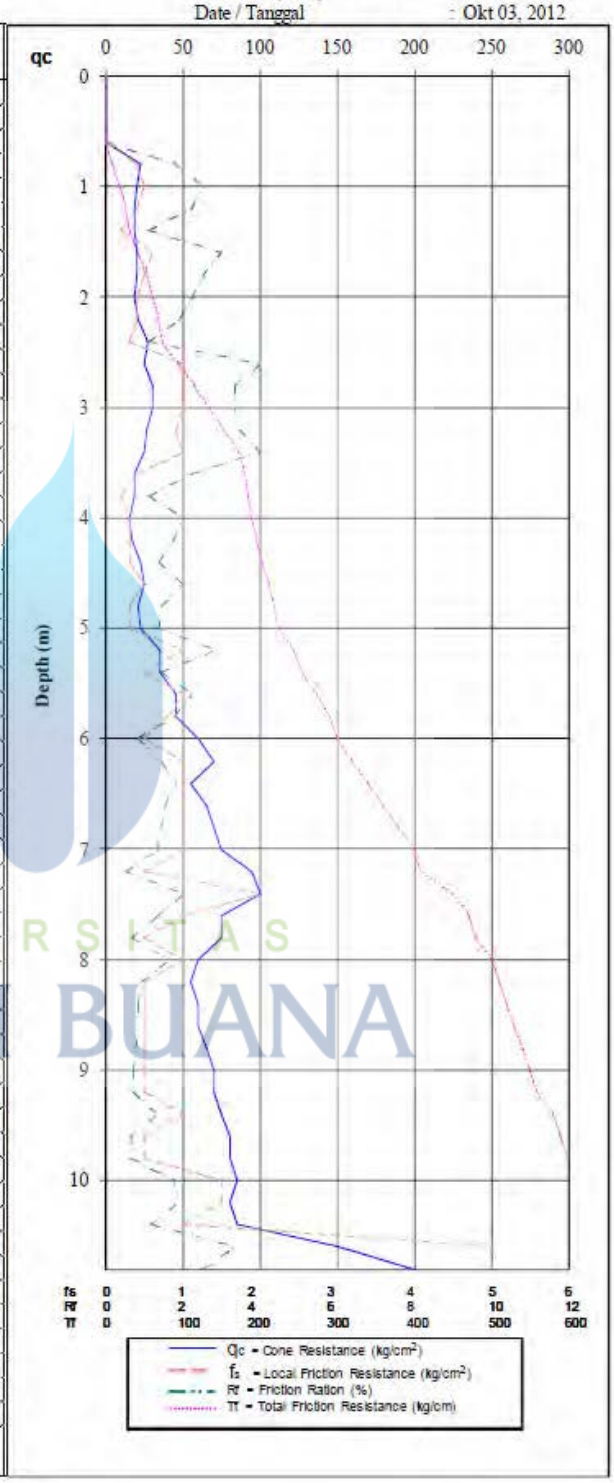
DATA & DIAGRAM
OF DUCTH CONE PENETRATION TEST

Project : BANK DANAMON, KUNINGAN-JAKARTA
Elevation/Elevasi : - m
Coordinate/Koordinat : X= -
Y= -

Point Number / Titik No. : DCPT-S.03
Operator / Juru Sondir : Aip Mulyono
Checked by / Diperiksa Oleh : -
Date / Tanggal : Okt 03, 2012

Depth m	C_w kg/cm²	T_w kg/cm²	K_w kg/cm²	q_c kg/cm²	f_s kg/cm²	T_f kg/cm	R_f %
0.00	0	0	0	0	0	0	0
0.20	0	0	0	0	0.000	0.00	#####
0.40	0	0	0	0	0.000	0.00	#####
0.60	0	0	0	0	0.000	0.00	#####
0.80	22	26	4	22	0.400	8.00	1.82
1.00	20	25	5	20	0.500	18.00	2.50
1.20	18	22	4	18	0.400	26.00	2.22
1.40	18	20	2	18	0.200	30.00	1.11
1.60	20	26	6	20	0.600	42.00	3.00
1.80	20	25	5	20	0.500	52.00	2.50
2.00	18	22	4	18	0.400	60.00	2.22
2.20	21	25	4	21	0.400	68.00	1.90
2.40	27	30	3	27	0.300	74.00	1.11
2.60	25	35	10	25	1.000	94.00	4.00
2.80	30	40	10	30	1.000	114.00	3.33
3.00	30	40	10	30	1.000	134.00	3.33
3.20	26	35	9	26	0.900	152.00	3.46
3.40	25	35	10	25	1.000	172.00	4.00
3.60	18	22	4	18	0.400	180.00	2.22
3.80	18	20	2	18	0.200	184.00	1.11
4.00	15	18	3	15	0.300	190.00	2.00
4.20	17	20	3	17	0.300	196.00	1.76
4.40	22	25	3	22	0.300	202.00	1.36
4.60	25	30	5	25	0.500	212.00	2.00
4.80	21	24	3	21	0.300	218.00	1.43
5.00	22	25	3	22	0.300	224.00	1.36
5.20	35	45	10	35	1.000	244.00	2.86
5.40	35	40	5	35	0.500	254.00	1.43
5.60	45	55	10	45	1.000	274.00	2.22
5.80	45	53	8	45	0.800	290.00	1.78
6.00	60	65	5	60	0.500	300.00	0.83
6.20	70	80	10	70	1.000	320.00	1.43
6.40	55	65	10	55	1.000	340.00	1.82
6.60	65	75	10	65	1.000	360.00	1.54
6.80	70	80	10	70	1.000	380.00	1.43
7.00	75	85	10	75	1.000	400.00	1.33
7.20	95	100	5	95	0.500	410.00	0.53
7.40	100	120	20	100	2.000	450.00	2.00
7.60	75	85	10	75	1.000	470.00	1.33
7.80	75	80	5	75	0.500	480.00	0.67
8.00	60	70	10	60	1.000	500.00	1.67
8.20	55	60	5	55	0.500	510.00	0.91
8.40	60	65	5	60	0.500	520.00	0.83
8.60	60	65	5	60	0.500	530.00	0.83
8.80	65	70	5	65	0.500	540.00	0.77
9.00	70	75	5	70	0.500	550.00	0.71
9.20	70	75	5	70	0.500	560.00	0.71
9.40	75	85	10	75	1.000	580.00	1.33
9.60	80	85	5	80	0.500	590.00	0.63
9.80	80	85	5	80	0.500	600.00	0.63
10.00	85	100	15	85	1.500	630.00	1.76
10.20	80	95	15	80	1.500	660.00	1.88
10.40	85	95	10	85	1.000	680.00	1.18
10.60	150	200	50	150	5.000	780.00	3.33
10.80	200	250	50	200	5.000	880.00	2.50



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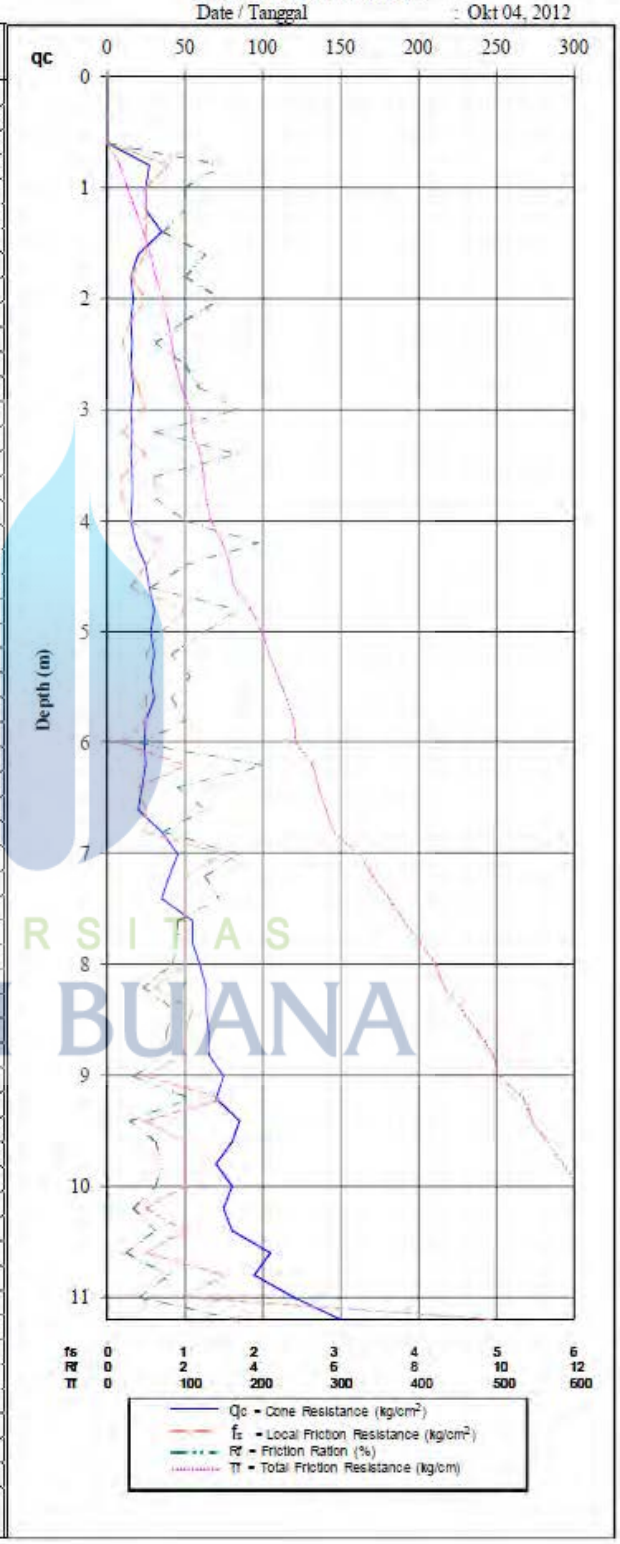
DATA & DIAGRAM
OF DUCTH CONE PENETRATION TEST

Project : BANK DANAMON, KUNINGAN-JAKARTA
Elevation/Elevasi : - m
Coordinate/Koordinat : X= -
Y= -

Point Number / Titik No. : DCPT-S.04
Operator / Juru Sondir : Aip Mulyono
Checked by / Diperiksa Oleh : -
Date / Tanggal : Okt 04, 2012

Depth m	C_w kg/cm²	T_w kg/cm²	K_w kg/cm²	q_c kg/cm²	f_s kg/cm²	T_f kg/cm	R_f %
0.00	0	0	0	0	0	0	0
0.20	0	0	0	0	0.000	0.00	#####
0.40	0	0	0	0	0.000	0.00	#####
0.60	0	0	0	0	0.000	0.00	#####
0.80	27	35	8	27	0.800	16.00	2.96
1.00	25	30	5	25	0.500	26.00	2.00
1.20	25	30	5	25	0.500	36.00	2.00
1.40	35	40	5	35	0.500	46.00	1.43
1.60	20	25	5	20	0.500	56.00	2.50
1.80	15	18	3	15	0.300	62.00	2.00
2.00	17	22	5	17	0.500	72.00	2.94
2.20	15	18	3	15	0.300	78.00	2.00
2.40	16	18	2	16	0.200	82.00	1.25
2.60	15	18	3	15	0.300	88.00	2.00
2.80	17	21	4	17	0.400	96.00	2.35
3.00	15	20	5	15	0.500	106.00	3.33
3.20	16	18	2	16	0.200	110.00	1.25
3.40	15	20	5	15	0.500	120.00	3.33
3.60	16	18	2	16	0.200	124.00	1.25
3.80	16	18	2	16	0.200	128.00	1.25
4.00	15	18	3	15	0.300	134.00	2.00
4.20	18	25	7	18	0.700	148.00	3.89
4.40	25	30	5	25	0.500	158.00	2.00
4.60	27	30	3	27	0.300	164.00	1.11
4.80	30	40	10	30	1.000	184.00	3.33
5.00	28	35	7	28	0.700	198.00	2.50
5.20	30	35	5	30	0.500	208.00	1.67
5.40	28	34	6	28	0.600	220.00	2.14
5.60	30	35	5	30	0.500	230.00	1.67
5.80	25	30	5	25	0.500	240.00	2.00
6.00	24	26	2	24	0.200	244.00	0.83
6.20	25	35	10	25	1.000	264.00	4.00
6.40	22	26	4	22	0.400	272.00	1.82
6.60	20	25	5	20	0.500	282.00	2.50
6.80	35	40	5	35	0.500	292.00	1.43
7.00	45	60	15	45	1.500	322.00	3.33
7.20	40	50	10	40	1.000	342.00	2.50
7.40	35	45	10	35	1.000	362.00	2.86
7.60	55	65	10	55	1.000	382.00	1.82
7.80	55	65	10	55	1.000	402.00	1.82
8.00	60	70	10	60	1.000	422.00	1.67
8.20	64	70	6	64	0.600	434.00	0.94
8.40	64	75	11	64	1.100	456.00	1.72
8.60	65	75	10	65	1.000	476.00	1.54
8.80	65	75	10	65	1.000	496.00	1.54
9.00	75	80	5	75	0.500	506.00	0.67
9.20	70	85	15	70	1.500	536.00	2.14
9.40	85	90	5	85	0.500	546.00	0.59
9.60	80	90	10	80	1.000	566.00	1.25
9.80	70	80	10	70	1.000	586.00	1.43
10.00	80	90	10	80	1.000	606.00	1.25
10.20	75	80	5	75	0.500	616.00	0.67
10.40	80	90	10	80	1.000	636.00	1.25
10.60	105	110	5	105	0.500	646.00	0.48
10.80	95	110	15	95	1.500	676.00	1.58
11.00	120	130	10	120	1.000	696.00	0.83
11.20	150	200	50	150	5.000	796.00	3.33



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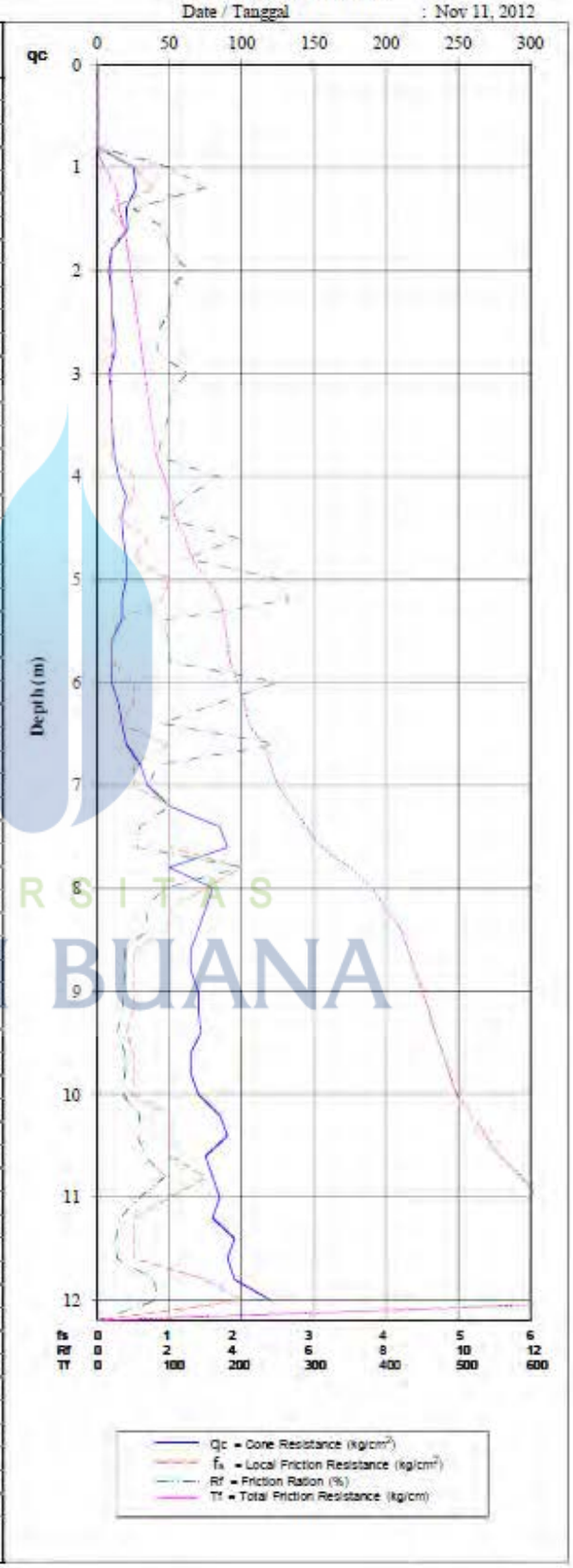
DATA & DIAGRAM
OF DUCTH CONE PENETRATION TEST

Project : BANK DANAMON, KUNINGAN-JAKARTA
Elevation/Elevasi : - m
Coordinate/Koordinat : X= -
Y= -

Point Number / Titik No. : DCPT-S.05
Operator / Juru Sondir : Aip Mulyono
Checked by / Diperiksa Oleh : -
Date / Tanggal : Nov 11, 2012

Depth m	C_w kg/cm²	T_w kg/cm²	K_w kg/cm²	q_c kg/cm²	f_s kg/cm²	T_f kg/cm	R_f %
0.00	0	0	0	0	0	0	0
0.20	0	0	0	0	0.000	0.00	#####
0.40	0	0	0	0	0.000	0.00	#####
0.60	0	0	0	0	0.000	0.00	#####
0.80	0	0	0	0	0.000	0.00	#####
1.00	25	30	5	25	0.500	10.00	2.00
1.20	27	35	8	27	0.800	26.00	2.96
1.40	20	22	2	20	0.200	30.00	1.00
1.60	21	25	4	21	0.400	38.00	1.90
1.80	10	12	2	10	0.200	42.00	2.00
2.00	8	10	2	8	0.200	46.00	2.50
2.20	10	12	2	10	0.200	50.00	2.00
2.40	10	12	2	10	0.200	54.00	2.00
2.60	12	14	2	12	0.200	58.00	1.67
2.80	12	14	2	12	0.200	62.00	1.67
3.00	8	10	2	8	0.200	66.00	2.50
3.20	10	12	2	10	0.200	70.00	2.00
3.40	10	12	2	10	0.200	74.00	2.00
3.60	11	13	2	11	0.200	78.00	1.82
3.80	12	14	2	12	0.200	82.00	1.67
4.00	15	20	5	15	0.500	92.00	3.33
4.20	20	25	5	20	0.500	102.00	2.50
4.40	17	20	3	17	0.300	108.00	1.76
4.60	18	25	7	18	0.700	122.00	3.89
4.80	20	25	5	20	0.500	132.00	2.50
5.00	20	30	10	20	1.000	152.00	5.00
5.20	17	26	9	17	0.900	170.00	5.29
5.40	17	20	3	17	0.300	176.00	1.76
5.60	10	12	2	10	0.200	180.00	2.00
5.80	10	12	2	10	0.200	184.00	2.00
6.00	10	15	5	10	0.500	194.00	5.00
6.20	15	20	5	15	0.500	204.00	3.33
6.40	17	20	3	17	0.300	210.00	1.76
6.60	20	30	10	20	1.000	230.00	5.00
6.80	30	35	5	30	0.500	240.00	1.67
7.00	35	40	5	35	0.500	250.00	1.43
7.20	50	60	10	50	1.000	270.00	2.00
7.40	85	95	10	85	1.000	290.00	1.18
7.60	90	100	10	90	1.000	310.00	1.11
7.80	50	70	20	50	2.000	350.00	4.00
8.00	80	95	15	80	1.500	380.00	1.88
8.20	75	85	10	75	1.000	400.00	1.33
8.40	70	80	10	70	1.000	420.00	1.43
8.60	65	70	5	65	0.500	430.00	0.77
8.80	65	70	5	65	0.500	440.00	0.77
9.00	70	75	5	70	0.500	450.00	0.71
9.20	70	75	5	70	0.500	460.00	0.71
9.40	72	76	4	72	0.400	468.00	0.56
9.60	65	70	5	65	0.500	478.00	0.77
9.80	65	70	5	65	0.500	488.00	0.77
10.00	70	75	5	70	0.500	498.00	0.71
10.20	85	95	10	85	1.000	518.00	1.18
10.40	90	100	10	90	1.000	538.00	1.11
10.60	75	85	10	75	1.000	558.00	1.33
10.80	80	95	15	80	1.500	588.00	1.88
11.00	85	95	10	85	1.000	608.00	1.18
11.20	80	85	5	80	0.500	618.00	0.63
11.40	95	100	5	95	0.500	628.00	0.53
11.60	90	95	5	90	0.500	638.00	0.56
11.80	95	110	15	95	1.500	668.00	1.58
12.00	120	140	20	120	2.000	708.00	1.67
12.20	220						



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LAMPIRAN – 3

Hasil Pengujian Laboratorium

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WATER CONTENT & BULK DENSITY DETERMINATION

PROJECT : **BANK DANAMON**

LOCATION : **KUNINGAN - JAKARTA SELATAN**

BORING No. : **BH. 1** **TESTED BY** : **Ddy**

Date of test	Sample No. and depth.	Can	Wt. Of wet soil + Can	Wt. Of dry soil + Can	Wt. Of Can	Water Cont. W_N	Average water content	γ wet	Average
	meter		gr.	gr.	gr.	%	%	gr/cm^3.	
17 OKT. 2012	**UDS. 1**	93	81.90	61.67	10.10	39.228	39.196		
	1.00 ~ 1.50	10	81.54	61.61	10.72	39.163			
	UDS. 2	47	74.48	56.26	10.17	39.531	39.589		
	3.00 ~ 3.50	76	62.11	47.33	10.05	39.646			
	DENSITY	55	48.75	37.00	7.20	39.430	39.456	1.7411	1.7417
		50	49.15	37.38	7.57	39.483		1.7424	
	UDS. 3	71	72.92	54.98	10.08	39.955	39.883		
	7.00 ~ 7.50	38	76.81	57.55	9.17	39.810			
	DENSITY	48	48.15	36.55	7.20	39.523	39.578	1.7160	1.7172
		36	48.58	36.94	7.57	39.632		1.7185	

Note *: volume of ring 1* 86.1924 cm^3.

: volume of ring 2 23.864 cm^3.

** Density Test.*

		No.
		FIG.

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WATER CONTENT & BULK DENSITY DETERMINATION

PROJECT : **BANK DANAMON**

LOCATION : **KUNINGAN - JAKARTA SELATAN**

BORING No. : **BH.2 & BH. 3** **TESTED BY** : **Ddy**

Date of test	Sample No. and depth.	Can	Wt. Of wet soil + Can	Wt. Of dry soil + Can	Wt. Of Can	Water Cont. W_N	Average water content	γ wet	Average
	meter		gr.	gr.	gr.	%	%	gr/cm³.	
22 NOP. 2012	**BH. 2 - UDS. 1**	2	49.67	35.67	10.05	54.645	54.378		
	10.00 ~ 10.50	3	37.35	27.74	9.98	54.110			
	UDS. 2	4	56.52	44.95	10.26	33.353	33.429		
	26.00 ~ 26.50	5	46.35	37.26	10.13	33.505			
	DENSITY	6	52.35	41.65	9.95	33.754	33.407	1.7767	1.7738
		7	52.15	41.65	9.89	33.060		1.7709	
	UDS. 3	8	59.39	44.53	10.07	43.122	42.867		
	30.00 ~ 30.50	9	58.60	44.21	10.44	42.612			
	DENSITY	10	49.55	37.50	9.79	43.486	43.568	1.6661	1.6674
		11	49.65	37.55	9.83	43.651		1.6686	
	UDS. 4	12	73.85	57.87	10.16	33.494	33.624		
	55.00 ~ 30.50	13	71.58	56.05	10.04	33.754			
	DENSITY	14	49.20	38.55	6.98	33.735	33.744	1.7692	1.7730
		15	52.50	41.80	10.10	33.754		1.7767	
	BH. 3 - UDS. 1	16	49.55	38.75	10.08	37.670	37.639		
	1.50 ~ 2.00	17	59.42	45.96	10.17	37.608			
	UDS. 2	18	51.75	39.27	10.30	43.079	43.045		
	4.00 ~ 4.50	19	57.98	43.61	10.20	43.011			
	UDS. 3	20	40.02	28.27	9.93	64.068	64.253		
	6.50 ~ 7.00	21	43.84	30.54	9.90	64.438			

Note *: volume of ring 1* 86.1924 cm³.

: volume of ring 2 23.864 cm³.

** Density Test.*

		No.
		FIG.

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LIQUID AND PLASTIC LIMITS TEST

PROJECT : BANK DANAMON

LOCATION : KUNINGAN - JAKARTA SELATAN

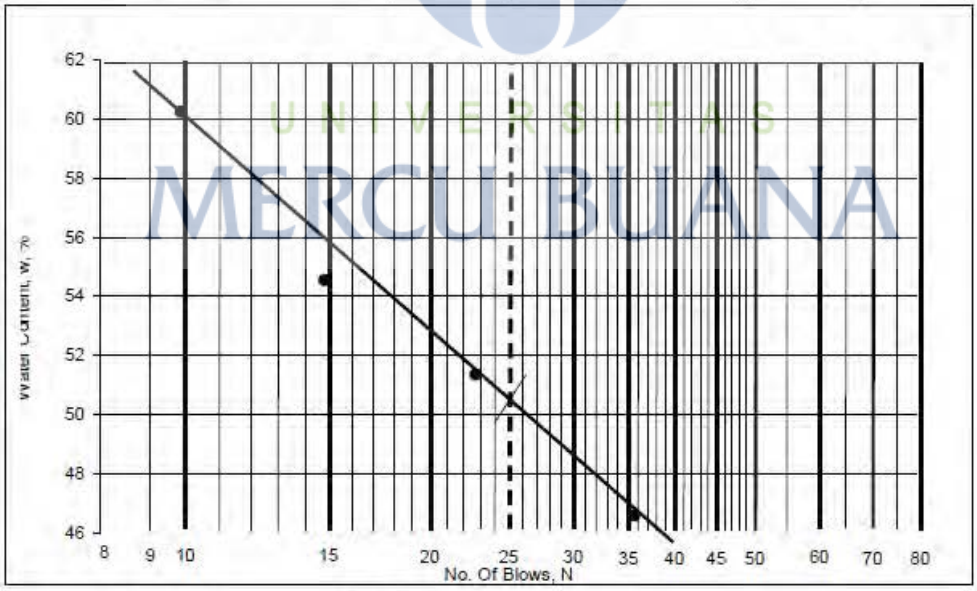
SAMPLE CODE	: BH.1-UDS. 1	DATE OF TEST	: 18 OKT. 2012
DEPTH	: 1.00 ~ 1.50 M	TESTED BY	: DD/AR

Liquid Limit Determination

Container No.		181	175	209	205	
No. OF BLOWS, N		36	23	16	10	
Wt. of wet soil + can	gr	38.07	37.91	38.52	38.70	
Wt. of dry soil + can	gr	28.10	27.40	27.30	26.70	
Wt. of can	gr	6.70	6.93	6.73	6.78	
Wt. of dry soil	gr	21.40	20.47	20.57	19.92	
Wt. of moisture	gr	9.97	10.51	11.22	12.00	
WATER CONTENT, v	%	46.59	51.34	54.55	60.24	

Plastic Limit Determination

Container No.			210		186	
Wt. of wet soil + can	gr		17.28	#	17.90	
Wt. of dry soil + can	gr		14.82	#	15.20	
Wt. of can	gr		6.92	#	6.50	
Wt. of dry soil	gr		7.90		8.70	
Wt. of moisture	gr		2.46		2.70	
WATER CONTENT, v	%		31.14		31.03	



Liquid Limit : 50.30 %
Plastic Limit : 31.09 %
Plasticity Index : 19.21 %

USCS : MH

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LIQUID AND PLASTIC LIMITS TEST

PROJECT : BANK DANAMON

LOCATION : KUNINGAN - JAKARTA SELATAN

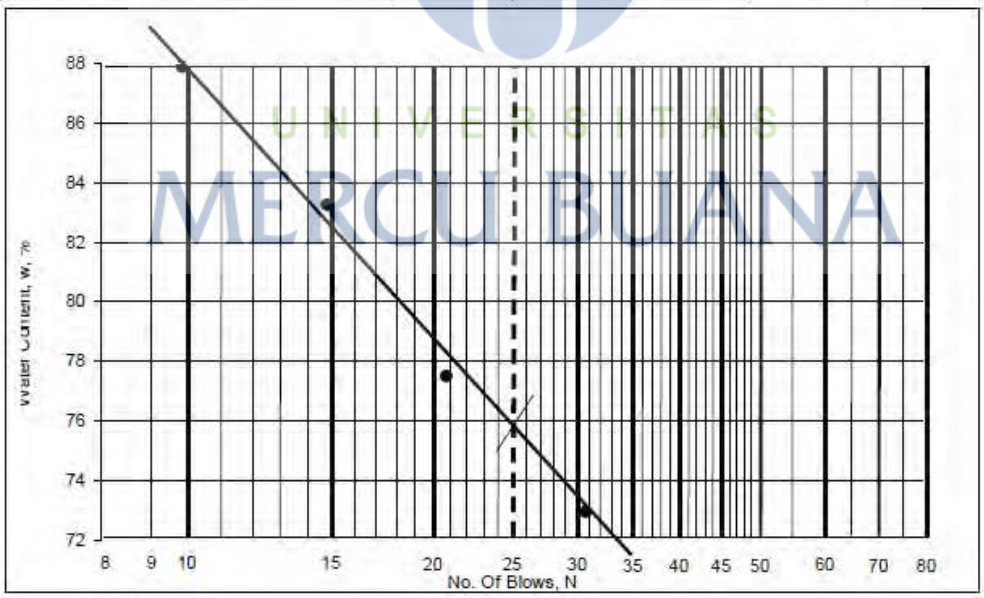
SAMPLE CODE	: BH. 1 - UDS. 2	DATE OF TEST	: 18 OKT. 2012
DEPTH	: 3.00 ~ 3.50 M	TESTED BY	: DD/AR

Liquid Limit Determination

Container No.		105	106	107	108	
No. OF BLOWS, N		31	21	15	10	
Wt. of wet soil + can	gr	42.85	40.63	41.73	40.18	
Wt. of dry soil + can	gr	27.43	25.72	25.68	24.44	
Wt. of can	gr	6.29	6.48	6.40	6.53	
Wt. of dry soil	gr	21.14	19.24	19.28	17.91	
Wt. of moisture	gr	15.42	14.91	16.05	15.74	
WATER CONTENT, v	%	72.94	77.49	83.25	87.88	

Plastic Limit Determination

Container No.			109		162	
Wt. of wet soil + can	gr		18.58		19.79	
Wt. of dry soil + can	gr		15.50		16.30	
Wt. of can	gr		7.25		6.96	
Wt. of dry soil	gr		8.25		9.34	
Wt. of moisture	gr		3.08		3.49	
WATER CONTENT, v	%		37.33		37.37	



Liquid Limit : 75.90 %
Plastic Limit : 37.35 %
Plasticity Index : 38.55 %

USCS : MH

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LIQUID AND PLASTIC LIMITS TEST

PROJECT : BANK DANAMON

LOCATION : KUNINGAN - JAKARTA SELATAN

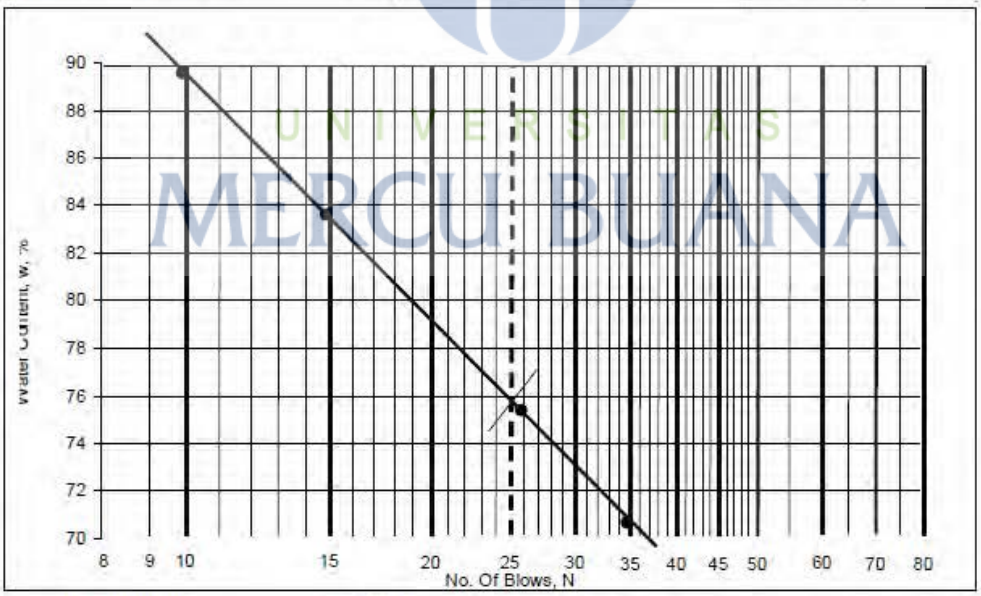
SAMPLE CODE	: BH. 1 - UDS. 3	DATE OF TEST	: 18 OKT. 2012
DEPTH	: 7.00 ~ 7.50 M	TESTED BY	: DD/AR

Liquid Limit Determination

Container No.		94	95	96	97	
No. OF BLOWS, N		35	26	15	10	
Wt. of wet soil + can	gr	30.17	28.17	31.73	31.14	
Wt. of dry soil + can	gr	20.34	18.79	20.30	19.39	
Wt. of can	gr	6.43	6.35	6.63	6.27	
Wt. of dry soil	gr	13.91	12.44	13.67	13.12	
Wt. of moisture	gr	9.83	9.38	11.43	11.75	
WATER CONTENT, v	%	70.67	75.40	83.61	89.56	

Plastic Limit Determination

Container No.			98		94	
Wt. of wet soil + can	gr		12.30		13.53	
Wt. of dry soil + can	gr		10.65		11.53	
Wt. of can	gr		6.22		6.18	
Wt. of dry soil	gr		4.43		5.35	
Wt. of moisture	gr		1.65		2.00	
WATER CONTENT, v	%		37.25		37.38	



Liquid Limit : 75.90 %
Plastic Limit : 37.31 %
Plasticity Index : 38.59 %

USCS : MH

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LIQUID AND PLASTIC LIMITS TEST

PROJECT : BANK DANAMON

LOCATION : KUNINGAN - JAKARTA SELATAN

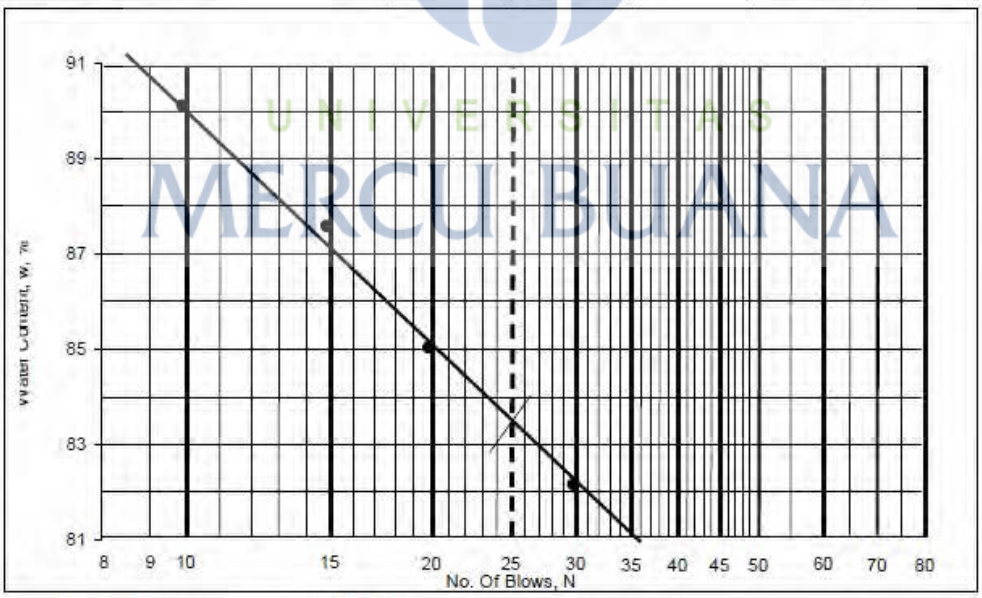
SAMPLE CODE	: BH. 2 - UDS.1	DATE OF TEST	: 22 NOP. 2012
DEPTH	: 10.00 ~ 10.50 M	TESTED BY	: DD/AR

Liquid Limit Determination

Container No.		89	90	91	# 92	
No. OF BLOWS, N		30	20	15	10	
Wt. of wet soil + can	gr	45.31	44.22	44.93	45.06	
Wt. of dry soil + can	gr	27.63	26.62	26.95	26.66	
Wt. of can	gr	6.11	5.92	6.42	6.24	
Wt. of dry soil	gr	21.52	20.70	20.53	20.42	
Wt. of moisture	gr	17.68	17.60	17.98	18.40	
WATER CONTENT, v	%	82.16	85.02	87.58	90.11	

Plastic Limit Determination

Container No.			93		94	
Wt. of wet soil + can	gr		17.93		18.77	
Wt. of dry soil + can	gr		14.15		14.80	
Wt. of can	gr		6.11		6.41	
Wt. of dry soil	gr		8.04		8.39	
Wt. of moisture	gr		3.78		3.97	
WATER CONTENT, v	%		47.01		47.32	



Liquid Limit : 83.50 %
Plastic Limit : 47.17 %
Plasticity Index : 36.33 %

USCS : MH

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LIQUID AND PLASTIC LIMITS TEST

PROJECT : BANK DANAMON

LOCATION : KUNINGAN - JAKARTA SELATAN

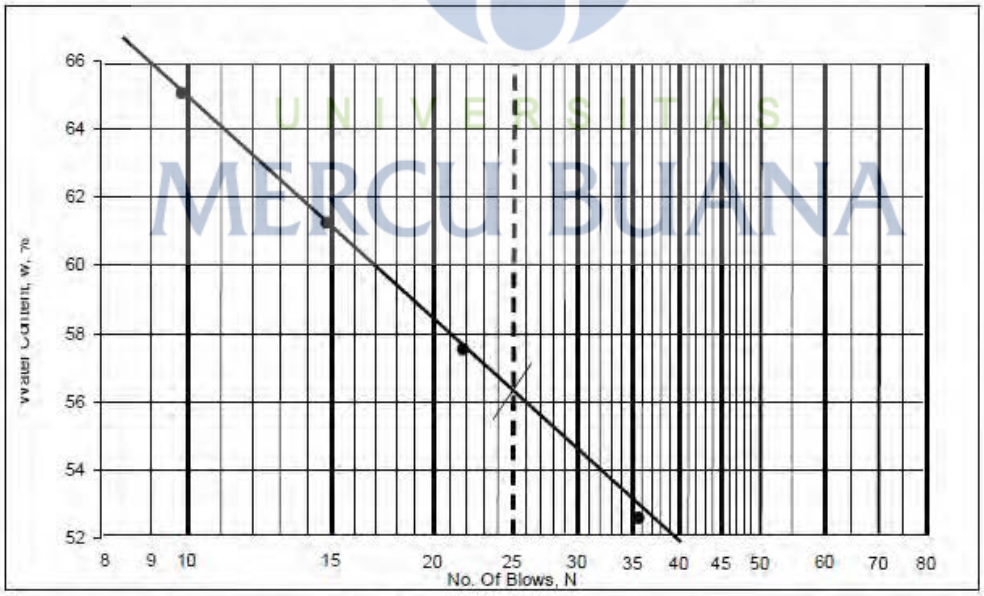
SAMPLE CODE	: BH. 2 - UDS. 2	DATE OF TEST	: 22 NOP. 2012
DEPTH	: 26.00 ~ 26.50 M	TESTED BY	: DD/AR

Liquid Limit Determination

Container No.		101	102	103	104	
No. OF BLOWS, N		36	22	15	10	
Wt. of wet soil + can	gr	35.07	40.24	45.62	42.03	
Wt. of dry soil + can	gr	25.11	27.78	30.72	27.94	
Wt. of can	gr	6.17	6.12	6.39	6.28	
Wt. of dry soil	gr	18.94	21.66	24.33	21.66	
Wt. of moisture	gr	9.96	12.46	14.90	14.09	
WATER CONTENT, v	%	52.59	57.53	61.24	65.05	

Plastic Limit Determination

Container No.			105		106	
Wt. of wet soil + can	gr		20.58		23.91	
Wt. of dry soil + can	gr		17.23		19.82	
Wt. of can	gr		6.26		6.45	
Wt. of dry soil	gr		10.97		13.37	
Wt. of moisture	gr		3.35		4.09	
WATER CONTENT, v	%		30.54		30.59	



Liquid Limit : 56.40 %
Plastic Limit : 30.56 %
Plasticity Index : 25.84 %

USCS : MH

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LIQUID AND PLASTIC LIMITS TEST

PROJECT : BANK DANAMON

LOCATION : KUNINGAN - JAKARTA SELATAN

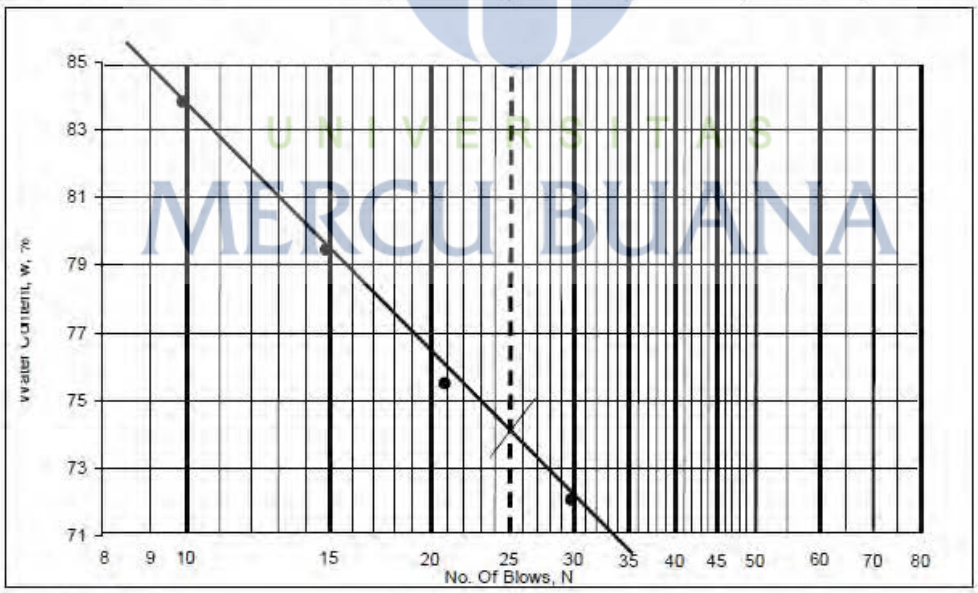
SAMPLE CODE :	BH.2 - UDS.3	DATE OF TEST	: 22 NOP. 2012
DEPTH :	30.00 ~ 30.50 M	TESTED BY	: DD/AR

Liquid Limit Determination

Container No.		178	179	180	181	
No. OF BLOWS, N		30	21	15	10	
Wt. of wet soil + can	gr	34.97	35.56	40.31	41.83	
Wt. of dry soil + can	gr	23.18	23.20	25.50	25.90	
Wt. of can	gr	6.82	6.83	6.86	6.90	
Wt. of dry soil	gr	16.36	16.37	18.64	19.00	
Wt. of moisture	gr	11.79	12.36	14.81	15.93	
WATER CONTENT, v	%	72.07	75.50	79.45	83.84	

Plastic Limit Determination

Container No.			183		184	
Wt. of wet soil + can	gr		19.70		21.00	
Wt. of dry soil + can	gr		16.20		17.12	
Wt. of can	gr		6.87		6.80	
Wt. of dry soil	gr		9.33		10.32	
Wt. of moisture	gr		3.50		3.88	
WATER CONTENT, v	%		37.51		37.60	



Liquid Limit : 74.20 %
Plastic Limit : 37.56 %
Plasticity Index : 36.64 %

USCS : MH

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LIQUID AND PLASTIC LIMITS TEST

PROJECT : BANK DANAMON

LOCATION : KUNINGAN - JAKARTA SELATAN

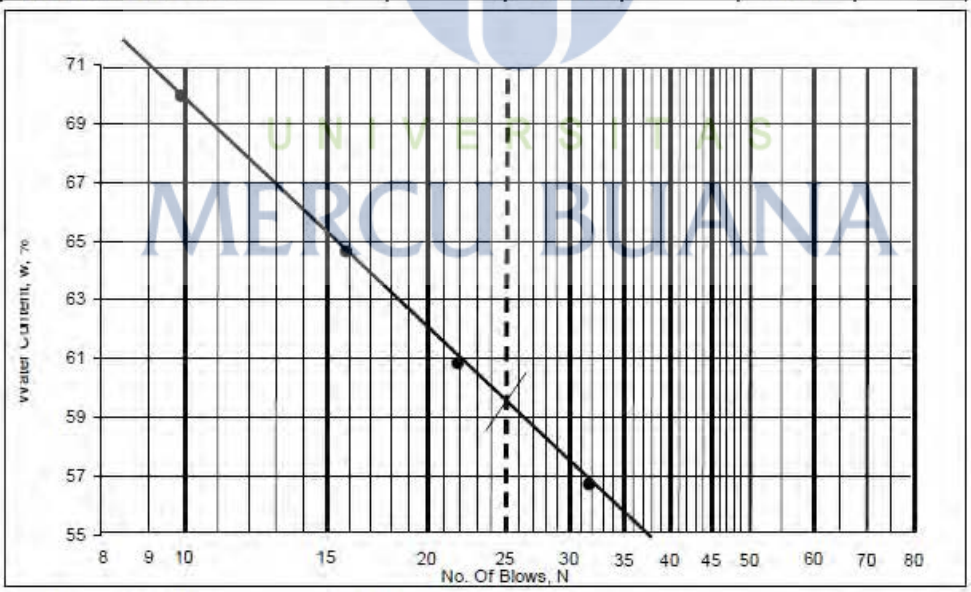
SAMPLE CODE	: BH.2 - UDS.4	DATE OF TEST	: 22 NOP. 2012
DEPTH	: 55.00 ~ 55.50 M	TESTED BY	: DD/AR

Liquid Limit Determination

Container No.		128	129	130	131	
No. OF BLOWS, N		32	22	16	10	
Wt. of wet soil + can	gr	33.18	46.04	43.59	44.50	
Wt. of dry soil + can	gr	23.65	31.20	29.15	28.89	
Wt. of can	gr	6.85	6.81	6.81	6.57	
Wt. of dry soil	gr	16.80	24.39	22.34	22.32	
Wt. of moisture	gr	9.53	14.84	14.44	15.61	
WATER CONTENT, v	%	56.73	60.84	64.64	69.94	

Plastic Limit Determination

Container No.			132		133	
Wt. of wet soil + can	gr		20.56		21.25	
Wt. of dry soil + can	gr		17.25		17.76	
Wt. of can	gr		6.86		6.81	
Wt. of dry soil	gr		10.39		10.95	
Wt. of moisture	gr		3.31		3.49	
WATER CONTENT, v	%		31.86		31.87	



Liquid Limit : 59.50 %
Plastic Limit : 31.86 %
Plasticity Index : 27.64 %

USCS : MH

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LIQUID AND PLASTIC LIMITS TEST

PROJECT : BANK DANAMON

LOCATION : KUNINGAN - JAKARTA SELATAN

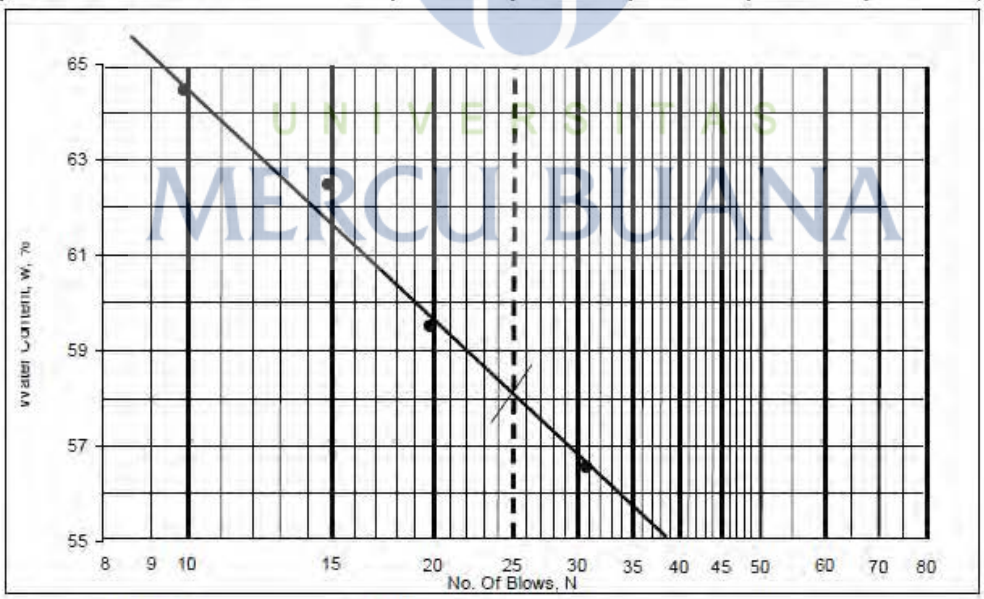
SAMPLE CODE	: BH.3 - UDS.1	DATE OF TEST	: 23 NOP. 2012
DEPTH	: 1.50 ~ 2.00 M	TESTED BY	: DD/AR

Liquid Limit Determination

Container No.		177	178	179	180	
No. OF BLOWS, N		31	20	15	10	
Wt. of wet soil + can	gr	48.70	47.82	45.24	50.23	
Wt. of dry soil + can	gr	33.57	32.52	30.45	33.23	
Wt. of can	gr	6.82	6.81	6.78	6.86	
Wt. of dry soil	gr	26.75	25.71	23.67	26.37	
Wt. of moisture	gr	15.13	15.30	14.79	17.00	
WATER CONTENT, v	%	56.56	59.51	62.48	64.47	

Plastic Limit Determination

Container No.			181		140	
Wt. of wet soil + can	gr		23.87		22.87	
Wt. of dry soil + can	gr		19.50		18.75	
Wt. of can	gr		6.89		6.79	
Wt. of dry soil	gr		12.61		11.96	
Wt. of moisture	gr		4.37		4.12	
WATER CONTENT, v	%		34.66		34.45	



Liquid Limit : 58.10 %
Plastic Limit : 34.55 %
Plasticity Index : 23.55 %

USCS : MH

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LIQUID AND PLASTIC LIMITS TEST

PROJECT : BANK DANAMON

LOCATION : KUNINGAN - JAKARTA SELATAN

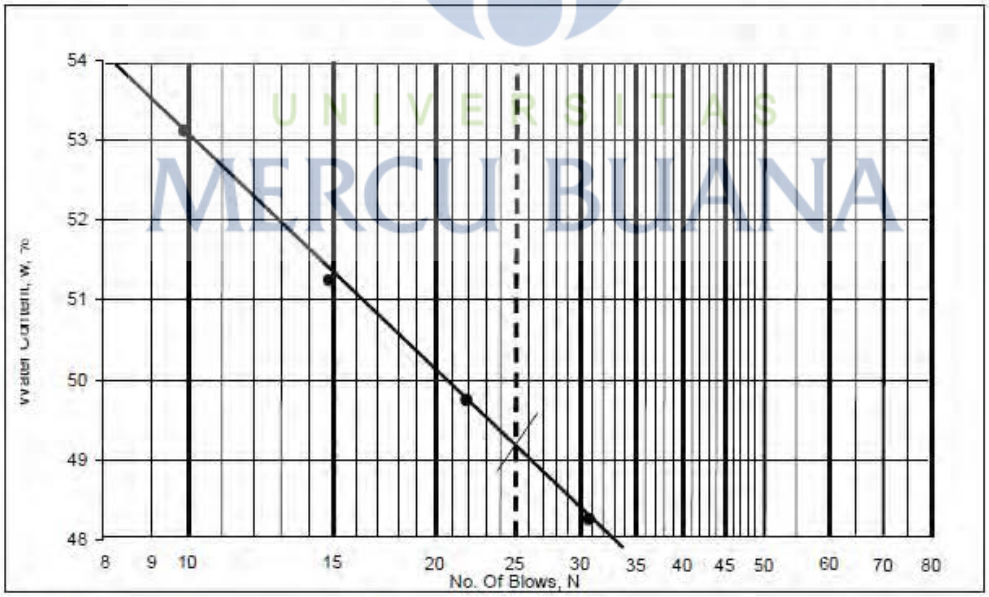
SAMPLE CODE :	BH.3 - UDS.2	DATE OF TEST	: 23 NOP. 2012
DEPTH :	4.00 ~ 4.50 M	TESTED BY	: DD/AR

Liquid Limit Determination

Container No.		107	108	109	110	
No. OF BLOWS, N		31	22	15	10	
Wt. of wet soil + can	gr	42.97	47.12	48.50	44.81	
Wt. of dry soil + can	gr	31.06	33.63	34.51	31.68	
Wt. of can	gr	6.38	6.51	7.21	6.96	
Wt. of dry soil	gr	24.68	27.12	27.30	24.72	
Wt. of moisture	gr	11.91	13.49	13.99	13.13	
WATER CONTENT, v	%	48.26	49.74	51.25	53.11	

Plastic Limit Determination

Container No.			111		138	
Wt. of wet soil + can	gr		23.14		21.65	
Wt. of dry soil + can	gr		19.25		18.00	
Wt. of can	gr		7.03		6.30	
Wt. of dry soil	gr		12.22		11.70	
Wt. of moisture	gr		3.89		3.65	
WATER CONTENT, v	%		31.83		31.20	



Liquid Limit : 49.20 %
Plastic Limit : 31.51 %
Plasticity Index : 17.69 %

USCS : ML

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LIQUID AND PLASTIC LIMITS TEST

PROJECT : BANK DANAMON

LOCATION : KUNINGAN - JAKARTA SELATAN

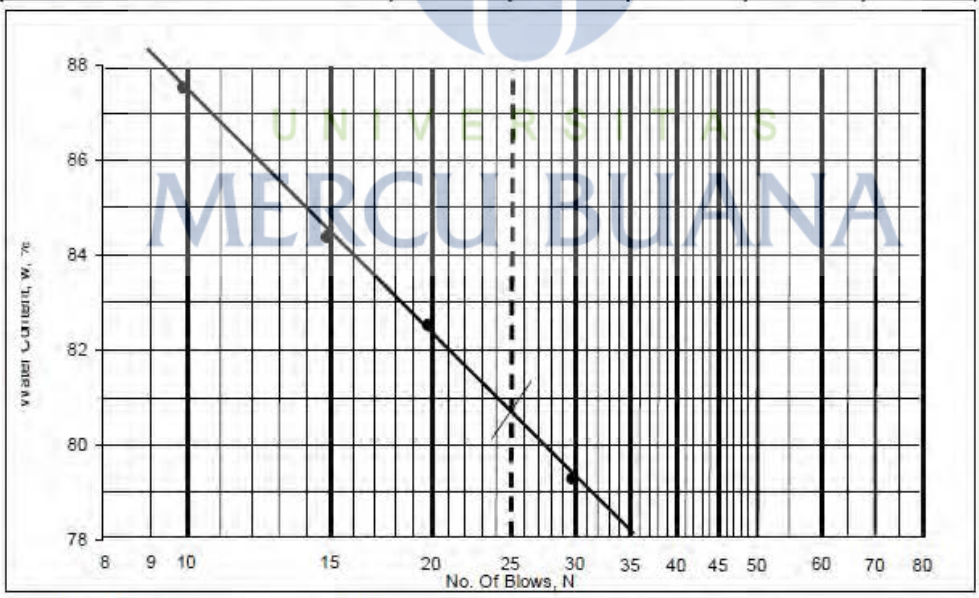
SAMPLE CODE	: BH.3 - UDS.3	DATE OF TEST	: 23 NOP. 2012
DEPTH	: 6.50 ~ 7.00 M	TESTED BY	: DD/AR

Liquid Limit Determination

Container No.		95	96	97	98	
No. OF BLOWS. N		30	20	15	10	
Wt. of wet soil + can	gr	30.59	35.87	36.01	40.64	
Wt. of dry soil + can	gr	19.87	22.65	22.40	24.57	
Wt. of can	gr	6.35	6.63	6.27	6.21	
Wt. of dry soil	gr	13.52	16.02	16.13	18.36	
Wt. of moisture	gr	10.72	13.22	13.61	16.07	
WATER CONTENT, v	%	79.29	82.52	84.38	87.53	

Plastic Limit Determination

Container No.			99		100	
Wt. of wet soil + can	gr		20.32		19.68	
Wt. of dry soil + can	gr		15.95		15.50	
Wt. of can	gr		6.18		6.28	
Wt. of dry soil	gr		9.77		9.22	
Wt. of moisture	gr		4.37		4.18	
WATER CONTENT, v	%		44.73		45.34	



Liquid Limit : 80.80 %
Plastic Limit : 45.03 %
Plasticity Index : 35.77 %

USCS : MH

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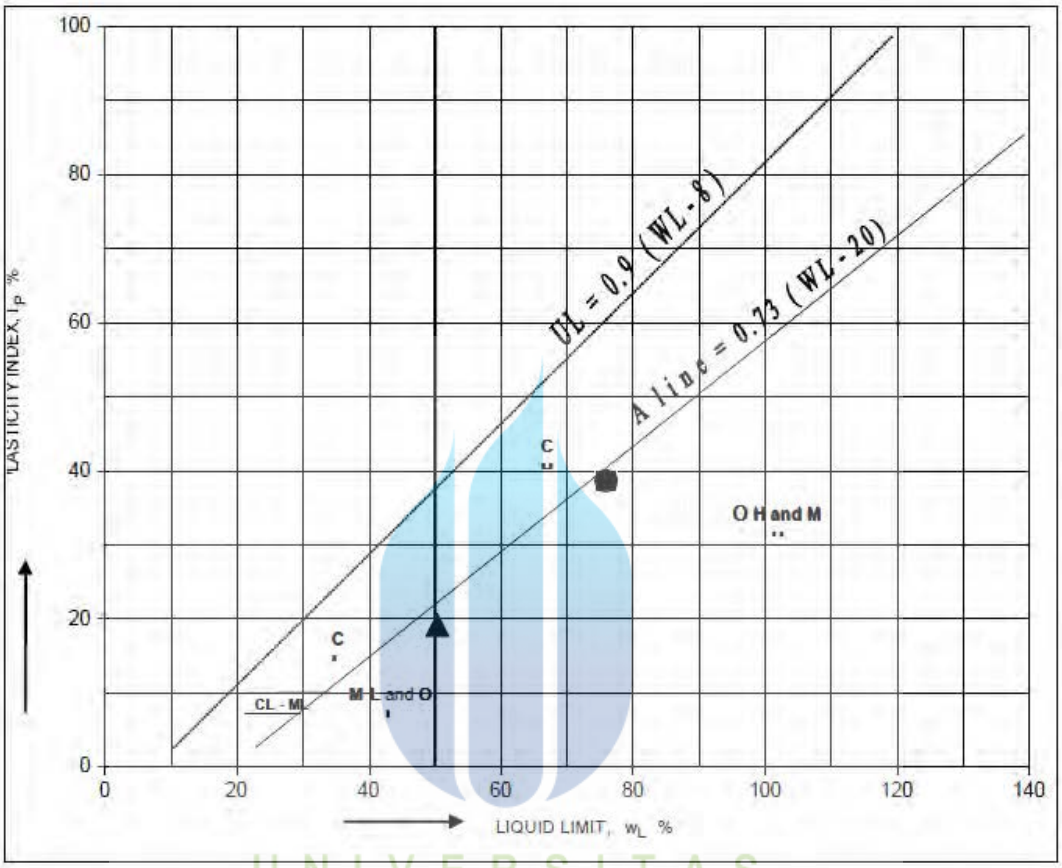
CASAGRANDE'S PLASTICITY CHART

PROJECT : **BANK DANAMON**
LOCATION : **KUNINGAN - JAKARTA SELATAN**

BORING No : BH.1
Date : 18 OKT. 2012
Tested by : Dd



SAMPLE CODE	DEPTH (M)	SYMBOL	w_n %	w_L %	w_P %	I_P %	I_L %	USCS	DESCRIPTION
BH.1-UDS.1	1.00 ~ 1.50	▲	39.196	50.30	31.09	19.21	42.20	MH	Lanau Kelempungan
UDS. 2	3.00 ~ 3.50	■	39.589	75.90	37.35	38.55	5.81	MH	Lanau Kelempungan
UDS. 3	7.00 ~ 7.50	●	39.883	75.90	37.31	38.59	6.67	MH	Lanau Kelempungan
		◆							
		△							
		□							
		○							
		◇							

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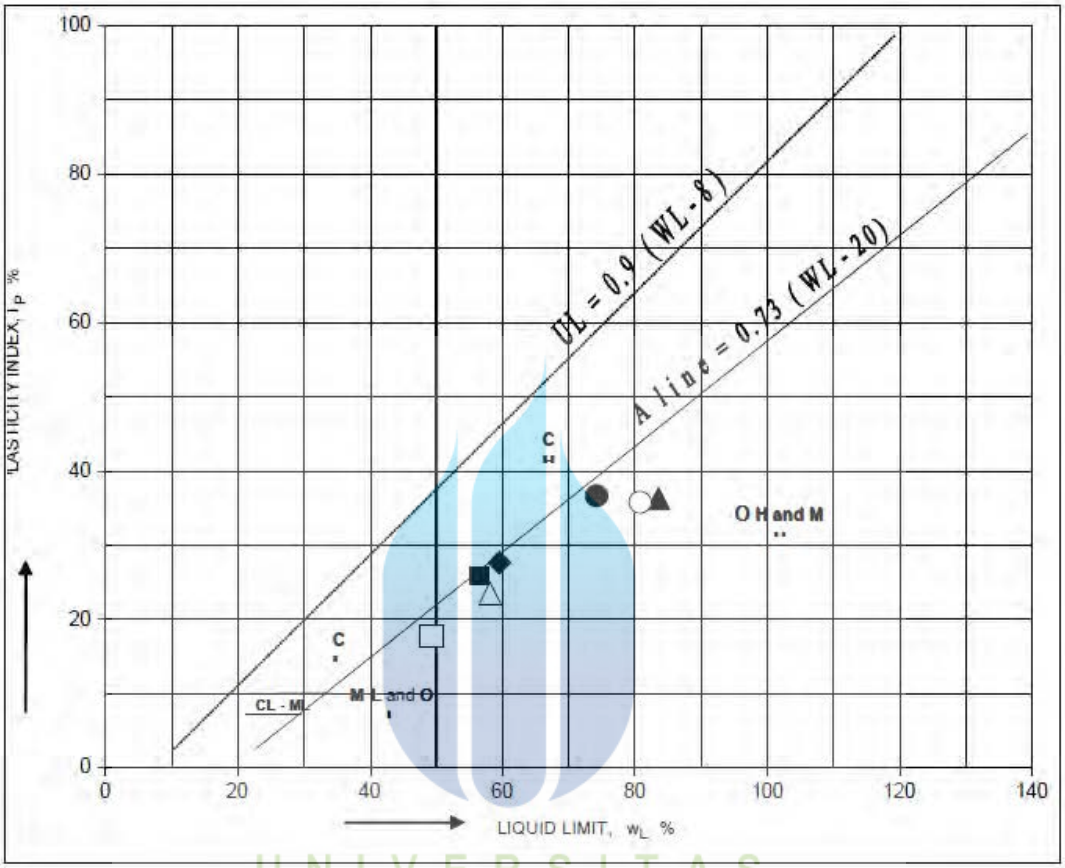
CASAGRANDE'S PLASTICITY CHART

PROJECT : BANK DANAMON
LOCATION : KUNINGAN - JAKARTA SELATAN

BORING No : BH.2 & BH.3
Date : 22 NOP. 2012
Tested by : Dd



SAMPLE CODE	DEPTH (M)	SYMBOL	w_n %	w_L %	w_P %	I_P %	I_L %	USCS	DESCRIPTION
BH.2-UDS.1	10.00 ~ 10.50	▲	54.378	83.50	47.17	36.33	19.84	MH	Lanau Kelempungan
UDS. 2	26.00 ~ 26.50	■	33.429	56.40	30.56	25.84	11.10	MH	Lanau Kelempungan
UDS. 3	30.00 ~ 30.50	●	42.867	74.20	37.56	36.64	14.48	MH	Lanau Kelempungan
UDS. 4	55.00 ~ 55.50	◆	33.624	59.50	31.86	27.64	6.38	MH	Lanau kelempungan
BH.3-UDS.1	1.50 ~ 2.00	△	37.639	58.10	34.55	23.55	13.12	MH	Lanau kelempungan
UDS. 2	4.00 ~ 4.50	□	43.045	49.20	31.51	17.69	65.21	ML	Lanau kelempungan
UDS. 3	6.50 ~ 7.00	○	64.253	80.80	45.03	35.77	53.74	MH	Lanau kelempungan
		◇							

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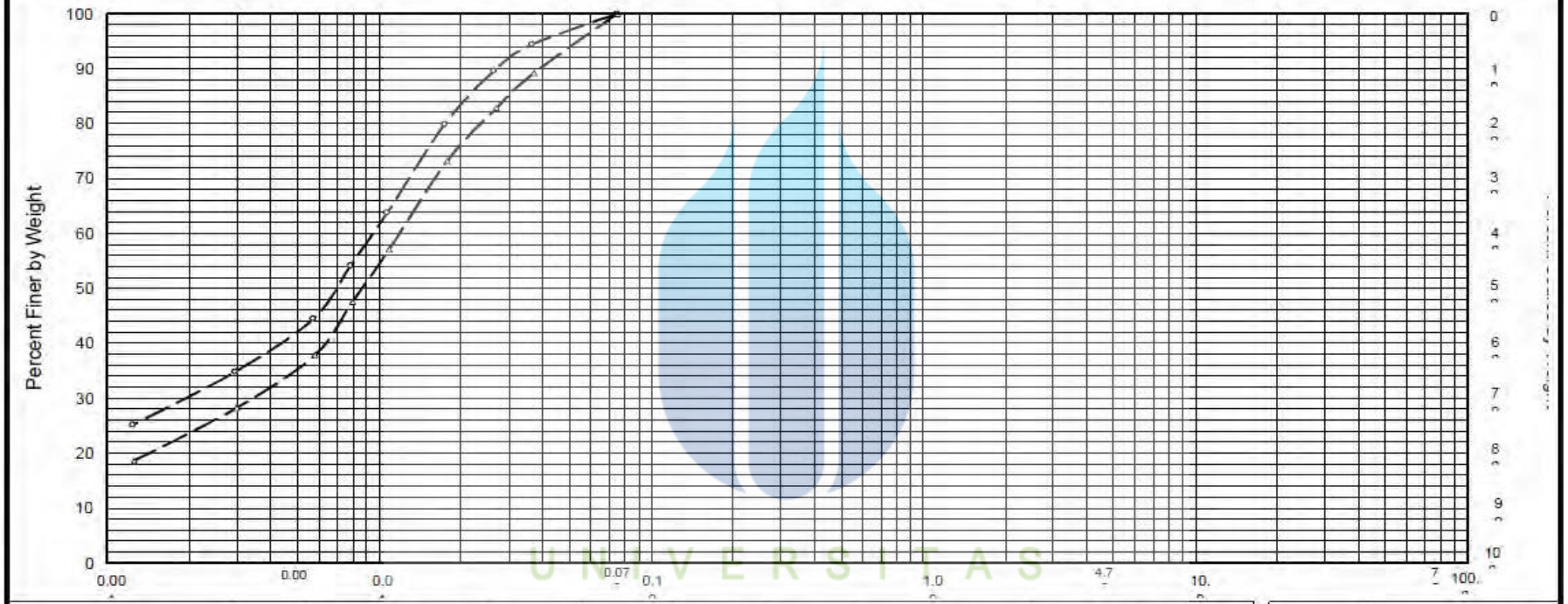
ASTM

PARTICLE SIZE DISTRIBUTION CURVE

COLOID	CLA	S I L	S A N			G R A V E	COBBL
			Fin	Mediu	Coars		



Sample Code	Symbol	Gravel, %	Sand, %	Silt, %	Clay, %	Max ϕ, mm	D60, mm	D30, mm	D10, mm	$Cu = \frac{D}{D}$	$Cc = \frac{(D_3}{D_{60} \times}$	W_L, %	Ip, %	USCS
BH.1-UDS.1 : 1.00 ~ 1.50 m		0.00	0.00	58.00	42.00	0.075	-	-	-	-	-	50.30	19.21	MH
BH.1-UDS.2 : 3.00 ~ 3.50 m		0.00	0.00	65.00	35.00	0.075	-	-	-	-	-	75.90	38.55	MH

PROJECT : **BANK DANAMON**
LOCATION : **KUNINGAN - JAKARTA SELATAN**

Tested by : AR
Date of Test : 20 OKT. 2012

No. :
Fig

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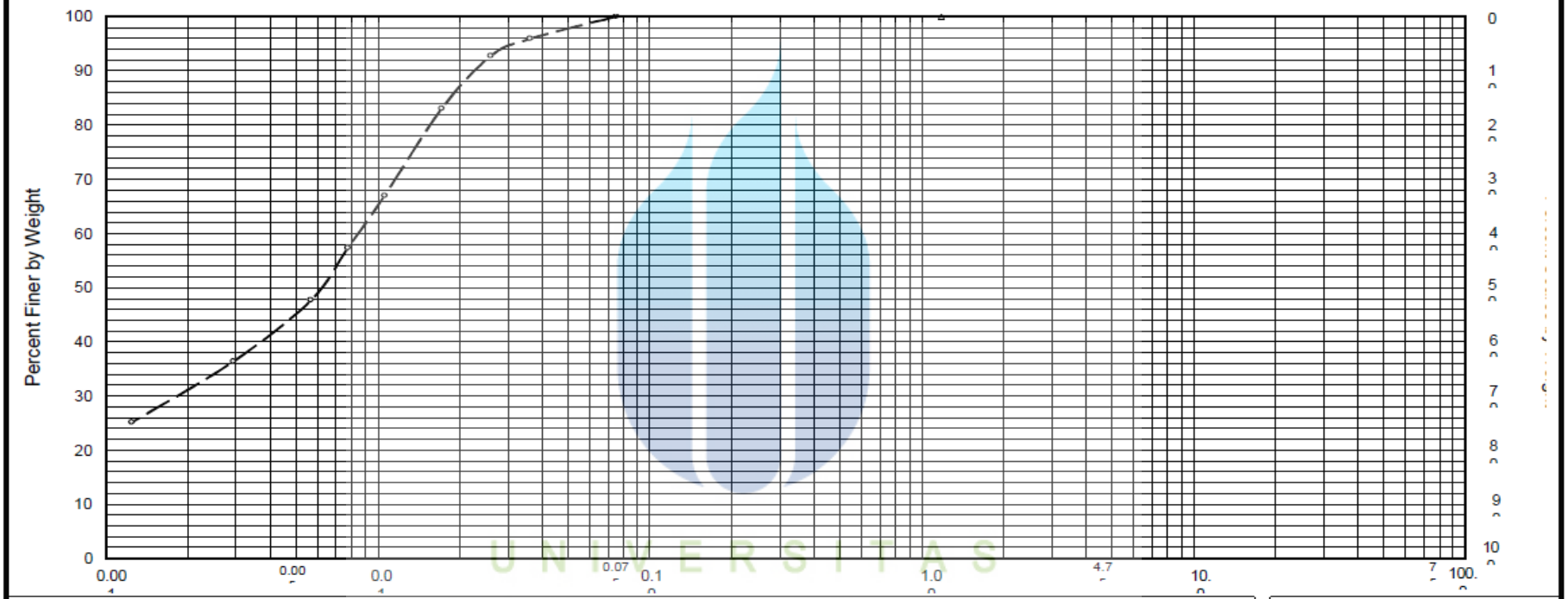
ASTM

PARTICLE SIZE DISTRIBUTION CURVE

COLOID	CLA	S I L	S A N			G R A V E	COBBL
			Fin	Mediu	Coars		



Sample Code	Symbol	Gravel, %	Sand, %	Silt, %	Clay, %	Max ϕ, mm	D60, mm	D30, mm	D10, mm	Cu = $\frac{D}{D}$	Cc = $\frac{(D_3}{D_{60} \times}$	W_L, %	Ip, %	USCS
BH.1-UDS.3 : 7.00 ~ 7.50 m		0.00	0.00	55.00	45.00	0.075	-	-	-	-	-	75.90	38.59	MH

	PROJECT : **BANK DANAMON** **LOCATION** : **KUNINGAN - JAKARTA SELATAN**	Tested by : AR Date of Test : 20 OKT. 2012	No. Fig

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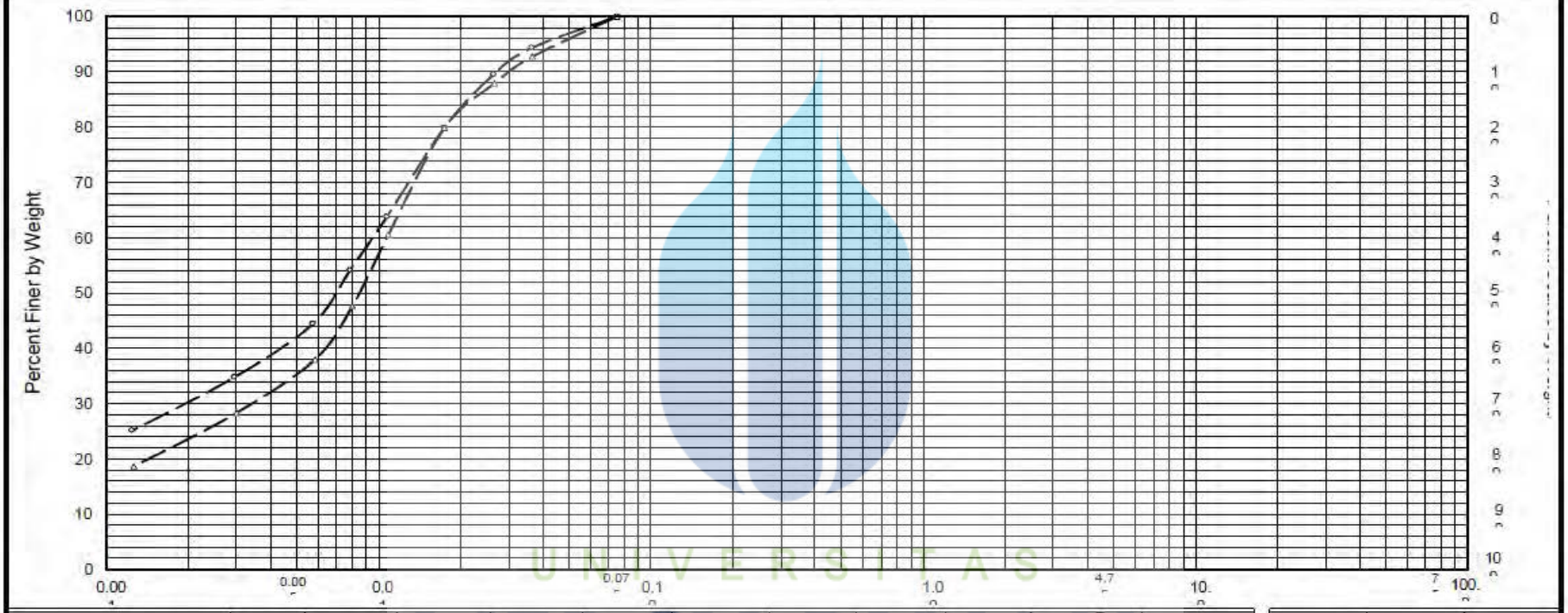
ASTM

PARTICLE SIZE DISTRIBUTION CURVE

COLOID	CLA	S I L	S A N			G R A V E	COBBL
			Fin	Mediu	Coars		



Sample Code	Symbol	Gravel, %	Sand, %	Silt, %	Clay, %	Max ϕ, mm	D60, mm	D30, mm	D10, mm	$Cu = \frac{D}{D}$	$Cc = \frac{(D_3}{D_{60} \times}$	W_L, %	Ip, %	USCS
BH.2-UDS.1 : 10.00~10.50 m		0.00	0.00	58.00	42.00	0.075	-	-	-	-	-	83.50	36.33	MH
BH.2-UDS.2 : 26.00~26.50 m		0.00	0.00	65.00	35.00	0.075	-	-	-	-	-	56.40	25.84	MH

PROJECT : **BANK DANAMON**
LOCATION : **KUNINGAN - JAKARTA SELATAN**

Tested by : AR
Date of Test : 24 NOP. 2012

No. :
Fig

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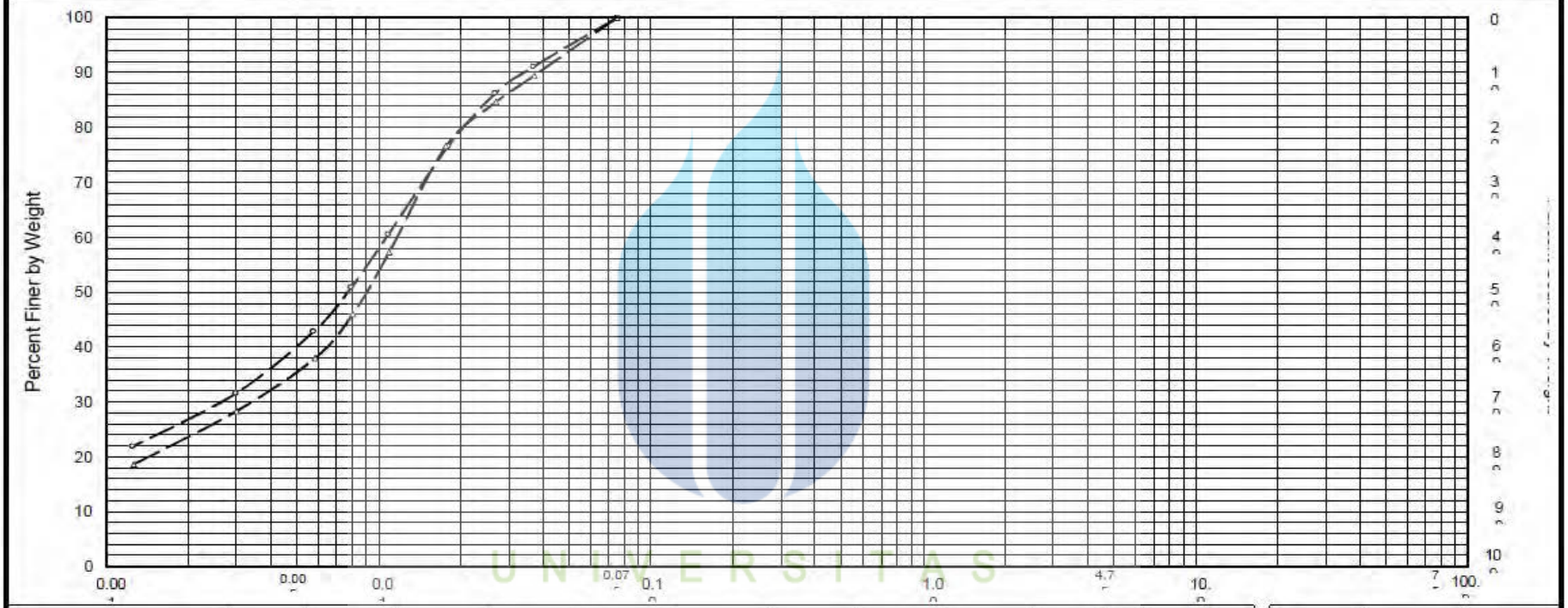
ASTM

PARTICLE SIZE DISTRIBUTION CURVE

COLOID	CLA	S I L	S A N			G R A V E	COBBL
			Fin	Mediu	Coars		



Sample Code	Symbol	Gravel, %	Sand, %	Silt, %	Clay, %	Max ϕ, mm	D60, mm	D30, mm	D10, mm	Cu = $\frac{D}{D}$	Cc = $\frac{(D_3}{D_{60} \times}$	W_L, %	Ip, %	USCS
BH.2-UDS.3 : 30.00-30.50 m		0.00	0.00	60.00	40.00	0.075	-	-	-	-	-	74.20	36.64	MH
BH.2-UDS.4 : 26.00-26.50 m		0.00	0.00	64.00	36.00	0.075	-	-	-	-	-	59.50	27.64	MH

PROJECT : **BANK DANAMON**
LOCATION : **KUNINGAN - JAKARTA SELATAN**

Tested by : AR
Date of Test : 24 NOP. 2012

No. :
Fig

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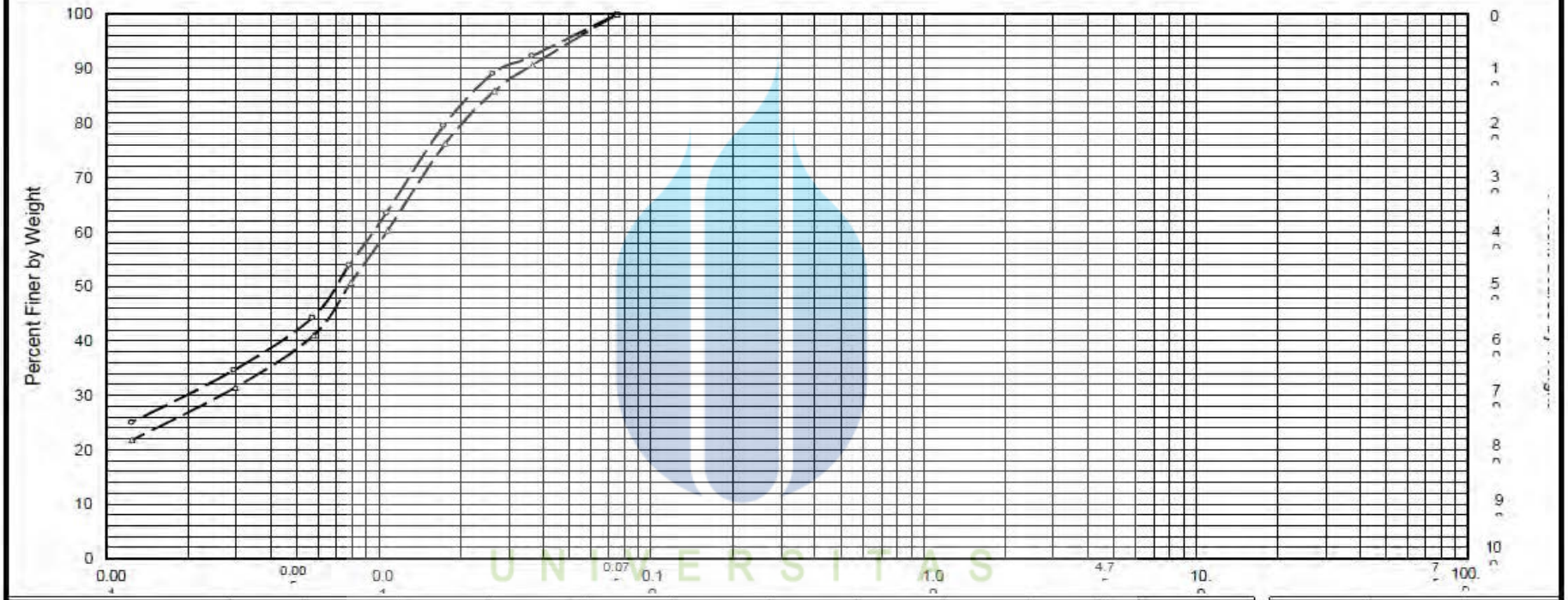
ASTM

PARTICLE SIZE DISTRIBUTION CURVE

COLOID	CLA	S I L	S A N			G R A V E	COBBL
			Fin	Mediu	Coars		



Sample Code	Symbol	Gravel, %	Sand, %	Silt, %	Clay, %	Max ϕ, mm	D60, mm	D30, mm	D10, mm	Cu = $\frac{D}{D}$	Cc = $\frac{(D_3}{D_{60}}$ x	W_L, %	Ip, %	USCS
BH.3-UDS.1 : 1.50 ~ 2.00 m		0.00	0.00	58.00	42.00	0.075	-	-	-	-	-	58.10	23.55	MH
BH.3-UDS.2 : 4.00 ~ 4.50 m		0.00	0.00	62.00	38.00	0.075	-	-	-	-	-	49.20	17.69	ML

PROJECT : **BANK DANAMON**
LOCATION : **KUNINGAN - JAKARTA SELATAN**

Tested by : AR
Date of Test : 20 OKT. 2012

No. :
Fig

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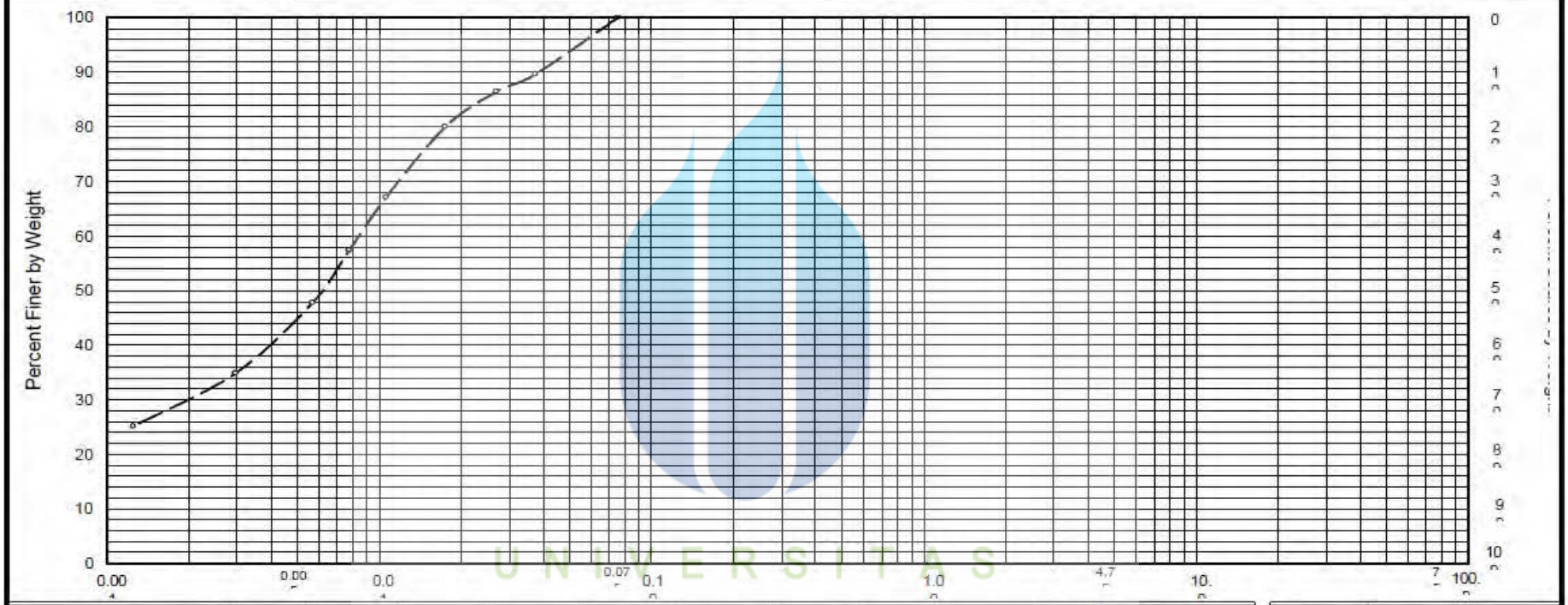
ASTM

PARTICLE SIZE DISTRIBUTION CURVE

COLOID	CLA	S I L	S A N			G R A V E	COBBL
			Fin	Mediu	Coars		



Sample Code	Symbol	Gravel, %	Sand, %	Silt, %	Clay, %	Max ϕ, mm	D60, mm	D30, mm	D10, mm	Cu = $\frac{D}{D}$	Cc = $\frac{(D_3}{D_{60} \times}$	W_L, %	Ip, %	USCS
BH.3-UDS.3 : 6.50 ~ 7.00 m		0.00	0.00	55.00	45.00	0.075	-	-	-	-	-	80.80	35.77	MH
		-	-	-	-	-	-	-	-	-	-	-	-	-

PROJECT : **BANK DANAMON**
LOCATION : **KUNINGAN - JAKARTA SELATAN**

Tested by : JS
Date of Test : 24 NOP. 2012

No. :
Fig

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SPECIFIC GRAVITY TEST

PROJECT : BANK DANAMON
LOCATION : KUNINGAN - JAKARTA SELATAN

Tested By : AR

a	Date of testing		22 OKT. 2012				
b	Sample No. / Depth. M			BH.1-UDS.1 1.00 ~ 1.50	UDS.2 3.00 ~ 3.50	UDS.3 7.00 ~ 7.50	
c	Container No.			13	14	15	
d	Wt. of cont. + dry soil	gram		53.29	56.26	52.39	
e	Wt. of container	gram		35.29	40.42	36.46	
f	Wt. of dry soil, (d - e)	gram		18.00	15.84	15.93	
g	Pycnometer no.			13	14	15	
h	Wt. of pycnometer	gram		41.85	47.78	43.83	
i	Wt. of water in pyc. at 29° C	gram		104.02	103.51	103.01	
j	Wt. of pyc. + soil + water	gram		157.04	161.15	156.73	
k	Temperature at (j)	°C		30.0	30.0	30.0	
l	Deffloccular corr. (γ_w at k / γ_w 29° C)			0.9997	0.9997	0.9997	
m	Wt. of water in pyc. Corr. (i x l)	gram		103.989	103.479	102.979	
n	Floated water (f + h + m - j)	gram		6.799	5.949	6.009	
o	Gs at T° C (f / n)			2.6475	2.6627	2.6510	
p	Coefficient Temperature			0.9963	0.9963	0.9963	
q	Specific Gravity (o x p)			2.6377	2.6528	2.6412	

No.	Pycno	Water in pyc at 29°	No.	Pycno	Water	T°	γ_{Water}	Deff. Cor.	Note
1	39.60	100.49	16	39.76	96.82	27	0.9967	1.0007	Dikalibarasi : 04 MEI 2012 at 29° C
2	43.22	101.35	17	48.42	100.06	28	0.9963	1.0003	
3	40.80	102.70	18			29	0.9960	1.0000	
4	45.56	106.92	19			30	0.9957	0.9997	
5	49.96	105.02	20			31	0.9954	0.9994	
6	44.35	101.83	21			32	0.9951	0.9991	
7	45.47	108.19	22			33	0.9947	0.9987	
8	44.23	102.20	23						
9	46.56	103.39	24						
10	44.56	106.07	25						
11	48.58	103.44							
12	40.93	102.85							
13	41.85	104.02							
14	47.78	103.51							
15	43.83	103.01							

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SPECIFIC GRAVITY TEST

PROJECT : BANK DANAMON
LOCATION : KUNINGAN - JAKARTA SELATAN

Tested By : AR

a	Date of testing		23 NOPEMBER 2012				
b	Sample No. / Depth. M		BH.2-UDS.1 10.00~10.50	UDS.2 26.00~26.50	UDS.3 30.00~30.50	UDS.4 55.00~55.50	
c	Container No.		4	5	6	7	
d	Wt. of cont. + dry soil	gram	57.60	63.17	61.94	62.34	
e	Wt. of container	gram	37.68	42.36	38.70	39.17	
f	Wt. of dry soil, (d - e)	gram	19.92	20.81	23.24	23.17	
g	Pycnometer no.		4	5	6	7	
h	Wt. of pycnometer	gram	45.56	49.96	44.35	45.47	
i	Wt. of water in pyc. at 29° C	gram	106.92	105.02	101.83	108.19	
j	Wt. of pyc. + soil + water	gram	164.85	167.90	160.63	168.06	
k	Temperature at (j)	°C	30.0	30.0	30.0	30.0	
l	Deffloculant corr. (γ_w at k / γ_w 29° C)		0.9997	0.9997	0.9997	0.9997	
m	Wt. of water in pyc. Corr. (i x l)	gram	106.888	104.988	101.799	108.158	
n	Floated water (f + h + m - j)	gram	7.518	7.858	8.759	8.738	
o	Gs at T° C (f / n)		2.6497	2.6481	2.6531	2.6518	
p	Coefficient Temperature		0.9963	0.9963	0.9963	0.9963	
q	Specific Gravity (o x p)		2.6399	2.6383	2.6433	2.6420	

No.	Pycno	Water in pyc at 29°	No.	Pycno	Water	T°	γ_{Water}	Deff. Cor.	Note
1	39.60	100.49	16	39.76	96.82	27	0.9967	1.0007	Dikalibarasi : 04 MEI 2012 at 29° C
2	43.22	101.35	17	48.42	100.06	28	0.9963	1.0003	
3	40.80	102.70	18			29	0.9960	1.0000	
4	45.56	106.92	19			30	0.9957	0.9997	
5	49.96	105.02	20			31	0.9954	0.9994	
6	44.35	101.83	21			32	0.9951	0.9991	
7	45.47	108.19	22			33	0.9947	0.9987	
8	44.23	102.20	23						
9	46.56	103.39	24						
10	44.56	106.07	25						
11	48.58	103.44							
12	40.93	102.85							
13	41.85	104.02							
14	47.78	103.51							
15	43.83	103.01							

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SPECIFIC GRAVITY TEST

PROJECT : BANK DANAMON
LOCATION : KUNINGAN - JAKARTA SELATAN

Tested By : AR

a	Date of testing		23 NOPEMBER 2012			
b	Sample No. / Depth. M		BH.3-UDS.1 1.50 ~ 2.00	UDS.2 4.00 ~ 4.50	UDS.3 6.50 ~ 7.00	
c	Container No.		8	9	10	
d	Wt. of cont. + dry soil	gram	58.92	63.05	55.21	
e	Wt. of container	gram	37.48	40.39	37.40	
f	Wt. of dry soil, (d - e)	gram	21.44	22.66	17.81	
g	Pycnometer no.		8	9	10	
h	Wt. of pycnometer	gram	44.23	46.56	44.56	
i	Wt. of water in pyc. at 29° C	gram	102.20	103.39	106.07	
j	Wt. of pyc. + soil + water	gram	159.81	164.09	161.67	
k	Temperature at (j)	°C	30.0	30.0	30.0	
l	Deffloccullant corr. (γ_w at k / γ_w 29° C)		0.9997	0.9997	0.9997	
m	Wt. of water in pyc. Corr. (i x l)	gram	102.169	103.359	106.038	
n	Floated water (f + h + m - j)	gram	8.029	8.489	6.738	
o	Gs at T° C (f / n)		2.6702	2.6693	2.6431	
p	Coefficient Temperature		0.9963	0.9963	0.9963	
q	Specific Gravity (o x p)		2.6603	2.6595	2.6334	

No.	Pycno	Water in pyc at 29°	No.	Pycno	Water	T°	γ_{Water}	Deff. Cor.	Note
1	39.60	100.49	16	39.76	96.82	27	0.9967	1.0007	Dikalibarasi : 04 MEI 2012 at 29° C
2	43.22	101.35	17	48.42	100.06	28	0.9963	1.0003	
3	40.80	102.70	18			29	0.9960	1.0000	
4	45.56	106.92	19			30	0.9957	0.9997	
5	49.96	105.02	20			31	0.9954	0.9994	
6	44.35	101.83	21			32	0.9951	0.9991	
7	45.47	108.19	22			33	0.9947	0.9987	
8	44.23	102.20	23						
9	46.56	103.39	24						
10	44.56	106.07	25						
11	48.58	103.44							
12	40.93	102.85							
13	41.85	104.02							
14	47.78	103.51							
15	43.83	103.01							

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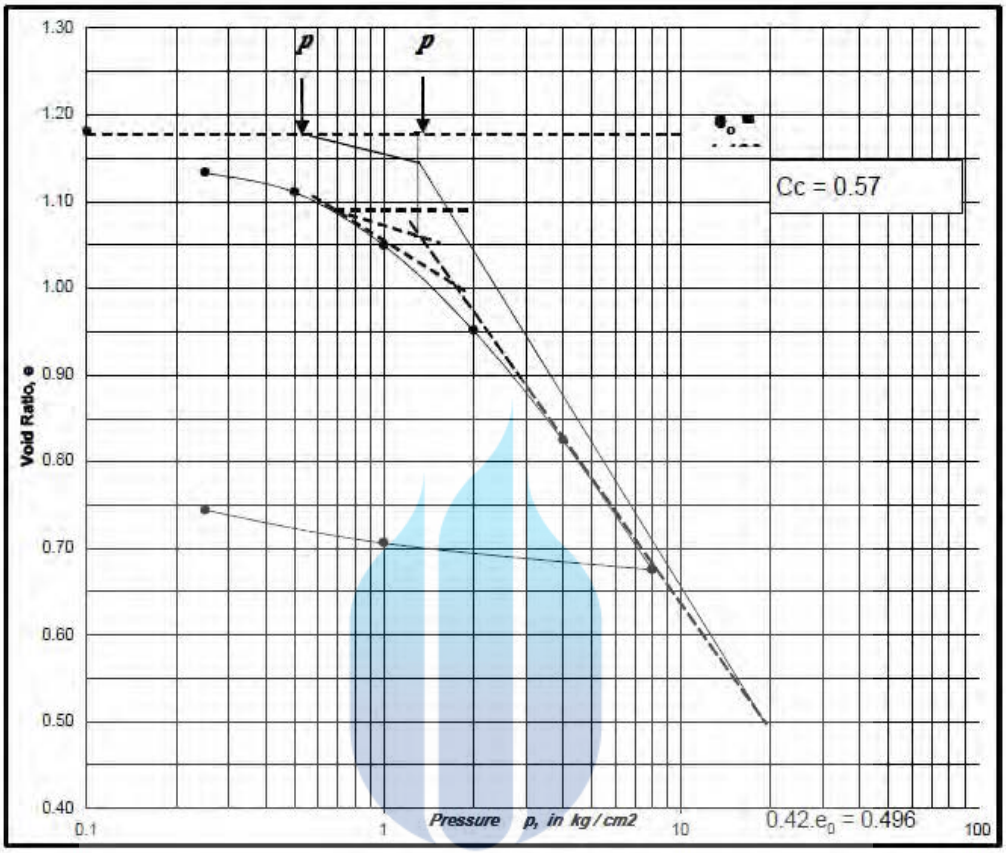
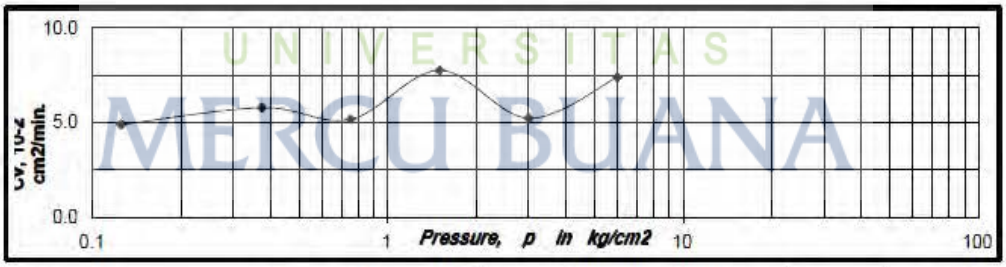
CONSOLIDATION TEST - *e* log *p* CURVE

PROJECT : BANK DANAMON
LOCATION: KUNINGAN - JAKARTA SELATAN

TESTED BY : Lodang
CHECKED BY : djoko





Date of Testing	: **01~05 NOP, 2012**	SPECIMEN IDENTITY		Initial	Final
SAMPLE CODE	: **BH.1-UDS. 2**	Diameter	cm	5.050	5.050
Depth	: **3.00 ~ 3.50 M**	Height	cm	2.000	1.600
Eff.Overb.Pressure, p_o	: **0.51** *kg/cm²*	Water Content	%	39.795	28.000
Critical Pressure, p_c	: **1.30** *kg/cm²*	Dry Density	t/m³	1.217	1.521
		Specific Gravity		2.653	
		Void Ratio		1.180	0.744
		Degree of Saturation	%	89.46	99.83

No. :

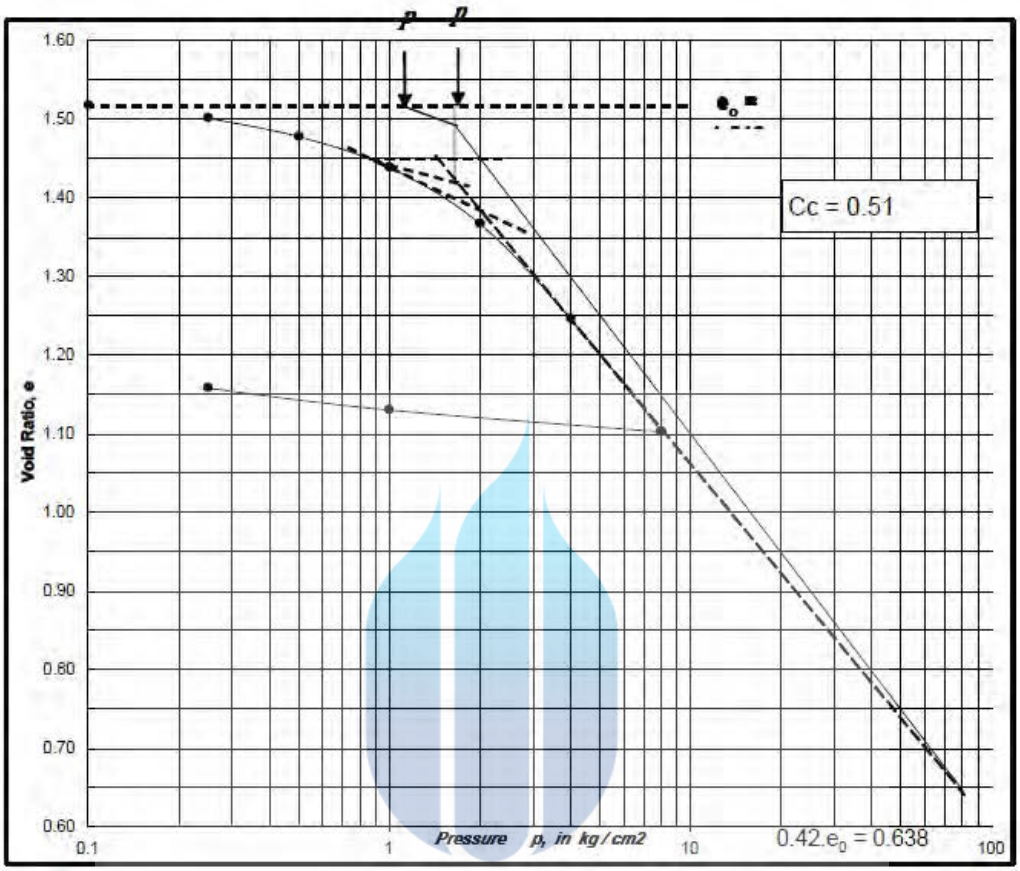
Fig.

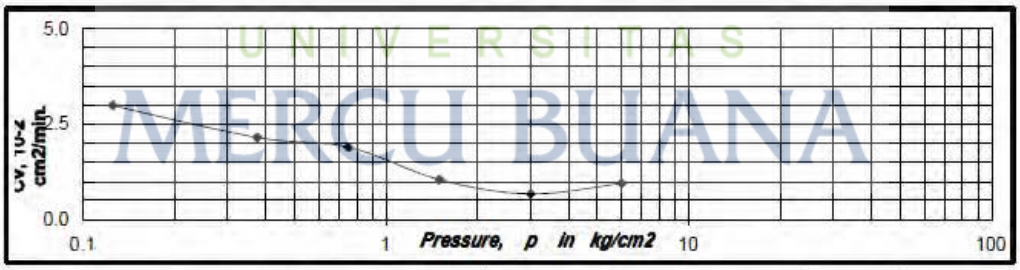
http://digilib.mercubuana.ac.id/

CONSOLIDATION TEST - *e* log *p* CURVE

PROJECT : BANK DANAMON
LOCATION : KUNINGAN - JAKARTA SELATAN

TESTED BY : Lodang
CHECKED BY : djoko





Date of Testing	: **15~19 DES. 2012**	SPECIMEN IDENTITY		Initial	Final
SAMPLE CODE	: **BH.2-UDS. 1**	Diameter	cm	5.050	5.050
Depth	: **10.00 ~ 10.50 M**	Height	cm	2.000	1.714
Eff.Overb.Pressure, p_o	: **1.12** *kg/cm²*	Water Content	%	54.405	43.524
Critical Pressure, p_c	: **1.65** *kg/cm²*	Dry Density	t/m³	1.048	1.223
		Specific Gravity,		2.640	
		Void Ratio		1.518	1.158
		Degree of Saturation	%	94.61	99.23

No. :

Fig.

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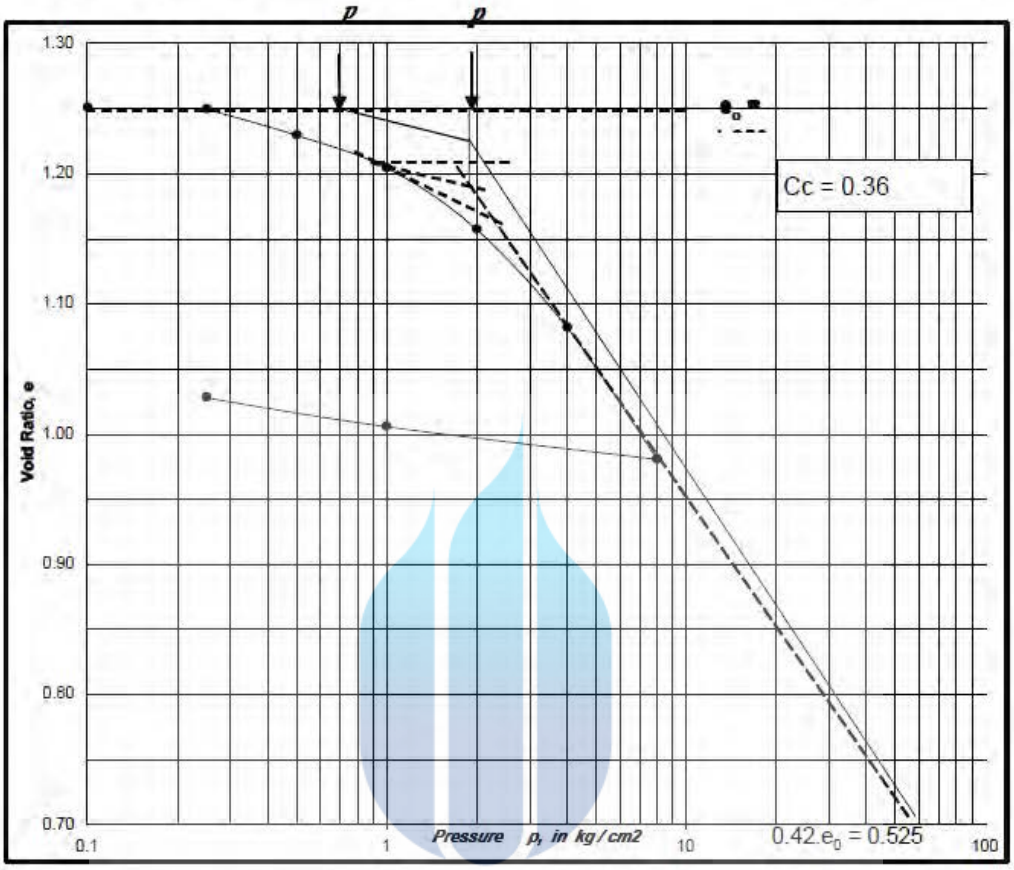
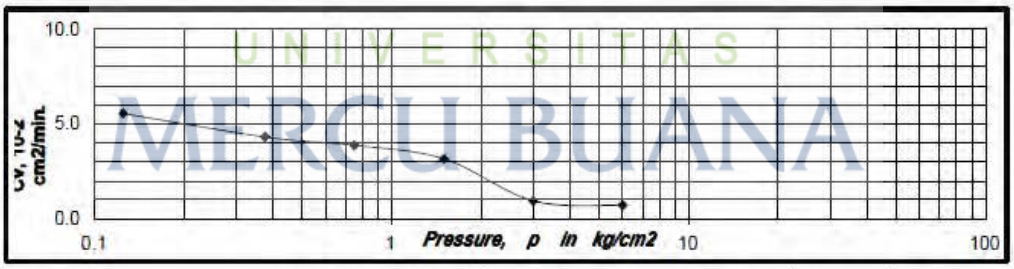
CONSOLIDATION TEST - *e* log *p* CURVE

PROJECT : SHELL PETROL STATION
LOCATION: KUNINGAN - JAKARTA SELATAN

TESTED BY : Lodang
CHECKED BY : djoko





Date of Testing	: **15~19 DES. 2012**	SPECIMEN IDENTITY		Initial	Final
SAMPLE CODE	: **BH.3-UDS. 2**	Diameter ,	cm	5.050	5.050
Depth	: **4.00 ~ 4.50 M**	Height ,	cm	2.000	1.802
Eff.Overb.Pressure, p_o :	**0.68** *kg/cm²*	Water Content ,	%	43.400	38.332
Critical Pressure, p_c :	**2.18** *kg/cm²*	Dry Density ,	t/m³	1.182	1.312
		Specific Gravity,		2.660	
		Void Ratio ,		1.250	1.028
		Degree of Saturation	%	92.32	99.19

No. :

Fig.

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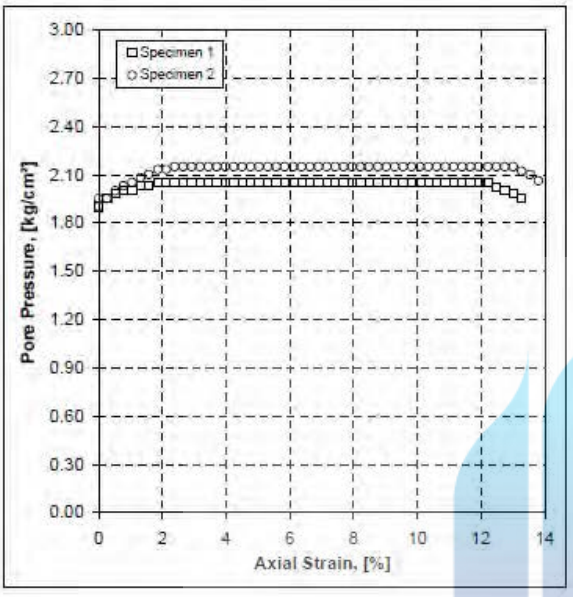
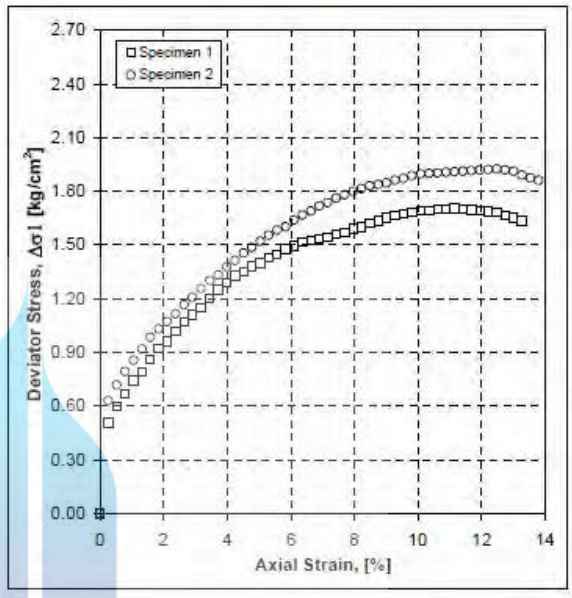
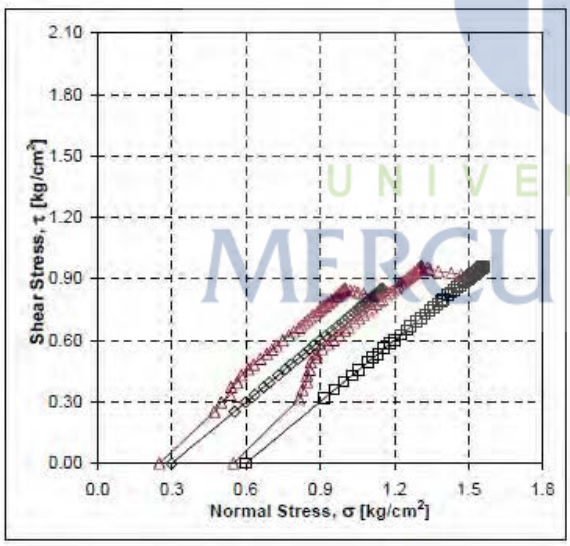
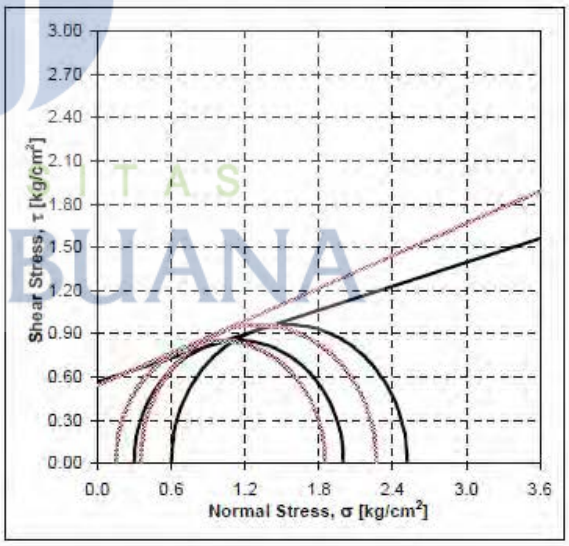
CU TRIAXIAL COMPRESSION TEST (ASTM D 4767)

Project No.	: -	Borehole	: BH-1 / UDS-2
Client	: -	Depth (m)	: 3.00 - 3.50
Project	: BANK DANAMON	Tested date	: December 17, 2012
Location	: Kuningan - Jakarta Selatan	Tested by	: Znr
		Checked by	: Rdt









STRENGTH PARAMETERS			
Total Stress		Effective Stress	
ϕ (°)	15.46	ϕ' (°)	20.66
Cu, kg/cm²	0.57	C', kg/cm²	0.53

Moisture Content (%)	40.54	40.67
Unit Weight (kN/m³)	17.38	17.47
Specific Gravity	2.653	2.653
Void Ratio	1.102	1.093

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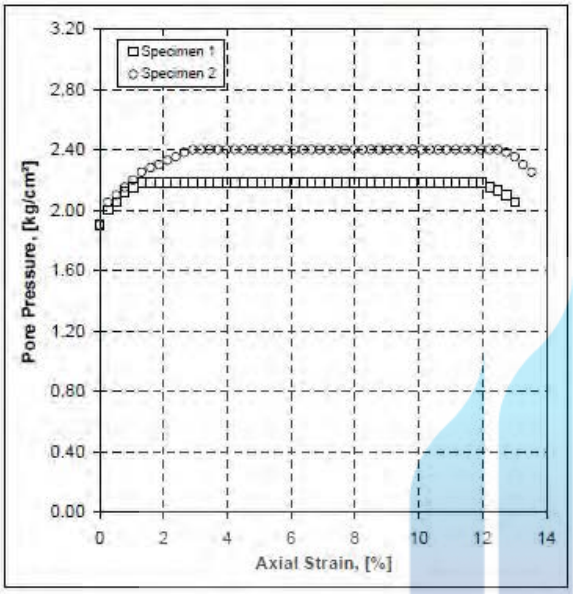
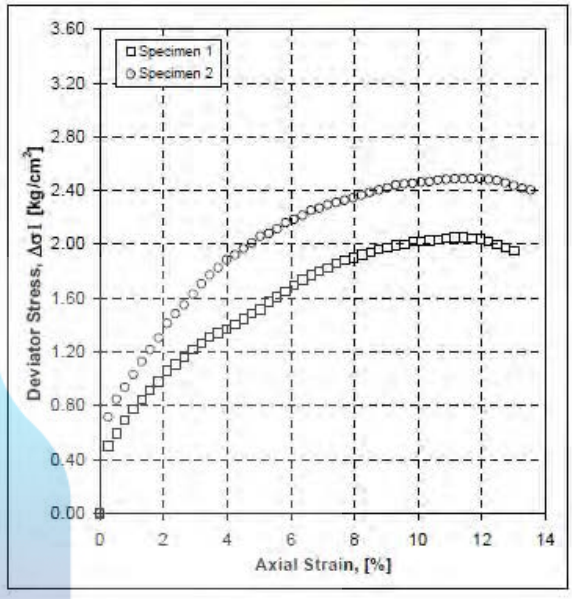
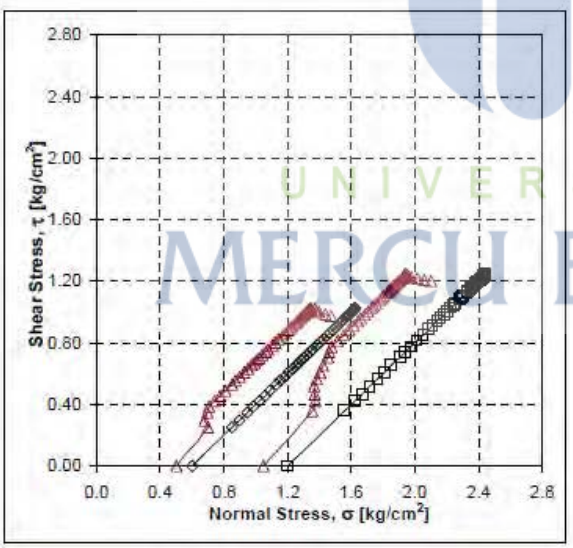
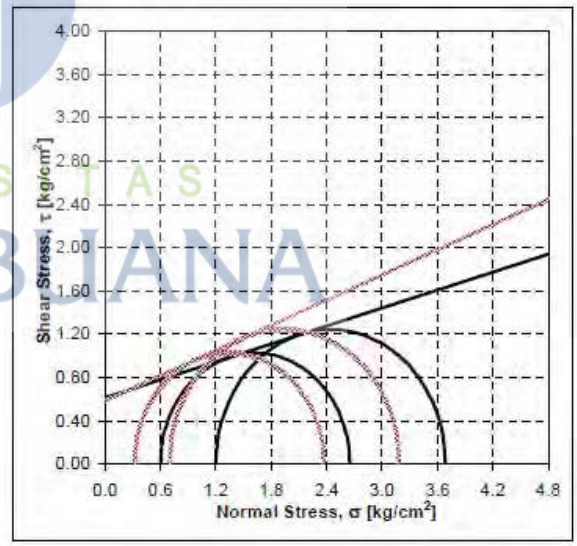
CU TRIAXIAL COMPRESSION TEST (ASTM D 4767)

Project No.	: -	Borehole	: BH-1 / UDS-3
Client	: -	Depth (m)	: 7.00 - 7.50
Project	: BANK DANAMON	Tested date	: December 20, 2012
Location	: Kuningan - Jakarta Selatan	Tested by	: Znr
		Checked by	: Rdt









STRENGTH PARAMETERS			
Total Stress		Effective Stress	
ϕ (°)	15.44	ϕ' (°)	21.36
Cu, kg/cm²	0.62	C', kg/cm²	0.58

Moisture Content (%)	41.36	41.80
Unit Weight (kN/m³)	17.11	17.16
Specific Gravity	2.641	2.641
Void Ratio	1.139	1.139

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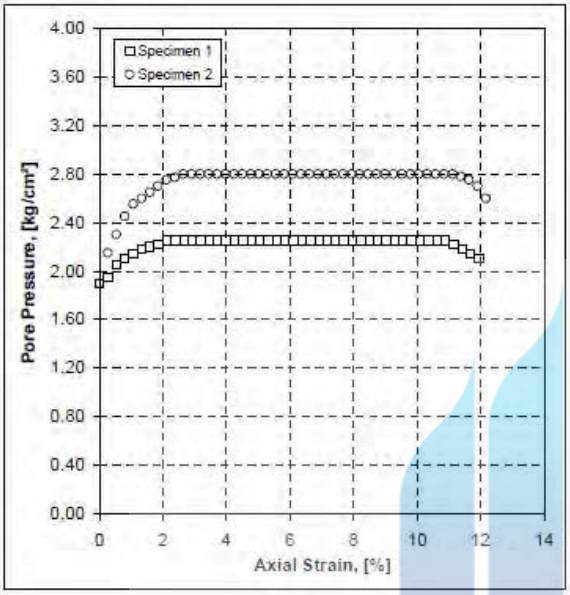
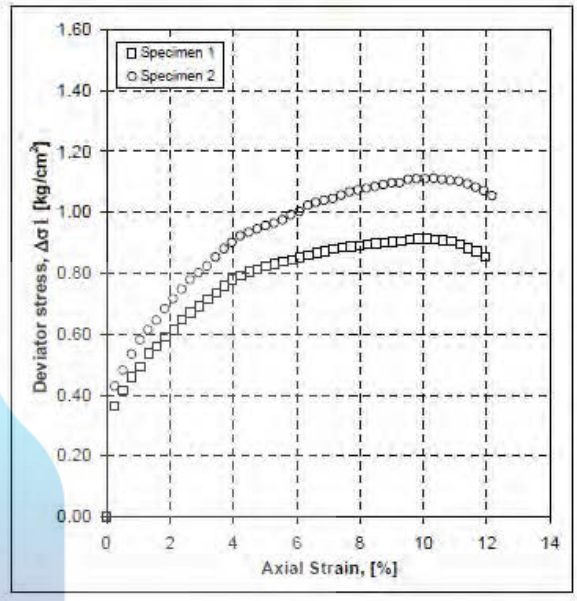
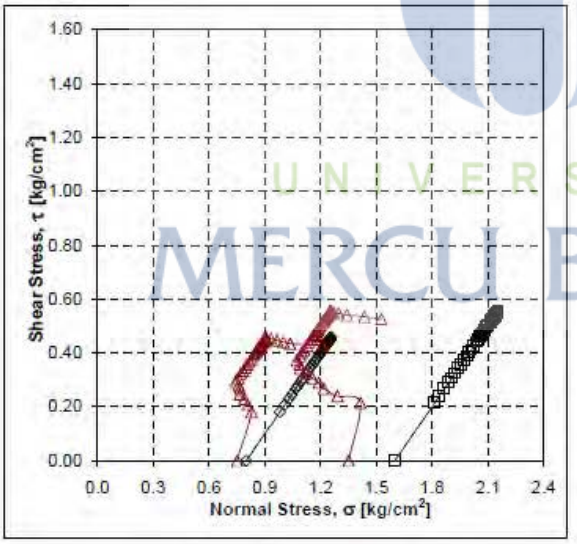
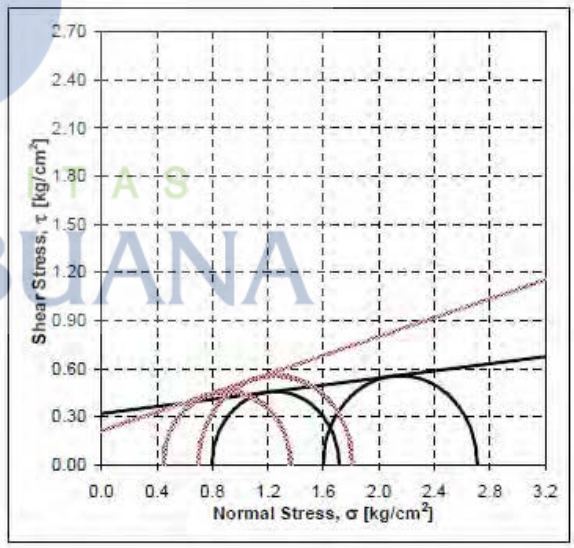
CU TRIAXIAL COMPRESSION TEST (ASTM D 4767)

Project No.	: -	Borehole	: BH-2 / UDS-1
Client	: -	Depth (m)	: 10.00 - 10.50
Project	: BANK DANAMON	Tested date	: December 20, 2012
Location	: Kuningan - Jakarta Selatan	Tested by	: Znr
		Checked by	: Rdt









STRENGTH PARAMETERS			
Total Stress		Effective Stress	
ϕ (°)	6.32	ϕ' (°)	16.47
Cu, kg/cm²	0.32	C', kg/cm²	0.21

Moisture Content (%)	54.69	55.10
Unit Weight (kN/m³)	16.19	16.21
Specific Gravity	2.640	2.640
Void Ratio	1.472	1.476

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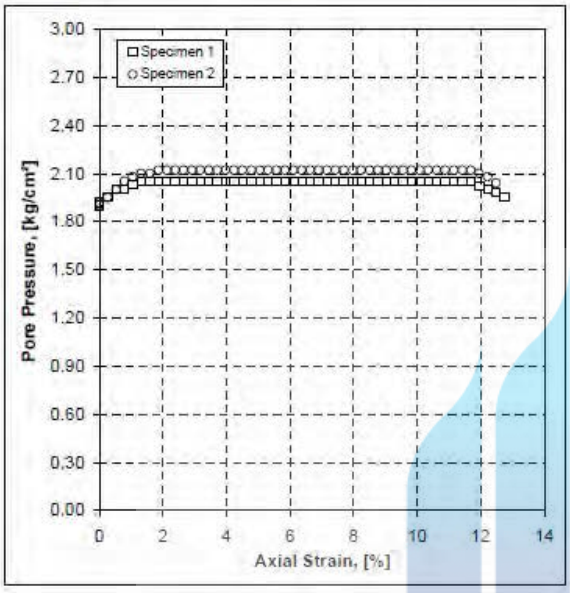
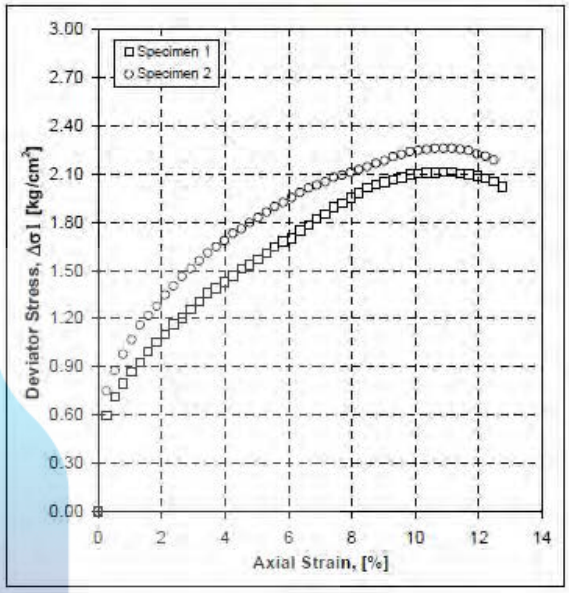
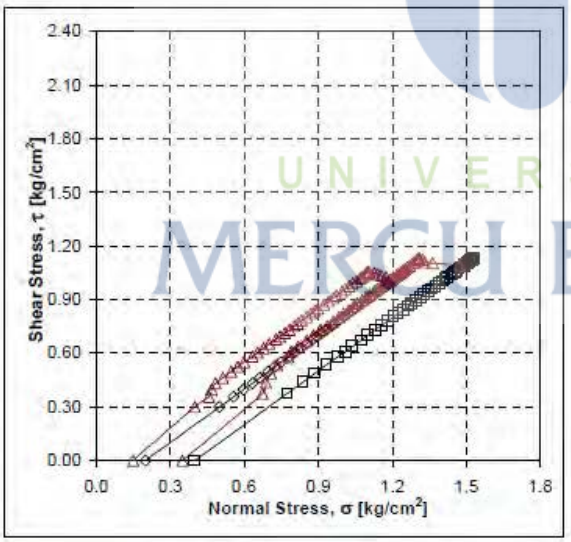
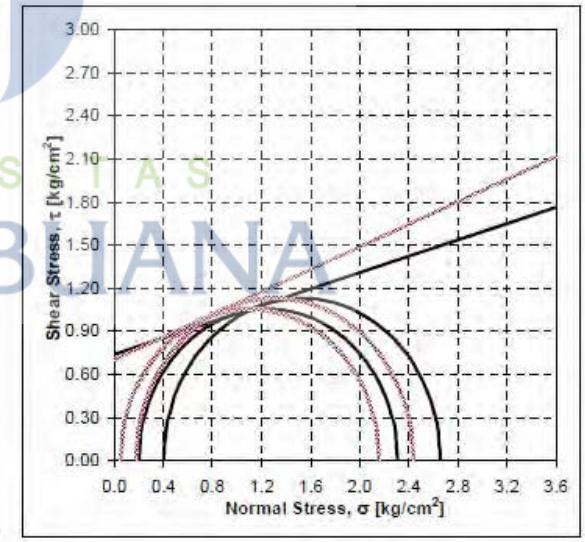
CU TRIAXIAL COMPRESSION TEST (ASTM D 4767)

Project No.	: -	Borehole	: BH-3 / UDS-1
Client	: -	Depth (m)	: 1.50 - 2.00
Project	: BANK DANAMON	Tested date	: December 17, 2012
Location	: Kuningan - Jakarta Selatan	Tested by	: Znr
		Checked by	: Rdt









STRENGTH PARAMETERS			
Total Stress		Effective Stress	
ϕ (°)	15.88	ϕ' (°)	21.53
Cu, kg/cm²	0.74	C', kg/cm²	0.70

Moisture Content (%)	38.20	38.43
Unit Weight (kN/m³)	17.63	17.68
Specific Gravity	2.660	2.660
Void Ratio	1.044	1.041

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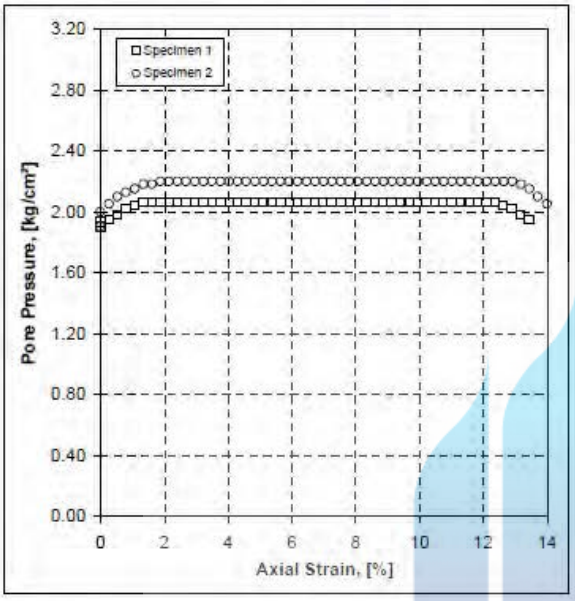
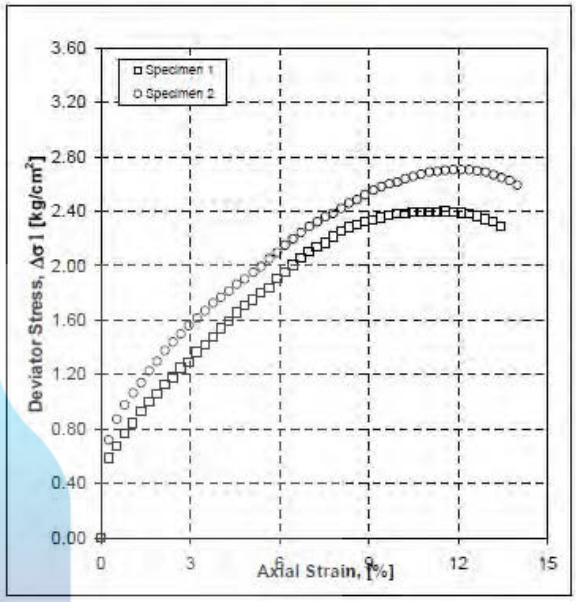
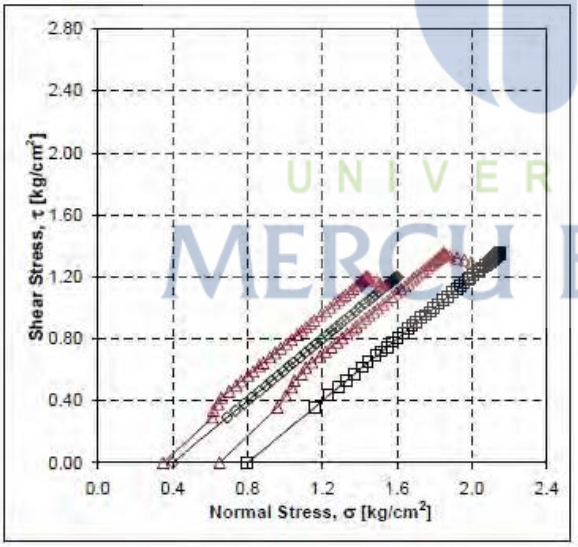
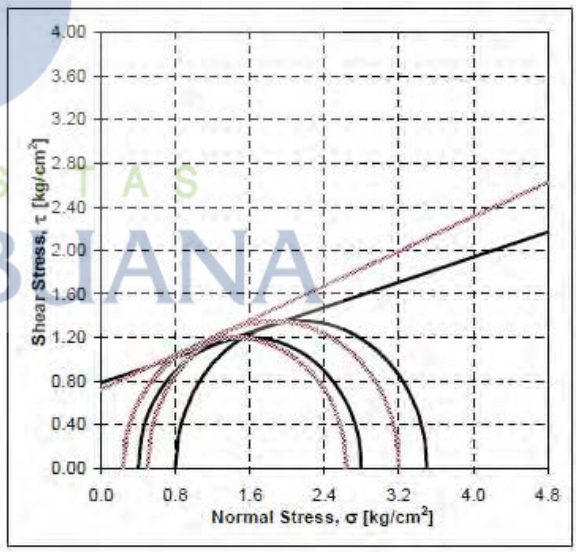
CU TRIAXIAL COMPRESSION TEST (ASTM D 4767)

Project No.	: -	Borehole	: BH-3 / UDS-2
Client	: -	Depth (m)	: 4.00 - 4.50
Project	: BANK DANAMON	Tested date	: December 17, 2012
Location	: Kuningan - Jakarta Selatan	Tested by	: Znr
		Checked by	: Rdt









STRENGTH PARAMETERS			
Total Stress		Effective Stress	
ϕ (°)	16.07	ϕ' (°)	21.75
Cu, kg/cm²	0.79	C', kg/cm²	0.72

Moisture Content (%)	44.10	43.71
Unit Weight (kN/m³)	16.97	16.95
Specific Gravity	2.660	2.660
Void Ratio	1.213	1.210

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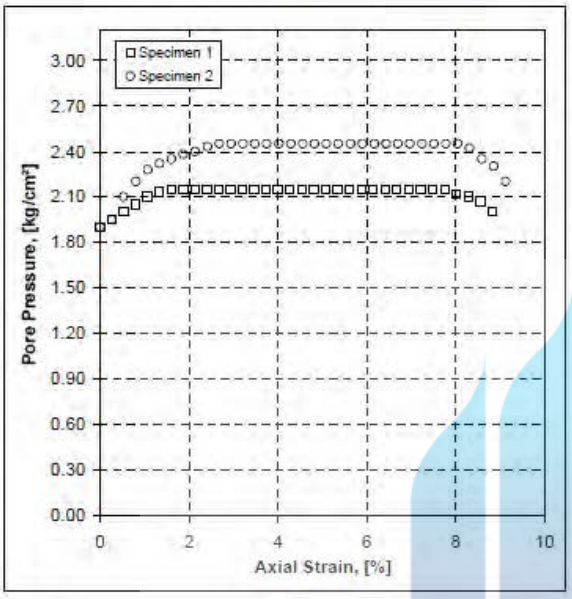
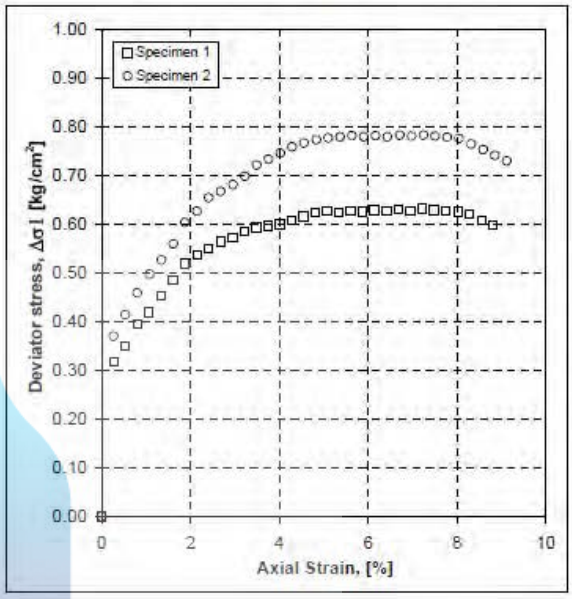
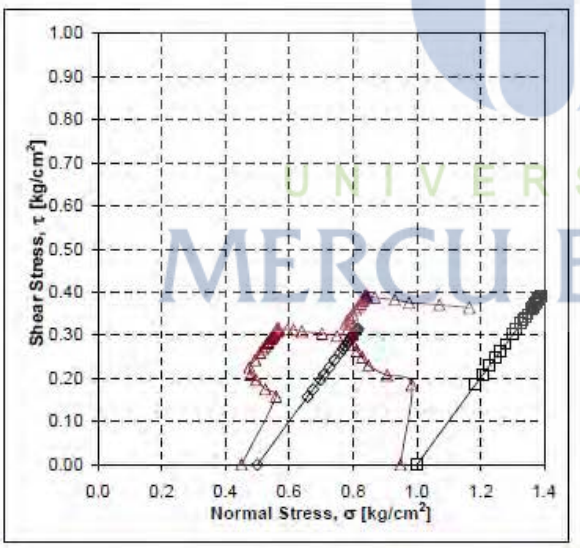
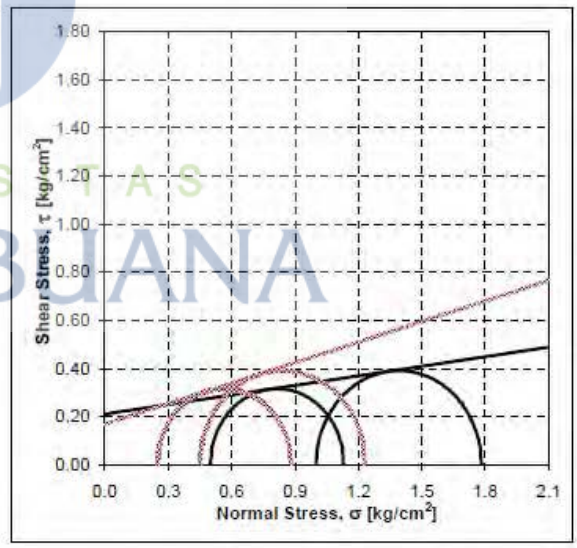
CU TRIAXIAL COMPRESSION TEST (ASTM D 4767)

Project No.	: -	Borehole	: BH-3 / UDS-3
Client	: -	Depth (m)	: 6.50 - 7.00
Project	: BANK DANAMON	Tested date	: December 20, 2012
Location	: Kuningan - Jakarta Selatan	Tested by	: Znr
		Checked by	: Rdt









STRENGTH PARAMETERS			
Total Stress		Effective Stress	
ϕ (°)	7.55	ϕ' (°)	15.92
Cu, kg/cm²	0.21	C', kg/cm²	0.17

Moisture Content (%)	64.42	64.52
Unit Weight (kN/m³)	15.48	15.50
Specific Gravity	2.633	2.633
Void Ratio	1.740	1.738

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LAMPIRAN – 4

Photo Pelaksanaan Pekerjaan

Dan Core Samples

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DATA SONDIR & BOR

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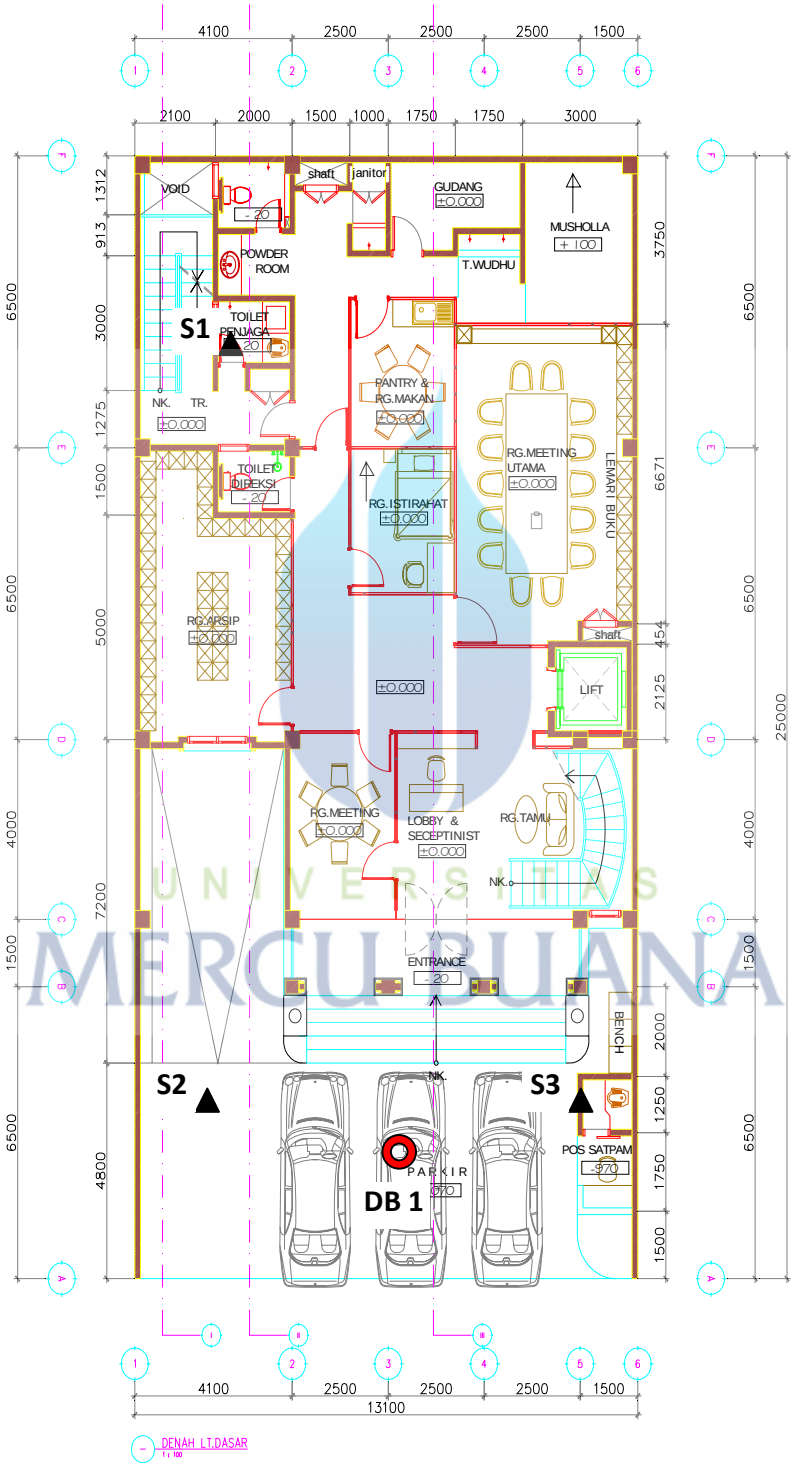
LAMPIRAN :

Layout Titik Soil Test



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Dokumentasi :

Foto Bor Dalam 1 Lokasi Jl. Surya No. 54 Kebayoran Baru

Foto Sondir 2 Lokasi Jl. Surya No. 54 Kebayoran Baru

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Foto Sondir 1 Lokasi Jl. Surya No. 54 Kebayoran Baru

Foto Sondir 3 Lokasi Jl. Surya No. 54 Kebayoran Baru

PROJECT : RUMAH TINGGAL

DATE : 10-11/3/2012

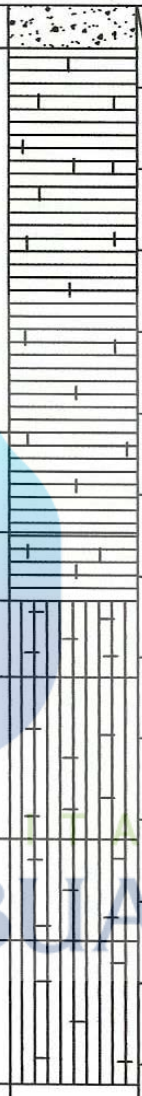
LOCATION : KEBAYORAN BARU

POINT : DB1

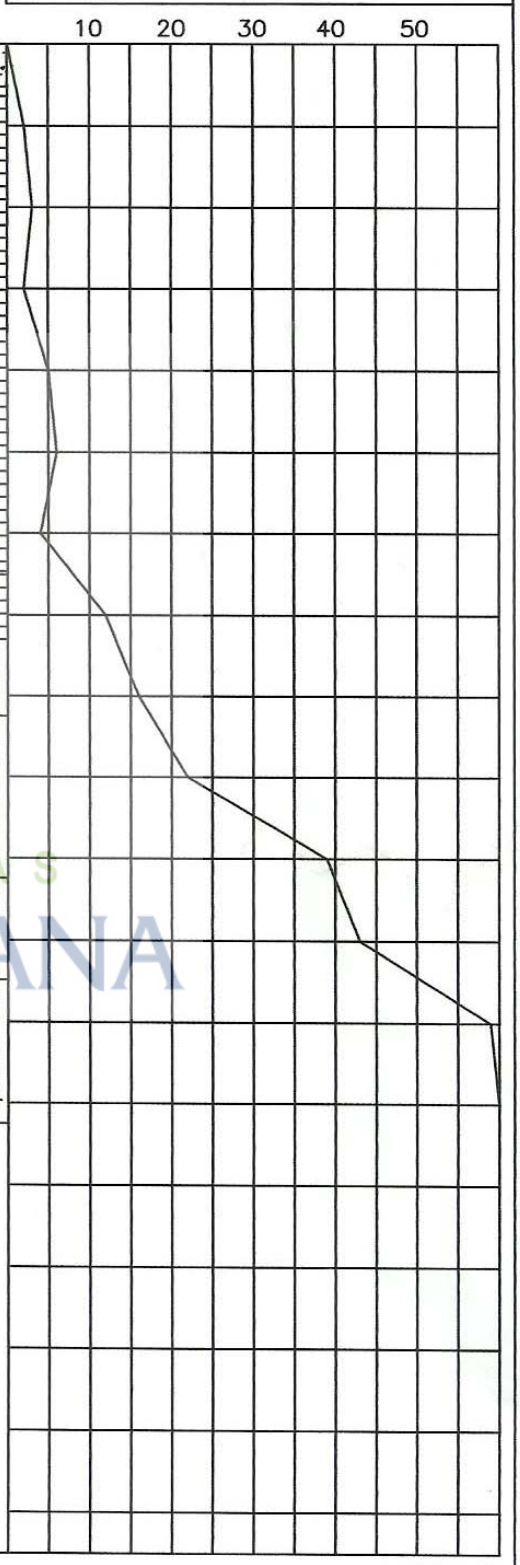
BORING LOG

DEPTH IN METER	SAMPLE & SPT	BLOWS	DESCRIPTION
0			Urugan puing-puing
2	■⊠	2	Lempung kelanauan, soft to medium stiff, berwarna coklat
4	■⊠	3	
6	⊠	2	
8	⊠	5	
10	⊠	6	
12	⊠	4	Lempung kelanauan, medium stiff, berwarna coklat keputihan
14	⊠	12	Lempung kelanauan, stiff, berwarna coklat abu-abu kehitaman
16	⊠	16	Lanau kelempungan, stiff, berwarna coklat keabuan
18	⊠	22	Lanau kelempungan, very stiff to hard, berwarna coklat kehitaman
20	⊠	39	
22	⊠	43	Lanau lempung membatu, hard, berwarna coklat keabuan
24	⊠	59	Lanau lempung membatu, hard, berwarna hitam kecoklatan
26	⊠	>60	
			Stop bor 26.50m
28	⊠		
30	⊠		
32	⊠		
34	⊠		
36	⊠		

SYMBOL



SPT CURVE



LEGEND

- ■ UNDISTURBED SAMPLE
- ⊠ SPT
- CLAY
- SILT
- SAND
- GRAVEL
- ORGANIK

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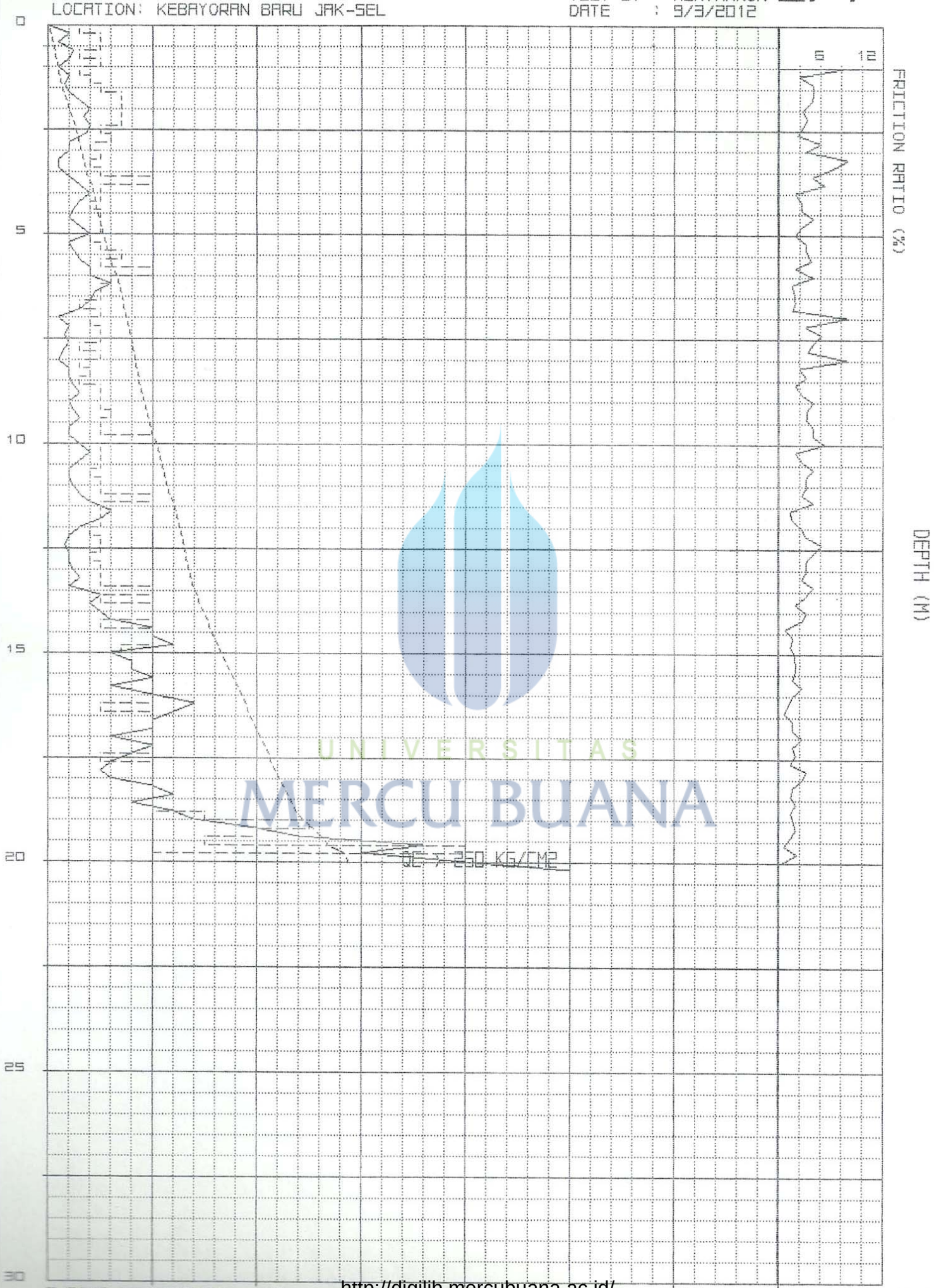
PROJECT : RUMAH TINGGAL
POINT : S1
LOCATION: KEBAYORAN BARU JAK-SEL

TEST NO :
TEST BY : MUKTHARON
DATE : 9/3/2012

CPT



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CONE RESISTANCE	100		200	300	400 KG/CM2
LOCAL FRICTION	2.0		4.0	6.0	8.0 KG/CM2
TOTAL FRICTION	1000		2000	3000	4000 KG/CM

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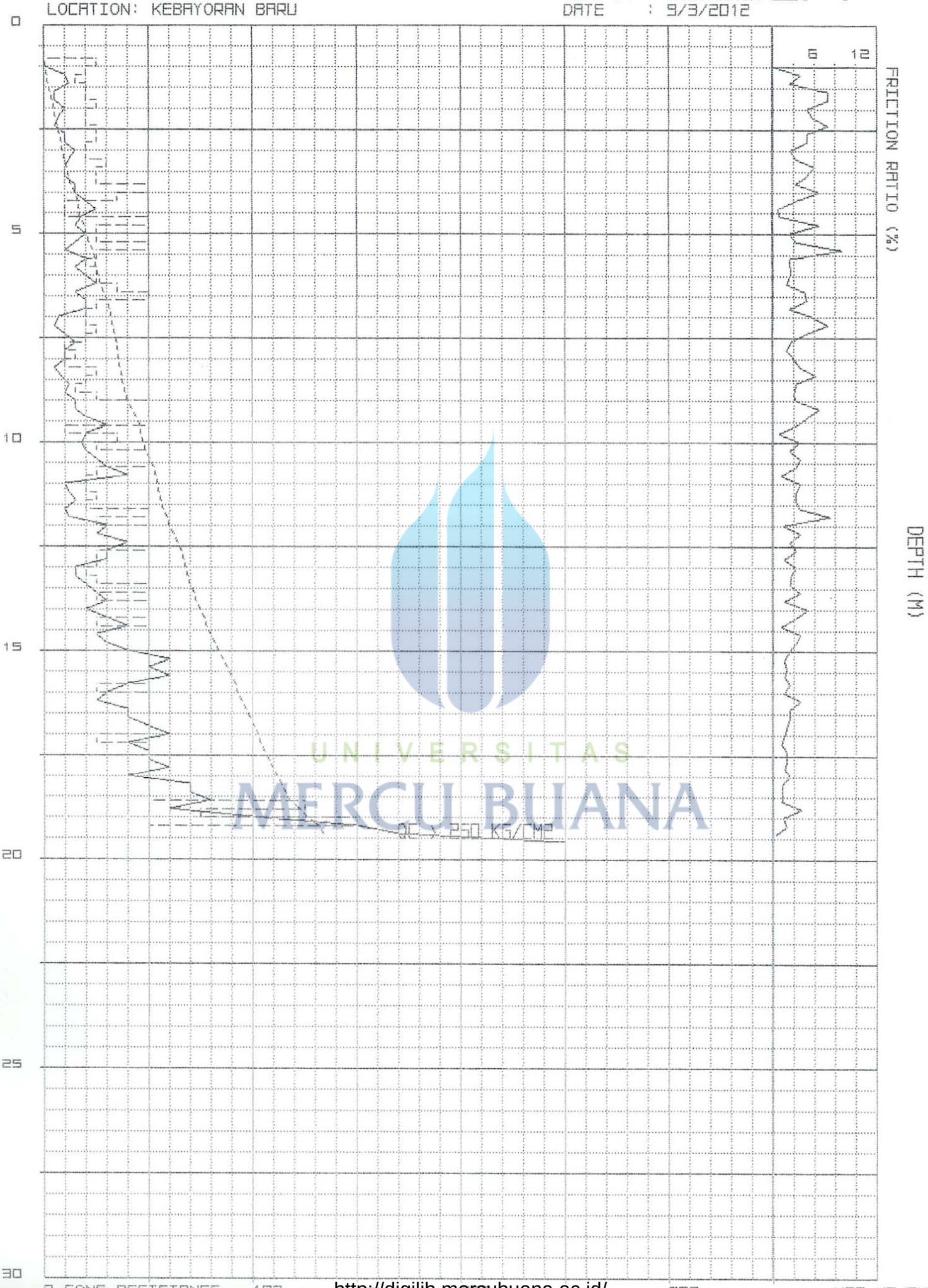
PROJECT : RUMAH TINGGAL
POINT : 52
LOCATION: KEBAYORAN BARU

TEST NO :
TEST BY : MUKTHARON
DATE : 9/3/2012

CPT



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O CONE RESISTANCE	100			300	400 KG/CM2
O LOCAL FRICTION	2.0		4.0	6.0	8.0 KG/CM2
O TOTAL FRICTION	1000		2000	3000	4000 KG/CM

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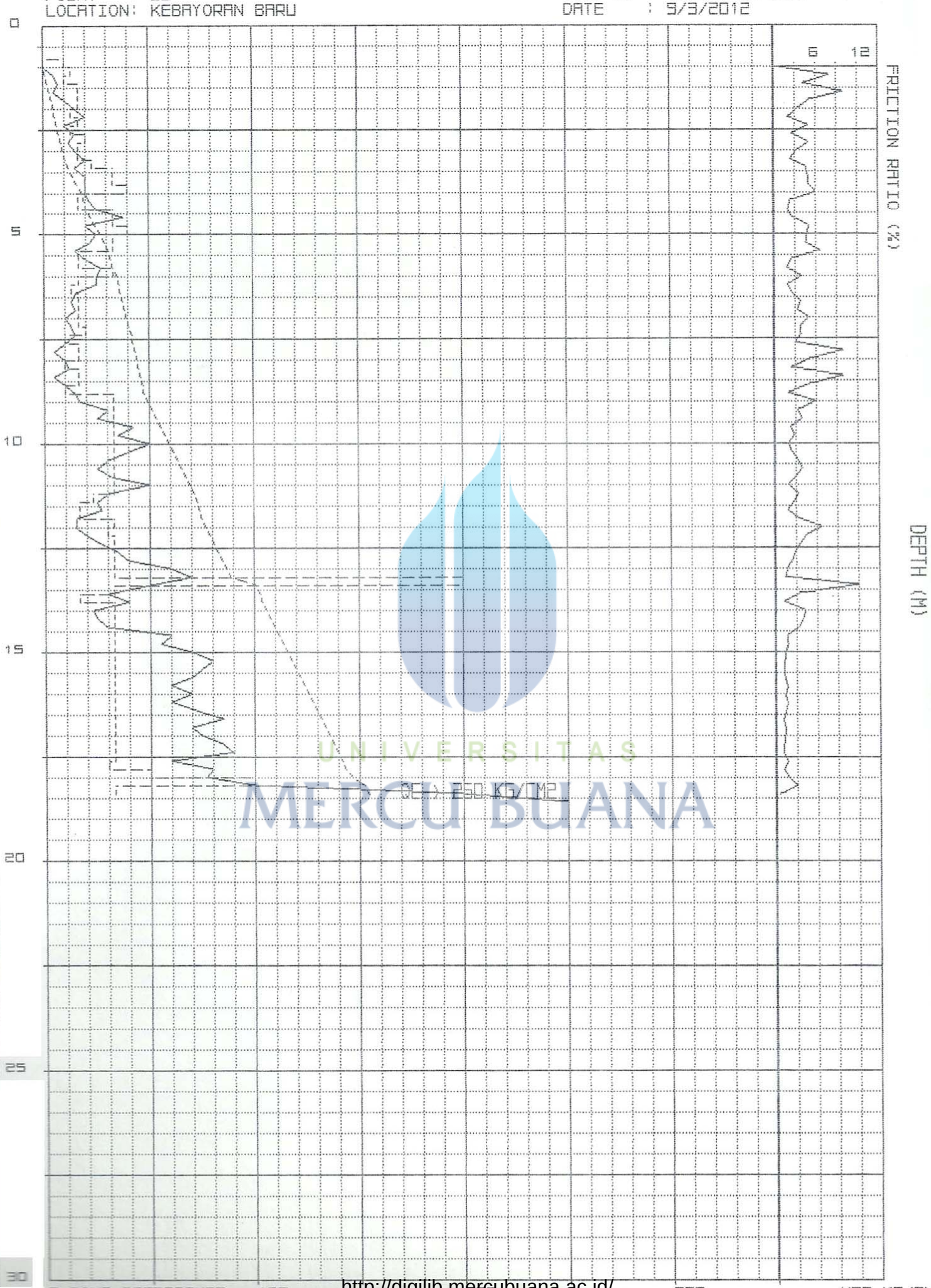
PROJECT : RUMAH TINGGAL
POINT : 53
LOCATION: KEBAYORAN BARU

TEST NO :
TEST BY : MUKTHARON
DATE : 9/3/2012

CPT



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0 CONE RESISTANCE	100		300		400 KG/CM2
0 LOCAL FRICTION	3.0		6.0	9.0	12.0 KG/CM2
0 TOTAL FRICTION	1000		2000	3000	4000 KG/CM

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LAMPIRAN A: DATA

- **PENYELIDIKAN LAPANGAN**

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PENYELIDIKAN LAPANGAN – STANDART PENENTRATION TEST

(SPT)

BORING LOG

HOLE NO.	BH	II

Project Name	: UPPD Petamburan/Tomang	Type of Driling	: Wash Boring	Coordinat.
Location	: Petamburan	Driller	: Jana	x -
Ground Level (GL)	: -	Date	: 08-10 Desember 2013	y -
Ground Wtr Level (GWL)	: 5.10 m	Supervisor	: -	z -

SCALE	DEPTH. (m)	ELEVATION. (m)	THICKNESS. (m)	LOG SYMBOL	GENERAL SOIL DESCRIPTION	FIELD SAMPLING AND TESTING Depth Below Existing Ground Level in M		Blowa Penetrastion Each 15 cm N-1	N-2	N-3	N Blows N2+N3 30 cm	N-Value	γw t/m3	Gs	W %	LL %	PL %	Type	C kg/cm2	ϕ
1			2.50	MI	Tanah merah berlapis abu-abu, berbintik keputihan, bergradasi halus agak berpasir sedikit, dan lembab agak lengket lempung	UDS 1	1.00 - 1.55													
2	2.50					SPT 1	1.00 - 2.50	2	2	4	6									
3			2.00	MI	Tanah merah berlapis abu-abu, berbintik keputihan, bergradasi halus agak berpasir sedikit, dan lembab agak lengket lempung	UDS 2	3.00 - 3.55													
4	4.50					SPT 2	2.50 - 4.50	2	3	4	7									
5			2.00	MI	Tanah merah berlapis abu-abu, berbintik keputihan, bergradasi halus agak berpasir sedikit, dan lembab agak lengket lempung	UDS 3	5.00 - 5.55													
6	6.50					SPT 3	4.50 - 6.50	3	5	6	11									
7			2.00	MI	Tanah merah berlapis abu-abu, berbintik keputihan, bergradasi halus agak berpasir sedikit, dan lembab agak lengket lempung															
8	8.50					SPT 4	6.50 - 8.50	2	3	3	6									
9			2.00	MI	Tanah merah berlapis abu-abu, berbintik keputihan, bergradasi halus agak berpasir sedikit, dan lembab agak lengket lempung															
10	10.50					SPT 5	8.50 - 10.50	3	3	5	8									
11			2.00	MI	Tanah merah berlapis abu-abu, berbintik keputihan, bergradasi halus agak berpasir sedikit, dan lembab agak lengket lempung															
12	12.50					SPT 6	10.50 - 12.50	5	7	11	18									
13			2.00	MI	Tanah merah berlapis abu-abu, berbintik keputihan, bergradasi halus agak berpasir sedikit, dan lembab agak lengket lempung															
14	14.50					SPT 7	12.50 - 14.50	6	9	14	23									
15			2.00	MI	Tanah merah berlapis abu-abu, berbintik keputihan, bergradasi halus agak berpasir sedikit, dan lembab agak lengket lempung															
16	16.50					SPT 8	14.50 - 16.50	9	11	25	36									
17			2.00	SF	Tanah coklat tua kemerahan, berbintik putih, bergradasi kasar agak berpasir, dan lengket lempung															
18	18.50					SPT 9	16.50 - 18.50	11	21	29	50									
19			2.00	SF	Tanah coklat tua kemerahan, berbintik putih, bergradasi kasar agak berpasir, dan lengket lempung															
20	20.50					SPT 10	18.50 - 20.50	13	25	35	60									
21			2.00	SF	Tanah coklat tua kemerahan, berbintik putih, bergradasi kasar agak berpasir, dan lengket lempung															
22	22.50					SPT 11	20.50 - 22.50	21	35	45	80									
23			2.00	SF	Tanah coklat tua kemerahan, berbintik putih, bergradasi kasar agak berpasir, dan lengket lempung															
24	24.50					SPT 12	22.50 - 24.50	20	37	46	83									
25			2.00	SW	Tanah berpasir kehitaman, bergradasi kasar sedikit berpasir dan lengket lempung															
26	26.50					SPT 13	24.50 - 26.50	18	20	21	41									
27			2.00	SW	Tanah berpasir kehitaman, bergradasi kasar sedikit berpasir dan lengket lempung															
28	28.50					SPT 14	26.50 - 28.50	19	21	23	44									
29			2.00	SW	Tanah berpasir kehitaman, bergradasi kasar sedikit berpasir dan lengket lempung															
30	30.50					SPT 15	28.50 - 30.50	20	21	23	44									
31			2.00																	
32	32.50					SPT 16	30.50 - 32.50	0	0	0	0									
33			2.00																	
34	34.50					SPT 17	32.50 - 34.50	0	0	0	0									
35			2.00																	
36	36.50					SPT 18	34.50 - 36.50	0	0	0	0									
37			2.00																	
38	38.50					SPT 19	36.50 - 38.50	0	0	0	0									
39			1.50																	
40	40.00					SPT 20	38.50 - 40.00	0	0	0	0									

LEGEND :				
	UNDISTURBED SAMPLE	CLAY	ALLUVIAL	GROUND WATER LEVEL
	DISTURBED SAMPLE	SILT	ORGANIC	FINE SAND
	SPT TEST	SAND	TUFF ROCK	GRAVELL

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LAMPIRAN B:
DATA

- **PENYELIDIKAN DILABORATORIUM**

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PENYELIDIKAN DILABORATORIUM
PEMERIKSAAN KADAR AIR ASLI

(Natural Water Content Test)

Project	: UPPD	Tested by	: Lab. UIKA
Location	: Petamburan	Date	: 01 – 01 – 2014
Coordinates	X:…… Y:……	Point	: HB
Ground Elevasi	: - m	Checked by	: Feril Hariati, ST., M. Eng
Groung Water Elev.	: 5.10 m		

Boring No.		**BH-2**		
Depth	**(m)**	**1.00-1.55**	**3.00-3.55**	**5.00-5.55**
UDS No.		**UDS1**	**UDS2**	**UDS3**
Berat Cawan + Tanah Basah (W_1)	(gr)	30,6	28,5	26,2
Berat Cawan + Tanah Kering (W_2)	(gr)	29,9	27,9	25,7
Berat Air (W_3) = (W_1) - (W_2)	(gr)	0,7	0,6	0,5
Berat Cawan (W4)	(gr)	11	11	11
Berat Kering (W5) = (W2) - (W4)	(gr)	18,9	16,9	14,7
Kadar Air (W3) / (W5) x 100%	(%)	3,70	3,55	3,40

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Analisa hasil:

Dari hasil pengujian, nampak bahwa pemeriksaan kadar air diperoleh untuk UDS1 = 3,70%, UDS2 = 3.55%, UDS3 = 3.40% dan hal ini menunjukkan bahwa dari hasil penelitian kadar air tanah tersebut cukup sedang untuk digunakan struktur pondasi dalam maupun dangkal, diperlukan perbaikan tanah berupa pembuangan muka air tanah. [***Braja M.Das., MT***]

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PEMERIKSAAN BERAT JENIS

(Specific Gravity Test)

Project	: UPPD	Tested by	: Lab. UIKA
Location	: Petamburan	Date	: 02 – 01 – 2014
Coordinates	X:…… Y:……	Point	: HB
Ground Elevasi	: - m	Checked by	: Feril Hariati, ST., M. Eng
Groung Water Elev.	: 5.10 m		

Boring No.		**BH-2**		
Depth	**(m)**	**1.00-1.55**	**3.00-3.55**	**5.00-5.55**
UDS No.		**UDS1**	**UDS2**	**UDS3**
Berat piknometer + Tanah (W1)	(gr)	49,2	47,6	48,6
Berat piknometer (W2)	(gr)	35,5	30,5	35,6
Berat Tanah (WT) = (W1) - (W2)	(gr)	13,7	17,1	13
Berat piknometer + Air + Tanah (W3)	(gr)	144	145,8	140,6
Berat piknonmeter + Air (Pada T) (W4)	(gr)	135,1	135,1	132,6
(W5) = (W1 - W2) + W4	(gr)	148,8	152,2	145,6
Isi Tanah (W5) - (W3)	(gr)	4,80	6,40	5,00
Berat Jenis Tanah (Gs) = (WT/(W5 - W3))	(gr/cm3)	2,854	2,672	2,600

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Analisa hasil:

Dari hasil pengujian, didapat nilai *specific gravity* (Gs) sebesar UDS1 = 2.854 gr/cm^3, UDS2 = 2.672 gr/cm^3, UDS3 = 2.600 gr/cm^3. Hal ini menunjukkan bahwa berat jenis tanah tersebut masih cukup baik dan cocok untuk konstruksi yang mendapatkan tekanan dari massa tanah itu sendiri. Parameter berat jenis tanah yang baik untuk konstruksi adalah 2.1 - 2.8 %. Jadi dapat dikatakan percobaan berjalan dengan baik. Berdasarkan Gs yang diperoleh, contoh tanah yang dipakai pada percobaan ini termasuk jenis tanah dengan mineral tanah *Kalsit* ***[Wesley L.D. "Mekanika Tanah", PU, 1977 & Bowles, J.E. Engineering Properties of Soils and their Measurement, Mc Graw Hill, 1979].***

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Tabel Nilai-Nilai Khas Berat Jenis Untuk Mineral-Mineral Tanah

Mineral	Berat Jenis	Mineral	Berat Jenis
Bentonit	2,13 - 2,18	Mika	2,80 - 2,90
Gipsum	2,30	Delomit	2,87
Gibsit	2,30 - 2,40	Aragonit	2,94
Montmorilonit	2,40	Anhydrit	3,00
Felspar Ortoklas	2,56	Biotit	3,00 - 3,10
Ilit	2,60	Hornblende	3,00 - 3,47
Kuarsa	2,60	Augit	3,20 - 3,40
Kaolinit	2,60 - 2,63	Olivin	3,27 - 3,37
Klorit	2,60 -3,00	Limonit	3,80
Felspar Plagioklas	2,62 - 2,76	Siderit	3,83 - 3,88
Talkum	2,70 - 2,80	Hermatit	4,90 - 5,30
Kalsit	2,80 - 2,90	Magnetit	5,17 - 5,18

dengan kemungkinan tanah tesebut termasuk golongan lanau atau ***lempung***, karena tanah lanau atau lempung mempunyai berat jenis berkisar antara 2,6 – 2,9. [**M Das, Braja.1993. *Mekanika Tanah Jilid I*. Jakarta: Erlangga. Bab 1 Tanah dan batuan, Hal 15 -17)**

Macam Tanah	Berat Jenis (*Gs*)
Kerikil	2,65 – 2, 68
Pasir	2,65 – 2, 68
Lanau organic	2,62 – 2, 68
Lempung organic	2,58 – 2,65
Lempung anorganik	2,68 – 2,75
Humus	1,37
Gambut	1,25 -1, 80

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LABORATORIUM TEKNIK SIPIL

PEMERIKSAAN BERAT ISI

(Unit Weight)

Project	: UPPD	Tested by	: Lab. UIKA
Location	: Petamburan	Date	: 03 – 01 – 2014
Coordinates	X:…… Y:……	Point	: HB
Ground Elevasi	: - m	Checked by	: Feril Hariati, ST., M. Eng
Groung Water Elev.	: 5.10 m		

A	**Nomor Ring/Nomor Cawan**			**UDSI**	**UDS2**	**UDS3**
B	**Kedalaman Tanah**		m	**1.00-1.55**	**3.00-3.55**	**5.00-5.55**
C	Berat Ring		gr	14,00	14,00	14,00
D	Berat cawan		gr	12,00	12,00	12,00
E	Berat Ring + Cawan + Tanah Basah		gr	72,20	73,60	73,10
F	Berat Tanah Basah (E) - (C) - (D)		gr	46,20	47,60	47,10
G	Volume Ring (Volume Tanah basah)		gr/cm^3	28,60	28,60	28,60
H	Berat Isi Tanah Basah (F)/(G)	(γw)	gr/cm^3	1,62	1,66	1,65
I	Berat Ring + Cawan + Tanah Kering		gr/cm^3	56,00	55,00	55,00
J	Berat Tanah Kering (I) - (C) - (D)		gr	30,00	29,00	29,00
K	Berat Air (F) - (J)		gr	16,20	18,60	18,10
L	Kadar Air ((K) / (J)) x 100%	(w)	%	54,00	64,14	62,41
M	Berat isi Tanah Kering (H)/(1+L)	(γd)	gr	0,03	0,03	0,03
N	Berat Jenis/GS		gr/cm^3	2,333	1,565	1,646
O	Volume Tanah Kering (J)/(N)		gr/cm^3	12,86	18,53	17,62
P	Isi Pori (G)-(O)	(e)		15,74	10,07	10,98
Q	Derajat Kejenuhan /Sr ((K)/(P)) x 100%	(Sr)	%	102,90	184,66	164,82
R	Porositas ((K)/(G)x100%	(n)	%	56,64	65,03	63,29

Analisa hasil: Dari hasil percobaan diatas dapat disimpulkan bahwa sampel tanah tersebut memiliki kadar air sebesar UDSI= 54.00%, UDS2= 64.14%, UDS3= 62.41% dan berat volume tanah kering sebesar UDSI= 12.86 gr/cm^3, UDS2= 18.53 gr/cm^3, UDS3= 17.62 gr/cm^3. Jadi dapat disimpulkan bahwa tanah tidak terlalu jenuh air. ***[Braja M.Das, Mekanika Tanah]***

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PEMERIKSAAN BATAS-BATAS ATTERBERG

(Atterberg limits)

Project	: UPPD	Tested by	: Lab. UIKA
Location	: Petamburan	Date	: 04 – 01 – 2014
Coordinates	X:…… Y:……	Point	: HB
Ground Elevasi	: - m	Checked by	: Feril Hariati, ST., M. Eng
Groung Water Elev.	: 5.10 m		

	Batas Cair UDS1					Batas Plastis
	Jumlah Pukulan		**28**	**25**	**17**	
	No. Krus		I	II	III	I
A	Berat Cawan + Tanah Basah	gr	40.4	38.4	27.4	27.5
B	Berat Cawan + Tanah Kering	gr	38.2	27.9	23.2	25.6
C	Berat Air (A - B)	gr	2.2	10.5	4.2	1.9
D	Berat Krus (Cawan)	gr	11.7	11.75	11.5	11.9
E	Berat Tanah Kering (B - D)	gr	26.5	16.15	11.7	13.7
F	Kadar Air	%	8.30	65.02	35.90	13.87
G	Rata-Rata	%	36.40			13.87

Batas Cair (Liquid Limits)	36.40	%
Batas Plastis (Plastis Limit)	13.87	%
Indeks Plastisitas (Plasticity Index)	22.54	%

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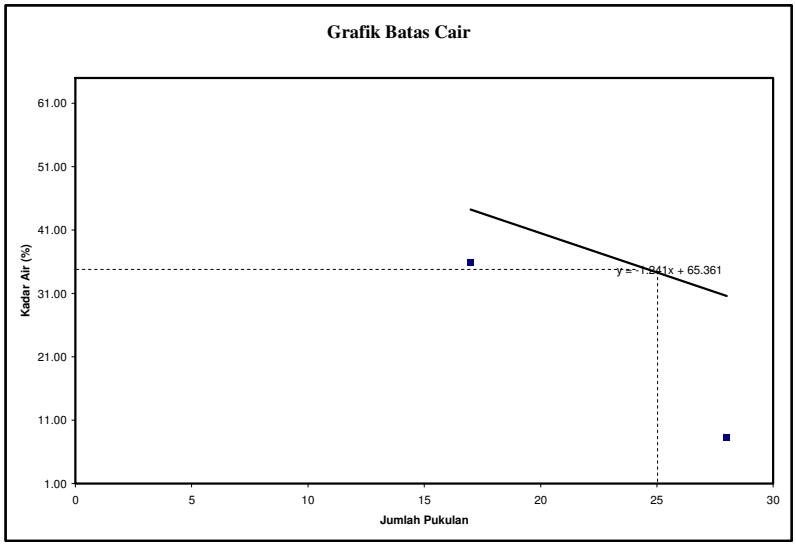

Batas Cair UDS2						Batas Plastis
Jumlah Pukulan			25	25	8	
	No. Krus		I	II	III	I
A	Berat Cawan + Tanah Basah	gr	30,1	35,1	27,6	26,8
B	Berat Cawan + Tanah Kering	gr	29,6	26,5	23,3	26,4
C	Berat Air (A - B)	gr	0,5	8,6	4,3	0,4
D	Berat Krus (Cawan)	gr	11,3	11,4	10,5	11,6
E	Berat Tanah Kering (B - D)	gr	18,3	15,1	12,8	14,8
F	Kadar Air	%	2,73	56,95	33,59	2,70
G	Rata-Rata	%	31,09			2,70

Batas Cair (Liquid Limits)	31,09	%
Batas Plastis (Plastis Limit)	2,70	%
Indeks Plastisitas (Plasticity Index)	28,39	%

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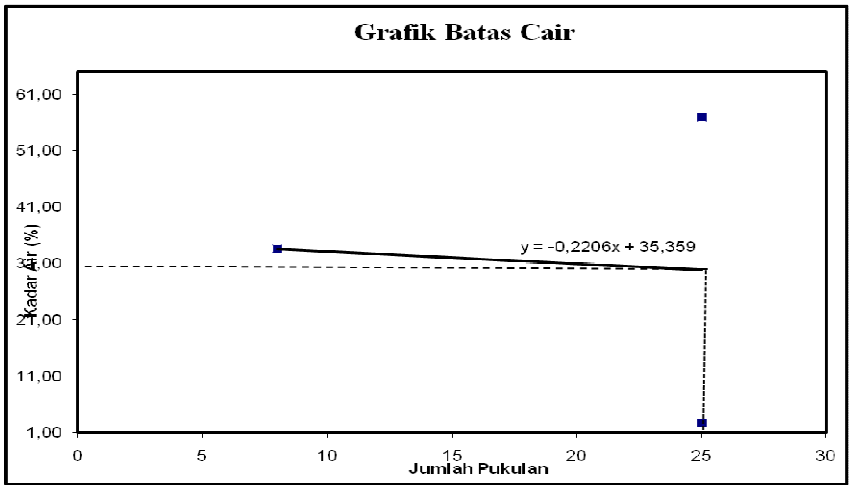

Batas Cair UDS3						Batas Plastis
Jumlah Pukulan			30	25	12	
	No. Krus		I	II	III	I
A	Berat Cawan + Tanah Basah	gr	39.6	35.9	29.2	23.7
B	Berat Cawan + Tanah Kering	gr	35.2	26.4	22.2	21.5
C	Berat Air (A - B)	gr	4.4	9.5	7	2.2
D	Berat Krus (Cawan)	gr	11.7	11.75	11.5	11.9
E	Berat Tanah Kering (B - D)	gr	23.5	14.65	10.7	9.6
F	Kadar Air	%	18.72	64.85	65.42	22.92
G	Rata-Rata	%		49.66		22.92

Batas Cair (Liquid Limits)	49.66	%
Batas Plastis (Plastis Limit)	22.92	%
Indeks Plastisitas (Plasticity Index)	26.75	%

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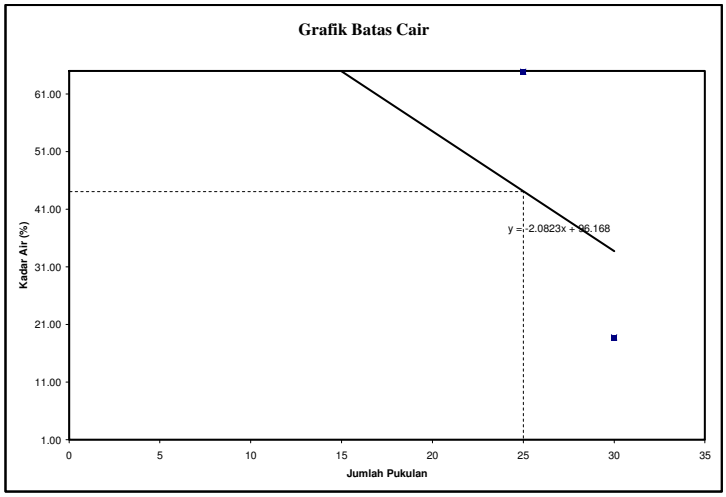


Sumber Kesalahan:

1. Kurang teliti pada waktu menimbang.
2. Adukan tanah kurang homogen.
3. Batang tanah tidak tepat berdiameter 1/8" (3 mm) secara merata.

