ESTIMATION OF GRAIN CHARACTERISTICS OF SOILS BY USING

CONE PENETRATION TEST (CPT) DATA

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ABSTRACT

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Due to lack of soil sampling during a conventional cone penetration testing (CPT), it is necessary to classify soils based on recorded tip and sleeve friction and pore pressure (if available) values. However, currently available soil classification models are based on deterministic and judgemental determination of soil classification boundaries which do not address the uncertainties intristic to the problem. Moreover, size and quality of databases used in the development of these soil classification models are undocumented and thus questionable. Similar limitations do also exist in the development of SPT-CPT correlations which are widely used in SPT dominated design such as soil liquefaction triggering.

To eliminate these discussed limitations, within the confines of this study it is attempted to present (1) a new probabilistic CPT- based soil classification methodology, and (2) new SPT-CPT correlations which address the uncertainties intrinsic to the problems. For these purposes, a database composed of 400 CPT/SPT boring data pairs was compiled. It is intended to develop probabilistic models, which will correlate CPT tip and sleeve friction values to actual soil classification and CPT tip resistance to SPT blow count N.

The new set of correlations, model parameters of which estimated by implementing maximum likelihood methodology, presented herein are judged to represent a robust and defensible basis for (1) prediction of soil type based on CPT data and, (2) estimation of SPT-N value for given CPT data.

KEYWORDS: Cone penetration test, soil classification, standard penetration test, correlation, maximum likelihood methodology, limit state models.

ÖΖ

KONİK PENETRASYON DENEYİ (CPT) VERİLERİNİ KULLANARAK ZEMİNLERİN DANE ÖZELLİKLERİNİN BELİRLENMESİ

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Konik penetrasyon deneyinde numune alınamaması nedeniyle zeminleri ölçülen uç direnci, zemin sürtünme direnci ve (varsa) boşluk suyu basıncı verilerine dayanarak sınıflandırmak gerekmektedir. Ancak, mevcut ve güncel zemin sınıflandırma modelleri deterministik ve yargısal esaslı olup, probleme ait belirsizlikleri göstermezler. Ayrıca, bu zemin sınıflandırma modellerini geliştirmek için kullanılan veritabanlarının büyüklüğü ve kalitesi belgelenmemiştir. Bu sebepten bu modellerin büyüklüğü ve kalitesi bilinmemektedir. Zemin sıvılaşma potansiyelinin belirlenmesi gibi SPT'ye dayalı tasarı yöntemlerinde geniş olarak kullanılan mevcut SPT-CPT bağıntılarında da benzer sınırlamalar vardır.

Bu çalışmada, belirtilen sınırlamalardan kurtulmak için (1) yeni bir CPT'ye dayalı zemin sınıflandırma yöntemi ve (2) yeni SPT-CPT ilişkileri sunulmuştur. Sunulan çalışmalar problemlere ait belirsizlikleri göstermektedir. Bu amaçla 400 CPT/SPT sondaj veri çiftinden oluşan bir veri tabanı hazırlanmıştır. CPT uç ve sürtünme direnci verilerini gerçek zemin sınıflandırılması ile ve CPT uç direncini SPT vuruş sayısı, N ile ilişkilendirecek olasılıksal modeller oluşturulmak amaçlanmıştır.

Model değişkenleri, maksimum olasılık yöntemi kullanılarak bulunan yeni bağıntılar, (1) CPT verisi kullanılarak zemin tipi tahmini ve belirli CPT verisi için SPT-N değerinin belirlenmesi çalışmaları için sağlam ve tutarlı bir temel oluşturacak şekilde değerlendirilmiştir.

Anahtar kelimeler: Konik penetrasyon deneyi (CPT), zemin sınıflandırılması, standard penetrasyon deneyi, maximum olasılık yöntemi, limit durum modelleri.

To My Family

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Cone Penetration Test (CPT) is widely used as an in-situ penetration test for site investigation and geotechnical design purposes. Its standardized procedure and instruments, incorporated with modern electronics and technology, offer an in-situ test with many advantages such as simplicity, repeatibility, continuous logging and precision, over other penetration tests. Nevertheless, due to lack of soil sampling in conventional CPT and due to the necessity to use CPT data in Standard Penetration Test (SPT) based design and analysis methods, such as liquefaction susceptibility analysis, a good mapping between CPT and SPT is required.

In the past decades, CPT channel measurements versus soil type correlation and the relationship between CPT tip resistance and SPT blowcount N subjects have been studied by many researchers and several CPT based soil classification charts (Robertson and Wride (1997), Olsen and Mitchell (1995)) and SPT-CPT correlations (Kulhawy and Mayne (1990)) have been recommended.

1.2 RESEARCH STATEMENT

The goal of these studies is to develop probabilistically based correlations i) for the use of CPT to classify subsurface soils, and ii) between SPT-N and CPT channel measurements. For this purpose, a database composed of 400 CPT/boring data components of tip resistance (q_c), friction ratio (R_f), soil classification based on Unified Soil Classification System (USCS), fines content (FC), mean particle size (D_{50}) and SPT blow count value (N) was compiled.

1.3 SCOPE

Following this introduction, Chapter 2 presents an overview of : (1) available CPT-based soil classification charts, and (2) available SPT-CPT correlations. Limitations of existing charts and correlations are also discussed in this chapter.

Chapter 3 presents the procedures followed for processing data from penetration tests to compile a database.

Chapter 4 discusses the development of probabilistically-based (1) CPT soil classification boundary curves, and (2) SPT-CPT correlations.

Finally, a summary of the research, major conclusions, and recommendations for future areas of study are presented in Chapter 5.

CHAPTER 2

AN OVERVIEW OF AVAILABLE SOIL CLASSIFICATION METHODOLOGIES BASED ON CPT DATA AND SPT-CPT CORRELATIONS

2.1 CONE PENETRATION TEST (CPT)

In cone penetration test, a cone penetrometer connected to the tip of series of rods is hydralically pushed into the ground at a constant rate (2 cm/sec) and continuous resistance measurements of the cone penetrometer are recorded. The reference test instrument consist of a cone with 60° apex angle and a diameter of 35.7 mm (10 cm² cross-sectional area) and a 150 cm² friction sleeve located above the cone. Resistance values are measured as the combined resistance to penetration of the cone as tip resistance (q_c) and the resistance of friction sleeve as friction resistance (f_s). Attaching additional sensors to CPT system to measure pore water pressure, verticality, shear wave velocity, etc. can also provide relevant data in addition to tip and friction resistances. Figure 2.1 illustrates the schematic view of a cone penetrometer probe.



Figure 2.1: Schematic view of a cone penetrometer probe

2.1.1 CPT Corrections

When performing a CPT with pore water pressure measurement, due to the inner geometry of the cone penetrometer, the ambient pore water pressure causes additional resistance on the shoulder area behind the cone. This phenomenon is known as unequal area effect and reduce the measured tip resistance (Campanella et al.(1982)). A correction is necessary to take into account this unequal area effects as given in Equation (2.1):

$$q_t = q_c + u \cdot (1-a) \tag{2.1}$$

where " q_t " and q_c " are corrected and measured tip resistances, respectively, "u" is pore water pressure acting behind the cone, and "a" is cone area ratio determined using calibration vessel.

Softer soil layers above and below the cone tip also affect the CPT data. Measured CPT tip resistance is smaller in thin layers of granular soils embedded within softer layers than in thicker layers of the same granular soils (Figure 2.2). Vreugdenhil et al. (1994) provided a procedure based on a simplified elastic solution for correcting the cone penetration resistance of thin stiff layers sandwiched between softer layers. According to this work, the error in the measured tip resistance is a function of the thickness and the relative stiffness of the thin stiff layer. Robertson and Fear (1995) recommended a conservative thin layer correction (corresponding to $q_{cA}/q_{cB} = 2$ curve sketched in Figure 2.2) derived based on Vreugdenhil et al. (1994) as:

$$\mathbf{q}_{c}^{*} = \mathbf{K}_{H} \cdot \mathbf{q}_{cA} \tag{2.2}$$

where K_H is thin layer correction factor, q_c^* is the corrected tip resistance and q_{cA} is tip resistance of the stiff layer.

According to NCEER (1998), $q_{cA}/q_{cB} = 2$ curve is not adequately conservative. Further analysis of field data by Gonzalo Castro and Peter Robertson for NCEER workshop indicate that the lower bound of the range of field data plotted by G.Castro in Figure 2.3 provides more conservative K_H values and are used for these studies. The equation of the lower bound of the field curve is:

$$K_{\rm H} = 0.25 \cdot \left(\left(({\rm H}/{\rm d_{\odot}})/17 \right) - 1.77 \right)^2 + 1.0$$
(2.3)

where H is the thickness of the interbedded layer in mm, q_{cA} and q_{cB} is tip resistance of the stiff and soft layers, respectively, and d_c is diameter of the cone in mm.



Figure 2.2: Illustration of thin layer correction



Figure 2.3: Thin-Layer correction factor K_H

2.2 STANDARD PENETRATION TEST (SPT)

The standard penetration test was developed in the United States in 1927 and is used worldwide to a greater extent than any other in-situ test. Ideally, the test is performed by dropping a free-falling hammer weighing 63.5 kg (~ 140 lb) on to the drill rods from a height of 760 mm (~30 in.). The number of blows necessary to achieve a penetration of 30 cm (after a seating drive of 15 cm) of a standard sample tube is defined as the penetration resistance or SPT-N value. Sample of soil, usually obtained during test, can be used to perform laboratory tests for the estimation of soil type, index properties, particle size distribution, etc.

It has been addressed by many researchers that the standard penetration test has been in fact conventionally performed by using different kinds of hammers in different parts of the world, with different energy delivery systems which also have varying degrees of efficiency. Additionally, the borehole diameters and the sampling techniques also differ significantly, which in turn cause a large variability in the measured values depending on the combinations of actual test procedures and equipment used.

Schmertmann (1976) and Kovacs et al. (1983) have shown that the actual energy delivered to the sampler rods in performing SPT in different areas of the world may vary between 40% to 90% of the theoretical free-fall energy intended to be delivered by the falling hammer. Depending on the amount of energy applied by the hammer, the results may differ significantly. Schmertmann (1976), and Palacios (1977), based on theoretical and field studies, summarized the most important factors that may influence the results of a SPT test as: (1) the use of drilling mud vs. casing for supporting the walls of the drill hole; (2) the use of a hollow stem auger versus casing and water; (3) the size of the drill hole; (4) the number of turns of the rope around the drum; (5) the use of a small or a large anvil; (6) the length of the drive rods; (7) the use of nonstandard sampling tubes; (8) the depth range over which the penetration resistance is measured. Additional researchers have since added : (1) varying mechanisms used to raise and drop the hammer, (2) hammer type, and (3) and length and diameter of rods between the impacting hammer and the sampler.

How to correct for all the deviations in the SPT procedures from the "standard" procedure has been resolved after NCEER (1997). A consensus among expert panel members has been achieved and a series of recommendations were presented, which will be discussed later in this chapter.

2.2.1 SPT Corrections

The measured SPT resistance needs to be corrected to account for overburden stress. As a definition, "normalized" SPT blowcounts (N_1 -values) correspond to the SPT resistance (N values) corrected to values that would have been measured under 100 kPa vertical effective stress as:

$$\mathbf{N}_1 = \mathbf{C}_N \cdot \mathbf{N} \tag{2.4}$$

where C_N is an effective overburden-based correction factor. This factor is commonly calculated from the equation (Liao and Whitman (1986)) given in Table 2.1.

The length of the drill rods, the diameter of the borehole and sampler type also affect the SPT data. Wave equation studies (Schmertman and Palacios (1979)) show that the theoretical maximum energy ratio decreases with decreasing rod length, especially if rod length is less than about 10 m. This decrease in measured energy is due to the rapid return of the tension wave before all the hammer energy can be transmitted to the rods. Similarly, if borehole diameter larger than the standard borehole diameter of 65-115 mm is drilled then the SPT measurements can be off as much as 15 %. Removing the liners from SPT sampler designed for liners improves sample recovery but reduces the measured blowcount by about %20 due to higher frictional resistance inside sampler.

As was briefly listed in Section 2.2, any combination of SPT equipment procedures other than the "standardized" ones (Table 2.1) requires a correction for the measured SPT resistance. The NCEER (1997) suggested-corrections need to be performed as stated by:

$$\mathbf{N}_{1,60} = \mathbf{N} \cdot \mathbf{C}_{\mathbf{N}} \cdot \mathbf{C}_{\mathbf{E}} \cdot \mathbf{C}_{\mathbf{B}} \cdot \mathbf{C}_{\mathbf{R}} \cdot \mathbf{C}_{\mathbf{S}}$$
(2.5)

where N is the in-situ measured SPT blowcounts obtained by driving a standard sampling tube 30 cm into the ground.

Energy delivered from hammer to SPT rods can be measured by instrumenting a portion of rod string with 2 strain gauges and 2 accelerometers between anvil and rods. Using the energy ratio (ER), the ratio of delivered hammer energy to theoretical potential energy of free-falling hammer, and Equation (2.6) as recommended by Seed et al. (1985), the blowcount normalized to 60% of the theoretical energy, N_{60} can be computed as:

$$N_{60} = N_{\text{field}} \cdot \frac{\text{ER}}{60}$$
(2.6)

and as a consequence Equation (2.5) reduces to:

$$\mathbf{N}_{1,60} = \mathbf{N}_{60} \cdot \mathbf{C}_{\mathrm{N}} \cdot \mathbf{C}_{\mathrm{B}} \cdot \mathbf{C}_{\mathrm{S}}$$
(2.7)

Factor	Term	Equipment Variable	Correction
Overburden	C _N	_	$(P_a/\sigma'_v)^{0.5}$
Pressure			$C_N \le 2$
Energy Ratio	C _E	Safety Hammer	0.60-1.17
Lifergy Ratio		Donut Hammer	0.45-1.00
		65-115 mm	1.00
Borehole Diameter	C _B	150 mm	1.05
		200 mm	1.15
		3-4 m	0.75
		4-6 m	0.85
Rod Length		6-10 m	0.95
	C _R	10-30 m	1.0
		> 30 m	< 1.0
Sampling Method	C	Standard Sampler	1.0
Sampling Method	US	Sampler without liners	1.15-1.30

 Table 2.1: Summary of the correction factors for SPT measurements (After 1997 NCEER Workshop)

2.3 SOIL CLASSIFICATION BASED on CPT DATA

2.3.1 Robertson and Wride (1997) CPT-Based Soil Classification Chart

It is possible to estimate the grain characteristics of soils directly from CPT results using the soil behaviour type chart shown in Figure 2.4 (Robertson (1990)), constructed based on field data and experiences of authors. The boundaries between soil behaviour type zones 2-7 can be approximated as concentric circles (Jefferies and Davies (1993)). The radius of these circles, termed the soil behavior type index I_C (Robertson and Wride (1997)) is calculated from the following equation:

$$I_{\rm C} = \left[(3.47 - \log Q)^2 + (\log F + 1.22)^2 \right]^{0.5}$$
(2.8)

where

$$Q = (q_c - \sigma_{vo}) / Pa \times (Pa / \sigma'_{vo})^n$$
(2.9)

and

$$F = [f_{s} / (q_{c} - \sigma_{vo})] \times 100 \%$$
(2.10)

where Q is the normalized tip resistance, dimensionless; F is the normalized friction ratio, in percent; σ_{vo} and σ'_{vo} are the total and effective overburden stresses, respectively; Pa is the reference pressure, equal to 100 kPa.



Figure 2.4: CPT-based soil classification chart (Robertson (1990))

The value of the exponent "n" in Equation (2.9) varies from 0.5 to 1.0 depending on the grain characteristics of soils (Olsen (1997)). However, the soil behavior chart in Figure 2.4 was developed using an exponent of 1.0, which is the appropriate value for clayey soil types. For clean sands an exponent value of 0.5 is more appropriate, and a value intermediate between

0.5 and 1.0 would be appropriate for silts and sandy silts. Robertson and Wride (1997) recommended the following procedure for calculating the soil behavior type index I_c. The first step is to differentiate soil types characterized as clays from soil types characterized as sands and silts. The recommended procedure is performed by assuming an exponent n of 1.0 and calculating the dimensionless normalized tip resistance Q and the initial value of I_c . If calculated I_c is greater than 2.6, the soil is classified as clayey. This value of $I_{\rm C}$ is used to estimate soil type. However, if the $I_{\rm C}$ calculated with exponent of 1.0 is less than 2.6, Q should be recalculated using an exponent n of 0.5. I_c should then be recalculated using Equation (2.7). If recalculated remains I_c less than 2.6, the soil is defined as nonplastic and granular. This $I_{\rm C}$ is used to estimate soil type. However, If $I_{\rm C}$ iterates above and below a value of 2.6, the soil is likely to be very silty and possibly plastic. At this instant, normalized, dimensionless cone tip resistance (qc1N) should be recalculated by using Equation (2.11) using an intermadiate exponent n of 0.7 as given in Equation (2.12).

$$q_{c1N} = C_Q (q_c / Pa)$$

(2.11)

where

$$C_{Q} = (Pa / \sigma'_{vo})^{n}$$

$$(2.12)$$

and where C_Q is the normalization factor for cone tip resistance (At shallow depths C_Q becomes large because of low overburden pressure; however, values >1.7 should not be applied for design purposes). I_C is then recalculated from Equation (2.8) using recalculated value of q_{c1N} . This intermediate I_C is then used to predict soil type.

The boundaries of soil behavior type are given in terms of the index, I_c , as shown in Table 2.2. The soil behavior type index does not apply to zones 1,8 and 9.

Soil Behavior Type Index, I _C	Zone	Soil Behavior Type
I _c <1.31	7	Gravelly sand to dense sand
$1.31 < I_{\rm C} < 2.05$	6	Sands: clean sand to silty sand
$2.05 < I_{\rm C} < 2.60$	5	Sand Mixtures: silty sand to sandy silt
$2.60 < I_{\rm C} < 2.95$	4	Silt Mixtures: clayey silt to silty clay
$2.95 < I_{\rm C} < 3.60$	3	Clays: silty clay to clay
3.60 <i<sub>C</i<sub>	2	Organic soils: peats

 Table 2.2: Boundaries of soil behavior type (after Robertson (1990))

2.3.2 Olsen and Mitchell (1995) CPT-Based Soil Classification Chart

The CPT soil classification chart in Figure 2.5, developed by Olsen and Mitchell (1995) using a large database of CPT/boring database, is based on a new cone penetration resistance normalization technique.

According to the new normalization technique, based on stress focus concept, the trends of cone resistance with effective stress can be described using a variable stress exponent which provides a better undestanding of the exponential relationship of cone resistance with vertical effective stress(Olsen (1994)). Normalized tip and friction resistances, recommended to be used in Figure 2.5, are described as:

$$q_{c1e} = \frac{(q_c - \sigma_{vo})}{(\sigma'_{vo})^c} = \frac{(q_c)_{net}}{(\sigma'_{vo})^c}$$
(2.13)

$$f_{s1e} = \frac{f_s}{(\sigma'_{vo})^s}$$
(2.14)

$$FR = \frac{f_{s1e}}{q_{c1e}} \times 100 \cong \frac{f_s}{q_c} \times 100$$
(2.15)

where σ_{vo} and σ'_{vo} are the total and effective overburden stresses; q_{cle} is the normalized tip resistance; f_{sle} is the normalized friction resistance; FR (or R_f) is friction ratio; c is cone resistance stress exponent; s is sleeve stress exponent (approximately equal to c).



Figure 2.5: CPT-based soil classification chart (Olsen (1994))

Stress exponent contours, given in Figure 2.5, are used to determine the stress exponent for normalization of tip resistance given in (2.13). These cone resistance stress exponent contours exhibit several predictable trends; (1) high values for loose sands, (2) very low values for over-consolidated sands, (3) values of approximately 1.0 for normally consolidated clays, (4) values slightly below unity (0.75-0.9) for slightly over-consolidated clays, (5) values as high as 1.2 for unstable silty clay mixtures. An iterative solution is required for

normalization procedure. Initially, a stress exponent is assumed and the q_{cle} is calculated using Equation (2.13). The resulting q_{cle} and calculated friction ratio are used to determine the chart-based contour stress exponent from Figure 2.5. If chart-based stress exponent is not equal to the assumed stress exponent, a new assumed value must be tried. About 3 to 9 iterations are usually required until the chart-based value is sufficiently close to the assumed value. Completing iterations, final q_{cle} value and friction ratio is used to predict soil classification from Figure 2.5.

In Figure 2.5, soil classification number (SCN) = 0 represents a pure silt, SCN = 1 represents a fine sand or low silt content silty sand, and finally SCN = -1 represents the boundary between silty clay and clayey silt. As a result, SCN's greater than 1 represent sand and SCN's less than -1 represent clay. The boundary between normally consalidated and over consalidated soils are also shown in Figure 2.5 together with the trends for increasing over consalidation. Soil classification descriptions are also shown near SCN boundaries.

2.3.3 Limitations of Available CPT-Based Soil Classification Charts

To eliminate the disadvantage of CPT stated as lack of soil sampling, researchers have tried to develop a standard CPT-based soil classification technique. Normalized CPT data-based soil classification charts presented in Section 2.3 (Robertson and Wride (1997) and Olsen and Mitchell (1995)) largely dominate the current practice in the use of CPT to predict soil classification. Presented charts have been widely accepted and used in practice, however suggested deterministic soil classification zones in both charts do not address the uncertainties in the locations and the forms of these boundaries. Also in both charts, soil classification boundaries, separating soil classification zones, are determined based on engineering judgements and experiences of authors which provide no quantifiable insight into the problem. Moreover, size and quality of data bases of both charts, used to produce soil classification boundaries, are unknown and questionable since CPT/boring databases were not presented with proposed soil classification methods.

2.4 SPT-CPT CORRELATIONS

A number of studies have been presented over years to relate the SPT-N value to CPT tip resistance. Robertson et al. (1983) reviewed these correlations and presented the relationship shown in Figure 2.6 relating $(q_c/Pa)/N_{60}$ ratios with the mean particle size, D_{50} . q_c values are normalized by reference pressure Pa(100 kPa). It is observed that $(q_c/Pa)/N_{60}$ ratio exponentially increases with increasing particle size.

Kulhawy and Mayne (1990) gathered the databases of Robertson and Campanella (1983), Zervogiannis and Kalteziotis (1988), Chin et al. (1988), Jamiolkowski et al. (1985), Andrus and Youd (1987), Kasim et al. (1986), Seed and deAlba (1986) and Muromachi (1981) and proposed a $(q_c / Pa)/N - D_{50}$ correlation, given in Figure 2.7.



Figure 2.6: CPT-SPT correlation with grain size

(Robertson et al.(1983))





(Kulhawy and Mayne (1990))

In other studies, relationship between $(q_c/Pa)/N$ ratio and fines content (FC) investigated by Jamiolkowski et al. (1985), Kasim et al. (1986), Muromachi (1981), Chin et al. (1988). Kulhawy and Mayne (1990) also gathered the databases of these studies and presented a correlation relating $(q_c/Pa)/N$ ratios with the fines contect. As seen in Figure 2.8, $(q_c/Pa)/N$ ratio decreases with increasing fines content.



Figure 2.8: CPT-SPT correlation with fines content

(Kulhawy and Mayne (1990))
Inspired by Jefferies and Davies (1993), Peter Robertson combined the soil classification chart shown in Figure 2.4 and the correlation given in Figure 2.6 to provide a continuous variation of $(q_c/Pa)/N_{60}$ with soil type as given in Equation (2.13).

$$(q_c / Pa) / N_{60} = 8.5(1 - I_C / 4.6)$$
 (2.16)

where I_c is soil behavior type index as defined in Equation (2.8)

This equation (2.16) suggests a simple method to estimate the SPT-N value from CPT results. Jefferies and Davies (1993) suggested that the SPT values estimated by using Equation (16) and CPT data are more reliable than SPT-N values obtained after a SPT.

2.4.1 Limitations of Available SPT-CPT Correlations

Due to the necessity to use CPT data in Standard Penetration Test (SPT) data based design and analysis correlations, SPT-CPT correlations have been a topic of considerable interest in the past decades. In general, assuming a linear relationship between q_c and N, variation of $(q_c/Pa)/N$ ratio as a function of grain charateristics has been searched.

Kulhawy and Mayne (1990) compiled a database from past SPT-CPT correlation studies and recommended a SPT-CPT correlation with D_{50} (Figure 2.7) and a SPT-CPT correlation with fines content (Figure 2.8).

However, compiled database did not define the energy ratio of SPT data. In other words, in proposed correlations SPT-N values do not correspond to an energy ratio of 60 % (that is N_{60}). Moreover, correlation shown in Figure 2.7 relating $(q_c/Pa)/N$ ratios with the mean particle size has relatively little data for the soils with D_{50} values of 1 to 10. Similary, SPT-CPT correlation in Figure 2.8 suffers the same problem for soils with 55 to 90 % fines content values. All these limitations address the need to develop a probabilisticly-based SPT-CPT correlation based on "high quality" database.

CHAPTER 3

CPT-BASED SOIL CLASSIFICATION AND SPT-CPT CORRELATION DATABASES

3.1 EVALUATION OF CPT AND SPT MEASUREMENTS

For assessing the CPT-based soil classification and SPT-CPT correlation models, a database of 400 CPT/SPT-boring data pairs composed of tip resistance (q_c), friction ratio (R_f) and soil classification based on Unified Soil Classification System (USCS), fines content (FC), mean particle size (D_{50}) and SPT blow count value (N) was compiled. CPT and SPT data was obtained from 3 different databases that are: (1) Pasific Earthquake Researh Center (PEER), Turkey Ground Failure (August 1999 Earthquakes) Database, (2) Karaca (2001) and, (3) Buski-East Waste Water Treatment Plant Project.

Pasific Earthquake Researh Center (PEER), Turkey Ground Failure (August 1999 Earthquakes) Database was originated from site investigation studies performed in Adapazari and İzmit Bay after 17 August 1999 Kocaeli Earthquake as a consequence of the joint research supported by University of California, Berkeley, Brigham Young University, University of California, Los Angeles, ZETAŞ, SAU and METU. A rope and 2 1/4 turns on a clockwise rotating cathead system was used to perform the standard penetration test. The driving energy was delivered by the 76 cm-high drop of a safety hammer weighing approximately 63.5 kgf. CPT's were performed using an electronic cone penetrometer probe. Soil classification was performed based on Unified Soil Classification System (USCS) as discussed in Wagner (1957) by laboratory testing of the disturbed samples retrieved from the boreholes. Mean grain size and percent fines content values of retrieved samples were estimated by sieve analysis as described in ASTM D-442-63.

Karaca (2001) performed site investigation studies composed of 8 SPT and 6 CPT, performed by ZMG corp., to study the large vertical displacements experienced by structures in Adapazari during 17 August 1999 Kocaeli Earthquake. SPT was performed by a rope and cathead system and a donut hammer and CPT was performed using an electronic cone penetrometer probe.

Finally, Buski-East Waste Water Treatment Plant Project Database was originated from site investigation studies performed in Bursa. In situ and laboratory tests were performed by ERBEY and PROTEST. An electronic cone penetrometer probe was used to perform CPT. SPT results and CPT profiles are presented in Appendix B and Appendix C, respectively.

In order to develop a good mapping between SPT and CPT, after a sensitive study, 65 CPT logs were matched with 65 boreholes within 2 m of each CPT hole to form data pairs, tabulated in Appendix A. 50 out of 65 data

pairs were gathered from PEER, Turkey Ground Failure (August 1999 Earthquakes) Database, 13 from Buski-East Waste Water Treatment Plant Project Database and 2 from Karaca (2001). After having compiled data pairs, necessary correction were applied to CPT and SPT data as described in Section 2.1.1 and Section 2.2.1, respectively.

Since cone penetration test responds to soil and delivers data approximately every 2 cm, whereas data obtained in SPT (soil classification based on (USCS), fines content (FC), mean particle size (D_{50})) are defined over a 30 cm length, to smooth the detail in CPT and to determine representative CPT values for corresponding SPT pair, measured CPT data is algebraically averaged over the depth internal corresponding to the SPT (that is, 30 cm) on all two CPT data channels, tip resistance (q_c), friction ratio (R_f) as shown in Figure 3.1.



Figure 3.1: Illustration of determining representative CPT measurements

Figure 3.2 summarizes compiled CPT/boring database. Circles represent clayey soils, triangles represent silt and silt mixtures, and finally squares represent sand and sand mixtures. Database presented in Figure 3.2 is used to determine soil classification boundaries by using maximum likelihood methodology, which will be discussed in Chapter 4.

Figure 3.3 presents the distribution of $(q_c/Pa)/N_{60}$ ratio with mean particle size D_{50} , varying between 0.001 and 10 mm. $(q_c/Pa)/N_{60}$ increases with increasing D_{50} . Moreover, the distribution shows an increasing scatter with increasing D_{50} , especially for greater than about 0.1 mm.



Figure 3.2: Database for CPT-based soil classification used in this study



Figure 3.3: Database for SPT-CPT-correlation with D₅₀ used in this study

In Figure 3.4, the distribution of $(q_c/Pa)/N_{60}$ ratio with percent fines content is illustrated. $(q_c/Pa)/N_{60}$ ratio decreases as a function of increasing FC. There is also scatter in this figure, but a decrease of $(q_c/Pa)/N_{60}$ with increasing FC is clear.



Figure 3.4: Database for SPT-CPT-correlation with FC used in this

study

CHAPTER 4

DEVELOPMENT OF CPT-BASED SOIL CLASSIFICATION MODEL AND SPT-CPT CORRELATIONS

4.1 DEVELOPMENT OF CPT-BASED SOIL CLASSIFICATION MODEL

For the development of CPT-based soil classification model, compiled database, including CPT-boring pairs as shown in Figure 3.2 in Section 3.1, was used. Having developed representative limit state models, the maximum likelihood (ML) method was implemented. Development of limit state models and implementation of ML method is discussed in the following sections.

4.1.1 Limit State Models and Maximum Likelihood Method for CPT-Based Soil Classification

The first step in developing a limit state model for the CPT-based soil classification is to select a mathematical model, which will capture the essentials of the problem. The model for the limit-state function has the general form $\hat{g} = g(x, \Theta)$, where x is a set of descriptive variables and Θ is the set of unknown model parameters. The limit-state surfaces $g_i(x, \Theta) = 0$ denotes the

boundaries between soil classification zones in our specific problem. Inspired by currently available method of Robertson and Wride (1997), classifying soils as sands, silts, clays etc. based on the relative position of the CPT data in normalized tip resistance (q_{c1}) as given in Equation (2.11) and friction ratio (R_f) domain as shown in Figure 4.1, it was decided to identify soil classification zones as the circles with varying unknown radii (θ_3 , θ_4 , θ_5 , θ_6) drawn from the same central coordinates of (θ_1 , θ_2).



Figure 4.1: A Schematic representation of soil classification zones based on CPT-data (Robertson and Wride (1997))

The following model was adopted for the limit state function for CPTbased soil classification:

$$\hat{g}_{j}(R,\theta) = R - \theta_{j}$$
 j=3,4,5,6 (4.1)

where,

R: Soil behavior type index expressed as:

$$R = \sqrt{(\log(R_{f}) - \theta_{1})^{2} + (\log(q_{c} \cdot C_{N}) - \theta_{2})^{2}}$$
(4.2)

R_f: Friction Ratio expressed as:

$$R_{f} = \frac{f_{s}}{q_{c}} \times 100 \%$$
 (4.3)

C_N: Normalization factor for vertical effective overburden stress expressed as:

$$C_{N} = \left(\frac{100}{\sigma_{v}^{1}}\right)^{n} \qquad n = \begin{cases} R < \theta_{4} & 0.5\\ \theta_{4} < R < \theta_{5} & 0.5 \cdot (1 + \frac{R - \theta_{4}}{\theta_{5} - \theta_{4}})\\ R > \theta_{5} & 1 \end{cases}$$
(4.4)

q_c: Measured CPT tip resistance in units of MPa,

fs: Measured CPT sleeve resistance in units of MPa,

n: Normalization stress exponent which varies from 0.5 to 1.0 depending on the grain characteristics of soils (Olsen (1997))

In addition to q_c and R_f , vertical effective stress (σ'_v) was also chosen as one of the descriptive variables to better characterize the boundaries between soil classification zones. $\theta = (\theta_1, K, \theta_6)$ is the set of unknown model parameters.

The limit state function given in equation (4.1) assumes that the boundaries between soil zones can be completely explained by the three descriptive variables of q_c , R_f and σ'_v . Obviously other variables exist which may influence classification of soils. Even if the selected descriptive variables were to fully classify soils, the adopted mathematical expression may not have the ideal form. Hence, equation (4.1) is an imperfect model of the limit-state function. This is signified by use of a superposed hat on g. To account for the influences of the missing variables and the possible incorrect model form, a random model correction term, ε , is introduced and the corrected limit state function is written as:

$$g_{j}(q_{c}, R_{f}, \sigma'_{v}, \varepsilon, \theta) = \sqrt{(\log(R_{f}) - \theta_{1})^{2} + (\log(q_{c} \cdot (\frac{100}{\sigma'_{v}})^{n}) - \theta_{2})^{2}} - \theta_{j} + \varepsilon$$
(4.5)

It is reasonable and also convenient to assume that ε has the normal distribution. With the aim of producing an unbiased model (i.e., one that, in the average, makes the correct prediction), the mean of ε is set to zero. The standard deviation of ε , denoted σ_{ε} , however is unknown and must be

estimated. The set of unknown parameters of the model, therefore, is $\Theta = (\theta, \sigma_{\varepsilon}).$

For the sake of brevity, in the following the notation q, F and E to denote the descriptive variables q_c , R_f and σ'_v will be used, respectively. With this definition, the limit-state function takes the form:

$$g_{j}(q_{,F},E,\epsilon,\theta) = \sqrt{(\log(F) - \theta_{1})^{2} + (\log(q_{,} \cdot (\frac{100}{E})^{n}) - \theta_{2})^{2}} - \theta_{j} + \epsilon$$
 (4.6)

4.1.2 Formulation of Likelihood Function for CPT-Based Soil Classification

Let q_i , F_i , and E_i be the values of q_c , R_f and σ'_v at the ith CPT data pair observation, respectively, and let ε_i be the corresponding realization of the model correction term. If the ith CPT data pair is proved to be obtained from a layer of sand and sand mixture by laboratory testing of obtained soil samples, then $g_3(q_i, F_i, E_i, \varepsilon_i, \theta) > 0$ and $g_4(q_i, F_i, E_i, \varepsilon_i, \theta) \le 0$, if from a layer of silt and silt mixture, then $g_4(q_i, F_i, E_i, \varepsilon_i, \theta) > 0$ and $g_5(q_i, F_i, E_i, \varepsilon_i, \theta) \le 0$, if from a layer of clay and clay mixture, then $g_5(q_i, F_i, E_i, \varepsilon_i, \theta) > 0$ and $g_6(q_i, F_i, E_i, \varepsilon_i, \theta) \le 0$.