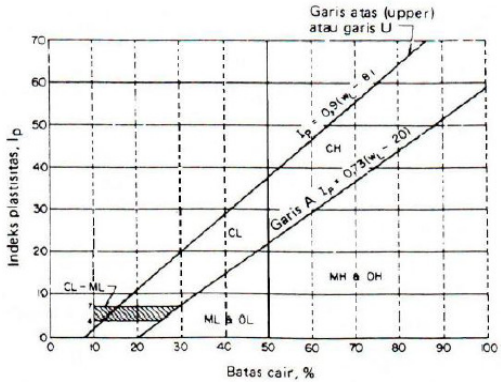
Analisa hasil:

Setelah dilakukan pertimbangan dari data *plastic limit* dan *liquid limit* dapat dilihat klasifikasi dari contoh tanah. Caranya adalah dengan memplot harga *plasticity indexs* dan *liquid limit* pada *plasticity chart*. Dari titik yang didapat, diketahui klasifikasi dari tanah tersebut UDSI= 22.54%, UDS2= 28.39%, UDS3= 26.75% berperilaku sebagai tanah kelempungan yang berpasir halus dan sedikit kasar (MI untuk UDS1, UDS2, UDS3) dengan nilai indeks plastisitas sedang. [***Braja M.Das., MT &*** **Bowles, 1986***]

Tabel Potensi Pengembangan Berdasarkan Indeks Plastisitas

Potensi Pengembangan	Indeks Plastisitas
Rendah	0 – 15
Sedang	10 – 35
Tinggi	21 – 35
Sangat tinggi	> 35

Gambar Diagram Plastisitas



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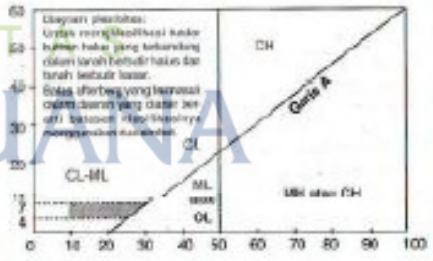
Tabel Klasifikasi Tanah Sistem Unified

Divisi			Simbol Kelompok	Nama Jenis		Kriteria Klasifikasi	
	Kerikil 50% atau lebih dari fraksi kasar tertahan saringan no. 4 (4,75 mm)	Kerikil bersih (sedikit atau tak ada butiran halus)	GW	Kerikil gradasi baik dan campuran pasir-kerikil, sedikit atau tidak mengandung butiran halus	Klasifikasi berdasarkan prosentase butiran halus: Kurang dari 5% lolos saringan no. 200: GW, GP, SW, SP. Lebih dari 12% lolos saringan no. 200: Batasan klasifikasi yang memenuhi simbol dobel	$C_u = \frac{D_{60}}{D_{10}} > 4$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ antara 1 dan 3	
			GP	Kerikil gradasi buruk dan campuran pasir-kerikil, sedikit atau tidak mengandung butiran halus.		Tidak memenuhi kedua kriteria untuk GW	
		Kerikil banyak kandungan butiran halus	GM	Kerikil berlanau, campuran kerikil-pasir-lanau		Batas-batas Atterberg di bawah garis A atau PI < 4	Bila batas Atterberg berada di daerah arsir dari diagram plastisitas, maka dipakai dobel simbol
			GC	Kerikil berlempung, campuran kerikil-pasir-lempung		Batas-batas Atterberg di atas garis A atau PI > 7	
	Pasir lebih dari 50% fraksi kasar lolos saringan no. 4 (4,75 mm)		SW	Pasir gradasi baik, pasir berkerikil, sedikit atau tidak mengandung butiran halus.		$C_u = \frac{D_{60}}{D_{10}} > 6$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ antara 1 dan 3	
			SP	Pasir gradasi buruk, pasir berkerikil, sedikit atau tidak mengandung butiran halus.		Tidak memenuhi kedua kriteria untuk SW	
		Pasir bersih kandungan butiran halus	SM	Pasir berlanau, campuran pasir-lanau		Batas-batas Atterberg di bawah garis A atau PI < 4	Bila batas Atterberg berada di daerah arsir dari diagram plastisitas, maka dipakai dobel simbol
			SC	Pasir berlanau, campuran pasir-lempung		Batas-batas Atterberg di atas garis A atau PI > 7	

Tanah berbutir halus 50% atau lebih lolos saringan no. 200 (0,075mm)	Lanau dan lempung batas cair 50% atau kurang	ML	Lanau tak organik dan pasir sangat halus, serbuk batuan atau pasir halus berlanau atau berlempung	
		CL	Lempung tak organik dengan plastisitas rendah sampai sedang, lempung berkerikil, lempung berpasir, lempung berlanau, lempung kurus (lean clays')	
	Lanau dan lempung batas cair > 50%	OL	Lanau organik dan lempung berlanau organik dengan plastisitas rendah	
		MH	Lanau tak organik atau pasir halus diatomae, lanau elastik.	
		CH	Lempung tak organik dengan plastisitas tinggi, lempung gemuk ('fat clays')	
		OH	Lempung organik dengan plastisitas sedang sampai tinggi	
Tanah dengan organik tinggi			Gambut ('peat'), dan tanah lain dengan kandungan organik tinggi	Manual untuk identifikasi secara visual dapat dilihat ASTM Designation D-2488

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PEMERIKSAAN GESER LANGSUNG

(Direct Shear Test)

Project	: UPPD	Tested by	: Lab. UIKA
Location	: Petamburan	Date	: 05 – 01 – 2014
Coordinates	X:…… Y:……	Point	: HB
Ground Elevasi	: - m	Checked by	: Feril Hariati, ST., M. Eng
Groung Water Elev.	: 5.10 m		

SAMPEL UDS1

Sample dia. : 6.365 cm
Sample ht. : 2 cm
Sample A. : 31.832 cm^2

Faktor koreksi : 0.528
Hasil c = 0.62 kg/cm^2
θ = 80.51°
γ = 2.576 kg/cm^3

Waktu	Beban = 3.167 kg		Beban = 6.334 kg		Beban = 9.501 kg	
	σ = 0.0995 (kg/cm^2)		σ = 0.1990 (kg/cm2)		σ = 0.2985 (kg/cm2)	
(menit)	Pergeseran	Dial	Pergeseran	Dial	Pergeseran	Dial
0,00	0	0	0	0	0	0
0,15	10	15	10	22	20	30
0,30	12	18	13	25	24	48
0,45	25	22	26	28	26	57
1,00	29	28	35	35	30	68
1,15	46	40	50	39	36	89
1,30	55	58	55	55	44	150
1,45	68	72	67	78	58	155
2,00	70	88	70	80	72	160
	Gaya geser (kg)	46,464	Gaya geser (kg)	42,240	Gaya geser (kg)	84,480
	Teg. geser (t) (kg/cm^2)	1,460	Teg. geser (t) (kg/cm^2)	1,327	Teg. geser (t) (kg/cm^2)	2,654
	Berat sample (kg)	0,165	Berat sample (kg)	0,162	Berat sample (kg)	0,160
	γ (kg/cm^3)	2,576	γ (kg/cm^3)	2,545	γ (kg/cm^3)	2,513

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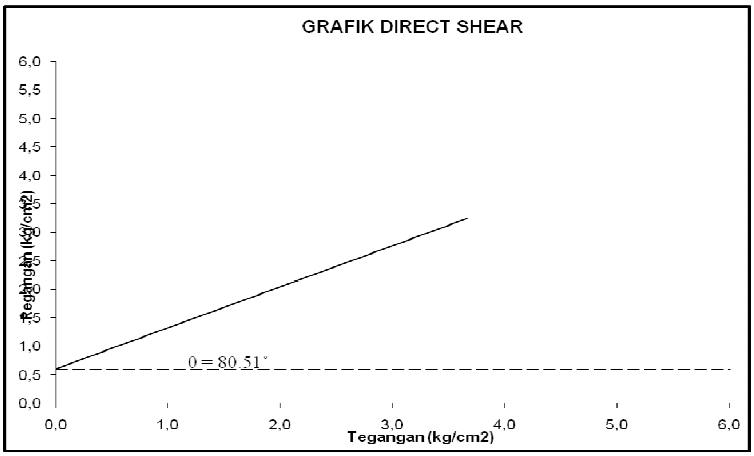

Kekuatan geser tanah (s) : C + σ tan θ

: 0.62 + 0.0995 tan 80.51°

: **1.215 kg/cm^2**

SAMPEL UDS2

Sample dia. : 6.365 cm

Sample ht. : 2 cm

Sample A. : 31.832 cm^2

Faktor koreksi : 0.528

Hasil c = 0.22 kg/cm^2

θ = 23°

γ = 2.388 kg/cm^3

Waktu (menit)	Beban = 3.167 kg σ = 0.0995 (kg/cm^2)		Beban = 6.334 kg σ = 0.1990 (kg/cm2)		Beban = 9.501 kg σ = 0.2985 (kg/cm2)	
	Pergeseran	Dial	Pergeseran	Dial	Pergeseran	Dial
0.00	0	0	0	0	0	0
0.15	12	24	12	20	12	17
0.30	24	15	24	17	24	20
0.45	36	22	36	42	36	30
1.00	48	30	48	30	48	55
1.15	60	27	60	58	60	68
1.30	72	50	72	64	72	70
1.45	84	62	84	87	84	86
2.00	96	55	96	70	96	72
	Gaya geser (kg)	32.736	Gaya geser (kg)	45.936	Gaya geser (kg)	45.408
	Teg. geser (t) (kg/cm^2)	1.028	Teg. geser (t) (kg/cm^2)	1.443	Teg. geser (t) (kg/cm^2)	1.426
	Berat sample (kg)	0.152	Berat sample (kg)	0.150	Berat sample (kg)	0.147
	γ (kg/cm^3)	2.388	γ (kg/cm^3)	2.356	γ (kg/cm^3)	2.309

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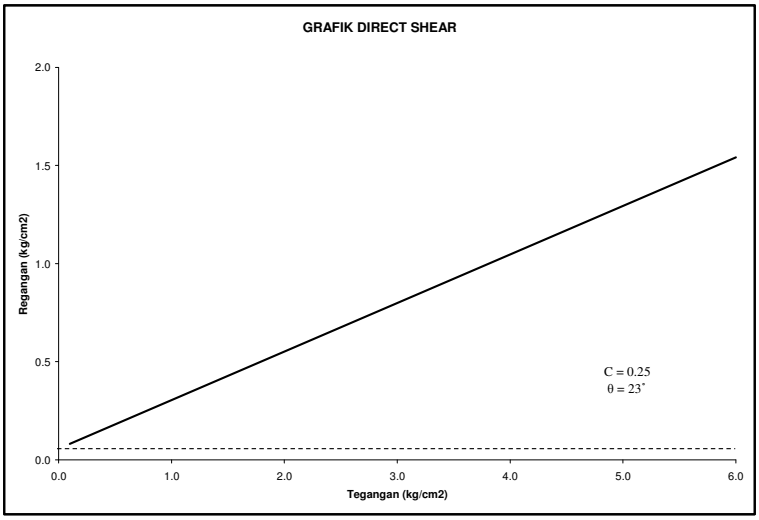

Kekuatan geser tanah (s) : C + σ tan θ

: 0.22 + 0.0995 tan 23˚

: **0.292 kg/cm^2**

SAMPEL UDS3

Sample dia. : 6.365 cm

Sample ht. : 2 cm

Sample A. : 31.832 cm^2

Faktor koreksi : 0.528

Hasil c = 0.14 kg/cm^2

θ = 83.74˚

γ = 2.278 kg/cm^3

Waktu (menit)	Beban = 3.167 kg		Beban = 6.334 kg		Beban = 9.501 kg	
	σ = 0.0995 (kg/cm^2)		σ = 0.1990 (kg/cm2)		σ = 0.2985 (kg/cm2)	
	Pergeseran	Dial	Pergeseran	Dial	Pergeseran	Dial
0,00	0	0	0	0	0	0
0,15	9	7	7	14	10	16
0,30	10	10	11	19	18	22
0,45	23	12	24	23	21	32
1,00	28	27	32	27	28	45
1,15	54	34	48	31	34	65
1,30	68	49	51	43	43	83
1,45	85	56	64	64	56	96
2,00	99	90	69	65	68	200
	Gaya geser (kg)	47,52	Gaya geser (kg)	34,320	Gaya geser (kg)	105,600
	Teg. geser (t) (kg/cm^2)	1,493	Teg. geser (t) (kg/cm^2)	1,078	Teg. geser (t) (kg/cm^2)	3,317

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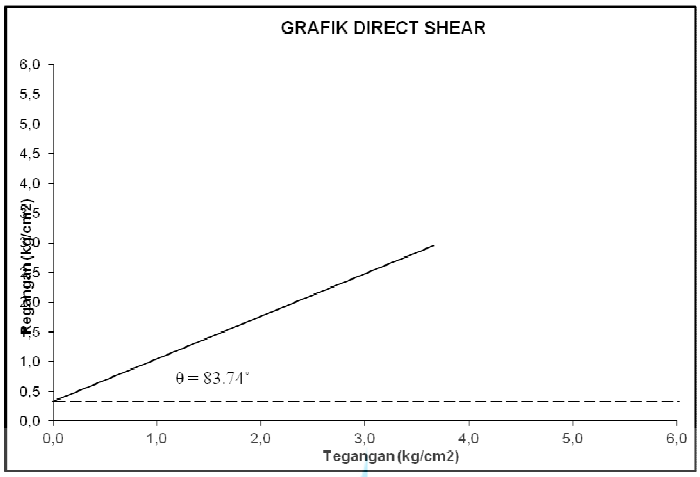
	Berat sample (kg)	0,145	Berat sample (kg)	0,142	Berat sample (kg)	0,140
	γ (kg/cm^3)	2,278	γ (kg/cm^3)	2,230	γ (kg/cm^3)	2,199



Kekuatan geser tanah (s) : C + σ tan θ

: 0.14+ 0.0995 tan 83.74°

: **1.047 kg/cm^2**

Analisa hasil:

Berdasarkan hasil grafik diatas, diperoleh nilai c untuk UDS1= 0.62 kg/cm^2, UDS2 = 0.22 kg/cm^2, UDS3 = 0.14 kg/cm^2 dan θ untuk UDS1= 80.51°, UDS2 = 23°, UDS3 = 83.74°. Sehingga dapat disimpulkan bahwa tanah tersebut mempunyai kekuatan geser tanah dengan nilai tersebut diatas terhadap gaya horizontal, maka apabila digunakan untuk pondasi dalam maupun dangkal akan mengalami pergeseran yang relatif sedang. [***Braja M.Das., MT]***

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FAKULTAS TEKNIK JURUSAN SIPIL
UNIVERSITAS IBN KHALDUN BOGOR
LABORATORIUM TEKNIK SIPIL

PEMERIKSAAN KONSOLIDASI

(Consolidation Test)

Project	: UPPD	Tested by	: Lab. UIKA
Location	: Petamburan	Date	: 01 – 01 – 2014
Coordinates	X:…… Y:……		: 08 – 01 – 2014
Ground Elevasi	: - m	Point	: HB
Groung Water Elev.	: 5.10 m	Checked by	: Feril Hariati, ST., M. Eng

Diameter Ring	5	cm
Tinggi Ring	1.5	cm

Boring No.		**BH-2**	**BH-2**	**BH-2**
Depth	**(m)**	**1.00-1.55**	**3.00-3.55**	**5.00-5.55**
UDS No.		**UDS1**	**UDS1**	**UDS1**
A	Berat Ring (gr)	14,2	14,2	14,2
B	Berat Tanah Basah + Ring (gr)	56,2	68,7	58,2
C	Berat Contoh Tanah (gr)	42	62,9	44
D	Berat Cawan (gr)	12	12	12
E	Berat Contoh Kering+Cawan+Cincin (gr)	54,6	55,6	54,6
F	Berat Contoh Kering (gr)	28,4	29,4	28,4
G	Berat Air (C - F)	13,6	33,5	15,6
H	Kadar Air (G/F)x100% (%)	0,48	1,14	0,55
I	Volume Contoh Basah/Cincin (cm3)	1,38	1,38	1,38
J	Berat Isi Basah = (C/I) (gr/cm3)	30,39	45,51	31,84
K	Berat Isi Kering = J/(100 - H) x 100% (gr/cm3)	0,31	0,46	0,32

SAMPEL UDS1

Beban (kg)	0,5	1	2	4	8	16	4	0,5
Tekanan (kg/cm2)	0,25	0,5	1	2	4	8	2,00	0,25
0 detik	0	18.5	25	38	60	91.9	151	112
6 detik	2	19.6	25	38.3	60.5	100	150	108

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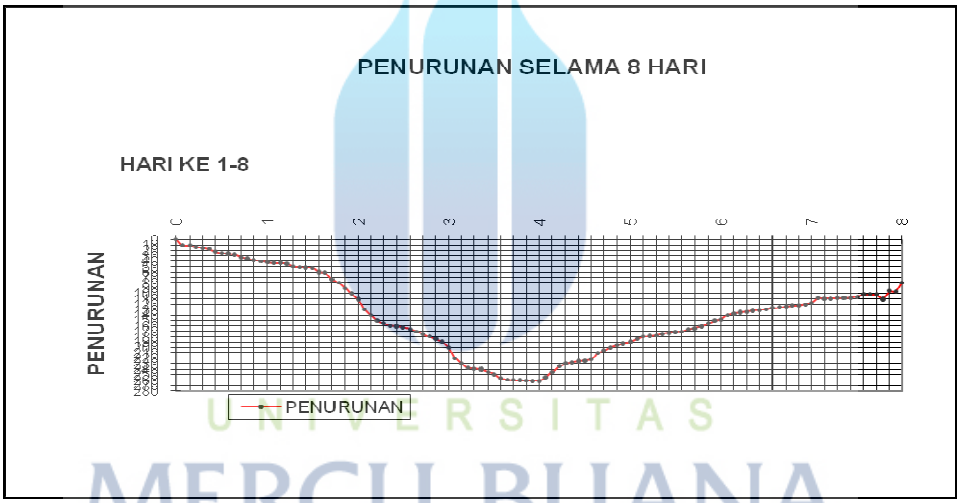
15 detik	2	20	25.5	40	60.8	100	150	109.1
30 detik	2	20	25.8	40	70.6	109	140.3	109
1 menit	2	21.5	26.3	40.3	70.8	115	140.1	108
2 menit	3.5	22.6	26.5	41	80	118	140	108
4 menit	10	23	27	41.6	80	137	130.5	107.6
8 menit	12.6	23	27.3	45	80.6	138	130.2	106
15 menit	14.1	25.5	27.9	50	80.7	138.2	130	102
30 menit	16	26	28	50.2	90	139	130	101.5
1 jam	16.6	26	28	50.6	90	142	120.5	101.6
2 jam	17.2	26.3	29.2	50.8	90.6	146	120.3	110
4 jam	17.9	27	29.6	56.3	91	146.3	120	95.5
8 jam	18	27	31	57	91.2	149	120	96
24 jam	18	27.3	35	57	91.6	150	110	98



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SAMPEL UDS2

Beban (kg)	0,5	1	2	4	8	16	4	0,5
Tekanan (kg/cm2)	0,25	0,5	1	2	4,00	8,00	2,00	0,25
0 detik	0	23	26,5	30,3	37	55	83	52
6 detik	3	23	26,7	30,5	37	55	86	52
15 detik	3,1	23,5	26,8	30,8	37,5	55,8	90	45,7
30 detik	3	23,9	26,8	32	37,9	68	86,7	45,6
1 menit	3	24	27	32	38	68,7	85	45,5
2 menit	3,5	24	27	33,4	39,2	68,9	85	42
4 menit	12	24,3	27,3	33,6	39,4	72	78	42,5

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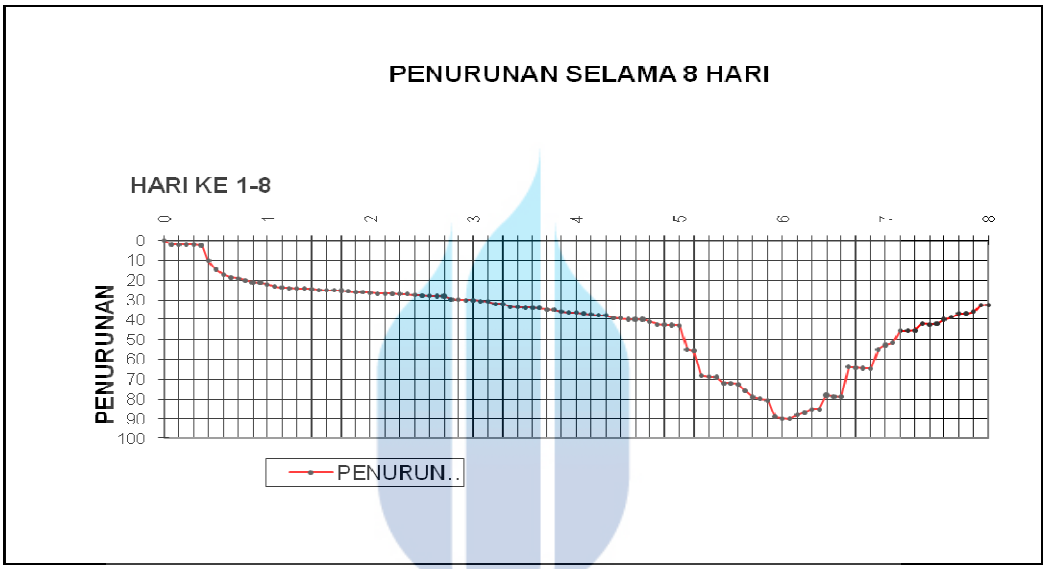
8 menit	15,5	24,7	27,6	34	40	72	78,7	42,3
15 menit	16	24,9	27,9	34	40	72,4	78,9	40
30 menit	17,5	25	28	34,2	40	76	64	39
1 jam	18	25,1	28	34,9	41,2	79	64,2	37
2 jam	21	25,5	29,5	35	42,5	79,8	64,6	37
4 jam	21,9	26	29,8	36	42,8	80,5	64,8	36
8 jam	21,1	26	30	36,6	42,9	80,7	55	32,6
24 jam	21,9	26,3	30	36,6	43	80,9	53	32,5



SAMPEL UDS3

Beban (kg)	0,5	1	2	4	8	16	4	0,5
Tekanan (kg/cm2)	0,25	0,5	1	2	4	8	2,00	0,25
0 detik	0	42	120	205	264	189	140	112
6 detik	15	43,8	130	210	258	185	140,2	108
15 detik	15	44	140	220	250	180	137	109,1
30 detik	15	44,6	150	235	243	179	135	109
1 menit	15	50	155	240	238	178	134	108
2 menit	18	50,7	159	245	228	175	132	108
4 menit	20	52	160	246	226	173	130,8	107,6
8 menit	22	52,5	162	248	225	171	130	106
15 menit	25,5	60	165	250	222	170	127	102
30 menit	26	61	170	252	210	166	125	101,5

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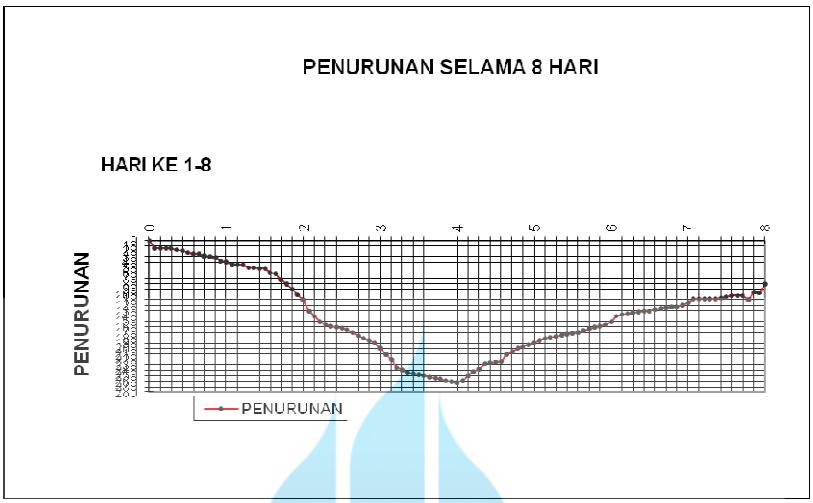
1 jam	28	73	175,6	254	205	164	124	101,6
2 jam	30	80	180	256	200	160	122	110
4 jam	32	90	185	258	196	158	122	95,5
8 jam	38	100	190	260	193	155	120	97
24 jam	40	110	200	261	190	151,2	115	80



Analisa hasil:

Percobaan ini lebih banyak dilakukan untuk mengetahui sifat-sifat pemampatan tanah pada saat dibebani. Dari hasil pengujian, diperoleh nilai penurunan terjadi pada UDS1= 150 (hari ke 6), UDS2 = 80.9 (hari ke 6), UDS3 = 261 (hari ke 4). ***[Braja M.Das., MT, 1988]***

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PEMERIKSAAN ANALISA BUTIRAN

(Grained Size Analysis)

Project	: UPPD	Tested by	: Lab. UIKA
Location	: Petamburan	Date	: 06 – 01 – 2014
Coordinates	X:…… Y:……	Point	: HB
Ground Elevasi	: - m	Checked by	: Feril Hariati, ST., M. Eng
Groung Water Elev.	: 5.10 m		

Sieve Analysis

SAMPEL UDS1

US. STANDARD		Sample		Cumulative		Cumulative	
Diameter (mm)	No	Retained (gram)	% Retained	Retained (gram)	% Retained	Passing (gram)	% Passing
4,75	4	0,00	0,00	0,00	0,00	0,000	100,000
2,00	10	0,10	0,05	1,10	0,05	0,050	99,950
1,00	18	0,16	0,08	1,20	0,13	0,130	99,870
0,5	35	0,20	0,10	1,88	0,23	0,230	99,770
0,25	**60**	**0,24**	**0,12**	**2,30**	**0,35**	**0,350**	**99,650**
0,15	100	0,28	0,14	3,70	0,49	0,490	99,510
0,075	200	0,30	0,15	4,82	0,64	0,006	99,360
<0,075	>200	198,72	99,36	200,00	100,00	100,000	0,000

Berat Sampel Total (gram)	200,00

Hidrometer Test

Waktu Percobaan (menit)	Suhu (oC)	Pembacaan Hidrometer (Rh)	Diameter (mm)	Koreksi Suhu (k)	Rh+k	N %	Kalibrasi (a)
1 menit	28	45	0,000	1	46	95,68	1,04
2 menit	28	42	0,060	1	43,0	89,44	1,04
3 menit	28	40	0,050	1	41,0	85,28	1,04
8 menit	28	38	0,040	1	39,0	81,12	1,04
15 menit	28	36	0,200	1	37,0	76,96	1,04
30 menit	28	30	0,200	1	31,0	64,48	1,04
60 menit	28	27	0,009	1	28,0	58,24	1,04
240 menit	28	25	0,003	1	26,0	54,08	1,04

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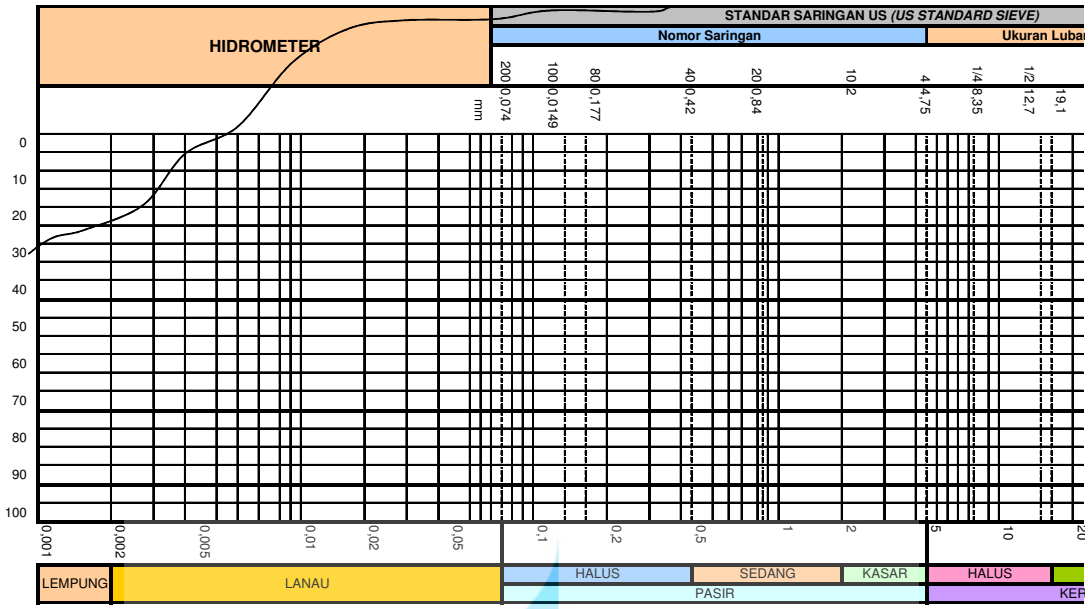
1440 menit	28	20	0,001	1	21,0	43,68	1,04



Sieve Analysis

SAMPEL UDS2

US. STANDARD		Sample		Cumulative		Cumulative	
Diameter (mm)	No	Retained (gram)	% Retained	Retained (gram)	% Retained	Passing (gram)	% Passing
4,75	4	0,00	0,00	0,00	0,00	0,000	100,000
2,00	10	0,22	0,17	0,06	0,17	0,110	99,890
1,00	18	0,29	0,15	0,18	0,26	0,255	99,745
0,5	35	0,58	0,29	0,84	0,55	0,545	99,455
0,25	**60**	**1,39**	**0,70**	**2,28**	**1,24**	**1,240**	**98,760**
0,15	100	1,46	0,73	3,69	1,97	1,970	98,030
0,075	200	1,11	0,56	4,79	2,53	0,025	97,475
<0,075	>200	194,95	97,48	200,00	100,00	100,000	0,000
Berat Sampel Total (gram)		200,00					

Hidrometer Test

Waktu Percobaan (menit)	Suhu (oC)	Pembacaan Hidrometer (Rh)	Diameter (mm)	Koreksi Suhu (k)	Rh+k	N %	Kalibrasi (a)
1 menit	28	47	0,000	1	48	99,84	1,04
2 menit	28	44	0,060	1	45,0	93,6	1,04
3 menit	28	38	0,050	1	39,0	81,12	1,04
8 menit	28	35	0,040	1	36,0	74,88	1,04
15 menit	28	32	0,200	1	33,0	68,64	1,04
30 menit	28	28	0,200	1	29,0	60,32	1,04
60 menit	28	26	0,009	1	27,0	56,16	1,04
240 menit	28	23	0,003	1	24,0	49,92	1,04

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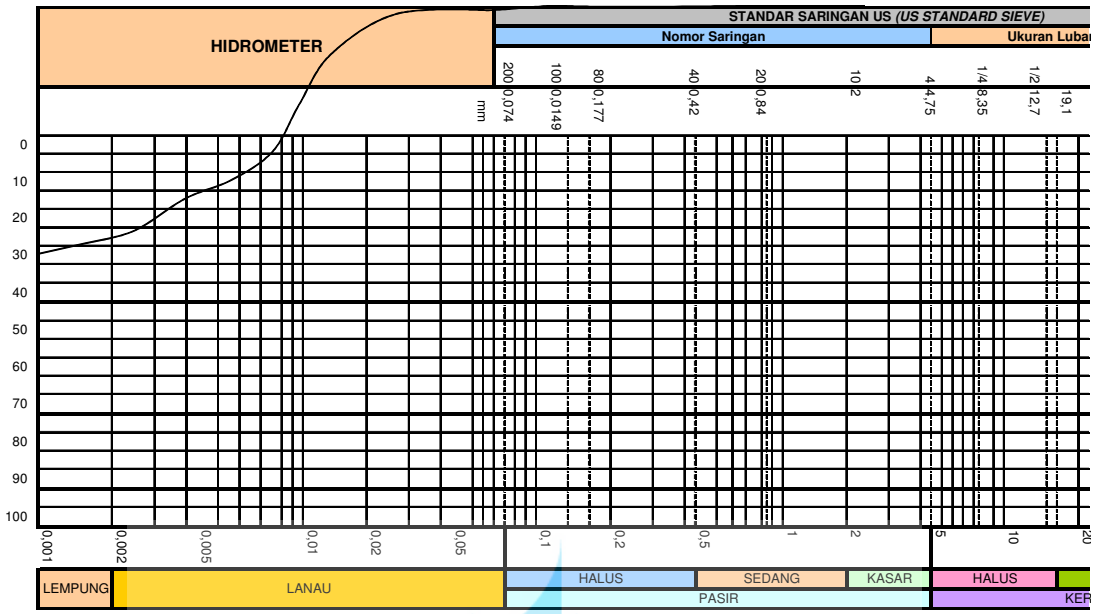
1440 menit	28	20	0,001	1	21,0	43,68	1,04



Sieve Analysis

SAMPEL UDS3

US. STANDARD		Sample		Cumulative		Cumulative	
Diameter (mm)	No	Retained (gram)	% Retained	Retained (gram)	% Retained	Passing (gram)	% Passing
4,75	4	0,00	0,00	0,00	0,00	0,000	100,000
2,00	10	0,30	0,15	0,06	0,15	0,150	99,850
1,00	18	0,45	0,23	0,18	0,38	0,375	99,625
0,5	35	0,65	0,33	0,84	0,70	0,700	99,300
0,25	**60**	**1,87**	**0,94**	**2,28**	**1,64**	**1,635**	**98,365**
0,15	100	1,62	0,81	3,69	2,45	2,445	97,555
0,075	200	1,80	0,90	4,79	3,35	0,033	96,655
<0,075	>200	193,31	96,66	200,00	100,00	100,000	0,000
Berat Sampel Total (gram)		200,00					

Hidrometer Test

Waktu Percobaan (menit)	Suhu (oC)	Pembacaan Hidrometer (Rh)	Diameter (mm)	Koreksi Suhu (k)	Rh+k	N %	Kalibrasi (a)
1 menit	28	44,6	0,000	1	45,6	94,848	1,04
2 menit	28	40	0,060	1	41,0	85,28	1,04
3 menit	28	38	0,050	1	39,0	81,12	1,04
8 menit	28	36	0,040	1	37,0	76,96	1,04
15 menit	28	30	0,200	1	31,0	64,48	1,04
30 menit	28	27	0,200	1	28,0	58,24	1,04
60 menit	28	22	0,009	1	23,0	47,84	1,04

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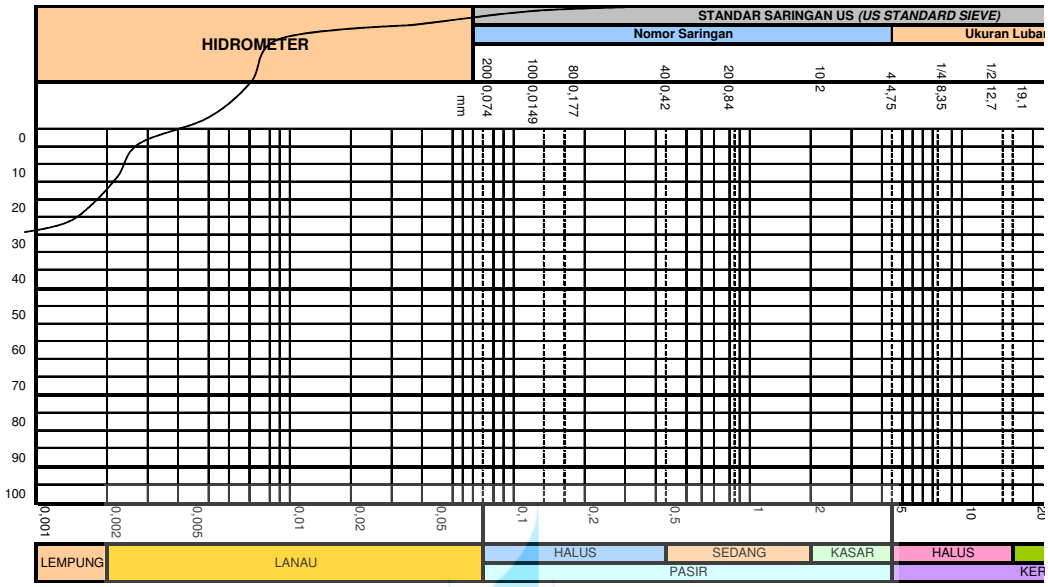
240 menit	28	20	0,003	1	21,0	43,68	1,04
1440 menit	28	18	0,001	1	19,0	39,52	1,04



Berdasarkan data dari analisis saringan yang dilakukan, maka dapat di analisis melaluin kurva distribusi bahwa klasifikasi tanah berdasarkan USCS, dapat dikelompokkan sebagai berikut :

- kerikil 76.2 s/d 4.75 (mm) →0 %
- pasir 4.75 s/d 0.075 (mm) → UDS1= 0.64 %, UDS2 = 2.53 %, UDS3 = 4.79 %
- halus (lanau dan lempung)< 0.075 (mm) → UDS1 = 99.360%, UDS2 = 97,475%, UDS3 = 96.655%

Berdasarkan *American Association of State Highway and Transportaton Officials* (AASHTO), tanah tersebut dapat diklasifikasikan sebagai berikut:

- kerikil 76.2 (mm) s/d 2 (mm) → UDS1= 0.05 %, UDS2 = 0.17 %, UDS3 = 0.30 %
- pasir 2 (mm) s/d 0.075 (mm) → UDS1= 0.64 %, UDS2 = 2.53 %, UDS3 = 4.79 %
- lanau dan lempung < 0.075 (mm) → UDS1 = 99.360%, UDS2 = 97,475%, UDS3 = 96.655%

Dari hasil analisis gradasi diperoleh bahwa butiran tanah dikelompokkan sebagai tanah berbutir halus (fine-grained soils).

- Pada bagian tanah yang kasarnya, persentasenya tidak terlalu banyak dan juga tidak terlalu sedikit. Dan pada bagian tanah kasarnya ini, hampir seluruhnya adalah sand (pasir), bahkan hampir sedikit dijumpai gravel (kerikil).

[M Das, Braja.1993. Mekanika Tanah Jilid I. Jakarta: Erlangga. Bab 1 Tanah dan Batuan 17 – 24]

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PEMERIKSAAN TRIAXIAL TEST

(Triaxial7bn ed Undrained (TXUU) Test)

Project	: UPPD	Tested by	: Lab. UIKA
Location	: Petamburan	Date	: 07– 01 – 2014
Coordinates	X:…… Y:……	Point	: HB
Ground Elevasi	: - m	Checked by	: Feril Hariati, ST., M. Eng
Groung Water Elev.	: 5.10 m		

Berat		=	138,88	gr
Dimensi :	Diameter	=	3,81	cm
	Tinggi	=	7,62	cm
	Luas Penampang	=	11,3951	cm2
Tegangan Sel		=	0,5	kg/cm2
Kalibrasi Alat terhadap Load		=	0,17988	kg/mm

Sampel UDS1

Time in Minute	Deformation Dial	Strain Rate (%)	Correct ed Area (cm2)	Dial Reading	Load (kg)	σ1-σ3 = [P/A] (kg/cm2)	Cell (σ3) (kg/cm2)
0	0,0000	0	11,4010	0,0	0,0000	0,0000	0,5
2	1,5240	2	11,6340	15,0	2,6982	0,2319	0,5
4	3,0480	4	11,8760	18,0	3,2379	0,2726	0,5
6	4,5720	6	12,1290	19,0	3,4177	0,2818	0,5
8	6,0960	8	12,3920	22,0	3,9574	0,3193	0,5
10	7,6200	10	12,6680	25,0	4,4970	0,3550	0,5
12	9,1440	12	12,9560	25,0	4,4970	0,3471	0,5
14	10,6680	14	13,2570	27,8	5,0007	0,3772	0,5
16	12,1920	16	13,5730	29,0	5,2165	0,3843	0,5
18	13,7160	18	13,9040	29,5	5,3065	0,3817	0,5
20	15,2400	20	14,2510	29,8	5,3605	0,3761	0,5
22	16,7640	22	14,6170	30,0	5,3964	0,3692	0,5

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Berat = 138,79 gr
Dimensi : Diameter = 3,81 cm
Tinggi = 7,62 cm
Luas
Penampang = 11,3951 cm2
Tegangan Sel = 1,0 kg/cm2
Kalibrasi Alat terhadap Load = 0,18378 kg/mm
Sampel UDS2

Time in Minute	Deformation Dial	Strain Rate (%)	Correct ed Area (cm2)	Dial Reading	Load (kg)	σ1-σ3 = [P/A] (kg/cm2)	Cell (σ3) (kg/cm2)
0	0,0000	0	11,4010	0,0	0,0000	0,0000	1,0
2	1,5240	2	11,6340	17,0	3,1243	0,2686	1,0
4	3,0480	4	11,8760	19,0	3,4919	0,2940	1,0
6	4,5720	6	12,1290	22,0	4,0432	0,3334	1,0
8	6,0960	8	12,3920	24,0	4,4108	0,3559	1,0
10	7,6200	10	12,6680	28,0	5,1460	0,4062	1,0
12	9,1440	12	12,9560	30,0	5,5135	0,4256	1,0
14	10,6680	14	13,2570	35,0	6,4324	0,4852	1,0
16	12,1920	16	13,5730	37,0	6,8000	0,5010	1,0
18	13,7160	18	13,9040	39,0	7,1676	0,5155	1,0
20	15,2400	20	14,2510	39,0	7,1676	0,5030	1,0
22	16,7640	22	14,6170	40,0	7,3514	0,5029	1,0

Berat = 137,8 gr
Dimensi : Diameter = 3,81 cm
Tinggi = 7,62 cm
Luas
Penampang = 11,3951 cm2
Tegangan Sel = 1,5 kg/cm2
Kalibrasi Alat terhadap Load = 0,18072 kg/mm
Sampel UDS3

Time in Minute	Deformation Dial	Strain Rate (%)	Correct ed Area (cm2)	Dial Reading	Load (kg)	σ1-σ3 = [P/A] (kg/cm2)	Cell (σ3) (kg/cm2)
0	0,0000	0	11,4010	0,0	0,0000	0,0000	1,5
2	1,5240	2	11,6340	20,0	3,6145	0,3107	1,5
4	3,0480	4	11,8760	24,0	4,3374	0,3652	1,5
6	4,5720	6	12,1290	28,0	5,0603	0,4172	1,5
8	6,0960	8	12,3920	30,0	5,4217	0,4375	1,5
10	7,6200	10	12,6680	33,0	5,9639	0,4708	1,5
12	9,1440	12	12,9560	35,0	6,3253	0,4882	1,5

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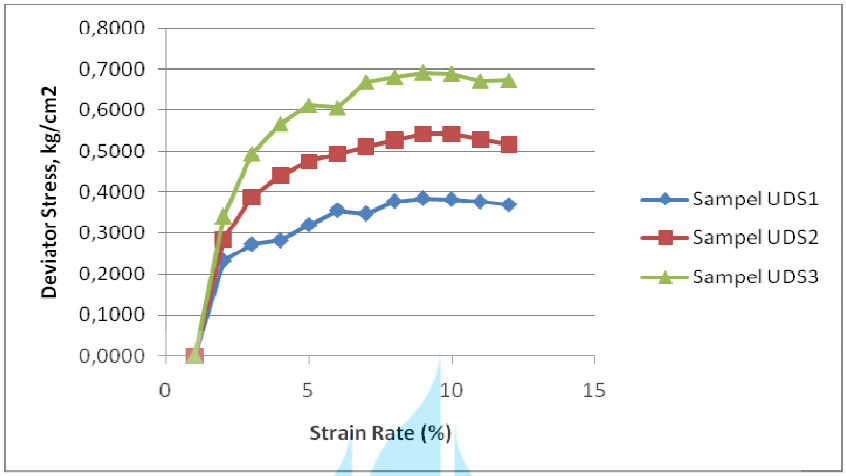
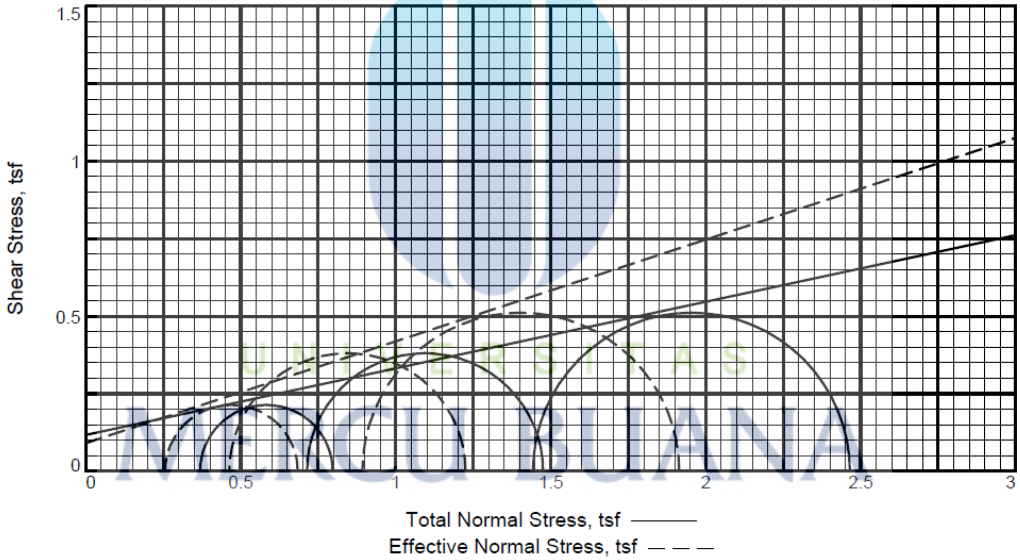
14	10,6680	14	13,2570	35,0	6,3253	0,4771	1,5
16	12,1920	16	13,5730	48,0	8,6748	0,6391	1,5
18	13,7160	18	13,9040	48,0	8,6748	0,6239	1,5
20	15,2400	20	14,2510	50,0	9,0362	0,6341	1,5
22	16,7640	22	14,6170	52,0	9,3976	0,6429	1,5





Sampel	Kohesi (c)	Sudut Geser (φ)
UDS1	0,12	10°
UDS2	0,15	8°
UDS3	0,20	8°

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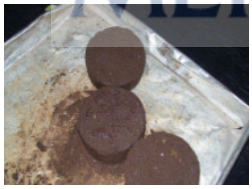

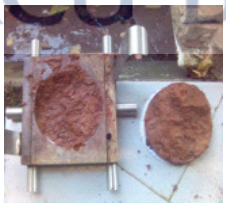

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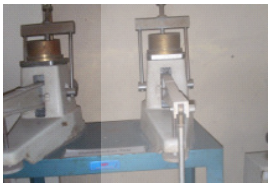

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GEOTECHNICAL INVESTIGATION REPORT

AT

THE PROPOSED AUSTRALIAN EMBASSY BUILDING SITE

PATRA KUNINGAN BARAT ROAD – CENTRAL JAKARTA

BOOK - I

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GEOTECHNICAL INVESTIGATION REPORT
AT THE PROPOSED NEW AUSTRALIAN EMBASSY
AT JALAN PATRA – KUNINGAN – CENTRAL JAKARTA

JUNE 2010

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GEOTECHNICAL INVESTIGATION REPORT AT THE PROPOSED NEW AUSTRALIAN EMBASSY AT JALAN PATRA KUNINGAN – CENTRAL JAKARTA

JUNE 2010

I. INTRODUCTION

AURECON- Australia has requested **P.T. SOFOCO** to conduct a geotechnical investigation at a proposed new Australian Embassy Site located at jalan Patra, Kuningan – Central Jakarta

The purpose of the geotechnical investigation is to determine the subsoil condition of the proposed site,

The field work was carried out during October to October 14 2009, and is followed by laboratory testing of the samples in Jakarta.

This report presents all of the results of the investigation consisting both field tests and laboratory tests.

II. SCOPE OF SOIL INVESTIGATION

The geotechnical investigation consists of the following tests:

- Drilling of ten boreholes to 30m depth
- Standard Penetration Test (SPT) at every 1.5m depth intervals
- Undisturbed samples in soft soil and firm soil by using open drive thin wall tube sampler
- Pressuremeter Test
- Downhole Seismic Test
- Laboratory test on recovered samples
- Report showing the results of the above tests, analysis of soil properties and foundation recommendations, including the site specific seismic response analysis .

III. PERFORMED GEOTECHNICAL INVESTIGATION

III.1 Site Surface Description

The proposed site is situated within the 'Embassy Row' area where most of the embassies of various countries are located at the East Kuningan district, as shown in vicinity map in Figure 1.

The site consists of an open and flat rectangle shape land with a dimension of approximately 310m by 125m and an area of 37,760m^2, and is joining at the northern boundary with the proposed British Embassy site.

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The proposed site is bordering in the western side with a vacant open lot, and at the south with the Patra Kuningan I road.. At the east is bordering with the Patra Kuningan Barat (West Patra Kuningan) road..

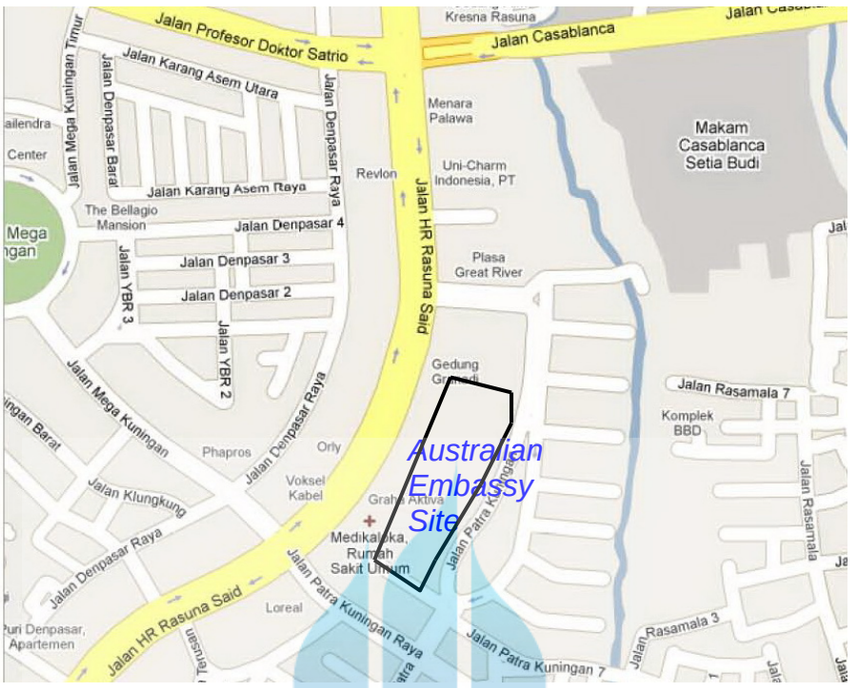

Figure 2. Vicinity Map of Proposed New Australian Embassy Site

The proposed embassy site was formerly part of an exclusive residential housing compound from the Indonesian State Oil Company, known as the Pertamina Village, and was developed during the 1970s, but has recently been demolished and leaving an open land where it is now partly overgrown by tall grass and some big trees.

The existing ground surface has about 3.0m in elevation difference between the highest and lowest points and creating several water-locked areas during the rain season.

III. 2. Content of Work

The content of the field site investigation work consists of drilling and sampling at ten locations (BH1 to BH10) and six shallow trial pits (TP1 to TP6), and are distributed to encompass the entire site footprint as shown in the Layout Plan of boreholes in Figure 1 below:

The positioning of the boreholes and Trial Pits were determined by GPS and their corresponding elevation of ground surface at the time of the investigation work were measured by transit level, and using an official reference DKI benchmark No. 502, which is located at about 3 km from the site, and which elevation was referenced to the Priok Peil (PP) Chart Datum .

After discovering that there is a discrepancy of the elevation readings with corresponding topographical survey map for the site, a re-measuring survey was carried during June 8, 2010, and using as reference the same benchmark (= MAG03) used for the topography survey.

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The Layout Plan and coordinates and new elevations is shown in Figure 1 and Table 1, respectively.

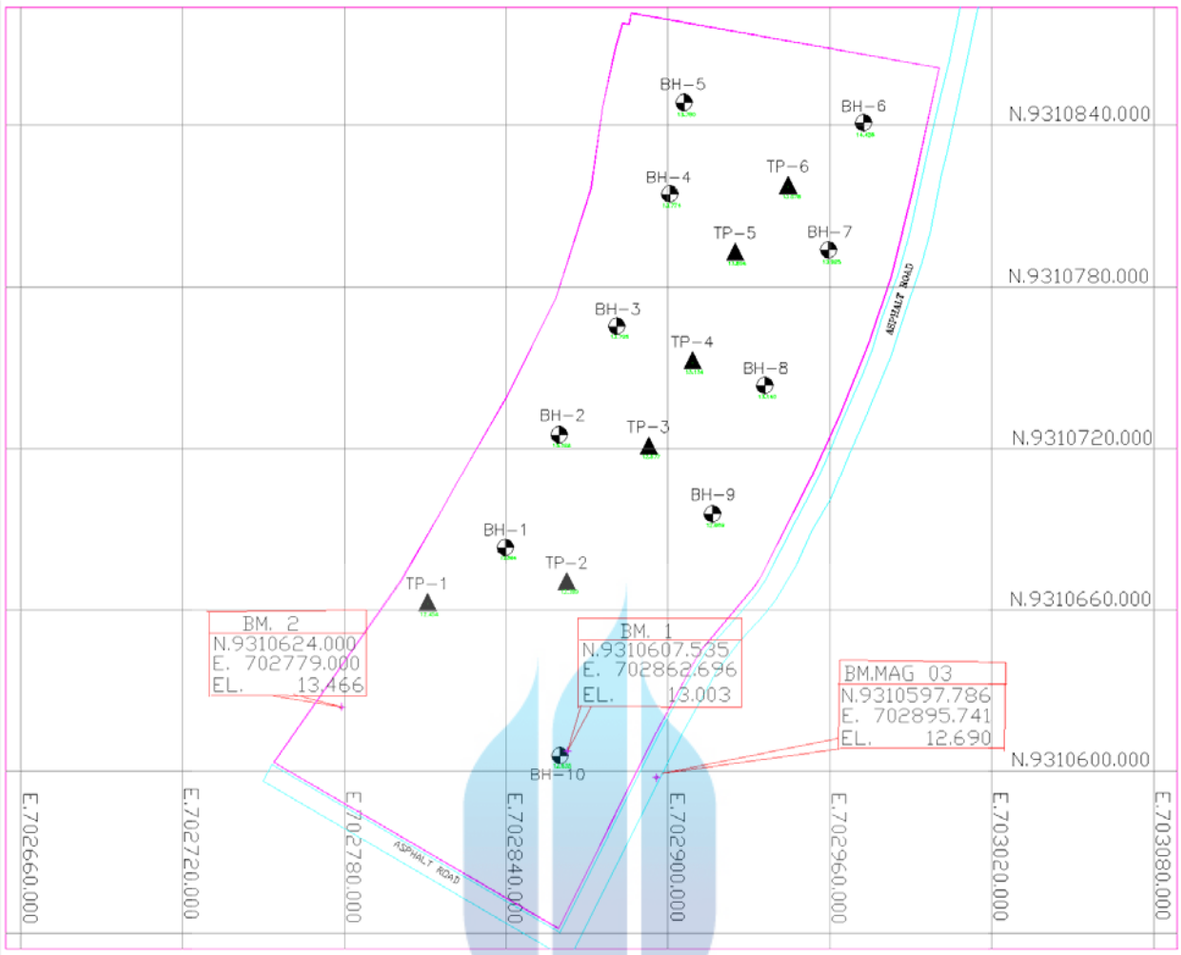

Figure 1. Layout Plan of Geotechnical Test Locations

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Borehole No.	Coordinates		Elevation (meter)
	Easting	Northing	
BH.1	702839.760	9310683.153	12.56
BH.2	702859.732	9310725.383	13.32
BH.3	702881.038	9310765.659	13.80
BH.4	702900.564	9310814.511	13.77
BH.5	702905.996	9310848.477	14.40
BH.6	702972.404	9310840.926	14.43
BH.7	702959.630	931793.700	13.93
BH.8	702935.807	9310743.522	13.14
BH.9	702916.481	9310695.606	12.67
BH.10	702860.028	9310606.022	12.64

Trial Pit	Coordinates		Elevation (meter)
	Easting	Northing	
TP.1	702810.832	9310662.033	12.45
TP.2	702862.460	9310669.796	12.37
TP.3	702892.853	9310720.575	12.58
TP.4	702909.147	9310752.044	13.13
TP.5	702924.943	9310792.291	13.89
TP.6	702944.507	9310817.039	13.58

Table 1. List of Coordinates of Test Locations and Elevation of Ground Surface

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III.3 Boring and Sampling Work

The drilling work was performed using two rotary spindle boring machines and applying the water-mud wash boring method. See Figure 3. The borehole diameter used was 100 mm.

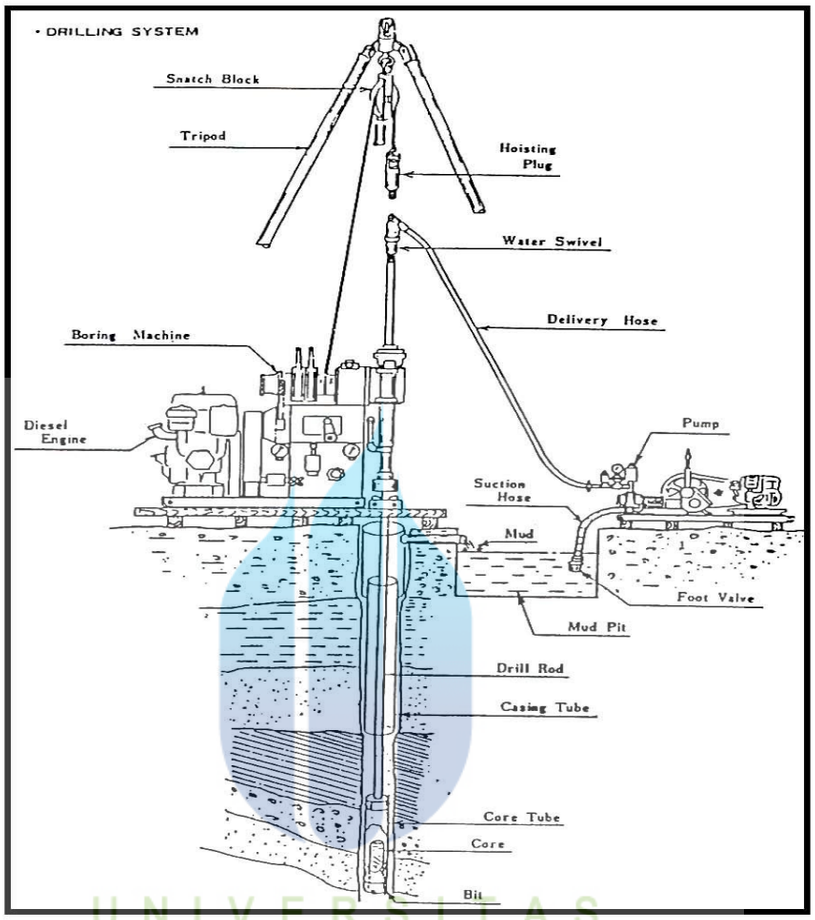

Figure 2 Typical Drilling Machine Setup for Soil Testing

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At designated depth where soil sampling is required, the borehole bottom is cleaned by flushing out all drill cuttings from the borehole and the drill bit is then extracted from the borehole. After cleaning the base of the borehole the sampler is inserted and pushed by hydraulic force in order to obtain samples of approximately 800 to 900mm length.

Standard Penetration Tests (SPT) were carried out in the borehole at each 1.5m depth intervals. Undisturbed samples were recovered from the most upper soft soil layer, using thin walled tube samplers for further determination of their properties in the laboratory.

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Figure 3 . View of Typical Soil Profile in Trial Pit TP.3 to 3.0m Depth
(note that there is no ground water , and the vertical unsupported excavation wall)

The soil profiles from the six hand dug trial pits as presented in Appendix A.2, show tuffaceous (=volcanic ash) clays with very high plasticity to enable a smooth unsupported but stable vertical excavation wall up to more than 3.0m depth.

III.4. Downhole Seismic Test

The down hole seismic test is performed in boreholes BH.01 and BH.06 to 30m depth.
The purpose of the test is to determine the seismic wave velocity of the ground in order to classify the subsoil to 30m depth based on their shear wave velocities as is required by the Indonesian Specification SNI 1726-2002 ie. Standard for Structural Design of Earthquake Resistant Structures.

For dynamic design of foundations and structures, the soil layers are classified as belongs to the soft, medium stiff or medium dense and hard or dense clay or sand category using either the average N-values, of undrained shear strength or shear wave velocities.
The down hole seismic test is to obtain the shear wave velocities in the borehole by inserting a borehole-pick that is equipped with three geophone components for horizontal (x,y) and vertical (z) directions. The borehole pick is inserted in the bore hole at the points for several depth variation, normally at every 1.0m depth intervals.

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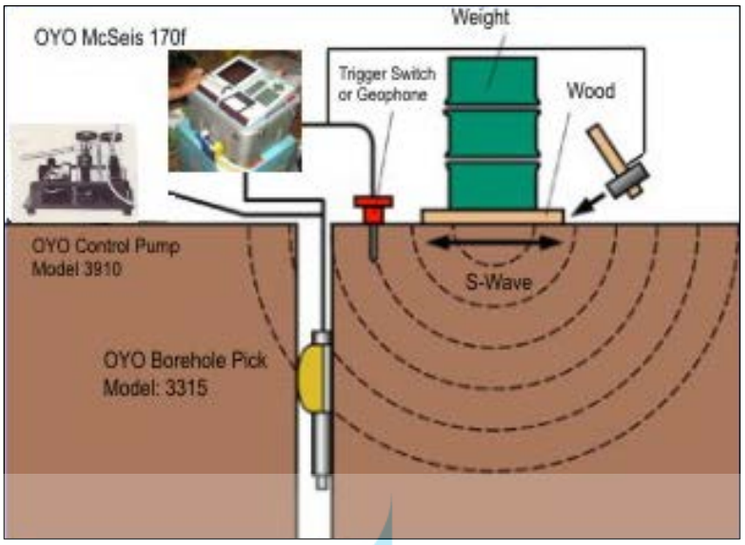

Figure 4 Layout of Downhole Seismic Measuring System

At ground surface point about 1- 2 meters from borehole is impacted by hammer. Seismic wave will propagate to subsurface and the signal will be received by the geophones which is firmly attached to the borehole wall, and by cable the shock wave data is transferred to recorder seismograph at the ground surface..

The first wave arrival at the geophone is the P-wave, and followed by the second S-wave. To increase the signal /noise ratio (S/N) of S-wave amplitude, the impact force have to be performed in horizontal direction, while the P-wave is persisted as first event but in smaller amplitude.

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The result of field measurement is saved in digital files format, and then all of these files have to be processed and analyzed for their first arrival time of both seismic wave types.

The detailed description of downhole seismic tests and results is shown in Appendix A.2 of this report.

The average shear wave velocities for borehole BH.01 and BH06 is 267 and 214 m./second, respectively, and could be classified as a medium type of soil.

A summary of the results is given on Table 2 below.

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Table 2 a -True Velocity of P-Wave and S-Wave
At Borehole BH-01

P WAVE					S WAVE				
Layer	Depth (m)		Thickness (m)	Vp (m/s)	Layer	Depth (m)		Thickness (m)	Vs (m/s)
1	0.0	1.0	1.0	785.7	1	0.0	1.0	1.0	248.5
2	1.0	4.0	3.0	888.7	2	1.0	3.0	2.0	157.3
3	4.0	7.0	3.0	1214.4	3	3.0	7.0	4.0	244.7
4	7.0	13.0	6.0	829.9	4	7.0	13.0	6.0	241.8
5	13.0	30.0	17.0	1662.4	5	13.0	20.0	7.0	291.4
					6	20.0	30.0	10.0	329.8
								V_s AVERAGE	267.3

Table 2b - True Velocity of P-Wave and S-Wave
At Borehole BH-06

P WAVE					S WAVE				
Layer	Depth (m)		Thickness (m)	Vp (m/s)	Layer	Depth (m)		Thickness (m)	Vs (m/s)
1	0.0	1.0	1.0	471.4	1	0.0	1.0	1.0	248.5
2	1.0	5.0	4.0	852.6	2	1.0	6.0	5.0	109.7
3	5.0	15.0	10.0	827.4	3	6.0	15.0	9.0	226.0
4	15.0	30.0	15.0	1662.1	4	15.0	22.0	7.0	304.8
					5	22.0	26.0	4.0	263.5
					6	26.0	30.0	4.0	329.7
								V_s AVERAGE	214.7

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III.5 Pressuremeter Test

The elastic properties of the soil were determined by means of the Lateral Load tests in boreholes to determine such as the earth pressure at rest, yield and failure pressure, subgrade reaction and elastic modulus.

The test consists of the insertion of a pressurized rubber tube into the borehole and inflated while their corresponding increasing of radius is measured.

The result of the stress and strain relationship were plotted and the above parameters are graphically determined and calculated from the stress strain curves.

In total six pressure-meter tests have been performed and the results are shown in Appendix A.3., and a summary is given in Table 3.

No of Boring and depth (meter)	Pressure at Rest (kN/m^2)	Yield Pressure (kN/m^2)	Failure Pressure (kN/m^2)	Modulus of Soil Reaction (MN/m^3)	Elastic Modulus (MN/m^2)
BH.4 -3.0	90	350	450	261.2	13.0.
BH.4 -5.0	60	270	410	54.0	2.77
BH.4 –6.5	60	420	820	347.1	16.87
BH.9 –2.0	60	380	730	126.7	6.34
BH.9 – 3.5	90	310	550	142.2	7.10
BH.9 –9.0	78	800	1000	364.6	18.6

Table 3. Pressuremeter Results from Boreholes BH.4 and BH.9

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III.6 Laboratory Tests

Undisturbed samples recovered from the boreholes from the soft upper soil layers were tested in the laboratory in order to determine their physical and engineering properties by means of the following tests:

1. Index Properties and Classification:
   - Natural Moisture Content (ASTM D 2216)
   - Bulk Density (ASTM D-1557)
   - Specific Gravity (ASTM D127)
   - Void Ratio (ASTM D-2216)
   - Atterberg Limits (Plastic and Liquid Limits) (ASTM D4318)
   - Particle Size Distribution (ASTM D422)
   - Shrink-Swell Index (AS 1289.7.1.1)
2. Engineering Properties:
   - Unconsolidated Undrained Triaxial Test (ASTM D2850)
   - Consolidation test (ASTM D 2435)

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The laboratory test results is tabulated in the summary of soil test data and presented in Appendix B in this Report, including graphs of grain size distribution, triaxial test and consolidation tests.

IV.0 SUBSOIL CONDITIONS

IV.1 Local Geology

The subsoil of Jakarta comprises the end and bottom part of a wide alluvial fan that has been formed by the activities of the nearby volcanoes (Gede, Salak and Pangrango), and which is situated at about 60 kilometres south of Jakarta and where it is interfacing with the marine sediments at North Jakarta.

The most upper 5 to 10m soil consists predominantly of weathered volcanic ash and is known as the Jakarta Tuffaceous Red Clays. This clay have a relative low bulk density, but have high shear strength and very high plasticity range between 30 to 60 percent, and mineralogical could be identified as an allophane. (L. Wesley)

IV.2 Soil Stratification and Classification

As shown the soil/rock stratification from top (=ground surface) to bottom can be shown as the cross sectional profile across boreholes is as follows:

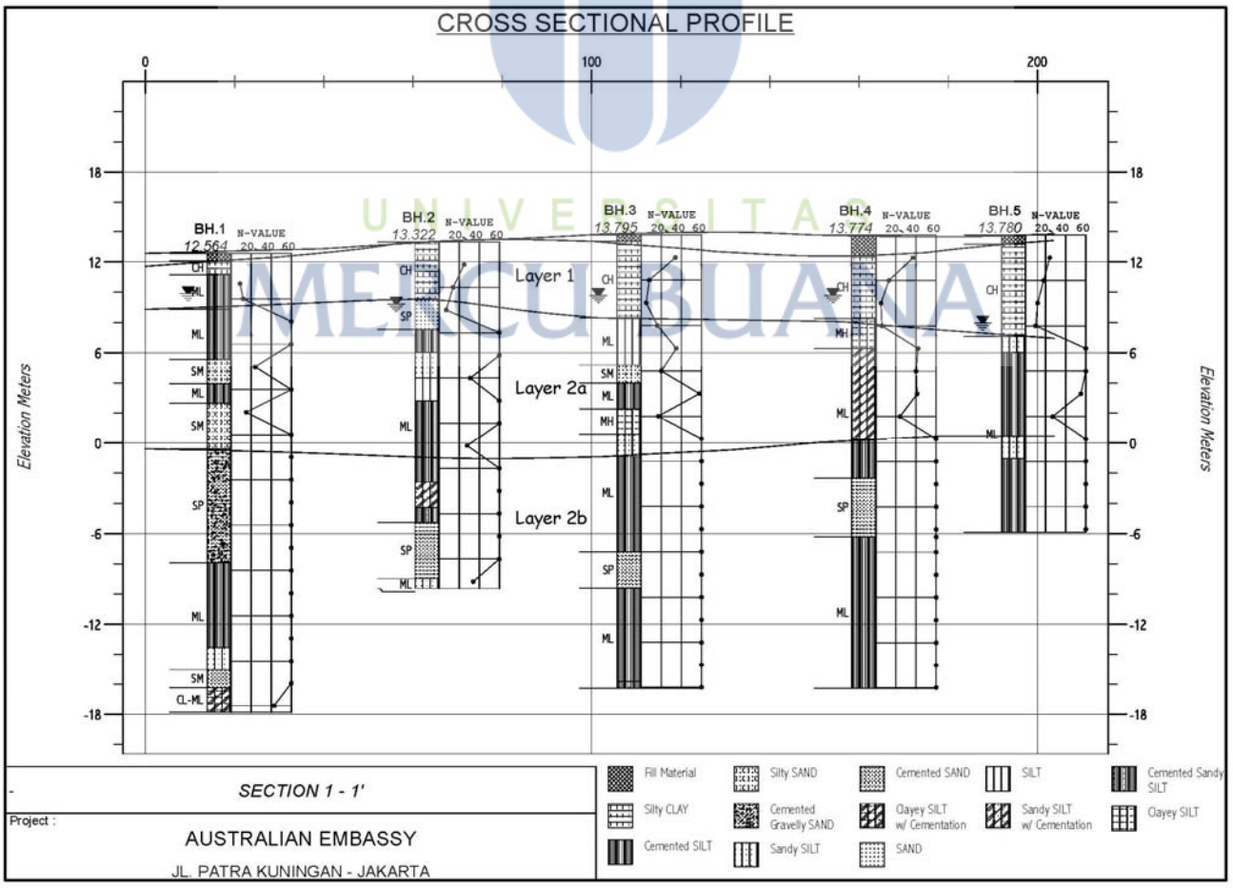

Figure 4a . Cross Section of Soil at Australian Embassy Site through Boreholes BH1 ~BH5

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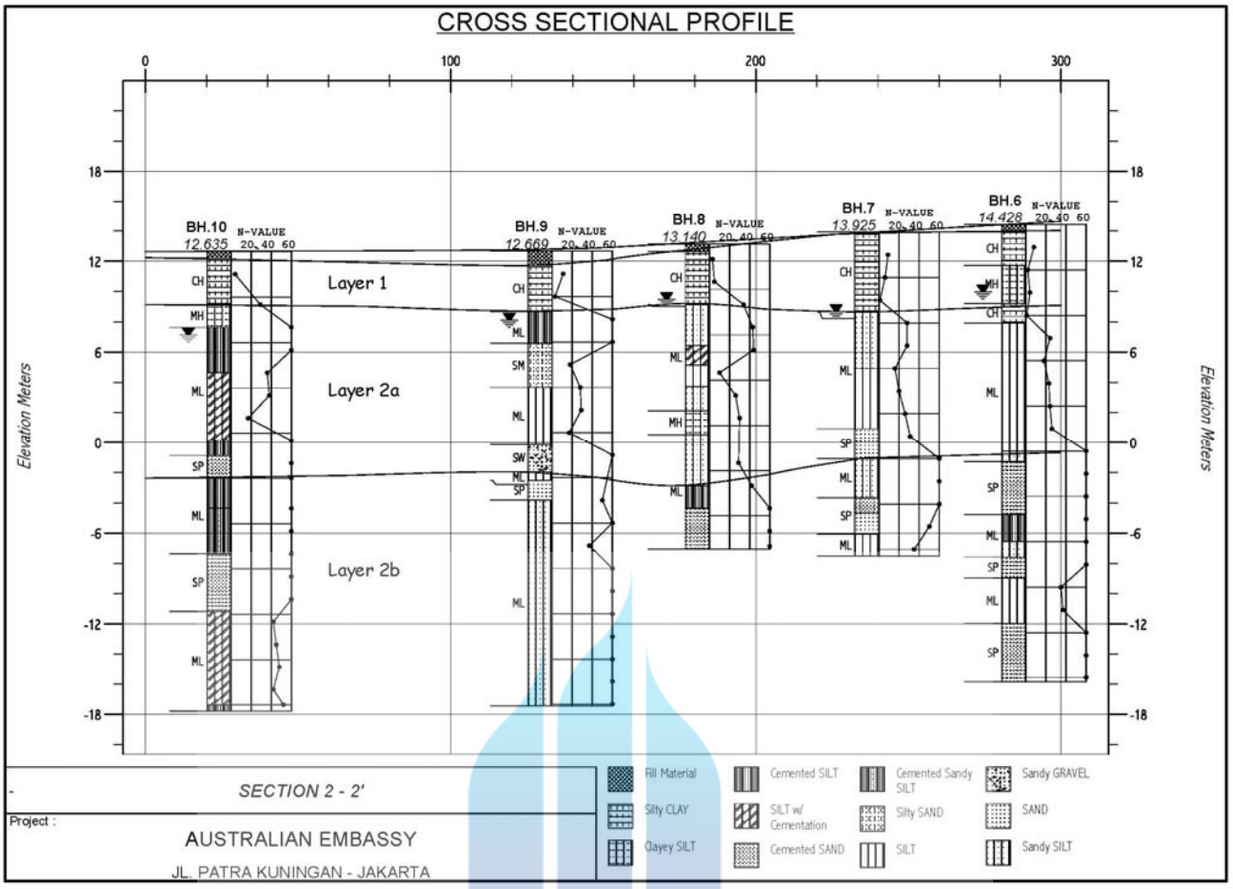

Figure 4b . Cross Section of Soil at Australian Embassy Site through Boreholes BH6 ~BH10

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Stratum/Layer1: Weathered Volcanic Ash

Highly plastic volcanic Silty Clay, ranging from soft to very stiff consistency

The thickness of this layer range from 5.0 to 8.0m, and has a soft to very stiff consistency with N_{SPT} = 3 to 37

The soft soils coincides with the ground water table fluctuation, mainly between depth of 3.5 to 5.5m (=Elevation + 7.0 to +9.0m) from ground surface

Stratum/Layer 2a : River Alluvial Deposits

This stratum of alluvial deposits can be divided into two sublayers, namely layer 2a and layer 2b.

<u>Soil layer 2a</u> consists of mainly of cemented silts and sand layers and extends to about elevation +0.0m to -3.0m and are of high variability ranging from loose to very dense consistency with N_{SPT} = 10 to 60.

<u>Soil Layer 2b</u>. This soil stratum starts at approximately elevation +0.0m and is basically the same soil material as layer 2a, however the cementation is more stronger and their consistency is very hrd or dense as shown by the N_{SPT} of higher than 60blows/30cm penetration.

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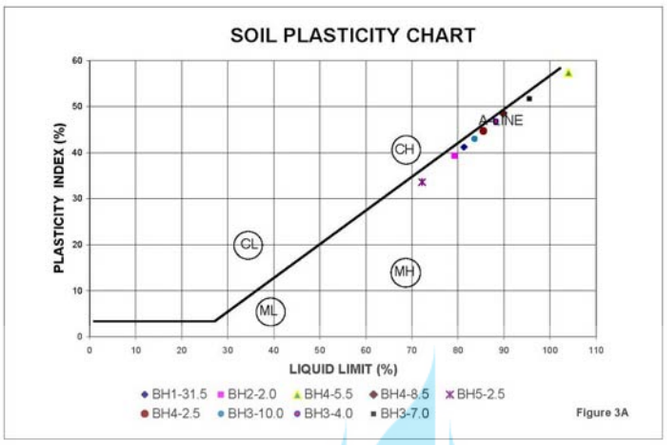
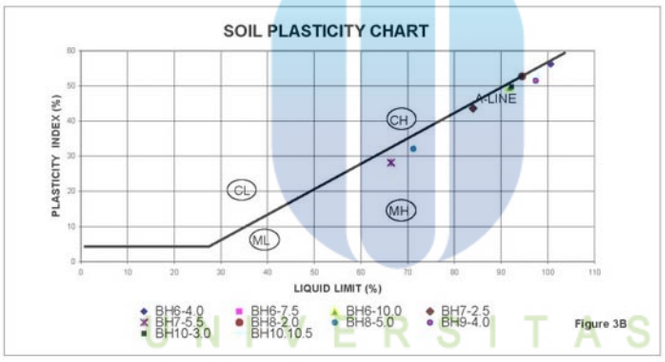
IV.3 Soil Characteristics

The subsoil layers as described above show that the upper silty clays above the water table line has high plasticity and have also very high undrained shear strength.

The average thickness of this layer is approximately 4.0m, and this upper clay layer is only suitable to support light loads or small shallow footings.





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Based on the obtained test results, the average soil parameters of the upper soil layers can be determined as follows:

Layer 1 : Medium stiff to very stiff Volcanic Silty Clay/Clayey Silt

-Thickness of Soil layer		:	4 to 6 m
- Wet Density	γ_w	:	16.0 kN/m3
- Moisture Content	w_n	:	55%
- Plasticity Index	PI	:	45%
- Undrained shear Strength	c_u	:	50 kN/m2
- Friction Angle	ϕ	:	27°
- Preconsolidation Pressure	P_c	:	180 kN/m2 (=Overconsolidated clay)
- Compression Index	C_c	:	0.30
- Recompression Index	$C_{r:}$	:	0.05
- Coefficient of Earth Pressure at Rest	K_o	:	0.6 (from Pressuremeter Test)
- Coefficient of Active Earth Pressure	K_a	:	0.38
- Coefficient of Passive Earth Pressure	K_p	:	2.7
- Young Elasticity Modulus	E	:	6 MN/m^2
- Coefficient of Soil Reaction	k_m	:	14 MN/m^3

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Layer 2a : Stiff to very hard cemented Clayey Silt or Silty Sand

-Thickness of Soil layer		:	7 to 9 m
- Wet Density	γ_w	:	15 kN/m3
- Moisture Content	w_n	:	60%
- Plasticity Index	PI	:	40%
- Undrained shear Strength	c_u	:	25 kN/m2
- Friction Angle	ϕ	:	37°
- Preconsolidation Pressure	P_c	:	170 kN/m2 (=Overconsolidated)
- Compression Index	C_c	:	0.4
- Recompression Index	C_r	:	0.06
- Coeffcient of Earth Pressure at Rest	K_o	:	0.4 (from Pressuremeter Test)
- Coefficient of Active Earth Pressure	K_a	:	0.24
- Coefficient of Passive Earth Pressure	K_p	:	4.0
- Young Elasicity Modulus	E	:	19 MN/m^2 (from Pressuremeter Test)
- Coefficient of Soil Reaction	k_m	:	37 MN/m^3 (from Pressuremeter Test)

IV.4 Soil Bearing Capacity and Settlemen of Foundations

The proposed soil bearing layers that could support the structural loads shall be either the upper soil layer 1, or soil layer 2b.

Shallow Foundation

Layer -1

In case shallow foundation support is used within layer 1, with footing width of say 1000mm to 1500mm and a structure load of 100kPa, and based on the prevailing soil parameters as described above and where the soil is in a pre-consolidated condition, hence the long term (=consolidation) calculated settlement is 15 to 30mm, respectively.

The Short term (=elastic) settlement of the 1000mm and 1500mm footing width and structure load pressure of 100kPa, will amount 13 to 20mm .

Hence the total (maximum) absolute settlement (immediate & long term), for 1000mm and 1500mm wide footing is estimated to amount to 30mm and 50mm, respectively.

Layer 2a

In case shallow foundation support is used within layer 2a, with footing width of say 1000mm to 1500mm and a structure load of 100kPa, and based on the prevailing soil parameters as described above and where the soil is in a pre-consolidated condition, the the long term (=consolidation) calculated settlement is 9 to 15mm, respectively.

The Short term (=elastic) settlement of the 1000mm and 1500mm footing width and structure load pressure of 100kPa, will amount 4 to 6mm .

Hence the total (maximum) absolute settlement (immediate & long term), for 1000mm and 1500mm wide footing is estimated to amount to 13mm and 20mm, respectively.

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Raft Foundation

Layer -1

In raft foundation support is used within layer 1, and say using a structure load of 30kPa, and based on the prevailing soil parameters as described above and the compressible soil is about 5.0m to 6.0m thick and is in a pre-consolidated condition, hence the long term (=consolidation) settlement will be relatively small and range maximum 30 to 40mm.

Deep foundation

Large diameter bored piles are the most suitable foundation system to be used for support of the high column loads of the Chancery buildings. Besides of their high load capacity per pile, this pile method is also more environmental friendly when compared with driven pile.

The piles shall be embedded at least 5m into to the very dense silt and sand layer (at Layer 2b) or reach minimum to elevation RL -5m. These piles are considered as predominant end-bearing piles.

Depending on the required load support for the building, 800mm and/or 1000mm diameter bored piles may be used here and using allowable load capacity of 3000 and 4000 kN, respectively.(See Plate 1 for Bored Pile Capacity vs Depth).

The estimated settlement for the abovementioned bored piles will be negligible for both short and long term for single piles, and amounts to 3 to 5mm for pile groups (2 to 4 piles)

The lateral load capacity of 800mm and 1000mm diameter bore piles is 200 kN and 300 kN, respectively.

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Jakarta, 28 June 2010

Benny Kumara

http://digilib.mercubuana.ac.id/

ALLOWABLE BEARING CAPACITY OF CONCRETE BORED PILES

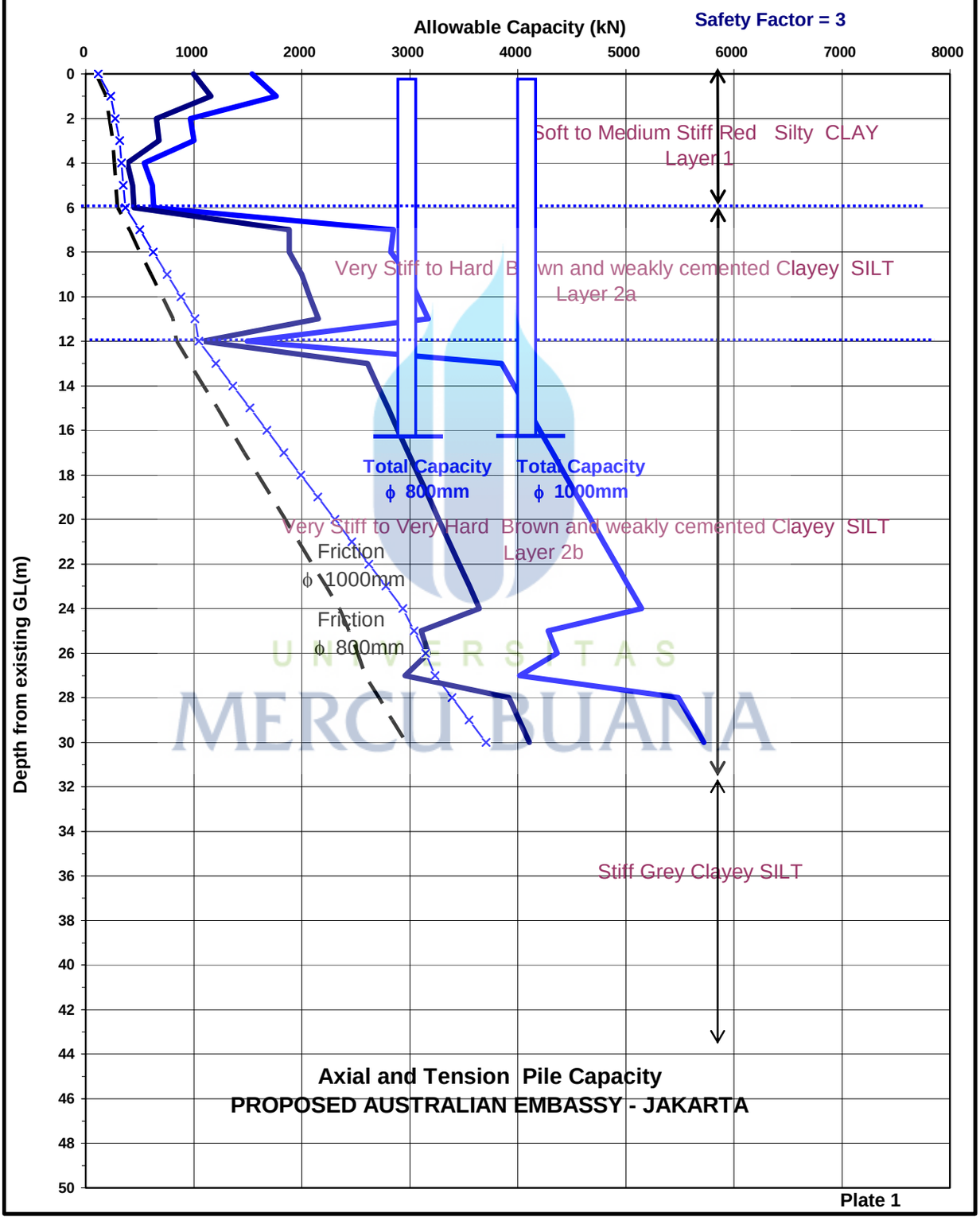

Plate 1

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SUPPLEMENT REPORT

GEOTECHNICAL INVESTIGATION

AT

THE PROPOSED AUSTRALIAN EMBASSY BUILDING SITE

PATRA KUNINGAN BARAT ROAD – CENTRAL JAKARTA

BOOK - II

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JUNE 2010

SOFOCO

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REVISED SUPPLEMENT REPORT OF GEOTECHNICAL INVESTIGATION
AT THE PROPOSED AUSTRALIAN EMBASSY BUILDING SITE
PATRA KUNINGAN ROAD , CENTRAL JAKARTA.
JUNE 2010

1. Soft and Swampy Soil Material

As a consequence of uneven accumulation of volcanic ash during eruptions in the past era and the transportation by surface water, causes some areas as at this site to have lower elevation than their surrounding area. Such is the case at the swampy area at the Australian Embassy site where about 3.0m difference of ground surface can be observed.

The swamps are ponding water areas and the soil at the bottom of the swamp consists of the same volcanic ash, but is covered by organic material brought in by water from surrounding areas.

While for Jakarta area, the month of November is already the start of the rainy season, it could be observed that the ground water table in borehole BH.5 has raised to about 2.0m during early December 2009 or is at RL. + 10.08m, while at borehole BH.10 there was no appreciable raise in water level, but has slightly dropped 75cm over a period of the 2 months.

2. Batter Slopes in the Upper Clays

The upper clay is a volcanic clay that has relatively high undrained shear strength of 30 to 60 Kpa, and high angle of internal friction (15° to 27°).

For open excavations into this soil formation is possible to have relatively steep embankment slopes of 1:1 for temporary conditions, such as for excavation for basements, and 1: 1.5 for permanent battered slopes.

3. Use of Existing Soil Material for Engineered Fill

The present upper clays that is known as the Jakarta Red Clays are of volcanic ash origin and although is classified as a clay, it is more a silt soil and is a commonly used and is a well sought fill material and known to have excellent compaction characteristics.

While during the geotechnical investigation no compaction test have been performed on the volcanic clay, however from experience of testing similar type of soils, the following compaction characteristics are prevalent (based on the Standard Proctor Test).

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Maximum Dry Density (MDD) kN/m3	Optimum Moisture Content (%) (%)
12.8	36
13.4	31

Soaked CBR = 6 ~ 9 %

Normally the above parameters are used for use of engineer fill and for subgrade for pavement.

The red clay has relatively low swell potential of 1.5 to 2 %, hence is a good backfill material.

4. Soil Bearing Capacity for Intermediate Depth

The bearing capacity of 150 kPa applies generally to the most upper soil layer which in the soil report is identified as Layer-1. As seen from the cross-sectional profile of boreholes, this Layer-1 extends to approximately RL +9.0m.

When the basement level is placed at RL + 9.0m, then it is already at Layer-2a and which comprised a cemented silt and with consistency of N-value of 20 ~ 60. In this case the safe bearing capacity is at least 250 kPa.

5. Ground Water Table

Table 1 show the ground water levels that were recorded in the borehole during the time of drilling. On the average the water table range 2.65m to 5.45m from exitsing ground surface or is at RL +9.4m to +11.06m. At two boreholes, at BH.5 and BH.10 which are located at the most northern part and the most southern part, respectively, the water table were monitored for a period of 2months (October to December 2009). The results is shown in Figure 1 below.

BOREHOLE No..	BOREHOLE EIEVATION (METER)	GROUND WATER TABLE ELEVATION DURING DRILLING PERIOD (METER)
BH.1	12.56	9.91
BH.2	13.32	9.22
BH.3	13.8	9.77
BH.4	13.77	9.54
BH.5	14.4	9
BH.6	14.43	9.97
BH.7	13.93	8.68
BH.8	13.14	9.465
BH.9	12.67	8.11
BH.10	12.64	9.63

Table 1. Ground water Table during the time of Geotechnical Exploration

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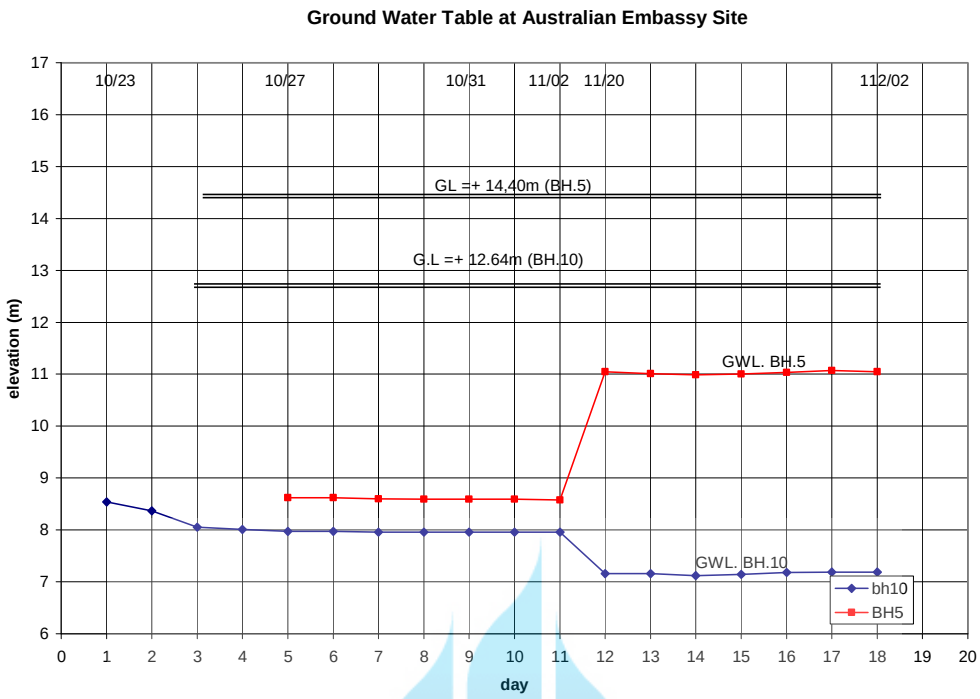

Figure 1. Long Term Monitoring of Ground water Table at Boreholes BH.5 and BH.10

While for Jakarta area, the month of November is already the start of the rainy season, it could be observed that the ground water table in borehole BH.5 has risen to about 2.0m during early December 2009 or is at RL. + 11.0m, while at borehole BH.10 there was no appreciable raise in water level, but has slightly dropped 75cm over a period of the 2 months.

It is reasonable to take the (maximum)design Water Level is at + RL 11.0m. and used for estimating the maximum uplift force at the basement floor.

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6. Datum and Survey Elevation Levels

There have been some confusion in the past when reading the ground surface elevation levels of the boreholes and trial pits in the geotechnical report and comparing with the corresponding levels as mentioned in the topographical survey map (ex Golder Associates) because of use of different of reference Bench Marks of each survey.

The geotechnical survey for positioning of the boreholes have used the following Reference Benchmark:

BM DKI No. 502 with the elevation Level (Ref. Datum Peil Priok) = +14.508m.

Golder Associate Surveyors have used for their reference elevation benchmark :

BM Pal Batu 3ST with the Elevation Level (Ref. Datum Peil Priok) = + 18.716m

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In order to alleviate the misinterpretation of the elevation level readings, a joint survey was carried out during June 8, 2010, and the elevation o the borehole positions were taken from the reference benchmark MAG 03 that was established by Golder's Surveyor and was found still preserved at the time of the new survey.

The result of the this new level survey is that the elevation levels of the geotechnical report has to be reduced by 1.29m. All elevation levels in the revised Geotechnical and this supplement report has been corrected to the new corrected elevation levels.

7. Earthquake Design Parameters

The downhole seismic and the N-SPT tests are the reference tests for classification of soil for earthquake design. In addition a specific site response spectra analysis was also carried out to Determine the appropriate ground peak velocity and acceleration of the soil can be determined as follows:

Location	Average N-SPT		Average Shear Velocity Vs (m/sec)	
	Field Test	(SNI1726-2002)	Downhole Test	(SNI1726-2002)
BH-1	32	>15 = Medium	303	>175 - Medium
BH-2	10	<15 = Soft	233	>175 - Medium

Table 2. Average N-SPT and Shear Wave Velocity values and Soil Classsification

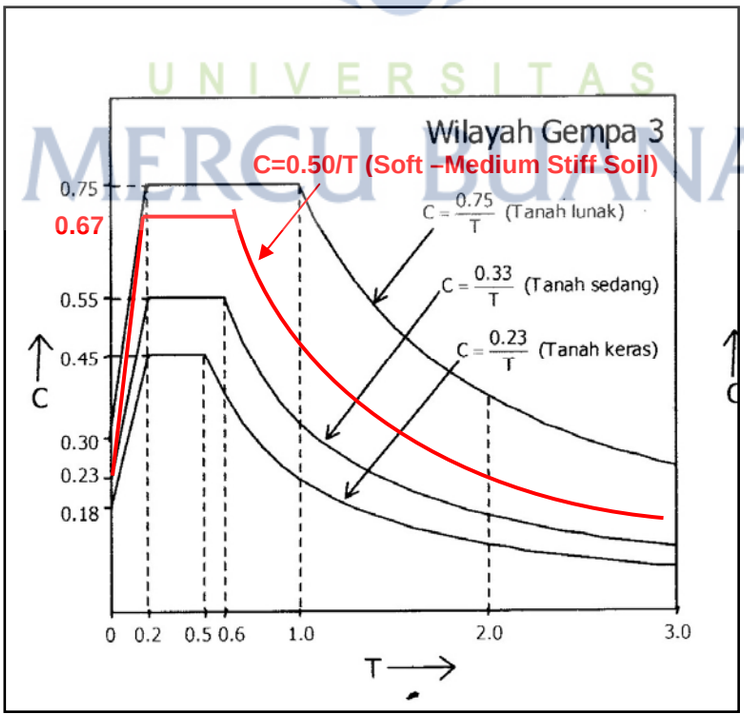

Figure 2. Earthquake Design Response Spectra at Ground Surface based on SSRS analysis at Australian Embassy Site and SNI 1726-2002 for Earthquake Zone 3

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As shown from above table, and from the N-SPT values taken from boreholes BH.01 and BH-06 show an average medium type soil and soft soil respectively. However, the downhole test results show for both boreholes of a medium type soil.

The site specific response spectra analysis which was based on input of the shear wave velocities and five historical earthquake sources gives a spectral response is presented in Book III, and summarized as in figure 2 above.

The site response spectrum is shown as a spectral line at in-between the soft and medium stiff spectral soil response classiication line.

The earthquake design response factor C = 0.50/T, and where T = The (Fundamental) natural frequency of the structure..

The static equivalent earthquake (base) shear force of the building could be determined to follow the formula as stated by SNI 1726-2002 or UBC 1989. as follows:

$$V = [(C.I).W]/R$$

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Surface Geologic Map of Jakarta Area

Reference PETA GEOLOGI LEMBAR JAKARTA DAN KEPULAUAN SERIBU,JAWA(1992)
Pusat Penelitian dan Pengembangan Geologi - Bandung

Legend:
Qa - Recent River Deposits : **Mud**, Sand, gravel and Cobbles
QBr - Beach Ridge Deposits : **Sand**, Clay, with Molluscs Shells
Qav = Unit of Conglomeratic
and Tuffaceous Sandstone : Tuffaceous Sandstone conglomerate, **Tuff** and **breccia**

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APPENDIX A.1

BOREHOLE LOGS

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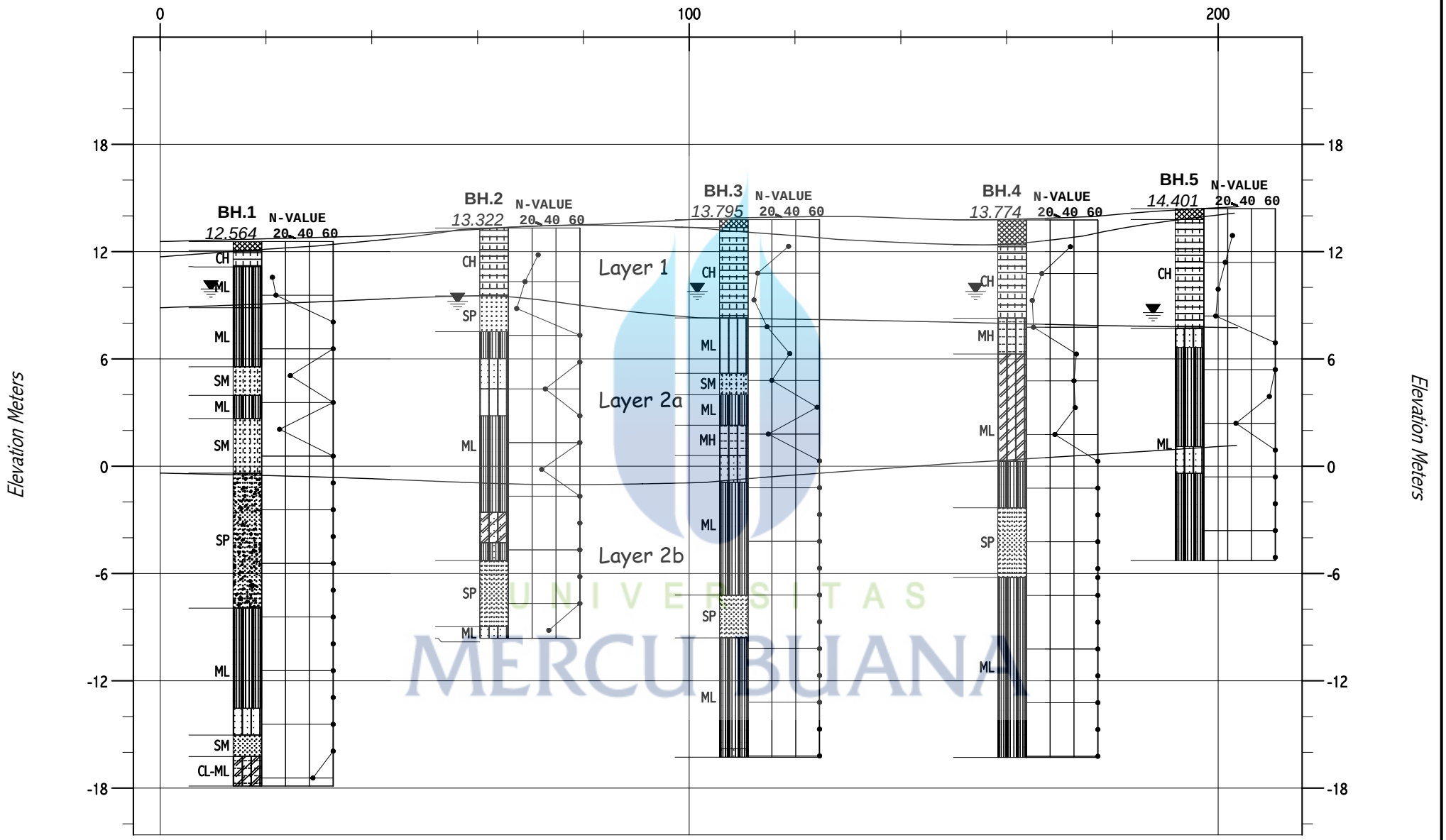
CROSS SECTIONAL PROFILE



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SECTION 1 - 1'

Project :

AUSTRALIAN EMBASSY

JL. PATRA KUNINGAN - JAKARTA

Fill Material
Silty SAND
Cemented SAND
SILT
Cemented Sandy SILT
Silty CLAY
Cemented Gravelly SAND
Clayey SILT w/ Cementation
Sandy SILT w/ Cementation
Clayey SILT
Cemented SILT
Sandy SILT
SAND

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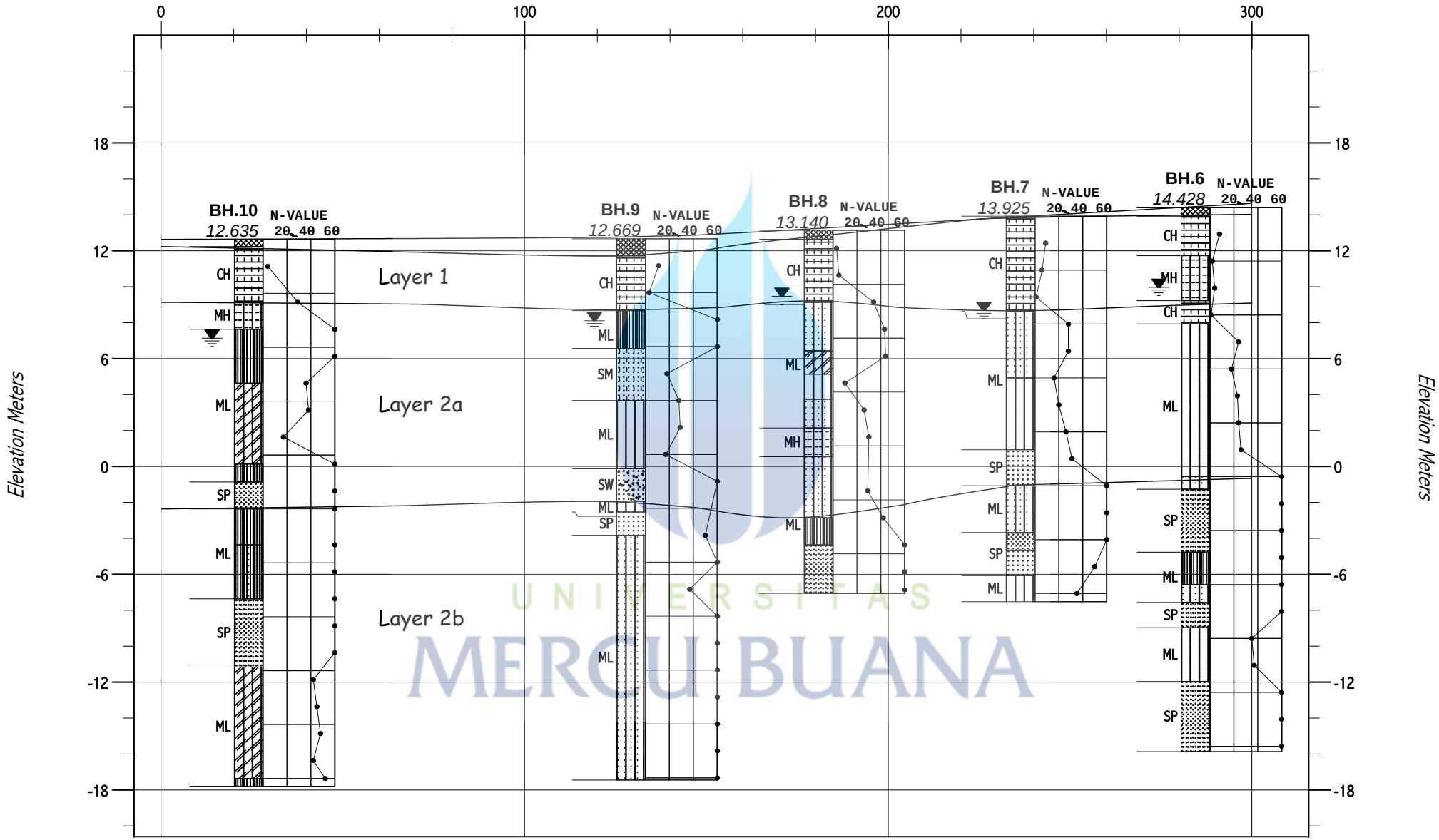
CROSS SECTIONAL PROFILE



SECTION 2 - 2'

Project :

AUSTRALIAN EMBASSY

JL. PATRA KUNINGAN - JAKARTA

Fill Material
Silty CLAY
Sandy SILT
Cemented SILT
SILT w/ Cementation
Cemented SAND
Cemented Sandy SILT
Silty SAND
SILT
Sandy GRAVEL
SAND
Sandy SILT

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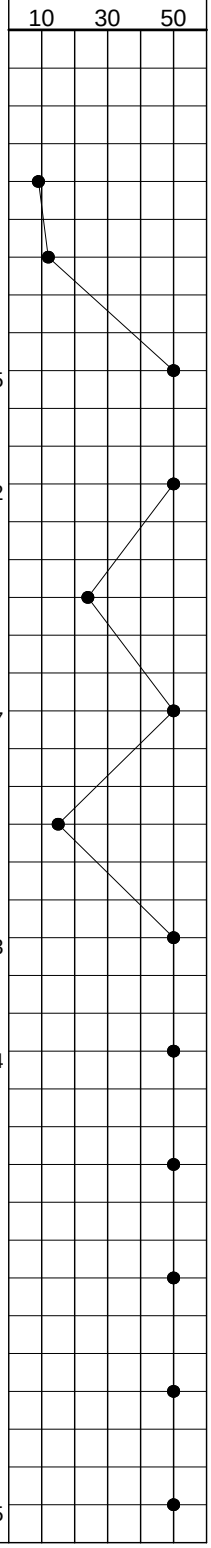
BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : BH.1
ELEVATION : 12.564 M
G.W.L. : - 2.65 M BELOW GROUND SURFACE

COORDINATE
E = 702839.760
N = 9310683.153

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
		0.00	Fill material of ruins.		
		0.50	Stiff, light grey and yellowish brown silty clay.		
				1.50-2.00	UDS
	2/15 4/15 5/15	CH	Ditto, colouring greyish brown.	2.00-2.45	9
	2/15 4/15 8/15			3.00-3.45	12
		3.70	Very hard, brown cemented silt.		
	15/15 27/15 23/10	ML		4.50-4.90	50/25
	50/12		Ditto.	6.00-6.12	50/12
		7.00	Medium dense, brownish black silty sand.		
	5/15 10/15 14/15	SM		7.50-7.95	24
		8.60	Very hard, black cemented silt.		
	16/15 40/15 10/2	ML		9.00-9.32	50/17
		9.90	Medium dense, dark grey silty sand.		
	3/15 6/15 9/15	SM		10.50-10.95	15
		11.40	Very hard, grey cemented silt.		
	14/15 35/15 15/8	ML		12.00-12.38	50/23
		12.95	Very dense, black cemented gravelly sand.		
	50/14			13.50-13.64	50/14
	50/5		Ditto.	15.00-15.05	50/5
	50/5	SP	Ditto.	16.50-16.55	50/5
	50/5		Ditto.	18.00-18.05	50/5
	50/15		Ditto.	19.50-19.65	50/15

CURVE



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SOFOCO

PROJECT : AUSTRALIAN EMBASSY

BORING No. : BH.1

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE (10 30 50)
20 / -8	20.00				
	20.50	Very hard, dark grey cemented silt.			
21	30/15 20/6		21.00-21.21	50/21	
22 / -10	16/15 50/10	Ditto.	22.50-22.75	50/10	
23	ML				
24 / -12	16/15 50/14	Ditto.	24.00-24.29	50/14	
25	22/15 50/7	Ditto, colouring greenish grey.	25.50-25.72	50/7	
26 / -14	26.10	Very hard, greenish grey sandy silt.			
27	ML 10/15 25/15 25/10		27.00-27.40	50/25	
28 / -16	27.60 SM 50/14	Very dense, grey cemented silty sand.	28.50-28.64	50/14	
29	28.80 CL-ML	Hard, berownish grey clayey silt.			
30 / -18	10/15 18/15 25/15		30.00-30.45	43	
31	30.45	Boring terminated at a depth of 30.45 M, on October 18 - 21, 2009.			
32 / -20		NOTE :			
33		UDS = Undisturbed Sample			
34 / -22					
35					
36 / -24					
37					
38 / -26					
39					
40 / -28					
41					
42 / -30					
43					

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SOFOCO

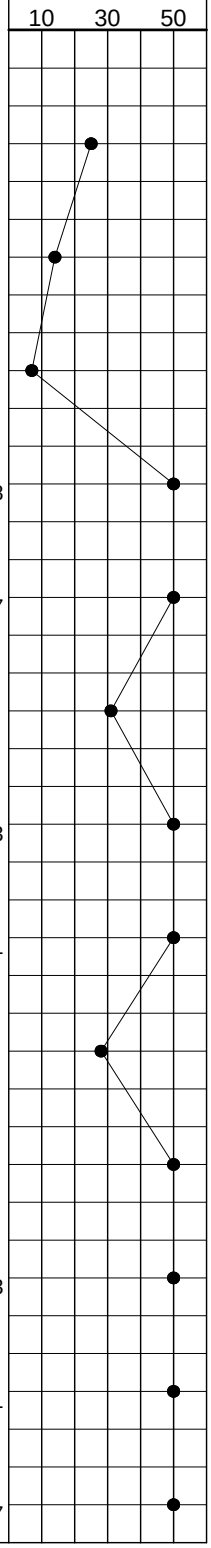
BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : BH.2
ELEVATION : 13.322 M
G.W.L. : - 4.10 M BELOW GROUND SURFACE

COORDINATE
E = 702859.732
N = 9310725.383

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
	0.00	Very stiff, red silty clay.		
	5/15 10/15 15/15 CH	Ditto.	1.50-1.95	25
			2.50-3.00	UDS
	4/15 6/15 8/15	Ditto, stiff colouring light brown.	3.00-3.45	14
	3.80	Loose, black fine sand.		
	2/15 3/15 4/15 SP		4.50-4.95	7
	5.80	Very hard, black cemented silt.		
	35/15 15/3 ML		6.00-6.18	50/18
	7.30	Very hard, dark brown fine sandy silt.		
	40/15 10/2 ML		7.50-7.67	50/17
	9.00	Very stiff, brown silt.		
	6/15 12/15 19/15 ML		9.00-9.45	31
	10.50	Very hard, dark grey cemented silt.		
	12/15 30/15 20/8		10.50-10.88	50/23
	16/15 32/15 18/6	Ditto, colouring greenish grey.	12.00-12.36	50/21
	ML			
	7/15 12/15 16/15	Ditto, very stiff.	13.50-13.95	28
	15/15 50/6	Ditto, very hard collouring grey.	15.00-15.21	50/6
	15.90	Very hard, grey sandy silt with cementation.		
	12/15 27/15 23/8 ML		16.50-16.88	50/23
	17.60	Very hard, black cemented fine sandy silt.		
	35/15 15/6 ML		18.00-18.21	50/21
	18.60	Very dense, black cemented sand.		
	40/15 10/2 SP		19.50-19.67	50/17

CURVE



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PROJECT : AUSTRALIAN EMBASSY

BORING No. : BH.2

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE (10 30 50)
20 / -8	14/15 30/15 20/6 — SP — 20.00	Very dense, black cemented sand.	21.00-21.36	50/21	
22	7/15 15/15 19/15 — ML — 22.30 / 22.95	Hard, black fine sandy silt.	22.50-22.95	34	
23 / -10		Boring terminated at a depth of 22.95 M, on October 23 - 25, 2009.			
24		NOTE :			
25 / -12		UDS = Undisturbed Sample			
26					
27 / -14					
28					
29 / -16					
30					
31 / -18					
32					
33 / -20					
34					
35 / -22					
36					
37 / -24					
38					
39 / -26					
40					
41 / -28					
42					
43 / -30					

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SOFOCO

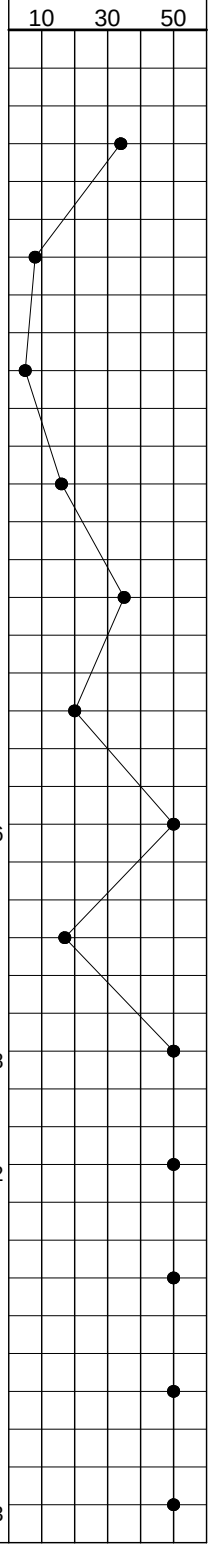
BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : BH.3
ELEVATION : 13.795 M
G.W.L. : - 4.025 M BELOW GROUND SURFACE

COORDINATE
E = 702881.038
N = 9310765.659

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
		0.00	Fill material of red silty clay with ruins.		
		0.45	Hard, light brown silty clay.		
	5/15 14/15 19/15		Ditto.	1.50-1.95	34
	2/15 3/15 5/15	CH	Ditto, medium stiff colouring light brown.	3.00-3.45	8
				4.00-4.50	UDS
	2/15 2/15 3/15		Ditto.	4.50-4.95	5
		5.50	Stiff, brown silt.		
	3/15 6/15 10/15			6.00-6.45	16
		ML		7.00-7.50	uds
	8/15 12/15 23/15		Ditto, hard.	7.50-7.95	35
		8.60	Medium dense, dark grey silty sand.		
	17/15 8/15 12/15	SM		9.00-9.45	20
		9.80	Very hard, brown cemented silt.	10.00-10.40	UDS
	12/15 19/15 31/11	ML		10.50-10.91	50/26
		11.50	Very stiff, grey clayey silt.		
	3/15 7/15 10/15	MH		12.00-12.45	17
		13.20	Very hard, dark grey to black sandy silt.		
	11/15 37/15 13/3	ML		13.50-13.83	50/18
		14.70	Very hard, greenish grey cemented silt.		
	10/15 31/15 19/7			15.00-15.37	50/22
	21/15 50/8		Ditto.	16.50-16.73	50/8
		ML			
	25/15 50/6		Ditto, with trace of fine sand.	18.00-18.21	50/6
	50/13		Very hard, dark grey cemented silt.	19.50-19.63	50/13

CURVE



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PROJECT : AUSTRALIAN EMBASSY

BORING No. : BH.3

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE (10 30 50)
20	20.00 ML	Very hard, dark grey cemented silt.			
21 -8	41/15 9/2 — 21.00 SP	Very dense, black cemented fine sand.	21.00-21.17	50/17	●
22	15/15 19/15 31/10	Ditto.	22.50-22.90	50/25	●
23 -10	23.40 16/15 37/15 13/5	Very hard, grey cemented silt.	24.00-24.35	50/20	●
24 -12	15/15 30/15 20/8 ML	Ditto.	25.50-25.88	50/23	●
25	33/15 17/6	Ditto.	27.00-27.21	50/21	●
26 -14	32/15 18/7	Ditto.	28.50-28.72	50/22	●
27 -16	29.60 ML 50/7 30.07	Very hard, black cemented fine sandy silt.	30.00-30.07	50/7	●
28		Boring terminated at a depth of 30.07 M, on October 20 - 24, 2009.			
29 -18		NOTE :			
30		UDS = Undisturbed Sample			
31 -20					
32 -22					
33 -24					
34 -26					
35 -28					
36 -30					
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SOFOCO

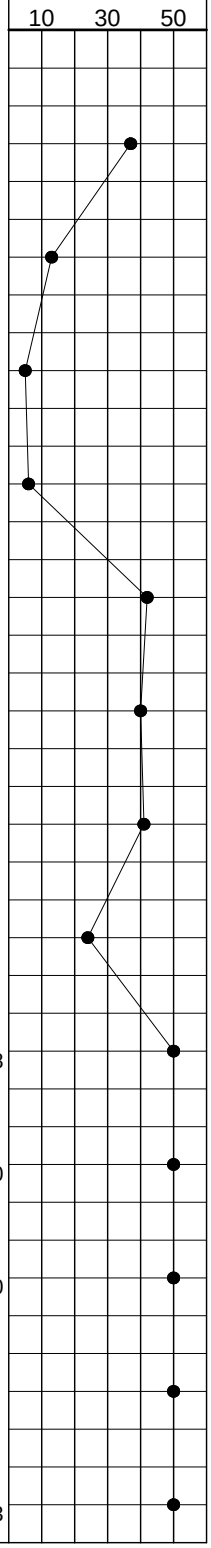
BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : BH.4
ELEVATION : 13.774 M
G.W.L. : - 4.23 M BELOW GROUND SURFACE

COORDINATE
E = 702900.564
N = 9310814.511

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
		0.00	Fill material of red silty clay mixed with gravel.		
	7/15 15/15 22/15	1.40	Hard, red silty clay.	1.50-1.95	37
				2.50-3.00	UDS
	3/15 5/15 8/15	CH	Ditto, stiff colouring light brown.	3.00-3.45	13
	1/15 2/15 3/15		Ditto, medium stiff.	4.50-4.95	5
	1/15 2/15 4/15	5.50 MH	Medium stiff, brown clayey silt.	5.50-6.00	UDS
				6.00-6.45	6
	10/15 18/15 24/15	7.50	Hard, brown silt with cementation.	7.50-7.95	42
				8.50-9.00	UDS
	10/15 17/15 23/15		Ditto.	9.00-9.45	40
	10/15 18/15 23/15	ML	Ditto.	10.50-10.95	41
	4/15 8/15 16/15		Ditto, very stiff colouring dark grey.	12.00-12.45	24
	14/15 35/15 15/3	13.50	Very hard, grey cemented silt.	13.50-13.83	50/18
	12/15 26/15 24/5	ML	Ditto, colojuring greenish grey.	15.00-15.35	50/20
	20/15 50/10	16.10	Very dense, grey cemented sand.	16.50-16.75	50/10
	24/15 50/8	SP	Ditto.	18.00-18.23	50/8
	35/15 15/8		Ditto.	19.50-19.73	50/23

CURVE



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PROJECT : AUSTRALIAN EMBASSY

BORING No. : BH.4

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE (10 30 50)
20	20.00	Very hard, black cemented silt.			
21 / -8	50/8	Ditto.	21.00-21.08	50/8	
22 / 23 / -10	50/10	Ditto.	22.50-22.60	50/10	
24	50/11	Ditto, collouring grey.	24.00-24.11	50/11	
25 / -12	ML 20/15 50/10	Ditto.	25.50-25.75	50/10	
26 / 27	50/10	Ditto.	27.00-27.10	50/10	
-14 / 28	50/5	Ditto.	28.50-28.55	50/5	
29 / -16 / 30	50/6 30.06	Ditto, colouring greenish grey.	30.00-30.06	50/6	
31 / -18 / 32		Boring terminated at a depth of 30.06 M, on October 27 - 30, 2009.			
33 / -20 / 34		NOTE : UDS = Undisturbed Sample			
35 / -22 / 36					
37 / -24 / 38					
39 / -26 / 40					
41 / -28 / 42					
43 / -30					

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SOFOCO

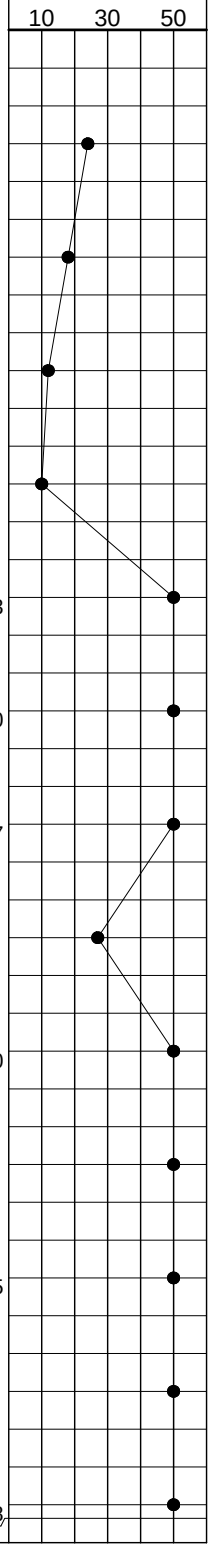
BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : BH.5
ELEVATION : 14.401 M
G.W.L. : - 5.415 M BELOW GROUND SURFACE

COORDINATE
E = 702905.996
N = 9310848.477

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
		0.00	Fill material of ruins.		
		0.60	Very stiff, greyish brown silty clay.		
	5/15 9/15 15/15		Ditto.	1.50-1.95	24
				2.50-3.00	UDS
	5/15 8/15 10/15	CH	Ditto, colouring brown and yellowish grey.	3.00-3.45	18
	4/15 6/15 6/15		Ditto, stiff colouring brownish grey.	4.50-4.95	12
	3/15 4/15 6/15		Ditto, colouring greyish brown.	6.00-6.45	10
		6.70	Dark brown, very fine sandy silt.	7.00-7.50	UDS
	12/15 25/15 25/8	ML	Very hard, brown sandy silt.	7.50-7.88	50/23
		7.75	Very hard, dark brown cemented silt.		
	12/15 50/10	ML		9.00-9.25	50/10
	9/15 24/15 26/12		Ditto.	10.50-10.92	50/27
	7/15 12/15 15/15	11.80 ML	Very stiff, greyish brown fine sandy silt.	12.00-12.45	27
	10/15 35/15 15/5	13.30 ML	Very hard, black sandy silt.	13.50-13.85	50/20
	25/15 50/8	14.80	Very hard, grey cemented sand.	15.00-15.23	50/8
	50/15	ML	Ditto.	16.50-16.65	50/15
	21/15 50/5		Ditto.	18.00-18.20	50/5
	33/15 17/3	19.68		19.50-19.68	50/18

CURVE



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SOFOCO

PROJECT : AUSTRALIAN EMBASSY

BORING No. : BH.5

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE 10 30 50
20		Boring terminated at a depth of 19.68 M, on October 25 - 27, 2009.			
-6					
21					
		NOTE :			
22					
-8		UDS = Undisturbed Sample			
23					
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25					
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-12					
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-14					
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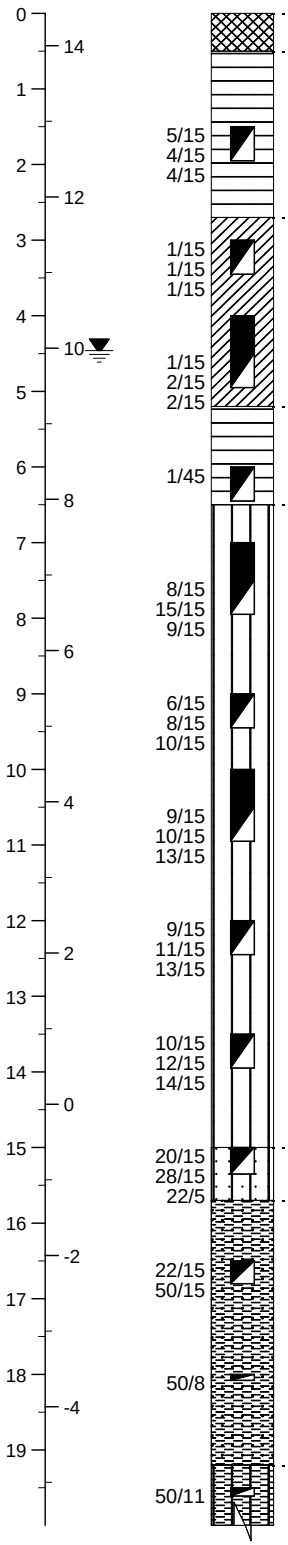
SOFOCO

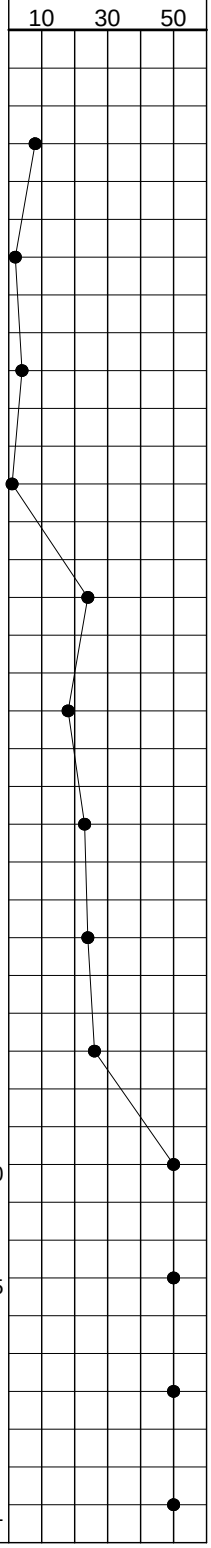
BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : BH.6
ELEVATION : 14.428 M
G.W.L. : - 4.46 M BELOW GROUND SURFACE

COORDINATE
E = 702972.404
N = 9310840.926

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
		0.00	Fill material of red silty clay mixed with ruins.		
		0.50	Medium stiff, brown and grey silty clay.		
	5/15 4/15 4/15	CH		1.50-1.95	8
		2.70	Very soft, greyish brown clayey silt.		
	1/15 1/15 1/15	MH		3.00-3.45	2
				4.00-4.50	UDS
	1/15 2/15 2/15		Ditto, soft.	4.50-4.95	4
		5.20	Very soft, light brown silty clay.		
	1/45	CH		6.00-6.45	1/45
		6.50	Very sgtiff, brown silt.		
				7.00-7.50	UDS
	8/15 15/15 9/15		Ditto, colouring light brown.	7.50-7.95	24
	6/15 8/15 10/15			9.00-9.45	18
			Ditto, colouring brown.	10.00-10.50	UDS
	9/15 10/15 13/15	ML		10.50-10.95	23
	9/15 11/15 13/15		Ditto.	12.00-12.45	24
	10/15 12/15 14/15		Ditto.	13.50-13.95	26
	20/15 28/15 22/5	15.00 ML	Very hard, light brown and black sandy silt.	15.00-15.35	50/20
		15.70	Very dense, greyish black cemented sand.		
	22/15 50/15	SP		16.50-16.80	50/15
	50/8		Ditto.	18.00-18.08	50/8
	50/11	19.20 ML	Very hard, brown cemented silt	19.50-19.61	50/11





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PROJECT : AUSTRALIAN EMBASSY

BORING No. : BH.6

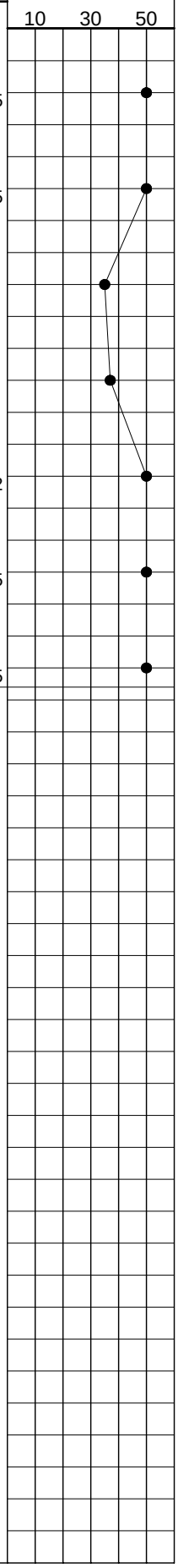
DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
20.00	ML	Very hard, brown cemented silt.		
21.00	ML	Very dense, black sandy silt.	21.00-21.40	50/25
22.00	SP	Very dense, black cemented fine sand.	22.50-22.80	50/15
23.40	ML	Hard, grey silt.	24.00-24.45	35
		Ditto.	25.50-25.95	37
26.40	SP	Very dense, black cemented fine sand.	27.00-27.12	50/12
		Ditto.	28.50-28.65	50/15
			30.00-30.30	50/15
30.30		Boring terminated at a depth of 30.30 M, on October 20 - 22, 2009.		

Depth scale: 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43

Elevation scale: -6, -8, -10, -12, -14, -16, -18, -20, -22, -24, -26, -28

Blow counts: 20/15, 22/15, 28/10; 25/15, 50/15; 10/15, 15/15, 20/15; 10/15, 15/15, 22/15; 50/12; 50/15; 20/15, 50/15

CURVE



NOTE :

UDS = Undisturbed Sample

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SOFOCO

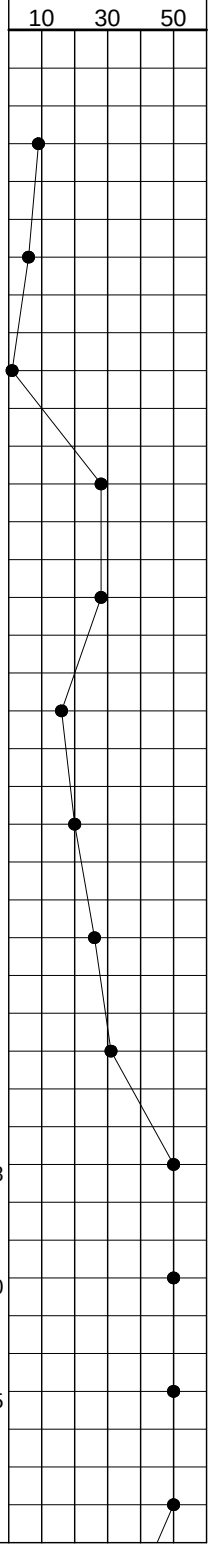
BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : BH.7
ELEVATION : 13.925 M
G.W.L. : - 5.25 M BELOW GROUND SURFACE

COORDINATE
E = 702959.630
N = 9310793.700

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
	0.00	Stiff, light brown silty clay.		
	3/15 4/15 5/15	Ditto.	1.50-1.95	9
	CH		2.50-3.00	UDS
	3/15 3/15 3/15	Ditto, medium stiff.	3.00-3.45	6
	1/45	Ditto, very soft.	4.50-4.95	1/45
	5.30	Ver stiff, black fine sandy silt.	5.50-6.00	UDS
	8/15 13/15 15/15		6.00-6.45	28
	ML			
	7/15 14/15 14/15	Ditto.	7.50-7.95	28
	9.00	Stiff, brown silt.	9.00-9.45	16
	6/15 7/15 9/15			
			10.00-10.50	UDS
	6/15 9/15 11/15	Ditto, very stiff colouring greyish brown.	10.50-10.95	20
	ML			
	6/15 12/15 14/15	Ditto, colouring grey.	12.00-12.45	26
	13.00	Dense, black fine sand.		
	12/15 15/15 16/15		13.50-13.95	31
	SP			
	12/15 18/15 32/10	Very dense, grey cemented sandy silt.	15.00-15.40	50/18
	15.00			
	ML			
	20/15 50/10	Ditto.	16.50-16.75	50/10
	17.60	Very dense, black cemented fine sand.		
	26/15 50/15		18.00-18.30	50/15
	SP			
	18.60	Dense, black silty fine sand.		
	SP			
	18/15 23/15		19.50-19.95	50

CURVE



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PROJECT : AUSTRALIAN EMBASSY

BORING No. : BH.7

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE 10 30 50
20	27/15	20.00 Hard, grey silt.			
21	11/15 15/15 20/15 ML	21.45	21.00-21.45	35	
22 -8		Boring terminated at a depth of 21.45 M, on October 23 - 25, 2009.			
23		NOTE :			
24 -10		UDS = Undisturbed Sample			
25					
26 -12					
27					
28 -14					
29					
30 -16					
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32 -18					
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34 -20					
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42 -28					
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-30					

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SOFOCO

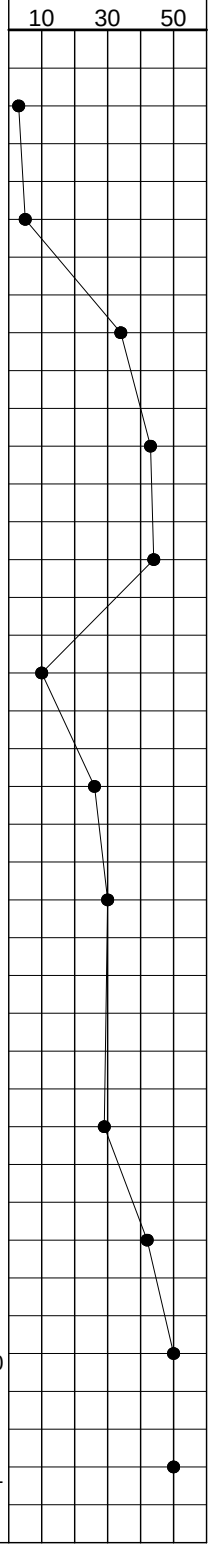
BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : BH.8
ELEVATION : 13.140 M
G.W.L. : - 3.675 M BELOW GROUND SURFACE

COORDINATE
E = 702935.807
N = 9310743.522

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
		0.00	Fill material of red silty clay with runis.		
		0.50	Stiff, red and grey silty clay.		
1 / 12	1/15, 1/15, 2/15			1.00-1.45	3
2		CH		2.00-2.50	UDS
2 / 10	2/15, 2/15, 3/15		Ditto, medium stiff colouring light brown.	2.50-2.95	5
4	8/15, 15/15, 19/15	4.00	Hard, dark grey sandy silt.	4.00-4.45	34
5 / 8		ML		5.00-5.50	UDS
6	17/15, 20/15, 23/15		Ditto.	5.50-5.95	43
7 / 6	8/15, 18/15, 26/15	6.70 ML	Very hard, brown silt with cementation.	7.00-7.45	44
8		8.00	Stiff, light brown silt.	8.00-8.50	UDS
9 / 4	3/15, 3/15, 7/15	ML		8.50-8.95	10
10	7/15, 11/15, 15/15	9.40 ML	Very stiff, brown fine sandy silt.	10.00-10.45	26
11 / 2		11.00	Very stiff, grey clayey skilt.		
12	8/15, 12/15, 18/15	MH		11.50-11.95	30
13 / 0	9/14, 15/19, 15/33	12.60	Hard, black fine sandy silt.		
14		ML			
15 / -2	8/15, 14/15, 15/15		Ditto, very stiff.	14.50-14.95	29
16	15/15, 17/15, 25/15	16.00 ML	Hard, black cemented silt.	16.00-16.45	42
17 / -4					
18	15/15, 30/15, 20/5	17.50	Very dense, black cemented sand.	17.50-17.85	50/20
19 / -6	35/15, 15/6	SP	Ditto.	19.00-19.21	50/21

CURVE (10 30 50)



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SOFOCO

PROJECT : AUSTRALIAN EMBASSY

BORING No. : BH.8

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE 10 30 50
20	40/15 10/5 20.20	Boring terminated at a depth of 20.20 M, on October 25 - 28, 2009.	20.00-20.20	50/20	
21 -8		NOTE :			
22		UDS = Undisturbed Sample			
23 -10					
24					
25 -12					
26					
27 -14					
28					
29 -16					
30					
31 -18					
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39 -26					
40					
41 -28					
42					
43 -30					

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SOFOCO

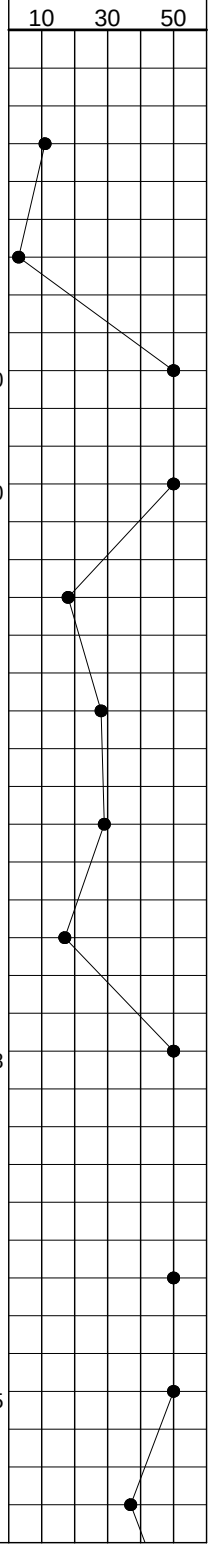
BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : BH.9
ELEVATION : 12.669 M
G.W.L. : - 4.56 M BELOW GROUND SURFACE

COORDINATE
E = 702916.481
N = 9310695.606

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
		0.00	Fill material of red silty mixed with gravel.		
		0.95	Stiff, brown silty clay.		
	4/15 5/15 6/15	CH		1.50-1.95	11
	1/15 1/15 2/15		Ditto, soft colouring light brown.	3.00-3.45	3
		4.00	Very hard, brown cemented silt.	4.00-4.35	UDS
	14/15 50/10	ML		4.50-4.75	50/10
	13/15 26/15 24/5	6.10	Ditto.	6.00-6.35	50/20
			Very dense, black silty fine sand.		
	6/15 8/15 10/15	SM	Ditto, medium dense.	7.50-7.95	18
	10/15 13/15 15/15	9.00	Very stiff, black silt.	9.00-9.45	28
				10.00-10.50	UDS
	6/15 13/15 16/15	ML	Ditto.	10.50-10.95	29
	7/15 8/15 9/15		Ditto.	12.00-12.45	17
		12.80	Very dense, black gravelly sand.	13.00-13.35	UDS
	10/15 27/15 23/3	SW		13.50-13.83	50/18
		14.60 ML	Very stiff, dark grey silt.		
		15.20 SP	Medium dense, black fine sand.		
	10/15 15/15 35/15	16.50	Hard, black sandy silt.	16.50-16.95	50
	19/15 50/15	ML	Ditto, very hard.	18.00-18.30	50/15
	10/15 17/15		Ditto, hard.	19.50-19.95	37

CURVE



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PROJECT : AUSTRALIAN EMBASSY

BORING No. : BH.9

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE (10 30 50)
20 / -8	20/15	Very hard, dark grey fine sandy silt. (20.00)			
21	18/15 30/15 20/10	Ditto.	21.00-21.40	50/25	
22 / -10	25/15 50/15	Ditto.	22.50-22.80	50/15	
23 / 24 / -12	25/15 50/10	Ditto.	24.00-24.25	50/10	
25	ML				
26 / -14	29/15 50/5	Ditto.	25.50-25.70	50/5	
27	21/15 30/15 20/10	Ditto, colouring grey.	27.00-27.40	50/25	
28 / -16	50/10	Ditto.	28.50-28.60	50/10	
29 / 30	50/12 (30.12)	Ditto.	30.00-30.12	50/12	
-18 / 31		Boring terminated at a depth of 30.12 M, on October 27 - 30, 2009.			
32 / -20 / 33		NOTE : UDS = Undisturbed Sample			
34 / -22 / 35					
36 / -24 / 37					
38 / -26 / 39					
40 / -28 / 41					
42 / -30 / 43					

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SOFOCO

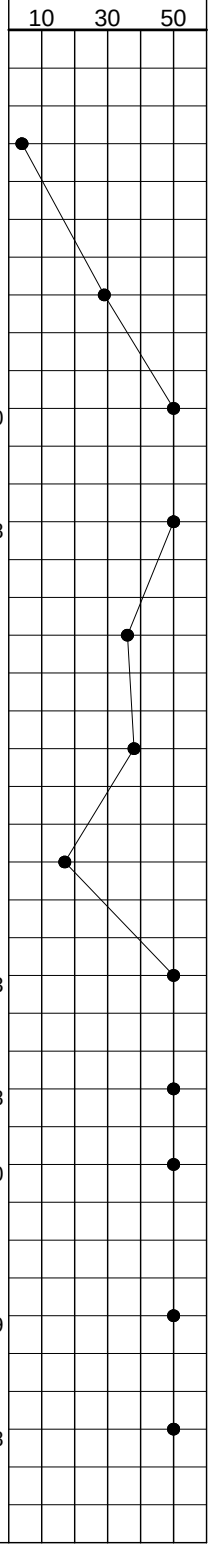
BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : BH.10
ELEVATION : 12.635 M
G.W.L. : - 3.0o1 M BELOW GROUND SURFACE

COORDINATE
E = 702860.028
N = 9310606.022

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS		DESCRIPTION	DEPTH (M)	N
		0.00	Fill material of ruins.		
		0.40	Soft, red silty clay.		
	1/15 2/15 2/15	CH	Ditto.	1.50-1.95	4
			Ditto, colouring grey.	3.00-3.50	UDS
	6/15 12/15 17/15	3.50 MH	Very stiff, brownish grey silty clay.	3.50-3.95	29
	30/15 20/5	5.00	Very hard, brown cemented silt.	5.00-5.20	50/20
	35/15 15/3	ML	Ditto, colouring dark grey.	6.50-6.68	50/18
	9/15 14/15 22/15	8.00	Hard, dark grey silt with cementation .	8.00-8.45	36
	14/15 17/15 21/15	ML	Ditto.	9.50-9.95	38
				10.50-11.00	UDS
	5/15 7/15 10/15		Ditto, very stiff.	11.00-11.45	17
	50/13	12.50 ML	Very hard, dark grey cemented skilt.	12.50-12.63	50/13
	36/15 14/3	13.50 SP	Very dense, black cemented sand.	14.00-14.18	50/18
	34/15 16/5	15.00 ML	Very hard, black cemented silt with trace of sand.	15.00-15.20	50/20
	40/15 10/4	17.00	Very hard, dark grey cemented sandy silt.	17.00-17.19	50/19
	35/15 15/3	ML	Ditto.	18.50-18.68	50/18

CURVE



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PROJECT : AUSTRALIAN EMBASSY

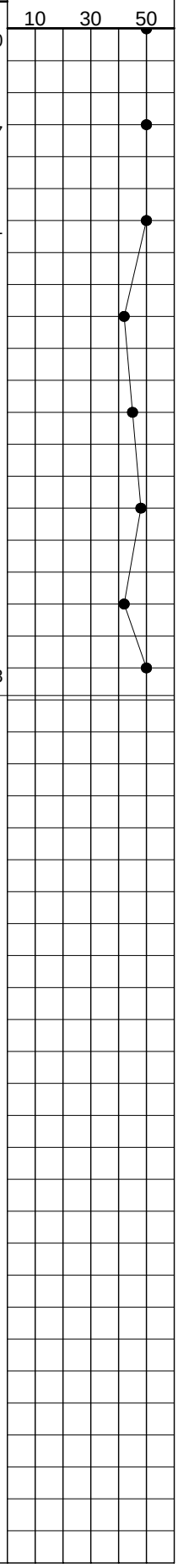
BORING No. : BH.10

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N
20 / -8	50/10	Very dense, black cemented sand.	20.00-20.10	50/10
21 / 22 / -10	38/15, 12/2 — SP	Ditto.	21.50-21.67	50/17
23	50/11	Ditto.	23.00-23.11	50/11
24 / -12 / 25	15/15, 18/15, 24/15	Hard, grey silt with cementation .	24.50-24.95	42
26 / -14 / 27	16/15, 20/15, 25/15 — ML	Ditto.	26.00-26.45	45
28 / -16	17/15, 21/15, 27/15	Ditto.	27.50-27.95	48
29	15/15, 19/15, 23/15	Ditto.	29.00-29.45	42
30 / -18	16/15, 25/15, 25/13 — ML	Very nhard, dark grey cemented silt.	30.00-30.43	50/28
31 / 32 / -20 / 33 / 34 / -22 / 35 / 36 / -24 / 37 / 38 / -26 / 39 / 40 / -28 / 41 / 42 / -30 / 43		Boring terminated at a depth of 30.43 M, on October 18 - 23, 2009.		

NOTE :

UDS = Undisturbed Sample

CURVE



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APPENDIX A.2

TRIAL PIT LOGS

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BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : TP.1
ELEVATION : 12.454 M
G.W.L. : - -

COORDINATE
E = 702810.832
N = 9310662.033

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE 10 30 50
0.00	CH	Brown silty clay.			
		Ditto, colouring dark brown.	1.00-1.25	UDS	
		Ditto, colouring light brown.	2.00-2.25	UDS	
3.20		Ditto.	3.00-3.20	UDS	

Test Pit terminated at a depth of 3.20 M, on October 28 - 29, 2009.

NOTE :

UDS = Undisturbed Sample

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BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : TP.2
ELEVATION : 12.369 M
G.W.L. : - -

COORDINATE
E = 702862.460
N = 9310669.796

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE 10 30 50
0 / 12	0.00	Red silty clay.			
1	CH	Ditto, colouring light brown.	1.00-1.25	UDS	
2 / 10		Ditto.	2.00-2.30	UDS	
3	3.00 MH 3.30	Yellowish brown clayey silt.	3.00-3.30	NRU	
4 / 8		Test Pit terminated at a depth of 3.30 M, on October 28 - 29, 2009.			
5		NOTES :			
6 / 6		UDS = Undisturbed Sample			
7		NRU = No Recovery of UDS			
8 / 4					
9					
10 / 2					
11					
12 / 0					
13					
14 / -2					
15					
16 / -4					
17					
18 / -6					
19					

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BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : TP.3
ELEVATION : 12.577 M
G.W.L. : - -

COORDINATE
E = 702892.853
N = 9310720.575

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE (10 30 50)
0.00		Fill material of ruins mixed with gravel.			
0.60	CH	Grey silty clay.	1.00-1.25	UDS	
		Ditto.	2.00-2.20	NRU	
3.00	MH	Light brown clayey silt.	3.00-3.25	UDS	
3.25		Test Pit terminated at a depth of 3.25 M, on October 28 - 29, 2009.			

NOTES :

UDS = Undisturbed Sample

NRU = No Recovery of UDS

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BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : TP.4
ELEVATION : 13.134 M
G.W.L. : - -

COORDINATE
E = 702909.147
N = 9310752.044

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE 10 30 50
0	0.00	Red silty clay.			
1 / 12	CH	Ditto, colouring red and light brown.	1.00-1.30	UDS	
2		Ditto.	2.00-2.30	UDS	
3 / 10	3.30	Ditto, colouring yellowish brown.	3.00-3.30	UDS	
4		Test Pit terminated at a depth of 3.30 M, on October 30 to November 1, 2009.			
5 / 8		NOTE :			
6		UDS = Undisturbed Sample			
7 / 6					
8					
9 / 4					
10					
11 / 2					
12					
13 / 0					
14					
15 / -2					
16					
17 / -4					
18					
19 / -6					

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BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : TP.5
ELEVATION : 13.894 M
G.W.L. : - -

COORDINATE
E = 702924.943
N = 9310792.291

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE 10 30 50
0	0.00	Fill material of gravel with silty clay.			
1	0.60	Red and light brown silty clay.	1.00-1.25	UDS	
2 (12)	CH	Ditto.	2.00-2.30	UDS	
3		Ditto, colouring red and whitish brown.	3.00-3.30	UDS	
	3.30	Test Pit terminated at a depth of 3.30 M, on October 30 to November 1, 2009.			
4 (10)					
5		NOTE :			
6 (8)		UDS = Undisturbed Sample			
7					
8 (6)					
9					
10 (4)					
11					
12 (2)					
13					
14 (0)					
15					
16 (-2)					
17					
18 (-4)					
19					
(-6)					

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BORING PROFILE

PROJECT : AUSTRALIAN EMBASSY
LOCATION : PATRA KUNINGAN - JAKARTA
BORING No. : TP.6
ELEVATION : 13.578 M
G.W.L. : - -

COORDINATE
E = 702944.507
N = 9310817.039

DEPTH/ ELEV. (M)	SOIL, SAMPLER AND STRATA SYMBOLS	DESCRIPTION	DEPTH (M)	N	CURVE 10 30 50
0	0.00	Fill material of silty clay mixed with gravel.			
	0.50	Red and yellowish white silty clay.			
1			1.00-1.30	UDS	
12	CH				
2		Ditto.	2.00-2.30	UDS	
3		Ditto, colouring red and yellowish brown.	3.00-3.30	UDS	
10	3.30	Test Pit terminated at a depth of 3.30 M, on October 30 to November 1, 2009.			
4					
5		NOTE :			
8		UDS = Undisturbed Sample			
6					
7					
6					
8					
9					
4					
10					
11					
2					
12					
13					
0					
14					
15					
-2					
16					
17					
-4					
18					
19					
-6					

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APPENDIX A.3

DOWNHOLE SEISMIC TEST

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CHAPTER I

1.1 General

Downhole seismic measurements have been carried out at the new Australian Embassy site at Jl. Patra Kuningan Jakarta at 2 (two) boreholes, namely BH-01 and BH-06

Seismic measurement at each depth level were carried out three times, firstly by impact at the vertical direction and two other impacts to left and right horizontal direction. The distance from of vertical impact point to borehole is one meter, and for horizontal impact is two meters from borehole.

1.2 Field work method

Using *down hole seismic* in field work need the borehole pick with three geophone components for horizontal (x,y) and vertical (z) directions. The borehole pick is inserted bore hole at the points for several depth variation.

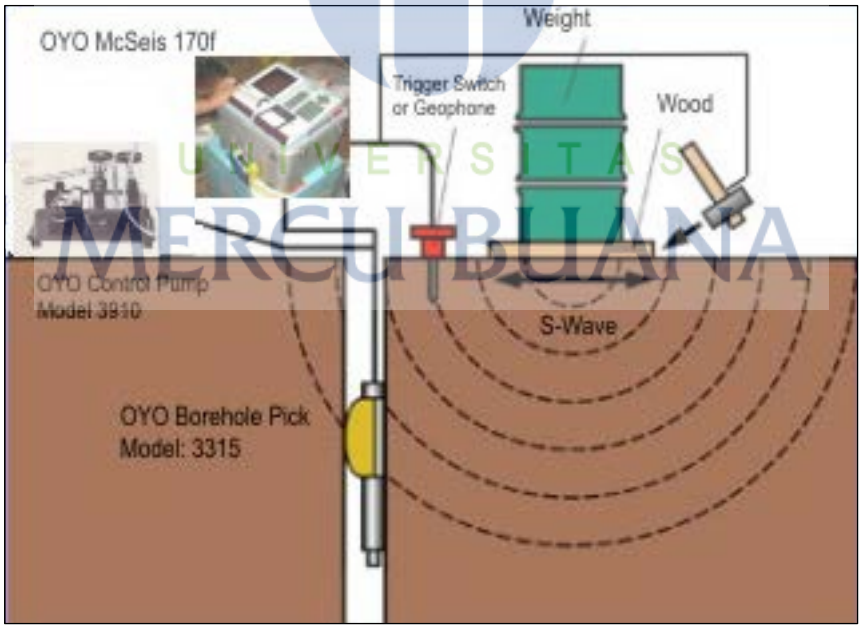

Figure 1.1. Layout of Downhole Seismic

At ground surface point about 1- 2 meters from borehole is impacted by hammer. Seismic wave will propagate to subsurface down direction and this signal will be

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responded by geophones which stick on wall of borehole and by cable will be transferred to recorder seismograph at the ground surface.

The equipment type which have been used in this survey was Seismograph OYO McSeis 170f (24 channels) and borehole pick (OYO).

As mention before, the first wave arrival at the geophone is the P-wave, and followed by the second S-wave. To increase the signal /noise ratio (S/N) of S-wave amplitude, the impact force have to be performed in horizontal direction, while the P-wave is persisted as first event but in smaller amplitude.

The result of field measurement is saved in digital files format, and then all of these files have to be processed and analyzed for their *first arrival time* of both seismic wave types.

1.3. Borehole BH-01

Waveform record of Vertical *impact* (*P- Wave*) for each depth is shown in Figure 1.1. Based on this record, then have been done *first arrival time picking* for *P- wave*. The result of *picking* is shown in table 1.1. Horizontal *Impact* to observe S-wave have been done from right and left from the borehole which the similar distant two meters. The record results of right and left impacts for each geophone component are displayed in one figure 1.2, 1.3 and figure 1.4. The result of first arrival time picking for S-wave is shown in Table 1.1.

First arrival time of *P-Wave* and *S-Wave* then be corrected by geometric correction based on equation (1) and then be calculated *interval velocity* based equation (2). The results are in Table 1.1.

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Table 1.1
First Arrival Time, Geometric Correction and Interval Velocity
at Borehole BH-01

P WAVE					S WAVE				
Depth (m)	Fcorr	Tp (msec)	Tp_{Corr} (msec)	Vp Interval (m/sec)	Depth (m)	Fcorr	Ts (msec)	Ts_{Corr} (msec)	Vs Interval (m/sec)
0	0.0000	1.3	0.0	769.2	0	0.0000	8.0	0.0	250.0
1	0.7071	1.8	1.3	785.7	1	0.4472	9.0	4.0	248.5
2	0.8944	2.8	2.5	811.9	2	0.7071	14.7	10.4	157.8
3	0.9487	3.8	3.6	908.6	3	0.8321	20.1	16.7	156.9
4	0.9701	4.8	4.7	950.9	4	0.8944	23.7	21.2	223.6
5	0.9806	5.6	5.5	1198.2	5	0.9285	27.1	25.2	252.6
6	0.9864	6.4	6.3	1217.0	6	0.9487	30.5	28.9	265.5
7	0.9899	7.2	7.1	1227.4	7	0.9615	34.6	33.3	228.8
8	0.9923	8.4	8.3	828.2	8	0.9701	38.7	37.6	235.0
9	0.9939	9.6	9.5	829.1	9	0.9762	43.2	42.2	214.7
10	0.9950	10.8	10.7	829.8	10	0.9806	47.4	46.5	232.2
11	0.9959	12.0	12.0	830.3	11	0.9839	51.7	50.9	229.8
12	0.9965	13.2	13.2	830.8	12	0.9864	55.1	54.4	287.5
13	0.9971	14.4	14.4	831.1	13	0.9884	58.5	57.8	288.8
14	0.9975	15.0	15.0	1654.8	14	0.9899	61.9	61.3	289.7
15	0.9978	15.6	15.6	1656.8	15	0.9912	65.3	64.7	290.5
16	0.9981	16.2	16.2	1658.4	16	0.9923	68.7	68.1	291.1
17	0.9983	16.8	16.8	1659.6	17	0.9932	72.1	71.6	291.5
18	0.9985	17.4	17.4	1660.6	18	0.9939	75.5	75.0	291.9
19	0.9986	18.0	18.0	1661.4	19	0.9945	78.9	78.4	292.2
20	0.9988	18.6	18.6	1662.0	20	0.9950	82.3	81.8	292.5
21	0.9989	19.2	19.2	1662.6	21	0.9955	85.3	84.9	328.9
22	0.9990	19.8	19.8	1663.0	22	0.9959	88.3	87.9	329.2
23	0.9991	20.4	20.4	1663.4	23	0.9962	91.3	91.0	329.4
24	0.9991	21.0	21.0	1663.8	24	0.9965	94.3	94.0	329.6
25	0.9992	21.6	21.6	1664.0	25	0.9968	97.3	97.0	329.8
26	0.9993	22.2	22.2	1664.3	26	0.9971	100.4	100.1	329.9
27	0.9993	22.8	22.8	1664.5	27	0.9973	103.4	103.1	330.1
28	0.9994	23.4	23.4	1664.7	28	0.9975	106.4	106.1	330.2
29	0.9994	24.0	24.0	1664.9	29	0.9976	109.4	109.1	330.3
30	0.9994	24.6	24.6	1665.0	30	0.9978	112.4	112.2	330.4

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1.4. Borehole: BH-06

Waveform record of Vertical *impact* (*P- Wave*) for each depth is shown in Figure 1.5. Based on this record, then have been done *first arrival time picking* for *P- wave*. The result of *picking* is shown in table 1.2. Horizontal *Impact* to observe S-wave have been done from right and left from the borehole which the similar distant two meters. The record results of right and left impacts for each geophone component are displayed in one figure 1.6, 1.7 and figure 1.8. The result of first arrival time picking for S-wave is shown in Table 2.2.

First arrival time of *P-Wave* and *S-Wave* then be corrected by geometric correction based on equation (1) and then be calculated *interval velocity* based equation (2). The results are in Table 1.2.

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Table 1.2
First Arrival Time, Geometric Correction and Interval Velocity
at Borehole BH-06

P WAVE					S WAVE				
Depth (m)	Fcorr	Tp (msec)	Tp_{Corr} (msec)	Vp Interval (m/sec)	Depth (m)	Fcorr	Ts (msec)	Ts_{Corr} (msec)	Vs Interval (m/sec)
0	0.0000	2.2	0.0	454.5	0	0.0000	8.0	0.0	250.0
1	0.7071	3.0	2.1	471.4	1	0.4472	9.0	4.0	248.5
2	0.8944	4.0	3.6	686.6	2	0.7071	15.2	10.7	149.5
3	0.9487	5.0	4.7	857.8	3	0.8321	25.1	20.9	98.5
4	0.9701	6.0	5.8	928.1	4	0.8944	33.2	29.7	112.9
5	0.9806	7.0	6.9	958.6	5	0.9285	41.9	38.9	108.9
6	0.9864	8.2	8.1	816.7	6	0.9487	51.8	49.2	97.5
7	0.9899	9.4	9.3	821.6	7	0.9615	56.6	54.4	190.4
8	0.9923	10.6	10.5	824.7	8	0.9701	60.8	59.0	219.2
9	0.9939	11.8	11.7	826.7	9	0.9762	65.5	63.9	202.4
10	0.9950	13.0	12.9	828.1	10	0.9806	69.7	68.4	223.7
11	0.9959	14.2	14.1	829.0	11	0.9839	73.9	72.7	232.6
12	0.9965	15.4	15.3	829.8	12	0.9864	78.2	77.1	224.1
13	0.9971	16.6	16.6	830.4	13	0.9884	82.5	81.5	228.3
14	0.9975	17.8	17.8	830.8	14	0.9899	86.3	85.4	255.5
15	0.9978	19.0	19.0	831.1	15	0.9912	89.5	88.7	305.2
16	0.9981	19.6	19.6	1655.9	16	0.9923	92.7	92.0	306.5
17	0.9983	20.2	20.2	1657.5	17	0.9932	95.9	95.2	307.4
18	0.9985	20.8	20.8	1658.8	18	0.9939	99.1	98.5	308.2
19	0.9986	21.4	21.4	1659.9	19	0.9945	102.3	101.7	308.8
20	0.9988	22.0	22.0	1660.8	20	0.9950	105.5	104.9	309.4
21	0.9989	22.6	22.6	1661.5	21	0.9955	108.7	108.2	309.8
22	0.9990	23.2	23.2	1662.1	22	0.9959	112.3	111.9	269.2
23	0.9991	23.8	23.8	1662.6	23	0.9962	116.2	115.7	260.0
24	0.9991	24.4	24.4	1663.0	24	0.9965	120.2	119.8	247.2
25	0.9992	25.0	25.0	1663.4	25	0.9968	124.0	123.6	262.7
26	0.9993	25.6	25.6	1663.7	26	0.9971	127.3	126.9	298.1
27	0.9993	26.2	26.2	1664.0	27	0.9973	130.3	130.0	329.5
28	0.9994	26.8	26.8	1664.2	28	0.9975	133.3	133.0	329.6
29	0.9994	27.4	27.4	1664.4	29	0.9976	136.4	136.0	329.8
30	0.9994	28.0	28.0	1664.6	30	0.9978	139.4	139.1	329.9

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CHAPTER II

CONCLUSION

1. The analysis results of the first arrival time to obtain P-Wave and S-Wave velocities of soil layers (true velocity) at borehole BH-01 is displayed in Table 1.1. There are five soil layers if based on P-wave velocity and six soil layer if base on S-wave velocity values.

2. From table 1.1, based on formula (3), the average of *shear wave velocity* (S-Wave) at borehole BH-01 is $\overline{V}_s$ = 267.3 m/second. Based on Table 1.1, the classification of soil type at this survey location is type of medium soil.

3. The analysis results of the first arrival time to obtain P-Wave and S-Wave velocities of soil layers (true velocity) at borehole BH-06 is displayed in Table 1.2. There are four soil layers if based on P-wave velocity and six soil layers if base on S-wave velocity values.

4. From table 3.2, based on formula (3), the average of *shear wave velocity* (S-Wave) at borehole BH-06 is $\overline{V}_s$ =214.7 **m/second**. Based on Table 1.1, the classification of soil type at this survey location is type of medium soil.

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Table 2.1
True Velocity of P-Wave and S-Wave
At Borehole BH-01

P WAVE					S WAVE				
Layer	Depth (m)		Thickness (m)	Vp (m/s)	Layer	Depth (m)		Thickness (m)	Vs (m/s)
1	0.0	1.0	1.0	785.7	1	0.0	1.0	1.0	248.5
2	1.0	4.0	3.0	888.7	2	1.0	3.0	2.0	157.3
3	4.0	7.0	3.0	1214.4	3	3.0	7.0	4.0	244.7
4	7.0	13.0	6.0	829.9	4	7.0	13.0	6.0	241.8
5	13.0	30.0	17.0	1662.4	5	13.0	20.0	7.0	291.4
					6	20.0	30.0	10.0	329.8
								V_s AVERAGE	267.3

Table 2.2
True Velocity of P-Wave and S-Wave
At Borehole BH-06

P WAVE					S WAVE				
Layer	Depth (m)		Thickness (m)	Vp (m/s)	Layer	Depth (m)		Thickness (m)	Vs (m/s)
1	0.0	1.0	1.0	471.4	1	0.0	1.0	1.0	248.5
2	1.0	5.0	4.0	852.6	2	1.0	6.0	5.0	109.7
3	5.0	15.0	10.0	827.4	3	6.0	15.0	9.0	226.0
4	15.0	30.0	15.0	1662.1	4	15.0	22.0	7.0	304.8
					5	22.0	26.0	4.0	263.5
					6	26.0	30.0	4.0	329.7
								V_s AVERAGE	*214.7*

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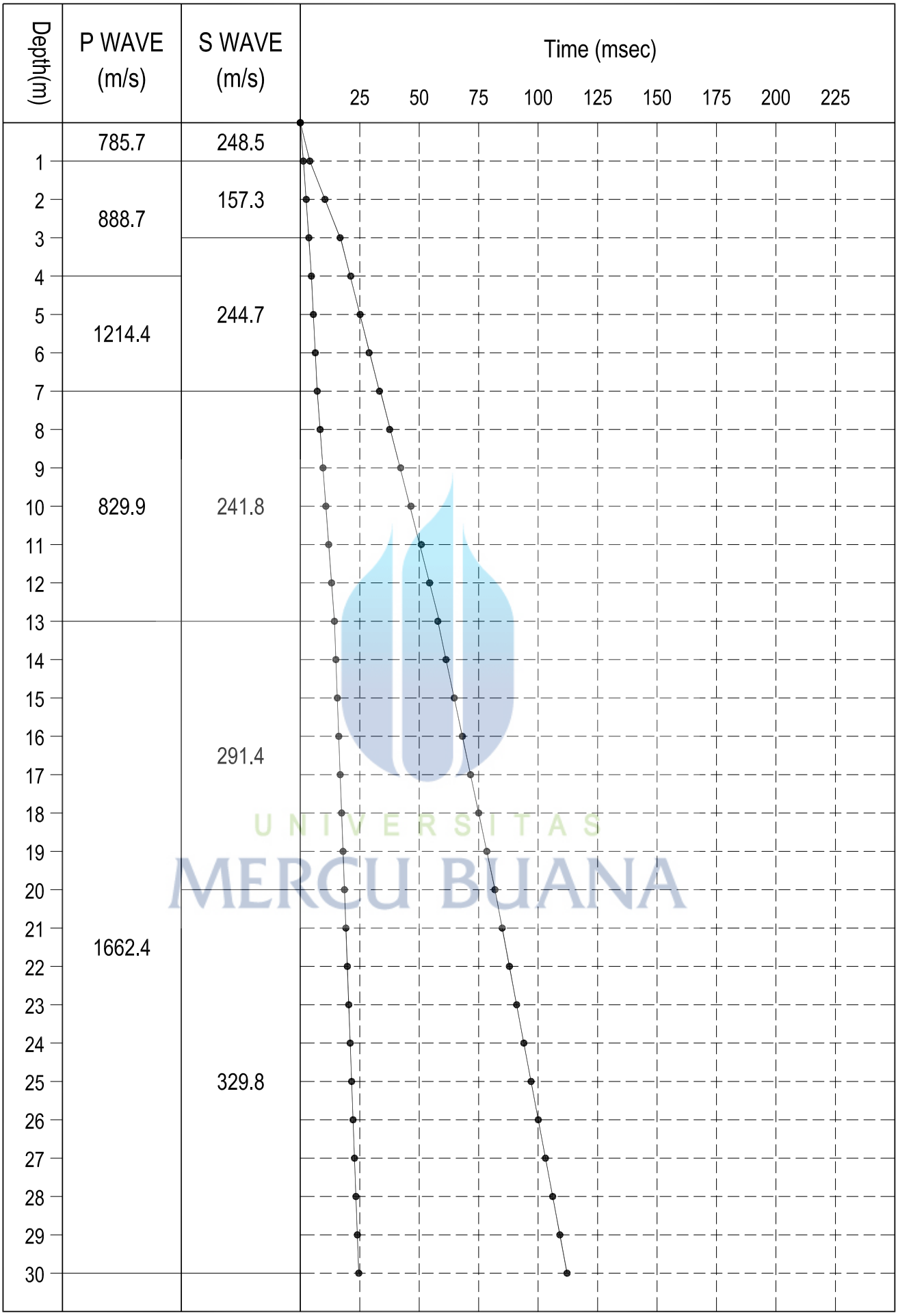

Figure 3.1. P-Wave and S-Wave True Velocity

BOREHOLE : BH-01

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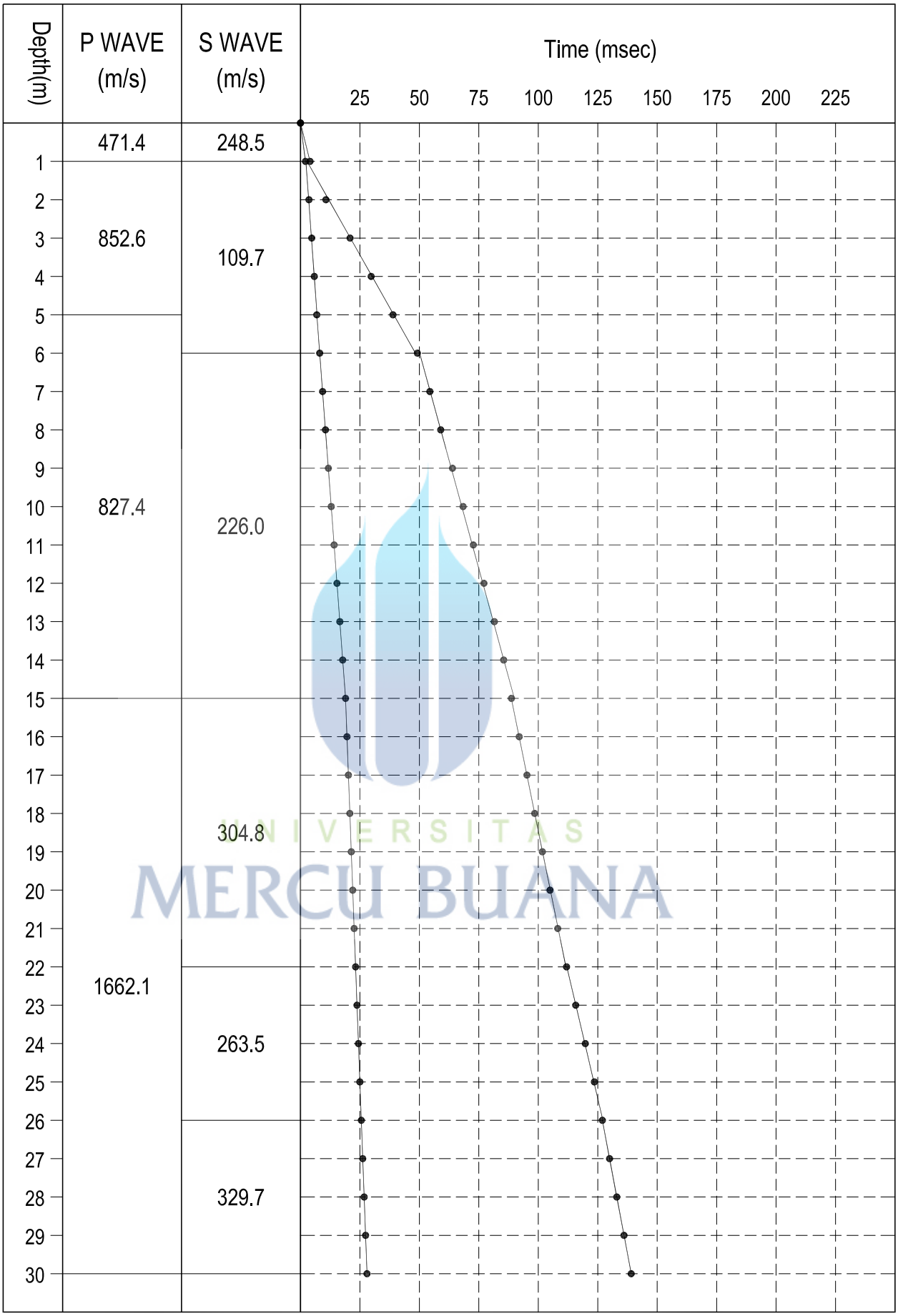

Figure 3.2. P-Wave and S-Wave True Velocity
BOREHOLE : BH-06

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APPENDIX A.4

PRESSUREMETER TEST RESULTS

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LATERAL LOAD TEST (L.L.T.)