Assuming the observations compiled from different sites to be statistically independent, the likelihood function can be written for "n" sand and sand mixture cases, "k" silt and silt mixture cases and "m" clay and clay mixture cases as the product of the probabilities of the observations, i.e.,

$$L(\theta, \sigma_{\epsilon}) = \prod_{\substack{\text{Sand and}\\\text{Sand Mixture}}} P\left[g_{4}(q_{i}, F_{i}, E_{i}, \epsilon_{i}, \theta) \le 0\right] I P\left[g_{3}(q_{i}, F_{i}, E_{i}, \epsilon_{i}, \theta) > 0\right] \times \\ \prod_{\substack{\text{Silt and}\\\text{Silt Mixture}}} P\left[g_{5}(q_{i}, F_{i}, E_{i}, \epsilon_{i}, \theta) \le 0\right] I P\left[g_{4}(q_{i}, F_{i}, E_{i}, \epsilon_{i}, \theta) > 0\right] \times \\ \prod_{\substack{\text{Clay and}\\\text{Clay Mixture}}} P\left[g_{6}(q_{i}, F_{i}, E_{i}, \epsilon_{i}, \theta) \le 0\right] I P\left[g_{5}(q_{i}, F_{i}, E_{i}, \epsilon_{i}, \theta) > 0\right] \times$$

$$(4.7)$$

Suppose the measured values q_i , F_i , and E_i at each observation are exact, i.e., no measurement or estimation error is present. Then, noting that:

$$g(q_i, F_i, E_i, \varepsilon_i, \theta) = \hat{g}(q_i, F_i, E_i, \theta) + \varepsilon_i$$
(4.8)

has the normal distribution with mean $\hat{g}(q_i, F_i, E_i, \epsilon_i, \theta)$ and standard deviation σ_{ϵ} , the likelihood function (4.8) can be written as:

$$L(\theta, \sigma_{\varepsilon}) = \prod_{\substack{\text{Sand and}\\\text{Sand Mixture}}} \Phi\left[-\frac{\hat{g}_{4}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] - \Phi\left[-\frac{\hat{g}_{3}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] \times \prod_{\substack{\text{Silt and}\\\text{Silt Mixture}}} \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] - \Phi\left[-\frac{\hat{g}_{4}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] \times (4.9)$$

$$\prod_{\substack{\text{Clay and}\\\text{Clay Mixture}}} \Phi\left[-\frac{\hat{g}_{6}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] - \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, F_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, E_{i}, \theta)}{\sigma_{\varepsilon}}\right] + \Phi\left[-\frac{\hat{g}_{5}(q_{i}, E_{i}, \theta)}{\sigma_{\varepsilon$$

where $\Phi[\cdot]$ is the standard normal cumulative probability function. Note that the above is a function of the unknown parameters θ and σ_{ϵ} . Having formulated the likelihood function, unknown model parameters $\theta = (\theta_1, K, \theta_6)$ and standard deviation σ_{ε} of the model error term ε are estimated as the point estimates of those parameters, which maximize the likelihood function.

Table 4.1 summarizes the model parameters of the CPT-based soil classification limit state model.

 Table 4.1: Maximum likelihood estimates of model parameters for CPTbased soil classification

θ_1	θ_2	θ_3	θ_4	θ_5	θ_6	σ_{ϵ}
-12.835	8.064	2.175	14.540	15.350	17.589	0.307

4.2 DEVELOPMENT OF SPT-CPT CORRELATIONS

Database, used to develop correlation between SPT-N value and CPT tip resistance, q_c , as a function of mean grain size (D_{50}) and fines content (FC), is shown in Figure 3.4 and Figure 3.5, respectively, in Section 3.1. Additionally, for assessing SPT-CPT correlation with soil behavior type index (R), R values were determined as described in Section 4.1 and are tabulated in Appendix 4. To develop correlations, an appropriate probabilistic model was developed and the maximum likelihood method was implemented. Development of probabilistic model and implementation of ML method is discussed next in this chapter.

4.2.1 Probabilistic Model and Maximum Likelihood Method

Maximum likelihood approach for developing a model for the SPT-CPT correlations begins with the selection of a mathematical model. The model for the correlation is going to have functional form of $\hat{g} = g(x, \Theta)$ where x is a set of descriptive variables and Θ is the set of unknown model parameters.

Following a fastidious sensitivity study and a deep literature survey, the representative functional form to be used in analysis is determined as:

$$\hat{g} = g(N_{60}, D_{50}, FC, R, \theta, \varepsilon)$$
 (4.10)

 $\theta = (\theta_1, K, \theta_7)$ is the set of model parameters different for each model, and ε is the error term to account for the influence of the missing variables and the possible incorrect model form.

For the error terms in all models, it is reasonable and also convenient to assume that ε has the normal distribution. With the aim of producing an unbiased model (i.e., one that, in the average, makes the correct prediction), the mean of ε is set to zero. The standard deviation of ε , denoted σ_{ε} , however is unknown and must be estimated. The set of unknown parameters of the model, therefore, is $\Theta = (\theta, \sigma_{\varepsilon})$.

4.2.2 Formulation of the Likelihood Function for SPT-CPT Correlation with Mean Grain Size (D_{50})

Figure 4.2 illustrates the distribution of q_c with mean grain size, D_{50} , varying between 0.001 mm to 10 mm. It is observed from the figure that for D_{50} less than 0.1 mm, q_c falls between about 0.1 and 5 MPa and for coarser mean grain size values, there is a sudden increase in q_c , values of which goes up to 30 MPa.



Figure 4.2: Distribution of q_c with mean grain size, D₅₀

After a sensitivity analysis, following form of equation was found to be representative for all data pairs and appropriate to assess a probabilistic model:

$$\mathbf{q}_{c} = \boldsymbol{\theta}_{1} \times \mathbf{N}_{60}^{\boldsymbol{\theta}_{3}} \times \mathbf{D}_{50}^{\boldsymbol{\theta}_{2}} \pm \boldsymbol{\sigma}_{\varepsilon q}$$
(4.11)

In Figure 4.2, there is an increasing scatter with increasing D_{50} , particularly for D_{50} greater than 0.1 mm. It is more reasonable to use variable $\sigma_{\epsilon,q}$, increasing with increasing D_{50} :

$$\sigma_{\varepsilon,q} = \theta_4 + \theta_5 \times (3 + \log D_{50}) \tag{4.12}$$

Having formulated the likelihood function, unknown model parameters $\theta = (\theta_1, K, \theta_5)$ are estimated as the point estimates of those parameters, which maximize the likelihood function.

Table 4.2 summarizes the model parameters of SPT-CPT correlation with D_{50} .

 Table 4.2: Maximum likelihood estimates of model parameters for SPT-CPT correlation with D₅₀

θ_1	θ_2	θ_3	θ_4	θ_5
0.7175	0.1193	0.9773	1.2165	1.4758

Complied data points with the suggested closed form solution are shown in Figure 4.3. The curves in the Figures 4.3(a) and (b) show the predictions by the proposed closed form solution and the points represent the compiled database. Both the curves and the data points were drawn for varying bins of input parameters to observe sensitivity of results. In Figure 4.3(a), ranges of parameters are that: N_{60} is less than 11 and in Figure 4.3(b) N_{60} was changed to more than 11. Changing the parameter, it was intended to understand the variation of q_c with the changes in model parameters. It can be concluded from these figures that q_c is proportional to N_{60} and according to maximum likelihood estimates of model parameters for SPT-CPT correlation with D_{50} , there is a linear relationship between q_c and N_{60} for varying D_{50} .



Figure 4.3: Variation of qc-D50 with changes in variable N60

4.2.3 Formulation of the Likelihood Function for SPT-CPT Correlation with Percent Fines Content (FC)

In Figure 4.4, database, used to develop relationship between SPT-N and q_c as a function of percent fines content (FC) is presented. In this figure, it can be seen that q_c increases with decreasing FC.



Figure 4.4: Distribution of q_c with fines content, FC

A sensitivity analysis was carried out and consequently, linear equation given below was found to be appropriate and representative for emprical model:

$$q_{c} = N_{60}^{\theta_{3}} \times (\theta_{1} \times FC + \theta_{2}) \pm \sigma_{\varepsilon,q}$$
(4.13)

Since there is wide scatter in q_c versus FC plot shown in Figure 4.5, particularly for lower FC values,. $\sigma_{\epsilon,q}$ is defined as variable, linearly decreasing with increasing FC as:

$$\sigma_{\varepsilon,q} = \theta_4 + \theta_5 \times (100 - FC) \tag{4.14}$$

Model parameters $\theta = (\theta_1, K, \theta_5)$ are estimated as the point estimates of those parameters, which maximize the likelihood function.

Table 4.3 summarizes the model parameters of SPT-CPT correlation with FC.

Table 4.3: Maximum likelihood estimates of model parameters for SPT-
CPT correlation with FC

θ_1	θ_2	θ_3	θ_4	θ_5
-0.0131	1.7293	0.7250	1.3521	0.0496

Complied data points with the suggested closed form solution are shown in Figure 4.5. In Figure 4.5(a), ranges of parameters are that: N_{60} is less than 11 and in Figure 4.5 (b) N_{60} was changed to more than 11. It is observed that q_c is proportional to N_{60} and according to maximum likelihood estimates of model parameters for SPT-CPT correlation with FC, there is a non-linear relationship between q_c and N_{60} for varying FC.



Figure 4.5: Variation of qc-FC with changes in variable N₆₀

4.2.4 Formulation of the Likelihood Function for SPT-CPT Correlation with Soil Behavior Type Index (R)

The distribution of q_c with soil behavior type index, R, calculated for all data points as discussed in Section 4.1 is illustrated in Figure 4.6. As shown in this figure, for R greater than about 15, q_c varies between 0.1 and 5 MPa and, q_c increases up to 30 MPa as R decreases for R less than 15.



Figure 4.6: Distribution of q_c with soil behavior type index, R

After a sensitivity study, for assessing a probabilistic model of SPT-CPT correlation with soil behavior type index (R), the equation given below was found to be appropriate.

$$q_{c} = \theta_{1} \times N_{60}^{\theta_{3}} \times \exp(\theta_{2} \times R) \pm \sigma_{\epsilon,q}$$
(4.15)

Scatter in q_c versus R plot, presented in Figure 4.7, increases with decreasing R, particularly for R less than about 15.3. Since scatter in Figure 4.7 varies with R, a variable $\sigma_{\epsilon,q}$ equation, linearly increasing with decreasing R, was defined as:

$$\sigma_{\varepsilon,q} = \theta_4 + \theta_5 \times (16 - R) \tag{4.16}$$

Employing maximum likelihood methodology, unknown model parameters $\theta = (\theta_1, K, \theta_5)$ are estimated as the point estimates of those parameters.

Table 4.4 summarizes the estimated model parameters of SPT-CPT correlation with R.

 Table 4.4: Maximum likelihood estimates of model parameters for SPT-CPT correlation with R

θ_1	θ_2	θ_3	θ_4	θ_5
4.8E+08	-1.3240	0.5117	0.7905	1.7249

Complied data points with the suggested closed form solution are shown in Figure 4.8. In Figure 4.8(a), ranges of parameters are that: N_{60} is less than 11 and in Figure 4.8(b) N_{60} is more than 11. From these figures and from maximum likelihood estimates q_c and N_{60} is proportional and there is a nonlinear relationship between q_c and N_{60} for varying R.



Figure 4.7: Variation of $q_c\mbox{-}R$ with changes in variable N_{60}

CHAPTER 5

SUMMARY AND CONCLUSION

5.1 SUMMARY

The purpose of these studies was to develop robust and defensible probabilistically-based correlations i) for the use of CPT in soil classification, and ii) between SPT blowcount value, N and CPT tip resistance measurement, q_c . To develop proposed correlations, a database composed of 400 CPT/boring data pairs of tip resistance (q_c), friction ratio (R_f), soil classification based on USCS, fines content (FC), mean particle size (D_{50}) and SPT blowcount value (N) was compiled.

Having compiled the CPT/boring database, probabilistically based empirical models were developed and maximum likelihood method was implemented for the unbiased estimation of i) CPT-based soil classification boundary curves and, ii) SPT-CPT corrrelations. As a conclusion, main research findings can be summarized as:

• For CPT-based soil classification boundaries:

Figure 5.1 presents the boundary curves drawn by using the parameters summarized in Table 4.1 in Section 4.1.2. Also on the same figure, there are the normalized CPT tip resistance and friction ratio values with soil classification descriptions. In this figure, soil behavior type index, R, given in Equation 5.1, defines soil types. Table 5.1 presents soil behavior types.

$$R = \sqrt{(\log(R_f) + 12.835)^2 + (\log(q_c \cdot C_N) - 8.064)^2}$$
(5.1)

C_N: Normalization factor for vertical effective overburden stress expressed as:

$$C_{N} = \left(\frac{100}{\sigma_{v}^{1}}\right)^{n} \qquad n = \begin{cases} R < 14.54 & 0.5\\ 14.54 < R < 15.35 & 0.5 \cdot (1 + \frac{R - 14.54}{15.35 - 14.54})\\ R > 15.35 & 1 \end{cases}$$
(5.2)

q_c: Measured CPT tip resistance in units of MPa,

f_s: Measured CPT sleeve resistance in units of MPa,

R_f: Friction Ratio

n: Normalization stress exponent which varies from 0.5 to 1.0 depending on the grain characteristics of soils (Olsen (1997))

• For SPT-CPT Correlation with Mean Grain Size (D₅₀):

Following closed form solution, given in Equation (5.1), was proposed.

$$q_{c} = 0.717 \times N_{60}^{0.977} \times D_{50}^{0.119} \pm \sigma_{\epsilon,q}$$
(5.3)

$$\sigma_{\epsilon,q} = 1.217 + 1.476 \times (3 + \log D_{50})$$

• For SPT-CPT Correlation with Percent Fines Content (FC)

Following closed form solution, given in equation (5.2), was proposed.

$$q_{c} = N_{60}^{0.7250} \times (-0.0131 \times FC + 1.7293) \pm \sigma_{\epsilon,q}$$
(5.4)

 $\sigma_{\epsilon,q} = 1.3521 + 0.0496 \times (100 - FC)$



Figure 5.1: Proposed CPT-based soil classification chart

Soil Behaviour Type Index, R	Soil Type
R<14.54	Sand and Sand Mixtures
14.54 <r<15.35< td=""><td>Silt and Silt Mixtures</td></r<15.35<>	Silt and Silt Mixtures
R>15.35	Clay and Clay Mixtures

Table 5.1: Boundaries of soil behavior type

• For SPT-CPT Correlation with Soil Behavior Type Index (R)

Following closed form solution, given in equation (5.3), was proposed.

$$q_{c} = 4.8E + 08 \times N_{60}^{0.5117} \times exp(-1.324 \times R) \pm \sigma_{\epsilon,q}$$
 (5.5)

 $\sigma_{\epsilon,q} = 0.7905 + 1.7249 \times (16 - R)$

All currently available SPT-CPT correlations, discussed in Chapter 2, had been developed for the variation of $(q_c/Pa)/N$ ratio with grain characteristics, such as mean grain size, percent fines content and soil behavior type index, assuming a linear relationship between q_c and N. Figure 5.2 through Figure 5.4 present a comparison of, predictions by proposed emprical models with the compiled database. Figures are plotted in $(q_c/Pa)/N_{60}^{0.0}$ versus grain characteristics (D₅₀, FC and R, respectively) domain to ease the comparison with currently available correlations and mean prediction equations are also provided in each figure.



Figure 5.2: Variation of $(q_c / Pa) / N_{60}^{-\theta_3}$ ratio with D_{50}



Figure 5.3: Variation of $(q_c / Pa) / N_{60}^{-\theta_3}$ ratio with FC



Figure 5.4: Variation of $(q_c / Pa) / N_{60}^{-\theta_3}$ ratio with R

5.2 CONCLUSIONS

As a part of these studies followings can be concluded:

• For CPT-based soil classification:

Proposed CPT-based soil classification method provides a quantifiable insight in to the problem. As shown in Figure 5.1, new set of soil classification boundaries clearly identify various soil classification zones which adress the uncertainties in the locations and the forms of these boundaries. Presently, three available soil zones of i) sand, ii) silt and iii) clay mixtures can be extended to a more detailed and finer classification zones once more CPT and soil classification data pairs become available. • For SPT-CPT correlations:

More advanced probabilistic tools, maximum likelihood methodology, were used to develop and evalute correlations and probabilistic models are based on significantly more number of data pairs than currently available methods. The resulting correlations provide a significantly improved basis and unbiased estimates for SPT-CPT correlations. For variation of q_c with D_{50} , there is a linear relationship between q_c and N_{60} as offered by currently available correlations but q_c and N_{60} have non-linear trend for varying fines content, FC and varying soil behavior type index, R.

APPENDIX A

SPT-CPT DATA PAIRS

In Appendix A, site names, SPT log and CPT log names of data pairs are tabulated. In addition, a name is given to each data pair which is also tabulated.

Phase	Site Name	CPT Log Name	SPT Log Name	Name of SPT- CPT Pair
	Site A	CPT-A3	SPT-A1	A-1
		CPT-A1	SPT-A2	A-2
	Site B	CPT-B1	SPT-B1	B-1
		СРТ-В3	SPT-B2	В-2
		CPTC3	SPTC2	C-1
1	Site C	CPT-C2	SPT-C5 AND SPT- C6	C-2
		CPT-C7 AND CPT- C1	SPT-C1	C-3
		CPT-C4	SPT-C3 AND SPT- C4	C-4
	Site D	CPT-D3	SPT-D2	D-1
		CPT-D2	SPT-D1	D-2
		CPT-D1	SPT-D3	D-3
	Site E	CPT-E1	SPT-E1	E-1
	Site F CPT-F1		SPT-F1	F-1
	Site G	CPT-G1	SPT-G2	G-1
		CPT-G3	SPT-G1	G-2
	Site H	CPT-H2	SPT-H1	H-1
	Site I	CPT-I2	SPT-I1	I-1
	Site I	CPT-J4	SPT-J2	J-1
	Site J	CPT-J2	SPT-J1	J-2

Table A.1: SPT-CPT pairs from Pasific Earthquake Researh Center (PEER),Turkey Ground Failure (August 1999 Earthquakes) Database
Phase	Site-Line	CPT Log Name	SPT Log Name	Name of SPT-CPT Pair
1	Site K	СРТ-К2	SPT-K1	K-1
1	Site L	CPT-L1	SPT-L1	L-1
		CPT-1-11	SPT-1-11	L1-1
		CPT-1-42	SPT-1-42	L1-2
		CPT-1-41	SPT-1-41	L1-3
	Line 1	СРТ-1-32	SPT-1-32	L1-4
		CPT-1-16	SPT-1-16	L1-5
		CPT-1-24	SPT-1-24	L1-6
2		CPT-1-02	SPT-1-02	L1-7
2	Line 2	CPT-2-10	SPT-2-10	L2-1
	Line 2	CPT-2-3	SPT-2-3	L2-2
	Line 2	СРТ-3-3	SPT-3-3	L3-1
	Line 5	CPT-3-6	SPT-3-6	L3-2
		CPT-4-13	SPT-4-13	L4-1
	Line 4	CPT-4-3	SPT-4-3	L4-2
		СРТ-4-22	SPT-4-22	L4-3

 Table A.1 (cont.): SPT-CPT pairs from Pasific Earthquake Researh Center (PEER), Turkey Ground Failure (August 1999 Earthquakes) Database

-

Dhaga	Site Nome	Name of CPT	Name of SPT	Name of SPT-
Phase	Site Name	Log	Log	CPT Pair
	Çark Canal	CPT-1-24-cc	SPT-1-24-cc	CC-1
	Cumhuriyet Avenue	CPT-4-22-ca	SPT-4-22-ca	CA-1
	Değirmendere	CPT-DN1	SPT-DN1	DN-1
	Nose	CPT-DN2	SPT-DN2	DN-2
		CPT-SH2	SPT-SH2	HS-1
	Hotel Sapanca	CPT-SH4	SPT-SH4	HS-2
4	*	CPT-SH7	SPT-SH7	HS-3
		CPT-SH11	SPT-SH11	HS-4
	Police Station	CPT-PS3	SPT-PS3	PS-1
		CPT-PS4	SPT-PS4	PS-2
	Soccer Field	CPT-SF5	SPT-SF5	SF-1
	Yakin Street	CPT-A3-ys	SPT-A1-ys	YS-1
		CPT-A1-ys	SPT-A2-ys	YS-2
	Yalova Harbor	CPT-YH4	SPT-YH3	YH-1
		СРТ-ҮНЗ	SPT-YH1	YH-250

Table A.1 (cont.): SPT-CPT pairs from Pasific Earthquake Researh Center(PEER), Turkey Ground Failure (August 1999 Earthquakes) Database

Site Name	Name of CPT Log	Name of SPT Log	Name of SPT-CPT Pair
Tigcilar District (Site A)	CPT-Tigcilar-1A	SPT-TSK-1	TD-1
Cumhuriyet Disrict (Site E)	CPT-CUM-3	SPT-CSK-1	CD-1

 Table A.2: SPT-CPT pairs from Karaca (2001) Database

Table A.3: SPT-CPT pairs from	Buski East	Waste	Water	Treatment	Plant
Pro	oject Databa	nse			

Site Name	CPT Log Name	SPT Log Name	Name of SPT-CPT Pair
	CPT-1	SK7	BCP-1
	CPT-2	S104	BCP-2
	CPT-3	S102	BCP-3
	CPT-7	S105	BCP-4
	CPT-8	S103	BCP-5
	CPT-14	S110	BCP-6
Demirtas	CPT-15	S101	BCP-7
	CPT-16	S106	BCP-8
	CPT-17	SK5	BCP-9
	CPT-18	S107	BCP-10
	CPT-19	S108	BCP-11
	CPT-20	SK1	BCP-12
	CPT-21	S109	BCP-13

APPENDIX B

SPT LOG AND LABORATORY TEST RESULTS

In Appendix B, STP log and laboratory test results of borings tabulated in Appendix A is presented.

Sai	nple	Deptl	n (m)						
Boring Name	Sample No	From	То	N ₆₀	LL	PI	%FC	D ₅₀	USCS
	SPT-1	1.65	1.95	7	70	50	95		СН
SK101	SPT-2	3.65	3.95	8	NP	NP	54		ML
	SPT-5	9.65	9.95	10	NP	NP	50	0.074	SM-ML
	SPT-4	7.7	8	4	26	7	39	0.1	SM-SC
SK102	SPT-5	9.5	9.8	11	NP	NP	8	1	SW-SM
SK 102	SPT-7	13.7	14	17	19	5	33	0.31	SM-SC
	SPT-8	15.7	16	17	NP	NP	16	0.9	SM
	SPT-3	5.65	5.95	6	35	15	74		CL
	SPT-4	7.65	7.95	7	NP	NP	19	0.17	SM
SK102	SPT-5	9.65	9.95	7	28	13	56		CL
51103	SPT-7	13.65	13.95	8	NP	NP	44	0.08	SM
	SPT-8	15.65	15.95	7	NP	NP	42	0.1	SM
	SPT-11	21.6	21.9	8	NP	NP	13		SM
	SPT-1	1.7	2	4	42	27	77		CL
	SPT-2	3.7	4	7	30	11	68	0.014	CL
SK104	SPT-3	5.7	6	6	NP	NP	29	0.14	SM
SK104	SPT-4	7.7	8	7	48	33	86	0.001	CL
	SPT-5	9.7	10	14	21	6	27	0.4	SM-SC
	SPT-6	11.7	12	14	NP	NP	18	0.33	SM
	SPT-1	1.65	1.95	7	32	11	65		CL
	SPT-2	3.65	3.95	6	NP	NP	13	0.28	SM
SK105	SPT-3	5.65	5.95	5	NP	NP	18	0.28	SM
31105	SPT-5	9.65	9.95	12	NP	NP	32	0.17	SM
	SPT-7	13.65	13.95	12	17	6	37	0.18	SM-SC
	SPT-8	15.65	15.95	11	NP	NP	28	0.22	SM
	SPT-1	1.65	1.95	7	74	52	98		СН
	SPT-2	3.7	4	5	45	29	88	0.001	CL
SK106	SPT-3	5.7	6	5	NP	NP	17	0.49	SM
	SPT-4	7.7	8	9	NP	NP	11	0.5	SW-SM
	SPT-5	9.7	10	7	20	6	21	0.55	SM-SC

 Table B.2 : SPT Results and laboratory test result of Buski East Waste

 Water Treatment Plant Project Database

Sa	nple	Deptl	n (m)						
Boring Name	Sample No	From	То	N ₆₀	LL	PI	%FC	D ₅₀	USCS
SK107	SPT-1	1.7	2	4	61	40	95		СН
51107	SPT-2	3.7	4	5	40	24	76		CL
	SPT-1	1.7	2	5	40	22	80		CL
	SPT-2	3.7	4	4	44	25	88	0.001	CL
SK108	SPT-3	5.7	6	4	40	25	75	0.001	CL
	SPT-5	9.7	10	6	NP	NP	13	0.39	SM
	SPT-7	13.7	14	8	NP	NP	4	3.3	SW
	SPT-1	1.65	1.95	4	33	15	70		CL
	SPT-2	3.65	3.95	4	38	20	70		CL
SK100	SPT-4	7.65	7.95	10	NP	NP	14	0.27	SM
51109	SPT-5	9.65	9.95	12	NP	NP	5	0.5	SW
	SPT-6	11.65	11.95	8	NP	NP	7	0.55	SW-SM
	SPT-7	13.65	13.95	10	27	6	43	0.09	SM-SC
	SPT-1	1.7	2	5	35	17	88		CL
SK110	SPT-4	7.7	8	5	23	5	26	0.24	SM-SC
SKITU	SPT-7	13.7	14	7	NP	NP	13	0.52	SM
	SPT-8	15.7	16	8	NP	NP	18	0.5	SM
SK1	SPT-5	7.65	7.95	9	23		38	0.2	SM
QV/F	SPT-12	18.15	18.45		34	16	53	0.004	CL
SND	SPT-5	7.65	7.95				9	0.7	SM
SK7	SPT-4	6.65	6.95				39	0.14	SM

Table B.2 (cont.) : SPT Results and laboratory test result of Buski Counselin Project

	SAMP	LE	XX (0/)	C	AT	TERB LIMIT	ERG S	%	FINES CO	ONTENI	[USCS	N	N
Boring Name	Sample No	Depth (m)	W _n (%)	Gs	LL	PL	PI	4 (%)	10 (%)	40 (%)	200 (%)	0505	1	[⊥] ¶field
	SPT-1	1.50-1.95	34.8		34	26	8	100.0	100.0	100.0	89.9	ML	3 -3 -4	7
	SPT-2	3.00-3.45	18.0	2.581		NP		100.0	98.9	96.4	40.0	SM	3 -4 -5	9
	SPT-3	4.50-4.95	31.9	2.585	33	24	9	100.0	100.0	97.5	87.0	ML	3 -4 -5	9
	SPT-4	6.00-6.45	16.0			NP		98.9	97.9	73.3	13.8	SM	4 -5 -7	12
	SPT-5	7.50-7.95	19.2			NP		97.1	96.1	89.7	14.9	SM	9 -19 -33	52
TSK-1	SPT-6	9.00-9.45	17.1	2.577		NP		100.0	97.5	84.7	21.5	SM	8 -30 -39	69
	SPT-7	10.50-10.95	16.4			NP		100.0	100.0	77.1	12.2	SM	9 -27 -38	65
	SPT-8	12.00-12.45	31.2			NP		100.0	100.0	98.5	29.2	SM	16 - 17 - 20	37
	SPT-9	13-50-13.95	23.2			NP		100.0	100.0	97.8	41.2	SM	15 -19 -25	44
	SPT-10	15.00-15.42	38.6	2.673	39	26	12	98.3	96.2	92.5	86.9	ML	10 -15 -17	32
	SPT-11	16.50-16.95	34.6		36	24	11	100.0	98.8	96.5	90.0	ML	8 -12 -15	27
	SPT-1	1.50-1.95	29.0	2.624	32	24	8	100.0	96.5	86.6	67.1	ML	3 -3 -4	7
	SPT-2	3.00-3.45	33.9		47	22	25	100.0	98.2	95.7	85.2	CL	3 -3 -4	7
	SPT-3	5.00-5.45	35.6	2.620	44	22	22	100.0	97.0	92.2	84.8	CL	2 -3 -3	6
CSK-1	SPT-4	6.00-6.45	36.9	2.627	37	21	16	100.0	100.0	100.0	94.9	CL	3 -5 -9	14
	SPT-5	7.50-7.95	35.1	2.631	42	23	19	100.0	100.0	98.2	91.5	CL	5 -6 -7	13
	SPT-6	9.00-9.45	30.4	2.571		NP		100.0	100.0	98.0	43.5	SM	12 - 26 - 39	65
	SPT-7	10.50-10.95	17.7			NP		96.5	92.5	65.5	5.8	SM-SW	8 - 18 - 36	54

 Table B.1 : SPT Results and laboratory test result of Karaca (2001) Database

A3 o Crealius XC90H o. U. C. Berkaley method. AWJ rods. ss et al. 1983)	Remarks											
487°E to CPT- iivalent t 3. Sancio athead i er Kovad	(mm) 010				<2µm		0.003		<2µm	0.002		0.12
N 30.39 respect ade, equ and R. E sy and c nmer (p	(uuu) 050				0.0035		0.045		0.012	0.057		0.29
F-A1 77922° m with tom m to tom m to tom m to tom m to tom m to tom m to tom m to tom m to tom m to tom m to tom m to tom m to to tom m to to to to to to to to to to to to to	(%) umi 7 >				36		>10%		18	10		
D: SP1 35: 40.7 35: 40.7 35: J. D 5: Safe 8: Safe	(%) turi ç >				61		16		31	15		
Test I rdinato levatio uipmei gineei Systei er Typ	uni c7 > sanî %		06	94	100	87	74	92	97	70	58	5
S Coo E ing Eq ible Er SPT Hamm	Plasticity Index		13	23	35	23	9	28	20			
GP Drill sspons	imi.I biupi.I		41	53	65	46	29	55	47	30	29	
Re	Moisture Content (%)		38	39	39	37	29	44	39	27	27	24
	^{n s} Torvane (kPa)			28	50	22	23	25	26			
key /28/00	Pocket Pen (kPa) Ju				140	80	20	80	75	450	275	300
ling Performance in Adapazari, Tu Cumhuriyet District, Adapazari S.) S.) (atameter tricome bit (22400, 0.77m 06/26/00, 0.77m 06	Description	ASPH: Boring performed through asphalt and subgrade of Tul street	FILL: Materials transition from a brown to gray gravelly sand to red sitty clay of hard	consistency	CH: Brown, moist, sticky, high plasticity silty clay without visible sand particles. S-A1-4 shows darker tones and some fine to medium sand content		ML: Gray silt with sand. Field description: ML	ML: Brown, low plasticity silt with fine sand and some red clay points	CH: High plasticity gray clay with low sand content (traces). At 6.3 m a thin fine sand seam was identified. Sample A1-7 exhibits some sand seams	ML: Gray sandy silt. Increasing sand content with depth		SP: Medium to fine poorly graded gray sand
d Build Streets, A. jisi, A. 90m 06	Energy Ratio (%)		37	46	42	57	53	55	20	65	75	64
Yakin S Aancio Teknolo ash with ML=0.5	(m) rhgna.l boA		4.27	5.80	5.80	7.32	7.32	8.84	8.84	10.37	11.85	11.85
ul and ul and fo B. S. emin T. tary wa on: G'	Casing Depth (m)											
iame: Grou : Site A - T e 23, 2000 I by: Rodol I by: Rodol fethod: Ro ble Elevati olid flight a	Blows/15 cm SPT		1-3-3	3-2-5	2-3-4	1-2-2	2-2-2	1-2-1	1-1-2	6-9-9	6-9-10	11-20-23
Project N Location Date: Jun Field Log Operator Dofilling N Water Tai	Γευδην (cm) Κετονειλ		18/45	40/45	31/45	36/45	40/45	45/45	39/45	37/45	41/45	41/45
	Sample Type and No.		S-A1-1	S-A1-2	S-A1-3	S-A1-4	S-A1-5	S-A1-6	S-A1-7	S-A1-8	S-A1-9	S-A1-10
CB-BYU-U TAS-SaU-N oint Research ponsored by 'SF, Caltrar	sosn		M	MH/CH	5	ы	ML/ML-	공	CL/ML	ML	ML	ß
D BN - SZO	Vgolothil		33	\$	333	}		}})	/ } }			
	Depth Scale (m)	.	<u>.</u>		<u>.</u>		4	<u>.</u>		<u>.</u>	<u>φ</u>	.