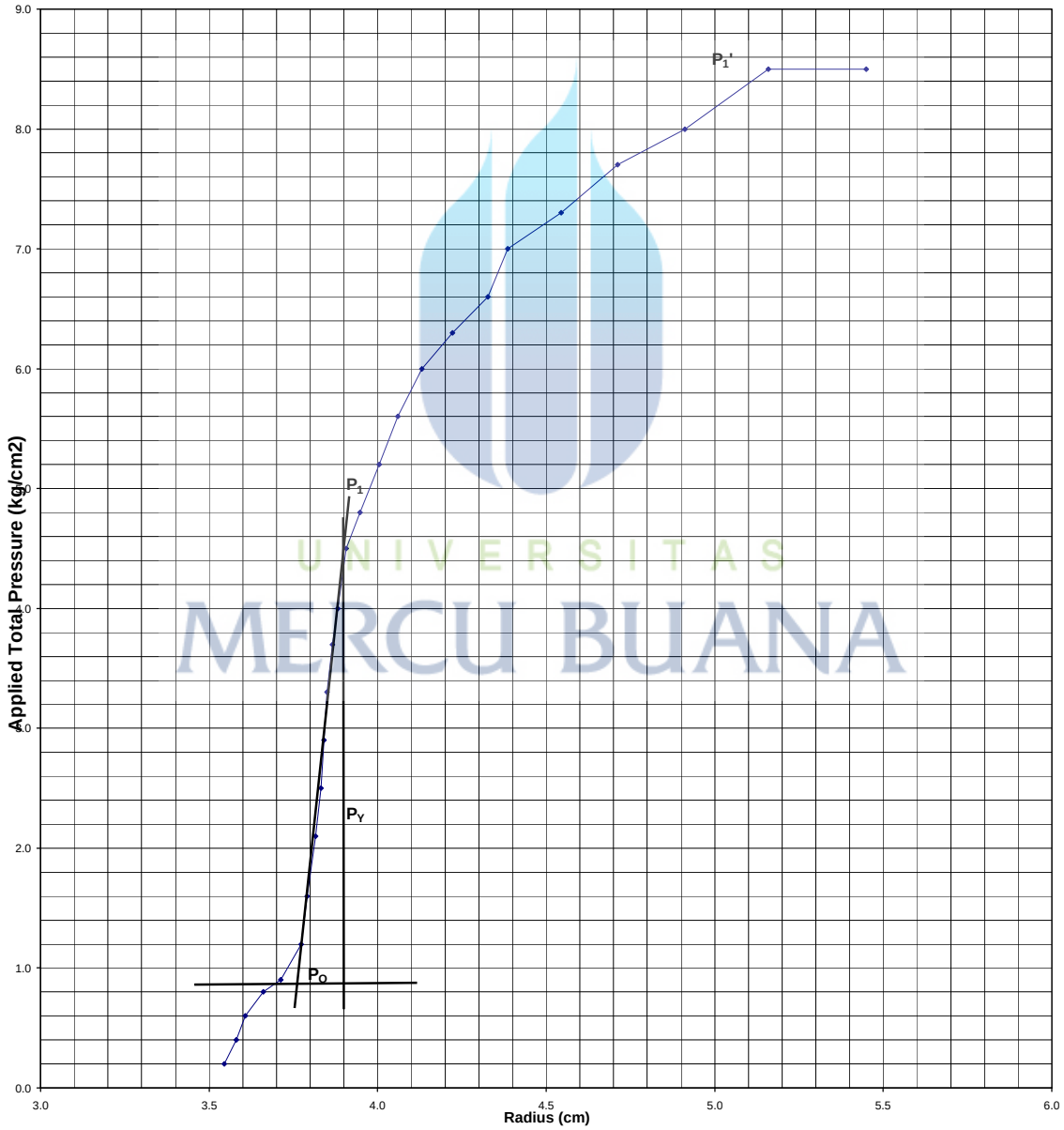
Project:	NEW AUSTRALIAN EMBASSY	Date:	October 31, 2009
Location:	JL. PATRA KUNINGAN, KUNINGAN - JAKARTA	Time:	
Boring No.:	BH.4 - 3.00 m	Initial water level of standpipe (cm)	1.50
S.P.T.:	0	Water level of standpipe after insertion (cm)	1.70

Pressure at Rest (P0)	Yield Pressure (Py)	Failure Pressure (Pl)	Coef Of Soil Reaction (k)	Elastic Modulus (E)
0.9 kg/cm2	3.5 kg/cm2	4.5 kg/cm2	26.12 kg/cm3	130.39 kg/cm2
90 KN/m2	350 KN/m2	450 KN/m2	261200 KN/m3	13039 KN/m2

Po =	0.9	Kg/cm2	ro =	3.77	cm	rm =	3.84	cm	Pl' =	5.4	Kg/cm2	δ =	0.42
Py' =	4.4	Kg/cm2	ry' =	3.91	cm	Km =	26.12	Kg/cm3	Pl =	4.5	Kg/cm2		
deltaP =	3.5	Kg/cm2	delta r =	0.13	cm								

E= (1+δ) * r * Km = 130.39

LATERAL LOAD TEST CURVE



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LATERAL LOAD TEST (L.L.T.)

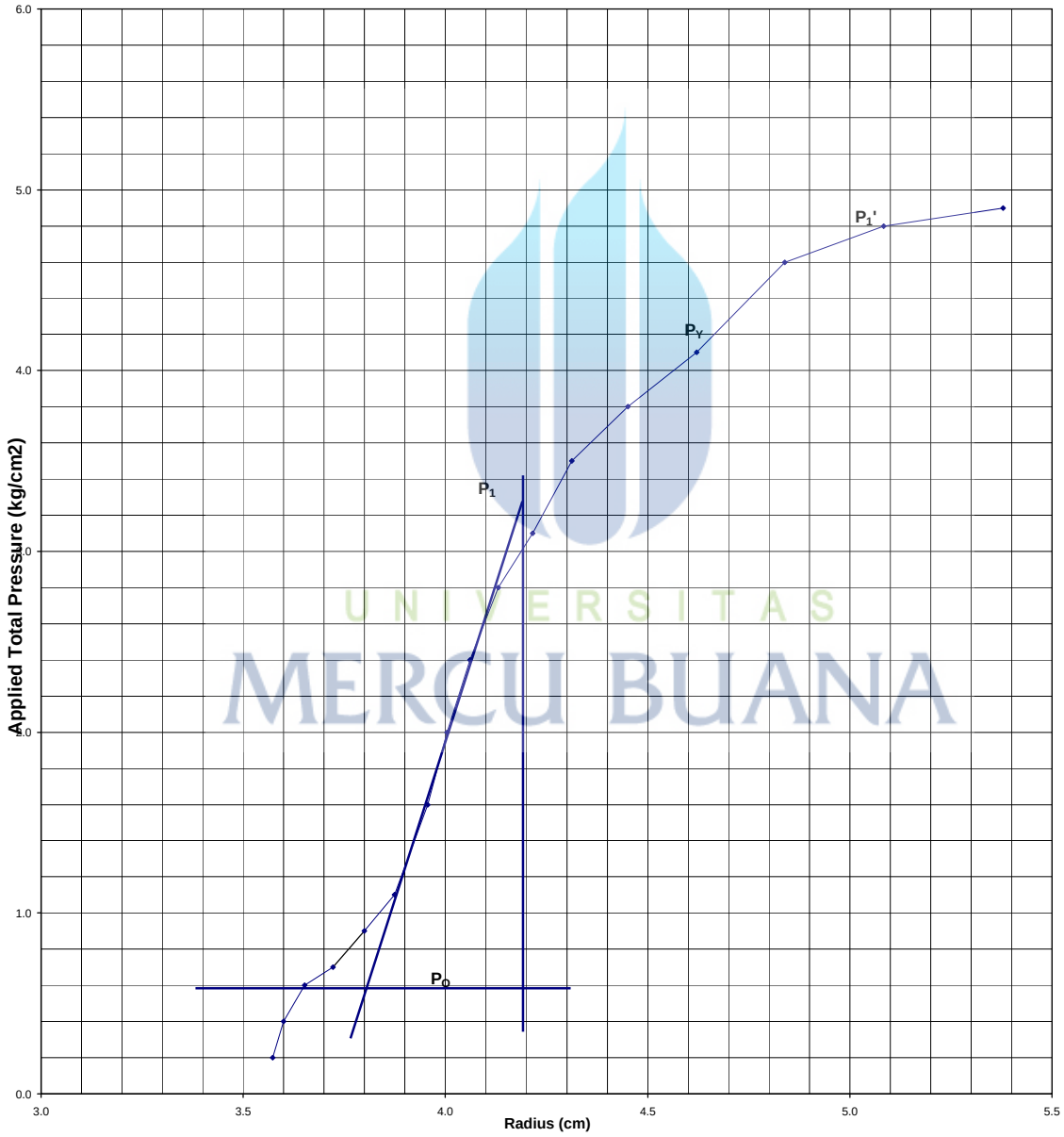
Project:	NEW AUSTRALIAN EMBASSY	Date:	October 31, 2009
Location:	JL. PATRA KUNINGAN, KUNINGAN - JAKARTA	Time:	
Boring No.:	BH.4 - 5.00 m	Initial water level of standpipe (cm)	2.50
S.P.T.:	5	Water level of standpipe after insertion (cm)	2.80

Pressure at Rest (P0)	Yield Pressure (Py)	Failure Pressure (Pl)	Coef Of Soil Reaction (k)	Elastic Modulus (E)
0.6 kg/cm2	2.7 kg/cm2	4.1 kg/cm2	5.4 kg/cm3	27.73 kg/cm2
60 KN/m2	270 KN/m2	410 KN/m2	54000 KN/m3	2773 KN/m2

Po =	0.6	Kg/cm2	ro =	3.70	cm	rm =	3.95	cm	Pl' =	4.8 Kg/cm2	δ = 0.42
Py' =	3.3	Kg/cm2	ry' =	4.20	cm	Km =	5.4	Kg/cm3	Pl =	4.1 Kg/cm2	
deltaP =	2.7	Kg/cm2	delta r =	0.50	cm						

E= (1+δ) * r * Km = 27.73

LATERAL LOAD TEST CURVE



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LATERAL LOAD TEST (L.L.T.)

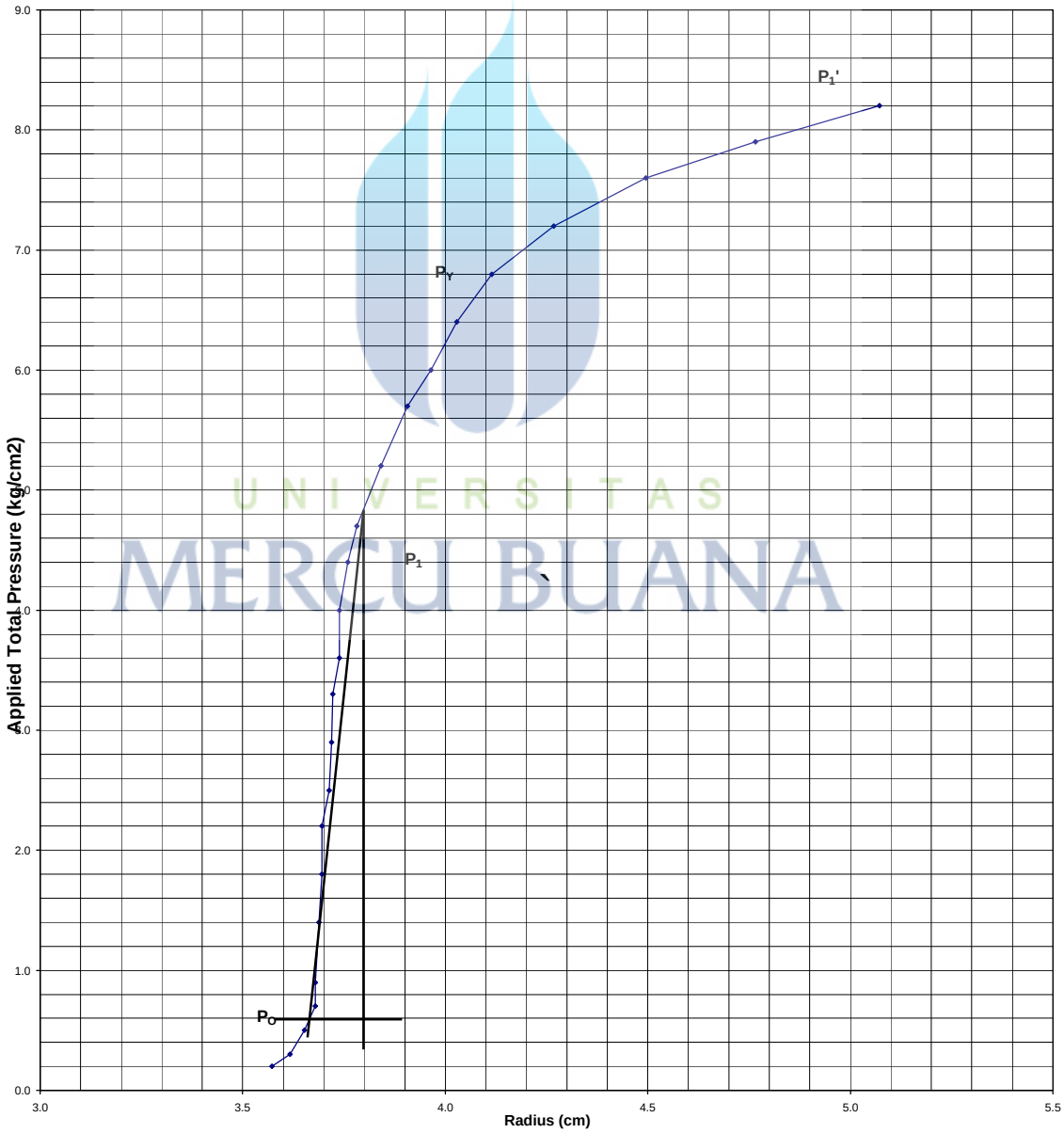
Project:	NEW AUSTRALIAN EMBASSY	Date:	October 31, 2009
Location:	JL. PATRA KUNINGAN, KUNINGAN - JAKARTA	Time:	
Boring No.:	BH.4 - 6.50 m	Initial water level of standpipe (cm)	2.00
S.P.T.:	6	Water level of standpipe after insertion (cm)	2.30

Pressure at Rest (P0)	Yield Pressure (Py)	Failure Pressure (Pl)	Coef Of Soil Reaction (k)	Elastic Modulus (E)
0.6 kg/cm2	4.2 kg/cm2	8.2 kg/cm2	34.71 kg/cm3	168.74 kg/cm2
60 KN/m2	420 KN/m2	820 KN/m2	347100 KN/m3	16874 KN/m2

Po =	0.6	Kg/cm2	ro =	3.68	cm	rm =	3.7395	cm	Pl' =	6.8 Kg/cm2	δ = 0.42
Py' =	4.8	Kg/cm2	ry' =	3.80	cm	Km =	34.71	Kg/cm3	Pl =	8.2 Kg/cm2	
deltaP =	4.2	Kg/cm2	delta r =	0.12	cm						

E= (1+δ) * r * Km = 168.74

LATERAL LOAD TEST CURVE



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LATERAL LOAD TEST (L.L.T.)

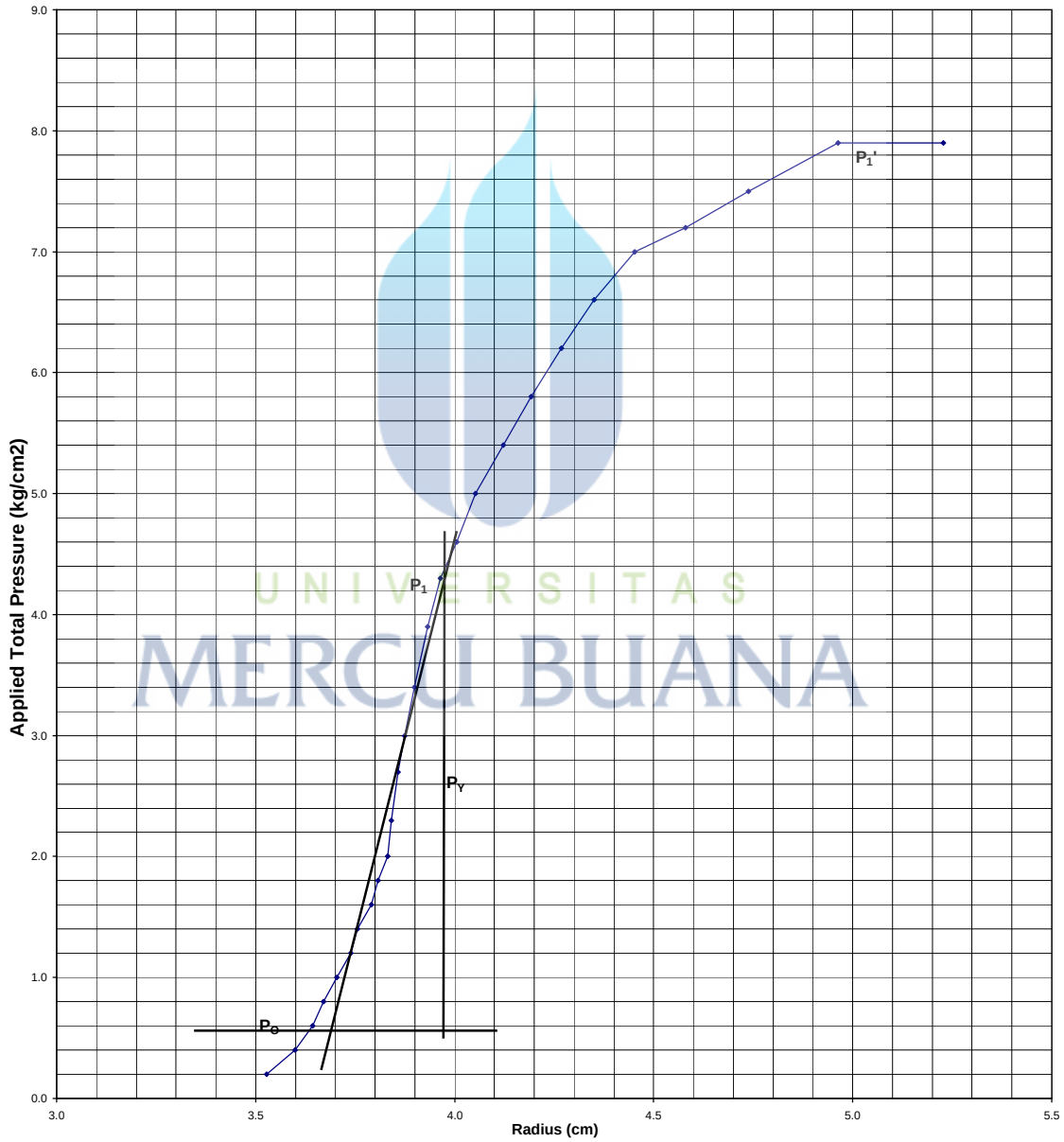
Project:	NEW AUSTRALIAN EMBASSY	Date:	October 31, 2009
Location:	JL. PATRA KUNINGAN, KUNINGAN - JAKARTA	Time:	
Boring No.:	BH.9 - 2.00 m	Initial water level of standpipe (cm)	1.00
S.P.T.:	11	Water level of standpipe after insertion (cm)	1.10

Pressure at Rest (P0)	Yield Pressure (Py)	Failure Pressure (Pl)	Coef Of Soil Reaction (k)	Elastic Modulus (E)
0.6 kg/cm2	3.8 kg/cm2	7.3 kg/cm2	12.67 kg/cm3	63.41 kg/cm2
60 KN/m2	380 KN/m2	730 KN/m2	126700 KN/m3	6341 KN/m2

Po =	0.6	Kg/cm2	ro =	3.70	cm	rm =	3.85	cm	Pl' =	7.9	Kg/cm2	δ =	0.42
Py' =	4.4	Kg/cm2	ry' =	4.00	cm	Km =	12.67	Kg/cm3	Pl =	7.3	Kg/cm2		
deltaP =	3.8	Kg/cm2	delta r =	0.30	cm								

E= (1+δ) * r * Km = 63.41

LATERAL LOAD TEST CURVE



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LATERAL LOAD TEST (L.L.T.)

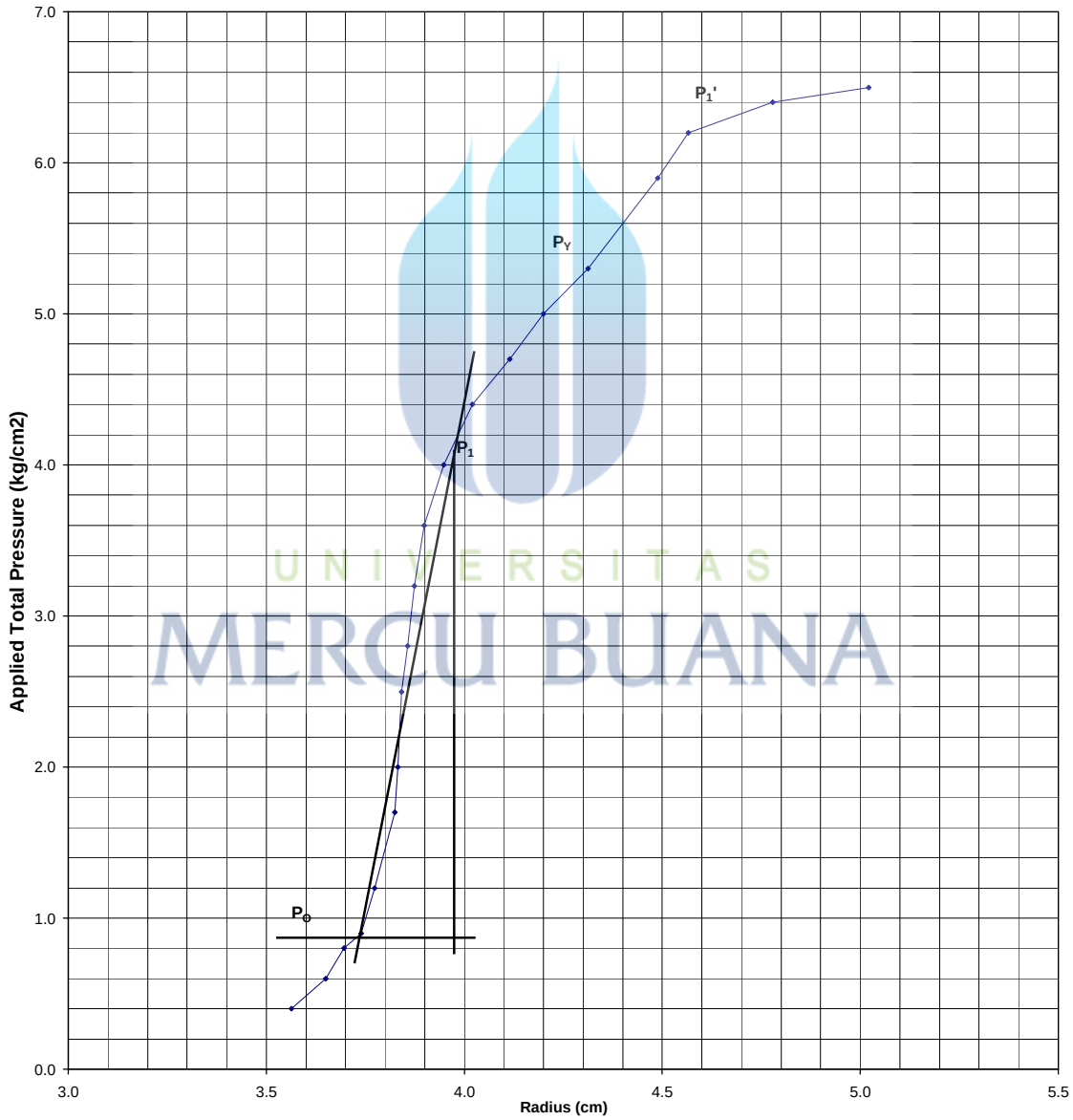
Project:	NEW AUSTRALIAN EMBASSY	Date:	October 31, 2009
Location:	JL. PATRA KUNINGAN, KUNINGAN - JAKARTA	Time:	
Boring No.:	BH.9 - 3.50 m	Initial water level of standpipe (cm)	1.50
S.P.T.:	4	Water level of standpipe after insertion (cm)	1.70

Pressure at Rest (P0)	Yield Pressure (Py)	Failure Pressure (Pl)	Coef Of Soil Reaction (k)	Elastic Modulus (E)
0.9 kg/cm2	3.1 kg/cm2	5.5 kg/cm2	14.22 kg/cm3	70.97 kg/cm2
90 KN/m2	310 KN/m2	550 KN/m2	142200 KN/m3	7097 KN/m2

Po =	0.9	Kg/cm2	ro =	3.73	cm	rm =	3.839	cm	Pl' =	6.4 Kg/cm2	δ = 0.42
Py' =	4	Kg/cm2	ry' =	3.95	cm	Km =	14.22	Kg/cm3	Pl =	5.5 Kg/cm2	
deltaP =	3.1	Kg/cm2	delta r =	0.22	cm						

E= (1+δ) * r * Km = 70.97

LATERAL LOAD TEST CURVE



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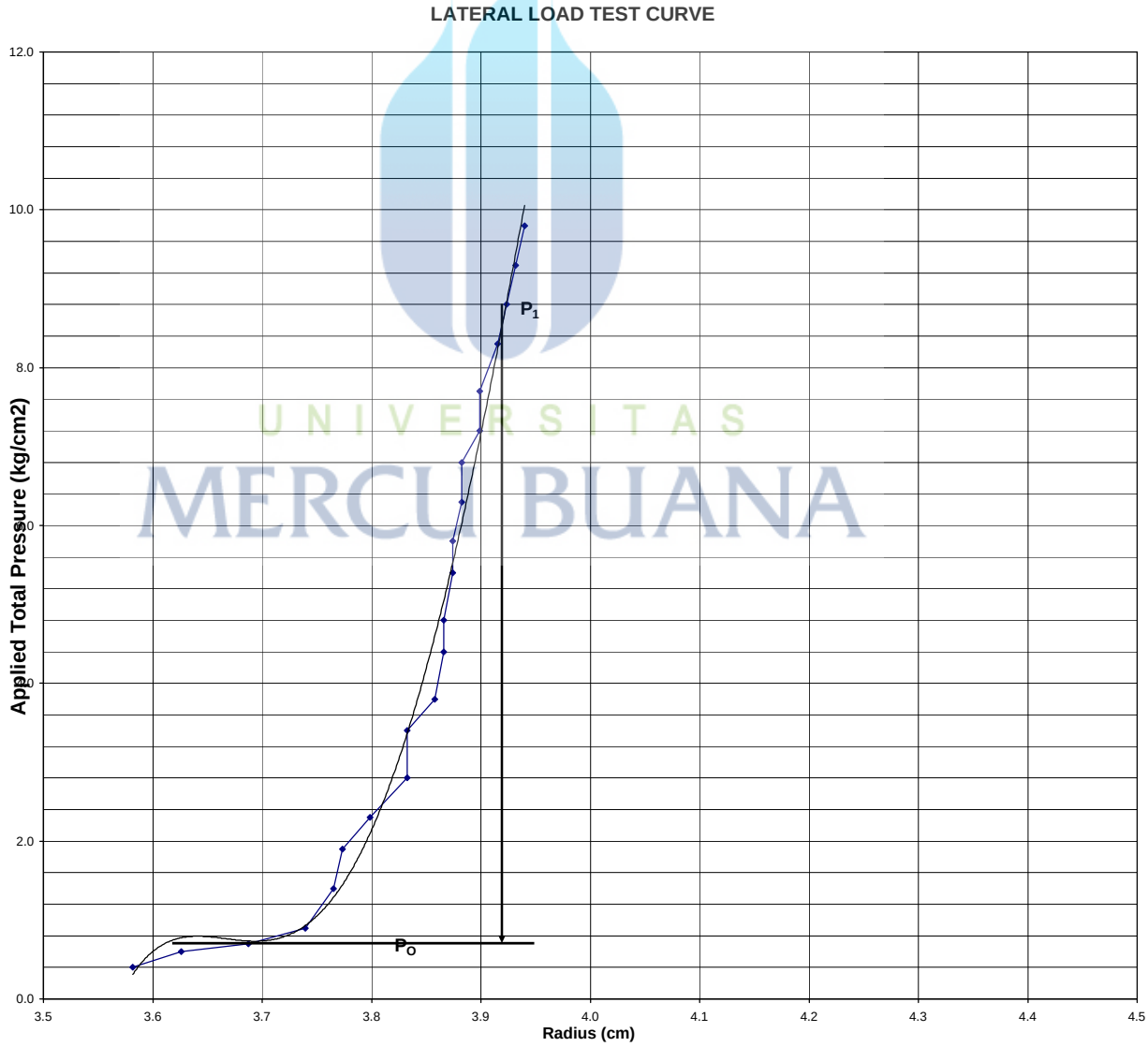
LATERAL LOAD TEST (L.L.T.)

Project:	NEW AUSTRALIAN EMBASSY	Date:	October 31, 2009
Location:	JL. PATRA KUNINGAN, KUNINGAN - JAKARTA	Time:	
Boring No.:	BH.9 - 9.00 m	Initial water level of standpipe (cm)	1.20
S.P.T.:	29	Water level of standpipe after insertion (cm)	1.40

Pressure at Rest (P0)	Yield Pressure (Py)	Failure Pressure (Pl)	Coef Of Soil Reaction (k)	Elastic Modulus (E)
0.78 kg/cm2	8.0 kg/cm2	10 kg/cm2	36.45 kg/cm3	180.5 kg/cm2
78 KN/m2	802 KN/m2	1000 KN/m2	364500 KN/m3	18054 KN/m2

Po =	0.78	Kg/cm2	ro =	3.70	cm	rm =	3.81	cm	Pl' =	9.8 Kg/cm2	δ = 0.42
Py' =	8.8	Kg/cm2	ry' =	3.92	cm	Km =	36.45	Kg/cm3	Pl =	10 Kg/cm2	
deltaP :	8.02	Kg/cm2	delta r =	0.22	cm						

E= (1+δ) * r * Km = 180.5



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LAPORAN PENYELIDIKAN TANAH

CENTENNIAL TOWER
JL. JEND. GATOT SUBROTO
JAKARTA

FACTUAL REPORT

Prepared for

PT. CITRATAMA INTI PERSADA

JANUARI 2013

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Prepared by

PT. DAYA CREASI MITRAYASA
Design & Engineering Consultant
Tendean Square Unit No.27
Jl. Wolter Monginsidi No. 122 - 124, Jakarta Selatan, INDONESIA
Phone (62-21) 7278 4046, Fax. (62-21) 7278 6905
E-mail: dmitra@indo.net.id

http://digilib.mercubuana.ac.id/

LAPORAN PENYELIDIKAN TANAH
Centennial Tower
Jl. Jend. Gatot Subroto
Jakarta

FACTUAL REPORT

Prepared for

PT. CITRATAMA INTI PERSADA

Prepared by

PT. DAYA CREASI MITRAYASA
Design & Engineering Consultant

Jakarta, Januari 2013

PT. DAYA CREASI MITRAYASA

Ir. Margijanto Djumhari

No. Reg : 1.2.500.2.31.09.000051

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0	10 Januari 2013	Factual Report	WA	WA	DRN	MD

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Gambar 4C Variation Of Engineering Soil Parameters Versus Depth Deep Boring

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DAFTAR TABEL

Tabel 3.1 Koordinat Titik Penyelidikan Tanah

Tabel 3.2 Standar ASTM untuk Pengujian Laboratorium

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1.0 PENDAHULUAN

1.1 Umum

Factual Report ini menyajikan hasil penyelidikan tanah Proyek Centennial Tower yang berlokasi di Jl. Jend. Gatot Subroto – Jakarta. **PT. Citratama Inti Persada** menunjuk **PT. Daya Creasi Mitrayasa**, untuk melakukan penyelidikan tanah. Laporan ini menyampaikan data hasil pengujian laboratorium dan lapangan berupa pengujian sondir dan pengeboran dalam (*deep boring*) yang dikerjakan pada September – Desember 2012.

Tujuan dari penyelidikan tanah adalah sebagai berikut :

a. Untuk mendapatkan informasi secara umum mengenai kondisi lapisan tanah dan profil tanah yang ada pada lokasi rencana proyek.

b. Untuk mendapatkan nilai kuantitatif tanah yakni parameter *index properties* dan *engineering properties*.

c. Untuk mengidentifikasi kemungkinan tipe fondasi yang akan digunakan untuk mendukung struktur atas bangunan berdasarkan kriteria daya dukung ijin dan penurunan ijin serta faktor ekonomis.

d. Untuk mengantisipasi kemungkinan masalah-masalah yang mungkin timbul selama proses konstruksi berlangsung.

1.2 Gambaran Umum Proyek

Proyek Centennial Tower terletak di Jl. Jend. Gatot Subroto – Jakarta dengan luas lahan ± 11.939 m^2. Rencana lokasi proyek akan digunakan sebagai gedung perkantoran dengan 37 lantai, 3 lapis basement, dan 5 podium parkir. Lokasi proyek merupakan lahan kosong dengan semak belukar dan pepohonan.

Lokasi proyek dapat dilihat pada **Gambar 1**.

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PT. Daya Creasi Mitrayasa	**Lokasi Proyek Centennial Tower** Laporan Penyelidikan Tanah Jl. Jend. Gatot Subroto – Jakarta	Project No. **DCM.G.12-047** Gambar **1**

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2.0
LINGKUP PEKERJAAN

Sesuai dengan proposal dan kontrak yang diajukan, lingkup pekerjaan kami meliputi :

1. Pengeboran dalam (*deep boring)* sebanyak **5 titik :**
   - 1 titik @ sedalam 90 m (dengan metode *Continuous Coring)*
   - 4 titik @ sedalam 60 m (dengan metode *Continuous Coring)*

2. Pengujian *Standard Penetration Test* (SPT) dengan interval **1.50 m.**

3. Pengambilan *Undisturbed Sample* (UDS) pada tanah soft hingga stiff sebanyak **29 tabung.**

4. Pengujian *Cone Penetration Test* (CPT) atau sondir 2.5 ton sebanyak **9 titik** hingga mencapai tanah keras dengan pembacaan tahanan konus $q_c \geq 250$ kg/cm^2 atau mencapai kapasitas maksimum alat.

5. Pengujian laboratorium pada UDS sampel untuk memperoleh parameter-parameter *index properties* dan *engineering properties* tanah yang meliputi pengujian:

   a. *Index Properties Parameter*
      - *Moisture Content*
      - *Unit Weight*
      - *Specific Gravity*
      - *Atterberg Limits*
        - *Plastic Limit*
        - *Liquid Limit*
        - *Plasticity Index*
      - *Grain Size Analysis*
        - *Mechanical Method*
        - *Hydrometer Method*

   b. *Engineering Properties Parameter*
      - *Triaxial CU*
      - *1-D Consolidation Test*
      - *Unconfined Compression Test*

6. Pembuatan laporan yang menyajikan data-data faktual penyelidikan tanah meliputi :
   - *Boring log* untuk setiap titik bor
   - Profil lapisan tanah
   - Analisa kondisi lapisan tanah

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3.0 PROSEDUR DAN METODE PELAKSANAAN

3.1 Lokasi Penyelidikan Tanah

Lokasi titik penyelidikan tanah berupa pengeboran dalam dan pengujian sondir telah ditetapkan dan disetujui oleh pemberi tugas sebelum pekerjaan pengeboran dimulai. Lokasi titik penyelidikan tanah dapat dilihat pada **Gambar 2**. Koordinat titik Penyelidikan Tanah berdasarkan hasil pengukuran topografi dapat dilihat pada **Tabel 3.1**.

Tabel 3.1 Koordinat Titik Penyelidikan Tanah

Soil Test	KOORDINAT		
	Easting	Northing	Elevation (m)
Deep Boring			
DB-1	701465.6586	9311002.3794	9.902
DB-2	701436.1056	9311015.6328	9.489
DB-3	701460.3814	9311032.4451	9.511
DB-4	701497.7655	9310990.5772	10.064
DB-5	701460.2511	9310969.7478	9.733
CPT / SONDIR			
S-1	701417.5908	9311036.3667	9.575
S-2	701450.9499	9311057.8955	9.704
S-3	701441.8090	9311036.6467	9.506
S-4	701455.3191	9311014.7254	9.516
S-5	701478.2811	9311019.1077	9.699
S-6	701476.7760	9311003.9061	9.796
S-7	701444.8703	9310995.9796	9.489
S-8	701478.8548	9310988.0604	9.862
S-9	701474.8165	9310973.9761	10.048

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3.2 Pengeboran, Pengambilan Sampel dan Pengujian SPT

Pengeboran dalam dilakukan dengan menggunakan metode *Continuous Coring*. Untuk mencegah terjadinya longsoran pada dinding lubang bor, maka pengeboran dilakukan dengan bantuan *casing* dan/atau *slurry bentonite*. Panjang *casing* yang digunakan disesuaikan dengan kondisi tanah.

Pada masing-masing titik bor dilakukan pengujian *Standard Penetration Test* (SPT) sesuai dengan standar ASTM D 1586. Pengujian SPT dilakukan dengan cara memasukkan tabung *split spoon sampler* sepanjang 45 cm ke dalam tanah dengan cara menjatuhkan hammer tipe *automatic tip hammer* seberat 63.50 kg secara jatuh bebas dari ketinggian 76 cm. Setiap pukulan yang dibutuhkan untuk memasukkan tabung *split spoon sampler* sedalam 10 cm dicatat. Nilai N-SPT adalah jumlah pukulan yang dibutuhkan untuk memasukkan tabung sedalam 30 cm terakhir ke dalam tanah. Nilai N-SPT pada 15 cm pertama tidak diperhitungkan dengan alasan bahwa 15 cm tanah teratas merupakan tanah terganggu (*disturbed sample*) dan harus diabaikan dalam pengambilan nilai N-SPT.

Pengujian SPT dilakukan untuk mengetahui kepadatan relatif (*relative density*) pada tanah *cohesionless* (pasir dan kerikil) dan konsistensi tanah pada tanah kohesif (lanau dan lempung) serta untuk mendapatkan contoh tanah terganggu yang diperlukan untuk identifikasi dan klasifikasi lapisan tanah dalam pembuatan *boring log*. *Boring log* hasil pengeboran dibuat berdasarkan hasil pengujian *index properties* contoh tanah terganggu dari pengujian SPT dan identifikasi visual pada saat di lapangan.

Pada kedalaman tertentu, contoh tanah tidak terganggu (*undisturbed soil sample*, UDS) diambil untuk dilakukan pengujian laboratorium. Pengambilan contoh tanah UDS dilakukan dengan menggunakan tabung *open drive shelby thin walled sampler* tipe U berdiameter 76 mm dan panjang 60 cm. Contoh tanah terganggu dan contoh tanah tidak terganggu ini kemudian dicatat dengan seksama menurut sistem USCS oleh *geotechnical engineer* ke dalam *boring log*. **Lampiran-A** memperlihatkan *boring log* hasil pengeboran untuk masing-masing titik bor.

3.3 Cone Penetration Test (CPT)

Pengujian CPT (sondir) dilaksanakan sesuai dengan prosedur yang dikeluarkan oleh ICSMFE (*International Conference of Soil Mechanics and Foundation Engineering*) dengan menggunakan sondir berkapasitas 2.5 ton, dua buah manometer dengan nilai pembacaan 0 – 60 kg/cm^2 untuk tekanan rendah dan 0 – 200 kg/cm^2 untuk tekanan yang lebih tinggi. Selama pengujian berlangsung, alat sondir dijaga agar tetap vertikal dengan kecepatan penetrasi tidak melebihi 2.0 cm/detik.

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Pembacaan tahanan konus (*Cone Resistance*) dan tahanan total (*Total Resistance*) dilakukan setiap interval 20.0 cm. Pengujian dihentikan bila pembacaan tahanan konus (q_c) sudah mencapai nilai lebih besar atau sama dengan 200 kg/cm^2.

Lampiran-B memperlihatkan hasil pengujian sondir untuk masing-masing titik sondir yang ditampilkan dalam bentuk tabel data dan grafik sondir yang menunjukkan hubungan tahanan konus dan tahanan kumulatif terhadap kedalaman serta hubungan antara *friction ratio* dan *local friction* terhadap kedalaman.

3.4 Pengujian Laboratorium

Pengujian laboratorium dilakukan pada contoh tanah UDS untuk mendapatkan parameter *index properties* dan *engineering properties*. Pengujian laboratorium ini dilakukan sesuai dengan standar ASTM dibawah pengawasan *geotechnical engineer*. Standar-standar pengujian laboratorium yang digunakan diperlihatkan pada **Tabel 3.2**.

Tabel 3.2 Standard ASTM untuk Pengujian Laboratorium

Tipe Test	Referensi
Physical Properties :	
1. Moisture Content	ASTM D 2216
2. Dry Density	ASTM D 2937
3. Specific Gravity	ASTM D 854
4. Atterberg Limit	ASTM D 4318
✓ Plastic Limit	ASTM D 4318
✓ Liquid Limit	ASTM D 4318
✓ Plasticity Index	ASTM D 4318
5. Grain Size analysis	ASTM D 422
Engineering Properties :	
1. Triaxial CU Test	ASTM D 4767
2. 1-D Consolidation Test	ASTM D 2435
3. Unconfined Compression Test	ASTM D 2166

Hasil Pengujian Laboratorium setiap contoh tanah untuk setiap lubang bor disajikan dalam **Lampiran-C**.

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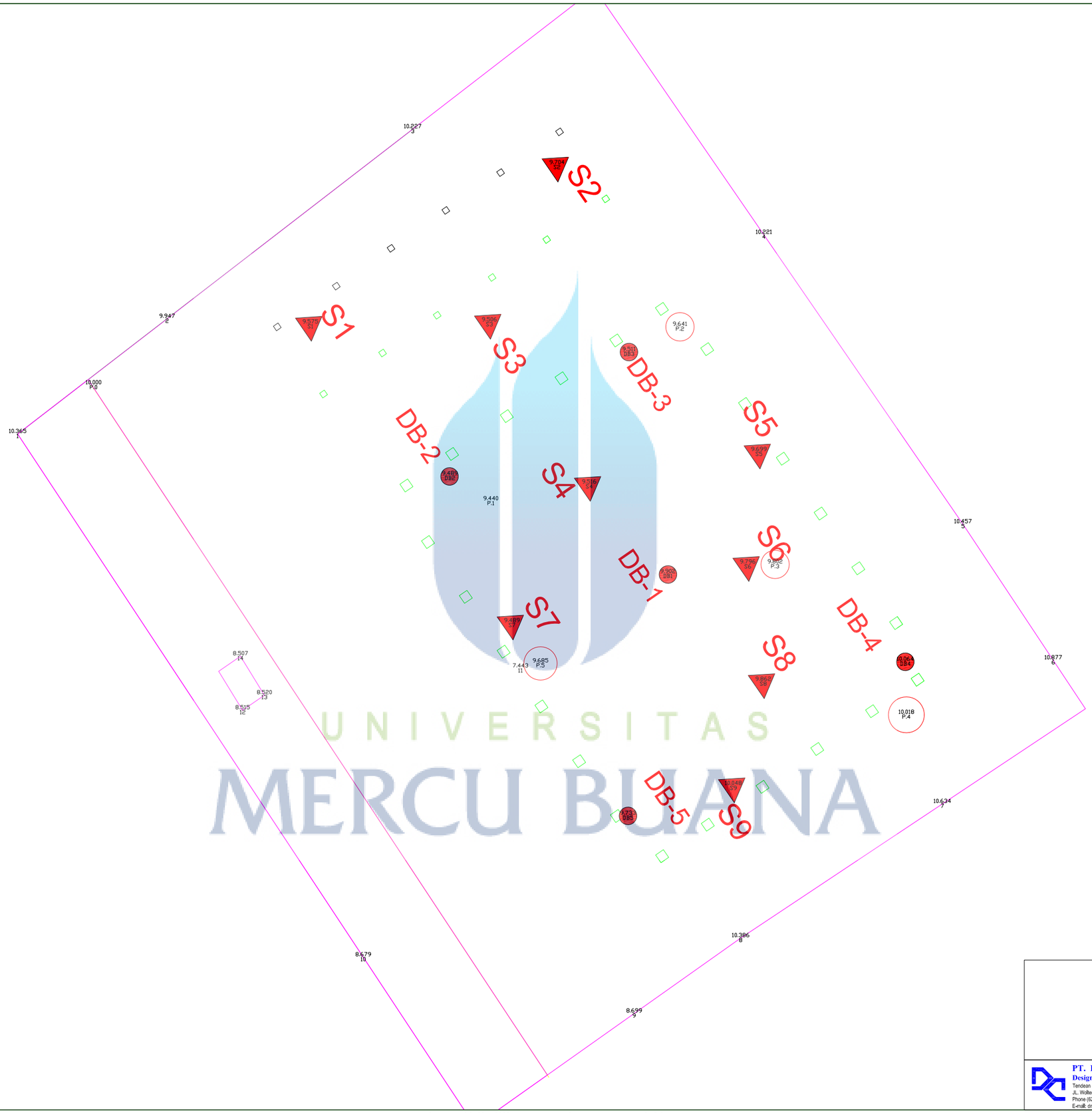

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LOKASI PENYELIDIKAN TANAH

CENTENNIAL TOWER
PT. Citratama Inti Persada
Jln. Jend. Gatot Subroto - Jakarta

PT. DAYA CREASI MITRAYASA
Design & Engineering Consultant
Tendean Square Unit No. 27
JL. Wolter Monginsidi No. 122 - 124, Jakarta Selatan
Phone (62-21) 7278 4046, Fax. (62-21) 7278 6905
E-mail: dmitra@indo.net.id

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4.0
ANALISA KONDISI TANAH

Pada *Factual Report* ini, klasifikasi jenis tanah yang ditampilkan pada proyek Centennial Tower merupakan klasifikasi yang didasarkan pada pengujian laboratorium dan pengujian lapangan berupa pengujian sondir dan *deep boring*.

Pada pengujian 9 (sembilan) titik sondir yang dilakukan, terlihat pada titik S-1, sondir terhenti pada kedalaman 12 m, pada S-2 sondir terhenti pada kedalaman 12.2 m, pada S-3 sondir terhenti pada kedalaman 13.8 m, pada S-4 sondir terhenti pada kedalaman 11.4 m, pada S-5 sondir terhenti pada kedalaman 11.8 m, pada S-6 sondir terhenti pada kedalaman 12.2 m, pada S-7 sondir terhenti pada kedalaman 12.8 m, pada S-8 sondir terhenti pada kedalaman 11.4 m, dan pada S-9 sondir terhenti pada kedalaman 13 m. Pengujian sondir dihentikan pada pembacaan tahanan ujung dan selimut mencapai 250 kg/cm2. Dari pengujian sondir tersebut, dapat disimpulkan bahwa kedalaman lapisan keras pada proyek ini cukup seragam.

Pada pengeboran *deep boring* yang dilakukan mencapai 5 titik pada kedalaman 60 m dan kedalaman 90 m. Lapisan tanah keras ditemukan pada kedalaman ±10.5 m hingga kedalaman ±13.5 m. Pada saat pengeboran berlangsung ditemukan muka air tanah pada ±9.5 m hingga kedalaman ±10.3 m dibawah permukaan tanah.

Gambar 3 menunjukkan profil lapisan tanah dan **Gambar 4** menunjukkan hubungan variasi parameter-paramater *physical* dan *engineering* tanah terhadap kedalaman. Secara umum, gambaran kondisi lapisan tanah berdasarkan hasil pengeboran dalam di lokasi proyek sebagai berikut:

- **Kedalaman 0 m – 12.00 m**

  Jenis tanah pada kedalaman berupa jenis tanah Lempung Kelanuan (Silty CLAY/CH) dan Lanau Kelempungan – Lanau Kepasiran (Clayey SILT – Sandy SILT/MH-ML) dengan konsistensi *soft – very stiff*.

  N-SPT rata – rata = 10 (range 1 – 23).

  Dari pengujian laboratorium didapatkan parameter–parameter berikut:

  - Natural Water Content : Wn = 27.30 – 82.99 %
  - Specific Gravity : Gs = 2.599 – 2.688
  - Atterberg Limit : LL = 40.64 – 90.00 %, PL = 25.90 – 67.00 %, PI = 14.41 – 58.15 %.
  - Triaxial UU Test : c' = 0.060 – 0.490 kg/cm², ϕ' = 30.7 – 37.80^0
  - Unconfined Compression Test : Qu = 0.400 – 1.472 kg/cm²

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- **Kedalaman 12.00 m – 60.00 m**

  Jenis tanah pada kedalaman berupa jenis tanah Lempung Kelanuan (Silty CLAY/CH-CL) dan Lanau Kelempungan – Lanau Kepasiran (Clayey SILT – Sandy SILT/MH-ML) dengan konsistensi *very stif - hard*. Terdapat lensa lapisan Pasir (SAND/SP) dengan kerapatan *dense* yang kedalaman lapisan tanah ini tidak beraturan serta ketebalan lapisan bervariasi antara 1 – 5 meter.

  N-SPT rata – rata = 38 (range 19 – 52).

  Dari pengujian laboratorium didapatkan parameter–parameter berikut:

  - Natural Water Content : Wn = 21.30 – 76.03%
  - Specific Gravity : Gs = 2.600 – 2.681
  - Atterberg Limit : LL = 38.25 – 101.00 %, PL = 20.38 – 65.00 %, PI = 14.00 – 60.10 %.
  - Triaxial UU Test : c' = 0.200 – 0.400 kg/cm², ϕ' = 31.9 – 37.5^0
  - Unconfined Compression Test : Qu = 0.363 – 1.913 kg/cm²
  - Consolidation Test : Pc = 4.004 – 5.414 kg/cm², Cc = 0.220 – 0.420, Cs = 0.023 – 0.090, Cr = 0.022 – 0.108

- **Kedalaman 60.00 m – 90.00 m**

  Kedalaman ini hanya terdapat pada DB-1, jenis tanah pada kedalaman berupa jenis tanah Lempung Kelanuan (Silty CLAY/CH) dengan konsistensi *very stif - hard*. Pada Kedalaman ini terdapat lapisan Lanau (SILT/MH) dengan konsistensi *hard* pada kedalaman 65.5 – 69 meter.

  N-SPT rata – rata = 37 (range 21 – 50).

  Dari pengujian laboratorium didapatkan parameter–parameter berikut:

  - Natural Water Content : Wn = 36.18 – 38.99 %
  - Specific Gravity : Gs = 2.635– 2.638
  - Atterberg Limit : LL = 81.00 – 84.00 %, PL = 37.00 – 38.00 %, PI = 44.00 – 46.00 %.
  - Consolidation Test : Pc = 4.317 – 4.371 kg/cm², Cc = 0.240 – 0.420, Cs = 0.064 – 0.145, Cr = 0.067 – 0.090.

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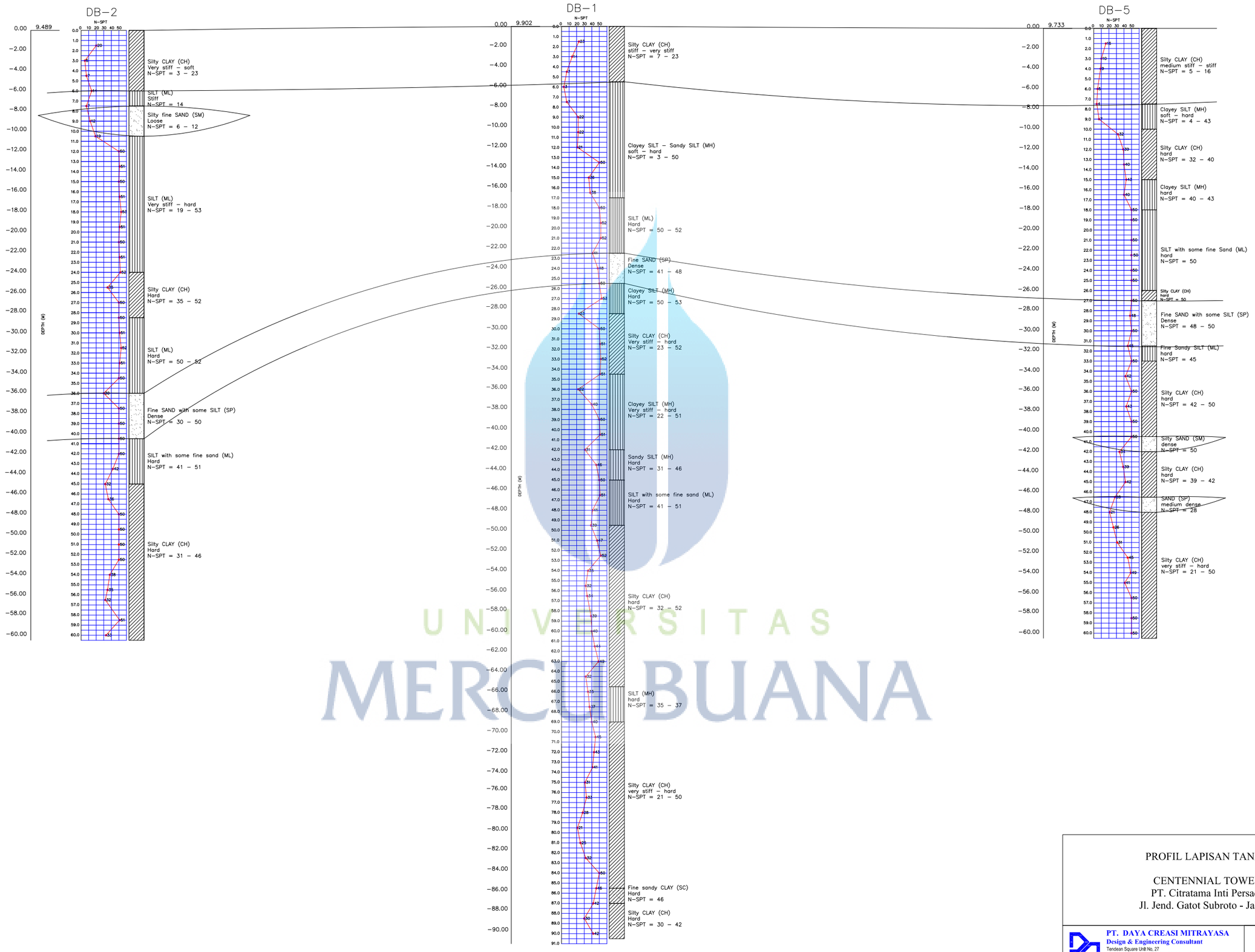

PROFIL LAPISAN TANAH

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Phone (62-21) 7278 4046, Fax.. (62-21) 7278 6905
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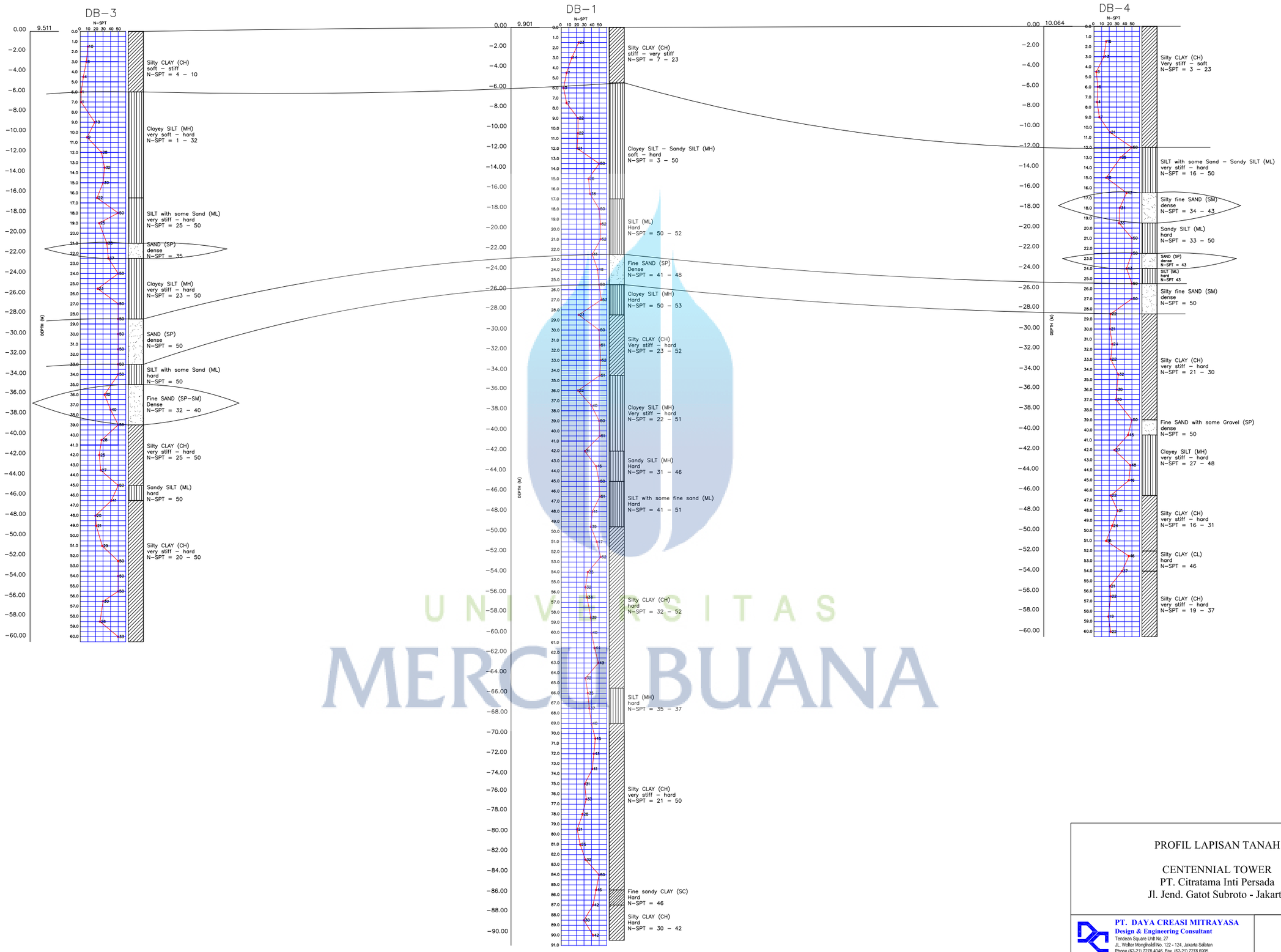

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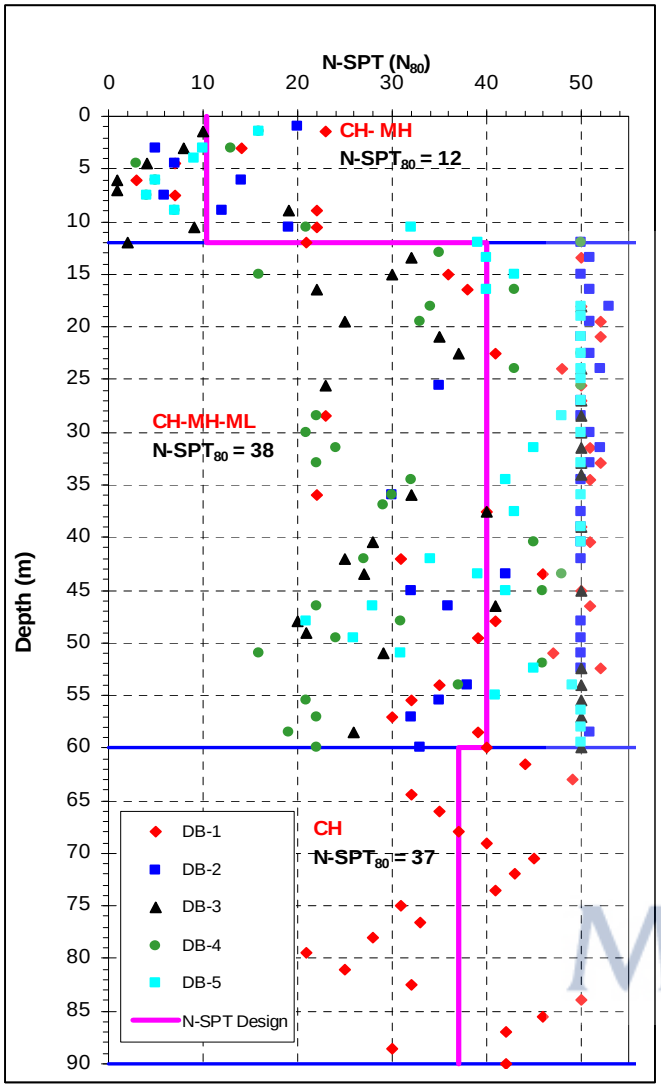

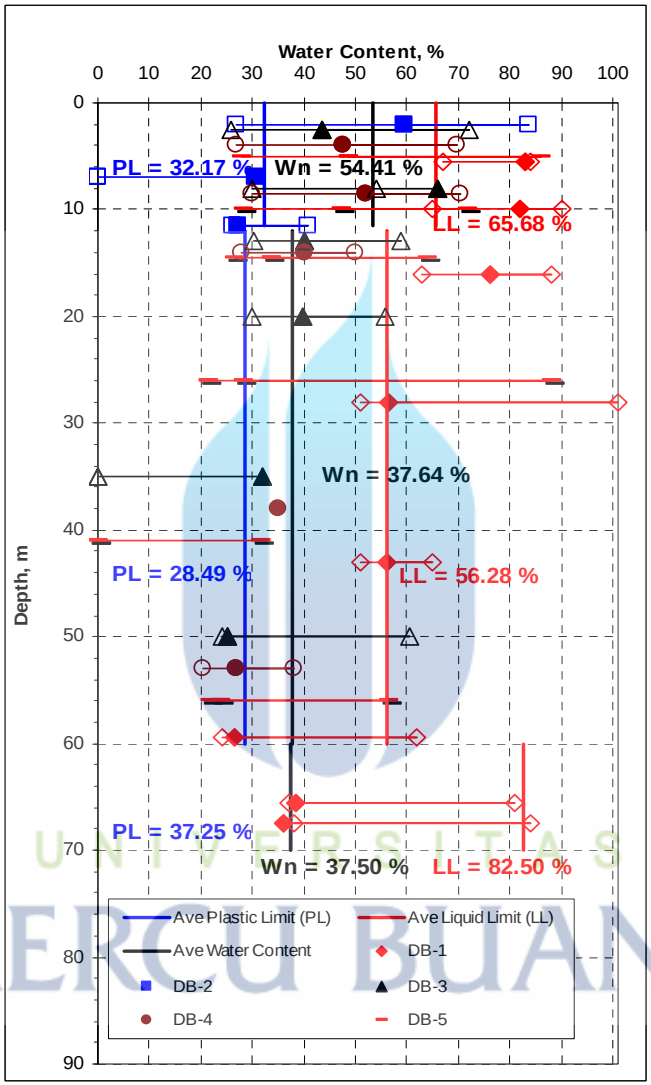

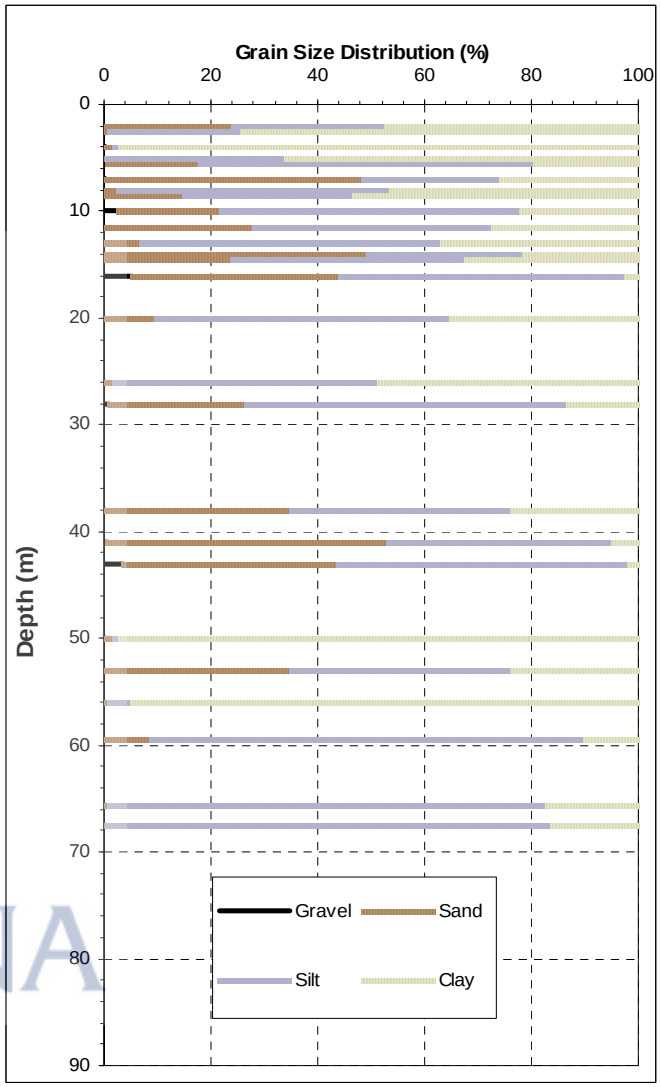

PT. Daya Creasi Mitrayasa

VARIATION OF PHYSICAL SOIL PARAMETERS VERSUS DEPTH DEEP BORING

Laporan Penyelidikan Tanah
Centennial Tower
Jl. Jend. Gatot Subroto – Jakarta

Project No.
DCM.G.12-047

Gambar
4A

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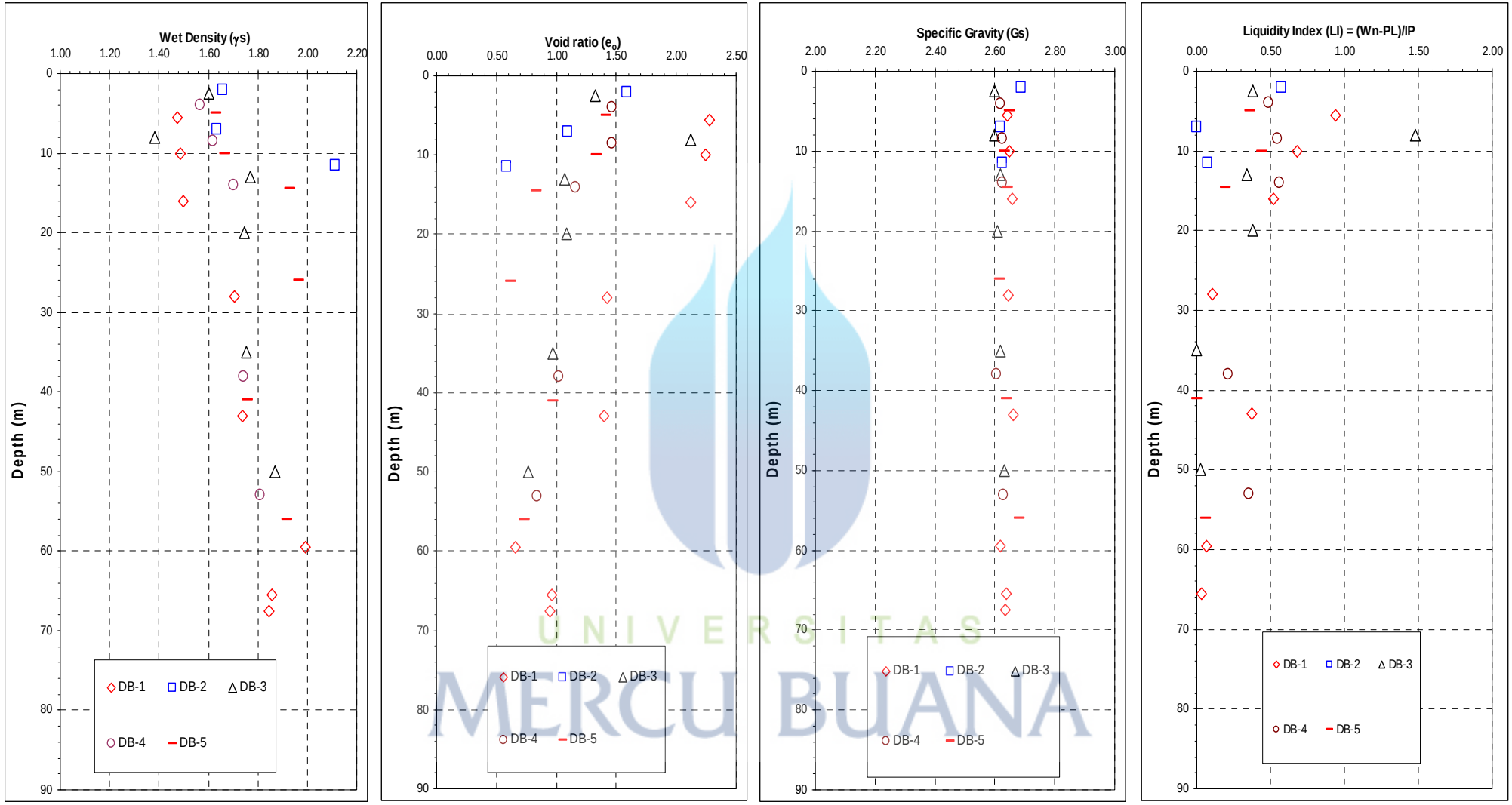

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VARIATION OF PHYSICAL SOIL PARAMETERS VERSUS DEPTH DEEP BORING

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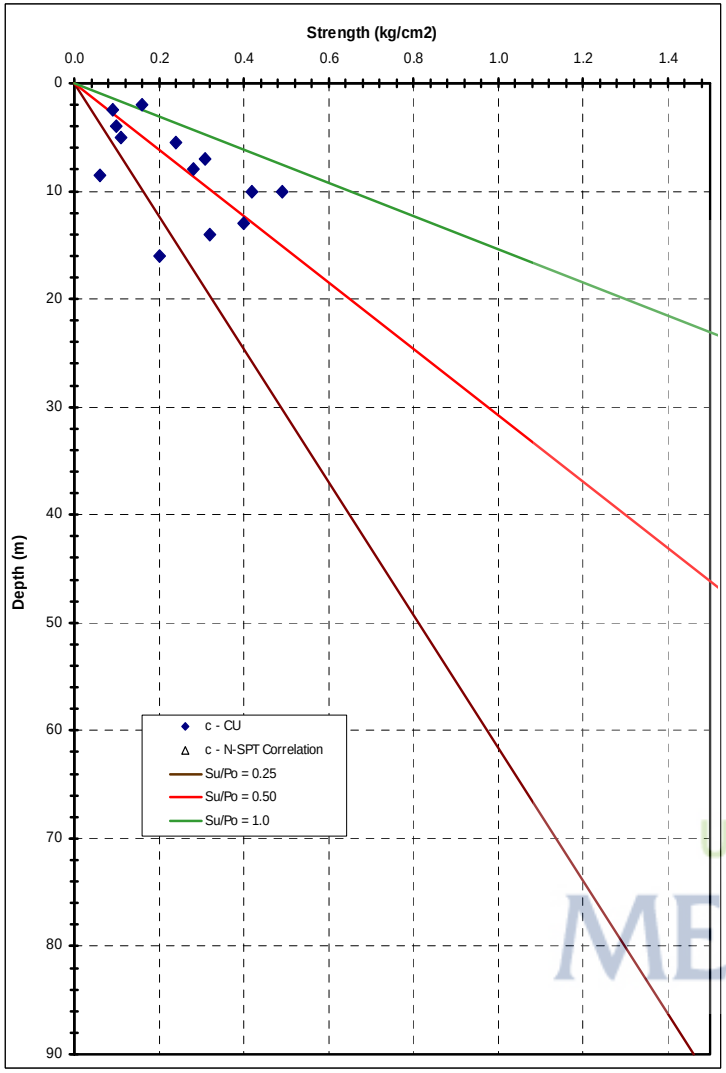

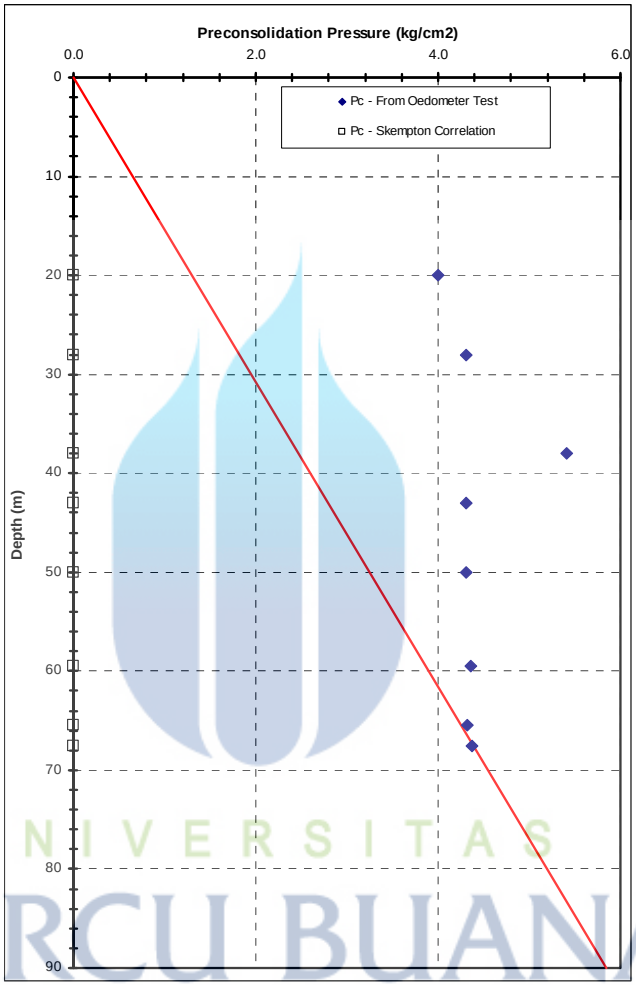

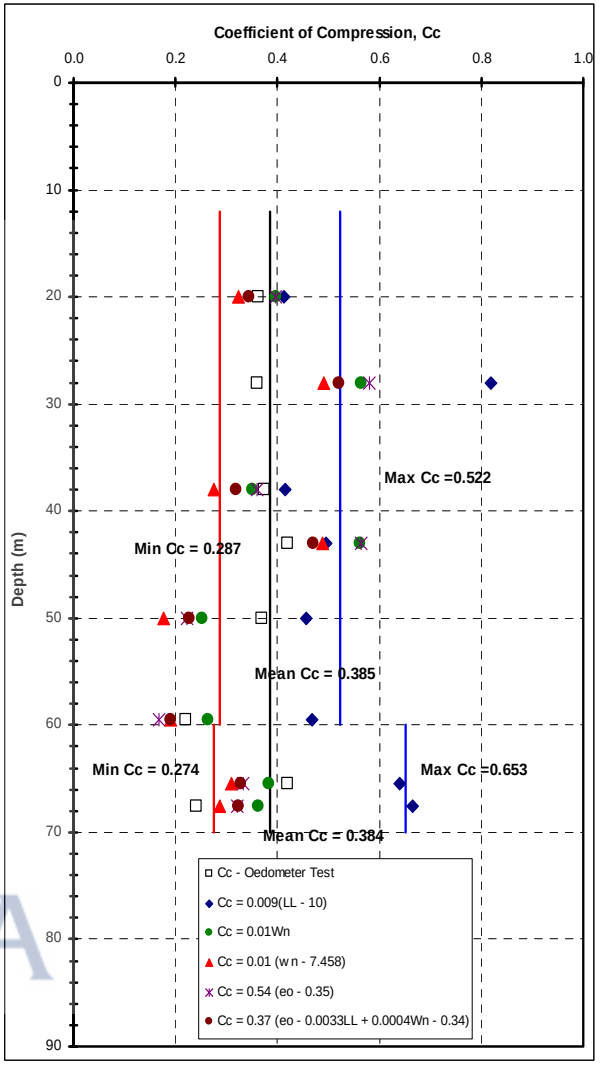

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PT. Daya Creasi Mitrayasa	**VARIATION OF ENGINEERING SOIL PARAMETERS VERSUS DEPTH** **DEEP BORING** **Laporan Penyelidikan Tanah** **Centennial Tower** Jl. Jend. Gatot Subroto – Jakarta	Project No. DCM.G.12-047 Gambar **4C**

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LAMPIRAN – A

BORING LOG

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BORING LOGS

Lampiran Boring Log ini dan informasi yang berhubungan dengan kondisi lapisan tanah hanya berlaku pada lokasi yang diperlihatkan pada **Gambar 2** dan pada waktu pekerjaan penyelidikan tanah dilakukan. Kondisi tanah dan muka air tanah pada lokasi lain mungkin berbeda dari yang diamati pada lokasi ini. Seiring dengan berjalannya waktu mungkin mengakibatkan perubahan pada kondisi tanah dan muka air tanah pada lokasi ini.

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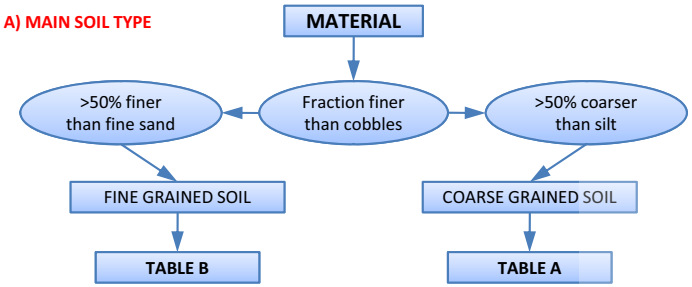
Soils are described below:

a. MAIN SOIL TYPE & UNIFIED CLASSIFICATION SYMBOL (BLOCK LETTERS)
b. Plasticity if fine grained or Particle Size Distribution and Grading if coarse grained
c. Particle shape
d. Color
e. Secondary minor component(s); name, estimated proportion, plasticity, particle size, colour
f. Moisture content
g. Consistency or density
h. Geological origin (FILL, ALLUVIUM, COLLUVIUM, RESIDUAL, etc.)

e.g. Silty SAND (SM); medium grained, poorly graded, rounded, yellow-brown, with trace of fine grained subangular gravel, dry, loose. Quaternary Alluvium

A) MAIN SOIL TYPE



B) PLASTICITY (fine grained soils) OR

DESCRIPTIVE TERM	LIQUID LIMIT (%)
Low plasticity	< 35
Medium plasticity	35 < LL < 50
High plasticity	> 50

GRADING (coarse grained soils)

DESCRIPTIVE TERM	DEFINITIONS
Well graded	Good representation of all particle size from largest to the smallest
Poorly graded	One or more intermediate size poorly represented
Gap graded	One or more intermediate sizes absent
Uniform	Essentially one size

C) PARTICLE SHAPE

	Rounded
	Subrounded
	Subangular
	Angular

D) COLOR

PARAMETER	DESCRIPTION
Tone	Light/ Dark / Mottled
Shade	Pinkish / reddish / Yellowish / Brownish / Greenish / Bluish / Grayish
Hue	Pink / Red / Yellow / Orange / Brown / Green / Blue / Purple / White / Grey / Black
Distribution	Uniform / Non-uniform (spotted, mottled, streaked, striped)

G) CONSISTENCY OR DENSITY

GRAVEL/SAND (GW, GP, GM, GC)

DESCRIPTION	FIELD TEST
Loosely Packed	Can be remolded from exposure by hand or easily removed by shovel
Tightly Packed	Requires pick for removal, either as lumps or as disaggregated material

SAND (SW, SP, SM, SC)

DENSITY	FIELD TEST	DCP (Blows/ 150mm)	SPT (N)	RELATIVE DENSITY (%)	CPT q_c (Mpa)
Very Loose	Easily penetrated with 13mm reinforcing rod pushed by hand. Can be excavated with a spade; 50mm wooden peg can be driven easily	0 – 1	< 4	< 15	0 – 2
Loose	Easily penetrated with 13mm reinforcing rod pushed by hand. Can be excavated with a spade; 50mm wooden peg can be driven easily	1 – 3	4 – 10	15 – 35	2 – 5
Medium Dense	Penetrated with 13mm reinforcing rod driven with 2kg hammer – hard shoveling	3 – 8	10 – 30	35 – 65	5 – 15
Dense	Penetrated 300mm with 13mm reinforcing rod driven with 2kg hammer, requires pick for excavation; 50mm wooden peg hard to drive	8 – 15	30 – 50	65 – 85	15 – 25
Very Dense	Penetrated only 25 – 50mm with 13mm reinforcing rod driven with 2kg hammer	> 15	> 50	> 85	> 25

TABLE A: COARSE GRAINED SOILS: more than half of the material less than 60mm is larger than 0.06mm

		GRADATIONS		NATURE OF FINES	DRY STRENGTH	SYMBOL	TYPICAL NAME
>50% coarser than coarse sand	Gravels	Good	Wide range in grain size	Clean material (not enough fines to bind coarse grains)	None	GW	Well graded gravels and sand - gravel mixtures, little or no fines
		Poor	Predominantly one size or range of sizes			GP	Poorly graded gravels and gravel - sand mixtures little or no fines
		Good to Fair	"Dirty" Materials (excess of Fines)	Fines are non-plastic	None to med	GM	Silty gravels, gravel - sand - silt mixtures
				Fines are plastic	Med to high	GC	Clayey gravels, gravel - sand - clay mixtures
>50% finer than fine gravel	Sands	Good	Wide range in grain size	Clean material (not enough fines to bind coarse grains)	None	SW	Well graded sands and gravelly sands, little or no fines
		Poor	Predominantly one size or range of sizes			SP	Poorly graded sands and gravelly sands, little or no fines
		Good to Fair	"Dirty" Materials (excess of Fines)	Fines are non-plastic	None to med	SM	Silty sand, sand - silt, mixtures
				Fines are plastic	Med to high	SC	Clayey sand, sand - clay, mixtures

E) PROPORTION OF SECONDARY & MINOR COMPONENT

COARSE GRAINED SOILS		FINE GRAINED SOILS	
% fines	Modifier	% coarse	Modifier
< 5	"with a trace of"	<15	"with a trace of"
>5; <15	"with some"	>15; <30	"with some"
>15	Prefix soil with "silty, clayey, sandy, or gravelly"	>30	Prefix soil with "silty, clayey, sandy, or gravelly"

SILT AND CLAY (ML, CL, OL, MH, CH, OH, Pt)

CONSISTENCY	FIELD TEST	DCP (blows/ 150mm)	SPT (N)	Su (kPa)	UCS (pocket penetrometer, kPa)	CPT q_c (kPa)
Very Soft	Easily penetrated 40mm by thumb. Exudes between thumb and fingers when squeezed	< 1	< 2	< 12	< 25	0 – 180
Soft	Easily penetrated 10 mm by thumb. Can be moulded by light finger pressure	1 – 1.5	2 – 4	12 – 25	25 – 50	180 – 375
Medium Stiff	Impression made by thumb with moderate effort. Can be moulded by strong finger pressure	1.5 – 3	4 – 8	25 – 50	50 – 100	375 – 750
Stiff	Slight impression made by thumb, cannot be moulded by fingers	3 – 6	8 – 15	50 – 100	100 – 200	750 – 1500
Very Stiff	Very tough. Readily indented by thumbnail	7 – 12	15 – 30	100 – 200	200 – 400	1500 – 3000
Hard	Brittle, indented with difficulty by thumbnail	> 12	> 30	> 200	> 400	> 3000

F) Moisture Content

CONDITION	CRITERIA
Dry	Cohesive soils hard and friable, granular sands free running
Moist	Soils feel cool, darkened in colour, Cohesive soils can be moulded, Granular soils cohere
Wet	Soil feels cool, darkened in colour, Free water forms on hands when handling

TABLE B: FINE GRAINED SOILS: more than half of the material less than 60mm is smaller than 0.06mm

DRY STRENGTH	DILATANCY	TOUGHNESS	SYMBOL	TYPICAL NAME
None to low	Quick to slow	None	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
Medium to high	None to very slow	Medium	CL	Inorganic clays of low ie. medium plasticity, gravelly clays, sandy clays etc
Low to medium	Slow	Low	OL	Organic silts and organic silt clays of low plasticity
Low to medium	Slow to none	Low to medium	MH	Inorganic silts, micaceous or diatomeceous fine sands or silts, elastic silts
High to very high	None	High	CH	Inorganic clays of high plasticity
Medium to high	None to very slow	Low to medium	OH	Organic clays of medium to high plasticity
Readily identified by colour, odour, spongy feel and generally by fibrous textures			Pt	Peat muck and other highly organic soils

ORGANIC AND ARTIFICIAL MATERIALS

PREFERRED TERM	TYPE
Fibrous Peat Charcoal Wood Fragments Roots (greater than 2mm dia) Root fibers (less than 2mm dia)	Organic Matter
Oil, Bitumen Domestic Refuse Brickbats Concrete Rubble Fibrous Plaster Wood Places, shavings, sawdust Iron Fillings, Drums, Steel Scrap Bottles, Broken Glass Leather	Waste Fill

TYPE	COARSE								FINE		ORGANIC
			Gravel			Sand					
	Boulders	Cobbles	coarse	medium	fine	coarse	medium	fine	Silt	Clay	Organic Soil
Size Range [mm]	200	60	20	6	2	0.6	0.2	0.06	0.002		
Graphic Symbol											

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DATA FOR DESCRIPTION AND CLASSIFICATION OF SOILS

PT. DAYA CREASI MITRAYASA
Design & Engineering Consultant

Rev-0, 16 July 2008, By: Hartono Wu

H) CLASSIFICATION OF SOIL ACCORDING TO ORIGIN

CLASSIFICATION	PROCESS OF FORMATION	NATURE OF DEPOSITS
Residual	Chemical weathering of parent rock with little or nor movement of particles	Product of complete weathering is a clay whose type depends mainly on the weathering process. Products of partial weathering are more stony and depend more on rock type. Soil becomes more compact, more stony and less weathered with increasing depth
Alluvial	Material transported and deposited by water action	Vary from finest clays to very coarse gravel and boulders. Soils usually show pronounced stratification. River gravels are usually rounded.
Colluvial	Materials transported by gravity	Includes screes, avalanches, landslips, hillside creep, downwash material and solifluction deposits. Varies from clays to boulders. Material is usually heterogeneous with a wide range of particle sizes.
Glacial	Materials transported and deposited by glacial ice or by melted waters from glaciers	Glacial till and moraine deposits usually have broad grading ranging from clay to boulders. Grain size in the outwash material decreases with distance from the source of melt water. Stratification in moraines and till is usually heterogeneous but outwash deposits give rise to laminated (varved) silt and clay in glacial lakes. Grains are typically angular.
Aeolian or loessial	Materials transported and deposited by wind	Highly uniform gradation with indistinct or not stratification. Typically silt or fine sand sized but sometimes the surface is covered by a single layer of pebbles. Loess typically has a secondary structure of vertical cracks, joints and root holes.
Organic	Formed in place by growth and decay of plants	Peats are dark coloured, fibrous or amorphous and highly compressible. Mixtures of fine sediment and organic matter produce organic silt and clays.
Volcanic	Ash and pumice deposited in volcanic eruptions	Silt sized particles along with larger volcanic debris. Particles are highly angular and often vesicular. Weathering produces a highly plastic, sometimes expansive clay. The weathered consolidated deposits sometimes from a light, easily-worked stone.
Evaporites	Materials precipitated or evaporated from solutions of high salts content	Forms cemented soils or soft sedimentary rocks. Includes oolites precipitated from calcium in sea water and gypsum precipitated from sulphate-rich playa takes in deserts. Evaporites may form as a hard crust just below the surface in arid regions.

DETERMINATION OF DRY STRENGTH, DILATANCY, TOUGHNESS AND PLASTICITY

1. Dry Strength (Crushing Characteristics)

After removing particles larger than 0.44mm size, mould a pat of soil to the consistency of putty, adding of water if necessary. Allow the pat to dry completely by oven, sun or air drying, and then test its strength by breaking and crumbling between in fingers. The strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity. High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

2. Dilatancy (Reaction to Shaking)

After removing particles larger than 0.4mm sieve size, prepare a pat of moist soil with a volume of about 8cm crumbled. Add enough water if necessary to make the soil soft but not sticky. Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consist of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens and finally it cracks or crumbs. The rapidity of appearance of water during shaking and of its disappearance during the squeezing assist in indentifying the character of the fines in a soil. Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction, inorganic silts, such as a typical rock flour, show a moderately quick reaction.

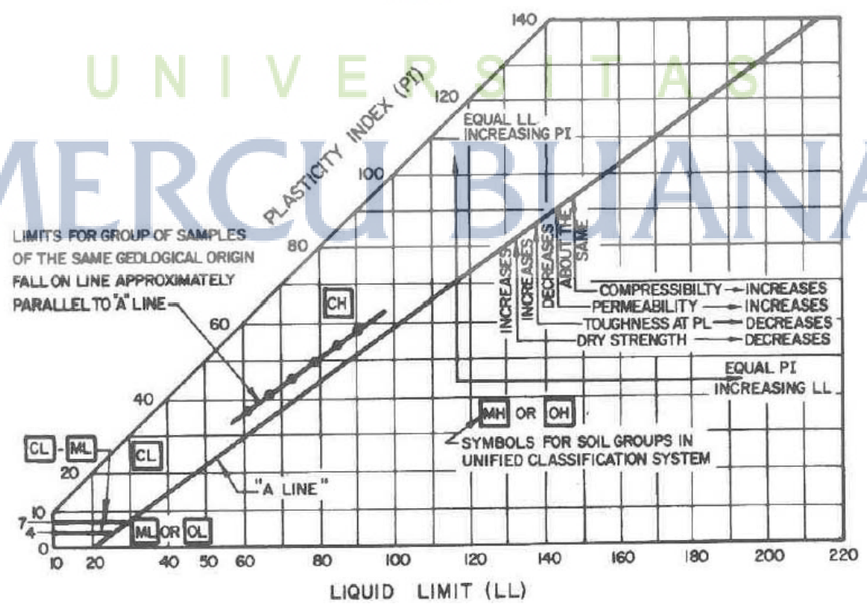
3. Toughness (Consistency near Plastic Limit)

After removing particles larger than the 0.4mm sieve size a specimen of soil about 12mm cube in size is moulded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about 3mm in diameter. The thread is then folded and re-rolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached. After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles. The tougher the thread near the plastic limit and the stiffer the lump when its finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicates either inorganic clay of low plasticity, or materials such as kaolin-type clays which occur below the A-line. Highly organic clays have a very weak and spongy feel at the plastic limit.

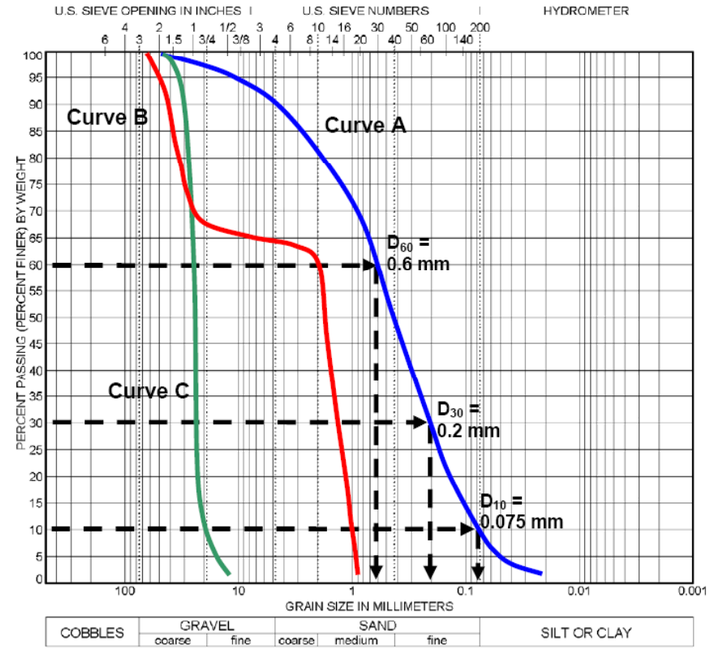
4. Smear Test

A fragment of soil smeared between the thumb and forefinger or drawn across the thumbnail will, by the smoothness and sheen of the smear surface, indicate the plasticity of the soil. A soil of low plasticity will exhibit a rough textured, dull smear while a soil of high plasticity will exhibit a slick, waxy smear surface.

PLASTICITY CHART AND SIGNIFICANCE OF ATTERBERG LIMITS (NAVFAC ,1986a)



EVALUATION OF TYPE OF GRADUATION FOR COARSE GRAINED SOILS



Curve	D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	Gradation
A	0.075	0.2	0.6	8.0	0.9	Well graded (1)
B	1	1.5	2	2.0	1.12	Poorly graded - Gap graded (2)
C	19	25	27	1.4	1.2	Poorly graded

(1) Soil does not meet C_u and C_c criteria for well-graded soil but GSD curve clearly indicates a well-graded soil

(2) The C_u and C_c parameters indicate a uniform (or poorly) graded material, but the GSD curve clearly indicates a gap-graded soil.

Note: For clarity only the D_{10}, D_{30}, and D_{60} sizes for Curve A are shown on the figure.

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BORING LOG

Boring No. : DB-1

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*29 September 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.902*
DRILLER :	*Djais*	LOGGED BY :	*Rudito*
DRILL RIG :	*Tone*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial : -9.50 m At Completion : -9.80 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	N-SPT	STANDARD PENETRATION TEST 10 30 50
0		CH	Silty CLAY, brown, very stiff			
1						
2			ditto	6 10 13	23	
3			Silty CLAY, reddish brown mottled gray, stiff	4 6 8	14	
4						
5			Silty CLAY, yellowish and garyish brown, stiff	1 3 4	7	
6	UDS	MH	Clayey SILT, brown, soft	1 1 2	3	
7						
8			Clayey SILT, brown, medium stiff	1 3 4	7	
9			Clayey SILT, brown, very stiff	6 9 13	22	
10	UDS					
11			ditto	6 10 12	22	
12			ditto	6 9 12	21	
13						
14			Fine Sandy SILT, gray, hard	28 50/10	50	
15			SILT, brown, hard	10 15 21	36	
16	UDS					
17		ML	SILT, brown, hard	15 17 21	38	
18			ditto	9 23 27	50	
19						
20			ditto	9 24 28/9	50	

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BORING LOG

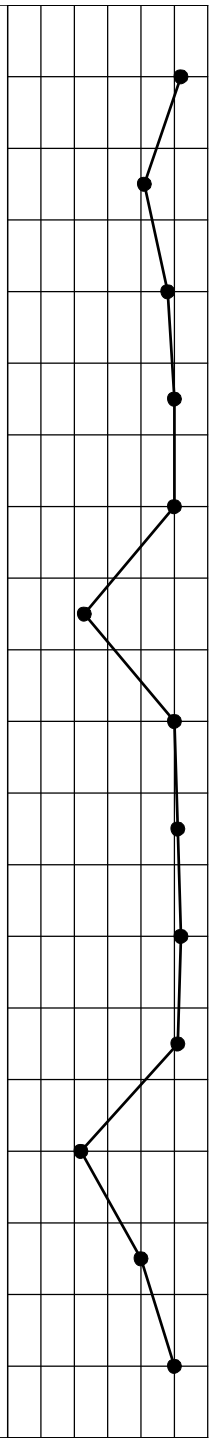
Boring No. : DB-1

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*29 September 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.902*
DRILLER :	*Djais*	LOGGED BY :	*Rudito*
DRILL RIG :	*Tone*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial : -9.50 m At Completion : -9.80 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	N-SPT
20					
21		ML	ditto SILT, brown, hard	15 24 28	52
22					
23		SP	Fine SAND, dark gray, poorly graded, dense	8 18 23	41
24			ditto	10 20 28	48
25					
26		MH	Clayey SILT, brownish gray, hard	50/15	50
27			ditto	9 23 30/10	50
28	UDS				
29		CH	Silty CLAY, gray, very stiff	9 10 13	23
30			Silty CLAY, brownish gray, hard	10 22 28	50
31					
32			ditto	10 24 27	51
33			ditto	15 26 26/9	52
34					
35		ML	Clayey SILT, dark gray, hard	18 28 23/9	51
36			Clayey SILT, dark gray, very stiff	7 11 11	22
37					
38			Clayey SILT, dark gray, hard	10 17 23	40
39			ditto	16 25 25/10	50
40					

STANDARD PENETRATION TEST



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BORING LOG

Boring No. : DB-1

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*29 September 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.902*
DRILLER :	*Djais*	LOGGED BY :	*Rudito*
DRILL RIG :	*Tone*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial : -9.50 m At Completion : -9.80 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	N-SPT	STANDARD PENETRATION TEST 10 30 50
40		ML	ditto	16 30 21/8	51	
41			Clayey SILT, dark gray, hard			
42		MH	Sandy SILT, light brown, hard	9 13 18	31	
43	UDS					
44			Sandy SILT, grayish and yellowish brown, hard	10 15 31	46	
45		ML	SILT with some fine SAND, dark gray, hard	12 30 20/7	50	
46						
47			ditto	12 21 30	51	
48			Clayey SILT, gray mottled yellow, hard	10 17 24	41	
49						
50		CH	Silty CLAY, brownish gray, hard	10 16 23	39	
51			ditto	10 20 27	47	
52						
53			ditto	11 22 30	52	
54			ditto	10 16 19	35	
55						
56			ditto	10 15 17	32	
57			ditto	9 10 20	30	
58						
59			ditto	10 17 22	39	
60	UDS		ditto	11 19 21	40	
61						

UNIVERSITAS MERCU BUANA

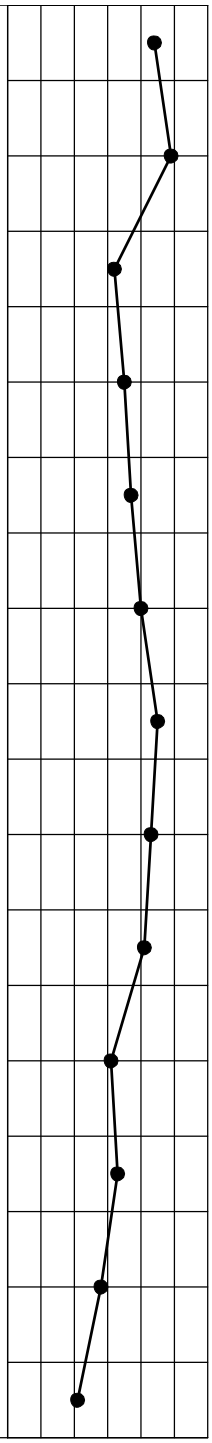
BORING LOG

Boring No. : DB-1

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*29 September 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.902*
DRILLER :	*Djais*	LOGGED BY :	*Rudito*
DRILL RIG :	*Tone*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial : -9.50 m At Completion : -9.80 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	N-SPT	STANDARD PENETRATION TEST (10 30 50)
61		CH	ditto	10 20 24	44	
62			ditto			
63			Silty CLAY, brownish gray, hard	12 22 27	49	
64						
65			ditto	9 15 17	32	
66	UDS	MH	SILT, brown, hard	10 17 18	35	
67						
68	UDS		SILT, brownish gray, hard	11 16 21	37	
69		CH	Silty CLAY, gray, hard	12 16 24	40	
70						
71			ditto	12 19 26	45	
72			ditto	1 18 25	43	
73						
74			ditto	12 17 24	41	
75			ditto	12 14 17	31	
76						
77			ditto	10 15 18	33	
78			Silty CLAY, dark gray, very stiff	8 10 18	28	
79						
80			Silty CLAY, dark gray, very stiff	5 8 13	21	



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BORING LOG

Boring No. : DB-1

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*29 September 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.902*
DRILLER :	*Djais*	LOGGED BY :	*Rudito*
DRILL RIG :	*Tone*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial : -9.50 m At Completion : -9.80 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	N-SPT	STANDARD PENETRATION TEST 10 30 50
80			Silty CLAY, dark gray, very stiff			
81			ditto	7 10 15	25	
82						
83			ditto	11 15 17	32	
84			ditto	22 25 25/6	50	
85						
86		SC	Fine Sandy CLAY, yellowish gray, hard	16 23 23	46	
87		CH	Silty CLAY with some sand, brownish gray, hard	13 19 23	42	
88						
89			Silty CLAY, brownish gray, hard	8 13 17	30	
90			ditto	10 18 24	42	
91			Drilling terminated at depth 90 meters			
92						
93						
94						
95						
96						
97						
98						
99						
100						

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BORING LOG

Boring No. : DB-2

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*15 Oktober 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.489*
DRILLER :	*Djais*	LOGGED BY :	*Rudito*
DRILL RIG :	*Tone*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial : -10.10 m At Completion : -10.30 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	STANDARD PENETRATION TEST N-SPT (10 30 50)
0		CH	Silty CLAY, brown, very stiff		
1			ditto	10 10 10	20
2	UDS				
3			Silty CLAY, grayish brown, medium stiff	1 2 3	5
4					
5			ditto	1 3 4	7
6		ML	SILT, brown, stiff	2 6 8	14
7	UDS				
8		SM	Silty Fine Sand, brown mottled white, loose	3 3 3	6
9			ditto	3 5 7	12
10					
11		ML	SILT with some fine Sand, grayish brown, very stiff	5 7 12	19
12	UDS		SILT, brown, hard	14 50/15	50
13					
14			Clayey SILT, light brown, hard	15 24 27	51
15			ditto	17 28 32/11	50
16					
17			ditto	10 25 26	51
18			SILT, brown, hard	22 25 28/8	50
19					
20			SILT, brown, hard	30 50/15	50

UNIVERSITAS MERCU BUANA

BORING LOG

Boring No. : DB-2

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*15 Oktober 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.489*
DRILLER :	*Djais*	LOGGED BY :	*Rudito*
DRILL RIG :	*Tone*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial : -10.10 m At Completion : -10.30 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	N-SPT	STANDARD PENETRATION TEST 10 30 50
20			SILT, brown, hard			
21		ML	SILT, dark gray, poorly cemented, hard	25 50/15	50	
22						
23			SILT, light brown, poorly cemented, hard	13 23 28/12	50	
24		CH	Silty CLAY, gray, hard	14 22 30/10	50	
25						
26			ditto	9 15 20	35	
27			ditto	12 19 31	50	
28						
29		ML	SILT, dark gray, poorly cemented, hard	51/12	50	
30			ditto	52/12	51	
31						
32			ditto	52/12	52	
33			SILT, dark gray, hard	51/10	51	
34						
35			ditto	50/13	50	
36		SP	Fine Sand with some Silt, black, poorly graded, dense	12 13 17	30	
37						
38			ditto	13 25 25/10	50	
39			Fine Sand with some Silt, black, poorly graded, dense	13 27 23/10	50	
40						

UNIVERSITAS MERCU BUANA

BORING LOG

Boring No. : DB-2

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*15 Oktober 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.489*
DRILLER :	*Djais*	LOGGED BY :	*Rudito*
DRILL RIG :	*Tone*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial ▽ : -10.10 m At Completion ▼ : -10.30 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	STANDARD PENETRATION TEST N-SPT	10 30 50
40		SP	Fine Sand with some Silt, black, poorly graded, dense	14 24 26/11	50	
41		ML				
42			SILT with some fine Sand, gray, hard	18 27 23	50	
43			SILT with some fine Sand, gray, hard			
44			ditto	10 19 23	42	
45		CH	Silty CLAY, brownish gray, hard	7 13 19	32	
46						
47	UDS		ditto	10 15 21	36	
48			ditto	14 22 28/11	50	
49						
50			ditto	14 25 25/13	50	
51			ditto	14 27 23/10	50	
52						
53			ditto	12 24 26/8	50	
54			Silty CLAY, light gray, hard	10 16 22	38	
55						
56			ditto	10 14 21	35	
57			ditto	10 13 19	32	
58						
59			ditto	19 24 27	51	
60			ditto	10 16 17	33	
61			Drilling terminated at depth 60 meters			
62						

UNIVERSITAS MERCU BUANA

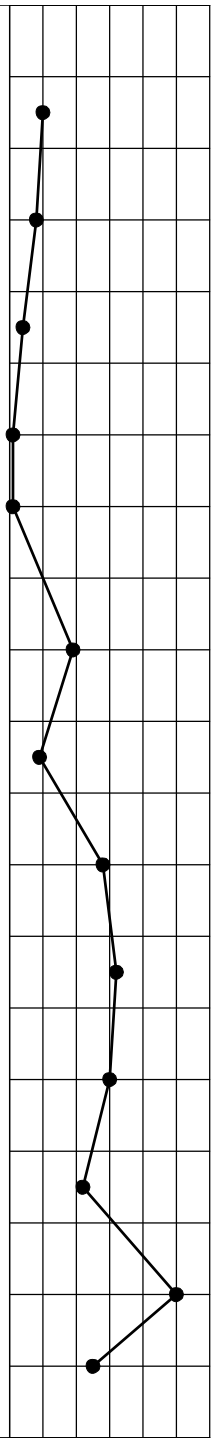
BORING LOG

Boring No. : DB-3

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*10 Oktober 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.511*
DRILLER :	*Akhiri*	LOGGED BY :	*Rudito*
DRILL RIG :	*AX-OP1*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial : -10.00 m At Completion : -10.15 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	N-SPT	STANDARD PENETRATION TEST 10 30 50
0		CH	Silty CLAY, grayish brown, stiff			
1						
2			ditto	3 4 6	10	
3	UDS		Silty CLAY, reddish gray, stiff	2 3 5	8	
4						
5			Silty CLAY, reddish and brownish gray, soft	1 2 2	4	
6		MH	Clayey SILT, light brown, very soft	1/45	1	
7			ditto	1/45	1	
8	UDS					
9			Clayey SILT, brown, very stiff	3 7 12	19	
10						
11			Clayey SILT, brown, stiff	3 4 5	9	
12			Clayey SILT, brown, very stiff	6 10 18	28	
13	UDS	CH-MH				
14			Clayey SILT, gray, hard	7 12 20	32	
15			ditto	6 11 19	30	
16						
17		ML	SILT with some fine Sand, brown, very stiff	10 10 12	22	
18			SILT with some fine Sand, brown, hard	7 17 33/11	50	
19			SILT with some fine Sand, brown, very stiff	9 10 15	25	
20						



UNIVERSITAS MERCU BUANA

BORING LOG

Boring No. : DB-3

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*10 Oktober 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.511*
DRILLER :	*Akhiri*	LOGGED BY :	*Rudito*
DRILL RIG :	*AX-OP1*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial ▽ : -10.00 m At Completion ▼ : -10.15 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	STANDARD PENETRATION TEST N-SPT	10 30 50
21		SP	SILT with some fine Sand, brown, very stiff	7 10 25	35	
22			SAND, dark gray, poorly graded, dense			
23		MH	Clayey SILT, gray, hard	8 13 24	37	
24			Clayey SILT, dark gray, hard	9 24 26/12	50	
25						
26			Clayey SILT, gray, very stiff	8 11 12	23	
27			Clayey SILT, brownish gray, very stiff	12 25 25/7	50	
28						
29		SP	SAND, dark gray, poorly graded, dense	50/11	50	
30			ditto	12 25 25/11	50	
31						
32			ditto	10 30 20/10	50	
33		ML	SILT with some fine Sand, dark brown, hard	7 35 15/5	50	
34			Clayey SILT, dark gray, hard	50/13	50	
35	UDS	SM	Fine SAND, black, poorly graded, dense			
36		SP	Fine SAND, black, poorly graded, dense	9 12 20	32	
37						
38			ditto	10 13 27	40	
39		CH	Silty CLAY, gray, hard	11 20 30/14	50	
40						

UNIVERSITAS MERCU BUANA

BORING LOG

Boring No. : DB-3

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*10 Oktober 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.511*
DRILLER :	*Akhiri*	LOGGED BY :	*Rudito*
DRILL RIG :	*AX-OP1*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial : -10.00 m At Completion : -10.15 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	N-SPT	STANDARD PENETRATION TEST 10 30 50
40		CH	Silty CLAY, gray, hard	7 12 16	28	
41			Silty CLAY, brownish gray, very stiff			
42			Silty CLAY, brownish gray, very stiff	9 10 15	25	
43						
44			ditto	9 11 16	27	
45		ML	Fine Sandy SILT, dark gray, hard	9 17 33/13	50	
46						
47		CH	Silty CLAY, gray, hard	11 16 25	41	
48			Silty CLAY, light gray, very stiff	6 8 12	20	
49			ditto	6 9 12	21	
50		UDS				
51			Silty CLAY with contains of shell frag, light gray, very stiff	8 12 17	29	
52						
53			Silty CLAY, ligth gray, hard	12 40 10/5	50	
54			Silty CLAY, brownish gray, hard	20 50/14	50	
55						
56			ditto	12 33 17/5	50	
57			ditto	9 12 18	30	
58						
59			Silty CLAY, brownish gray, very stiff	8 11 15	26	
60		SC	Fine Sandy CLAY, yellowish brown, hard	17 26 24/11	50	
61			Drilling terminated at depth 60 meters			
62						

UNIVERSITAS MERCU BUANA

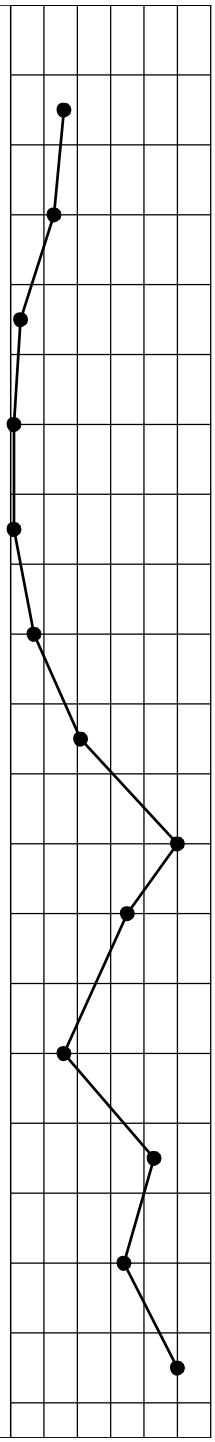
BORING LOG

Boring No. : DB-4

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*17 Oktober 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*10.064*
DRILLER :	*Akhiri*	LOGGED BY :	*Rudito*
DRILL RIG :	*AX-OP1*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial ▽ : -10.10 m At Completion ▼ : -10.25 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	N-SPT	STANDARD PENETRATION TEST 10 30 50
0		CH	Silty CLAY, reddish brown, very stiff			
1						
2			Silty CLAY, reddish brown, very stiff	5 8 8	16	
3			Silty CLAY, reddish brown, stiff	9 6 7	13	
4		UDS				
5			Silty CLAY, reddish and brownish gray, soft	1 1 2	3	
6			ditto	1 2 3	1	
7						
8			Silty CLAY, brown mottled white, soft	1 2 2	1	
9		UDS	Silty CLAY, brown, medium stiff	2 3 4	7	
10						
11			Silty CLAY, brown, very stiff	6 9 12	21	
12		ML	SILT with some Sand, dark brown, hard	9 50/8	50	
13			Clayey SILT, gray, hard	8 16 19	35	
14		UDS	CL-ML			
15			Clayey SILT, light brown, very stiff	5 7 9	16	
16						
17		SM	Silty Fine SAND, dark brown, poorly graded, dense	8 17 26	43	
18			ditto	7 15 19	34	
19						
20		ML	Fine Sandy SILT, dark gray, hard	10 33 17/5	50	



UNIVERSITAS MERCU BUANA

BORING LOG

Boring No. : DB-4

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*17 Oktober 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*10.064*
DRILLER :	*Akhiri*	LOGGED BY :	*Rudito*
DRILL RIG :	*AX-OP1*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial : -10.10 m At Completion : -10.25 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	STANDARD PENETRATION TEST N-SPT	10 30 50
21		ML	Fine Sandy SILT, dark gray, hard	9 22 28/4	50	
22			SILT, gray, hard			
23		SP	Medium Sand, dark gray, poorly graded, dense	12 19 21/10	50	
24		ML	SILT, dark gray, hard	8 18 25	43	
25						
26		SM	Silty Fine SAND, dark gray, poorly graded	12 25 25/11	50	
27			ditto	11 28 25/7	50	
28						
29		CH	Silty CLAY, brownish gray, very stiff	7 10 12	22	
30			ditto	7 9 12	21	
31						
32			Silty CLAY, dark gray, very stiff	5 10 14	24	
33			ditto	7 9 13	22	
34						
35			Silty CLAY, dark gray, hard	9 13 19	32	
36			ditto	9 12 18	30	
37			Silty CLAY, dark gray, very stiff	8 11 18	29	
38	UDS					
39		SP	Fine SAND with some Gravel, black, poorly graded, dense	27 38 12/5	50	
40						

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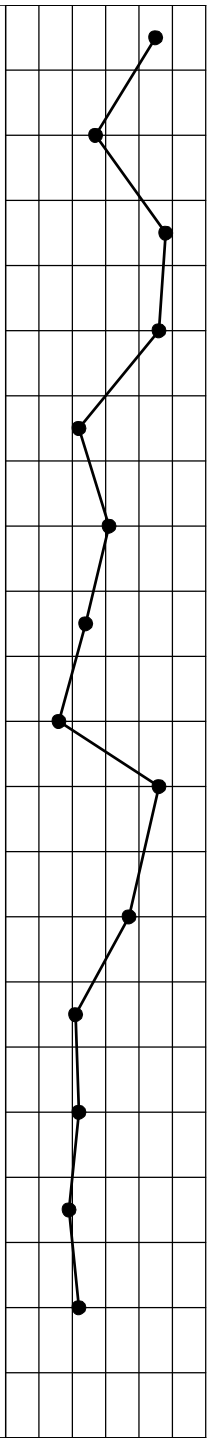
BORING LOG

Boring No. : DB-4

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*17 Oktober 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*10.064*
DRILLER :	*Akhiri*	LOGGED BY :	*Rudito*
DRILL RIG :	*AX-OP1*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial ▽ : -10.10 m At Completion ▼ : -10.25 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	STANDARD PENETRATION TEST N-SPT	10 30 50
40		SP	Fine SAND with some Gravel, black, poorly graded, dense	7 16 29	45	
41		MH				
42			Clayey SILT, dark gray, hard	6 10 17	27	
43			Silty CLAY, brownish gray, very stiff			
44			Clayey SILT, brownish gray, hard	12 23 25	48	
45			ditto	9 19 27	46	
46						
47		CH	Silty CLAY, light gray, very stiff	5 8 14	22	
48			Silty CLAY, light gray, hard	9 13 18	31	
49						
50			Silty CLAY, light gray, very stiff	5 9 15	24	
51			ditto	5 7 9	16	
52		CL	Silty CLAY, brownish gray, hard	10 20 26	46	
53	UDS					
54		CH	Silty CLAY, brownish gray, hard	12 17 20	37	
55						
56			Silty CLAY, brownish gray mottled yellow, very stiff	8 10 11	21	
57			ditto	7 10 12	22	
58						
59			ditto	7 8 11	19	
60			ditto	8 10 12	22	
61			Drilling terminated at depth 60 meters			
62						



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BORING LOG

Boring No. : DB-5

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*24 Oktober 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.733*
DRILLER :	*Djais*	LOGGED BY :	*Rudito*
DRILL RIG :	*Tone*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial : -10.00 m At Completion : -10.10 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	N-SPT	STANDARD PENETRATION TEST 10 30 50
0		CH				
1						
2			Silty CLAY, brown mottled black, very stiff	5 8 8	16	
3			Silty CLAY, reddish brown mottled gray, stiff	2 4 6	10	
4			Silty CLAY, yellowish and grayish brown, stiff	2 4 5	9	
5		UDS				
6			Silty CLAY, yellowish and grayish brown, medium stiff	1 2 3	1	
7						
8		MH	Clayey SILT, brown mottled white, soft	1 2 2	1	
9			ditto	1 2 5	7	
10		UDS	CH Silty CLAY, brown, hard	4 12 20	32	
11						
12			ditto	7 15 24	39	
13						
14			Silty CLAY, grayish brown, hard	10 15 25	40	
15		UDS	MH Clayey SILT, grayish brown, hard	13 18 25	43	
16						
17			ditto	12 17 23	40	
18			ML SILT with some Fine Sand, brown, poorly cemented, hard	20 25 25/10	50	
19			ditto	15 30 20/9	50	
20						

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BORING LOG

Boring No. : DB-5

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*24 Oktober 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.733*
DRILLER :	*Djais*	LOGGED BY :	*Rudito*
DRILL RIG :	*Tone*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial ▽ : -10.00 m At Completion ▼ : -10.10 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	N-SPT	STANDARD PENETRATION TEST (10 30 50)
20			ditto			
21		ML	SILT with some Fine Sand, brown, hard	13 25 25/12	50	
22						
23			Clayey SILT, grayish brown, hard	12 27 23/10	50	
24			SILT with some Fine Sand, brown, poorly cemented, hard	25 50/11	50	
25			ditto	35 50/10	50	
26	UDS	CH	Silty CLAY, dark gray, hard			
27		SP	Fine SAND with some Silt, dark gray, dense	20 25 25/5	50	
28						
29				12 23 25	48	
30			Fine SAND, black, poorly graded, dense	13 27 23/10	50	
31						
32		ML	Fine Sandy SILT, dark gray, poorly cemented, hard	15 20 25	45	
33		CH	Silty CLAY, gray, hard	13 24 26/11	50	
34						
35			Silty CLAY, dark gray, hard	10 19 23	42	
36			ditto	15 20 30/10	50	
37						
38			ditto	11 18 25	43	
39			Silty CLAY, dark gray, hard	17 30 20/8	50	
40						

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BORING LOG

Boring No. : DB-5

PROJECT :	***Centennial Tower***	PROJECT NO. :	*DCM.G.12-047*
CLIENT :	*PT. Citratama Inti Persada*	TESTED DATE :	*24 Oktober 2012*
LOCATION :	*Jl. Jend. Gatot Subroto - Jakarta*	ELEVATION :	*9.733*
DRILLER :	*Djais*	LOGGED BY :	*Rudito*
DRILL RIG :	*Tone*	BORING METHOD :	*Continuous Coring*

GROUND WATER TABLE : Initial : -10.00 m At Completion : -10.10 m

ELEVATION/ DEPTH (m)	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	N1 N2 N3	N-SPT	STANDARD PENETRATION TEST 10 30 50
40						
41	UDS	SM	Silty CLAY, dark gray, hard	15 25 25/10	50	
			Silty SAND, balck, poorly graded, dense			
42		CH	Silty CLAY, yellowish gray, very stiff	10 15 19	34	
43						
44			ditto	11 17 22	39	
45			ditto	15 18 24	42	
46						
47		SP	SAND, black, poorly graded, medium dense	9 12 16	28	
48		CH	Silty CLAY, ligth brown, very stiff	4 8 13	21	
49						
50			ditto	5 10 16	26	
51			Silty CLAY, ligth brown, hard	10 13 18	31	
52						
53			ditto	10 20 25	45	
54			ditto	13 23 26	49	
55			ditto	10 17 24	41	
56	UDS					
57			Silty CLAY, brownish gray, hard	13 25 25/10	50	
58						
59			ditto	12 23 27/13	50	
60			ditto	15 30 20/10	50	
61			Drilling terminated at depth 60 meters			
62						

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LAMPIRAN – B

CONE PENETRATION TEST (CPT)

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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 1**
Tested By	**Wiyono**
Elevation	**9.575**
GWL	**- 10.00**
Tested Date	**28-Sep-2012**

S - 1

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
1	**0.00**	**0**	**0**	0.00	0.00	0.00	0.00	Granular Soil
2	0.20	27	38	1.10	22.00	22.00	4.07	Silty Clay/Clay
3	0.40	28	40	1.20	24.00	46.00	4.29	Silty Clay/Clay
4	0.60	30	45	1.50	30.00	76.00	5.00	Silty Clay/Clay
5	0.80	60	80	2.00	40.00	116.00	3.33	Silty Clay/Clay
6	**1.00**	**55**	**80**	2.50	50.00	166.00	4.55	Silty Clay/Clay
7	1.20	37	55	1.80	36.00	202.00	4.86	Silty Clay/Clay
8	1.40	40	70	3.00	60.00	262.00	7.50	Silty Clay/Clay
9	1.60	40	65	2.50	50.00	312.00	6.25	Silty Clay/Clay
10	1.80	37	60	2.30	46.00	358.00	6.22	Silty Clay/Clay
11	**2.00**	**30**	**50**	2.00	40.00	398.00	6.67	Silty Clay/Clay
12	2.20	27	38	1.10	22.00	420.00	4.07	Silty Clay/Clay
13	2.40	28	38	1.00	20.00	440.00	3.57	Silty Clay/Clay
14	2.60	27	40	1.30	26.00	466.00	4.81	Silty Clay/Clay
15	2.80	28	42	1.40	28.00	494.00	5.00	Silty Clay/Clay
16	**3.00**	**20**	**30**	1.00	20.00	514.00	5.00	Silty Clay/Clay
17	3.20	15	22	0.70	14.00	528.00	4.67	Silty Clay/Clay
18	3.40	13	19	0.60	12.00	540.00	4.62	Silty Clay/Clay
19	3.60	13	19	0.60	12.00	552.00	4.62	Silty Clay/Clay
20	3.80	13	18	0.50	10.00	562.00	3.85	Silty Clay/Clay
21	**4.00**	**12**	**17**	0.50	10.00	572.00	4.17	Silty Clay/Clay
22	4.20	12	17	0.50	10.00	582.00	4.17	Silty Clay/Clay
23	4.40	14	22	0.80	16.00	598.00	5.71	Silty Clay/Clay
24	4.60	10	15	0.50	10.00	608.00	5.00	Silty Clay/Clay
25	4.80	8	12	0.40	8.00	616.00	5.00	Silty Clay/Clay
26	**5.00**	**12**	**17**	0.50	10.00	626.00	4.17	Silty Clay/Clay
27	5.20	8	12	0.40	8.00	634.00	5.00	Silty Clay/Clay
28	5.40	6	9	0.30	6.00	640.00	5.00	Silty Clay/Clay
29	5.60	7	11	0.40	8.00	648.00	5.71	Silty Clay/Clay
30	5.80	9	14	0.50	10.00	658.00	5.56	Silty Clay/Clay
31	**6.00**	**10**	**15**	0.50	10.00	668.00	5.00	Silty Clay/Clay
32	6.20	11	17	0.60	12.00	680.00	5.45	Silty Clay/Clay
33	6.40	13	20	0.70	14.00	694.00	5.38	Silty Clay/Clay
34	6.60	17	26	0.90	18.00	712.00	5.29	Silty Clay/Clay
35	6.80	20	33	1.30	26.00	738.00	6.50	Silty Clay/Clay
36	**7.00**	**35**	**50**	1.50	30.00	768.00	4.29	Silty Clay/Clay
37	7.20	23	35	1.20	24.00	792.00	5.22	Silty Clay/Clay
38	7.40	20	33	1.30	26.00	818.00	6.50	Silty Clay/Clay
39	7.60	45	60	1.50	30.00	848.00	3.33	Silty Clay/Clay
40	7.80	80	100	2.00	40.00	888.00	2.50	Silt-Sand/Clayey Sand-Silt
41	**8.00**	**100**	**130**	3.00	60.00	948.00	3.00	Silt-Sand/Clayey Sand-Silt
42	8.20	85	120	3.50	70.00	1018.00	4.12	Silty Clay/Clay
43	8.40	60	90	3.00	60.00	1078.00	5.00	Silty Clay/Clay
44	8.60	75	100	2.50	50.00	1128.00	3.33	Silt-Sand/Clayey Sand-Silt
45	8.80	135	165	3.00	60.00	1188.00	2.22	Silt-Sand/Clayey Sand-Silt
46	**9.00**	**130**	**155**	2.50	50.00	1238.00	1.92	Granular Soil

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Design & Engineering Consultants

DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 1**
Tested By	**Wiyono**
Elevation	**9.575**
GWL	**- 10.00**
Tested Date	**28-Sep-2012**

S - 1

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
47	9.20	160	185	2.50	50.00	1288.00	1.56	Granular Soil
48	9.40	125	160	3.50	70.00	1358.00	2.80	Silt-Sand/Clayey Sand-Silt
49	9.60	95	120	2.50	50.00	1408.00	2.63	Silt-Sand/Clayey Sand-Silt
50	9.80	80	100	2.00	40.00	1448.00	2.50	Silt-Sand/Clayey Sand-Silt
51	**10.00**	**100**	**120**	2.00	40.00	1488.00	2.00	Granular Soil
52	10.20	55	70	1.50	30.00	1518.00	2.73	Silt-Sand/Clayey Sand-Silt
53	10.40	30	40	1.00	20.00	1538.00	3.33	Silty Clay/Clay
54	10.60	37	50	1.30	26.00	1564.00	3.51	Silty Clay/Clay
55	10.80	50	65	1.50	30.00	1594.00	3.00	Silt-Sand/Clayey Sand-Silt
56	**11.00**	**65**	**80**	1.50	30.00	1624.00	2.31	Silt-Sand/Clayey Sand-Silt
57	11.20	75	95	2.00	40.00	1664.00	2.67	Silt-Sand/Clayey Sand-Silt
58	11.40	150	180	3.00	60.00	1724.00	2.00	Granular Soil
59	11.60	130	160	3.00	60.00	1784.00	2.31	Silt-Sand/Clayey Sand-Silt
60	11.80	170	200	3.00	60.00	1844.00	1.76	Granular Soil
61	**12.00**	**225**	**250**	2.50	50.00	1894.00	1.11	Granular Soil
62	12.20							
63	12.40							
64	12.60							
65	12.80							
66	**13.00**							
67	13.20							
68	13.40							
69	13.60							
70	13.80							
71	**14.00**							
72	14.20							
73	14.40							
74	14.60							
75	14.80							
76	**15.00**							
77	15.20							
78	15.40							
79	15.60							
80	15.80							
81	**16.00**							
82	16.20							
83	16.40							
84	16.60							
85	16.80							
86	**17.00**							
87	17.20							
88	17.40							
89	17.60							
90	17.80							
91	**18.00**							

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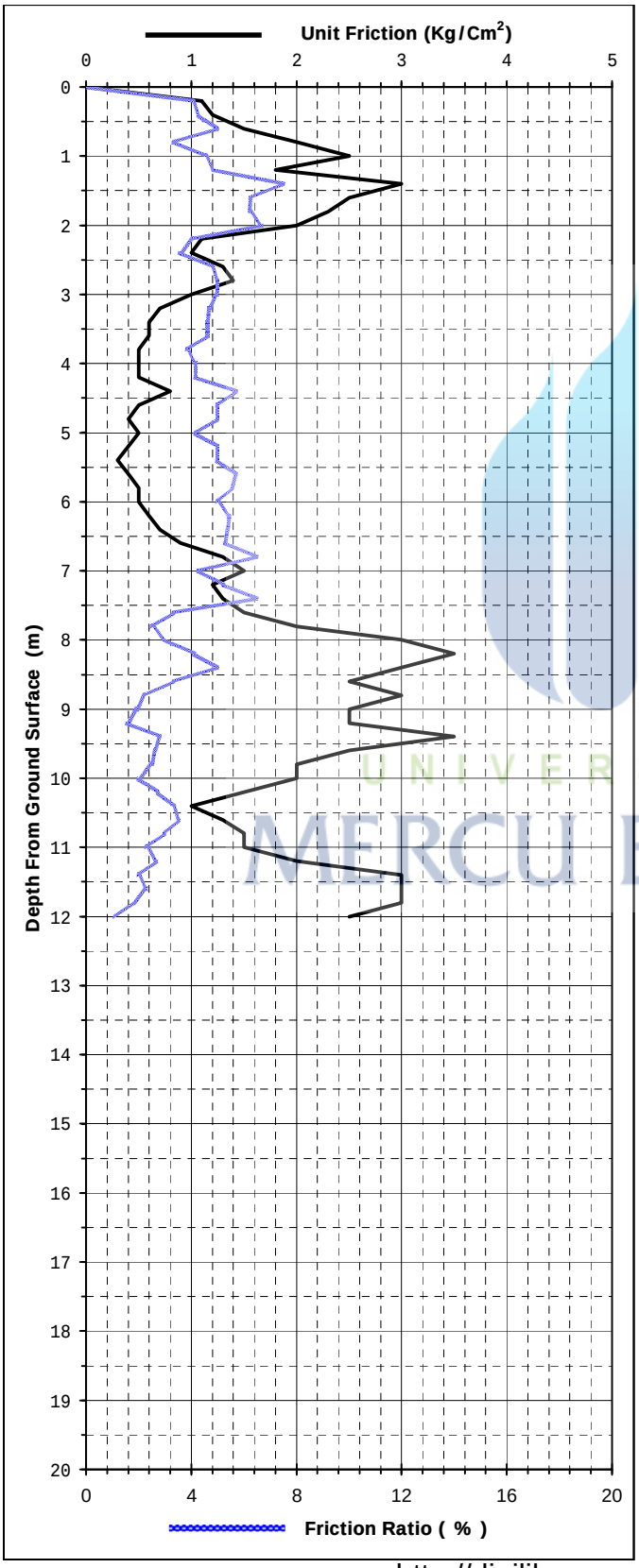
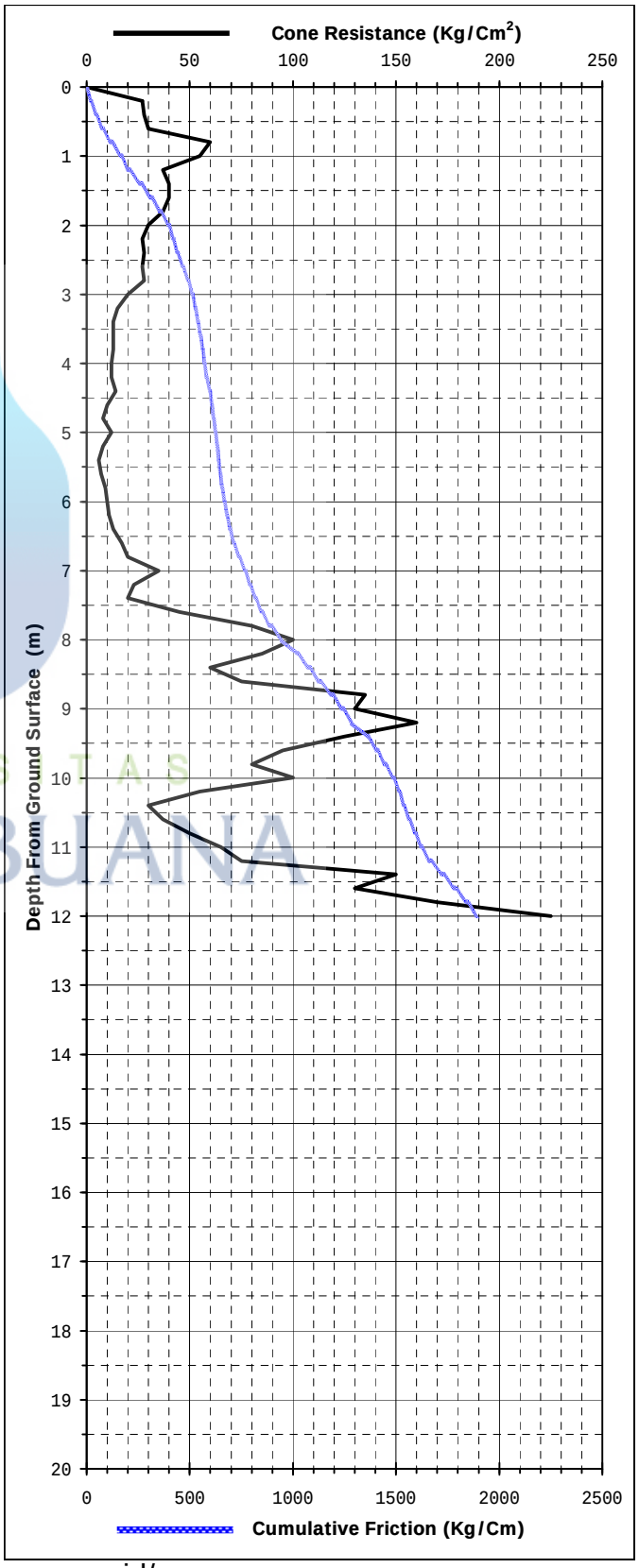
DUTCH CONE PENETROMETER TEST (ASTM D 3441)

Project No.	: DCM.G.12-047	Borehole	: **S - 1**
Client	: **PT. CITRATAMA INTI PERSADA**	Elevation (m)	: 9.575
Project	: **CENTENNIAL TOWER**	Tested date	: 28-Sep-2012
Location	: Jl. Jend. Gatot Subroto - Jakarta	Tested by	: Wiyono
GWL (m)	: - 10.00	Checked by	: Rudi





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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 2**
Tested By	**Wiyono**
Elevation	**9.704**
GWL	**- 9.50**
Tested Date	**27-Sep-2012**

S - 2

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
1	**0.00**	**0**	**0**	0.00	0.00	0.00	0.00	Granular Soil
2	0.20	50	63	1.30	26.00	26.00	2.60	Silt-Sand/Clayey Sand-Silt
3	0.40	46	57	1.10	22.00	48.00	2.39	Silt-Sand/Clayey Sand-Silt
4	0.60	35	47	1.20	24.00	72.00	3.43	Silty Clay/Clay
5	0.80	48	60	1.20	24.00	96.00	2.50	Silt-Sand/Clayey Sand-Silt
6	**1.00**	**21**	**31**	1.00	20.00	116.00	4.76	Silty Clay/Clay
7	1.20	30	45	1.50	30.00	146.00	5.00	Silty Clay/Clay
8	1.40	33	50	1.70	34.00	180.00	5.15	Silty Clay/Clay
9	1.60	31	47	1.60	32.00	212.00	5.16	Silty Clay/Clay
10	1.80	30	47	1.70	34.00	246.00	5.67	Silty Clay/Clay
11	**2.00**	**23**	**32**	0.90	18.00	264.00	3.91	Silty Clay/Clay
12	2.20	25	33	0.80	16.00	280.00	3.20	Silty Clay/Clay
13	2.40	28	36	0.80	16.00	296.00	2.86	Silt-Sand/Clayey Sand-Silt
14	2.60	30	40	1.00	20.00	316.00	3.33	Silty Clay/Clay
15	2.80	33	47	1.40	28.00	344.00	4.24	Silty Clay/Clay
16	**3.00**	**26**	**37**	1.10	22.00	366.00	4.23	Silty Clay/Clay
17	3.20	25	34	0.90	18.00	384.00	3.60	Silty Clay/Clay
18	3.40	23	32	0.90	18.00	402.00	3.91	Silty Clay/Clay
19	3.60	23	33	1.00	20.00	422.00	4.35	Silty Clay/Clay
20	3.80	24	36	1.20	24.00	446.00	5.00	Silty Clay/Clay
21	**4.00**	**17**	**25**	0.80	16.00	462.00	4.71	Silty Clay/Clay
22	4.20	14	20	0.60	12.00	474.00	4.29	Silty Clay/Clay
23	4.40	13	17	0.40	8.00	482.00	3.08	Silty Clay/Clay
24	4.60	12	17	0.50	10.00	492.00	4.17	Silty Clay/Clay
25	4.80	12	16	0.40	8.00	500.00	3.33	Silty Clay/Clay
26	**5.00**	**12**	**17**	0.50	10.00	510.00	4.17	Silty Clay/Clay
27	5.20	15	20	0.50	10.00	520.00	3.33	Silty Clay/Clay
28	5.40	17	23	0.60	12.00	532.00	3.53	Silty Clay/Clay
29	5.60	12	17	0.50	10.00	542.00	4.17	Silty Clay/Clay
30	5.80	9	14	0.50	10.00	552.00	5.56	Silty Clay/Clay
31	**6.00**	**9**	**13**	0.40	8.00	560.00	4.44	Silty Clay/Clay
32	6.20	9	14	0.50	10.00	570.00	5.56	Silty Clay/Clay
33	6.40	10	16	0.60	12.00	582.00	6.00	Silty Clay/Clay
34	6.60	12	17	0.50	10.00	592.00	4.17	Silty Clay/Clay
35	6.80	16	24	0.80	16.00	608.00	5.00	Silty Clay/Clay
36	**7.00**	**23**	**35**	1.20	24.00	632.00	5.22	Silty Clay/Clay
37	7.20	31	45	1.40	28.00	660.00	4.52	Silty Clay/Clay
38	7.40	20	30	1.00	20.00	680.00	5.00	Silty Clay/Clay
39	7.60	22	37	1.50	30.00	710.00	6.82	Silty Clay/Clay
40	7.80	44	60	1.60	32.00	742.00	3.64	Silty Clay/Clay
41	**8.00**	**25**	**37**	1.20	24.00	766.00	4.80	Silty Clay/Clay
42	8.20	21	32	1.10	22.00	788.00	5.24	Silty Clay/Clay
43	8.40	18	28	1.00	20.00	808.00	5.56	Silty Clay/Clay
44	8.60	18	27	0.90	18.00	826.00	5.00	Silty Clay/Clay
45	8.80	20	28	0.80	16.00	842.00	4.00	Silty Clay/Clay
46	**9.00**	**50**	**65**	1.50	30.00	872.00	3.00	Silt-Sand/Clayey Sand-Silt

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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 2**
Tested By	**Wiyono**
Elevation	**9.704**
GWL	**- 9.50**
Tested Date	**27-Sep-2012**

S - 2

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
47	9.20	30	47	1.70	34.00	906.00	5.67	Silty Clay/Clay
48	9.40	38	52	1.40	28.00	934.00	3.68	Silty Clay/Clay
49	9.60	45	67	2.20	44.00	978.00	4.89	Silty Clay/Clay
50	9.80	58	73	1.50	30.00	1008.00	2.59	Silt-Sand/Clayey Sand-Silt
51	**10.00**	**46**	**65**	1.90	38.00	1046.00	4.13	Silty Clay/Clay
52	10.20	45	58	1.30	26.00	1072.00	2.89	Silt-Sand/Clayey Sand-Silt
53	10.40	50	65	1.50	30.00	1102.00	3.00	Silt-Sand/Clayey Sand-Silt
54	10.60	50	67	1.70	34.00	1136.00	3.40	Silty Clay/Clay
55	10.80	53	70	1.70	34.00	1170.00	3.21	Silt-Sand/Clayey Sand-Silt
56	**11.00**	**80**	**100**	2.00	40.00	1210.00	2.50	Silt-Sand/Clayey Sand-Silt
57	11.20	65	80	1.50	30.00	1240.00	2.31	Silt-Sand/Clayey Sand-Silt
58	11.40	70	85	1.50	30.00	1270.00	2.14	Silt-Sand/Clayey Sand-Silt
59	11.60	75	92	1.70	34.00	1304.00	2.27	Silt-Sand/Clayey Sand-Silt
60	11.80	85	105	2.00	40.00	1344.00	2.35	Silt-Sand/Clayey Sand-Silt
61	**12.00**	**185**	**210**	2.50	50.00	1394.00	1.35	Granular Soil
62	12.20	225	250	2.50	50.00	1444.00	1.11	Granular Soil
63	12.40							
64	12.60							
65	12.80							
66	**13.00**							
67	13.20							
68	13.40							
69	13.60							
70	13.80							
71	**14.00**							
72	14.20							
73	14.40							
74	14.60							
75	14.80							
76	**15.00**							
77	15.20							
78	15.40							
79	15.60							
80	15.80							
81	**16.00**							
82	16.20							
83	16.40							
84	16.60							
85	16.80							
86	**17.00**							
87	17.20							
88	17.40							
89	17.60							
90	17.80							
91	**18.00**							

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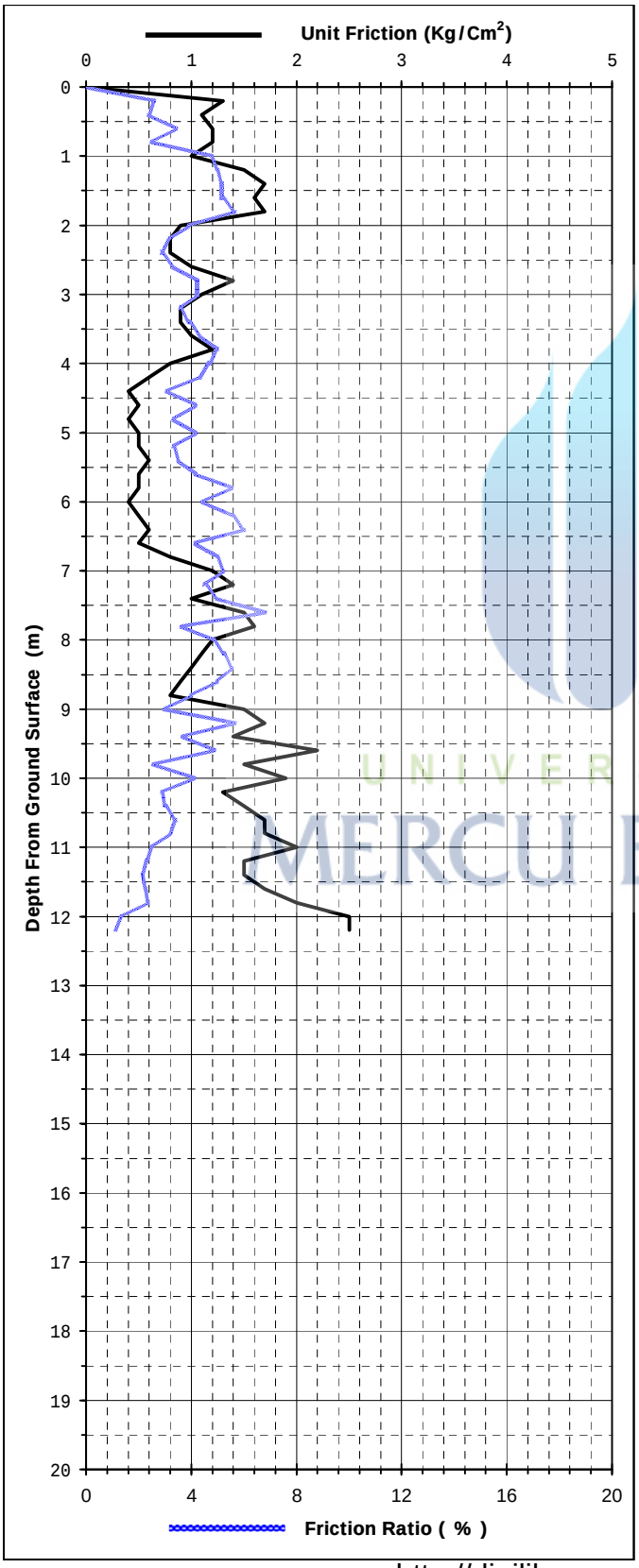
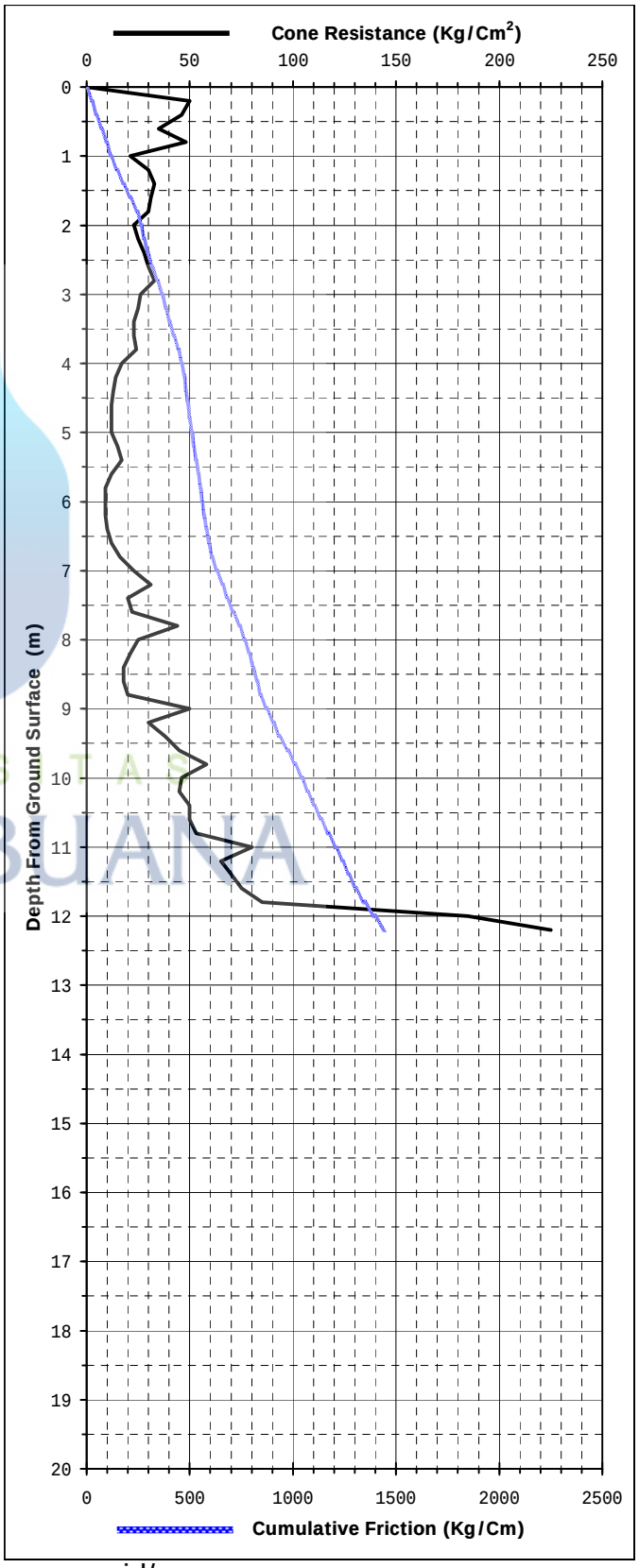
DUTCH CONE PENETROMETER TEST (ASTM D 3441)

Project No.	: DCM.G.12-047	Borehole	: **S - 2**
Client	: **PT. CITRATAMA INTI PERSADA**	Elevation (m)	: 9.704
Project	: **CENTENNIAL TOWER**	Tested date	: 27-Sep-2012
Location	: Jl. Jend. Gatot Subroto - Jakarta	Tested by	: Wiyono
GWL (m)	: - 9.50	Checked by	: Rudi





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PT. Daya Creasi Mitrayasa
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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 3**
Tested By	**Wiyono**
Elevation	**9.506**
GWL	**- 10.00**
Tested Date	**28-Sep-2012**

S - 3

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
1	**0.00**	**0**	**0**	0.00	0.00	0.00	0.00	Granular Soil
2	0.20	25	37	1.20	24.00	24.00	4.80	Silty Clay/Clay
3	0.40	33	44	1.10	22.00	46.00	3.33	Silty Clay/Clay
4	0.60	35	48	1.30	26.00	72.00	3.71	Silty Clay/Clay
5	0.80	40	58	1.80	36.00	108.00	4.50	Silty Clay/Clay
6	**1.00**	**40**	**55**	1.50	30.00	138.00	3.75	Silty Clay/Clay
7	1.20	72	88	1.60	32.00	170.00	2.22	Silt-Sand/Clayey Sand-Silt
8	1.40	56	75	1.90	38.00	208.00	3.39	Silty Clay/Clay
9	1.60	52	70	1.80	36.00	244.00	3.46	Silty Clay/Clay
10	1.80	22	35	1.30	26.00	270.00	5.91	Silty Clay/Clay
11	**2.00**	**17**	**25**	0.80	16.00	286.00	4.71	Silty Clay/Clay
12	2.20	17	26	0.90	18.00	304.00	5.29	Silty Clay/Clay
13	2.40	20	29	0.90	18.00	322.00	4.50	Silty Clay/Clay
14	2.60	23	33	1.00	20.00	342.00	4.35	Silty Clay/Clay
15	2.80	25	35	1.00	20.00	362.00	4.00	Silty Clay/Clay
16	**3.00**	**18**	**27**	0.90	18.00	380.00	5.00	Silty Clay/Clay
17	3.20	17	24	0.70	14.00	394.00	4.12	Silty Clay/Clay
18	3.40	17	25	0.80	16.00	410.00	4.71	Silty Clay/Clay
19	3.60	17	25	0.80	16.00	426.00	4.71	Silty Clay/Clay
20	3.80	18	27	0.90	18.00	444.00	5.00	Silty Clay/Clay
21	**4.00**	**16**	**24**	0.80	16.00	460.00	5.00	Silty Clay/Clay
22	4.20	16	23	0.70	14.00	474.00	4.38	Silty Clay/Clay
23	4.40	15	22	0.70	14.00	488.00	4.67	Silty Clay/Clay
24	4.60	13	19	0.60	12.00	500.00	4.62	Silty Clay/Clay
25	4.80	12	17	0.50	10.00	510.00	4.17	Silty Clay/Clay
26	**5.00**	**15**	**21**	0.60	12.00	522.00	4.00	Silty Clay/Clay
27	5.20	12	16	0.40	8.00	530.00	3.33	Silty Clay/Clay
28	5.40	10	15	0.50	10.00	540.00	5.00	Silty Clay/Clay
29	5.60	10	15	0.50	10.00	550.00	5.00	Silty Clay/Clay
30	5.80	10	16	0.60	12.00	562.00	6.00	Silty Clay/Clay
31	**6.00**	**21**	**30**	0.90	18.00	580.00	4.29	Silty Clay/Clay
32	6.20	17	25	0.80	16.00	596.00	4.71	Silty Clay/Clay
33	6.40	16	25	0.90	18.00	614.00	5.63	Silty Clay/Clay
34	6.60	19	30	1.10	22.00	636.00	5.79	Silty Clay/Clay
35	6.80	22	33	1.10	22.00	658.00	5.00	Silty Clay/Clay
36	**7.00**	**23**	**35**	1.20	24.00	682.00	5.22	Silty Clay/Clay
37	7.20	26	37	1.10	22.00	704.00	4.23	Silty Clay/Clay
38	7.40	30	42	1.20	24.00	728.00	4.00	Silty Clay/Clay
39	7.60	29	43	1.40	28.00	756.00	4.83	Silty Clay/Clay
40	7.80	30	43	1.30	26.00	782.00	4.33	Silty Clay/Clay
41	**8.00**	**32**	**45**	1.30	26.00	808.00	4.06	Silty Clay/Clay
42	8.20	33	48	1.50	30.00	838.00	4.55	Silty Clay/Clay
43	8.40	36	50	1.40	28.00	866.00	3.89	Silty Clay/Clay
44	8.60	45	60	1.50	30.00	896.00	3.33	Silty Clay/Clay
45	8.80	80	97	1.70	34.00	930.00	2.13	Silt-Sand/Clayey Sand-Silt
46	**9.00**	**95**	**110**	1.50	30.00	960.00	1.58	Granular Soil

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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 3**
Tested By	**Wiyono**
Elevation	**9.506**
GWL	**- 10.00**
Tested Date	**28-Sep-2012**

S - 3

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
47	9.20	125	145	2.00	40.00	1000.00	1.60	Granular Soil
48	9.40	135	155	2.00	40.00	1040.00	1.48	Granular Soil
49	9.60	130	155	2.50	50.00	1090.00	1.92	Granular Soil
50	9.80	110	140	3.00	60.00	1150.00	2.73	Silt-Sand/Clayey Sand-Silt
51	**10.00**	**125**	**160**	3.50	70.00	1220.00	2.80	Silt-Sand/Clayey Sand-Silt
52	10.20	65	85	2.00	40.00	1260.00	3.08	Silt-Sand/Clayey Sand-Silt
53	10.40	35	50	1.50	30.00	1290.00	4.29	Silty Clay/Clay
54	10.60	35	48	1.30	26.00	1316.00	3.71	Silty Clay/Clay
55	10.80	37	52	1.50	30.00	1346.00	4.05	Silty Clay/Clay
56	**11.00**	**40**	**55**	1.50	30.00	1376.00	3.75	Silty Clay/Clay
57	11.20	60	80	2.00	40.00	1416.00	3.33	Silty Clay/Clay
58	11.40	110	135	2.50	50.00	1466.00	2.27	Silt-Sand/Clayey Sand-Silt
59	11.60	140	175	3.50	70.00	1536.00	2.50	Silt-Sand/Clayey Sand-Silt
60	11.80	140	170	3.00	60.00	1596.00	2.14	Silt-Sand/Clayey Sand-Silt
61	**12.00**	**130**	**165**	3.50	70.00	1666.00	2.69	Silt-Sand/Clayey Sand-Silt
62	12.20	90	115	2.50	50.00	1716.00	2.78	Silt-Sand/Clayey Sand-Silt
63	12.40	70	85	1.50	30.00	1746.00	2.14	Silt-Sand/Clayey Sand-Silt
64	12.60	75	89	1.40	28.00	1774.00	1.87	Granular Soil
65	12.80	80	95	1.50	30.00	1804.00	1.88	Granular Soil
66	**13.00**	**105**	**125**	2.00	40.00	1844.00	1.90	Granular Soil
67	13.20	100	125	2.50	50.00	1894.00	2.50	Silt-Sand/Clayey Sand-Silt
68	13.40	170	195	2.50	50.00	1944.00	1.47	Granular Soil
69	13.60	200	230	3.00	60.00	2004.00	1.50	Granular Soil
70	13.80	210	250	4.00	80.00	2084.00	1.90	Granular Soil
71	**14.00**							
72	14.20							
73	14.40							
74	14.60							
75	14.80							
76	**15.00**							
77	15.20							
78	15.40							
79	15.60							
80	15.80							
81	**16.00**							
82	16.20							
83	16.40							
84	16.60							
85	16.80							
86	**17.00**							
87	17.20							
88	17.40							
89	17.60							
90	17.80							
91	**18.00**							

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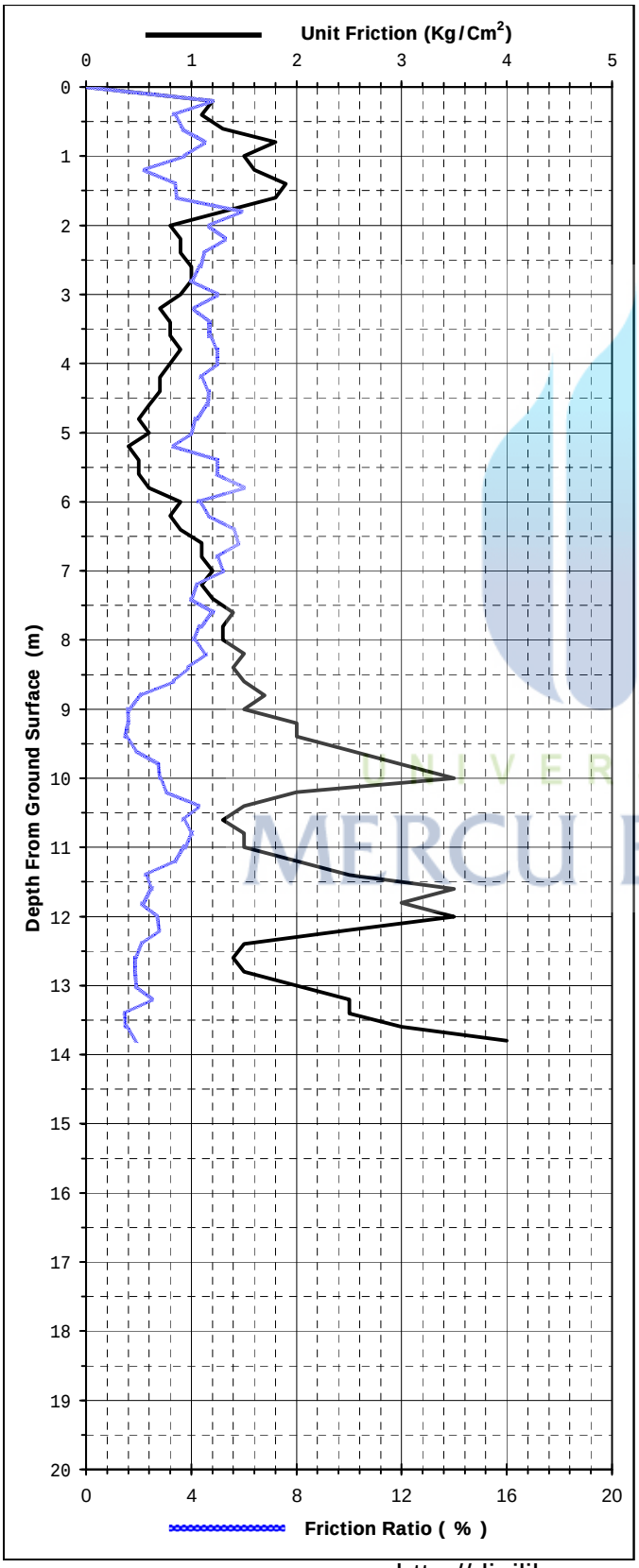
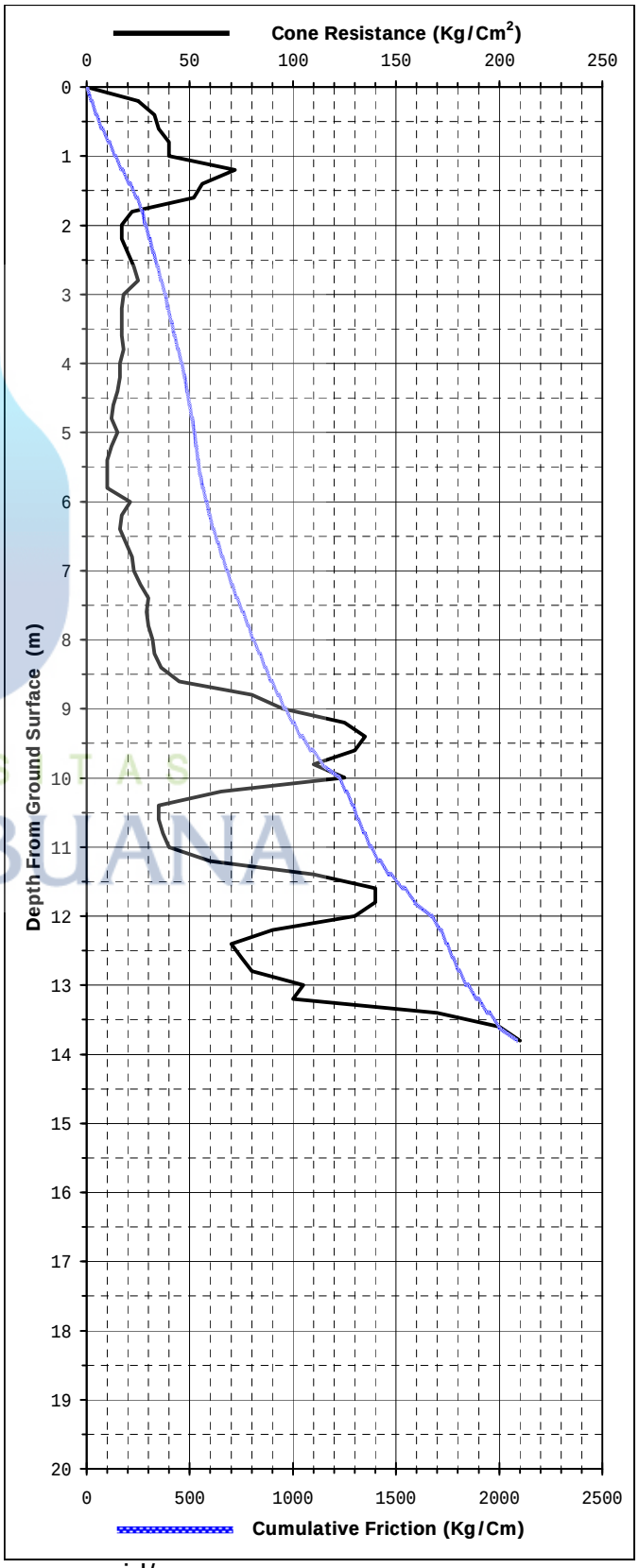
DUTCH CONE PENETROMETER TEST (ASTM D 3441)

Project No.	:	DCM.G.12-047	Borehole	:	**S - 3**
Client	:	**PT. CITRATAMA INTI PERSADA**	Elevation (m)	:	9.506
Project	:	**CENTENNIAL TOWER**	Tested date	:	28-Sep-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Wiyono
GWL (m)	:	- 10.00	Checked by	:	Rudi





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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 4**
Tested By	**Wiyono**
Elevation	**9.516**
GWL	**- 10.00**
Tested Date	**29-Sep-2012**

S - 4

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
1	**0.00**	**0**	**0**	0.00	0.00	0.00	0.00	Granular Soil
2	0.20	40	60	2.00	40.00	40.00	5.00	Silty Clay/Clay
3	0.40	58	75	1.70	34.00	74.00	2.93	Silt-Sand/Clayey Sand-Silt
4	0.60	65	85	2.00	40.00	114.00	3.08	Silt-Sand/Clayey Sand-Silt
5	0.80	62	80	1.80	36.00	150.00	2.90	Silt-Sand/Clayey Sand-Silt
6	**1.00**	**57**	**78**	2.10	42.00	192.00	3.68	Silty Clay/Clay
7	1.20	47	70	2.30	46.00	238.00	4.89	Silty Clay/Clay
8	1.40	38	65	2.70	54.00	292.00	7.11	Silty Clay/Clay
9	1.60	32	55	2.30	46.00	338.00	7.19	Silty Clay/Clay
10	1.80	30	55	2.50	50.00	388.00	8.33	Silty Clay/Clay
11	**2.00**	**37**	**57**	2.00	40.00	428.00	5.41	Silty Clay/Clay
12	2.20	25	40	1.50	30.00	458.00	6.00	Silty Clay/Clay
13	2.40	25	40	1.50	30.00	488.00	6.00	Silty Clay/Clay
14	2.60	26	40	1.40	28.00	516.00	5.38	Silty Clay/Clay
15	2.80	28	41	1.30	26.00	542.00	4.64	Silty Clay/Clay
16	**3.00**	**22**	**30**	0.80	16.00	558.00	3.64	Silty Clay/Clay
17	3.20	21	25	0.40	8.00	566.00	1.90	Granular Soil
18	3.40	20	25	0.50	10.00	576.00	2.50	Silt-Sand/Clayey Sand-Silt
19	3.60	18	22	0.40	8.00	584.00	2.22	Silt-Sand/Clayey Sand-Silt
20	3.80	17	22	0.50	10.00	594.00	2.94	Silty Clay/Clay
21	**4.00**	**16**	**20**	0.40	8.00	602.00	2.50	Silt-Sand/Clayey Sand-Silt
22	4.20	18	24	0.60	12.00	614.00	3.33	Silty Clay/Clay
23	4.40	17	24	0.70	14.00	628.00	4.12	Silty Clay/Clay
24	4.60	18	24	0.60	12.00	640.00	3.33	Silty Clay/Clay
25	4.80	21	29	0.80	16.00	656.00	3.81	Silty Clay/Clay
26	**5.00**	**26**	**38**	1.20	24.00	680.00	4.62	Silty Clay/Clay
27	5.20	47	53	0.60	12.00	692.00	1.28	Granular Soil
28	5.40	36	46	1.00	20.00	712.00	2.78	Silt-Sand/Clayey Sand-Silt
29	5.60	30	40	1.00	20.00	732.00	3.33	Silty Clay/Clay
30	5.80	23	32	0.90	18.00	750.00	3.91	Silty Clay/Clay
31	**6.00**	**16**	**23**	0.70	14.00	764.00	4.38	Silty Clay/Clay
32	6.20	15	23	0.80	16.00	780.00	5.33	Silty Clay/Clay
33	6.40	15	24	0.90	18.00	798.00	6.00	Silty Clay/Clay
34	6.60	14	22	0.80	16.00	814.00	5.71	Silty Clay/Clay
35	6.80	13	20	0.70	14.00	828.00	5.38	Silty Clay/Clay
36	**7.00**	**21**	**32**	1.10	22.00	850.00	5.24	Silty Clay/Clay
37	7.20	20	33	1.30	26.00	876.00	6.50	Silty Clay/Clay
38	7.40	20	34	1.40	28.00	904.00	7.00	Silty Clay/Clay
39	7.60	20	33	1.30	26.00	930.00	6.50	Silty Clay/Clay
40	7.80	26	40	1.40	28.00	958.00	5.38	Silty Clay/Clay
41	**8.00**	**22**	**35**	1.30	26.00	984.00	5.91	Silty Clay/Clay
42	8.20	23	35	1.20	24.00	1008.00	5.22	Silty Clay/Clay
43	8.40	26	37	1.10	22.00	1030.00	4.23	Silty Clay/Clay
44	8.60	30	45	1.50	30.00	1060.00	5.00	Silty Clay/Clay
45	8.80	34	50	1.60	32.00	1092.00	4.71	Silty Clay/Clay
46	**9.00**	**50**	**67**	1.70	34.00	1126.00	3.40	Silty Clay/Clay

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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 4**
Tested By	**Wiyono**
Elevation	**9.516**
GWL	**- 10.00**
Tested Date	**29-Sep-2012**

S - 4

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
47	9.20	45	63	1.80	36.00	1162.00	4.00	Silty Clay/Clay
48	9.40	85	100	1.50	30.00	1192.00	1.76	Granular Soil
49	9.60	140	160	2.00	40.00	1232.00	1.43	Granular Soil
50	9.80	95	120	2.50	50.00	1282.00	2.63	Silt-Sand/Clayey Sand-Silt
51	**10.00**	**75**	**100**	2.50	50.00	1332.00	3.33	Silt-Sand/Clayey Sand-Silt
52	10.20	70	87	1.70	34.00	1366.00	2.43	Silt-Sand/Clayey Sand-Silt
53	10.40	65	80	1.50	30.00	1396.00	2.31	Silt-Sand/Clayey Sand-Silt
54	10.60	40	55	1.50	30.00	1426.00	3.75	Silty Clay/Clay
55	10.80	30	45	1.50	30.00	1456.00	5.00	Silty Clay/Clay
56	**11.00**	**125**	**148**	2.30	46.00	1502.00	1.84	Granular Soil
57	11.20	200	225	2.50	50.00	1552.00	1.25	Granular Soil
58	11.40	230	250	2.00	40.00	1592.00	0.87	Granular Soil
59	11.60							
60	11.80							
61	**12.00**							
62	12.20							
63	12.40							
64	12.60							
65	12.80							
66	**13.00**							
67	13.20							
68	13.40							
69	13.60							
70	13.80							
71	**14.00**							
72	14.20							
73	14.40							
74	14.60							
75	14.80							
76	**15.00**							
77	15.20							
78	15.40							
79	15.60							
80	15.80							
81	**16.00**							
82	16.20							
83	16.40							
84	16.60							
85	16.80							
86	**17.00**							
87	17.20							
88	17.40							
89	17.60							
90	17.80							
91	**18.00**							

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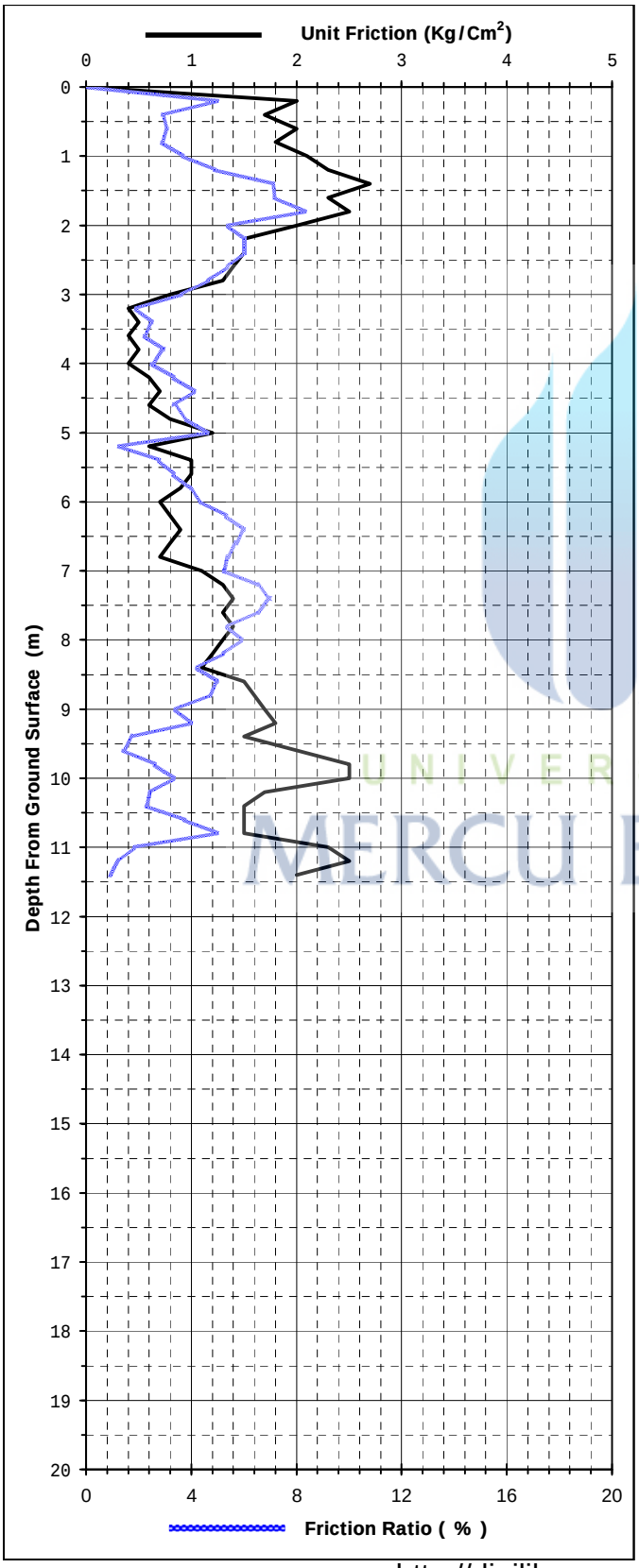
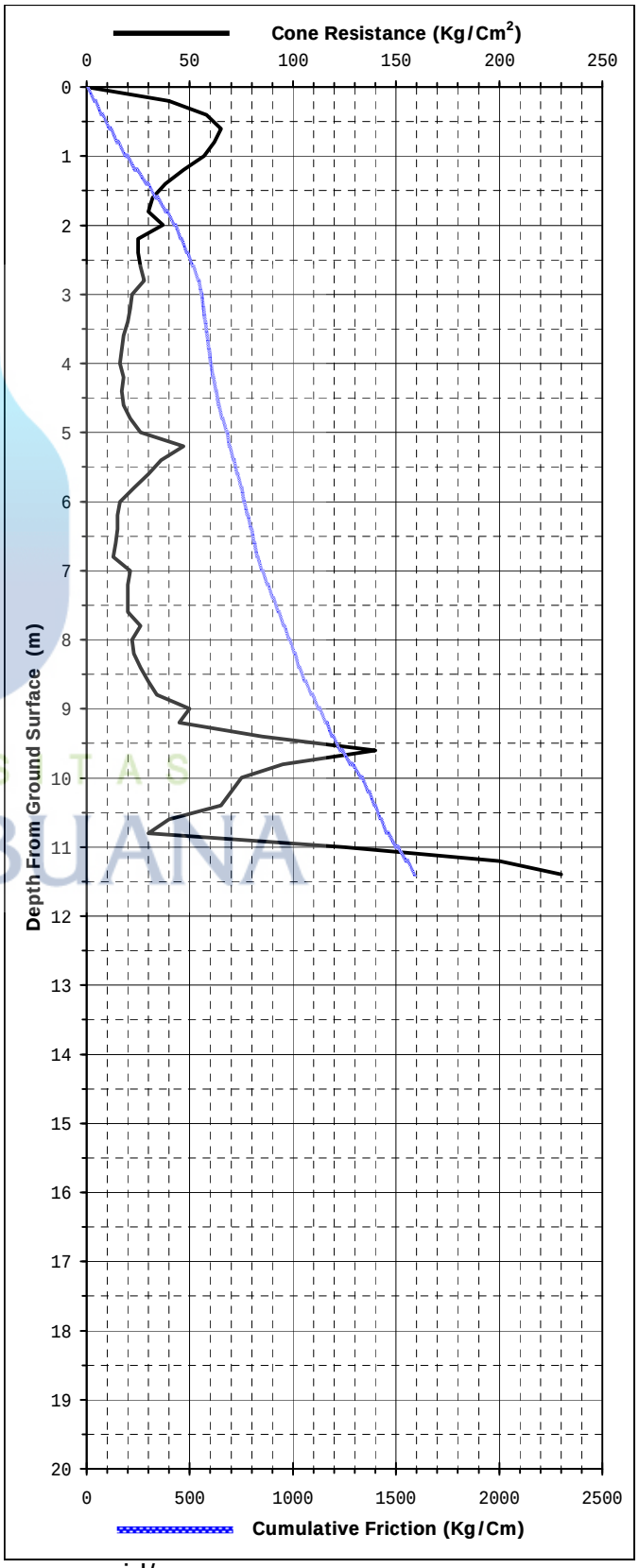
DUTCH CONE PENETROMETER TEST (ASTM D 3441)

Project No.	:	DCM.G.12-047	Borehole	:	**S - 4**
Client	:	**PT. CITRATAMA INTI PERSADA**	Elevation (m)	:	9.516
Project	:	**CENTENNIAL TOWER**	Tested date	:	29-Sep-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Wiyono
GWL (m)	:	- 10.00	Checked by	:	Rudi





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PT. Daya Creasi Mitrayasa
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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 5**
Tested By	**Wiyono**
Elevation	**9.699**
GWL	**- 10.00**
Tested Date	**29-Sep-2012**

S - 5

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
1	**0.00**	**0**	**0**	0.00	0.00	0.00	0.00	Granular Soil
2	0.20	60	80	2.00	40.00	40.00	3.33	Silty Clay/Clay
3	0.40	85	105	2.00	40.00	80.00	2.35	Silt-Sand/Clayey Sand-Silt
4	0.60	65	95	3.00	60.00	140.00	4.62	Silty Clay/Clay
5	0.80	50	80	3.00	60.00	200.00	6.00	Silty Clay/Clay
6	**1.00**	**57**	**85**	2.80	56.00	256.00	4.91	Silty Clay/Clay
7	1.20	57	90	3.30	66.00	322.00	5.79	Silty Clay/Clay
8	1.40	55	85	3.00	60.00	382.00	5.45	Silty Clay/Clay
9	1.60	45	70	2.50	50.00	432.00	5.56	Silty Clay/Clay
10	1.80	43	70	2.70	54.00	486.00	6.28	Silty Clay/Clay
11	**2.00**	**40**	**70**	3.00	60.00	546.00	7.50	Silty Clay/Clay
12	2.20	48	73	2.50	50.00	596.00	5.21	Silty Clay/Clay
13	2.40	40	65	2.50	50.00	646.00	6.25	Silty Clay/Clay
14	2.60	40	65	2.50	50.00	696.00	6.25	Silty Clay/Clay
15	2.80	35	52	1.70	34.00	730.00	4.86	Silty Clay/Clay
16	**3.00**	**27**	**38**	1.10	22.00	752.00	4.07	Silty Clay/Clay
17	3.20	25	33	0.80	16.00	768.00	3.20	Silty Clay/Clay
18	3.40	22	31	0.90	18.00	786.00	4.09	Silty Clay/Clay
19	3.60	20	28	0.80	16.00	802.00	4.00	Silty Clay/Clay
20	3.80	18	26	0.80	16.00	818.00	4.44	Silty Clay/Clay
21	**4.00**	**25**	**35**	1.00	20.00	838.00	4.00	Silty Clay/Clay
22	4.20	22	29	0.70	14.00	852.00	3.18	Silty Clay/Clay
23	4.40	20	26	0.60	12.00	864.00	3.00	Silty Clay/Clay
24	4.60	16	22	0.60	12.00	876.00	3.75	Silty Clay/Clay
25	4.80	12	17	0.50	10.00	886.00	4.17	Silty Clay/Clay
26	**5.00**	**13**	**19**	0.60	12.00	898.00	4.62	Silty Clay/Clay
27	5.20	13	18	0.50	10.00	908.00	3.85	Silty Clay/Clay
28	5.40	14	20	0.60	12.00	920.00	4.29	Silty Clay/Clay
29	5.60	14	21	0.70	14.00	934.00	5.00	Silty Clay/Clay
30	5.80	14	22	0.80	16.00	950.00	5.71	Silty Clay/Clay
31	**6.00**	**30**	**38**	0.80	16.00	966.00	2.67	Silt-Sand/Clayey Sand-Silt
32	6.20	15	22	0.70	14.00	980.00	4.67	Silty Clay/Clay
33	6.40	13	19	0.60	12.00	992.00	4.62	Silty Clay/Clay
34	6.60	15	21	0.60	12.00	1004.00	4.00	Silty Clay/Clay
35	6.80	17	23	0.60	12.00	1016.00	3.53	Silty Clay/Clay
36	**7.00**	**35**	**47**	1.20	24.00	1040.00	3.43	Silty Clay/Clay
37	7.20	25	35	1.00	20.00	1060.00	4.00	Silty Clay/Clay
38	7.40	12	20	0.80	16.00	1076.00	6.67	Silty Clay/Clay
39	7.60	11	16	0.50	10.00	1086.00	4.55	Silty Clay/Clay
40	7.80	10	16	0.60	12.00	1098.00	6.00	Silty Clay/Clay
41	**8.00**	**17**	**25**	0.80	16.00	1114.00	4.71	Silty Clay/Clay
42	8.20	12	17	0.50	10.00	1124.00	4.17	Silty Clay/Clay
43	8.40	8	12	0.40	8.00	1132.00	5.00	Silty Clay/Clay
44	8.60	15	22	0.70	14.00	1146.00	4.67	Silty Clay/Clay
45	8.80	45	60	1.50	30.00	1176.00	3.33	Silty Clay/Clay
46	**9.00**	**100**	**120**	2.00	40.00	1216.00	2.00	Granular Soil

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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 5**
Tested By	**Wiyono**
Elevation	**9.699**
GWL	**- 10.00**
Tested Date	**29-Sep-2012**

S - 5

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
47	9.20	70	95	2.50	50.00	1266.00	3.57	Silty Clay/Clay
48	9.40	85	105	2.00	40.00	1306.00	2.35	Silt-Sand/Clayey Sand-Silt
49	9.60	90	110	2.00	40.00	1346.00	2.22	Silt-Sand/Clayey Sand-Silt
50	9.80	120	145	2.50	50.00	1396.00	2.08	Granular Soil
51	**10.00**	**120**	**140**	2.00	40.00	1436.00	1.67	Granular Soil
52	10.20	95	115	2.00	40.00	1476.00	2.11	Silt-Sand/Clayey Sand-Silt
53	10.40	50	65	1.50	30.00	1506.00	3.00	Silt-Sand/Clayey Sand-Silt
54	10.60	55	70	1.50	30.00	1536.00	2.73	Silt-Sand/Clayey Sand-Silt
55	10.80	70	90	2.00	40.00	1576.00	2.86	Silt-Sand/Clayey Sand-Silt
56	**11.00**	**55**	**75**	2.00	40.00	1616.00	3.64	Silty Clay/Clay
57	11.20	95	115	2.00	40.00	1656.00	2.11	Silt-Sand/Clayey Sand-Silt
58	11.40	60	85	2.50	50.00	1706.00	4.17	Silty Clay/Clay
59	11.60	175	200	2.50	50.00	1756.00	1.43	Granular Soil
60	11.80	220	250	3.00	60.00	1816.00	1.36	Granular Soil
61	**12.00**							
62	12.20							
63	12.40							
64	12.60							
65	12.80							
66	**13.00**							
67	13.20							
68	13.40							
69	13.60							
70	13.80							
71	**14.00**							
72	14.20							
73	14.40							
74	14.60							
75	14.80							
76	**15.00**							
77	15.20							
78	15.40							
79	15.60							
80	15.80							
81	**16.00**							
82	16.20							
83	16.40							
84	16.60							
85	16.80							
86	**17.00**							
87	17.20							
88	17.40							
89	17.60							
90	17.80							
91	**18.00**							

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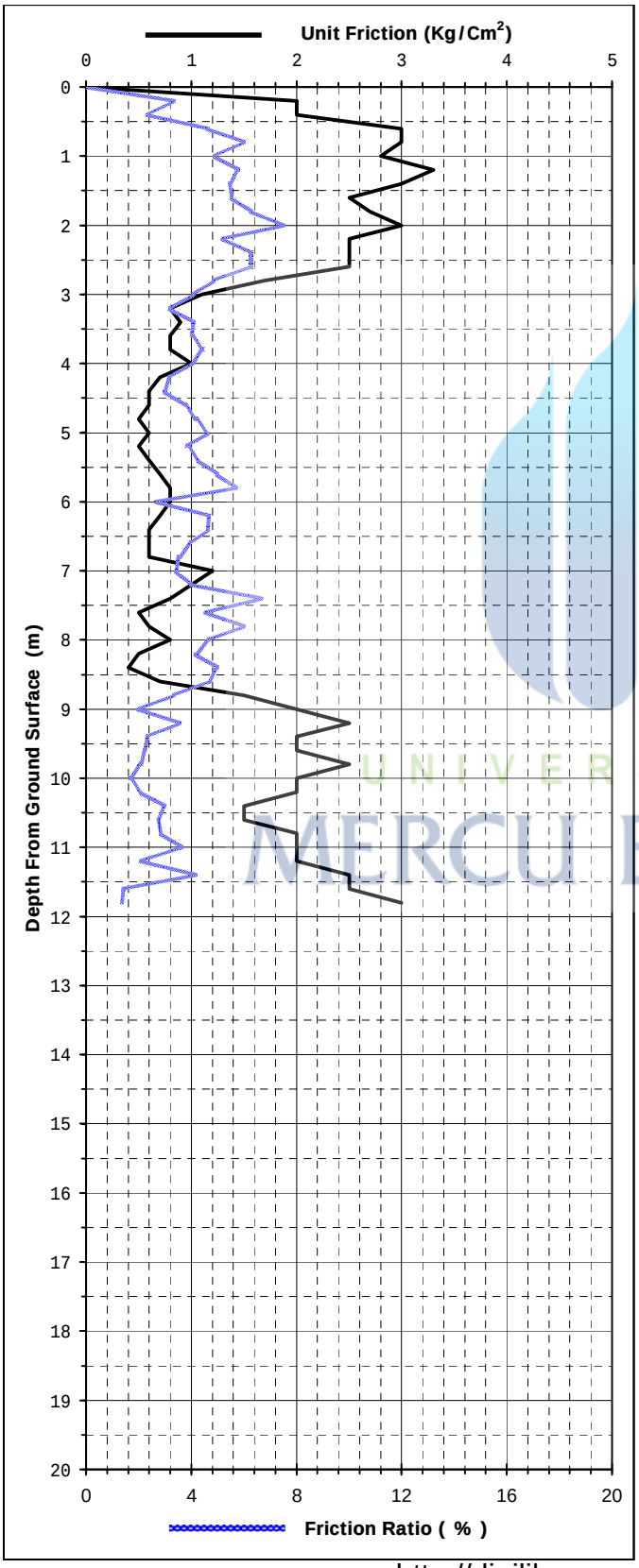
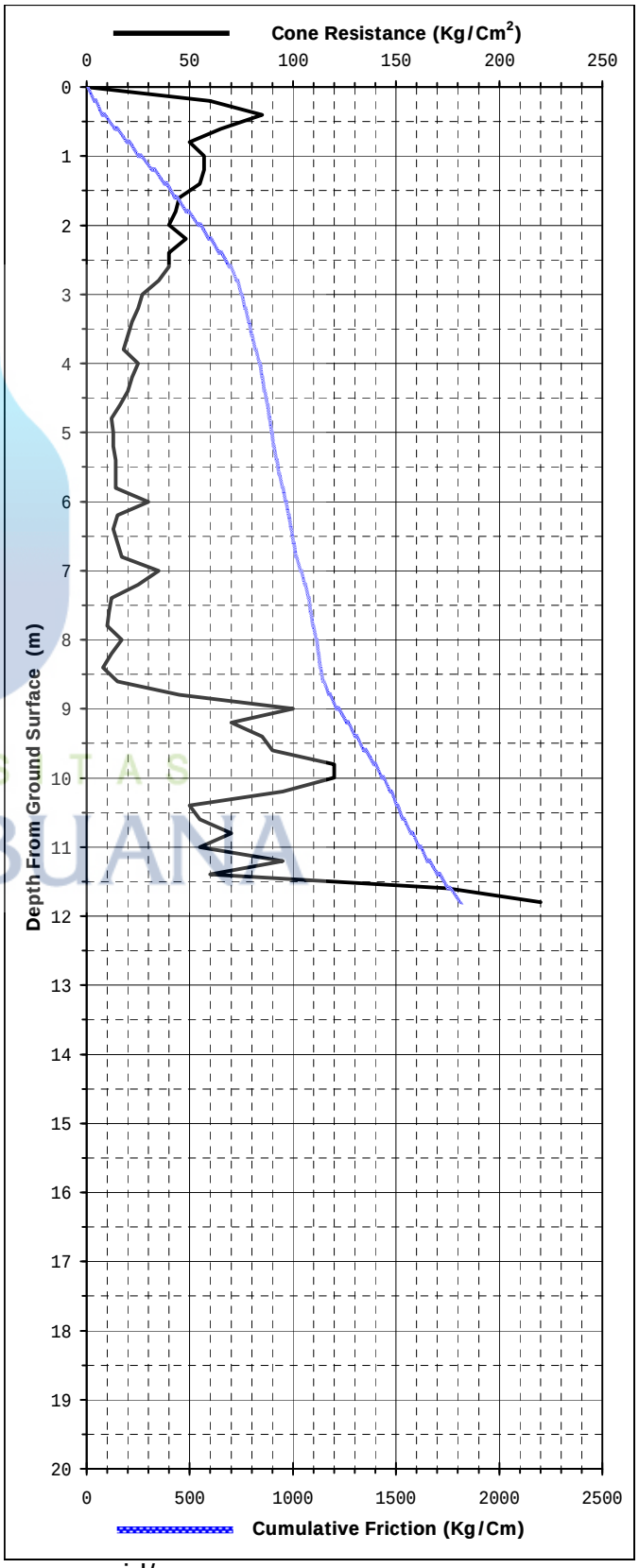
DUTCH CONE PENETROMETER TEST (ASTM D 3441)

Project No.	: DCM.G.12-047	Borehole	: **S - 5**
Client	: **PT. CITRATAMA INTI PERSADA**	Elevation (m)	: 9.699
Project	: **CENTENNIAL TOWER**	Tested date	: 29-Sep-2012
Location	: Jl. Jend. Gatot Subroto - Jakarta	Tested by	: Wiyono
GWL (m)	: - 10.00	Checked by	: Rudi





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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 6**
Tested By	**Wiyono**
Elevation	**9.796**
GWL	**- 9.50**
Tested Date	**30-Sep-2012**

S - 6

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
1	**0.00**	**0**	**0**	0.00	0.00	0.00	0.00	Granular Soil
2	0.20	30	45	1.50	30.00	30.00	5.00	Silty Clay/Clay
3	0.40	42	65	2.30	46.00	76.00	5.48	Silty Clay/Clay
4	0.60	90	115	2.50	50.00	126.00	2.78	Silt-Sand/Clayey Sand-Silt
5	0.80	25	40	1.50	30.00	156.00	6.00	Silty Clay/Clay
6	**1.00**	**30**	**47**	1.70	34.00	190.00	5.67	Silty Clay/Clay
7	1.20	35	50	1.50	30.00	220.00	4.29	Silty Clay/Clay
8	1.40	40	60	2.00	40.00	260.00	5.00	Silty Clay/Clay
9	1.60	42	65	2.30	46.00	306.00	5.48	Silty Clay/Clay
10	1.80	45	70	2.50	50.00	356.00	5.56	Silty Clay/Clay
11	**2.00**	**32**	**55**	2.30	46.00	402.00	7.19	Silty Clay/Clay
12	2.20	32	52	2.00	40.00	442.00	6.25	Silty Clay/Clay
13	2.40	35	50	1.50	30.00	472.00	4.29	Silty Clay/Clay
14	2.60	32	50	1.80	36.00	508.00	5.63	Silty Clay/Clay
15	2.80	30	48	1.80	36.00	544.00	6.00	Silty Clay/Clay
16	**3.00**	**32**	**48**	1.60	32.00	576.00	5.00	Silty Clay/Clay
17	3.20	25	38	1.30	26.00	602.00	5.20	Silty Clay/Clay
18	3.40	24	36	1.20	24.00	626.00	5.00	Silty Clay/Clay
19	3.60	20	30	1.00	20.00	646.00	5.00	Silty Clay/Clay
20	3.80	16	22	0.60	12.00	658.00	3.75	Silty Clay/Clay
21	**4.00**	**13**	**19**	0.60	12.00	670.00	4.62	Silty Clay/Clay
22	4.20	13	20	0.70	14.00	684.00	5.38	Silty Clay/Clay
23	4.40	14	21	0.70	14.00	698.00	5.00	Silty Clay/Clay
24	4.60	7	10	0.30	6.00	704.00	4.29	Silty Clay/Clay
25	4.80	9	12	0.30	6.00	710.00	3.33	Silty Clay/Clay
26	**5.00**	**15**	**20**	0.50	10.00	720.00	3.33	Silty Clay/Clay
27	5.20	13	18	0.50	10.00	730.00	3.85	Silty Clay/Clay
28	5.40	12	17	0.50	10.00	740.00	4.17	Silty Clay/Clay
29	5.60	14	20	0.60	12.00	752.00	4.29	Silty Clay/Clay
30	5.80	17	24	0.70	14.00	766.00	4.12	Silty Clay/Clay
31	**6.00**	**17**	**26**	0.90	18.00	784.00	5.29	Silty Clay/Clay
32	6.20	21	33	1.20	24.00	808.00	5.71	Silty Clay/Clay
33	6.40	28	40	1.20	24.00	832.00	4.29	Silty Clay/Clay
34	6.60	17	23	0.60	12.00	844.00	3.53	Silty Clay/Clay
35	6.80	13	20	0.70	14.00	858.00	5.38	Silty Clay/Clay
36	**7.00**	**17**	**26**	0.90	18.00	876.00	5.29	Silty Clay/Clay
37	7.20	17	28	1.10	22.00	898.00	6.47	Silty Clay/Clay
38	7.40	18	30	1.20	24.00	922.00	6.67	Silty Clay/Clay
39	7.60	50	65	1.50	30.00	952.00	3.00	Silt-Sand/Clayey Sand-Silt
40	7.80	75	90	1.50	30.00	982.00	2.00	Granular Soil
41	**8.00**	**38**	**55**	1.70	34.00	1016.00	4.47	Silty Clay/Clay
42	8.20	14	21	0.70	14.00	1030.00	5.00	Silty Clay/Clay
43	8.40	22	30	0.80	16.00	1046.00	3.64	Silty Clay/Clay
44	8.60	27	36	0.90	18.00	1064.00	3.33	Silty Clay/Clay
45	8.80	35	45	1.00	20.00	1084.00	2.86	Silt-Sand/Clayey Sand-Silt
46	**9.00**	**70**	**85**	1.50	30.00	1114.00	2.14	Silt-Sand/Clayey Sand-Silt

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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 6**
Tested By	**Wiyono**
Elevation	**9.796**
GWL	**- 9.50**
Tested Date	**30-Sep-2012**

S - 6

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
47	9.20	62	77	1.50	30.00	1144.00	2.42	Silt-Sand/Clayey Sand-Silt
48	9.40	45	60	1.50	30.00	1174.00	3.33	Silty Clay/Clay
49	9.60	115	145	3.00	60.00	1234.00	2.61	Silt-Sand/Clayey Sand-Silt
50	9.80	110	135	2.50	50.00	1284.00	2.27	Silt-Sand/Clayey Sand-Silt
51	**10.00**	**100**	**130**	3.00	60.00	1344.00	3.00	Silt-Sand/Clayey Sand-Silt
52	10.20	95	120	2.50	50.00	1394.00	2.63	Silt-Sand/Clayey Sand-Silt
53	10.40	63	80	1.70	34.00	1428.00	2.70	Silt-Sand/Clayey Sand-Silt
54	10.60	25	40	1.50	30.00	1458.00	6.00	Silty Clay/Clay
55	10.80	25	35	1.00	20.00	1478.00	4.00	Silty Clay/Clay
56	**11.00**	**45**	**55**	1.00	20.00	1498.00	2.22	Silt-Sand/Clayey Sand-Silt
57	11.20	45	55	1.00	20.00	1518.00	2.22	Silt-Sand/Clayey Sand-Silt
58	11.40	90	105	1.50	30.00	1548.00	1.67	Granular Soil
59	11.60	97	110	1.30	26.00	1574.00	1.34	Granular Soil
60	11.80	105	125	2.00	40.00	1614.00	1.90	Granular Soil
61	**12.00**	**190**	**210**	2.00	40.00	1654.00	1.05	Granular Soil
62	12.20	225	250	2.50	50.00	1704.00	1.11	Granular Soil
63	12.40							
64	12.60							
65	12.80							
66	**13.00**							
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76	**15.00**							
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80	15.80							
81	**16.00**							
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89	17.60							
90	17.80							
91	**18.00**							

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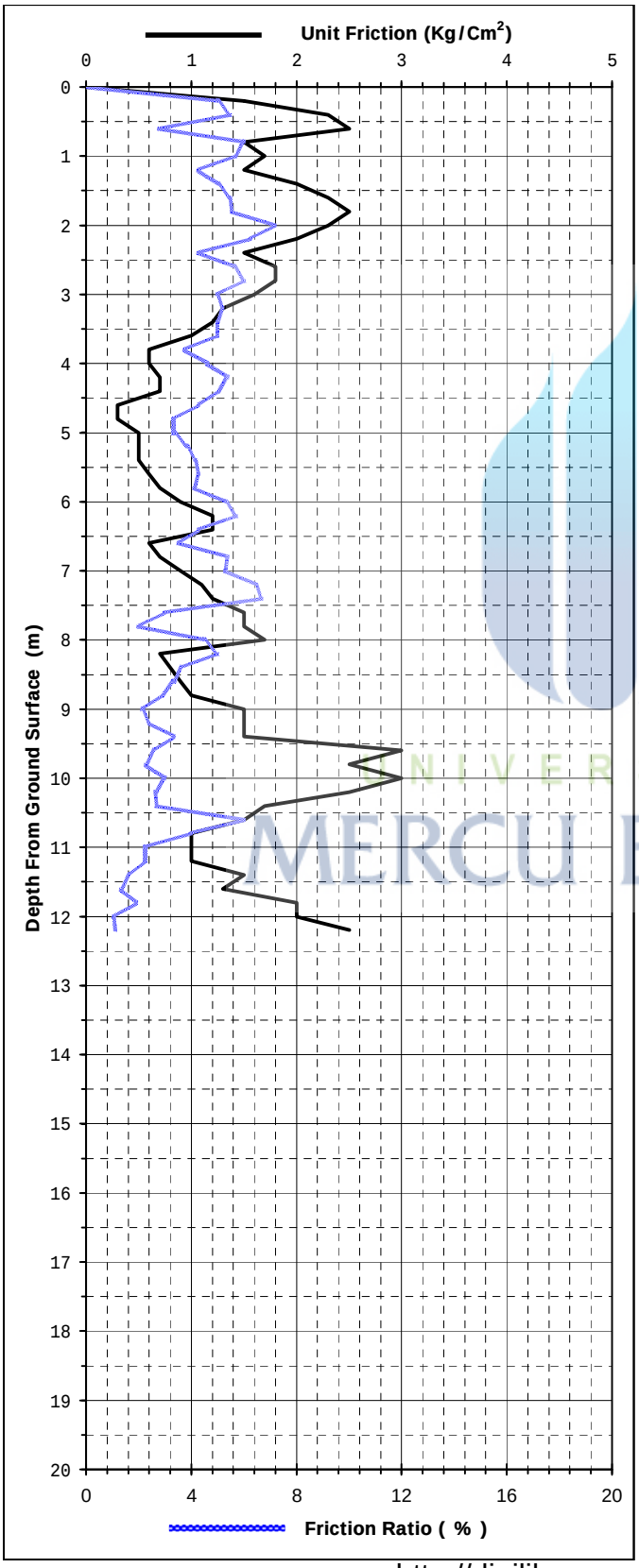
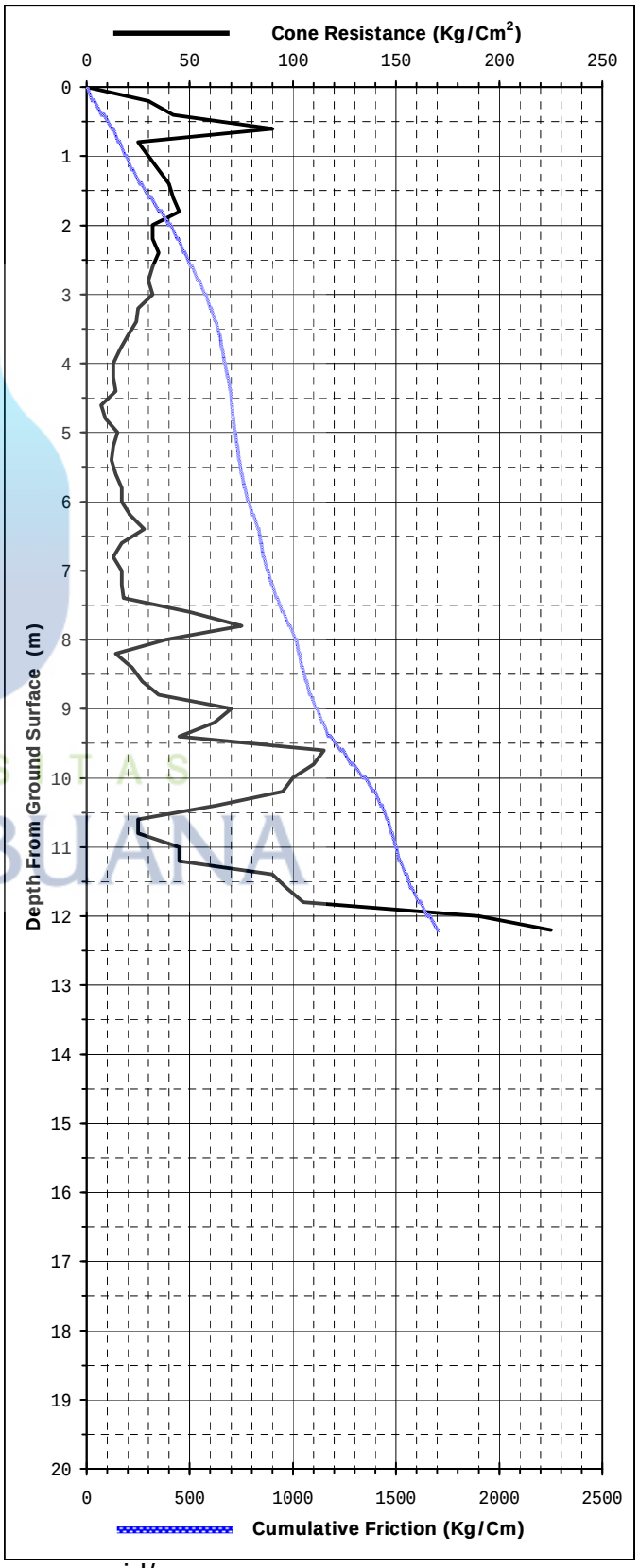
DUTCH CONE PENETROMETER TEST (ASTM D 3441)

Project No.	: DCM.G.12-047	Borehole	: **S - 6**
Client	: **PT. CITRATAMA INTI PERSADA**	Elevation (m)	: 9.796
Project	: **CENTENNIAL TOWER**	Tested date	: 30-Sep-2012
Location	: Jl. Jend. Gatot Subroto - Jakarta	Tested by	: Wiyono
GWL (m)	: - 9.50	Checked by	: Rudi





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PT. Daya Creasi Mitrayasa
Design & Engineering Consultants

DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 7**
Tested By	**Wiyono**
Elevation	**9.489**
GWL	**- 9.50**
Tested Date	**1-Oct-2012**

S - 7

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
1	**0.00**	**0**	**0**	0.00	0.00	0.00	0.00	Granular Soil
2	0.20	60	80	2.00	40.00	40.00	3.33	Silty Clay/Clay
3	0.40	70	93	2.30	46.00	86.00	3.29	Silt-Sand/Clayey Sand-Silt
4	0.60	50	65	1.50	30.00	116.00	3.00	Silt-Sand/Clayey Sand-Silt
5	0.80	60	80	2.00	40.00	156.00	3.33	Silty Clay/Clay
6	**1.00**	**65**	**82**	1.70	34.00	190.00	2.62	Silt-Sand/Clayey Sand-Silt
7	1.20	50	66	1.60	32.00	222.00	3.20	Silty Clay/Clay
8	1.40	48	65	1.70	34.00	256.00	3.54	Silty Clay/Clay
9	1.60	45	65	2.00	40.00	296.00	4.44	Silty Clay/Clay
10	1.80	43	62	1.90	38.00	334.00	4.42	Silty Clay/Clay
11	**2.00**	**40**	**58**	1.80	36.00	370.00	4.50	Silty Clay/Clay
12	2.20	52	70	1.80	36.00	406.00	3.46	Silty Clay/Clay
13	2.40	30	45	1.50	30.00	436.00	5.00	Silty Clay/Clay
14	2.60	30	40	1.00	20.00	456.00	3.33	Silty Clay/Clay
15	2.80	32	40	0.80	16.00	472.00	2.50	Silt-Sand/Clayey Sand-Silt
16	**3.00**	**23**	**32**	0.90	18.00	490.00	3.91	Silty Clay/Clay
17	3.20	25	38	1.30	26.00	516.00	5.20	Silty Clay/Clay
18	3.40	30	40	1.00	20.00	536.00	3.33	Silty Clay/Clay
19	3.60	17	23	0.60	12.00	548.00	3.53	Silty Clay/Clay
20	3.80	15	20	0.50	10.00	558.00	3.33	Silty Clay/Clay
21	**4.00**	**14**	**20**	0.60	12.00	570.00	4.29	Silty Clay/Clay
22	4.20	11	15	0.40	8.00	578.00	3.64	Silty Clay/Clay
23	4.40	7	10	0.30	6.00	584.00	4.29	Silty Clay/Clay
24	4.60	7	11	0.40	8.00	592.00	5.71	Silty Clay/Clay
25	4.80	8	11	0.30	6.00	598.00	3.75	Silty Clay/Clay
26	**5.00**	**12**	**17**	0.50	10.00	608.00	4.17	Silty Clay/Clay
27	5.20	13	17	0.40	8.00	616.00	3.08	Silty Clay/Clay
28	5.40	16	23	0.70	14.00	630.00	4.38	Silty Clay/Clay
29	5.60	13	18	0.50	10.00	640.00	3.85	Silty Clay/Clay
30	5.80	11	15	0.40	8.00	648.00	3.64	Silty Clay/Clay
31	**6.00**	**16**	**22**	0.60	12.00	660.00	3.75	Silty Clay/Clay
32	6.20	17	26	0.90	18.00	678.00	5.29	Silty Clay/Clay
33	6.40	17	25	0.80	16.00	694.00	4.71	Silty Clay/Clay
34	6.60	17	27	1.00	20.00	714.00	5.88	Silty Clay/Clay
35	6.80	18	30	1.20	24.00	738.00	6.67	Silty Clay/Clay
36	**7.00**	**18**	**28**	1.00	20.00	758.00	5.56	Silty Clay/Clay
37	7.20	18	29	1.10	22.00	780.00	6.11	Silty Clay/Clay
38	7.40	20	32	1.20	24.00	804.00	6.00	Silty Clay/Clay
39	7.60	27	38	1.10	22.00	826.00	4.07	Silty Clay/Clay
40	7.80	30	43	1.30	26.00	852.00	4.33	Silty Clay/Clay
41	**8.00**	**30**	**45**	1.50	30.00	882.00	5.00	Silty Clay/Clay
42	8.20	29	38	0.90	18.00	900.00	3.10	Silty Clay/Clay
43	8.40	28	38	1.00	20.00	920.00	3.57	Silty Clay/Clay
44	8.60	32	47	1.50	30.00	950.00	4.69	Silty Clay/Clay
45	8.80	40	55	1.50	30.00	980.00	3.75	Silty Clay/Clay
46	**9.00**	**65**	**85**	2.00	40.00	1020.00	3.08	Silt-Sand/Clayey Sand-Silt

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PT. Daya Creasi Mitrayasa
Design & Engineering Consultants

DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 7**
Tested By	**Wiyono**
Elevation	**9.489**
GWL	**- 9.50**
Tested Date	**1-Oct-2012**

S - 7

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
47	9.20	67	85	1.80	36.00	1056.00	2.69	Silt-Sand/Clayey Sand-Silt
48	9.40	70	85	1.50	30.00	1086.00	2.14	Silt-Sand/Clayey Sand-Silt
49	9.60	60	75	1.50	30.00	1116.00	2.50	Silt-Sand/Clayey Sand-Silt
50	9.80	55	68	1.30	26.00	1142.00	2.36	Silt-Sand/Clayey Sand-Silt
51	**10.00**	**47**	**56**	0.90	18.00	1160.00	1.91	Granular Soil
52	10.20	45	55	1.00	20.00	1180.00	2.22	Silt-Sand/Clayey Sand-Silt
53	10.40	44	55	1.10	22.00	1202.00	2.50	Silt-Sand/Clayey Sand-Silt
54	10.60	40	53	1.30	26.00	1228.00	3.25	Silty Clay/Clay
55	10.80	33	47	1.40	28.00	1256.00	4.24	Silty Clay/Clay
56	**11.00**	**80**	**97**	1.70	34.00	1290.00	2.13	Silt-Sand/Clayey Sand-Silt
57	11.20	100	125	2.50	50.00	1340.00	2.50	Silt-Sand/Clayey Sand-Silt
58	11.40	75	95	2.00	40.00	1380.00	2.67	Silt-Sand/Clayey Sand-Silt
59	11.60	125	148	2.30	46.00	1426.00	1.84	Granular Soil
60	11.80	145	165	2.00	40.00	1466.00	1.38	Granular Soil
61	**12.00**	**75**	**90**	1.50	30.00	1496.00	2.00	Granular Soil
62	12.20	115	140	2.50	50.00	1546.00	2.17	Silt-Sand/Clayey Sand-Silt
63	12.40	170	190	2.00	40.00	1586.00	1.18	Granular Soil
64	12.60	195	225	3.00	60.00	1646.00	1.54	Granular Soil
65	12.80	230	250	2.00	40.00	1686.00	0.87	Granular Soil
66	**13.00**							
67	13.20							
68	13.40							
69	13.60							
70	13.80							
71	**14.00**							
72	14.20							
73	14.40							
74	14.60							
75	14.80							
76	**15.00**							
77	15.20							
78	15.40							
79	15.60							
80	15.80							
81	**16.00**							
82	16.20							
83	16.40							
84	16.60							
85	16.80							
86	**17.00**							
87	17.20							
88	17.40							
89	17.60							
90	17.80							
91	**18.00**							

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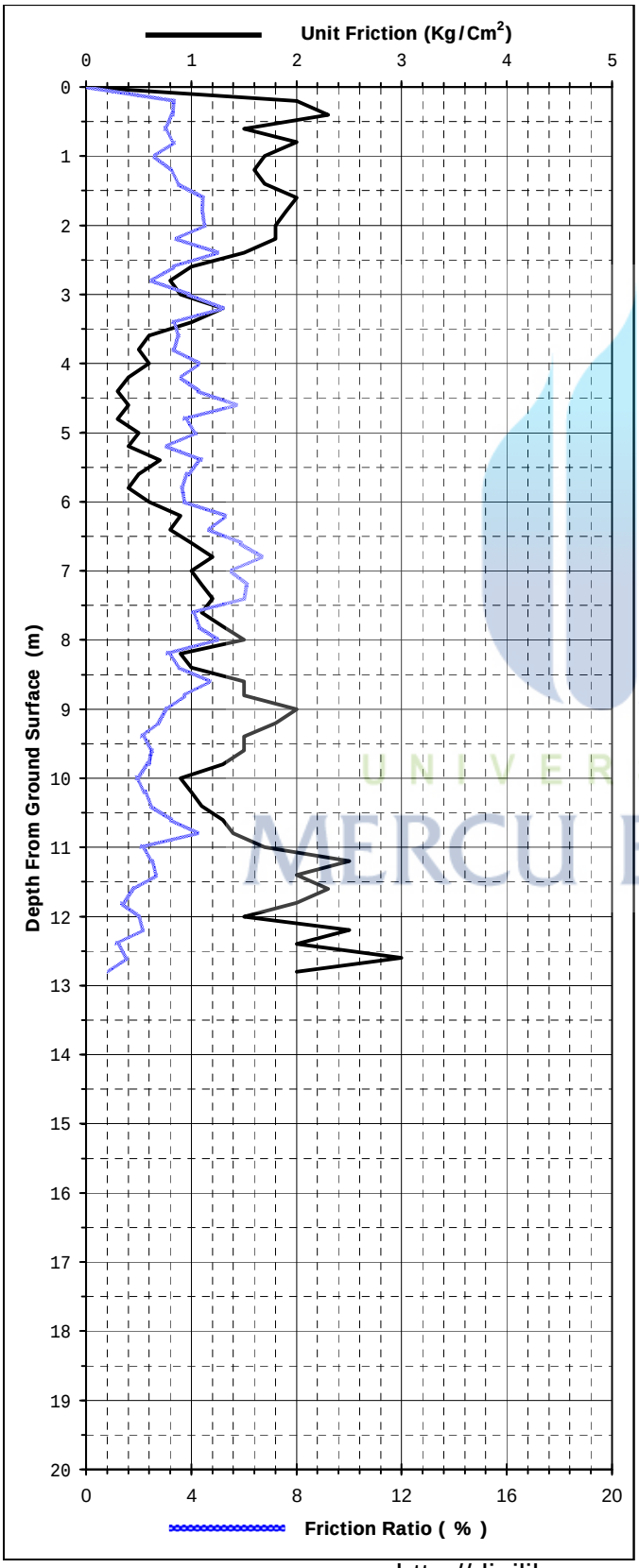
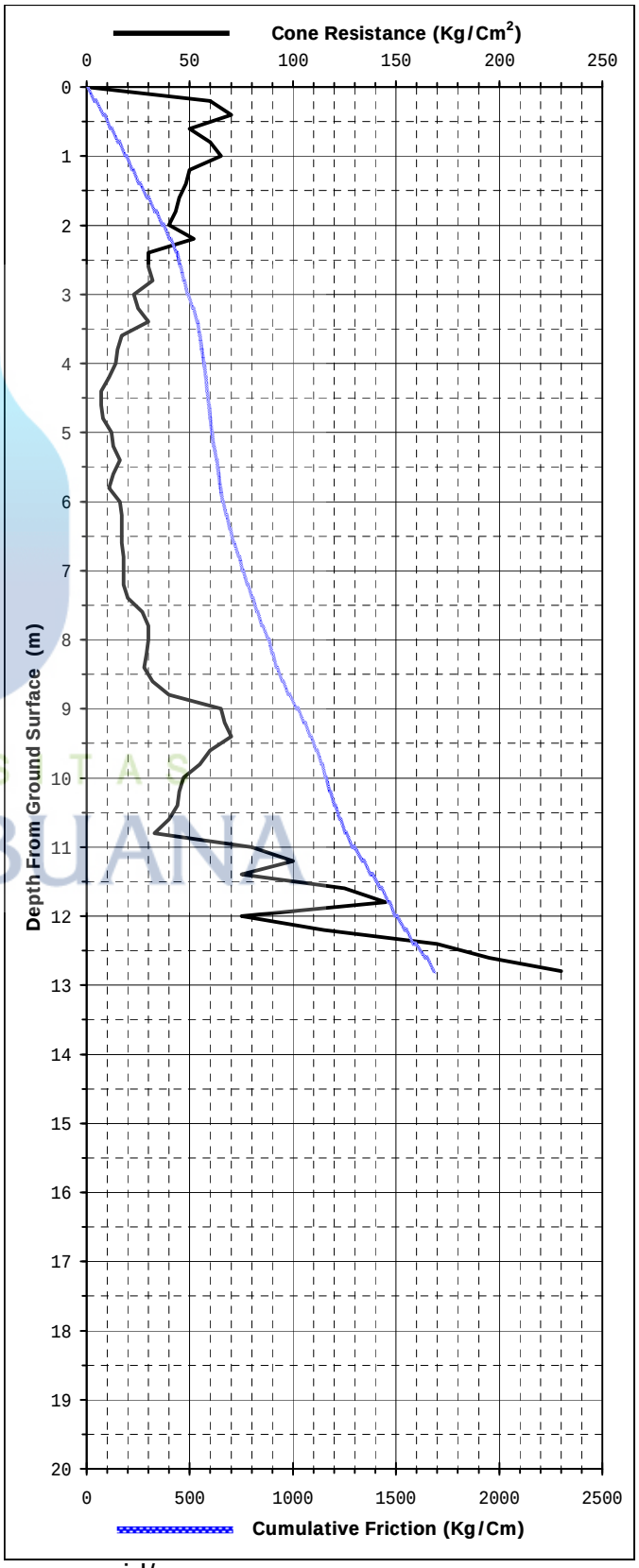
DUTCH CONE PENETROMETER TEST (ASTM D 3441)

Project No.	: DCM.G.12-047	Borehole	: **S - 7**
Client	: **PT. CITRATAMA INTI PERSADA**	Elevation (m)	: 9.489
Project	: **CENTENNIAL TOWER**	Tested date	: 1-Oct-2012
Location	: Jl. Jend. Gatot Subroto - Jakarta	Tested by	: Wiyono
GWL (m)	: - 9.50	Checked by	: Rudi





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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 8**
Tested By	**Wiyono**
Elevation	**9.862**
GWL	**- 10.50**
Tested Date	**30-Sep-2012**

S - 8

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
1	**0.00**	**0**	**0**	0.00	0.00	0.00	0.00	Granular Soil
2	0.20	22	35	1.30	26.00	26.00	5.91	Silty Clay/Clay
3	0.40	50	70	2.00	40.00	66.00	4.00	Silty Clay/Clay
4	0.60	65	83	1.80	36.00	102.00	2.77	Silt-Sand/Clayey Sand-Silt
5	0.80	40	65	2.50	50.00	152.00	6.25	Silty Clay/Clay
6	**1.00**	**44**	**65**	2.10	42.00	194.00	4.77	Silty Clay/Clay
7	1.20	40	60	2.00	40.00	234.00	5.00	Silty Clay/Clay
8	1.40	34	55	2.10	42.00	276.00	6.18	Silty Clay/Clay
9	1.60	35	60	2.50	50.00	326.00	7.14	Silty Clay/Clay
10	1.80	39	70	3.10	62.00	388.00	7.95	Silty Clay/Clay
11	**2.00**	**42**	**70**	2.80	56.00	444.00	6.67	Silty Clay/Clay
12	2.20	41	68	2.70	54.00	498.00	6.59	Silty Clay/Clay
13	2.40	42	68	2.60	52.00	550.00	6.19	Silty Clay/Clay
14	2.60	30	45	1.50	30.00	580.00	5.00	Silty Clay/Clay
15	2.80	25	35	1.00	20.00	600.00	4.00	Silty Clay/Clay
16	**3.00**	**25**	**40**	1.50	30.00	630.00	6.00	Silty Clay/Clay
17	3.20	20	30	1.00	20.00	650.00	5.00	Silty Clay/Clay
18	3.40	18	30	1.20	24.00	674.00	6.67	Silty Clay/Clay
19	3.60	17	25	0.80	16.00	690.00	4.71	Silty Clay/Clay
20	3.80	16	24	0.80	16.00	706.00	5.00	Silty Clay/Clay
21	**4.00**	**21**	**27**	0.60	12.00	718.00	2.86	Silt-Sand/Clayey Sand-Silt
22	4.20	17	24	0.70	14.00	732.00	4.12	Silty Clay/Clay
23	4.40	15	20	0.50	10.00	742.00	3.33	Silty Clay/Clay
24	4.60	17	23	0.60	12.00	754.00	3.53	Silty Clay/Clay
25	4.80	22	28	0.60	12.00	766.00	2.73	Silt-Sand/Clayey Sand-Silt
26	**5.00**	**43**	**52**	0.90	18.00	784.00	2.09	Granular Soil
27	5.20	30	40	1.00	20.00	804.00	3.33	Silty Clay/Clay
28	5.40	25	34	0.90	18.00	822.00	3.60	Silty Clay/Clay
29	5.60	30	42	1.20	24.00	846.00	4.00	Silty Clay/Clay
30	5.80	43	54	1.10	22.00	868.00	2.56	Silt-Sand/Clayey Sand-Silt
31	**6.00**	**28**	**43**	1.50	30.00	898.00	5.36	Silty Clay/Clay
32	6.20	15	22	0.70	14.00	912.00	4.67	Silty Clay/Clay
33	6.40	8	13	0.50	10.00	922.00	6.25	Silty Clay/Clay
34	6.60	12	18	0.60	12.00	934.00	5.00	Silty Clay/Clay
35	6.80	15	22	0.70	14.00	948.00	4.67	Silty Clay/Clay
36	**7.00**	**15**	**24**	0.90	18.00	966.00	6.00	Silty Clay/Clay
37	7.20	17	26	0.90	18.00	984.00	5.29	Silty Clay/Clay
38	7.40	22	32	1.00	20.00	1004.00	4.55	Silty Clay/Clay
39	7.60	16	25	0.90	18.00	1022.00	5.63	Silty Clay/Clay
40	7.80	14	22	0.80	16.00	1038.00	5.71	Silty Clay/Clay
41	**8.00**	**22**	**30**	0.80	16.00	1054.00	3.64	Silty Clay/Clay
42	8.20	20	30	1.00	20.00	1074.00	5.00	Silty Clay/Clay
43	8.40	20	28	0.80	16.00	1090.00	4.00	Silty Clay/Clay
44	8.60	25	36	1.10	22.00	1112.00	4.40	Silty Clay/Clay
45	8.80	40	50	1.00	20.00	1132.00	2.50	Silt-Sand/Clayey Sand-Silt
46	**9.00**	**37**	**50**	1.30	26.00	1158.00	3.51	Silty Clay/Clay

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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 8**
Tested By	**Wiyono**
Elevation	**9.862**
GWL	**- 10.50**
Tested Date	**30-Sep-2012**

S - 8

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
47	9.20	45	60	1.50	30.00	1188.00	3.33	Silty Clay/Clay
48	9.40	50	65	1.50	30.00	1218.00	3.00	Silt-Sand/Clayey Sand-Silt
49	9.60	50	63	1.30	26.00	1244.00	2.60	Silt-Sand/Clayey Sand-Silt
50	9.80	55	67	1.20	24.00	1268.00	2.18	Silt-Sand/Clayey Sand-Silt
51	**10.00**	**25**	**40**	1.50	30.00	1298.00	6.00	Silty Clay/Clay
52	10.20	27	40	1.30	26.00	1324.00	4.81	Silty Clay/Clay
53	10.40	30	43	1.30	26.00	1350.00	4.33	Silty Clay/Clay
54	10.60	28	38	1.00	20.00	1370.00	3.57	Silty Clay/Clay
55	10.80	27	38	1.10	22.00	1392.00	4.07	Silty Clay/Clay
56	**11.00**	**37**	**45**	0.80	16.00	1408.00	2.16	Silt-Sand/Clayey Sand-Silt
57	11.20	75	200	12.50	250.00	1658.00	16.67	Silty Clay/Clay
58	11.40	220	250	3.00	60.00	1718.00	1.36	Granular Soil
59	11.60							
60	11.80							
61	**12.00**							
62	12.20							
63	12.40							
64	12.60							
65	12.80							
66	**13.00**							
67	13.20							
68	13.40							
69	13.60							
70	13.80							
71	**14.00**							
72	14.20							
73	14.40							
74	14.60							
75	14.80							
76	**15.00**							
77	15.20							
78	15.40							
79	15.60							
80	15.80							
81	**16.00**							
82	16.20							
83	16.40							
84	16.60							
85	16.80							
86	**17.00**							
87	17.20							
88	17.40							
89	17.60							
90	17.80							
91	**18.00**							

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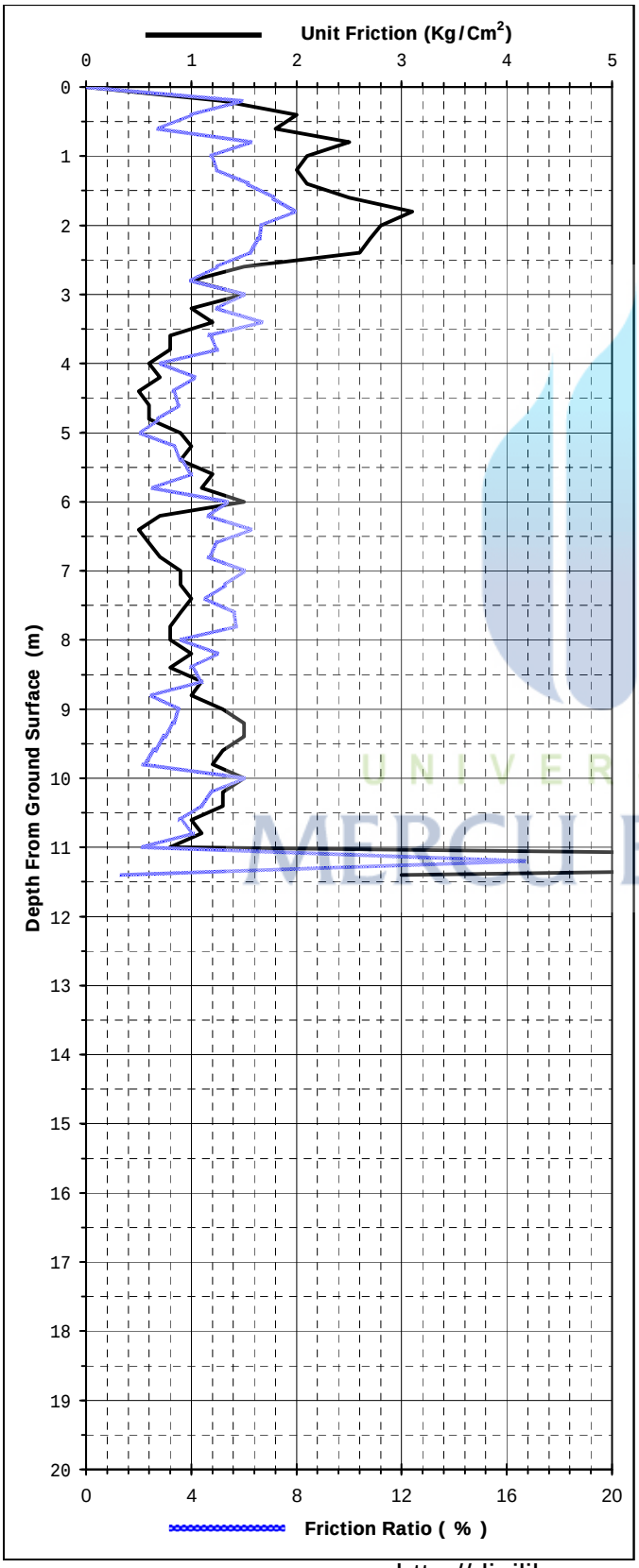
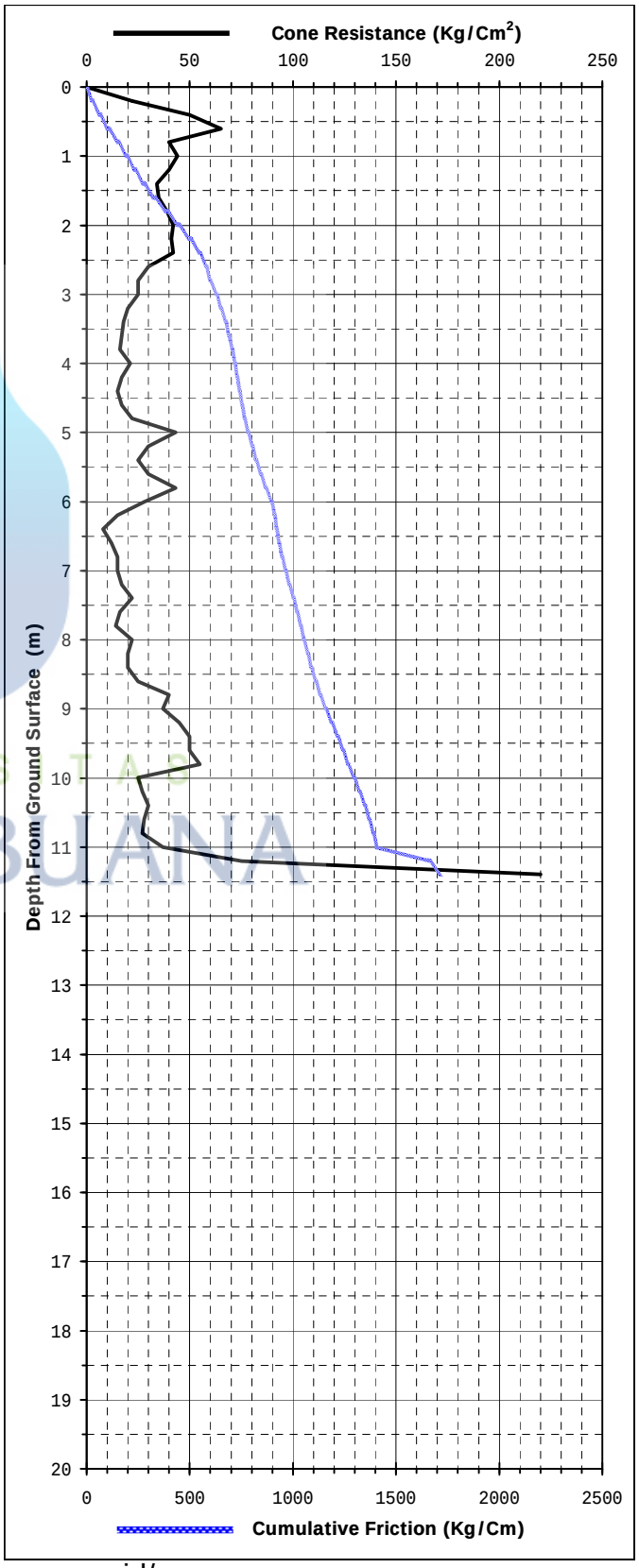
DUTCH CONE PENETROMETER TEST (ASTM D 3441)

Project No.	:	DCM.G.12-047	Borehole	:	**S - 8**
Client	:	**PT. CITRATAMA INTI PERSADA**	Elevation (m)	:	9.862
Project	:	**CENTENNIAL TOWER**	Tested date	:	30-Sep-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Wiyono
GWL (m)	:	- 10.50	Checked by	:	Rudi





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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	**DCM.G.12-047**
Project Name	**CENTENNIAL TOWER**
Location	**Jl. Jend. Gatot Subroto - Jakarta**
Borehole No.	**S - 9**
Tested By	**Wiyono**
Elevation	**10.048**
GWL	**- 10.50**
Tested Date	**1-Oct-2012**

S - 9

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
1	**0.00**	**0**	**0**	0.00	0.00	0.00	0.00	Granular Soil
2	0.20	48	60	1.20	24.00	24.00	2.50	Silt-Sand/Clayey Sand-Silt
3	0.40	65	85	2.00	40.00	64.00	3.08	Silt-Sand/Clayey Sand-Silt
4	0.60	77	100	2.30	46.00	110.00	2.99	Silt-Sand/Clayey Sand-Silt
5	0.80	70	90	2.00	40.00	150.00	2.86	Silt-Sand/Clayey Sand-Silt
6	**1.00**	**63**	**82**	1.90	38.00	188.00	3.02	Silt-Sand/Clayey Sand-Silt
7	1.20	47	70	2.30	46.00	234.00	4.89	Silty Clay/Clay
8	1.40	55	85	3.00	60.00	294.00	5.45	Silty Clay/Clay
9	1.60	55	80	2.50	50.00	344.00	4.55	Silty Clay/Clay
10	1.80	47	75	2.80	56.00	400.00	5.96	Silty Clay/Clay
11	**2.00**	**46**	**75**	2.90	58.00	458.00	6.30	Silty Clay/Clay
12	2.20	48	80	3.20	64.00	522.00	6.67	Silty Clay/Clay
13	2.40	45	75	3.00	60.00	582.00	6.67	Silty Clay/Clay
14	2.60	38	65	2.70	54.00	636.00	7.11	Silty Clay/Clay
15	2.80	28	45	1.70	34.00	670.00	6.07	Silty Clay/Clay
16	**3.00**	**25**	**40**	1.50	30.00	700.00	6.00	Silty Clay/Clay
17	3.20	25	41	1.60	32.00	732.00	6.40	Silty Clay/Clay
18	3.40	22	38	1.60	32.00	764.00	7.27	Silty Clay/Clay
19	3.60	21	31	1.00	20.00	784.00	4.76	Silty Clay/Clay
20	3.80	20	28	0.80	16.00	800.00	4.00	Silty Clay/Clay
21	**4.00**	**28**	**40**	1.20	24.00	824.00	4.29	Silty Clay/Clay
22	4.20	27	37	1.00	20.00	844.00	3.70	Silty Clay/Clay
23	4.40	27	36	0.90	18.00	862.00	3.33	Silty Clay/Clay
24	4.60	27	37	1.00	20.00	882.00	3.70	Silty Clay/Clay
25	4.80	27	40	1.30	26.00	908.00	4.81	Silty Clay/Clay
26	**5.00**	**25**	**36**	1.10	22.00	930.00	4.40	Silty Clay/Clay
27	5.20	32	45	1.30	26.00	956.00	4.06	Silty Clay/Clay
28	5.40	40	53	1.30	26.00	982.00	3.25	Silty Clay/Clay
29	5.60	35	47	1.20	24.00	1006.00	3.43	Silty Clay/Clay
30	5.80	32	43	1.10	22.00	1028.00	3.44	Silty Clay/Clay
31	**6.00**	**20**	**30**	1.00	20.00	1048.00	5.00	Silty Clay/Clay
32	6.20	10	17	0.70	14.00	1062.00	7.00	Silty Clay/Clay
33	6.40	9	15	0.60	12.00	1074.00	6.67	Silty Clay/Clay
34	6.60	10	15	0.50	10.00	1084.00	5.00	Silty Clay/Clay
35	6.80	11	17	0.60	12.00	1096.00	5.45	Silty Clay/Clay
36	**7.00**	**9**	**13**	0.40	8.00	1104.00	4.44	Silty Clay/Clay
37	7.20	11	16	0.50	10.00	1114.00	4.55	Silty Clay/Clay
38	7.40	14	20	0.60	12.00	1126.00	4.29	Silty Clay/Clay
39	7.60	13	20	0.70	14.00	1140.00	5.38	Silty Clay/Clay
40	7.80	13	19	0.60	12.00	1152.00	4.62	Silty Clay/Clay
41	**8.00**	**12**	**17**	0.50	10.00	1162.00	4.17	Silty Clay/Clay
42	8.20	19	26	0.70	14.00	1176.00	3.68	Silty Clay/Clay
43	8.40	20	28	0.80	16.00	1192.00	4.00	Silty Clay/Clay
44	8.60	25	38	1.30	26.00	1218.00	5.20	Silty Clay/Clay
45	8.80	35	43	0.80	16.00	1234.00	2.29	Silt-Sand/Clayey Sand-Silt
46	**9.00**	**35**	**47**	1.20	24.00	1258.00	3.43	Silty Clay/Clay

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DUTCH CONE PENETROMETER TEST

General Information

Client	PT. CITRATAMA INTI PERSADA
Project No.	DCM.G.12-047
Project Name	CENTENNIAL TOWER
Location	Jl. Jend. Gatot Subroto - Jakarta
Borehole No.	S - 9
Tested By	Wiyono
Elevation	10.048
GWL	- 10.50
Tested Date	1-Oct-2012

S - 9

NO	Depth	Manometer Reading		Unit Friction, If	Local Friction, LF	Total Friction, JHL	Friction Ratio, fr	Type of soil
		Cone Resistance	Total Resistance					
	[m]	[kg/cm^2]	[kg/cm^2]	[kg/cm^2]	[kg/cm]	[kg/cm]	[%]	
47	9.20	40	57	1.70	34.00	1292.00	4.25	Silty Clay/Clay
48	9.40	70	90	2.00	40.00	1332.00	2.86	Silt-Sand/Clayey Sand-Silt
49	9.60	78	100	2.20	44.00	1376.00	2.82	Silt-Sand/Clayey Sand-Silt
50	9.80	70	95	2.50	50.00	1426.00	3.57	Silty Clay/Clay
51	**10.00**	**80**	**105**	2.50	50.00	1476.00	3.13	Silt-Sand/Clayey Sand-Silt
52	10.20	75	90	1.50	30.00	1506.00	2.00	Granular Soil
53	10.40	60	80	2.00	40.00	1546.00	3.33	Silty Clay/Clay
54	10.60	40	52	1.20	24.00	1570.00	3.00	Silt-Sand/Clayey Sand-Silt
55	10.80	65	80	1.50	30.00	1600.00	2.31	Silt-Sand/Clayey Sand-Silt
56	**11.00**	**95**	**120**	2.50	50.00	1650.00	2.63	Silt-Sand/Clayey Sand-Silt
57	11.20	75	95	2.00	40.00	1690.00	2.67	Silt-Sand/Clayey Sand-Silt
58	11.40	85	110	2.50	50.00	1740.00	2.94	Silt-Sand/Clayey Sand-Silt
59	11.60	65	85	2.00	40.00	1780.00	3.08	Silt-Sand/Clayey Sand-Silt
60	11.80	67	85	1.80	36.00	1816.00	2.69	Silt-Sand/Clayey Sand-Silt
61	**12.00**	**32**	**45**	1.30	26.00	1842.00	4.06	Silty Clay/Clay
62	12.20	80	100	2.00	40.00	1882.00	2.50	Silt-Sand/Clayey Sand-Silt
63	12.40	90	105	1.50	30.00	1912.00	1.67	Granular Soil
64	12.60	95	110	1.50	30.00	1942.00	1.58	Granular Soil
65	12.80	110	130	2.00	40.00	1982.00	1.82	Granular Soil
66	**13.00**	**225**	**250**	2.50	50.00	2032.00	1.11	Granular Soil
67	13.20							
68	13.40							
69	13.60							
70	13.80							
71	**14.00**							
72	14.20							
73	14.40							
74	14.60							
75	14.80							
76	**15.00**							
77	15.20							
78	15.40							
79	15.60							
80	15.80							
81	**16.00**							
82	16.20							
83	16.40							
84	16.60							
85	16.80							
86	**17.00**							
87	17.20							
88	17.40							
89	17.60							
90	17.80							
91	**18.00**							

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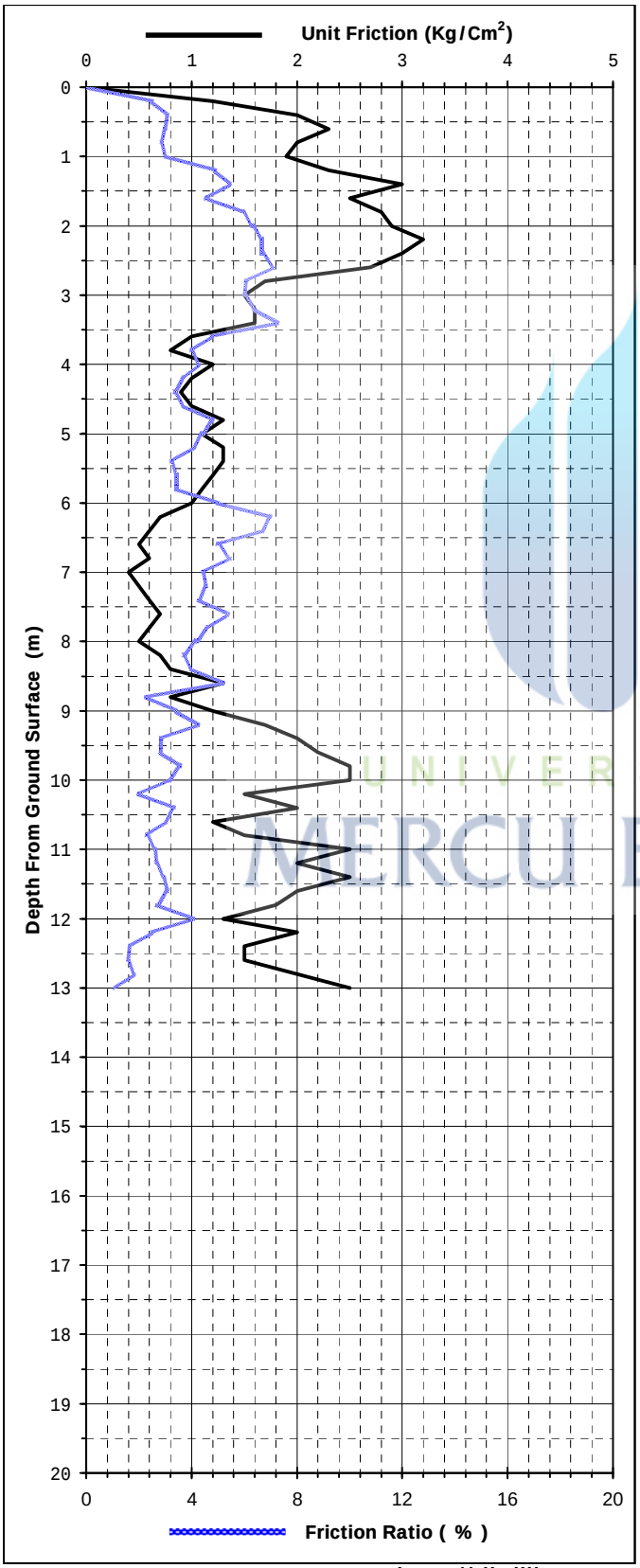
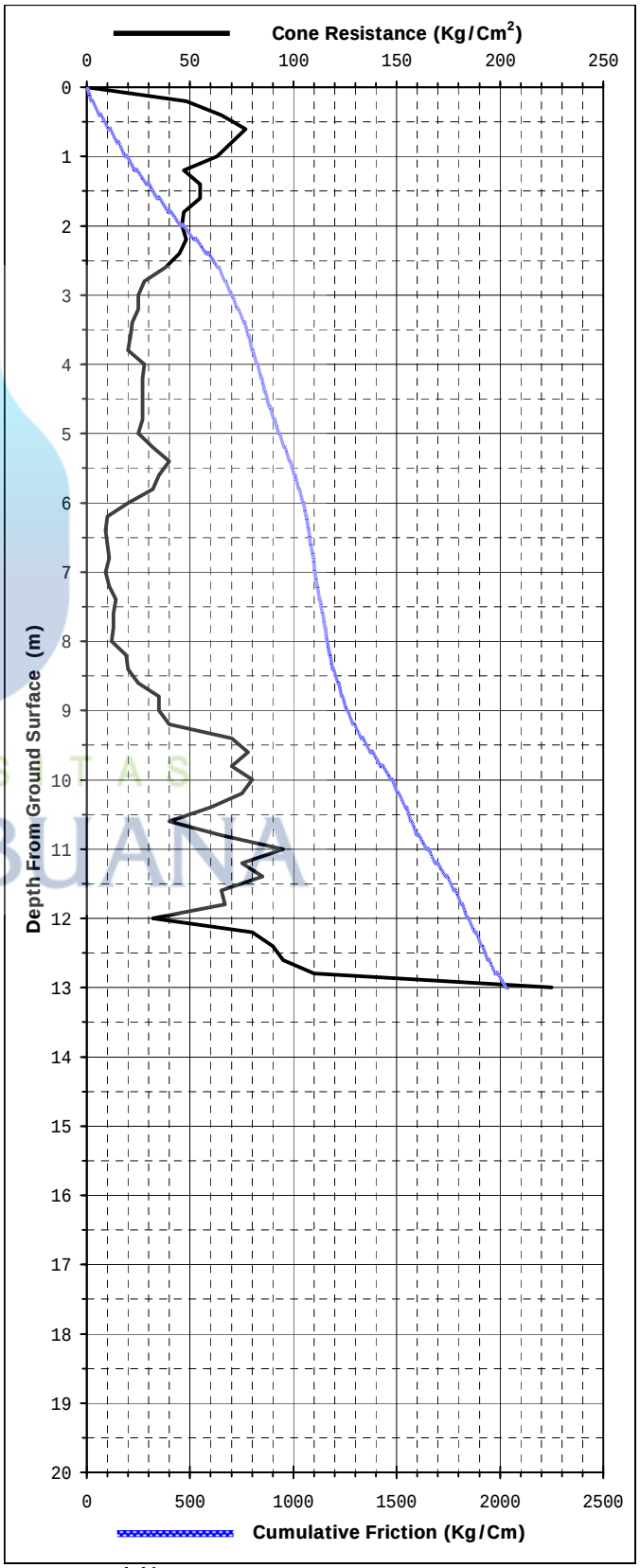
PT. DAYA CREASI MITRAYASA
Design & Engineering Consultants

DUTCH CONE PENETROMETER TEST (ASTM D 3441)

Project No.	:	DCM.G.12-047	Borehole	:	**S - 9**
Client	:	**PT. CITRATAMA INTI PERSADA**	Elevation (m)	:	10.048
Project	:	**CENTENNIAL TOWER**	Tested date	:	1-Oct-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Wiyono
GWL (m)	:	- 10.50	Checked by	:	Rudi





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Methods for performing index properties test of soils

Test	Procedure	ASTM/AASHTO	Applicable Soil Types	Applicable Soil Properties	Limitations/Remaks
Spesific Gravity	The volume of a known mass of soil is compared to the known volume of water in a calibrated pyncnometer	D 854 D 5550 T 100	Sand, silt, clay, peat	Used in calculation of e_o	Particularly helpful in cases where unusual solid minerals are encountered
Moisture content, Wn	Dry soil in oven at 100 ± 5°C	D 2216 T 265	Gravel, sand, silt, clay, peat	e_o, γ	Simple index test for all materials
Organic content	After preforming a moisture content test at 110°C (230°F), the sample is ignited in a muffle furnace at 440°C (824°F) to measure the ash content	D 2974 T 194	All soil types where organic matter is suspected to be a concern	Not related to any specific performance parameters, but samples high in organic content will have high compressibility	Recommended on all soils suspected to contain organic materials
Unit weight and density	Extract a tube sample; measure dimensions and weight	D 2216 T 265	Soils where undisturbed samples can be taken, i.e., silt, clay, peat	γ_t, γ_{dry}, ρ_{tot}, ρ_{dry}, ρ_t	Not appropriate for clean granular materials where undisturbed smapling is not possible. Very usefull index test
Atterberg Limits, LL, PL, SL, LI	LL - Moisture content associated with closure of the groove at 25 blows of specimen in Casagrande cup PL - Moisture content associated with crumbling of rolled soil at 1/8 inch (3mm)	D 4318 T 89 T 90	Clay, silt, peat; silty and clayey sands to determine whether SM or SC	Soil classification and used in consolidation parameters	Not appropriate in nonplastic granular soil. Recommended for all plastic materials
Mechanical sieve	Please air dry material on a series of successively smaller screens of known opening size and vibrate to separate particles of a specific equivalent diameter	D 422 T 88	Gravel, sand, silt	Soil classification	Not appropriate for clay soils. Useful, particularly in clean and dirty granular materials
Wash sieve	Flush fine particles through a U.S. No. 200 (0.075 mm) sieve with water	C 177 D 1140 T 88	Sand, silt, clay	Soil classification	Needed to assess fines content in dirty granular materials
Hydrometer	Allow particles to settle, and measure specific gravity of the solution with time	D 422 D 1140 T 88	Fine sand, silt, clay	Soil classification	Helpful to assess relative quantity of silt and clay
Sand Equivalent	Sample passing No.4 (4.75 mm) sieve is separated into sand and clay size particles	D 2419 T 176	Gravel, sand, silt, clay	Aggregate classification Compaction	Useful for aggregates

Symbol used in Table

e_o : in-situ void ratio γ_{dry} : dry unit weight γ : unit weight P_t : total vertical stress

ρ_{dry} : dry density ρ_{tot} : total density γ_t : total unit weight

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Methods for performing engineering properties test of soils

Test	Procedure	Applicable Soil Types	Soil Properties	Limitations/Remaks
1-D oedometer	Incremental loads are applied to a soil specimen confined by a rigid ring; deformation values are recorded with time; loads are typically doubled for each increment and applied for 24 hours each	Primarily clays and silts; granular soils can be tested, but typically are not	p_c, OCR, C_c, $C_{c\varepsilon}$, C_r, $C_{r\varepsilon}$, C_α, $C_{\alpha\varepsilon}$, c_v, k	Recommended for fine grained soils. Results can be useful index to other critical parameters
Constant rate of strain oedometer	Loads are applied such that Δu is between 3 and 30 percent of the applied vertical strees during testing	Clays and silts; not applicable to free draining granular soils	p_c, C_c, $C_{c\varepsilon}$, C_r, $C_{r\varepsilon}$, c_v, k	Requires special testing equipment, but can reduce testing time significantly
Unconfined Compression (UC)	A specimen is placed in a loading apparatus and sheared under axial compression with no confinement	Clays and silts; cannot be performed on granular soils or fissured and varved materials	Su, UC	Provides rapid means to approximate undrained shear strength, but disturbance effects, test rate, and moisture migration will affect results
Unconsolidated Undrained Triaxial shear	The specimen is not allowed to consolidate under the confininf stress, and the specimen is loaded at a quick enough rate to prevent drainage	Clays and silts	Su, UU	Sample must be nearly saturated. Sample disturbance and rate effects will affect measured strength
Consolidated Drained Compression (CDC)	The specimen is allowed to consolidate under the confining stress, and the specimen is loaded at a quick enough rate to prevent drainage	Sands, silts, clays	ϕ', c', E	Can be run on clay specimen, but time consuming. Best triaxial test to obtain deformation properties
Consolidated Drained Compression (CDC)	The specimen is allowed to consolidate under the confining stress with drainage allowed, and then is sheared with no drainage allowed, but pore water pressures measured	Sands, silts, clays, peats	ϕ', c', Su, CUC, E	Recommended to measure pore pressures during test. Useful test to assess effective stress strength parameter. Not recommended for measuring deformation properties
Direct Shear	The specimen is sheared on a forced failure plane at a constant rate, which is a function of the hydraulic conductivity of the specimen	Compacted fill materials; sands, silts, and clays	ϕ', ϕ'r	Requires assumption of drainage conditions. Relatively easy to perform
Flexible Wall Permeameter	The specimen is encased in a membrane, consolidated backpressure saturated, and measurements of flow with time are recorded for a specific gradient	Relatively low permeability materials ($k \leq 1x10^{-5}$ cm/s); clays & silts	k	Recommended for fine grained materials. Backpressure saturation required. Confining stress needs to be provided. System permeability must be at least an order of magnitude greater than that of the specimen. Time needed to allow inflow and outflow to stabilize
Rigid Wall Permeameter	The specimen is placed in a rigid wall cell, vertical confinement is applied, and flow measurements are recorded with time under constant head or falling head conditions	Relatively high permeability materials; sands, gravels, and silts	k	Need to control gradient. Not for use in fine grained soils. Monitor for sidewall leakage

Symbol used in Table

ϕ' : peak effective stress friction angle
ϕ'r : residual effective stress friction angle
c' : effective stress cohesion intercept
S_u : undrained shear strength
P_c : preconsolidation stress
OCR : overconsolidation ratio
c_v : vertical coefficient of consolidation
E : Young`s modulus
k : hydraulic conductivity
C_c : compression index
$C_{c\varepsilon}$: modified compression index
C_r : recompression index
$C_{r\varepsilon}$: modified recompression index
C_α : secondary compression index
$C_{\alpha\varepsilon}$: modified secondary compression index

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MOISTURE CONTENT DETERMINATION

PROJECT : GATOT SUBROTO TOWER.
LOCATION : Jl. Gatot Subroto Jakarta.
DATE : 18 - 11 - 2012
TESTED BY : W. Triadi
CHECKED BY : Ir. Theo F. Najoan.

SAMPLE NUMBER	Satuan	DB.1					
DEPTH		5.50 - 6.00 M.		10.00 - 10.50 M.		16.00 - 16.50 M.	
Container number		68	60	44	38	61	AC
Weight of wet soil + container	g	64.33	66.06	57.37	63.5	53.2	55.18
Weight of dry soil + container	g	40	40.68	36.72	39.42	34.64	36.08
Weight of container	g	10.45	10.3	11.03	10.6	10.07	11.12
Weight of water	g	24.33	25.38	20.65	24.08	18.56	19.1
Weight of dry soil	g	29.55	30.34	25.69	28.82	24.57	24.96
Moisture content	%	82.34	83.65	80.38	83.55	75.54	76.52
Avarage	%	82.99		81.97		76.03	

SAMPLE NUMBER	Satuan	DB.1					
DEPTH		28.00 - 28.50 M.		43.00 - 43.50 M.		59.50 - 60.00 M.	
Container number		78B	73B	32	72B	49	297
Weight of wet soil + container	g	43.38	46.75	56.5	49.09	52.42	50.17
Weight of dry soil + container	g	31.56	33.49	39.51	35.25	43.52	41.9
Weight of container	g	10.64	9.98	10.31	9.8	10.54	10.06
Weight of water	g	11.82	13.26	16.99	13.84	8.9	8.27
Weight of dry soil	g	20.92	23.51	29.2	25.47	32.98	31.84
Moisture content	%	56.50	56.40	58.18	54.34	26.99	25.97
Avarage	%	56.45		56.26		26.48	

SAMPLE NUMBER	Satuan	DB.1					
DEPTH		65.50 - 66.00 M.		67.50 - 68.00 M.			
Container number		8	5	101	35		
Weight of wet soil + container	g	58.04	56.86	54.96	48.43		
Weight of dry soil + container	g	44.61	44.01	43.02	38.28		
Weight of container	g	10.00	10.0	10.11	10.15		
Weight of water	g	13.43	12.85	11.94	10.15		
Weight of dry soil	g	34.61	33.97	32.91	28.13		
Moisture content	%	38.80	37.83	36.28	36.08		
Avarage	%	38.32		36.18			

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UNIT WEIGHT TEST

PROJECT : GATOT SUBROTO TOWER.
LOCATION : Jl. Gatot Subroto Jakarta.
D A T E : 22 - 11 - 2012
TESTED BY : W. Triadi
CHECKED BY : Ir. Theo F. Najoan.

SAMPLE NUMBER	Satuan	DB.1					
DEPTH		5.50 - 6.00 M.		10.00 - 10.50 M.		16.00 - 16.50 M.	
Number of specimen		1	2	1	2	1	2
Diameter of sample.	mm	38	38	38	38	38	38
Height of sample.	mm	76	76	76	76	76	76
Area of sample.	mm^2	1134.11	1134.11	1134.11	1134.11	1134.11	1134.11
Volume of sample.	cm^3	86.19	86.19	86.19	86.19	86.19	86.19
Weight of sample.	gr	125.41	128.74	128.8	127.26	127.94	129.84
Unit weight (γ_n)	t/m^3	1.455	1.494	1.494	1.476	1.484	1.506
A v a r a g e (γ_n)	t/m^3	1.4743		1.4854		1.4954	

SAMPLE NUMBER	Satuan	DB.1					
DEPTH		28.00 - 28.50 M.		43.00 - 43.50 M.		59.50 - 60.00 M.	
Number of specimen		1	2	1	2	1	2
Diameter of sample.	mm	50	50	50	50	50	50
Height of sample.	mm	20	20	20	20	20	20
Area of sample.	mm^2	1963.50	1963.50	1963.50	1963.50	1963.50	1963.50
Volume of sample.	cm^3	39.27	39.27	39.27	39.27	39.27	39.27
Weight of sample.	gr	66.75	67.35	65.98	70.35	78.54	78.09
Unit weight (γ_n)	t/m^3	1.700	1.715	1.680	1.791	2.000	1.989
A v a r a g e (γ_n)	t/m^3	1.7074		1.7358		1.9943	

SAMPLE NUMBER	Satuan	DB.1					
DEPTH		65.50 - 66.00 M.		67.50 - 68.00 M.			
Number of specimen		1	2	1	2		
Diameter of sample.	mm	50	50	50	50		
Height of sample.	mm	20	20	20	20		
Area of sample.	mm^2	1963.50	1963.50	1963.50	1963.50		
Volume of sample.	cm^3	39.27	39.27	39.27	39.27		
Weight of sample.	gr	71.32	74.42	72.92	71.87		
Unit weight (γ_n)	t/m^3	1.816	1.895	1.857	1.830		
A v a r a g e (γ_n)	t/m^3	1.856		1.844			

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SPECIFIC GRAVITY TEST

PROJECT : GATOT SUBROTO TOWER.
LOCATION : Jl. Gatot Subroto Jakarta.
D A T E : 19 - 11 - 2012
TESTED BY : W Triadi
CHECKED BY : Ir. Theo F. Najoan.

SAMPLE NUMBER	DB.1					
DEPTH	5.50 - 6.00 M.		10.00 - 10.50 M.		16.00 - 16.50 M.	
Picnometer number	X	Z	F	D	2	4
Weight of picnometer + soil (W_1)	35.07	36.35	40.61	40.56	30.3	29.23
Weight of picnometer (W_2)	29.25	30.75	34.91	34.94	24.53	23.32
Weight of soil ($WT = W_1 - W_2$)	5.82	5.6	5.7	5.62	5.77	5.91
Weight of picnometer + soil.						
Temp. T_1 deg. C						
Weight of picnometer + water + soil (W_3)	82.37	84.24	88.28	87.9	77.56	77.09
Temp. Tx deg. C	26° C	26° C	26° C	26° C	26° C	26° C
Weight of picno + water Tx deg.C (W_4)	78.75	80.76	84.73	84.4	73.96	73.4
$W_5 = W_1 - W_2 + W_4$	84.57	86.36	90.43	90.02	79.73	79.31
Volume of soil ($W_5 - W_3$)	2.2	2.12	2.15	2.12	2.17	2.22
Specific gravity = $WT / (W_5 - W_3)$	2.644	2.640	2.650	2.649	2.657	2.661
A v a r a g e	2.642		2.649		2.659	

SAMPLE NUMBER	DB.1					
DEPTH	28.00 - 28.50 M.		43.00 - 43.50 M.		59.50 - 60.00 M.	
Picnometer number	X	Z	D	F	2	4
Weight of picnometer + soil (W_1)	35.77	37.41	41.57	41.56	32.65	31.62
Weight of picnometer (W_2)	29.25	30.75	34.94	34.91	24.53	23.32
Weight of soil ($WT = W_1 - W_2$)	6.52	6.66	6.63	6.65	8.12	8.3
Weight of picnometer + soil.						
Temp. T_1 deg. C						
Weight of picnometer + water + soil (W_3)	82.81	84.9	88.54	88.88	78.98	78.53
Temp. Tx deg. C	26° C	26° C	26° C	26° C	26° C	26° C
Weight of picno + water Tx deg.C (W_4)	78.75	80.76	84.4	84.73	73.96	73.4
$W_5 = W_1 - W_2 + W_4$	85.27	87.42	91.03	91.38	82.08	81.7
Volume of soil ($W_5 - W_3$)	2.46	2.52	2.49	2.5	3.1	3.17
Specific gravity = $WT / (W_5 - W_3)$	2.649	2.641	2.661	2.658	2.618	2.617
A v a r a g e	2.645		2.660		2.617	

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SPECIFIC GRAVITY TEST

PROJECT : GATOT SUBROTO TOWER.
LOCATION : Jl. Gatot Subroto Jakarta.
D A T E : 19 - 11 - 2012
TESTED BY : W Triadi
CHECKED BY : Ir. Theo F. Najoan.

SAMPLE NUMBER	DB.1					
DEPTH	65.50 - 66.00 M.		67.50 - 68.00 M.			
Picnometer number	9	4R	N	2H		
Weight of picnometer + soil (W_1)	30.33	35.04	30.99	41.4		
Weight of picnometer (W_2)	22.73	27.42	23.22	33.73		
Weight of soil ($WT = W_1 - W_2$)	7.6	7.62	7.77	7.67		
Weight of picnometer + soil.						
Temp. T_1 deg. C						
Weight of picnometer + water + soil (W_3)	75.14	82.04	75.92	88.41		
Temp. Tx deg. C	26° C	26° C	26° C	26° C		
Weight of picno + water Tx deg.C (W_4)	70.42	77.31	71.1	83.65		
$W_5 = W_1 - W_2 + W_4$	78.02	84.93	78.87	91.32		
Volume of soil ($W_5 - W_3$)	2.88	2.89	2.95	2.91		
Specific gravity = WT / ($W_5 - W_3$)	2.639	2.637	2.634	2.636		
A v a r a g e	2.638		2.635			

SAMPLE NUMBER						
DEPTH						
Picnometer number						
Weight of picnometer + soil (W_1)						
Weight of picnometer (W_2)						
Weight of soil ($WT = W_1 - W_2$)						
Weight of picnometer + soil.						
Temp. T_1 deg. C						
Weight of picnometer + water + soil (W_3)						
Temp. Tx deg. C						
Weight of picno + water Tx deg.C (W_4)						
$W_5 = W_1 - W_2 + W_4$						
Volume of soil ($W_5 - W_3$)						
Specific gravity = WT / ($W_5 - W_3$)						
A v a r a g e						

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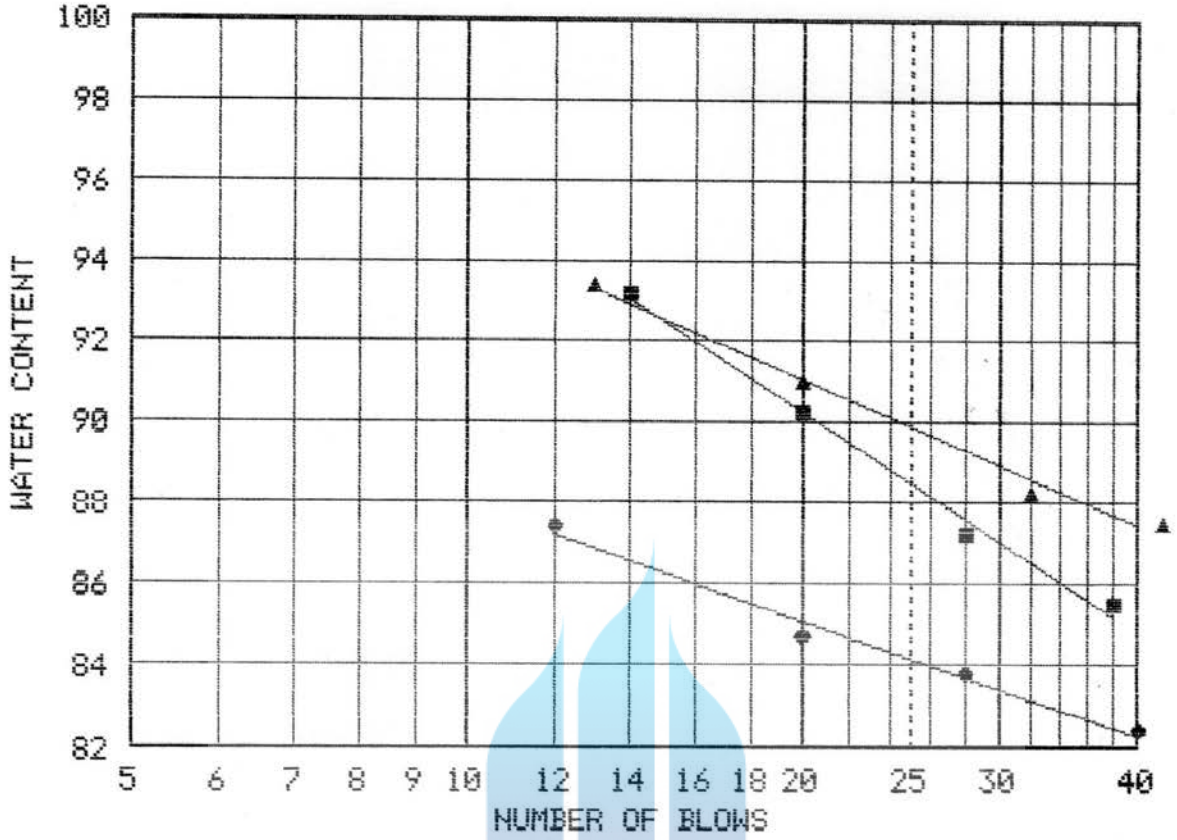
LIQUID AND PLASTIC LIMITS TEST REPORT



	Location + Description	LL	PL	PI	-200	USCS	AASHTO
●	DB.1 / 5.50 - 6.00 M. BROWN. Elastic silt with sand.	84	67	17	82.10	MH	A-7-5(24)
▲	DB.1 / 10.00 - 10.50 M. BROWN. Sandy elastic silt.	90	65	25	67.50	MH	A-7-5(23)
■	DB.1 / 16.00 - 16.50 M. Brownish gray. Sandy elastic silt.	88	63	25	55.70	MH	A-7-5(15)

Project No.:
Project: GATOT SUBROTO TOWER.

Client:
Location: JL. GATOT SUBROTO JAKARTA.

Date: 22 - 11 - 2012

LIQUID AND PLASTIC LIMITS TEST REPORT

PT KONAS TUNNGAL, JLN GAJAHLUMANTUNG 7, BANDUNG

Remarks:
TESTED BY : L. HERLIKA.
CHECKED BY : Ir. THEO FN

Fig. No. 1

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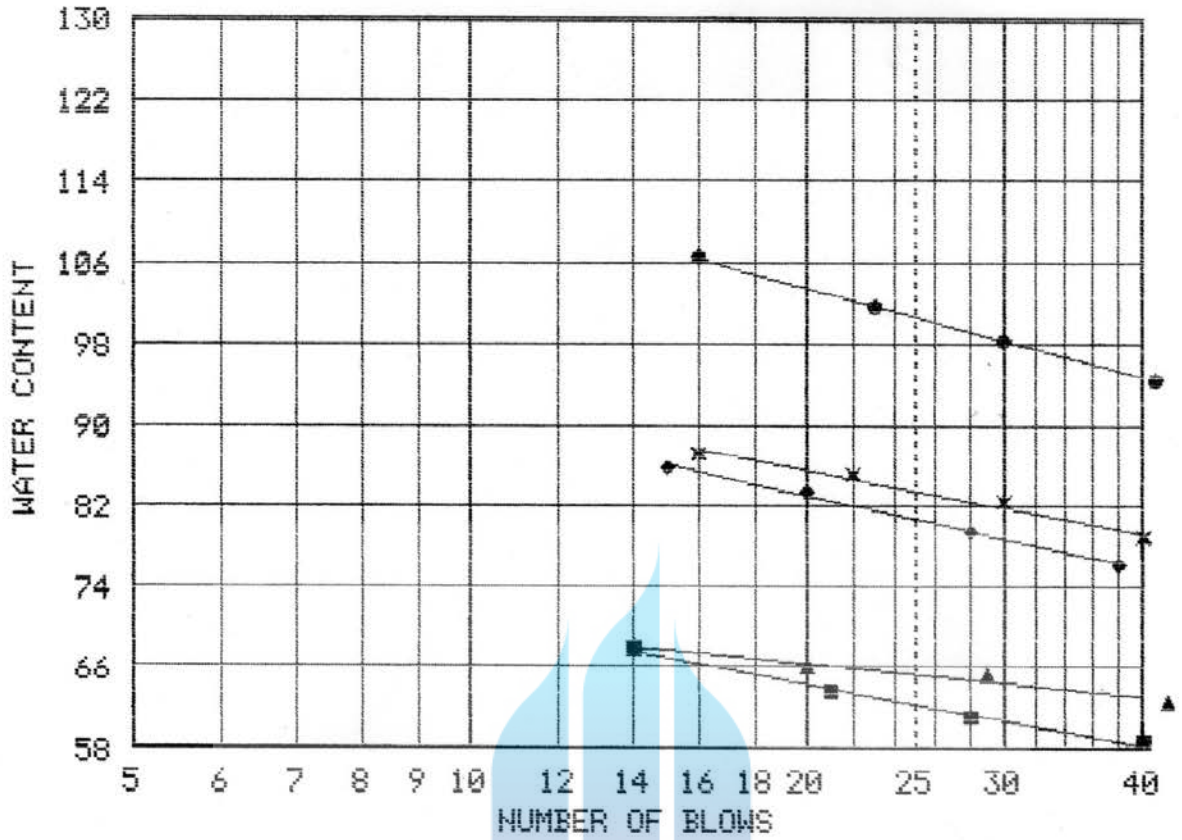
http://digilib.mercubuana.ac.id/

LIQUID AND PLASTIC LIMITS TEST REPORT



	Location + Description	LL	PL	PI	-200	USCS	AASHTO
●	DB.1 / 28.00 - 28.50 M. Greyish brown. Elastic silt with sand.	101	51	50	73.30	MH	A-7-5(42)
▲	DB.1 / 43.00 - 43.50 M. Yellowish brown. Sandy elastic silt.	65	51	14	56.10	MH	A-7-5(9)
■	DB.1 / 59.50 - 60.00 M. GREY. Fat clay.	62	24	38	91.00	CH	A-7-6(39)
◆	DB.1 / 65.00 - 66.00 M. BROWN. Elastic silt.	81	37	44	98.90	MH	A-7-5(54)
x	DB.1 / 67.50 - 68.00 M. Brownish gray. Elastic silt.	84	38	46	99.50	MH	A-7-5(57)

Project No.:
Project: GATOT SUBROTO TOWER.

Client:
Location: JL. GATOT SUBROTO JAKARTA.

Date: 22 - 11 - 2012

Remarks:
TESTED BY : L. HERLIKA.
CHECKED BY : Ir. THEO FN

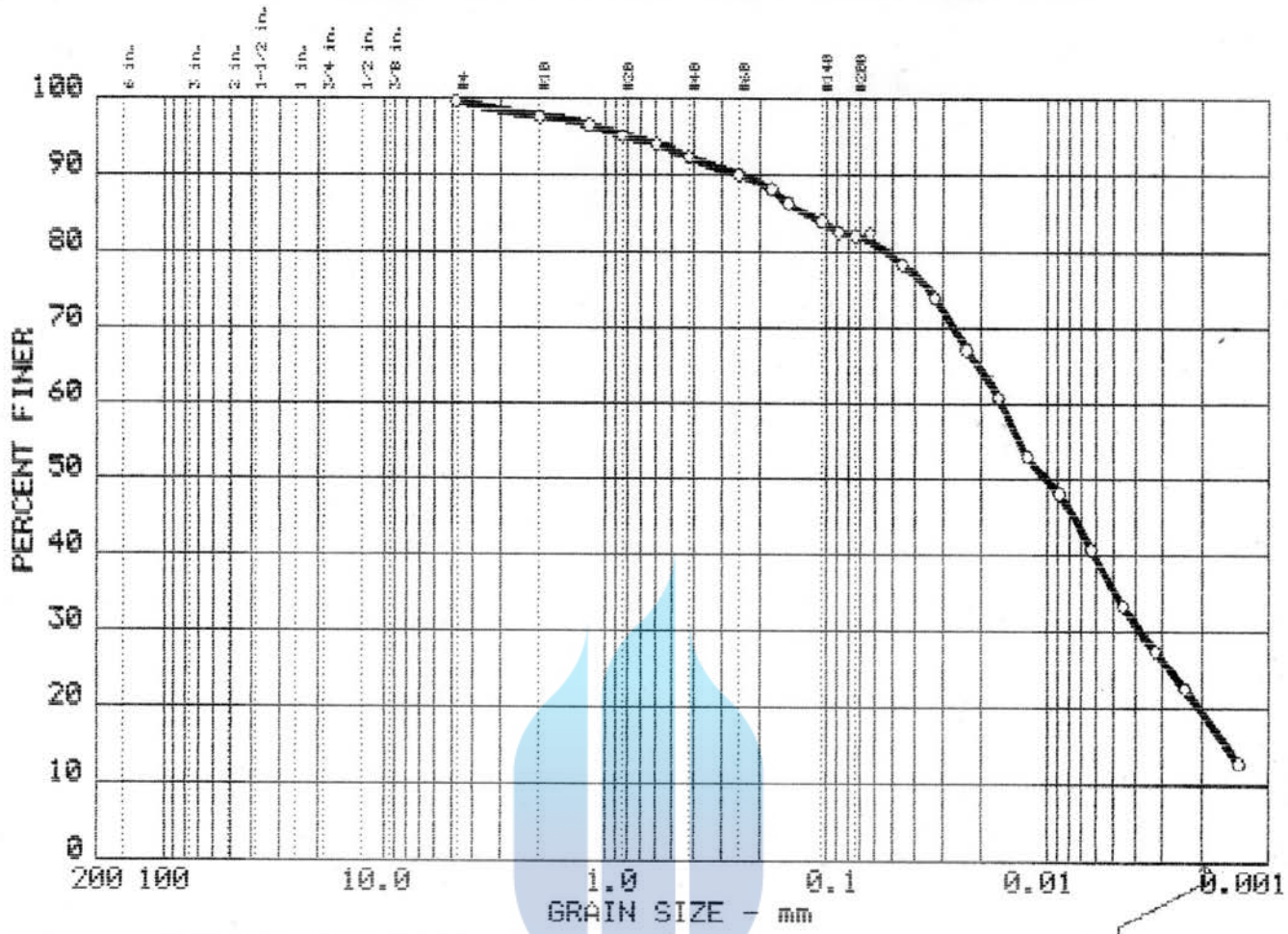
LIQUID AND PLASTIC LIMITS TEST REPORT

PT KONAS TUNNGAL, JLN GAJAHLUMANTUNG 7, BANDUNG

Fig. No. 1

UNIVERSITAS MERCU BUANA
http://digilib.mercubuana.ac.id/

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	9	0.0	0.5	17.5	62.6	19.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	84.00	17.00	0.12		0.01	0.004	0.0015			

MATERIAL DESCRIPTION	USCS	AASHTO
○ Brown, Elastic silt with sand.	MH.	A-7-5(24.4)

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
○ Location: DB.1 / 5.50 - 6.00 M.

Date: 17 - 11 - 2012.

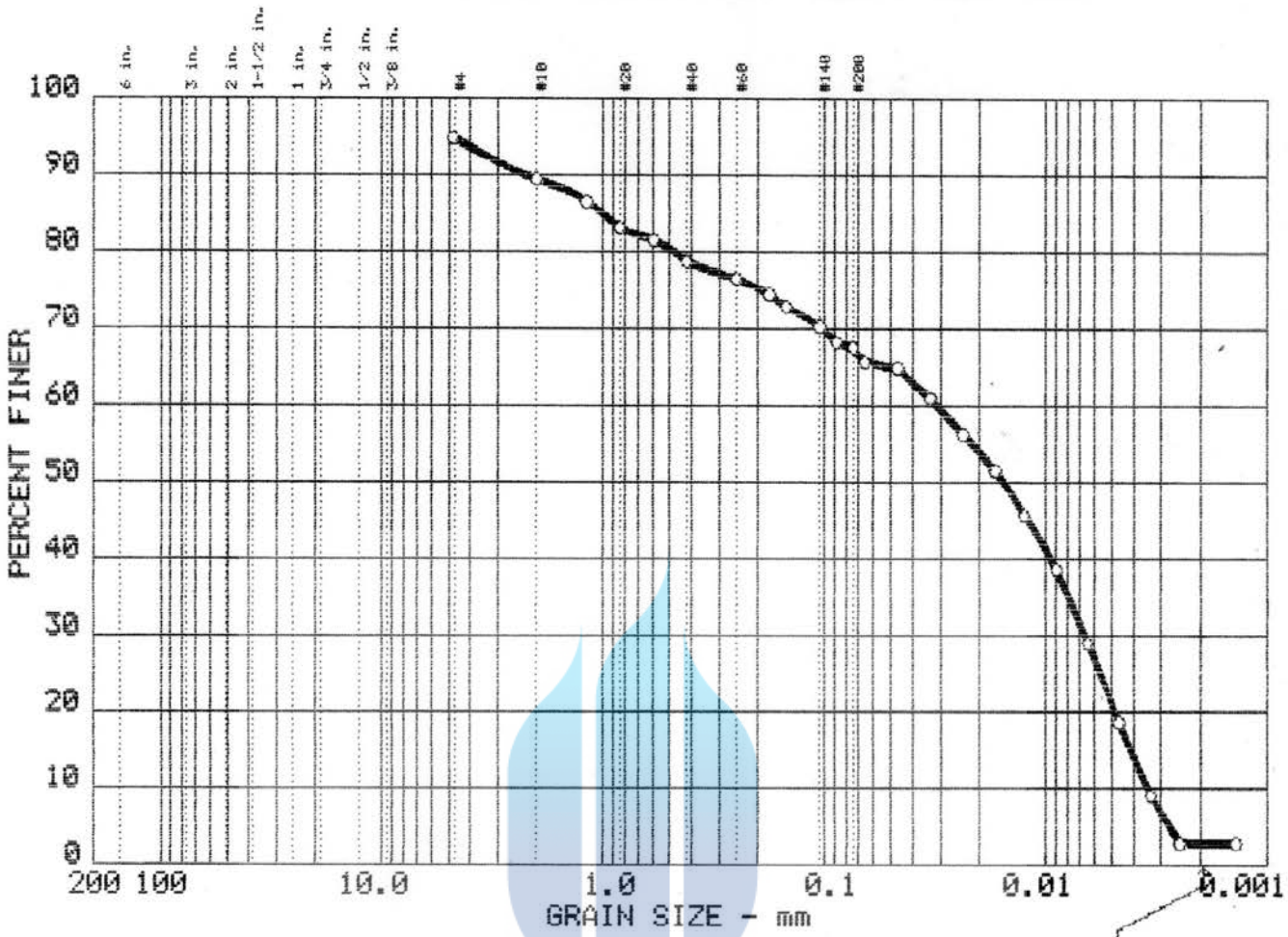
Remarks:
TESTED BY : W. TRIADI.
CHECKED BY : Ir. THEO FN

GRAIN SIZE DISTRIBUTION TEST REPORT
PT KONAS TUNGGAL SOIL LABORATORY

Figure No._____

UNIVERSITAS MERCU BUANA
http://digilib.mercubuana.ac.id/

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	10	0.0	5.2	27.3	64.7	2.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	90.00	25.00	1.01		0.02	0.007	0.0041	0.0035	0.41	8.9

MATERIAL DESCRIPTION	USCS	AASHTO
○ Brown, Sandy elastic silt.	MH.	A-7-5(22.8)

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
○ Location: DB.1 / 10.00 = 10.50 M.

Date: 20 - 11 - 2012.

Remarks:
TESTED BY : W. TRIADI.
CHECKED BY : Ir. THEO FN

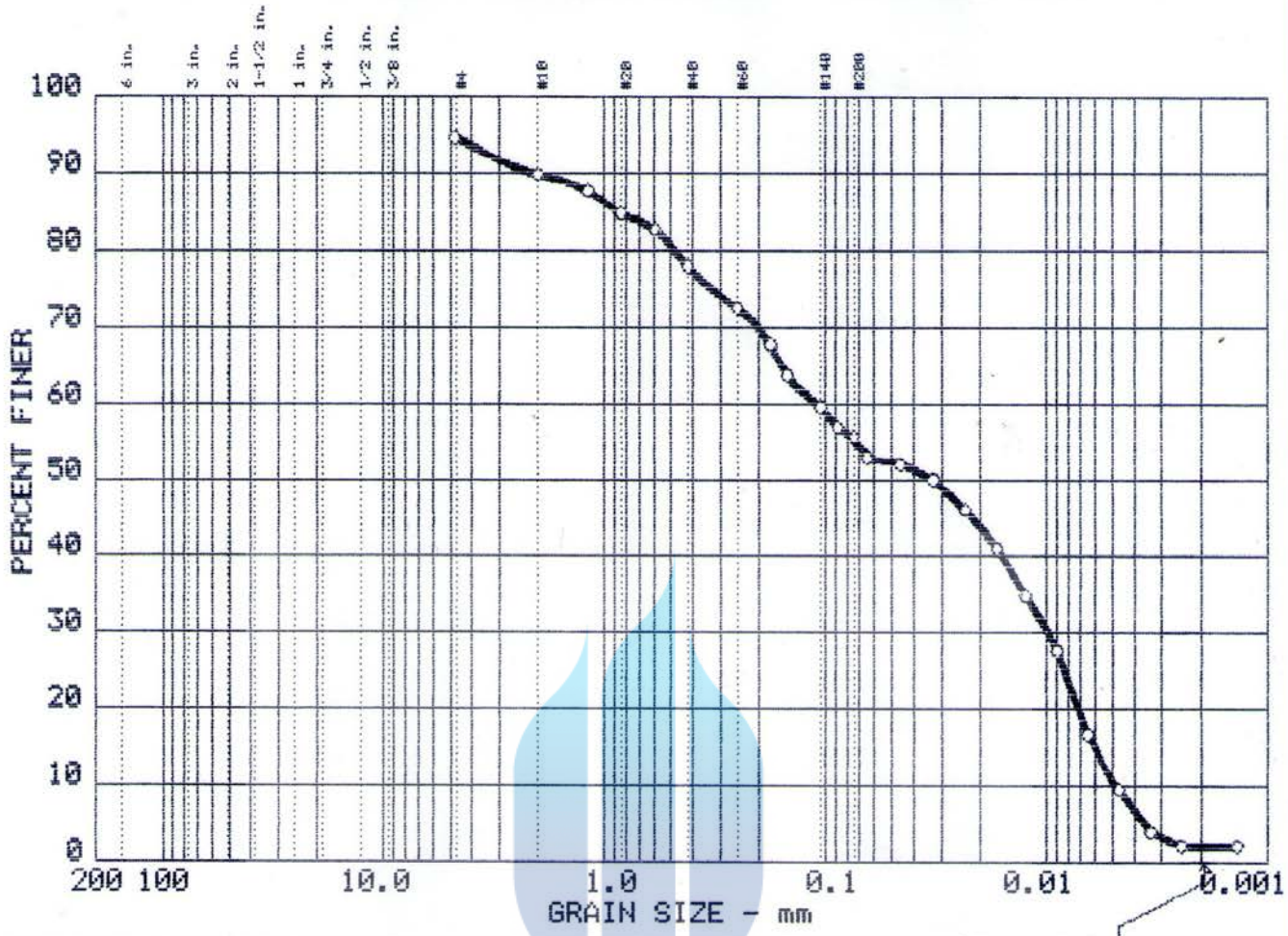
GRAIN SIZE DISTRIBUTION TEST REPORT
PT KONAS TUNGGAL SOIL LABORATORY

Figure No._____

UNIVERSITAS MERCU BUANA

http://digilib.mercubuana.ac.id/

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	11	0.0	5.3	39.0	53.5	2.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	88.00	25.00	0.84	0.11	0.03	0.010	0.0061	0.0048	0.18	22.4

MATERIAL DESCRIPTION	USCS	AASHTO
○ Brownish gray, Sandy elastic silt.	MH.	A-7-5(15.4)

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
○ Location: DB.1 / 16.00 - 16.50 M.

Date: 20 - 11 - 2012.

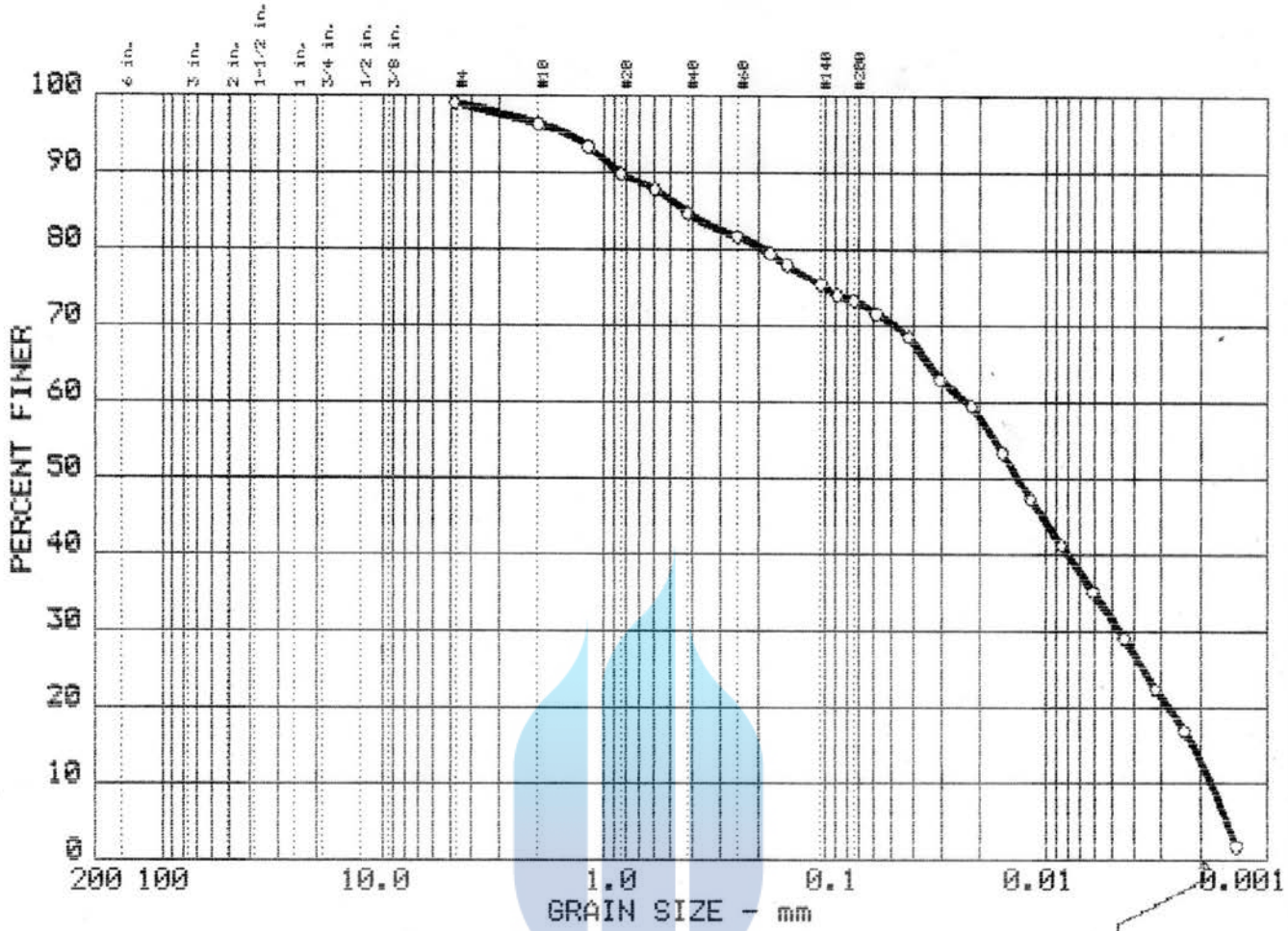
Remarks:
TESTED BY : W. TRIADI.
CHECKED BY : Ir. THEO FN

GRAIN SIZE DISTRIBUTION TEST REPORT
PT KONAS TUNGGAL SOIL LABORATORY

Figure No._____

UNIVERSITAS MERCU BUANA
http://digilib.mercubuana.ac.id/

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	12	0.0	0.9	25.7	60.4	13.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	101.0	50.00	0.43		0.01	0.005	0.0022	0.0018	0.52	12.6

MATERIAL DESCRIPTION	USCS	AASHTO
○ Greyish brown, Elastic silt with sand.	MH.	A-7-5(42.4)

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
○ Location: DB.1 / 28.00 - 28.50 M.

Date: 20 - 11 - 2012.

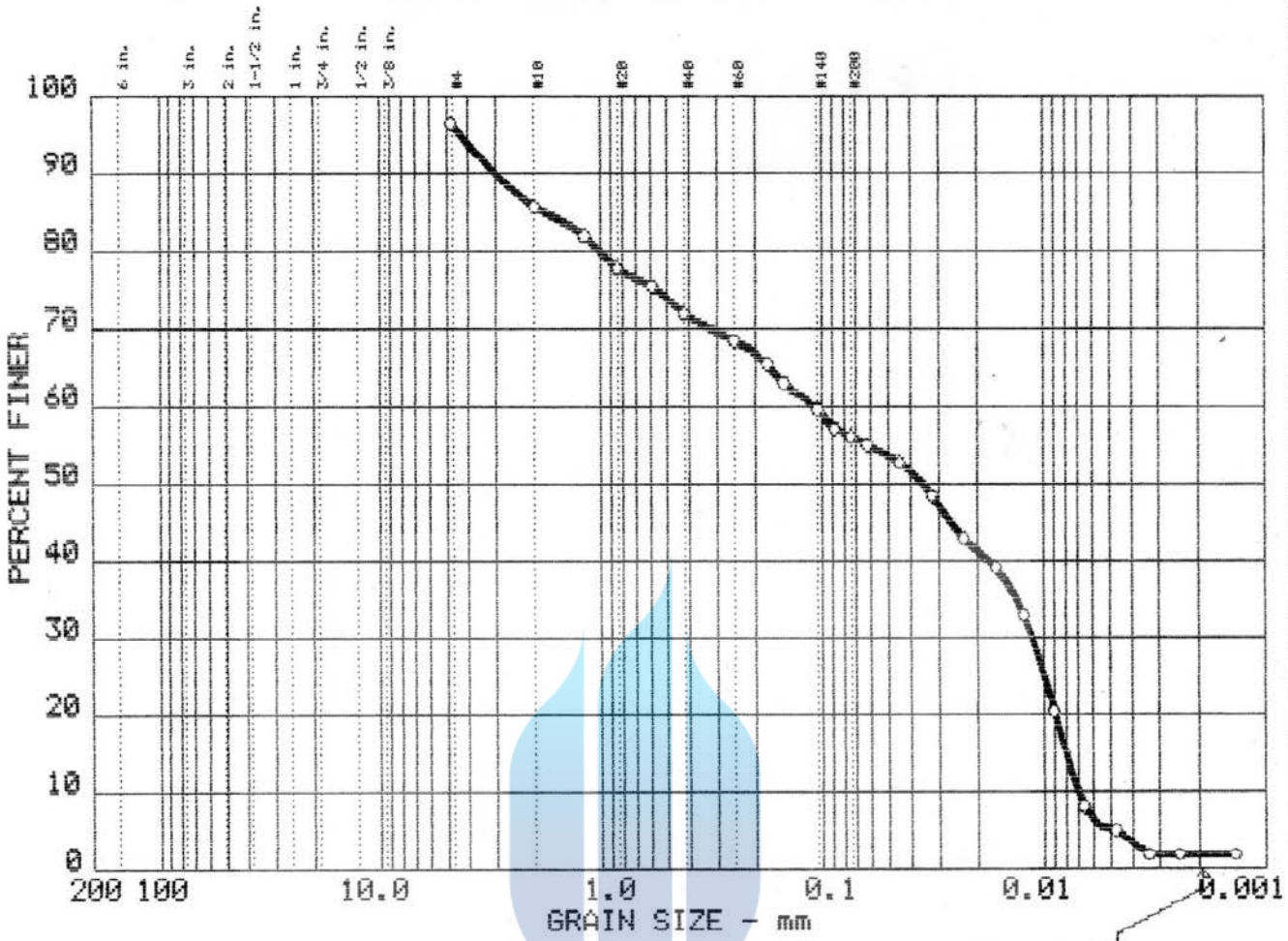
Remarks:
TESTED BY : W. TRIADI.
CHECKED BY : Ir. THEO FN

GRAIN SIZE DISTRIBUTION TEST REPORT
PT KONAS TUNGGAL SOIL LABORATORY

Figure No._____

UNIVERSITAS MERCU BUANA
http://digilib.mercubuana.ac.id/

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	13	0.0	3.6	40.3	54.3	1.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	65.00	14.00	1.78	0.11	0.04	0.011	0.0080	0.0070	0.17	15.4

MATERIAL DESCRIPTION	USCS	AASHTO
○ Yellowish brown, Sandy elastic silt.	MH.	A-7-5(8.5)

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
○ Location: DB.1 / 43.00 - 43.50 M.

Date: 20 - 11 - 2012.

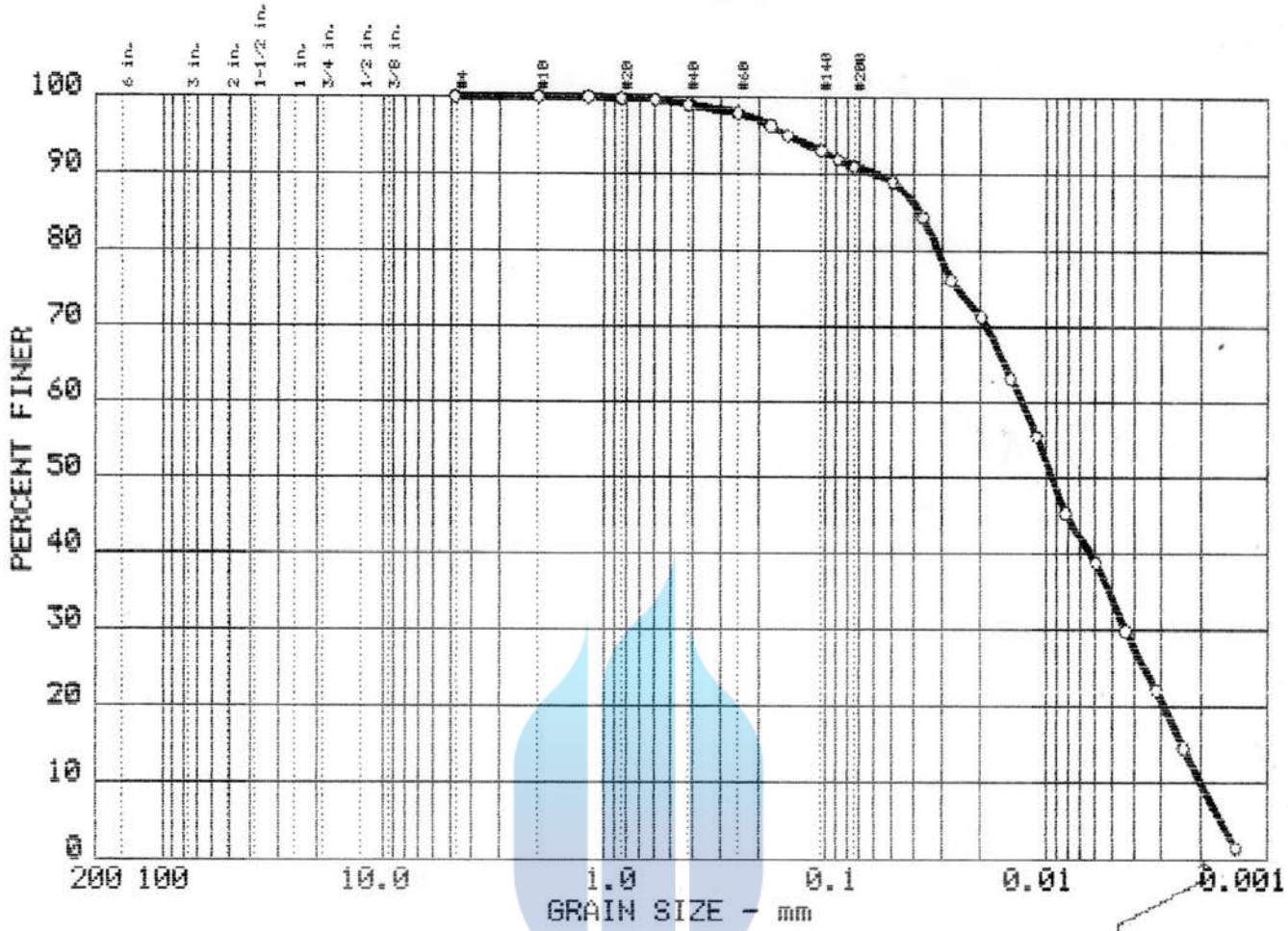
Remarks:
TESTED BY : W. TRIADI.
CHECKED BY : Ir. THEO FN

GRAIN SIZE DISTRIBUTION TEST REPORT
PT KONAS TUNGGAL SOIL LABORATORY

Figure No._____

UNIVERSITAS MERCU BUANA
http://digilib.mercubuana.ac.id/

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	14	0.0	0.0	9.0	81.1	9.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	62.00	38.00			0.01	0.004	0.0024	0.0020	0.74	6.5

MATERIAL DESCRIPTION	USCS	AASHTO
○ Grey, Fat clay.	CH.	A-7-6(38.6)

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
○ Location: DB.1 / 59.50 - 60.00 M.

Date: 20 - 11 - 2012.

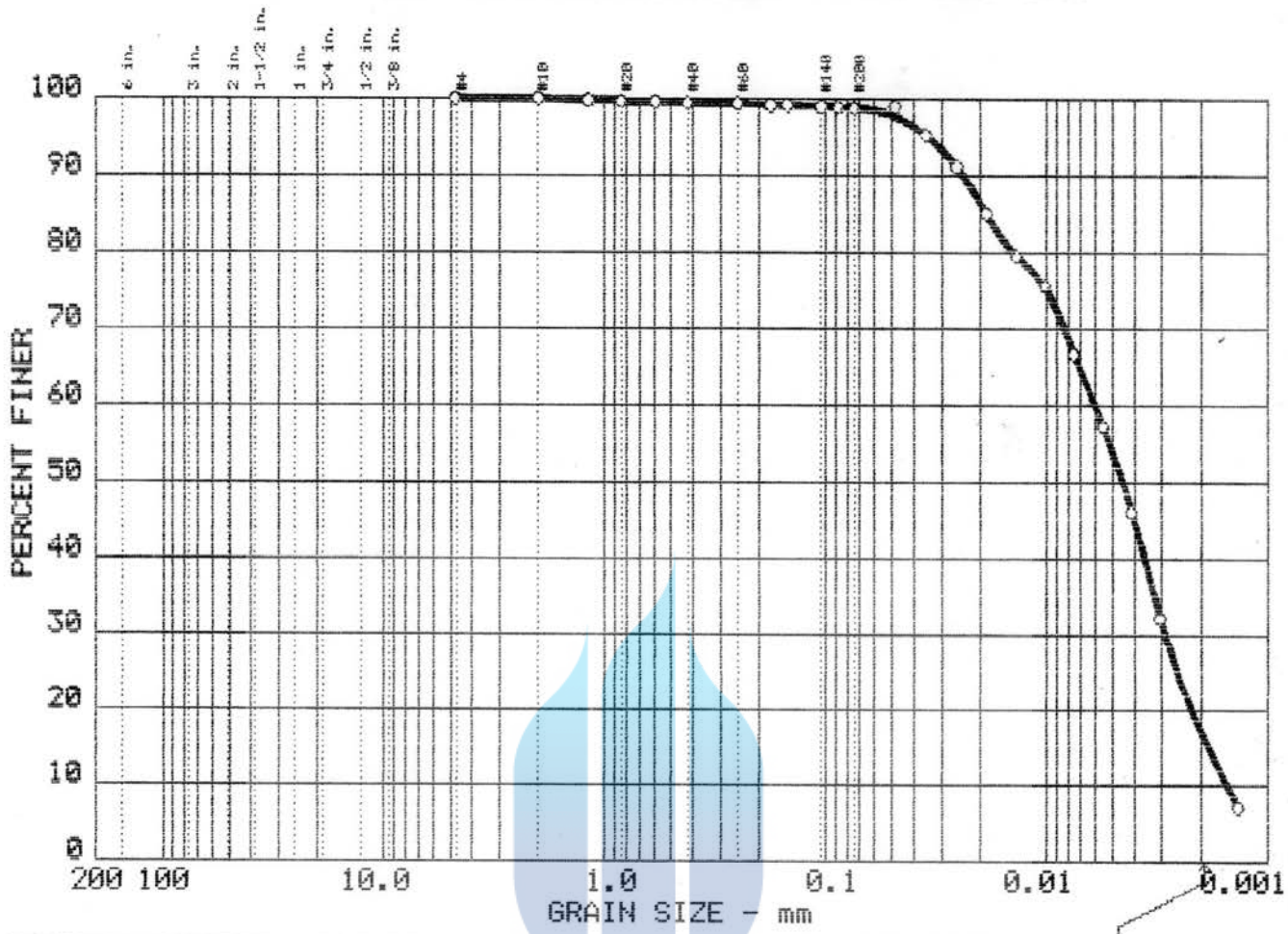
Remarks:
TESTED BY : W. TRIADI.
CHECKED BY : Ir. THEO FN

GRAIN SIZE DISTRIBUTION TEST REPORT
PT KONAS TUNGGAL SOIL LABORATORY

Figure No._____

UNIVERSITAS MERCU BUANA
http://digilib.mercubuana.ac.id/

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	15	0.0	0.0	1.1	82.0	16.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	81.00	44.00			0.00	0.003	0.0019	0.0015	0.92	4.0

MATERIAL DESCRIPTION	USCS	AASHTO
○ Brown, Elastic silt.	MH.	A-7-5(54.5)

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
○ Location: DB.1 / 65.00 - 66.00 M.

Date: 20 - 11 - 2012.

Remarks:
TESTED BY : W. TRIADI.
CHECKED BY : Ir. THEO FN

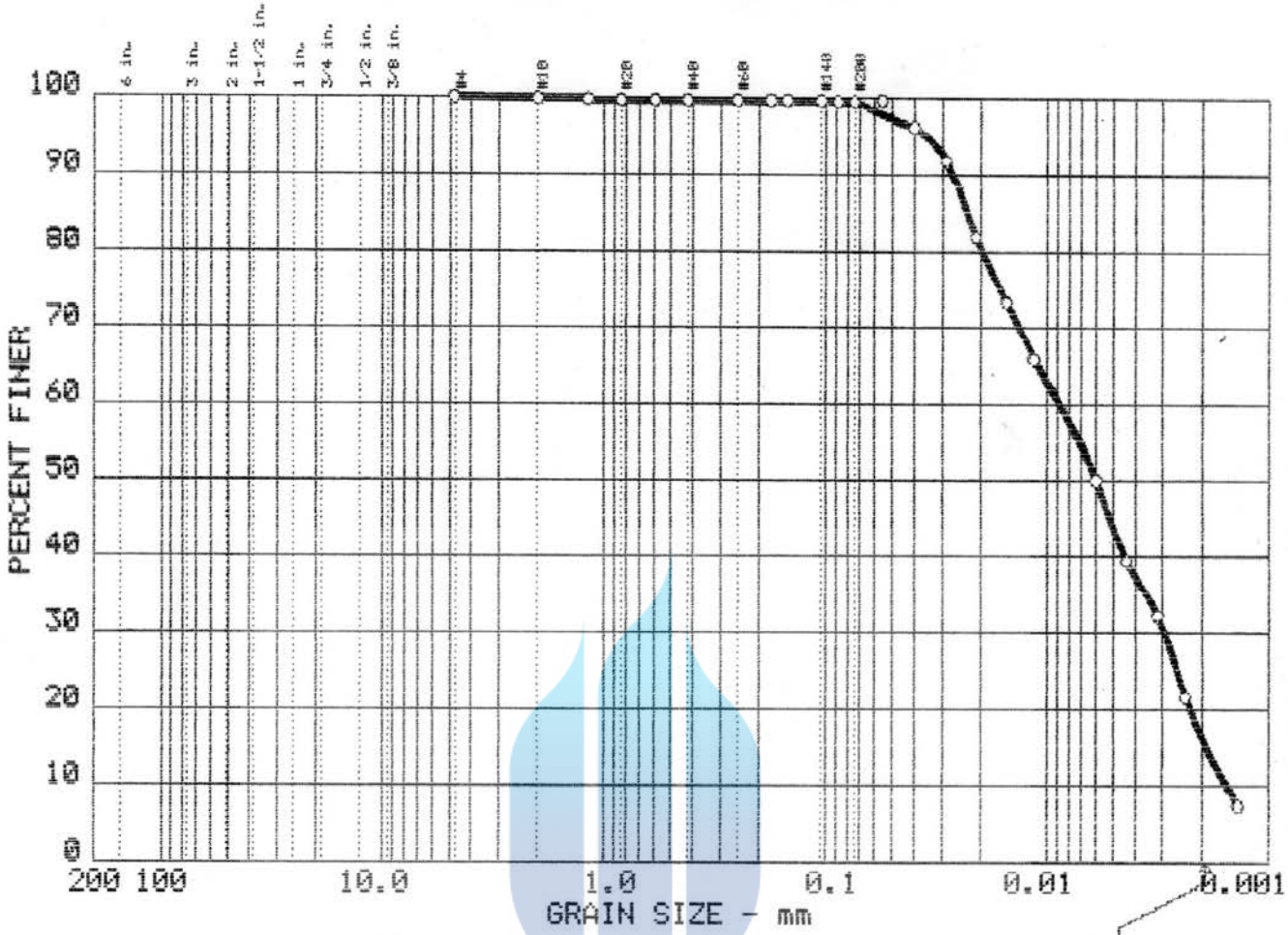
GRAIN SIZE DISTRIBUTION TEST REPORT
PT KONAS TUNGGAL SOIL LABORATORY

Figure No._____

UNIVERSITAS MERCU BUANA

http://digilib.mercubuana.ac.id/

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	17	0.0	0.0	0.5	83.4	16.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	84.00	46.00			0.01	0.003	0.0019	0.0016	0.63	5.6

MATERIAL DESCRIPTION	USCS	AASHTO
○ Brownish gray, Elastic silt.	MH.	A-7-5(57.1)

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
○ Location: DB.1 / 67.50 - 68.00 M.

Date: 20 - 11 - 2012.

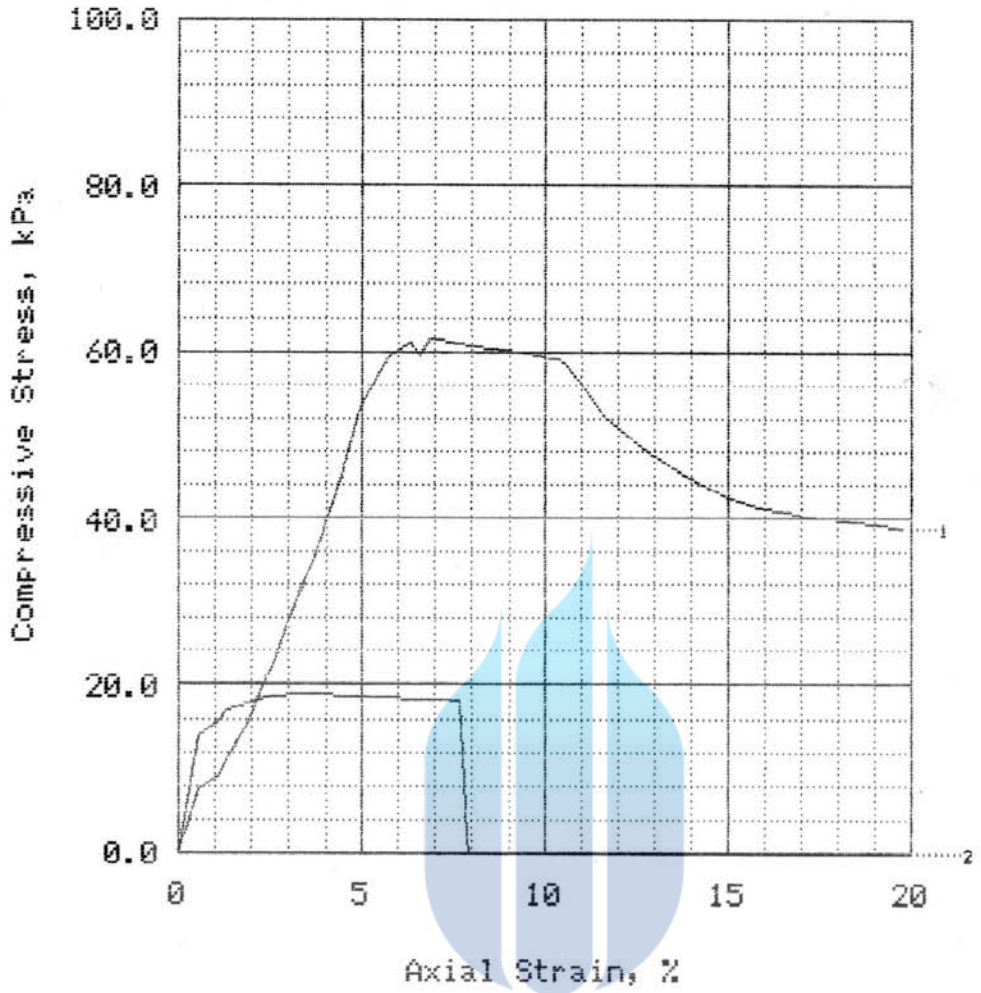
Remarks:
TESTED BY : W. TRIADI.
CHECKED BY : Ir. THEO FN

GRAIN SIZE DISTRIBUTION TEST REPORT
PT KONAS TUNGGAL SOIL LABORATORY

Figure No._____

UNIVERSITAS MERCU BUANA
http://digilib.mercubuana.ac.id/

UNCONFINED COMPRESSION TEST



Sample number:	1	2		
Unconfined strength, kPa	61.6	19.0		
Undrained shear strength, kPa	30.8	9.5		
Strain rate, %/min	0.500	0.500		
Water content, %	82.3	82.3		
Void ratio	2.2031	2.4417		
Saturation, %	98.7	89.0		
Dry density, g/cc	0.8	0.8		
Specimen diameter, cm	3.80	3.80		
Specimen height, cm	7.60	7.60		

Description: BROWN. Elastic silt with sand.

LL = 84.00	PL = 67.00	PI = 17.0	GS = 2.64	Type: UNDISTURBED.

Project No.:
Date: 19 - 11 - 2012
Remarks:
TESTED BY : W. TRIADI.
CHECKED BY : Ir. THEO FN.
NO.1 UNDISTURBED SAMPLE.
NO.2 REMOULDED SAMPLE.
Fig No.

Client: PT. CITRATAMA INTI PERSADA.

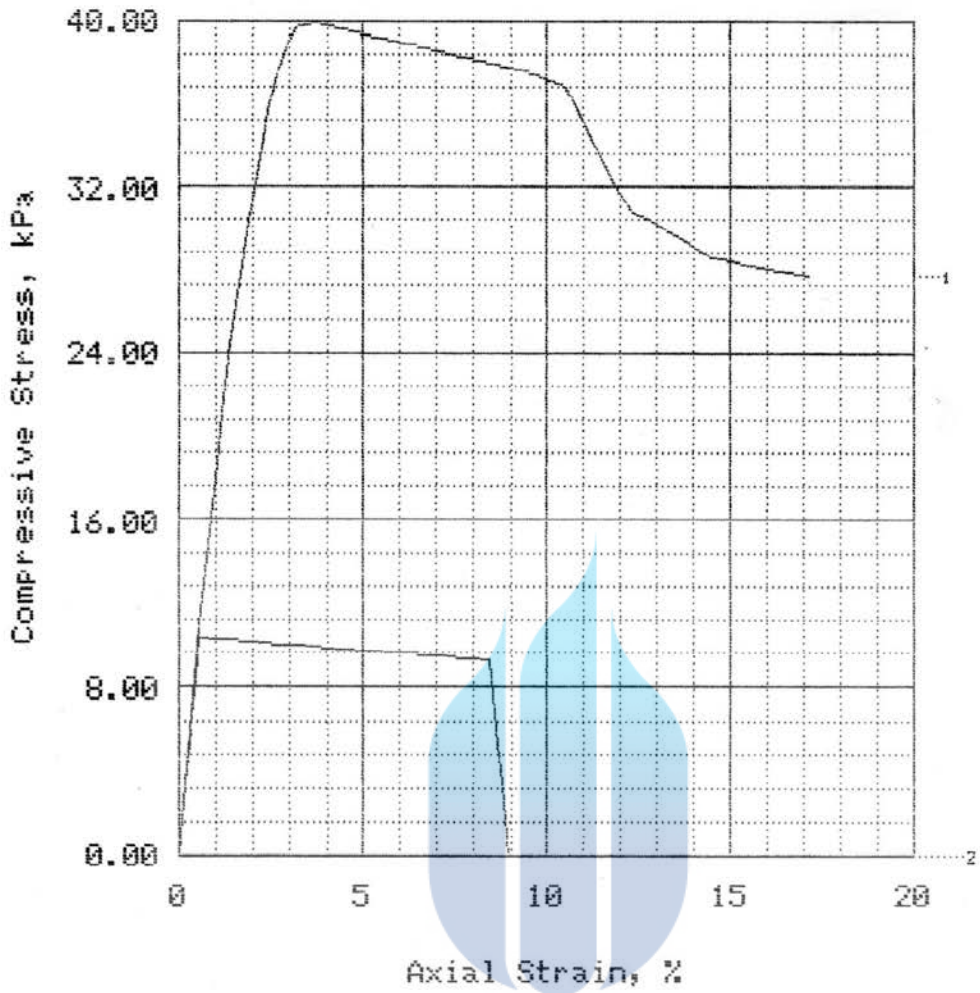
Project: GATOT SUBROTO TOWER.
JAKAARTA.
Location: DB.1
DEPTH : 5.50 - 6.00 M.

UNCONFINED COMPRESSION TEST
PT. KONAS TUNGGAL SOIL LABORATORY

UNIVERSITAS MERCU BUANA

http://digilib.mercubuana.ac.id/

UNCONFINED COMPRESSION TEST



Sample number:	1	2		
Unconfined strength, kPa	39.96	10.33		
Undrained shear strength, kPa	19.98	5.17		
Strain rate, %/min	0.500	0.500		
Water content, %	80.4	80.4		
Void ratio	2.3448	2.8979		
Saturation, %	90.8	73.5		
Dry density, g/cc	0.8	0.7		
Specimen diameter, cm	3.80	3.80		
Specimen height, cm	7.60	7.60		

Description: BROWN. Sandy elastic silt.

LL = 90.00	PL = 65.00	PI = 25.0	GS = 2.65	Type: UNDISTURBED1

Project No.:
Date: 19 - 11 - 2012
Remarks:
TESTED BY : W. TRIADI.
CHECKED BBY : Ir. THEO FN.
NO.1 UNDISTURBED SAMPLE.
NO.2 REMOULDED SAMPLE.
Fig No.

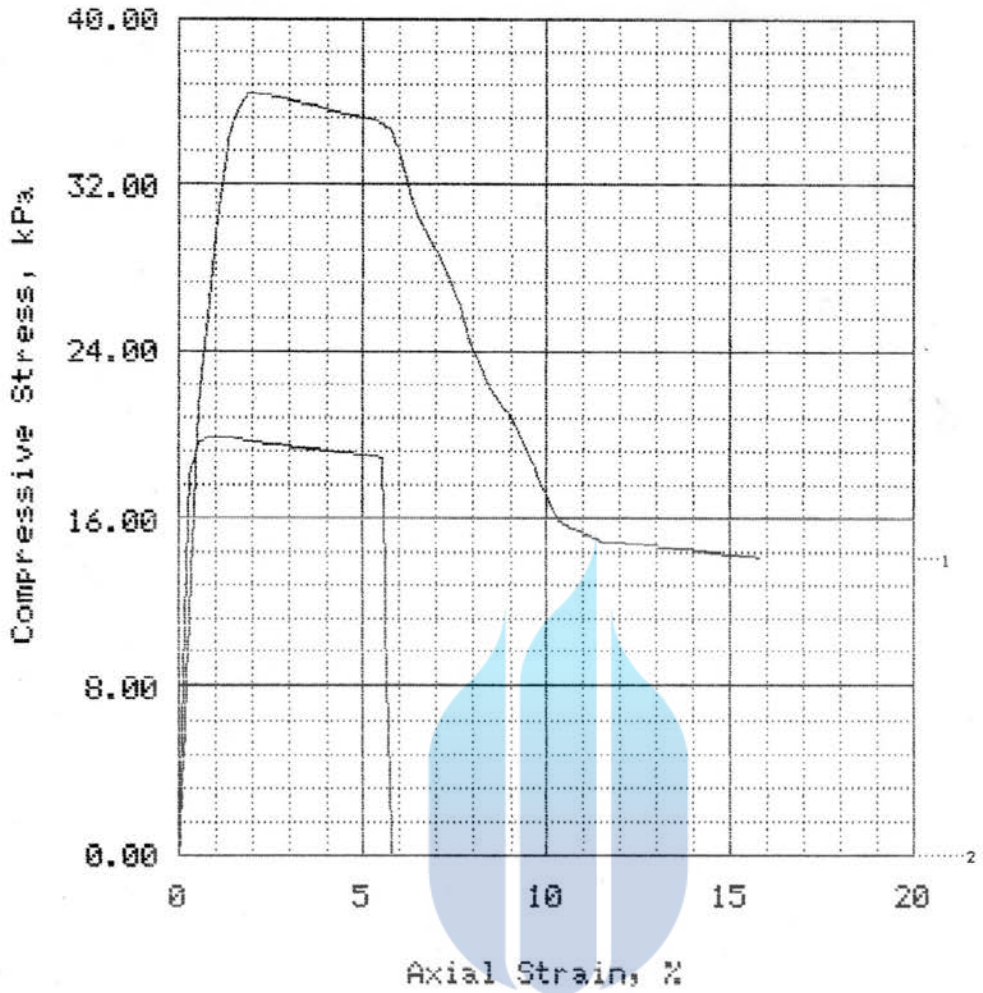
Client: PT. CITRATAMA INTI PERSADA.

Project: GATOT SUBROTO TOWER.
JAKARTA.
Location: DB.1
DEPTH : 10.00 - 10.50 M.

UNCONFINED COMPRESSION TEST
PT. KONAS TUNGGAL SOIL LABORATORY

UNIVERSITAS MERCU BUANA
http://digilib.mercubuana.ac.id/

UNCONFINED COMPRESSION TEST



Sample number:	1	2		
Unconfined strength, kPa	36.32	19.89		
Undrained shear strength, kPa	18.16	9.94		
Strain rate, %/min	0.500	0.500		
Water content, %	75.5	75.5		
Void ratio	2.1457	2.5733		
Saturation, %	93.6	78.1		
Dry density, g/cc	0.8	0.7		
Specimen diameter, cm	3.80	3.80		
Specimen height, cm	7.60	7.60		

Description: Brownish gray. Sandy elastic silt.

LL = 88.00	PL = 63.00	PI = 25.0	GS = 2.66	Type: UNDISTURBED.

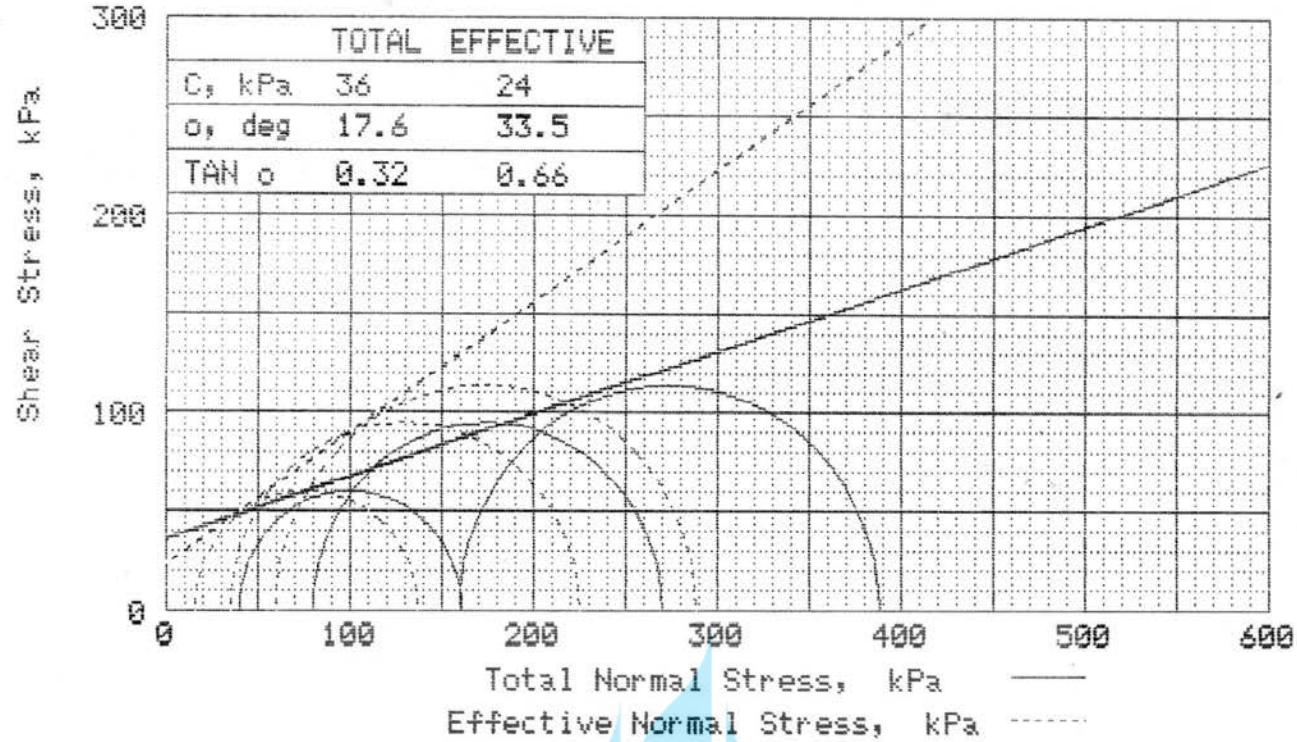
Project No.:
Date: 19 - 11 - 2012
Remarks:
TESTED BY : W. TRIADI.
CHECKED BY : Ir. THEO FN
NO.1 UNDISTURBED SAMPLE.
NO.2 REMOULDED SAMPLE.
Fig No.

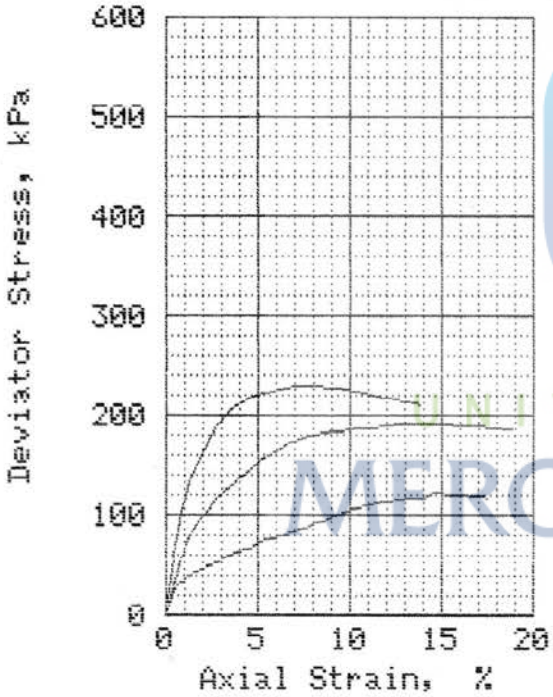
Client: PT. CITRATAMA INTI PERSADA.

Project: GATOT SUBROTO TOWER.
JAKARTA.
Location: DB.1
DEPTH : 16.00 - 16.50 M.

UNCONFINED COMPRESSION TEST
PT. KONAS TUNGGAL SOIL LABORATORY

UNIVERSITAS MERCU BUANA
http://digilib.mercubuana.ac.id/





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	79.0	82.3	83.7
	DRY DENSITY, g/cc	0.8	0.8	0.8
	SATURATION, %	96.4	94.2	96.7
	VOID RATIO	2.164	2.308	2.284
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.60
AT TEST	WATER CONTENT, %	70.0	73.6	64.5
	DRY DENSITY, g/cc	0.9	0.9	1.0
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.848	1.943	1.702
	DIAMETER, cm	3.65	3.63	3.54
	HEIGHT, cm	7.41	7.42	7.21
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190	190	190
CELL PRESSURE, kPa		230	270	350
FAILURE STRESS, kPa		121	190	228
PORE PRESSURE, kPa		214	235	290
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		137	225	288
$\bar{\sigma}_3$ FAILURE, kPa		16	35	60

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDISTURBED.
DESCRIPTION: Brown.
Elastic silt with sand.
LL= 84.00 PL= 67.00 PI=17.0
SPECIFIC GRAVITY= 2.64
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. CITRATAMA INTI PERSADA.

PROJECT: GATOT SUBROTO TOWER.
JAKARTA.
SAMPLE LOCATION: DB.1
DEPTH : 5.50 - 6.00 M.

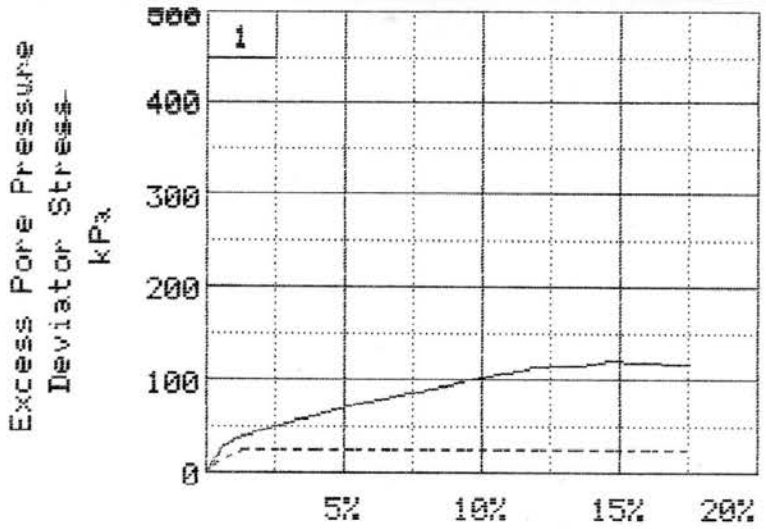
PROJ. NO.: DATE: 15 - 11 - 2012

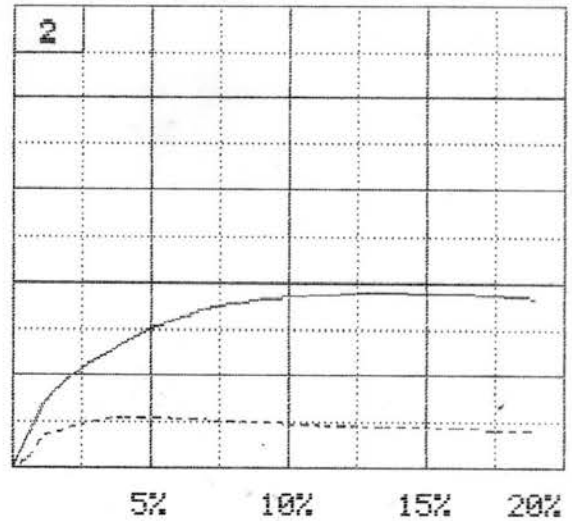
TRIAXIAL SHEAR TEST REPORT

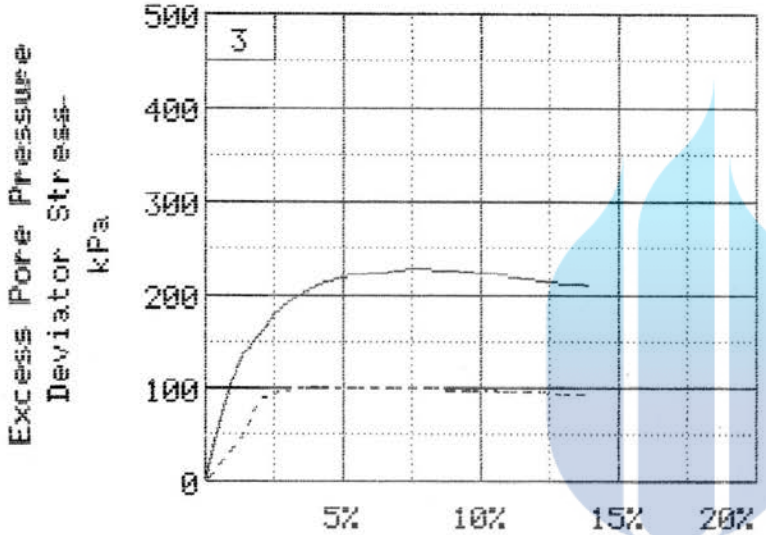
PT. KONAS TUNGGAL SOIL LABORATORY

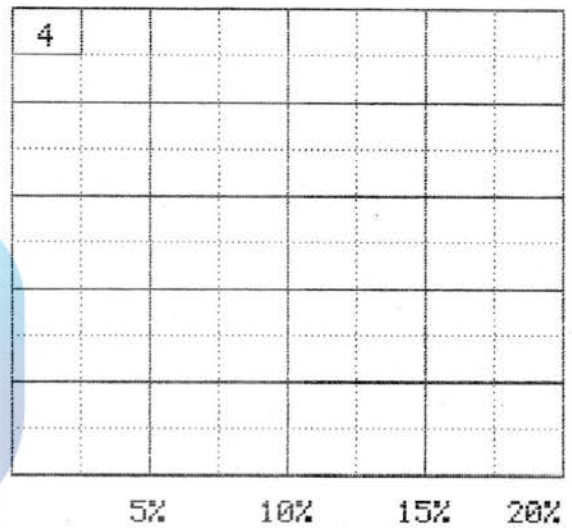
UNIVERSITAS MERCU BUANA

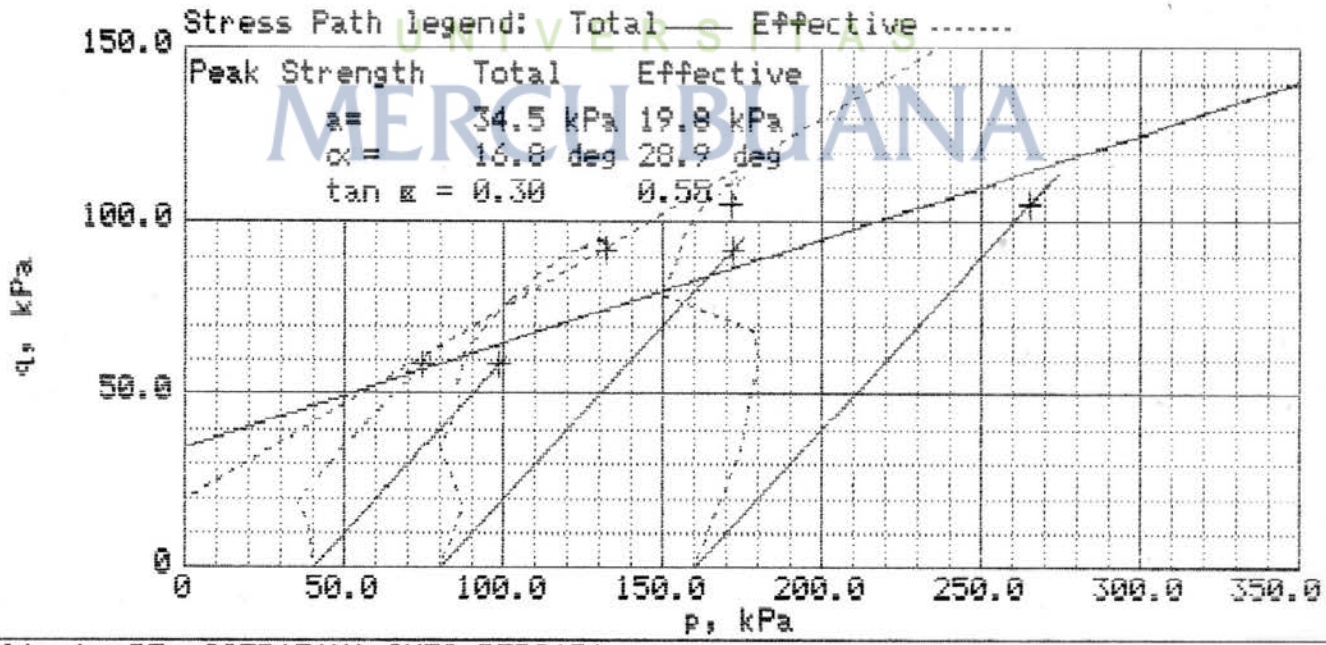
http://digilib.mercubuana.ac.id/











Client: PT. CITRATAMA INTI PERSADA.
Project: GATOT SUBROTO TOWER. JAKARTA.
Location: DB.1 DEPTH : 5.50 - 6.00 M.
File: TXL-0268 Project No.: Page 2/2 Fig. No.____

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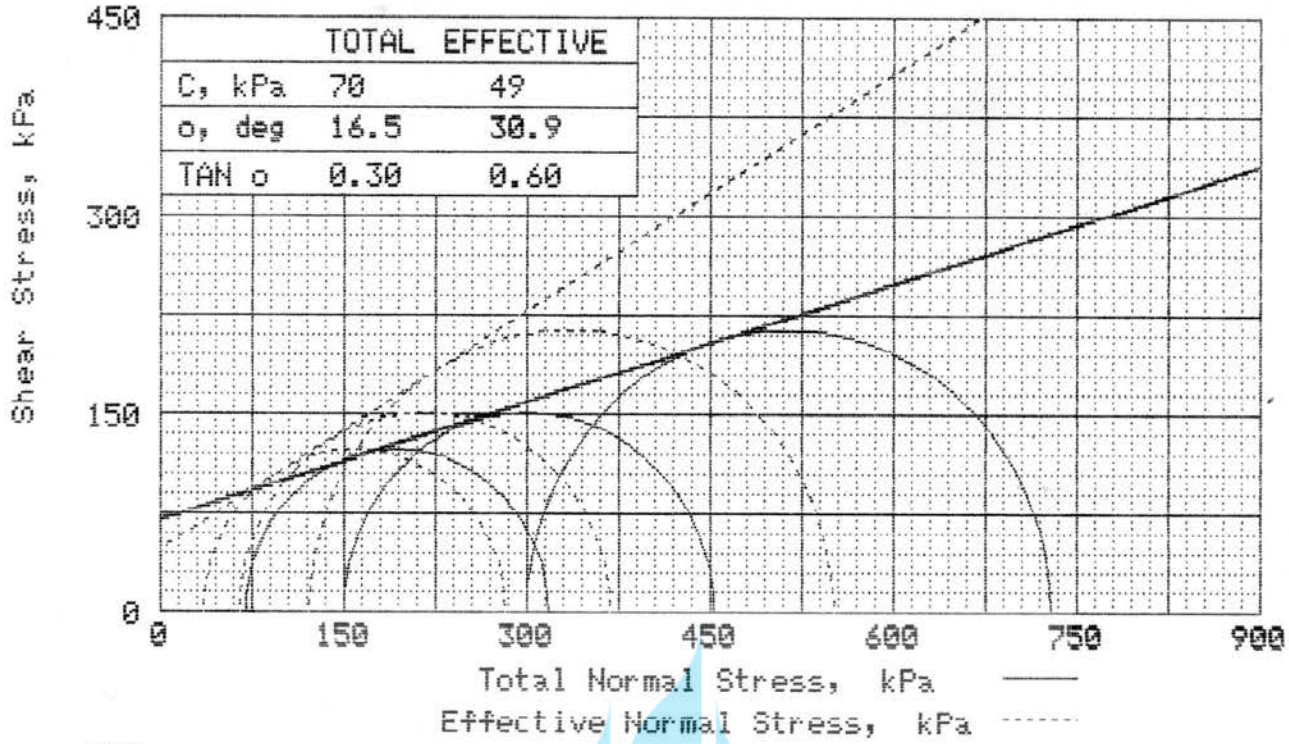

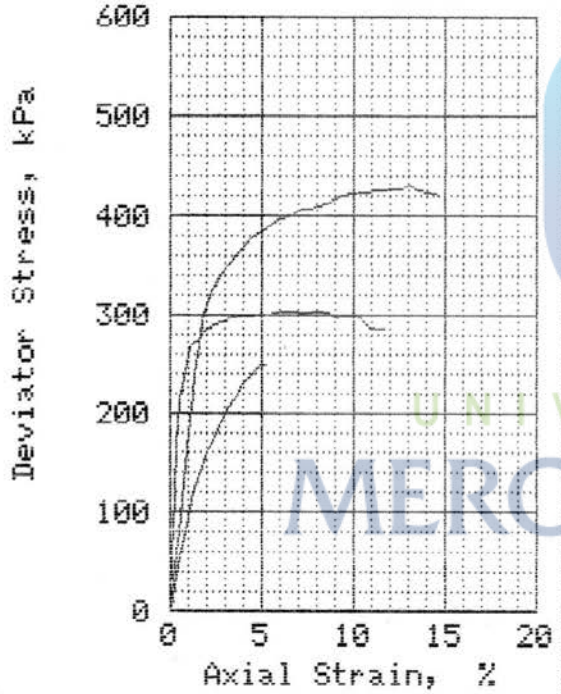

SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	80.4	80.4	83.6
	DRY DENSITY, g/cc	0.8	0.8	0.8
	SATURATION, %	95.2	95.2	98.2
	VOID RATIO	2.238	2.238	2.255
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.60
AT TEST	WATER CONTENT, %	81.1	76.1	77.0
	DRY DENSITY, g/cc	0.8	0.9	0.9
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	2.149	2.017	2.040
	DIAMETER, cm	3.74	3.78	3.71
	HEIGHT, cm	7.61	7.16	7.46
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190	190	190
CELL PRESSURE, kPa		260	340	490
FAILURE STRESS, kPa		248	303	430
PORE PRESSURE, kPa		225	275	368
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		283	368	552
$\bar{\sigma}_3$ FAILURE, kPa		35	65	122

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDITURBED.
DESCRIPTION: Brown.
Sandy elastic silt.
LL= 90.00 PL= 65.00 PI=25.0
SPECIFIC GRAVITY= 2.65
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. CITRATAMA INTI PERSADA.

PROJECT: GATOT SUBROTO TOWER.
JAKARTA.
SAMPLE LOCATION: DB.1
DEPTH : 10.00 - 10.50 M.

PROJ. NO.: DATE: 17 - 11 - 2012

TRIAXIAL SHEAR TEST REPORT

PT. KONAS TUNGGAL SOIL LABORATORY

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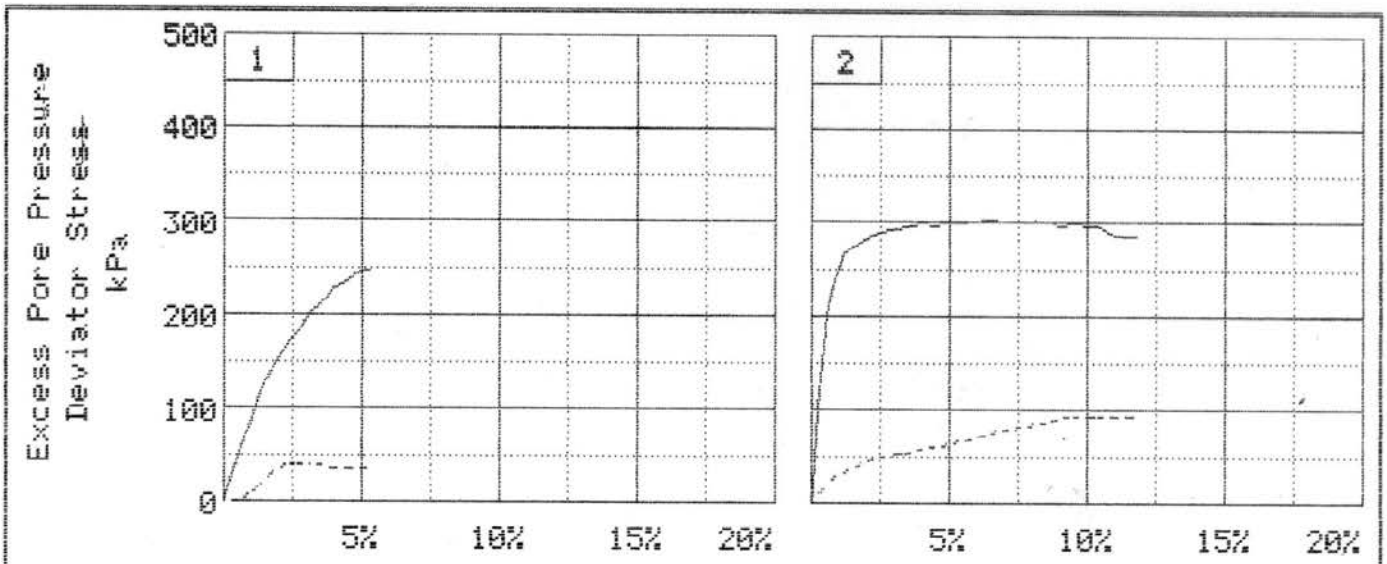

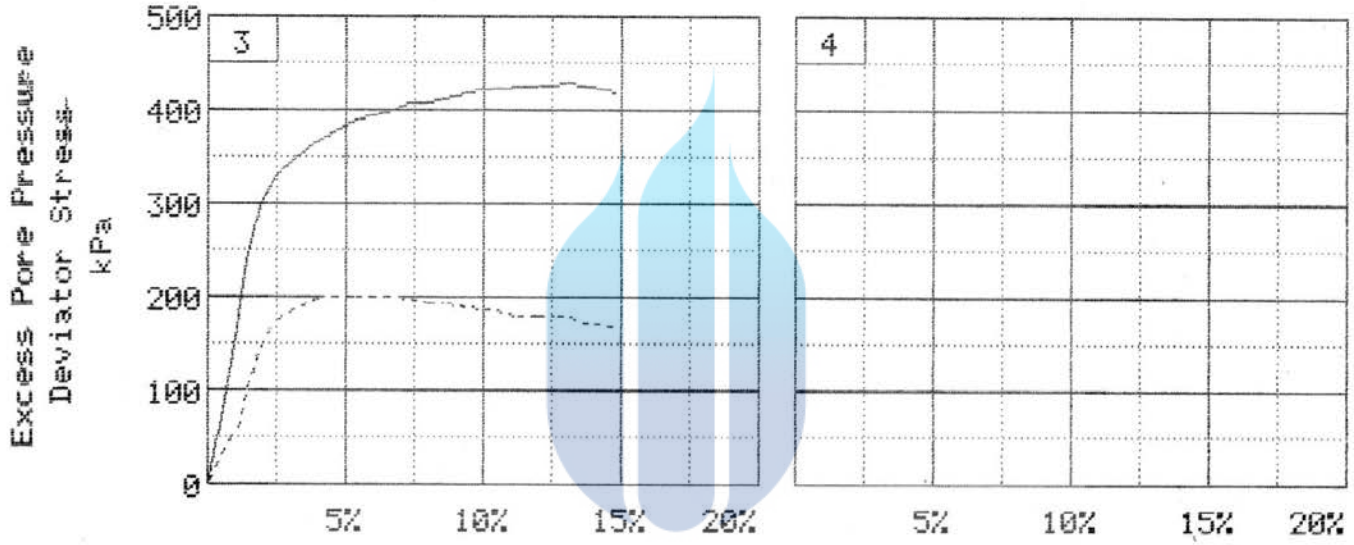

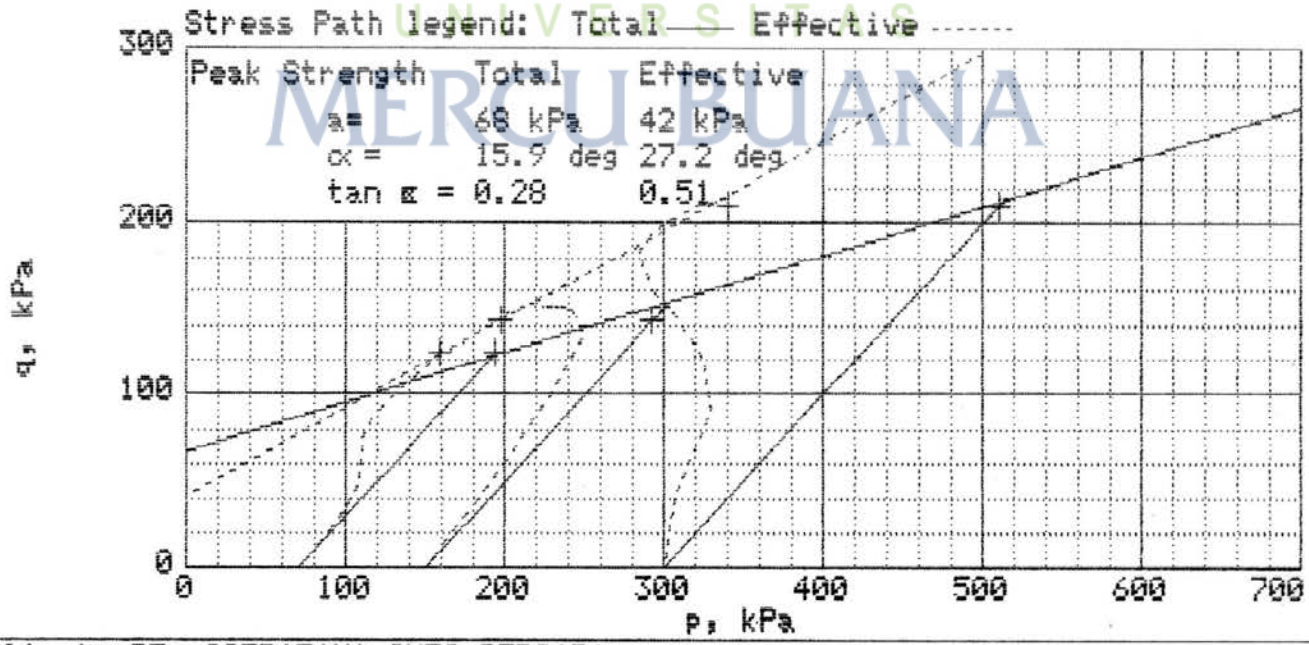

Client: PT. CITRATAMA INTI PERSADA.
Project: GATOT SUBROTO TOWER. JAKARTA.
Location: DB.1 DEPTH : 10.00 - 10.50 M.
File: TXL-0269 Project No.: Page 2/2 Fig. No.____

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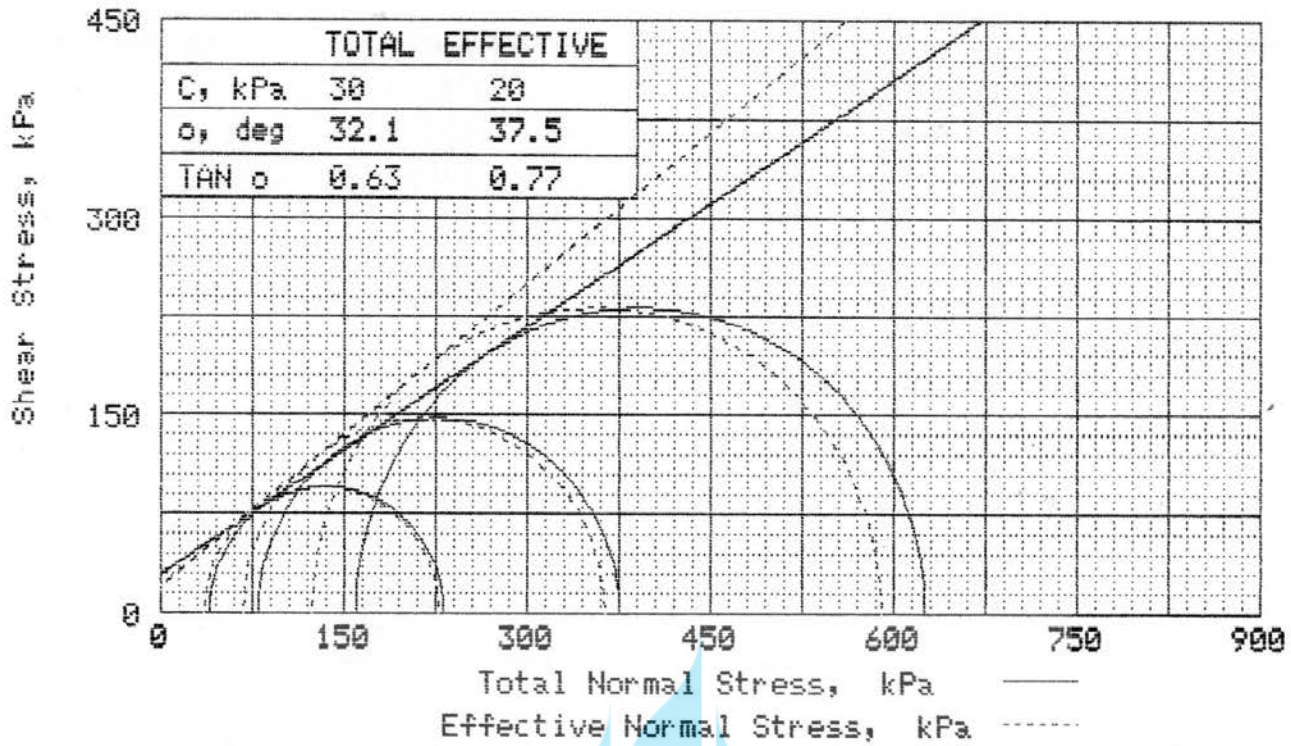

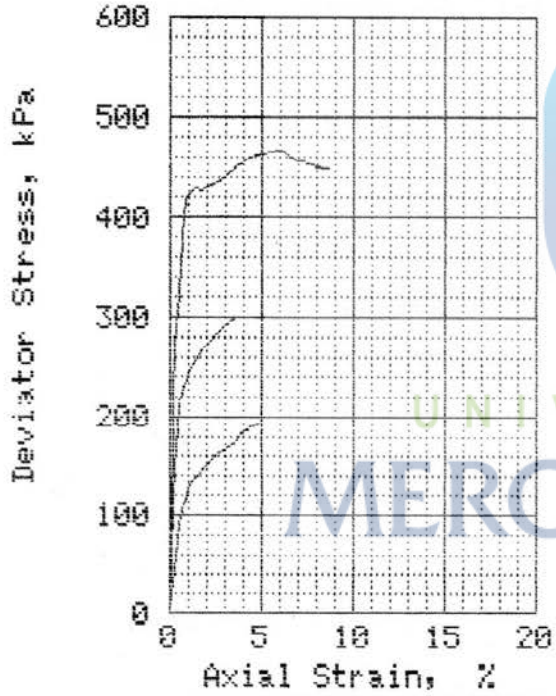

SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	75.5	75.5	75.5
	DRY DENSITY, g/cc	0.9	0.9	0.9
	SATURATION, %	95.7	95.7	95.7
	VOID RATIO	2.100	2.100	2.100
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.60
AT TEST	WATER CONTENT, %	84.3	80.0	77.4
	DRY DENSITY, g/cc	0.8	0.9	0.9
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	2.243	2.128	2.060
	DIAMETER, cm	3.84	3.88	3.89
	HEIGHT, cm	7.79	7.35	7.16
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190	190	190
CELL PRESSURE, kPa		230	270	350
FAILURE STRESS, kPa		192	296	466
PORE PRESSURE, kPa		194	202	226
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		228	364	590
$\bar{\sigma}_3$ FAILURE, kPa		36	68	124

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDISTURBED.
DESCRIPTION: Brownish gray.
Sandy elastic silt.
LL= 88.00 PL= 63.00 PI=25.0
SPECIFIC GRAVITY= 2.66
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. CITRATAMA INTI PERSADA.

PROJECT: GATOT SUBROTO TOWER.
JAKARTA.
SAMPLE LOCATION: DB.1
DEPTH : 16.00 - 16.50 M.