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.1: SPT log: SPT-A1

A3 to Creatius XC90H io. U. C. Berkeley method. AWJ rods. ics et al. 1983)	Remarks									At approximately 7.15 m, an 8-cm thick stratum of	Dlack, incrous materia (Peat) was identified in the sample	
487°E to CPT uivalent B. Sanc sathead er Kova	(mm) 01G				<2µm		0.001		<2µm	0.001	0.08	0.1
N 30.39 respect and R. I and R. I and c mmer (p	(mm) 02D				0.001		0.018		0.007	0.026	0.12	0.33
T-A2 77922°1 m with stom ma stom ma stom ma stom ma stom ma stom ma et Hanllé ety Hanllé	(%) uuri 7 >				57		12		30	13		
D: SP1 D: SP1 D: SP1 D: SP1 D: SP1 D: SP1 D: Cus D: Cus D: Cus D: Cus D: Cus D: Cus D: SP1 D:	(%) turi ç >				75		18		42	20		
Test redinate levatic uipme nginee Syste rer Typ	uni ç7 > təni %		74	86	100	85	93	96	66	85	8	9
S Coo ing Eq sible Er Hamir	Plasticity Index		8	æ	23	25	7	20	22	1		
GF Drill Spons	imi.I biopi.I		31	35	51	49	35	43	51	39		
ž	Moisture Content (%)		37	36	44	37	8	4	43	33	ŝ	13
8	Torvane (kPa)		10	18	48	53	35	31	37	36		
rkey 06/28/(Pocket Pen (kPa)		150	75		120	160		75	170	380	320
ing Performance in Adapazari, T. Cumhuriyet District, Adapazari S.) S.) diameter tricone bit é(2400, 0.79m 06/26/00, 0.85m nepth of 1m	Description	ASPH: Asphalt of Yakin Street.	Fil	ML: Brown clayey slit to slity clay with some red oxidation points and some fine sand	CH: Brown high plasticity silty clay to clayey silt. Some fine	to measure sare in a siny clay matrix was observed in the wash water	ML: Brown/gray clayey silt with traces of fine sand	CH: Gray silty clay of medium to high plasticity. Sticky to the	fingers. Softens when remoulded	ML: Gray clayey silt with some fine sand	SP-SM: Poorly graded gray fine sand with sit. Gravel content ~ 8% in sample S-A2- 10	
treets, isi, A. jisi, A. 70m 0	Energy Ratio (%)		37	53	· .	52	65		65	09	61	,
lure an Yakin S ancio eknolo eknolo ish with NT = 0 as used	(m) rugası boğ		4.27	5.80		7.32	7.32		8.84	10.37	11.89	12.82
Ind Fail Ind Pand y fo B. S. fo B. S. fo B. S. for B. for B. S. for B. S. fo	Depth (m) Depth (m)				2.55	3.35	4.15	4.95	5.95	6.95	8.45	9.95
Jame: Grou i: Site A - Tu ne 24, 2000 j by: Rodolf j by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf i by: Rodolf 	Blows/15 cm SPT		1-2-1	1-2-2		2-1-1	2-3-4		1-1-2	3-5-5	12-20-16	7-10-15
Project I Project I Jul Jul Jult Lo; Pperato Dilling I Nater Ta Votes: S	Γευδιμ (cm) Κεςολειλ		28/45	42/45	42/42	40/45	28/45	42/42	39/45	32/45	38/45	38/45
	эдүТ эlqms2 .oN bas		S-A2-1	S-A2-2	SH-A2-3	S-A2-4	S-A2-5	SH-A2-6	S-A2-7	S-A2-8	S-A2-9	S-A2-10
CB-BYU-U TAS-SaU-M oint Research ponsored by PG&E EC, PG&E	SOSO		ML/CL	ML	CH/MH	сгисн	۲ ۲	CL	MH/CH	W	SP-SM	SP-SM
BN ∼ ∞ 2 0	vgolothi.I				}}	}},		}}	}}}			• • • •
	Depth Scale (m)	0			<u></u>		4	<u>د</u>	9		<u>φ</u>	9

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Figure B.2: SPT log: SPT-A2

B3 c Creatius XC90H i, U. C. Berkeley nethod, AMJ rods. s et al. 1983)	Remarks										Parra 1 of
024°E t to CPT ivalent to Sancio athead n athead n	(mm) 01G		<2µm	0.014 <21m	0.05	0.06		0.21	0.17	<2µm	
N 30.40 h respec ade, equ and R. B sy and c nmer (pe	(mm) 05Q		0.012	0.05	0.17	0.13	0.5	1.7	9.0	0.001	
F-B1 78513° ccm with tom m tom m tom m tom m tom m e, Bray e, pull ety Har	(%) uni 2 >		28	<10%		15 15	2.			59	
D: SP1 55: 40.7 75: 1. D 75: J. D m: Rop 6: Safe	(%) uni 5 >		33	<15%		39	2.			89	
Test I rdinate levatio levatio uipmen ginee Syster Syster	uni ç7 > eənî %		96	82	23 23	44 86	8	5	5	100	
S Coo E ing Eq ible Er SPT Hamm	Plasticity Index									40	
GP Drilli	nmil binpil		37	31	ŧ.,	27			T.	62	
Re	Moisture Content (%)		32	32	30.24	27	11	1	15	33	
-	Uorvane (kPa) 5 U									38	
key lapazar	Pocket Pen (kPa) 9 <i>u</i>		50	60	250 110	150	2			200	
fing Performance in Adapazar, Tu prak Street, Karaosman District, A, S.) S.) S.) S.) S.) S.) S.) S.) S.) S.)	Description	Fill: Rubble from demolition of building B1. Brown sandy silty clay	CLAYEY SILT: Olive gray clayes silt with traces of fine sand. S-C2-B is gray brown clause silt The brown tonce	may be due to oxidation of ferric minerals	SAND AND SILT: Brown low plasticity silt to silty fine sand. FC of recovered samples varies from 14% to 66%		SILTY SAND: Gray sand mixtures grading with depth from sandy silt to sand with silt and sand with silt and fine to	coarse gravel. Gravel content is irregularly variable from 2% to 27%. The shape of the gravel particles is variable from flat and elongated to well proportioned angular and rounded		CH: Stiff gray moist high plasticity silty clay. Wash water shows traces of shells.	
d Build nd Yaj jisi, A. 19 cm- 3 m 00 depth	Energy Ratio (%)			49	63	88	63	99		67	
Lure and Ave. a ancio eknolo sh with NL = 3. ed to a	(m) rigan Leagth (m)		5.80	5.80	7.32	8.84	8.84	10.37	11.89	13.42	_
uyudibi uyudibi fo B. Sa emin T tary wa on: G\	Casing Depth (m)		1.55	2.55	3.35	4.15	4.95	6.15	7.95	10.45	
<pre>4ame: Grou *: Site B - Ki y 4, 2000 g by: Rodoll by: Rodoll f: ZETAS (Z Method: Ro ble Elevati solid flight au</pre>	Blows/15 cm SPT		1-1-1	2-1-2	2-5-3	4-3-6	10-12-14	9-13-16	9-15-17	3-3-5	
Project I Location Date: Jul Tield Lo Derato Drilling I Nater Ta Votes: S	Γευβην (cm) Γευβην (cm)		31/45	32/45	41/45	27/45	30/45	21/45	18/45	35/45	•
	Sample Type .oN bas		S-B1-1	S-81-2A	S-B1-3A S-B1-3A S-B1-3B	S-B1-4A	S-B1-5	S-B1-6	S-B1-7	S-B1-8	
ICB-BYU-U STAS-SaU-A Joint Research Sponsored by NSP, Caltra. CEC, PG&I	nace		ML	ž 2	WL SM	NN NN	WS	WS-MS	SP-SM	5 	
	(m) succe inque		н	н			FEFFFF		HEFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF		<u> </u>
	(m) sleep drond	<u>.</u>		ů.	4			2-1-0		6	Ť.

Figure B.3: SPT log: SPT-B1

T-B3 Io Creatius XC90H o, U. C. Borkeley method, ANJ rods. cs et al. 1983)	Remarks	SPT-B1-11 was performed using BW rods and donut harmmer	
024°E th c CP uivalent i 3. Sanci athead er Kovae	(mm) 010	0.037	<1µm
N 30.40 h respec ade, equ and R. f ey and c mmer (p	(uuu) 05CI	- 60 [.] 0	0.001
-B1 8513° Iom mit Bray e, pully ty Har	(%) umi 7 >	<10%	58
D: SPT ss: 40.7 nr: -22 c nr: -22 c nr: Cust nr: Safe e: Safe	(%) turi ç $>$	<15%	80
Test I prdinate Elevatio quipmer ngineer Syster ner Typ	uni 57 > səaii %	8	100
S Coc E ing Eq ible E SP1 Hamn	Plasticity Index		34
GP Drill spons	timi.I biupi.I	21	58
Re	Moisture Content (%)	- 28	37
-	Torvane (kPa)		
lapazar	Pocket Pen (kPa) 9 <i>u</i>	275	220
ing Performance in Adapazari, Tu orak Street, Karaosman District, A. S.) diameter tricone bit 3(0500, Caved in at 3.05 m 07/08 of 1 m	Description	CLAY AND SAND: Interbedded thin strata of gray sitiy sand to sandy slit and gray slity clay to clayro slit Mosis gray high plasticity Mosis gray high plasticity sility clay. Very thin (< 1 cm) red oxid:ced seams found in \$-81-11.	
J Build nd Yap isi, A. 9 cm- 3 m 06 depth	Energy Ratio (%)	63	
Ave. a Ave. a ancio eknolo sh with VL = 3.	(m) rhgan Loof	16.46	
und Fail uyudibi fo B. Si cemin T. tary wa on: GV	Casing Depth (m)	10.45	10.45
Vame: Grot Name: Grot Nat, 2000 g by: Rodol r: ZETAS (Z Method: Ro ible Elevati Solid flight au	Blows/15 cm SPT	4-5-8	3-5-7
Project Date: Jul Field Lo Derato Drilling Nater Ta	Γευδήν (cm) Γευδήν (cm)	32/45	27/45
	Sample Type snd No.	S-B1-9 S-B1-10	S-B1-11
B-BYU-I AS-SaU-I int Researc onsored by W, Caltra 3C, PG&	SOSO	WS	ъ
CE SE Joi	7golorhi I	}}} <i>\</i> } / ///////////////////////////////////	7
	Depth Scale (m)	15 4 33 25	16

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.3(cont.): SPT log: SPT-B1

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s XC90H srkeley WJ rods.	Remarks										
E CPT-B3 ant to Crealiu nicio, U. C. B ad method. A ovacs et al. 1			E		35						
0024° act to 1 B. Sa cathe per Kc	(mm) 01G		<2µ		0.00	0.15	0.15		ć	77.0	0.21
N 30.4 th resp hade, e and R ley and mmer ((mm) 08D		0.014		0.038	0.4	0.48		4	2	0.9
T-B2 78513 ccm wi ccm wi stom n stom n . Bray 0. Bray 0e, pul	(%) um 7 >		21		4	Ŷ					
D: SP' 140. 140. 140. 140. 140. 140. 140. 140.	(%) umi ç >		30		80						,
Test I rdinate levatio uipmer ngineer Syster er Typ	ավ č ⁷ > Խոն "		87		91	5	5		c	°	4
S Coo E Ble Eq SPT Hamm	Plasticity Index		18		6						,
GP	imi.I biopi.I		42		37						
Re l	Moisture Content (%)		34		33	16	20		ţ	=	15
	u ⁸ Torvane (kPa)										
key apazari	Pocket Pen (kPa) 9 <i>u</i>										
ling Performance in Adapazari, Tu orak Street, Karaosman District, Ak S S diameter tricone bit 37/06/00	Description	Fill: Dark brown well graded sand with fine gravel	CLAYEY SILT: Brown clayey silt with fine sand and red oxidized zones		CANDV SII T. Crow condu with	SANDT SILT. Gray saried site SAND: Well to poorly graded gray sand. Sand with silt in the upper 2 m of the laver. Gravel	content in recovered samples is variable from 0% in S-B2-5	to 12 % in S-B2-7			
d Build Ind Ya jisi, A. 68 m 19 cm-	Energy Ratio (%)		54	51	5	63	65				67
Ave. a Ave. a ancio eknolo sh with VL = 1.	(m) rhgaal box		4.27	5.80	7.32	7.32	8.84	9.77	5	11.40	11.89
nd Fail iyudibi o B. Se amin T. any wa any wa iger us	Casing Depth (m)		1.35	2.15	2.95	3.85	4.65	5.45	202	0.00	7.95
Name: Grou n: Site B - Ku ly 5, 2000 g by: Rodolf r: ZETAS (Zu Method: Rot able Elevatit Solid flight au	Blows/15 cm SPT		1-2-1	1-2-1	1-1-1	4-8-3	9-9-10	9-14-17	0 44 40	0 ++	11-15-16
Project Project Date: Ju Sate: Ju Sperato Drilling Vater T.	Γευβήν (cm) Κεςονειλ		31/45	0/45	35/45	35/45	27/45	0/45	46146	040	15/45
	Sample Type and No.		S-B2-1	S-B2-2	S-B2-3	S-B2-4A S-B2-4B	S-B2-5	S-B2-6	1 00 0	1-70-0	S-B2-8
CB-BYU-U TAS-SaU-J oint Research ponsored by SBP, Caltra:	sosn		С		٦	WS-dS	SP-SM			M0	SW
D Z S S Z O	Vgolothil		, н "	H [] H	I [H		· . · .		1.1.1.	· . · . · .	. ¹ .
	Depth Scale (m)	o ,	- 0		ŝ	4	-0	9	r-		æ

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.4: SPT log: SPT-B2

.C4 b Crealius XC90H J. C. Berkeley hethod, AWJ rods. s et al. 1983)	Remarks										
221°E t to CPT- ivalent to t. Sancio. athead m arthead m	(uuu) 010			<2µm		- <2µm		0.001 0.11	.	<2µm	1
V 30.39/ respected ade, equ and R. B sy and c	(mm) 05CI			<2µm		0.027		0.07	2.8	0.007	1
7-C1 78370°h cm with cm ma tiom ma tiom ma tion ma tion ma tion ma tion ma tion ma tion ma tion ma tion ma tion ma tion ma tion ma tion	(%) uni 7 >			67		14		÷,		32	
D: SP1 55:40.7 75:1.0 75:1.0 8:53f	(%) uni 5 >			84		18		4 '		42	
Test I rdinate levatio ginee Syste	uni ç7 > xənî %		66	66		86 90	67	53	-	89	
S Coo E E ing Eq ible Er Hamm	Plasticity Index		17	42		ω,					
GP	nmil binpil		44	25		36 30	26	31		32	
Re	Moisture Content (%)		40	42		383	28	. 29	14	30	
	Uorvane (kPa) 5 U		4	32	24	23	23			30	
key	Pocket Pen (kPa) 9u		30	120	100	180	170	180			
Ing Performance in Adapazari, Tr istrict, Adapazari S.) S.) diameter tricone bit 06/28, 1.56 m 07/08, 1.53 m 07/1 2PT-C1	Description	Fill: Dark brown clayey fill	CLAY: Brown tan silty clay to dayey silt. Red oxidation points in samples indicating oxidation of ferric minerals			SANDY SILT: Gray low	pleasucity sandy slitt interbedded with gray silty clay with traces of fine sand. Thin	gray day layer at approximately 5.15 m. SAND: Gray sand to silty sand	intersporsed with thin layers of silty clay. Variable gravel content in samples S-C1-6B and S-C1-7 (10 % - 20 %)		ML: Gray low plasticity clayey silt with fine sand
d Build tiklal D jisi, A. 42 m	Energy Ratio (%)			47		63	64	59	56	71	
llure ar treet, Is ancio Teknolo ish witt WL = 1 NL = 1 n away	(m) rhgna.l boff		5.80	5.80		7.32	8.84	8.84	10.37	11.85	
Ind Fai iölük S. Ifo B. S Zemin 7 dary we tary we tary we	Casing Depth (m)				2.0	4.15	5.0	5.95	7.3	9.45	
Jame: Gro i: Site C - E a 26, 2000 J by: Rodol r: ZETAS (2 Method: Ro ible Elevati pproximate	Blows/15 cm SPT		1-1-1	1-2-2		2-3-5	2-5-9	5-12-30	7-13-7	3-3-8	
Project I Location Date: Jur Date: Jur Operator Operator Nater Ta Notes: A	Γευβην (cm) Κεςολειλ		43/45	35/45	40/42	33/45	35/45	40/45	38/45	36/45	
METU METU B	Sample Type and No.		S-C1-1	S-C1-2	SH-C1-3	S-C1-4A S-C1-4B	S-C1-5	S-C1-6A S-C1-6B	S-C1-7	S-C1-8	
CB-BYU-U TAS-SaU-A bint Research ponsored by SP, Caltras	naca		ML/CL	ъ		ML	ML	ML SW-SM	ds .	W	
D E Y S N O	(m) subscript		/////	[]]]	////		H H				
	Depth Scale (m)	· · · · ·			, ·	4	Ω L ι ι ι	9		 	-10

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Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.5: SPT log: SPT-C1

F-C4 In Creatius XC90H o. U. C. Berkeley method, AWJ rods. cs et al. 1983)	Remarks	Located near the sediment ejecta							Black fibrous wood chip at		
221°E t to CP' iivalent 3. Sanci athead er Kovad	(mm) 01G			0.003		<2µm		<2µm	2	<2µm	<2µm
N 30.39 h respected, equand R. E	(unm) 02D			0.013		0.003		0.014	5.	0.006	0.002
F-C2 78370°1 cm with thom m th	(%) uni 2 >			8		41		24		40	49
D: SP 35: 40.7 35: 40.7 35: J. D 8: Safe	(%) uni 5 >			22		60		34		48	60
Test rdinate levatio uipmel nginee Syste	uni ç7 > mañ %		26	94	66	66	87	7	92	66	66
S Coo E E ing Eq ible Er Hamm	Plasticity Index		15	15	45	28	15			26	
GP Drill Spons	timi.I biopi.I		40	42	74	73	42	27	34	49	37
ž	Moisture Content (%)		37	43	41	26	33	26	53	38	36
	u ⁸ Torvane (kPa)		20	45	72	53					50
v03	Pocket Pen (kPa) 9 u		50	80	170	85	230		300	130	280
ing Performance in Adapazari, T istrict, Adapazari S.) S.) Seizelion, 1:59 m 07/08, 0.98 m 0 of 1.6 m	Description	CLAYEY SILT: Dark brown dayey silt with uniform color. Moist, soft consistency.	CLAYEY SILT: Brown clayey sitt to high plasticity silty clay. Traces of fine sand				CLAYEY SILT: Olive gray clayey silt with fine sand to sandy silt interbedded with	day seams. Very thin lamination at about 5.25 m.	SW-SM: Well graded gray sand with silt. Approximately 8% gravel content	CLAYEY SILT: Alternating strata of gray silty clay and clayey silt.	
d Build tiklal D 19 cm- 45 m (Energy Ratio (%)		54		69		73	70	75	65	71
ure an reet, Is ancio eknolo sh with ML = 1.1	Rod Length (m)		4.27		7.32		8.84	8.84	10.37	10.37	13.42
ind Fail Blük St o B. S. emin T ary wa uger us	Casing Depth (m)			2.4	3.2	4.05	4.85	5.65	6.45	7.5	8.9
Vame: Grou ne 27, 2000 g by: Rodolf by: Rodolf nethod: Rot nble Elevati solid flight au	Blows/15 cm SPT		1-1-1		2-2-4	,	2-4-3	5-15-19	2-5-6	1-3-3	4-3-4
Project N Location Date: Jur Date: Jur Operator Operator Nater Ta Notes: S	Γευβην (cw) Κεconειλ		38/45	42/42	35/45	40/42	36/45	38/45	36/45	35/45	43/45
	Sample Type and No.		S-C2-1	SH-C2-2	S-C2-3	SH-C2-4	S-C2-5	S-C2-6A	S-C2-7	S-C2-8	S-C2-9
CB-BYU-U CAS-SaU-A bint Research ponsored by SF, Caltrau EC, PG&I	naca		CL/ML	ML/CL	н	HW	ML/CL	ML	W	CL/CH	ML
D E S S Z D	vgolothi.I	C HI C I	нрнрн		I [] H []	нДн	н	Ъ	∃н∏н	ΩHΩHΩ	нСнСн
	Depth Scale (m)	·	· · · · · · · · · · · · · · · · · · ·		m	4	<u>ب</u>				

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.6: SPT log: SPT-C2

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C4 C4 D Creatius XC90H J. U. C Berkeley nethod: ANU rods. s et al. 1983)	Remarks		An attempt to obtain a Shelby tube sample at 1.5 m failed			Traces of shells in sample	6-C3-3	Traces of wood fragments in	sample S-C3-5	
221°E to CPT-i valent ti Sancic athead n arthead n	(mm) 01D					,	0.001	<2µm		<2µm
4 30.39 respect ade, equ and R. B sy and c	(uuu) 05Q				0.18		0.09	0.027		0.033
R370°h m with tom me tom me tom me tom me tom me	(%) umi 7 >						16	16		15
D: SP1 35: 40.7 35: 40.7 35: J. D m: Rop 6: Safe	(%) umi 5 >						13.	23		18
Test I rdinate levatio uipmer gineer Syster	uni ç7 > əaaî %				28	88	97 37	83	86	75
S Coo E E ible Er Hamm	Plasticity Index					15	20		36	
GP Drill sspons	imi.I biupi.I					40	- 45	31	67	28
a a a a a a a a a a a a a a a a a a a	Moisture Content (%)				27	38	3%	31	42	25
	^{u s} Torvane (kPa)								23	
rkey	Pocket Pen (kPa) q _u				06	130	125		70	370
ing Performance in Adapazari, Tu istrict, Adapazari istrict, Adapazari 'yofel:2000 5 m	Description	Fill: The boring was drilled through a thin concrete slab on grade under which lies a gray slity sandy fill	SILT: Brown silt to clayey silt with traces of fine sand interspersed with strata of brown silty sand to sandy silt				SM: Gray silty fine sand	SILTY CLAY: Gray sitty clay to clayey silt with some fine sand	CLAY AND SILT: Gray low patcing sit with sand interbedded with gray high patch of the output zone towards the upper portion of sample S-C3-6. The remoled	
d Build tiklal D jisi, A. 30 m (Energy Ratio (%)				67	99	99		62	: 65
lure an reet, Is ancio eknolo ish with ML = 1.	(m) rugası boğ				7.32	8.84	8.84	10.37	10.37	13.42
ind Fail ölük Sta fo B. S. emin T tary wa uger to	Depth (m) Depth (m)			2.8	3.75	4.55	5.45	6.65	7.65	9.75
Jame: Grou i: Site C - B ne 27, 2000 j by: Rodol j by: Rodol i bi i: ZETAS (Z Method: Ro ible Elevati solid flight au	Blows/15 cm SPT				3-3-4	2-2-1	3-10-8	3-4-7	1-3-2	2-7-14
Project N Cocation Date: Jur Jate: Jur Jerator Derator Dilling I Vater Ta Iotes: S	Γευβήν (cu) Γευδήν (cu)			42/42	38/45	43/45	38/45	36/45	35/45	45/45
	Sample Type and No.			SH-C3-1	S-C3-2	S-C3-3	S-C3-4A S-C3-4B	S-C3-5	s.c3.6	S-C3-7
B-BYU-U AS-SaU-J int Research sonsored by SF, Caltrau EC, PG&E	NSCS				SM	CLML	SM	ML	СН/МН	ML
	vgolorhi.I								Н.,.Н.,.Н.,.	H
	Depth Scale (m)	°			4	0	9			9

Figure B.7: SPT log: SPT-C3

C4 Io Creatius XC90H o, U. C. Berkeley method, AWJ rods. cs et al. 1983)	Remarks		Sand catcher was used to aid sample recovery	Sand catcher was used	Sand catcher was used	Sand catcher was used
221ºE to CPT- uivalent t B. Sanci athead er Kovae	(mm) 010			<2µm		0.003 <2µm
N 30.39 respect ade, equ and R. I ey and c mmer (p	(mm) 02D			0.003		0.07 0.018
T-C4 78370° 510m m stom m 0. Bray 0. Bray pe, pull ety Har	(%) uni 7 >			46		29
D: SP 35: 40.1 45: 40.10 45: 40.100000000000000000000000000000000000	(%) uni ç >			22		15 35
Test Irdinatu Ilevatic Uuipme nginee Syste	uni č7 > sani %			66		52
S Coo E ing Eq ible Er SPT Hamr	Plasticity Index			22		
GP Drill sspons	nimi.I biupi.I			45		30
ž	Moisture Content (%)			42		88
	u ⁸ Torvane (kPa)			31		24
rkey	Pocket Pen (kPa)			60		50
ing Performance in Adapazari, 1 istrict, Adapazari S.) Bilmeter triccone bit 8(03/00	Description	Fill: The boring was drilled through a thin (~5 cm) concrete slab on the west entrance of building C2	CLAYEY SILT: Brown sity clay/clayey silt to sandy sit/sity sand			
liklal D liklal D lisi, A. 9 cm- 44 m (Energy Ratio (%)		48	47	61	62
rreet, Is ray eknoloj sh with VL = 0.th	(m) rhgna I boM		4.27	5.80	7.32	8.84
und Fail sölük St vra Batu Zemin T tary wa tary wa ton: GV	Casing Depth (m)		1.45	2.45	3.45	4.35
Vame: Gro :: Site C - E y 19, 2000 g by: M. Bo :: ZETAS (2 Method: Ro ible Elevati	Blows/15 cm SPT		2-1-2	3-1-1	2-1-1	3-2-3
Project I Location Date: Jul Field Loy Dperatol Drilling I Vater Ta lotes:	Γευβην (cm) Κεςολειλ		0/45	29/45	0/45	27/45
	Sample Type Sand No.			S-C4-1		S-C4-2A S-C4-2B
3B-BYU- FAS-SaU- int Resear ponsored h SF, Caltri EC, PG&	naca			сг		RF
	Vgolothil			, п _н п	н п н п	нпн
			and the first	10-11-10-11	ունեններ	

Figure B.8: SPT log: SPT-C4

7T-C4 to Creatius XC90H So, U. C. Berkeley Imethod, AWJ rods. sos et al. 1983)	Remarks	Vane shear test at 1.25 m. First reading = 2.5 kPa, Average second reading = 3.5 kPa, Atthough the test was performed correctly, wong must be wong	5	Sand catcher was used for S-C5-2. One blow was	sufficient to drive the rods > 45 cm at 1.9 m. No sample was recovered. The sampler was reinserted at 2.3 m and	uriveri 40 cm. ivo sampre was recovered		
221°E ct to CP uivalent B. Sanc cathead er Kova	(mm) 010			<2µm		<2µm	<2µm	0.2
N 30.39 n respec ade, equ and R. E and R. E sy and c	(mm) 02D			0.005		0.002	0.017	0.7
F-C5 78370°F cm with cm matter stom matter to with the stor to bulk	(%) uuri 7 >			38		50	25	,
ID: SP1 es: 40.7 nt: Cus nt: Cus rs: J. D m: Rop e: Safe	(%) turi ç >			50		70	31	
Test ardinate ilevatic luipme nginee Syste ner Typ	uni ç7 > səniñ %			96	91	100	66	4
PS Coo E ling Eq sible E SPT Hamn	Plasticity Index			24	27	18	,	,
GF Drill espons	nimi.I biupi.I			44	48	42	36	
æ	Moisture Content (%)			41	41	40	37	4
	⁵ U ⁸ Torvane (kPa)							
Irkey	Pocket Pen (kPa)			40				
ling Performance in Adapazari, Tr istrict, Adapazari S.) diameter tricone bit 8/03/00	Description	Fill: Top soil of garden area on Wash water shows a fine to coarse sub-angular to sub- rounded colorful clean sand at 1.8 m	CL: Brown silty clay w/ red oxidized zones		CL: Gray silty clay		SILT: Gray clayey silt SAND: Gray fine to coarse	sand with traces of gravel. Fine gravel content in S-C5-7 = 8%
d Build tiklal D jisi, A. 9 cm-	Energy Ratio (%)		۰.	56		64	67	67
lure an reet, Is ancio eknolo ish with ble cave	Rod Length (m)		5.80	7.32		8.84	10.37	11.89
und Fai ölük St fenin T čemin T tary wa ion: Ho	Casing Depth (m)		1.75	2.85	4.25	5.05	5.95	6.95
Name: Gro n: Site C - E ly 27, 2000 g by: Rodo r: ZETAS (2 Method: Ro able Elevath 1.5 m south	Blows/15 cm SPT		1-1-1	1-0-1		1-1-3	6-17-23	14-17-17
Project I Location Date: Ju Sate: Ju Field Lo Dperato Orilling Nater Ti Votes: Yotes:	Γευδην (cm) Γευδην (cm)	0//0	0/45	27/45	44/50	38/45	40/45	22/45
	эдүТ эlqms2 .oN bas	SH-C5-1	S-C5-2	S-C5-3	SH-C5-4	S-C5-5	S-C5-6	S-C5-7
JCB-BYU-U 3TAS-SaU-J Joint Researci Sponsored by NSP, Caltrau CBC, PG&E	Discourse		×//	5	5	5	M	ß
	Depth Scale (m)				X////	111		
				1	11		цŰц	

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.9: SPT log: SPT-C5

						1
-C4 o Creatius XC90H s, U. C. Berkeley method, AWJ rods. ss et al. 1983)	Remarks					
221°E t to CPT ivalent tr 3. Sancic athead n athead n	(mm) 010		<2µm	<2µm	<2µm 0.01	
V 30.39 respec ade, equ and R. B sy and c	(uuu) 05Q		0.014	0.015	0.003	
-C6 8370°N cm with tom ma tom ma tom ma tom ma tom ma tom ma e, pulle	(%) umi 7 >		25	20	44 <10%	1
D: SPT 35:40.7 11:-16 11:Cus 75:J.D m: Rop e: Safe	(%) uni 5 >		30	28	57 <15%	
Test I rdinate levatio uipmer gineer Syster er Typ	uni 57 > १२०१३ %		94	87	99 45	
S Coo E ing Equi sible Er SPT Hamm	Plasticity Index				33	
GP Drill sspons	imi.I biupi.I		40	31	56 36	
ž	Moisture Content (%)		13	36	32	
	Torvane (kPa)				47	
rkey	Pocket Pen (kPa) qu		60	60	70	
ing Performance in Adapazari, Tu istrict, Adapazari S.) 08/03/00	Description	Fill: Top soil and brown clayey fill in east yard of building C2	ML: Brown silt to silt with sand w/ red oxidized zones		CH: Brown high plasticity silty clay.	SILTY SAND: Brown silty sand
iklal Di iklal Di isi, A. 3 9 cm-o 96 m 0	Energy Ratio (%)		48	53	65	
eet, Ist eet, Ist ancio eknoloj sh with VL = 0.	(m) rhgna I boff		4.27	5.80	7.32	
ind Fail ölük Str fo B. Se emin T. emin T. emin V.	Casing Depth (m)		0.95	1.50	1.50	
Vame: Grou 1: Site C - B 1y 27, 2000 9 by: Rodol r: ZETAS (Z Method: Ro sble Elevati	Blows/15 cm SPT		1-1-1	1-0-1	2-4-6	
roject I ocatior iate: Ju ield Lo iperato rrilling vater Ti lotes:	Length (cm) Recovery/		28/45	41/45	35/45	1
	Sample Type Sand No.		S-C6-1	S-C6-2	S-C6-3A S-C6-3B	
ICB-BYU-U STAS-SaU-M Joint Research Sponsored by NSP, Caltrat USC, PG&F	SOS0		WL	ML	SSC SC	
	(m) state (m)				冊	
	, -, -, -, , -, -, -, -, -, -, -, -, -,	°	<u>.</u>	13	E	

Figure B.10: SPT log: SPT-C6

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r-D1 to Crealius XC90H to Crealius XC90H to U. C. Berkeley method. AWJ rods se et al. 1983)	Remarks										
828°E ct to CP livalent 1 B. Sanci cathead er Kovad	(mm) 010		<2µm		<2µm		0.24	0.33	0.16		<2µm
N 30.40 h respectade, equand R. I and R. I ey and c mmer (p	(uuu) 05CI		0.011	- 0.06	0.004	,	1.1	1.7	0.7		0.007
T-D1 76929° cm wil stom m Stom m D. Bray D. Bray Pe, pull ety Ha	(%) umi 7 >		30		36						凝
D: SP: 	(%) turi ç >		37		2						42
Test rdinato llevatic uipme gginee Syste er Typ	uni ç7 > tanî %		8	71 59	66	88	4	e	2		8
S Coo E ing Eq ible Er SPT Hamir	Plasticity Index		4		26						25
GP Drill sspons	imi.I biupi.I		33	28 29	50	28					56
ž	Moisture Content (%)		30	32	8	쳤	15	11	24		
	u ⁸ Torvane (kPa)				42						57
rkey	Pocket Pen (kPa) q _u		10		70						220
ling Performance in Adapazari, Tr ahmediye District, Adapazari S.) dameter tricone bit 66/29/00, 1.70m 06/29/00	Description	Fill: Sandy clayey subgrade of sidewalk	CL: Black to dark gray clayey silt with some fine sand. The soil has organic odor but not	Probably due to nearby septic tank MI - Dark grav to black sandy	silt	CH: Brown silty clay with traces of red oxidized spots. Does not soften when remoulded	ML: Brown silt with traces of fine sand and red oxidized spots.	SAND: Well graded gray sand to well graded sand with fine gravel. Gravel content is inhomogeneous and varies from 3% to 24%, FC in all recovered samples is < 6%		MH: High plasticity silty clay with traces of fine sand	
d Build Çukur jisi, A. .68m 0	Energy Ratio (%)		41	53	53	63	64	67	99		2 75
lure an Street, ancio eknolo eknolo sh with ML = 1	(m) rhgan Loof		4.27	5.80	7.32	7.32	8.84	10.37	10.37		13.42
ind Fail eydan fo B. S. emin T tary wa on: G\	Casing Depth (m)		1.05	1.85	2.65	3.4	4.45	5.4	7.5		10
Vame: Grou I: Site D - M ne 28, 2000 g by : Rodoll g by : Rodoll r: ZETAS (Z Method: Roi sble Elevati	Blows/15 cm SPT		1-0-1	2-1-1	1-1-1	3-3-4	8-11-12	9-12-12	10-14-18		3-3-4
Project 1 Date: Ju Date: Ju Preld Lo Derato Drilling 1 Nater Ta Notes:	Γευδην (cm) Γευδην (cm)		26/45	39/45	36/45	40/45	12/45	10/45	31/45		36/45
	Sample Type and No.		S-D1-1	S-D1-2A S-D1-2B	S-D1-3	S-D1-4	S-D1-5	S-D1-6	S-D1-7		S-D1-8
JCB-BYU-L STAS-SaU-J Joint Researd Sponsored by NSP, Caltra	naca		5		CH/CL	W	sw	MS	WS-MS		MH/CH
	Lithology		////		5 5		1. ¹ . ¹ .				0
	, , , u									പ്പ	

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.11: SPT log: SPT-D1

-D1 to Creatius XC90H to U. Berkeley method, AWJ rods. cs et al. 1983)	Remarks									
0828°E t to CPT urvalent B. Sanci cathead oer Kova	(mm) 010			<2µm		<2µm	<2µm 0.15	0.25		0.13
N 30.40 respectade, eq and R. ey and o	D20 (mm)			0.02		0.021	0.03	1.3		0.4
T-D2 76929° m with stom m stom m 0. Bray 0. Bray be, pull ety Hau	(%) uuri 7 >			19		16	20			
D: SP 35: 40.7 75: J. D m: Rop 8: Safe	(%) turi ç >			24		22	23			
Test I Test I Ievatio Uipmel Iginee Syste	uni ç7 > sənî %			8	66	95	5	4		5
S Coo E E ing Eq ible Er SPT Hamm	Plasticity Index			12	13	12				
GP Drilli sspons	imi.I biupi.I			36	42	35	24			
a a	Moisture Content (%)			36	41	36	66	10		10
	u ⁸ Torvane (kPa)		37							
rkey	Pocket Pen (kPa) 9 <i>u</i>		110		06	70				
ing Performance in Adapazari, Tu ahmediye District, Adapazari S.) diameter tricone bit V0800 uiding	Description	Fill: Hard brick and brown fill material. The solid flight auger had difficulty, maybe due to a spread footing of the collapsed		CLAYEY SILT: Gray clayey silt to silty clay with fine sand and traces of shells. Strong	organic odor, but not due to soil composition	CLAYEY SILT: Brown clayey silt to silty clay with traces of fine sand and red oxidized	spots to sandy silt SAND: Grav well to poorly	graded sand with low silt content (< 6%) and varying fine gravel content (< 16%)		
d Build Cukur Jisi, A. 9 cm- psed b	Energy Ratio (%)		,		44	51	65	65		,
lure an Street, ancio eknoloj ish with vie cave	(m) rhgna I boxI				5.80	7.32	8.84	8.84		10.37
ind Fail leydan fo B. Si emin T. emin T. tary wa on: Ho	Casing Depth (m)		1.25	2.05	2.05	3.15	4.05	5.15		7.00
Name: Grot n: Site D - M ne 29, 2000 g by: Rodoll r: ZETAS (Z Method: Roi able Elevati 3oring on foc	Blows/15 cm SPT			,	1-2-1	1-1-2	3-9-9	9-12-12		10-13-17
Project occation Date: Ju Tield Lo Derato Drilling Vater Ti lotes: 1	Γευβήν (cm) Κεςονειλ		42/42	42/42	41/45	37/45	36/45	29/45		30/45
	Sample Type and No.		SH-D2-1	SH-D2-2	S-D2-3	S-D2-4	S-D2-5A S-D2-5B	S-D2-6		S-D2-7
B-BYU-L [AS-SaU-J.] int Researd ponsored by SF, Caltra BC, PG&I	SDSD			ML/CL	ML	CL/ML	ML SW-SM	SW		WS-WS
	rgolothil		n	н]н] Н [нСнС	H			· . · .
	Depth Scale (m)	· · · ·		2			4	ŝ	9	L

H: Shelby tube

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.12: SPT log: SPT-D2

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T-D1 to Creatius XC90H o, U. C. Berkeley method, AWJ rods. cs et al. 1983)	Remarks			No sample was recovered at 2.9 m. In a second attempt the rods sank 25	cm (3.15 m) and the	sampler was unven 40 GII		
828°E ct to CP iivalent i 3. Sanci athead er Kovad	D10 (mm)			<2µm	0.002	0.002	0.46	1
N 30.40 th respe ade, equ and R. f ey and c mmer (p	(uuu) 05CI			0.07	0.062	0.011	1.5	
D3 66929° cm wit tom m bray e, pull e, pull sty Har	(%) umi 7 >			16	10	6		1
D: SP1 55:40.7 11:416 5:J.D 5:J.D 6: Safe	(%) uni ç >			17	14	30		1
Test I rdinate levatio uipmer gineer Syster er Typ	ավ č ⁷ > Խուհ "			52	55	96	4	
S Coo E ing Eq ible Er SPT Hamm	Plasticity Index					12		
GP Drilli spons	imil biopil			30	31	32		
Re	Moisture Content (%)			30	27	30	18	
	u ⁸ Torvane (kPa)		,]
key	Pocket Pen (kPa)			,	,	150		1
ling Performance in Adapazari, Tu ahmediye Districi, Adapazari S.) diameter tricone bit 08/04/00	Description	Fill: The soil in the wash water is a medium to coarse sand that is pressumed to be fill for a neighboring pipe.	SILT: Brown sandy silt to low plasticity silt with traces of fine	sand		CLAYEY SILT: Brown low	plasticity clayey silt	SAND: Well graded gray sand
d Build Çukur jisi, A. 28 m,	Energy Ratio (%)		53	59	55		57	
lure ar Street ancio eknolo ash with WL = 2	(m) rhgna Leoff		5.80	7.32	7.32		8.84	
Ind Fai leydan fo B. S cemin T tary we tary we tary we	Casing Depth (m)		2.15	2.85	3.75		4.5	
<pre>4ame: Grout Site D - N y 26, 2000 g by: Rodol g by: Rodol c:: ZETAS (2 Method: Ro hele Elevati</pre>	Blows/15 cm SPT		3-2-2	2-2-2	3-6-4		7-6-13	
Project N Location Date: Jul Field Log Operator Orilling I Nater Ta Notes:	Γευβιμ (cm) Κεςολειλ		0/45	25/45	40/45		32/45	
DCLA METU ch W	Sample Type .oN bas		S-D3-1	S-D3-2	S-D3-3A	S-D3-3B	S-D3-4	
JCB-BYU-I ETAS-SaU-I Joint Researt Sponsored b NSF, Caltra CEC, PG&	SDS:0		, Liste	L.	W	С	SW	
	Depth Scale (m)					H	• •]
				ů.	14			5

Figure B.13: SPT log: SPT-D3

1 Crealius XC90H U. C. Berkeley ethod. AWJ rods. et al. 1983)	Remarks										
518°E lo CPT-E ivalent to Sancio, athead m r Kovacs	(mm) 010		0.2	-2µm		22pm 2020	- 1.0	<2µm 0.06		0.2 <21um	<2µm
30.400 espect de, equi de, equi und R. B und R. B y and ca imer (pe	(unin) 08D		0.51	0.06		005	0.08	0.048		0.6	0.014 L
-E1 7778°N m with 1 tom ma tom ma tom ma tom ma tom ma e, pulle	(%) umi z >			50 .	,	33333		£,			24
D: SPT ss: 40.7 nt: Cus nt: Cus nt: Cus nt: Cus ss: J. D m: Rop e: Safe	(%) uuri 5 >		,	- 28		42ß		- 16		. 8	5
Test I rrdinate llevatio uipmei ngineei Systei rer Typ	uni ç7 > sənî %		7	59 90	66	888	47 7	61 12		3	JR.
PS Coo E ling Eq sible Er SPT Hamm	Plasticity Index		,		22	8332				, [2
GF Drill espons	nimi.I biupi.I		,	33	52	61 62		26		. 8	39
æ	Moisture Content (%)		23	8 8	49		33	25 18		5 5	35
0	u ⁸ Torvane (kPa)				30	50					
key 18/04/0	Pocket Pen (kPa) 9 <i>u</i>			125	60	110	80	450	280	100	071
ing Performance in Adapazari, Tu Pistrict, Adapazari S.) S.) diameter tricone bit diameter tricone bit diamot. 46 cm 07/08/00, 0.34 m 1 leph of 0.8 m	Description	Fill: Brown sandy fill with rubble (bricks and concrete) and some fines. Black clayey soil with slight smell.	SP: Poorly graded, medium to fine brown clean sand	SILT AND SAND: Interbedded strata of brown low plasticity sandy silt and clayey silt with brown medium sand	SILTY CLAY: Brown clayey sit/sitly clay. Traces of	organics and oxidation vents	SAND: Gray fine to medium sand interbedded with gray low plasticity silt deposits. FC in this stratum varies from 3%			ol ave considered	CLAY: Gray clay with traces of
Ind Build Tigcila Jjisi, A. Docm 0 d to a d	Energy Ratio (%)							~			
Iure ar Ave., Bray eknolo ish with ML = 7 as use	(m) rhgna l boli		4.27	5.80	7.32		8.84	10.3	11.86	11.8	
avaklar avaklar han D. cemin T tary we tary we uger w	Casing Depth (m)		1.55	2.85	3.65	4.45	5.35	6.35	7.35	8.08	
lame: Grou : Site E - K y 3, 2000 j by: Jonatt by: Jonatt z: ZETAS (Z Method: Ro ble Elevati olid flight a	Blows/15 cm SPT		2-2-4	2-2-3	1-2-1		3-4-5	5-13-19	9-16-18	1-4-8	
Project N Location Date: Juli Field Log Operator Drilling A Water Ta Notes: S	Γευβήν (cm) Κετονειλ		34/45	36/45	41/45	35/42	45/45	41/45	40/45	45/45	
CLA DETU	эqүT эlqms2 and No.		S-E1-1	S-E1-2A S-E1-2B	S-E1-3	SH-E1-48 SH-E1-48 SH-E1-48	S-E1-5A S-E1-5B	S-E1-6A S-E1-6B	S-E1-7	S-E1-8A	S-E1-0D
CB-BYU-U IAS-SaU-N jint Research ponsored by SF, Caltrat EC, PG&E	naca		ę	WL ML	MH/CH	555	SP SP	ML SW-SM		ds Io	Ŀ
DA SZO	Vgolothi.I				H H	HHH	1.1.1.1.1		1.1.1.1	· . · . · . 🖌	1

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.14: SPT log: SPT-E1

									at	pu	5.7		3
T-F3 to Creatius XC90H to U. C. Berkeley method. ANJ rods. cs et al. 1983)	Remarks								Thin brown organic seam approx. 7.35 m	Wood fragments were fou	in the sample at approx. 8 m		Page 1 of
795°E at to CP' iivalent 3. Sanci athead er Kova	(mm) 01G	0.004	0.007	<2µm	<2µm	<2µm	0.013	~2µm	0.013	<2µm	2pm 2pm	2pm 2pm	
N 30.40 h respec ade, equ and R. E ey and c nmer (p	(uuu) 05Q	90.0	0.048	0.008	0.008	0.019	0.07	0.05	0.085	0.034	0.005	0.019	
T-F1 77148°1 cm with stom m stom m stom m or with ety Har	(%) uuri 7 >	2	. 6	38	27	44	9	- 15	<10%	13	, 58	234	
D: SP D:	(%) turi ç >	÷	7	42	40	18	80	20	<15%	17	- 20	403	
Test redinate levatic nginee Syste ner Typ	uni 57 > eani %	22	89	92	67	85	51	72 35	42	74	100 99	96 100	
S Coo E E ling Eq sible E SPT Hamn	Plasticity Index				19	13	,				29 17	29	
GF Drill espons	nimi.I biupi.I	28	27	31	47	35	28	28		31	57	588	
æ	Moisture Content (%)	8	58	33	37	31	27	88	26	29	88	333	
	u ⁸ Torvane (kPa)				28						55		
rkey	Pocket Pen (kPa) q _u				75						170		
Img Performance in Adapazari, Tr. un District, Adapazari S.) diameter tricone bit 2772/100, caved in 08/04/00 -F1	Description	Fill: Hole is drilled through fill and rubble of the foundation of the building that was located to the north of building F1	ML: Brown low plasticity sandy silt to silt		CL: Brown low plasticity silty clay to clayey silt with traces of fine sand	SII T AND SAND: Grav sandy	silt to sitty sand. FC of recovered samples varies from 35% to 77%				CLAY: Gray silty clay to clayey silt with traces of fine sand. LL of recovered samples varies from 38 to 57		
d Build Yenig Jisi, A. 64 m CPT	Energy Ratio (%)	50	57	51	54	64	67	7 59	59	9 57	9 61	2 70	
lure ar Street ancio eknolo ish with ML = 1 ML = 1	(m) rhgna l boff	4 27	5.80	5.80	7.32	8.84	8.84	10.3	10.3	11.8	11.8	13.42	
ind Fai önmez fo B. S emin T tary wa tary wa tary wa tary wa	Casing Depth (m)	0.95	1.75	2.55	3.45	4.45	5.35	6.15	6.95	7.95	8.95	9.95	
lame: Grou 2 20, 200 3 by: Rodol by: Rodol 3 c ZETAS (Z Method: Ro hble Elevati ocated app	Blows/15 cm SPT	1-2-3	3-2-2	2-3-2	2-1-2	2-3-6	2-7-2	3-7-7	4-4-9	5-6-7	2-4-7	3-4-5	9
Project N Location Date: Jul Date: Jul Date: Log Operator Drilling A Mater Ta Notes: L	Γευβιμ (cm) Κετονειλ	38/45	32/45	32/45	32/45	36/45	35/45	33/45	45/45	34/45	37/45	31/45	helbv tub
	Sample Type and No.	S-F1-1	S-F1-2	S-F1-3	S-F1-4	S-F1-5A S-F1-5B	S-F1-6	S-F1-7A S-F1-7B	S-F1-8	S-F1-9	S-F1-10A S-F1-10B	S-F1-11A S-F1-11B	S-HS (LdS
JCB-BYU-U STAS-SaU-J Joint Researci Sponsored by NSP, Caltra CEC, PG&E	Rocentry	ž	ML	ML	MUCL	k c	M	ML	SM	١	CHML	CH/MH	sold Snoon (
	(m) state (m)				////	111:			1		//////	°	S: S
	(-)-)-) +(I	<u> </u>					n Liii	9	<u>^</u>		6		

Figure B.15: SPT log: SPT-F1

	1	
-F3 to Creatius XC90H o. U. C. Berkeley method. ANJ rods. ss et al. 1983)	Remarks	
795°E th to CPT iivalent th 3. Sancic athead r er Kovac	(mm) 01C	0.001
N 30.40 h respec ade, equ and R. f ey and c mmer (p	(uuu) ()5 U	0.019
-F1 7148° cm with tom m bray e, pulle e, pulle	(%) uuri 7 >	4,
5: SPT 5: 40.7 5: J. D 7: Rop 7: Safe	(%) uni ç >	5.
Test If dinate evatiou ipmen gineer Systen er Type	mu č ⁷ > sonh %	980
S Coorr Ela Die Engu SPT S Amme	Plasticity Index	. 13
GPS Drillir sponsil	imi.I biupi.I	5838
Res	Moisture Content (%)	323
	Torvane (kPa)	
Key	Pocket Pen (kPa) 9 u	
ling Performance in Adapazari, Tu ûn Districi, Adapazari S.) 3) diameter tricone bit diameter tricone bit 572/100, caved in 08/04/00 F1	Description	SM: Gray sith fine sand
Yenigi Yenigi 9 cm- 54 m (Energy Ratio (%)	54
street, street, sknoloji th with fL = 1.6 m from	(m) rigna. I box	14.94
nd Failt nmez S smin Te ary was nn: GW	Casing Depth (m)	11.95
lame: Grou :: Site F - Sö y 20, 2000 j by: Rodolif by: Rodolif c:: ZETAS (Zá Method: Rot ble Elevatic ocated appro	Blows/15 cm SPT	4-13-20
Project N Location Date: الالا Tield Log Diperator Dilling A Vater Ta Iotes: ال	Length (cm) Recovery/	37/45
	əqyT əlqməč .oN bas	S-F1-12A S-F1-12B
B-BYU-I AS-SaU-I int Researc sonsored by SF, Caltra EC, PG&I	naca	MLCL
STATIS & STATIS	vgolothi.I	
	Depth Scale (m)	: 13

Figure B.15(cont.): SPT log: SPT-F1

Page 2 of 2

G1 to Crealius XC90H o, U. C. Berkeley method. ANJ rods. cs et al. 1983)	Remarks		Roots were found in sample S-G1-1								
896°E to CPT uivalent 3. Sanci athead er Kova	(mm) 01 U		<2µm			<2µm	<2µm	<2µm		<2µm	
N 30.40 respect ade, equ and R. f sy and c nmer (p	(uuu) 05 D		0.013			0.005	0.009	0.028 0.15		0.005	
T-G1 77450°I m with stom mi stom mi stom mi b. Bray oe, pulk	(%) um (%)		26			40	32	- 19			
D: SP1 D: SP1 D: SP1 D: -7 c Dn: -7 c D	(%) turi ç >		35			50	42 -	25		50	
Test ordinate Elevatic Juipme nginee Syste	uni ç7 > tərri %		26	69	96	97	71	33	67	66	66
S Coc E E ling Eq sible E SPT Hamn	Plasticity Index		16	,		33	25			22	22
GI	timi.I biupi.I		41	29	33	53	48 25	34	27	58	52
e e	Moisture Content (%)		35	32	36	38	38	34	27	36	8
	⁵ u ⁸ Torvane (kPa)					39				34	24
rkey	Pocket Pen (kPa)		20	200	60	100	120	120		150	120
ing Performance in Adapazari, Tu gun Districi, Adapazari S.) diameter tricone bit X7/08/00, 0.41 m 08/04 Jepth of 1 m 08/04	Description	Fill: 20 cm of topsoil followed by a dark brown to black clayey silt with sand	CLAYEY SILT: Interbedded strata of olive brown to brown clayey silt with traces of fine sand and brown sandy silt			CLAY: High plasticity gray sitty day	SILT AND SAND: Gray silt	wares from 22% to 99%. 4 wares from 22% to 69%. 4 mm red silty clay to clayey silt seam found at approx. 7.2 m		MH: High plasticity gray clayey silt. Softens when remoulded. Red oxidized 5 mm-thick seam at approx. 9.2 m	
d Build t, Yeni jisi, A. 19 cm- 67 m (d to a	Energy Ratio (%)		50	51	55		67	61	62	64	70
Iure an r Stree ancio eknolo sh with ML = 0 as use	(m) rugaa loof		4.27	5.80	7.32	7.32	8.84	10.37	11.89	11.89	13.42
Ind Fail asircila fo B. S. femin T. tary wa tary wa uger w	Casing Depth (m)		1.45	2.25	3.05	3.95	4.75	5.55	6.95	7.95	8.95
Name: Grou Name: Grou Iy 5, 2000 g by: Rodol r: ZETAS (2 Method: Ro able Elevati Solid flight a	Blows/15 cm SPT		1-1-2	2-3-4	2-2-2	1-2-2	2-3-6	4-3-5	5-4-6	2-3-3	2-3-4
Project Location Date: Ju Field Lo Operato Drilling Nater T.	Γευδήν (cm) Γεεςολειλ		33/45	38/45	32/45	33/45	36/45	40/45	31/45	33/45	30/45
	Sample Type snd No.		S-G1-1	S-G1-2	S-G1-3	S-G14	S-G1-5A S-G1-5B	S-G1-6A S-G1-6B	S-G1-7	S-G1-8	S-G1-9
CB-BYU-U TAS-SaU-I oint Researc ponsored by ponsored by EC, PG&I	sosn		CL/ML	ML	ML	CH	WC .	ML	M	Ħ	MH/CH
D EN S S S O	vgolothil		ПНДН	H	нДн	/////	/ .:.	l::;::	l::::il		
	Depth Scale (m)	• · · · ·	ñ7			4	. <u>.</u>	<u>.</u>		.	. ი

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.16: SPT log: SPT-G1

													of 2
G1 o Crealius XC90H o, U. C. Berkeley nethod, AWJ rods. ss et al. 1983)	Remarks												Page 1
896°E to CPT-(ivalent tr S. Sancio athead n er Kovac	(mm) 010		,	<2µm	0.003	0.002 <2µm		~2µm	-1µm	<2um	<2µm 22µm		
N 30.400 respect ade, equ and R. B ey and c mmer (pc	D20 (uuu)		,	0.04	0.028	0.022		0.007	0.001	0.029	0.007	100 c	
T-G2 77450° m with stom m b. Bray 0. Bray be, pull ety Hat	(%) uuri 7 >			18	9	9 40		20	59	18	30 30	ž	
D: SP D: SP D: SP D: -3 c D: -3 c D: -3 c D: -3 c D: -3 c D: -3 c D: -3 c D: -3 c D: -3 c D: -3 c D: SP D: S	(%) turi ç >			22	14	17 68		43	85	21	45	5	
Test I redinate levatio uipme nginee Syste	uni ç7 > tənî %			65	78	77 95	75	99 92	66	68	66 68	ę	
S Coo E E ing Eq ible Er SPT Hamm	Plasticity Index				7	30		13	31		18 24	6	
Drilli	timi.I biupi.I			25	33	37 60	30	44 26	58	36	4 43	2	
Re	Moisture Content (%)			29	15	15		37 28	47	98	33	5	
	u ⁸ Torvane (kPa)							24	25		35	22	
Key	Pocket Pen (kPa) 9 u			75			75	110	60		120	ş	
ing Parformance in Adapazari, Tr. gün Districi, Adapazari S.) diameter tricone bit 27/08/00, 0.45 m 07/14, 0.44 m 01 depth of 1.3 m	Description	Fill: Rubble from sidewalk. Black dayey sand with strong odor, probably due to a nearby septic tank	ML: Brown low plasticity silt with fine sand to sandy silt			CH: Gray high plasticity silty clay with traces of fine sand	ML: Gray low plasticity clayey sitt to sitt with sand. Red clay seams from approximately 6.15 m to 6.2 m		CH: Soft gray, high plasticity silty clay	ML: Gray clayey silt with traces of fine sand	CLAY: Gray silty clay to clayey silt. Some shells at approx. 10.3 m		
d Build t, Yenig jisi, A. 3 19 cm- d to a c	Energy Ratio (%)			58			60	66	· ,		,	5	
lure an r Stree ancio eknolo ish with ML = 0. as use	(m) rhgaa.l boxl		3.67	5.80			8.84	10.37		11.29		10.01	
ind Fail asircila fo B. Sa emin T emin T tary wa on: G\	Depth (m) Depth (m)			2.45	3.25		5.15	5.95	7.45	8.45	9.45	10.05	
Vame: Grou :: Site G - H y 6, 2000 g by: Rodol : ZETAS (Z Method: Ro sble Elevati Solid flight au	Blows/15 cm SPT		1-2-2	3-4-5			2-3-3	2-6-7		3-4-4		4 F C	90
roject I locatior late: Ju ield Lo Dperato brilling I Vater Ta	Γευβήν (cm) Κετονειλ		0/45	35/45	80/90		40/45	35/45	41/40	32/45	42/42	37146	tul
	Sample Type and No.		S-G2-1	S-G2-2	SH-G2-3A	SH-G2-3B SH-G2-3C	S-G2-4	S-G2-5A S-G2-5B	SH-G2-6	S-G2-7A	S-G2-78 SH-G2-8	د د د	SPT) SH: St
JCB-BYU-U STAS-SaU-A Joint Research Sponsored by NSP, Caltrau CBC, PG&E	Racemer			ML	×	CH/MH	WL	ML	5 = / / /	ž	CLML		pend Spit Spoon (S
	(m) succentration					5			\$ } }		/////	·/////	S: S
	(<u> </u>	N			4	ي. بالالا	9	<u></u>		6	أيتنبك	

Figure B.17: SPT log: SPT-G2

G1 o Creatius XC90H s, U. C. Berkeley method, AWJ nods. ss et al. 1983)	Remarks				
896°E to CPT- uivalent t B. Sancic athead r er Kovac	(mm) 010	<1µm	-2µm		<2µm
N 30.40 respect ade, equ and R. f ey and c mmer (p	(uuu) 05Q	0.001	0.021		0.006
7-G2 m with tom m tom m tom m Bray e, pull et, Har	(%) uni 7 >	51	-15		35
D: SP1 55:40.7 11:-3 c 5: J. D 5: J. D 11: Rop 6: Safe	(%) uni ç >	61	. 18		47
Test I rdinate levatio Lipmer gineer Syster er Typ	rauj č7 > soañ %	88	97 76		66
S Cool E ing Equ ible Er SPT Hamm	Plasticity Index	30			18
GP Drill spons	imi.I biupi.I	51	35 26		47
Re	Moisture Content (%)	31	38		32
	Torvane (kPa)	55			
key /04	Pocket Pen (kPa) 9 u	200	320		175
ling Performance in Adapazari, Tr. gun District, Adapazari S.) S.) diameter tricone bit diameter tricone bit depth of 1.3 m	Description		ML: Interbedded strata of gray low plasticity silt with sand and gray clayey silt. Some red clay seams		
l Build I, Yeni isi, A. 9 cm- 1 to a	Energy Ratio (%)	61	69		70
r Street r Street sknoloj sh with VL = 0. as used	(m) rhgas.I boX	14.94	14.94		17.99
nd Failt asircilar o B. Sa emin Te any was on: GW	Casing Depth (m)	10.95	11.95		13.95
Vame: Grot 1: Site G - H 1y 6, 2000 g by: Rodol r: ZETAS (Z Method: Rol ible Elevati, colid flight au	Blows/15 cm SPT	2-4-5	5-10-15		3-4-7
Project I Cocation Date: Jul Pate: Jul Pater Lo Derator Drilling I Vater Ta Iotes: S	Γευβην (cm) Κεςολειλ	37/45	39/45		37/45
	Sample Type and No.	S-G2-9	S-G2-10A S-G2-10B		S-G2-11
(CB-BYU-U STAS-SaU-J Joint Researc Sponsored by NSP, Caltra CBC, PG&I	nace	CH/CL			ML/CL
	violotti.l			~	
	Depth Scale (m)	Г: Г		Ę	4-1

Figure B.17(cont.): SPT log: SPT-G2

Page 2 of 2

Depth Scale (m)	CL BTAS-SetU Joint Research NSF, Calter NSF, Calter CL USCS CBC, PG&	WICLA WICLA WICLA WICLA WICLA WICLA	Project Project Darialing Notatri Liceatio Accovery/ Darialing 202 1 202 1 202 1 202 1 202 1 202 202 1 202 202	Name: Grc 81 b - 1 - 1 - 200 0 g by: Robe 9 by: Robe 7 - 2 - 2 - 200 0 g 9 by: Robe 8 - 2 - 1 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2	Casing from the first series of the first seri	Red. Yan ancio se knoloji k = 41. R. L = 41. R. Ad Length (n) R. J. 27	4 Energy Ratio (%) 12 m 0 4	Ing Performance in Adapazari, Tur District, Adapazari diameter tricone bit 771400, caved in, 08,04,00 Page Description Asphalt: Pavement of Kinali Asphalt: Pavement of Kinali Fill Black sandy fill Fill Black sandy fill Fill Black gray to black day with sand	S Locket Pen (kPa)	6 4 6 (£Pa)	S Noisture (%) Instruction (%)	C Blaining A C C C C C C C C C C C C C C C C C C	Televan T	× 1 × 1 × 1 × 1 × 1 × 1 × 1 × 1 × 1 × 1	21 21 21 21 21 21 21 21 21 21 21 21 21 2	0.038 0.038	9487°E ct to CPT- uivalent to CPT- uivalent de Sanctio athead m cathead m cathead m cathead m cathead m	H1 5 Ceallus XC90H - U. C. Benteley Funds ANJ rods. 8 et al. 1983) 8 et al. 1983)	
N	WS	S-H1-2	33/45	3-7-4	2.15	5.80	58	SM: Gray to brown silty sand		.,	31		15			0.19			
	CLML	S-H1-3	39/45	1-1-2	2.9	5.80	42	CLAY: Brown, grading to gray clayey silt to silty clay	60	35 4	43 43	17	98	29	10	0.009	0.002		
4	CH/MH	S-H1-4	41/45	1-2-1	3.75	7.32	55		190	39	45 7	0 37	100	4	50	0.002	<2µm		
	WC	S-H1-5A S-H1-5B	38/45	2-2-3	4.85	8.84	55	ML: Gray low plasticity silt with sand			4.0	17	88	8 8	44	0.013	<2µm 0.009		
9-	ML	S-H1-6	38/45	4-5-8	5.65	8.84	55	2			31	۲	80	10	2	0.04	0.005		
ниции 	MH	S-H1-7A S-H1-7B	38/45	2-2-5	6.45	10.37	60 60	CLAYEY SILT: Gray high plasticity sitly clay to clayey sitt interspersed with thin layers of sitly sand to sandy	75	32	888	21	66 26	35.	18	0.008	<2µm		
neHenii o	CLMH	S-H1-8	32/45	2-4-4	7.25	11.89	60	115	60	50	38	10 22	66	38	20	0.008	<2µm		
n:::::::::::::::::::::::::::::::::::::	HW	S-H1-9	31/45	2-3-4	8.45	11.89	60		190	51	42	88	88	28	8	0.004	<2µm		
		S-H1-10/	A 45/45	3-6-3	9.85	13.42	59	SP-SM: Gray fine to medium sand with silt					0			0.3	0.08		
	W	S-H1-106	60				59	ML: Gray clayey silt			8	87 9	8	20	13	0.02	<2µm		
	ъ	S-H1-11	39/45	2-3-4	10.95	14.94	60	CH: Dark gray stiff high plasticity clay	170	80	38 7	0 46	8	70	55	0.001	<2µm		
Si C	gend Spit Spoon	(SPT) SH:	Shelby tu	be														Page 1 of 2	

Figure B.18: SPT log: SPT-H1

o Crealius XC90H 3. U. C. Berkeley nethod. AWJ rods. Se et al. 1983)	Remarks										
246°E Jivalent t 3. Sancic athead r er Kovac	D10 (mm)				<1µш <2µш	<2µm <2µm	11 mults	<1µm	0.087	0.081	0.10
N 30.39 ade, equ and R. f ey and c mmer (p	(mm) 05G		41µm		0.036	0.019	0.006	0.010	0.30	0.25	0.32
T-1-32 77651° 409 m stom m 0. Bray 0. Bray be, pull ety Har	(%) uni 7 >		61		16	20 18	33	27			
D: SP 35: 40.7 37: 40.7 40.7 40.7 40.7 40.7 40.7 40.7 40.7	(%) uni 5 >		11		208	27	48 25	36			
Test rdinato llevatic uipme aginee Syste er Typ	$\mathfrak{curl} \ \mathfrak{cl} > \mathfrak{soug} \ \mathfrak{h}$		66		5 46	88 80	94	96	80	6	5
S Coo ing Eq sible Er SPT Hamr	Plasticity Index		48			13	33				
GP Drill sspons	timi.I biopi.I		73		29	30	53 33	35			
ž	Moisture Content (%)		37		303	88	3023	36	23	21	19
	^{2 u} Torvane (kPa)		40		17	24	29	39			
	Pocket Pen (kPa)		160	_	50	20	50	50			
gations, Adapazari, Turkey S.) diameter tricone bit 7/11/00, 0.76 m 07/19	Description	Fill: Top soil and black silty clay with organic odor	CH: Gray high plasticity silty clay	SANDY SILT: Brown sandy silt		CLAYEY SILT: Gray clayey silt to silty clay with traces of fine sand			SP-SM: Fine to medium gray poorly graded sand with silt		
Investi -32 jisi, A. 71 m 0	Energy Ratio (%)		54	57	60	53	63	62			,
action CPT-1 ancio eknolo ash with WL =0.1	(m) rhgan loof		4.27	5.80	7.32	8.84	8.84	10.37	11.85	11.89	11.85
Liquet th from Ifo B. S Cemin T Cemin T tary we tary we	Casing Depth (m)		0.95	1.95	2.75	3.95	4.75	5.95	6.95	7.85	8.75
Name: CPT 1: 1.5 m nor 1y 10, 2000 g by: Rodol r: ZETAS (2 Method: Ro	Blows/15 cm SPT		2-2-4	3-2-4	2-1-3	2-2-2	2-4-5	5-5-5	8-15-13	13-21-20	12-20-23
Project Date: Ju Sate: Ju ield Lo Derato Dirilling Vater Tá lotes:	Length (cm) Recovery/		29/45	0/45	43/45	36/45	34/45	30/45	37/45	31/45	30/45
	Sample Type 201 No.		S-1-32-1	S-1-32-2	S-1-32-3A S-1-32-3B	S-1-32-4A S-1-32-4B	S-1-32-5A S-1-32-5B	S-1-32-6	S-1-32-7	S-1-32-8	S-1-32-9
CB-BYU-U FAS-SaU-N int Research ponsored by: SF, Caltrar EC, PG&H	naca		5		ЧЧ	ML/CL	ЧЧ	M	SP-SM	SP-SM	WS-dS
D EX S S Z D	vgolorbil		{},	/	199	CHCH] H [] H	ПНСН	· . · · .	· ·.·	1.1
	Depth Scale (m)	o	Σ		. m	4	φ.				ი .