PROJ. NO.: DATE: 22 - 11 - 2012

TRIAXIAL SHEAR TEST REPORT

PT. KONAS TUNGGAL SOIL LABORATORY

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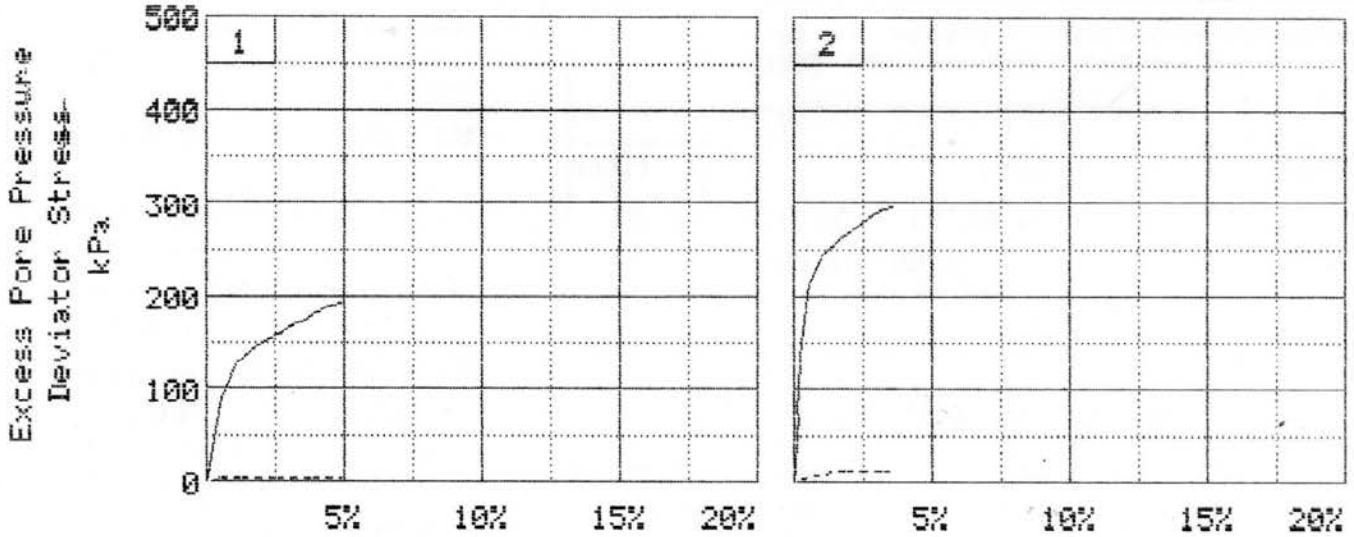

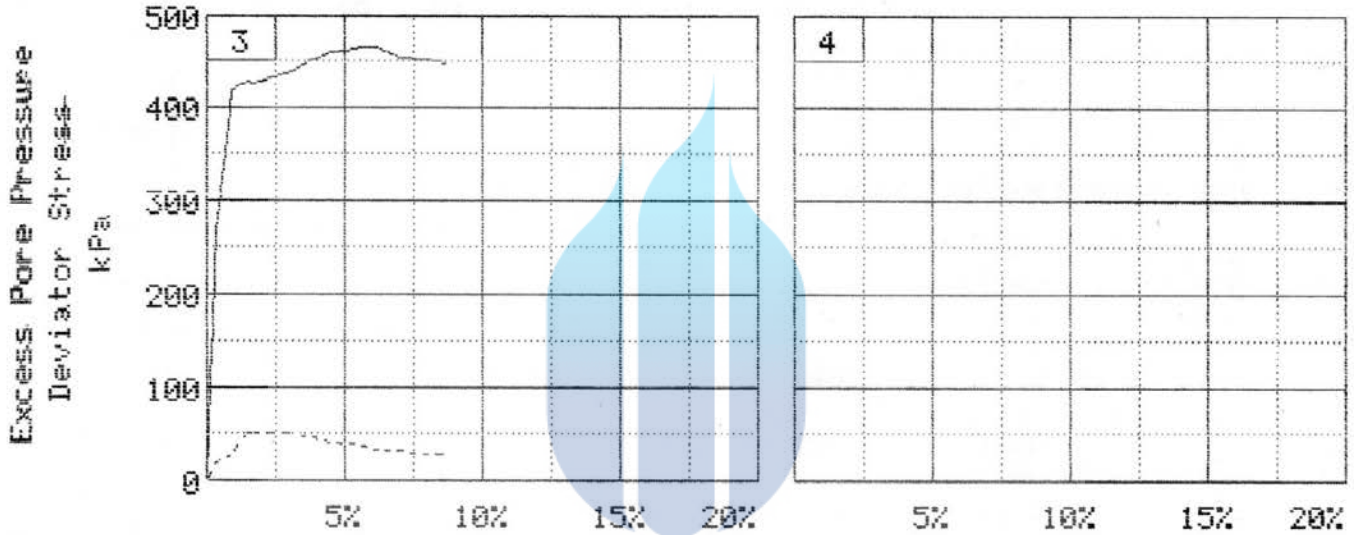

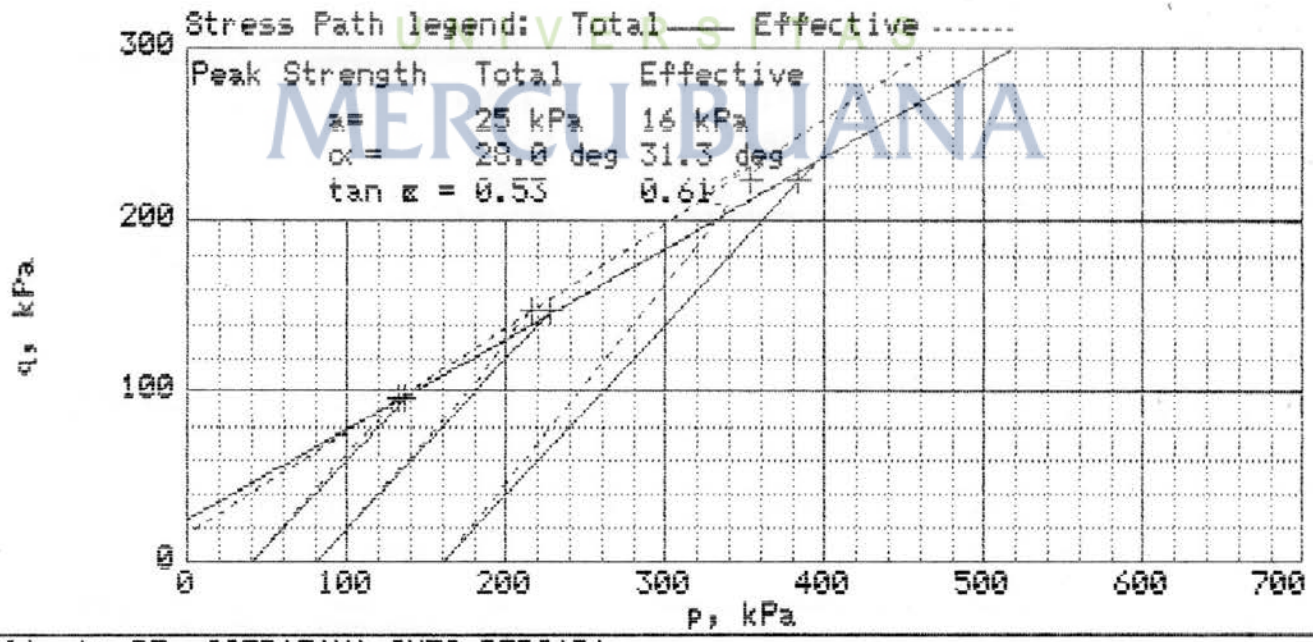

Client: PT. CITRATAMA INTI PERSADA.
Project: GATOT SUBROTO TOWER. JAKARTA.
Location: DB.1 DEPTH : 16.00 - 16.50 M.
File: TXL-0272 Project No.: Page 2/2 Fig. No.____

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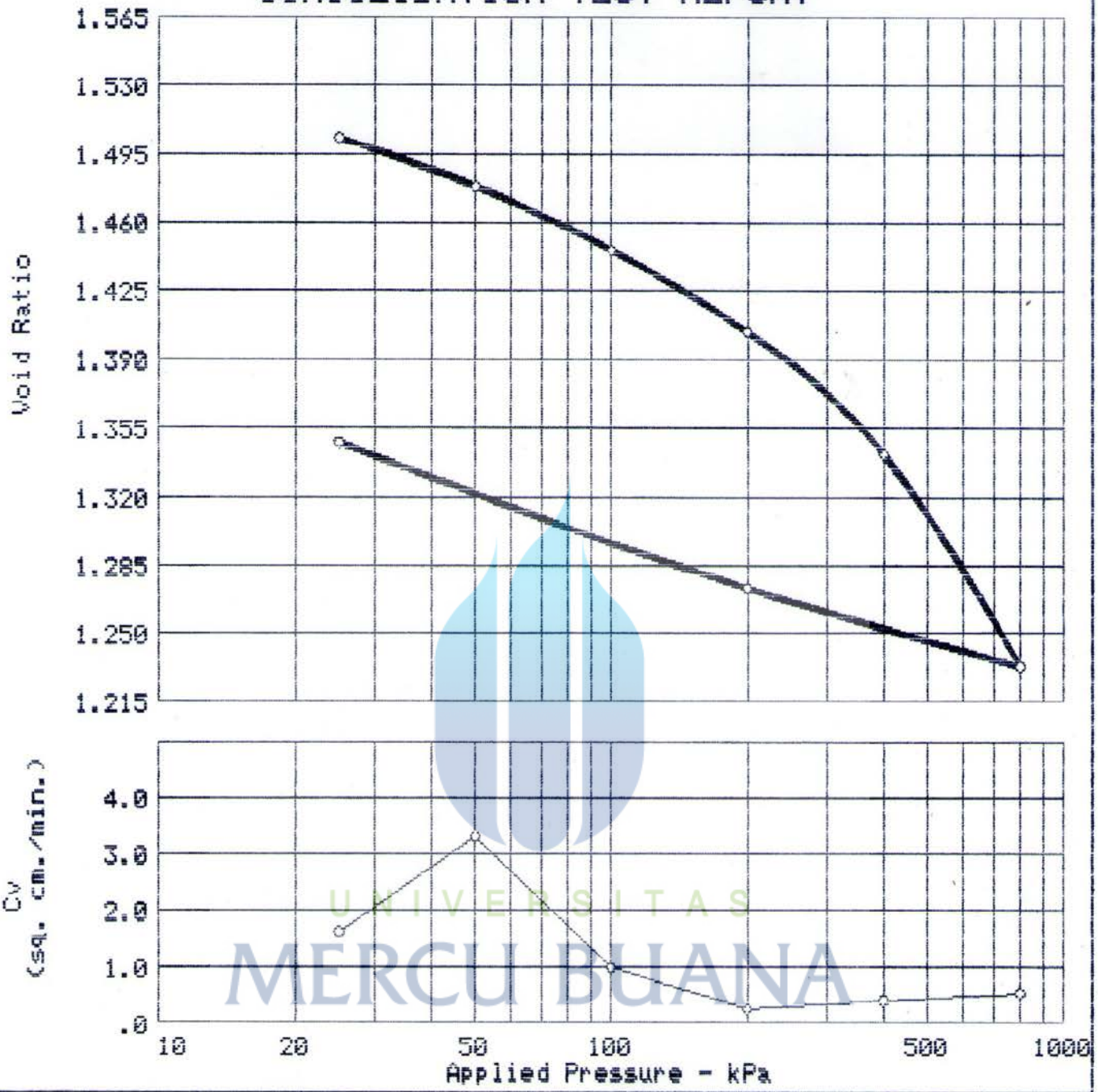
CONSOLIDATION TEST REPORT



Swell press.	Nat. Sat.	Nat. Moist.	Dry Density	LL	PI	Sp.Gr.	Precons. press.	C_c	e_o
	99.5 %	56.5	1095.7	101.00	50.00	2.65	431.31	0.36	1.5058

TEST RESULTS	MATERIAL DESCRIPTION
Compression Index = 0.36	Greyish brown. Elastic silt with sand. Class: MH.
Project No.: Project: GATOT SUBROTO TOWER JAKARTA. Location: DB.1 DEPTH : 28.00 - 28.50 M. Date: 14 - 11 - 2012	Remarks: TESTED BY : W. TRIADI. CHECKED BY : Ir.THEO FN
CONSOLIDATION TEST REPORT PT KONAS TUNGGAL, JLN GAJAHLUMANTUNG 7, BANDUNG	UNDISTURBED. Fig. No. 5

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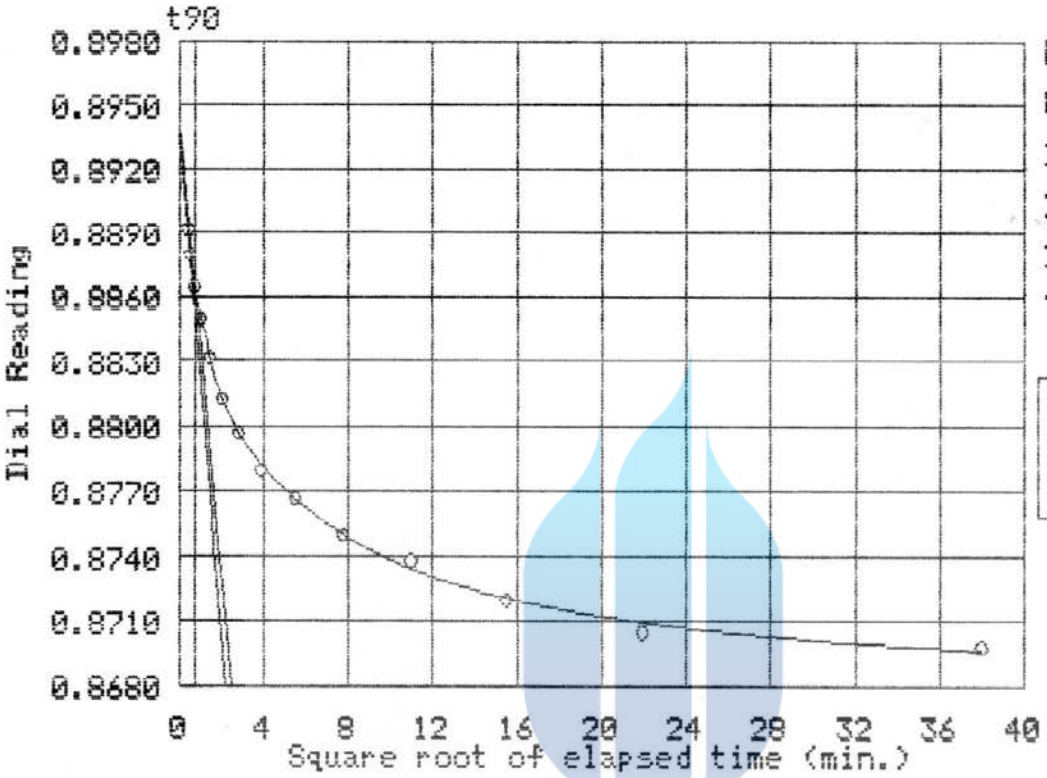
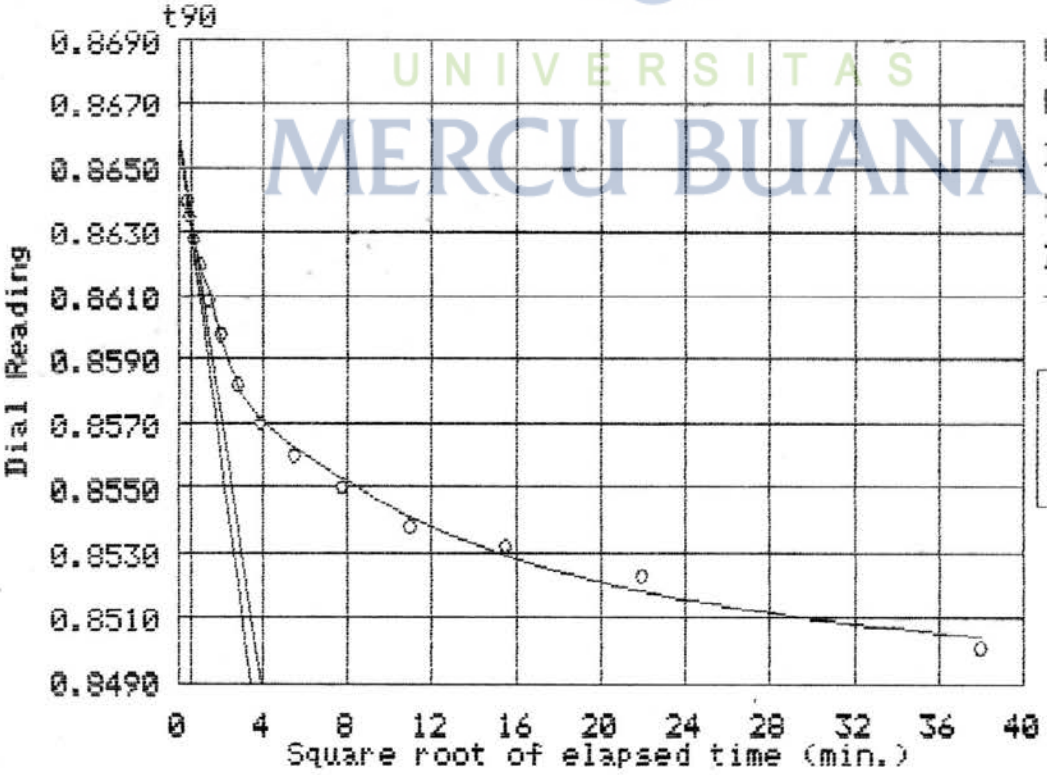
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 28.00 - 28.50 M.
Date: 14 - 11 - 2012



Load No.= 1
Load= 25.00 kPa
D_0 = 0.8940
D_{90} = 0.8864
D_{100}= 0.8855
T_{90}= 0.53 min.

C_v @ T_{90} =
1.61 $cm^2/min.$



Load No.= 2
Load= 50.00 kPa
D_0 = 0.8660
D_{90} = 0.8633
D_{100}= 0.8630
T_{90}= 0.25 min.

C_v @ T_{90} =
3.32 $cm^2/min.$

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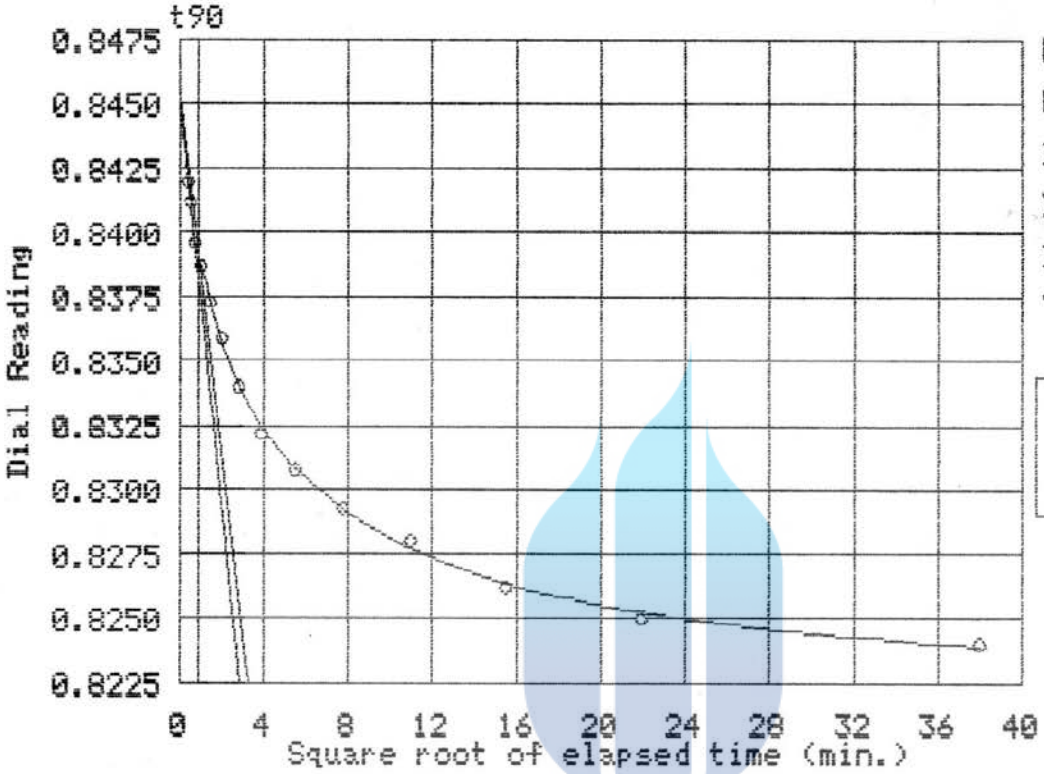
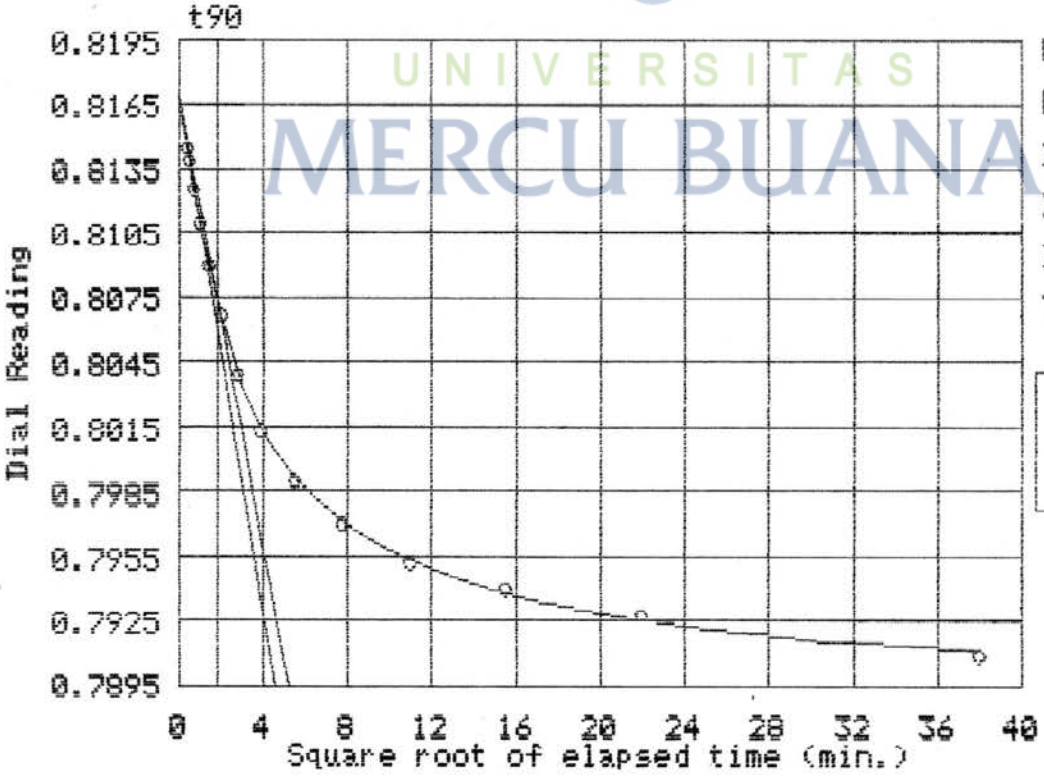
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 28.00 - 28.50 M.
Date: 14 - 11 - 2012



Load No.= 3
Load= 100.00 kPa
D_0 = 0.8452
D_{90} = 0.8389
D_{100}= 0.8381
T_{90}= 0.83 min.

C_v @ T_{90} =
0.98 cm^2/min.



Load No.= 4
Load= 200.00 kPa
D_0 = 0.8169
D_{90} = 0.8075
D_{100}= 0.8064
T_{90}= 3.27 min.

C_v @ T_{90} =
0.24 cm^2/min.

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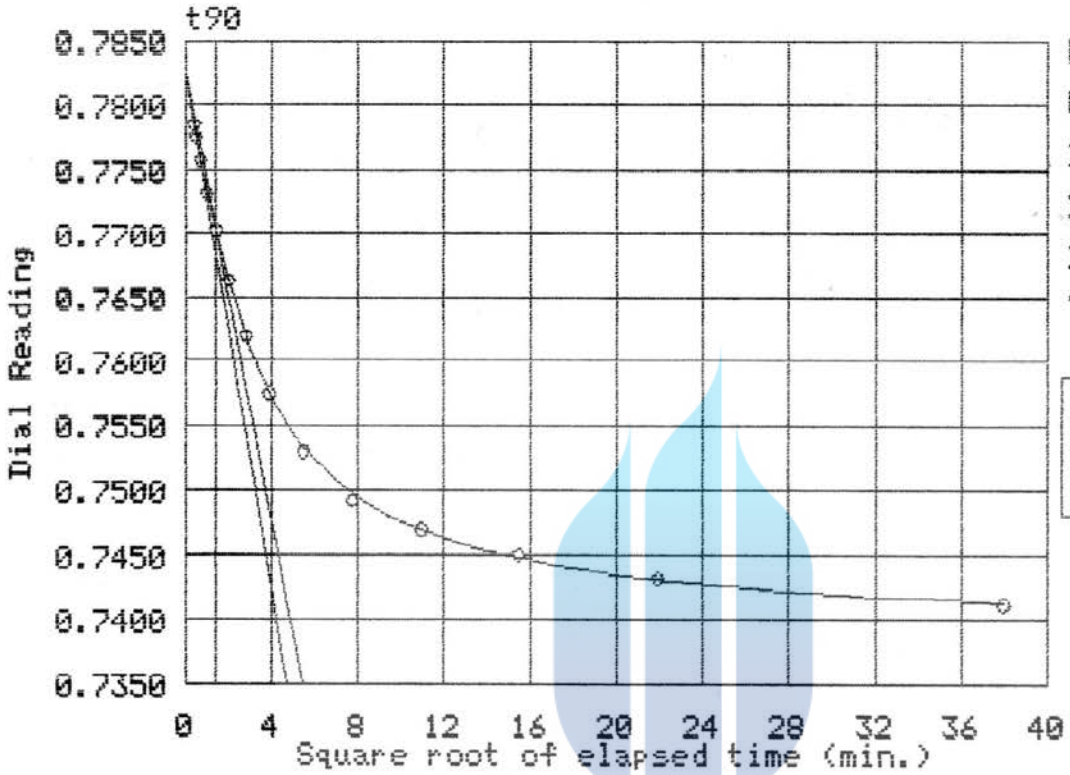
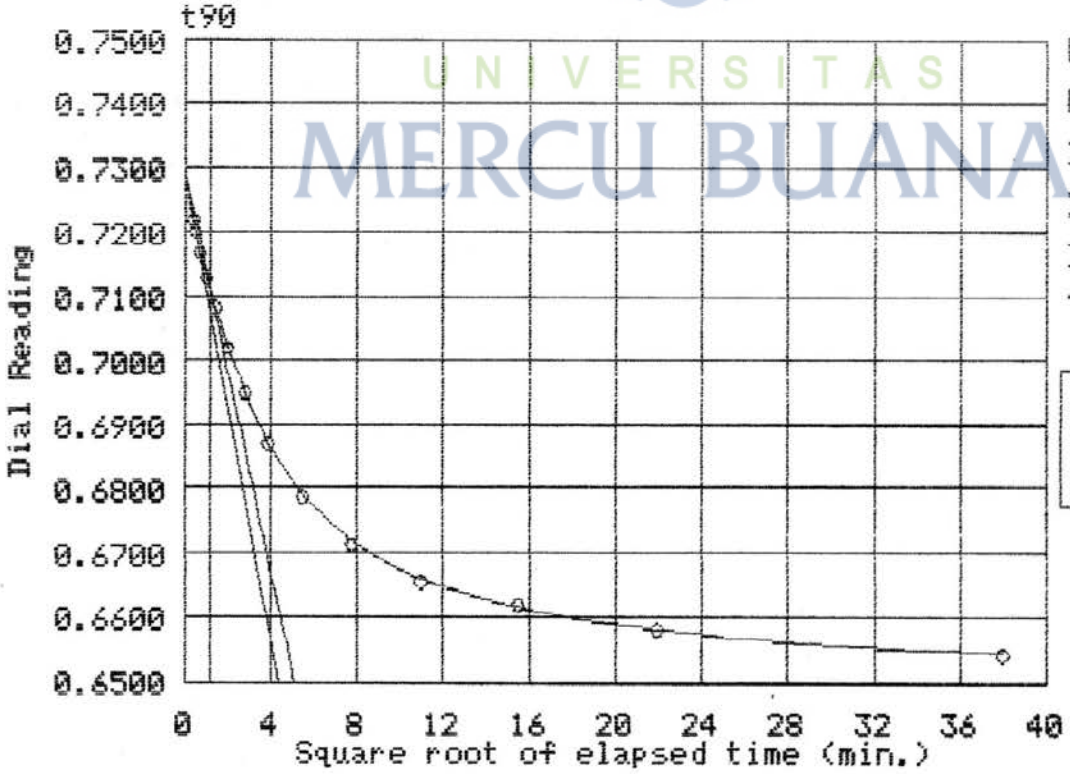
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 28.00 - 28.50 M.
Date: 14 - 11 - 2012



Load No.= 5
Load= 400.00 kPa
D_0 = 0.7826
D_{90} = 0.7705
D_{100}= 0.7692
T_{90}= 1.93 min.

C_v @ T_{90} =
0.39 $cm.^2/min.$



Load No.= 6
Load= 800.00 kPa
D_0 = 0.7292
D_{90} = 0.7110
D_{100}= 0.7090
T_{90}= 1.35 min.

C_v @ T_{90} =
0.52 $cm.^2/min.$

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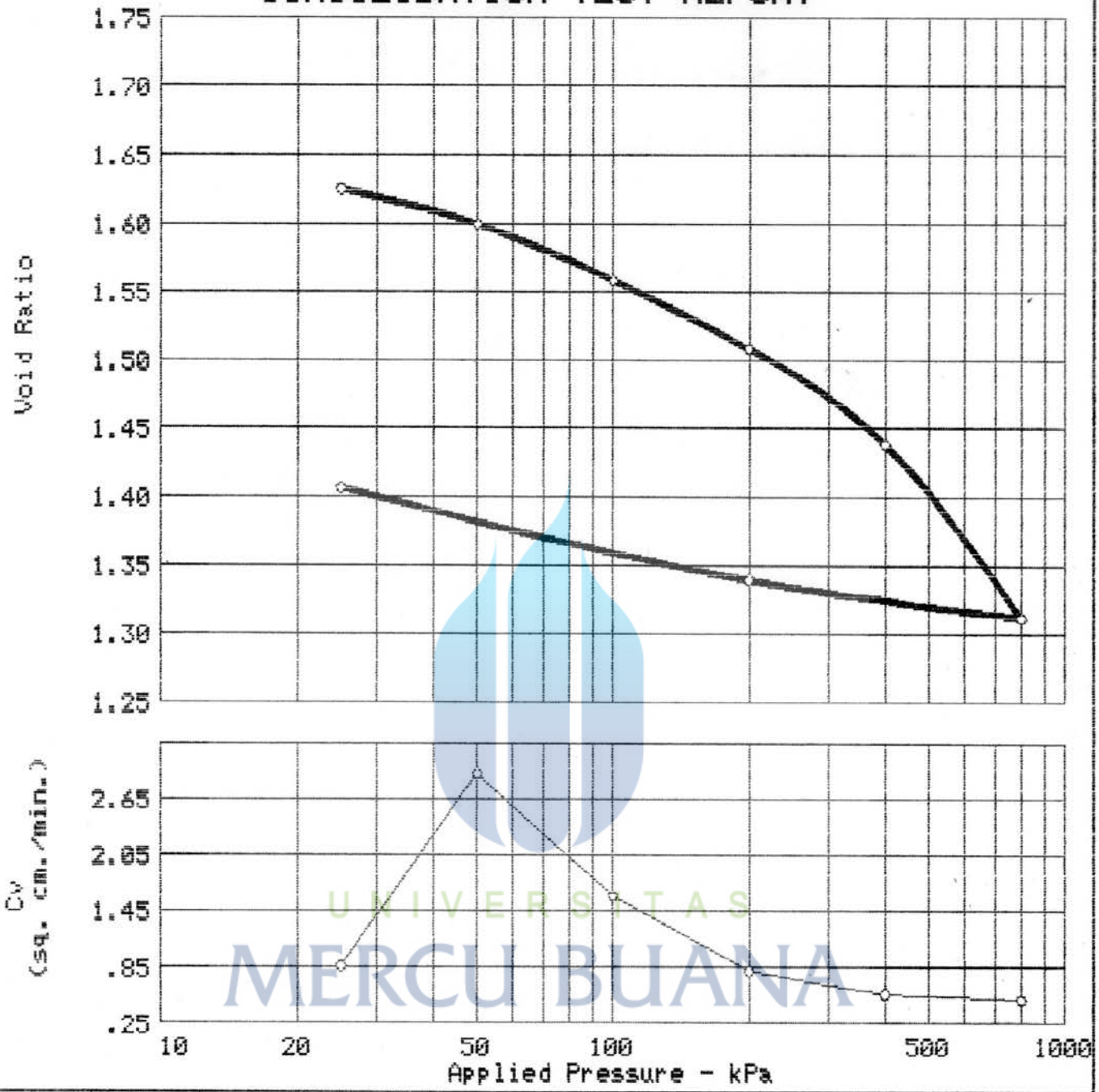
CONSOLIDATION TEST REPORT



Swell press.	Nat. Sat.	Nat. Moist.	Dry Density	LL	PI	Sp.Gr.	Precons. press.	C_c	e_o
	90.0 %	56.2	1007.9	65.00	14.00	2.66	430.68	0.42	1.6613

TEST RESULTS	MATERIAL DESCRIPTION
Compression Index = 0.42	Yellowish brown. Sandy elastic silt. Class: MH.
Project No.: Project: GATOT SUBROTO TOWER JAKARTA. Location: DB.1 DEPTH : 43.00 - 43.50 M. Date: 14 - 11 - 2012	Remarks: TESTED BY : W. TRIADI. CHECKED BY : Ir.THEO FN
CONSOLIDATION TEST REPORT PT KONAS TUNGGAL, JLN GAJAHLUMANTUNG 7, BANDUNG	UNDISTURBED. Fig. No. 6

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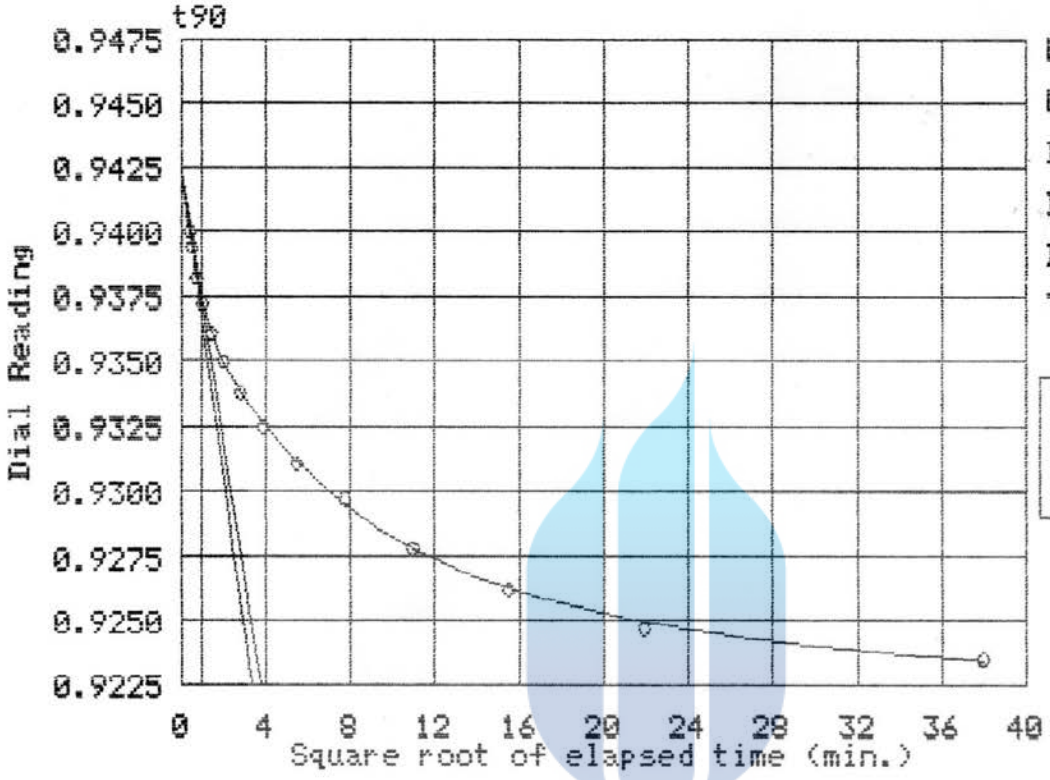
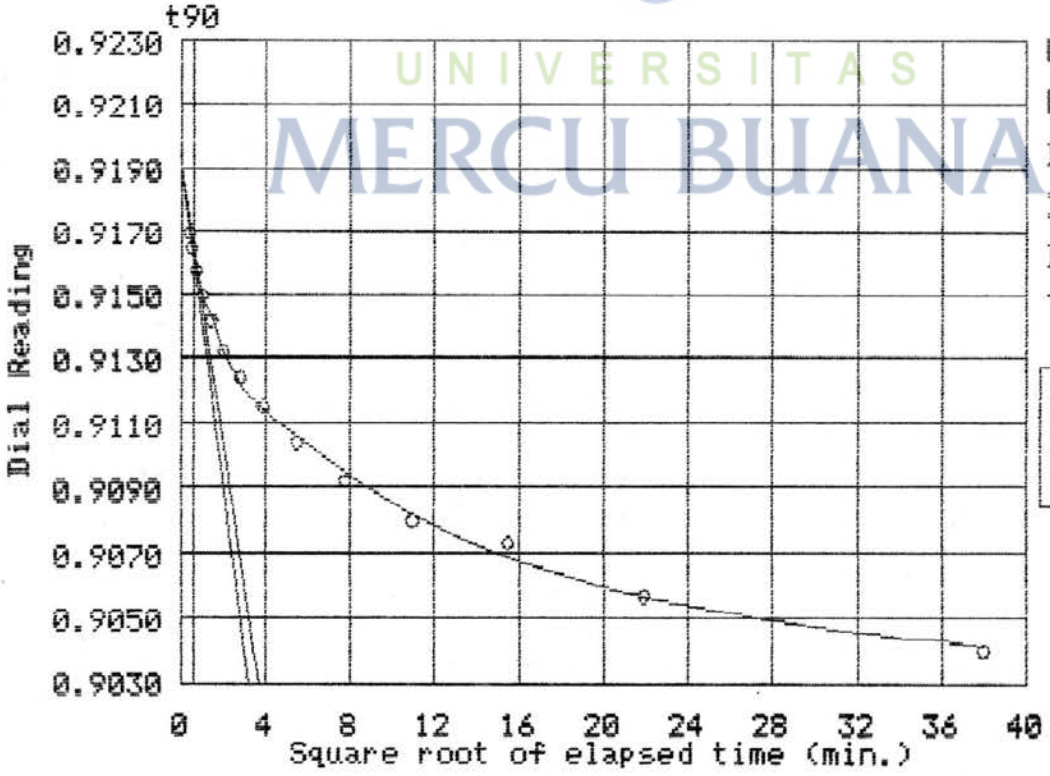
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 43.00 - 43.50 M.
Date: 14 - 11 - 2012



Load No.= 1
Load= 25.00 kPa
D_0 = 0.9424
D_{90} = 0.9372
D_{100}= 0.9367
T_{90}= 0.98 min.

C_v @ T_{90} =
0.86 cm^2/min.



Load No.= 2
Load= 50.00 kPa
D_0 = 0.9190
D_{90} = 0.9162
D_{100}= 0.9159
T_{90}= 0.28 min.

C_v @ T_{90} =
2.93 cm^2/min.

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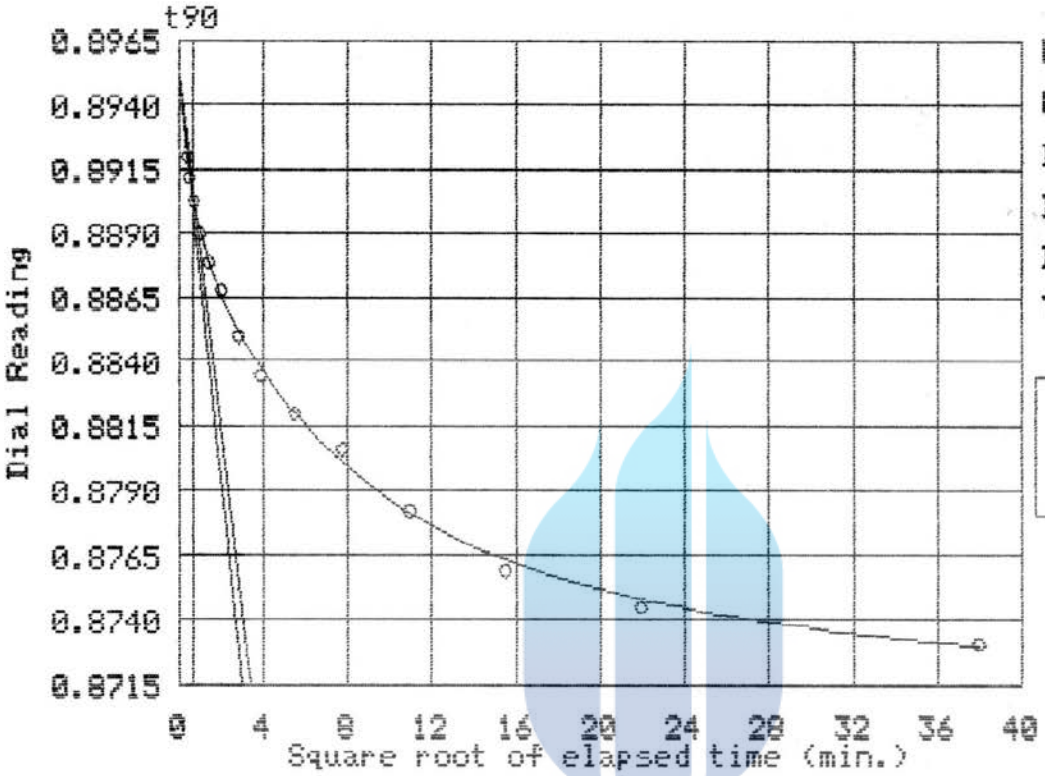
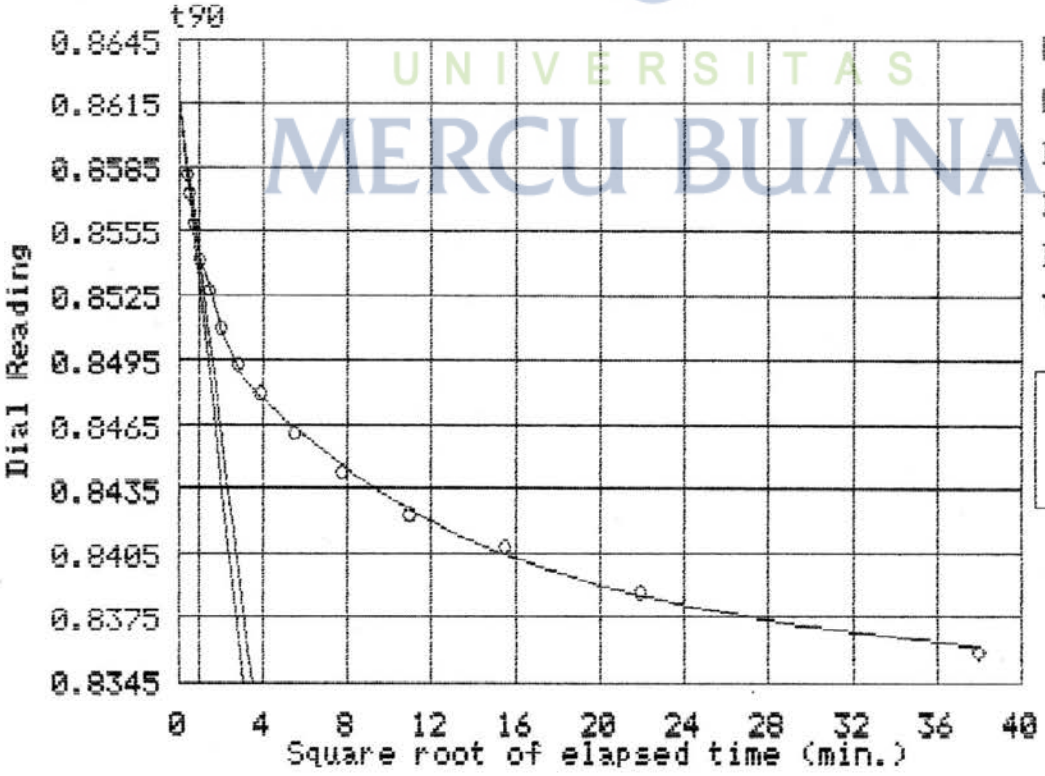
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 43.00 - 43.50 M.
Date: 14 - 11 - 2012



Load No.= 3
Load= 100.00 kPa
D_0 = 0.8952
D_{90} = 0.8903
D_{100}= 0.8898
T_{90}= 0.50 min.

C_v @ T_{90} =
1.61 $cm^2/min.$



Load No.= 4
Load= 200.00 kPa
D_0 = 0.8618
D_{90} = 0.8541
D_{100}= 0.8533
T_{90}= 0.96 min.

C_v @ T_{90} =
0.80 $cm^2/min.$

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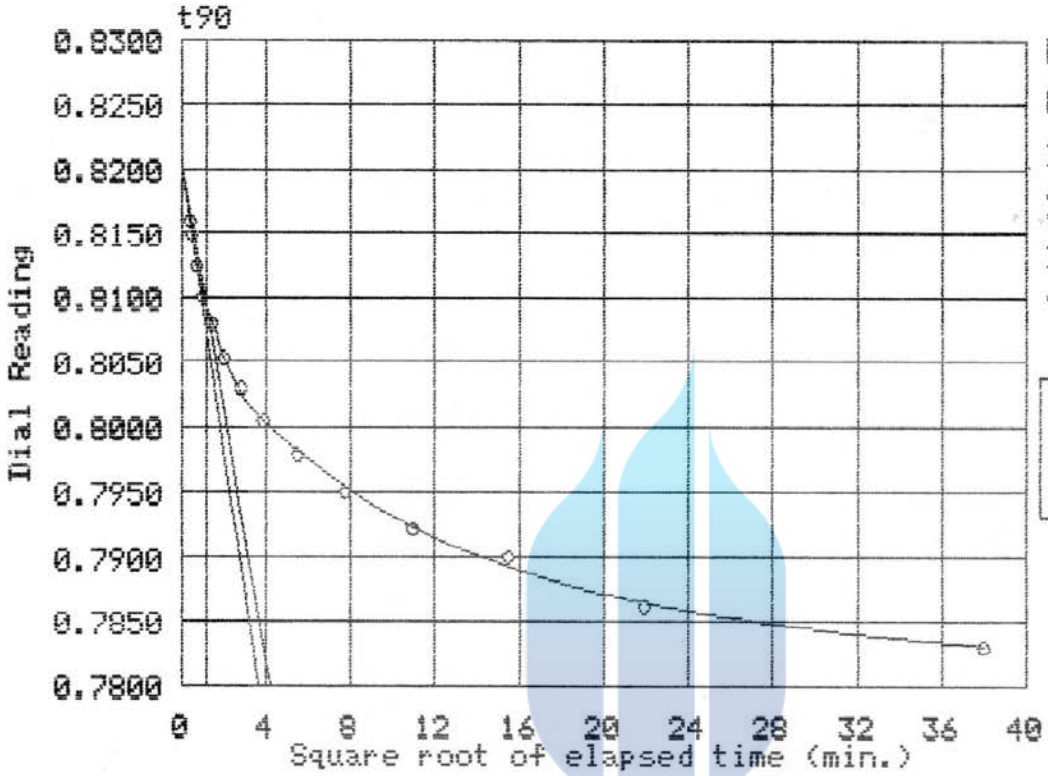
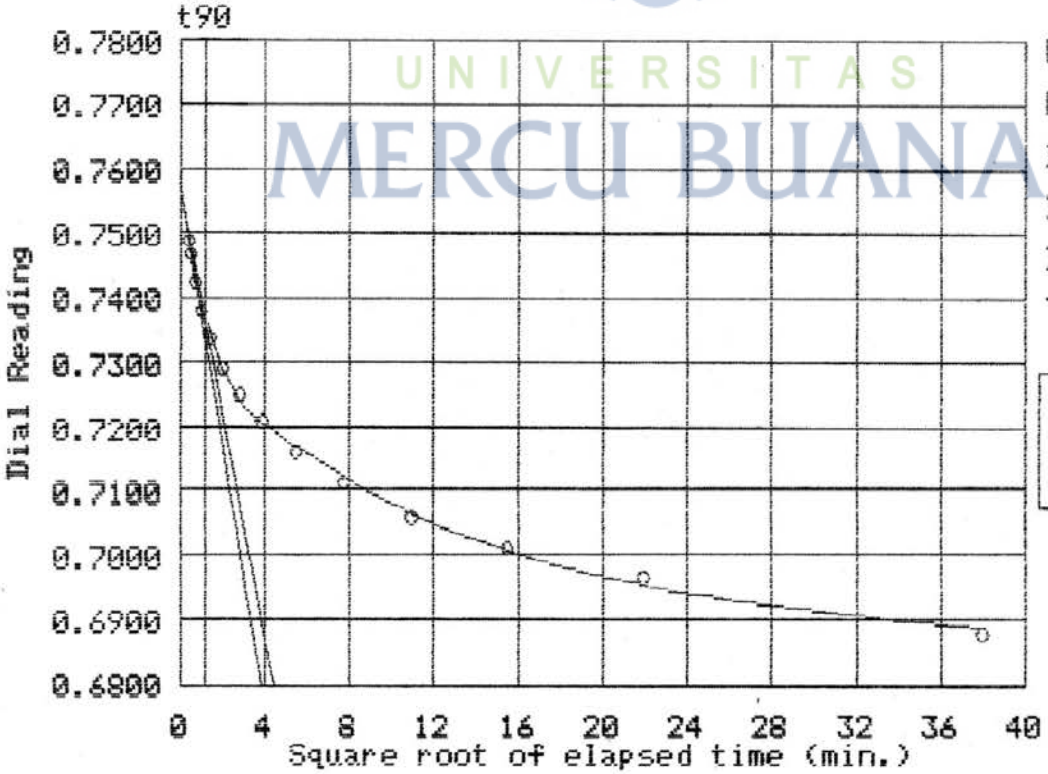
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 43.00 - 43.50 M.
Date: 14 - 11 - 2012



Load No.= 5
Load= 400.00 kPa
D_0 = 0.8204
D_{90} = 0.8094
D_{100}= 0.8082
T_{90}= 1.32 min.

C_v @ T_{90} =
0.56 cm^2/min.



Load No.= 6
Load= 800.00 kPa
D_0 = 0.7570
D_{90} = 0.7367
D_{100}= 0.7344
T_{90}= 1.36 min.

C_v @ T_{90} =
0.50 cm^2/min.

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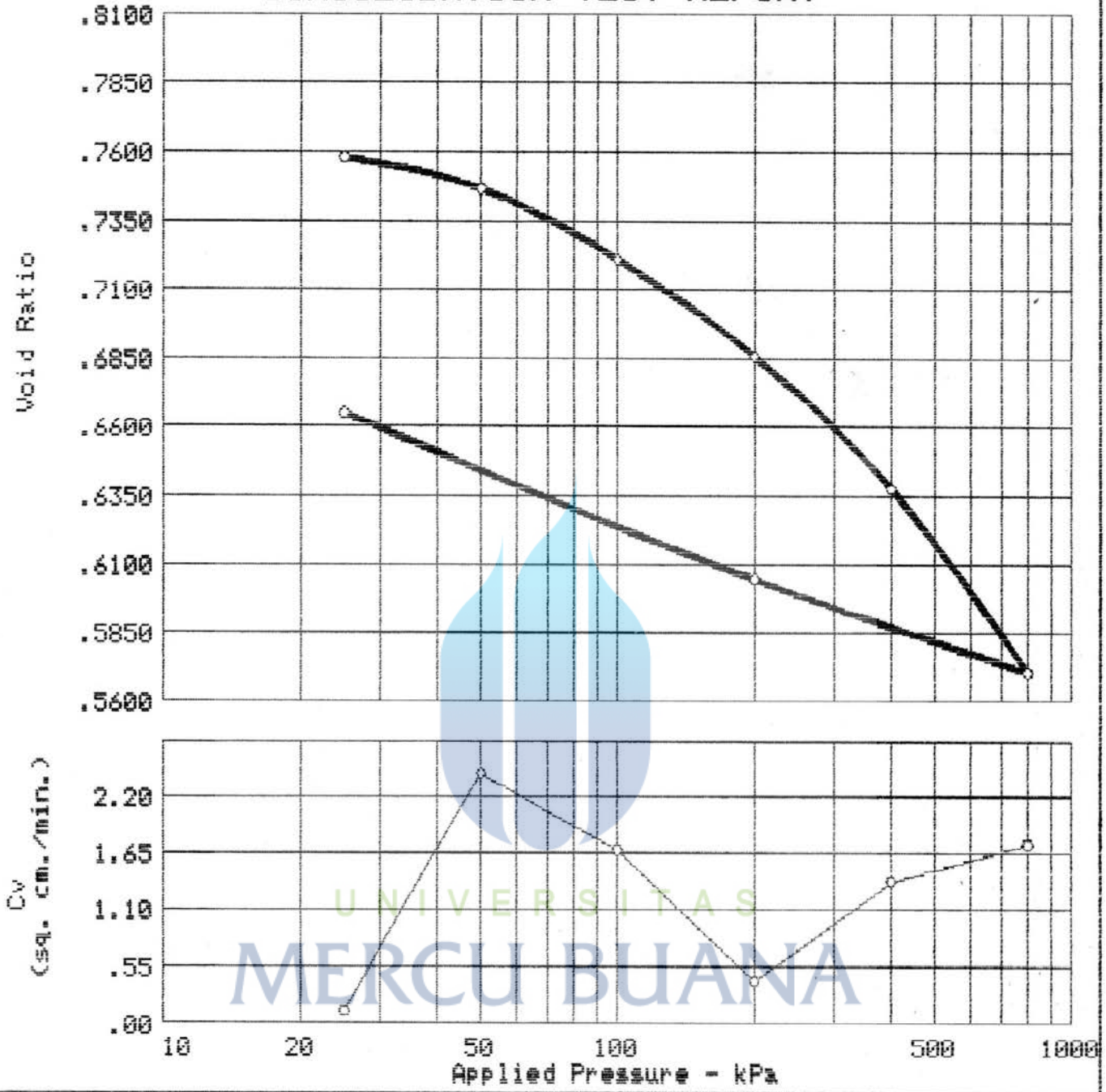
CONSOLIDATION TEST REPORT



Swell press.	Nat. Sat.	Nat. Moist.	Dry Density	LL	PI	Sp.Gr.	Precons. press.	C_c	e_o
	94.1 %	26.3	1574.2	62.00	38.00	2.62	436.17	0.22	0.7327

TEST RESULTS	MATERIAL DESCRIPTION
Compression Index = 0.22	GREY. FAT CLAY. Class: CH.
Project No.: Project: GATOT SUBROTO TOWER JAKARTA. Location: DB.1 DEPTH : 59.50 - 60.00 M. Date: 14 - 11 - 2012	Remarks: TESTED BY : W. TRIADI. CHECKED BY : Ir.THEO FN
CONSOLIDATION TEST REPORT PT KONAS TUNGGAL, JLN GAJAHLUMANTUNG 7, BANDUNG	UNDISTURBED. Fig. No. 7

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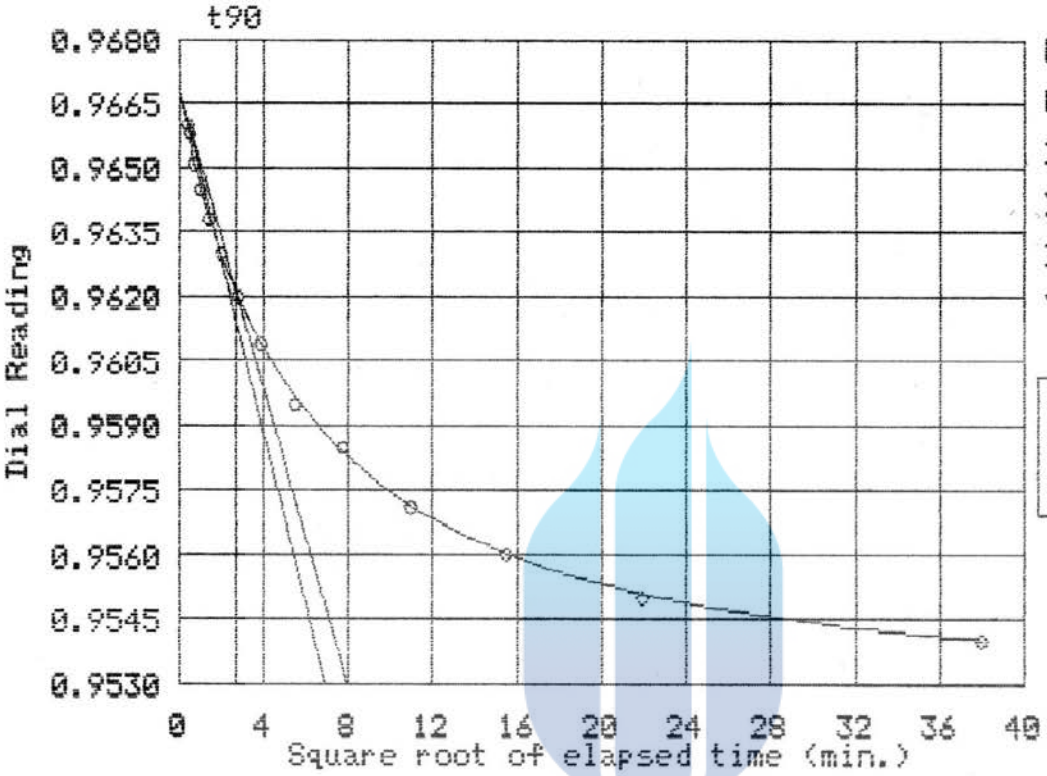
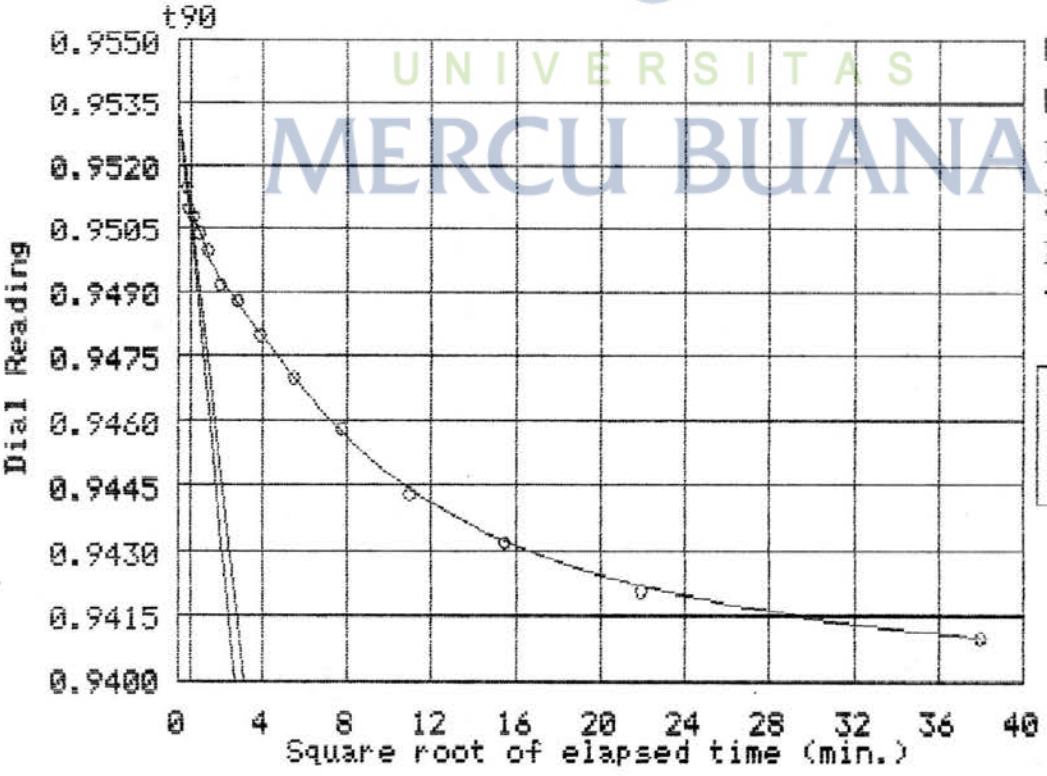
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 59.50 - 60.00 M.
Date: 14 - 11 - 2012



Load No.= 1
Load= 25.00 kPa
D_0 = 0.9668
D_{90} = 0.9621
D_{100}= 0.9615
T_{90}= 7.44 min.

C_v @ T_{90} =
0.12 cm^2/min.



Load No.= 2
Load= 50.00 kPa
D_0 = 0.9535
D_{90} = 0.9509
D_{100}= 0.9506
T_{90}= 0.36 min.

C_v @ T_{90} =
2.43 cm^2/min.

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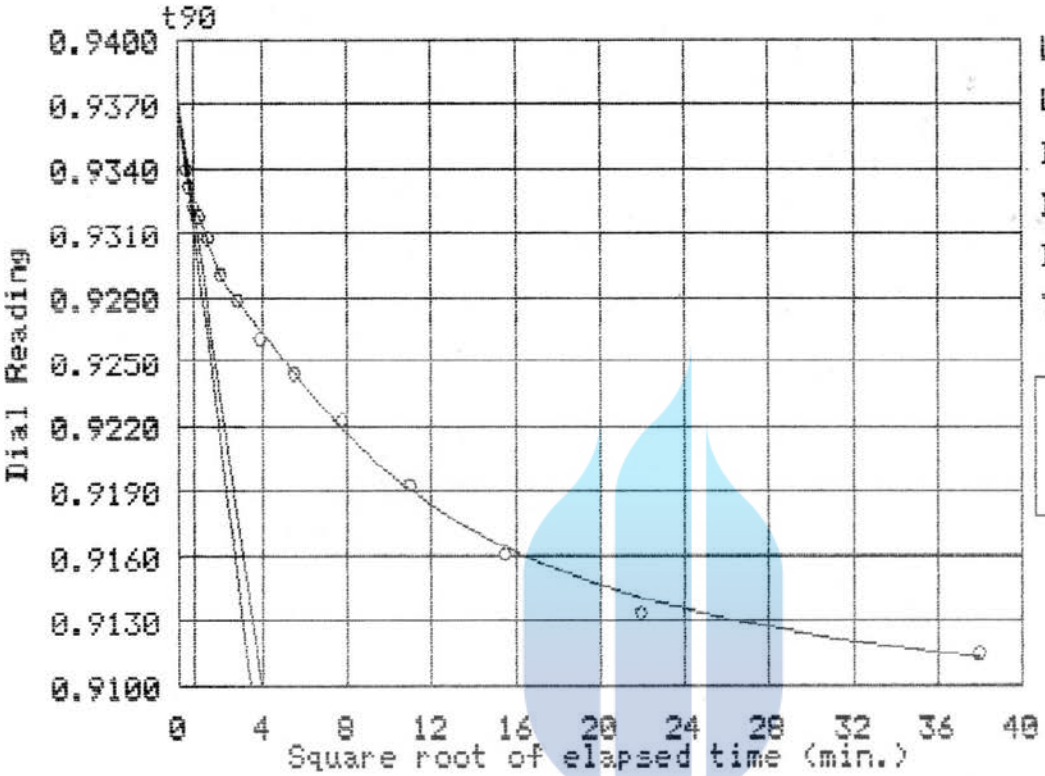
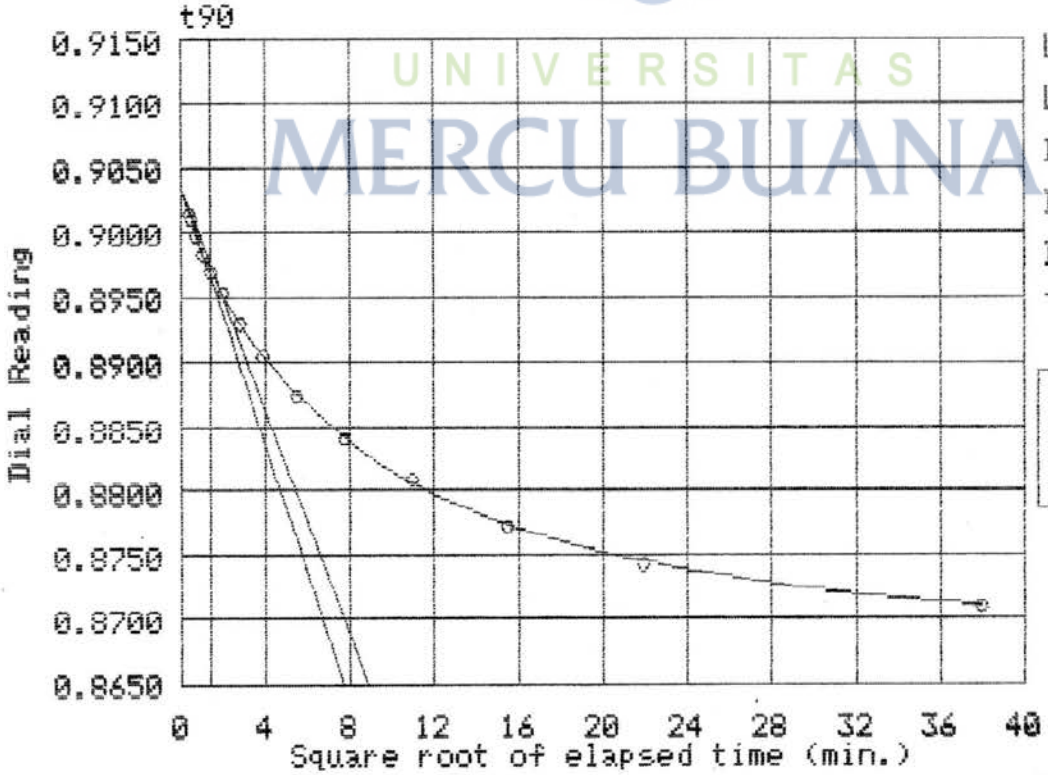
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 59.50 - 60.00 M.
Date: 14 - 11 - 2012



Load No.= 3
Load= 100.00 kPa
D_0 = 0.9372
D_{90} = 0.9323
D_{100}= 0.9317
T_{90}= 0.50 min.

C_v @ T_{90} =
1.68 cm^2/min.



Load No.= 4
Load= 200.00 kPa
D_0 = 0.9035
D_{90} = 0.8973
D_{100}= 0.8966
T_{90}= 2.02 min.

C_v @ T_{90} =
0.41 cm^2/min.

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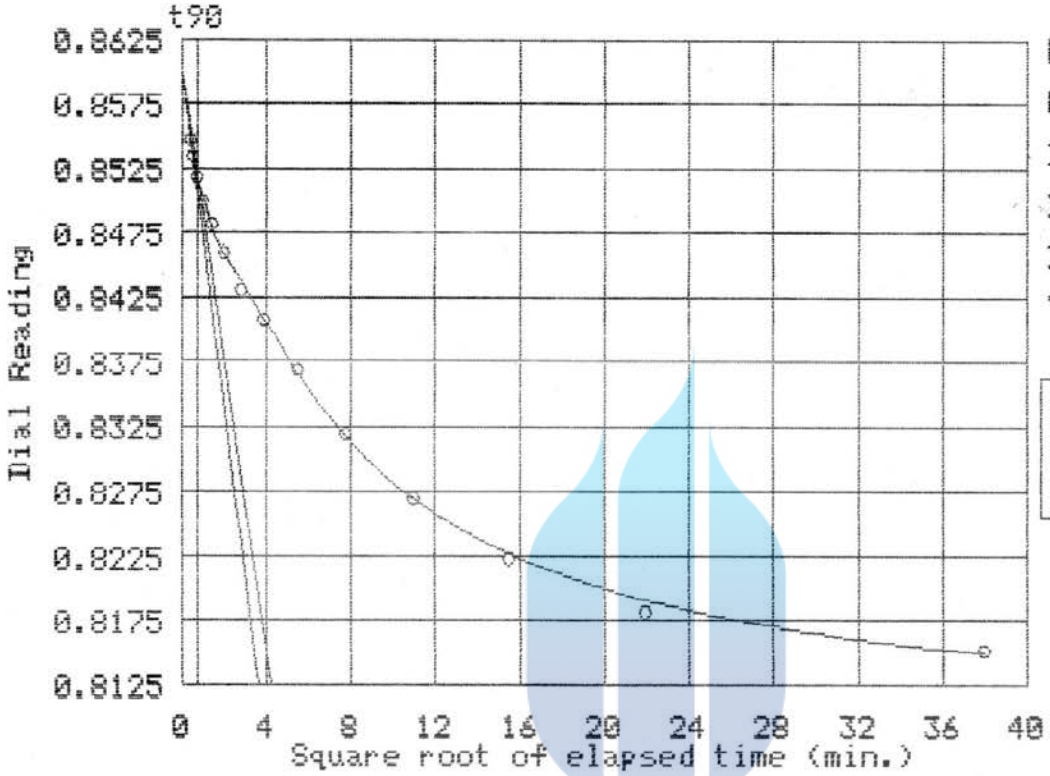
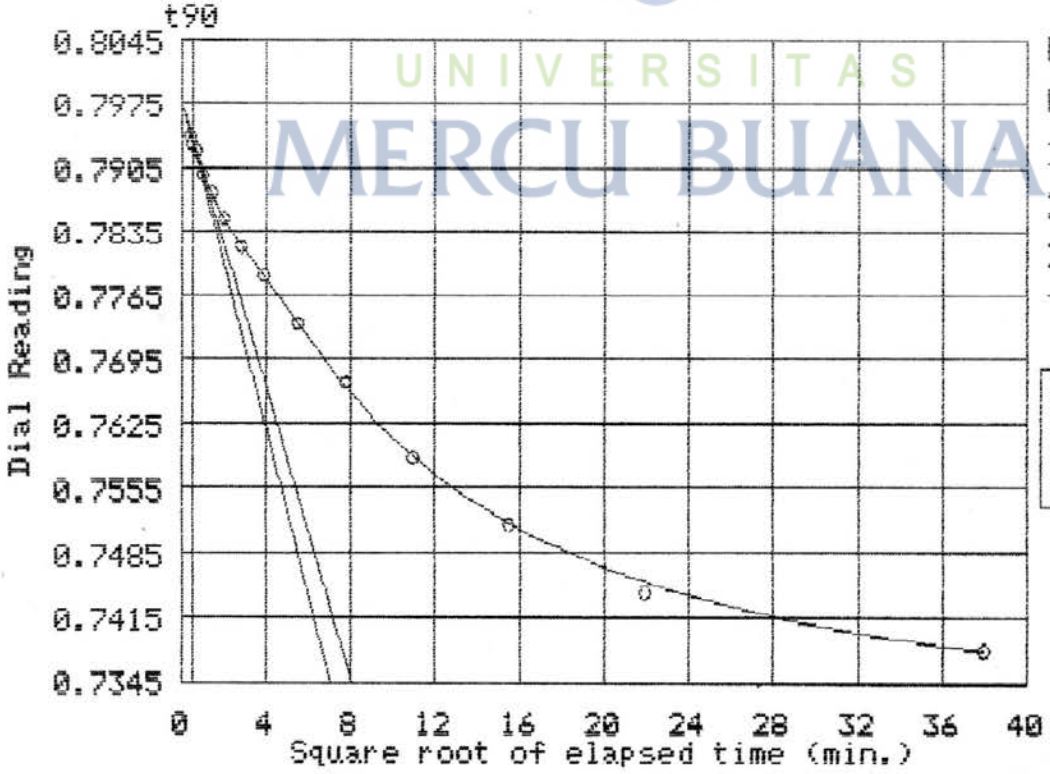
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 59.50 - 60.00 M.
Date: 14 - 11 - 2012



Load No.= 5
Load= 400.00 kPa
D_0 = 0.8600
D_{90} = 0.8515
D_{100}= 0.8505
T_{90}= 0.57 min.

C_v @ T_{90} =
1.37 cm^2/min.



Load No.= 6
Load= 800.00 kPa
D_0 = 0.7976
D_{90} = 0.7934
D_{100}= 0.7929
T_{90}= 0.42 min.

C_v @ T_{90} =
1.73 cm^2/min.

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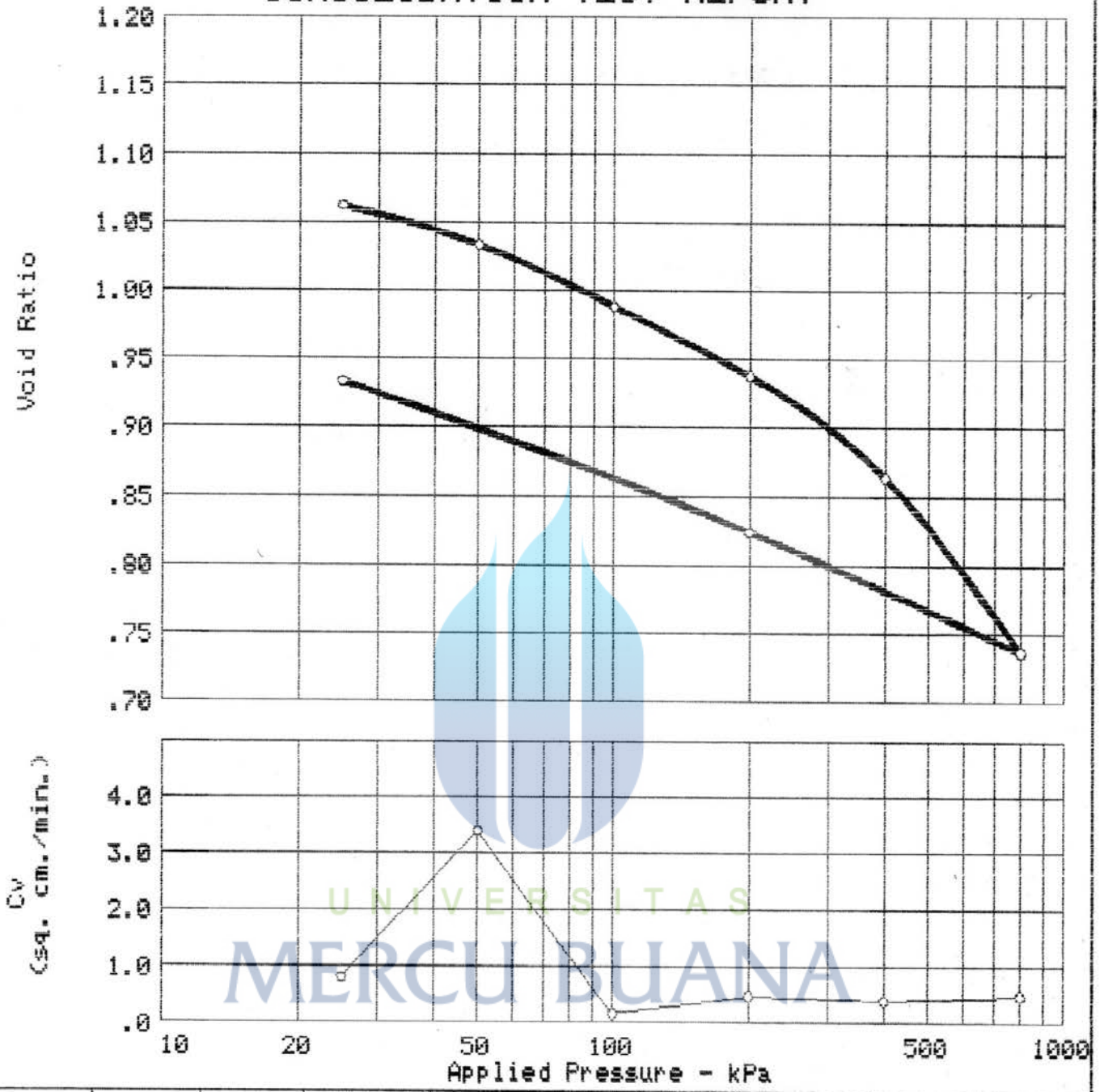
CONSOLIDATION TEST REPORT



Swell press.	Nat. Sat.	Nat. Moist.	Dry Density	LL	PI	Sp.Gr.	Precons. press.	C_c	e_o
	99.7 %	38.3	1370.5	81.00	44.00	2.64	431.71	0.42	1.0135

TEST RESULTS	MATERIAL DESCRIPTION
Compression Index = 0.42	BROWN. Elastic silt. Class: MH.
Project No.: Project: GATOT SUBROTO TOWER JAKARTA. Location: DB.1 DEPTH : 65.50 - 66.00 M. Date: 14 - 11 - 2012	Remarks: TESTED BY : W. TRIADI. CHECKED BY : Ir.THEO FN
CONSOLIDATION TEST REPORT PT KONAS TUNGGAL, JLN GAJAHLUMANTUNG 7, BANDUNG	UNDISTURBED. Fig. No. 8

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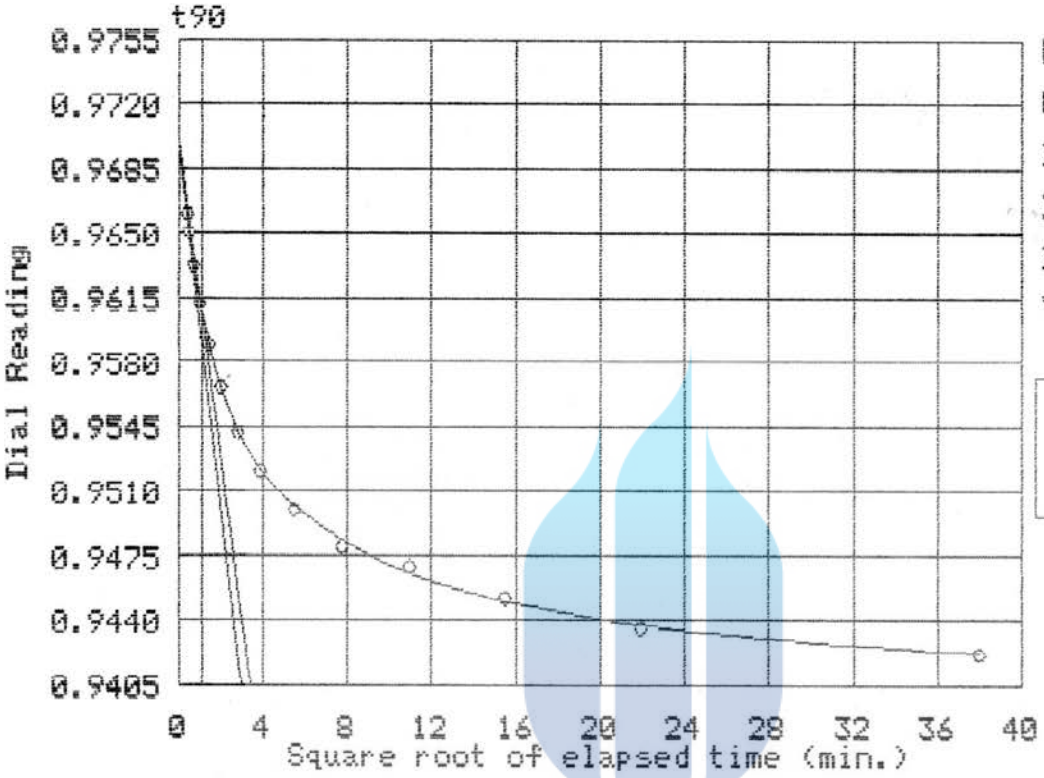
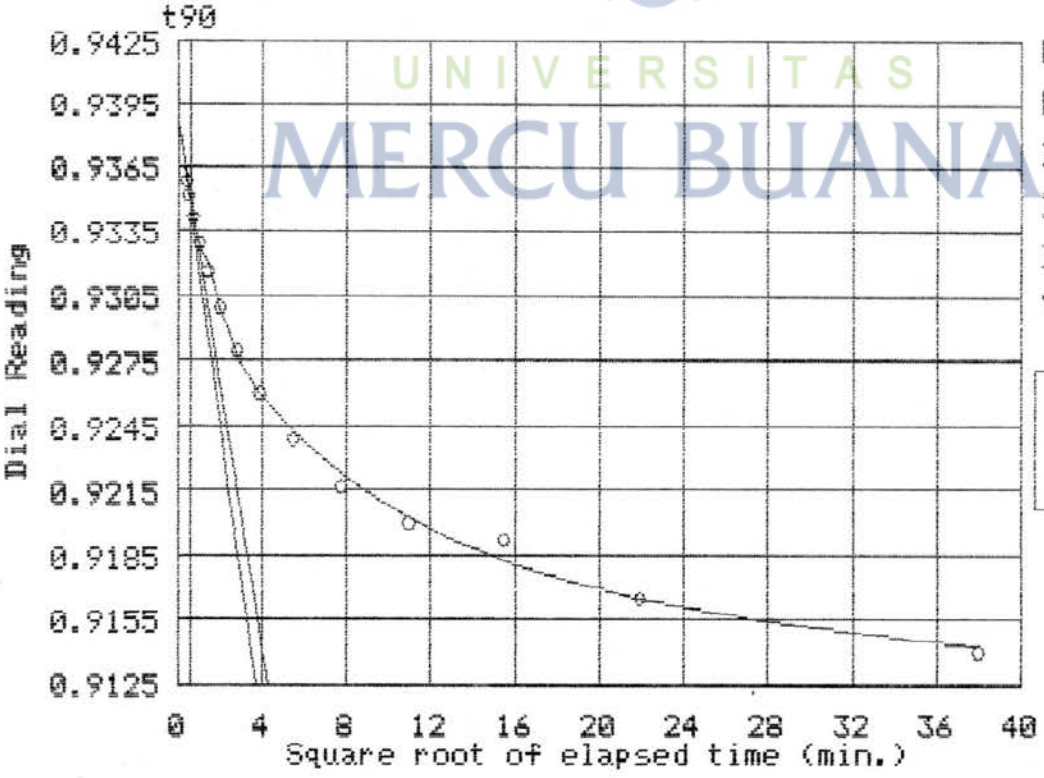
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 65.50 - 66.00 M.
Date: 14 - 11 - 2012



Load No.= 1
Load= 25.00 kPa
D_0 = 0.9701
D_{90} = 0.9608
D_{100}= 0.9597
T_{90}= 1.15 min.

C_v @ T_{90} =
0.79 $cm.^2/min.$



Load No.= 2
Load= 50.00 kPa
D_0 = 0.9387
D_{90} = 0.9349
D_{100}= 0.9345
T_{90}= 0.26 min.

C_v @ T_{90} =
3.40 $cm.^2/min.$

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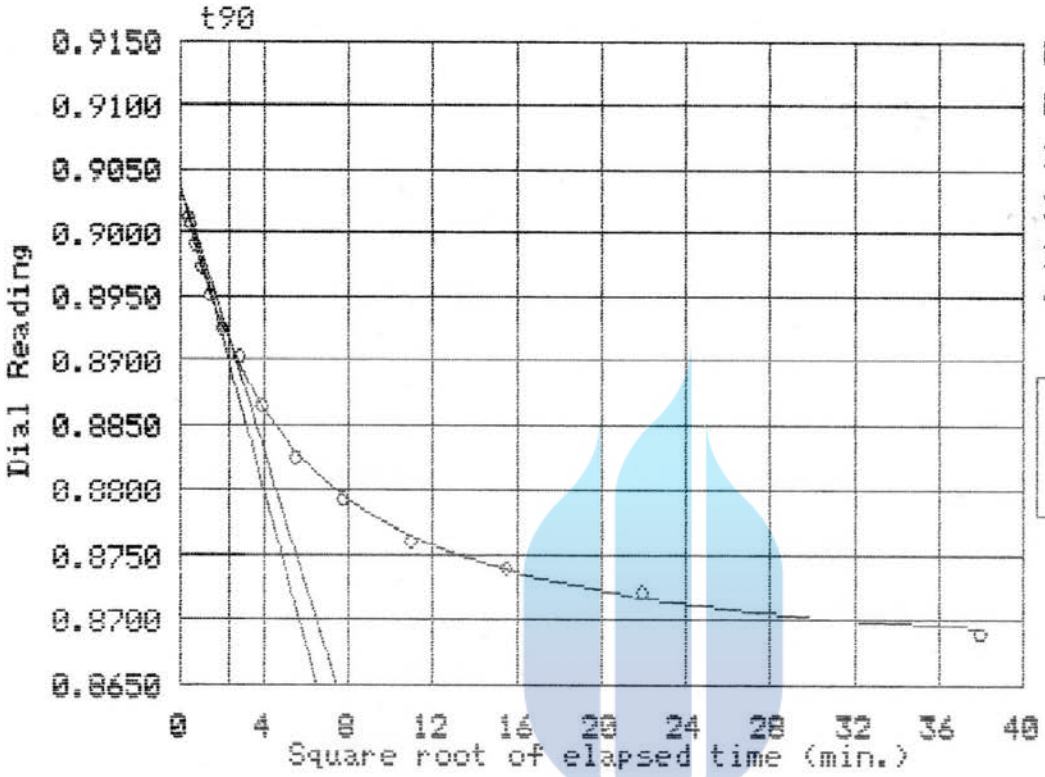
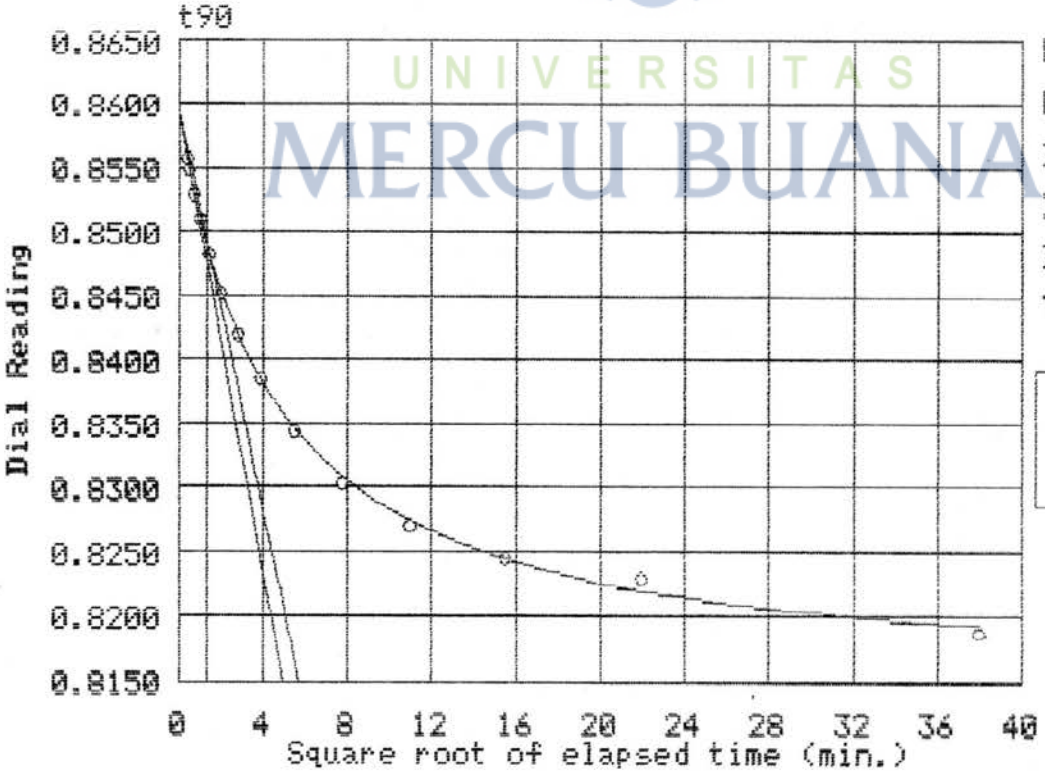
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 65.50 - 66.00 M.
Date: 14 - 11 - 2012



Load No.= 3
Load= 100.00 kPa
D_0 = 0.9037
D_{90} = 0.8915
D_{100}= 0.8901
T_{90}= 5.48 min.

C_v @ T_{90} =
0.15 $cm^2/min.$



Load No.= 4
Load= 200.00 kPa
D_0 = 0.8594
D_{90} = 0.8491
D_{100}= 0.8480
T_{90}= 1.73 min.

C_v @ T_{90} =
0.47 $cm^2/min.$

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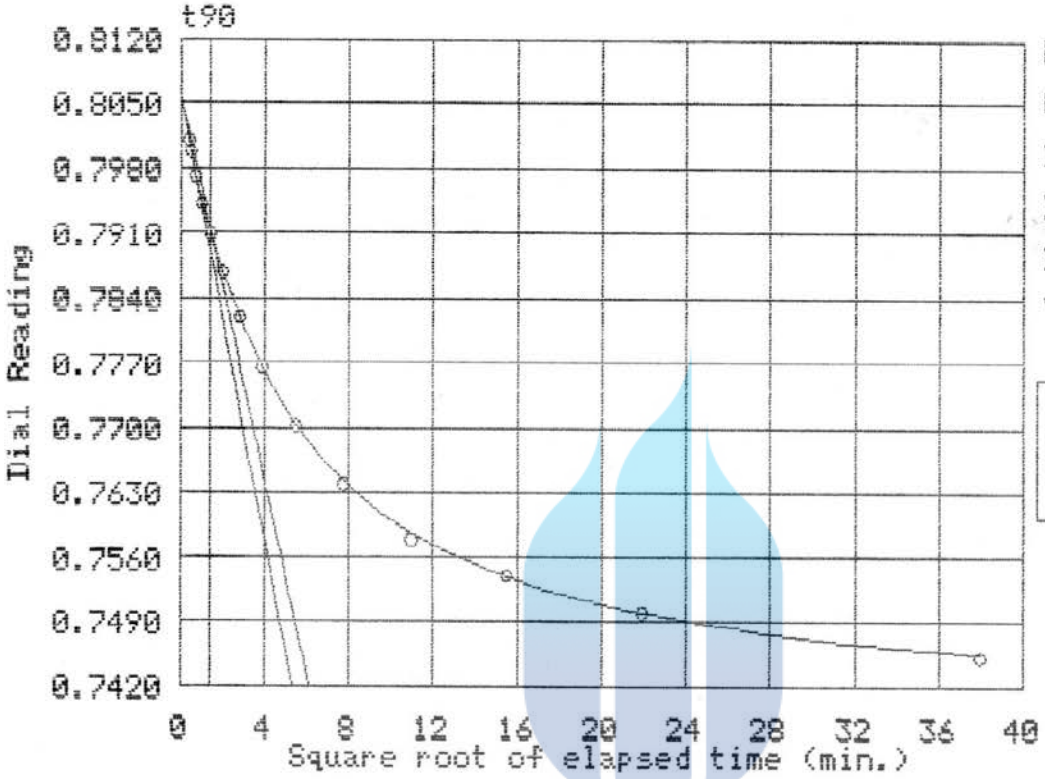
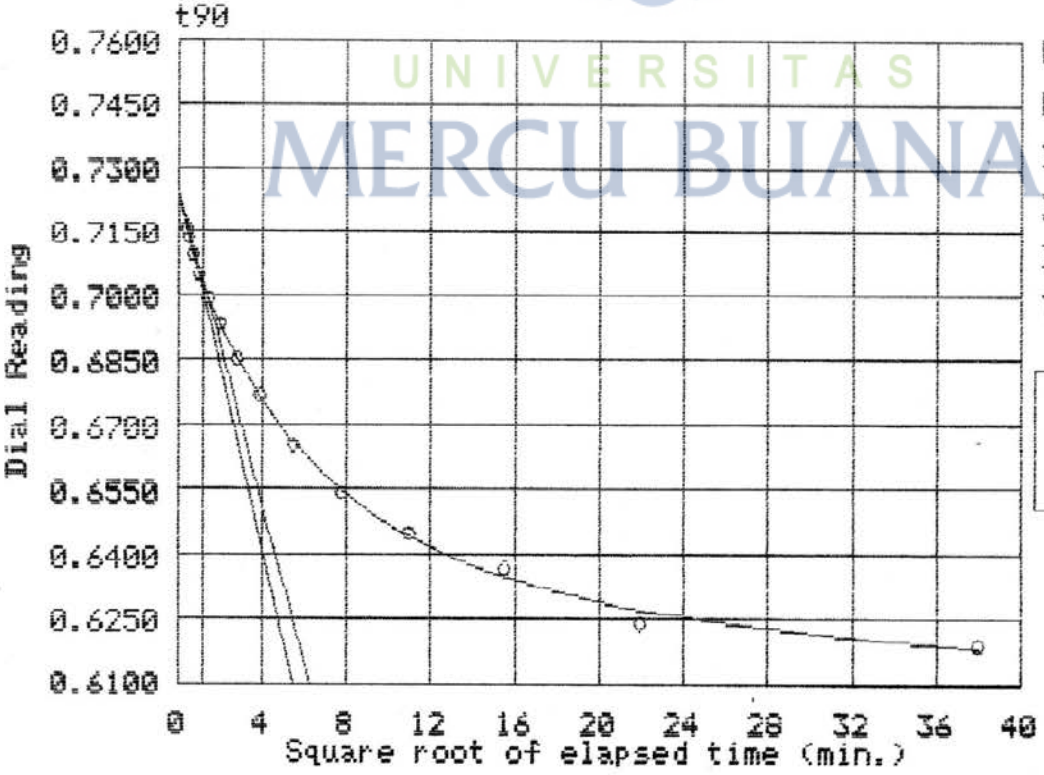
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 65.50 - 66.00 M.
Date: 14 - 11 - 2012



Load No.= 5
Load= 400.00 kPa
D_0 = 0.8058
D_{90} = 0.7913
D_{100}= 0.7897
T_{90}= 1.94 min.

C_v @ T_{90} =
0.39 $cm.^2/min.$



Load No.= 6
Load= 800.00 kPa
D_0 = 0.7244
D_{90} = 0.7025
D_{100}= 0.7001
T_{90}= 1.43 min.

C_v @ T_{90} =
0.47 $cm.^2/min.$

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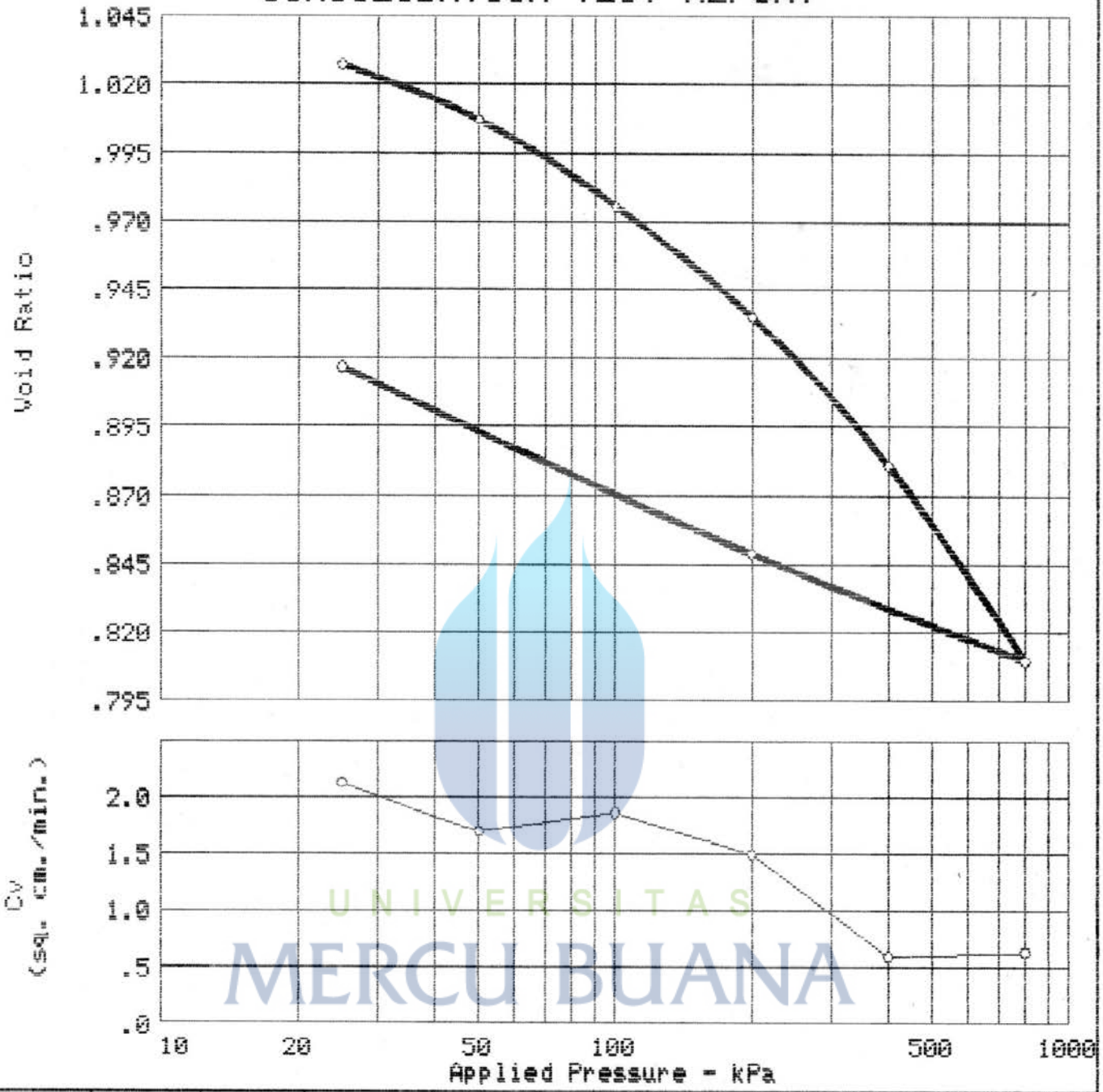
CONSOLIDATION TEST REPORT



Swell press.	Nat. Sat.	Nat. Moist.	Dry Density	LL	PI	Sp.Gr.	Precons. press.	C_c	e_o
	96.7 %	36.1	1345.1	84.00	46.00	2.65	437.13	0.24	0.9886

TEST RESULTS	MATERIAL DESCRIPTION
Compression Index = 0.24	Brownish gray. Elastic silt. Class: MH.
Project No.: Project: GATOT SUBROTO TOWER JAKARTA. Location: DB.1 DEPTH : 67.50 - 68.00 M. Date: 14 - 11 - 2012	Remarks: TESTED BY : W. TRIADI. CHECKED BY : Ir.THEO FN
CONSOLIDATION TEST REPORT PT KONAS TUNGGAL, JLN GAJAHLUMANTUNG 7, BANDUNG	UNDISTURBED. Fig. No. 9

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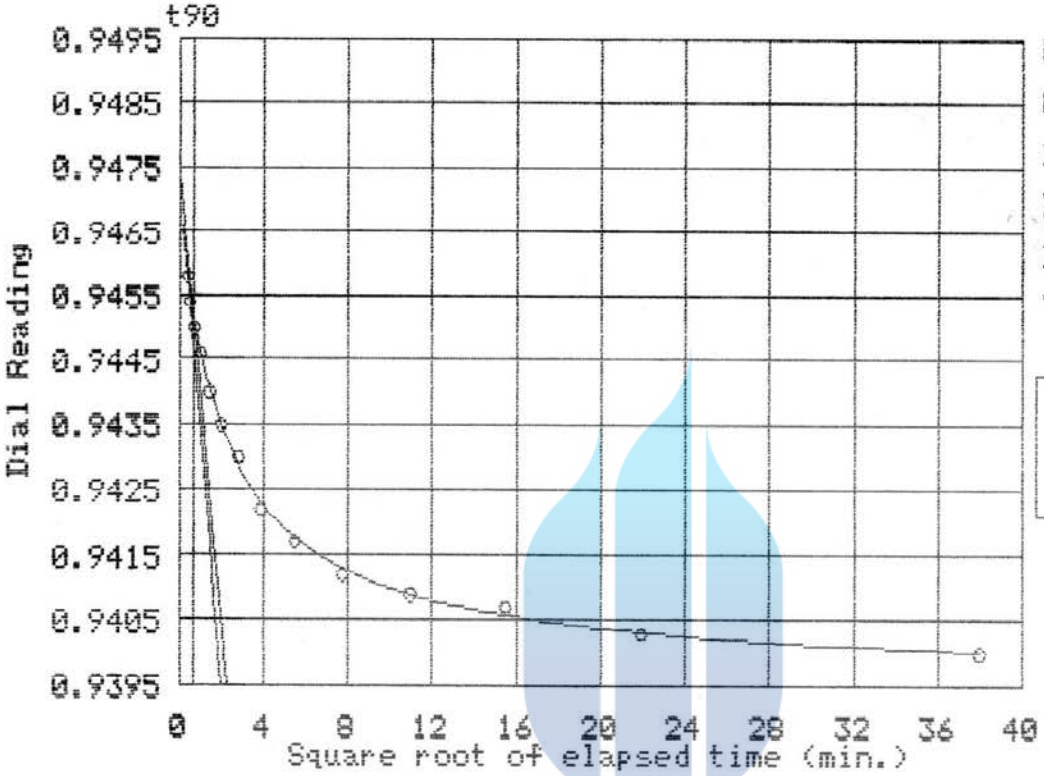
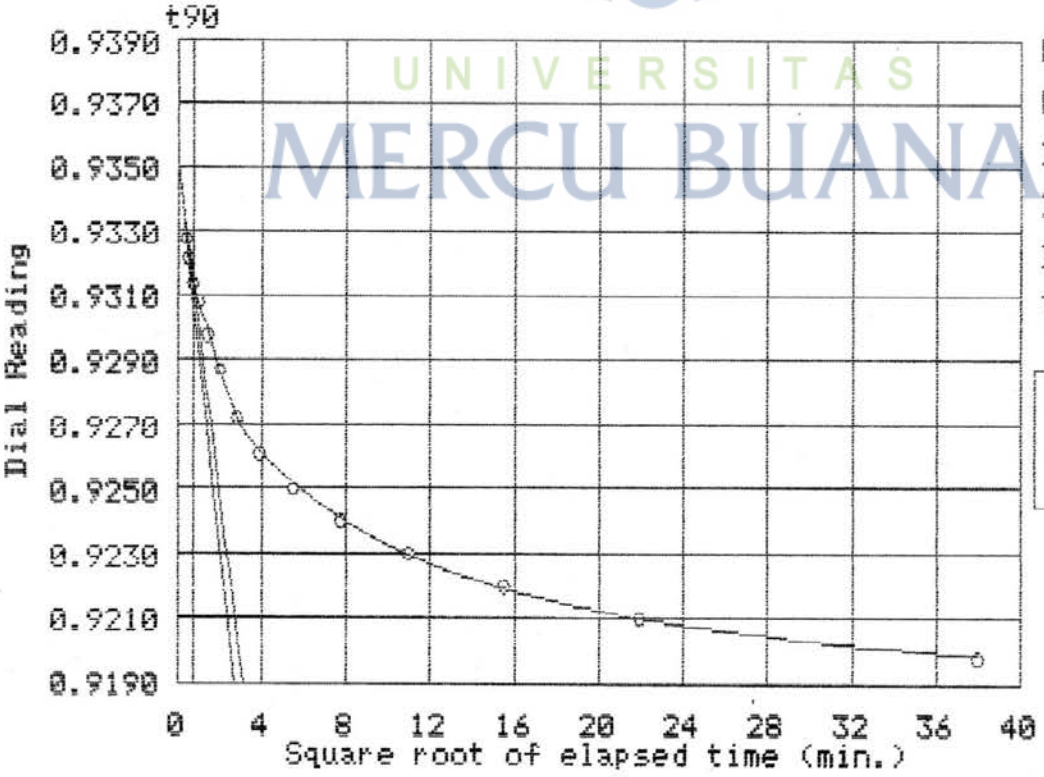
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 67.50 - 68.00 M.
Date: 14 - 11 - 2012



Load No.= 1
Load= 25.00 kPa
D_0 = 0.9474
D_{90} = 0.9452
D_{100}= 0.9449
T_{90}= 0.42 min.

C_v @ T_{90} =
2.13 $cm.^2/min.$



Load No.= 2
Load= 50.00 kPa
D_0 = 0.9352
D_{90} = 0.9315
D_{100}= 0.9310
T_{90}= 0.51 min.

C_v @ T_{90} =
1.70 $cm.^2/min.$

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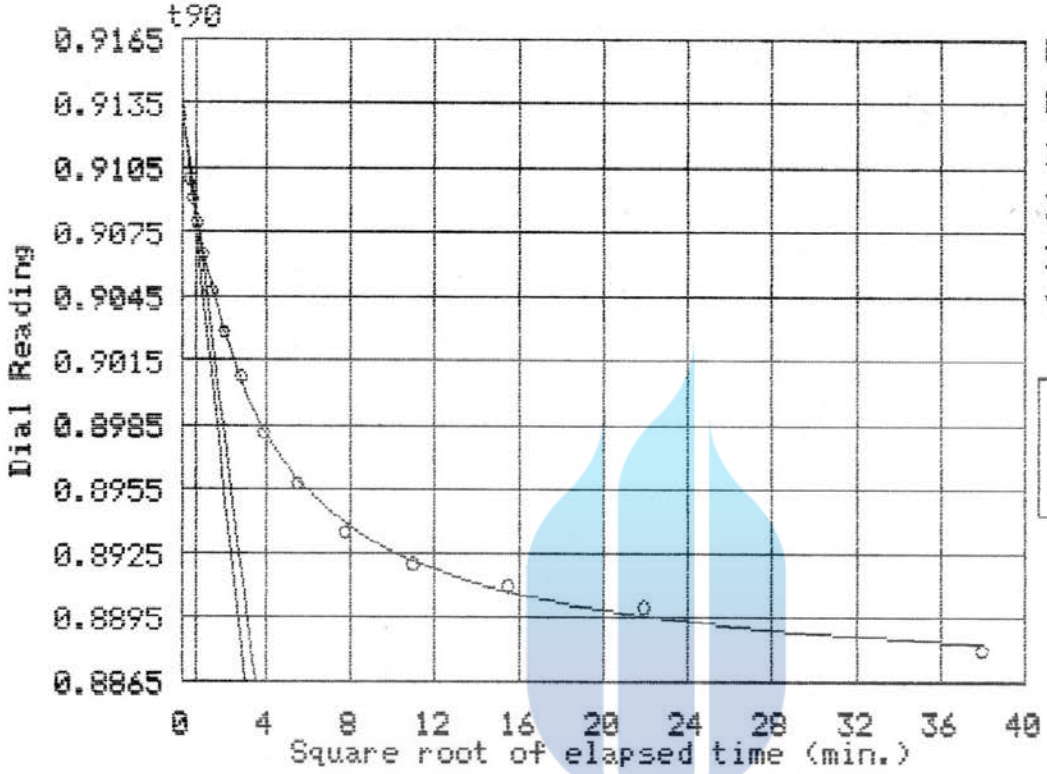
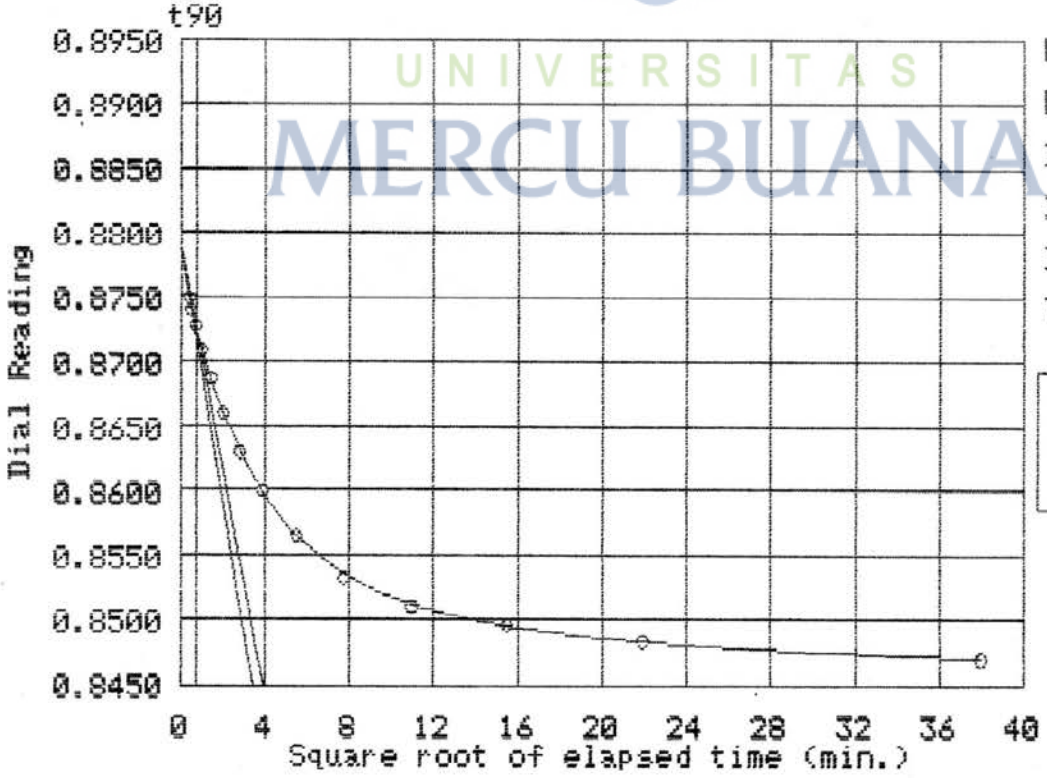
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 67.50 - 68.00 M.
Date: 14 - 11 - 2012



Load No.= 3
Load= 100.00 kPa
D_0 = 0.9136
D_{90} = 0.9083
D_{100}= 0.9077
T_{90}= 0.46 min.

C_v @ T_{90} =
1.86 $cm.^2/min.$



Load No.= 4
Load= 200.00 kPa
D_0 = 0.8790
D_{90} = 0.8726
D_{100}= 0.8718
T_{90}= 0.55 min.

C_v @ T_{90} =
1.50 $cm.^2/min.$

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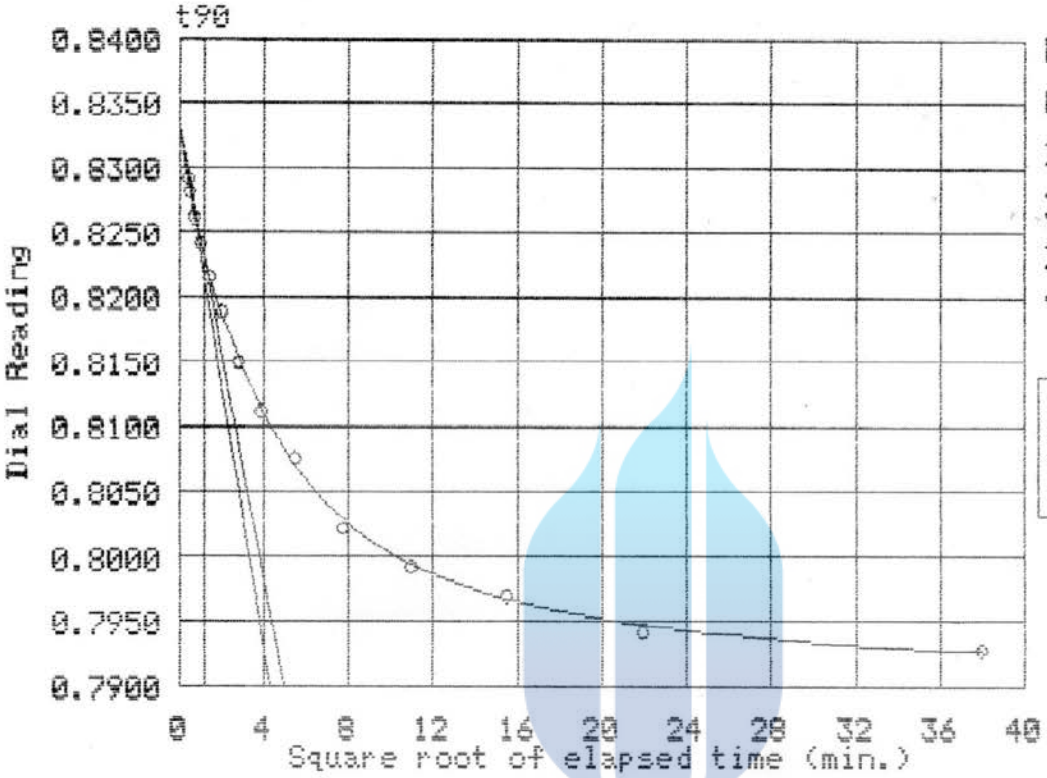
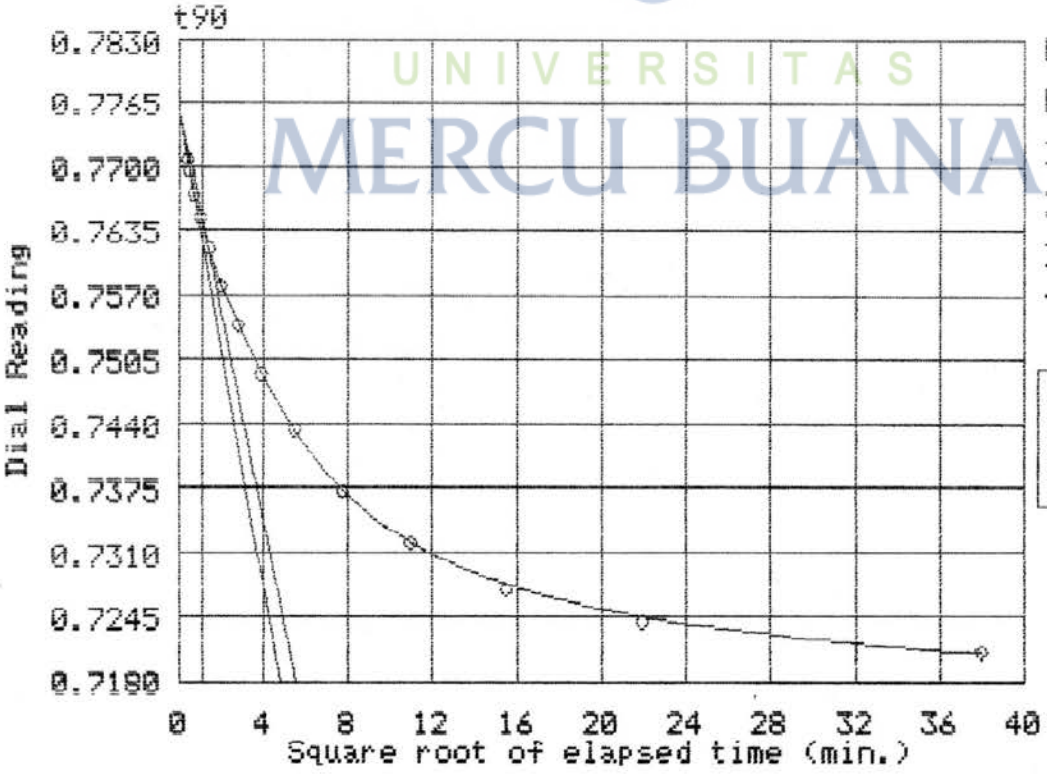
Dial Reading vs. Time

Project No.:
Project: GATOT SUBROTO TOWER JAKARTA.
Location: DB.1
DEPTH : 67.50 - 68.00 M.
Date: 14 - 11 - 2012



Load No.= 5
Load= 400.00 kPa
D_0 = 0.8332
D_{90} = 0.8232
D_{100}= 0.8221
T_{90}= 1.33 min.

C_v @ T_{90} =
0.59 $cm^2/min.$



Load No.= 6
Load= 800.00 kPa
D_0 = 0.7756
D_{90} = 0.7643
D_{100}= 0.7631
T_{90}= 1.16 min.

C_v @ T_{90} =
0.63 $cm^2/min.$

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PT. DAYA CREASI MITRAYASA
Design & Engineering Consultants

SPECIFIC GRAVITY TEST (ASTM D 854)

Client	:	PT. Citratama Inti Persada	Project No.	:	DCM.G.12-047
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	16-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

Borehole : DB-2
Depth (m) : 2.00 - 2.50

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	62	63
Wt. of Pycno + cup [gram]	47.123	44.651
Wt. of Pycno + cup + soil [gram]	62.684	58.608
Wt. of Pycno + cup + water [gram]	144.405	144.909
Wt. of Pycno + cup + water + soil [gram]	154.195	153.658
Specific Gravity, Gs	2.696	2.680
Average of Specific Gravity, Gs	**2.688**	

Borehole : DB-2
Depth (m) : 7.00 - 7.50

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	1	2
Wt. of Pycno + cup [gram]	40.346	40.689
Wt. of Pycno + cup + soil [gram]	58.158	58.818
Wt. of Pycno + cup + water [gram]	139.411	139.108
Wt. of Pycno + cup + water + soil [gram]	150.379	150.351
Specific Gravity, Gs	2.603	2.633
Average of Specific Gravity, Gs	**2.618**	

Borehole : DB-2
Depth (m) : 11.50 - 12.00

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	5	6
Wt. of Pycno + cup [gram]	32.159	38.975
Wt. of Pycno + cup + soil [gram]	43.523	49.663
Wt. of Pycno + cup + water [gram]	81.679	138.167
Wt. of Pycno + cup + water + soil [gram]	88.689	144.803
Specific Gravity, Gs	2.610	2.638
Average of Specific Gravity, Gs	**2.624**	

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PT. DAYA CREASI MITRAYASA
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SPECIFIC GRAVITY TEST (ASTM D 854)

Client	:	PT. Citratama Inti Persada	Project No.	:	DCM.G.12-047
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	16-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample

Borehole : **DB-2**
Depth (m) : **46.50 - 47.00**

Description	**Test 1**	**Test 2**
Method of air removal	Heating	Heating
Temperature, ^{o}C	28°	28°
No. of pycno + cup [gram]	1	2
Wt. of Pycno + cup [gram]	40.346	40.689
Wt. of Pycno + cup + soil [gram]	54.986	55.928
Wt. of Pycno + cup + water [gram]	139.411	139.108
Wt. of Pycno + cup + water + soil [gram]	148.435	148.514
Specific Gravity, Gs	2.607	2.613
Average of Specific Gravity, Gs	**2.610**	

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WATER CONTENT DETERMINATION (ASTM D 2216)

Project No.	:	DCM.G.12-047	Tested date	:	8-Nov-12
Client	:	PT. Citratama Inti Persada	Tested by	:	Kbl
Project	:	Gatot Subroto Tower (Centennial Tower)	Checked by	:	Juweni
Location	:	Jl. Gatot Subroto - Jakarta			

UDS Sample

Borehole : **DB-2**
Depth (m) : **2.00 - 2.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	77.363	70.157	92.971
Wt. of dry soil + can [gram]	58.972	66.111	54.868
Wt. of can [gram]	25.237	21.468	21.724
Wt. of wet soil [gram]	52.126	48.689	71.247
Wt. of water [gram]	18.391	4.046	38.103
Wt. of dry soil [gram]	33.735	44.643	33.144
Water content, w %	54.516	9.063	114.962
γ_s [gram/cm^3]	**1.657**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.039**	**59.51**	

Borehole : **DB-2**
Depth (m) : **7.00 - 7.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	74.109	108.595	86.329
Wt. of dry soil + can [gram]	63.277	85.717	72.236
Wt. of can [gram]	22.787	24.496	21.946
Wt. of wet soil [gram]	51.322	84.099	64.383
Wt. of water [gram]	10.832	22.878	14.093
Wt. of dry soil [gram]	40.490	61.221	50.290
Water content, w %	26.752	37.370	28.023
γ_s [gram/cm^3]	**1.632**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.248**	**30.72**	

Borehole : **DB-2**
Depth (m) : **11.50 - 12.00**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	94.931	80.829	80.451
Wt. of dry soil + can [gram]	81.378	67.489	68.012
Wt. of can [gram]	27.500	21.710	22.960
Wt. of wet soil [gram]	67.431	59.119	57.491
Wt. of water [gram]	13.553	13.340	12.439
Wt. of dry soil [gram]	53.878	45.779	45.052
Water content, w %	25.155	29.140	27.610
γ_s [gram/cm^3]	**2.144**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.684**	**27.30**	

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WATER CONTENT DETERMINATION (ASTM D 2216)

Project No.	:	DCM.G.12-047	Tested date	:	8-Nov-12
Client	:	PT. Citratama Inti Persada	Tested by	:	Kbl
Project	:	Gatot Subroto Tower (Centennial Tower)	Checked by	:	Juweni
Location	:	Jl. Gatot Subroto - Jakarta			

UDS Sample

Borehole : **DB-2**
Depth (m) : **46.00 - 46.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	95.309	85.181	95.783
Wt. of dry soil + can [gram]	84.119	72.835	81.346
Wt. of can [gram]	36.032	22.383	20.949
Wt. of wet soil [gram]	59.277	62.798	74.834
Wt. of water [gram]	11.190	12.346	14.437
Wt. of dry soil [gram]	48.087	50.452	60.397
Water content, w %	23.270	24.471	23.904
γ_s [gram/cm^3]	**1.885**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.521**	**23.88**	

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ATTERBERG LIMITS TEST (ASTM D 4318)

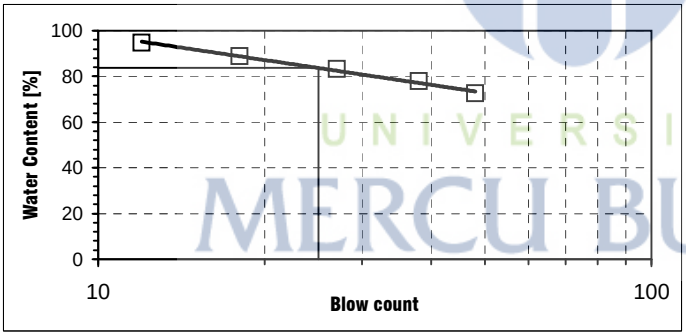
Project No.	:	DCM.G.12-047	Borehole	:	**DB-2**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	2.00 - 2.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	14-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	89.850	73.607	66.091	74.067	76.593
Wt. of dry soil + can [gram]	53.787	46.317	43.307	48.488	50.940
Wt. of can [gram]	15.719	15.620	15.882	15.625	15.539
Wt. of water [gram]	36.063	27.290	22.784	25.579	25.653
Wt. of dry soil [gram]	38.068	30.697	27.425	32.863	35.401
Water content, w [%]	94.733	88.901	83.077	77.835	72.464
No. of blows	12	18	27	38	48

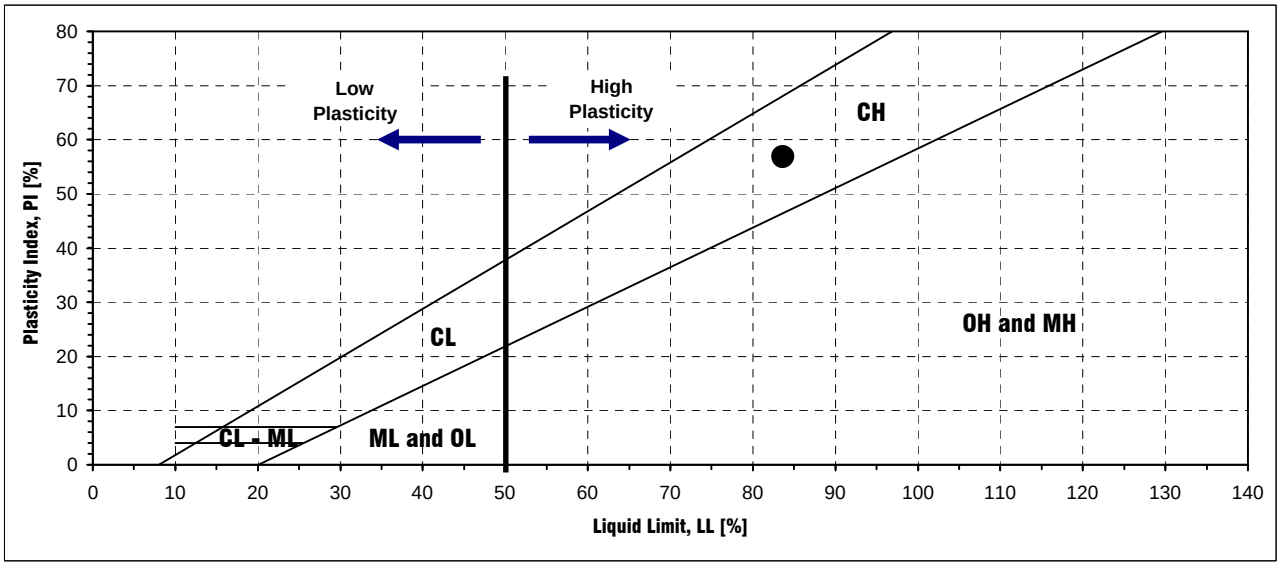
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	37.939	37.840	37.866		
Wt. of dry soil + can [gram]	33.235	33.261	33.233		
Wt. of can [gram]	15.713	16.652	15.573		
Wt. of water [gram]	4.704	4.579	4.633		
Wt. of dry soil [gram]	17.522	16.609	17.660		
Water content, w [%]	26.846	27.569	26.234		



Liquid limit [LL], %	:	83.670
Plastic limit [PL], %	:	26.883
Plasticity index [PI], %	:	56.787
Flow index	:	0.1877
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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PT. DAYA CREASI MITRAYASA
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ATTERBERG LIMITS TEST (ASTM D 4318)

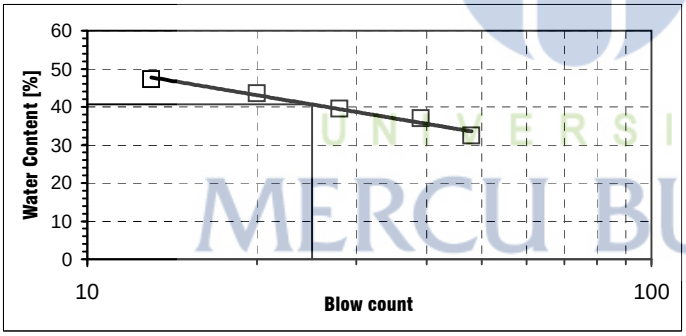
Project No.	:	DCM.G.12-047	Borehole	:	**DB-2**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	11.50 - 12.00
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	19-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	80.092	64.244	66.009	74.270	56.756
Wt. of dry soil + can [gram]	59.096	49.250	51.573	58.202	46.434
Wt. of can [gram]	14.608	14.864	14.954	14.739	14.586
Wt. of water [gram]	20.996	14.994	14.436	16.068	10.322
Wt. of dry soil [gram]	44.488	34.386	36.619	43.463	31.848
Water content, w [%]	47.195	43.605	39.422	36.969	32.410
No. of blows	13	20	28	39	48

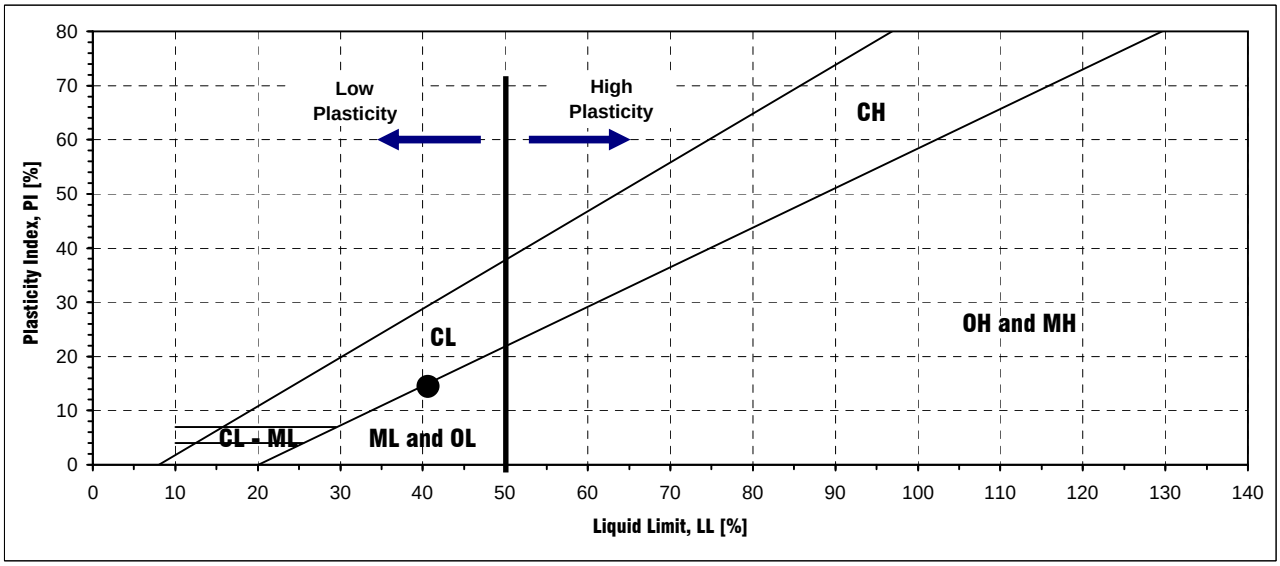
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	36.219	36.486	36.442		
Wt. of dry soil + can [gram]	31.782	31.965	31.887		
Wt. of can [gram]	14.669	14.760	14.713		
Wt. of water [gram]	4.437	4.521	4.555		
Wt. of dry soil [gram]	17.113	17.205	17.174		
Water content, w [%]	25.928	26.277	26.523		



Liquid limit [LL], %	:	40.644
Plastic limit [PL], %	:	26.243
Plasticity index [PI], %	:	14.401
Flow index	:	0.2730
Classification	:	ML - Silt

Soil Classification by Plasticity Chart [Casagrande Chart]



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ATTERBERG LIMITS TEST (ASTM D 4318)

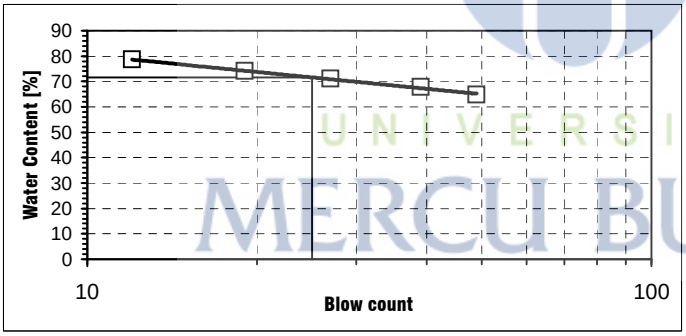
Project No.	:	DCM.G.12-047	Borehole	:	**DB-2**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	46.00 - 46.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	16-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	93.769	87.967	90.430	80.999	92.290
Wt. of dry soil + can [gram]	59.865	57.515	59.789	55.005	62.521
Wt. of can [gram]	16.706	16.403	16.727	16.603	16.574
Wt. of water [gram]	33.904	30.452	30.641	25.994	29.769
Wt. of dry soil [gram]	43.159	41.112	43.062	38.402	45.947
Water content, w [%]	78.556	74.071	71.156	67.689	64.790
No. of blows	12	19	27	39	49

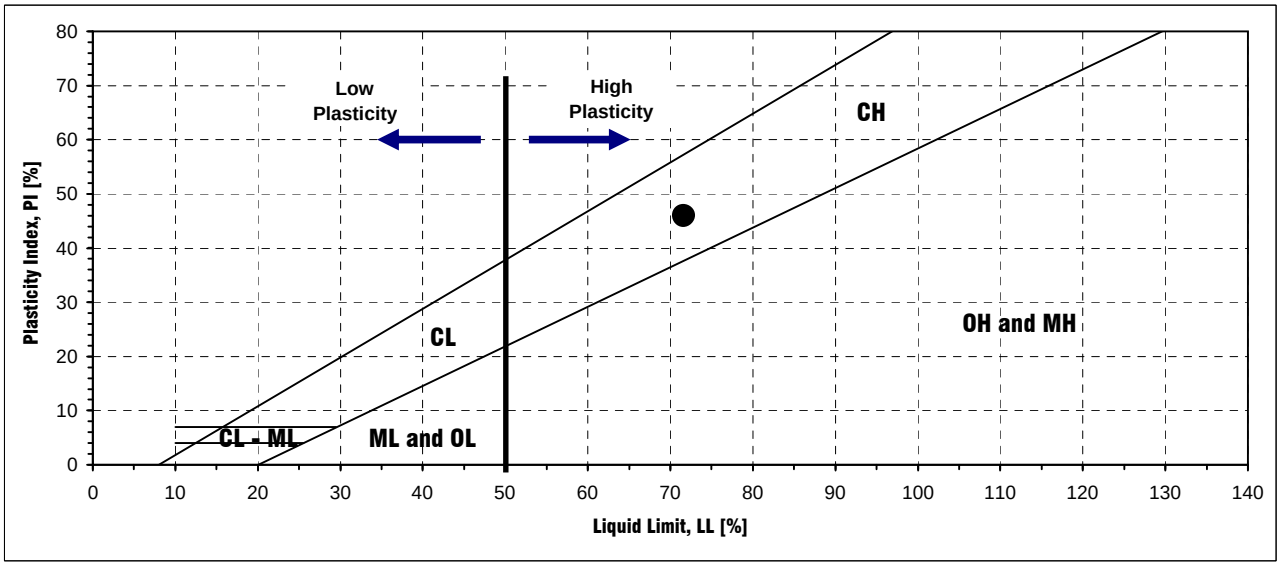
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	38.621	38.639	38.619		
Wt. of dry soil + can [gram]	34.099	34.137	34.128		
Wt. of can [gram]	16.607	16.522	16.503		
Wt. of water [gram]	4.522	4.502	4.491		
Wt. of dry soil [gram]	17.492	17.615	17.625		
Water content, w [%]	25.852	25.558	25.481		



Liquid limit [LL], %	:	71.608
Plastic limit [PL], %	:	25.630
Plasticity index [PI], %	:	45.978
Flow index	:	0.1335
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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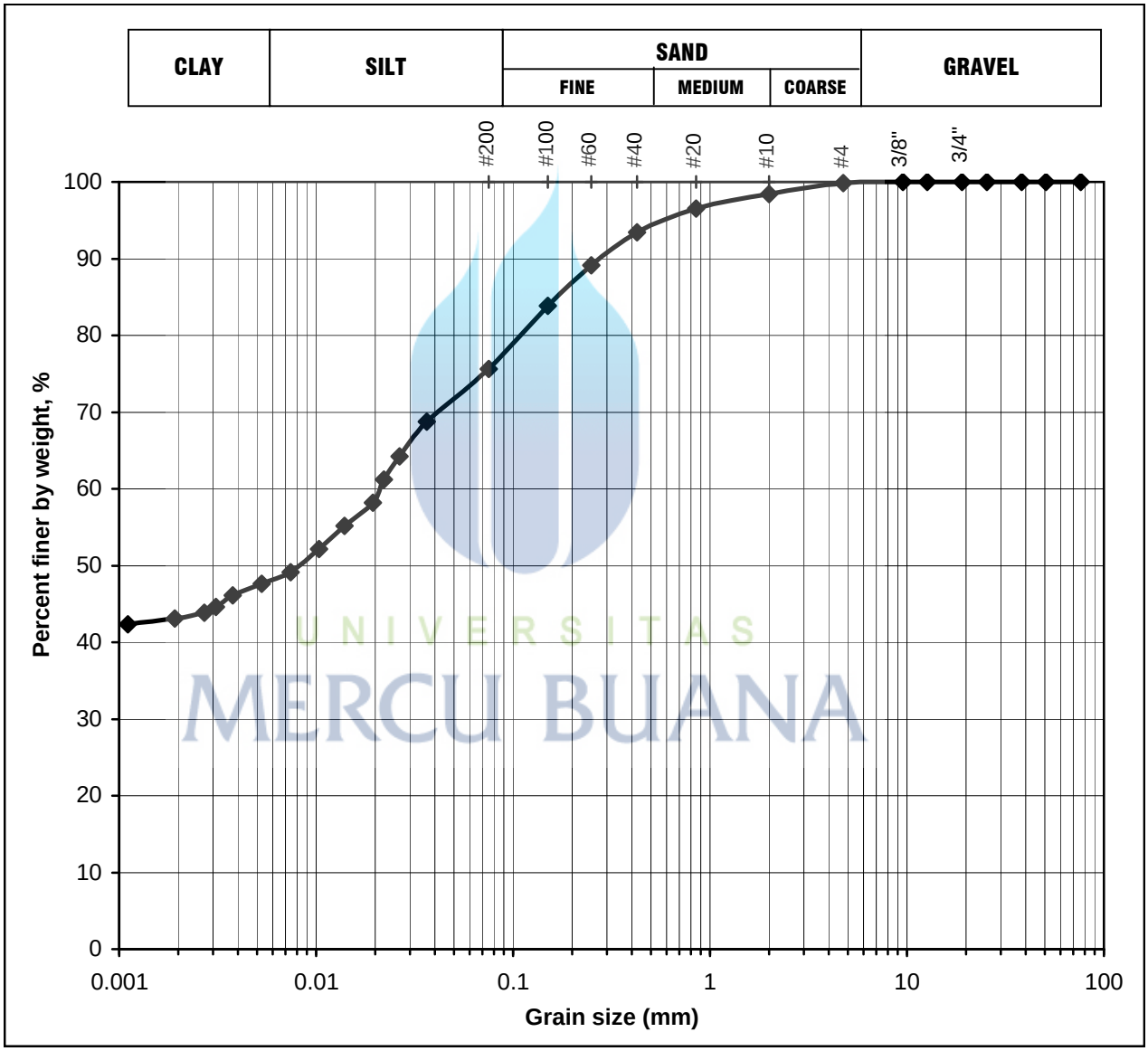
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-2**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	2.00 - 2.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	15-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-2 [2.00 - 2.50]	0.18	24.22	28.27	47.33	CH - Fat clay with sand

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.021	NA	NA	83.67	26.88

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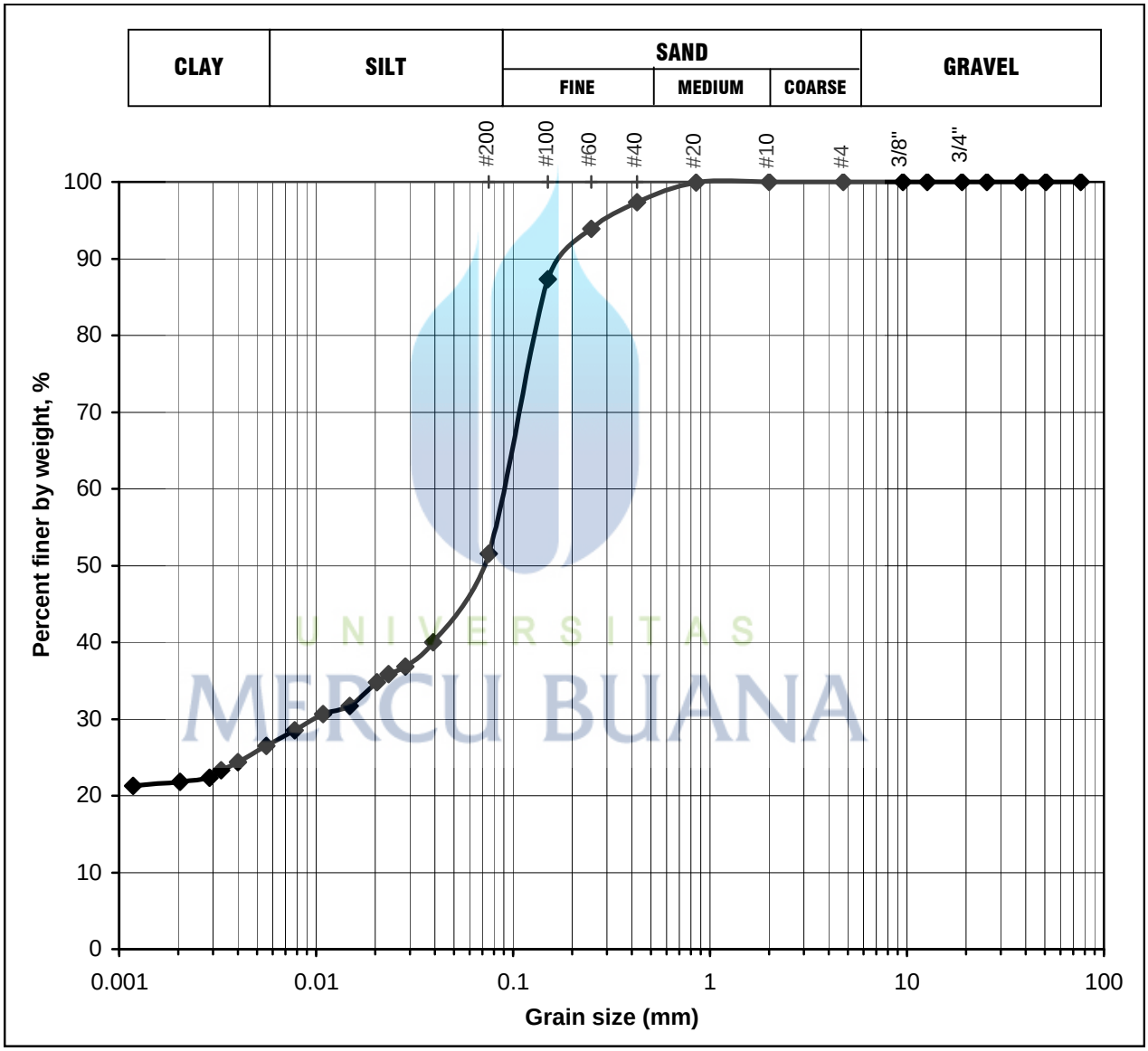
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-2**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	7.00 - 7.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	15-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-2 [7.00 - 7.50]	0.00	48.48	25.84	25.68	ML - Sandy silt

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.010	0.088	NA	NA		

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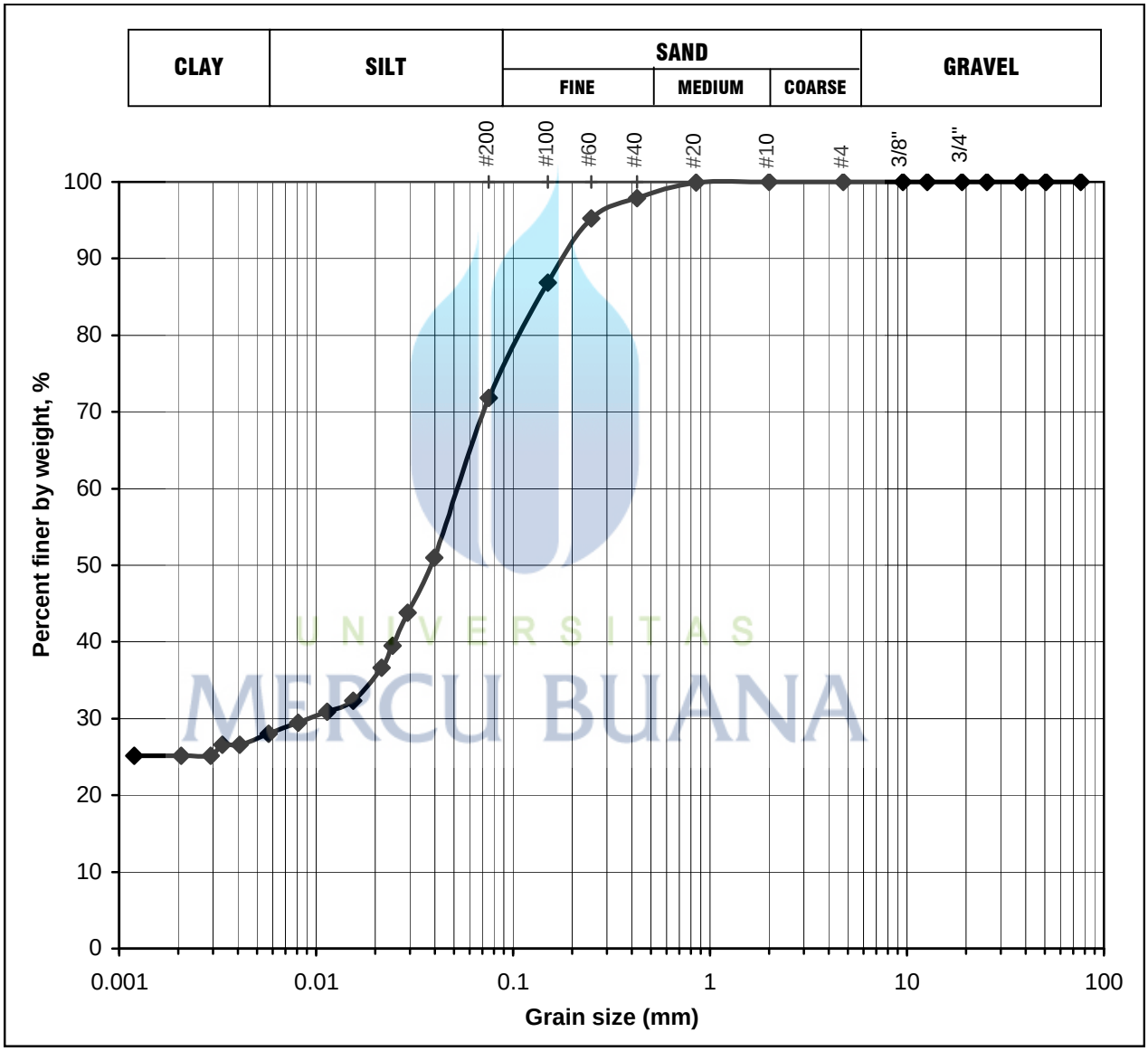
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-2**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	11.50 - 12.00
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	15-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-2 [11.50 - 12.00]	0.00	28.19	44.47	27.34	ML - Silt with sand

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.009	0.052	NA	NA	40.64	26.24

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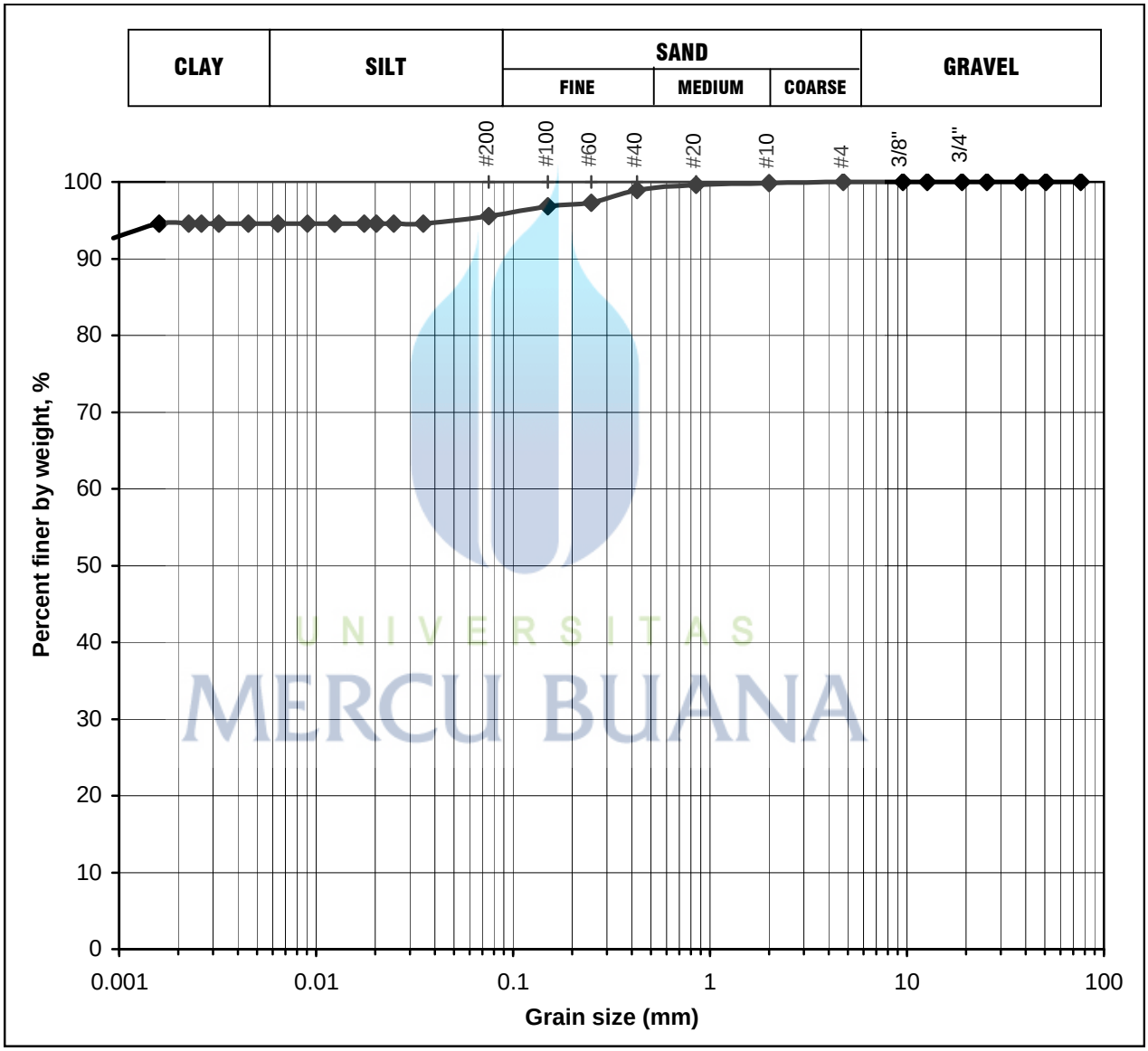
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-2**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	46.00 - 46.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	15-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-2 [46.00 - 46.50]	0.00	4.45	0.96	94.59	CH - Fat clay

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.000	NA	NA	71.61	25.63

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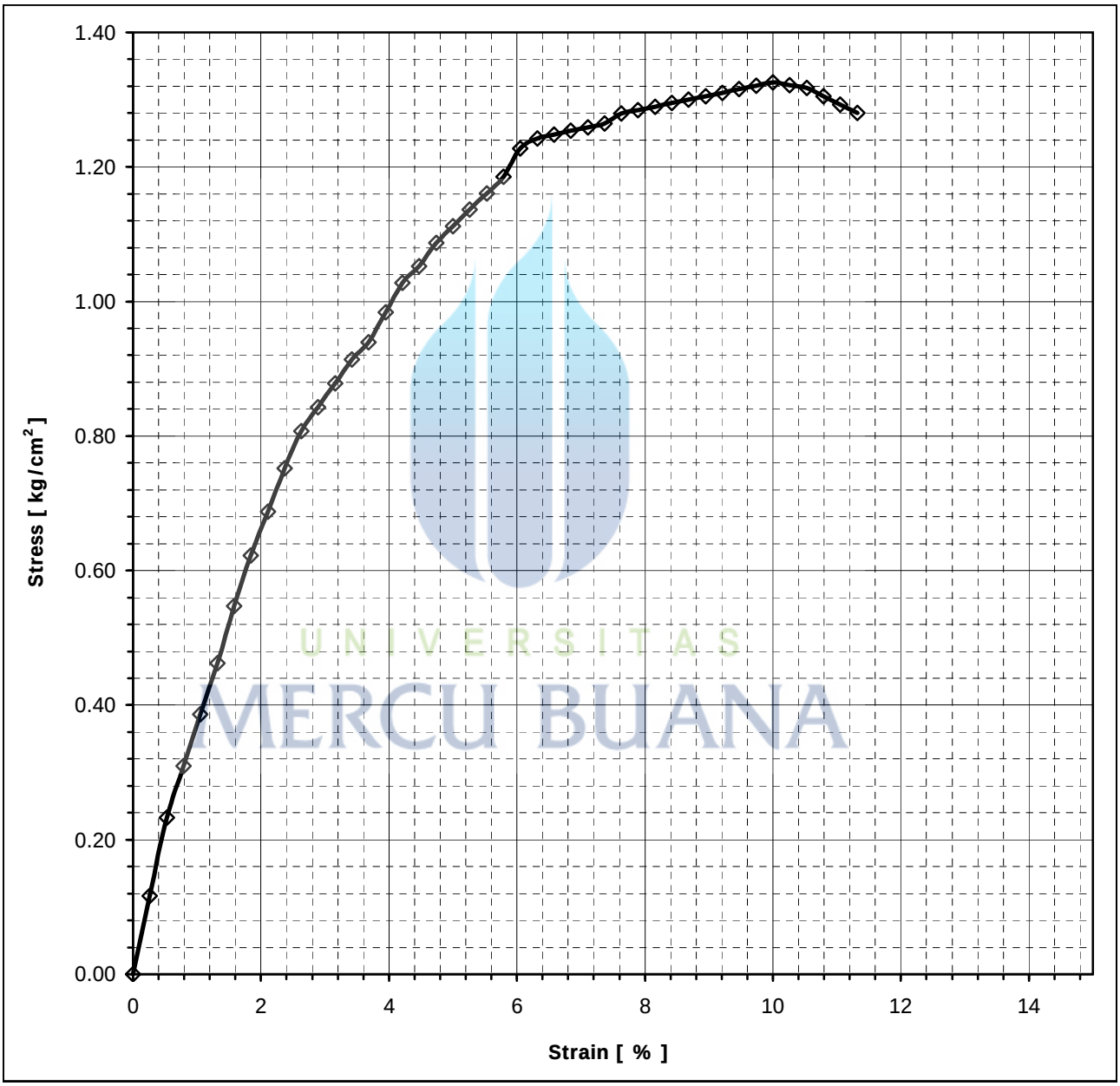
UNCONFINED COMPRESSION TEST (ASTM D 2166)

Project No.	:	DCM.G.12-047	Borehole	:	DB-2
Client	:	PT. Citratama Inti Persada	Depth (m)	:	2,00 - 2,50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	20-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Zaenuri
			Checked by	:	Juweni



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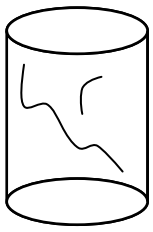
γ_s	:	16.589	kN/m^3
q_u	:	1.325	kg/cm^2
S_u	:	0.663	kg/cm^2
E	:	0.206	kg/cm^2

Failure sketch : Plastic Flow



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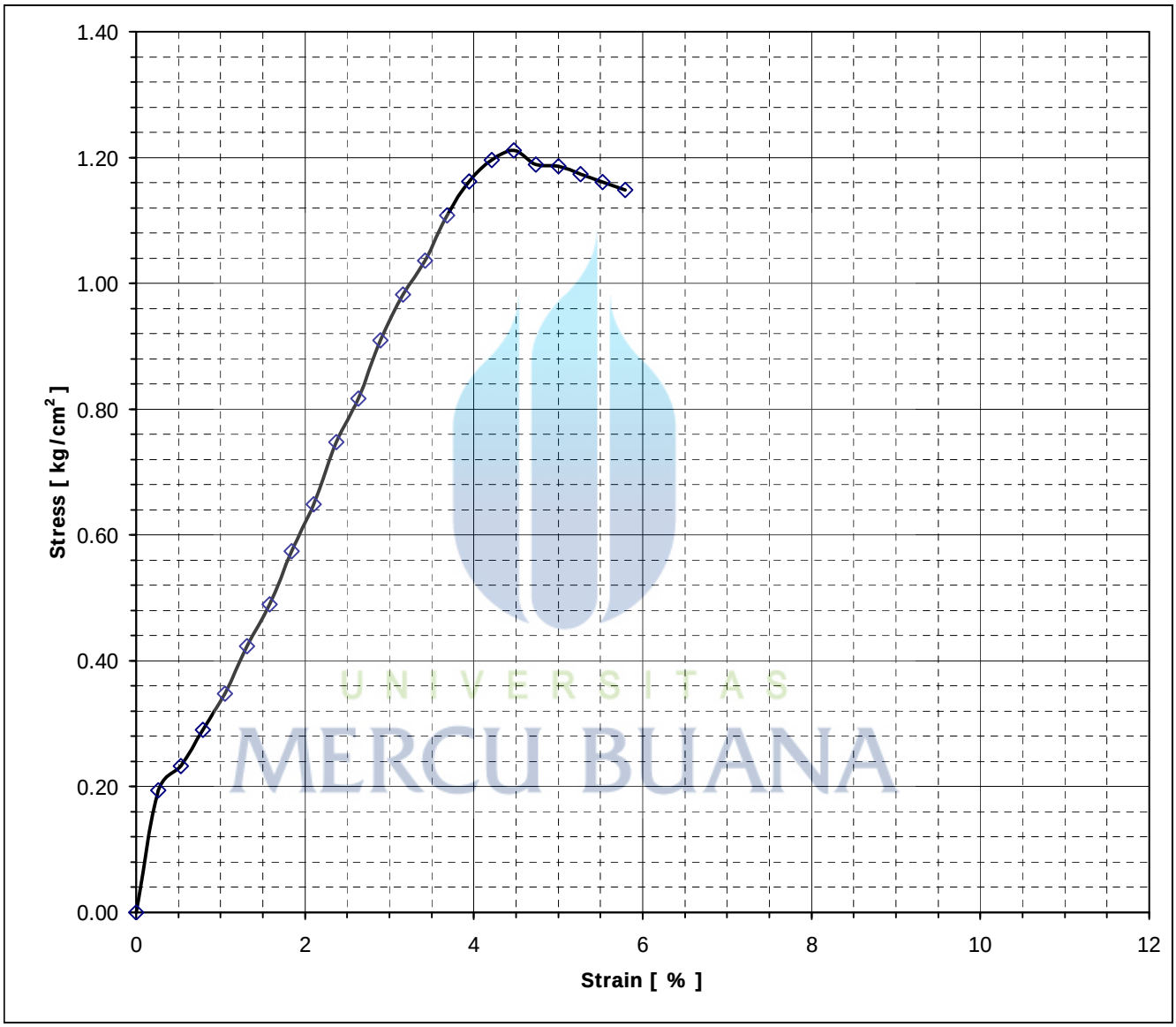
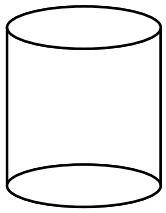
UNCONFINED COMPRESSION TEST (ASTM D 2166 - 91)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-2**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	7.00 - 7.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	16-Nov-12
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Zaenuri
			Checked by	:	Juweni



γ_s	:	**17.206**	kN/m^3
q_u	:	**1.211**	kg/cm^2
S_u	:	**0.606**	kg/cm^2
E	:	**0.238**	kg/cm^2

Failure Sketch :



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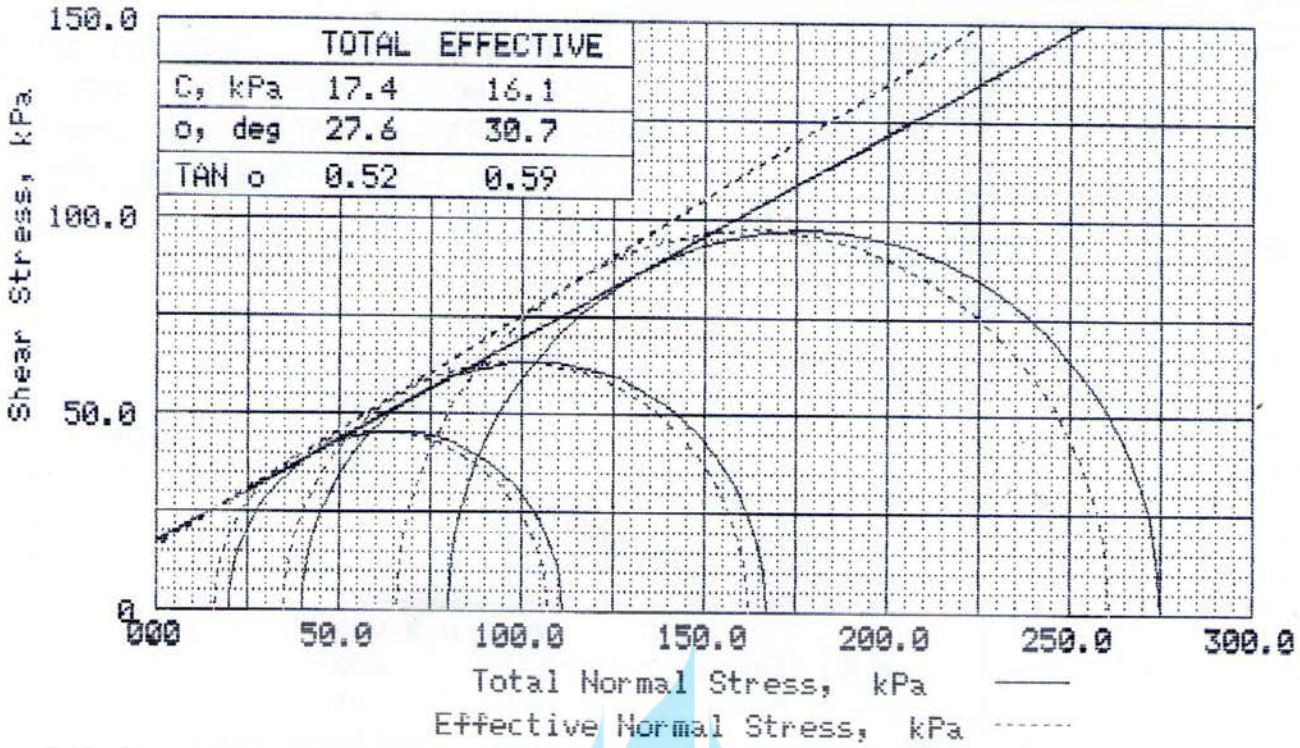

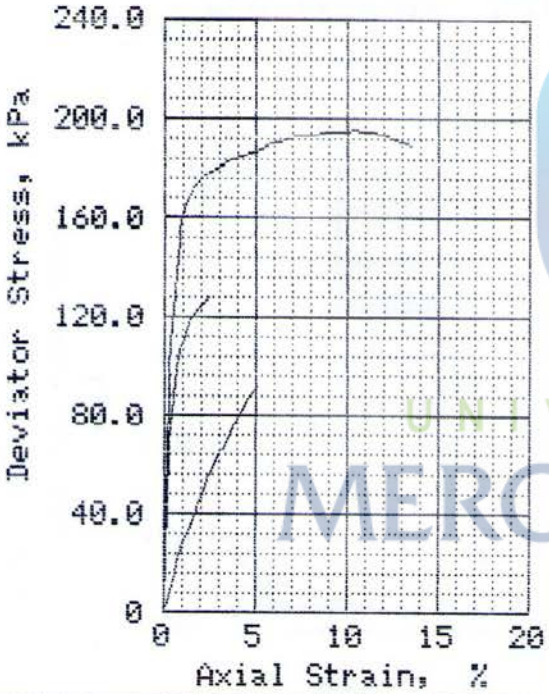

SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	59.5	59.5	59.5
	DRY DENSITY, g/cc	1.0	1.0	1.0
	SATURATION, %	99.4	99.4	99.4
	VOID RATIO	1.586	1.586	1.586
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.60
AT TEST	WATER CONTENT, %	66.7	66.3	64.9
	DRY DENSITY, g/cc	1.0	1.0	1.0
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.768	1.756	1.720
	DIAMETER, cm	3.88	3.98	3.99
	HEIGHT, cm	7.79	7.40	7.24
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190.0	190.0	190.0
CELL PRESSURE, kPa		210.0	230.0	270.0
FAILURE STRESS, kPa		91.3	127.3	195.0
PORE PRESSURE, kPa		194.0	195.0	204.0
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
σ_1 FAILURE, kPa		107.3	162.3	261.0
σ_3 FAILURE, kPa		16	35	66

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDISTURBED.
DESCRIPTION: BROWN.

LL= PL= PI=
SPECIFIC GRAVITY= 2.65
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. CITRATAM INTI PERSADA.

PROJECT: GATOT SUBROTO TOWER.
JAKARTA.
SAMPLE LOCATION: DB.2
DEPTH : 2.00 - 2.50 M.

PROJ. NO.: DATE: 22 - 11 - 2012

TRIAXIAL SHEAR TEST REPORT

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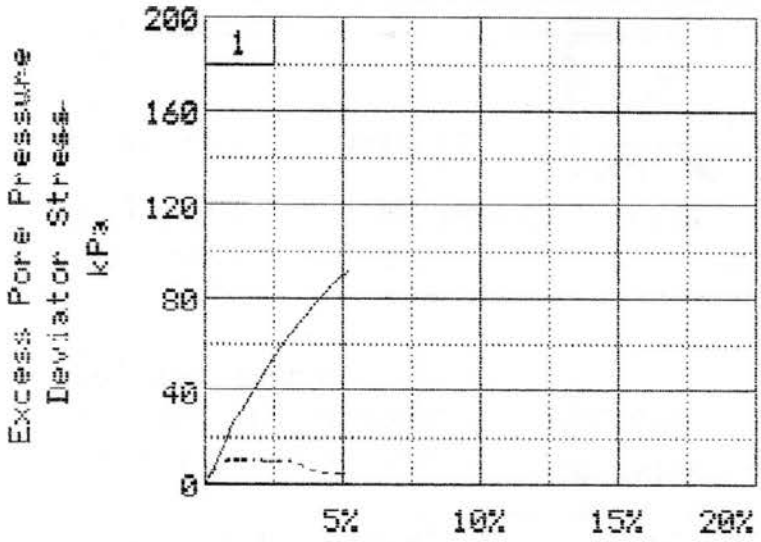

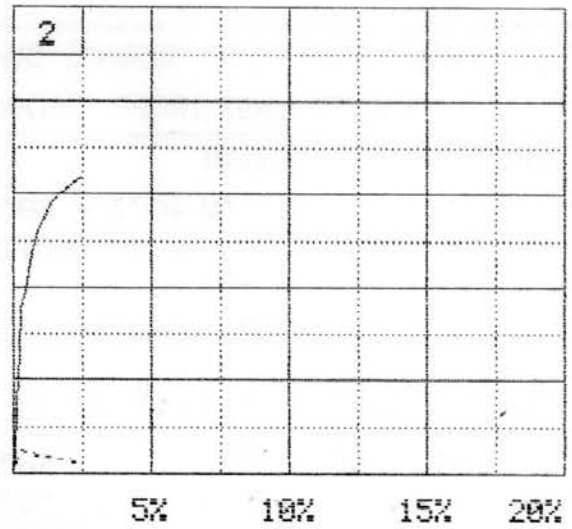

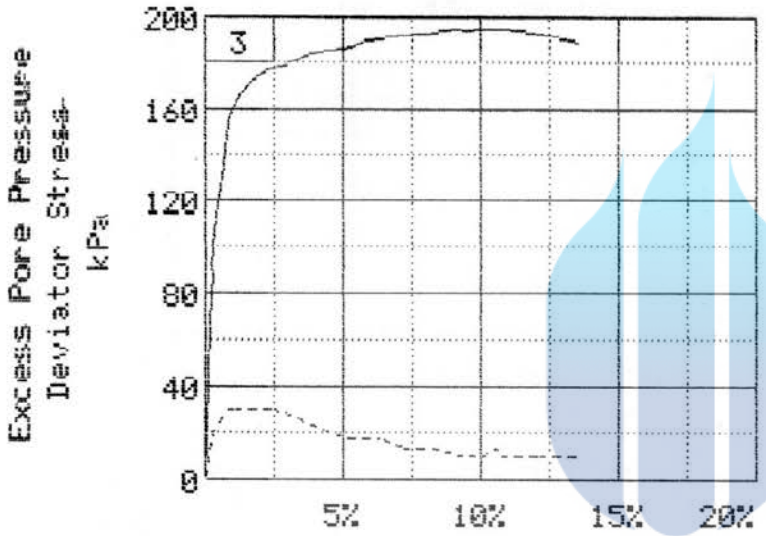

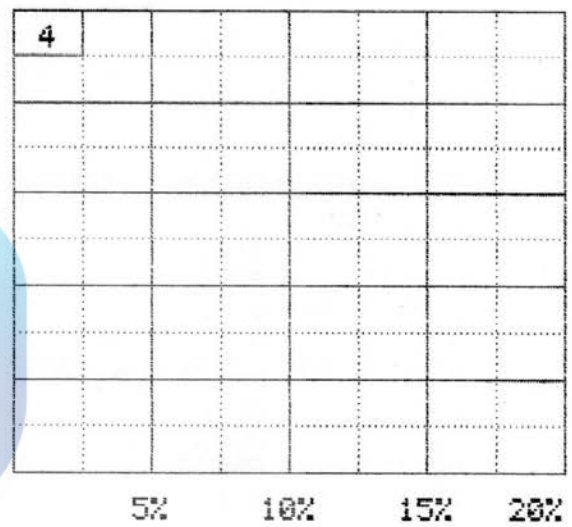

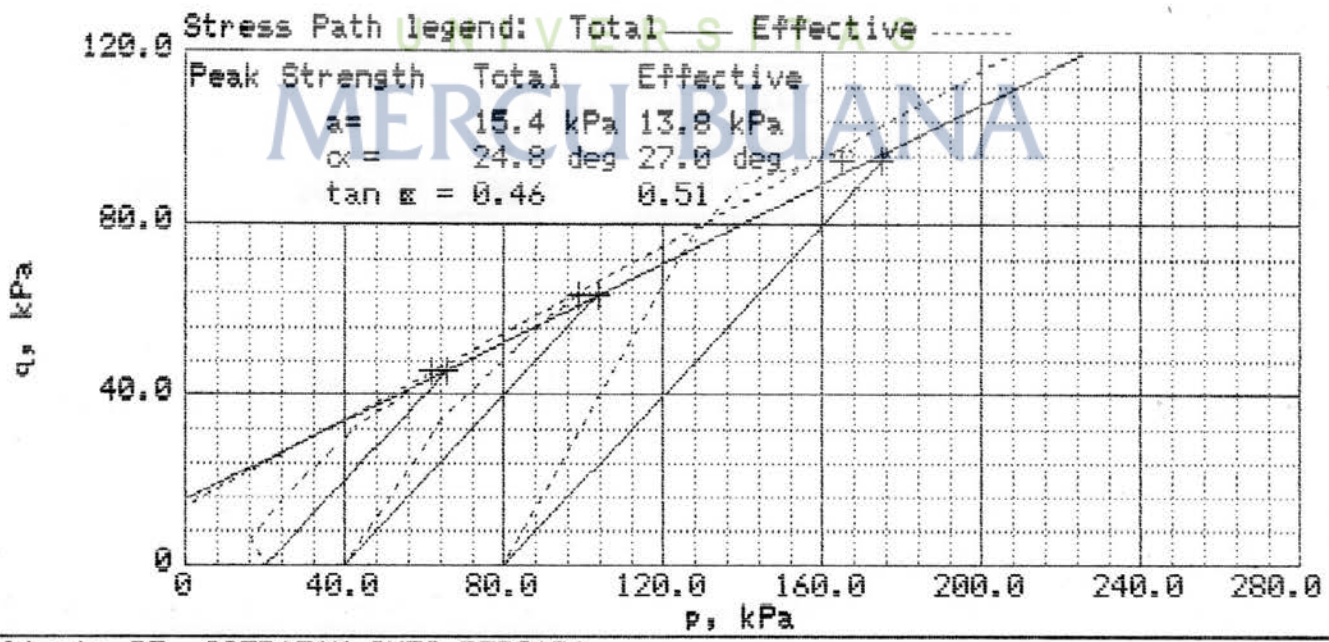

Client: PT. CITRATAM INTI PERSADA.
Project: GATOT SUBROTO TOWER. JAKARTA.
Location: DB.2 DEPTH : 2.00 - 2.50 M.
File: TXL-0271 Project No.: Page 2/2 Fig. No.____

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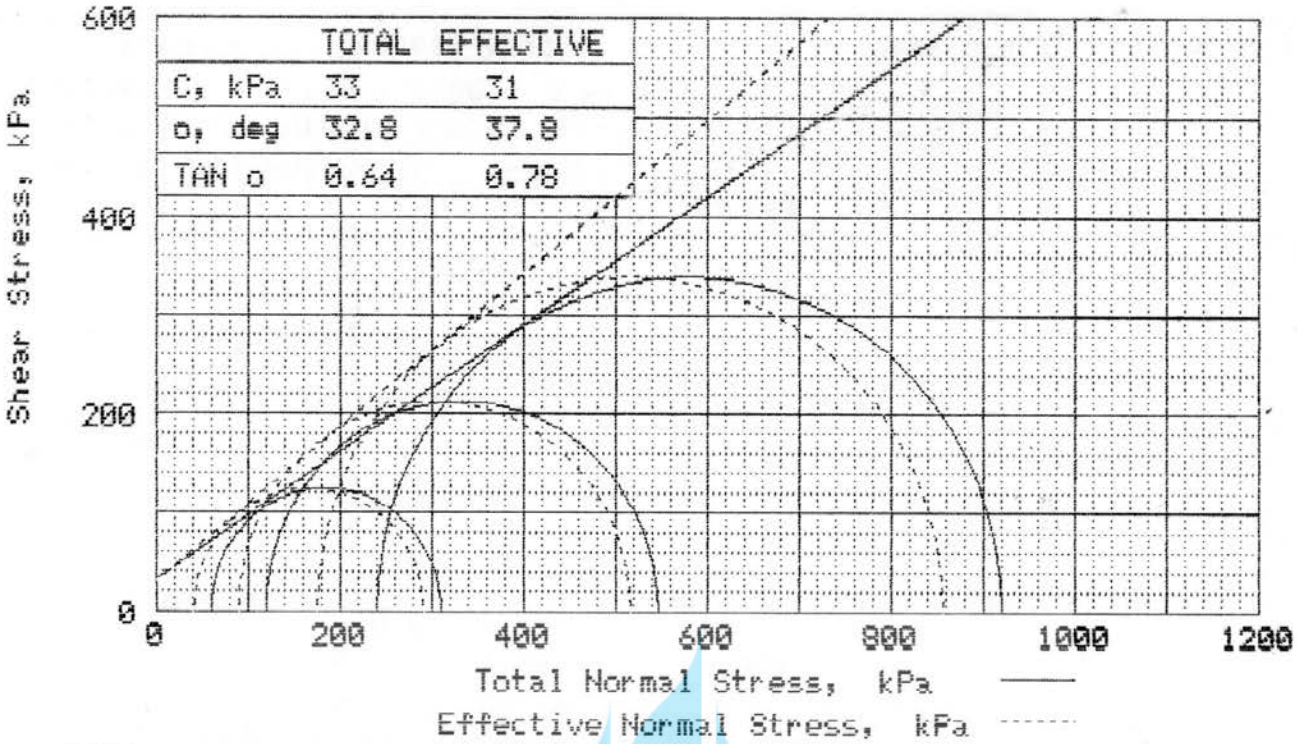
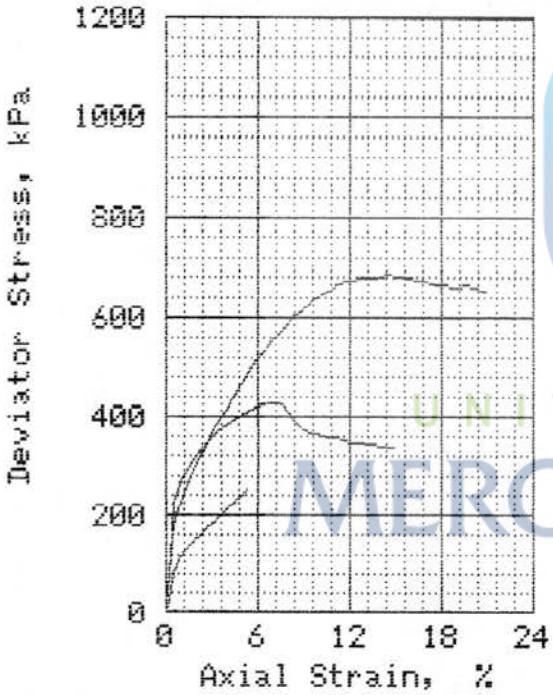


	TOTAL	EFFECTIVE
C, kPa	33	31
o, deg	32.8	37.8
TAN o	0.64	0.78



SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	30.7	30.7	30.8
	DRY DENSITY, g/cc	1.3	1.3	1.3
	SATURATION, %	73.8	73.8	75.9
	VOID RATIO	1.101	1.101	1.074
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.60
AT TEST	WATER CONTENT, %	26.4	26.3	17.0
	DRY DENSITY, g/cc	1.6	1.6	1.8
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.701	0.696	0.452
	DIAMETER, cm	3.45	3.57	3.28
	HEIGHT, cm	7.46	6.97	7.16
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190	190	190
CELL PRESSURE, kPa		250	310	430
FAILURE STRESS, kPa		251	427	681
PORE PRESSURE, kPa		209	220	254
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		292	517	857
$\bar{\sigma}_3$ FAILURE, kPa		41	90	176

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDISTURBER.
DESCRIPTION: BROWN.