Legend S: Spit Spoon (SPT) SH: Shelby tube * Estimated Energy Ratio

Figure B.19: SPT log: SPT-I1

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/2 to Creatius XC90H o. U. C. Berkeley method, AWJ rods. Se et al. 1983)	Remarks											
077°E lo CPT-J livalent t 3. Sancic athead r er Kovac	D10 (mm)		<2µm		<2µт	<2µm		<0.08		<0.08 <2µm	0.002	<0.08
N 30.41 respect t and R. E ey and c mmer (p	(uuu) 05Q		0.01		0.02	0.005		0.12		0.13	0.013	0.15
T-J1 77518° m with stom m stom m stom m be, pull be, pull ety Hat	(%) uni 2 >		25		26	37			÷	4 '	1	
D: SP1 55:40.7 75:J.D 6:Safe	(%) uni 5 >		35		32 '	50				- 85	18	
Test I rdinate levatio uipmee gineee Syste ier Typ	$\mathfrak{curl} \ \mathfrak{c}_{L} > \mathfrak{soug} \ \mathfrak{h}$		67	93	92 76	96	94	18	88	14 99	91	19
S Coo E ing Eq ible Er SPT Hamm	Plasticity Index		15	10	2	29	32			- 16		
GP Drilli spons	imi.I biupi.I		43	37	35 29	55	62		28	- 49	30	
Re	Moisture Content (%)		36	36	335	40	41	25	24	37	31	23
08/04	Torvane (kPa)					26	43					
key 41 m (Pocket Pen (kPa) 9 u		30	120		90	80	300	450	230	210	
d Building Performance in Adapazani, angun District, Adapazari bi Gar-diameter tricone bit fan 06/30, 0.7 m 07/08, 0.76 m 07/14 d to a depth of 1.2 m	Description	Fill: 5 cm-thick concrete slab followed by brown clayey sand	ML: Brown to gray clayey silt with traces of fine sand to silt with sand. Red oxidized zones throughout the stratum			CH: Gray high plasticity silty clay with traces of fine sand.	Wood pieces tound at approximately 3.9 m and 4.7	SILT AND SAND: Interbedded strata of gray low plasticity clayey silt and silty fine sand				
d Build nigũn jisi, A. .6 m 0 d to a	Energy Ratio (%)		44	52	59	57	59	99	65	7 67 67	99	,
eet, Yé eet, Yé ancio feknolo rish with WL = 0 as used	(m) rhgaal boff		4.27	5.80	5.80	7.32	8.84	8.84	10.3	10.37	11.8%	13.42
irak Str irak Str Ifo B. S Cemin T cemin T tary wa tary wa uger wa	Casing Depth (m)				2.75	3.55	4.35	5.15	5.95	6.75	8.3	10.15
Vame: Groi n: Site J - Ç ne 29, 2000 g by: Rodol r: ZETAS (2 Method: Ro ible Elevati solid flight al	Blows/15 cm SPT		1-1-1	1-2-3	1-3-3	1-1-1	1-2-2	6-7-6	6-12-16	5-5-7	3-4-4	9-15-12
Project I Location Date: Jur Date: Jur Prield Loy Operator Drilling I Water Ta Notes: S	Length (cm) Recovery/		35/45	34/45	38/45	38/45	36/45	41/45	42/45	43/45	36/45	40/45
METU METU	Sample Type and No.		S-J1-1	S-J1-2	S-J1-3A S-J1-3B	S-J1-4	S-J1-5	S-J1-6	S-J1-7	S-J1-8A S-J1-8B	S-J1-9	S-J1-10
JCB-BYU-L STAS-SaU-J Joint Researc Sponsored by NSP, Caltra CBC, PG&1	SOSO .		ML/CL	ML	ML	5	CH/MH	SM	ML	SM ML/MH	₹	WS
	Lithology					5	55		111	1.111		•
	() of easy drawed	0 L	. <u>.</u>	11	<u>e</u>	4		ი 	9			

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Figure B.20: SPT log: SPT-J1

J2 to Creatius XC90H o. U. C. Berkeley method. AWJ rods. cs et al. 1983)	Remarks								
077°E to CPT- uivalent 3. Sanci athead er Kovad	(mm) 010				<2µm	<0.07	<2µm <2µm	<2µm	<2µm
N 30.41 respect ade, equ and R. f ey and c mmer (p	(uuu) 05CI			0.07	<2µm	0.09	0.006	0.013	<2µm
F-J2 77518° m with atom m stom m stom m bay bey Hau	(%) uni 7 >			,	68		36 18	25	55
D: SP1 55:40.7 11:Cus 75:J.D 8:Safe	(%) umi 5 >				80		47 21	31	70
Test I rdinate levatio uipmei gineei Systei er Typ	uni ç7 > earîî %		81	53	66	30	99 70	86	100
S Coo E E ing Eq ible Er SPT Hamm	Plasticity Index			,	44		ę,		40
GP Drilli Spons	imil biopil		32	28	75		37 26	36	99
Å.	Moisture Content (%)		32	33	48	26	35 24	32	40
	Torvane (kPa)				30			48	
rkey /14	Pocket Pen (kPa) 9 <i>u</i>		50	230	100	310	130 >450	110	120
ling Performance in Adapazari, Tu District, Adapazari S.) S.) damater tricone bit 07/08/00, 0.69 m 08/04, 0.93 m 07 lepth of 1	Description	Fill: Electric power line burried at 0.5 m	ML: Brown low plasticity clayes silt with fine sand to sandy silt. Silt layers alternate with silty clayey silt		CH: Gray high plasticity silty day with traces of brown roots. Does not soften when remoulded	SILT AND SAND: Atternating strata of gray silty fine sand and low plasticity clavev silt to	sandy silt. Traces of wood at approximately 7.2 m. Seaming of gray silty clay with sandy silt in S-J2-6		CLAY AND SAND: Interbedded strata of high plasticity, gray silty day and silty fine sand
nigun anigun jisi, A. 1.89 m d to a	Energy Ratio (%)		50	62	56	. 65	7 63 63	9 61	9 65
lure an eet, Ye ancio feknolo ssh witt wL = 0 as use	(m) rigna Leofi		5.80	7.32	7.32	8.84	10.37	11.8	11.8
und Fai irak Str ffo B. S femin 7 tary we tary we uger w	Casing Depth (m)		1.75	2.65	4.00	5.15	6.25	7.05	8.35
Vame: Gro I: Site J - Ç ne 30, 2000 g by: Rodol g by: Rodol r: ZETAS (2 Method: Ro ible Elevati solid flight a	Blows/15 cm SPT		1-2-1	2-4-4	1-1-2	3-8-7	2-5-12	3-6-5	2-6-4
Project I Location Date: Juu Field Loi Operatoi Drilling I Water Ta Notes: S	Γευβήν (cm) Κεςονειλ		32/45	35/45	44/45	36/45	39/45	35/45	33/45
UCLA METU 하 또 E	эдүТ эңтвг .0И bas		S-J2-1	S-J2-2	S-J2-3	S-J2-4	S-J2-5A S-J2-5B	S-J2-6	S-J2-7A
ICB-BYU-I STAS-SaU- Joint Resean Sponsored b NSF, Caltri CEC, PG&	SDS:0		W	ML	3 5	WS	ML	ML	5
	Depth Scale (m)				*	5		1	ייאיייי
	_	ĭшш	Ì Î.	цц	Ĩ	Ĩ	Ĩ	Ĺш	

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.21: SPT log: SPT-J2

	K1 o Creatius XC90H , U. C. Berkeley rethod. AWJ rods. s et al. 1983)	Remarks										
	4°E to CPT-l ivalent to δ. Sancio athead π sr Kovaci	(mm) 01 U		<2µm		<2µm	0.002	<2µm	<2µm <0.07	0.08	<0.07	<2µm
	30.403 respect ade, equ and R. E sy and c nmer (p	(mm) 05D		0.004		0.028	0.019	0.003	0.02	0.024	0.1	0.005
	F-K1 m with m with tom ma tom tom tom tom to tom ma tom tom tom to tom tom tom tom tom to tom tom tom tom tom tom tom to tom tom tom tom tom tom tom tom to tom tom tom tom tom tom tom tom tom tom	(%) umi 7 >		40		25	6	47	54	÷		41
	D: SP1 5: 40.7 5: 5. J. D 7: 5: J. D 7: Rop 6: Safe	(%) umi ç >		54		29	17	60	30			50
	Test I redinate levatio levatio levatio Syster Syster er Typ	ավ č ⁷ > Խոն "		66		85	95	98	34 34	8	25	81
	S Cool E ing Equ ible Er SPT Hamm	Plasticity Index		23		6	14	21	۲,			10
	GP Drilli sspons	imi.I biupi.I		46		35	41	46	37	T.		37
	Re	Moisture Content (%)		39		¥	36	39	33	23	31	29
		u ⁸ Torvane (kPa)		26			24	36				36
	rkey	Pocket Pen (kPa) 9 u		70		30	40	70				190
	ding Performance in Adapazari, Turke palar District, Adapazari -diameter tricone bit 1726:00	Description	Fill: Clayey fill	CLAY AND SILT: Brown low plasticity clayey silt/silty clay with traces of fine sand. S-K1- 1 is dark orav and has a light	odor, probably due to a nearby septic tank. Transition to gray color occurs at approx. 5.5 m				SILTY SAND: Gray silty sand			ML: Gray low plasticity silt to sandy silt
	d Build e, Tigo iisi, A. 8 m 0,	Energy Ratio (%)		51	53	53	55	62	59	65	70	99
	ure an Avenu ancio eknolo sh with NL = 0.	(m) rhgaa.I boxI		4.27	5.80	7.32	7.32	8.84	8.84	10.37	11.89	13.42
	ind Fail avaklar fo B. Si emin T ary wa ar. GV	Depth (m) Casing		1.05	2.05	2.95	3.75	4.55	5.45	5.5	8.0	9.0
	ject Name: Ground Failt, cation: Site K - Kavaklar, te: July 26, 2000 id Log by: Rodolfo B. Sa id Log by: Rodolfo B. Sa id Log by: Rodolfo B. Sa id Log by: Rodolfo B. Sa ter Table Elevation: GV ter: Able Elevation: GV ter:	Blows/15 cm		5	2-2	2-3	Σ	-2	9-11	0-13-17	2-6-8	4-8-5
		TAS		÷	÷	5	1-2	2-1	5-	-		<u> </u>
	Project Name Location: Site Date: July 26, ield Log by: Derator: ZET Derator: ZET Drilling Metho Vater Table E lotes:	SPT Length (cm) Recovery/		26/45	0/45	38/45 2-:	38/45 1-2	34/45 2-1	38/45 2-9	40/45	43/45	34/45
	ICLA Project Name METU Location: Sile METU Location: Sile Pate: July 26 Field Log by: Coperator: ZEF a Variang Metho a Variang Metho a Variang Metho	SpT Sample Type Becovery/ الدهونا کو		S-K1-1 26/45 1-1	S-K1-2 0/45 1-	S-K1-3 38/45 2-:	S-K1-4 38/45 1-2	S-K1-5 34/45 2-1	S-K1-6A 38/45 2-9	S-K1-7 40/45 1	S-K1-8 43/45	S-K1-9A 34/45
	2B-BYU-UCIA Project Name State of the project Name Assaubility Date; July 26, Date; July 26, Date; July 26, Date: July 26, Dat	۲۵۵۲ ۲۶۵۶ (cm) ۲۶۳۵۶ (cm) ۲۶۳۵۶ (cm) ۲۶۳۵۶ (cm) ۲۶۳۵۶ (cm) ۲۶۳۵۶ (cm) ۲۶۳۵۶ (cm) ۲۶۳۵۶ (cm) ۲۶۳۵ (cm) ۲۶۳0 (cm)		CL S-K1-1 26/45 1-1	S-K1-2 0/45 1-	ML S-K1-3 38/45 2-	MUCL S-K1-4 38/45 1-2	CL S-K1-5 34/45 2-1	ML S-K1-6A 38/45 2-9 SM S-K1-6B	SP-SM S-K1-7 40/45 1	SM S-K1-8 43/45	ML S-K1-9A 34/45
	UCB-BYU-UCIA Project Name ZETAS-SuU-METU Location: Silo Joint Research Field Log by: Spomsored by Operation: ZET NSF, Catrens Water Table CEC, PC&E Notes:	۱ SPT Sample Type Bacovery/ Lange Type Lange Type Lange Type Lange Type		표 CL S-K1-1 26/45 1-1		T S-K1-3 38/45 2-	T 38/45 1-2	± CL S-K1-5 34/45 2-1	T ML S-K1-6A 38/45 2-	SP-SM S-K1-7 40/45 1	5.K1-8 43/45	ML S-K1-9A 34/45

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.22: SPT log: SPT-K1

-L1 to Crealius XC90H io, U. C. Berkeley method, AWJ rods. cs et al. 1983)	Remarks			A piece of gravel got stuck in the sampler and no	sample was recovered at 3.05 m (S-L1-3). When rods were reinserted in the hole,	depth and they were pushed to obtain a representative sample				
272°E to CPT uivalent 3. Sanci athead er Kova	(mm) 01G	<2µm	0.028	<2µm	0.02 0.002	0.005 <2µm	0.004	0.007	0.1	<2µm
N 30.40 respect ade, equ and R. I ey and c mmer (p	(mm) 08D	0.009	0.06	0.003	0.059	0.063	0.03	0.08	0.43	0.01
F-L1 77855° m with atom m b. Bray be, pull ety Har	(%) uuri 7 >	30	<10%	41	<10%	6 30	4	τ,		18
D: SP1 35: 40.7 35: 40.7 35: 40.7 35: 40.7 35: 5 1 Cus 75: J. D 75: J. D 75: Safe	(%) turi ç >	40	<15%	56	<15% 22	39 39	12	6.		32
Test I rdinate levatio uipme ginee Syste	uni ç7 > əaaî %	11	74	93	79 97	57 93	87	45	8	98
S Coo E E ing Eq ible Er Hamm	Plasticity Index	24	,	15	.6	21.	9			22
GP Drill sspons	imi.I biupi.I	46	26	41	28 37	31 42	33	22		51
R	Moisture Content (%)	40	31	44	33	333	35	88	17	39
	Torvane (kPa)	40				45				28
rkey	Pocket Pen (kPa) qu	180			50	150	160			50
ling Performance in Adapazari, Tr District, Adapazari S.) diameter tricone bit 07/24/00	Description	Fill: Pavement and bricks followed by said subgrade and black to gray clayey sit with fine sand and some gravel		CLAYEY SILT: Brown low plasticity silt with sand to sandy silt interspersed with	brown low plasticity silty clay. Samples exhibit red oxidation areas. FC varies from 57% to	e 16		SILTY SAND: Brown (S-L1-7) to gray (S-L1-8) sitly sand to sand with sitl. Approx. 5% fine gravel in S-L1-8		CLAYEY SILT: Gray clayey sitt interbedded with silt with sand
d Build , Orta [jisi, A. 19 cm-	Energy Ratio (%)	49	57	54	52	58	59	22		61
lure an wenue, ancio eknolo ish with ML = 0	(m) rugası boğ	4.27	5.80	7.32	7.32	8.84	8.84	10.37	11.89	11.89
Ind Fai hkara A fo B. S ternin T tary wa on: G	Casing Depth (m)	0.95	2.15	3.0	3.75	4.45	5.45	6.45	7.45	8.45
Vame: Grou N 24, 2000 g by: Rodol r: ZETAS (2 Method: Ro	Blows/15 cm SPT	3-2-2	3-3-2	2-1-1	4-3-2	2-2-2	3-3-6	16-15-18	10-13-18	3-8-6
Project Location Date: Ju Sield Lo Dirilling Vater Ti lotes:	Γευδιμ (cm) Γευδιμ (cm)	16/45	28/45	0/45	37/45	38/45	38/45	37/45	39/45	32/45
CITA TILL CITA	Sample Type and No.	S-L1-1	S-L1-2	S-L1-3	S-L1-4A S-L1-4B	S-L1-5A S-L1-5B	S-L1-6	S-L1-7A S-L1-7B	S-L1-8	S-L1-9A
CB-BYU-U TAS-SaU-N oint Research ponsored by SP, Caltran	SOSO	5	ML	ML/CL	ML	낭	ML	SP-SM	SP-SM	MH/CH
DEL SZO	vgolothil]н] н	∏ H ∏ I	I [] H []	н	FEFFFFFF	FFFF	H [] H
	Depth Scale (m)	o . o	N	<u>۳</u>	4			P	αα	

Figure B.23: SPT log: SPT-L1

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io Crealius XC90H o. U. C. Berkeley method. ANJ rods. cs et al. 1983)	Remarks											
207°E livalent t 3. Sancici athead r er Kovac	D10 (mm)			The second		-1µm	<1µm	41µm 22µm	0.005	<1µm	<1µm	15 mu 12 mu 11 mu 1 1 1 1 1 1 1 1 1 1 1 1 1
N 30.37 ade, equ and R. f ey and c mmer (p	(uuu) 05CI		mu 1>	0.041	0.003	0.048	0.004	0.007 0.028	0.14	0.025	0.022	0.031
77380° 77380° 333 m stom m stom m b. Bray De, pull ety Ha	(%) umi 2 >		59	16	17	15	40	33	8	21	19	38
D: SP 35: 40.1 35: 40.1 75: J. D m: Rop 6: Safe	(%) uni 5 >		73	20	56 f	18	53	43 16	10	26	24	24 47
Test I rdinate levatio uipmei ginee Syste	uni ç7 > xanî %		66	77	82 82 82	68	94	99 87	20	80	78	78 88
S Coo ng Eq ible Er Hamm	Plasticity Index		39		27		21					,
GP Drilli spons	imi.I biopi.I		63	31	328 328 328	40	39	37		34	33	35 35
Re	Moisture Content (%)		37	88	833 8		\$	35	26	13	29	833
	u ⁸ Torvane (kPa)		69	5	48		30					
	Pocket Pen (kPa) 9 u		120	130	120		80				100	40
gations, Adapazari, Turkey S.) diameter tricone bit 7/1//00	Description	Fill: Borehole drilled through street pavement (asphalt and subgrade)	CH: Gray with reddish brown zones, high plasticity silty clay	ML: Gray brown silt with sand	CLAY: Gray sitty clay with black organic points throughout sample	CLAYEY SILT: Gray clayey silt with varying sand content to silty clay with traces of fine sand			SILT: Gray low plasticity clayey silt with sand. Roots in sample S-1-11-7. Cemented silt clusters in sample S-1-1-	6		
1 1 jisi, A. 9 cm-	Energy Ratio (%)		57	49	57	99	61	64	64	65	65	99
action PT-1-1 ancio eknolo ksh with ML = 2	(m) rigan Leogi		4.27	5.80	7.32	7.32	8.84	10.37	10.37	11.89	13.42	13.42
Liquef th of C fo B. S emin T tary wa bar, G	Casing Depth (m)		1.15	2.15	2.95	3.75	4.75	5.65	6.55	7.55	8.45	9.45
Vame: CPT I: 1.5 m sou y 7, 2000 g by: Rodolf r: ZETAS (Z Method: Rol	Blows/15 cm SPT		2-4-4	2-2-2	2-3-3	2-1-4	2-2-2	2-2-6	6-4-2	2-2-4	2-3-5	1-2-2
roject I ocatior ocatior ield Lo iperato perato /ater Ti otes:	Length (cm) Recovery/		29/45	33/45	34/45	38/45	35/45	37/45	35/45	38/45	37/45	36/45
	Sample Type and No.		S-1-11-1	S-1-11-2A	S-1-11-28 S-1-11-3A S-1-11-38	S-1-11-4	S-1-11-5	S-1-11-6A S-1-11-6B	S-1-11-7	S-1-11-8	S-1-11-9	s-1-1- s-1-1-
(CB-BYU-U ITAS-SaU-A Joint Researd Sponsored by VSP, Caltras	naca		5	₩ E	, 억획	ML	ы	ЪĘ	WS	M	¥	낭
	Usepth Scale (m)		{ } }		////	ноно	нПнГ	H [] H				
		ĭ,		Ĩ.		11111		- UU		ñ	ñ	

Legend S: Spit Spoon (SPT) SH: Shelby tube * Estimated Energy Ratio

Figure B.24: SPT log: SPT-1-11

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o Crealius XC90H o. U. C. Berkeley method. AWJ rods. Se et al. 1983)	Remarks											
1696°E Jivalent t 3. Sancio athead r er Kovao	D10 (mm)		<2µm	0.08	<1µm	<1µm	<1µm	41 mu 12 mu 12	<1µm	0.078	<1µm	<1µm
N 30.40 ade, equ and R. E sy and c nmer (p	(uuu) 05CI		0.07	0.29	0.005	0.002 <2µm	0.002	0.013	0.002	0.26	0.003	0.006 <1µm
F-1-42 77948° 534 m tom mitom mitom mitom mitom tom mitom mitom stary Harl	(%) umi 7 >		17		뵹	48 61	25	28	48		46	88
D: SP1 5:40.7 11:29.6 11:Cus 5:1.D 10:Rop 11:Safe	(%) uni ç >		20		49	61 72	70	358	63		63	45 80
Test I rdinate levatio levatio uipmer gineer Syster Syster er Typ	uni č7 > ranit %		51	6	98	100 97	100	88	67	6	86	97 100
S Coo E ing Eq ible Er SPT Hamm	Plasticity Index				14	20 34		18	16		36	23 31
GP Drill sspons	imi.I biupi.I		26		39	48 75	39	43 35	40		64	51 58
ž	Moisture Content (%)		28	24	35	37 42	27	37 33	38	23	35	84
	u ⁸ Torvane (kPa)					33	22	34				39 55
	Pocket Pen (kPa) 9 u					110 88	80	80 150		190		90 125
gations, Adapazari, Turkey S.) diameter tricone bit 37/20/00	Description	Fail	SILTY SAND: Brown sandy sit/sitly sand to sand with sit		CLAYEY SILT: Red brown to gray alternating layers and	seams or now to man plasmony silty clay and clayey silt interspersed with some deposits of silt with sand				SP-SM: Gray poorly graded fine sand with silt	CH: Gray high plasticity silty day	
2 2 jisi, A. 62 m (ured	Energy Ratio (%)											
PT-1-4 PT-1-4 rray eknolo ish with ML = 0 t meas	(m) rhgan Loof		3.67	5.20	6.72	8.24	8.24	9.77	11.29	11.29		12.82
Liquef th of C a Batu emin T emin T ary wa vas no	Depth (m) Depth (m)		1.35	3.85	3.15	3.95	4.95	5.85	6.75	7.95		8.95
Name: CPT 1: 1.5 m sou ly 18, 2000 g by: M. Boi r: ZETAS (Z Method: Rol able Elevati SPT energy	Blows/15 cm SPT		1-1-1	5-3-2	2-2-2	2-1-2	2-2-3	2-3-5	2-3-8	11-5-3		2-2-2
Project I Locatior Date: Ju Field Lo Drilling Nater T.	Γευδήν (cm) Κεςολειλ		37/45	42/45	38/45	42/45	42/45	42/45	42/45	31/45		33/45
	Sample Type and No.		S-1-42-1	S-1-42-2	S-1-42-3	S-1-42-4A S-1-42-4B	S-1-42-5	S-1-42-6A S-1-42-6B	S-1-42-7	S-1-42-8A	S-1-42-8B	S-1-42-9A S-1-42-9B
CB-BYU-U TAS-SaU-J oint Researd ponsored by iSF, Caltra	naca		M	SP-SM	5	MM	ML	ЧU	Ъ	SP-SM	£	뮰
DH ~ ~ZO	Vgolothi.I		HEHEHE	FFFFF	Н. Н. П.	нрнр	н	нДн] H [] F	1.1	3)	[]
	Depth Scale (m)	o	<u>.</u>	N	<u>۳</u>	4	φ.					<u>م</u>

Legend S: Spit Spoon (SPT) SH: Shelby tube * Estimated Energy Ratio

Figure B.25: SPT log: SPT-1-42

Name: CPT Liquefaction Investigations, Adapazari, Turkey Test ID: SPT-1.41 1t.5 m west of CPT-1.41 Elevation: 20.20 m 9 Yr, 2000 BP: Rouble B. Sancio 9 Yr, Scotion: B. Sancio Drilling Equipment: Custom made, equivalent to Crealius XC90H 6 Yr, Scotion: B. Sancio Drilling Equipment: Custom made, equivalent to Crealius XC90H 6 Yr, Scotion: B. Sancio Drilling Equipment: Custom made, equivalent to Crealius XC90H 6 Yr, Scotion: B. Sancio Drilling Equipment: Custom made, equivalent to Crealius XC90H 6 Yr, Scotio: B. Sancio Drilling Equipment: Custom made, equivalent to Crealius XC90H 6 Yr, Scotio: B. Sancio Drilling Equipment: Custom made, equivalent to Crealius XC90H 6 Yr, B. Camin Teknolojisi, A. S.) Responsible Engineers: Jr.). Bay and R. B. Sancio, U. C. Berkeley Abto: Staten: Suble Y. Saley Hammer Type: Saleiy Hammer (per Koracs et al. 1983) Hammer Type: Saleiy Hammer (per Koracs et al. 1983)	Remarks			The soil recovered in S-1- 41-2B at approx. 2.6 m was	identified by Bora Baturay as being very similar to the soil ejected to the surface	aner me vocaell earmquake						
	(mm) 01 U		<2µm 2µm	41µm 22µm	22µm 412	11 mults mults	<1µm	0.08 <2µm	0.11	0.088	41µm 12	
	(uuu) 05Q		0.070	0.016	0.027	0.022	0.005	0.22 0.028	0.44	0.35	0.003	
	(%) uuri 7 >		15 18	213	17	19 51	40	13 -			24	
	(%) umi 5 >		18 25	26 15	20 63	25 67	50	- 16			57 26	
	uni c7 > eanit %		51 75	83	83 83	94 100	92	9 84	5	8	98 91	
	Plasticity Index					8 30	30	. ,			25	
	nimi.I biupi.I		26 29	30.	- 29	35 53	54				51 32	
	Moisture Content (%)		33	22	33	38	26	28	19	20	33	
	u ⁸ Torvane (kPa)				36		59				65	
	Pocket Pen (kPa) q _u		40		70	75	130				150	
	Description	Fill: Pavement (asphalt and subgrade) of Ipçi street followed by dark clay	SILT: Brown to olive brown sandy silt to silt with sand			CH: Brown gray to gray high	presucrty sury cray	SP-SM: Gray poorly graded fine sand with silt grading to poorly graded fine to medium	sand with silt. Sand is interspersed with thin strata of ssilt with sand (S-1-41-6B)		CH: Gray high plasticity silty clay	ML: Gray low plasticity siit with traces of fine sand
	Energy Ratio (%)								~			
	(m) rhgna Leoff		4.27	5.80	7.32	7.32	8.84	8.84	10.3	11.8	11.8	
	Casing Depth (m)		1.35	2.45	3.25	4.05	4.85	5.65	6.45	7.45	8.45	
	Blows/15 cm SPT		1-0-1	1-2-2	2-2-2	2-1-3	2-2-3	2-5-7	12-17-22	14-16-20	2-2-5	
roject ocatior iate: Ju ield Lo perato rilling lotes: \$	Length (cm) Recovery/		36/45	38/45	40/45	40/45	38/45	37/45	37/45	35/45	38/45	
UCB-BYU-UCLA L ZETAS-SaU-METU L Joint Research F Sponsored by: NSF, Caltrans CEC, FG&E N	əqryfe Type sad No.		S-1-41-1A S-1-41-1B	S-1-41-2A S-1-41-2B	S-1-41-3A S-1-41-3B	S-1-41-4A S-1-41-4B	S-1-41-5	S-1-41-6A S-1-41-6B	S-1-41-7	S-1-41-8	S-1-41-9A S-1-41-9B	
	SDS0		۲. ۲	EZ	망	생동	5 J	SP-SM ml	SP-SM	SP-SM	불	
	(m) succ inquir visolothi.I			1111	1111	11/	\$ }]
	(m) along thread	P	· · · · · ·	m		4	φ.	9 .			იი	(

Legend S: Spit Spoon (SPT) SH: Shelby tube * Estimated Energy Ratio

Figure B.26: SPT log: SPT-1-41

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95
Crealius XC90H U. C. Berkeløy ethod. AMJ rods. e et al. 1983)	Remarks										
246°E ivalent to î. Sancio, athead m ar Kovacs	D10 (mm)				41µm 42µm	<2µm <2µm	17 mu 17 mu 17	<1µm	0.087	0.081	0.10
N 30.39 ade, equ and R. B sy and c	(mm) 05CI		41µm		0.036	0.019	0.006	0.010	0.30	0.25	0.32
7-1-32 77651°1 409 m tom me tom me tom me tom me tom me	(%) uni 7 >		61		16	20 18	88	27		γ.	
D: SP1 35: 40.7 35: 40.7 35: 40.7 35: 40.7 35: 40.7 35: 40.7 35: 40.7 35: 40.7 35: 40.7 35: 40.7 4 35: 40.7 7 4 35: 40.7 7 4 35: 40.7 7 7 7 7 8 7 8 7 7 8 7 8 7 7 8 7 7 7 7	(%) uni 5 >		11		28	27	48 25	36			
Test I rdinate levatio uipmer gineer Syster	uni č7 > mañ %		66		56	88	94	96	œ	6	5
S Coo E E ing Eq ible Er Hamm	Plasticity Index		48			13	33				
GP Drill sspons	timi.I biupi.I		73		29	30 30	53 33	35			
a a	Moisture Content (%)		37		302	88	302	36	23	21	19
	u ⁸ Torvane (kPa)		40		17	24	29	39			
	Pocket Pen (kPa) q _u		160	_	50	20	50	50	-		
jations, Adapazari, Turkey S.) diameter tricone bit 7/11/00, 0.76 m 07/19	Description	Fill: Top soil and black silty clay with organic odor	CH: Gray high plasticity silty clay	SANDY SILT: Brown sandy silt		CLAYEY SILT: Gray clayey silt to silty clay with traces of fine sand			SP-SM: Fine to medium gray poorly graded sand with silt		
-32 -32 jisi, A. 9 cm-	Energy Ratio (%)		54	57	60	53	63	62			
action I CPT-1 ancio eknoloj sh with ML =0.1	(m) rugan Leogi		4.27	5.80	7.32	8.84	8.84	10.37	11.89	11.89	11.89
Liquef In from fo B. S. emin T tary wa tary wa	Casing Depth (m)		0.95	1.95	2.75	3.95	4.75	5.95	6.95	7.85	8.75
Vame: CPT 1: 1.5 m nort 1y 10, 2000 g by: Rodolf r: ZETAS (Z Method: Rot hble Elevati	Blows/15 cm SPT		2-2-4	3-2-4	2-1-3	2-2-2	2-4-5	5-5-5	8-15-13	13-21-20	12-20-23
Project I Date: Jul Date: Jul Pield Log Pperator Dilling I Vater Ta lotes:	Γευβιν (cw) Κετολειλ		29/45	0/45	43/45	36/45	34/45	30/45	37/45	31/45	30/45
	Sample Type and No.		S-1-32-1	S-1-32-2	S-1-32-3A S-1-32-3B	S-1-32-4A S-1-32-4B	S-1-32-5A S-1-32-5B	S-1-32-6	S-1-32-7	S-1-32-8	S-1-32-9
CB-BYU-U FAS-SaU-N jint Research ponsored by: SF, Caltrar EC, PG&E	naca		5		ЧЧ	ML/CL	MCH	M	WS-dS	SP-SM	SP-SM
	vgolorbi.I		{},	/ 888	199	C H C H] H [] H	I, H , H	·.··.	· ·.·	1.1
1	Depth Scale (m)	0	-	2	3	4	5	9		80	

Figure B.27: SPT log: SPT-1-32

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to Creallus XC90H lo, U. C. Berkeley method, AWJ rods. cs et al. 1983)	Remarks		Although no sample was recovered, the walls of the sampler show olive-gray	sandy silt	At approx. 2.7 m the wash water shows medium to coarse sand						
755°E livalent 3. Sanci athead er Kova	(mm) 01G			41µm 3µm		<1µm	<2µm	11 mults	0.042	0.10	
N 30.37 ade, equ and R. f sy and c nmer (p	(uuu) 05CI			0.032	41μm	0.011	0.051	0.008	0.20	0.30	41µm
F-1-16 77449° 303 m tom m tom m tom m tom m tom m tom m sty Har	(%) uuri 7 >			17	69	31	12	35 16			59
D: SP1 5: 40.7 11: Cus 5: J. D 11: Rop 11: Safe	(%) umi ç >			32	83	37	15	44	5		70
Test I dinate evatio ipmer gineer Syster er Typ	uni 57 > eanî %			82 82	98	82	65	83	13	7	66
S Coor ng Equ ible En Kamm	Plasticity Index				26	9		22			44
GP Drilli spons	imi.I biopi.I			313	48	34	39	40			89
Re	Moisture Content (%)			88	42	33	31	33	27	21	45
	u ⁸ Torvane (kPa)										
	Pocket Pen (kPa) gu										
gations, Adapazari, Turkey S.) 07/12/mone bit a eccelerometers	Description	Fill: Borehole performed at level ground in a vacant lot. Brown clayey soil	SILT: Brown silt with fine sand		CLAYEY SILT: Gray clayey silt to silty clay with fine sand interspersed with sandy clayey silt				SAND: Gray sitty fine sand to poorly graded fine to medium sand with silt		CH: Olive gray high plasticity sitty clay. Does not soften when remoulded
Investi 1-16 Jjisi, A. Jjisi, A. J.37 m I withou	Energy Ratio (%)							2	0	6	
faction CPT- ancio Teknolo ssh witi WL = 0 corded	(m) rugan (m)		4.27	5.80	5.80	7.32	8.84	10.3	11.8	11.8	11.8
Liquel ay fronr fo B. S femin 7 tary we tary we was re	Casing Depth (m)		0.95	1.85	2.75	3.75	4.85	6.15	7.15	8.35	9.15
Hame: CPT 1.5 m awy 11, 2000 g by: Rodol r: ZETAS (2 Method: Ro sble Elevati	Blows/15 cm SPT		2-2-1	2-2-5	1-2-1	1-2-2	5-6-9	2-3-9	5-7-10	7-11-16	2-3-3
roject h ocatior ate: Jul ield Lo perato perato rilling 1 fater Ta otes: S	Length (cm) Recovery/		0/45	40/45	37/45	37/45	39/45	44/45	28/45	40/45	31/45
	əqr Təlqməd and No.		S-1-16-1	S-1-16-2A S-1-16-2B	S-1-16-3	S-1-16-4	S-1-16-5	S-1-16-6A S-1-16-6B	S-1-16-7	S-1-16-8	S-1-16-9
CB-BYU-U FAS-SaU-A jint Researcd ponsored by SF, Caltrai EC, PG&I	SDSD			۲.	С	ML	ML	¥С	WS	SP-SM	ъ
D H S S S O	rgolorhil		i i i i i]н]н[нДн	СнСнСн	ПнСн	1.1.1.1.1	1.1.	33
	Depth Scale (m)	o 	Σ	. ñ	<u>.</u>	4		φ 			<u>ო</u>

Figure B.28: SPT log: SPT-1-16

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o Crealius XC90H 3. U. C. Borkeley nethod. AWJ rods. Se et al. 1983)	Remarks									
1296°E Jivalent t 3. Sancic athead r er Kovac	(mm) 010		3µm 41µm	<3µm	<2µm <1µm	<1µm	<1µm	<0.08	<0.08	0.23
N 30.38 ade, equ and R. f sy and c mmer (p	(uuu) 05 U		0.026	0.019	0.094	0.002	0.011	0.20	0.20	1.3
77639° 77639° 201 m stom m tom m tom m stom m ety Harl	(%) uuri 7 >		44	Ŧ	<10% 20	52	23			
D: SP 35: 40.1 37: 1 Cus 36: 28.0 37: 1 Cus 37	(%) turi ç >		32 51	30	<15% 28	70	31			
Test rrdinato llevatic uipme nginee Syste rer Typ	uni ç7 > təni %		65 80	78	88	66	98	17	£	4
PS Coo E E ling Eq sible El Hamn	Plasticity Index		24	18		35	æ	,		
Gf Gf	nimi.I biupi.I		30	41	34	61	37			
CŽ	Moisture Content (%)		53	31	333	43	37	21	52	6
	⁵ U ⁸ (kPa)					35	36			
	Pocket Pen (kPa) q _u			70		120	125			
gations, Adapazari, Turkey S.) see CPT-1-24	Description	Fill: Dark brown to black silty gravelly sand. Fill for burried sever canal. Roots from nearby tree	SILTY CLAY: Atternating strata of brown-gray, low to high plasticity silty clay and clayey silt with fine sand interbedded with deposits of	silty sand and sandy silt. Gray color prevails beyond a depth of approx. 4 m				SAND: Gray fine to medium sand with sit to sily sand grading to sand with gravel. Sample S-1-24-10 is 22% rounded fine gravel		
-24 -24 jisi, A. 9 cm- sured,	Energy Ratio (%)		57	62	67	55	61	99	67	99
CPT-1 CPT-1 ancio eknolo eknolo sh with	(m) rugası boğ		5.80	7.32	8.84	8.84	10.37	10.37	11.89	13.42
Liquef ay from fo B. S. fo B. S. fo B. S. for B. S. for B. S.	Casing Depth (m)		2.15	3.25	4.05	4.85	5.65	6.65	7.65	8.85
Vame: CPT Name: CPT 3.2 m awe y 10, 2000 g by: Rodol r: ZETAS (2 Method: Ro able Elevati SFA was use	Blows/15 cm SPT		2-2-2	2-1-2	3-3-3	2-2-3	3-4-4	9-14-20	10-14-19	17-21-22
roject / ocatior ate: Jul ield Loi perato rilling I vater Ta lotes: S	I cength (cm) Recovery/		30/45	32/45	36/45	39/45	34/45	39/45	36/45	20/45
	Sample Type and No.		S-1-24-3A S-1-24-3B	S-1-24-4	S-1-24-5A S-1-24-5B	S-1-24-6	S-1-24-7	S-1-24-8	S-1-24-9	S-1-24-10
CB-BYU-U TAS-SaU-A loint Researd Sponsored by VSP, Caltrau	naca		Ե볼	Ъ	WR	ъ	M	WS	SP-SM	- ds
	(m) succ inque		нннн	НЦН	Н	I H	Н			
	Cont along thread	9		· · · · ·	4	<u>.</u>				. .

Figure B.29: SPT log: SPT-1-24

XC90H rrkeley XJ rods. 83)	Remarks										
E nt to Crealius ncio, U. C. Be d method. Al				-							
6374°E uivaler B. Sarr cathea ser Kov	D10 (mm)			<1µm		<2µm			<1µп	<1µm	41µm
N 30.3 ade, eq and R. ey and i mmer (p	(uuu) 05D		7	0.002		0.045	mu 1>	41pm	0.003	0.005	0.027
T-1-02 77346° 712 m stom m stom m stom m be, pull be, pull éty Hai	(%) uuri 7 >		ß	51		12	57	60	40	40	16
D: SP 35: 40. 11: 26. 11: Cus 75: J. C 8: Saf	(%) turi ç >	2	ŧ	61		16	67	73	65	50	21
Test rdinatu levatic levatic ginee Syste er Typ	with $\varsigma_L > source with the second s$	g	06	38		4	26	66	100	66	95
S Coo E ing Eq ible Er SPT Hamm	Plasticity Index		23	35			51	50	43	25	
GP Drill sspons	imi.I biupi.I		60	58		24	62	75	65	44	29
an N	Moisture Content (%)	5	6	32		31	40	32	8	8	32
	⁵ u Torvane (kPa)	9	0	41			76	115	06	29	
	Pocket Pen (kPa) 9 u			06		230	150	460	240	65	70
gations, Adapazari, Turkey S.) dameter tricone bit 07/17/00	Description	Fill: Hole drilled through pavement (asphalt and subgrade) followed by sand	CH: Gray to reddish brown high plasticity silty clay		ML: Sandy silt to silt with sand		CH: Gray high plasticity silty day. Traces of shells in S-1- 02-5 and S-1-02-6				ML: Dark gray silt with traces of fine sand
-02 -02 jisi, A. 13 cm- ured	Energy Ratio (%)	***	6	55*		-09	. 65*	65*	65*	65*	65.
CPT-1 CPT-1 cPT-1 ray eknolo eknolo sh with ML = 1 t meas	Rod Length (m)	100	10.0	5.20		6.72	8.24	8.24	11.28	11.28	12.82
Liquef ay from ra Batu ra Batu rany wa tary wa tary wa son: G'	Casing Depth (m)	200	06.0	1.95		3.35	4.45	5.45	6.95	7.95	8.95
Name: CPT 1: 1.5 m awa 1: 1.5 m awa 1: 1.5 m awa 1: 1.5 m awa 1: 1.5 m awa 1: 1.5 m awa 1: 1.5 m awa 1: 2 m aw	Blows/15 cm SPT	0	-z-0	2-3-3		3-3-4	2-3-3	3-5-9	2-4-4	2-1-2	2-2-3
Project cocation Jate: Ju Field Lo Derato Drilling Vater T Votes:	I ength (cm) Recovery/	00145	24/07	27/45		30/45	33/45	32/45	28/45	22/45	35/45
	Sample Type and No.			S-1-02-2		S-1-02-3	S-1-02-4	S-1-02-5	S-1-02-6	S-1-02-7	S-1-02-8
CB-BYU-I TAS-SaU-J Joint Researc Sponsored by VSP, Caltra CEC, PG&I	naca	ē	5	ъ		ML	5	5	5	5 TT	M
	vgolothi.I		1 } }	55			555	555	5555	53	
	(m) sles8 thras	9		<u>۹</u>	۳.		4	φφ			.

Figure B.30: SPT log: SPT-1-02

to Crealius XC90H to Crealius XC90H io, U. C. Berkeley method ANJ rods. tcs et al. 1983)	Remarks								3 to 5 mm thick clay seams in sample S-2-10-8	At approx. 9.4 m, the wash water shows fine gravel
1171°E Jivalent B. Sanci athead er Kova	(mm) 01G	<1µm	<1µm	mu 12 mu 12	<2µm 0.001	22µm 22µm	Spm 2pm	0.002	0.02	× ×. 088
N 30.39 ade, equ and R. E ey and c nmer (p	(uuu) ()5D	41m	0.001	0.009	0.023	0.029	0.021	0.088	0.15	0.15
77883° 77883° 344 m tom m tom m tom m tom m tom m tom m ety Har	(%) uni 2 >		57	212	22	14	17	10	<10%	
D: SP1 35: 40.7 35: 40.7 35: J. D m: Rop e: Safe	(%) uni 5 >		74	43 25	24 43	25 18	238	4	<10%	
Test I rdinate levatio uipme nginee Syste	uni ç7 > xənî %	95	66	91 86	78 94	92 45	80 84	41	20	24 20
S Coo E E ing Eq ible Er Hamm	Plasticity Index	36	44	- 16	22			,		
GP Drill Sspons	timi.I biupi.I	64	70	41 25	31 47	8.	32			
ž	Moisture Content (%)	8	42	88	88	333	338	24	23	88
	u ⁸ Torvane (kPa)	46	50	190						
	Pocket Pen (kPa) 9u	80	130	40	6					
jations, Adapazari, Turkey S.) Giameter tricone bit inrimediately after drilling ended	Description	Fill: Hole drilled through pavement (asphalt and subgrade). Gravel in wash water at aprox. 0.7 m CH: Brown gray to gray sifty cdH: Brown gray to gray sifty		ML: Brown clayey silt with fine sand	CL: Brown clayey silt	SILT: Sitt with fine sand		SM: Gray silty fine sand		
Investig 0 19 cm- -2-10-5	Energy Ratio (%)	53	53	51	29					
PT-2-11 PT-2-11 Irray eknolo ish with ble was	(m) digaal boff	4.27	5.80	5.80	7.32	8.84	10.37	11.85	11.85	13.42
Liquel th of C rra Batu fany we ion: Hk	Casing Depth (m)	0.95	1.75	2.75	3.95	4.75	6.05	7.45	8.45	9,45
Hame: CPT Hame: CPT 1.5 m nor 3 by: M. Bo 3 by: M. Bo 7 ZETAS (2 Method: Ro toble Elevati toceleromet	Blows/15 cm SPT	2-2-1	2-1-2	1-2-2	1-1-1	3-6-6	4-5-8	10-15-19	12-15-22	11-14-19
roject h ocatior ate: Jul ield Lo; iperato rilling l ater Ta otes: /	Γευβην (cm) Γευδην (cm)	22/45	29/45	39/45	30/45	30/45	33/45	27/45	41/45	40/45
	Sample Type and No.	S-2-10-1	S-2-10-2	S-2-10-3A S-2-10-3B	S-2-10-4A S-2-10-4B	S-2-10-5A S-2-10-5B	S-2-10-6A S-2-10-6B	S-2-10-7	S-2-10-8	S-2-10-9A S-2-10-9B
CB-BYU-U TAS-SaU-I oint Researc ponsored by PGR1 BF, Caltra	naca	5	ъ	CLML		WL	¥۲	SM	WS	SM
PH ~ ~ZO	(m) subo inqe 2 vgolorbi.I	<u> </u>	{ } } }	}	N					
	Depth Scale (m)				4	<u>د</u>	9	<u></u>	°,	-

Figure B.31: SPT log: SPT-2-10

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o Crealius XC90H o. U. C. Berkeley method. ANU rods. Se et al. 1983)	Remarks		Roots in the tip of the sampler									
469°E iivalent t 3. Sancio athead i ar Kovao	(mm) 01 U		<1µm	<1µm	<2µm	41µm	11 1 1 1 1 1 1 1 1	17 mu 17 mu 17 17	17 mu 17 mu 17		0.005	0.07
V 30.39 ade, equ and R. B sy and c	D20 (unu)		0.002	0.016	0.022	0.009	0.001	0.009	0.006	~2µm	0.17	0.20
77969°1 77969°1 407 m 407 m tiom ma tiom ma 5. Bray 9. Bray ety Han	(%) um 7 >		48	23	15	29	255	26	408	61	8	
D: SP1 35: 40.7 35: 40.7 35: 40.7 35: 40.7 35: 40.7 35: 40 36: 5 36 36 36 36 36 36 36 36 36 36 36 36 36	(%) turi ç >		64	30	20	88	66 27	36 25	47 55	72	10	
Test I rdinate levatio uipmei ginee Systei er Typ	uni ç7 > sənî %		67	87	06	96	100 85	88 86	98 97	100	20	£
S Coo E ing Eq ible Er SPT Hamir	Plasticity Index		38			18	42 -	9	28 16	40		
GF Drill sspons	nımi. I biupi. I		64	33	8	47	67 37	37 36	39	65		
ž	Moisture Content (%)		38	31	37	37	30	32	88	40	23	5
	u ⁸ Torvane (kPa)		52				42			45		
	Pocket Pen (kPa) 9 u		140	25	60		75		_			
pations. Adapazari, Turkey Migros parking lot (alameter tricone bit 7/13/00 d and recorded high values	Description	Fill: Gravel pack for parking lot followed by sandy clayey soil	CH: Brown gray high plasticity sifty clay	CLAYEY SILT: Tan brown dayey silt with traces of fine sand		SILTY CLAY: Brown stiff silty day	CLAYEY SILT: Gray clayey		SILTY CLAY: Gray high plasticity silty clay		SAND: Gray silty fine sand to fine sand with silt	
nvestig -03, in 9 cm- 92 m 0	Energy Ratio (%)											
action I CPT-2 ancio eknolo sh with ML = 0.	(m) rhgaa.I boxI		4.27	5.80	5.80	7.32	8.84	8.84	10.37	11.29	13.42	12.82
y from to B. S. fo B. S. emin T tary wa on: G\	Depth (m) Depth (m)		0.5	1.95	2.95	3.95	4.85	5.75	6.55	7.95	9.15	9.95
tame: CPT tame: CPT y 13, 2000 g by: Rodoll by: Rodoll z: ZETAS (Z Method: Rol he accelerc	Blows/15 cm SPT		1-2-2	1-1-1	2-2-3	3-2-3	1-1-2	2-3-3	2-2-2	2-2-4	5-12-19	11-17-28
Project N Date: Jul Jate: Jul Pate: Jul Pater Log Prestor Vater Ta Votes: T	Γευβήν (cm) Κεςονειλ		30/45	22/45	33/45	25/45	32/45	32/45	34/45	29/45	37/45	42/45
	эдүТ эңтты .oV bas		S-2-3-1	S-2-3-2	S-2-3-3	S-2-3-4	S-2-3-5A S-1-3-5B	S-2-3-6A S-2-3-6B	S-2-3-7A S-2-3-7B	S-2-3-8	S-2-3-9	S-2-3-10
CB-BYU-U TAS-SaU-N oint Research ponsored by: iSP, Caltrar ISP, Caltrar	sosa		5	R	M	M	КЧ	CL/ML	CH/MH	5	WS .	SP-SM
	Lithology		55	H.[] H.[] H	HH	ПННН	н	н <u>[</u>] Н []	н н н	HHH	H · · ·	• • •
	(3 mm d	° Luu	цĨц		 	4	Ω L L L L	9		, i li i i i	<u>6</u>	цīц

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Figure B.32: SPT log: SPT-2-03

		_			_					_	_	
to Creatus XC90H lo, U. C. Berkeley method, AWJ rods. cs et al. 1983)	Remarks	Casino was initially left at	0.95 m, but it moved downward 0.3 m		The soil of samples S-2-3- 28 and S-2-3-46 is your	zb and Sz-S-44/ is very similar in appearance to the soil seen at the surface (sand boil ejecta) of the nearby Site G (Phase 1)			Too much clipping and high velocity values in the SPT energy records. The data cannot be used.			
l665°E uivalent 3. Sanci athead er Kova	(mm) 01G			<2µm	254 M m125	Spm 22pm	11 mu mu mu f	<2µm <.08	mu12 mu12	<1µm 0.001	<1µm	<1µm
N 30.40 ade, equ and R. E sy and c	(mm) 02D			0.023	0.022	0.009	0.019	0.065	0.015	0.020	0.002	0.008
-3-03 7496° 669 m tom ma tom m	(%) uni 7 >		:	6	85	27 17	88	15	20	100	47	8
D: SPT 5: 40.7 11: Cus 5: J. D 11: Rop 6: Safe	(%) umi ç >		;	8	83 15	38	84	. 18	31	23 14	65	42
Test I rdinate levatio uipmer gineer Syster er Typ	uni 57 > १२०१३ %		;	8	91 69	97 83	88	54 35	88 88	95 96	66	100
S Coo E E ing Eq ible Er SPT Hamm	Plasticity Index					- 15			9 ,		27	15
GP	imil biopil		:	29	-25	31	31	- 28	38	37 32	53	43
Re	Moisture Content (%)		:	R	313	45 31	333	27 23	333	37 30	40	38
	Torvane (kPa)											
	Pocket Pen (kPa) 9 <i>u</i>											
sitigations, Adapazar, Turkey A. S.) m-diameter tricone bit m 07/20/00	Description	Fill: Drilled through pavement (asphalt and subgrade)	ML: Gray silt with fine sand to silt with traces of fine sand		SILT AND SAND: Brown clavev silt with variable fine	sand content		SILTY SAND: Gray sandy silt to silty sand	CLAYEY SILT: Gray clayey sit		CLAY: Gray, stiff silty clay	
Investi jisi, A. n 9 cm	Energy Ratio (%)				60	59	63		- 2	- 2		-
PT-3-3 PT-3-3 fancio feknolo ash wit	Rod Length (m)			3.67	5.80	5.80	7.32	8.84	10.3	10.3	11.8	13.4
Lique st of Cl Ifo B. S Zemin 7 Dtary w	Casing Depth (m)			1.25	2.05	2.85	3.95	4.95	5.95	6.95	7.75	8.95
Vame: CPT 1: 1.5 m we 1y 15, 2000 g by: Rodo r: ZETAS (2 Method: Ro	Blows/15 cm SPT			1-1-2	2-3-4	1-2-2	2-2-3	4-6-6	3-6-7	3-5-6	2-2-3	3-3-4
Project I Date: Jul Jul Loy Derator Derator Drilling I Vater Ta lotes:	Γευβήν (cm) Κεςονειλ			36/45	35/45	32/45	34/45	36/45	33/45	34/45	32/45	28/45
	Sample Type and No.			S-3-3-1	S-3-3-2A S-3-3-2B	S-3-3A S-3-3B	S-3-34A S-3-34B	S-3-3-5A S-3-3-5B	S-3-3-6A S-3-3-6B	S-3-3-7A S-3-3-7B	S-3-3-8	S-3-3-9
CB-BYU-U TAS-SaU-A oint Researd ponsored by SF, Caltras	sosn			WL	EZ	MLCL	ЧЧ	ML	M	ML	Ч	ML/CL
DE S S S D	vgolothi.I				11:1	:;::l::		FFFFF	нсн	ΠH.	///	/////
	Depth Scale (m)	0	7	2		e.	4	5	9	N	80	6

Figure B.33: SPT log: SPT-3-3

	s XC90H erkeley WJ rods. 983)	Remarks		penetrated an cm with the last	he hammer hk 10 cm after erted in the hole g)								
	Iest ID: SN1-3-05 GPS Coordinates: SN1-3-05 Elevation: 29.482 m Drilling Equipment: Custon made equivalent to Crealius XC: Responsible Engineers. J. D. Bray and R. B. Sancio, U. C. Berkel SP System: Rope, pulley and cathead method. ANU Hammer Type: Safety Hammer (per Kovacs et al. 1983)			Sampler extra 10	blow of th Rods sar being ins (sloughir								
	0471°E uivaler B. San cathea er Kov	(mm) 010		41µm	0.010		<1µm	0.004	<2µm	<2µm	<2µm	41µm	
	N 30.4 ade, eq and R. sy and i nmer (p	(uuu) 05 U		0.008	0.060	rthm	0.005	0.094	0.036	0.020	0.055	0.001	
	T-3-06 77487° 482 m 482 m stom m stom m . Bray). Bray). Bray ety Harl	< 5 mm (%)		32		75	40	6	14	17	12	55	
	D: SP es: 40. nr: 29. nr: 29. nr: 29. nr: 29. e: Saf	(%) tuni ç >		40	æ	85	50	5	16	52	44	89	
	Test rdinato levatic upme nginee Syste ier Typ	$\mathfrak{uni} \ \mathfrak{\varsigma}_L > \mathfrak{soug} \ \mathfrak{h}$		88	25	66	92	35	82	93	58	66	
	S Coo E ing Eq ible Er SPT Hamm	Plasticity Index		20		40	12				,	28	
	GP Drill sspons	imi.t biupi.t		42	27	69	34		30	31	33	57	
	Ř	Moisture Content (%)		36	90	45	32	25	30	41	30	31	
		⁵ u Torvane (kPa)		34		41	26					78	
		Pocket Pen (kPa) 9 <i>u</i>		35		4	60			75		190	
	action Investigations, Adapazari, Turkey F-3-6 Rest Action (1997) et with 9 cm-diameter tricone bit M. = 1.16 m 07/20/00 treasured	Description	Fil	SILTY CLAY: Olive gray silty clay with traces of fine sand	SILT AND SAND: Interspersed strata of brown and gray sandy sitt and sifty sand	SILTY CLAY: Brown silty clay to clayey silt interbedded with thin deposits of silt with sand	and sandy silt	SILTY SAND: Silty fine sand	ML: Clayey silt with variable fine sand content			CH: Gray silty clay interbedded with thin layers of	silt with sand
	investig jisi, A. 9 cm- 16 m 0 ured	Energy Ratio (%)			,			· .			,		
	T-3-6 T-3-6 ray eknolo sh with ML = 1 ML = 1 t meas	(m) rigna l box		3.67	5.20	6.72	6.72	8.24	9.77	11.29	11.29	11.29	
	Liquef t of CP ra Batu tany wa tany wa tany wa tany wa tany wa tany wa tany wa tany wa tany wa tany wa tany wa tany wa tany ch	Casing Depth (m)		0.95	1.95	2.95	3.85	4.95	5.95	6.95	7.95	8.95	
	Vame: CPT v: 1.5m eas ly 17, 2000 g by: M. Bo r: ZETAS (2 method: Ro Method: Ro able Elevat	Blows/15 cm SPT		1-1-1	2-3-2	1-1-2	2-1-2	6-5-7	4-3-6	3-5-5	3-4-8	3-3-5	
	Project Location Date: Ju Field Lo Operato Drilling Nater Ti Notes: \$	Γευβήν (cm) Κεςολειλ		32/45	36/45	47/45	41/45	41/45	39/45	34/45	42/45	27/45	
	CCB-BYU-UCLA BTAS-SuU-METU BTAS-SuU-METU Joint Research Sponseed by: Date: July 17, 2000 Joint Research Sponseed by: Dependency: TETAS (Zemin TU Sponseed by: Dining Method: Relary war CBS, PC&E Notes: SPT energy was not water Table Elevation: GV	эqүT эlqms2 гоИ bas		S-3-6-1	S-3-6-2	S-3-6-3	S-3-6-4	S-3-6-5	S-3-6-6	S-3-6-7	S-3-6-8	S-3-6-9	
		naca		ъ	¥	5	CL/ML	WS	ML	ML	ML	CH/MH	
	D H S S Z O	Vgolothil		H: H		HH	H	FEFFFF				- 7	
		Depth Scale (m)	0	. T	N	2 	4	<u>د</u>	9			6	

Figure B.34: SPT log: SPT-3-6

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	Creatius XC90H U. C. Berkeley ethod. AMJ rods. et al. 1983)	Remarks										
	458°E ivalent to . Sancio, athead me	D10 (mm)	-1µm	×1µm	<2µm <1µm	41µm 41µm	с1µш	<2µm	<1µm	<1µm <2µm	41µm	0.086
	N 30.40 ade, equ and R. B y and c	D20 (mm)	0.006	0.080	0.054	0.003	0.022	0.062	0.019	0.013	0.008	0.32
	7612°h 7612°h 246 m tom ma tom tom tom tom ma tom tom tom tom tom tom tom tom tom tom	(%) uuri 7 >	41	<15%	33	30	8	5	20	30	34	
	D: SP1 55: 40.7 75: 1. D 75: J. D 75: J. D 8: Safe	(%) turi ç >	48	<20%	18 40	57 38	27	12	25	2238	42	
	Test I redinate levatio uipmei gineei Systei ner Typ	$\mathfrak{m}\mathfrak{l} \mathfrak{d} \mathbb{C}^{>} \mathfrak{south} \mathfrak{d} \mathfrak{d}$	87	43	57 96	95 83	91	58	93	89 74	100	7
	S Coo E ling Eq sible Er SPT Hamm	Plasticity Index	19		18	32						
	GF Drill espons	timi.t biupi.t	90		4122	5 54	33		30	26	30	
	æ	Moisture Content (%)	8	29	30	88	53	27	32	45 31	30	17
		⁵ u Torvane (kPa)	60		23	41	55	31		32	39	
	esigations, Adapazan, lurkey A. S.) cm-dameter tricone bit 07250/00 rithout accelerometers	Pocket Pen (kPa) 9 <i>u</i>	80	40	75	80	290	130		125	140	60
		Description	Fill: Pavement, gravel, dark gray sitly day with sand and black organic fragments	SAND AND SILT: Brown with red oxidized points, silty fine sand to low plasticity sandy silt	SILTY CLAY: Light brown with red oxidation points, silty day	with traces of tine sand	ML: Brown to gray interbedded strata of low plasticity silt with traces of fine sand to silt with sand and sandy silt				SAND: Gray silty sand grading to fine to medium sand with silt	
	nvestig 3 jisi, A. 3 9 cm- 64 m 0 1 withou	Επειεχ Ratio (%)										
	action PT-4-13 ray eknoloj sh with NL = 0. asurec	Rod Length (m)	4.27	5.80	7.32	7.32	8.84	10.37	10.37	11.89	13.42	13.42
	Liquef th of Cf ra Batu cemin T cemin T tary wa tary wa on: G/ was me	Casing Depth (m)	0.95	1.95	2.95	3.95	4.95	5.95	6.95	7.85	8.75	9.75
	vame. 1.5 m north of CP 1.9 (1.5 m north of CP 1.9 (1.8, 2000 g by: M. Bora Batur g by: M. Bora Batur r: ZETAS (Zemin Te Method: Rotary was bite Elevation: GM	Blows/15 cm SPT	2-2-2	2-4-4	1-0-2	2-1-3	3-4-5	6-4-6	2-3-6	2-4-4	3-4-3	4-13-20
	roject ocatior ate: Ju ield Lo perato rilling rilling	Length (cm) Recovery/	26/45	34/45	45/45	42/45	33/45	31/45	39/45	42/45	34/45	46/45
	CLA Project ABTU Date: J Pield L Operat Notes:	əqyT əlqme2 .oN bas	S-4-13-1	S-4-13-2	S-4-13-3A S-4-13-3B	S-4-13-4A S-4-13-4B	S-4-13-5	S-4-13-6	S-4-13-7	S-4-13-8A S-4-13-8B	S-4-13-9	S-4-13-10
	CB-BYU-U TAS-SaU-M oint Research ponsored by: (SF, Caltrat IBC, PG&H	SOSO	сг	WS	CL	당의	WL	ML	ML	Mal	ML	WS-dS
	D H X S N O	vgolothi.I			HH	H					· · · · ·	1.1.
		Depth Scale (m)	9		 	4	<u>د</u>	9			.	. 9

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Figure B.35: SPT log: SPT-4-13

to Crealius XC90H o. U. C. Berkeley method. ANJ rods. cs et al. 1983)	Remarks											
1174°E Jivalent t 3. Sanci athead i er Kovad	D10 (mm)		×1µm			42µm 41µm	с1µт	<2µm <0.08	<1µm	17. 11. 11. 11. 11. 11. 11. 11. 11. 11.	<2µm	<pre><8um 0.03</pre>
N 30.40 ade, equ and R. E ey and c mmer (p	(uuu) 05CI		0.003			0.046	0.001	0.092	0.014	0.020	0.022 <2µm	0.12 0.32
T-4-03 78579° 149 m stom m 5. Bray D. Bray pe, pull ety Har	(%) uni 7 >		47			13 23	53	<15%	29	51 30	18 56	
D: SP nt: 29. Tr: J. Cus m: Rop e: Saf	(%) uni ç >		56			17 27	61	<10%	35	87 38	88 25	
Test rrdinate levatic uipme nginee Syste rer Typ	uni č ⁷ > mit %		88			65 70	97	58	84	96 97	94 100	32
S Coo Ing Eq Ible Er SPT Hamir	Plasticity Index						35			18	37	
GF Drill espone	imi.I biopi.I					33 33	59		29	29 40	36	
e e e e e e e e e e e e e e e e e e e	Moisture Content (%)		32			25 27	51	55	23	333	88	¹⁸ 23
	Torvane (kPa)					30			67	50	51	
	Pocket Pen (kPa) 9 <i>u</i>					45		250	280	225	90 75	
tigations, Adapazart, Turkey -diameter tricone bit -ordiameter tricone bit	Description	Fill: Pavement, coarse sand.	SILTY CLAY: Brown sitty clay with traces of fine sand	SILT AND SAND: Brown dayey sandy silt to silty sand			CH: Light brown sifty clay	SAND AND SILT: Brown silty fine sand to fine to medium sand with silt	CLAYEY SILT: Gray clayey silt with traces of fine sand		CH: Gray silty clay	SAND AND SILT: Gray silty fine sand grading to fine to medium sand with silt
Investi 3 a) b) 9 cm 1.65 m d withc	Energy Ratio (%)									6	6	8
PT-4-: PT-4-: Teknol ash wit WL = '	Rod Length (m)		3.67	5.20	5.20	6.72	8.24	9.77	11.2	11.2	11.2	12.8
T Lique uth of C pra Bati Zemin ' Zemin ' Dtary w	Casing Depth (m)		1.05	1.85	2.65	3.45	4.65	5.75	6.95	8.25	9.15	9.95
Vame: CP N 15 m so Jy 19, 2000 g by: M. B(r: ZETAS (Method: Ro ible Elevat	Blows/15 cm SPT		6-5-2	1-1-1	2-2-2	4-2-2	2-3-2	13-13-14	5-4-4	3-4-6	5-3-4	14-18-22
Project I Location Date: Jul Field Loi Operatoi Drilling I Nater Ta Votes: S	Recovery/ Recovery/		5/45	0/45	0/45	39/45	25/45	39/45	27/45	40/45	35/45	43/45
	Sample Type .oN bas		S-4-3-1	S-4-3-2	S-4-3-3	S-4-3-4A S-4-3-4B	S-4-3-5	S-4-3-6A S-4-3-6A S-4-3-6B	S-4-3-7	S-4-3-8A S-4-3-8B	S-4-3-9A S-4-3-9B	S-4-3-10A S-4-3-10B
JCB-BYU-U BTAS-SaU-J Joint Researd Sponsored by NSP, Caltra NSP, Caltra	Rocomerce and a construction of the constructi		σ			WW	5	SP-SM	Å	당물	₩	SP-SM
	Depth Scale (m)	• •	∎80000 			4		с <u>е</u>	-7 -7	н Н Н 	₩ /	9

Legend S: Spit Spoon (SPT) SH: Shelby tube * Estimated Energy Ratio

Figure B.36: SPT log: SPT-4-3

r*E lent to Crealius XC90H ando, U. C. Berkeley ead method, AWJ rods. (ovacs et al. 1983)	D10 (mm)		E.E.		02 Sand catcher was used	um Sand catcher was used	pm Sand catcher was used	um Sand catcher was used	um Sand catcher was used	um Sand catcher was used	Sand catcher was used
40897 equival R. B. S d cath	(00)010	<u> </u>	77		200	2	8	40	₹	05 25	E
2 r made, y and l y and l ammer	(mm) 02U		0.00		0.06	0.00	0.01	0.00	0.06	0.00	2р
PT-4-2' 0.76464 0.511 m ustom i D. Bra ope, pu afety H.	(%) uni 2 >		8 4		10	38	23	39 26	4	45 56	55
Pers: J. C. S. Horsen: A. C. S. Horsen: A. C. S. Horsen: A. C. S. Horsen: A. C. S. Horsen: A. C. S. Horsen: A. C. S. S. Horsen: A. C. S. S. Horsen: A. C. S. S. Horsen: A. C. S. S. Horsen: A. C. S. S. Horsen: A. C. S. S. Horsen: A. C. S. S. S. Horsen: A. C. S. S. S. Horsen: A. C. S. S. S. S. S. S. S. S. S. S. S. S. S.	(%) uni ç >		53 55		15 20	50	26	अर्थ	16	60 75	81
Test prdina Elevati quipme ingine f Systu ner Ty	uni č7 > sanit %		97 99		5 8	100	26	66 66	54	100	66
PS Coo	Plasticity Index		28 32			28		15		33	38
GI Dril espon	nimi.I biupi.I		50 55		25 32	55	34	41 39	36	57 64	65
e e	Moisture Content (%)		86		35	41	88	63	29	39	43
	Torvane (kPa)		52			40	29	23		65 67	57
	Pocket Pen (kPa)		1.65			85	110	20		90 120	160
gations, Adapazari, Turkey S.) diameter tricone bit	Description	Fill	CH: Gray to brown high plasticity silty clay	SILT AND SAND: Brown silty sand to sandy silt grading to low plasticity silt with fine sand		SILTY CLAY: Brown, grading to gray interbedded strata of sifty clay and clayey sift			SANDY SILT: Gray sandy silt to silty fine sand	CH: Gray high plasticity silty day interspersed with some howm clav seams. Traces of	shells and wood chips
Investi 22 Djisi, A. bi 9 cm sured	Energy Ratio (%)							~	2	6	
PT-4-2 PT-4-2 Iray Feknolo ash with	(m) rugan (m)		4.27	5.80	5.80	7.32	8.84	10.3	10.3	11.8	11.8
Lique Ith of C ra Bati Zemin 7 otary w	Casing Depth (m)		0.85	1.65	2.55	3.55	4.65	5.65	6.65	7.95	8.95
tame: CP1 (ame: CP1 (ame) 20, 2000 (american american (american) (american (american) (a	Blows/15 cm SPT		2-1-3	2-2-2	2-2-2	2-1-2	2-1-2	2-2-2	6-8-6	2-2-3	2-3-5
roject / ocation ate: Jul ield Log perator rilling / ater Ta otes:	Γευβην (cu)) Κοεολειλ		33/45	0/45	44/45	43/45	44/45	40/45	33/45	42/45	31/45
	Sample Type snd No.		S-4-22-1A S-4-22-1B	S-4-22-2	S-4-22-3A S-4-22-3B	S-4-22-4	S-4-22-5	S-4-22-6A S-4-22-6B	S-4-22-7	S-4-22-8A S-4-22-8B	S-4-22-9
CB-BYU-U TAS-SaU-A oint Researd ponsored by iSF, Caltras	naca		CH/CL		ML	ъ	M	ML/CL	M	55	ъ
PH ~ %ZU	(m) superinded		[]			H	ННН	н	: #: #: #: :	H: / /	55
	(a) deal direal	° 	. <u>.</u>	- 7	^e	4	<u>ي</u>	9			പ്പ