LL= PL= PI=
SPECIFIC GRAVITY= 2.65
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. CITRATAMA INTI PERSADA.

PROJECT: GATOT SUBROTO TOWER.
JAKARTA.
SAMPLE LOCATION: DB.2
DEPTH : 7.00 - 7.50 M.

PROJ. NO.: DATE: 22 - 11 - 2012

TRIAXIAL SHEAR TEST REPORT

PT. KONAS TUNGGAL SOIL LABORATORY

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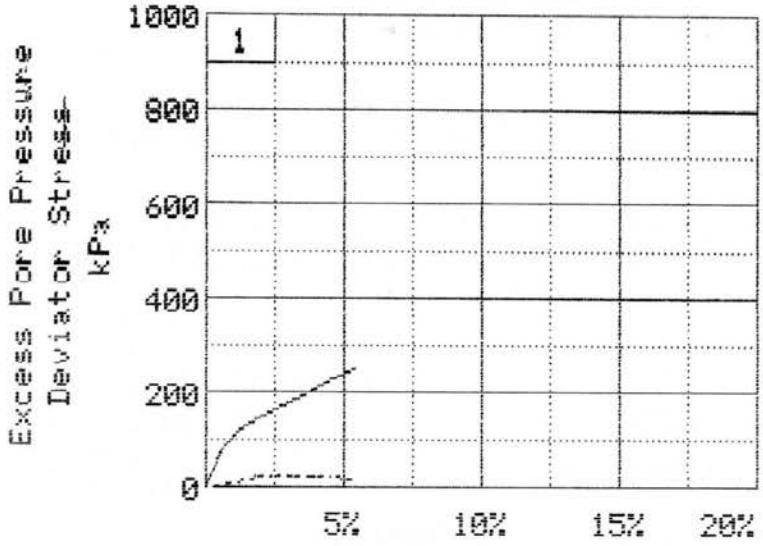

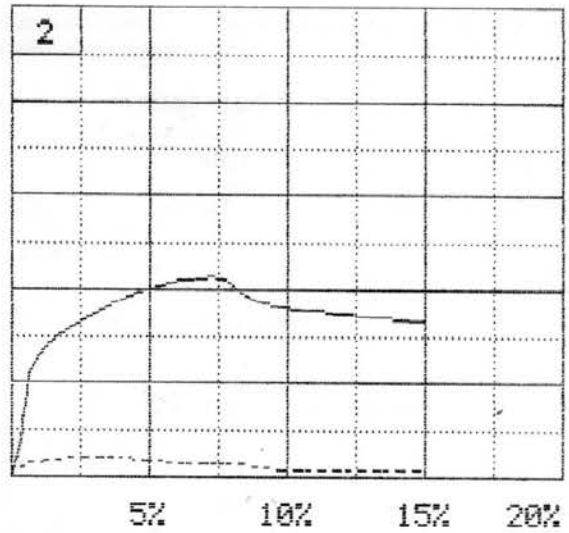

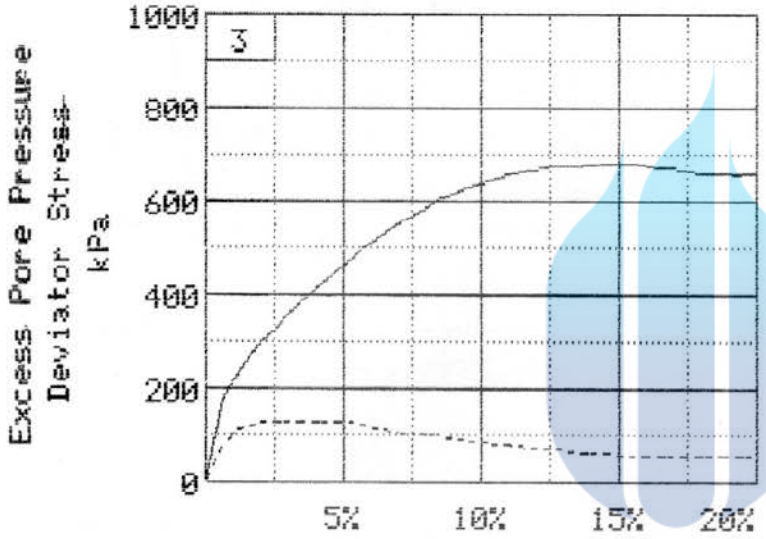

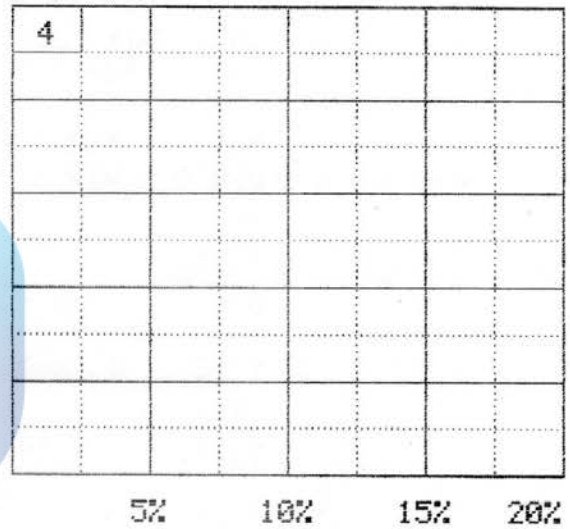

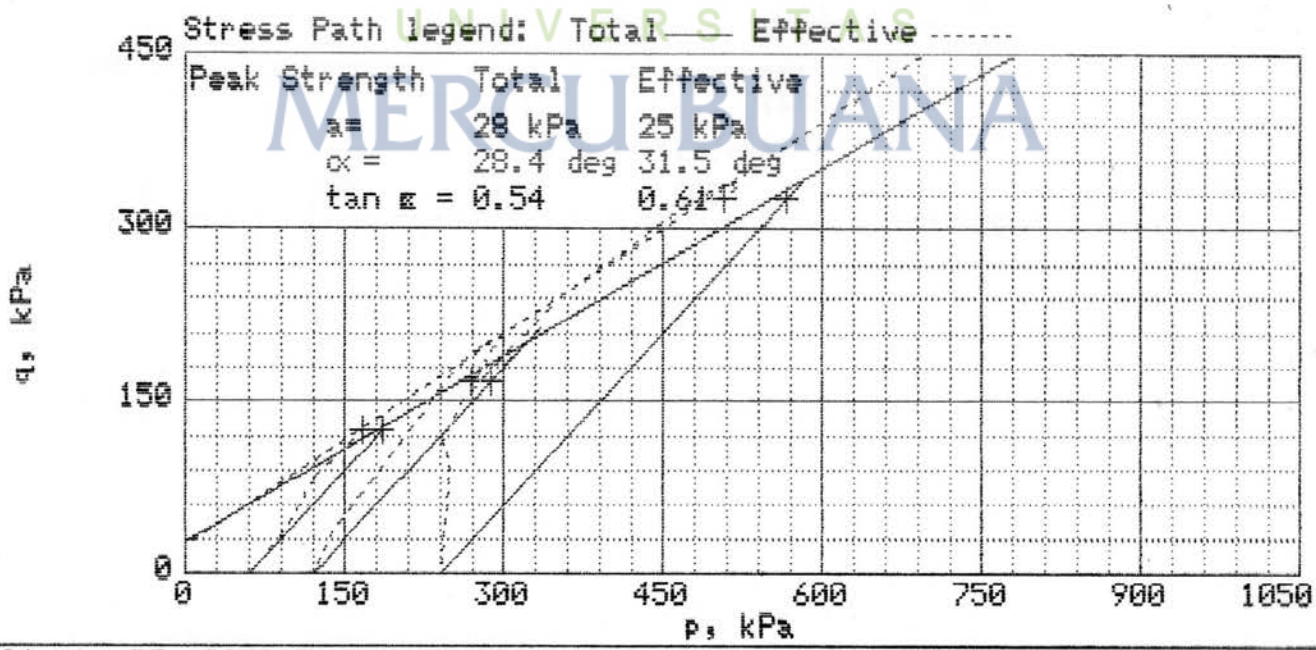

Client: PT. CITRATAMA INTI PERSADA.
Project: GATOT SUBROTO TOWER. JAKARTA.
Location: DB.2 DEPTH : 7.00 - 7.50 M.
File: TXL-0270 Project No.: Page 2/2 Fig. No.____

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LAMPIRAN – C

PENGUJIAN LABORATORIUM DB-3

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PT. DAYA CREASI MITRAYASA
Design & Engineering Consultants

SPECIFIC GRAVITY TEST (ASTM D 854)

Client	:	PT. Citratama Inti Persada	Project No.	:	DCM.G.12-047
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	16-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

Borehole : DB-3
Depth (m) : 2.50 - 3.00

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	1	2
Wt. of Pycno + cup [gram]	40.346	40.689
Wt. of Pycno + cup + soil [gram]	56.051	55.651
Wt. of Pycno + cup + water [gram]	139.411	139.108
Wt. of Pycno + cup + water + soil [gram]	148.993	148.386
Specific Gravity, Gs	2.565	2.632
Average of Specific Gravity, Gs	**2.599**	

Borehole : DB-3
Depth (m) : 8.00 - 8.50

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	49	50
Wt. of Pycno + cup [gram]	61.647	45.284
Wt. of Pycno + cup + soil [gram]	72.139	54.924
Wt. of Pycno + cup + water [gram]	161.096	145.207
Wt. of Pycno + cup + water + soil [gram]	167.542	151.150
Specific Gravity, Gs	2.593	2.608
Average of Specific Gravity, Gs	**2.600**	

Borehole : DB-3
Depth (m) : 13.00 - 13.50

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	51	52
Wt. of Pycno + cup [gram]	58.282	41.561
Wt. of Pycno + cup + soil [gram]	69.411	54.201
Wt. of Pycno + cup + water [gram]	156.847	142.353
Wt. of Pycno + cup + water + soil [gram]	163.700	150.194
Specific Gravity, Gs	2.603	2.634
Average of Specific Gravity, Gs	**2.618**	

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PT. DAYA CREASI MITRAYASA
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SPECIFIC GRAVITY TEST (ASTM D 854)

Client	:	PT. Citratama Inti Persada	Project No.	:	DCM.G.12-047
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	16-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

Borehole : DB-3
Depth (m) : 20.00 - 20.50

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	53	54
Wt. of Pycno + cup [gram]	31.886	28.918
Wt. of Pycno + cup + soil [gram]	43.981	40.446
Wt. of Pycno + cup + water [gram]	132.306	126.879
Wt. of Pycno + cup + water + soil [gram]	139.770	133.982
Specific Gravity, Gs	2.612	2.605
Average of Specific Gravity, Gs	**2.608**	

Borehole : DB-3
Depth (m) : 35.50 - 36.00

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	55	56
Wt. of Pycno + cup [gram]	34.528	60.746
Wt. of Pycno + cup + soil [gram]	50.762	77.597
Wt. of Pycno + cup + water [gram]	133.571	159.908
Wt. of Pycno + cup + water + soil [gram]	143.564	170.360
Specific Gravity, Gs	2.601	2.633
Average of Specific Gravity, Gs	**2.617**	

Borehole : DB-3
Depth (m) : 50.00 - 50.50

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	5	6
Wt. of Pycno + cup [gram]	32.159	38.975
Wt. of Pycno + cup + soil [gram]	45.007	52.154
Wt. of Pycno + cup + water [gram]	81.679	138.167
Wt. of Pycno + cup + water + soil [gram]	89.661	146.315
Specific Gravity, Gs	2.640	2.620
Average of Specific Gravity, Gs	**2.630**	

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WATER CONTENT DETERMINATION (ASTM D 2216)

Project No.	:	DCM.G.12-047	Tested date	:	4-Nov-12
Client	:	PT. Citratama Inti Persada	Tested by	:	Kbl
Project	:	Gatot Subroto Tower (Centennial Tower)	Checked by	:	Juweni
Location	:	Jl. Gatot Subroto - Jakarta			

UDS Sample

Borehole : **DB-3**
Depth (m) : **2.50 - 3.00**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	74.206	94.968	90.043
Wt. of dry soil + can [gram]	58.832	73.376	69.355
Wt. of can [gram]	23.870	23.539	21.156
Wt. of wet soil [gram]	50.336	71.429	68.887
Wt. of water [gram]	15.374	21.592	20.688
Wt. of dry soil [gram]	34.962	49.837	48.199
Water content, w %	43.973	43.325	42.922
γ_s [gram/cm^3]	**1.601**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.116**	**43.41**	

Borehole : **DB-3**
Depth (m) : **8.00 - 8.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	71.683	85.529	75.669
Wt. of dry soil + can [gram]	54.406	60.591	53.930
Wt. of can [gram]	28.186	21.552	21.864
Wt. of wet soil [gram]	43.497	63.977	53.805
Wt. of water [gram]	17.277	24.938	21.739
Wt. of dry soil [gram]	26.220	39.039	32.066
Water content, w %	65.892	63.880	67.795
γ_s [gram/cm^3]	**1.383**	**Average of water content [%]**	
γ_d [gram/cm^3]	**0.834**	**65.86**	

Borehole : **DB-3**
Depth (m) : **13.00 - 13.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	80.704	84.129	91.877
Wt. of dry soil + can [gram]	64.874	66.248	71.623
Wt. of can [gram]	25.055	21.113	21.949
Wt. of wet soil [gram]	55.649	63.016	69.928
Wt. of water [gram]	15.830	17.881	20.254
Wt. of dry soil [gram]	39.819	45.135	49.674
Water content, w %	39.755	39.617	40.774
γ_s [gram/cm^3]	**1.769**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.263**	**40.05**	

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PT. DAYA CREASI MITRAYASA
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WATER CONTENT DETERMINATION (ASTM D 2216)

Project No.	:	DCM 12-047	Tested date	:	4-Nov-12
Client	:	PT. Citratama Inti Persada	Tested by	:	Kbl
Project	:	Gatot Subroto Tower (Centennial Tower)	Checked by	:	Juweni
Location	:	Jl. Gatot Subroto - Jakarta			

UDS Sample

Borehole : **DB-3**
Depth (m) : **20.00 - 20.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	78.989	98.312	84.088
Wt. of dry soil + can [gram]	63.293	77.157	64.622
Wt. of can [gram]	24.056	23.421	15.933
Wt. of wet soil [gram]	54.933	74.891	68.155
Wt. of water [gram]	15.696	21.155	19.466
Wt. of dry soil [gram]	39.237	53.736	48.689
Water content, w %	40.003	39.368	39.980
γ_s [gram/cm^3]	**1.747**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.250**	**39.78**	

Borehole : **DB-3**
Depth (m) : **35.50 - 36.00**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	80.463	106.679	97.410
Wt. of dry soil + can [gram]	66.730	85.067	77.994
Wt. of can [gram]	25.349	14.747	16.729
Wt. of wet soil [gram]	55.114	91.932	80.681
Wt. of water [gram]	13.733	21.612	19.416
Wt. of dry soil [gram]	41.381	70.320	61.265
Water content, w %	33.187	30.734	31.692
γ_s [gram/cm^3]	**1.752**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.329**	**31.87**	

Borehole : **DB-3**
Depth (m) : **50.00 - 50.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	87.321	77.818	85.349
Wt. of dry soil + can [gram]	75.817	64.752	71.243
Wt. of can [gram]	28.527	13.828	15.820
Wt. of wet soil [gram]	58.794	63.990	69.529
Wt. of water [gram]	11.504	13.066	14.106
Wt. of dry soil [gram]	47.290	50.924	55.423
Water content, w %	24.326	25.658	25.452
γ_s [gram/cm^3]	**1.869**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.494**	**25.15**	

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ATTERBERG LIMITS TEST (ASTM D 4318)

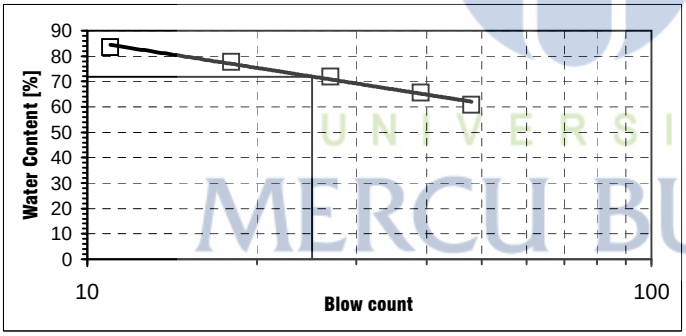
Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	2.50 - 3.00
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	14-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	80.720	77.515	76.656	79.236	79.490
Wt. of dry soil + can [gram]	51.275	50.395	51.024	53.899	55.361
Wt. of can [gram]	15.979	15.512	15.363	15.286	15.683
Wt. of water [gram]	29.445	27.120	25.632	25.337	24.129
Wt. of dry soil [gram]	35.296	34.883	35.661	38.613	39.678
Water content, w [%]	83.423	77.746	71.877	65.618	60.812
No. of blows	11	18	27	39	48

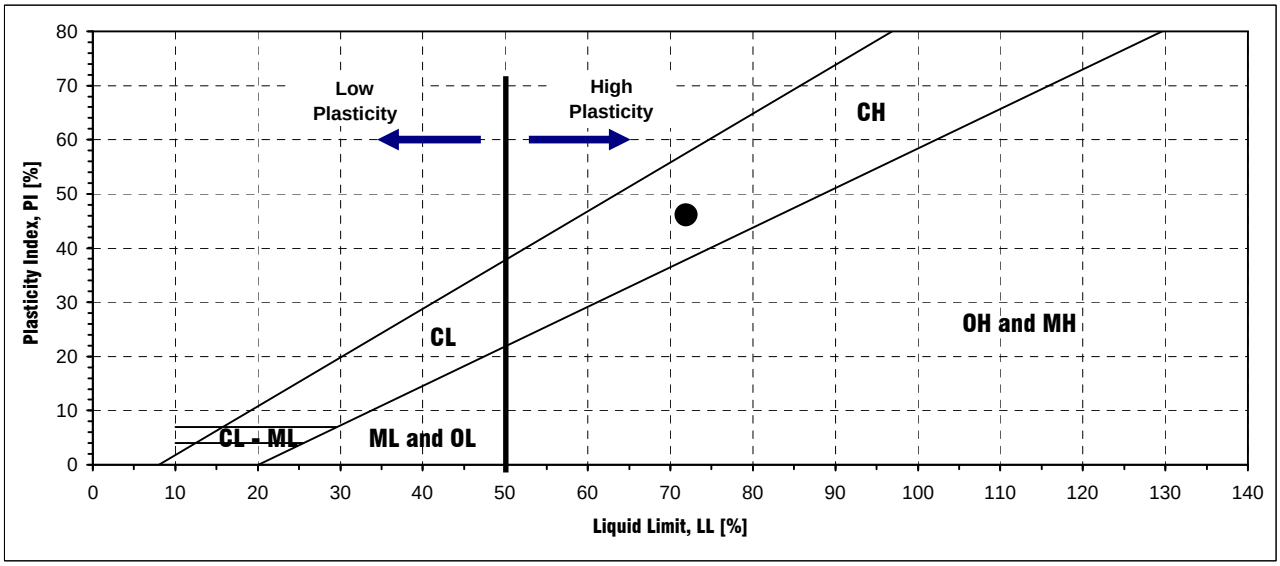
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	35.600	35.808	35.628		
Wt. of dry soil + can [gram]	31.000	31.896	31.789		
Wt. of can [gram]	15.536	15.800	15.561		
Wt. of water [gram]	4.600	3.912	3.839		
Wt. of dry soil [gram]	15.464	16.096	16.228		
Water content, w [%]	29.747	24.304	23.657		



Liquid limit [LL], %	:	71.969
Plastic limit [PL], %	:	25.902
Plasticity index [PI], %	:	46.067
Flow index	:	0.2108
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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ATTERBERG LIMITS TEST (ASTM D 4318)

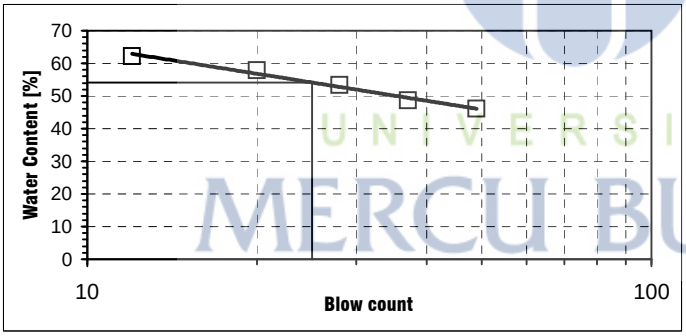
Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	8.00 - 8.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	14-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	89.970	73.014	49.971	68.871	54.966
Wt. of dry soil + can [gram]	61.383	51.792	37.799	51.287	42.676
Wt. of can [gram]	15.365	15.164	15.011	15.057	15.987
Wt. of water [gram]	28.587	21.222	12.172	17.584	12.290
Wt. of dry soil [gram]	46.018	36.628	22.788	36.230	26.689
Water content, w [%]	62.121	57.939	53.414	48.534	46.049
No. of blows	12	20	28	37	49

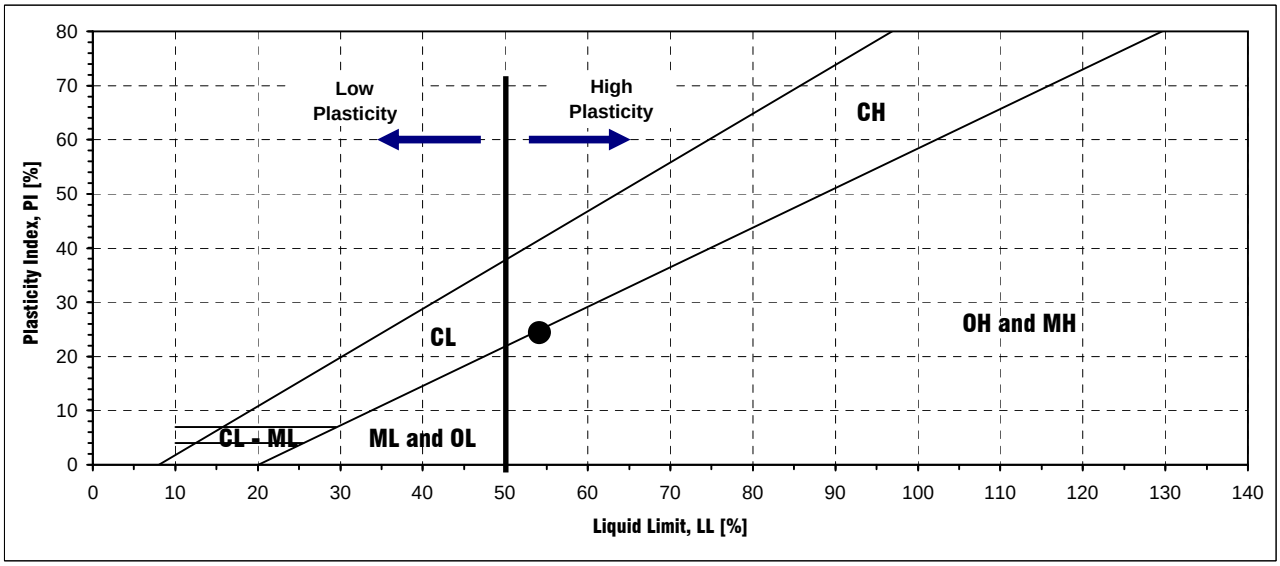
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	39.353	37.949	38.765		
Wt. of dry soil + can [gram]	33.685	32.638	33.754		
Wt. of can [gram]	15.605	15.178	15.617		
Wt. of water [gram]	5.668	5.311	5.011		
Wt. of dry soil [gram]	18.080	17.460	18.137		
Water content, w [%]	31.350	30.418	27.629		



Liquid limit [LL], %	:	54.140
Plastic limit [PL], %	:	29.799
Plasticity index [PI], %	:	24.341
Flow index	:	0.2219
Classification	:	MH - Elastic silt

Soil Classification by Plasticity Chart [Casagrande Chart]



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ATTERBERG LIMITS TEST (ASTM D 4318)

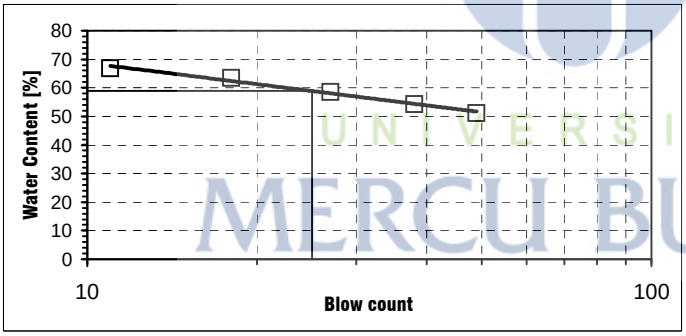
Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	13.00 - 13.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	19-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	75.405	76.066	66.821	68.222	60.033
Wt. of dry soil + can [gram]	51.444	52.358	48.012	49.714	45.055
Wt. of can [gram]	15.570	15.015	15.876	15.626	15.763
Wt. of water [gram]	23.961	23.708	18.809	18.508	14.978
Wt. of dry soil [gram]	35.874	37.343	32.136	34.088	29.292
Water content, w [%]	66.792	63.487	58.529	54.295	51.133
No. of blows	11	18	27	38	49

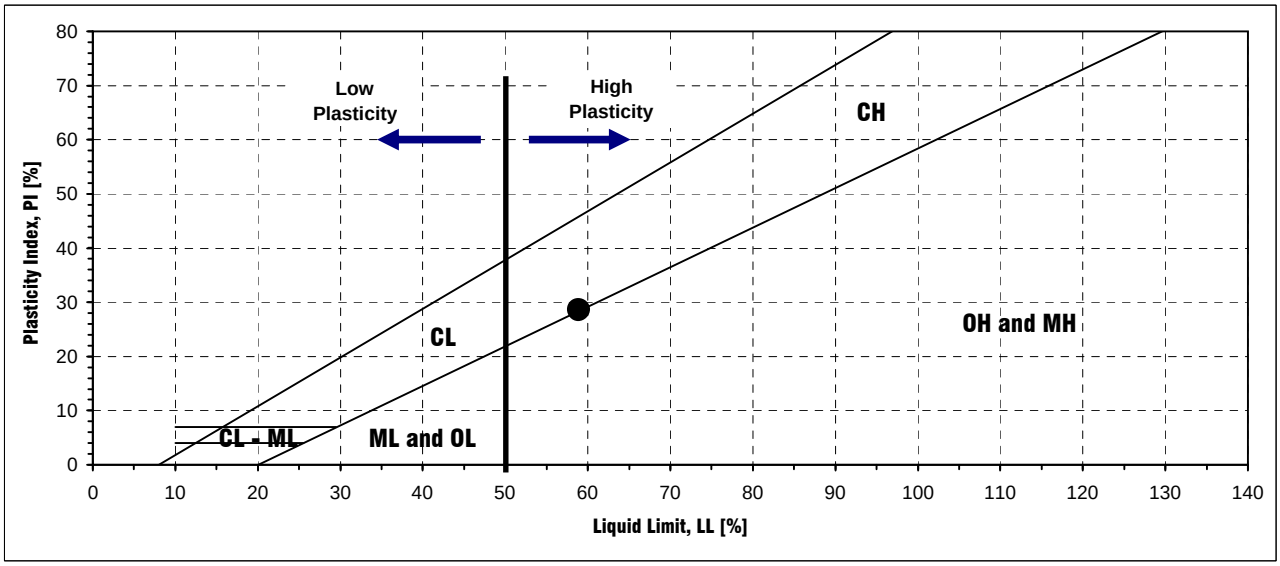
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	35.014	34.637	34.633		
Wt. of dry soil + can [gram]	30.538	30.159	30.289		
Wt. of can [gram]	15.866	15.536	15.711		
Wt. of water [gram]	4.476	4.478	4.344		
Wt. of dry soil [gram]	14.672	14.623	14.578		
Water content, w [%]	30.507	30.623	29.798		



Liquid limit [LL], %	:	58.888
Plastic limit [PL], %	:	30.309
Plasticity index [PI], %	:	28.579
Flow index	:	0.1819
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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ATTERBERG LIMITS TEST (ASTM D 4318)

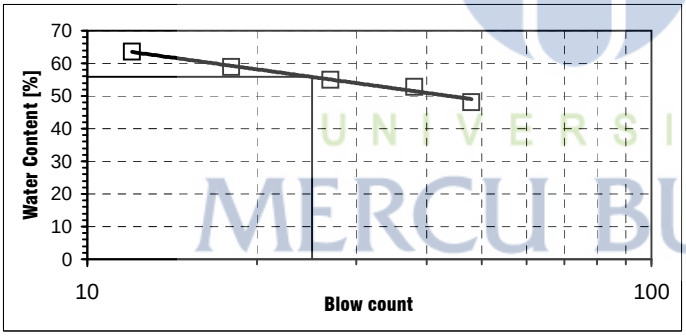
Project No.	: DCM.G.12-047	Borehole	: **DB-3**
Client	: PT. Citratama Inti Persada	Depth (m)	: 20.00 - 20.50
Project	: Gatot Subroto Tower (Centennial Tower)	Tested date	: 16-Nov-2012
Location	: Jl. Jend. Gatot Subroto - Jakarta	Tested by	: Rimanto
		Checked by	: Juweni
			UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	85.864	77.774	73.860	78.025	72.498
Wt. of dry soil + can [gram]	58.772	54.923	53.399	56.657	54.147
Wt. of can [gram]	16.132	16.131	16.183	16.176	16.007
Wt. of water [gram]	27.092	22.851	20.461	21.368	18.351
Wt. of dry soil [gram]	42.640	38.792	37.216	40.481	38.140
Water content, w [%]	63.537	58.906	54.979	52.785	48.115
No. of blows	12	18	27	38	48

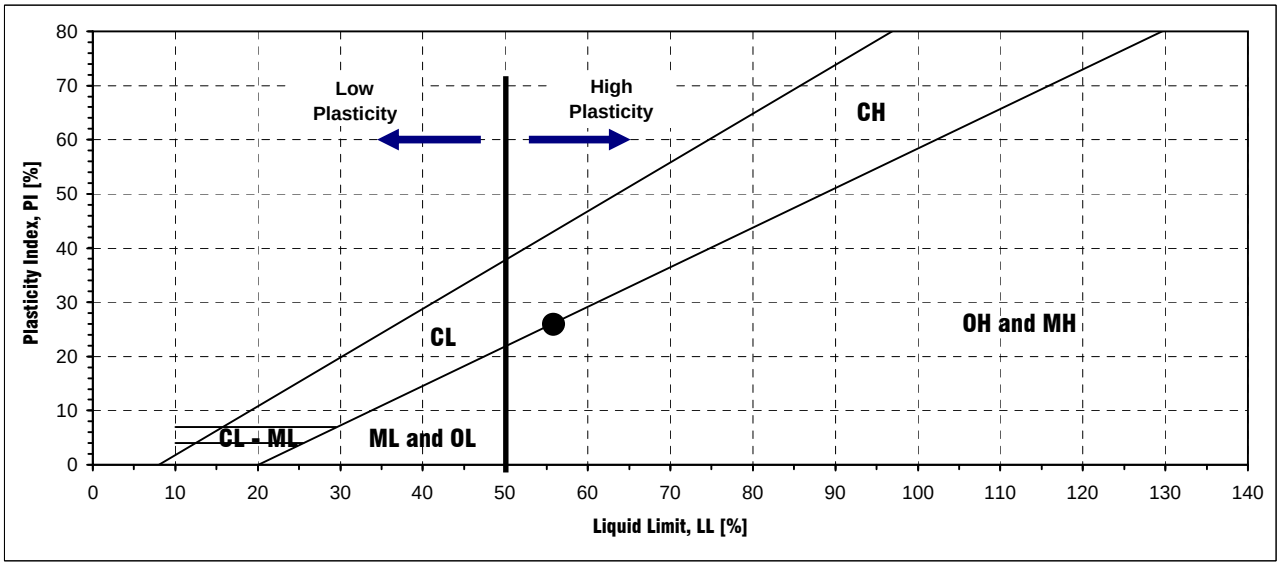
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	38.098	38.082	39.101		
Wt. of dry soil + can [gram]	32.998	32.889	33.998		
Wt. of can [gram]	16.098	16.181	16.134		
Wt. of water [gram]	5.100	5.193	5.103		
Wt. of dry soil [gram]	16.900	16.708	17.864		
Water content, w [%]	30.178	31.081	28.566		



Liquid limit [LL], %	:	55.842
Plastic limit [PL], %	:	29.941
Plasticity index [PI], %	:	25.901
Flow index	:	0.1866
Classification	:	MH - Elastic silt

Soil Classification by Plasticity Chart [Casagrande Chart]



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ATTERBERG LIMITS TEST (ASTM D 4318)

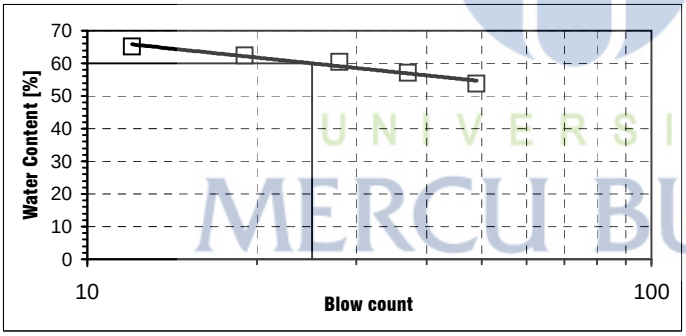
Project No.	: DCM.G.12-047	Borehole	: **DB-3**
Client	: PT. Citratama Inti Persada	Depth (m)	: 50.00 - 50.50
Project	: Gatot Subroto Tower (Centennial Tower)	Tested date	: 19-Nov-2012
Location	: Jl. Jend. Gatot Subroto - Jakarta	Tested by	: Rimanto
		Checked by	: Juweni
			UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	96.397	92.463	81.908	86.096	89.106
Wt. of dry soil + can [gram]	64.246	62.512	56.564	60.051	63.115
Wt. of can [gram]	14.900	14.441	14.661	14.383	14.755
Wt. of water [gram]	32.151	29.951	25.344	26.045	25.991
Wt. of dry soil [gram]	49.346	48.071	41.903	45.668	48.360
Water content, w [%]	65.154	62.306	60.483	57.031	53.745
No. of blows	12	19	28	37	49

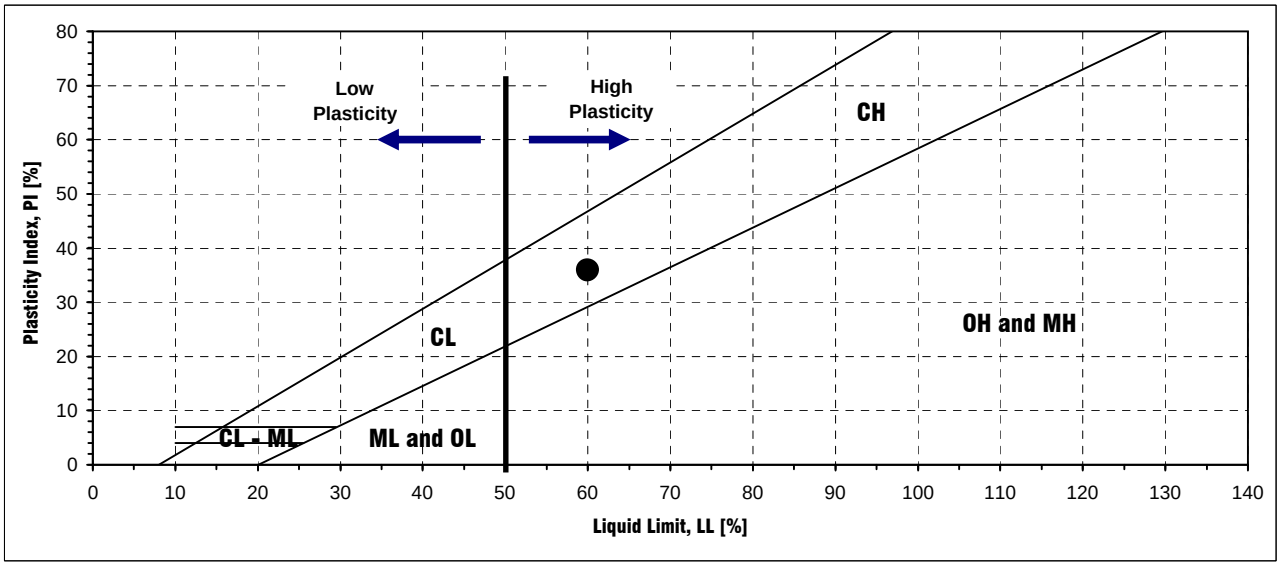
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	39.918	39.918	39.999		
Wt. of dry soil + can [gram]	35.212	35.201	35.232		
Wt. of can [gram]	15.621	15.708	15.496		
Wt. of water [gram]	4.706	4.717	4.767		
Wt. of dry soil [gram]	19.591	19.493	19.736		
Water content, w [%]	24.021	24.198	24.154		



Liquid limit [LL], %	:	60.012
Plastic limit [PL], %	:	24.124
Plasticity index [PI], %	:	35.887
Flow index	:	0.1326
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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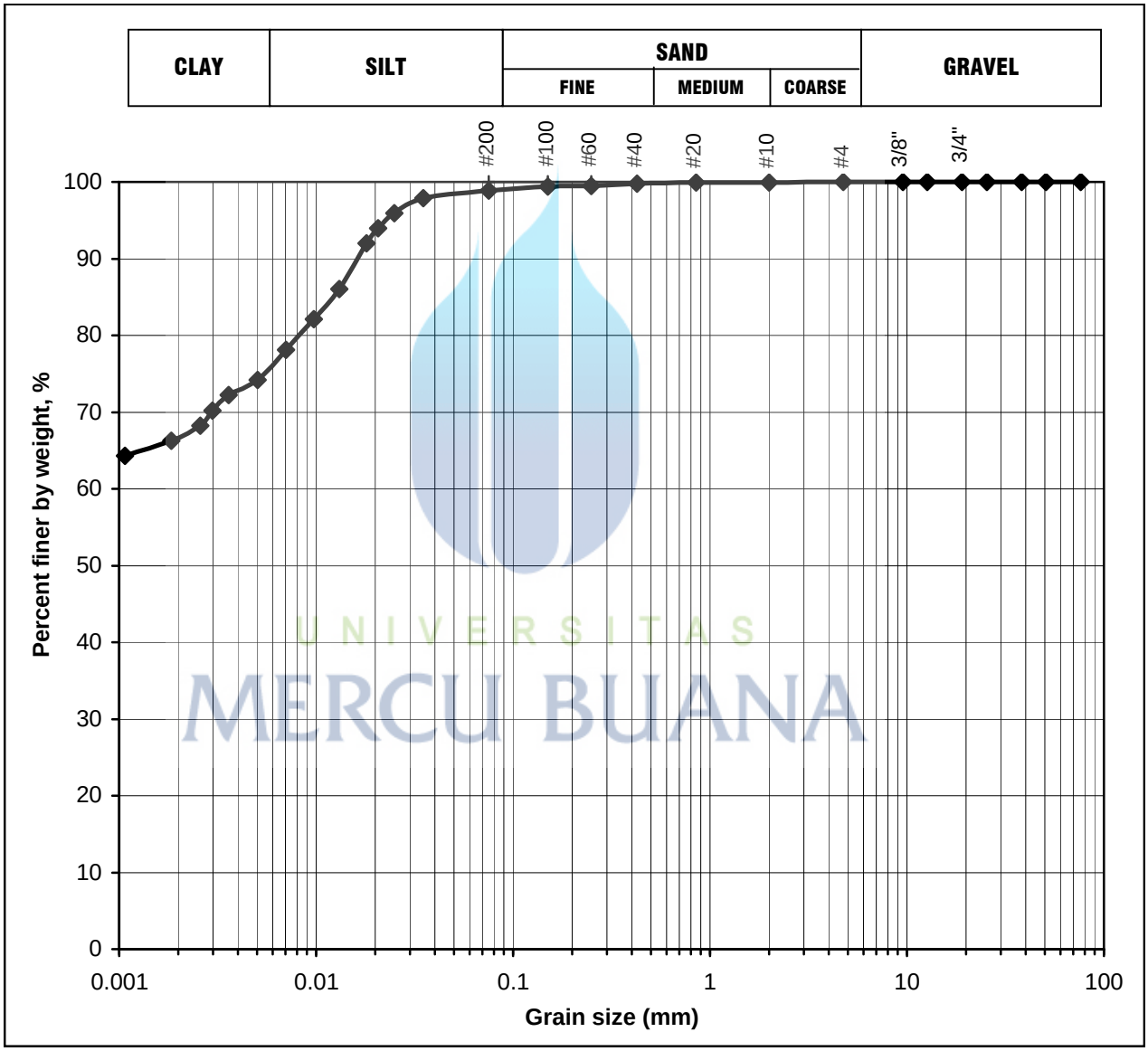
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	2,50 - 3,00
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	17-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-3 [2,50 - 3,00]	0.00	1.11	24.80	74.09	CH - Fat clay

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.000	NA	NA	71.97	25.90

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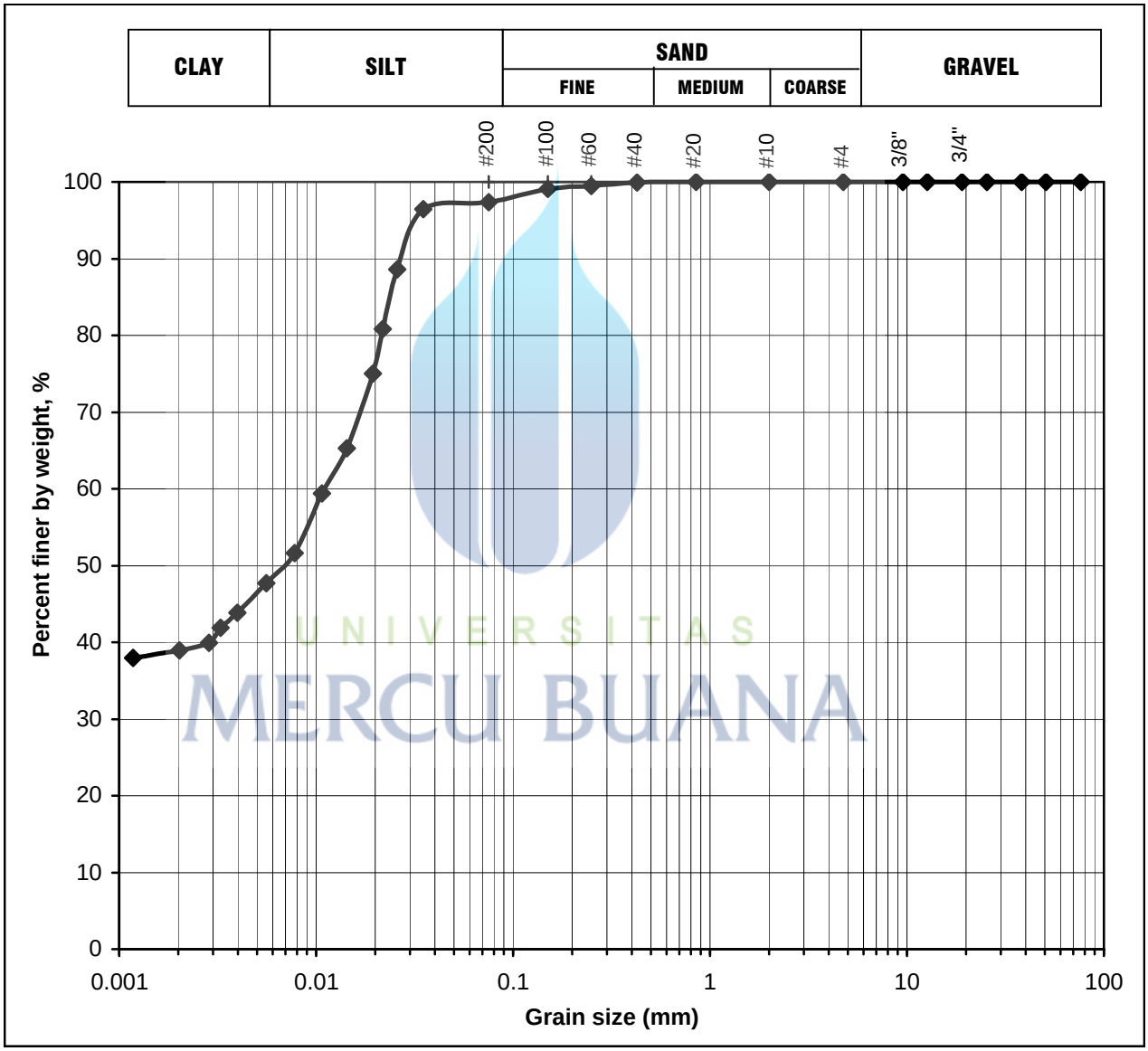
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	8,00 - 8,50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	17-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-3 [8,00 - 8,50]	0.00	2.61	51.12	46.28	MH - Elastic silt

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.011	NA	NA	54.14	29.79

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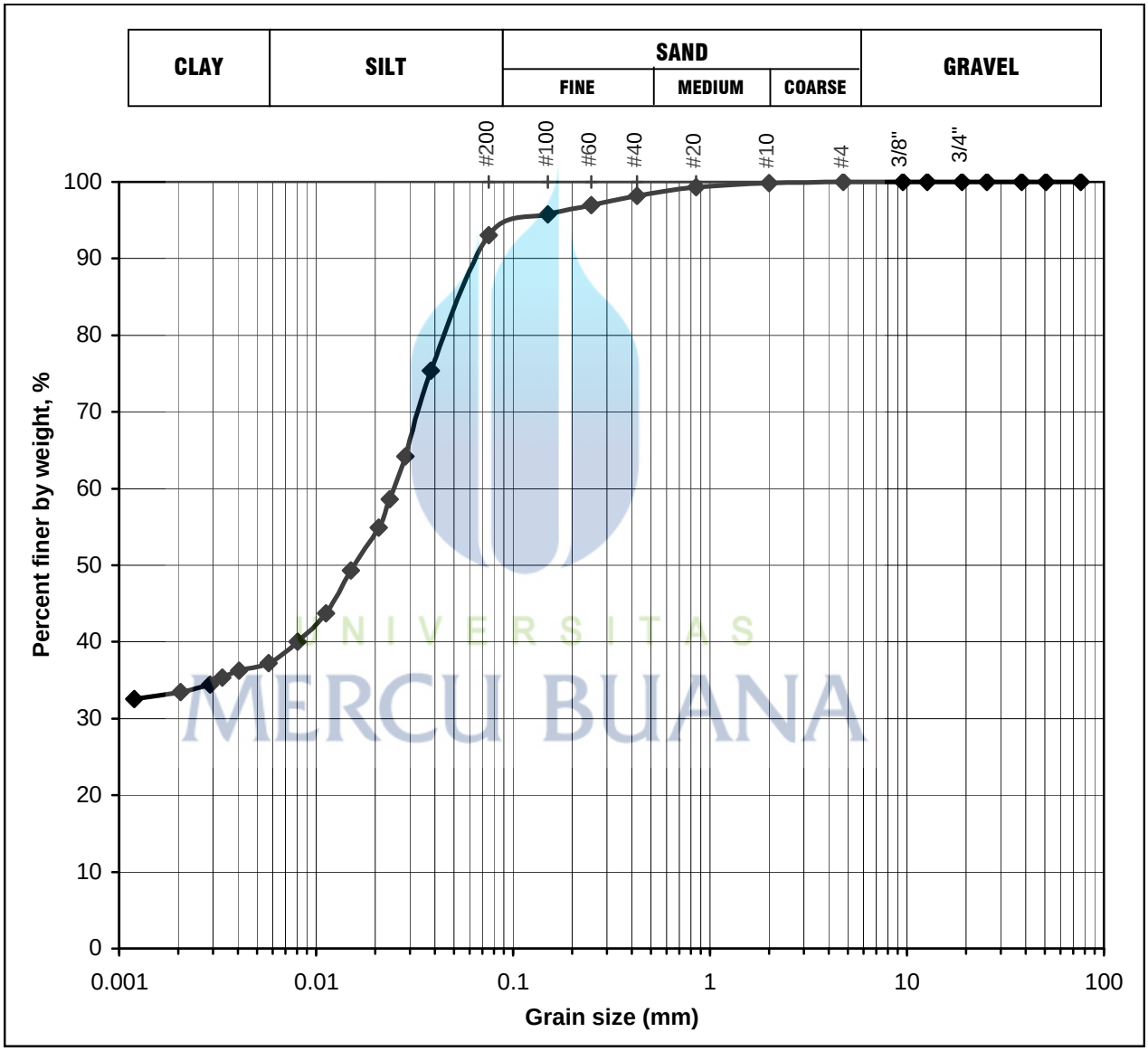
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	13,00 - 13,50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	17-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-3 [13,00 - 13,50]	0.00	6.96	56.24	36.80	CH - Fat clay

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.025	NA	NA	58.89	30.31

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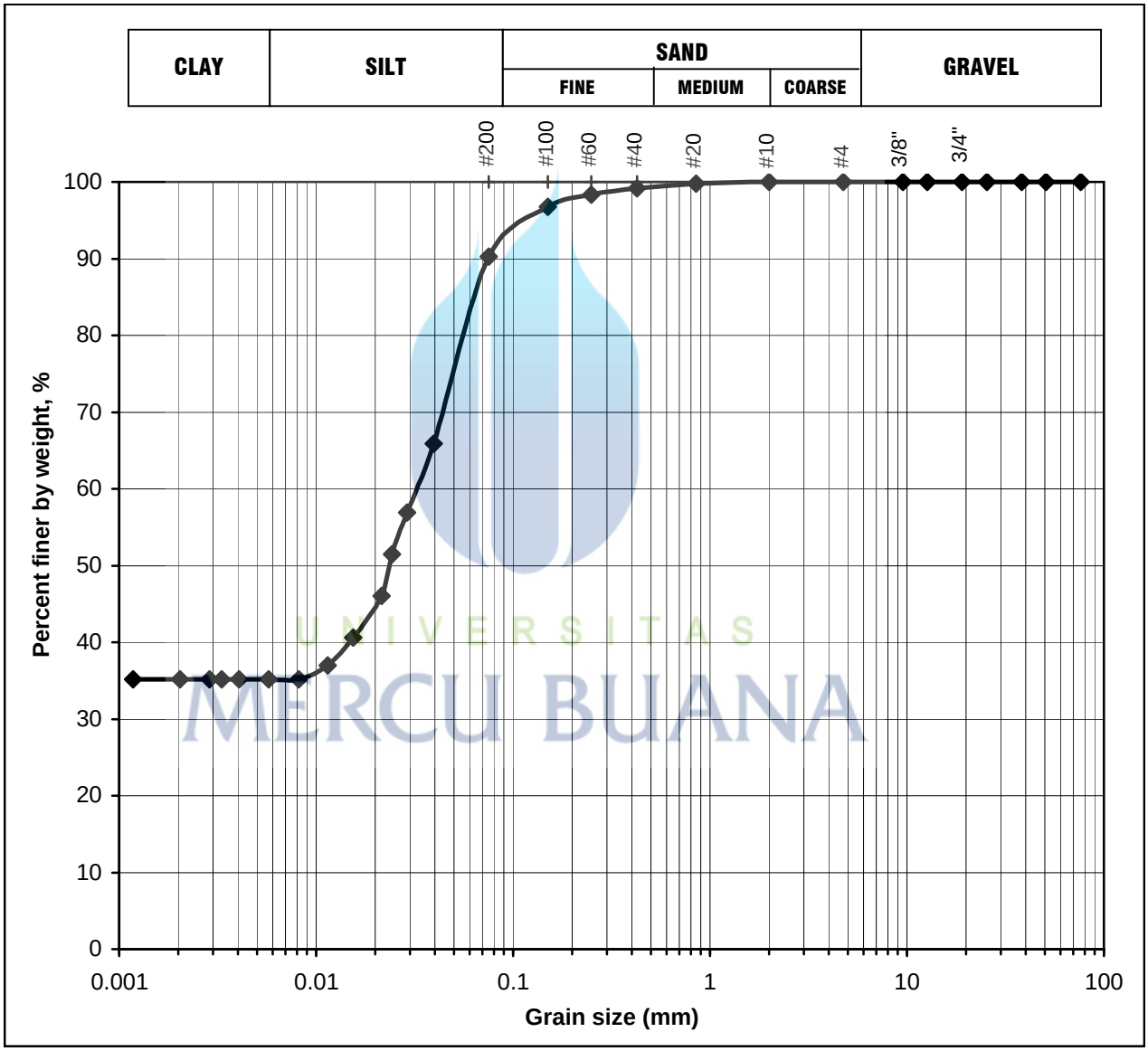
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	20,00 - 20,50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	17-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-3 [20,00 - 20,50]	0.00	9.73	55.07	35.21	MH - Elastic silt

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.032	NA	NA	55.84	29.94

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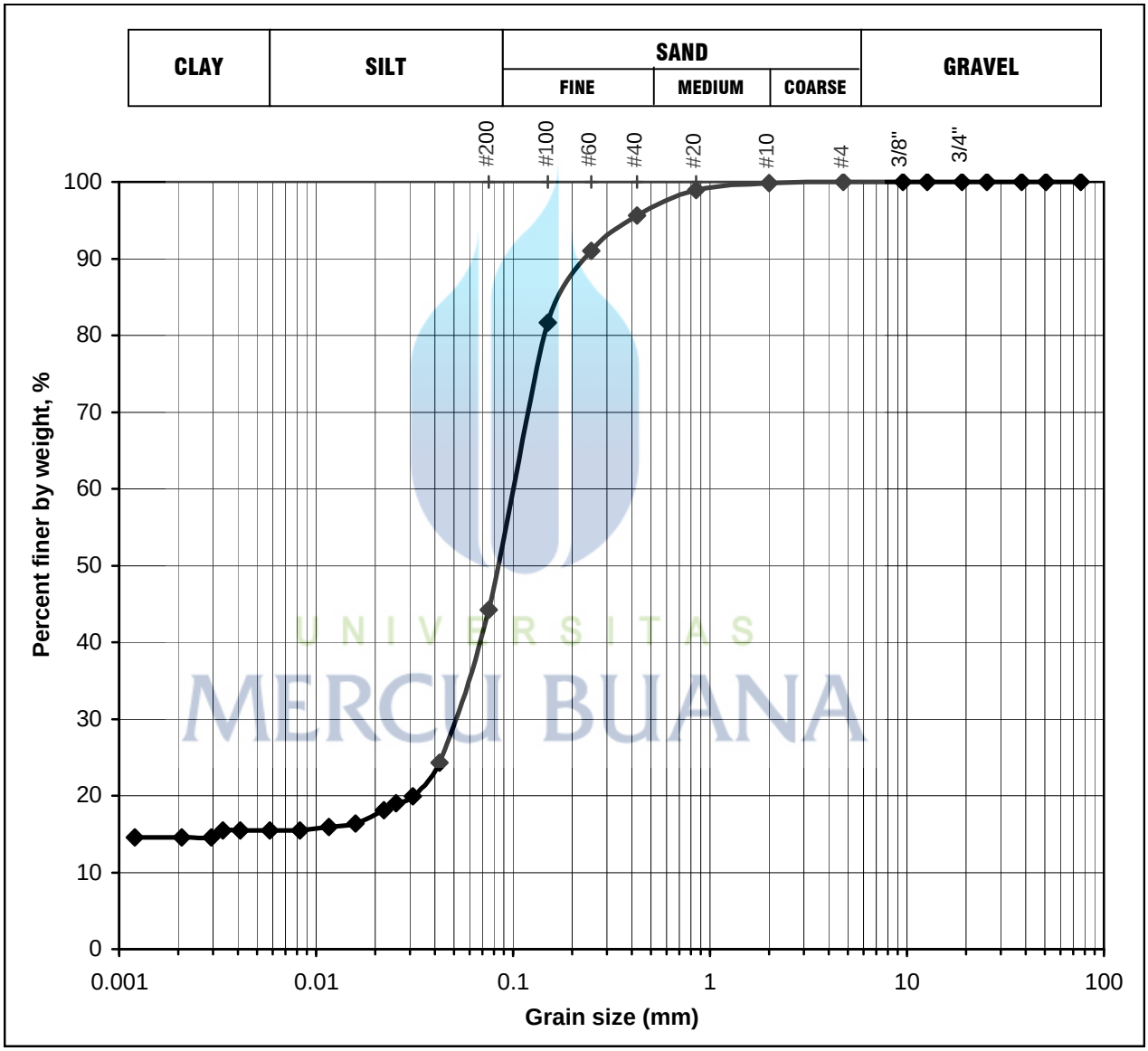
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	35,50 - 36,00
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	17-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-3 [35,50 - 36,00]	0.00	55.75	28.76	15.49	SM - Silty sand

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.050	0.100	NA	NA		

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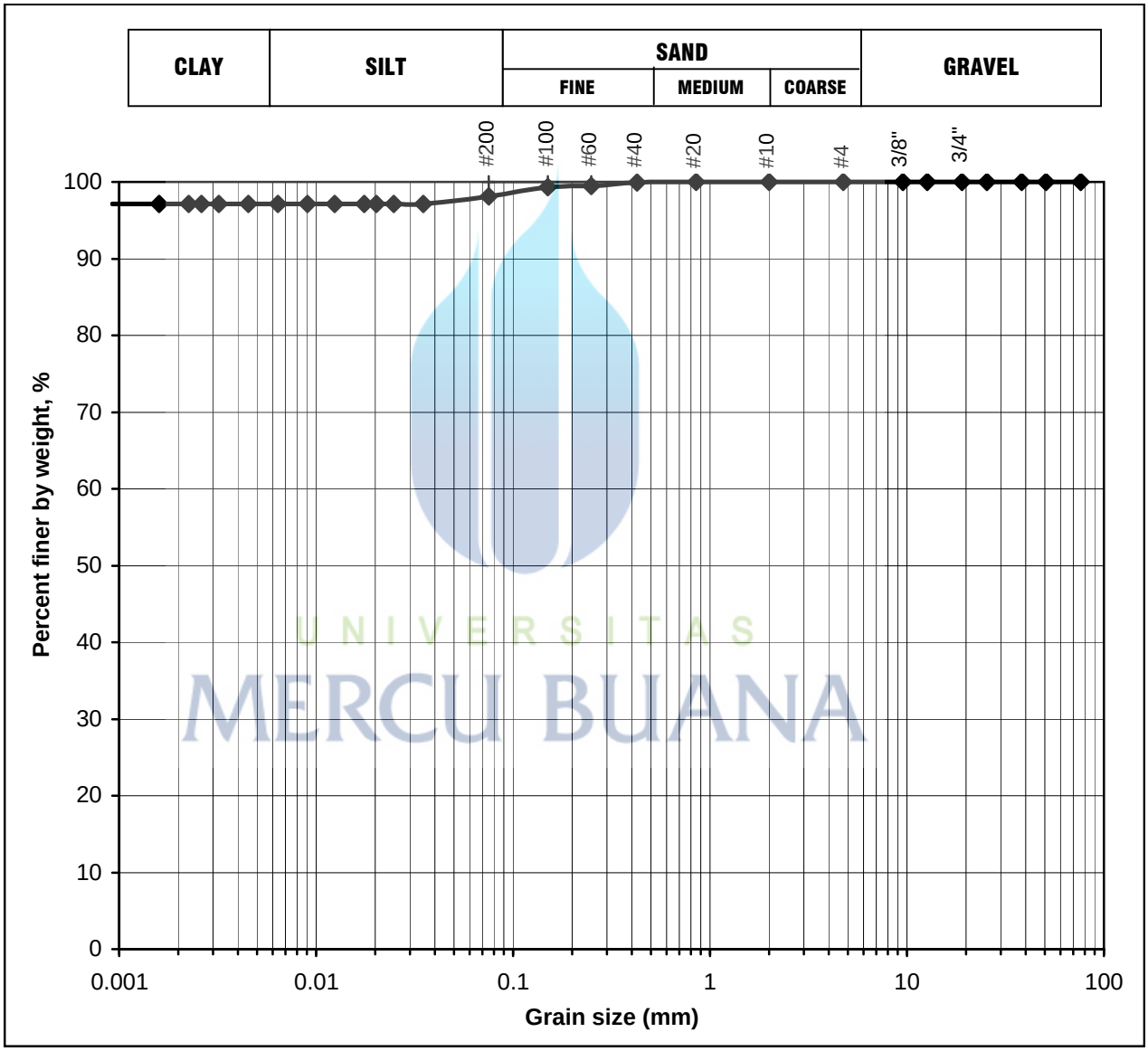
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	50,00 - 50,50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	17-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-3 [50,00 - 50,50]	0.00	1.85	0.98	97.17	CH - Fat clay

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.000	NA	NA	60.01	24.12

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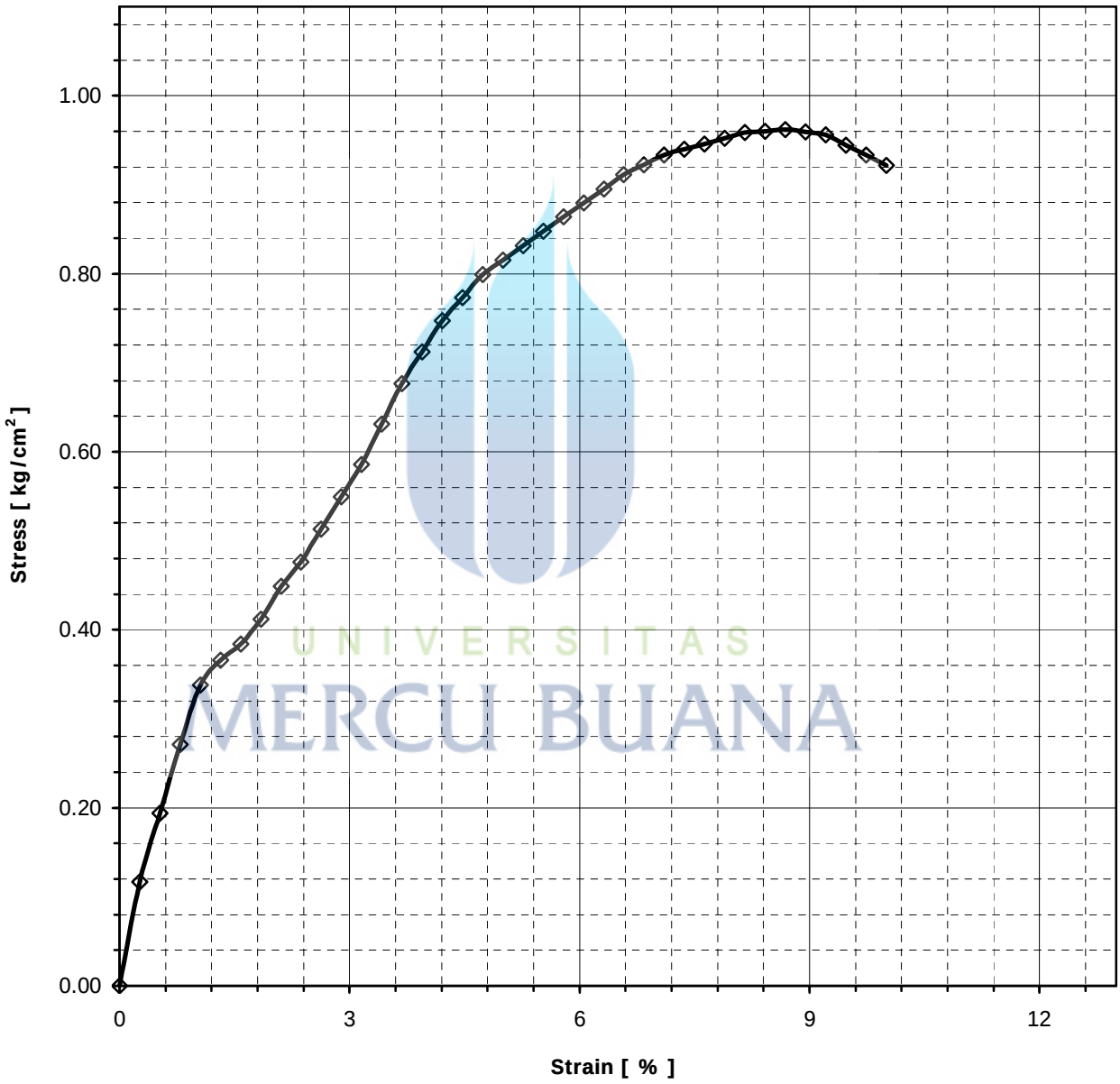
UNCONFINED COMPRESSION TEST (ASTM D 2166)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	2,50 - 3,00
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	17-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Zaenuri
			Checked by	:	Juweni



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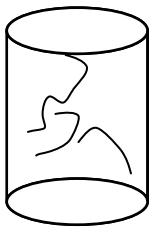
γ_s	:	16.011	kN/m³
q_u	:	0.962	kg/cm²
S_u	:	0.481	kg/cm²
E	:	0.145	kg/cm²

Failure sketch : Plastic Flow



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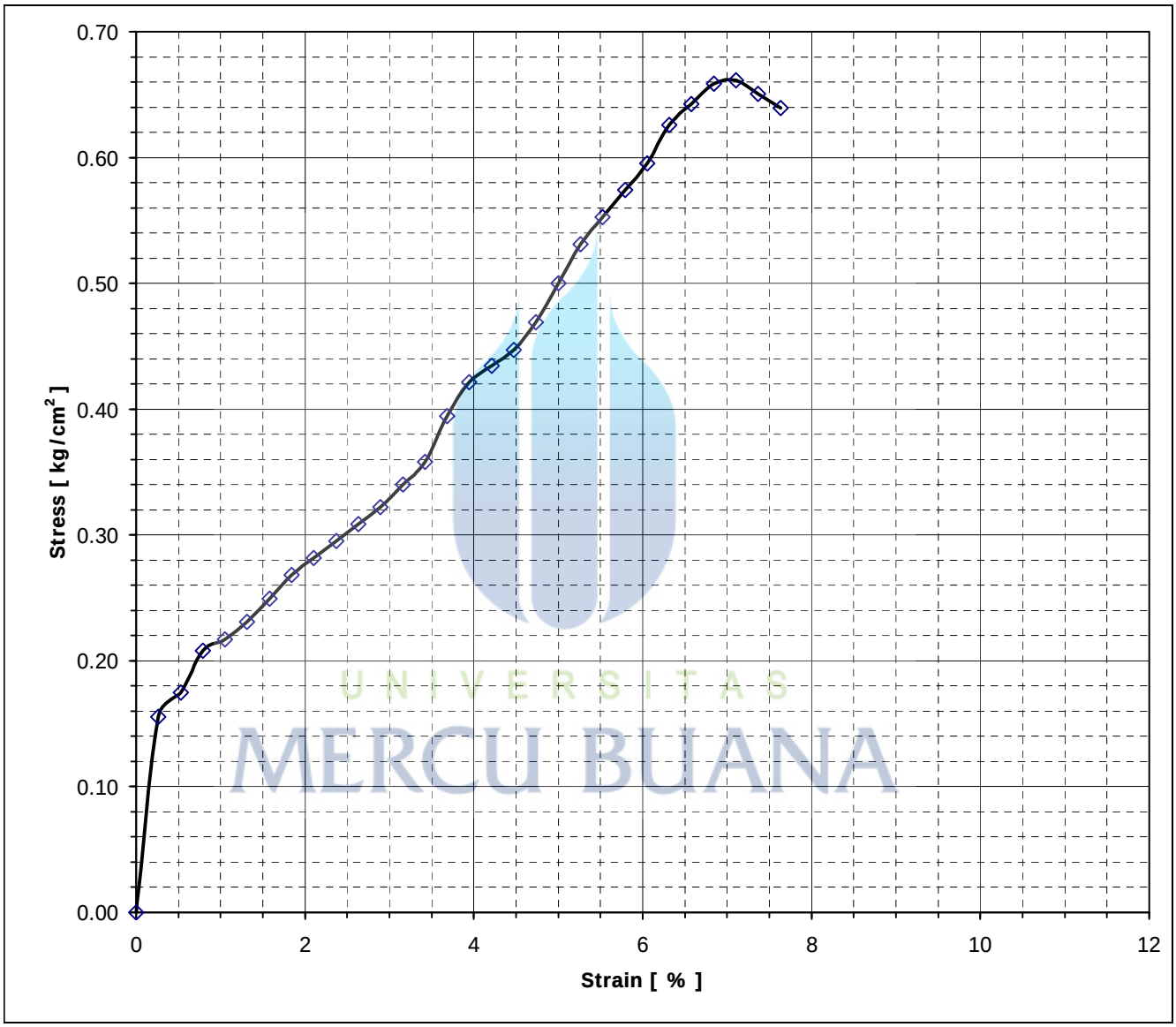
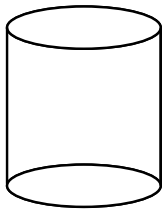
UNCONFINED COMPRESSION TEST (ASTM D 2166 - 91)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	8.00 - 8.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	16-Nov-12
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Zaenuri
			Checked by	:	Juweni



γ_s	:	**14.048**	kN/m^3
q_u	:	**0.661**	kg/cm^2
S_u	:	**0.331**	kg/cm^2
E	:	**0.077**	kg/cm^2

Failure Sketch :



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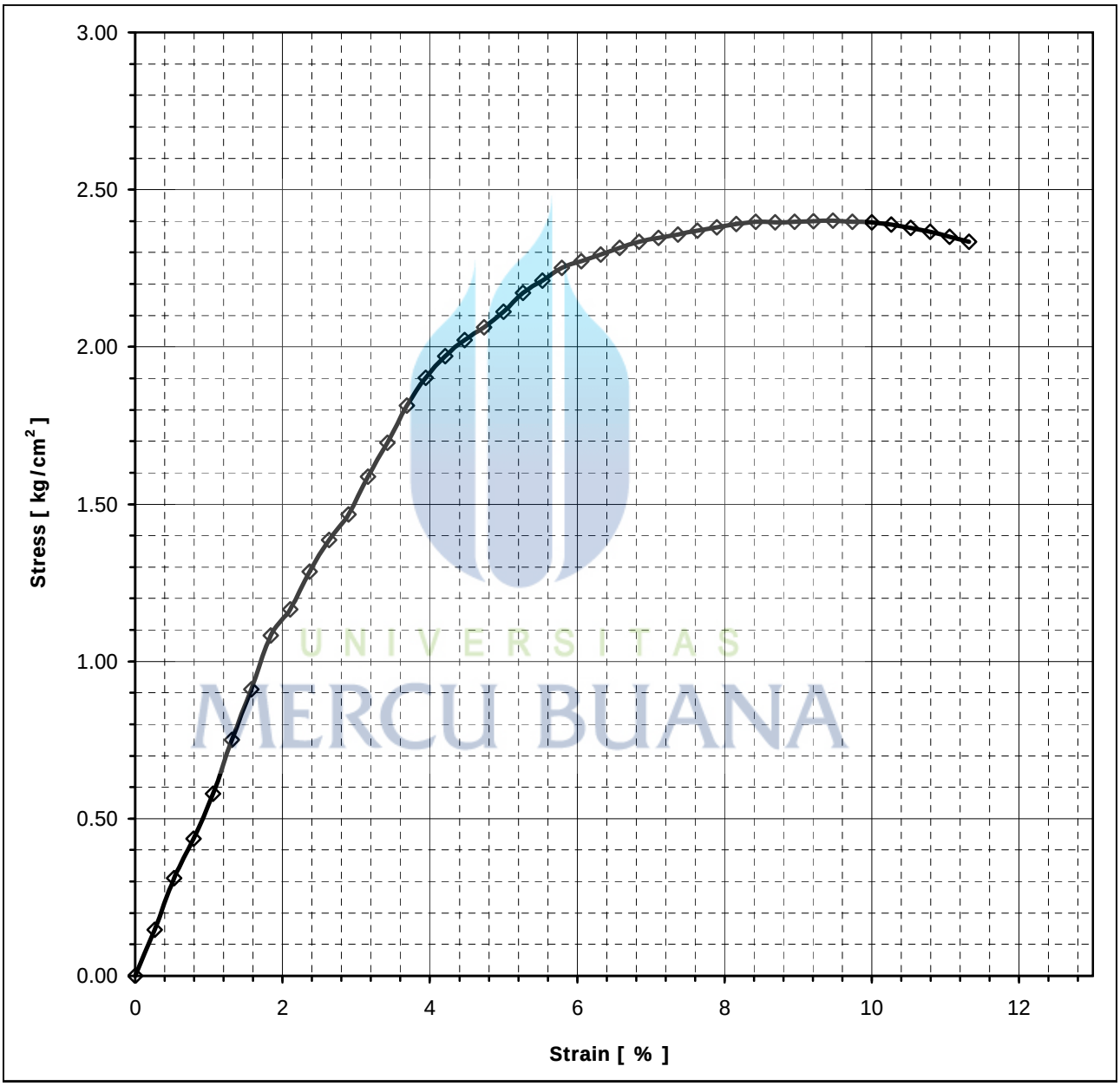
UNCONFINED COMPRESSION TEST (ASTM D 2166)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	13.00 - 13.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	20-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Zaenuri
			Checked by	:	Juweni



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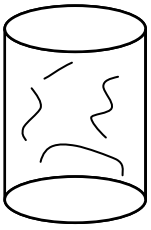
γ_s	:	17.635	kN/m^3
q_u	:	2.401	kg/cm^2
S_u	:	1.201	kg/cm^2
E	:	0.420	kg/cm^2

Failure sketch : Plastic Flow



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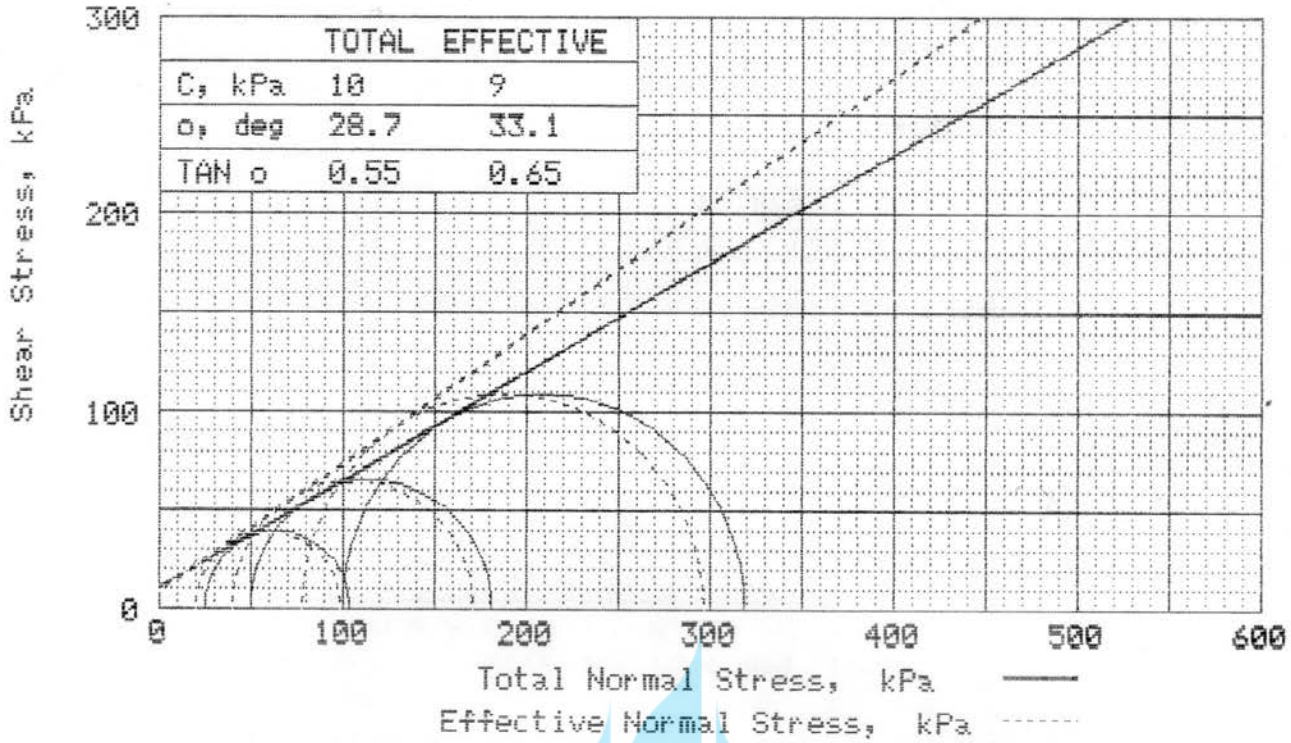

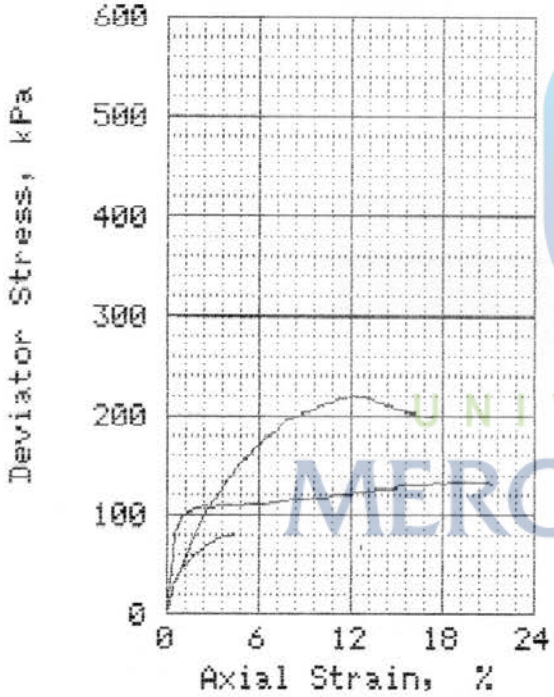

SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	45.0	45.0	45.3
	DRY DENSITY, g/cc	1.2	1.2	1.2
	SATURATION, %	92.9	92.9	92.6
	VOID RATIO	1.283	1.283	1.296
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.60
AT TEST	WATER CONTENT, %	38.4	37.2	41.8
	DRY DENSITY, g/cc	1.3	1.3	1.3
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.017	0.985	1.108
	DIAMETER, cm	3.62	3.67	3.67
	HEIGHT, cm	7.41	7.07	7.50
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190	190	190
CELL PRESSURE, kPa		215	240	290
FAILURE STRESS, kPa		79	131	219
PORE PRESSURE, kPa		195	200	212
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		99	171	297
$\bar{\sigma}_3$ FAILURE, kPa		20	40	70

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDISTURBED.
DESCRIPTION: BROWN.

LL= PL= PI=
SPECIFIC GRAVITY= 2.65
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. CITRA TAMA INTI PERSADA.

PROJECT: GATOT SUBROTO TOWER.
JL. GATOT SUBROTO JAKARTA.
SAMPLE LOCATION: DB.3
DEPTH : 2.50 - 3.00 M.

PROJ. NO.: DATE: 02 - 12 - 2012

TRIAXIAL SHEAR TEST REPORT

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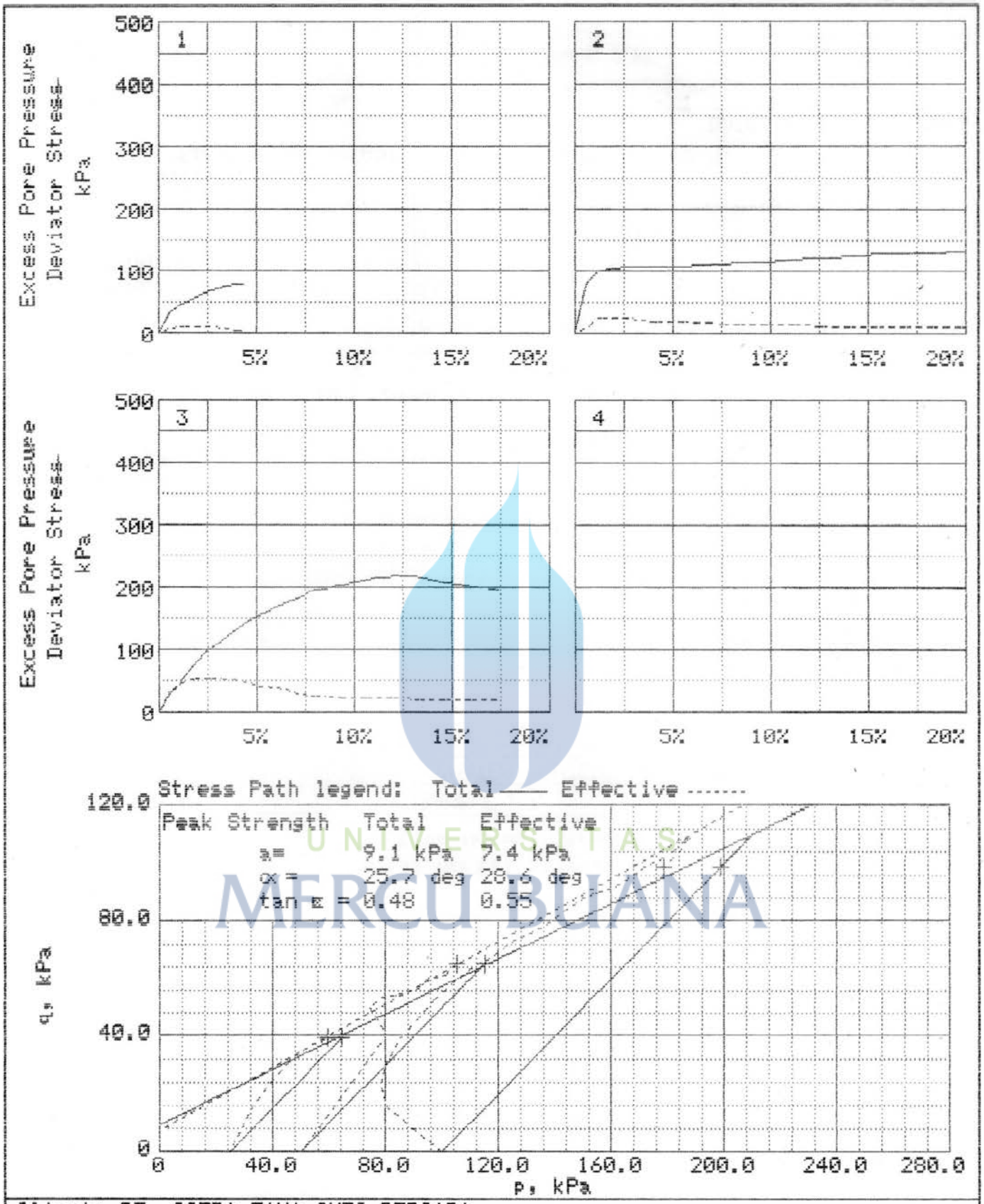

Client: PT. CITRA TAMA INTI PERSADA.
Project: GATOT SUBROTO TOWER. JL. GATOT SUBROTO JAKARTA.
Location: DB.3 DEPTH : 2.50 - 3.00 M.
File: TXL-0282 Project No.: Page 2/2 Fig. No.____

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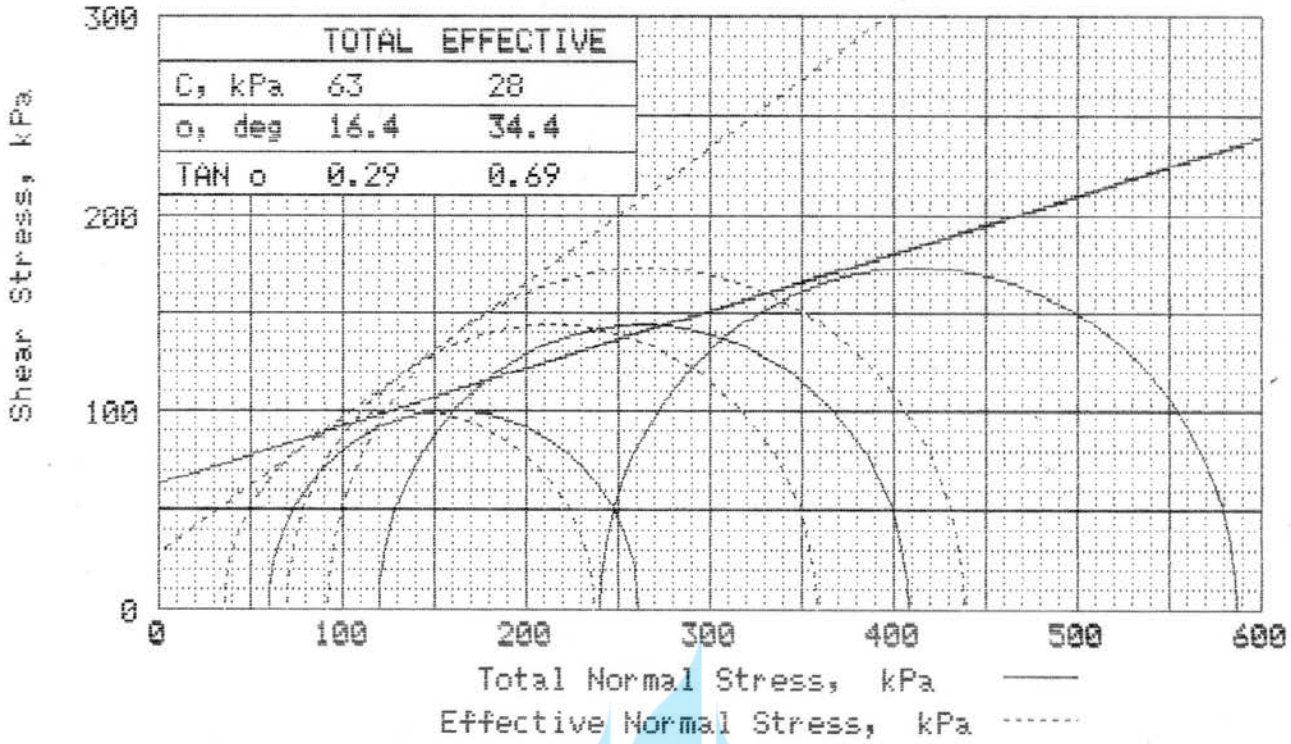

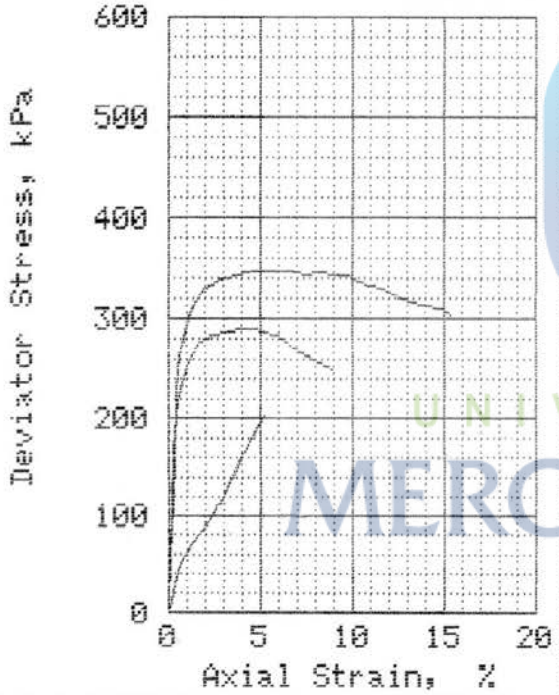

SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	65.9	65.9	63.9
	DRY DENSITY, g/cc	0.9	0.9	0.9
	SATURATION, %	90.6	90.6	82.7
	VOID RATIO	1.927	1.927	2.046
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.40
AT TEST	WATER CONTENT, %	64.6	60.6	52.8
	DRY DENSITY, g/cc	1.0	1.0	1.1
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.711	1.606	1.399
	DIAMETER, cm	3.66	3.70	3.43
	HEIGHT, cm	7.57	7.12	7.16
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190	190	190
CELL PRESSURE, kPa		250	310	430
FAILURE STRESS, kPa		201	288	347
PORE PRESSURE, kPa		214	240	338
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		237	358	439
$\bar{\sigma}_3$ FAILURE, kPa		36	70	92

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDISTURBED.
DESCRIPTION: BROWN.

LL= PL= PI=
SPECIFIC GRAVITY= 2.65
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. Citra Tama Inti Persada.

PROJECT: GATOT SUBROTO TOWER.
Jl. Gatot Subroto Jakarta.
SAMPLE LOCATION: DB.3
DEPTH : 8.00 - 8.50 M.

PROJ. NO.: DATE: 05 - 12 - 2012

TRIAXIAL SHEAR TEST REPORT

PT. KONAS TUNGGAL SOIL LABORATORY

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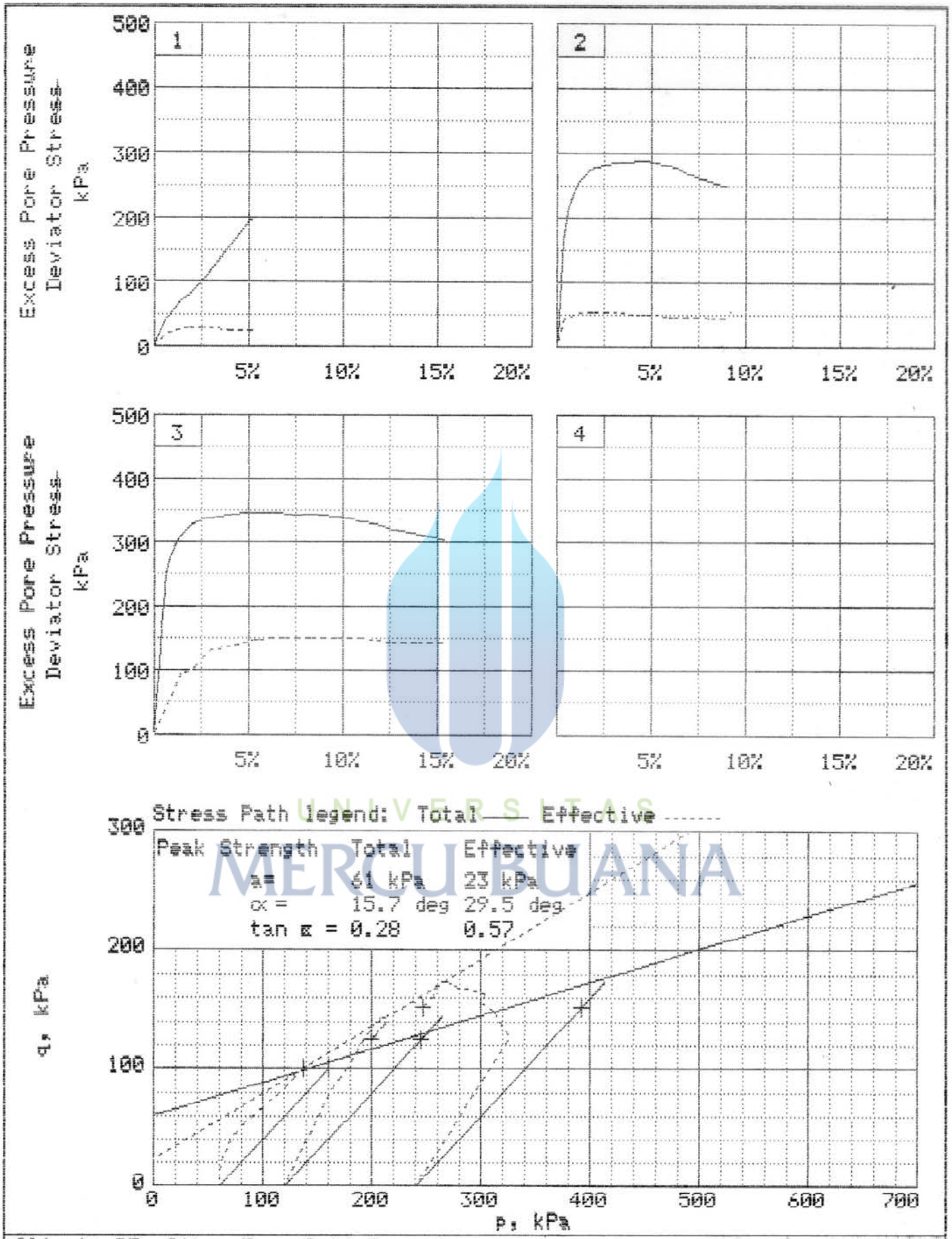

Client: PT. Citra Tama Inti Persada.

Project: GATOT SUBROTO TOWER. Jl. Gatot Subroto Jakarta.

Location: DB.3 DEPTH : 8.00 - 8.50 M.

File: TXL-0286 Project No.: Page 2/2 Fig. No.____

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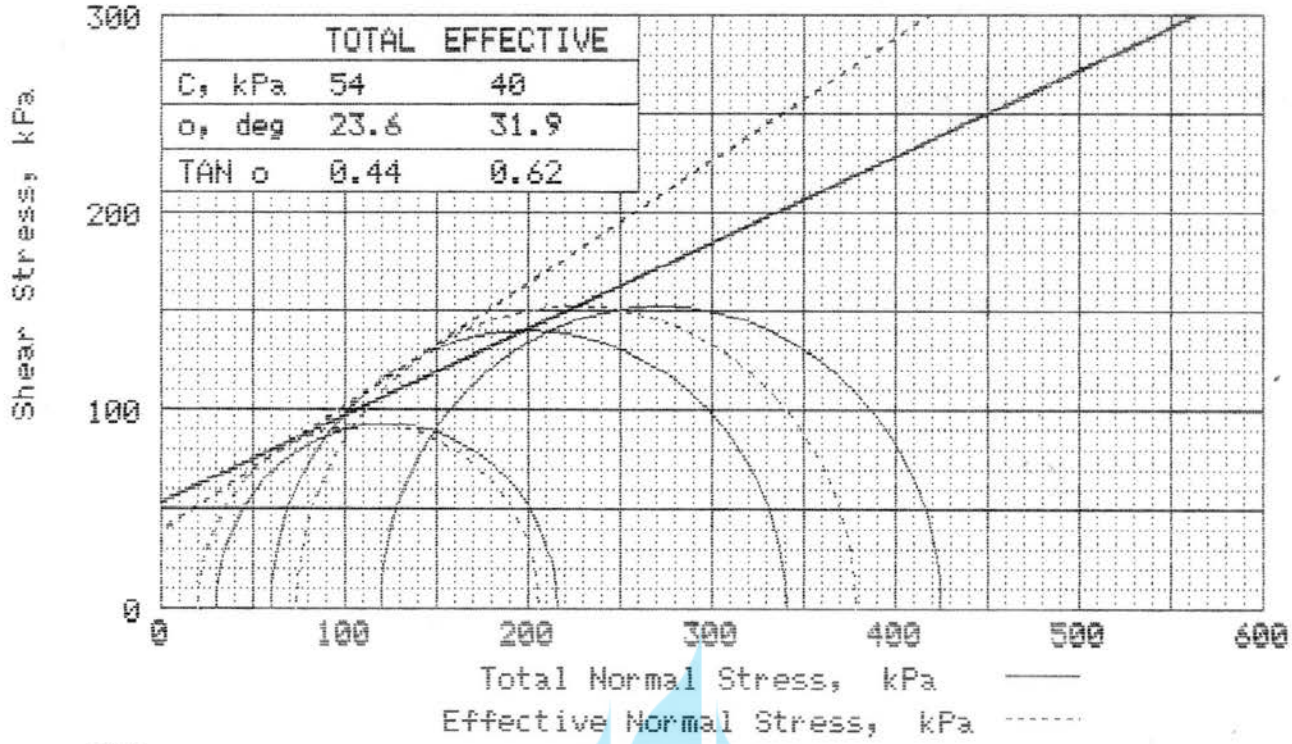

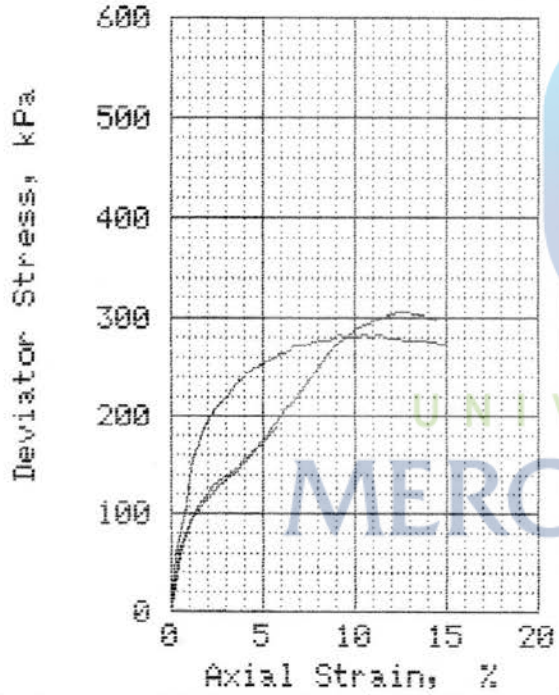

SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	39.8	39.6	40.8
	DRY DENSITY, g/cc	1.1	1.1	1.0
	SATURATION, %	71.9	71.8	68.7
	VOID RATIO	1.465	1.463	1.573
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.60
AT TEST	WATER CONTENT, %	39.1	39.4	40.7
	DRY DENSITY, g/cc	1.3	1.3	1.3
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.037	1.044	1.078
	DIAMETER, cm	3.46	3.56	3.42
	HEIGHT, cm	7.58	7.17	7.60
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190	190	190
CELL PRESSURE, kPa		220	250	310
FAILURE STRESS, kPa		186	281	305
PORE PRESSURE, kPa		200	190	236
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		206	341	379
$\bar{\sigma}_3$ FAILURE, kPa		20	60	74

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDISTURBED.
DESCRIPTION: GREY.

LL= PL= PI=
SPECIFIC GRAVITY= 2.65
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. Citra Tama Inti Persada.

PROJECT: GATOT SUBROTO TOWER.
JL. Gatot Subroto Jakarta.
SAMPLE LOCATION: DB.3
DEPTH : 13.00 - 13.50 M.

PROJ. NO.: DATE: 06 - 12 - 2012

TRIAXIAL SHEAR TEST REPORT

PT. KONAS TUNGGAL SOIL LABORATORY

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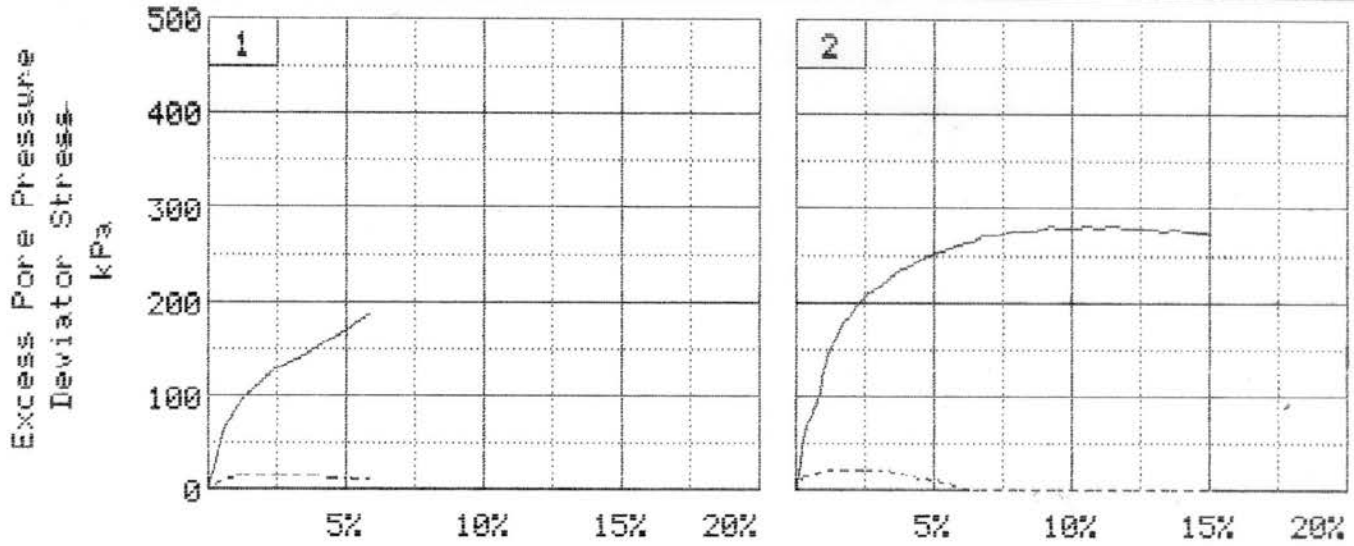

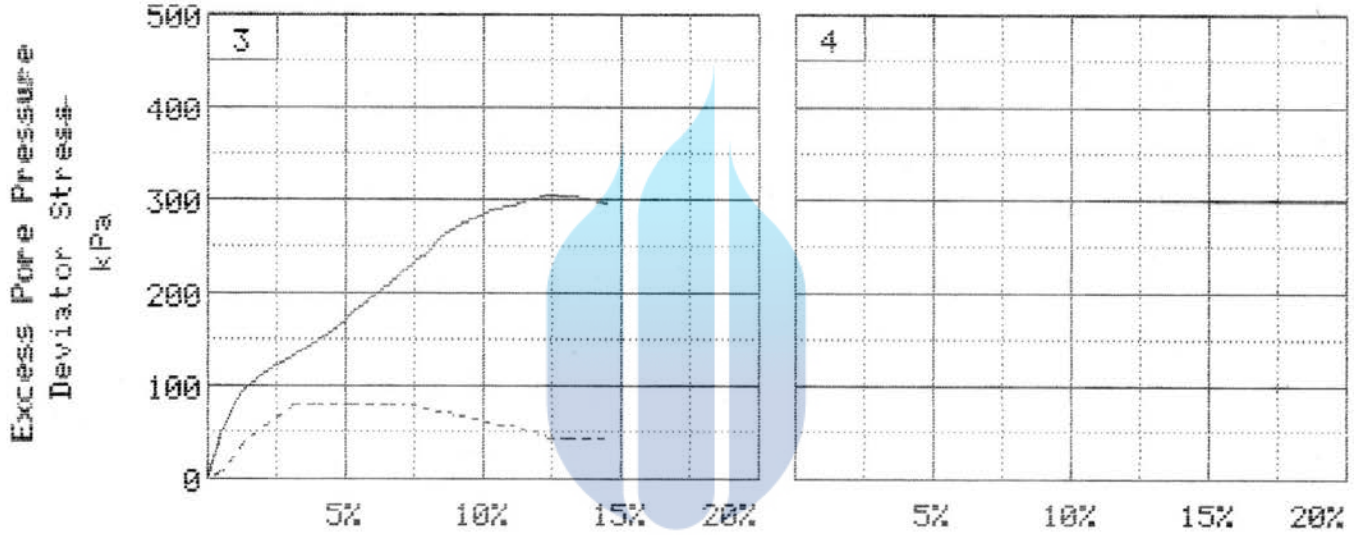

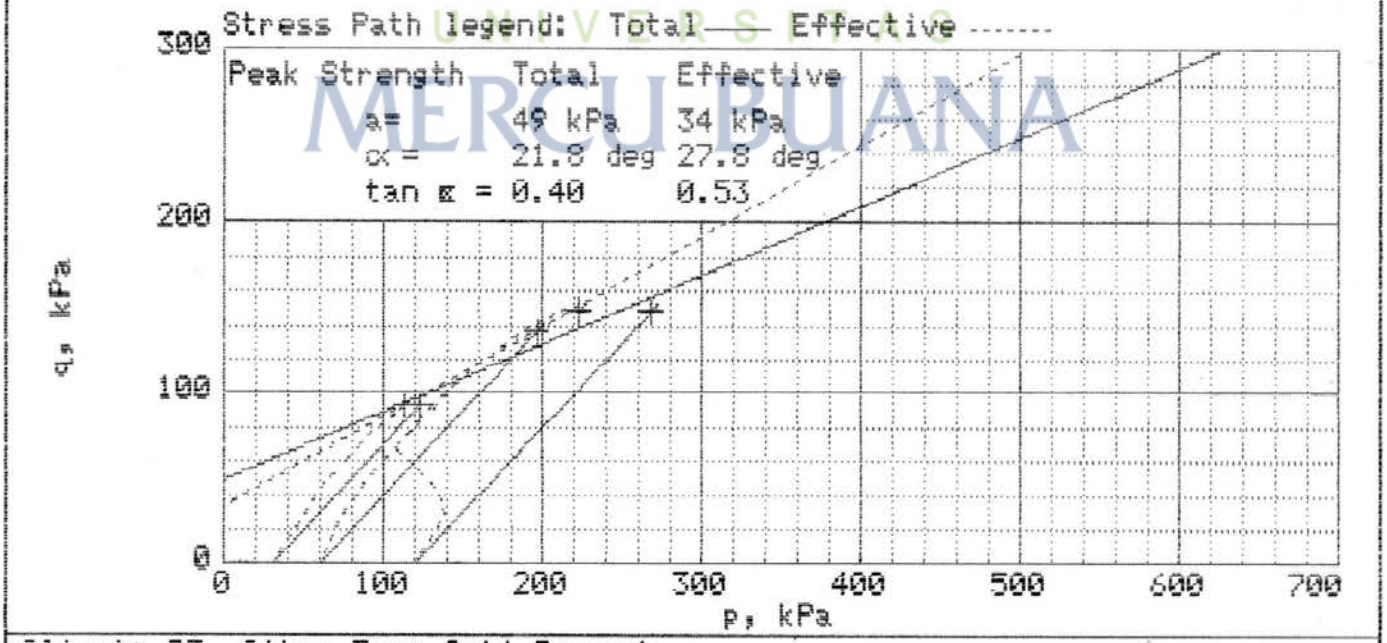

Client: PT. Citra Tama Inti Persada.
Project: GATOT SUBROTO TOWER. JL. Gatot Subroto Jakarta.
Location: DB.3 DEPTH : 13.00 - 13.50 M.
File: TXL-0287 Project No.: Page 2/2 Fig. No.____

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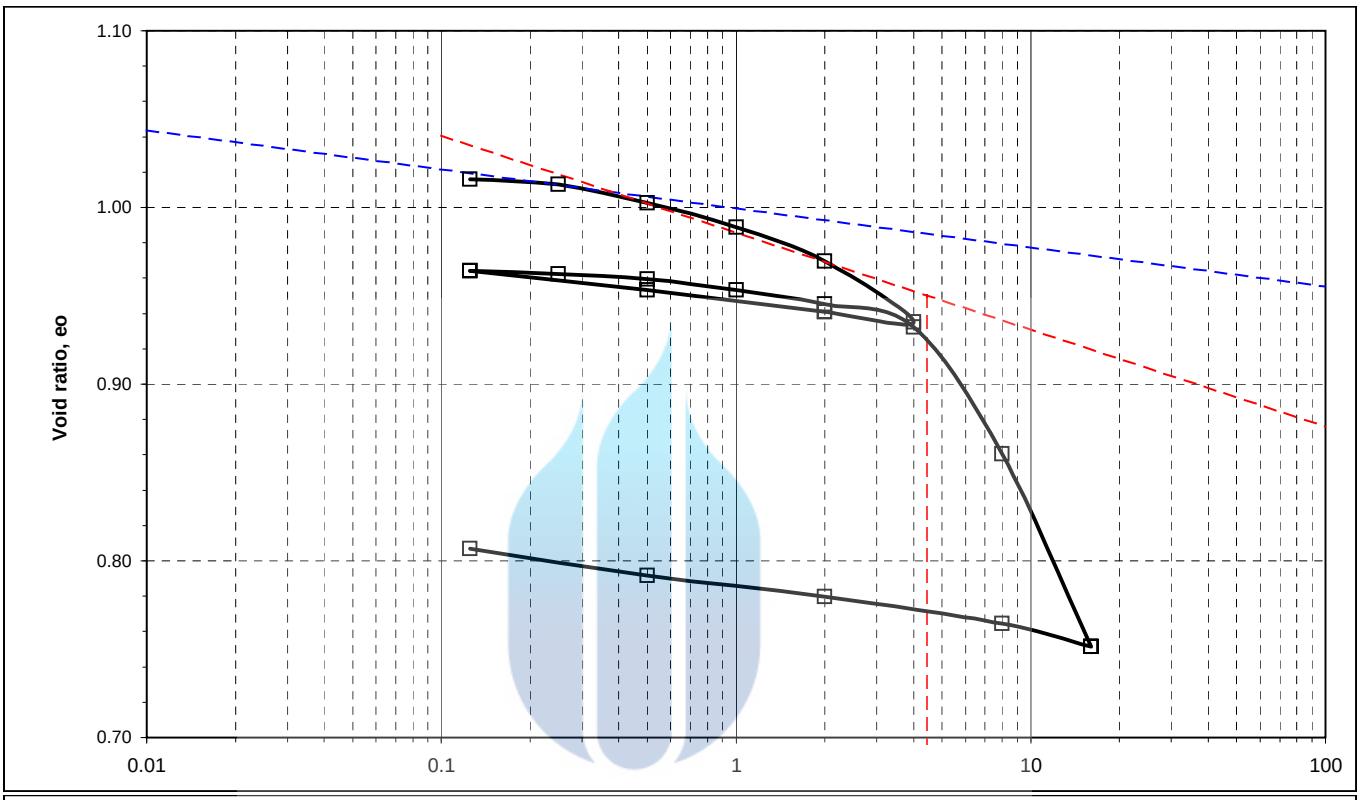
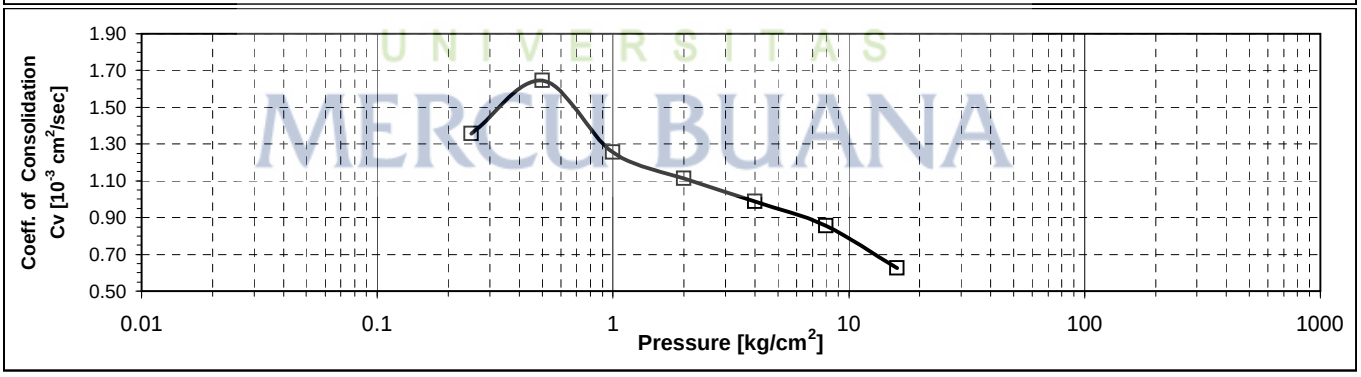
PT. DAYA CREASI MITRAYASA
Design & Engineering Consultants

CONSOLIDATION TEST (ASTM D 2435 - 90)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	20,00 - 20,50
Project	:	Centennial Tower	Testing date	:	18-Nov-12
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Kabul
			Checked by	:	Juweni





Pressure (kg/cm²)	0.250	0.50	1	2	4	8	16
Cv (10^{-3} cm²/sec)	1.3582	1.6459	1.2565	1.1133	0.9860	0.8536	0.6271
mv (cm²/kg)	2.36E-02	3.22E-02	3.00E-02	2.45E-02	2.08E-02	1.96E-02	1.66E-02
k (cm/second)	3.21E-05	5.30E-05	5.30E-05	2.72E-05	2.05E-05	1.68E-05	1.04E-05

Initial Moisture content	:	35.13	%	Initial degree of saturation	: 89.91 %
Final Moisture content	:	32.58	%	Final degree of saturation	: 100.00 %
Initial void ratio, eo	:	1.019		Preconsol. Pressure, Pc	: 4.004 kg/cm²
Final void ratio, ef	:	0.751		Range of Pc (kg/cm²)	3.568 to 4.440
Unit weight of soil, γ_s	:	1.746	t/m³	Compression index, Cc	: 0.362
				Swelling index, Cs	: 0.023
				Recompression index, Cr	: 0.022

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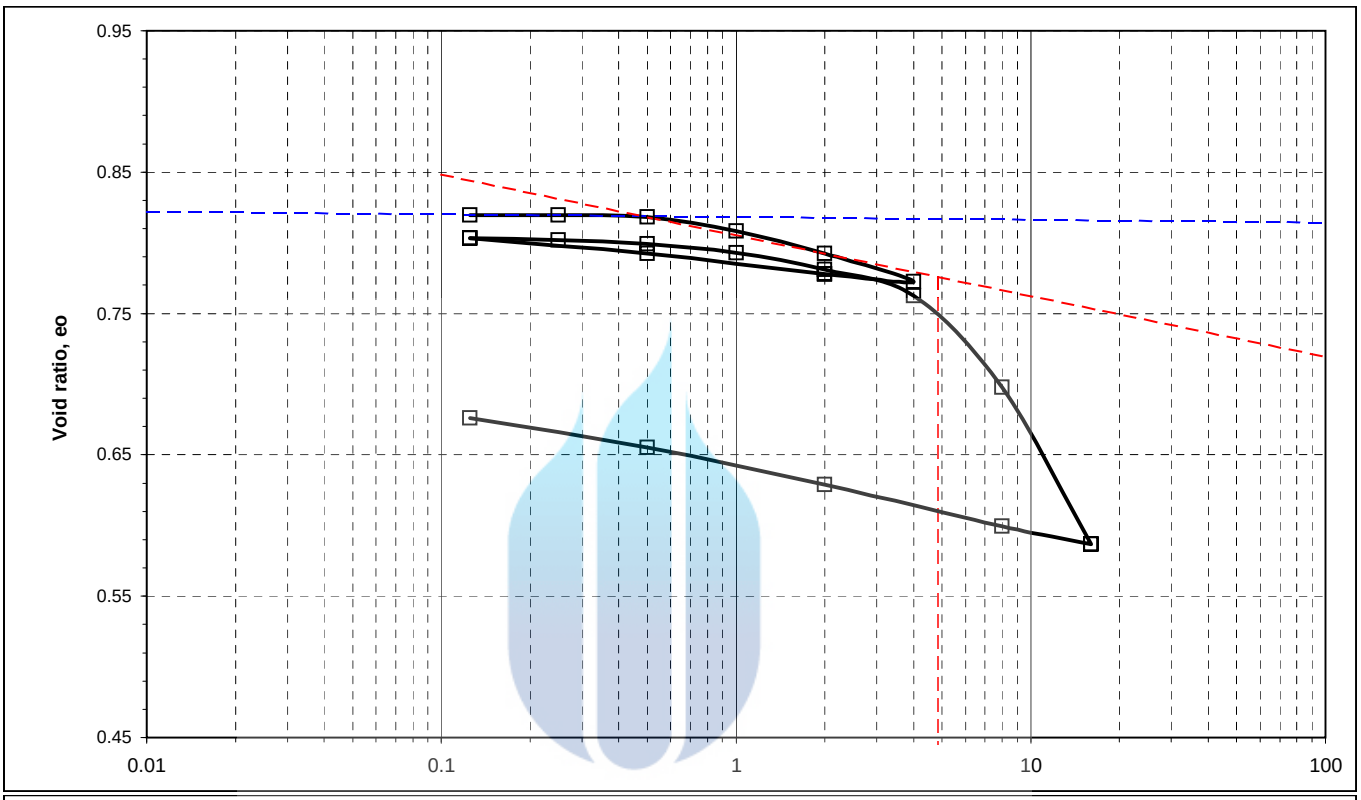
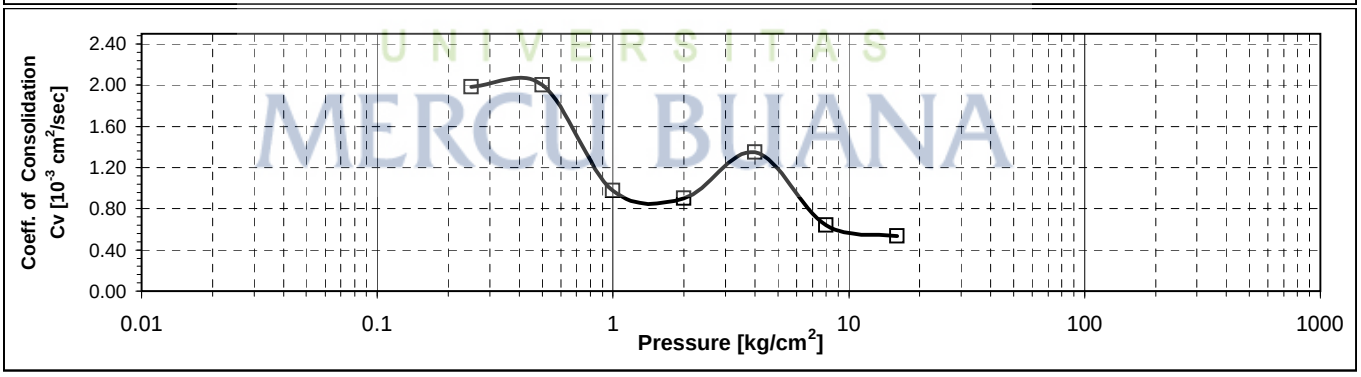
CONSOLIDATION TEST (ASTM D 2435 - 90)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-3**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	50,00 - 50,50
Project	:	Centennial Tower	Testing date	:	20-Nov-12
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Kabul
			Checked by	:	Juweni





Pressure (kg/cm²)	0.250	0.50	1	2	4	8	16
Cv (10^{-3} cm²/sec)	1.9816	2.0052	0.9741	0.9023	1.3518	0.6430	0.5371
mv (cm²/kg)	5.60E-04	2.80E-03	1.25E-02	1.50E-02	1.30E-02	1.68E-02	1.60E-02
k (cm/second)	1.11E-06	5.61E-06	5.61E-06	1.35E-05	1.76E-05	1.08E-05	8.59E-06

Initial Moisture content	:	27.58	%		
Final Moisture content	:	25.26	%		
Initial void ratio, eo	:	0.820			
Final void ratio, ef	:	0.587			
Unit weight of soil, γ_s	:	1.844	t/m^3		

Initial degree of saturation	:	88.50	%		
Final degree of saturation	:	100.00	%		
Preconsol. Pressure, Pc	:	4.307	kg/cm²		
Range of Pc (kg/cm^2)		3.794	to	4.820	
Compression index, Cc	:	0.369			
Swelling index, Cs	:	0.046			
Recompression index, Cr	:	0.002			

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LAMPIRAN – C

PENGUJIAN LABORATORIUM DB-4

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PT. DAYA CREASI MITRAYASA
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SPECIFIC GRAVITY TEST (ASTM D 854)

Client	:	PT. Citratama Inti Persada	Project No.	:	DCM.G.12-047
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	16-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

Borehole : DB-4
Depth (m) : 4.00 - 4.50

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	51	52
Wt. of Pycno + cup [gram]	58.282	41.561
Wt. of Pycno + cup + soil [gram]	74.492	58.299
Wt. of Pycno + cup + water [gram]	156.847	142.353
Wt. of Pycno + cup + water + soil [gram]	166.889	152.675
Specific Gravity, Gs	2.628	2.609
Average of Specific Gravity, Gs	**2.618**	

Borehole : DB-4
Depth (m) : 8.50 - 9.00

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	53	54
Wt. of Pycno + cup [gram]	31.886	28.918
Wt. of Pycno + cup + soil [gram]	44.687	41.960
Wt. of Pycno + cup + water [gram]	132.306	126.879
Wt. of Pycno + cup + water + soil [gram]	140.230	134.951
Specific Gravity, Gs	2.625	2.624
Average of Specific Gravity, Gs	**2.624**	

Borehole : DB-4
Depth (m) : 14.00 - 14.50

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	55	56
Wt. of Pycno + cup [gram]	34.528	60.746
Wt. of Pycno + cup + soil [gram]	47.836	73.657
Wt. of Pycno + cup + water [gram]	133.571	159.908
Wt. of Pycno + cup + water + soil [gram]	141.780	167.931
Specific Gravity, Gs	2.610	2.641
Average of Specific Gravity, Gs	**2.626**	

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SPECIFIC GRAVITY TEST (ASTM D 854)

Client	:	PT. Citratama Inti Persada	Project No.	:	DCM.G.12-047
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	16-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

Borehole : **DB-4**
Depth (m) : **38.00 - 38.50**

Description	**Test 1**	**Test 2**
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	57	58
Wt. of Pycno + cup [gram]	62.582	60.480
Wt. of Pycno + cup + soil [gram]	74.894	72.973
Wt. of Pycno + cup + water [gram]	161.423	159.676
Wt. of Pycno + cup + water + soil [gram]	168.999	167.385
Specific Gravity, Gs	2.600	2.611
Average of Specific Gravity, Gs	**2.606**	

Borehole : **DB-4**
Depth (m) : **53.00 - 53.50**

Description	**Test 1**	**Test 2**
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	59	60
Wt. of Pycno + cup [gram]	57.428	35.744
Wt. of Pycno + cup + soil [gram]	73.943	51.815
Wt. of Pycno + cup + water [gram]	160.725	135.679
Wt. of Pycno + cup + water + soil [gram]	170.959	145.631
Specific Gravity, Gs	2.629	2.626
Average of Specific Gravity, Gs	**2.628**	

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PT. DAYA CREASI MITRAYASA
Design & Engineering Consultants

WATER CONTENT DETERMINATION (ASTM D 2216)

Project No.	:	DCM.G.12-047	Tested date	:	8-Nov-12
Client	:	PT. Citratama Inti Persada	Tested by	:	Kbl
Project	:	Gatot Subroto Tower (Centennial Tower)	Checked by	:	Juweni
Location	:	Jl. Gatot Subroto - Jakarta			

UDS Sample

Borehole : **DB-4**
Depth (m) : **4.00 - 4.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	86.614	96.010	84.181
Wt. of dry soil + can [gram]	70.602	72.343	63.831
Wt. of can [gram]	37.320	21.302	22.000
Wt. of wet soil [gram]	49.294	74.708	62.181
Wt. of water [gram]	16.012	23.667	20.350
Wt. of dry soil [gram]	33.282	51.041	41.831
Water content, w %	48.110	46.369	48.648
γ_s [gram/cm^3]	**1.567**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.061**	**47.71**	

Borehole : **DB-4**
Depth (m) : **8.50 - 9.00**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	88.862	81.303	85.816
Wt. of dry soil + can [gram]	70.824	59.586	62.123
Wt. of can [gram]	37.937	16.617	15.613
Wt. of wet soil [gram]	50.925	64.686	70.203
Wt. of water [gram]	18.038	21.717	23.693
Wt. of dry soil [gram]	32.887	42.969	46.510
Water content, w %	54.848	50.541	50.942
γ_s [gram/cm^3]	**1.619**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.065**	**52.11**	

Borehole : **DB-4**
Depth (m) : **14.00 - 14.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	75.555	80.272	67.440
Wt. of dry soil + can [gram]	59.970	62.205	52.803
Wt. of can [gram]	21.997	16.557	16.369
Wt. of wet soil [gram]	53.558	63.715	51.071
Wt. of water [gram]	15.585	18.067	14.637
Wt. of dry soil [gram]	37.973	45.648	36.434
Water content, w %	41.042	39.579	40.174
γ_s [gram/cm^3]	**1.703**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.214**	**40.27**	

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Design & Engineering Consultants

WATER CONTENT DETERMINATION (ASTM D 2216)

Project No.	:	DCM.G.12-047	Tested date	:	8-Nov-12
Client	:	PT. Citratama Inti Persada	Tested by	:	Kbl
Project	:	Gatot Subroto Tower (Centennial Tower)	Checked by	:	Juweni
Location	:	Jl. Gatot Subroto - Jakarta			

UDS Sample

Borehole : **DB-4**
Depth (m) : **38.00 - 38.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	92.712	73.344	77.131
Wt. of dry soil + can [gram]	78.316	58.532	61.419
Wt. of can [gram]	37.885	17.092	14.683
Wt. of wet soil [gram]	54.827	56.252	62.448
Wt. of water [gram]	14.396	14.812	15.712
Wt. of dry soil [gram]	40.431	41.440	46.736
Water content, w %	35.606	35.743	33.619
γ_s [gram/cm^3]	**1.743**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.291**	**34.99**	

Borehole : **DB-4**
Depth (m) : **53.00- 53.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	95.517	81.045	90.050
Wt. of dry soil + can [gram]	82.931	68.713	73.106
Wt. of can [gram]	38.610	14.388	14.705
Wt. of wet soil [gram]	56.907	66.657	75.345
Wt. of water [gram]	12.586	12.332	16.944
Wt. of dry soil [gram]	44.321	54.325	58.401
Water content, w %	28.397	22.700	29.013
γ_s [gram/cm^3]	**1.809**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.428**	**26.70**	

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ATTERBERG LIMITS TEST (ASTM D 4318)

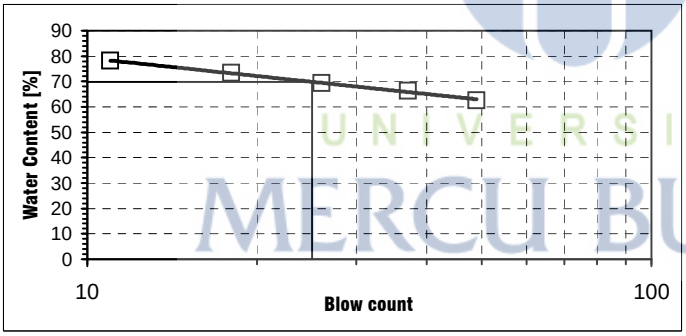
Project No.	: DCM.G.12-047	Borehole	: **DB-4**
Client	: PT. Citratama Inti Persada	Depth (m)	: 4.00 - 4.50
Project	: Gatot Subroto Tower (Centennial Tower)	Tested date	: 14-Nov-2012
Location	: Jl. Jend. Gatot Subroto - Jakarta	Tested by	: Rimanto
		Checked by	: Juweni
		UDS Sample	

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	89.864	91.844	77.887	82.846	81.894
Wt. of dry soil + can [gram]	56.863	59.187	52.007	55.691	56.084
Wt. of can [gram]	14.605	14.713	14.669	14.760	14.859
Wt. of water [gram]	33.001	32.657	25.880	27.155	25.810
Wt. of dry soil [gram]	42.258	44.474	37.338	40.931	41.225
Water content, w [%]	78.094	73.429	69.313	66.343	62.608
No. of blows	11	18	26	37	49

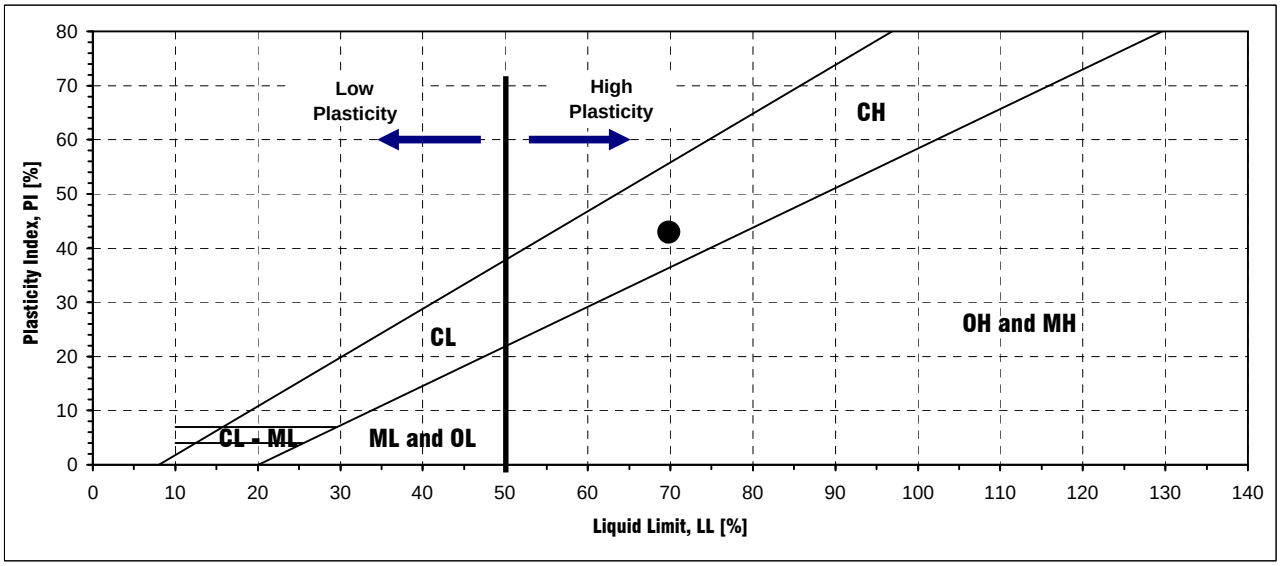
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	34.953	35.578	35.688		
Wt. of dry soil + can [gram]	31.000	31.169	31.221		
Wt. of can [gram]	15.415	15.176	15.214		
Wt. of water [gram]	3.953	4.409	4.467		
Wt. of dry soil [gram]	15.585	15.993	16.007		
Water content, w [%]	25.364	27.568	27.907		



Liquid limit [LL], %	:	69.865
Plastic limit [PL], %	:	26.946
Plasticity index [PI], %	:	42.919
Flow index	:	0.1455
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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ATTERBERG LIMITS TEST (ASTM D 4318)

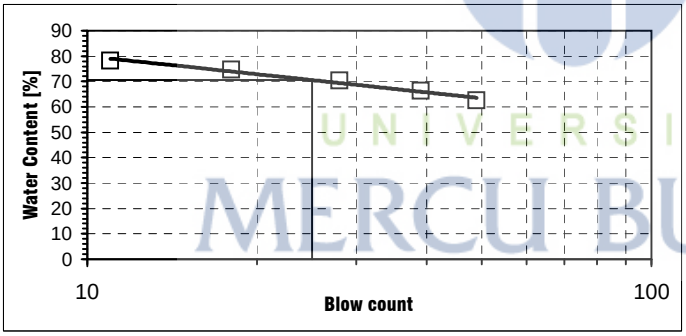
Project No.	: DCM.G.12-047	Borehole	: **DB-4**
Client	: PT. Citratama Inti Persada	Depth (m)	: 8.50 - 9.00
Project	: Gatot Subroto Tower (Centennial Tower)	Tested date	: 14-Nov-2012
Location	: Jl. Jend. Gatot Subroto - Jakarta	Tested by	: Rimanto
		Checked by	: Juweni
			UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	79.282	61.612	73.089	67.585	57.220
Wt. of dry soil + can [gram]	51.141	41.829	49.348	46.774	41.064
Wt. of can [gram]	15.146	15.309	15.562	15.415	15.215
Wt. of water [gram]	28.141	19.783	23.741	20.811	16.156
Wt. of dry soil [gram]	35.995	26.520	33.786	31.359	25.849
Water content, w [%]	78.180	74.597	70.269	66.364	62.501
No. of blows	11	18	28	39	49

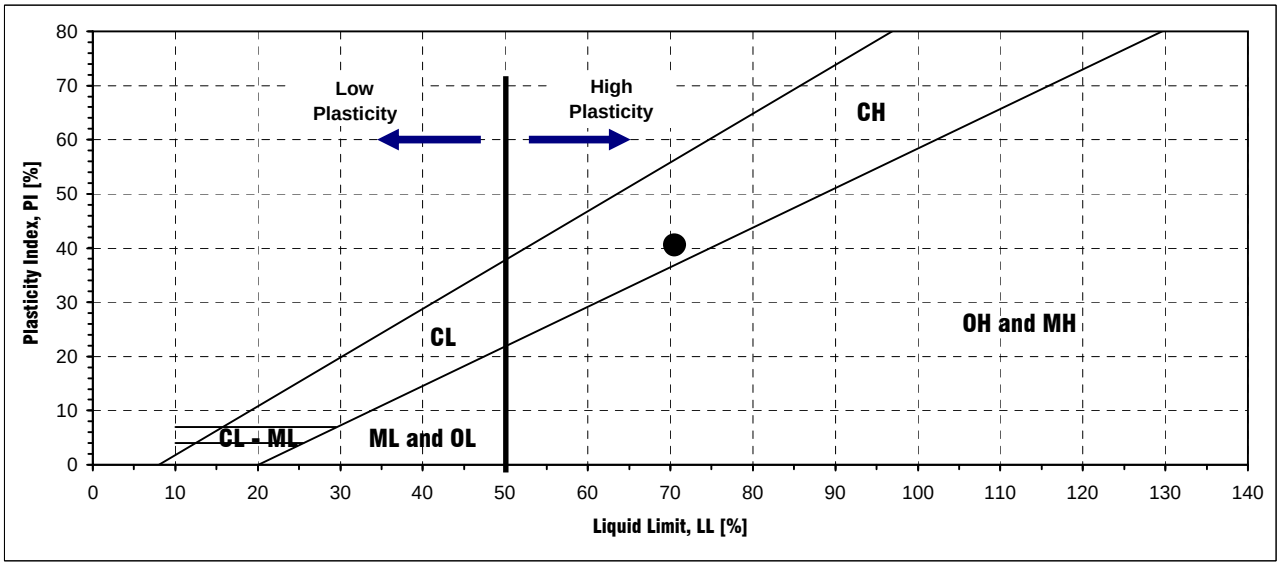
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	32.008	32.067	31.970		
Wt. of dry soil + can [gram]	28.302	28.234	28.151		
Wt. of can [gram]	15.458	15.801	15.571		
Wt. of water [gram]	3.706	3.833	3.819		
Wt. of dry soil [gram]	12.844	12.433	12.580		
Water content, w [%]	28.854	30.829	30.358		



Liquid limit [LL], %	:	70.550
Plastic limit [PL], %	:	30.014
Plasticity index [PI], %	:	40.537
Flow index	:	0.1464
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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ATTERBERG LIMITS TEST (ASTM D 4318)

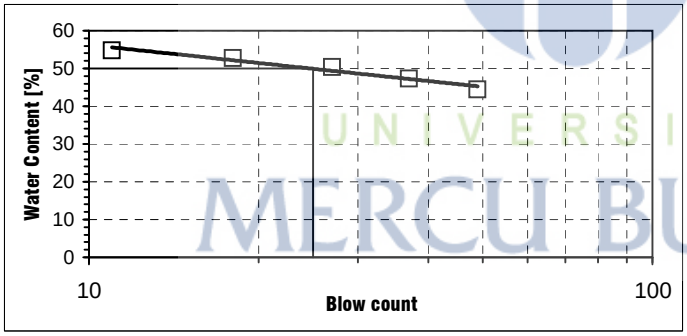
Project No.	: DCM.G.12-047	Borehole	: **DB-4**
Client	: PT. Citratama Inti Persada	Depth (m)	: 14.00 - 14.50
Project	: Gatot Subroto Tower (Centennial Tower)	Tested date	: 18-Nov-2012
Location	: Jl. Jend. Gatot Subroto - Jakarta	Tested by	: Rimanto
		Checked by	: Juweni
			UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	84.990	63.154	55.143	59.541	54.075
Wt. of dry soil + can [gram]	60.598	46.959	42.078	45.594	42.417
Wt. of can [gram]	16.073	16.255	16.131	16.129	16.177
Wt. of water [gram]	24.392	16.195	13.065	13.947	11.658
Wt. of dry soil [gram]	44.525	30.704	25.947	29.465	26.240
Water content, w [%]	54.783	52.746	50.353	47.334	44.428
No. of blows	11	18	27	37	49

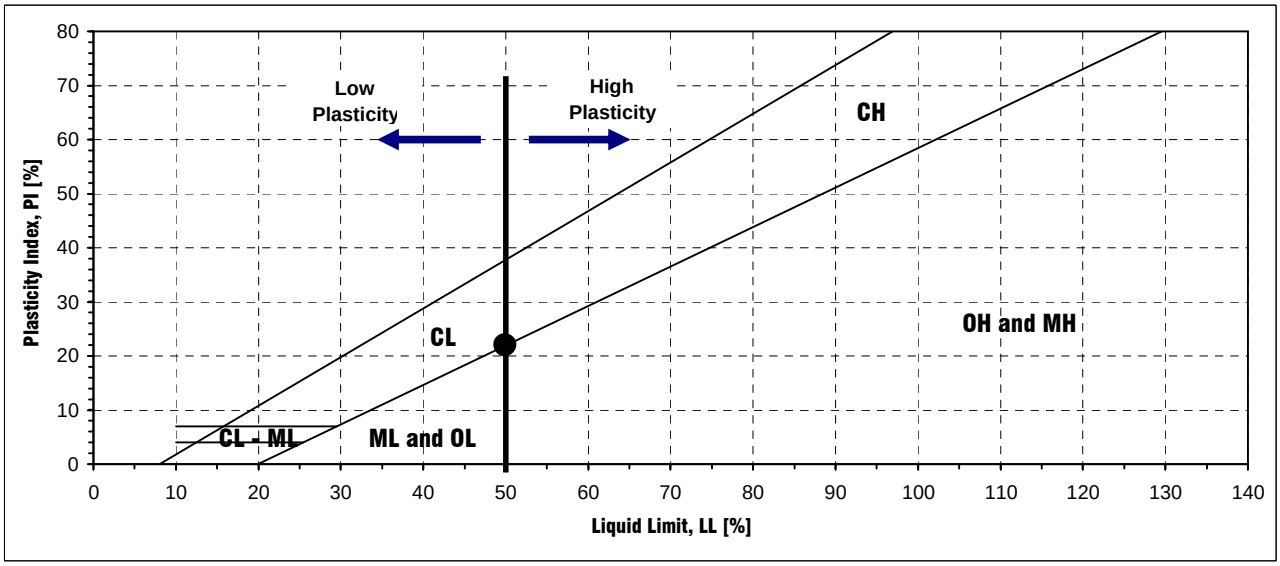
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	34.250	34.260	34.259		
Wt. of dry soil + can [gram]	30.362	30.298	30.379		
Wt. of can [gram]	16.585	16.183	16.183		
Wt. of water [gram]	3.888	3.962	3.880		
Wt. of dry soil [gram]	13.777	14.115	14.196		
Water content, w [%]	28.221	28.069	27.332		



Liquid limit [LL], %	:	49.918
Plastic limit [PL], %	:	27.874
Plasticity index [PI], %	:	22.044
Flow index	:	0.1384
Classification	:	CL - Lean clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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Design & Engineering Consultants

ATTERBERG LIMITS TEST (ASTM D 4318)

Project No.	: DCM.G.12-047	Borehole	: **DB-4**
Client	: PT. Citratama Inti Persada	Depth (m)	: 38.00 - 38.50
Project	: Gatot Subroto Tower (Centennial Tower)	Tested date	: 14-Nov-2012
Location	: Jl. Jend. Gatot Subroto - Jakarta	Tested by	: Rimanto
		Checked by	: Juweni

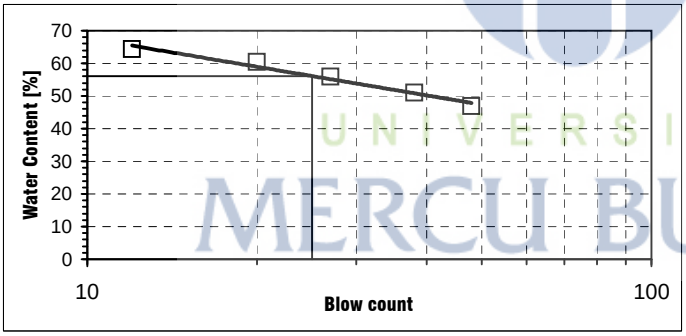
UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	84.591	68.466	69.979	78.713	55.780
Wt. of dry soil + can [gram]	57.733	48.562	50.611	57.529	43.024
Wt. of can [gram]	15.941	15.567	15.892	15.934	15.828
Wt. of water [gram]	26.858	19.904	19.368	21.184	12.756
Wt. of dry soil [gram]	41.792	32.995	34.719	41.595	27.196
Water content, w [%]	64.266	60.324	55.785	50.929	46.904
No. of blows	12	20	27	38	48

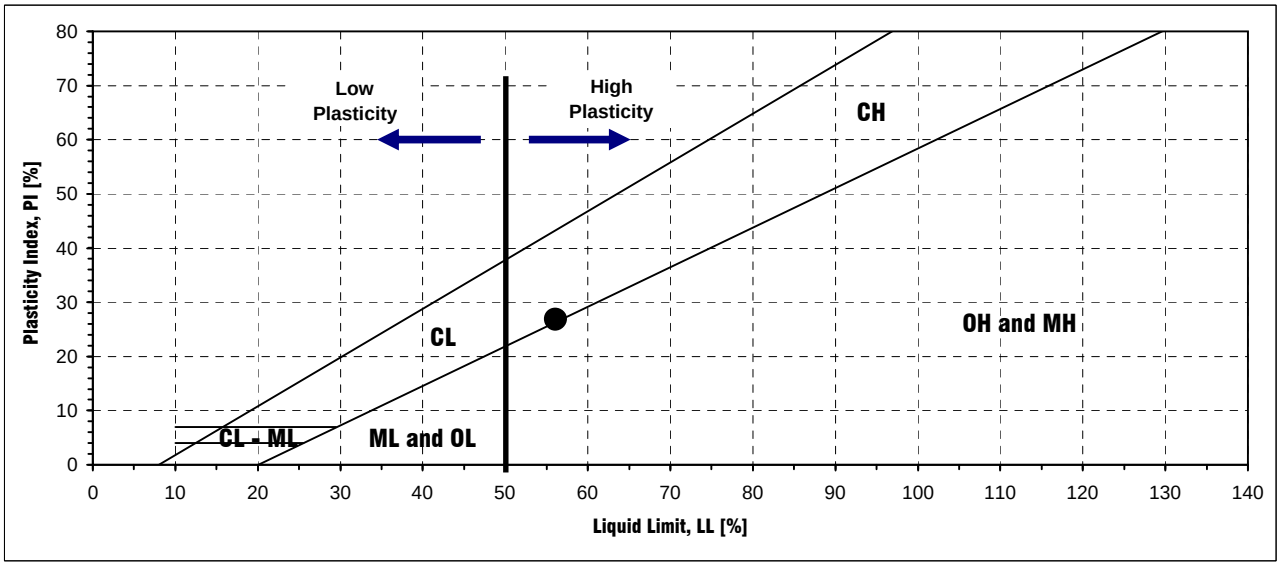
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	34.516	34.577	34.053		
Wt. of dry soil + can [gram]	30.408	30.331	30.065		
Wt. of can [gram]	16.182	15.904	16.584		
Wt. of water [gram]	4.108	4.246	3.988		
Wt. of dry soil [gram]	14.226	14.427	13.481		
Water content, w [%]	28.877	29.431	29.582		



Liquid limit [LL], %	:	56.125
Plastic limit [PL], %	:	29.297
Plasticity index [PI], %	:	26.828
Flow index	:	0.2280
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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ATTERBERG LIMITS TEST (ASTM D 4318)

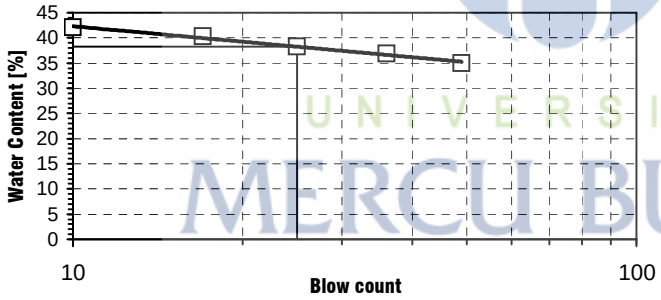
Project No.	: DCM.G.12-047	Borehole	: **DB-4**
Client	: PT. Citratama Inti Persada	Depth (m)	: 53.00 - 53.50
Project	: Gatot Subroto Tower (Centennial Tower)	Tested date	: 19-Nov-2012
Location	: Jl. Jend. Gatot Subroto - Jakarta	Tested by	: Rimanto
		Checked by	: Juweni
			UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	96.728	85.973	83.959	80.432	75.408
Wt. of dry soil + can [gram]	72.722	65.617	65.066	63.060	59.945
Wt. of can [gram]	15.639	15.074	15.656	15.955	15.720
Wt. of water [gram]	24.006	20.356	18.893	17.372	15.463
Wt. of dry soil [gram]	57.083	50.543	49.410	47.105	44.225
Water content, w [%]	42.055	40.275	38.237	36.879	34.964
No. of blows	10	17	25	36	49

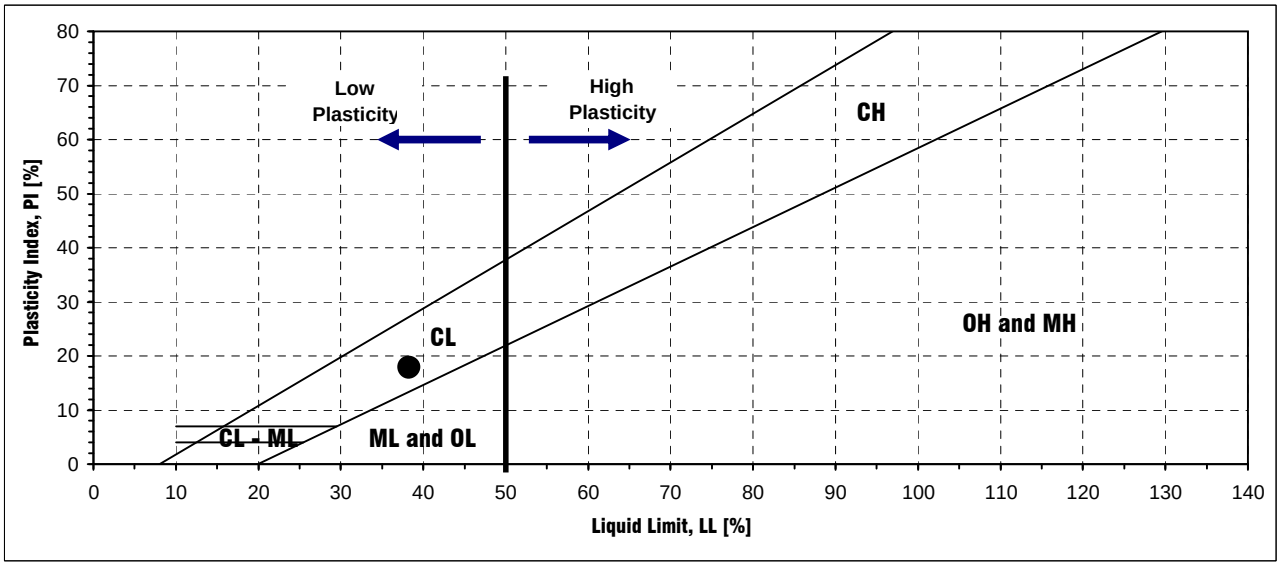
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	41.898	41.808	41.719		
Wt. of dry soil + can [gram]	37.656	37.705	37.359		
Wt. of can [gram]	16.764	16.800	16.801		
Wt. of water [gram]	4.242	4.103	4.360		
Wt. of dry soil [gram]	20.892	20.905	20.558		
Water content, w [%]	20.304	19.627	21.208		



Liquid limit [LL], %	:	38.248
Plastic limit [PL], %	:	20.380
Plasticity index [PI], %	:	17.868
Flow index	:	0.1150
Classification	:	CL - Lean clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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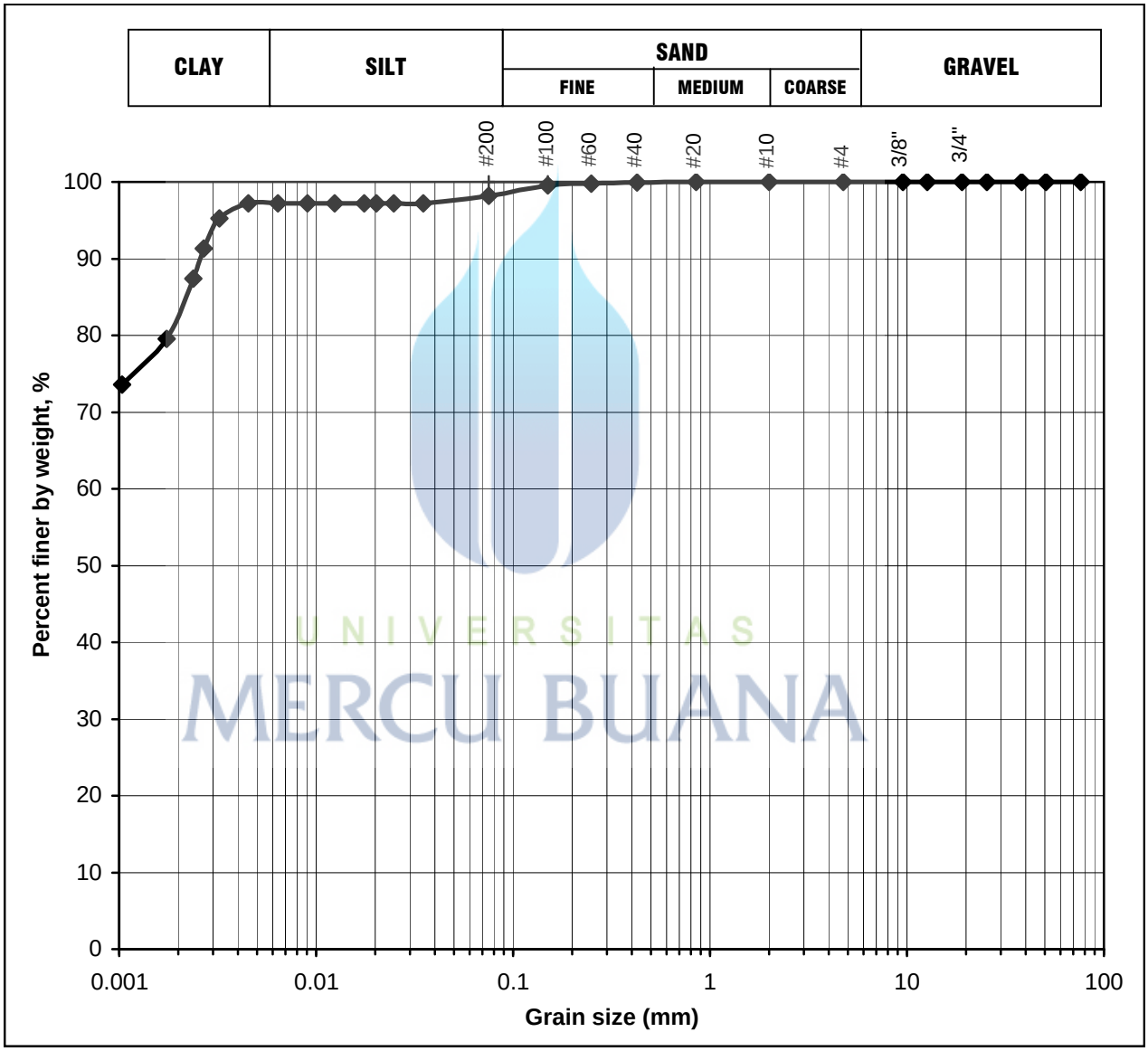
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-4**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	4,00 - 4,50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	18-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-4 [4,00 - 4,50]	0.00	1.84	0.98	97.18	CH - Fat clay

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.000	NA	NA	69.87	26.95

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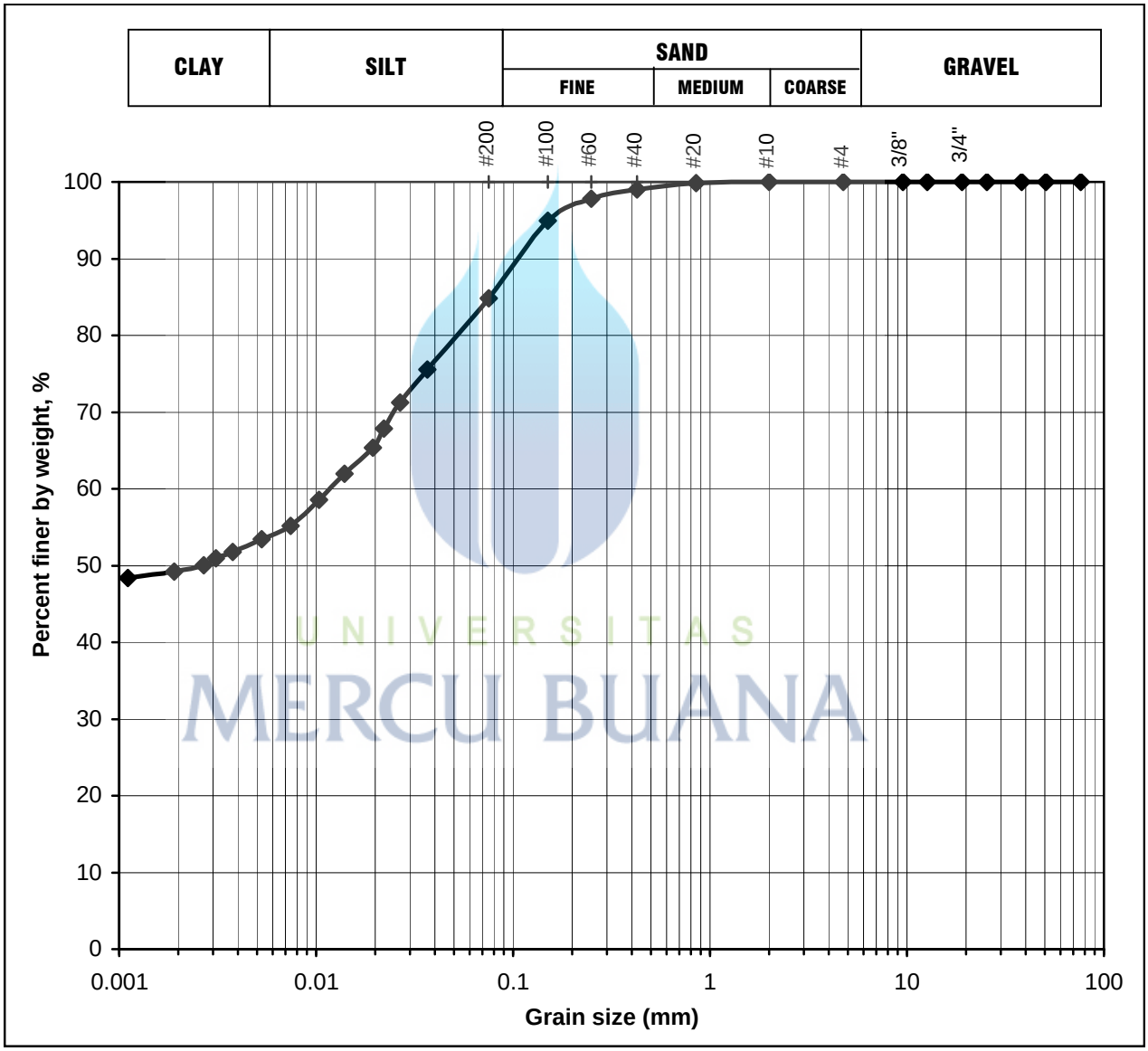
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-4**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	8,50 - 9,00
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	18-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-4 [8,50 - 9,00]	0.00	15.16	31.73	53.12	CH - Fat clay with sand

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.012	NA	NA	70.55	30.01

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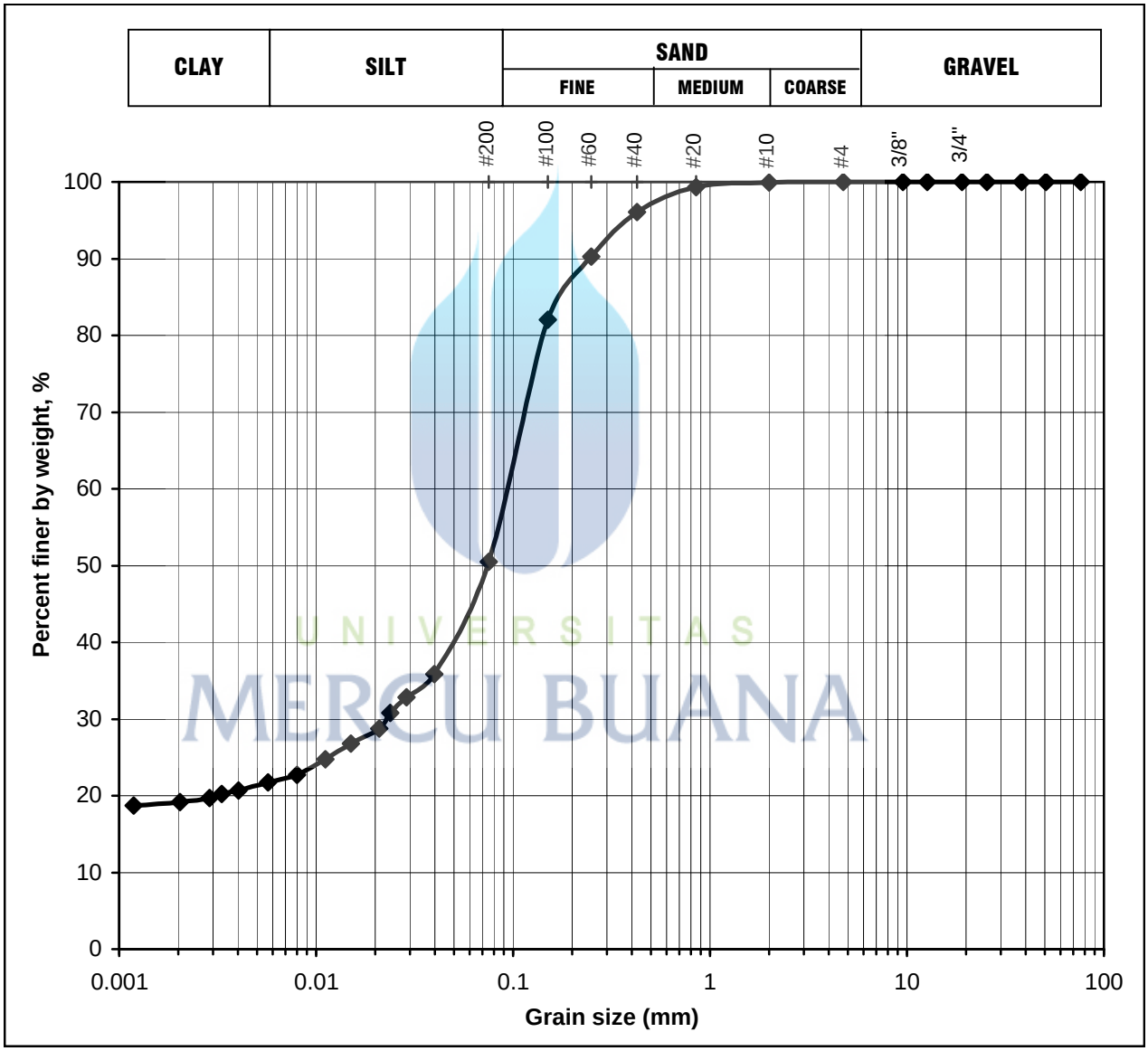
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-4**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	14,00 - 14,50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	18-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-4 [14,00 - 14,50]	0.00	49.49	29.22	21.29	CL - Sandy lean clay

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.023	0.092	NA	NA	49.92	27.87

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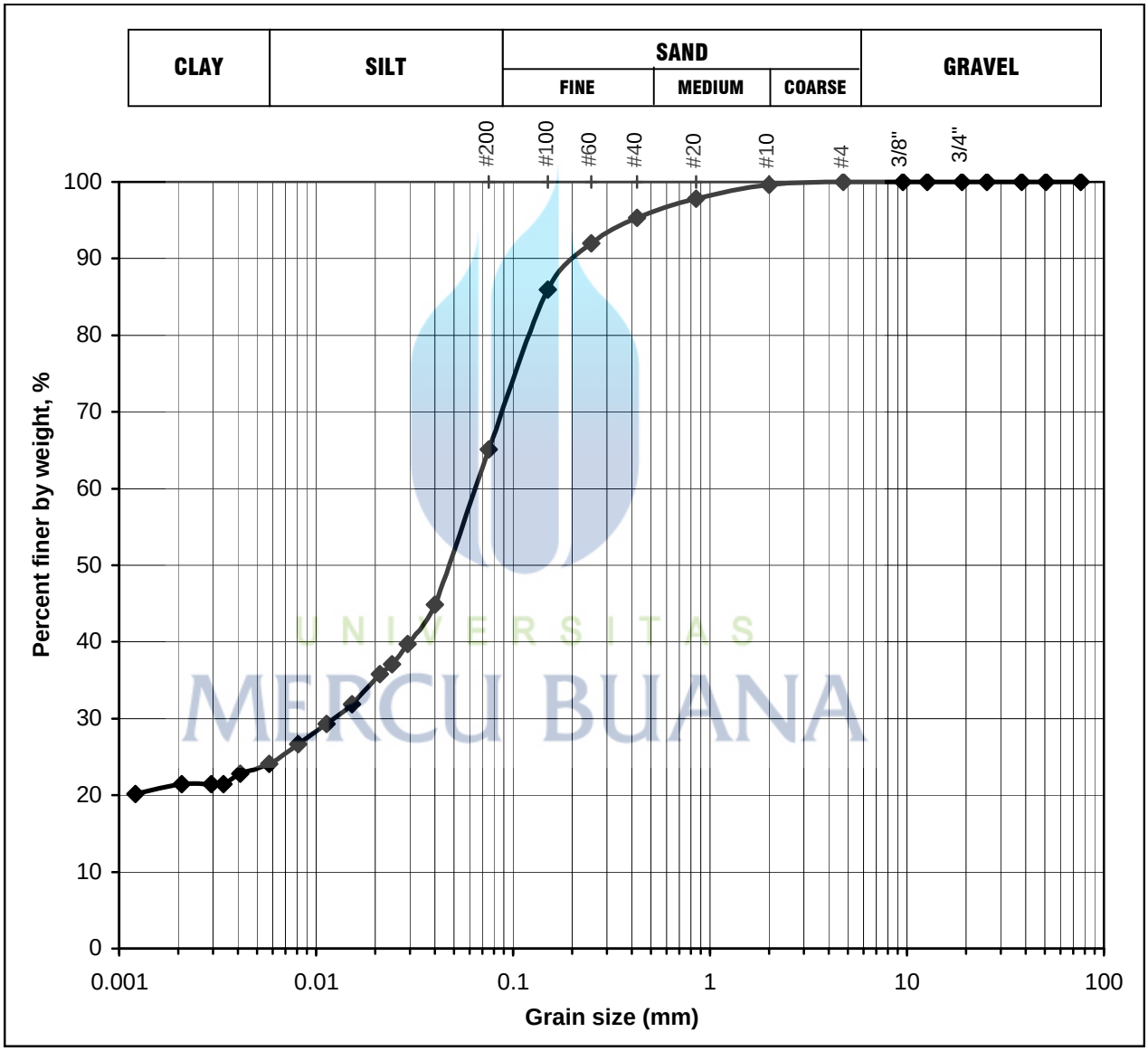
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-4**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	38,00 - 38,50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	18-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-4 [38,00 - 38,50]	0.00	34.93	41.62	23.45	CH - Sandy fat clay

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.012	0.064	NA	NA	56.14	29.30

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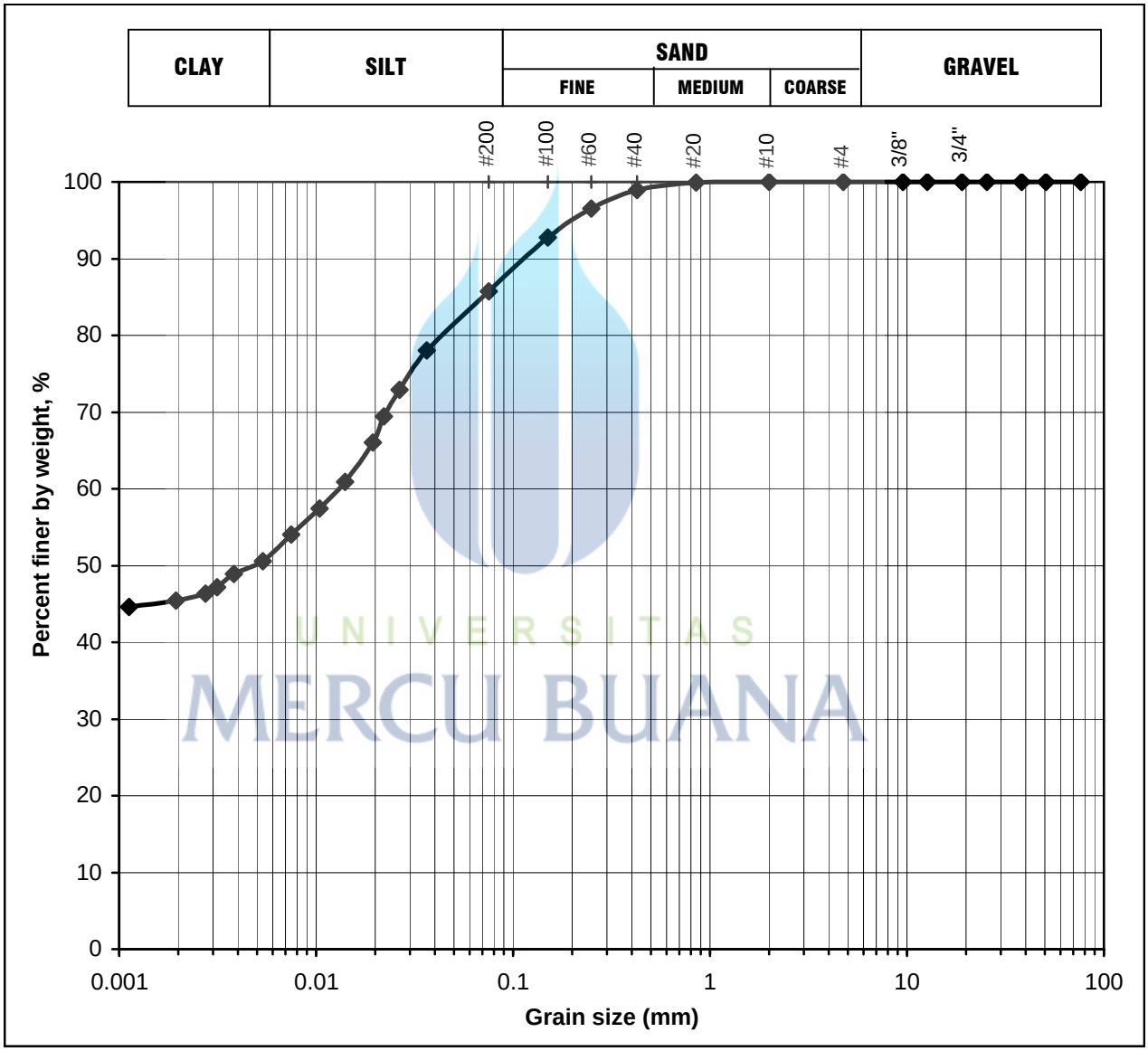
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-4**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	53,00 - 53,50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	18-Nov-2012
Location	:	Jl. Jend. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-4 [53,00 - 53,50]	0.00	14.25	35.58	50.17	CL - Lean clay

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.013	NA	NA	38.25	20.38

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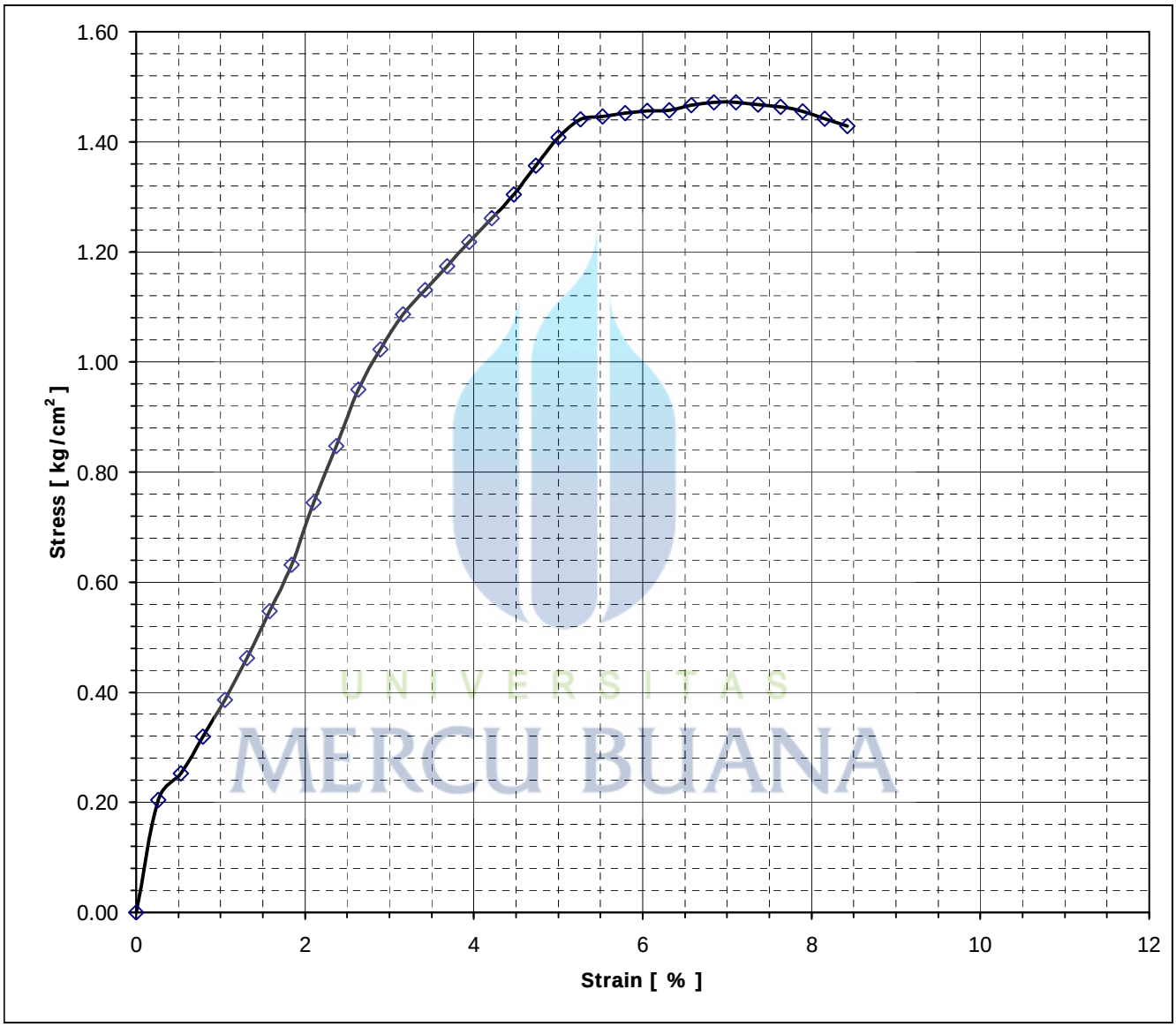
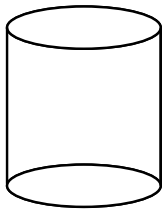
UNCONFINED COMPRESSION TEST (ASTM D 2166 - 91)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-4**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	4.00 - 4.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	16-Nov-12
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Zaenuri
			Checked by	:	Juweni



γ_s	:	**16.707**	kN/m^3
q_u	:	**1.472**	kg/cm^2
S_u	:	**0.736**	kg/cm^2
E	:	**0.271**	kg/cm^2

Failure Sketch :



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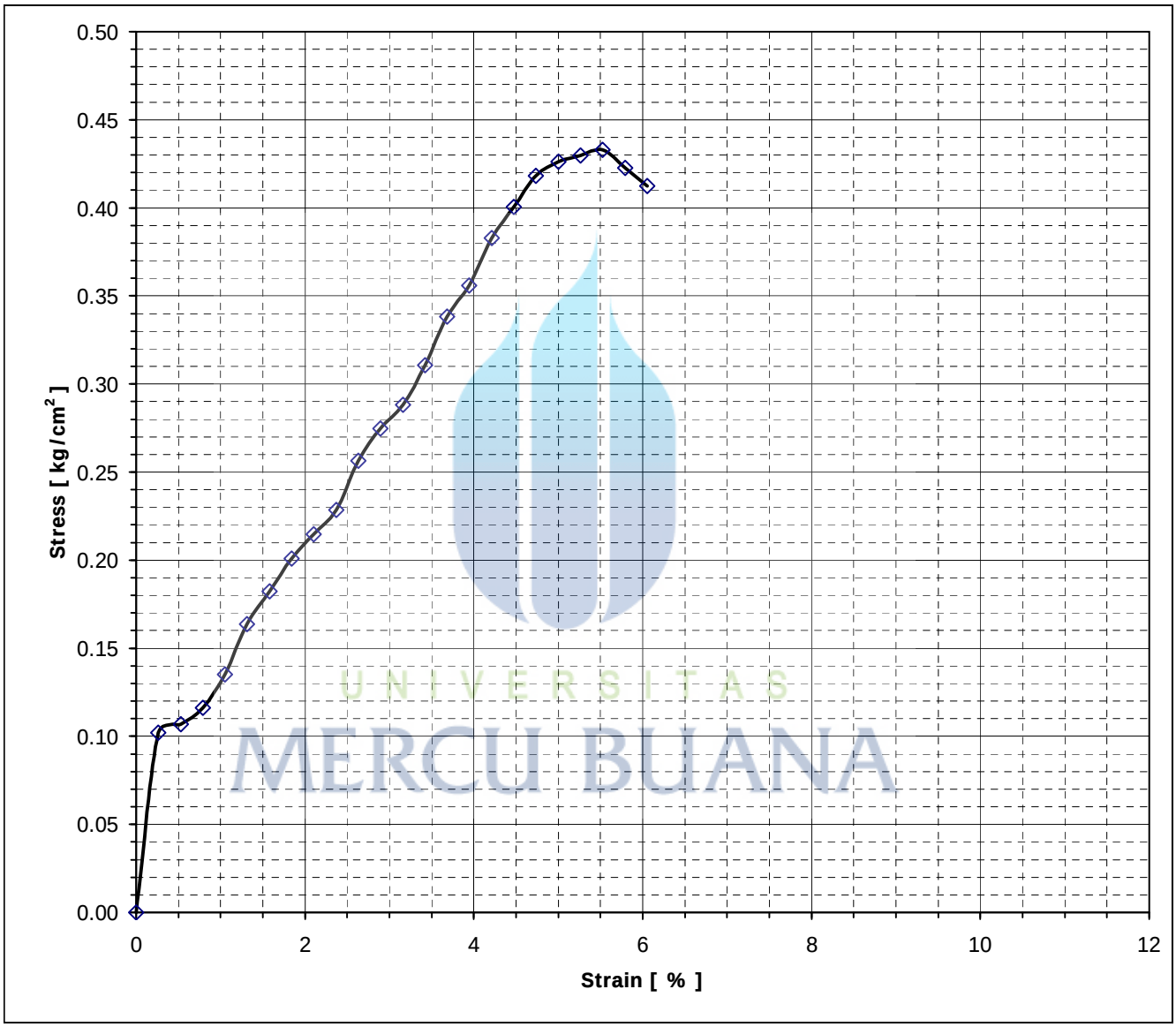
UNCONFINED COMPRESSION TEST (ASTM D 2166 - 91)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-4**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	8.50 - 9.00
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	16-Nov-12
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Zaenuri
			Checked by	:	Juweni



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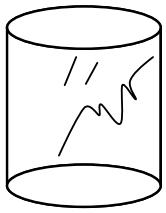
γ_s	:	**14.734**	kN/m^3
q_u	:	**0.433**	kg/cm^2
S_u	:	**0.217**	kg/cm^2
E	:	**0.075**	kg/cm^2

Failure Sketch :



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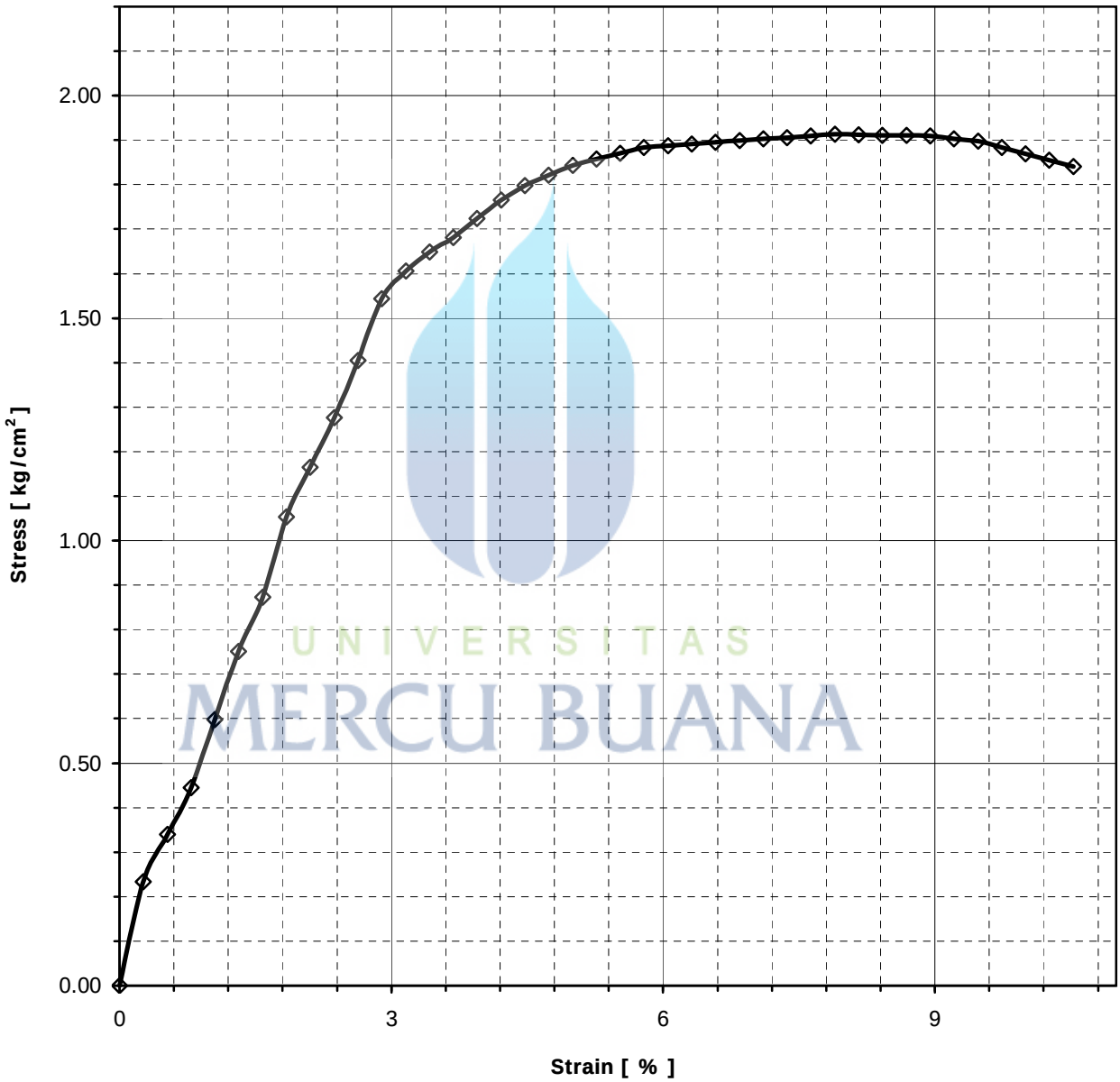
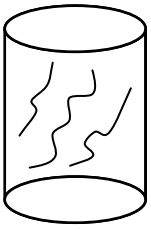
UNCONFINED COMPRESSION TEST (ASTM D 2166)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-4**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	14,00 - 14,50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	18-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Zaenuri
			Checked by	:	Juweni



γ_s	:	17.171	kN/m^3
q_u	:	1.913	kg/cm^2
S_u	:	0.957	kg/cm^2
E	:	0.357	kg/cm^2

Failure sketch : Plastic Flow



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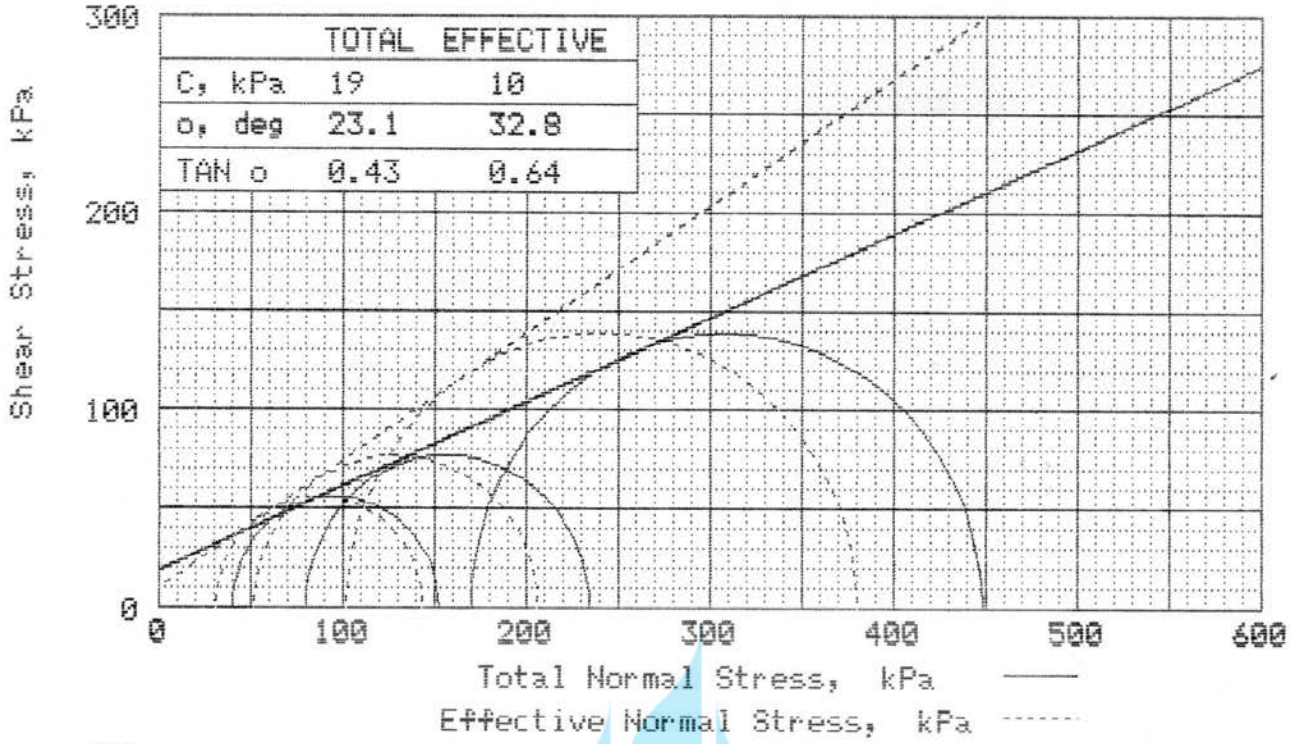

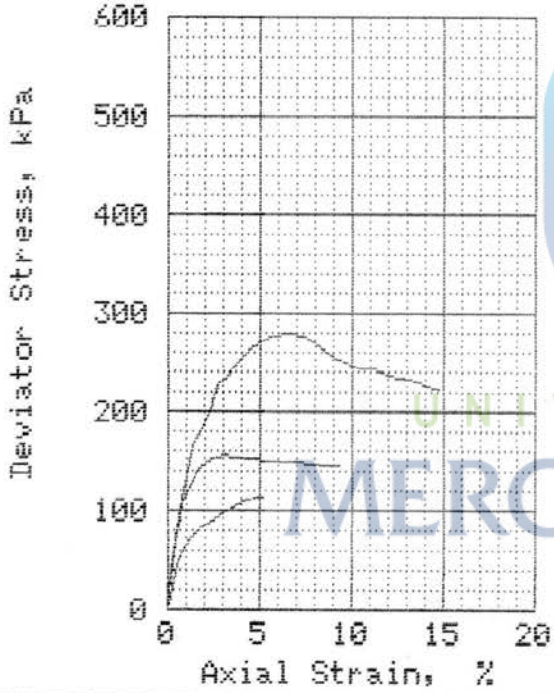

SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	48.2	48.2	48.6
	DRY DENSITY, g/cc	1.1	1.1	1.1
	SATURATION, %	92.0	92.0	96.7
	VOID RATIO	1.388	1.388	1.333
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.50
AT TEST	WATER CONTENT, %	52.9	47.5	47.0
	DRY DENSITY, g/cc	1.1	1.2	1.2
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.402	1.258	1.245
	DIAMETER, cm	3.78	3.78	3.74
	HEIGHT, cm	7.73	7.27	7.45
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190	190	190
CELL PRESSURE, kPa		230	270	360
FAILURE STRESS, kPa		113	155	278
PORE PRESSURE, kPa		199	218	258
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		144	207	380
$\bar{\sigma}_3$ FAILURE, kPa		31	52	102

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDISTURBED.
DESCRIPTION: BROWN & GREY.

LL= PL= PI=
SPECIFIC GRAVITY= 2.65
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. Citra Tama Inti Persada.

PROJECT: GATOT SUBROTO TOWER.
Jl. Gatot Subroto Jakarta.
SAMPLE LOCATION: DB.4
DEPTH : 4.00 - 4.50 M.

PROJ. NO.: DATE: 11 - 12 - 2012

TRIAXIAL SHEAR TEST REPORT

PT. KONAS TUNGGAL SOIL LABORATORY

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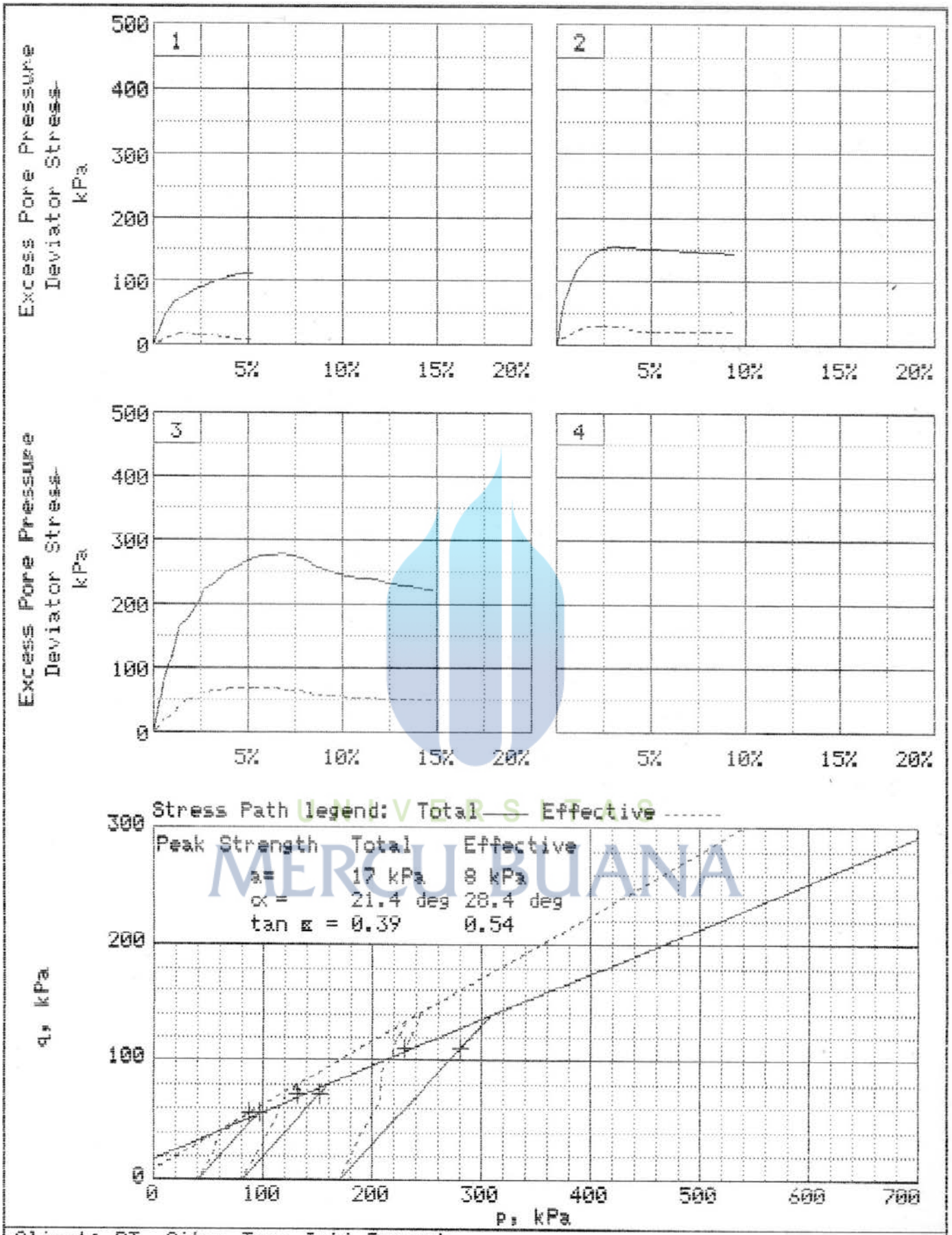

Client: PT. Citra Tama Inti Persada.
Project: GATOT SUBROTO TOWER. Jl. Gatot Subroto Jakarta.
Location: DB.4 DEPTH : 4.00 - 4.50 M.
File: TXL-0291 Project No.: Page 2/2 Fig. No.____

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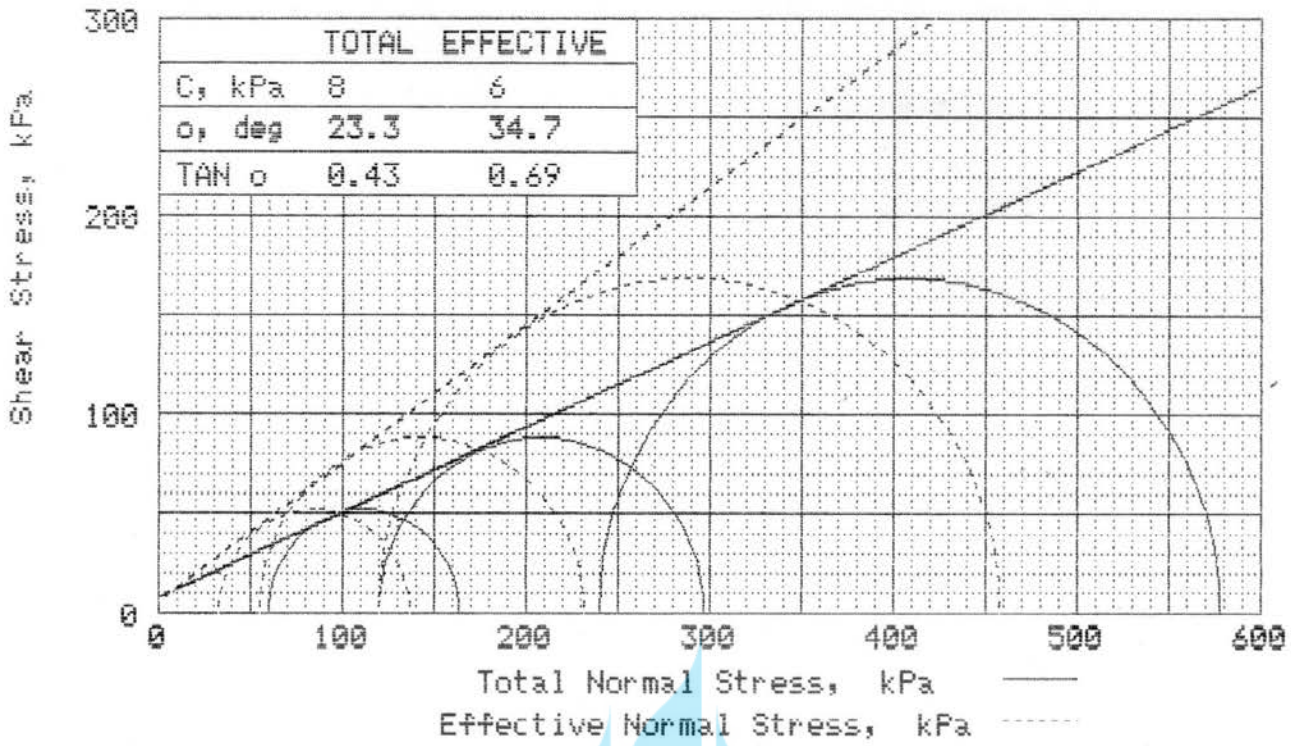

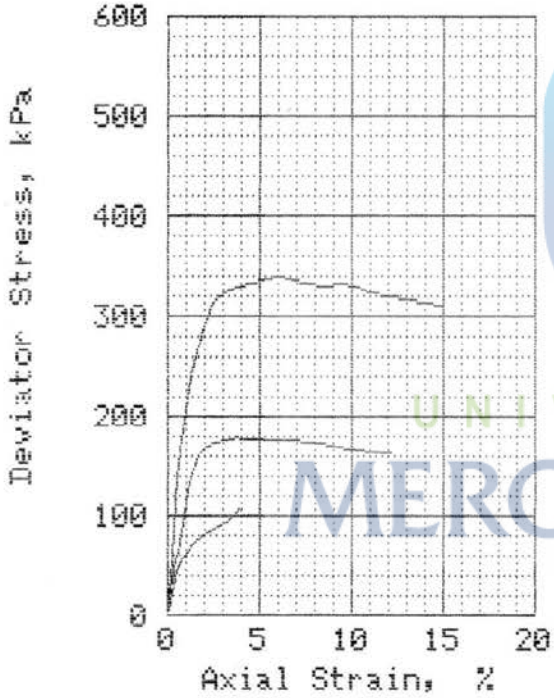

SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	52.0	52.0	52.2
	DRY DENSITY, g/cc	0.9	0.9	1.0
	SATURATION, %	73.3	73.3	77.5
	VOID RATIO	1.883	1.883	1.785
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.60
AT TEST	WATER CONTENT, %	39.3	33.6	40.7
	DRY DENSITY, g/cc	1.3	1.4	1.3
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.041	0.891	1.077
	DIAMETER, cm	3.26	3.23	3.34
	HEIGHT, cm	7.30	6.90	7.32
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190	190	190
CELL PRESSURE, kPa		250	310	430
FAILURE STRESS, kPa		104	177	338
PORE PRESSURE, kPa		217	255	310
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		137	232	458
$\bar{\sigma}_3$ FAILURE, kPa		33	55	120

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDISTURBED.
DESCRIPTION: BROWN.

LL= PL= PI=
SPECIFIC GRAVITY= 2.65
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. Citra Tama Inti Persada.

PROJECT: GATOT SUBROTO TOWER.
Jl. Gatot Subroto Jakarta.
SAMPLE LOCATION: DB.4
DEPTH : 8.50 - 9.00 M.

PROJ. NO.: DATE: 13 - 12 - 2012

TRIAXIAL SHEAR TEST REPORT

PT. KONAS TUNGGAL SOIL LABORATORY

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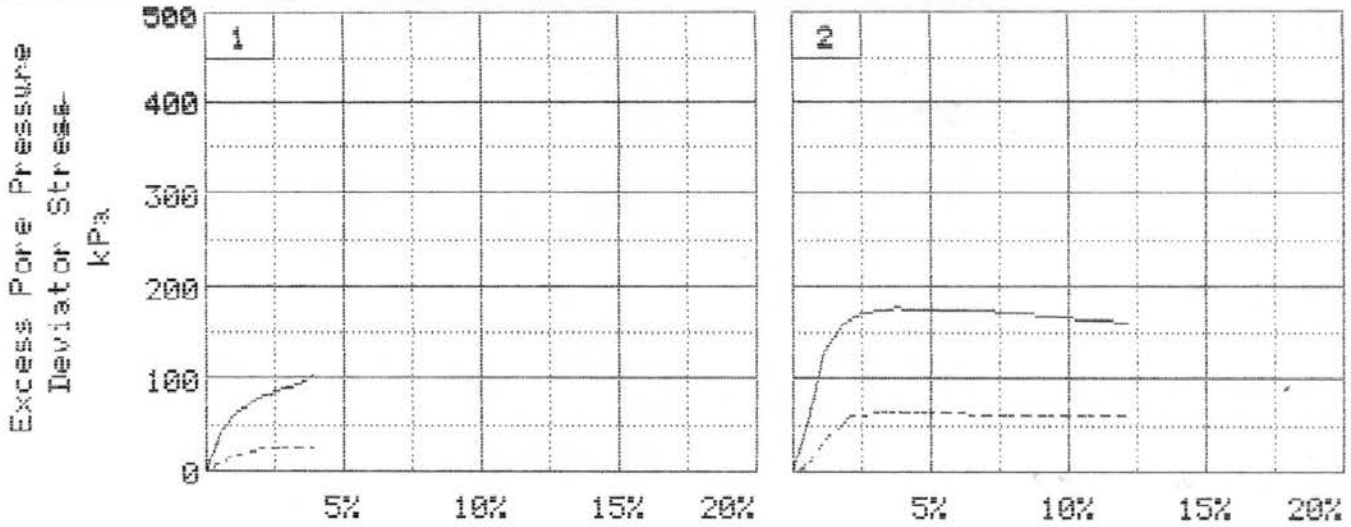

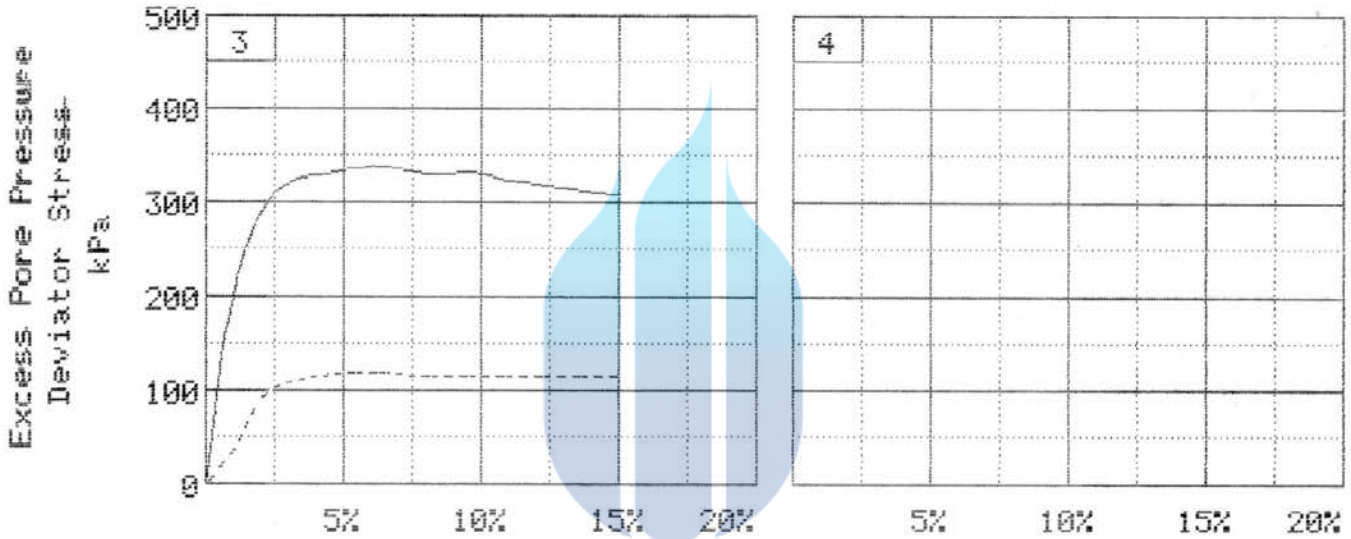

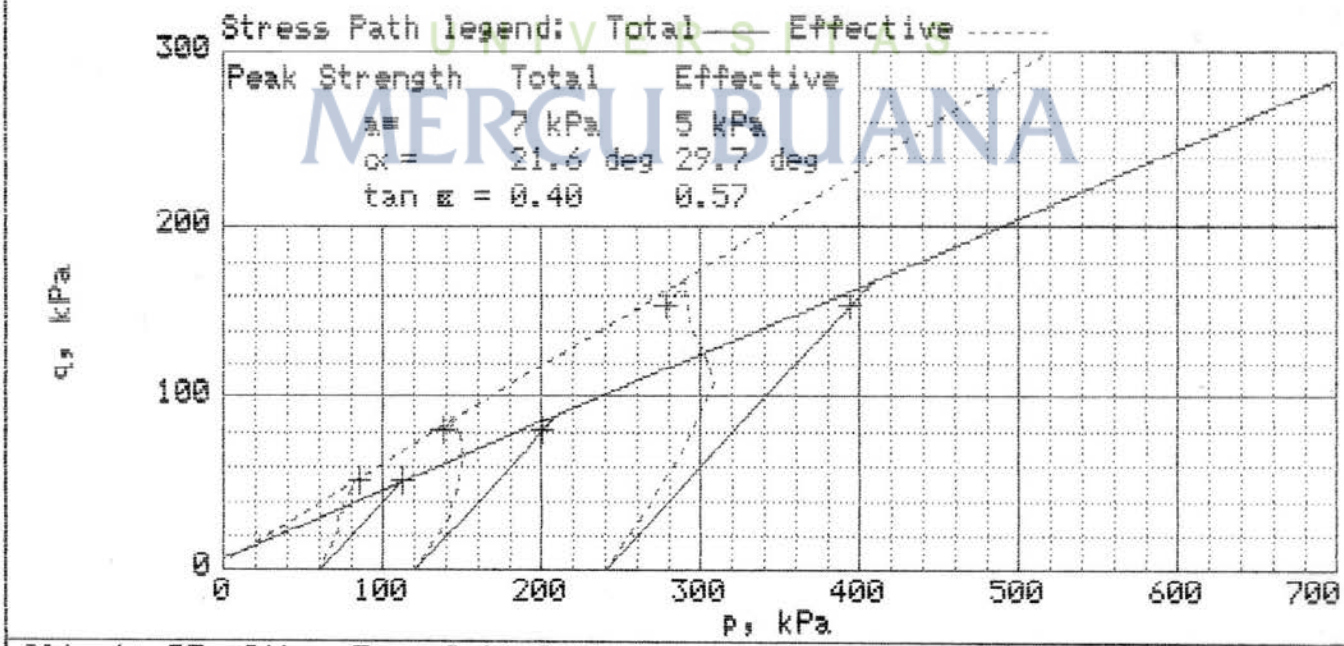

Client: PT. Citra Tama Inti Persada.
Project: GATOT SUBROTO TOWER. Jl. Gatot Subroto Jakarta.
Location: DB.4 DEPTH : 8.50 - 9.00 M.
File: TXL-0293 Project No.: Page 2/2 Fig. No.____

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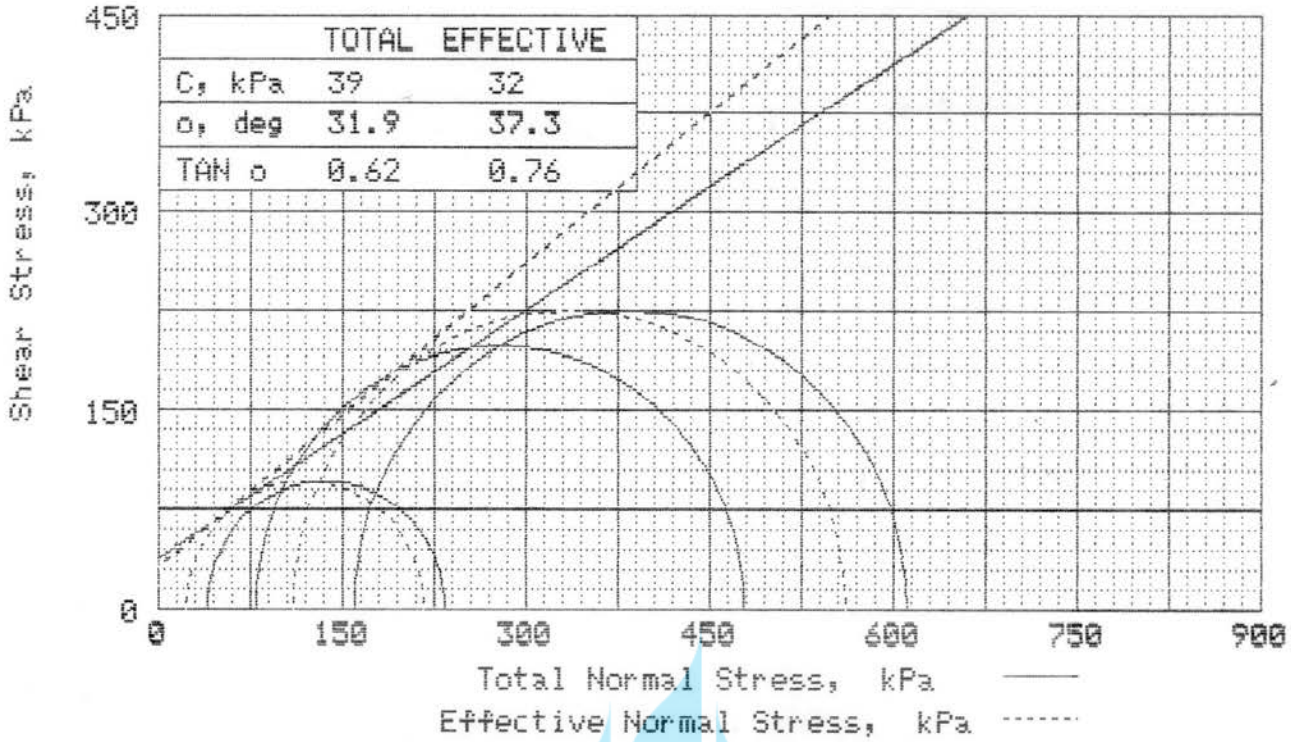

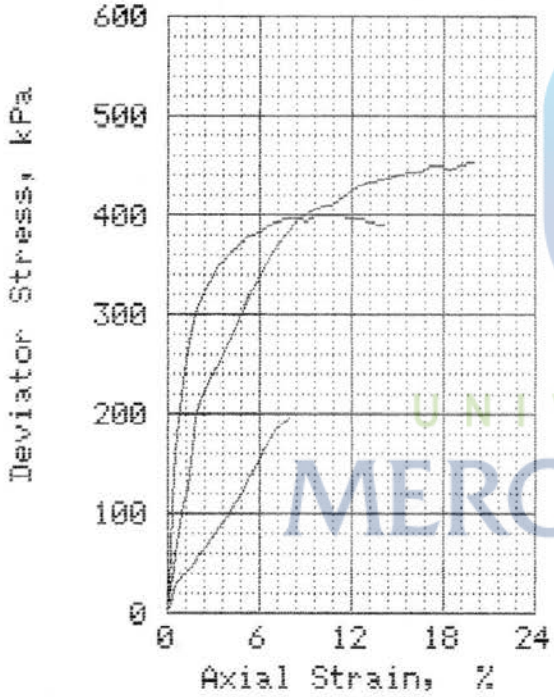

SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	40.1	40.1	40.3
	DRY DENSITY, g/cc	1.1	1.1	1.1
	SATURATION, %	75.6	75.6	77.6
	VOID RATIO	1.404	1.404	1.376
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.60
AT TEST	WATER CONTENT, %	40.0	39.7	36.3
	DRY DENSITY, g/cc	1.3	1.3	1.4
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.059	1.051	0.961
	DIAMETER, cm	3.52	3.63	3.48
	HEIGHT, cm	7.60	7.09	7.49
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190	190	190
CELL PRESSURE, kPa		230	270	350
FAILURE STRESS, kPa		194	399	452
PORE PRESSURE, kPa		207	190	240
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		217	479	562
$\bar{\sigma}_3$ FAILURE, kPa		23	80	110

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDISTURBED.
DESCRIPTION: BROWN.

LL= PL= PI=
SPECIFIC GRAVITY= 2.65
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. Citra Tama Inti Persada.

PROJECT: GATOT SUBROTO TOWER.
Jl. Gatot Subroto Jakarta.
SAMPLE LOCATION: DB.4
DEPTH : 14.00 - 14.50 M.

PROJ. NO.: DATE: 14 - 12 - 2012

TRIAXIAL SHEAR TEST REPORT

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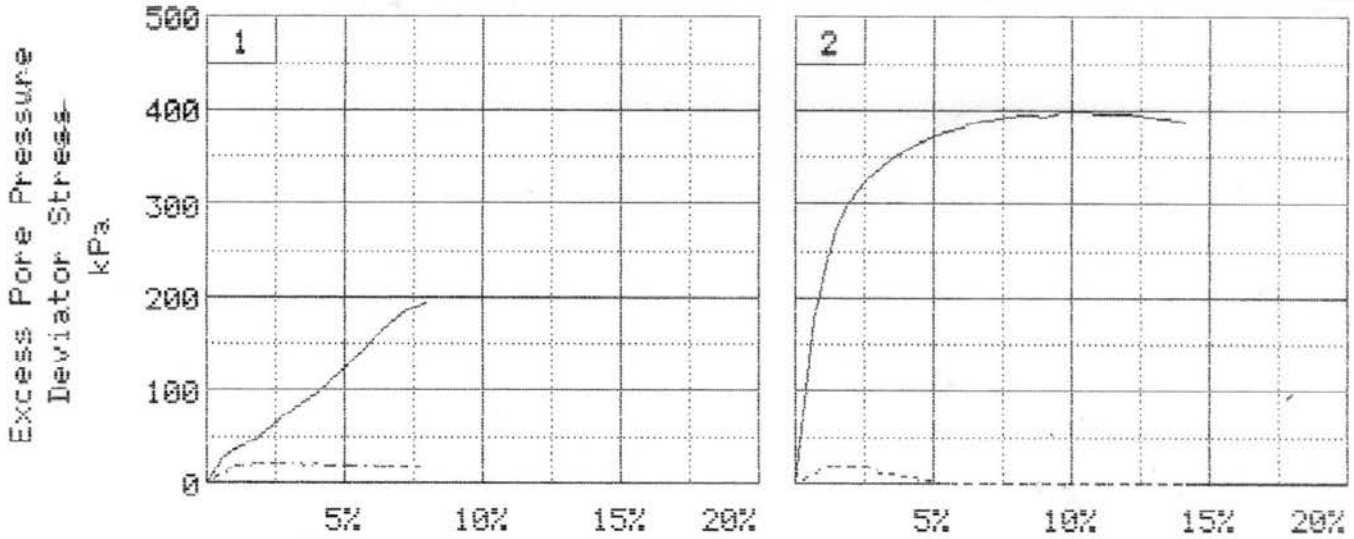

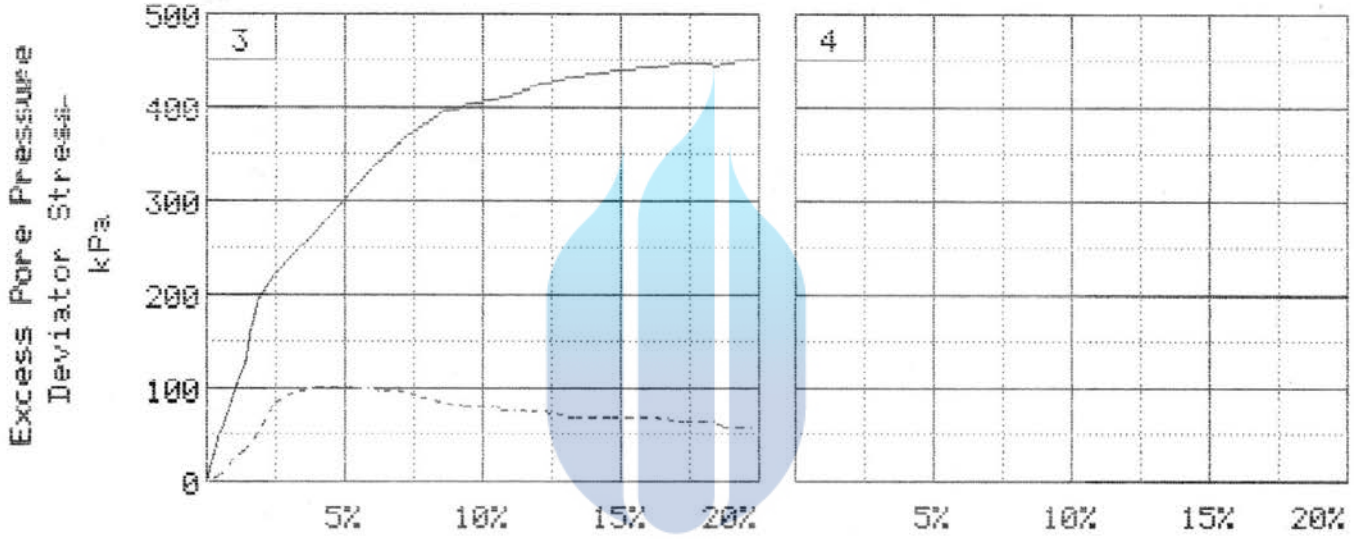

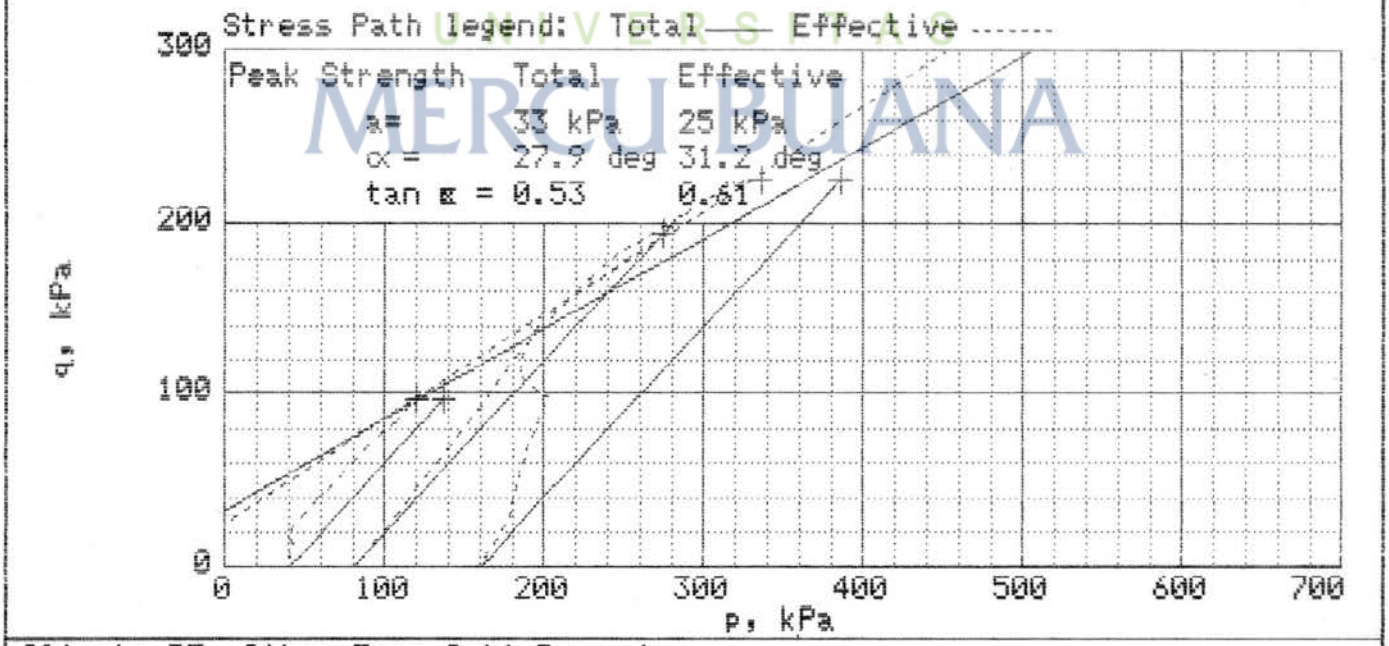

Client: PT. Citra Tama Inti Persada.
Project: GATOT SUBROTO TOWER. Jl. Gatot Subroto Jakarta.
Location: DB.4 DEPTH : 14.00 - 14.50 M.
File: TXL-0294 Project No.: Page 2/2 Fig. No.____

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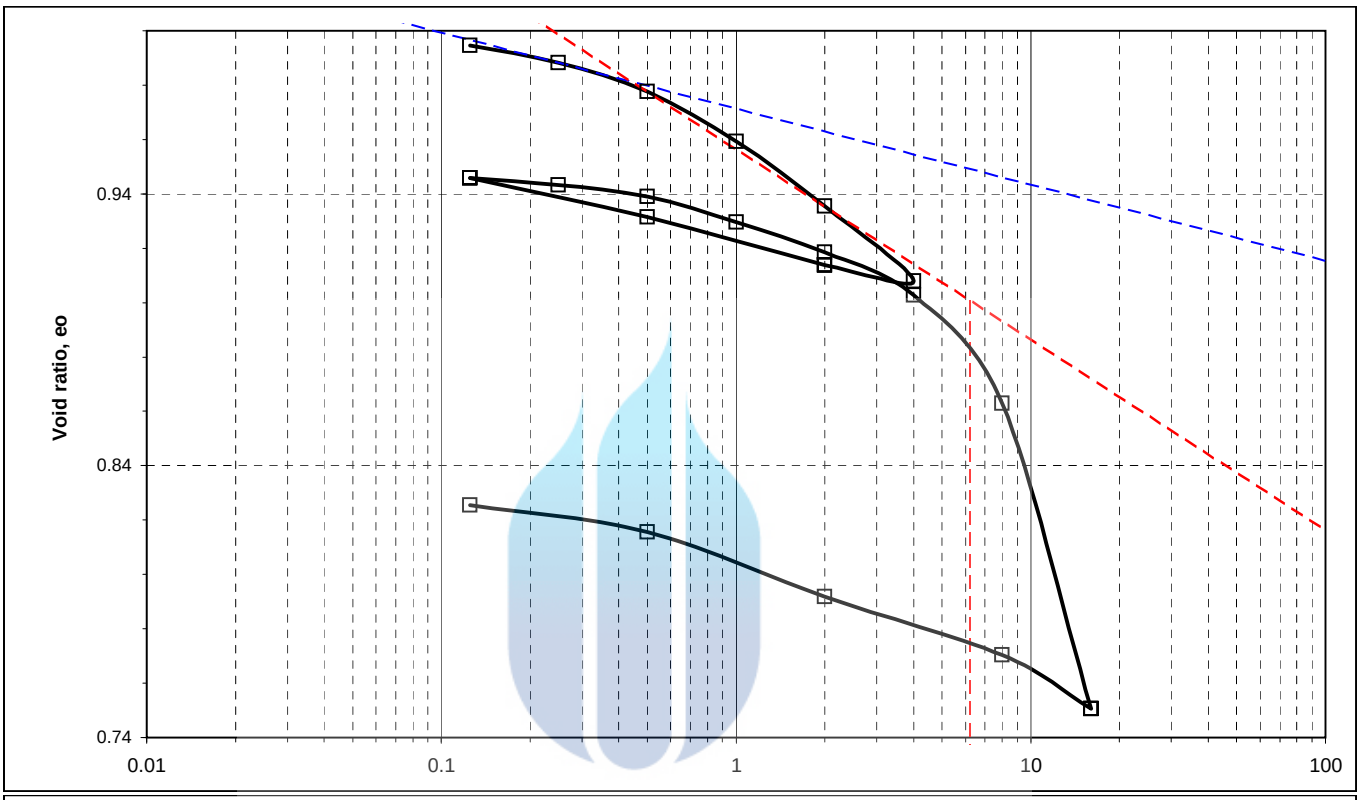
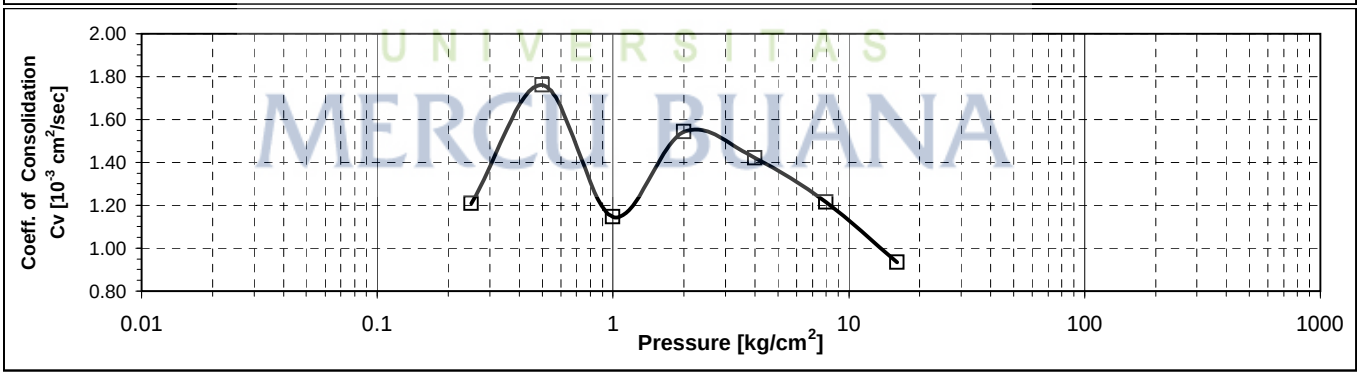
PT. DAYA CREASI MITRAYASA
Design & Engineering Consultants

CONSOLIDATION TEST (ASTM D 2435 - 90)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-4**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	38,00 - 38,50
Project	:	Centennial Tower	Testing date	:	20-Nov-12
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Kabul
			Checked by	:	Juweni





Pressure (kg/cm²)	0.250	0.50	1	2	4	8	16
Cv (10^{-3} cm²/sec)	1.2097	1.7613	1.1467	1.5443	1.4197	1.2151	0.9351
mv (cm²/kg)	3.20E-02	3.72E-02	3.72E-02	3.05E-02	2.21E-02	1.67E-02	1.54E-02
k (cm/second)	3.87E-05	6.55E-05	6.55E-05	4.71E-05	3.14E-05	2.03E-05	1.44E-05

Initial Moisture content	:	33.85	%	Initial degree of saturation	: 88.53 %
Final Moisture content	:	33.16	%	Final degree of saturation	: 100.00 %
Initial void ratio, eo	:	0.996		Preconsol. Pressure, Pc	: 5.414 kg/cm²
Final void ratio, ef	:	0.751		Range of Pc (kg/cm²)	4.591 to 6.237
Unit weight of soil, γ_s	:	1.747	t/m³	Compression index, Cc	: 0.373
				Swelling index, Cs	: 0.038
				Recompression index, Cr	: 0.028

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LAMPIRAN – C

PENGUJIAN LABORATORIUM DB-5

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PT. DAYA CREASI MITRAYASA
Design & Engineering Consultants

SPECIFIC GRAVITY TEST (ASTM D 854)

Client	:	PT. Citratama Inti Persada	Project No.	:	DCM.G.12-047
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	17-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

Borehole : **DB-5**
Depth (m) : **5.00 - 5.50**

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	5	6
Wt. of Pycno + cup [gram]	32.159	38.975
Wt. of Pycno + cup + soil [gram]	44.662	52.454
Wt. of Pycno + cup + water [gram]	81.679	138.167
Wt. of Pycno + cup + water + soil [gram]	89.394	146.628
Specific Gravity, Gs	2.611	2.686
Average of Specific Gravity, Gs	**2.649**	

Borehole : **DB-5**
Depth (m) : **10.00 - 10.50**

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	57	58
Wt. of Pycno + cup [gram]	62.582	60.480
Wt. of Pycno + cup + soil [gram]	72.632	71.512
Wt. of Pycno + cup + water [gram]	161.423	159.676
Wt. of Pycno + cup + water + soil [gram]	167.668	166.501
Specific Gravity, Gs	2.641	2.622
Average of Specific Gravity, Gs	**2.632**	

Borehole : **DB-5**
Depth (m) : **14.50 - 15.00**

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	59	60
Wt. of Pycno + cup [gram]	57.428	35.744
Wt. of Pycno + cup + soil [gram]	68.120	46.465
Wt. of Pycno + cup + water [gram]	160.725	135.679
Wt. of Pycno + cup + water + soil [gram]	167.398	142.306
Specific Gravity, Gs	2.660	2.619
Average of Specific Gravity, Gs	**2.640**	

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PT. DAYA CREASI MITRAYASA
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SPECIFIC GRAVITY TEST (ASTM D 854)

Client	:	PT. Citratama Inti Persada	Project No.	:	DCM.G.12-047
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	17-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni
					UDS Sample

Borehole : DB-5
Depth (m) : 26.00 - 26.50

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	62	63
Wt. of Pycno + cup [gram]	47.123	44.651
Wt. of Pycno + cup + soil [gram]	56.756	54.372
Wt. of Pycno + cup + water [gram]	144.405	144.909
Wt. of Pycno + cup + water + soil [gram]	150.343	150.928
Specific Gravity, Gs	2.607	2.626
Average of Specific Gravity, Gs	**2.616**	

Borehole : DB-5
Depth (m) : 41.00 - 41.50

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	49	50
Wt. of Pycno + cup [gram]	61.647	45.284
Wt. of Pycno + cup + soil [gram]	78.111	60.080
Wt. of Pycno + cup + water [gram]	161.096	145.207
Wt. of Pycno + cup + water + soil [gram]	171.321	154.388
Specific Gravity, Gs	2.639	2.635
Average of Specific Gravity, Gs	**2.637**	

Borehole : DB-5
Depth (m) : 56.00 - 56.50

Description	Test 1	Test 2
Method of air removal	Heating	Heating
Temperature, °C	28°	28°
No. of pycno + cup [gram]	51	52
Wt. of Pycno + cup [gram]	58.282	41.561
Wt. of Pycno + cup + soil [gram]	74.985	55.187
Wt. of Pycno + cup + water [gram]	156.847	142.353
Wt. of Pycno + cup + water + soil [gram]	167.339	150.880
Specific Gravity, Gs	2.689	2.672
Average of Specific Gravity, Gs	**2.681**	

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PT. DAYA CREASI MITRAYASA
Design & Engineering Consultants

WATER CONTENT DETERMINATION (ASTM D 2216)

Project No.	:	DCM.G.12-047	Tested date	:	8-Nov-12
Client	:	PT. Citratama Inti Persada	Tested by	:	Kbl
Project	:	Gatot Subroto Tower (Centennial Tower)	Checked by	:	Juweni
Location	:	Jl. Gatot Subroto - Jakarta			

UDS Sample

Borehole : **DB-5**
Depth (m) : **5.00 - 5.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	89.692	102.617	109.004
Wt. of dry soil + can [gram]	73.050	76.145	81.017
Wt. of can [gram]	38.497	22.174	23.446
Wt. of wet soil [gram]	51.195	80.443	85.558
Wt. of water [gram]	16.642	26.472	27.987
Wt. of dry soil [gram]	34.553	53.971	57.571
Water content, w %	48.164	49.049	48.613
γ_s [gram/cm^3]	**1.628**	Average of water content [%]	
γ_d [gram/cm^3]	**1.095**	**48.61**	

Borehole : **DB-5**
Depth (m) : **10.00 - 10.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	76.305	91.774	98.503
Wt. of dry soil + can [gram]	60.049	69.565	73.951
Wt. of can [gram]	23.947	23.505	23.445
Wt. of wet soil [gram]	52.358	68.269	75.058
Wt. of water [gram]	16.256	22.209	24.552
Wt. of dry soil [gram]	36.102	46.060	50.506
Water content, w %	45.028	48.218	48.612
γ_s [gram/cm^3]	**1.665**	Average of water content [%]	
γ_d [gram/cm^3]	**1.130**	**47.29**	

Borehole : **DB-5**
Depth (m) : **14.50 - 15.00**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	94.441	80.547	113.253
Wt. of dry soil + can [gram]	79.405	65.922	89.510
Wt. of can [gram]	33.801	21.190	23.054
Wt. of wet soil [gram]	60.640	59.357	90.199
Wt. of water [gram]	15.036	14.625	23.743
Wt. of dry soil [gram]	45.604	44.732	66.456
Water content, w %	32.971	32.695	35.727
γ_s [gram/cm^3]	**1.928**	Average of water content [%]	
γ_d [gram/cm^3]	**1.441**	**33.80**	

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WATER CONTENT DETERMINATION (ASTM D 2216)

Project No.	:	DCM.G.12-047	Tested date	:	8-Nov-12
Client	:	PT. Citratama Inti Persada	Tested by	:	Kbl
Project	:	Gatot Subroto Tower (Centennial Tower)	Checked by	:	Juweni
Location	:	Jl. Gatot Subroto - Jakarta			

UDS Sample

Borehole : **DB-5**
Depth (m) : **26.00 - 26.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	86.969	97.660	85.242
Wt. of dry soil + can [gram]	75.485	85.253	73.878
Wt. of can [gram]	25.129	21.045	21.650
Wt. of wet soil [gram]	61.840	76.615	63.592
Wt. of water [gram]	11.484	12.407	11.364
Wt. of dry soil [gram]	50.356	64.208	52.228
Water content, w %	22.806	19.323	21.758
γ_s [gram/cm^3]	**1.966**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.621**	**21.30**	

Borehole : **DB-5**
Depth (m) : **41.00 - 41.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	89.803	77.890	91.596
Wt. of dry soil + can [gram]	76.802	63.148	72.600
Wt. of can [gram]	34.556	15.831	14.500
Wt. of wet soil [gram]	55.247	62.059	77.096
Wt. of water [gram]	13.001	14.742	18.996
Wt. of dry soil [gram]	42.246	47.317	58.100
Water content, w %	30.775	31.156	32.695
γ_s [gram/cm^3]	**1.757**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.335**	**31.54**	

Borehole : **DB-5**
Depth (m) : **56.00 - 56.50**

Description	Test by Ring	Test 1	Test 2
Wt. of wet soil + can [gram]	101.578	84.137	100.179
Wt. of dry soil + can [gram]	90.330	70.570	83.444
Wt. of can [gram]	41.272	15.616	14.447
Wt. of wet soil [gram]	60.306	68.521	85.732
Wt. of water [gram]	11.248	13.567	16.735
Wt. of dry soil [gram]	49.058	54.954	68.997
Water content, w %	22.928	24.688	24.255
γ_s [gram/cm^3]	**1.918**	**Average of water content [%]**	
γ_d [gram/cm^3]	**1.547**	**23.96**	

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ATTERBERG LIMITS TEST (ASTM D 4318)

Project No.	: DCM.G.12-047	Borehole	: **DB-5**
Client	: PT. Citratama Inti Persada	Depth (m)	: 5.00 - 5.50
Project	: Gatot Subroto Tower (Centennial Tower)	Tested date	: 19-Nov-2012
Location	: Jl. Gatot Subroto - Jakarta	Tested by	: Rimanto
		Checked by	: Juweni

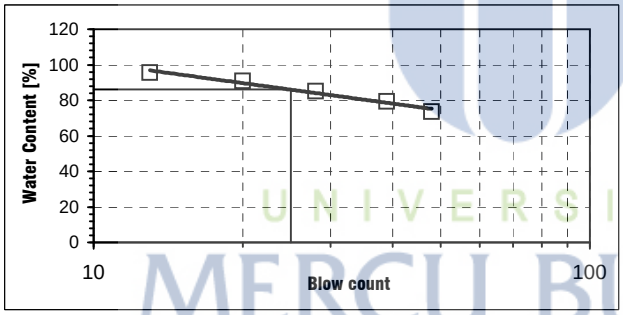
UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	90.336	86.117	79.639	84.372	73.988
Wt. of dry soil + can [gram]	54.300	52.940	50.485	54.214	49.496
Wt. of can [gram]	16.525	16.457	16.244	16.255	16.132
Wt. of water [gram]	36.036	33.177	29.154	30.158	24.492
Wt. of dry soil [gram]	37.775	36.483	34.241	37.959	33.364
Water content, w [%]	95.396	90.938	85.144	79.449	73.408
No. of blows	13	20	28	39	48

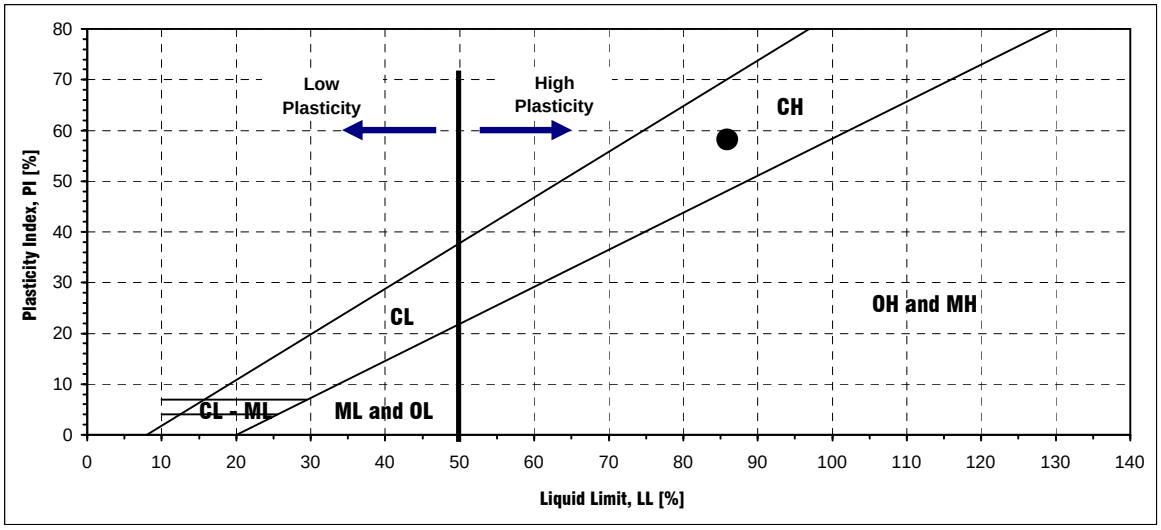
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	35.914	35.598	35.962		
Wt. of dry soil + can [gram]	31.492	31.296	31.488		
Wt. of can [gram]	15.570	15.897	15.365		
Wt. of water [gram]	4.422	4.302	4.474		
Wt. of dry soil [gram]	15.922	15.399	16.123		
Water content, w [%]	27.773	27.937	27.749		



Liquid limit [LL], %	:	85.972
Plastic limit [PL], %	:	27.820
Plasticity index [PI], %	:	58.153
Flow index	:	0.1961
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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ATTERBERG LIMITS TEST (ASTM D 4318)

Project No.	: DCM.G.12-047	Borehole	: **DB-5**
Client	: PT. Citratama Inti Persada	Depth (m)	: 10.00 - 10.50
Project	: Gatot Subroto Tower (Centennial Tower)	Tested date	: 16-Nov-2012
Location	: Jl. Gatot Subroto - Jakarta	Tested by	: Rimanto
		Checked by	: Juweni

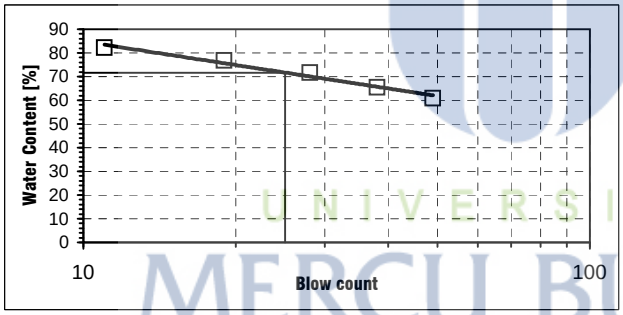
UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	92.752	79.039	74.254	71.984	72.780
Wt. of dry soil + can [gram]	58.398	51.973	50.201	50.042	51.600
Wt. of can [gram]	16.560	16.743	16.668	16.529	16.784
Wt. of water [gram]	34.354	27.066	24.053	21.942	21.180
Wt. of dry soil [gram]	41.838	35.230	33.533	33.513	34.816
Water content, w [%]	82.112	76.827	71.729	65.473	60.834
No. of blows	11	19	28	38	49

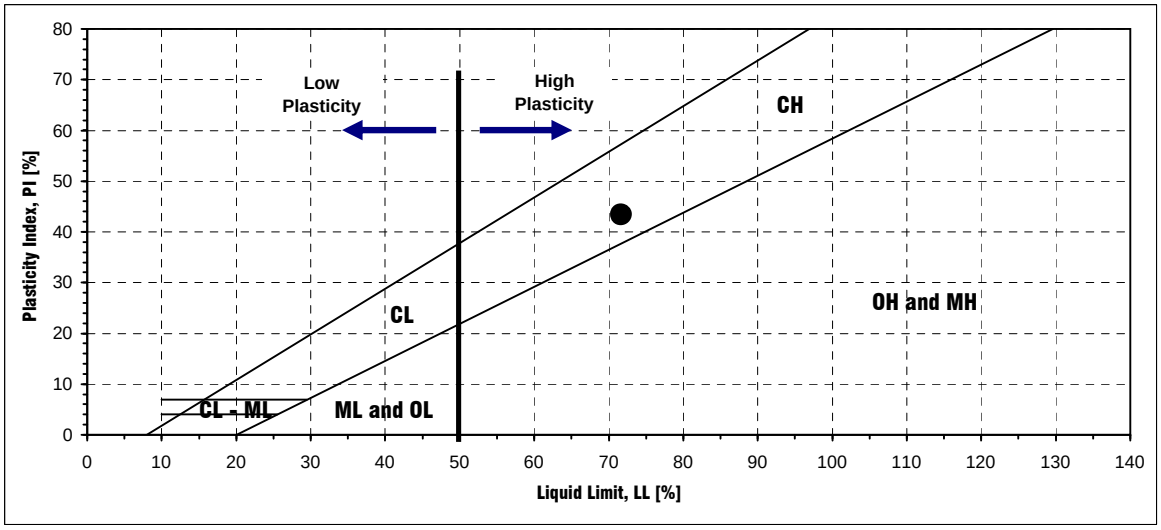
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	40.218	40.189	40.187		
Wt. of dry soil + can [gram]	34.888	34.879	34.774		
Wt. of can [gram]	15.934	15.937	15.829		
Wt. of water [gram]	5.330	5.310	5.413		
Wt. of dry soil [gram]	18.954	18.942	18.945		
Water content, w [%]	28.121	28.033	28.572		



Liquid limit [LL], %	:	71.708
Plastic limit [PL], %	:	28.242
Plasticity index [PI], %	:	43.466
Flow index	:	0.2001
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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ATTERBERG LIMITS TEST (ASTM D 4318)

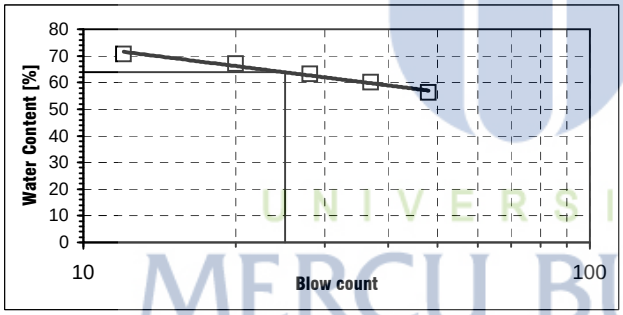
Project No.	: DCM.G.12-047	Borehole	: **DB-5**
Client	: PT. Citratama Inti Persada	Depth (m)	: 14.50 - 15.00
Project	: Gatot Subroto Tower (Centennial Tower)	Tested date	: 16-Nov-2012
Location	: Jl. Gatot Subroto - Jakarta	Tested by	: Rimanto
		Checked by	: Juweni
			UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	83.503	71.523	70.971	71.356	70.474
Wt. of dry soil + can [gram]	55.880	49.522	50.004	50.969	50.976
Wt. of can [gram]	16.825	16.730	16.801	16.962	16.274
Wt. of water [gram]	27.623	22.001	20.967	20.387	19.498
Wt. of dry soil [gram]	39.055	32.792	33.203	34.007	34.702
Water content, w [%]	70.728	67.093	63.148	59.949	56.187
No. of blows	12	20	28	37	48

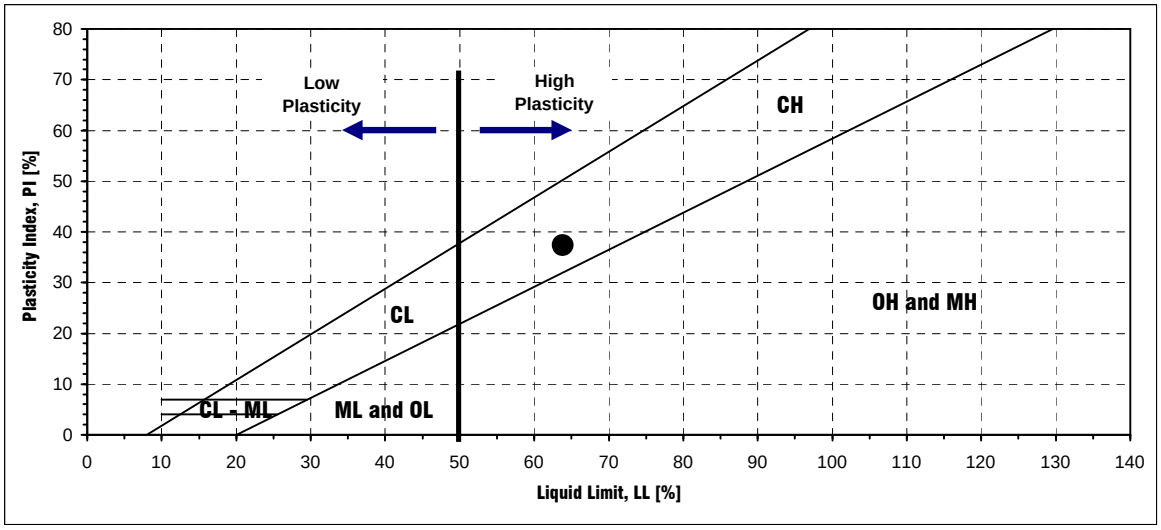
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	36.430	37.425	37.490		
Wt. of dry soil + can [gram]	32.067	32.905	32.890		
Wt. of can [gram]	15.541	15.821	15.707		
Wt. of water [gram]	4.363	4.520	4.600		
Wt. of dry soil [gram]	16.526	17.084	17.183		
Water content, w [%]	26.401	26.458	26.771		



Liquid limit [LL], %	:	63.842
Plastic limit [PL], %	:	26.543
Plasticity index [PI], %	:	37.299
Flow index	:	0.1650
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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ATTERBERG LIMITS TEST (ASTM D 4318)

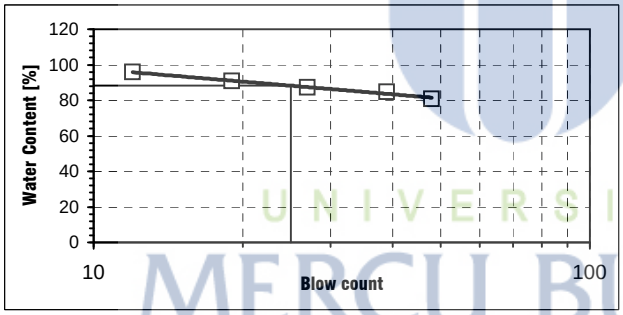
Project No.	: DCM.G.12-047	Borehole	: **DB-5**
Client	: PT. Citratama Inti Persada	Depth (m)	: 26.00 - 26.50
Project	: Gatot Subroto Tower (Centennial Tower)	Tested date	: 16-Nov-2012
Location	: Jl. Gatot Subroto - Jakarta	Tested by	: Rimanto
		Checked by	: Juweni
			UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	73.866	87.192	80.992	82.750	75.536
Wt. of dry soil + can [gram]	45.282	52.905	50.315	51.695	48.510
Wt. of can [gram]	15.456	15.143	15.170	15.021	15.055
Wt. of water [gram]	28.584	34.287	30.677	31.055	27.026
Wt. of dry soil [gram]	29.826	37.762	35.145	36.674	33.455
Water content, w [%]	95.836	90.798	87.287	84.679	80.783
No. of blows	12	19	27	39	48

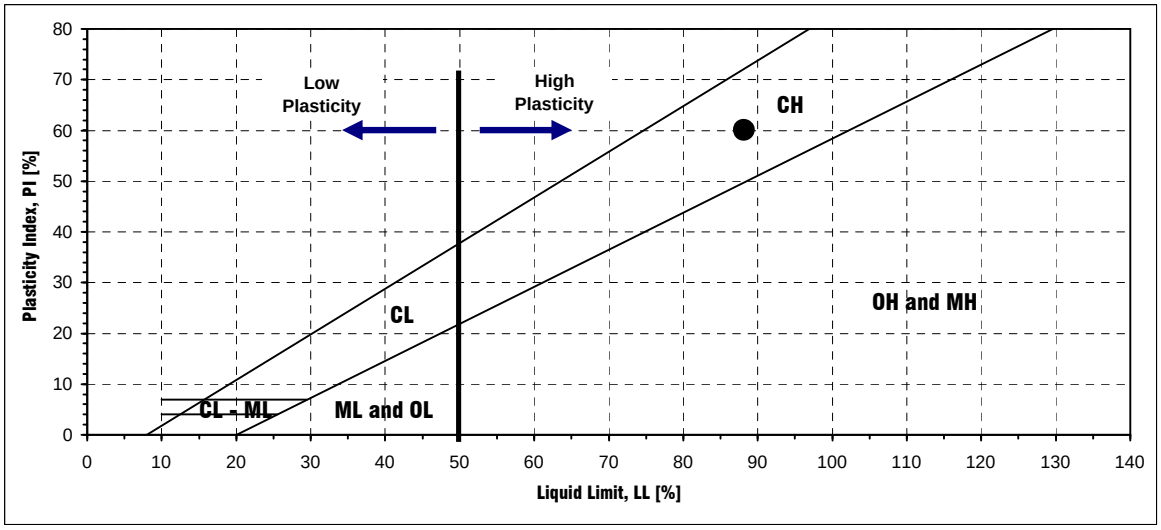
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	38.831	38.508	38.296		
Wt. of dry soil + can [gram]	33.614	33.458	33.497		
Wt. of can [gram]	15.609	15.808	15.563		
Wt. of water [gram]	5.217	5.050	4.799		
Wt. of dry soil [gram]	18.005	17.650	17.934		
Water content, w [%]	28.975	28.612	26.759		



Liquid limit [LL], %	:	88.217
Plastic limit [PL], %	:	28.115
Plasticity index [PI], %	:	60.102
Flow index	:	0.1165
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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ATTERBERG LIMITS TEST (ASTM D 4318)

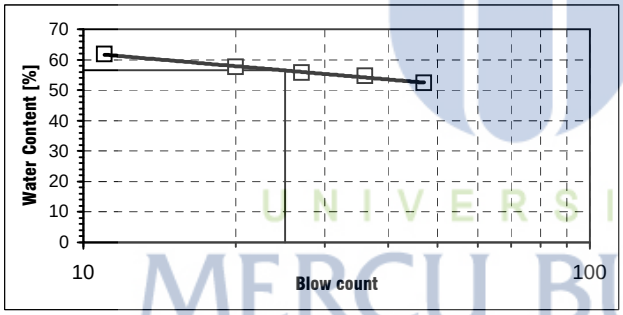
Project No.	: DCM.G.12-047	Borehole	: **DB-5**
Client	: PT. Citratama Inti Persada	Depth (m)	: 56.00 - 56.50
Project	: Gatot Subroto Tower (Centennial Tower)	Tested date	: 14-Nov-2012
Location	: Jl. Gatot Subroto - Jakarta	Tested by	: Rimanto
		Checked by	: Juweni
			UDS Sample

LIQUID LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	97.912	95.129	84.099	94.417	88.520
Wt. of dry soil + can [gram]	66.814	66.471	59.911	66.978	63.930
Wt. of can [gram]	16.499	16.707	16.529	16.745	16.965
Wt. of water [gram]	31.098	28.658	24.188	27.439	24.590
Wt. of dry soil [gram]	50.315	49.764	43.382	50.233	46.965
Water content, w [%]	61.807	57.588	55.756	54.623	52.358
No. of blows	11	20	27	36	47

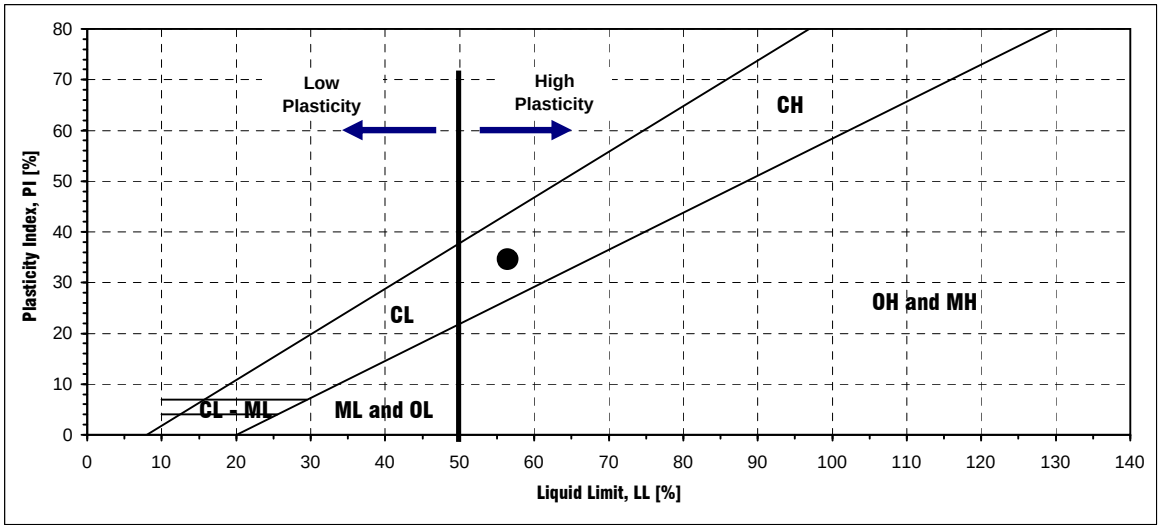
PLASTIC LIMIT DETERMINATION

Test No.	1	2	3	4	5
Wt. of wet soil + can [gram]	40.458	40.305	40.333		
Wt. of dry soil + can [gram]	35.999	35.898	35.897		
Wt. of can [gram]	15.638	15.539	15.704		
Wt. of water [gram]	4.459	4.407	4.436		
Wt. of dry soil [gram]	20.361	20.359	20.193		
Water content, w [%]	21.900	21.646	21.968		



Liquid limit [LL], %	:	56.463
Plastic limit [PL], %	:	21.838
Plasticity index [PI], %	:	34.625
Flow index	:	0.1104
Classification	:	CH - Fat clay

Soil Classification by Plasticity Chart [Casagrande Chart]



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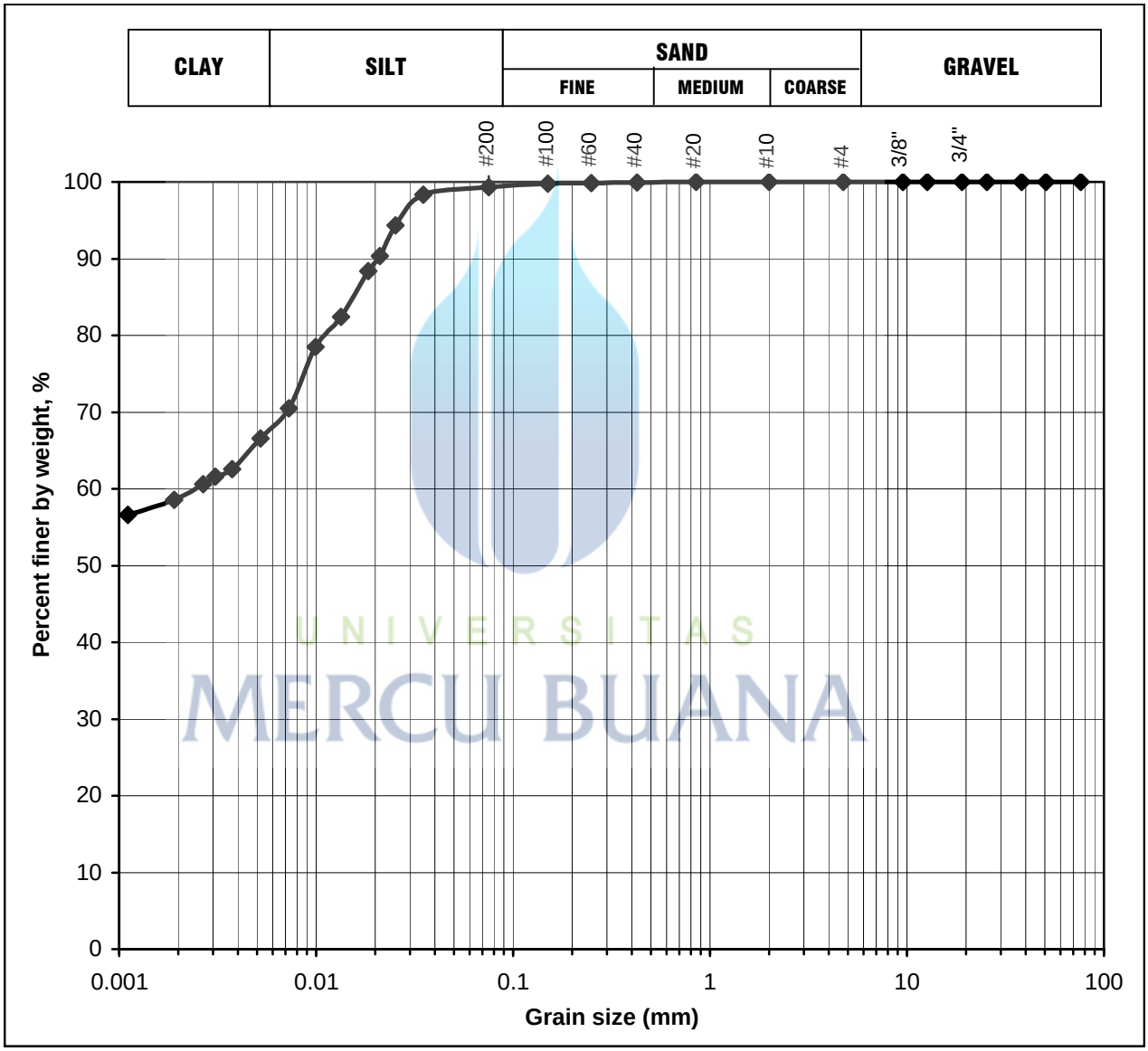
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-5**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	5.00 - 5.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	15-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-5 [5.00 - 5.50]	0.00	0.69	33.38	65.93	CH - Fat clay

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.002	NA	NA	85.97	27.82

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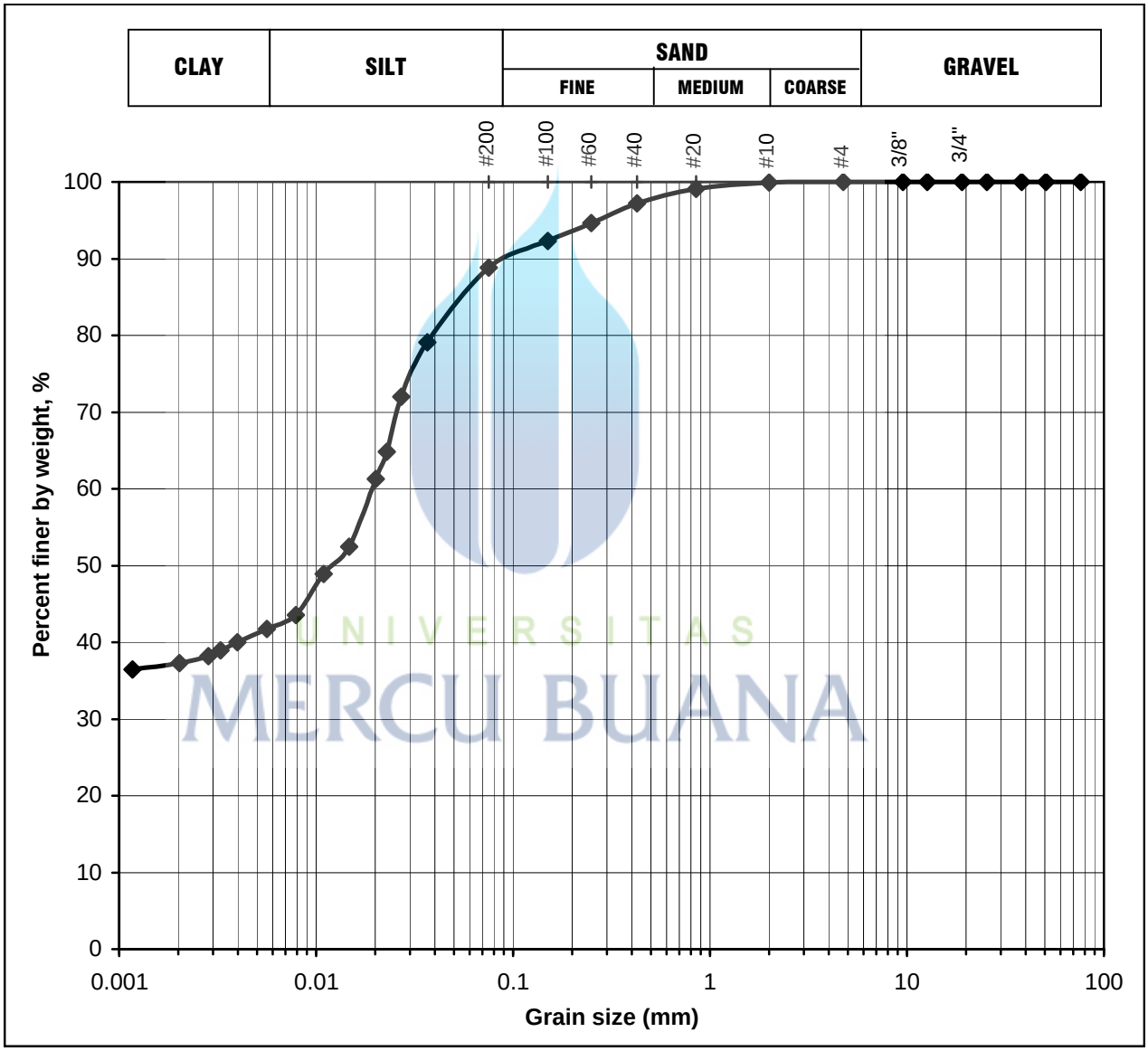
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-5**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	10.00 - 10.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	15-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-5 [10.00 - 10.50]	0.00	11.15	47.77	41.08	CH - Fat clay

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.019	NA	NA	71.71	28.24

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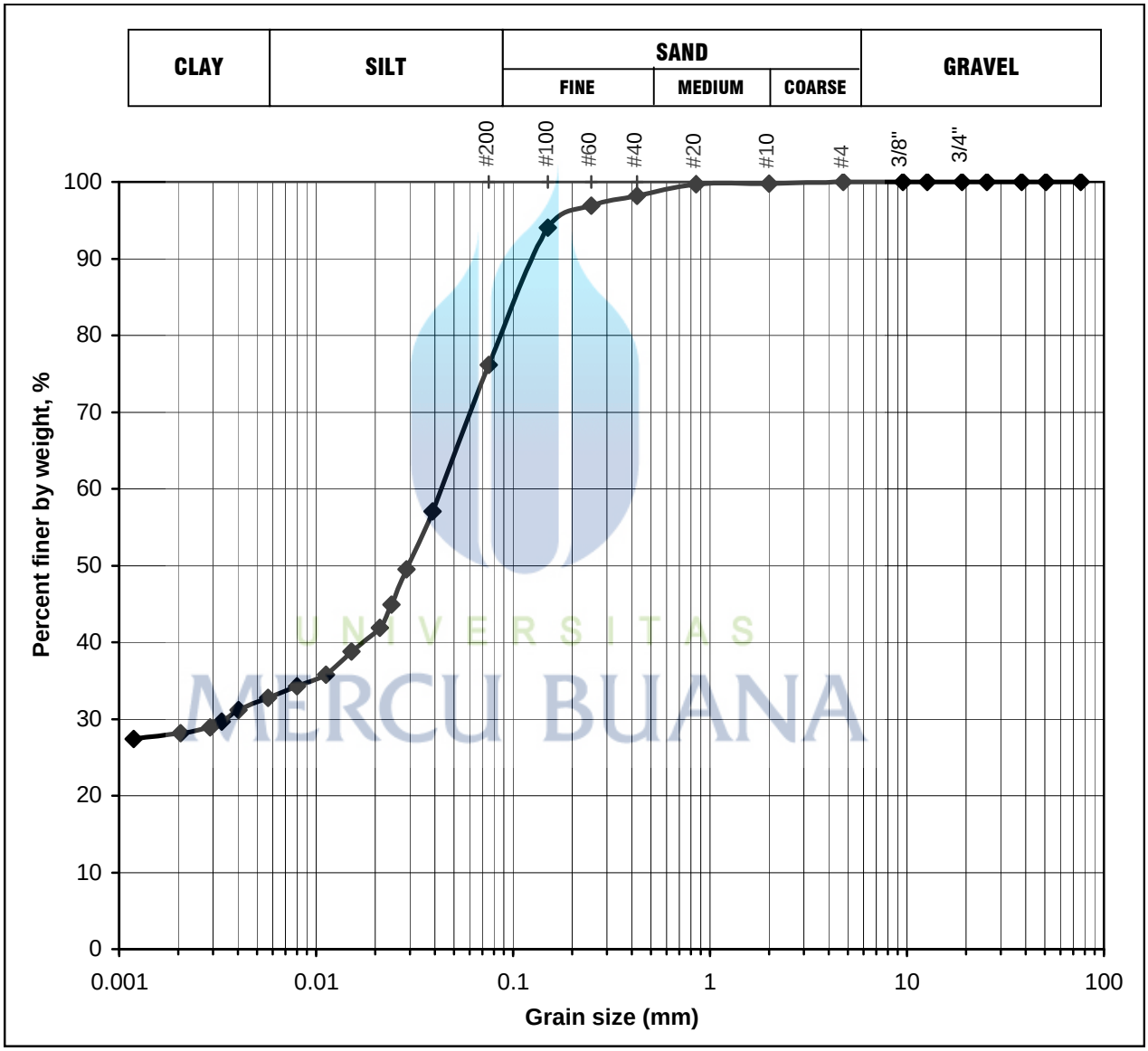
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-5**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	14.50 - 15.00
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	15-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-5 [14.50 - 15.00]	0.00	23.89	44.03	32.08	CH - Fat clay with sand

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.003	0.043	NA	NA	63.84	26.54

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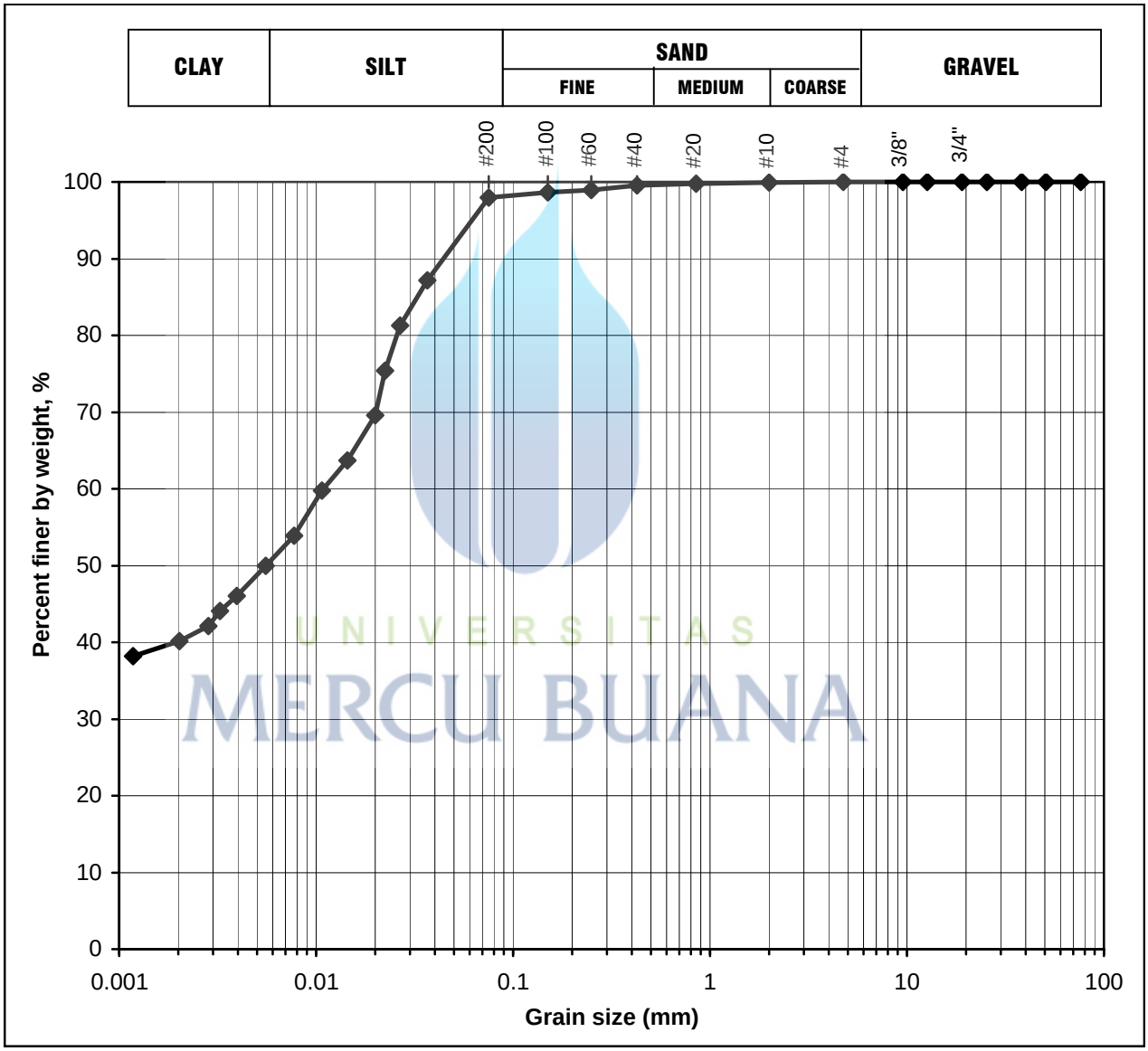
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-5**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	26.00 - 26.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	15-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-5 [26.00 - 26.50]	0.00	2.04	49.37	48.59	CH - Fat clay

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.011	NA	NA	88.22	28.12

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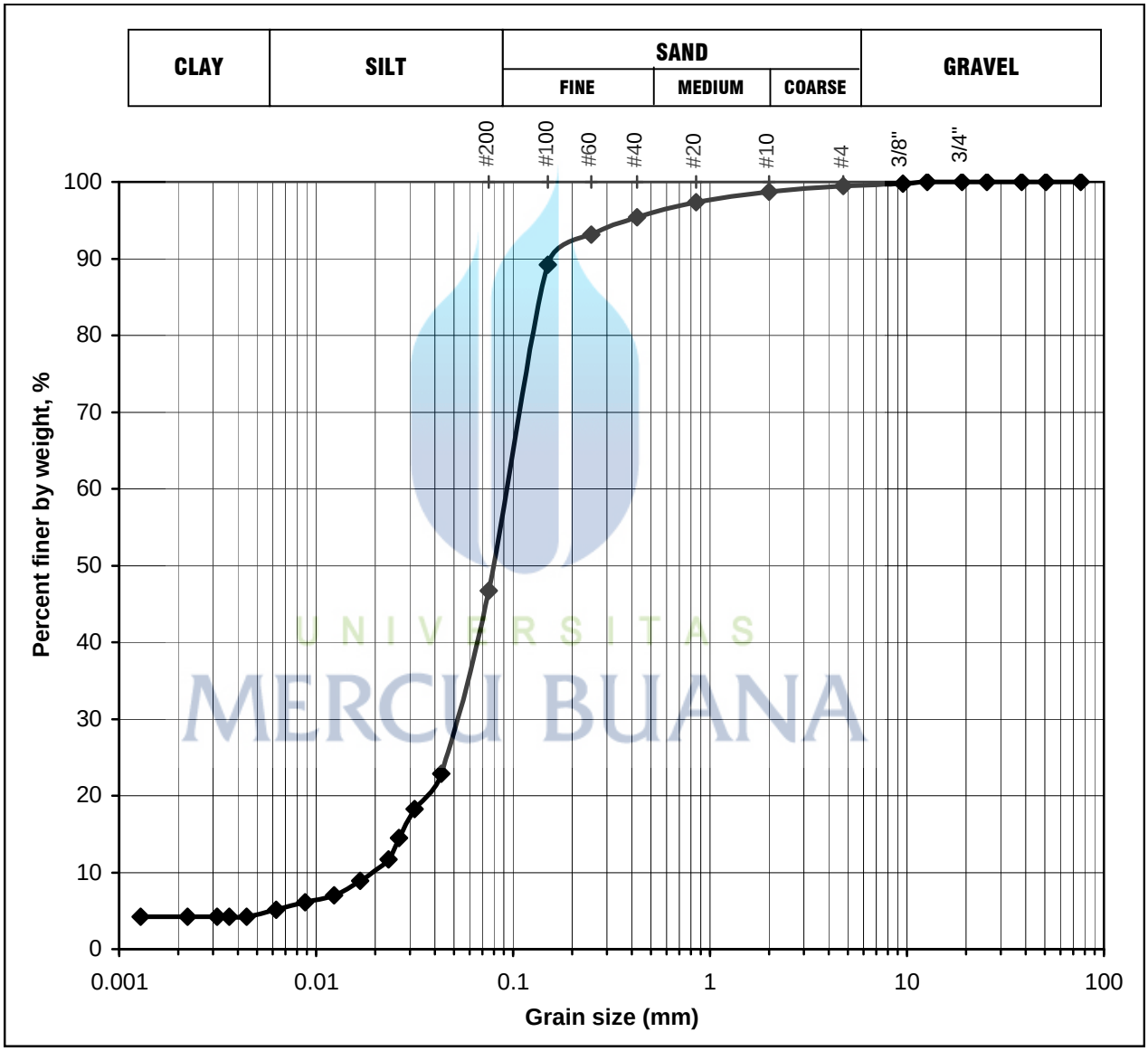
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-5**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	41.00 - 41.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	15-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-5 [41.00 - 41.50]	0.56	52.70	42.26	4.47	SM - Silty sand

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.019	0.051	0.093	4.876	1.455		

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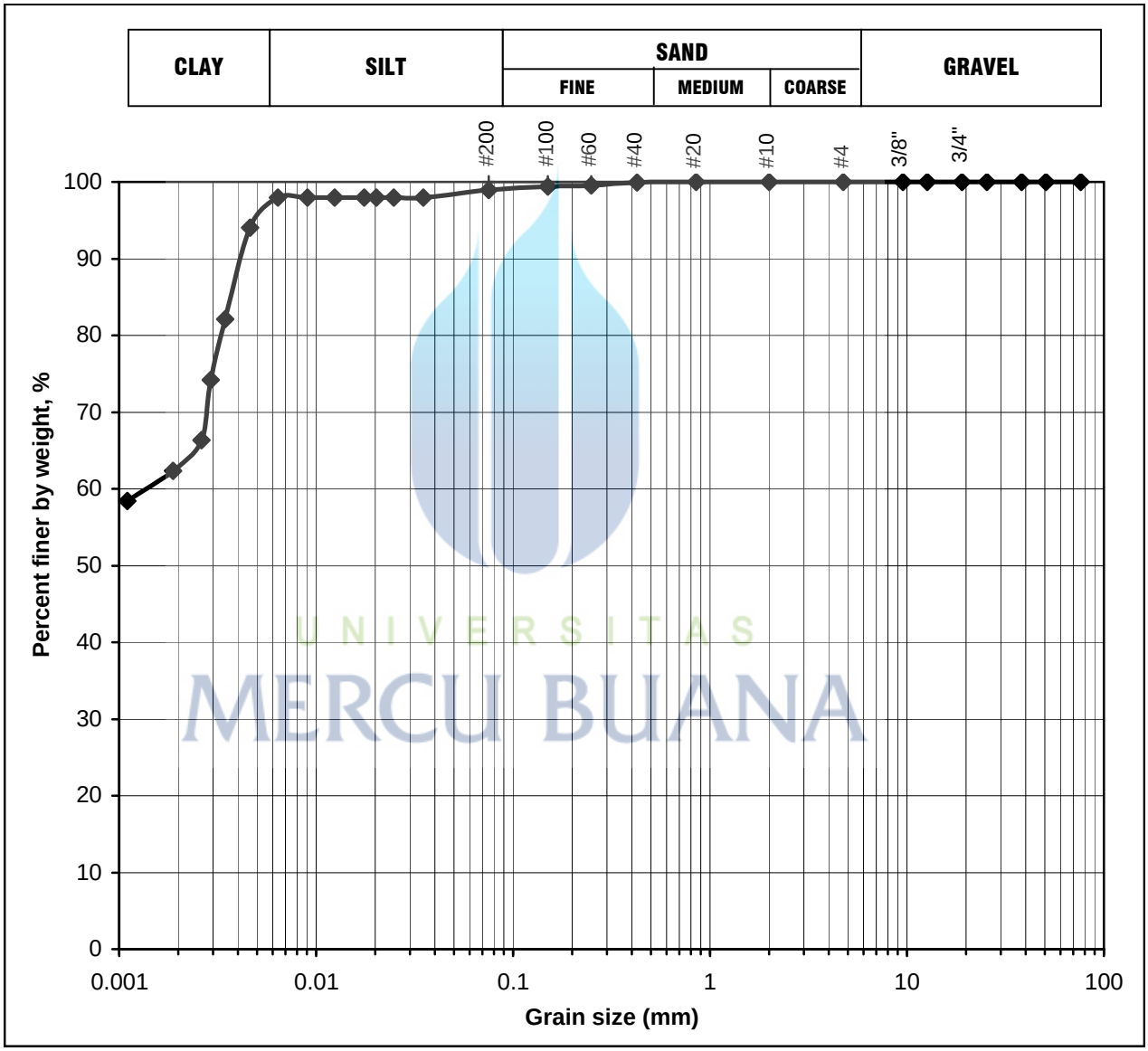
GRAIN SIZE DISTRIBUTION TEST (ASTM D 422)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-5**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	56.00 - 56.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	15-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Rimanto
			Checked by	:	Juweni

UDS Sample



Sample Code	Gravel, %	Sand, %	Silt, %	Clay, %	Unified Classification
DB-5 [56.00 - 56.50]	0.00	1.04	4.11	94.86	CH - Fat clay

D_{10}, mm	D_{30}, mm	D_{60}, mm	Cu	Cc	LL	PL
0.000	0.000	0.001	NA	NA	56.46	21.84

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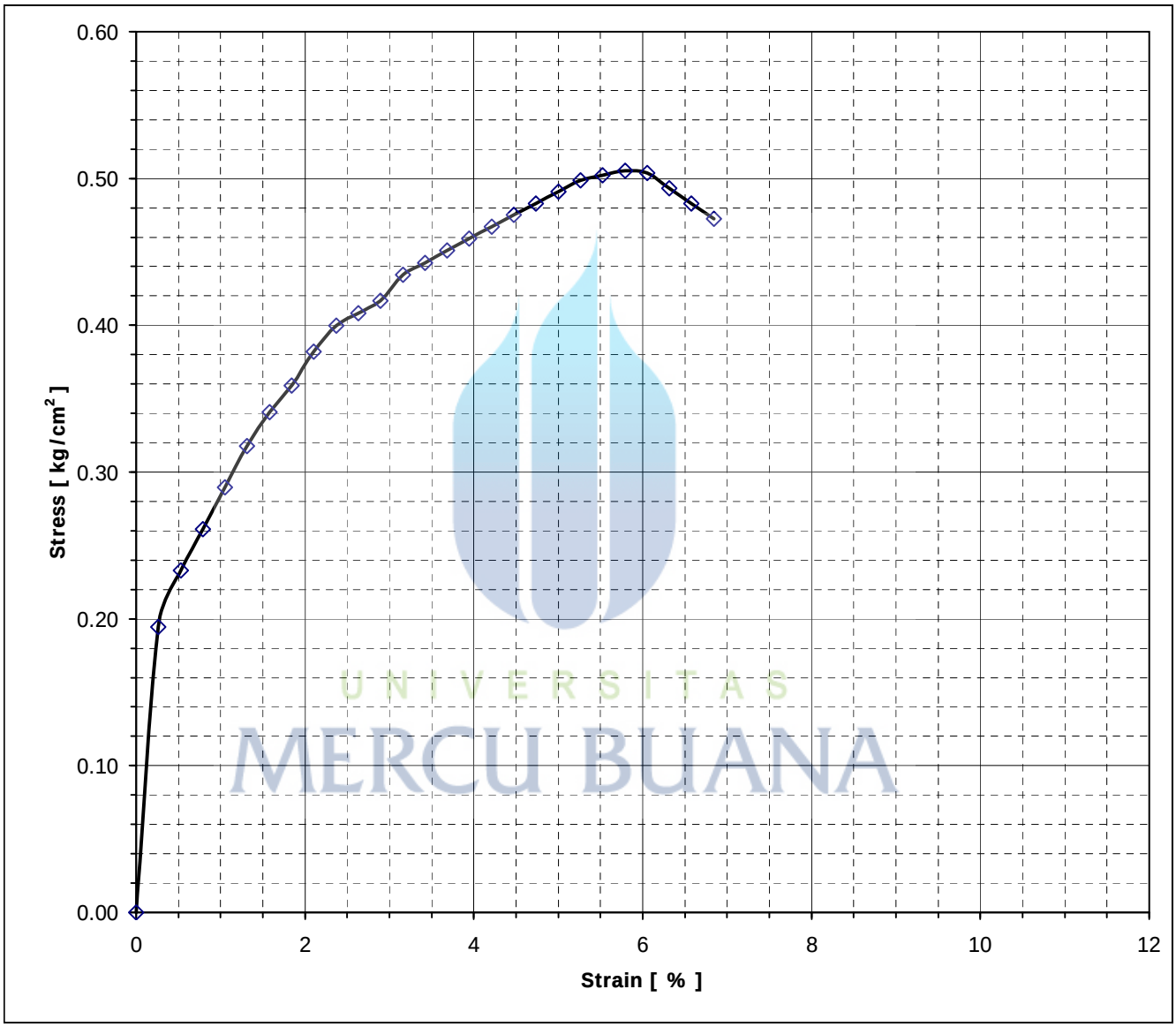
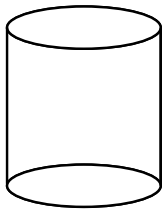
UNCONFINED COMPRESSION TEST (ASTM D 2166 - 91)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-5**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	5.00 - 5.50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	16-Nov-12
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Zaenuri
			Checked by	:	Juweni



Failure Sketch :



γ_s	:	**15.512**	kN/m^3
q_u	:	**0.505**	kg/cm^2
S_u	:	**0.253**	kg/cm^2
E	:	**0.068**	kg/cm^2

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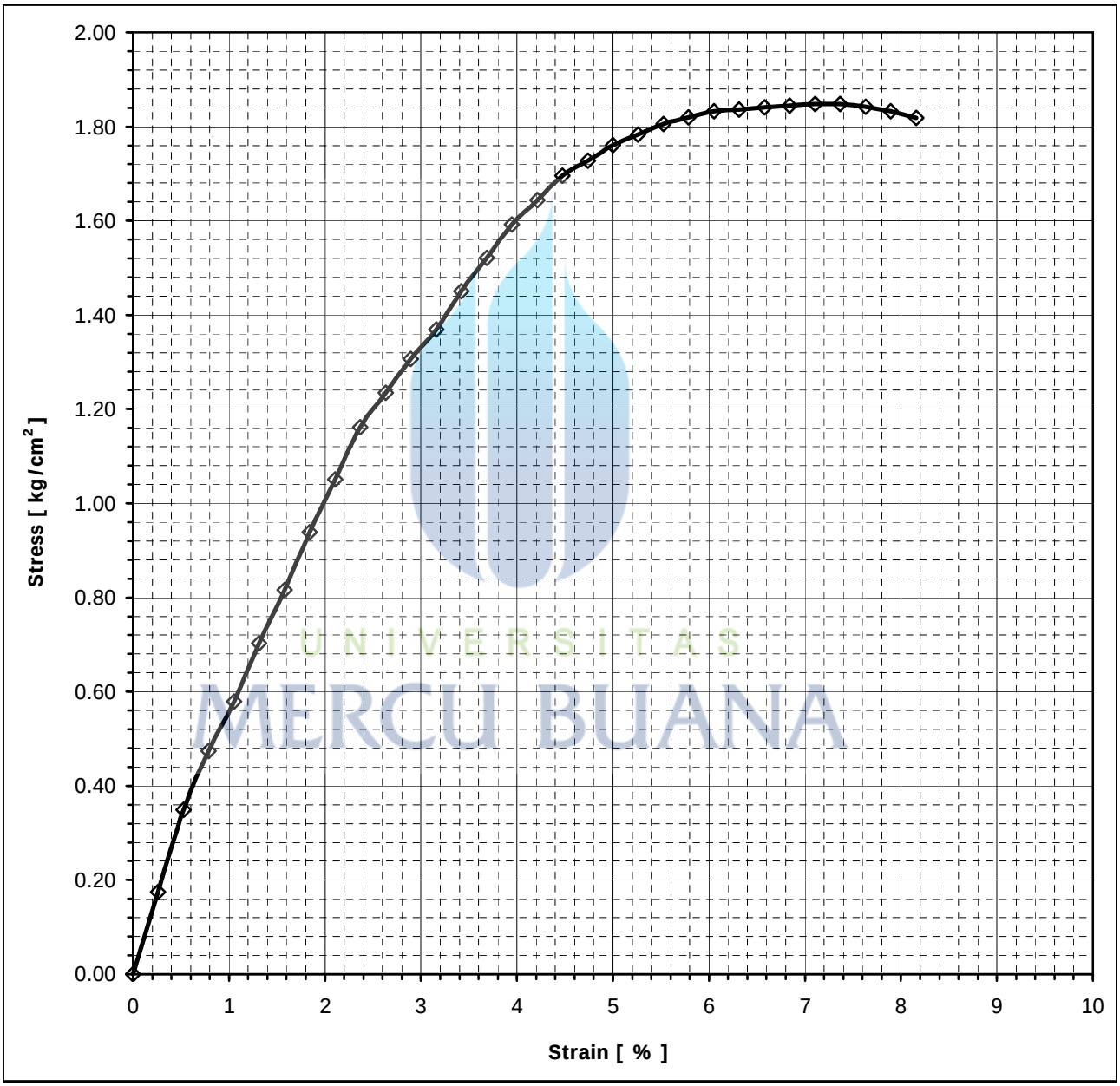
UNCONFINED COMPRESSION TEST (ASTM D 2166)

Project No.	:	DCM.G.12-047	Borehole	:	**DB-5**
Client	:	PT. Citratama Inti Persada	Depth (m)	:	10,00 - 10,50
Project	:	Gatot Subroto Tower (Centennial Tower)	Tested date	:	20-Nov-2012
Location	:	Jl. Gatot Subroto - Jakarta	Tested by	:	Zaenuri
			Checked by	:	Juweni



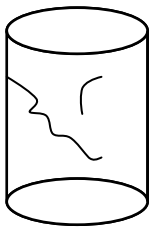
γ_s : 16.591 kN/m^3

q_u : 1.848 kg/cm^2

S_u : 0.924 kg/cm^2

E : 0.334 kg/cm^2

Failure sketch : Plastic Flow



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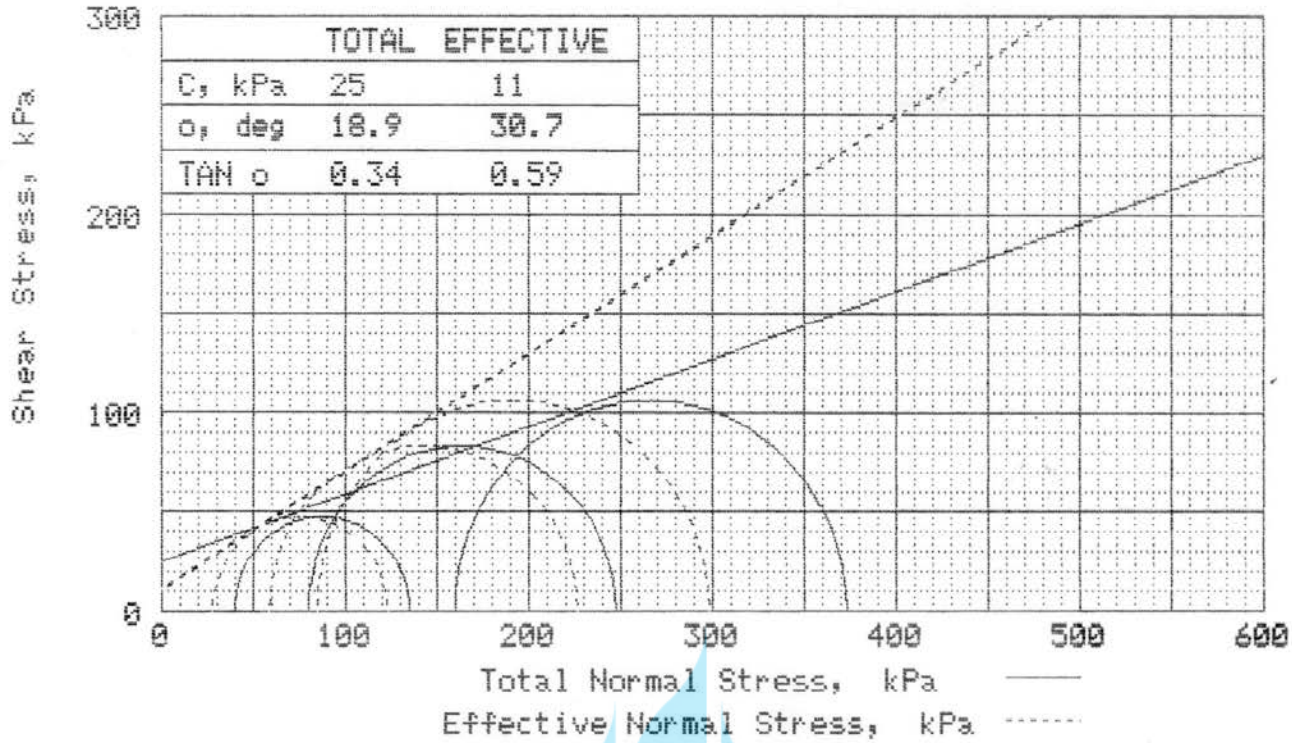

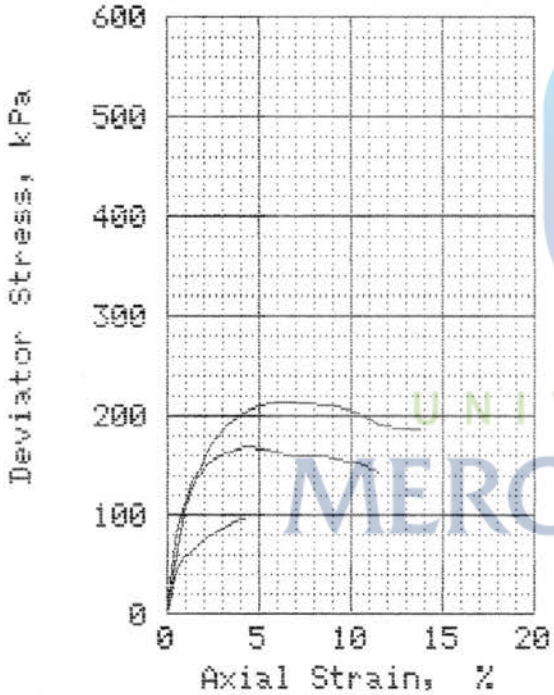

	SAMPLE NO.	1	2	3
INITIAL	WATER CONTENT, %	48.2	48.2	48.6
	DRY DENSITY, g/cc	1.0	1.0	1.0
	SATURATION, %	81.1	81.1	82.4
	VOID RATIO	1.575	1.575	1.563
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.60
AT TEST	WATER CONTENT, %	43.0	39.9	35.9
	DRY DENSITY, g/cc	1.2	1.3	1.4
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.139	1.058	0.952
	DIAMETER, cm	3.49	3.51	3.39
	HEIGHT, cm	7.46	7.11	7.27
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190	190	190
CELL PRESSURE, kPa		230	270	350
FAILURE STRESS, kPa		95	168	213
PORE PRESSURE, kPa		202	211	265
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		123	227	298
$\bar{\sigma}_3$ FAILURE, kPa		28	59	85

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDISTURBED.
DESCRIPTION: BROWN.

LL= PL= PI=
SPECIFIC GRAVITY= 2.65
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. Citra Tama Inti Persada.

PROJECT: GATOT SUBROTO TOWER.
Jl. Gatot subroto Jakarta.
SAMPLE LOCATION: DB.5
DEPTH : 5.00 - 5.50 M.

PROJ. NO.: DATE: 15 - 12 - 2012

TRIAXIAL SHEAR TEST REPORT

PT. KONAS TUNGGAL SOIL LABORATORY

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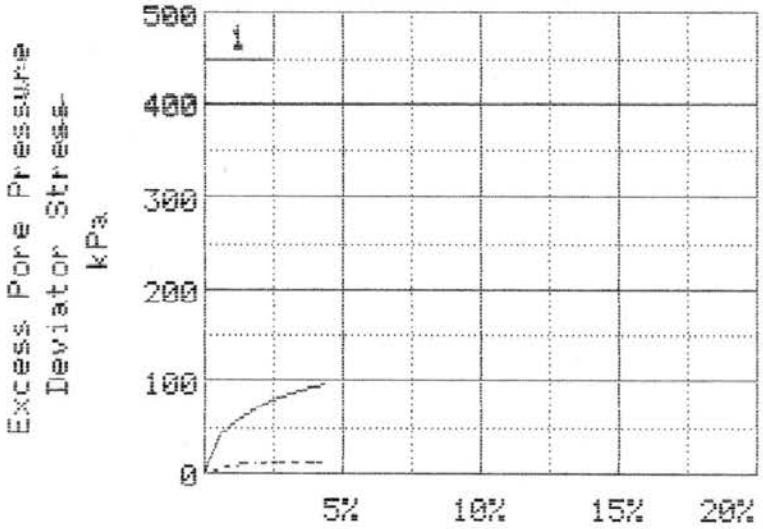

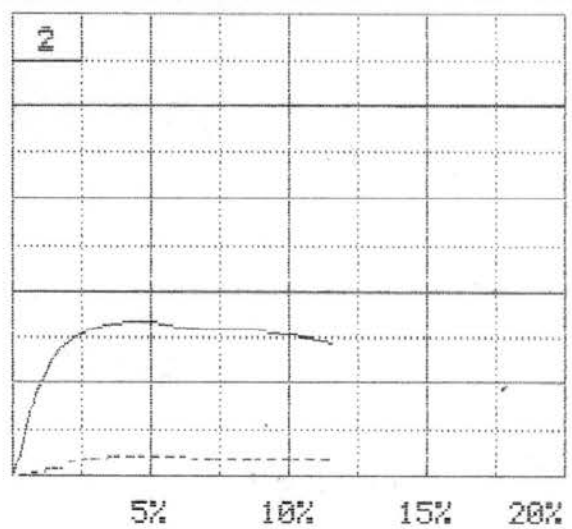

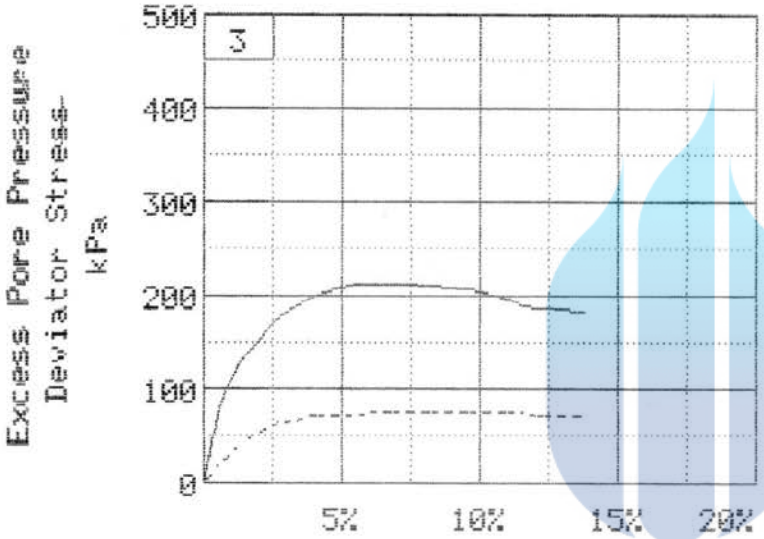

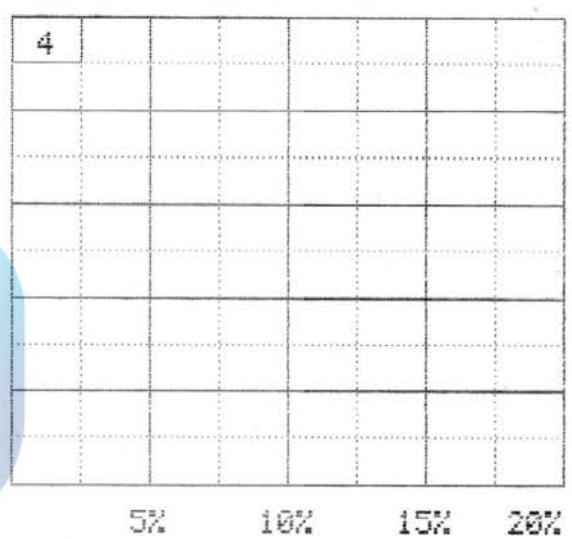

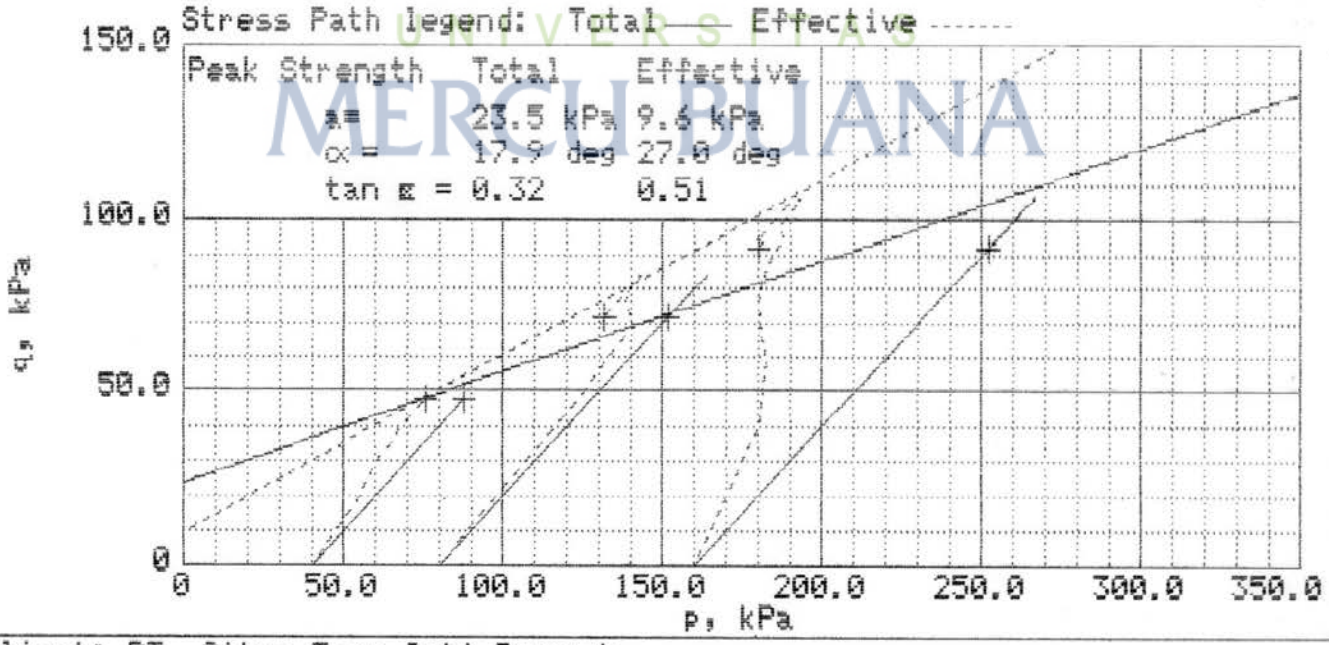

Client: PT. Citra Tama Inti Persada.
Project: GATOT SUBROTO TOWER. Jl. Gatot subroto Jakarta.
Location: DB.5 DEPTH : 5.00 - 5.50 M.
File: TXL-0295 Project No.: Page 2/2 Fig. No.____

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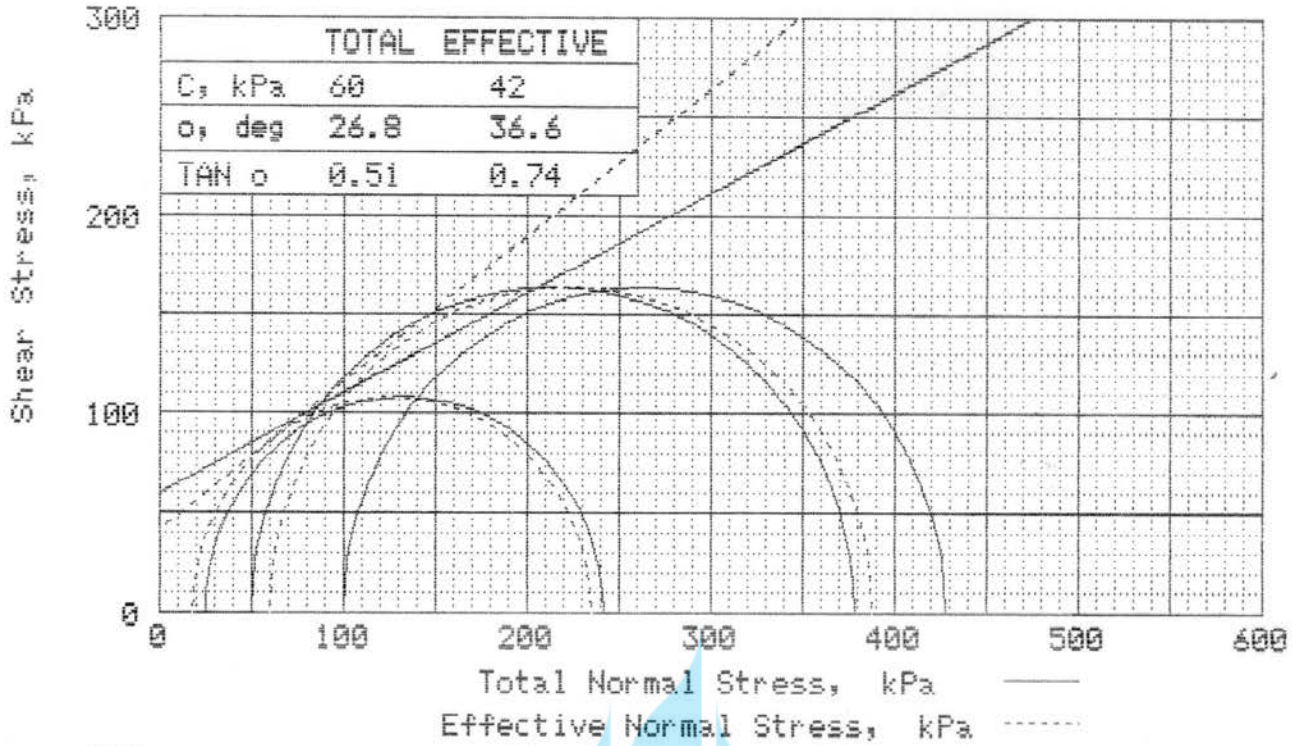

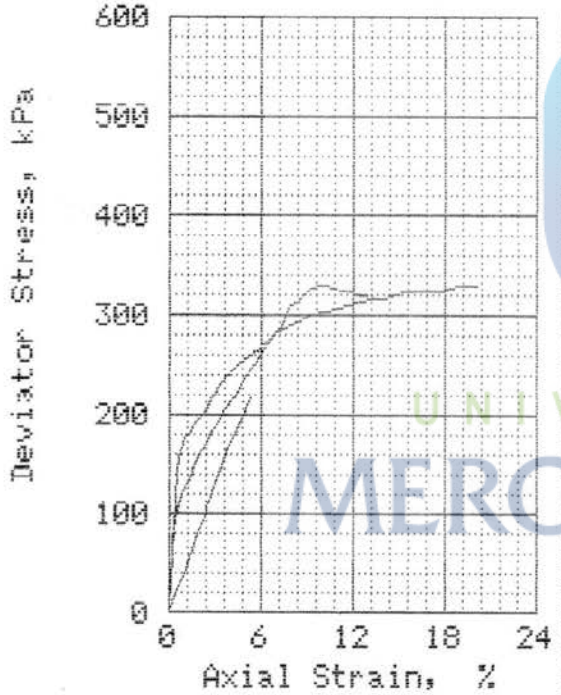

SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	45.0	45.0	48.6
	DRY DENSITY, g/cc	1.0	1.0	1.0
	SATURATION, %	75.0	75.0	74.6
	VOID RATIO	1.591	1.591	1.727
	DIAMETER, cm	3.80	3.80	3.80
	HEIGHT, cm	7.60	7.60	7.60
AT TEST	WATER CONTENT, %	42.5	40.2	42.4
	DRY DENSITY, g/cc	1.2	1.3	1.2
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.127	1.064	1.124
	DIAMETER, cm	3.46	3.51	3.39
	HEIGHT, cm	7.54	7.10	7.45
Strain rate, %/min		0.060	0.060	0.060
BACK PRESSURE, kPa		190	190	190
CELL PRESSURE, kPa		215	240	290
FAILURE STRESS, kPa		217	329	328
PORE PRESSURE, kPa		197	190	230
ULTIMATE STRESS, kPa				
PORE PRESSURE, kPa				
$\bar{\sigma}_1$ FAILURE, kPa		235	379	388
$\bar{\sigma}_3$ FAILURE, kPa		18	50	60

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UNDISTURBED.
DESCRIPTION: BROWN.

LL= PL= PI=
SPECIFIC GRAVITY= 2.65
REMARKS: TESTED BY : W. TRIADI.

CHECKED BY : Ir. THEO FN.

FIG. NO.

CLIENT: PT. Citra Tama Inti Persada.

PROJECT: GATOT SUBROTO TOWER.
Jl. Gatot Subroto Jakarta.
SAMPLE LOCATION: DB.5
DEPTH : 10.00 - 10.50 M.

PROJ. NO.: DATE: 17 - 12 - 2012

TRIAXIAL SHEAR TEST REPORT

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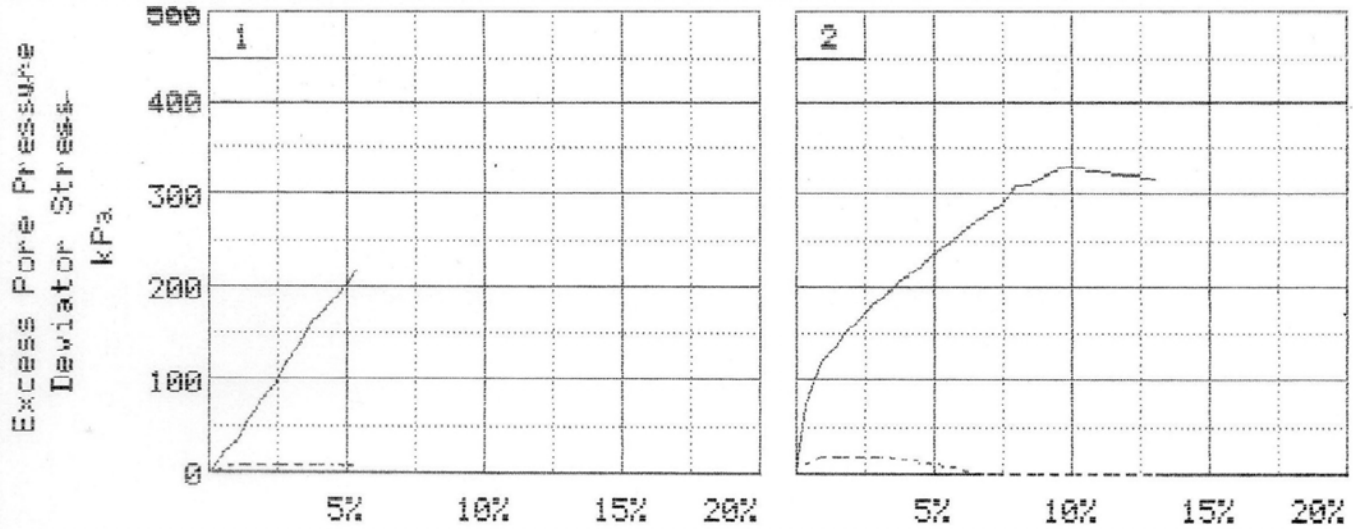

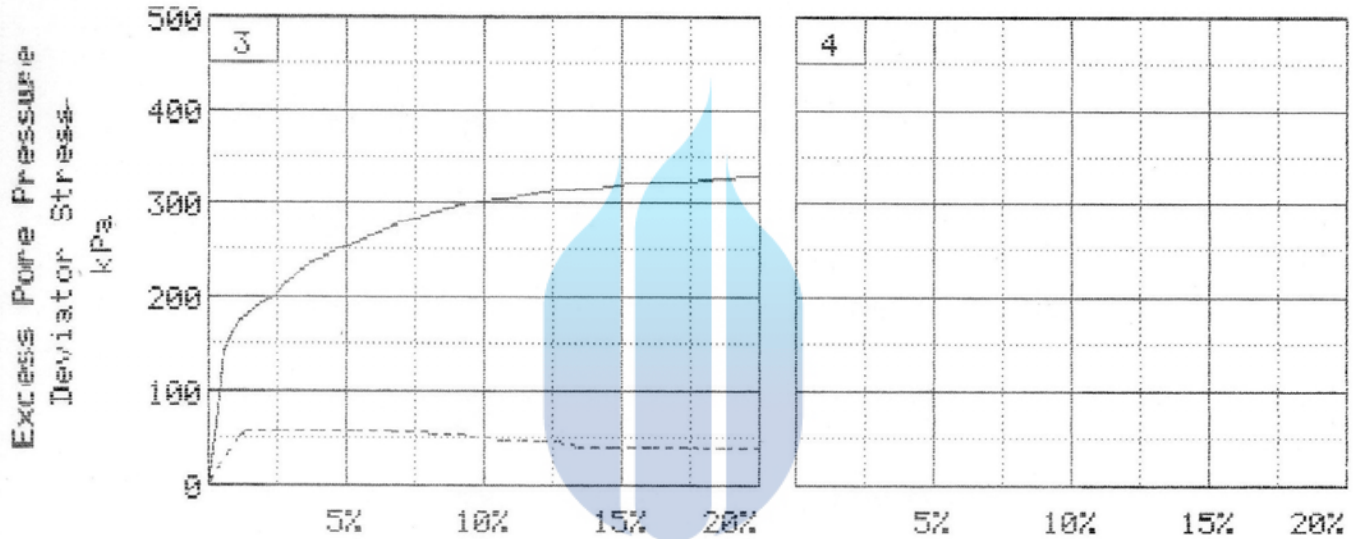

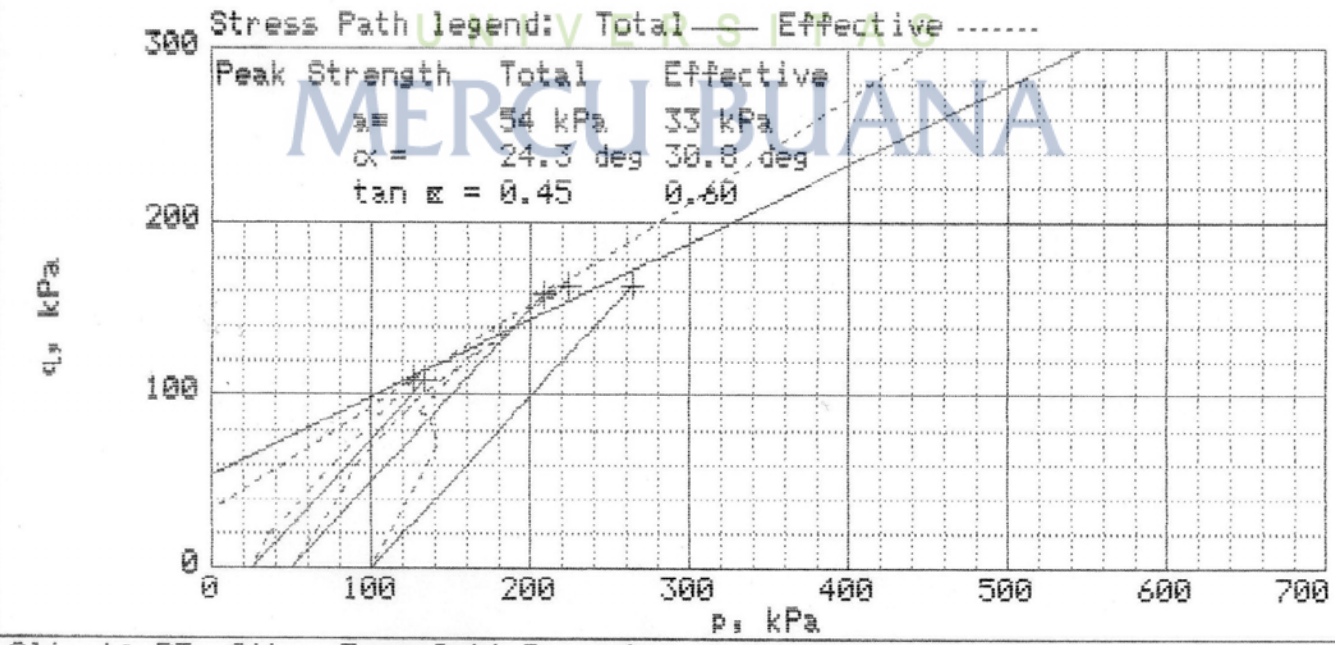

Client: PT. Citra Tama Inti Persada.
Project: GATOT SUBROTO TOWER. Jl. Gatot Subroto Jakarta.
Location: DB.5 DEPTH : 10.00 - 10.50 M.
File: TXL-0297 Project No.: Page 2/2 Fig. No.____

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LAMPIRAN – D

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FIELD ACTIVITY FIGURES

LINK NO.	DEEP BORING	CENTENNIAL TOWER PT. CITRATAMA INTI PERSADA	
		LOCATION	Jakarta
		MONTH	September – Oktober 2012

Location : DB – 1

Location : DB – 2

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FIELD ACTIVITY FIGURES

LINK NO.	DEEP BORING	CENTENNIAL TOWER PT. CITRATAMA INTI PERSADA	
		LOCATION	Jakarta
		MONTH	September – Oktober 2012

Location : DB – 3

Location : DB – 4

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FIELD ACTIVITY FIGURES

LINK NO.	DEEP BORING	CENTENNIAL TOWER PT. CITRATAMA INTI PERSADA	
		LOCATION	Jakarta
		MONTH	September – Oktober 2012

Location : DB – 5

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FIELD ACTIVITY FIGURES

LINK NO.	SONDIR/CPT	CENTENNIAL TOWER PT. CITRATAMA INTI PERSADA	
		LOCATION	Jakarta
		MONTH	September – Oktober 2012

Location : S – 1

Location : S – 2

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FIELD ACTIVITY FIGURES

LINK NO.	SONDIR/CPT	CENTENNIAL TOWER PT. CITRATAMA INTI PERSADA	
		LOCATION	Jakarta
		MONTH	September – Oktober 2012

Location : S – 3

Location : S – 4

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FIELD ACTIVITY FIGURES

LINK NO.	SONDIR/CPT	CENTENNIAL TOWER PT. CITRATAMA INTI PERSADA	
		LOCATION	Jakarta
		MONTH	September – Oktober 2012

Location : S – 5

Location : S – 6

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FIELD ACTIVITY FIGURES

LINK NO.	SONDIR/CPT	CENTENNIAL TOWER PT. CITRATAMA INTI PERSADA	
		LOCATION	Jakarta
		MONTH	September – Oktober 2012

Location : S – 7

Location : S – 8

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FIELD ACTIVITY FIGURES

LINK NO.	SONDIR/CPT	CENTENNIAL TOWER PT. CITRATAMA INTI PERSADA	
		LOCATION	Jakarta
		MONTH	September – Oktober 2012

Location : S – 9

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TARUMANEGARA bumiyasa

LAPORAN PENYELIDIKAN TANAH
PROYEK KIRANA COMMERCIAL AVENUE

KELAPA GADING

JAKARTA UTARA

JOB : 1S.12102

AGUSTUS 2012

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PT. TARUMANEGARA bumiyasa
Soil Investigation & Geotechnical Services
Survey & Supervision
Jln. K.H. TAISIR No. 3 (Kemanggisan Ilir III Ujung), Jakarta 11480
Telp. (021) 5321547 - 5308689 - 90 Fax. : (021) 5481413
E-mail : tbjkb@cbn.net.id / tbjkb2@yahoo.com
E-mail : tarumanegarabumiyasa@yahoo.com
Website : www.tarumanegara.co.id

Kepada Yth,

Jakarta, 9 Agustus 2012

PT. NUSA KIRANA Real Estate
Gedung Graha Kirana
Jl. Yos Sudarso No. 88
Jakarta Utara 14350

Perihal : Laporan Penyelidikan Tanah
Proyek **KIRANA COMMERCIAL AVENUE**
Kelapa Gading – Jakarta Utara

Dengan hormat,

Sesuai permintaan **PT. NUSA KIRANA Real Estate** maka **PT. TARUMANEGARA bumiyasa** Jakarta, pada tanggal 15 Juni 2012 sampai dengan 12 Juli 2012 telah melakukan penyelidikan tanah dilokasi rencana bangunan **KIRANA COMMERCIAL AVENUE** di Kelapa Gading – Jakarta Utara. Adapun jumlah dan macam pengujian ditentukan oleh pemberi tugas.

Dari hasil penyelidikan yang ada, dengan pengamatan di lapangan dilakukan analisa dan evaluasi data untuk menentukan daya dukung tanah yang hasilnya dapat dilihat dalam laporan ini.

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Semoga hasil penyelidikan ini bermanfaat adanya. Atas kepercayaan dan kerjasama yang baik, kami ucapkan banyak terima kasih.

Hormat kami
PT. TARUMANEGARA bumiyasa

Ir. Sudioto Susilo, MSCE
Direktur

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1.0 PENDAHULUAN

1.1 UMUM

Sesuai permintaan **PT. NUSA KIRANA Real Estate** untuk melakukan penyelidikan tanah yang meliputi 11 titik Sondir 2.5 Ton dan 5 titik Bor dalam dilokasi rencana pembangunan **KIRANA 3**, di Kelapa Gading – Jakarta Utara, maka **PT. TARUMANEGARA bumiyasa** Jakarta pada tanggal 15 Juni 2012 sampai dengan 12 Juli 2012 telah melakukan pekerjaan tersebut diatas, dimana letak titik Sondir dan Bor dapat dilihat pada denah titik uji terlampir dalam laporan ini.

1.2 TUJUAN

Tujuan dari penyelidikan tanah ini adalah untuk mengevaluasi kondisi tanah setempat yang akan digunakan untuk keperluan perencanaan pondasi pembangunan **KIRANA 3.**

1.3 TEMPAT DAN LOKASI PENYELIDIKAN

Penyelidikan dilakukan pada lokasi rencana bangunan yang telah ditentukan oleh perencana dan letak titik penyelidikan ditempatkan didaerah yang diperkirakan dapat mewakili kondisi tanah setempat. Lokasi penyelidikan berupa lahan tanah kosong.

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2.0 LINGKUP PEKERJAAN PENYELIDIKAN TANAH

2.1 DISTRIBUSI TITIK PENGUJIAN SONDIR DAN BOR MESIN

Pengujian Sondir 2.5 Ton dilakukan pada 11 titik dan 5 titik Bor dalam yang merupakan bagian dari rencana pembangunan **KIRANA 3** dimana letak titik pengujian dapat dilihat pada **Denah Titik Uji** terlampir. Elevasi lapisan tanah diukur dari elevasi permukaan masing - masing titik uji tanah setempat.

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Hasil pengujian Sondir 2.5 Ton dan Bor Mesin (Bor Hole) masing - masing mencapai kedalaman sebagai berikut :

No.	Sondir 2.5 ton	Kedalaman (m)	No.	Bor Mesin	Kedalaman (m)	Muka Air Tanah (m)
1.	S1	-12.40	1.	BH1	-30.50	-1.50
2.	S2	-14.00	2.	BH2	-50.00	-4.50
3.	S3	-14.60	3.	BH3	-30.50	-1.25
4.	S4	-11.40	4.	BH4	-40.00	-2.00
5.	S5	-15.00	5.	BH5	-30.50	-1.25
6.	S6	-12.60				
7.	S7	-13.00				
8.	S8	-13.40				
9.	S9	-12.20				
10.	S10	-12.40				
11.	S11	-13.20				

2.2 PROSEDUR PEMBORAN DAN SONDIR

Machine Boring (Bor Mesin)

Pemboran dilakukan dengan menggunakan Mesin Bor **YBM Type YSO-1H** dengan menggunakan Single Tube Core Barrel berdiameter 73 mm, dengan panjang 1.00 meter, serta menggunakan Casing berdiameter 89 mm, dimana pengeboran dihentikan sesuai permintaan pemberi tugas. Metode pengeboran dilakukan sesuai dengan Standard **ASTM D-2113-87**.

Standard Penetration Test (Pengujian Penetrasi Standard)

Standard Penetration Test dilakukan dengan menggunakan *"Standard Split Barrel Sampler Asembly"* yang dilengkapi dengan alat *Automatic Drop Hammer*. Pengetesan dilakukan dengan Standard **ASTM D-1586-92**.

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Dutch Cone Penetration Test (Sondir)

Pekerjaan Sondir dilakukan dengan alat tipe *Begemann* dengan peralatan yang terkalibrasi, termasuk pemeriksaan dimensi konus, selakup, piston dan kevakuman hidrolis untuk mendapatkan nilai Sondir yang tepat dan benar. Hasil tegangan konus dan selakup dihitung berdasarkan dimensi konus dan selakup yang dipergunakan. Kecepatan penekanan penetrasi berkisar 1 - 2 cm / detik, sesuai dengan Standard **ASTM D-3441-86.**

2.3 PENGUJIAN LABORATORIUM

Pengujian Laboratorium dilakukan sesuai dengan permintaan pemberi tugas, yaitu:

1. Index Properties Test (ASTM D-854-92 & ASTM D-2216-90)
2. Grain Size Analysis Test (ASTM D-421 & ASTM D-422)
3. Atterberg Limits Test (ASTM D-4318)
4. Unconfined Compression Test (ASTM D-2166-91)
5. CU Triaxial Test (ASTM D 4767-04)
6. Consolidation Test (ASTM D-2435-90)
7. Direct Shear test (ASTM D-3080-90)

Semua prosedur pengujian dilakukan sesuai dengan Standard ASTM

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2.4 PROFIL LAPISAN TANAH DAN LOG BOR

Profil lapisan tanah berdasarkan deskripsi secara visual dari lubang bor, dapat dilihat pada Borlog terlampir.

2.5 MUKA AIR TANAH

Pada saat pekerjaan pemboran dilakukan, muka air tanah dijumpai pada kedalaman sekitar -1.25 meter sampai dengan -4.50 meter dari permukaan tanah setempat.

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3.0 EVALUASI DATA

3.1 UMUM

Secara umum, dari hasil **11 titik DCPT/Sondir** dan **5 titik Deep Boring + SPT** pada proyek **Kirana 3**, dapat dilihat bahwa lapisan tanah :

S1-S11 : Lapisan pertama sampai kedalaman sekitar -9.00 meter terindikasi berupa lapisan lanau kelempungan dan lanau kepasiran dengan konsistensi sedang sampai kaku. lapisan selanjutnya sampai akhir pengujian DCPT di kedalaman -11.40 meter sampai -15.00 meter terindikasi berupa lapisan pasir dengan kepadatan sedang sampai sangat padat.

BH1 : Lapisan pertama sampai kedalaman sekitar -9.00 meter berupa lapisan lanau kelempungan dan lempung kelanauan dengan konsistensi sedang sampai kaku. Lapisan selanjutnya sampai kedalaman sekitar -16.00 meter berupa lapisan lanau kepasiran dan lanau dengan konsistensi sangat kaku sampai keras sekali. Lapisan selanjutnya sampai akhir pengujian SPT di kedalaman -30.50 meter terdiri dari lapisan lanau tersementasi dan lanau kepasiran dengan konsistensi keras sekali dan lapisan pasir kelanauan dengan kepadatan padat sampai sangat padat.

BH2 : Lapisan pertama sampai kedalaman sekitar -13.50 meter berupa lapisan lempung, lanau kepasiran, lanau kelempungan, dan lanau dengan konsistensi lunak sampai keras sekali. Lapisan selanjutnya sampai -33.00 meter terdiri dari lapisan pasir kelanauan dengan kepadatan padat sampai padat sekali dan lapisan lanau, lanau tersementasi dan lempung kelanauan dengan konsistensi keras sekali. Lapisan selanjutnya sampai akhir pengujian SPT di kedalaman -50.00 meter berupa lapisan lanau kelempungan dan lempung kelanauan dengan konsistensi sangat kaku.

BH3 : Lapisan pertama sampai kedalaman sekitar -13.00 meter berupa lapisan lempung, lempung kepasiran, lempung kelanauan, lanau kelempungan dan lanau kepasiran dengan konsistensi lunak sampai sedang. Lapisan selanjutnya sampai akhir pengujian SPT di kedalaman -30.50 meter berupa lapisan lanau tersementasi dan lanau berkerikil dengan konsistensi keras sekali.

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BH4 : Lapisan pertama sampai kedalaman sekitar -13.00 meter berupa lapisan lanau kelempungan, lempung, dan lanau kepasiran dengan konsistensi lunak sampai kaku. lapisan selanjutnya sampai kedalaman sekitar -30.50 meter berupa lapisan lanau tersementasi dengan konsistensi keras sekali. Lapisan selanjutnya sampai akhir pengujian SPT di kedalaman -40.00 meter berupa lapisan lempung kelanauan dan lempung.

BH5 : lapisan pertama sampai kedalaman sektiar -9.00 meter berupa lapisan lempung dan lempung kelanauan dengan konsistensi lunak sampai sedang. Lapisan selanjutnya sampai kedalaman sekitar -28.00 meter berupa lapisan lanau, lanau tersementasi dan lanau kepasiran dengan konsistensi keras sekali. Lapisan selanjutnya sampai akhir pengujian SPT di kedalaman -30.50 meter berupa lapisan pasir kelanauan dengan kepadatan padat.

Lapisan tanah keras dengan qc ≥ 250 kg/cm^2 dijumpai pada kedalaman -11.40 meter sampai -15.00 meter dari permukaan tanah setempat. Pada pengujian SPT, lapisan tanah keras dengan N-SPT > 40 blows/ft terdapat pada kedalaman -14.00 m sampai -17.00 m dari permukaan tanah setempat. Muka air tanah terdapat pada kedalaman sekitar -1.25 meter sampai -4.00 meter dari permukaan tanah setempat.

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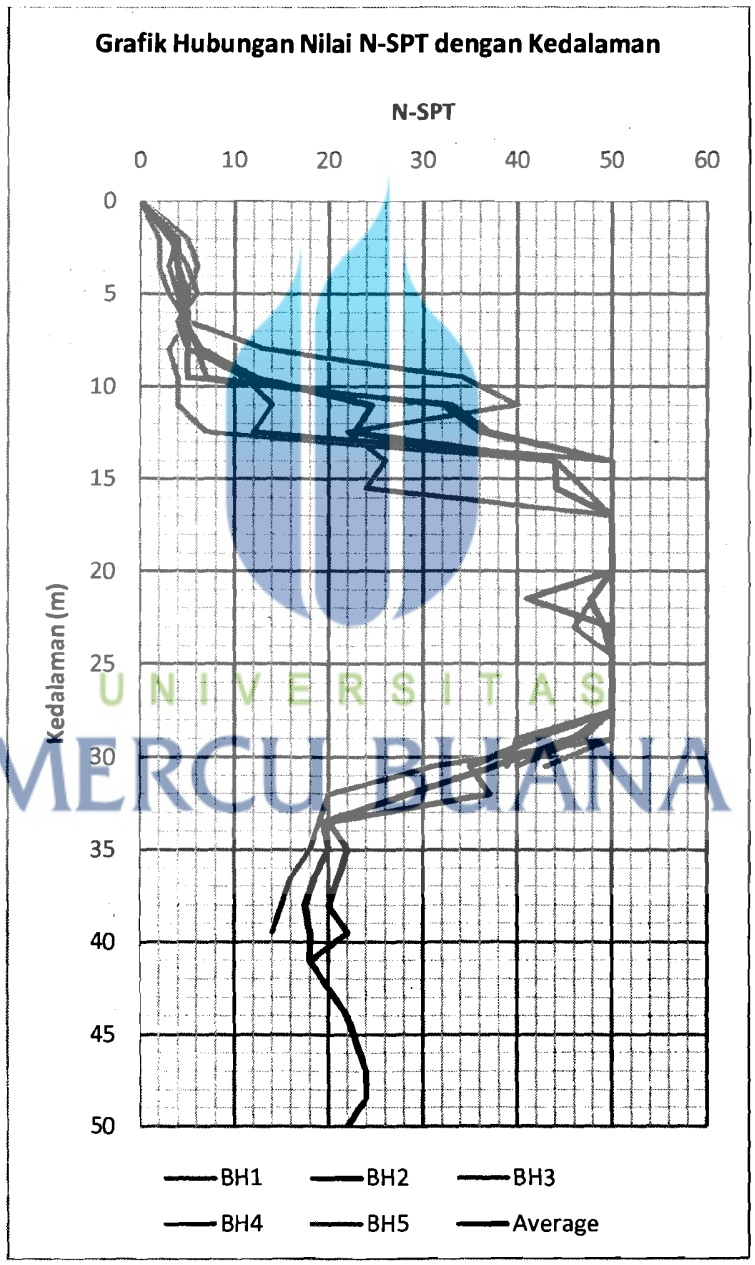
3.2 UJI LAPANGAN SPT

Uji SPT (Standar Penetration Test) dilakukan dengan interval 1.5 m, uji SPT dilakukan untuk mengetahui konsistensi maupun kepadatan tanah, dan hasil dari uji SPT dengan kedalaman pada masing-masing lubang bor dapat dilihat pada **Gambar 3.1**. Dari coring SPT, dapat dilakukan logging untuk jenis tanah, baik warna, dan sifat-sifat fisik lainnya yang dapat dilihat pada Boring Log.



Gambar 3.1. GrafikN-SPT dan q_c vs Kedalaman

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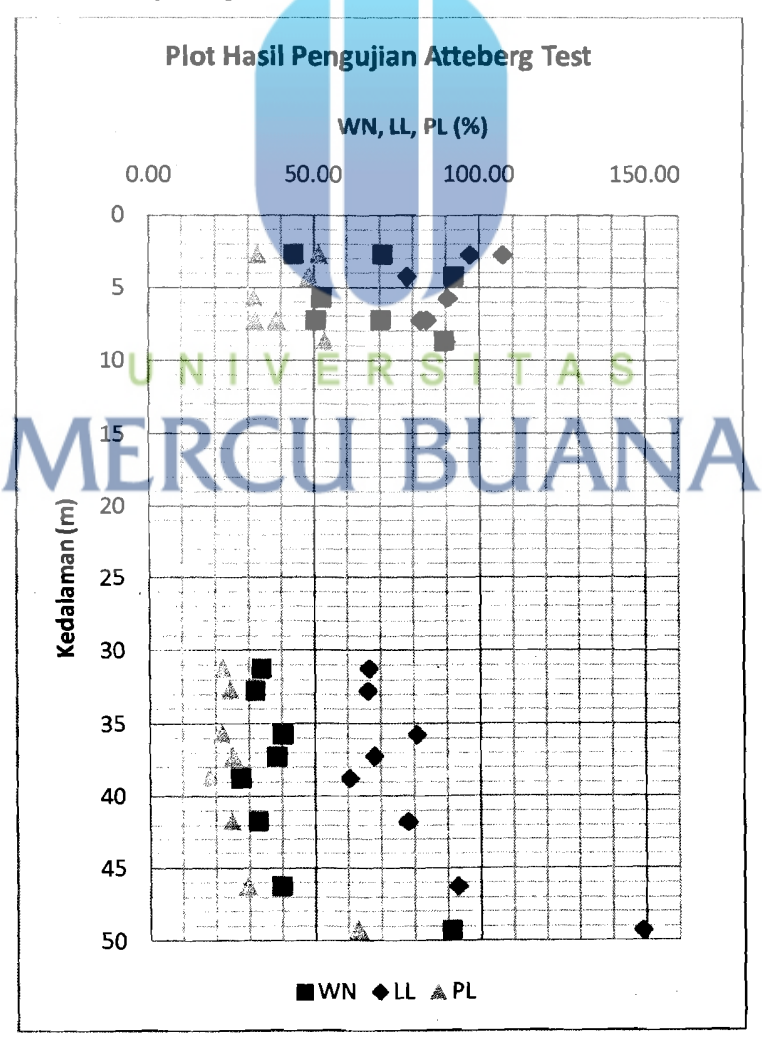
3.3 UJI LABORATORIUM

Untuk keperluan dalam desain pekerjaan geoteknik, parameter yang dibutuhkan tidak hanya berasal dari uji lapangan, namun memerlukan data pendukung dari uji laboratorium, dimana dari hasil uji laboratorium didapatkan beberapa parameter yang berupa karakteristik properti tanah, berupa batas-batas atterberg beserta kadar air natural, berat isi (γ_{wet}), Spesifik gravity (Gs), angka pori (e_o), dan banyak lagi, untuk parameter kekuatan tanah, didapatkan dari uji laboratorium berupa uji Triaxial, untuk parameter kemampatan tanah/*compressibility*, didapatkan dengan uji konsolidasi, yang sangat berguna dalam perhitungan penurunan tanah.

3.3.1 Uji Atterberg pada Undisturbed Sample

Pada **Gambar 3.2** dapat dilihat hasil pengujian Atterberg limit test untuk semua sample yang didapat.



Gambar 3.2. Uji Atterberg pada UDS DB1-DB5.

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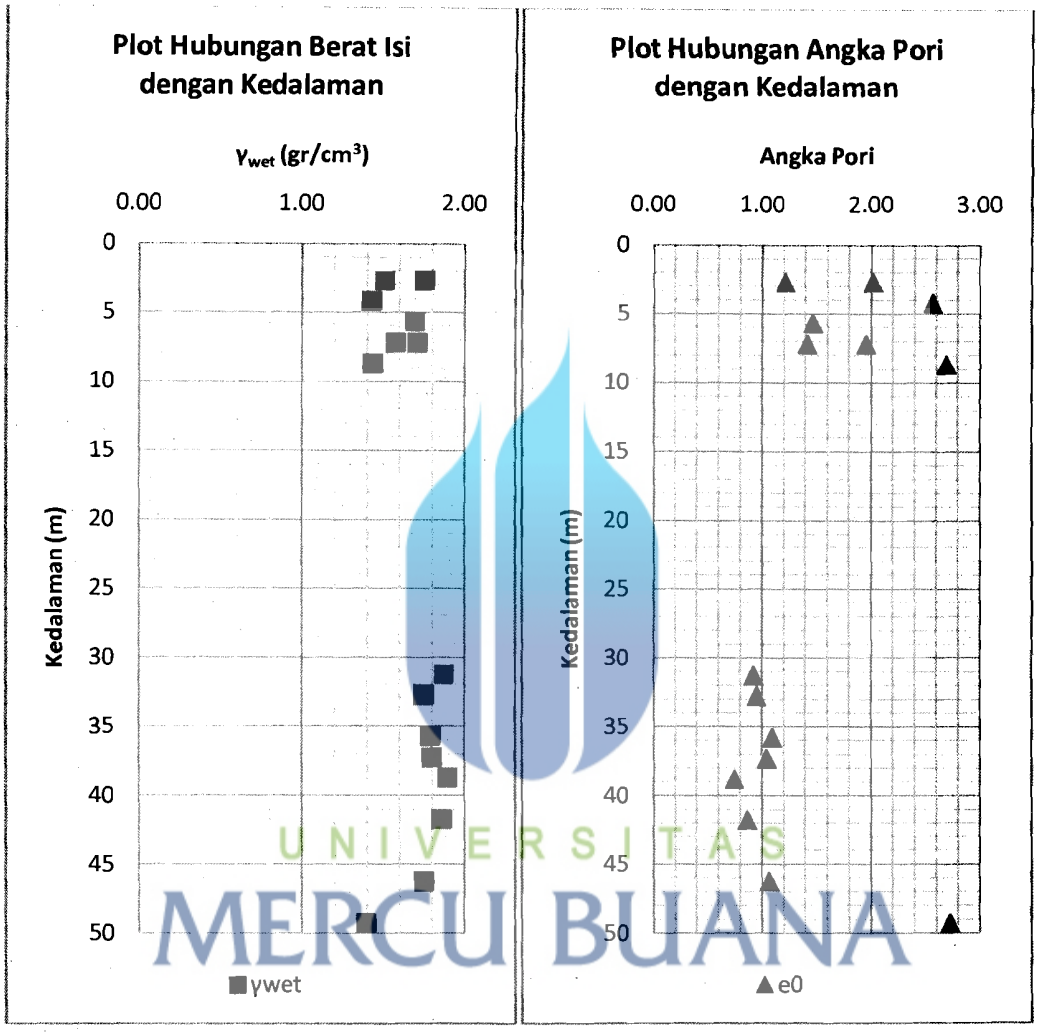
3.3.2 Berat Isi (γ_{wet}) dan Angka pori (e_0)

Berikut ini disampaikan nilai berat isi tanah dan nilai angka pori.



Gambar 3.3. Berat isi dan angka pori terhadap kedalaman.

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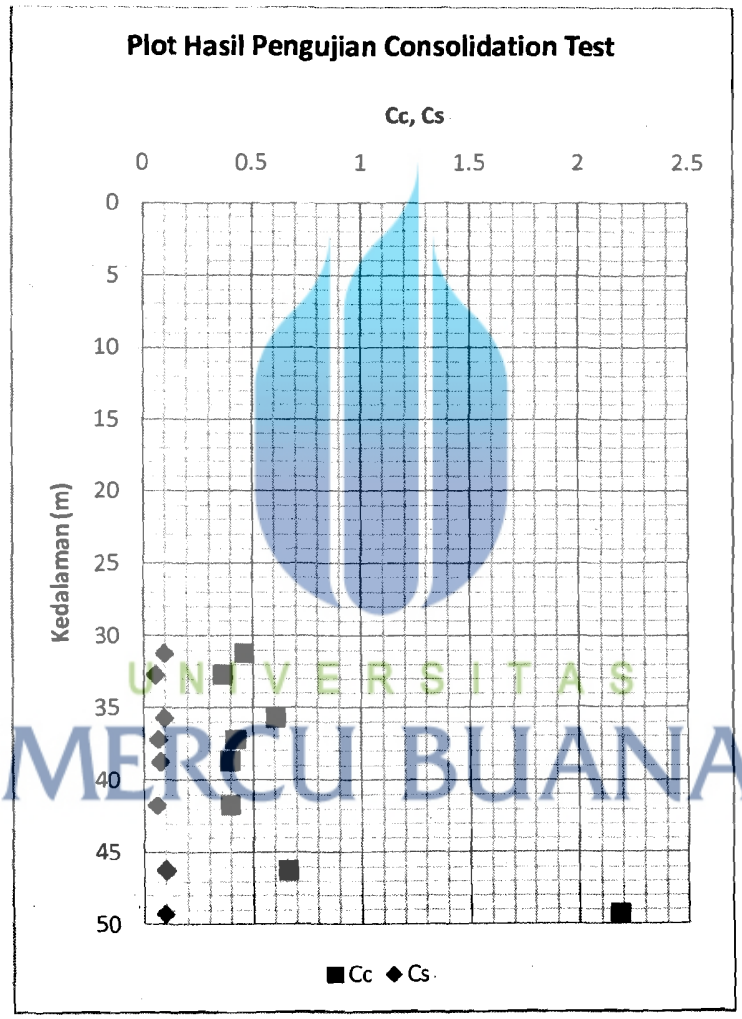
3.3.3 Uji Konsolidasi

Hasil uji konsolidasi menghasilkan nilai indeks kompresi (Cc), indeks swelling (Cs) dan nilai tegangan pra-konsolidasi (Pc). Pengujian untuk memperoleh nilai Cc dan Cs dilakukan dengan uji konsolidasi satu dimensi sesuai dengan **ASTM D-2435**. **Gambar 3.4** menunjukkan hubungan Cc,Cs dengan kedalaman.



Gambar 3.4. Indeks kompresi dan indeks swelling terhadap kedalaman.

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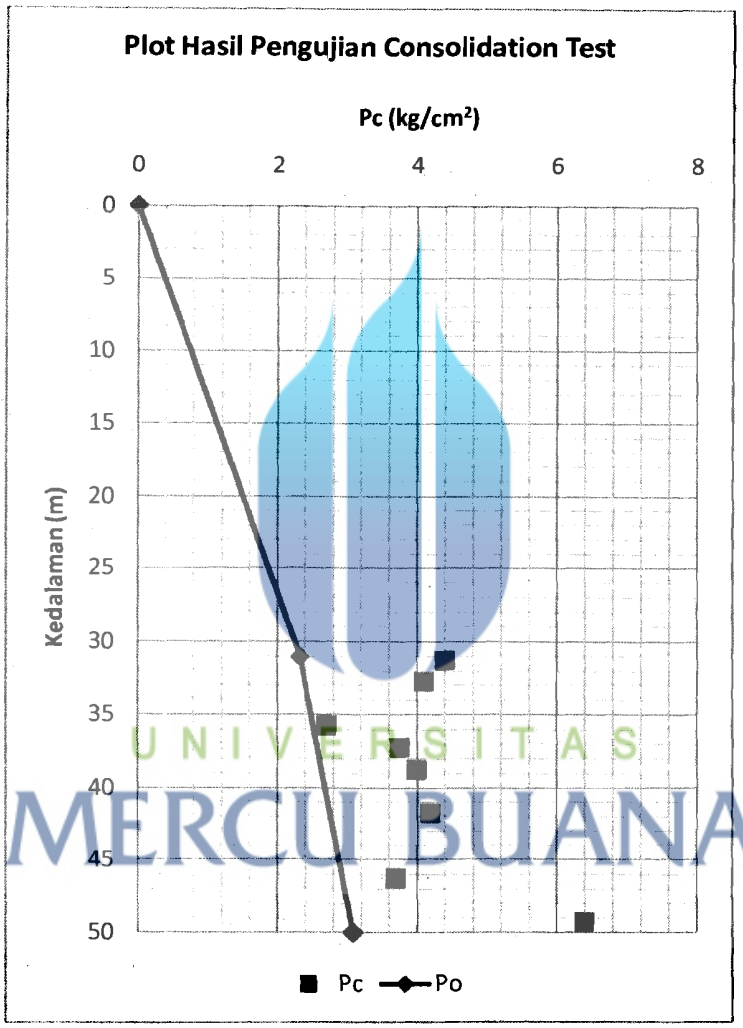
Untuk perhitungan konsolidasi tanah, haruslah diketahui kondisi inisial tegangan efektif dan nilai tegangan pra-konsolidasi. Dengan melakukan uji konsolidasi maka didapatkan nilai tegangan pra-konsolidasi Pc, dan dengan perhitungan manual untuk tegangan efektif maka akan didapatkan Po,



Gambar 3.5. Po, Pc.

Gambar 3.5 memberikan hasil Po dan Pc terhadap kedalaman, dimana dapat dilihat nilai Pc tidak menghimpit kurva tegangan vertikal efektif (Po) pada kedalaman awal.

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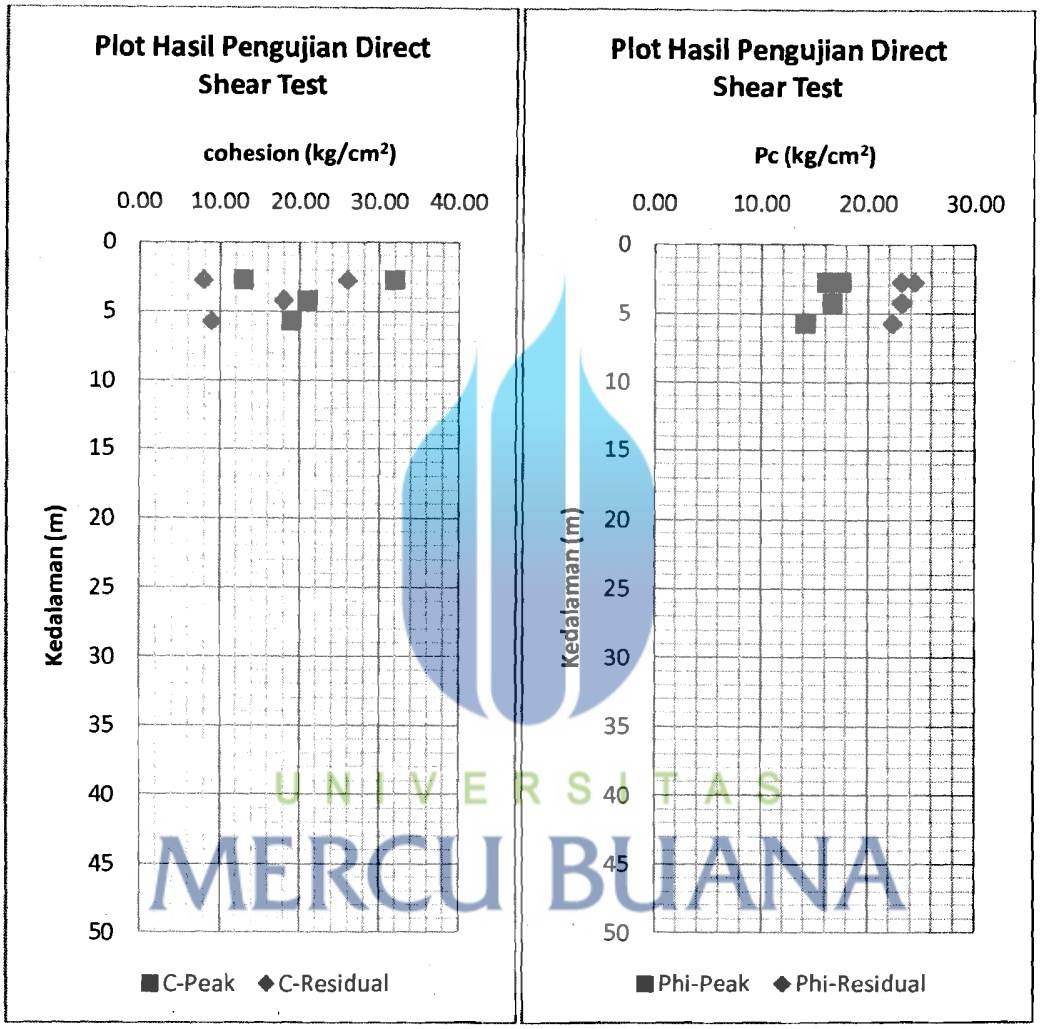
3.3.4 Uji Kuat Geser Tanah (Direct Shear)

Pengujian kuat geser tanah dilakukan dengan pengujian Direct Shear Test, berikut merupakan hasil pengujian dari beberapa sampel uji :



Gambar 3.6. Hubungan nilai kohesi dan sudut geser hasil uji Direct Shear terhadap kedalaman.

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3.4 PONDASI DALAM

Melihat kondisi lapisan tanah yang ada sebaiknya fundasi dalam bertumpu di lapisan tanah dengan nilai N-SPT > 40 dan qc > 250 kg/cm² di kedalaman seperti yang tercantum pada **Tabel 4.1**.

Dengan tiang pancang Δ 28 cm, Δ 32 cm, □ 20 x 20 cm2, □ 25 x 25 cm2, □ 30 x 30 cm2, □ 35 x 35 cm2, □ 40 x 40 cm2, dan □ 45 x 45 cm2 tersebut akan menghasilkan daya dukung ijin sebesar $\bar{Q}$ seperti pada **Tabel 4.1**.

Sebagai alternatif dapat menggunakan Tiang Bor pada kedalaman yang sama dengan diameter ∅ 30 cm, 40 cm, 50 cm, 60 cm, 70 cm, 80 cm, 90 cm, 100 cm, 110 cm, 120 cm, 130 cm, 140 cm, dan 150 cm atau Spun Pile dengan diameter ∅ 30 cm, 35 cm, 40 cm, 45 cm, 50 cm, dan 60 cm yang akan menghasilkan daya dukung ijin sebesar $\bar{Q}$ seperti pada **Tabel 4.1**.

4.0 KESIMPULAN DAN REKOMENDASI

4.1 UMUM

Secara umum, dari hasil 11 titik Sondir dan 5 titik Deep Boring serta SPT pada lokasi Kirana 3 yang telah dilakukan, dapat disimpulkan bahwa lapisan pertama sampai kedalaman sekitar -13.00 meter didominasi oleh lapisan tanah kohesif seperti lapisan lempung, lempung kelanauan, lanau kelempungan, lanau, dan lanau kepasiran dengan konsistensi lunak sampai sangat kaku. Lapisan selanjutnya sampai kedalaman sekitar -30.00 meter berupa lapisan tanah keras seperti lapisan lanau, lanau tersementasi, dan lanau kepasiran dengan konsistensi keras sekali. Terdapat juga lapisan pasir kelanauan dengan kepadatan sangat padat. Lapisan selanjutnya sampai akhir pengujian SPT di kedalaman -50.00 meter didominasi oleh lapisan tanah kohesif seperti lapisan lempung kelanauan, lempung, dan lanau kelempungan dengan konsistensi kaku sampai keras sekali.

Lapisan tanah keras dengan qc ≥ 250 kg/cm² dijumpai pada kedalaman -11.40 meter sampai -15.00 meter dari permukaan tanah setempat. Pada pengujian SPT, lapisan tanah keras dengan N-SPT > 40 blows/ft terdapat pada kedalaman -14.00 m sampai -17.00 m dari permukaan tanah setempat. Muka air tanah terdapat pada kedalaman sekitar -1.25 meter sampai -4.00 meter dari permukaan tanah setempat.

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4.2 DAYA DUKUNG

Berdasarkan evaluasi tersebut di atas jenis pondasi berikut daya dukung ijin yang direkomendasikan untuk dipilih dalam perencanaan adalah seperti yang tercantum pada **Tabel. 4.1**.

TABEL 4.1.DAYA DUKUNG IJIN

No. Jenis Pondasi	Kedalaman (m)	Daya Dukung Ijin		
1. Pondasi Dangkal B = 1.0 m – 2.0 m	-1.0 m -2.0 m	Q = 0.5 kg/cm² Q = 0.6 kg/cm²		
2. Tiang Pancang	**S1,S4,S6-S9,S10 12.00 – 14.00 m**	**S2,S3,S5,S11 14.00 - 15.00 m**	**BH1-BH5 12.00 m**	**BH1-BH5 17.00 m**
MF 28	19 ton	21 ton	-	-
MF 32	24 ton	27 ton	-	-
□ 20 x 20 cm	21 ton	24 ton	-	-
□ 25 x 25 cm	30 ton	33 ton	-	-
□ 30 x 30 cm	39 ton	44 ton	-	-
□ 35 x 35 cm	50 ton	56 ton	-	-
□ 40 x 40 cm	61 ton	69 ton	-	-
□ 45 x 45 cm	74 ton	84 ton	-	-
3. Tiang Bor	**S1,S4,S6-S9,S10 12.00 – 14.00 m**	**S2,S3,S5,S11 14.00 - 15.00 m**	**BH1-BH5 12.00 m**	**BH1-BH5 17.00 m**
Ø 30 cm	17 ton	18 ton	-	-
Ø 40 cm	27 ton	28 ton	-	-
Ø 50 cm	40 ton	41 ton	-	-
Ø 60 cm	55 ton	57 ton	108 ton	144 ton
Ø 70 cm	73 ton	74 ton	135 ton	176 ton
Ø 80 cm	92 ton	94 ton	164 ton	211 ton
Ø 90 cm	115 ton	117 ton	195 ton	248 ton
Ø 100 cm	139 ton	141 ton	229 ton	288 ton
Ø 110 cm	-	-	265 ton	330 ton
Ø 120 cm	-	-	300 ton	374 ton
Ø 130 cm	-	-	334 ton	421 ton
Ø 140 cm	-	-	370 ton	471 ton
Ø 150 cm	-	-	406 ton	522 ton
4. Tiang Spun Pile	**S1,S4,S6-S9,S10 12.00 – 14.00 m**	**S2,S3,S5,S11 14.00 - 15.00 m**	**BH1-BH5 12.00 m**	**BH1-BH5 17.00 m**
Ø 30 cm	31 ton	35 ton	-	-
Ø 35 cm	39 ton	44 ton	-	-
Ø 40 cm	48 ton	54 ton	-	-
Ø 45 cm	58 ton	66 ton	-	-
Ø 50 cm	69 ton	79 ton	-	-
Ø 60 cm	94 ton	107 ton	-	-

Catatan Tabel 4.1 :

- Semua ujung tiang harus bertumpu pada lapisan tanah keras dengan qc> 200kg/cm² dan N-SPT > 40.
- Daya dukung diatas tidak boleh melebihi kapasitas kekuatan bahan tiang yang digunakan.
- Daya dukung pada BH1-BH5 sudah memperhitungkan adanya galian basement ± 10.00 meter dan panjang tiang yg digunakan dihitung dari dasar basement.