Figure B.37: SPT log: SPT-4-22

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o Crealius XC90H A, U. C. Berkeley nethod, AWJ rods. s et al. 1983)	Remarks									
296°E ivalent tr Sancio athead n ar Kovac	(mm) 01D		aut Sum Alpm	<3µm	~2µm ~1µm	<1µm	<1µm	<0.08	<0.08	0.23
N 30.38 ade, equ and R. B sy and c	D20 (unu)		0.026	0.019	0.094	0.002	0.011	0.20	0.20	1.3
-1-24 7639°1 01 m lom ms bray a e, pulle	(%) uuri 7 >		' 44		<10%	52	23			
D: SPT 5: 40.7 11: Cus 5: J. D 11: Rop 6: Safe	(%) umi ç >		32	30	<15% 28	70	31			
Test I rdinate levatio levatio uipmer ngineer Syster er Typ	ավ č ⁷ > Խոն "		65 80	78	808	66	98	17	5	4
S Coo E ing Equible Er SPT Hamm	Plasticity Index		-24	18		35	8		,	
GP Drill spons	imi.I biupi.I		30	41	34	61	37			
Re	Moisture Content (%)		23	31	332	43	37	21	23	10
	u ⁸ Torvane (kPa)					35	36			
	Pocket Pen (kPa) 9 u			70		120	125			
gations, Adapazari, Turkey S.) see CPT-1-24	Description	Fill: Dark brown to black silty gravely sand. Fill for burried sever canal. Roots from nearby tree	SILTY CLAY: Alternating strata of brown-gray, low to high plasticity silty clay and clayey silt with fine sand interbedded with deposits of	silty sand and sandy silt. Gray color prevails beyond a depth of approx. 4 m				SAND: Gray fine to medium sand with silt to sily sand grading to sand with gravel. Sample S-1-24-10 is 22% rounded fine gravel		
Investi I-24 jisi, A. 1 9 cm- sured, of 2 m	Energy Ratio (%)		57	62	67	55	61	66	67	99
action CPT- CPT- ancio eknolo ish with sh with ot meat	Rod Length (m)		5.80	7.32	8.84	8.84	10.37	10.37	11.8	13.42
Liquef ay from fo B. S emin T tary wa tary wa on: No	Casing Depth (m)		2.15	3.25	4.05	4.85	5.65	6.65	7.65	8.85
<pre>4ame: CPT 3.2 m awe y 10, 2000 g by: Rodol r: ZETAS (Z Method: Ro hble Elevati bFA was use</pre>	Blows/15 cm SPT		2-2-2	2-1-2	3-3-3	2-2-3	3-4-4	9-14-20	10-14-19	17-21-22
roject N ocation bate: Jul ield Loş peratoi brilling N vater Ta lotes: S	Γευβήν (cm) Κεςονειλ		30/45	32/45	36/45	39/45	34/45	39/45	36/45	20/45
	Sample Type and No.		S-1-24-3A S-1-24-3B	S-1-24-4	S-1-24-5A S-1-24-5B	S-1-24-6	S-1-24-7	S-1-24-8	S-1-24-9	S-1-24-10
CB-BYU-U TAS-SaU-A loint Researd Sponsored by VSP, Caltrau CEC, PG&E	SOSA		년	С	ML	ъ	W	WS	SP-SM	ds .
	Techn scate (m)		НННН	H	H	I H	н			
	(a) deal drand	°		· · · · ·	4	<u>د</u>	9			n l

Figure B.38: SPT log: SPT-1-24-cc

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to Creatius XC90H io, U. C. Berkeley method, AWJ rods. tos et al. 1983)	Remarks				Sand catcher was used	Sand catcher was used	Sand catcher was used	Sand catcher was used	Sand catcher was used	Sand catcher was used	Sand catcher was used
897°E Jivalent B. Sanc sathead er Kova	(mm) 01G		1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1		0.002 <2µm	<1µm	<1µm	12 12 14 14	<2µm	41 mu 12 mu 12	
N 30.40 ade, equ and R. E sy and c nmer (p	(mm) 05D		0.004		0.062 0.024	0.005	0.018	0.004	0.063	0.003	<2µm
F-4-22 76464° 511 m stom m itom m . Bray). Bray be, pull ety Har	(%) uni 7 >		84		10	38	23	39 26	14	45 56	64
D: SP1 55: 40.7 75: J. D 75: J. D 75: J. D 75: Safe	(%) umi ç >		53 55		15 20	50	26	34	16	60 75	81
Test I redinate levatio uipme ginee Syste	uni ç7 > tənî %		97 99		85 8	100	67	88	54	100	66
S Coo ing Eq sible Er SPT Hamm	Plasticity Index		28 32			28		- 15		33	38
GP Drill sspons	nimi.I biupi.I		50 55		25 32	55	34	41 39	36	57 64	65
ž	Moisture Content (%)		48		35	41	38	83	29	39	43
	Torvane (kPa)		52			40	29	23		65 67	57
	Pocket Pen (kPa) 9 <i>u</i>		1.60			85	110	70		90 120	160
gations, Adapazari, Turkey S.) diameter tricone bit	Description	Fill	CH: Gray to brown high plasticity silty clay	SILT AND SAND: Brown silty sand to sandy silt grading to low plasticity silt with fine sand		SILTY CLAY: Brown, grading to gray interbedded strata of silty clay and clayey silt			SANDY SILT: Gray sandy silt to silty fine sand	CH: Gray high plasticity silty day interspersed with some howen clav seams. Traces of	shells and wood chips
Investi 2 jisi, A. 9 cm- sured	Energy Ratio (%)							_			
PT-4-2 PT-4-2 Iray Feknolo ash with ash with	(m) fignal koli		4.27	5.80	5.80	7.32	8.84	10.37	10.37	11.8	11.8
Liquet Ith of C rra Batu Cemin 7 fany we fion: N	Casing Depth (m)		0.85	1.65	2.55	3.55	4.65	5.65	6.65	7.95	8.95
Vame: CPT 1: 1.5 m sou y 20, 2000 g by: M. Bo f: ZETAS (Z Method: Ro sble Elevat	Blows/15 cm SPT		2-1-3	2-2-2	2-2-2	2-1-2	2-1-2	2-2-2	6-8-6	2-2-3	2-3-5
roject h ocatior ate: Jul ield Lo; perato rilling l /ater Ta otes:	I cngth (cm) Recovery/		33/45	0/45	44/45	43/45	44/45	40/45	33/45	42/45	31/45
	Sample Type and No.		S-4-22-1A S-4-22-1B	S-4-22-2	S-4-22-3A S-4-22-3B	S-4-22-4	S-4-22-5	S-4-22-6A S-4-22-6B	S-4-22-7	S-4-22-8A S-4-22-8B	S-4-22-9
CB-BYU-U TAS-SaU-A oint Researd ponsored by iSP, Caltras	naca		CH/CL		ML	ъ	W	MLCL	M	55	5
DH S SZO	(m) subo inqe 2		17			HHH	ннн	H	4 4 4	=== }	\$\$
	Depth Scale (m)	° 	. T	-13	E	4	<u>د</u>	9			പ

Figure B.39: SPT log: SPT-4-22-ca

Page 1 of 1

HC sb	hts										
to Crealius XC9 az, M.E.T.U. method. AWJ ro cs et al. 1983)	Rema										
3207°E uivalent t . T. Yilmi cathead r er Kovao	(mm) 010			<0.07	0.18	<0.07	<0.07	0.074	0.10	0.10	<0.07
N 29.78 ade, equ n and M ey and c mmer (p	(mm) 02D			2.9	8.8	0.12	2.6	4.1	2.6	3.7	1.9
72194° stom m D. Çeti pe, pull ety Ha	(%) umi 2 >				· ·		,				
mit Cus mit Rop	(%) uni ç >									,	
rdinate levatic uipme ginee Syste her Typ	uni ç7 > tənî %			20	2	40	14	10	6	80	17
S Coo E ing Eq ible Er SPT Hamir	Plasticity Index			ЧN	ďN	ď	đ	dN	ďN	ЧN	ď
GP Drill sspons	nimi.I biupi.I			٩	ď	ď	đ	ďz	ď	٩	đ
Re	Moisture Content (%)										
	Torvane (kPa) Survane										
	Pocket Pen (kPa) 9 <i>u</i>										
igations at Lateral Spread Sites indere S.) -diameter tricone bit	Description	FILL: Materials transition from brown gravelly sand to red sitty clay	SM: Brown silty sand		GW: Gray sandy gravel	SM: Brown silty sand. Decreasing silt content with depth.					
egirme egirme Çetin Jjisi, A.	Energy Ratio (%)			55*	60*	65*	65*	9 65*	9 65*	2 65*	4 65*
e D	(m) rhgas I box			.20	.72	4		23	11.23	12.8	14.3
70 ash Frik		<u> </u>		ŝ	9	8.2	9.7	÷	,		~ '
otechnical ndere Nos 00 Yilmaz, K Zemin Tek tary wash ion: 1.70	Casing Depth (m)			1.70 5	2.70 6	4.20 8.2	5.70 9.7	7.20 11	8.32	9.20	10.20
Name: Geotechnical 11: Degimendere Nos gust 29, 2000 8 by: M. T. Yilmaz, K 12 ZETAS (Zennin Tek Method: Rotary wash Metelevation: 1.70 able Elevation: 1.70	SPT Blows/15 cm Casing Depth (m)			4-4-4 1.70 5	8-9-7 2.70 6	4-4-10 4.20 8.2	10-10-12 5.70 9.7	7-12-9 7.20 11	6-7-8 8.32	6-6-10 9.20	7-8-7 10.20
Project Name: Gootonnical Location: Degimendere Nos Jate: Jugust 29, 2000 Field Log by: M. T. Yilmaz, K Derator: ZETAS (Zemin Tek Dilling Method: Rolary wash Arter Table Elevation: 1.70 Votes:	Depth (m) SPT Blows/15 cm Casing SPT Casing Casing Casing Casing SPT SPT SPT SPT SPT SPT SPT SPT SPT SPT			16/45 4-4-4 1.70 5	14/45 8-9-7 2.70 6	19/45 4-4-10 4.20 8.2	22/45 10-10-12 5.70 9.7	19/45 7-12-9 7.20 11	27/45 6-7-8 8.32	22/45 6-6-10 9.20	19/45 7-8-7 10.20
CLA Instance: Geolegical CLA Instance: Geolegical CLA Location: Degimandore Nos Leart Jay 2010 Date: August 29, 2010 Timaz, K Operator: ZETAS, Canin Tsuk Drilling Method: Rotary wash wash Water Table Elevation: 1,10 Notes:	Sample Type and No. Sering Blows/15 cm Spr Spr Casing Casing Casing Spr Spr Spr Spr Spr Spr Spr Spr Spr Spr			S-DN1-1 16/45 4-4-4 1.70 5	S-DN1-2 14/45 8-9-7 2.70 6	S-DN1-3 19!45 4-4-10 8.2	S-DN1-4 22/45 10-10-12 5.70 9.7	S-DN1-5 19/45 7-12-9 7.20 11	S-DN1-6 27/45 6-7-8 8.32	S-DN1-7 22/45 6-6-10 9.20	S-DN1-8 19/45 7-8-7 10.20
CB-BYU-UCIA Project Name: Gootennical SuburMETU Location: Dogimmedre Nos 7145-8U-METU Location: Dogimmedre Nos Analysis 29, 2000 oint Research Field Log Pin. Ti, 7 Vinnaz, K possored by: Operator, 2ETAS, Canin Tek Pist, Catteras Drilling Method: Rotary wash 250, PG&E Notes: Notes: 1,70 250, PG&E Notes: 1,70	Depth (cm) Casing Sample Type Sample Type Bows/15 cm Recovery/ Recovery/ Bows/15 cm Bows/15 cm Bows/15 cm Bows/15 cm Bows/15 cm Recovery/ Rec			SM S-DN1-1 16/45 4-4-4 1.70 5	GW-GM S-DN1-2 1445 8-9-7 2.70 6	SM S-DN1-3 19/45 4-4-10 4.20 8.2	SM S-DN1-4 22/45 10-10-12 5.70 9.7	SW-SM S-DN1-6 19/45 7-12-9 7.20 11	SP-SM S-DN1-6 27/45 6-7-8 8.32	SW-SM S-DN1-7 22/45 6-6-10 9.20	SM S-DN1-8 19/45 7-8-7 10.20

Figure B.40: SPT log: SPT-DN-1

H0	uks										
o Crealius XCS az, M.Ε.Τ.U. method. AWJ r	Rems										
207°E Livalent t . T. Yilm athead	D10 (mm)		<0.07	<0.07	<0.07	<0.07		0.075	0.13	<0.07	0.074
N 29.78 ade, equ n and M ey and c mmer (p	(mm) 02D		4.5	3.0	4.1	2.6		5.2	2.6	1.3	3.0
T-DN2 72194° stom m D. Çetir De, pull	(%) uni 2 >										
e: Safe	(%) uni 5 >										
Test I rdinate levatio levatio gineel Systel er Typ	uuy č7 > mañ %		12	4	£	13		10	9	17	10
S Cool ng Eq ible Er Kamm	Plasticity Index		ЧN	ЧN	ЧN	ЧN		NP	NP	ЧN	ЧN
GPilli	imi.I biopi.I		ЧN	ЧN	ЧN	ЧN		ЧN	ЧN	ЧN	ď
Re	Moisture Content (%)										
	Torvane (kPa)										
	Pocket Pen (kPa) qu										
igations at Lateral Spread Sites andere S) cS)	Description	SM: Gray to brown silty sand with gravel.									
Invest egirme Getin 19 cm	Energy Ratio (%)		50*	55	55*	60*		65*	9 65*	9 65*	2 65*
al Site ose, D eknolo ish witi 5 m	(m) rhgna I boM		3.67	6.72	6.72	8.24		9.77	11.2	11.2	12.8
lechnic dere N 00 emin 7 emin 7 tary we tary we	Casing Casing		1.20	2.38	3.34	4.20		6.20	7.20	8.20	9.50
lame: Geo gust 30, 20(a by: M. T. : ZETAS (Z Method: Ro ble Elevati	Blows/15 cm SPT		4-4-6	5-6-7	7-7-8	6-8-8		10-13-14	7-12-12	5-14-17	11-13-16
Project N Location Date: Aui Tield Log Dperator Drilling N Vater Ta Votes:	Length (cm) Recovery/		13/45	5/45	15/45	20/45		23/45	22/45	31/45	33/45
UBLC IN	Sample Type .oN bas		S-DN2-1	S-DN2-2	S-DN2-3	S-DN2-4		S-DN2-5	S-DN2-6	S-DN2-7	S-DN2-8
CB-BYU-U TAS-SaU-N oint Research ponsored by iSP, Caltran	SOSO		SM	SM	SP-SM	WS		WS-MS	WS-MS	SM	WS-WS
D H ~ ~ Z O	rgolothil										
	(m) slase (m)	°	· · · · · ·			4	ۍ ۱	9	<u></u>	8 G	9

Legend S: Spit Spoon (SPT) SH: Shelby Tube * Estimated Energy Ratio NP: Nonplastic

Figure B.41: SPT log: SPT-DN-2

to Creatius XC90H az, M.E.T.U. method, ANU rods. cs et al. 1983)	Remarks	
5563°E uivalent t . T. Yilm cathead	(mm) 01G	0.12
N 30.26 ade, equinand M	(uuu) 05Q	4.1
F-SH2 59852°I tom ma tom ma totim ety Har	(%) umi 7 >	
D: SP1 11: 10: 6 11: 10: 6 11: 10: 6 11: 10: 6 11: 10: 6 11: 10: 6 11: 10: 6 11: 10: 6 11: 10: 6 11: 10: 10: 6 11: 10: 10: 10: 10: 10: 10: 10: 10: 10:	(%) uni ç >	
Test I rdinate levatio levatio levatio levatio gineer Syster Syster er Typ	uni ç7 > tənî %	0
S Cool ng Equ ible Er SPT Hamm	Plasticity Index	đ
GP	nimi.I biupi.I	ЧN
Re	Moisture Content (%)	
	u ⁸ Torvane (kPa)	
	Pocket Pen (kPa) 4 <i>u</i>	
pations at Lateral Spread Sites S.) diameter tricone bit	Description	SM: Gray gravely silty sand
a si, A. 3 9 cm-o	Energy Ratio (%)	20
al Site I apanca sknoloj sh with 0 m	(m) rhgna I box	7.32
echnica Hotel, S Detin Pemin Te any wa: any wa:	Casing Depth (m)	3.00
Vame: Geol :: Sapanca gust 24, 200 g by: K. Ö. 4 r: ZETAS (Z Wethod: Rol ible Elevati	Blows/15 cm SPT	8-2-7
Project Location Date: Au Field Lo Dieratol Drilling Vater Ta lotes:	Γευβιμ (cm) Κεςολειλ	24/45
	əqrT əlqməč and No.	S.SH2-1
CB-BYU-U FAS-SaU-A bint Research ponsored by SP, Caltrau BC, PG&F	naca	WS-WS
STEL S S S S	vgolothil	
	Depth Scale (m)	

Legend S: Spit Spoon (SPT) SH: Shelby Tube * Estimated Energy Ratio NP: Nonplastic

Figure B.42: SPT log: SPT-SH2

													~
o Creatius XC90H az, M.E.T.U. nethod, AWJ rods. se et al. 1983)	Remarks				Fine material could be washed out.								Page 1 of 2
563°E Jivalent t T. Yilms athead r er Kovac	(mm) 010		0.42		0.38	<0.07	0.099	0.21	0.39		0.074	0.19	
N 30.26 ade, equ n and M ey and c mmer (p	(uuu) 05CI		6.4		9.5	<0.07	4.3	4.7	3.2		3.0	3.9	
T-SH4 69852° 50. Ceti 5. Ceti 5. Ceti 5. Ceti 6 ty Ha	(%) umi 7 >												
e: Safe	(%) turi ç >												
Test I rdinate levatio ginee Syste	uni ç7 > səniñ %		5		5	73	6	7	4		7	~	
S Coo B E B E B E F Hamm	Plasticity Index		NP		ЧN	ЧN	ЧN	ЧN	ЧN		ЧN	đ	
GP Drilli spons	iimi.I biupi.I		NP		ЧN	٩N	٩N	ЧN	ЧN		ЧN	Å	
Š	Moisture Content (%)												
	u ⁸ Torvane (kPa)												
	Pocket Pen (kPa) 4 <i>u</i>												
gations at Lateral Spread Sites S.) diameter tricone bit	Description	GW: Fine gravels with medium to coarse sand				ML: Gray sandy silt	SILTY SAND: Gray gravelly						
Investi a jisi, A. 19 cm-	Energy Ratio (%)		55*	56	59	55	_	56	64	64	64	2	Option
al Site Sapanc eknolo ish wit	(m) rigna Leof		4.27	5.80	5.80	7.32		8.84	8.84	10.37	11.80	13.42	10000
technic Hotel, S O Cetin Cemin T tary wa	Casing Depth (m)		0.95	1.80	2.60	3.60		4.50	5.40	6.40	9.32	9.20	E Poto
Vame: Geo sust 22, 200 g by: K. Ö. r: ZETAS (Z Method: Ro sble Elevati	Blows/15 cm SPT		4-2-1	2-2-3	5-5-5	6-8-6		4-4-6	2-3-4	3-4-5	5-5-6	5-5-6	ho • Entim
roject / ocatior ate: Au ield Lo; perato rilling l /ater Ta otes:	I cength (cm) Recovery/		18/45	0/45	10/45	23/45		20/45	23/45	0/45	13/45	13/45	T villo
	Sample Type and No.		S-SH4-1	S-SH4-2	S-SH4-3	S-SH4-4		S-SH4-5	S-SH4-6	S-SH4-7	S-SH4-8	S-SH4-9	40 CH CH
JCB-BYU-U 3TAS-SaU-N Joint Researd Sponsored by: NSP, Caltrat CBC, PG&E	Decen		Mg CM		GW-GM	W III	WS-MS	WS-MS	NS LL		WS-WS	WS-MS	jend
	Depth Scale (m)		0·0 -) * :€ ∾i	<u>00</u>		睛	FFF	FFFFF	FFFFFF	FFFFFFFF		j i
				i				- L L			, , , , , , , , , , , , , , , , , , ,	<u>.</u>	

Figure B.43: SPT log: SPT-SH4

o Creatius XC90H az, M.E.T.U. method, AWJ rods. 5s et al. 1983)	Remarks	
5563°E uivalent t . T. Yilmu cathead r	(mm) 010	0.19
N 30.26 ade, equ and M ey and c	(uuu) 05Q	4.5
T-SH4 69852° stom m 5. Çetir be, pull	(%) umi 7 >	
D: SP D: SP D: SP D: SP D: SP D: SP D: Safe	(%) turi ç >	
Test redinate llevatic uipme nginee Syste rer Typ	uuu 27 > eanit %	7
S Coo E E ling Eq sible E SPT Hamn	Plasticity Index	ď
GF Drill espons	nimi.I biupi.I	٩
Č.	Moisture Content (%)	
	⁵ u ⁸ Torvane (kPa)	
	Pocket Pen (kPa) 9 U	
ations at Lateral Spread Sites () iameter tricone bit	Description	
si, A. S	Energy Ratio (%)	99
apance sknoloji th with 0 m	(m) rhgaal box	14.94
echnica Hotel, S Çetin smin Te any was an: 0.5/	Casing Depth (m)	11.00
lame: Geot Sapanca I- just 22, 200 just 22, 200 just 22, 200 just 22, 200 just 22, 200 just 22, 200 just 20,	Blows/15 cm SPT	6-6-14
Project N Date: Aug Jate: Aug Jerator Dierator Drilling N Vater Ta Aotes:	Γευβην (cm) Κεςονειλ	18/45
	Sample Type and No.	S-SH4-10
B-BYU-L (AS-SaU-J int Researc consored by SF, Caltra EC, PG&I	SOSO	WS-WS
	vgolorhi.I	EEE EEE
	Depth Scale (m)	:

Figure B.43(cont.): SPT log: SPT-SH4

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														3
o Creatius XC90H iz, M.E.T.U. nethod. ANJ rods. s et al. 1983)	Remarks													Page 1 of
563°E Jivalent te T. Yilma athead n er Kovac	D10 (mm)		<0.07	1.7	0.23	0.33	0.20		<0.07	<0.07	<0.07	0.29	0.12	
N 30.26 ade, equ n and M. ey and c mmer (p	(uuu) 05CI		5.0	8.4	3.0	3.9	4.5		1.5	1.6	2.0	3.1	2.0	
r-SH7 59852° 59852° 59852° 508 59852°	(%) uni _{Z >}													
D: SP1 a: 40.6 a: K. Cus a: K. Cus	(%) uni ç >													
Test I dinate evatio evatio ipmer gineer Syster Syster er Typ	uni 57 > esañ %		14	-	5	4	9		13	7	12	9	5	
S Coor El ng Equ ble En SPT Hamm	Plasticity Index		dN	dN	ЧN	ďz	dN		ďz	ЧN	dN	ď	Å	
GP	imi.I biopi.I		NP	ЧN	ЧN	ЧN	ЧN		ЧN	NP	NP	ЧN	dN	
Re.	Moisture Content (%)													
	Torvane (kPa)													
	Pocket Pen (kPa) 9 u													
gations at Lateral Spread Sites S.) diameter tricone bit	Description	GW: Gray sandy gravel		0.00 O	ow: Gray gravely slify sand									
Investi a jisi, A.	Energy Ratio (%)		60		60	63	99	65	60	68	65	63	63	
al Site Sapanc eknolo sh with	(m) digan Leagth (m)		4.27	4.27	5.80	7.32	7.32	8.84	10.37	11.89	11.89	13.42	13.42	
echnic Hotel, S Petin Pemin T ary wa ary wa	Casing Depth (m)		0.90	1.30	2.60	3.40	4.20	5.00	5.90	6.80	7.80	9.00	10.30	
lame: Geot Sapanca I gust 21, 200 a by: K. Ö. (r: ZETAS (Z Method: Roi ble Elevati	Blows/15 cm SPT		9-7-4	4-2-1	4-3-2	3-4-4	3-5-4	3-4-5	6-1-7	4-6-11	9-7-6	7-6-6	1-4-6	
roject I ocation late: Au ield Loy perator rilling I (ater Ta otes:	Length (cm) Recovery/		23/45	14/45	10/45	22/45	21/45	0/45	14/45	13/45	22/45	18/45	20/45	
	Sample Type and No.		S-SH7-1	S-SH7-2	S-SH7-3	S-SH7-4	S-SH7-5	S-SH7-6	S-SH7-7	S-SH7-8	6-7HS-S	S-SH7-10	S-SH7-11	
ICB-BYU-U ICB-BYU-M Joint Research Sponsored by: VSF, Caltran CEC, PG&E	naca		GM	ß	SW	sw	SW		WS	WS-WS	WS-WS	WS-MS	WS-MS	end
	(m) superinque.	. 0	. 0.	0									<u></u>	Leg
	(m) sless drosQ	0		-7		4		ю — — — —	9	<u></u>	, °°, , ,	<u>6</u>		

Figure B.44: SPT log: SPT-SH7

o Crealius XC90H az, M.E.T.U. method, AWJ rods. :s et al. 1983)	Remarks		
563°E Jivalent t . T. Yilms cathead r er Kovac	D10 (mm)	0.24	<0.07
N 30.26 ade, equ n and M ey and c mmer (p	(uuu) 05CI	0.84	0.84
-SH7 9852° 9852° form m tom m o. Cetir e, pull	(%) uni 2 >		
D: SP1 a: 40.6 b: K. Cus b: K. Cus b: Safe	(%) umi ç >		
Test II dinate levation lipmen gineer Systen er Type	uni 57 > eani %	<u>م</u>	4
S Coor ng Equ ible En SPT Hamm	Plasticity Index	ď	ď
GPG	iimi.I biupi.I	đ	ЧN
Re	Moisture Content (%)		
	Usrvane (kPa)		
	Pocket Pen (kPa) q _u		
pations at Lateral Spread Sites \$) Jameter tricone bit	Description		
nvestig si, A. 5 9 cm-c	Energy Ratio (%)	61	65
apanca sknoloj sh with 5 m	(m) rhgas I box	14.94	16.46
schnica lotel, S četin smin Te ary was n: 1.2	Depth (m) Casing	11.80	13.50
Vame: Geote Bust 21, 200 gust 21, 200 g by: K. Ö. Ç r: ZETAS (Ze Method: Roti bible Elevatic	Blows/15 cm SPT	2-5-6	3-8-5
oject I catior fte: Au sld Lo erator illing I tter Ta ttes:	Γευδην (cm) Κεςολειλ	22/45	1/45
L J G E G Z Z	our base and No.	H7-12	H7-13
3-BYU-UCLA MS-SaU-MET 14 Research insored by: P, Caltrans C, PG&E	SOSU	WS-dS	S-S MS
Spo Spo CB	7golorhi.I		
	Depth Scale (m)	12	-13

Legend S: Spit Spoon (SPT) SH: Shelby Tube * Estimated Energy Ratio NP: Nonplastic

Figure B.44(cont.): SPT log: SPT-SH7

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HOE spo	arks											
to Crealius XC9 taz, M.E.T.U. method. AWJ r cs et al. 1983)	Rem											
5563°E uivalent . T. Yilm cathead er Kova	(mm) 01C		<0.07	0.12	<0.07 0.07		<0.07	0.11	<0.07	0.21	<0.07	
1 N 30.26 lade, eq n and M ley and (mmer (p	(uuu) 05CI		1.9	5.8	<0.07 1.8		1.9	3.0	1.1	2.4	0.42	
59852° 69852° 69852° 5. Çeti pe, pull	(%) uni 7 >								Ŷ			
mat: Cui Bi SP Cui Bi Rol Saf	(%) uni ç >											
Test rdinatu levatic levatic ginee Syste er Typ	$\mathfrak{curl} \subseteq_L > \mathfrak{soug} \ \%$		14	6	66 10		7	8	12	7	21	
S Coo Ing Eq ible Er SPT Hamir	Plasticity Index		ЧN	ЧZ	d d		dN	ЧN	ЧN	ЧN	ЧN	
GP Drill spons	imi.I biupi.I		ЧN	ЧN	дЧ		ЧN	ЧN	ЧN	ЧN	dN	
Re	Moisture Content (%)											
	u ^s Torvane (kPa)											
	Pocket Pen (kPa) 9 u											
gations at Lateral Spread Sites S.) diameter tricone bit	Description	SM: Dark gray gravelly silty sand										
Investi a jisi, A. 19 cm-	Energy Ratio (%)		60	64	65	53	56		57	62	63	60
al Site Sapan Sapan (eknolo ash with 20 m	(m) rigna l box		4.27	5.80	7.32	7.32	8.84	10.3	11.8%	11.85	13.42	13.42
technik Hotel, D0 Cetin Cetin Lany wa tary wa	Casing (m) diqa		1.50	2.62	3.50	4.40	5.40	6.40	7.40	8.40	9.40	10.61
Vame: Geo u: Sapanca gust 23, 201 g by: K. Ö. r: ZETAS (Z Method: Ro ible Elevati	Blows/15 cm SPT		6-6-3	9-7-4	2-3-4	1-1-1	5-6-7	6-6-7	2-5-8	2-2-4	10-5-6	6-9-10
Project Cocation Date: Au Sield Lo Dierato Drilling Vater Ta Iotes:	Γευβην (cm) Κεςολειλ		20/45	13/45	30/45	0/45	25/45	26/45	19/45	24/45	12/45	0/45
	Sample Type and No.		S-SH11-1	S-SH11-2	S-SH11-3	S-SH11-4	S-SH11-5	S-SH11-6	S-SH11-7	S-SH11-8	S-SH11-9	S-SH11- 10
CB-BYU-U STAS-SaU-M Joint Research Sponsored by: NSP, Caltrar CEC, PG&E	nace		WS	GW-GM	ML SW-SM		WS-WS	WS-WS	WS	WS-MS	WS	
	vsolothil											
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Figure B.45: SPT log: SPT-SH11

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r Creatius XC90H z, M.E.T.U. tethod, ANJ rods. s et al. 1983)	Remarks								
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gations at Lateral opreau ories / [zmit Bay S.) diameter tricone bit	Description	FILL: Brown silty clay.	FILL: Brown gravelly silty sand.	SM: Gray silty sand.	CL: Gray clay.		SM: Gray silty sand. CL: Gray clay.		
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2000 0. 0. 2000 Vati			,			47			
Police Just 26, by: K. I by: K. I ethod: ble Elev	Blows/15 cm SPT		8-20->30	3-1-2			4-3-3		
object trainer - control - Police atte: August 26, eld Log by: K. eld Log by: K. illing Method: atter Table Ele. totes:	Blows/12 cm 2bL I sugh (cm) Recovery/		14/45 8-20->30	0/45	45/50	45/50	40/45 4-3-3	42/50	45/50
ETU Location: Police ETU Date: August 26, Field Log by: K Operator: ZETA Operator: Zeta Notes: Notes: Notes:	Stample Type SPT الدموطر (cm) الدموطر (cm) الدموطر (cm)		S-PS3-1 14/45 8-20->30	S-PS3-2 0/45 3-1-2	SH-PS3-3 45/50	SH-PS3-4 45/50	S-PS3-5 40/45 4-3-3	SH-PS3-6 42/50	SH-PS3-7 45/50
CB-BYU-UCLA roylect varues: CB-BYU-UCLA roylect varues: 26, rAS-SuU-METU Date: August 26, oint Research Field Log by: K, pensored by: Operatod ST, Cateran Drilling Method: SC, PG&E Notes: Notes: Table Ele	Bows/12 cm SPT SPT Sample Type Sample Type USCS USCS USCS		SM S-PS3-1 14/45 8-20->30	SM S-PS3-2 0/45 3-1-2	CL SH-PS3-3 45/50	CL SH-PS34 45150	SM S-PS3-5 40.45 4-3-3	SH-PS3-6 42/50	SH-PS3-7 45/50

Figure B.46: SPT log: SPT-PS3

CICE-BYU-LICLA Interesting EETAAS-BUC-METU Secretion: Police Station, ensitin edge of Izmit Bay EETAAS-BUC-METU Juin: Nearch Separated Sites Test ID: SPT-PS3 ZETAAS-BUC-METU Secretion: Police Station, ensitin edge of Izmit Bay Separated Sites Zertaas Suc-METU Separated Sites Test ID: SPT-PS3 Juin: Nearch Separated Sites Date: Nupuer Sites Separated Sites Conditions: 41, 21, 20, 73733°E Juin: Nearch Separated Sites Date: Nupuer Sites Conditions: 41, 21, 20, 73733°E End Log by: K. O. Celin Separated Sites Separated Sites Date: Notation Site Sites Notating Equipment: Custom made, equivalent to Crealius XC30H Nample Tippe Date: Notation: 14, 0 mit Separated, equivalent to Crealius XC30H Nample Tippe Nample Tippe Separated, equivalent to Crealius XC30H Nample Tippe Nample Tippe Nample Tippe Nample Tippe Nample Tippe Nample Tippe Nater Table Elevation: 14.0 mt Tabuto (PR) Nater Table Elevation: 14.0 mt Nater Table Elevation: 14.0 mt Tabuto (PR) Nater Table Elevation: 14.0 mt Nater Table Elevation: 14.0 mt Tabuto (PR) Nater Table Elevation: 14.0 mt Nater Table Elevation: 14.0 mt Nater Table Elevation: 14.0 mt Nater Table Elevation: 14.0 mt Nater Table Elevation: 14.0 mt Nater Table Elevation: 14.0 mt Nater Table Elevation: 14.0 mt Nater Table Elev			
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, contraction and the second s		Tithology	

Legend S: Spit Spoon (SPT) SH: Shelby Tube * Estimated Energy Ratio NP: Nonplastic

Figure B.46(cont.): SPT log: SPT-PS3

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Page 2 of 2

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to Crealius XC9(az, M.E.T.U. method. AWJ ro cs et al. 1983)	Rema												
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gations at Lateral Spread Sites / izmit Bay S.) diameter tricone bit	Description	FILL: Brown silty clay.	FILL: Brown sandy silty gravel.	ML: Gray clayey silt.		CL: Gray sifty clay.					SM: Gray silty sand with shell fragments	CL: Gray silty clay	
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B-BYU-U AS-SaU-A int Research onsored by P. Caltra.	SOSO		GP-GM		ML		ы	CL			SM		с
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Figure B.47: SPT log: SPT-PS4

to Creatius XC90H naz, M.E.T.U. method. AWJ rods. sos et al. 1983)	Remarks							Laboratory test results will be available after testing "UD" samples.		
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GP Drilli spons	imi.I biupi.I		dv		ЧN	25	58		56	55
ß	Moisture Content (%)					22	60		58	69
	Torvane (kPa)									
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gations at Lateral Spread Sites y, next to the Navy Base S.) diameter tricone bit	Description	FILL: Brown silty clay.	SM: Gray silty sand.		ML: Gray clayey silt.	CL: Gray silty clay				
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al Site stern I: eknolo ash witt 90 m	(m) rigna Leofi		5.20		5.20		8.24		11.2%	
technik leld. Ea 00 Çetin Zemin T tary wa tary wa	Casing Depth (m)		1.70		2.66	3.70	4.70	5.70	6.70	8.26
Vame: Gec s: Soccer Fi gust 27, 20 g by: K. Ö. r: ZETAS (2 Method: Ro ible Elevati	Blows/15 cm SPT		3-5-E		1-1-2		0-0-1		0-0-1	
Project I Location Date: Au Field Loy Derator Drilling I Nater Ta Votes:	Γευβήν (cm) Κεςολειλ		23/45		17/45	45/50	33/45	40/50	41/45	42/50
	Sample Type and No.		S-SF5-1		S-SF5-2	SH-SF5-3	S-SF5-4	SH-SF5-5	S-SF5-6	SH-SF5-7
CB-BYU-U (TAS-SaU-A loint Researd by Researd by VSP, Caltra	naca		S.		ML	E	E		E.	E
PN ~ %ZU	Lithology					///	////			$\left \right \right $
	(a) deep draw[]	<u> </u>		N	.°	4		9		