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Penggunaan pondasi tiang secara kelompok disarankan untuk direncanakan dengan jarak antar tiang tidak lebih kecil dari 3 x diameter atau lebar penampang tiang untuk kedalaman tiang tersebut diatas dan dihitung Efisiensi Kelompok Tiang sesuai dengan jenis, dimensi, jarak, jumlah dan susunan kelompok tiang yang direncanakan.

Disarankan untuk melakukan Tes Pembebanan baik secara Statik maupun secara Dinamis. Pengujian tersebut dilakukan untuk mengoptimasikan dan mengkonfirmasi daya dukung *ultimate* dilapangan, sehingga daya dukung ijin pada **Tabel 4.1** boleh diperbesar. Dengan mengetahui besarnya daya dukung *ultimate* tersebut secara aktual, selain dapat menghasilkan perencanaan yang efisien dan efektif sehingga biaya *"Sub Structure"* menjadi ekonomis dengan besarnya angka keamanan yang diperkecil tersebut.

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DENAH TITIK UJI SONDIR DAN BOR MESIN

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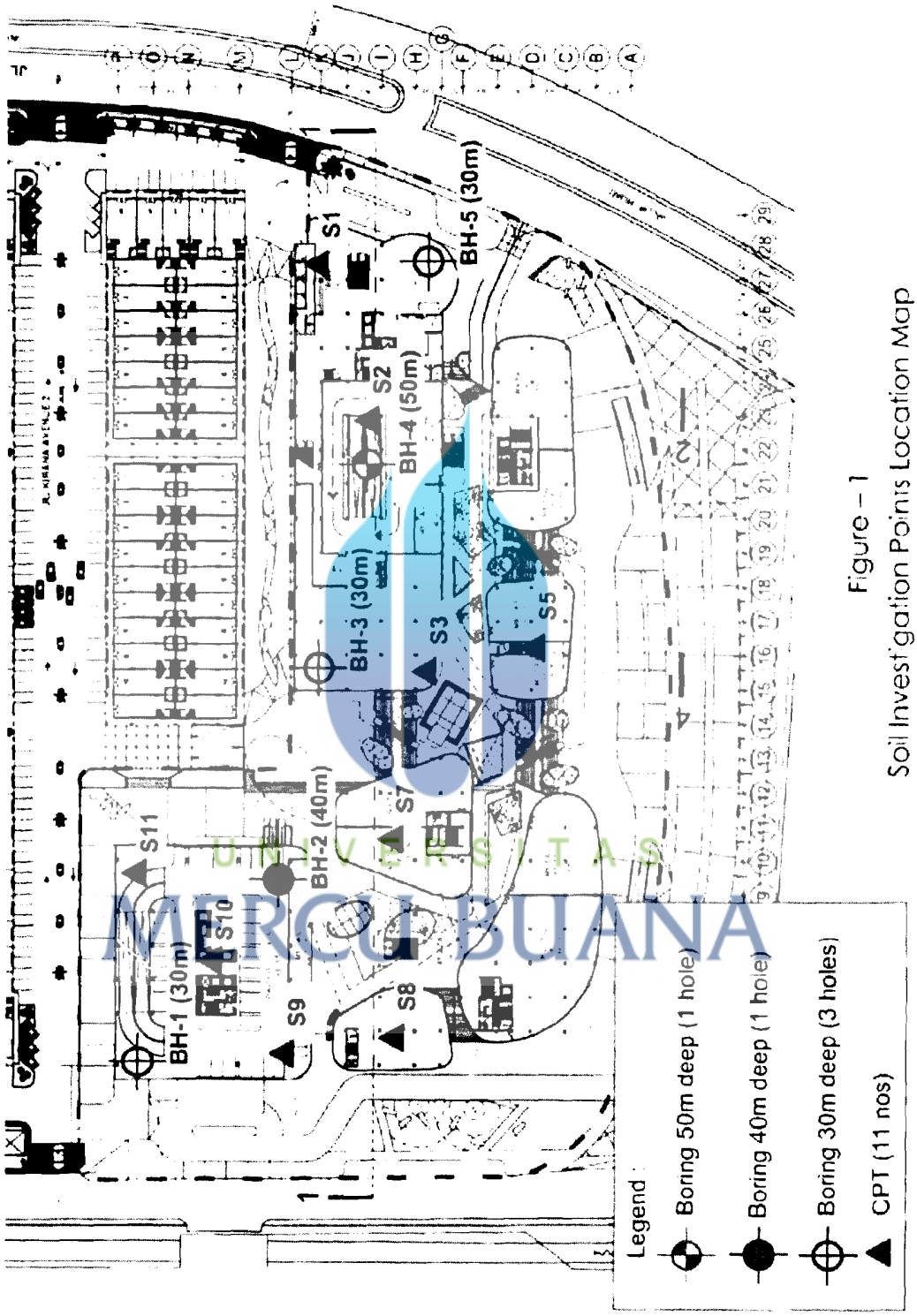

Figure – 1
Soil Investigation Points Location Map

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GRAFIK SONDIR 2.5 TON

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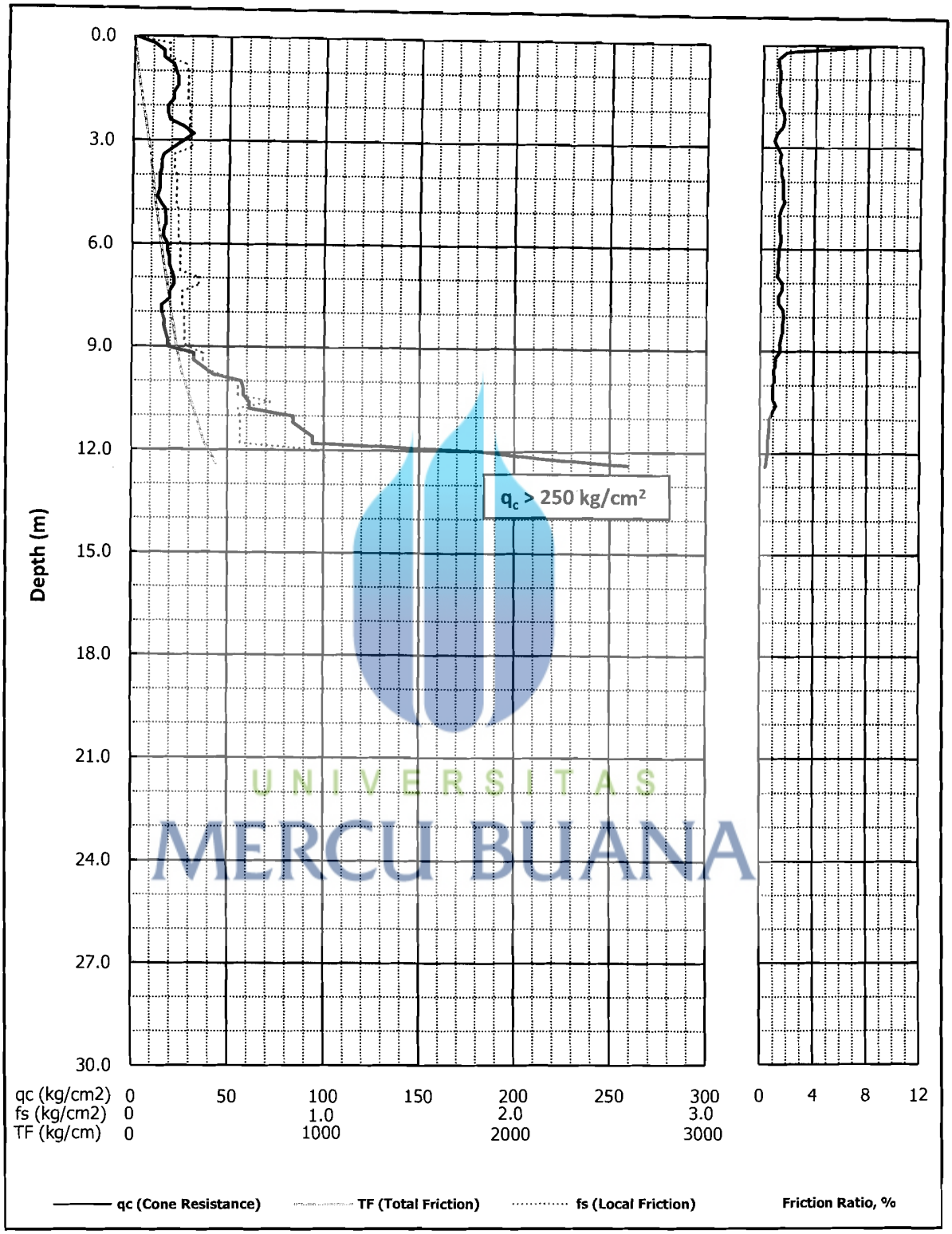
DUTCH CONE PENETRATION TEST (DCPT)

No. Job : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - North Jakarta
Point : **S.1**

Test By : Sartono Cs
Date : 12 Juli 2012
End of test : 12.40 m



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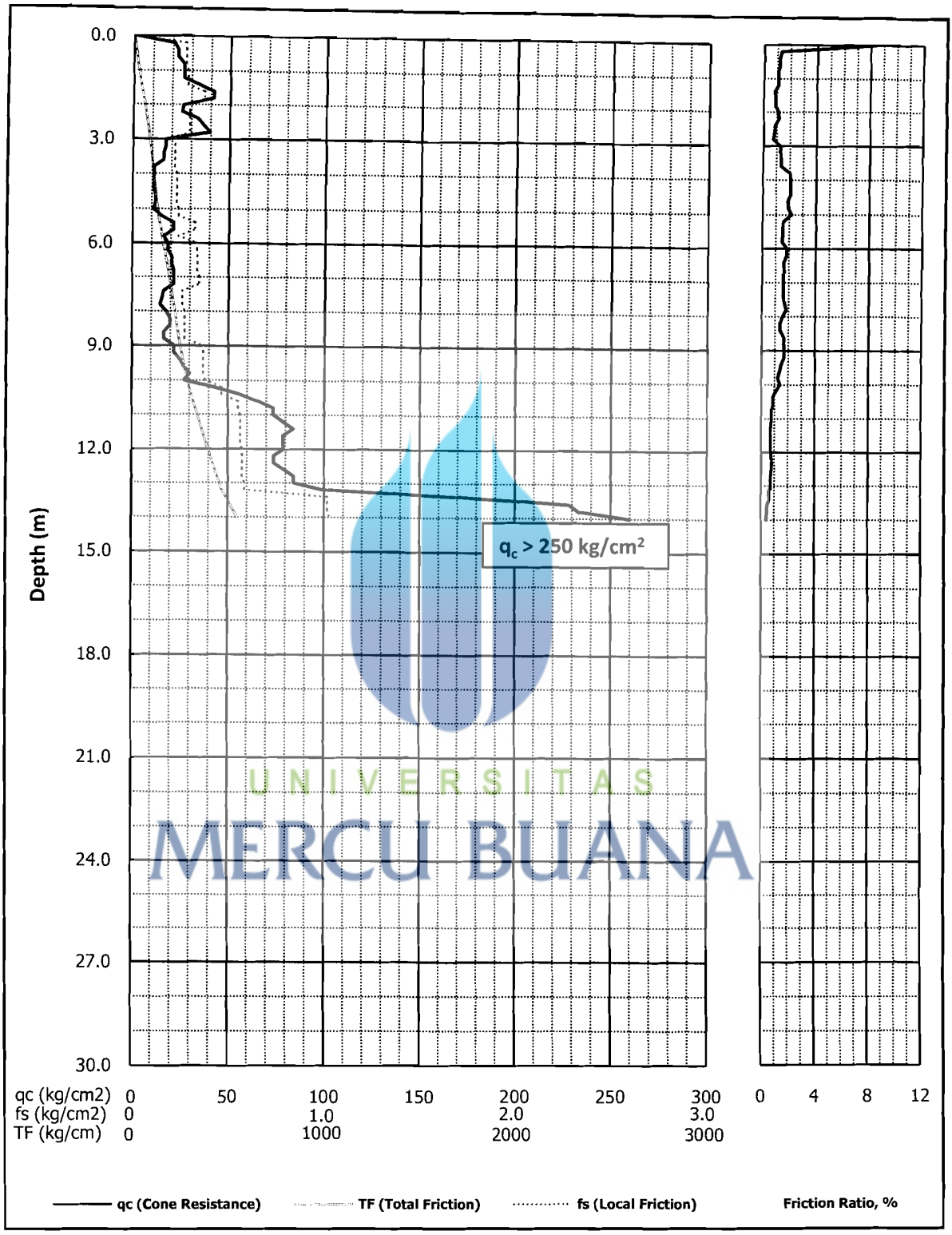
DUTCH CONE PENETRATION TEST (DCPT)

No. Job : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - North Jakarta
Point : **S.2**

Test By : Sartono Cs
Date : 11 Juli 2012
End of test : 14.00 m



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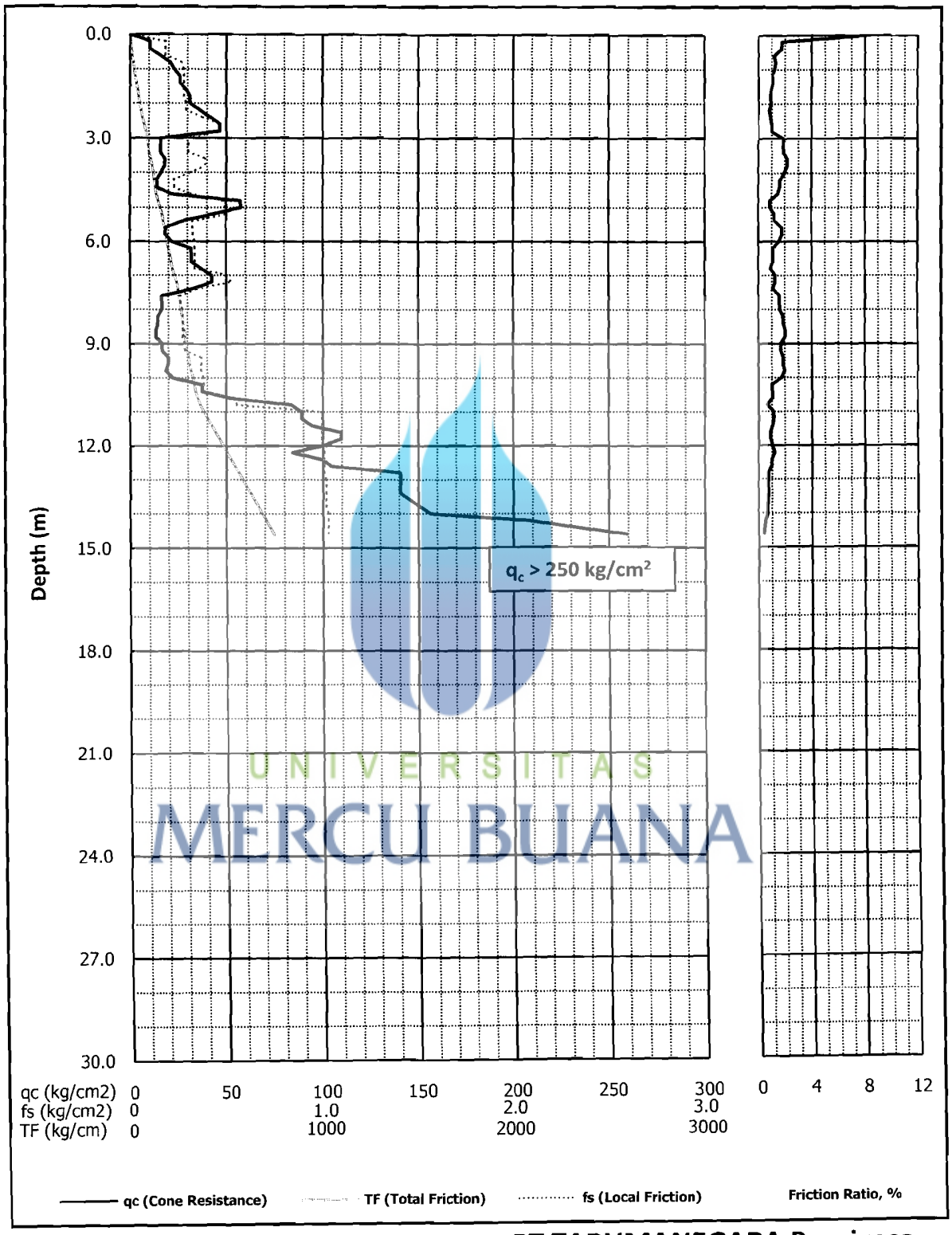
DUTCH CONE PENETRATION TEST (DCPT)

No. Job	: 1S.12102	**Test By**	: Sartono Cs
Project	: KIRANA 3	**Date**	: 07 Juli 2012
Location	: Kelapa Gading - North Jakarta	**End of test**	: 14.60 m
Point	: **S.3**		



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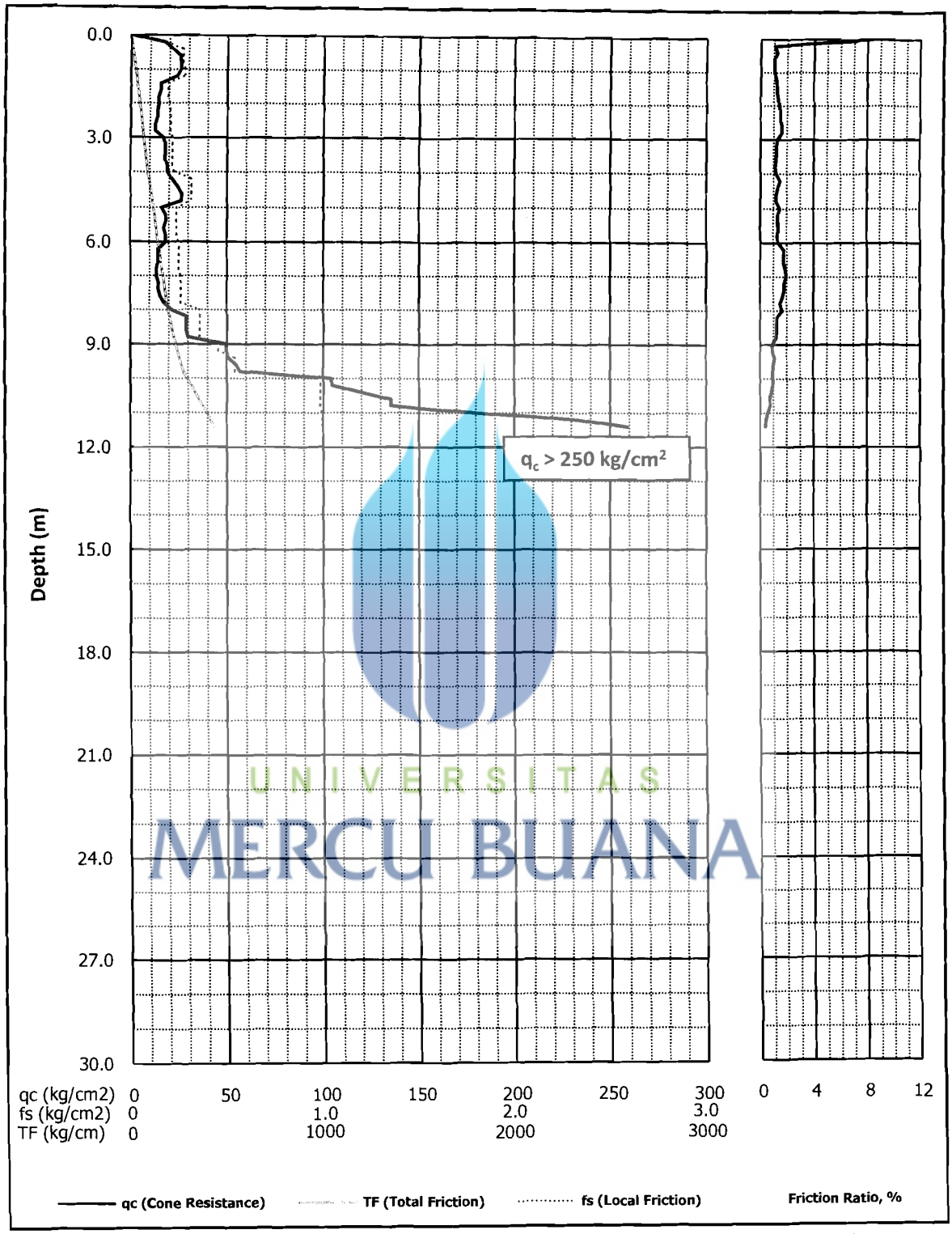
DUTCH CONE PENETRATION TEST (DCPT)

No. Job : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - North Jakarta
Point : **S.4**

Test By : Sartono Cs
Date : 11 Juli 2012
End of test : 11.40 m



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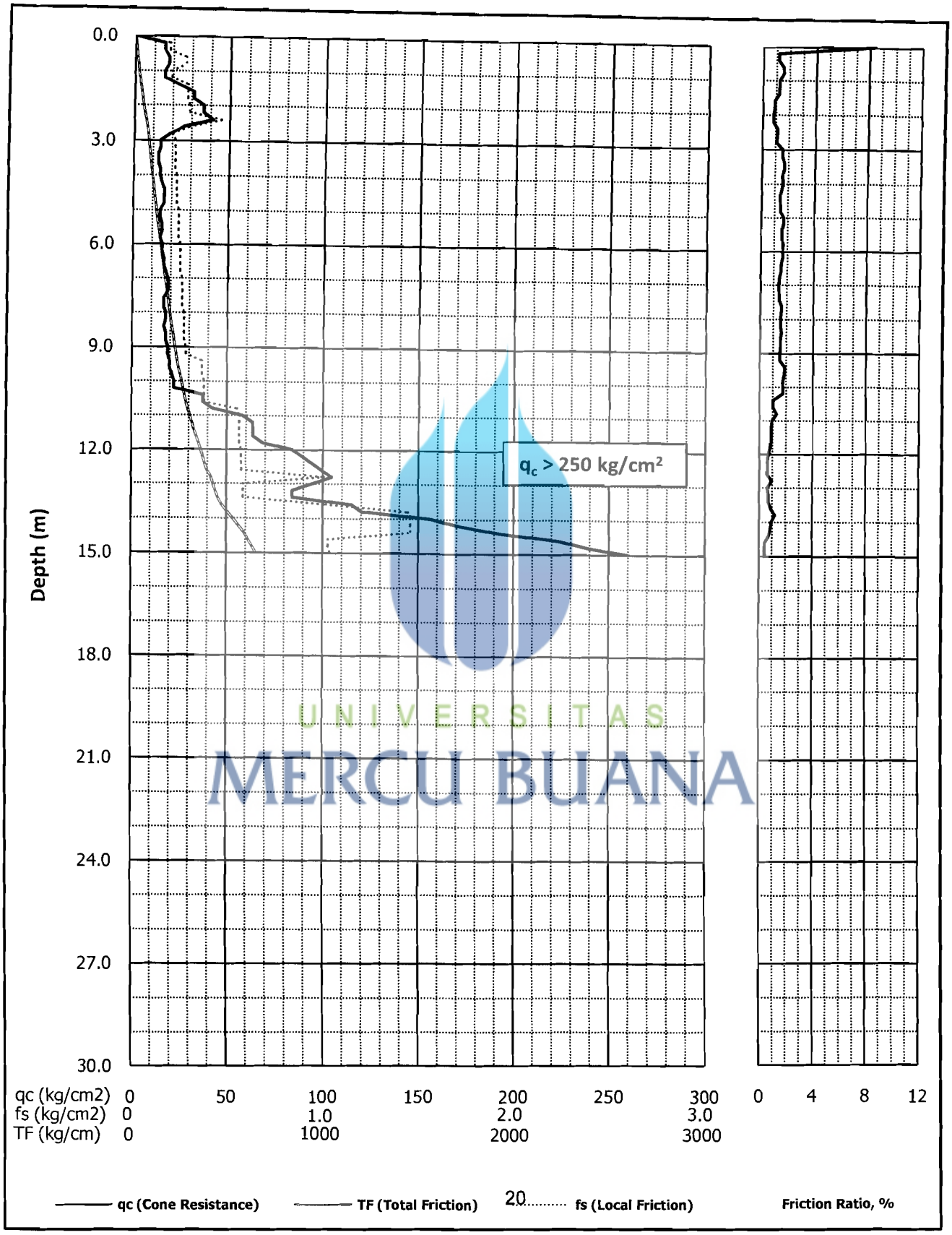
DUTCH CONE PENETRATION TEST (DCPT)

No. Job : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - North Jakarta
Point : **S.5**

Test By : Sartono Cs
Date : 07 Juli 2012
End of test : 15.00 m



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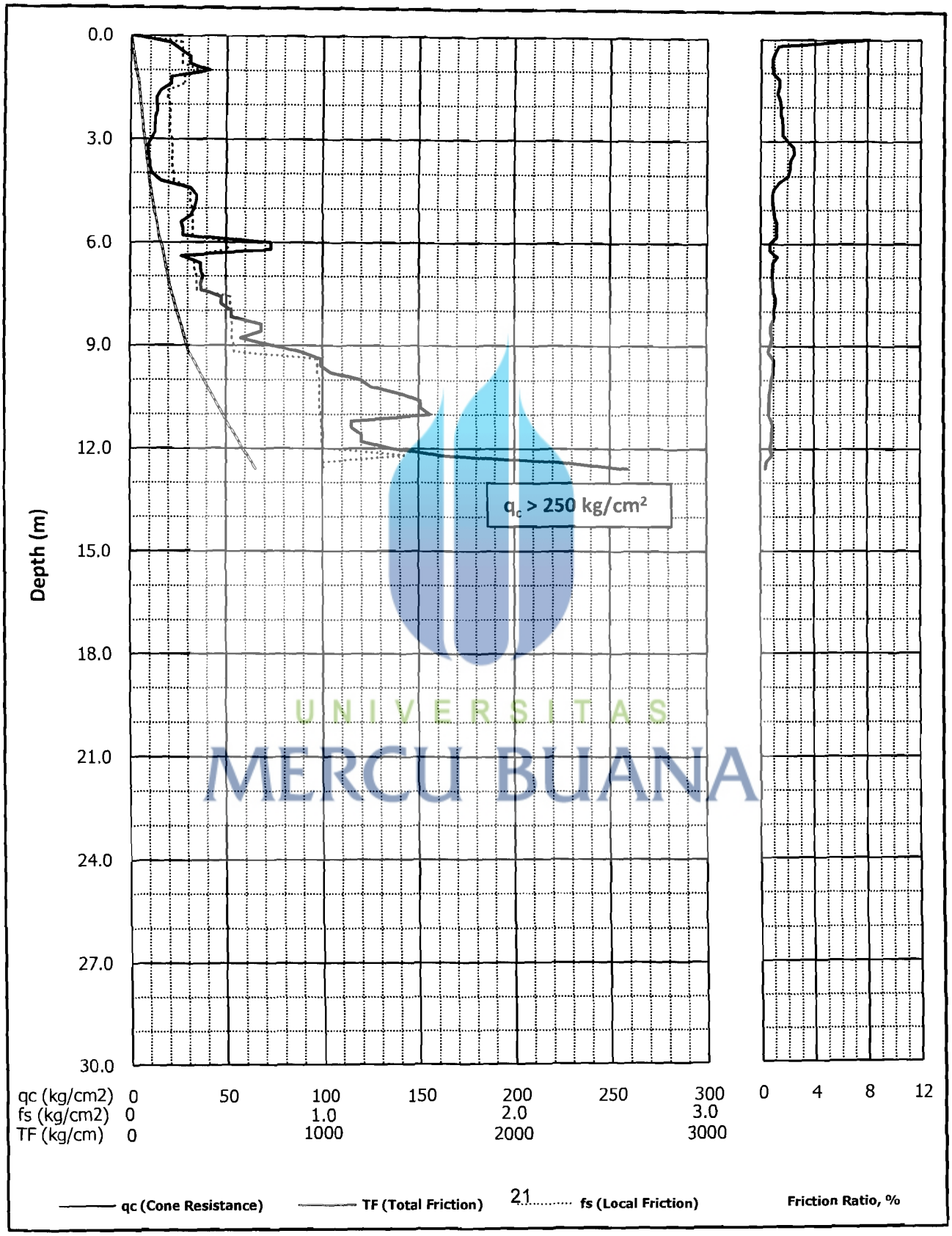
DUTCH CONE PENETRATION TEST (DCPT)

No. Job : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - North Jakarta
Point : **S.6**

Test By : Sartono Cs
Date : 10 Juli 2012
End of test : 12.60 m



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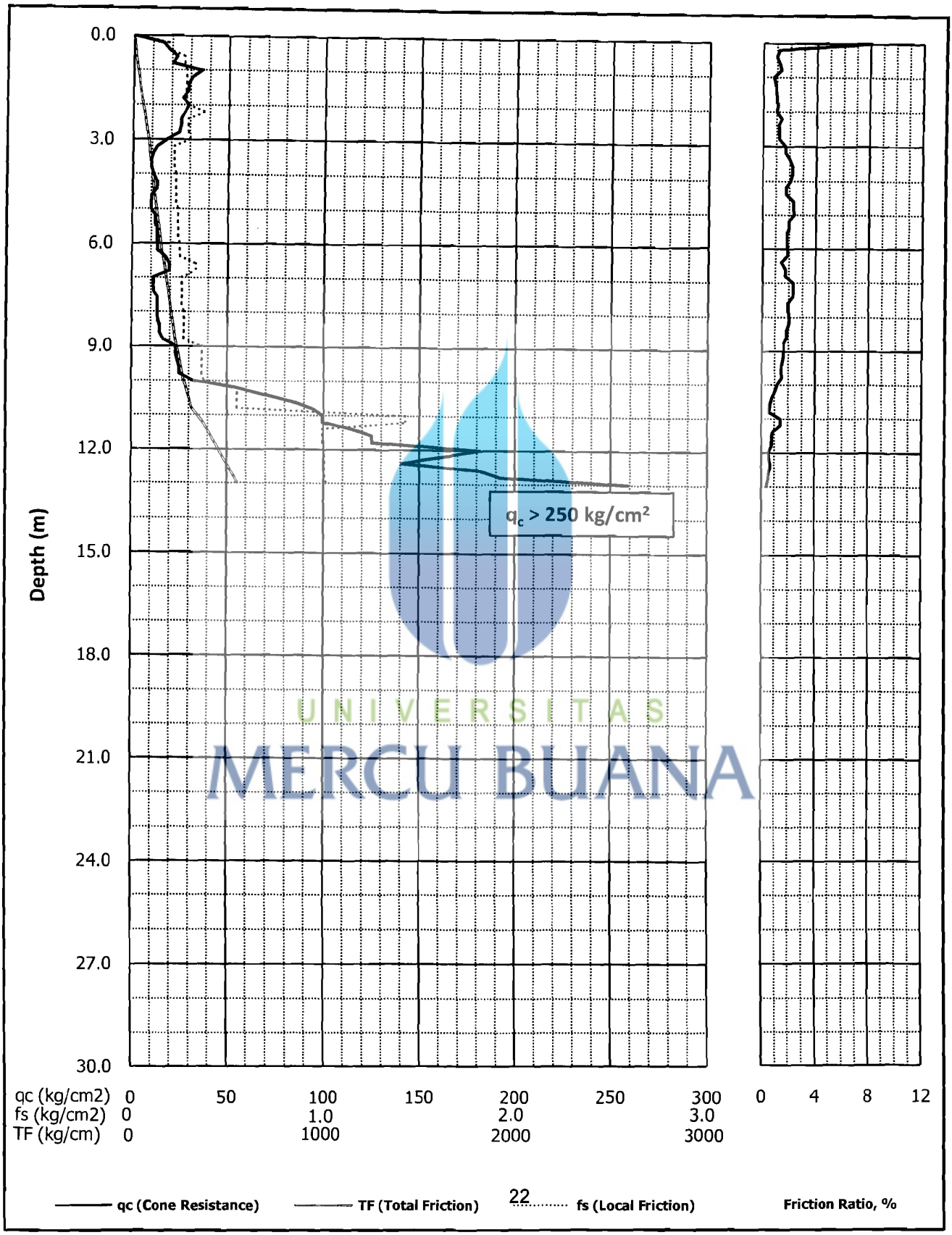
DUTCH CONE PENETRATION TEST (DCPT)

No. Job : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - North Jakarta
Point : **S.7**

Test By : Sartono Cs
Date : 09 Juli 2012
End of test : 13.00 m



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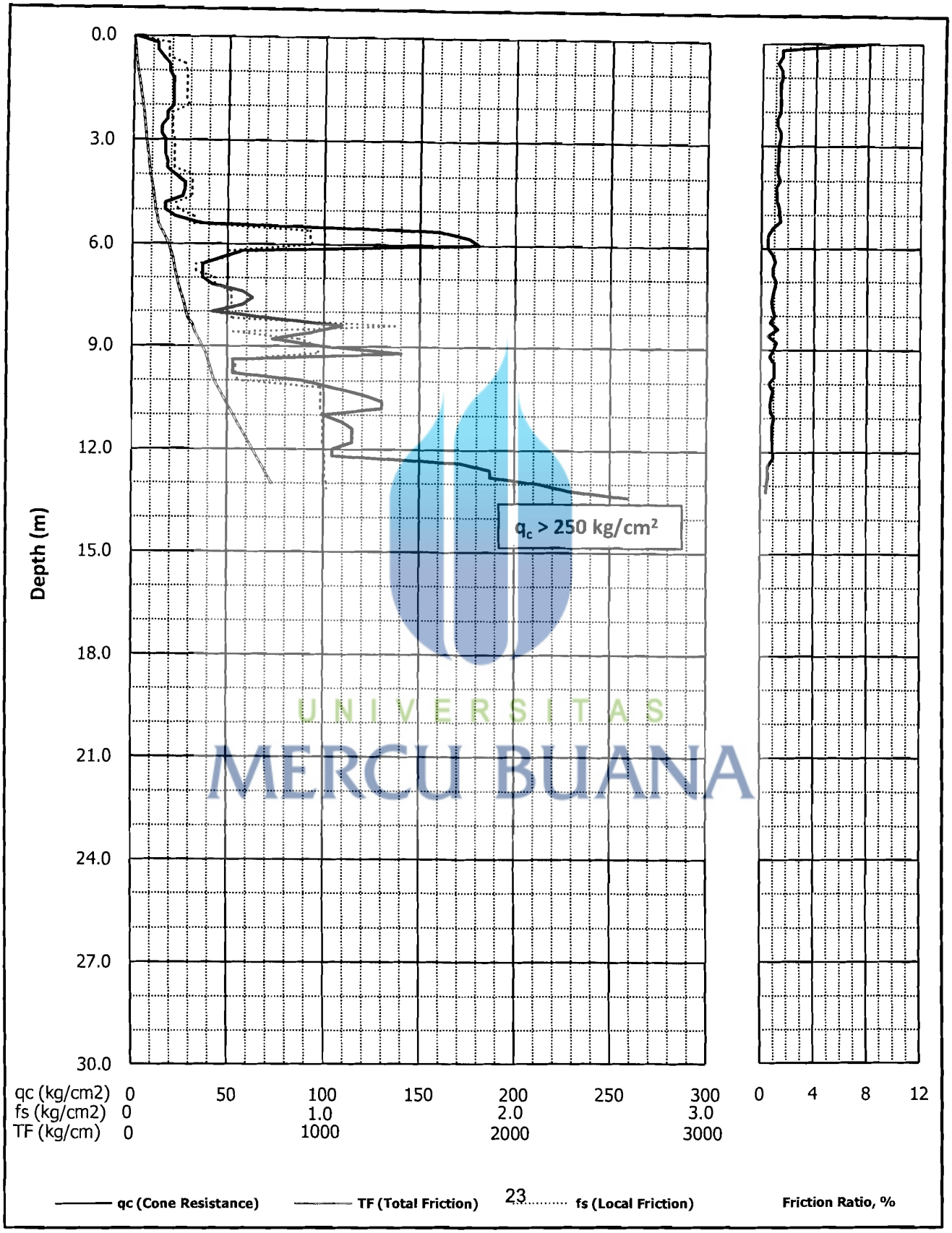
DUTCH CONE PENETRATION TEST (DCPT)

No. Job : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - North Jakarta
Point : **S.8**

Test By : Sartono Cs
Date : 10 Juli 2012
End of test : 13.40 m



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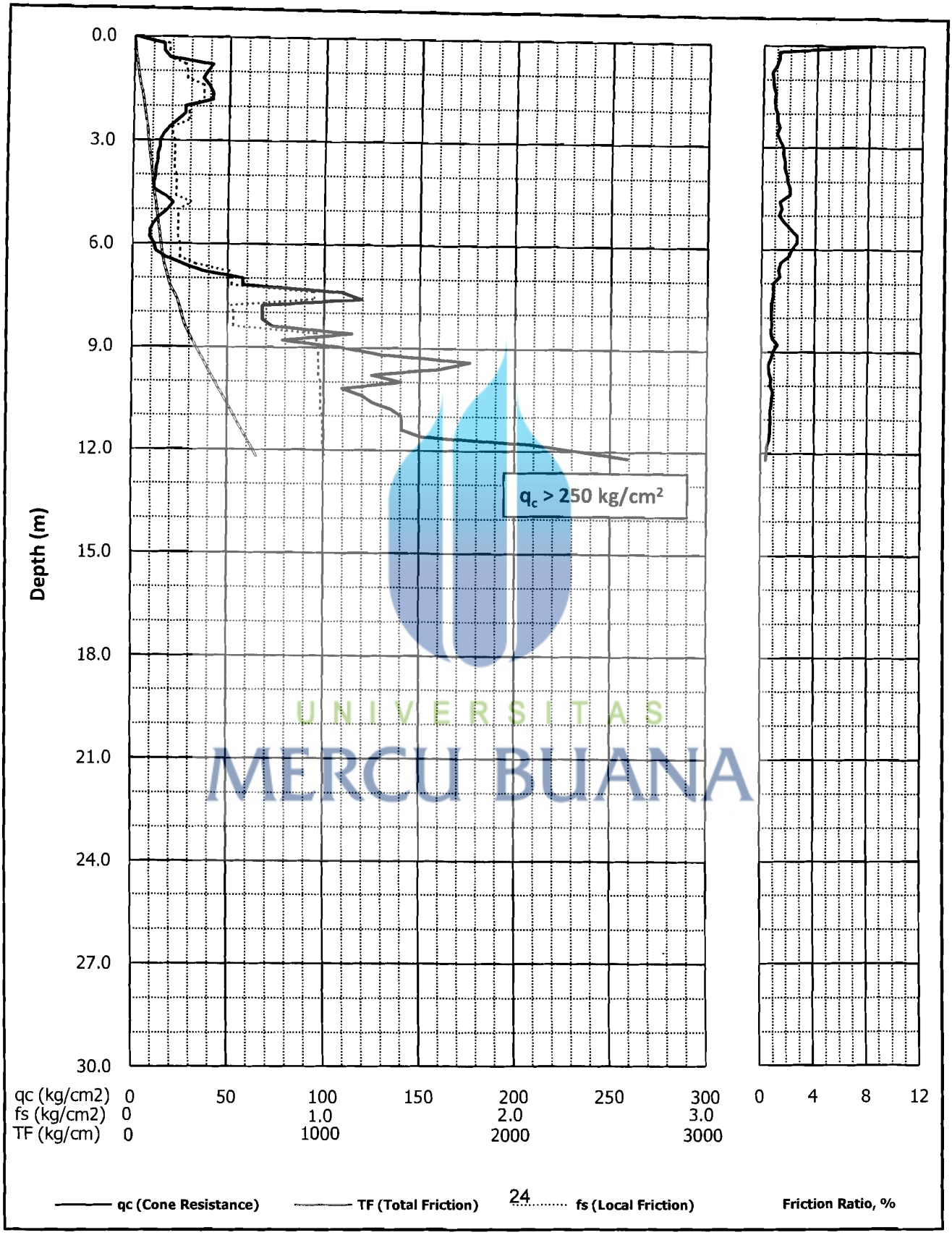
DUTCH CONE PENETRATION TEST (DCPT)

No. Job : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - North Jakarta
Point : **S.9**

Test By : Sartono Cs
Date : 09 Juli 2012
End of test : 12.20 m



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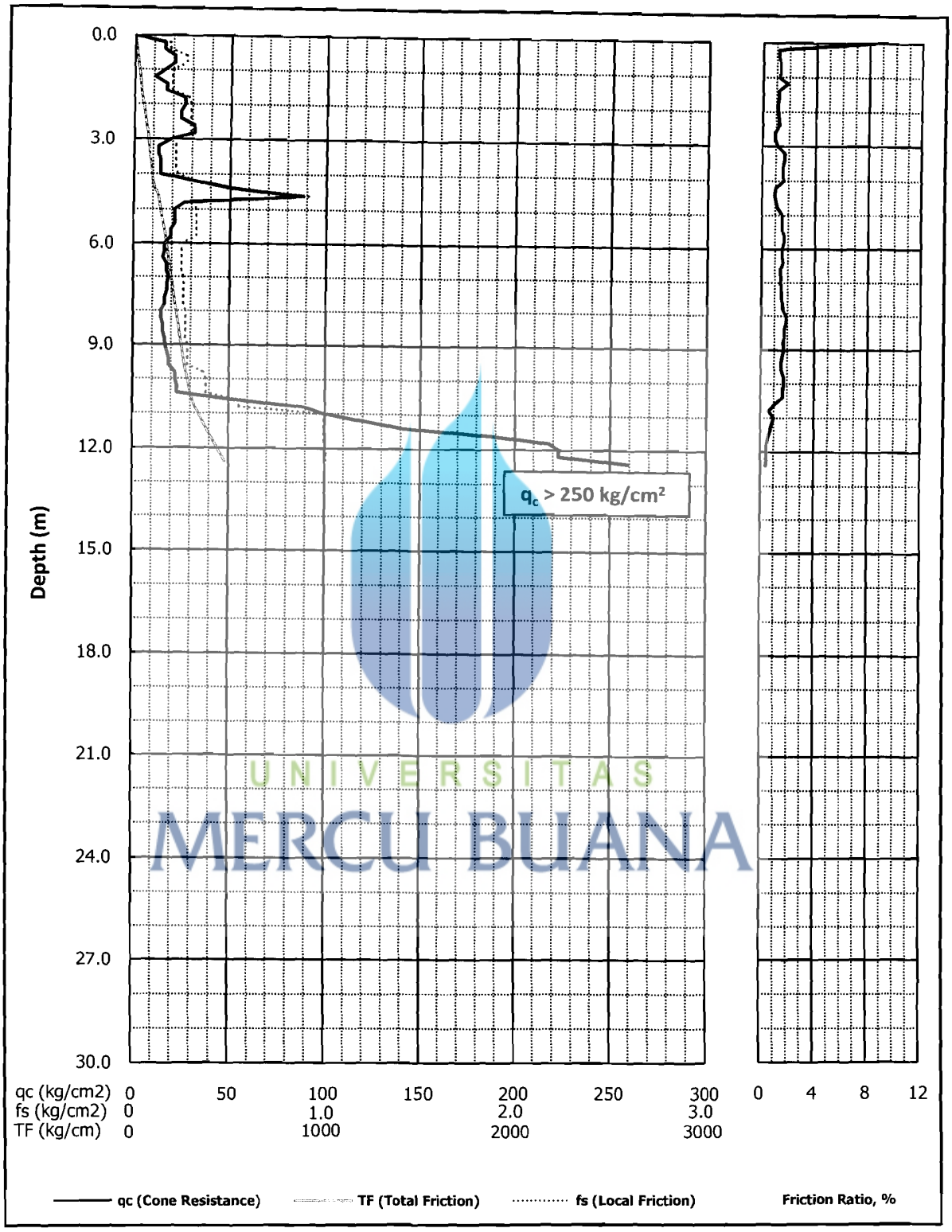
DUTCH CONE PENETRATION TEST (DCPT)

No. Job : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - North Jakarta
Point : **S.10**

Test By : Sartono Cs
Date : 08 Juli 2012
End of test : 12.40 m



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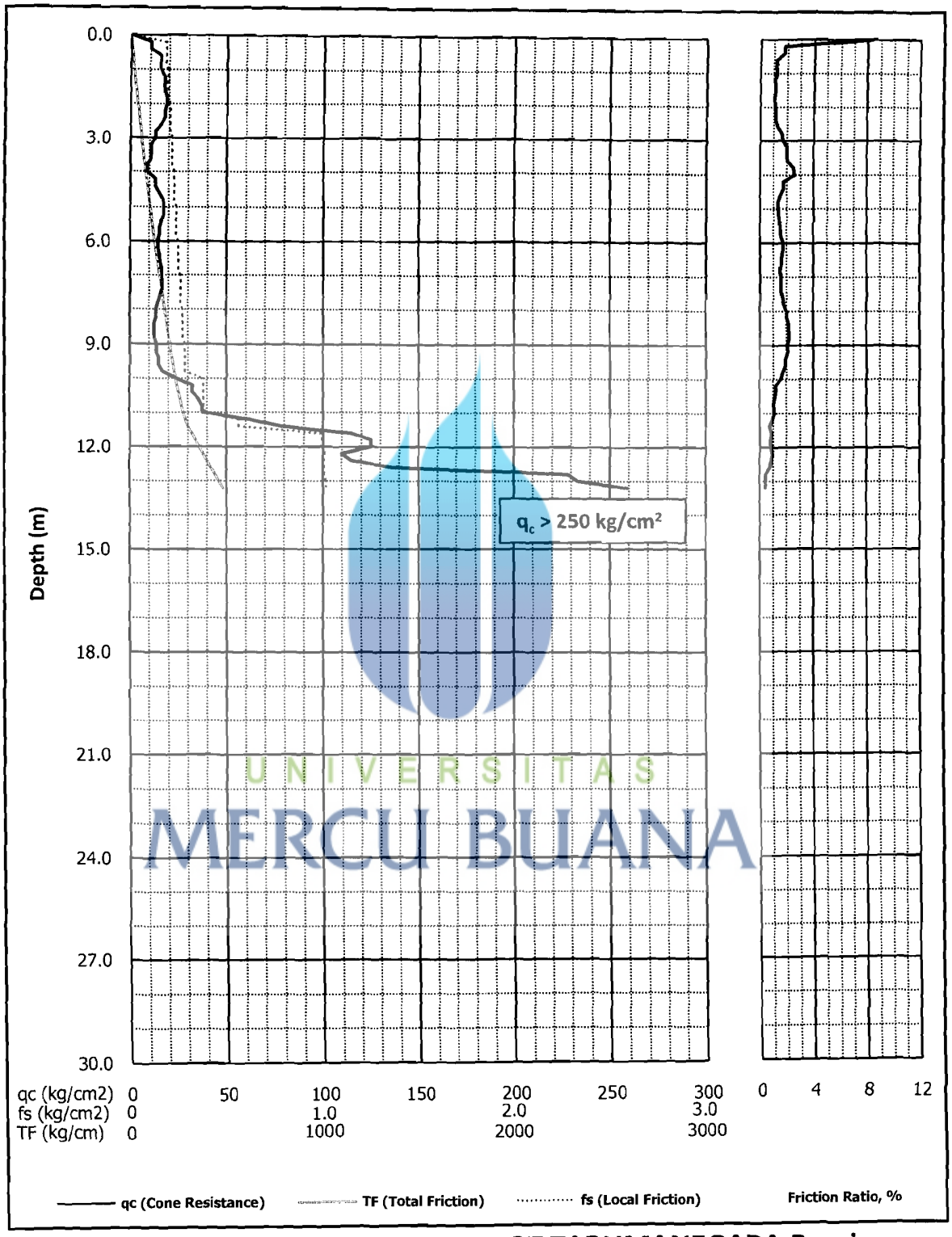
DUTCH CONE PENETRATION TEST (DCPT)

No. Job : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - North Jakarta
Point : ***S.11***

Test By : Sartono Cs
Date : 08 Juli 2012
End of test : 13.20 m



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LOG BOR

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BORING LOG

Project No. : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - Jakarta

Sta & Offset : -
Elevation : -
GWL : 1.50 m
Start Date : 04/07/2012
Finish Date : 07/07/2012
Bore Depth : 30.50 m
Core Dia. : 7.30 cm
Casing Dia. : 8.90 cm

Borhole Coor. :
Driller : Sartono
Hammer Type : Automatic Drop Hammer
Energy (65 % - 75 %)

Log No. **BH 1**

Remarks :
Shelby Tube, Rock Core, Casing, Split Spoon, Bag Sample
water content, %; plastic limit, %; liquid limit, %

Depth (m)	Symbol	Description
1–4	MH	CLAYEY SILT Red, moist, medium stiff, high plasticity BH1 - UD1 : 2.50 - 3.00 m
5–6	CH	SILTY CLAY Brownish grey, moist, medium stiff, high plasticity
7–9	CH	SILTY CLAY Brownish grey, moist, medium stiff, high plasticity BH1 - UD2 : 7.00 - 7.50 m
10–12	ML	SANDY SILT Dark brown with white noddles, moist, hard, low plasticity
13	ML	SILT Greenish white, moist, very stiff, low plasticity
14–16	ML	SILT Whitish brown, moist, very stiff, low plasticity
17–19	SP	SILTY SAND Black, moist to wet, very dense, poorly graded
20	ML	CEMENTED SILT Dark brown, wet, hard, low plasticity
21–22	SP	SILTY SAND Black, wet, very dense, poorly graded
23–25	ML	SANDY SILT Grey, moist, hard, low plasticity
26–30	SP	SILTY SAND Black, wet, very dense, poorly graded
		End of deep boring

Sampling — Standard Penetration Test

Depth (m)	Sample	N1	N2	N3	N
2	☒	2	2	3	5
3	☒	2	3	3	6
5	☒	2	2	3	5
6	☒	2	2	3	5
8	☒	3	5	8	13
9	☒	7	14	20	34
11	☒	8	18	22	40
12	☒	5	8	14	22
14	☒	6	10	16	26
15	☒	5	10	14	24
17	☒	25	50 / 15	-	>50
19	☒	17	28	22 / 10	>50
20	☒	30	50 / 15	-	>50
21	☒	31	50 / 15	-	>50
23	☒	18	26	24 / 10	>50
24	☒	15	25	25	50
26	☒	15	26	24 / 10	>50
27	☒	18	29	21 / 10	>50
29	☒	19	30	20 / 10	>50
30	☒	10	18	25	43

N - Value (10 20 30 40 50 60)

N-SPT>50 blows/ft

Laboratory Test: Strength Test (Type, c_u / c' (kg/cm²), ϕ_u / ϕ' (°), q_u (kg/cm²)), γt t/m³, Gs, e_o, Atterberg Limit (%) (20 40 60 80 100)

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BORING LOG

Project No. : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - Jakarta

Sta & Offset : -
Elevation : -
GWL : 4.50 m
Start Date : 28/06/2012
Finish Date : 02/07/2012
Bore Depth : 50.0 m
Core Dia. : 7.30 cm
Casing Dia. : 8.90 cm

Borhole Coor. :
Driller : Sartono
Hammer Type : Automatic Drop Hammer Energy (65 % - 75 %)

Log No. BH 2

Remarks :
Shelby Tube, Rock Core, Casing, Split Spoon, Bag Sample, water content, %, plastic limit, %, liquid limit, %

Depth (m)	Legend	Symbol	Description	Sampling: Depth (m)	Sample	Blows Per Each 15 cm: N1	N2	N3	N	N - Value	Laboratory Test: Strength Test: Type	c_u / c' (kg/cm²)	ϕ_u / ϕ' (°)	q_u (kg/cm²)	γt t/m³	GS	e_o	Atterberg Limit (%)
1		CH	CLAY Dark grey, moist, medium stiff, high plasticity	1														
2				2	☒	1	2	2	4									
3				3	☒	1	1	3	4									
4				4														
5		CH	CLAY Whitish brown, moist to wet, medium stiff, high plasticity	5	☒	1	2	3	5									
6				6														
7		CH	CLAY Greenish grey, moist to wet, medium stiff, high plasticity	7	☒	2	2	3	5									
8		ML	SANDY SILT Dark brown, wet, medium stiff, low plasticity	8	☒	1	2	3	5									
9		ML	CLAYEY SILT Green, moist, medium stiff, low plasticity	9	☒	1	2	3	5									
10				10														
11		ML	SANDY SILT Brown with white noddles, moist to wet, hard, low plasticity	11	☒	6	13	20	33									
12				12														
13		ML	SILT Grey, moist to wet, hard, low plasticity	13	☒	7	15	22	37									
14		SP	SILTY SAND Grey, wet, very dense, poorly graded	14	☒	14	21	29	50	N-SPT>50 blows/ft								
15				15	☒	15	23	27	50	N-SPT>50 blows/ft								
16				16														
17				17	☒	25	50 / 15	-	>50	N-SPT>50 blows/ft								
18				18														
19				19	☒	26	50 / 15	-	>50	N-SPT>50 blows/ft								
20				20	☒	24	50 / 15	-	>50	N-SPT>50 blows/ft								
21		ML	SILT Greenish grey, moist, hard, low plasticity	21	☒	8	18	23	41									
22				22														
23		ML	CEMENTED SILT Grey, moist to wet, hard, low plasticity	23	☒	16	24	26 / 10	>50	N-SPT>50 blows/ft								
24				24	☒	18	25	25 / 10	>50	N-SPT>50 blows/ft								
25				25														
26				26	☒	18	26	24 / 10	>50	N-SPT>50 blows/ft								
27				27	☒	19	27	23 / 10	>50	N-SPT>50 blows/ft								
28				28														
29		SP	SILTY SAND Black, wet, dense, poorly graded	29	☒	10	18	24	42									
30				30														

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BORING LOG

Project No. : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - Jakarta

Sta & Offset : -
Elevation : -
GWL : 4.50 m
Start Date : 28/06/2012
Finish Date : 02/07/2012
Bore Depth : 50.0 m
Core Dia. : 7.30 cm
Casing Dia. : 8.90 cm

Borhole Coor. :
Driller : Sartono
Hammer Type : Automatic Drop Hammer
Energy (65 % - 75 %)

Log No. BH 2

Remarks :
Shelby Tube, Rock Core, Casing, Split Spoon, Bag Sample, water content, %, plastic limit, %, liquid limit, %

Depth (m)	Legend	Symbol	Description	Sampling: Depth (m)	Sample	Core Recovery (%)	Blows Per Each 15 cm: N2	N3	N	Laboratory Test: Type	c / c' (kg/cm²)	φu / φ' (°)	σ' (kg/cm²)	γt t/m³	Gs	e₀	Atterberg Limit (%)
31		CH	SILTY CLAY Dark grey, moist, hard, high plasticity	31		8	15	20	35								
32				32		8	16	21	37								
33			BH2 - UD1 : 32.50 - 33.00 m	33		4	8	12	20								
34		ML	CLAYEY SILT Grey, moist, very stiff, low plasticity	34													
35				35		5	9	13	22								
36				36													
37		CH	SILTY CLAY Brownish grey, moist to wet, very stiff, high plasticity	37		5	8	13	21								
38			BH2 - UD2 : 37.00 - 37.50 m	38		5	9	11	20								
39				39		6	10	12	22								
40				40													
41			BH2 - UD3 : 41.00 - 41.50 m	41		6	8	10	18								
42				42		7	10	10	20								
43				43													
44				44		7	10	12	22								
45				45		7	10	13	23								
46			BH2 - UD4 : 46.00 - 46.50 m	46													
47				47		7	11	13	24								
48				48													
49		MH	CLAYEY SILT Brownish grey, moist to wet, very stiff, high plasticity	49		7	11	13	24								
50			BH2 - UD5 : 49.00 - 49.50 m	50		7	11	11	22								
			End of deep boring														
51				51													
52				52													
53				53													
54				54													
55				55													
56				56													
57				57													
58				58													
59				59													
60				60													

Standard Penetration Test — N - Value: 10 20 30 40 50 60

Atterberg Limit (%): 20 40 60 80 100

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BORING LOG

Project No. : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - Jakarta

Sta & Offset : -
Elevation : -
GWL : 1.25 m
Start Date : 15/06/2012
Finish Date : 18/06/2012
Bore Depth : 30.50 m
Core Dia. : 7.30 cm
Casing Dia. : 8.90 cm

Borhole Coor. :
Driller : Sartono
Hammer Type : Automatic Drop Hammer Energy (65 % - 75 %)

Log No. **BH 3**

Remarks :
Shelby Tube, Rock Core, Casing, Split Spoon, Bag Sample, water content, %, plastic limit, %, liquid limit, %

Depth (m)	Symbol	Description	Sampling Depth (m)	Sample	N1	N2	N3	N	Type	c_u / c' (kg/cm²)	ϕ_u / ϕ' (°)	q_u (kg/cm²)	γt t/m³	Gs	e_o	Atterberg Limit (%)
1	CH	CLAY Blackish red, moist, very soft, high plasticity BH3 - UD1 : 2.50 - 3.00 m	2	☒	1	1	1	2								
3			3	☒	1	1	1	2								
4	CH	SANDY CLAY Blackish brown, moist to wet, very soft, high plasticity	5	☒	1	1	2	3								
6	CH	SILTY CLAY Greyish brown, moist to wet, soft, high plasticity	8	☒	1	2	3	5								
7	MH	CLAYEY SILT Whitish grey, moist, medium stiff, high plasticity BH3 - UD2 : 7.00 - 7.50 m	8	☒	1	1	2	3								
9	MH	CLAYEY SILT Grey, moist to wet, soft, high plasticity	9	☒	1	2	2	4								
10	ML	SANDY SILT Grey with white noddles, moist to wet, medium stiff, low plasticity	11	☒	1	2	2	4								
12			12	☒	2	3	4	7								
14	ML	CEMENTED SILT Dark brown, moist to wet, hard, low plasticity	14	☒	14	20	24	44								
15			15	☒	15	21	26	47								
17			17	☒	16	23	28	>50								
18			18	☒	16	25	30	>50								
20			20	☒	14	24	28	>50								
21			21	☒	14	24	27	>50								
23	ML	GRAVELLY SILT Dark green, moist, hard, low plasticity	23	☒	14	25	25 10	>50								
24	ML	CEMENTED SILT Dark green, moist, hard, low plasticity	24	☒	15	27	23 10	>50								
26			26	☒	14	24	26	50								
27			27	☒	14	23	27	50								
29			29	☒	12	22	25	47								
30		End of deep boring	30	☒	10	18	22	40								

Standard Penetration Test — N - Value (10 20 30 40 50 60)

N-SPT>50 blows/ft

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BH3 - Page 1 of 1

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BORING LOG

Project No. : 15.12102
Project : KIRANA 3
Location : Kelapa Gading - Jakarta

Sta & Offset : -
Elevation : -
GWL : 2.00 m
Start Date : 18/06/2012
Finish Date : 24/06/2012
Bore Depth : 40.00 m
Core Dia. : 7.30 cm
Casing Dia. : 8.90 cm

Borhole Coor. :
Driller : Sartono
Hammer Type : Automatic Drop Hammer
Energy (65 % - 75 %)

Log No. **BH 4**

Remarks :
Shelby Tube, Rock Core, Casing, Split Spoon, Bag Sample
water content, %
plastic limit, %
liquid limit, %

Depth (m)	Legend	Symbol	Description	Sampling: Depth (m)	Sample	Blows Per Each 15 cm: N1	N2	N3	N	Standard Penetration Test: N - Value (10 20 30 40 50 60)	Laboratory Test: Strength Test: Type	c_u / c' (kg/cm²)	ϕ_u / ϕ' (°)	ϕ_d (kg/cm²)	γt t/m³	Gs	e_o	Atterberg Limit (%) (20 40 60 80 100)
1		MH	CLAYEY SILT Brownish red, lackish red, moist, very soft, high plasticity	1														
2				2	☒	1	1	2	3									
3			BH4 - UD1 : 4.00 - 4.50 m	3	☒	1	2	3	5									
4				4														
5				5	☒	1	2	4	6									
6				6	☒	1	1	3	4									
7		CH	CLAY Grey, wet, moist, medium stiff, high plasticity	7														
8				8	☒	2	2	3	5									
9				9	☒	2	4	7	11									
10		ML	SANDY SILT Grey with white noddles, moist to wet, stiff, low plasticity	10														
11				11	☒	2	5	9	14									
12				12	☒	4	5	7	12									
13				13														
14		ML	CEMENTED SILT Dark brown, moist to wet, hard, low plasticity	14	☒	11	25	25 / 10	>50	N-SPT>50 blows/ft								
15				15	☒	11	26	24 / 10	>50	N-SPT>50 blows/ft								
16				16														
17				17	☒	12	27	23 / 10	>50	N-SPT>50 blows/ft								
18				18	☒	13	29	21 / 10	>50	N-SPT>50 blows/ft								
19				19														
20				20	☒	14	30	20 / 10	>50	N-SPT>50 blows/ft								
21				21	☒	15	29	21 / 10	>50	N-SPT>50 blows/ft								
22				22														
23				23	☒	14	25	25 / 10	>50	N-SPT>50 blows/ft								
24				24	☒	16	32	18 / 5	>50	N-SPT>50 blows/ft								
25				25														
26		ML	CEMENTED SILT Dark black, wet, hard, low plasticity	26	☒	18	35	15 / 5	>50	N-SPT>50 blows/ft								
27				27	☒	14	29	21	50									
28				28														
29				29	☒	14	25	25	50									
30				30	☒	7	14	17	31									

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BORING LOG

Project No. : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - Jakarta

Sta & Offset : -
Elevation : -
GWL : 2.00 m
Start Date : 18/06/2012
Finish Date : 24/06/2012
Bore Depth : 40.00 m
Core Dia. : 7.30 cm
Casing Dia. : 8.90 cm

Borhole Coor. :
Driller : Sartono
Hammer Type : Automatic Drop Hammer
Energy (65 % - 75 %)

Log No. **BH 4**

Remarks :
Shelby Tube, Rock Core, Casing, Split Spoon, Bag Sample
water content, %
plastic limit, %
liquid limit, %

Depth (m)	Legend	Symbol	Description	Sampling: Depth (m)	Sample	Core Recovery (%)	Blows Per Each 15 cm: N2	N3	N	N - Value (10 20 30 40 50 60)	Laboratory Test: Strength Test: Type	c_u / c' (kg/cm²)	ϕ_u / ϕ' (°)	σ_v (kg/cm²)	γt t/m³	Gs	e_o	Atterberg Limit (%) (20 40 60 80 100)
31		CH	SILTY CLAY Dark grey, moist, very stiff, high plasticity			7	14	17	31									
32			BH4 - UD2 : 31.00 - 31.50 m	32		4	8	12	20									
33				33		4	8	11	19									
34				34														
35		CH	SILTY CLAY Grey, moist to wet, very stiff, high plasticity	35		4	7	11	18									
36			BH4 - UD3 : 35.50 - 36.00 m	36		3	6	10	16									
37				37														
38		CH	CLAY greenish yellow, moist, stiff, high plasticity	38		3	6	9	15									
39			BH4 - UD4 : 38.50 - 39.00 m	39		3	6	8	14									
40				40														
			End of deep boring															
41				41														
42				42														
43				43														
44				44														
45				45														
46				46														
47				47														
48				48														
49				49														
50				50														
51				51														
52				52														
53				53														
54				54														
55				55														
56				56														
57				57														
58				58														
59				59														
60				60														

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BORING LOG

Project No. : 1S.12102
Project : KIRANA 3
Location : Kelapa Gading - Jakarta

Sta & Offset : -
Elevation : -
GWL : -
Start Date : 25/06/2012
Finish Date : 27/06/2012
Bore Depth : 30.50 m
Core Dia. : 7.30 cm
Casing Dia. : 8.90 cm

Borhole Coor. :
Driller : Sartono
Hammer Type : Automatic Drop Hammer
Energy (65 % - 75 %)

Log No. BH 5

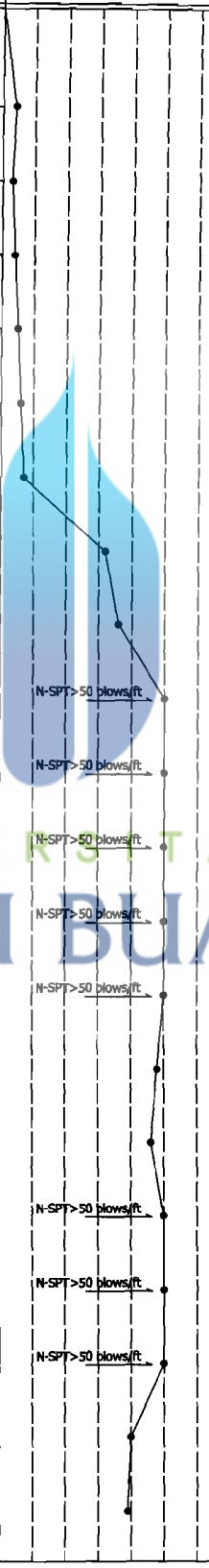
Remarks :
Shelby Tube, Rock Core, Casing, Spilt Spoon, Bag Sample
water content, %; plastic limit, %; liquid limit, %

Depth (m)	Legend	Symbol	Description
1–2		CH	CLAY Red, moist, soft, high plasticity
3–4		CH	CLAY Greyish brown, moist, soft, high plasticity
5–6		CH	SILTY CLAY Whitish grey, moist, medium stiff, high plasticity BH5 - UD1 : 5.50 - 6.00 m
7–9		CH	SILTY CLAY Grey, moist, medium stiff, high plasticity BH5 - UD2 : 8.50 - 9.00 m
10–13		ML	SILT Greenish brown, moist to wet, medium stiff to hard, low plasticity
14–16		ML	CEMENTED SILT Dark black, moist, hard, low plasticity
17–19		ML	SANDY SILT Dark black, moist, hard, low plasticity
20		ML	CEMENTED SILT Grey with white noddles, moist, hard, low plasticity
21–22		ML	SILT Greenish grey, moist to wet, hard, low plasticity
23–28		ML	SANDY SILT Dark grey with white noddles, moist to wet, hard, low plasticity
29–30		SP	SILTY SAND Dark brown, wet, dense, poorly graded
			End of deep boring

Sampling — Standard Penetration Test (Blows Per Each 15 cm)

Depth (m)	Sample	N1	N2	N3	N
2	☒	1	2	2	4
3–4	☒	1	1	2	3
5	☒	1	2	2	4
6	☒	1	2	3	5
8	☒	2	2	4	6
9	☒	2	3	4	7
11	☒	5	12	20	32
12	☒	7	14	22	36
14	☒	12	28	22 / 10	>50
15	☒	12	30	20 / 10	>50
17	☒	13	31	19 / 10	>50
19	☒	13	31	20 / 10	>50
20	☒	15	35	15 / 5	>50
21	☒	11	20	28	48
23	☒	11	19	27	46
25	☒	15	25	25 / 10	>50
26	☒	14	25	26 / 10	>50
28	☒	14	24	27 / 10	>50
29	☒	10	18	22	40
30	☒	10	17	22	39

N-Value (10 20 30 40 50 60)



Laboratory Test: Strength Test (Type, c_u / c' (kg/cm²), ϕ_u / ϕ' (°), σ_c (kg/cm²)); γt t/m³; Gs; e_o; Atterberg Limit (%) (20 40 60 80 100)

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SOIL PROFILE

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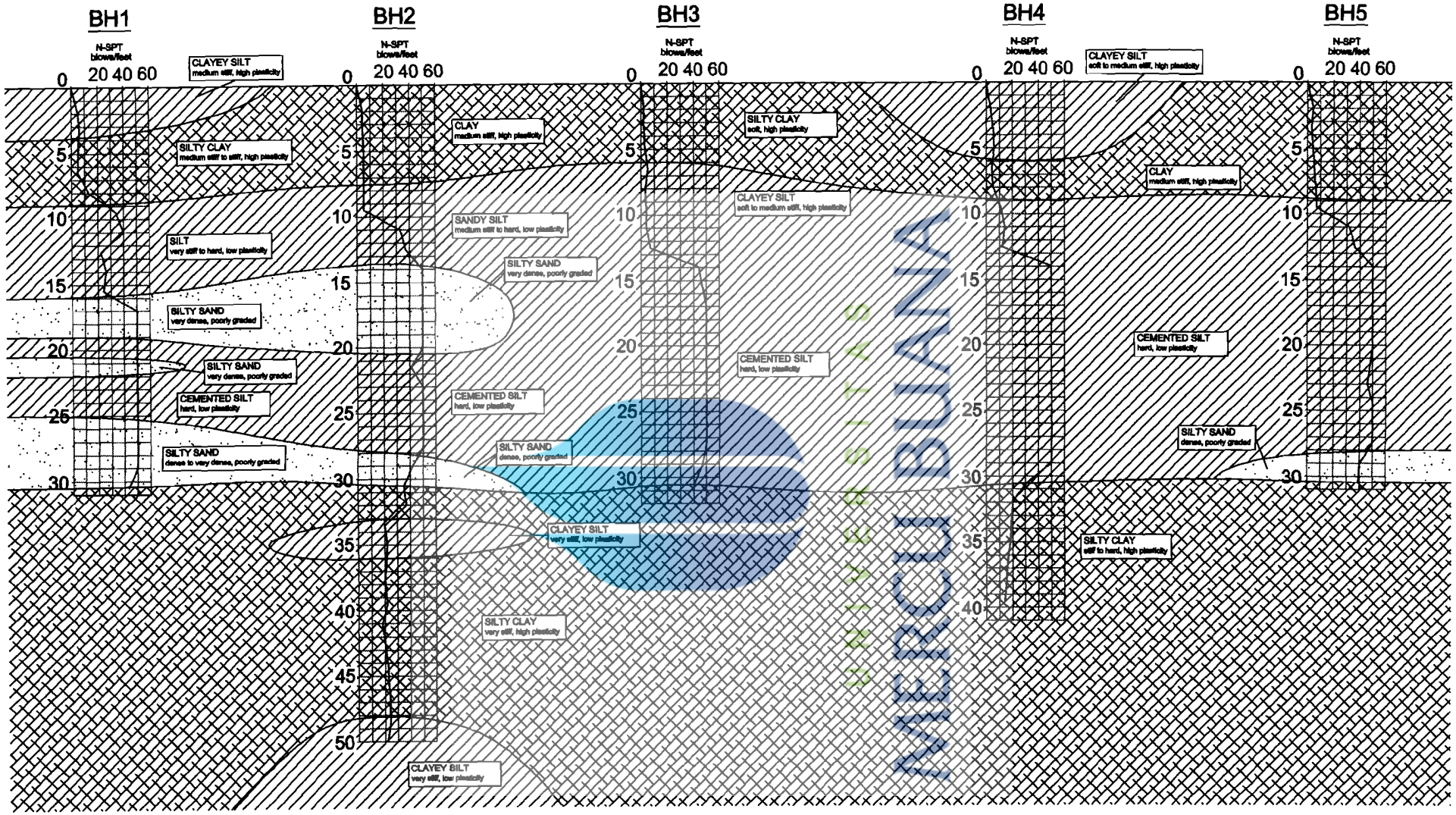

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DRAWING TITLE SOIL PROFILE BH1-BH2-BH3-BH4-BH5	LOCATION Kelapa Gading
PROJECT Kirana 3	CLIENT PT. IFP Pratama Desain

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RINGKASAN HASIL LABORATORIUM

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SUMMARY OF LABORATORY TEST

JOB NAME : **KIRANA 3**
LOCATION : **KELAPA GADING - JAKARTA**

Sample No				**BH1 - UD1**	**BH1 - UD2**	**BH2 - UD1**	**BH2 - UD2**	**BH2 - UD3**
Sampling Depth			m	**2.50 - 3.00**	**7.00 - 7.50**	**32.50 - 33.00**	**37.00 - 37.50**	**41.50 - 42.00**
Gradation	Gravel		%	0.00	0.00	0.00	0.00	0.00
	Sand		%	3.88	16.06	5.48	2.02	0.94
	Silt			52.92	36.44	69.12	65.98	55.36
	Clay		%	43.20	47.50	25.40	32.00	43.70
	Classified Grading Pass	No.10 (2.00 mm)	%	100.00	98.92	100.00	100.00	100.00
		No.40 (0.425 mm)	%	99.96	93.64	99.36	99.94	99.90
		No.200 (0.075 mm)	%	96.12	83.94	94.52	97.98	99.06
Liquid Limits		LL	%	107.13	84.23	66.00	67.89	78.20
Plasticity Index		Pi	%	55.61	52.05	41.50	42.76	53.42
Liquidity Index		Li		0.35	0.35	0.18	0.32	0.15
Classification				MH	CH	CH	CH	CH
Specific Gravity		Gs		2.67	2.75	2.59	2.65	2.62
Natural State	Water Content	ωn	%	70.80	50.61	32.07	38.60	32.76
	Wet Density	γt	gr/cm3	1.51	1.71	1.75	1.80	1.86
	Void Ratio	e		2.02	1.42	0.96	1.05	0.87
	Degree Saturaion	Sr	%	93.63	97.73	86.83	97.92	98.65
Unconfined Compression Test	Compressive Strength	qu	(kg/cm2)	0.48	0.36	0.75	1.42	1.79
	Remolded Strength	qr	(kg/cm2)	0.35	0.26	0.66	0.70	0.82
	Sensitivity Ration	St		1.35	1.35	1.13	2.02	2.18
Triaxial Compression Test	Type of Test					**CU**		
	Cohesion	C	(kPa)	13.00 / 8.00	-	-	-	-
	Angle of Internal Friction	Ø	(deg)	16.20 / 23.10	-	-	-	-
Consolidation Test	Yield of Consolidation	Pc	(kg/cm2)	-	-	4.10	3.75	4.20
	Compression Index	Cc		-	-	0.36	0.42	0.40
	Swelling Index	Cs		-	-	0.06	0.07	0.06

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SUMMARY OF LABORATORY TEST

JOB NAME : KIRANA 3
LOCATION : KELAPA GADING - JAKARTA

Sample No			BH2 - UD4	BH2 - UD5	BH3 - UD1	BH3 - UD2	BH4 - UD1
Sampling Depth		m	46.00 - 46.50	49.00 - 49.50	2.50 - 3.00	7.00 - 7.50	4.00 - 4.50
Gradation	Gravel	%	0.00	0.00	0.00	0.00	0.00
	Sand	%	2.82	5.38	4.76	1.20	1.36
	Silt		60.18	62.92	42.24	34.80	63.44
	Clay	%	37.00	31.70	53.00	64.00	35.20
	Classified Grading Pass	No.10 (2.00 mm) %	100.00	100.00	100.00	100.00	100.00
		No.40 (0.425 mm) %	99.52	99.26	99.90	99.92	99.96
		No.200 (0.075 mm) %	97.18	94.62	95.24	98.80	98.64
Liquid Limits		LL %	93.21	149.00	97.30	82.48	78.30
Plasticity Index		Pi %	63.85	86.04	64.21	43.83	29.75
Liquidity Index		Li	0.16	0.33	0.17	0.72	1.47
Classification			CH	MH	CH	MH	MH
Specific Gravity		Gs	2.59	2.72	2.70	2.74	2.65
Natural State	Water Content	ωn %	39.81	91.35	43.93	70.31	92.38
	Wet Density	γt gr/cm3	1.75	1.40	1.76	1.58	1.43
	Void Ratio	e	1.07	2.73	1.22	1.96	2.57
	Degree Saturaion	Sr %	1.77	1.46	97.64	98.22	95.17
Unconfined Compression Test	Compressive Strength	qu (kg/cm2)	1.08	0.74	1.56	0.48	0.84
	Remolded Strength	qr (kg/cm2)	0.92	0.46	1.25	0.45	0.56
	Sensitivity Ration	St	1.17	1.58	1.25	1.07	1.50
Triaxial Compression Test	Type of Test				CU		
	Cohesion	C (kPa)	-	-	32.00 26.00	-	21.00 18.00
	Angle of Internal Friction	Ø (deg)	-	-	17.50 24.40	-	16.70 23.20
Consolidation Test	Yield of Consolidation	Pc (kg/cm2)	3.70	6.40	-	-	-
	Compression Index	Cc	0.66	2.18	-	-	-
	Swelling Index	Cs	0.10	0.10	-	-	-

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SUMMARY OF LABORATORY TEST

JOB NAME : **KIRANA 3**
LOCATION : **KELAPA GADING - JAKARTA**

Sample No				**BH4 - UD2**	**BH4 - UD3**	**BH4 - UD4**	**BH5 - UD1**	**BH5 - UD2**
Sampling Depth			m	**31.00 - 31.50**	**35.50 - 36.00**	**38.50 - 39.00**	**5.50 - 6.00**	**8.50 - 9.00**
Gradation	Gravel		%	0.00	0.00	0.00	0.00	0.00
	Sand		%	5.70	6.72	7.16	11.12	1.76
	Silt			48.20	34.78	54.04	13.88	65.64
	Clay		%	46.10	58.50	38.80	75.00	32.60
	Classified Grading Pass	No.10 (2.00 mm)	%	100.00	100.00	100.00	99.26	100.00
		No.40 (0.425 mm)	%	99.60	99.50	98.68	94.28	99.94
		No.200 (0.075 mm)	%	94.30	93.28	92.84	88.88	98.24
Liquid Limits		LL	%	66.43	80.84	60.48	90.67	90.07
Plasticity Index		Pi	%	44.31	59.03	42.34	58.74	36.82
Liquidity Index		Li		0.27	0.31	0.22	0.35	0.98
Classification				CH	CH	CH	CH	MH
Specific Gravity		Gs		2.70	2.68	2.60	2.75	2.80
Natural State	Water Content	ωn	%	33.93	40.29	27.58	52.39	89.49
	Wet Density	γt	gr/cm3	1.88	1.79	1.90	1.69	1.43
	Void Ratio	e		0.93	1.10	0.75	1.47	2.70
	Degree Saturaion	Sr	%	98.78	98.35	95.51	97.80	92.83
Unconfined Compression Test	Compressive Strength	qu	(kg/cm2)	3.27	1.06	2.91	1.06	0.25
	Remolded Strength	qr	(kg/cm2)	2.99	0.67	2.57	0.89	0.15
	Sensitivity Ration	St		1.09	1.59	1.13	1.19	1.63
Triaxial Compression Test	Type of Test					**CU**		
	Cohesion	C	(kg/cm2)	-	-	-	17.00 / 9.00	-
	Angle of Internal Friction	Ø	(deg)	-	-	-	14.20 / 22.30	-
Consolidation Test	Yield of Consolidation	Pc	(kg/cm2)	4.40	2.70	4.00	-	-
	Compression Index	Cc		0.46	0.61	0.40	-	-
	Swelling Index	Cs		0.10	0.10	0.08	-	-

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INDEX PROPERTIES

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INDEX PROPERTIES

Project : KIRANA 3
Location of Project : Kelapa Gading
North Jakarta
Description of Soils :
Date of Testing : 02/07/12

Boring no.		BH 1	BH 1		
Sample no		UD 1	UD 2		
Depth (m)		2,50- 3,00	7,00- 7,50		
Can / Ring No.		11/h	15/k		
Wt. of can + wet soil	(gr)	60,20	68,36		
Wt. of can + dry soil	(gr)	43,69	52,62		
Wt. of can	(gr)	20,37	21,52		
Wt. of wet soil	(gr)	39,83	46,84		
Wt. of dry soil	(gr)	23,32	31,10		
Wt of water	(gr)	16,51	15,74		
Diameter of ring	(cm)	3,65	3,65		
Height of ring	(cm)	2,52	2,62		
Volume of ring	(cm3)	26,37	27,41		
W %		70,80	50,61		
Gs		2,67	2,75		
γ Wet	(gr/cm3)	1,511	1,709		
γ Dry	(gr/cm3)	0,884	1,134		
γ Sat	(gr/cm3)	1,553	1,722		
Sr		93,627	97,732		
e		2,019	1,424		
n		0,669	0,587		

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INDEX PROPERTIES

Project : KIRANA 3
Location of Project : Kelapa Gading
North Jakarta
Description of Soils :
Date of Testing : 02/07/12

Boring no.		BH 2	BH 2	BH 2	BH 2	BH 2
Sample no		UD 1	UD 2	UD 3	UD 4	UD 5
Depth (m)		32,50- 33,00	37,00- 37,50	41,50- 42,00	46,00- 46,50	49,00- 49,50
Can / Ring No.		13/n	5/d	8/m	7/s	10/w
Wt. of can + wet soil	(gr)	70,46	71,24	69,80	66,80	57,50
Wt. of can + dry soil	(gr)	58,60	57,42	57,65	53,65	39,87
Wt. of can	(gr)	21,62	21,62	20,56	20,62	20,57
Wt. of wet soil	(gr)	48,84	49,62	49,24	46,18	36,93
Wt. of dry soil	(gr)	36,98	35,80	37,09	33,03	19,30
Wt of water	(gr)	11,86	13,82	12,15	13,15	17,63
Diameter of ring	(cm)	3,65	3,65	3,65	3,65	3,65
Height of ring	(cm)	2,67	2,64	2,53	2,52	2,53
Volume of ring	(cm3)	27,94	27,62	26,47	26,37	26,47
W %		32,07	38,60	32,76	39,81	91,35
Gs		2,59	2,65	2,62	2,59	2,72
γ Wet	(gr/cm3)	1,748	1,796	1,860	1,751	1,395
γ Dry	(gr/cm3)	1,324	1,296	1,401	1,253	0,729
γ Sat	(gr/cm3)	1,813	1,807	1,866	1,769	1,461
Sr		86,826	97,916	98,651	96,584	90,984
e		0,957	1,045	0,870	1,068	2,731
n		0,489	0,511	0,465	0,516	0,732

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INDEX PROPERTIES

Project : KIRANA 3
Location of Project : Kelapa Gading
North Jakarta
Description of Soils :
Date of Testing : 02/07/12

Boring no.		BH 3	BH 3	BH 5	BH 5
Sample no		UD 1	UD 2	UD 1	UD 2
Depth (m)		2,50- 3,00	7,00- 7,50	5,50- 6,00	8,50- 9,00
Can / Ring No.		2/o	12/g	14/b	17/f
Wt. of can + wet soil	(gr)	70,29	62,55	64,89	60,18
Wt. of can + dry soil	(gr)	55,44	45,26	49,53	41,54
Wt. of can	(gr)	21,64	20,67	20,21	20,71
Wt. of wet soil	(gr)	48,65	41,88	44,68	39,47
Wt. of dry soil	(gr)	33,80	24,59	29,32	20,83
Wt of water	(gr)	14,85	17,29	15,36	18,64
Diameter of ring	(cm)	3,65	3,65	3,65	3,65
Height of ring	(cm)	2,65	2,54	2,52	2,63
Volume of ring	(cm3)	27,73	26,58	26,37	27,52
W %		43,93	70,31	52,39	89,49
Gs		2,70	2,74	2,75	2,80
γ Wet	(gr/cm3)	1,755	1,576	1,694	1,434
γ Dry	(gr/cm3)	1,219	0,925	1,112	0,757
γ Sat	(gr/cm3)	1,768	1,588	1,708	1,487
Sr		97,635	98,223	97,796	92,830
e		1,215	1,961	1,473	2,699
n		0,549	0,662	0,596	0,730

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INDEX PROPERTIES

Project : KIRANA 3
Location of Project : Kelapa Gading
North Jakarta
Description of Soils :
Date of Testing : 02/07/12

Boring no.		BH 4	BH 4	BH 4	BH 4
Sample no		UD 1	UD 2	UD 3	UD 4
Depth (m)		4,00- 4,50	31,00- 31,50	35,50- 36,00	38,50- 39,00
Can / Ring No.		11/p	4/k	15/q	16/h
Wt. of can + wet soil	(gr)	58,00	73,91	70,65	72,85
Wt. of can + dry soil	(gr)	39,93	60,73	56,54	61,58
Wt. of can	(gr)	20,37	21,89	21,52	20,71
Wt. of wet soil	(gr)	37,63	52,02	49,13	52,14
Wt. of dry soil	(gr)	19,56	38,84	35,02	40,87
Wt of water	(gr)	18,07	13,18	14,11	11,27
Diameter of ring	(cm)	3,65	3,65	3,65	3,65
Height of ring	(cm)	2,52	2,65	2,62	2,63
Volume of ring	(cm3)	26,37	27,73	27,41	27,52
W %		92,38	33,93	40,29	27,58
Gs		2,65	2,70	2,68	2,60
γ Wet	(gr/cm3)	1,427	1,876	1,792	1,895
γ Dry	(gr/cm3)	0,742	1,401	1,277	1,485
γ Sat	(gr/cm3)	1,462	1,882	1,801	1,914
Sr		95,171	98,778	98,347	95,511
e		2,572	0,928	1,098	0,751
n		0,720	0,481	0,523	0,429

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LAMPIRAN – LAMPIRAN

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DATA SONDIR & BOR

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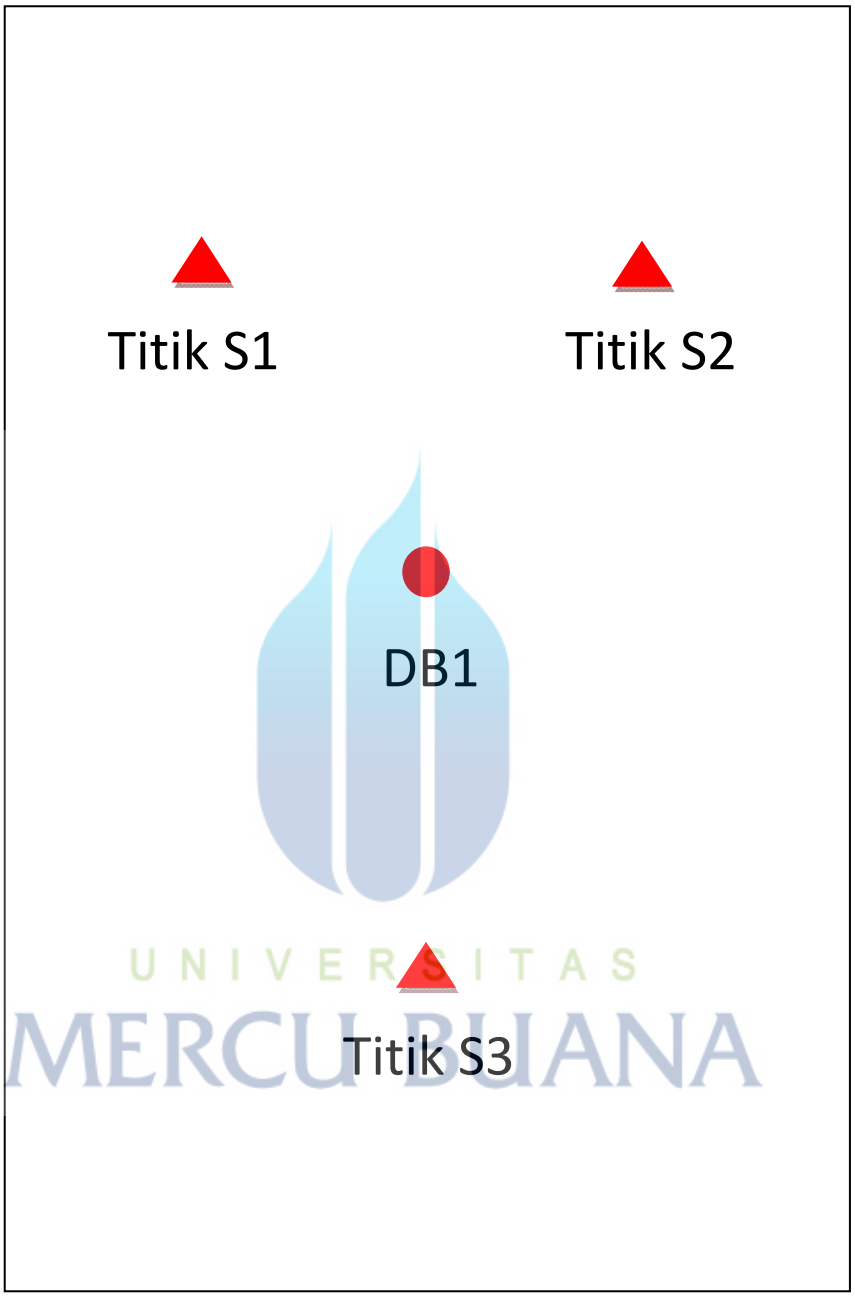

JL. PROKLAMASI

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Dokumentasi :

a. Lokasi Proyek Jln. Proklamasi No. 88, Menteng

b. Data Bor DB1

c. Sondir S1

d. Sondir S2

e. Sondir S3

f. Bacaan Manometer test Sondir

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BORING LOG

PROJECT : BANGUNAN 6 LANTAI

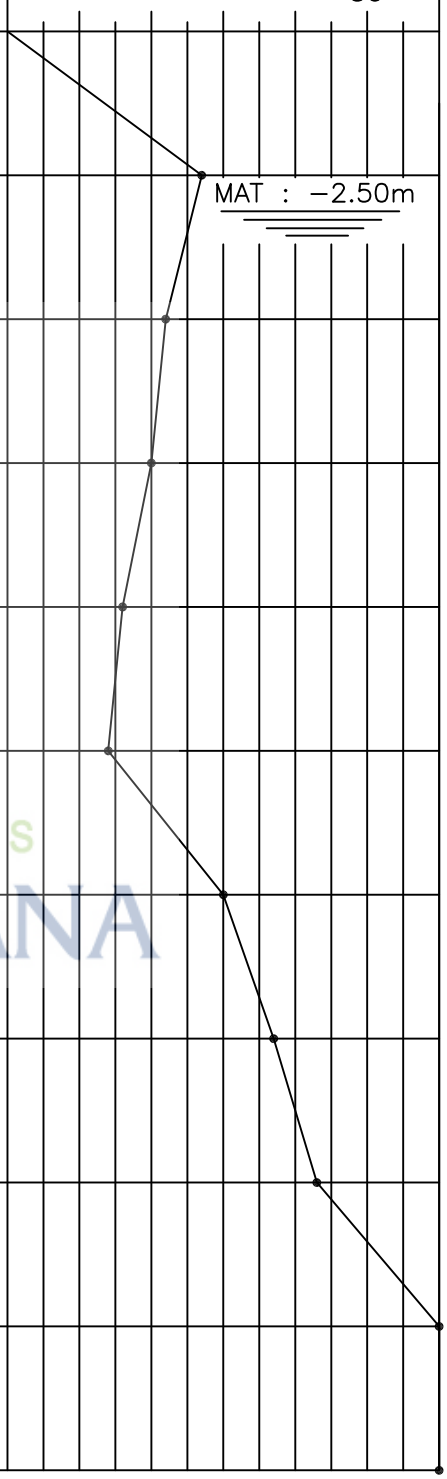
LOCATION : JL. PROKLAMASI NO. 88, JAKARTA

DATE : 31/07–02/08/2013

BORING : DB1

DEPTH (m)	INTERVAL	SYIMBOL	SOIL DESCRIPTION	150 mm	150 mm	150 mm	N BLOWS
1.00			Lempung, very stiff, coklat kekuningan				
2.00				8	12	15	27
3.00							
4.00				7	10	12	22
5.00							
6.00				7	9	11	20
7.00			Lanau kelempungan, very stiff to stiff coklat				
8.00				6	7	9	16
9.00							
10.00				6	6	8	14
11.00			Lempung, hard coklat kekuningan				
12.00				8	12	18	30
13.00							
14.00				10	16	21	37
15.00			Lanau kelempungan, hard kuning coklatan				
16.00				12	18	25	43
17.00							
18.00				19	30	40	70
19.00							
20.00				40	40	40	80

SPT. CURVE



LEGEND

- UNDISTURBED SAMPLE
- SPT
- CLAY
- SILT
- CLAYEYSILT
- SILTYCLAY
- ORGANIK
- SAND

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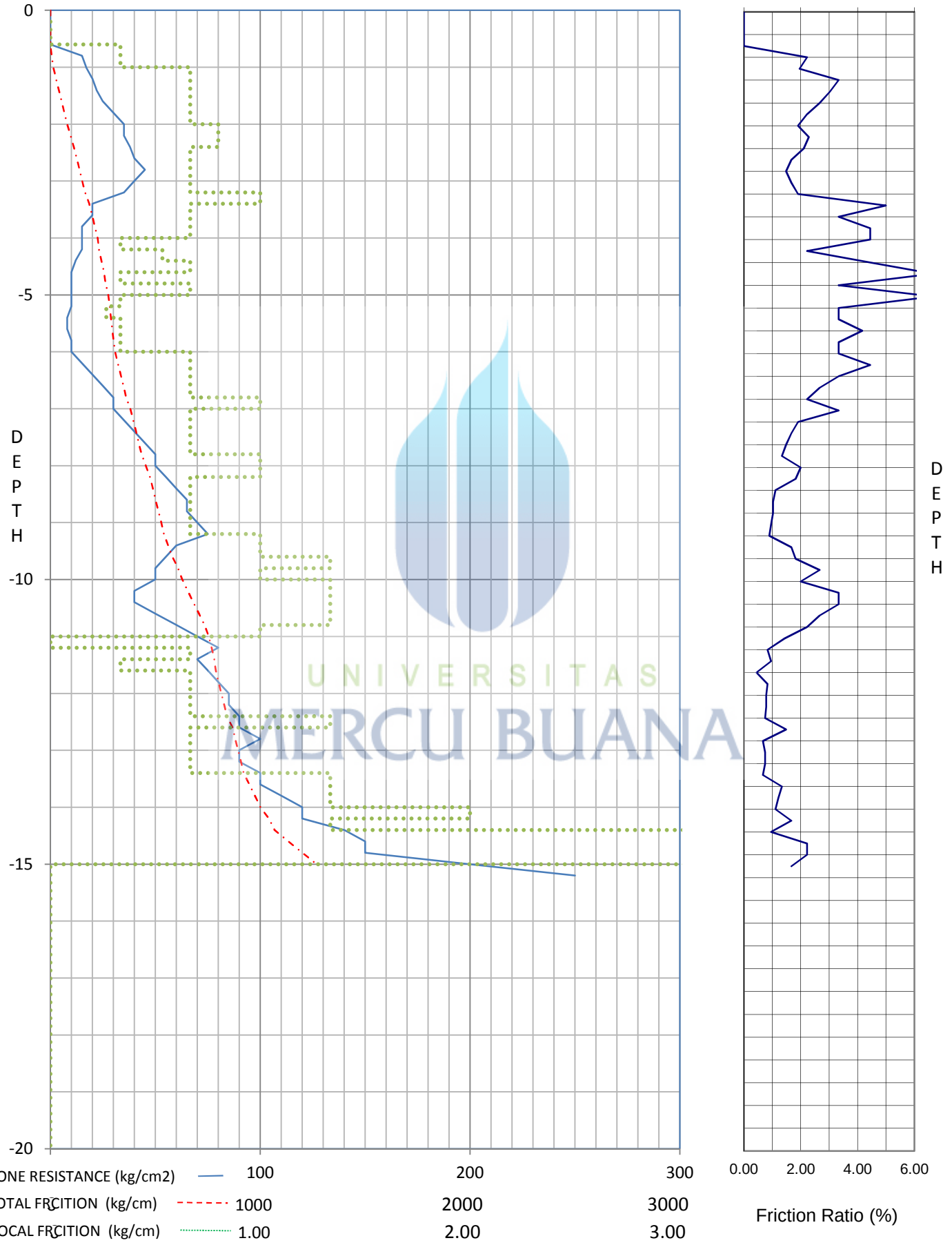
PUTRA DWI MANDIRI

CPT

Proyek : BANGUNAN 6 LANTAI
Point : S1
Location : Jln. Proklamasi No. 88, Jakarta

Elev. :
Test by : Aji
Date : 01/08/2013



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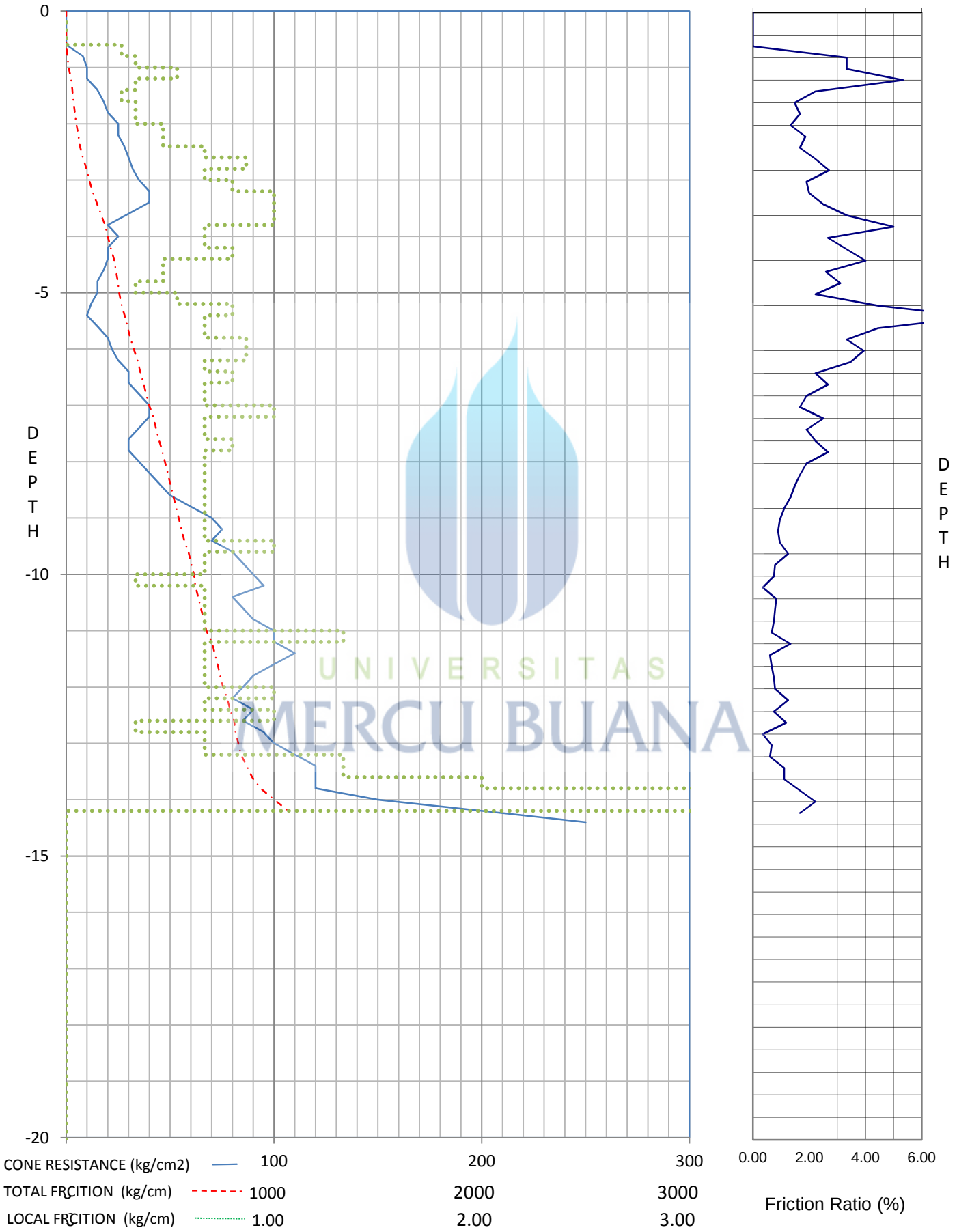
PUTRA DWI MANDIRI

CPT

Proyek : **BANGUNAN 6 LANTAI**
Point : **S2**
Location : **Jln. Proklamasi No. 88, Jakarta**

Elev. :
Test by : **Aji**
Date : **01/08/2013**



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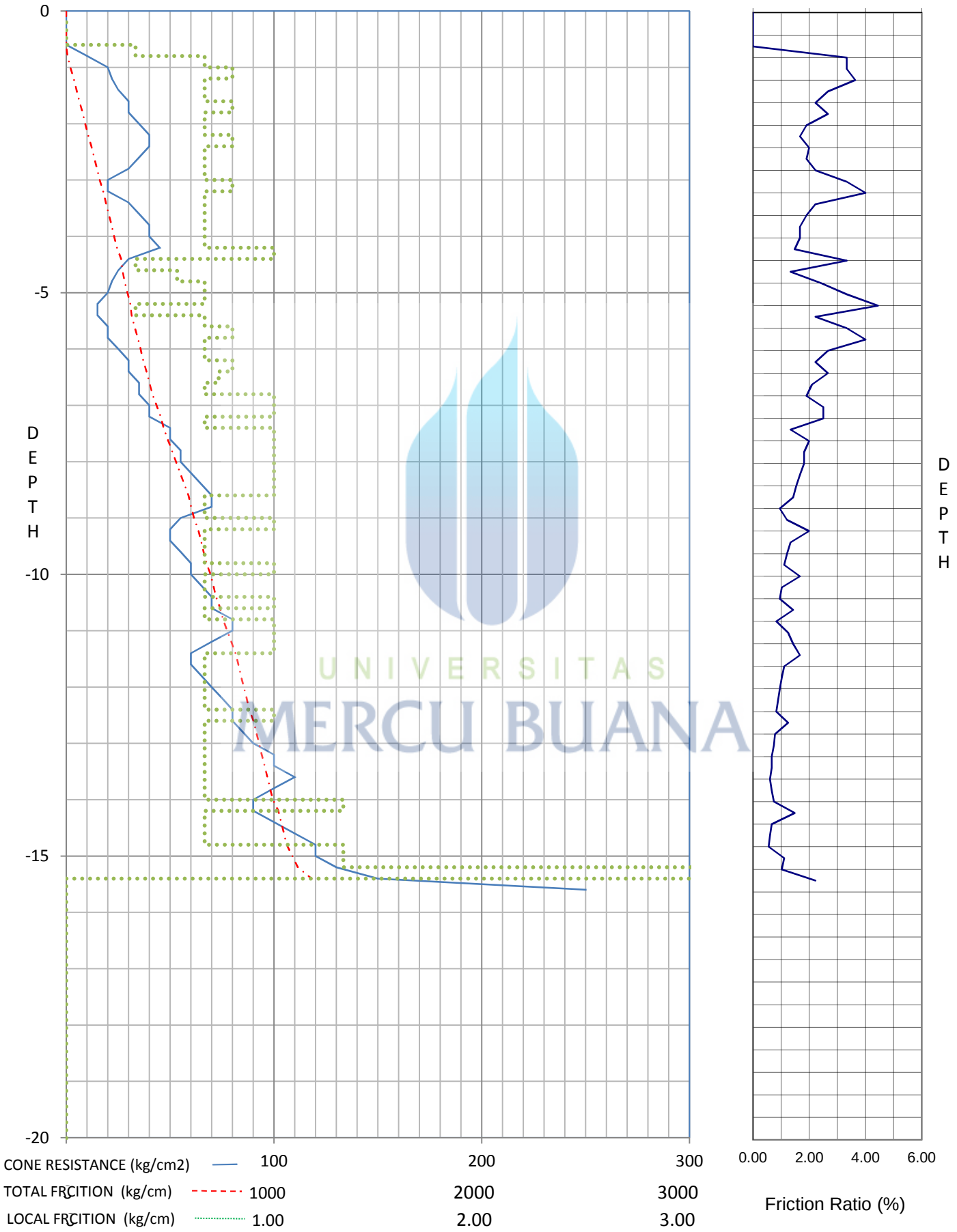
PUTRA DWI MANDIRI

CPT

Proyek : **BANGUNAN 6 LANTAI**
Point : **S3**
Location : **Jln. Proklamasi No. 88, Jakarta**

Elev. :
Test by : **Aji**
Date : **02/08/2013**



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TABEL DAYA DUKUNG TEKAN & TARIK PONDASI

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ALLOWABLE BEARING CAPACITY OF SINGLE PILE
(BASED ON NSPT DATA)

Reese's Method — $SF_{friction}$ = 2.50

DB.I — SF_{tip} = 2.50

Depth	Li	Desc	N	BORED PILE					
(m)	(m)	C/S	SPT	BP Φ 30	BP Φ 40	BP Φ 50	BP Φ 60	BP Φ 80	BP Φ100
2.00	2.00	CLAY	27	12.04	18.09	25.2	33.2	52.5	75.7
4.00	2.00	CLAY	22	17.27	24.68	32.9	42.0	62.6	86.6
6.00	2.00	CLAY	20	22.46	31.45	41.2	51.7	75.0	101.2
8.00	2.00	CLAY	16	26.20	36.14	46.7	57.8	81.9	108.4
10.00	2.00	CLAY	14	29.73	40.69	52.2	64.2	89.8	117.6
12.00	2.00	CLAY	30	42.52	60.09	79.3	100.3	147.3	201.1
14.00	2.00	CLAY	37	51.84	73.30	96.9	122.5	180.1	246.0
16.00	2.00	CLAY	43	60.90	86.06	113.7	143.7	211.0	288.1
18.00	2.00	CLAY	70	71.63	101.79	135.1	171.5	253.8	348.7
20.00	2.00	CLAY	80	79.17	111.83	147.6	186.6	273.9	373.8

Meyerhof's Method — $SF_{friction}$ = 2.50

DB.I — SF_{tip} = 2.50

Depth	Li	Desc	N	SQUARE PILE		
(m)	(m)	C/S	SPT	□ 30 X 30	□ 35 X 35	□ 40 X 40
2.00	2.00	CLAY	27	14.5	18.0	21.9
4.00	2.00	CLAY	22	20.4	24.8	29.4
6.00	2.00	CLAY	20	26.4	31.6	37.1
8.00	2.00	CLAY	16	30.7	36.4	42.4
10.00	2.00	CLAY	14	34.7	41.1	47.6
12.00	2.00	CLAY	30	51.0	61.4	72.3
14.00	2.00	CLAY	37	62.9	75.7	89.2
16.00	2.00	CLAY	43	74.4	89.5	105.4
18.00	2.00	CLAY	70	92.8	112.6	133.8
20.00	2.00	CLAY	80	105.6	128.2	152.3

Meyerhof's Method — $SF_{friction}$ = 2.50

DB.I — SF_{tip} = 2.50

Depth	Li	Desc	N	Spun Pile		
(m)	(m)	C/S	SPT	Ø 30	Ø 40	Ø 50
2.00	2.00	CLAY	27	11.36	17.18	24.0
4.00	2.00	CLAY	22	16.04	23.04	30.9
6.00	2.00	CLAY	20	20.72	29.14	38.3
8.00	2.00	CLAY	16	24.06	33.29	43.1
10.00	2.00	CLAY	14	27.24	37.38	48.0
12.00	2.00	CLAY	30	40.04	56.77	75.2
14.00	2.00	CLAY	37	49.35	69.98	92.7
16.00	2.00	CLAY	43	58.41	82.75	109.5
18.00	2.00	CLAY	70	72.82	105.00	141.1
20.00	2.00	CLAY	80	82.90	119.57	160.8

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ALLOWABLE TENSION CAPACITY OF SINGLE PILE
(BASED ON NSPT DATA)

Proyek : Bangunan 6 Lantai
Lokasi : Jln. Proklamasi No. 88, Menteng
Jakarta

Reese's Method

DB.I $SF_{friction}$ = 3.00

Depth	Li	Desc	N	faktor	cu	qd	Fi	LiFi	ΣLiFi	BORED PILE					
(m)	(m)	C/S	SPT	adhesi	(t/m2)	(t/m2)	(t/m2)	(t/m)	(t/m)	BP Φ 30	BP Φ 40	BP Φ 50	BP Φ 60	BP Φ 80	BP Φ100
2.00	2.00	CLAY	27	0.55	18.00	162	9.90	19.80	19.80	4.69	6.41	8.20	10.06	14.02	18.27
4.00	2.00	CLAY	22	0.55	14.67	132	8.07	16.13	35.93	8.58	11.74	15.05	18.51	25.88	33.86
6.00	2.00	CLAY	20	0.55	13.33	120	7.33	14.67	50.60	12.14	16.64	21.36	26.31	36.89	48.38
8.00	2.00	CLAY	16	0.55	10.67	96	5.87	11.73	62.33	15.06	20.68	26.60	32.83	46.18	60.74
10.00	2.00	CLAY	14	0.55	9.33	84	5.13	10.27	72.60	17.65	24.29	31.31	38.70	54.61	72.03
12.00	2.00	CLAY	30	0.55	30.00	270	10.00	20.00	92.60	22.39	30.76	39.57	48.85	68.75	90.45
14.00	2.00	CLAY	37	0.55	37.00	333	10.00	20.00	112.60	27.12	37.22	47.84	58.99	82.88	108.87
16.00	2.00	CLAY	43	0.55	43.00	387	10.00	20.00	132.60	31.86	43.68	56.11	69.14	97.01	127.30
18.00	2.00	CLAY	70	0.55	70.00	500	10.00	20.00	152.60	36.59	50.15	64.38	79.29	111.15	145.72
20.00	2.00	CLAY	80	0.55	80.00	500	10.00	20.00	172.60	41.33	56.61	72.65	89.44	125.28	164.14

Meyerhof's Method

DB.I $SF_{friction}$ = 3.00

Depth	Li	Desc	N	faktor	cu	qd	Fi	LiFi	ΣLiFi	SQUARE PILE		
(m)	(m)	C/S	SPT	adhesi	(t/m2)	(t/m2)	(t/m2)	(t/m)	(t/m)	☐ 30 X 30	☐ 35 X 35	☐ 40 X 40
2.00	2.00	CLAY	27	0.50	18.00	162	9.00	18.00	18.00	20.7	6.5	7.5
4.00	2.00	CLAY	22	0.50	14.67	132	7.33	14.67	32.67	10.0	11.8	13.7
6.00	2.00	CLAY	20	0.50	13.33	120	6.67	13.33	46.00	14.2	16.8	19.5
8.00	2.00	CLAY	16	0.50	10.67	96	5.33	10.67	56.67	17.6	20.9	24.2
10.00	2.00	CLAY	14	0.50	9.33	84	4.67	9.33	66.00	20.6	24.5	28.5
12.00	2.00	CLAY	30	0.50	30.00	270	10.00	20.00	86.00	26.7	31.6	36.7
14.00	2.00	CLAY	37	0.50	37.00	333	10.00	20.00	106.00	32.7	38.7	44.9
16.00	2.00	CLAY	43	0.50	43.00	387	10.00	20.00	126.00	38.7	45.9	53.2
18.00	2.00	CLAY	70	0.50	70.00	630	10.00	20.00	146.00	44.8	53.0	61.4
20.00	2.00	CLAY	80	0.50	80.00	720	10.00	20.00	166.00	50.8	60.1	69.7

Meyerhof's Method

DB.I $SF_{friction}$ = 3.00

Depth	Li	Desc	N	faktor	cu	qd	Fi	LiFi	ΣLiFi	Spun Pile		
(m)	(m)	C/S	SPT	adhesi	(t/m2)	(t/m2)	(t/m2)	(t/m)	(t/m)	Ø 30	Ø 40	Ø 50
2.00	2.00	CLAY	27	0.50	18.00	162	9.00	18.00	18.00	4.3	5.9	7.5
4.00	2.00	CLAY	22	0.50	14.67	132	7.33	14.67	32.67	7.9	10.8	13.9
6.00	2.00	CLAY	20	0.50	13.33	120	6.67	13.33	46.00	11.1	15.3	19.7
8.00	2.00	CLAY	16	0.50	10.67	96	5.33	10.67	56.67	13.8	19.0	24.5
10.00	2.00	CLAY	14	0.50	9.33	84	4.67	9.33	66.00	16.2	22.4	28.9
12.00	2.00	CLAY	30	0.50	30.00	270	10.00	20.00	86.00	20.9	28.8	37.2
14.00	2.00	CLAY	37	0.50	37.00	333	10.00	20.00	106.00	25.7	35.3	45.4
16.00	2.00	CLAY	43	0.50	43.00	387	10.00	20.00	126.00	30.4	41.7	53.7
18.00	2.00	CLAY	70	0.50	70.00	630	10.00	20.00	146.00	35.1	48.2	62.0
20.00	2.00	CLAY	80	0.50	80.00	720	10.00	20.00	166.00	39.9	54.7	70.2

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DATA LABORATORIUM

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SUMMARY OF LABORATORY TEST RESULT

PROJECT : PROKLAMASI
LOCATION : PROKLAMASI

Sample No.								
Bore Hole No.			DB - 1	DB - 1	DB - 1			
Sample Depth			1.50-2.00 M	3.50-4.00 M	5.50-6.00 M			
Gradition	Gravel	%	0	0	0			
	sand	%	8.78	7.38	5.74			
	Silt	%	47.47	50.12	52.26			
	Clay	%	43.75	42.50	42.00			
Liquit Limit		%	71.63	75.33	76.58			
Plastic Limit		%	36.01	34.01	40.53			
Plasticity indeks		%	35.62	41.32	36.05			
Shrinkage Limit		%						
Specific Grafity			2.612	2.596	2.588			
Dry Density		t/m^3	1.171	1.160	1.142			
Coefficient of Permeability		cm/sec						
Natural Strte	Water Content	%	38.56	37.62	40.32			
	Wet Density	t/m^3	1.623	1.596	1.602			
	Void Ratio		1.230	1.238	1.267			
	Porosity		0.552	0.553	0.559			
	Degree of Saturation		81.89	78.86	82.37			
unc. Comp	Compresssive strength	kg/cm^2						
	Sensivity							
Triaxial	Cohesion	kg/cm^2						
	Cohesion eff.	kg/cm^2						
	Angle of internal friction							
	Angle of internal friction eff.							
D.S	Cohesion	kg/cm^2	0.15	0.21	0.22			
	Angle of internal friction	°	14.58	14.6	15.3			
C.C	Coeff.of consolidation	cm/sec	6.385E-04	7.163E-04	6.527E-04			
	Compresssionindex		0.197	0.386	0.215			
Comp tion	Optimum Moisture Content							
	Max.Dry Density	t/m^3						
CBR	CBR	%						
	Dry density	t/m^3						
	Water Content	%						
	Test condition							
	Sample condition							
Swelling		kg/cm^2						

Remarks :

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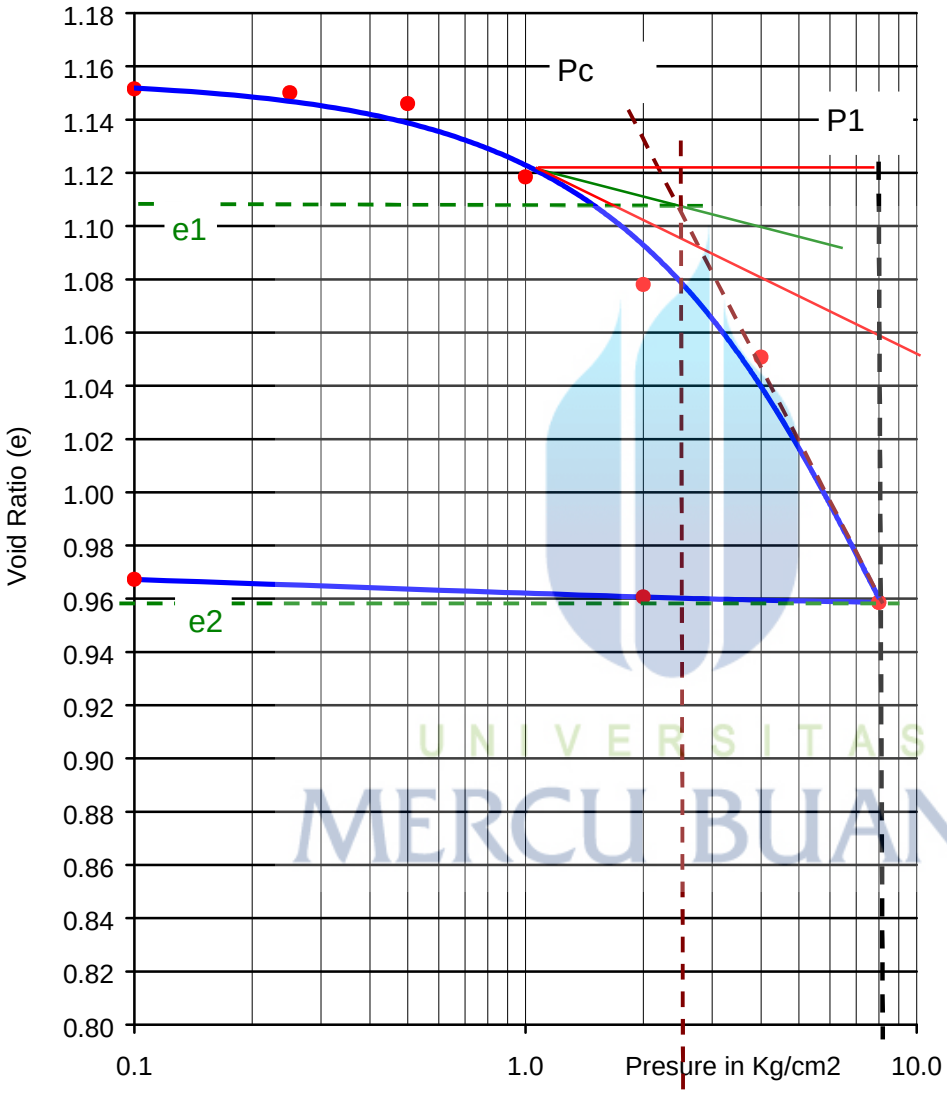
CONSOLIDATION TEST

Project	:	PROKLAMASI		Insitu Void ratio ,Eo	:	1.151	
Location	:	PROKLAMASI		Sample Area	:	38.50	cm^2
Date	:	0		Sample Height	:	2.0	cm
Test by	:	0					
Drilling No.	:	DB - 1					
Depth	:	1,50-2,00	m				

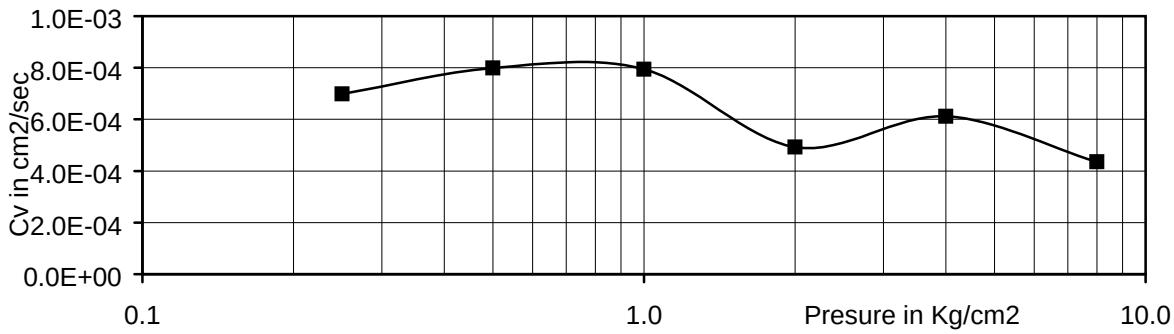


Pc (kg/cm2)	:	**1.4**
P1 (kg/cm2)	:	8.000
e1	:	**1.11**

Cc = (e1-e2)/log(p1/pc)

Cc	:	***0.197***
Cv	:	***6.385E-04***

Compression Index ,Cc = 0.197



Coeff.Consolidation ,Cv = 6.385E-04 cm^2 / sec

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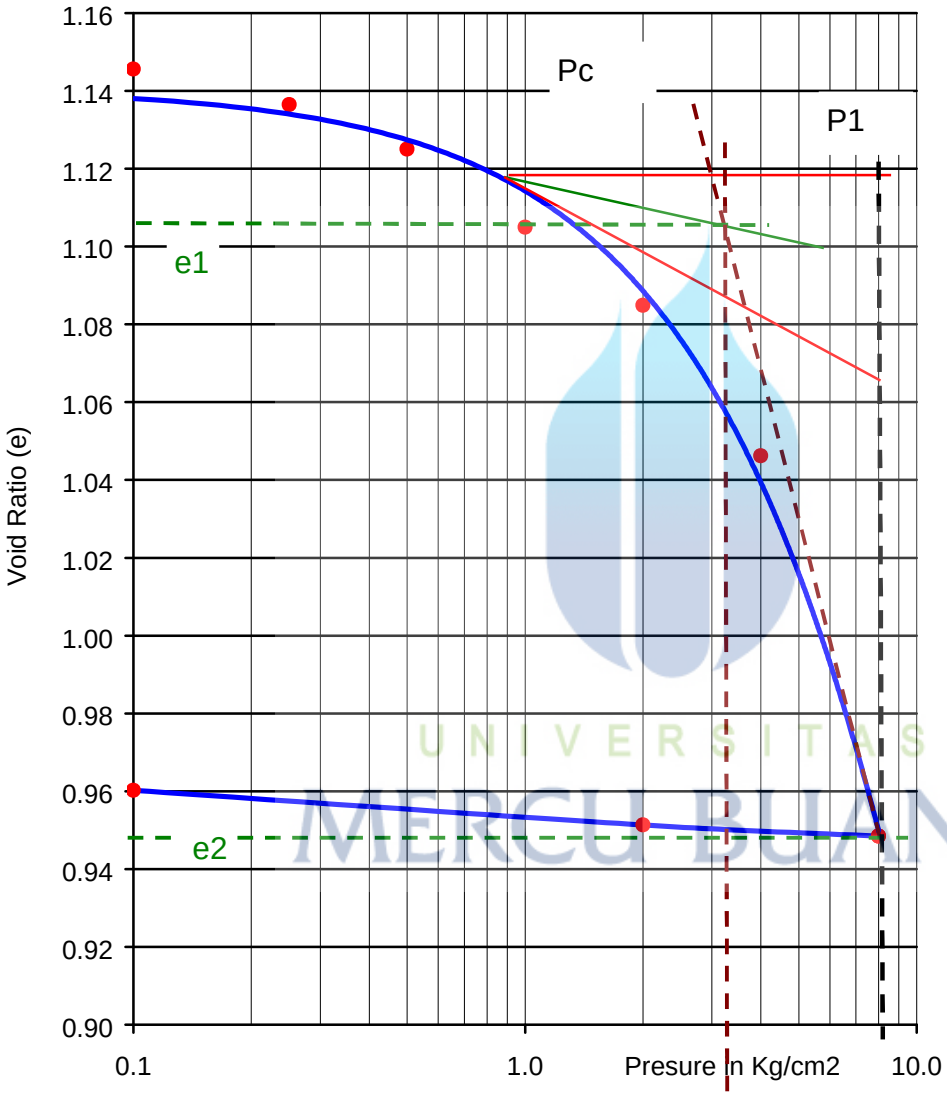
CONSOLIDATION TEST

Project	:	PROKLAMASI		Insitu Void ratio ,Eo	:	1.147	
Location	:	PROKLAMASI		Sample Area	:	38.50	cm^2
Date	:	0		Sample Height	:	2	cm
Test by	:	0					
Drilling No.	:	DB - 1					
Depth	:	3,50-4,00	m				

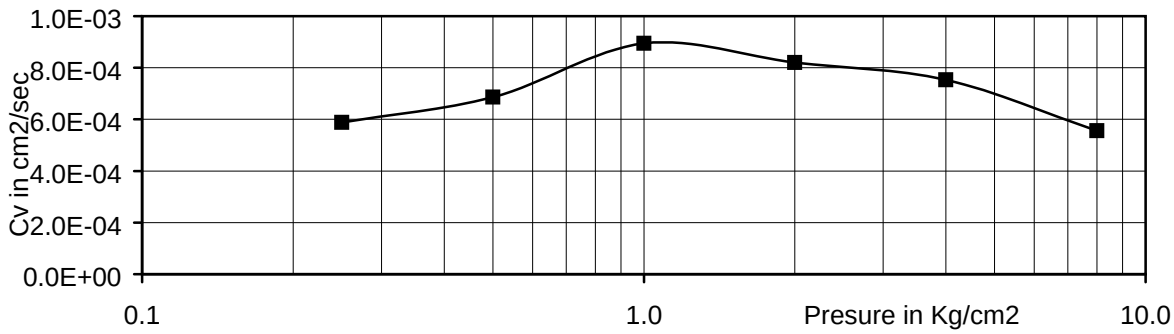


Pc (kg/cm2)	:	**3.2**
P1 (kg/cm2)	:	8.000
e1	:	**1.105**

Cc = (e1-e2)/log(p1/pc)

Cc	:	***0.386***
Cv	:	***7.163E-04***

Compression Index ,Cc = 0.386



Coeff.Consolidation ,Cv = 7.163E-04 cm^2 / sec

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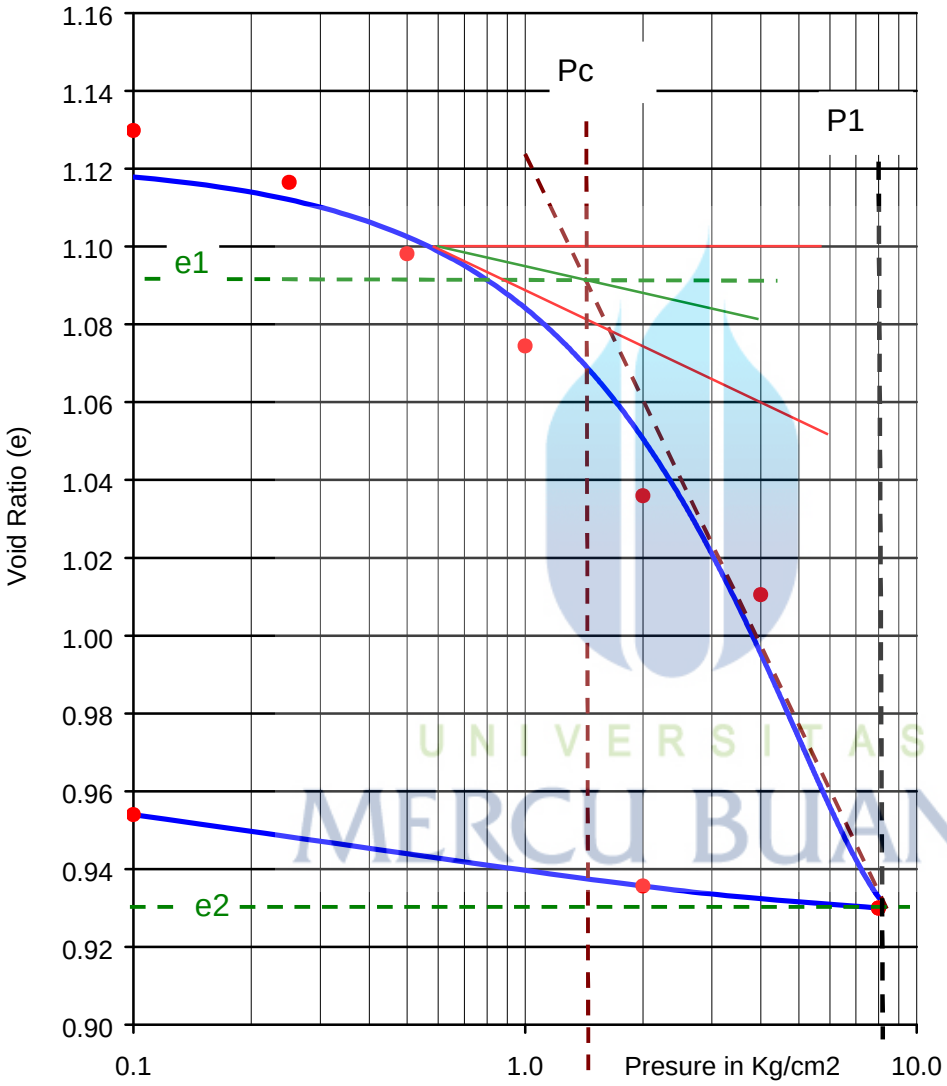
CONSOLIDATION TEST

Project	:	PROKLAMASI
Location	:	PROKLAMASI
Date	:	0
Test by	:	0
Drilling No.	:	DB - 1
Depth	:	3,50-4,00 m

Insitu Void ratio ,Eo	:	1.131	
Sample Area	:	38.50	cm^2
Sample Height	:	2	cm



Pc (kg/cm2)	:	**1.5**
P1 (kg/cm2)	:	8.000
e1	:	**1.092**

Cc = (e1-e2)/log(p1/pc)

Cc	:	***0.215***
Cv	:	***6.527E-04***

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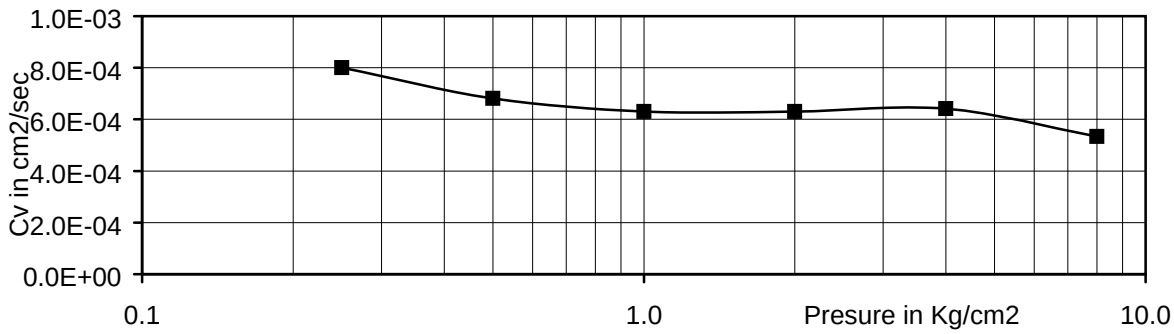
Compression Index ,Cc = 0.215



Coeff.Consolidation ,Cv = 6.527E-04 cm^2 / sec

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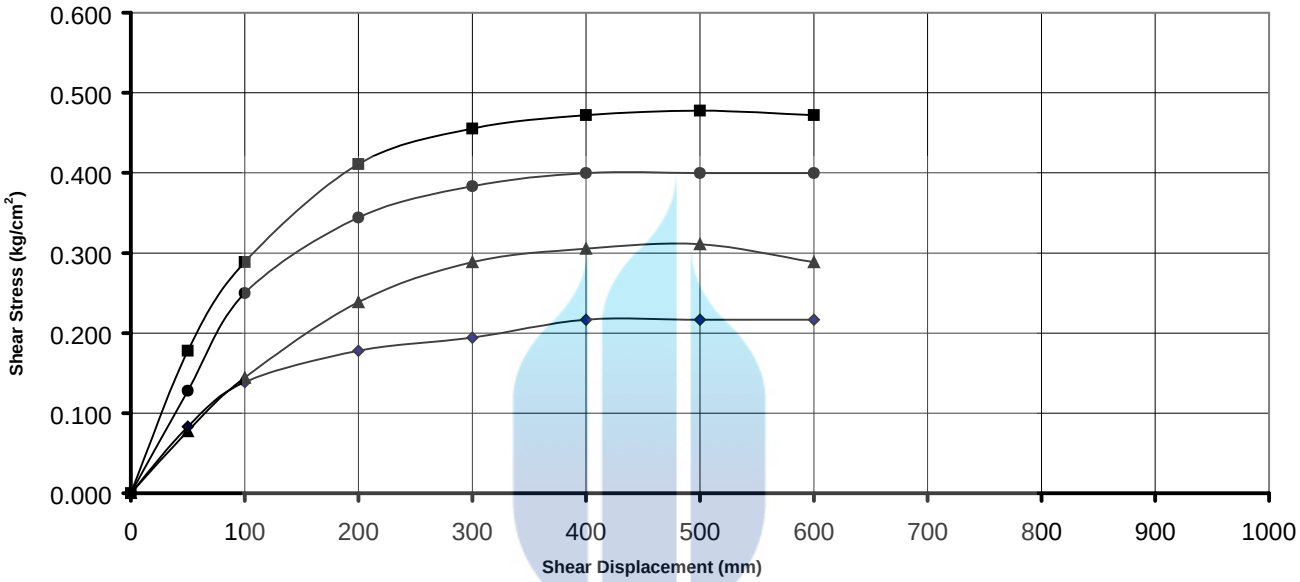
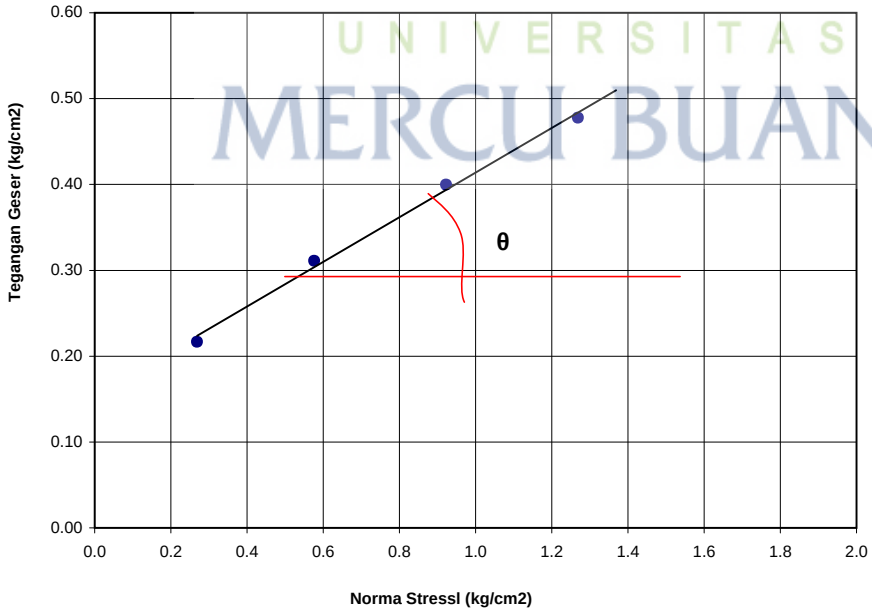
DIRECT SHEAR TEST

Project	: PROKLAMASI		**Drilling No.**	: DB - 1	
Location	: PROKLAMASI		**Depth**	: 1,50 - 2,00	m
Date	: 0		**LCR**	: 0.1444	
Tested by	: JHON		**Sample**	: 0	

Grafik Shear Displacement VS Shear Stress





Teg.Geser Max. kg/cm2		Teg.Normal kg/cm2	
A =	0.217	A =	0.269
B =	0.311	B =	0.577
C =	0.400	C =	0.923
D =	0.478	D =	1.269

Slope 0.2602

C = 0.15 kg/cm^2

θ = 14.6

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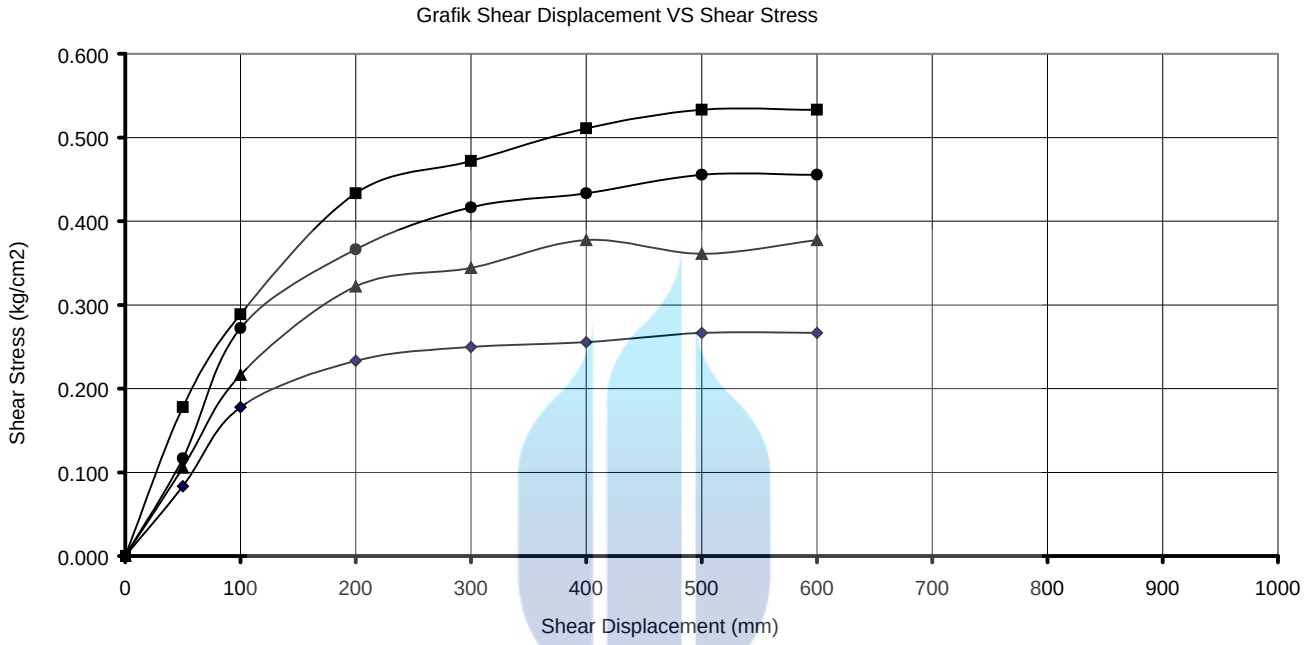
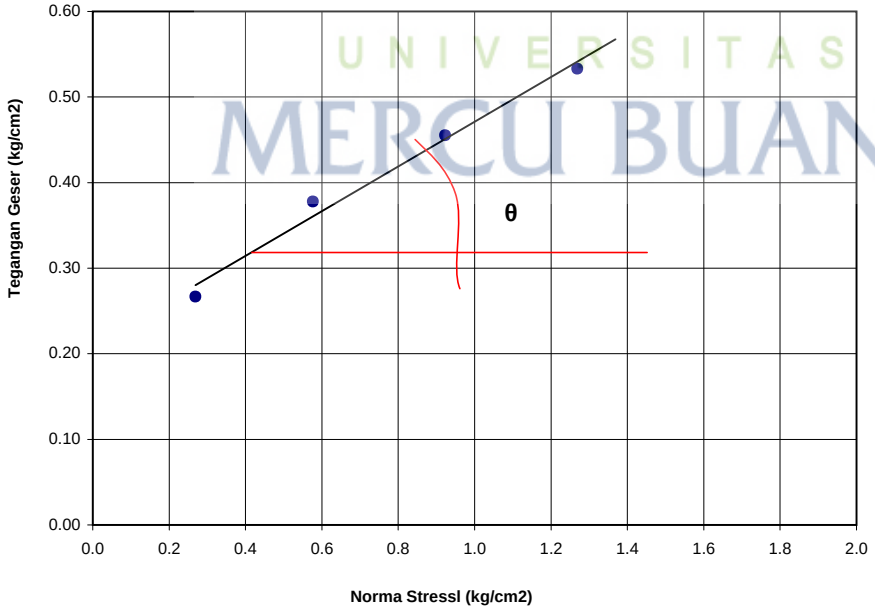
DIRECT SHEAR TEST

Project	: PROKLAMASI		**Drilling No.**	: DB - 1	
Location	: PROKLAMASI		**Depth**	: 3,50 - 4,00	m
Date	: 0		**LCR**	: 0.1444	
Tested by	: JHON		**Sample**	: 0	





Teg.Geser Max. kg/cm2		Teg.Normal kg/cm2	
A =	0.267	A =	0.269
B =	0.378	B =	0.577
C =	0.455	C =	0.923
D =	0.533	D =	1.269

Slope 0.2614

C = 0.21 kg/cm2

θ = 14.6

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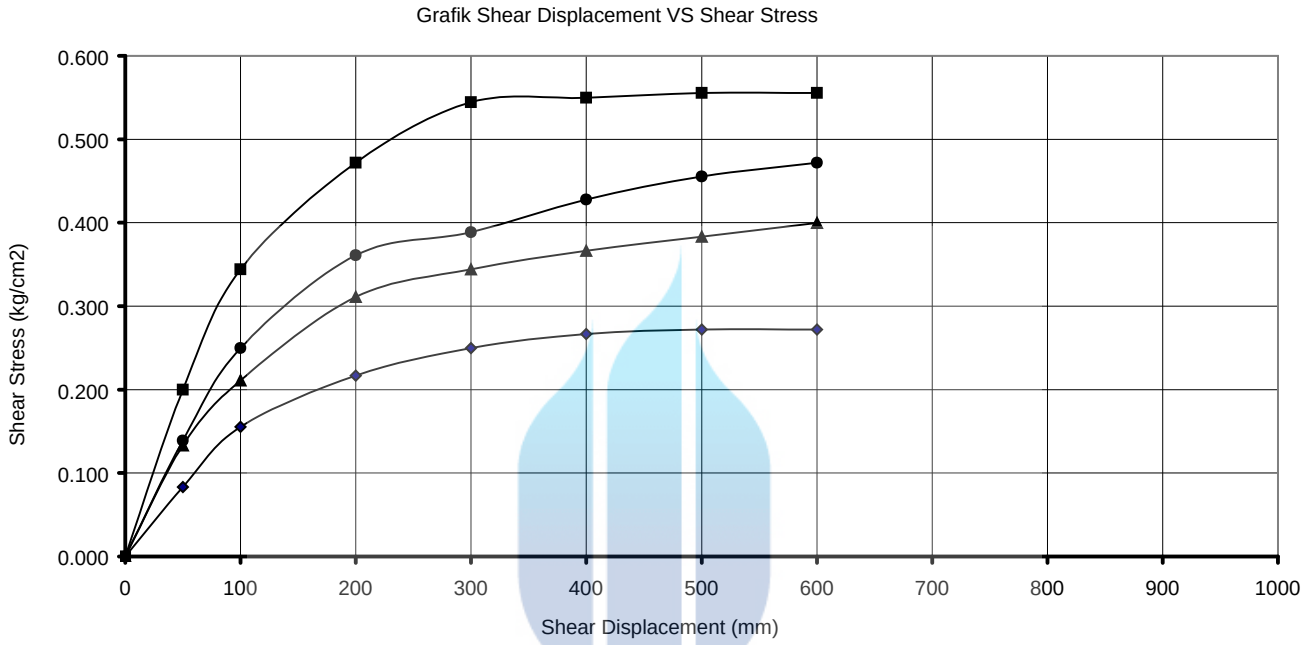
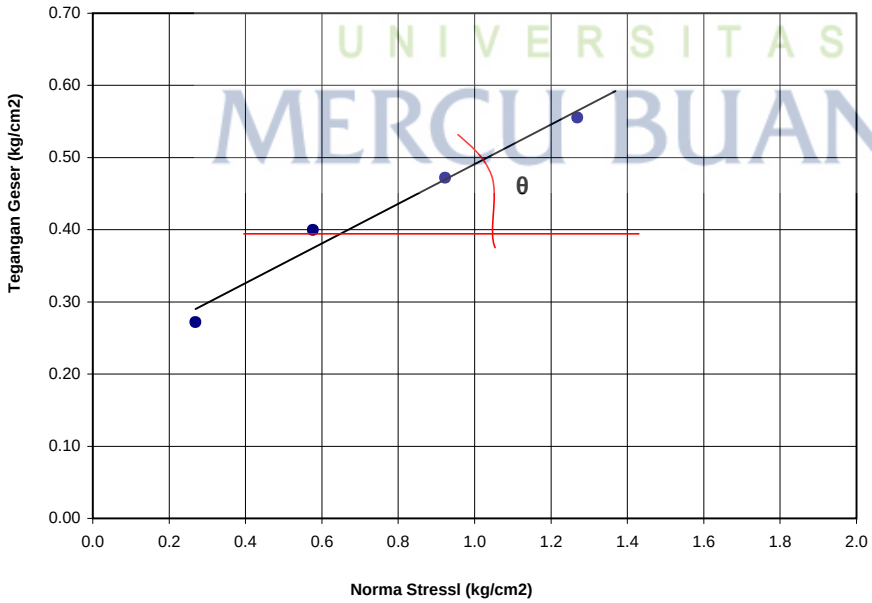
DIRECT SHEAR TEST

Project	: PROKLAMASI		**Drilling No.**	: DB - 1	
Location	: PROKLAMASI		**Depth**	: 5,50-6,00	m
Date	: 0		**LCR**	: 0.1444	
Tested by	: JHON		**Sample**	: 0	





Teg.Geser Max. kg/cm2		Teg.Normal kg/cm2	
A =	0.272	A =	0.269
B =	0.400	B =	0.577
C =	0.472	C =	0.923
D =	0.555	D =	1.269

Slope 0.2744

C = 0.216 kg/cm2

θ = 15.3

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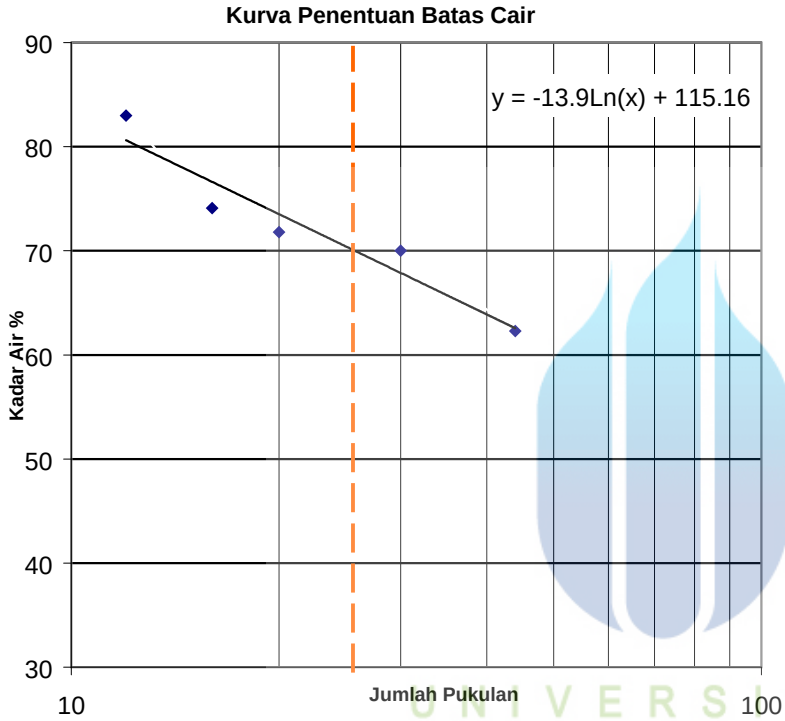
ATTERBERG LIMITS

PROJECT : PROKLAMASI
LOCATION : PROKLAMASI
DATE 0
TESTED BY 0
Drilling No. : DB - 1
Depth : 1.50-2.00 M



DARI GRFIK DIDAPAT :

LIQUIT LIMIT (LL)	: 70.42	%
PLATIC LIMIT (PL)	: 35.41	%
PLASTICITY INDEX (IP)	: 35.01	%

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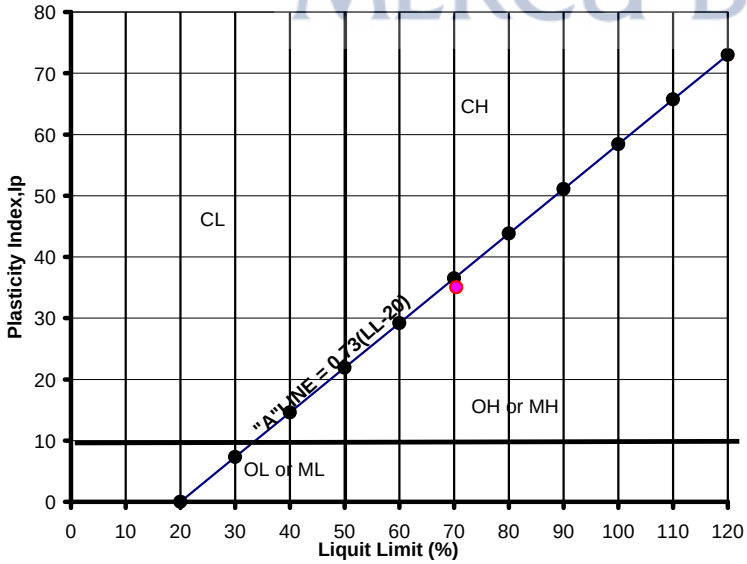
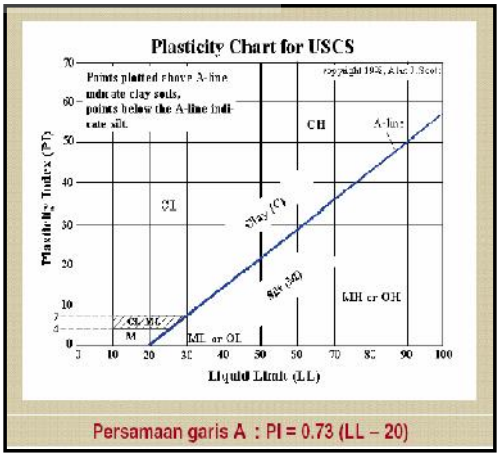
Clasification : MH





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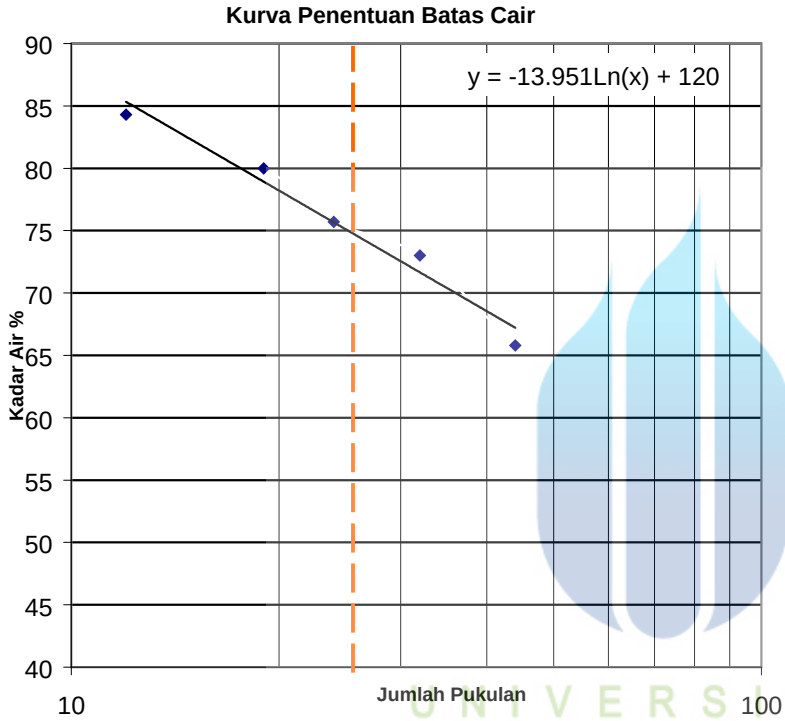
ATTERBERG LIMITS

PROJECT : PROKLAMASI
LOCATION : PROKLAMASI
DATE 0
TESTED BY 0
Drilling No. : DB - 1
Depth : 3.50-4.00 M



DARI GRFIK DIDAPAT :

LIQUIT LIMIT (LL)	: 75.09	%
PLATIC LIMIT (PL)	: 33.77	%
PLASTICITY INDEX (IP)	: 41.32	%

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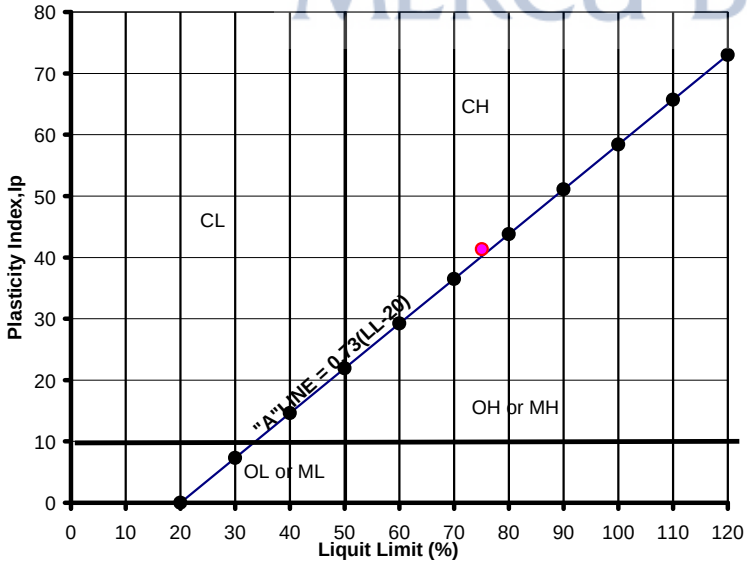
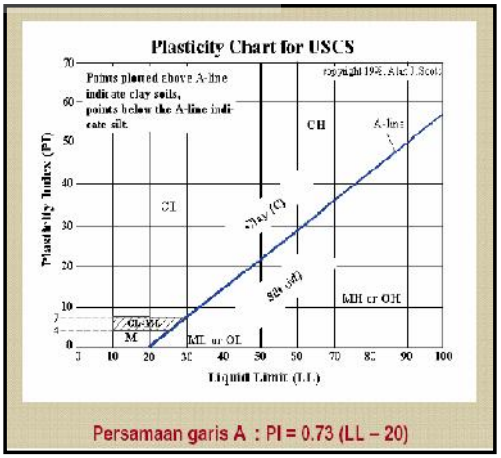
Clasification : CH





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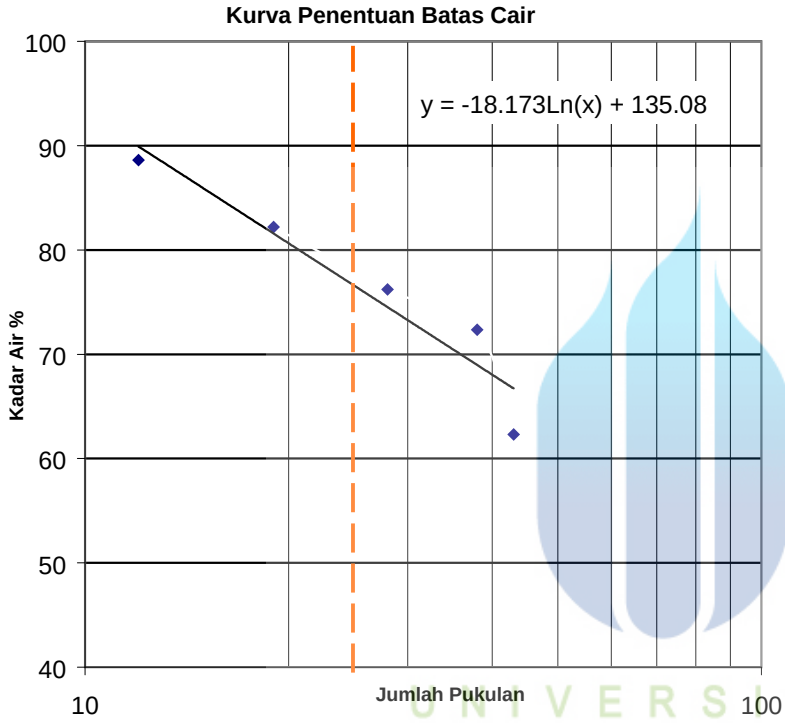
ATTERBERG LIMITS

PROJECT : PROKLAMASI
LOCATION : PROKLAMASI
DATE 0
TESTED BY 0
Drilling No. : DB - 1
Depth : 5.50-6.00 M



DARI GRFIK DIDAPAT :

LIQUIT LIMIT (LL)	: 76.58	%
PLATIC LIMIT (PL)	: 40.53	%
PLASTICITY INDEX (IP)	: 36.05	%

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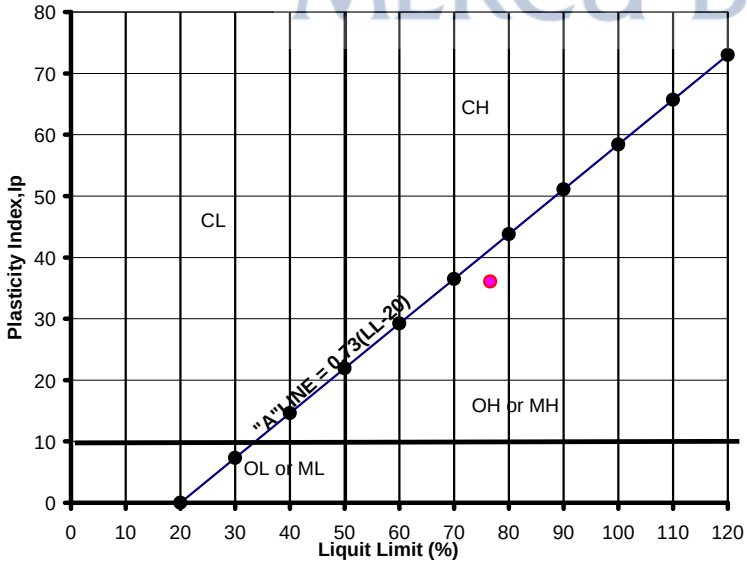
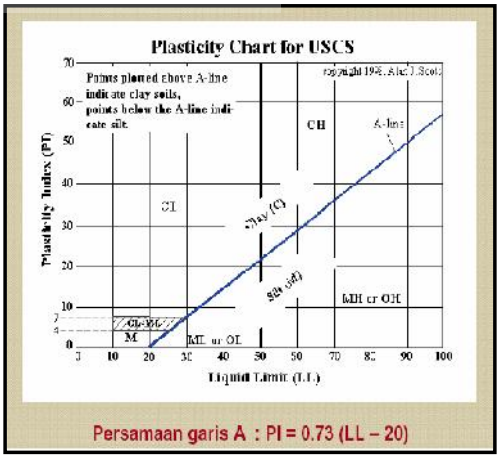
Clasification : MH





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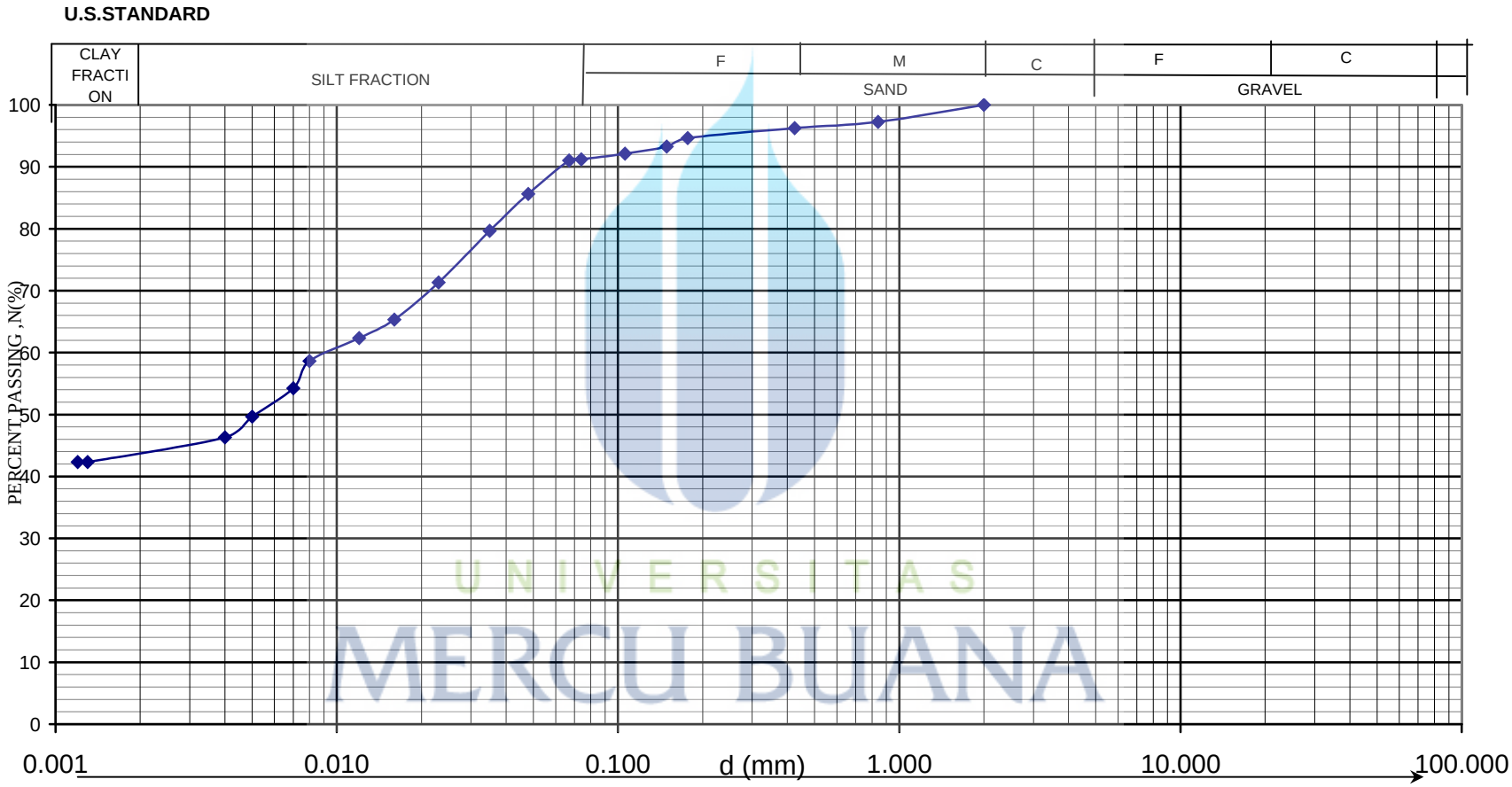
GRAINSIZE DISTRIBUTION CURVE

Project	:	PROKLAMASI	Drilling No.	DB - 1	
Location	:	PROKLAMASI	Depth	1.50-2.00	m



Gravel	% = 0.00	Silt	% = 47.47	d60 =	mm
Sand	% = 8.78	Clay	% = 43.75	d10 =	mm
Fines	% = 91.22			Cu =	

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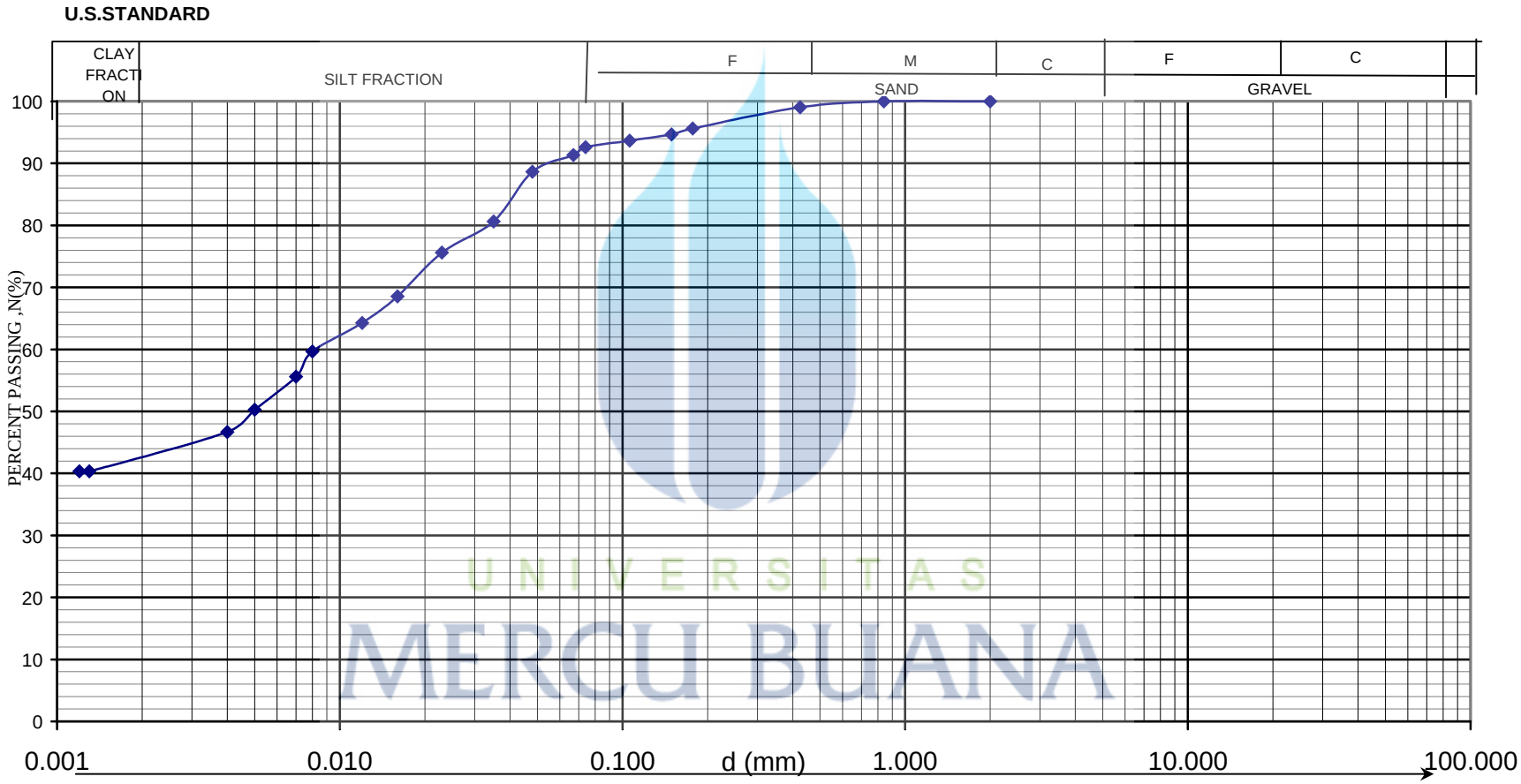
GRAINSIZE DISTRIBUTION CURVE

Project	:	PROKLAMASI	Drilling No.	DB - 1	
Location	:	PROKLAMASI	Depth	3.50-4.00	m



Gravel	% = 0.00	Silt	% = 50.12	d60 =	mm
Sand	% = 7.38	Clay	% = 42.50	d10 =	mm
Fines	% = 92.62			Cu =	

petrus marpaung

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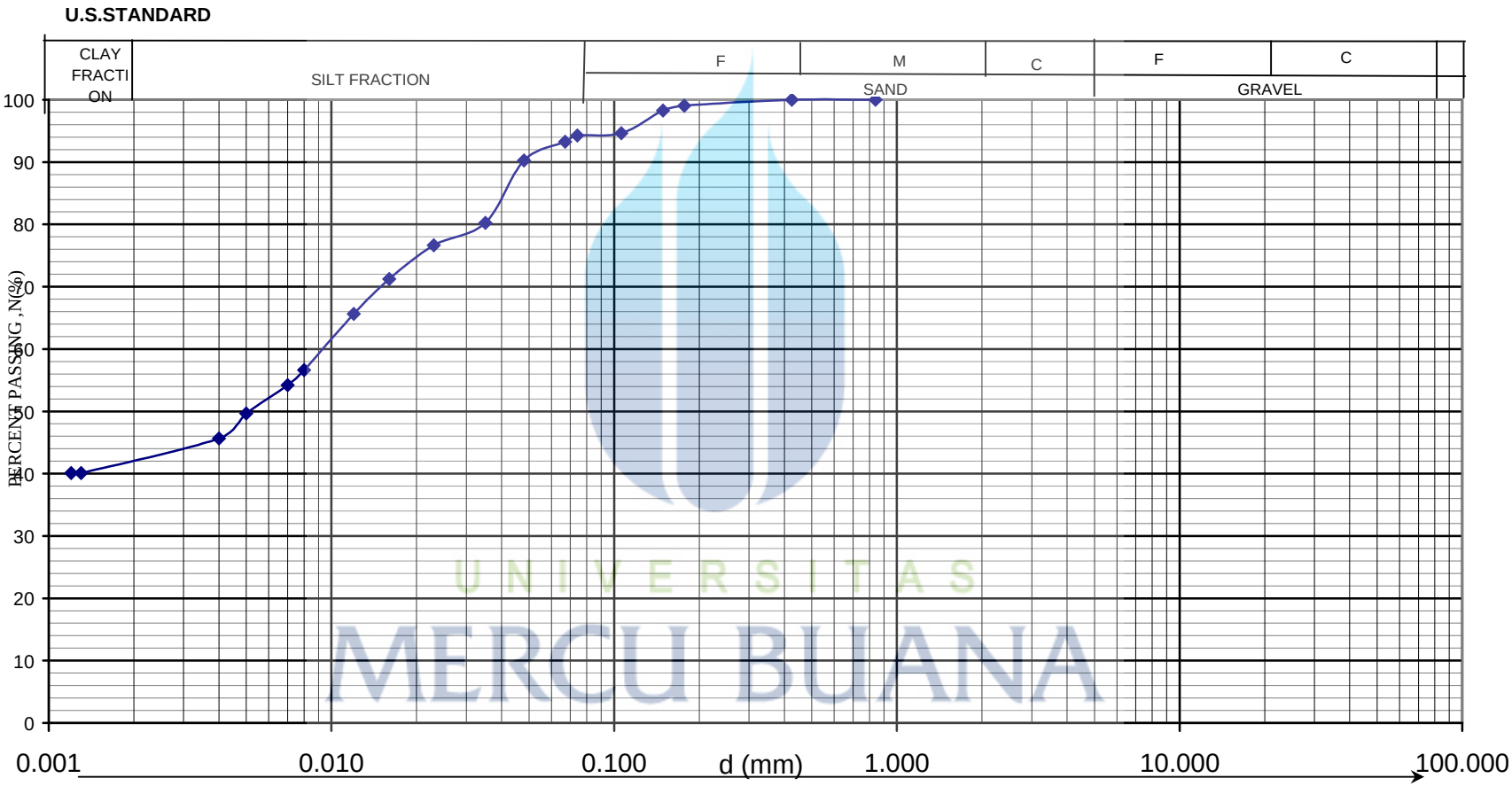
GRAINSIZE DISTRIBUTION CURVE

Project	:	PROKLAMASI	Drilling No.	DB - 1	
Location	:	PROKLAMASI	Depth	5.50-6.00	m



Gravel	% = 0.00	Silt	% = 52.26	d60 =	mm
Sand	% = 5.74	Clay	% = 42.00	d10 =	mm
Fines	% = 94.26			Cu =	

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Specification of Material

Item	Referance	Description	Specification
Agregate	ASTM C33 - 1999	Standard Specification for Concrete Aggregates	
	NI 2 PBI - 1971	Indonesian Concrete Code	
Coment	SNI 15-2049-2004	Portland Cement	Standard product: type I Special order: Type II or V
Admixture	ASTM C494 - 1985	Standard Specification for Chemical Admixture for Concrete	Type F: Water reducing admixtures
Concrete	SNI 03-2847-2002	Indonesian Concrete Code	Compressive strength at: 28 days : 600 kgf/cm2 (cube)
PC Wire	JIS G 3536 - 1999	Uncoated Stress-Relieved Steel Wire and Strand for Prestressed Concrete	SWPD 1
PC Bar	JIS G 3137 - 1994	Small Size Deformed Steel Bars for Preatressed Concrete	SBPDL 1275/1420
Spiral Wire	JIS G 3532 - 2000	Low Carbon Steel Wire	SWMA / SWMP
Joint Plate	JIS G 3101 - 2004	Rolled Steel for General Structure	SS-400
Welding	ANSI / AWS D1.1 - 1990	Structural Welding Code-Steel	AWS A S.1 / E 6013 NIKKO STEEL RB 26 / RD 260, LION 26, or equivalent

Classification

Outside Diameter D (mm)	Wall Thickness T (mm)	Class	Concrete Cross Section (cm2)	Unit Weight (kg/m)	Length L (M)	Bending Moment		Allowable Axial Load
						Crack (Ton.m)	Ultimate (Ton.m)	(Ton)
300	60	A2	452	113	6 - 12	2.50	3.75	72.60
		A3				3.00	4.50	70.75
		B				3.50	6.30	67.50
		C				4.00	8.00	65.40
350	65	A1	582	145	6 - 15	3.50	5.25	93.10
		A3				4.20	6.30	89.50
		B				5.00	9.00	86.40
		C				6.00	12.00	85.00
400	75	A2	766	191	6 - 16	5.50	8.25	121.10
		A3				6.50	9.75	117.60
		B				7.50	13.50	114.40
		C				9.00	18.00	111.50
450	80	A1	930	232	6 - 16	7.50	11.25	149.50
		A2				8.50	12.75	145.80
		A3				10.00	15.00	143.80
		B				11.00	19.80	139.10
		C				12.50	25.00	134.90
500	90	A1	1159	290	6 - 16	10.50	15.75	185.30
		A2				12.50	18.75	181.70
		A3				14.00	21.00	178.20
		B				15.00	27.00	174.90
		C				17.00	34.00	169.00
600	100	A1	1571	393	6 - 16	17.00	25.50	252.70
		A2				19.00	28.50	249.00
		A3				22.00	33.00	243.20
		B				25.00	45.00	238.30
		C				29.00	58.00	229.50

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KARTU ASISTENSI

NAMA	: Nurrul Widyawaty	MATA KULIAH	: Tugas Akhir
NIM	: 411 0912 0018	SMT/THN.AKAD	: IX / 2014
FAK/JUR	: FTPD / Teknik Sipil	DOSEN	: Ir. Desiana Vidayanti, MT

NO.	TGL	KETERANGAN	PARAF	NO.	TGL	KETERANGAN	PARAF
1		Judul / topik diperbaiki. Sesuai diskusi		6	10/5 14	- Plotting data oke - Perhitungan dilanjut	
2	1/3 14	- Maksud → tujuan → focus ke penelitian		7	16/6 14	- Hitung prosentase sumbangan fribr	
		- Batasan masalah → diatur lagi (diameter pile, beban, dll)				dan point karing yg msg lokasi	
		- Ruang lingkup lokasi → ?				- Berikan analisis atas hitungan anda	
		- Buat flow chart yg langkah perhitt		8		- Cek lagi hitt n yg penting N yg diambil (cari dasar teori) - Lanjutkan.	
3		Flow chart diperbaiki		9	27/6 14	Lanjutkan analisis	
4		Siapkan seminar				Acc. Siapkan sidang	
5		Plot lokasi dan tanah pd peta lokasi					

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