Figure B.48: SPT log: SPT-SF5

120

A3 to Crealius XC90H o. U. C. Berkeley method. AWJ rods. cs et al. 1983)	Remarks											
487°E to CPT- uivalent t B. Sancio athead i er Kovad	(mm) 010				<2µm		0.003		<2µm	0.002		0.12
N 30.39 respect ade, equ and R. f sy and c nmer (p	(uuu) 05 U				0.0035		0.045		0.012	0.057		0.29
F-A1 77922°I m with tom ma tom ma tom ma tom ma fay or bulk	(%) uuri 7 >				36		>10%		18	10		
D: SP 35: 40.7 30: -0 c 30: -0 c 31: -0	(%) turi ç >				61		16		31	15		
Test I rdinate llevatio uipmei gginee Systei ner Typ	uni ç7 > tənî %		06	94	100	87	74	92	97	70	58	5
S Coo E ing Eq ible Er SPT Hamm	Plasticity Index		13	23	35	23	9	28	20			
GP Drill sspons	imi.I biupi.I		41	53	65	46	29	55	47	30	29	
ž	Moisture Content (%)		38	39	39	37	29	44	39	27	27	24
	^{u s} Torvane (kPa)			28	50	22	23	25	26			
key /28/00	Pocket Pen (kPa) 9 <i>u</i>				140	80	20	80	75	450	275	300
ing Performance in Adapazari, Tu Cumhuriyet District, Adapazari S.) S.) Calmoler tricone bit 22400, 0.77m 06/26/00, 0.77m 06	Description	ASPH: Boring performed through asphalt and subgrade of Tul street	FILL: Materials transition from a brown to gray gravelly sand to red silty clay of hard	CH: Rrown moist sticky high	Cr. brown, most, sucy, ingr plasticity sith day without visible sand particles. S-A14 shows darker tones and some fine to medium sand content		ML: Gray silt with sand. Field description: ML	ML: Brown, low plasticity silt with fine sand and some red clay points	CH: High plasticity gray clay with low sand content (traces). At 6.3 m a thin fine sand seam was identified. Sample A1-7 exhibits some sand seams	ML: Gray sandy silt. Increasing sand content with depth		SP: Medium to fine poorly graded gray sand
d Build bireets, A. jisi, A. 00m 06	Energy Ratio (%)		37	46	42	57	53	55	50	65	75	64
Yakin S Yakin S ancio eknolo ish with ML=0.9	(m) rugası boğ		4.27	5.80	5.80	7.32	7.32	8.84	8.84	10.37	11.89	11.89
Ind Fai, Ind and fo B. S. emin T tary wa on: GV	Casing Depth (m)											
Vame: Grou Name: Grou ne 23, 2000 g by: Rodoll r: ZETAS (Z Method: Rol nble Elevati, solid flight au	Blows/15 cm SPT		1-3-3	3-2-5	2-3-4	1-2-2	2-2-2	1-2-1	1-1-2	6-6-9	6-9-10	11-20-23
Project I Location Date: Jui Date: Jui Dilling I Nater Ta Votes: S	Γευβιμ (cm) Κετονειλ		18/45	40/45	31/45	36/45	40/45	45/45	39/45	37/45	41/45	41/45
	эдүТ эlqms2 .oN bas		S-A1-1	S-A1-2	S-A1-3	S-A1-4	S-A1-5	S-A1-6	S-A1-7	S-A1-8	S-A1-9	S-A1-10
CB-BYU-U TAS-SaU-N oint Research ponsored by PG&F EC, PG&F	sosn		Å.	MH/CH	ъ	С	MLML-	ъ	CL/ML	ML	ML	ß
DEX SO	vgolorhi.I]}}	\$	<i>{}}</i> ,	} }		}})	/ } }			
	Depth Scale (m)	0	5	2	e		4	6	9	-	80	6

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.49: SPT log: SPT-A1-YS

-A3 to Creatius XC90H io, U. C. Berkeley method, AWJ rods. tos et al. 1983)	Remarks									At approximately 7.15 m, an 8-cm thick stratum of	back, indrous material (Peat) was identified in the sample	
487°E to CPT uivalent B. Sanc cathead er Kova	(mm) 01D				<2µm		0.001		<2µm	0.001	0.08	0.1
v 30.39 respect ade, equ and R. E and R. E	(mm) 02D				0.001		0.018		0.007	0.026	0.12	0.33
T-A2 77922°t m with stom ma stom ma b. Bray be pulk ety Han	(%) uuri 7 >				22		12		30	13		
D: SP 35: 40.7 30: -5 c 30: -5 c 31: -5	(%) turi ç >				75		18		42	20		
Test I rdinate llevatio uipmei gginee Systei ner Typ	uni ç7 > tənî %		74	86	100	85	93	96	66	85	8	9
S Coo E ing Eq sible Er SPT Hamir	Plasticity Index		8	8	23	25	7	20	22	11		
GP. Drilli esponsi	imi.I biupi.I		31	35	51	49	35	43	51	39		
ž	Moisture Content (%)		37	36	4	37	형	44	43	33	ŝ	8
8	Torvane (kPa)		10	18	48	53	35	31	37	36		
rkey 06/28/(Pocket Pen (kPa)		150	75		120	160		75	170	380	320
ing Performance in Adapazari. Tu Cumhuriyet Districi, Adapazari S.) S.) diameter tricone bit é(2400, 0.79m 06/26/00, 0.85m nepth of fm	Description	ASPH: Asphalt of Yakin Street.	Fill	ML: Brown clayey silt to silty clay with some red oxidation points and some fine sand	CH: Brown high plasticity silty clay to clayey silt. Some fine to modium could in a clay chart	to measure sare in a siny clay matrix was observed in the wash water	ML: Brown/gray clayey silt with traces of fine sand	CH: Gray silty clay of medium to high plasticity. Sticky to the	fingers. Softens when remoulded	ML: Gray clayey silt with some fine sand	SP-SM: Poorly graded gray fine sand with silt. Gravel content ~ 8% in sample S-A2- 10	
treets, lisi, A. 9 cm- 1 to a d	Energy Ratio (%)		37	53	· .	52	65		65	60	61	
Yakin S Yakin S ancio eknoloj ish with MT = 0.	(m) rugas I boxI		4.27	5.80		7.32	7.32		8.84	10.37	11.89	12.82
Ind Fail In and Co fo B. Se emin T. emin T. tary wa on: GV	Casing Depth (m)				2.55	3.35	4.15	4.95	5.95	6.95	8.45	9.95
Hame: Grou Hame: Site A - Tr ne 24, 2000 J by: Rodolf J by: Rodolf r: ZETAS (Z Method: Rol ible Elevati iolid flight au	Blows/15 cm SPT		1-2-1	1-2-2		2-1-1	2-3-4		1-1-2	3-5-5	12-20-16	7-10-15
Project Project Project Project Project Put Date: Jur Field Loy Operator Orilling A Nater Ta Notes: S	Γευβήν (cm) Κεςονειλ		28/45	42/45	42/42	40/45	28/45	42/42	39/45	32/45	38/45	38/45
	эдүТ эlqms2 .oN bas		S-A2-1	S-A2-2	SH-A2-3	S-A2-4	S-A2-5	SH-A2-6	S-A2-7	S-A2-8	S-A2-9	S-A2-10
CB-BYU-U FAS-SaU-N jint Research ponsored by SF, Caltrat EC, PG&E	naca		ML/CL	ML	CH/MH	слсн	M	CL	MH/CH	WL	SP-SM	WS-dS
D ENZ S S S S S S S S S S S S S S S S S S S	vgolothil				}}	}},	72	}}	}}}			
	Depth Scale (m)	0			<u></u>		4	ŝ	9	<u></u>	8 G	9

Legend S: Spit Spoon (SPT) SH: Shelby tube

Figure B.50: SPT log: SPT-A2-YS

79⁰E ralent to Crealiu ∵ Yilmaz, M.E.T thead method. / Kovacs et al. 1	(mm) 01D		0.07	0.07	.074	.070	0.07	0.07	un tr	1µm	mr 1
30.268 de, equiv and M. T / and cai mer (per	(uuu) 05CI		.20 <	0.30	0.25	0.23	0.18	0.10	0.074	0.026	0.028
-7H3 5971°N tom mac Cetin : e, pulley ity Ham	(%) umi 7 >						,		16 (18	17 (0
e: Safe	(%) uni ç >				,				18	25	24
I est I rdinate levatio uipmer gineer Syster er Typ	uni č7 > sanit %		16	9	10	ŧ	17	33	56	6	8
S Coo E ing Eq ible Er SPT Hamm	Plasticity Index		ЧN	gg	ďz	ЧZ	ďN	ď	19	17	18
GP Drill espons	timi.I biopi.I		ЧN	дд	ЧN	В	ЧN	В	31	35	36
Re	Moisture Content (%)									31	33
	u ⁸ Torvane (kPa)										
	Pocket Pen (kPa) 9u										
ations at Lateral Spread Sites .) iameter tricone bit											
igations at Lateral Spread S.) diameter tricone bit	Description	SM: Gray silly sand.							CL: Gray silty clay.		
invesugations at Lateral Spread Çetin jist, A. S.) n 9 cm-diameter tricone bit	Energy Rutio (%) Decchiptio	SM: Gray silly sand.	55*	60	65*	65*	65"	9 65*	2 65* CL: Gray silty clay.		
al still investigations at Lateral Spread falova . K.O. Çetin eknobijst, A.S.) tsh with 9 cm-diameter tricone bit 8 m	ويوني Bod Lengh (m) Energy Ratio (%)	SM: Gray silly sand.	5.20 55*	6.72 60*	8.24 65*	9.77 65*	9.77 65*	11.29 65*	12.82 65* CL: Gray silty clay.		
iechnical stile investigations at Lateral Spread arbor, Valova 7 Yimaz, K. O. Çetin Zenimi Teknolojisi, A. S.) kary wash with 9 cm-diameter tricone bit ion: 0.8 m	Cuing Deph (m) Kod Length (m) Deph (m)	SM: Gray silty sand.	2.43 5.20 55*	3.20 6.72 60*	4.20 8.24 65*	5.20 9.77 65*	6.20 9.77 65*	7.20 11.29 65*	8.20 12.82 65* CL: Gray sitty clay.	9.10	10.40
tame: Sociechnical Site Investigations at Lateral Spread ar: Yalova Harbor, Yalova gust 3, 2000 pby: M. T. Aimaz, K. O. Çetin r. 2ETXS (Zemin Teknolojisi, A. S.) Wethod: Rotary wash with 9 cm-diameter tricone bit bible Elevation: 0.8 m	دولت المحمد المحم المحمد المحم المحمد المحم المحمد	SM: Gray silly sand.	2.3-5 2.43 5.20 55*	5-6-6 3.20 6.72 60*	3.4.4 4.20 8.24 65*	3-5-6 5.20 9.77 65*	5-6-7 6.20 9.77 65*	3-5-6 7.20 11.29 65*	3.2-3 8.20 12.82 65 ⁺ CL: Gray silty clay.	9.10	10.40
Project Name: Geodechnical Stel investigations at Lateral Spread coatien: Yalova Harbor, Yalova Jate: August 3, 2000 iaid Log by: M. T. Yimaz, K. O. Çelin jead Log by: M. T. Yimaz, K. O. Çelin Jateling Method: Rotary wash with 9 cm-diameter tricone bit Vater Table Elevation: 0.8 m	الحمون الحمون المراجع المراجع المحمون الحمون الحمون المراجع	SM: Gray silly sand.	34/45 2.3-5 2.43 5.20 55*	30/45 5-6-6 3.20 6.72 60*	31/45 3-4-4 4.20 8.24 65*	35/45 3-5-6 5.20 9.77 65*	38/45 5-6-7 6.20 9.77 65*	38/45 3-5-6 7.20 11.29 65*	43/45 3-2-3 8.20 12.82 65 [•] CL: Gray silty clay.	9.10	40/50
Cardion: Yalivora Hando: Seoloscimical Sile investigations at Lateral Spread Leation: Yalivora Hando: Yalivora ETU Date: August 3, 2000 Teial Log By: M. T. Yimaz, K. O. Çetin Teial Log By: M. T. Yimaz, K. O. Çetin Derator: ZETNS (Zemin Teknolojisi, A. S.) Derator: ZETNS (Zemin Teknolojisi, A. S.) Derator: Date: August wash with 9 cm-diameter tricone bit Water Table Elevation: 0.8 m Notes:	Sample Type Barnple Type Brows/15 cm Scovery/ Brows/15 cm Brows/15 cm Scot Length (m) Scot Len	SM: Gray silty sand.	S-YH3-1 3445 2-3-5 2-43 5.20 55	S-YH3-2 30/45 5-6-6 3.20 6.72 60°	S-YH3-3 31/45 3-4-4 4.20 8.24 65	S-YH3-4 35/45 3-5-6 5.20 9.77 65*	S-YH3-5 38/45 5-6-7 6.20 9.77 65*	S-YH3-6 38/45 3-5-6 7.20 11.29 65*	S-YH3-7 43/45 3.2.3 8.20 12.82 65 CL: Gray sity clay.	SH-YH3-8 40/50 9.10	SH-YH3-8 40/50 10.40
2B-BYU-UCLA Project Name: Genetic micel stel investigations at Lateral Spread X5-SUUMETU Date: August 3, 2000 IAS-SUUMETU Date: August 3, 2000 init Reserch Field Log By: M. 1. 7 Miraz, K. O. Çein peators List Trimaz, K. O. Çein peators List Date: August 3, 2000 preserch Field Log By: M. 1. 7 Miraz, K. S. peators List Derturb: Titles (K. C. Çein Project Dinling Method: Rolary wash with 9 cm-diameter tricone bit BC, Pock Notes: Motes: Notes:	Used to the second seco	SM: Gray silty sand.	SM S-YH3-1 34/45 2-3-5 2-43 5-20 55*	SM SP-SM S-YH3-2 30/45 5-6-6 3.20 6.72 60*	SP-SM S-YH3-3 31/45 3-4-4 4-20 8.24 65*	SM S-YH3-4 35/45 3.5-6 5.20 9.77 65*	SM S-YH3-5 38/45 5-6-7 6.20 9.77 65*	SM S-YH3-6 38/45 3-5-6 7.20 11.29 65*	CL S-YH3.7 43/45 3.2.3 8.20 12.82 65 ⁻ CL: Gray silly clay.	CL SH-YH3-8 40/50 9.10	CL SH-YH3-8 40/50 10.40

Figure B.51: SPT log: SPT-YH3

to Crealius XC90H az, M.E.T.U. method, AWJ rods. cs et al. 1983)	Remarks		Not enough sample to perform Attenberg limit test						
879°E Jivalent T. Yilm athead er Kova	(mm) 01G	<0.07	0.12 <0.07 <0.07	0.087	0.074	<0.07	<1µm <0.07	<1µm	und is
N 30.26 ade, equ and M. sy and c nmer (p	(uuu) 05 U	7.9	0.33 0.20 <0.07	0.29 <0.07	0.22	0.17 0.24	0.074	0.017	0.0.0
T-YH1 65971° 50m m 50. Çetir pet, pull	(%) uni 7 >						- 15	28	9
D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D : SP D	(%) turi ç >						- 19	36	ŧ
Test ID: PS Coordinates: Elevation: ling Equipment: sible Engineers: SPT System: Hammer Type:	uni ç7 > əaaî %	7	7 12 84	9 74	11	5 23	59 29	14	2
	Plasticity Index	đ		ЧN	ad	d N N	20 NP	21	ŧ,
GP Drilli spons	imil biopil	đ	24 NN	ЧN	ANN	N N N	30 NP	41	2
Re	Moisture Content (%)								
	^{u s} Torvane (kPa)								
	Pocket Pen (kPa) 9 <i>u</i>								
gations at Lateral Spread Sites S.) diameter tricone bit	Description	SM: Gray silty sand.	ML: Gray sandy silt.	SM: Gray silty sand.			CL: Gray silty clay, with sandy silt traces. SM: Gray silty sand.	CL: Gray sitty clay, with sandy silt traces.	
Petin Setin 9 cm-	Energy Ratio (%)	50*	55*	60*	65*	65*	65*	65*	
al Site alova K. Ö. eknolo sh with 5 m	(m) rugas I boxI	3.67	5.20	6.72	8.24	9.77	11.29	12.82	
echnic echnic 00 Yilmaz, emin T iary wa iary wa	Depth (m) Depth (m)	1.20	2.70	3.70	5.20	6.20	7.70	8.70	9.00
lame: Geo :: Yalova Ha gust 01, 20(j by : M. T. :: ZETAS (Z Method: Rol ble Elevati	Blows/15 cm SPT	10-20-25	2-0-4	5-4-6	3-3-4	3-5-5	2-2-2	1-1-2	
roject N ocation Jate: Aug ield Log perator brilling M Vater Ta lotes:	Γευβήν (cm) Κεcovery/	21/45	37/45	37/45	36/45	40/45	42/45	36/45 43/50	43/30
	Sample Type and No.	S-YH1-1	S-YH1-2	S-YH1-3	S-YH1-4	S-YH1-5	S-YH1-6	S-YH1-7 SH-VH1-8	0-1 11-110
CB-BYU-U TAS-SaU-A oint Researd sponsored by ISP, Caltra	sosn	SP-SM	SP-SM ML ML	SP-SM	SP-SM SP-SM	MS	SM	5 5	ł
PN ~ %ZU	(m) surse inque		•••••					////	\overline{D}
	(m) den dirent	1 1 1 0		4			[®]	6	Ĩ

Legend S: Spit Spoon (SPT) SH: Shelby Tube * Estimated Energy Ratio NP: Nonplastic

Page 1 of 1

Figure B.52: SPT log: SPT-YH1

APPENDIX C

CPT PROFILES

In Appendix C, CTP profiles of tests tabulated in Appendix A are presented.



Figure C.1: CPT Profile: CPT-A3



Figure C.2: CPT Profile: CPT-A1



Figure C.3: CPT Profile: CPT-B1



Figure C.3(cont.): CPT Profile: CPT-B1



Figure C.4: CPT Profile: CPT-B3


Figure C.5: CPT Profile: CPT-C3



Figure C.6: CPT Profile: CPT-C2



Figure C.7: CPT Profile: CPT-C1



Figure C.8: CPT Profile: CPT-C4



Figure C.9: CPT Profile: CPT-D1



Figure C.9(cont.): CPT Profile: CPT-D1



Figure C.10: CPT Profile: CPT-D2



Figure C.11: CPT Profile: CPT-D3



Figure C.12: CPT Profile: CPT-E1



Figure C.12(cont.): CPT Profile: CPT-E1



Figure C.13: CPT Profile: CPT-F1



Figure C.14: CPT Profile: CPT-G1



Figure C.15: CPT Profile: CPT-G3



Figure C.16: CPT Profile: CPT-H2



Figure C.17: CPT Profile: CPT-I2



Figure C.18: CPT Profile: CPT-J2



Figure C.19: CPT Profile: CPT-J4



Figure C.20: CPT Profile: CPT-K2



Figure C.21: CPT Profile: CPT-L1



Figure C.22: CPT Profile: CPT-1-11



Figure C.23: CPT Profile: CPT-1-42



Figure C.24: CPT Profile: CPT-1-41



Figure C.25: CPT Profile: CPT-1-32



Figure C.26: CPT Profile: CPT-1-16



Figure C.27: CPT Profile: CPT-1-24



Figure C.28: CPT Profile: CPT-2-10



Figure C.29: CPT Profile: CPT-2-3



Figure C.30: CPT Profile: CPT-3-3



Figure C.31: CPT Profile: CPT-3-6



Figure C.32: CPT Profile: CPT-4-13



Figure C.33: CPT Profile: CPT-4-3



Figure C.34: CPT Profile: CPT-4-22



Figure C.35: CPT Profile: CPT-1-24-cc



Figure C.36: CPT Profile: CPT-4-22-ca



Figure C.37: CPT Profile: CPT-DN1



Figure C.38: CPT Profile: CPT-DN2


Figure C.39: CPT Profile: CPT-SH2



Figure C.40: CPT Profile: CPT-SH4



Figure C.41: CPT Profile: CPT-SH7



Figure C.41(cont.): CPT Profile: CPT-SH7



Figure C.42: CPT Profile: CPT-SH11



Figure C.43: CPT Profile: CPT-PS3



Figure C.44: CPT Profile: CPT-PS4



Figure C.45: CPT Profile: CPT-SF5



Figure C.46: CPT Profile: CPT-A3-ys



Figure C.47: CPT Profile: CPT-A1-ys



Figure C.48: CPT Profile: CPT-YH-4



Figure C.49: CPT Profile: CPT-YH-3



Project:	Buski-East Waste Water Treatment Plant
Operator:	ERBEY Mühendislik Müş. İnş. San. ve Tic. Ltd.Şti
Location:	Demirtas-BURSA
Test Name:	CPT-1

Figure C.50: CPT Profile: CPT-1



Project:	Buski-East Waste Water Treatment Plant
Operator:	PROTEST Yapı Araştırmaları ve Test Merkezi San ve Tic A.Ş.
Location:	Demirtas-BURSA
Test Name:	CPT-2

Figure C.51: CPT Profile: CPT-2



Project:	Buski-East Waste Water Treatment Plant
Operator:	PROTEST Yapı Araştırmaları ve Test Merkezi San ve Tic A.Ş.
Location:	Demirtas-BURSA
Test Name:	CPT-3

Figure C.52: CPT Profile: CPT-3



Project:	Buski-East Waste Water Treatment Plant
Operator:	PROTEST Yapı Araştırmaları ve Test Merkezi San ve Tic A.Ş.
Location:	Demirtas-BURSA
Test Name:	CPT-7

Figure C.53: CPT Profile: CPT-7



Project:	Buski-East Waste Water Treatment Plant
Operator:	PROTEST Yapı Araştırmaları ve Test Merkezi San ve Tic A.Ş.
Location:	Demirtas-BURSA
Test Name:	CPT-8

Figure C.54: CPT Profile: CPT-8



Project:	Buski-East Waste Water Treatment Plant
Operator:	PROTEST Yapı Araştırmaları ve Test Merkezi San ve Tic A.Ş.
Location:	Demirtas-BURSA
Test Name:	CPT-14

Figure C.55: CPT Profile: CPT-14



Project:	Buski-East Waste Water Treatment Plant
Operator:	PROTEST Yapı Araştırmaları ve Test Merkezi San ve Tic A.Ş.
Location:	Demirtas-BURSA
Test Name:	CPT-15

Figure C.56: CPT Profile: CPT-15



Project:	Buski-East Waste Water Treatment Plant
Operator:	PROTEST Yapı Araştırmaları ve Test Merkezi San ve Tic A.Ş.
Location:	Demirtas-BURSA
Test Name:	CPT-16

Figure C.57: CPT Profile: CPT-16



Project:	Buski-East Waste Water Treatment Plant
Operator:	ERBEY Mühendislik Müş. İnş. San. ve Tic. Ltd.Şti
Location:	Demirtas-BURSA
Test Name:	CPT-17

Figure C58: CPT Profile: CPT-17



Project:	Buski-East Waste Water Treatment Plant
Operator:	PROTEST Yapı Araştırmaları ve Test Merkezi San ve Tic A.Ş.
Location:	Demirtas-BURSA
Test Name:	CPT-18

Figure C.59: CPT Profile: CPT-18



Project:	Buski-East Waste Water Treatment Plant
Operator:	PROTEST Yapı Araştırmaları ve Test Merkezi San ve Tic A.Ş.
Location:	Demirtas-BURSA
Test Name:	CPT-19

Figure C.60: CPT Profile: CPT-19



Project:	Buski-East Waste Water Treatment Plant
Operator:	ERBEY Mühendislik Müş. İnş. San. ve Tic. Ltd.Şti
Location:	Demirtas-BURSA
Test Name:	CPT-20

Figure C.61: CPT Profile: CPT-20



Project:	Buski-East Waste Water Treatment Plant
Operator:	PROTEST Yapı Araştırmaları ve Test Merkezi San ve Tic A.Ş.
Location:	Demirtas-BURSA
Test Name:	CPT-21

Figure C.62: CPT Profile: CPT-21



Project:	Karaca (2001)
Operator:	ZMG Müşavirlik Proje Enstrümantasyon Tic. Ve İnş. Lmt. Şti.
Location:	Tıgcilar Disrict
Test Name:	CPT-Tigcilar-1A

Figure C.63: CPT Profile: CPT-Tigcilar-1A



Project:	Karaca (2001)
Operator	7MG Müsavirlik Proje Enstrümantasvon Tic. Ve İns. I.mt. Sti
operator	Zivio muşavınık i toje Enstrumantasyon tie. ve mş. Emt. şti.
Location:	Cumhuriyet Disrict
Test Name:	CPT-CUM-3

Figure C.64: CPT Profile: CPT-CUM-3

APPENDIX D

COMPILED DATABASE

In Appendix D, compiled database is presented.
Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
	SPT-1	1.8	5	32	8	67.1		ML	0.386	0.001	0.260	0.386	15.213
	SPT-2	3.3	5	47	25	85.2		CL	0.467	0.011	2.371	0.467	15.701
CD 1	SPT-3	5.26	5	44	22	84.8		CL	0.461	0.006	1.228	0.461	15.608
CD-1	SPT-4	6.3	11	37	16	94.9		CL	0.980	0.014	1.656	0.980	15.529
	SPT-5	7.8	10	42	19	91.5		CL	1.188	0.027	2.272	1.188	15.377
	SPT-6	9.3	54	NP	NP	43.5		SM	17.683	0.137	0.866	17.683	14.481
	s-1-02-1	1.24	4	69	39	98	0.001	СН	5.896	0.064	1.309	5.896	14.720
	s-1-02-2	2.49	5	58	35	98	0.002	СН	1.034	0.043	4.007	1.030	15.523
	s-1-02-3	3.74	7	24		71	0.045	ML	3.488	0.019	0.581	3.780	15.197
I 1 7	s-1-02-4	4.84	6	79	51	97	0.001	СН	1.004	0.046	4.530	1.006	15.590
L1-7	s-1-02-5	5.79	15	75	50	99	0.001	СН	1.998	0.085	4.267	1.999	15.442
	s-1-02-6	7.36	9	65	43	100	0.003	СН	1.260	0.046	3.693	1.265	15.540
	s-1-02-7	8.36	3	44	25	99	0.005	CL	0.952	0.024	2.553	0.967	15.496
	s-1-02-8	9.35	5	29		95	0.027	ML	1.733	0.021	1.356	1.741	14.991
	s-1-11-1	1.49	8	63	39	99	0.001	СН	0.939	0.048	5.086	0.939	15.629
	s-1-11-2	2.51	3	40	26	88	0.024	ML-CL	0.834	0.026	3.126	0.834	15.478
	s-1-11-3	3.27	6	40	27	88	0.017	ML-CL	0.982	0.032	3.274	0.982	15.461
	s-1-11-4	4.16	5	40		68	0.048	ML	3.222	0.020	0.629	3.222	15.322
T 1 1	s-1-11-5	5.2	4	39	21	94	0.004	CL	0.788	0.023	3.002	0.788	15.442
L1-1	s-1-11-6	6.04	9	37		99	0.007	ML	2.730	0.031	1.425	2.730	14.979
	s-1-11-7	6.85	6			20	0.14	SM	7.946	0.038	0.768	7.946	14.576
	s-1-11-8	7.99	7	34		80	0.025	ML	3.104	0.023	0.747	3.104	14.761
	s-1-11-9	8.79	9	33		78	0.022	ML	1.902	0.030	1.617	1.902	14.750
	s-1-11-10	9.79	4	32		82	0.02	ML-CL	0.784	0.013	1.719	0.784	15.477

Table D.1: Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
	s-1-16-1	1.31	3						0.729	0.029	4.018	0.724	
	s-1-16-2	2.2	6	31		82	0.029	ML	2.618	0.044	1.690	2.602	14.834
	s-1-16-3	3.19	3	48	26	98	0.001	CL	0.755	0.023	3.088	0.768	15.532
	s-1-16-4	4.1	4	34	6	82	0.011	ML	0.822	0.010	1.180	0.870	14.655
L1-5	s-1-16-5	5.31	15	39		65	0.051	ML	8.874	0.069	0.778	8.858	15.015
	s-1-16-6	6.42	12	34	22	72	0.026	CL ML	1.498	0.032	2.439	1.485	15.739
	s-1-16-7	7.42	18			13	0.2	SM	10.611	0.036	0.346	10.600	14.191
	s-1-16-8	8.78	28			7	0.3	SP- SM	17.105	0.053	0.313	17.105	14.069
	s-1-16-9	9.63	6	68	44	99	0.001	СН	1.015	0.050	4.968	1.049	15.740
	s-1-24-3	2.6	4	37	24	72	0.015	ML-CL	0.988	0.029	3.109	0.992	15.437
	s-1-24-4	3.65	3	41	18	78	0.019	CL	0.607	0.013	2.246	0.616	15.551
116	s-1-24-6	5.31	5	61	35	99	0.002	СН	0.738	0.019	2.639	0.731	15.540
L1-0	s-1-24-7	6.11	8	37	8	98	0.011	ML	2.597	0.037	1.490	2.585	14.785
	s-1-24-8	7.18	38			17	0.2	SM	23.713	0.100	0.433	23.701	14.138
	s-1-24-9	8.14	37			11	0.2	SP- SM	26.355	0.095	0.382	26.347	14.078
	s-1-32-1	1.29	5	73	48	99	0.001	СН	0.701	0.027	3.981	0.694	15.604
	s-1-32-2	2.16	6						0.981	0.030	3.006	0.972	
	s-1-32-3	3.19	4	29		64	0.02	ML	1.421	0.011	0.862	1.408	15.113
I 1 4	s-1-32-4	4.34	4	39	13	90	0.019	ML-CL	0.712	0.009	1.207	0.738	15.164
L1-4	s-1-32-5	5.08	9	43	33	94	0.013	ML	2.730	0.037	1.636	2.714	15.064
	s-1-32-6	6.33	10	35		96	0.01	ML	1.544	0.023	1.571	1.553	14.502
	s-1-32-7	7.28	29			8	0.3	SP- SM	18.532	0.078	0.423	18.515	14.155
	s-1-32-8	8.19	42			9	0.25	SP- SM	19.450	0.097	0.499	19.433	14.219
L1-3	s-1-41-1	1.65	1	27		63	0.05	ML	0.735	0.023	3.140	0.727	15.054

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
	s-1-41-2	2.77	4	30		74	0.03	ML	1.473	0.017	1.319	1.467	14.563
	s-1-41-3	3.6	4	29		91	0.015	ML-CL	3.150	0.020	0.687	3.141	14.639
I 1 2	s-1-41-4	4.44	4	44		96	0.012	ML-CL	1.431	0.021	1.765	1.654	15.112
L1-5	s-1-41-5	5.29	5	54	30	92	0.005	СН	0.781	0.028	3.552	0.778	15.558
	s-1-41-7	6.86	40			5	0.44	SP- SM	21.105	0.056	0.266	21.100	13.945
	s-1-41-8	7.85	37			8	0.35	SP- SM	24.718	0.080	0.327	24.710	14.005
	s-1-42-1	1.61	2	26		51	0.07	ML	1.359	0.042	4.115	1.358	15.142
	s-1-42-2	2.59	4			9	0.29	SP- SM	6.883	0.022	0.320	6.880	14.165
	s-1-42-3	3.54	4	39	14	98	0.005	CL	2.039	0.021	1.110	2.030	15.466
112	s-1-42-4	4.31	3	62	27	98	0.002	ML-CL	0.670	0.022	3.418	0.664	15.578
L1-2	s-1-42-5	5.3	5	39		100	0.002	ML	1.725	0.028	1.673	1.719	14.878
	s-1-42-6	6.19	8	40	18	96	0.013	CL/ML	1.242	0.022	1.930	1.238	15.126
	s-1-42-7	7.04	11	40	16	97	0.002	CL	1.333	0.031	2.553	1.334	15.499
	s-1-42-9	9.34	4	54	27	98	0.002	СН	1.184	0.032	2.786	1.178	15.494
	s-2-10-1	1.28	3	64	36	95	0.001	СН	0.653	0.043	6.427	0.650	15.799
	s-2-10-2	2.15	3	70	44	99	0.001	СН	0.605	0.021	3.479	0.601	15.594
	s-2-10-3	3.18	3	33	16	88	0.013	CL/ ML	1.073	0.015	1.407	1.068	14.869
121	s-2-10-4	4.33	2	39	22	86	0.015	ML-CL	1.056	0.017	1.584	1.043	15.184
L2-1	s-2-10-6	6.4	13	32		82	0.025	ML	3.403	0.034	1.151	3.387	15.139
	s-2-10-7	7.98	35			41	0.088	SM	16.718	0.070	0.419	16.702	14.191
	s-2-10-8	8.79	38			20	0.15	SM	22.844	0.093	0.408	22.830	14.124
	s-2-10-9	9.75	34			22	0.14	SM	26.972	0.105	0.388	26.971	14.081
12-2	s-2-3-1	1.3	4	64	38	97	0.002	CH	1.473	0.059	4.721	1.469	15.502
L2-2	s-2-3-2	2.34	2	33		87	0.016	ML	0.604	0.009	1.395	0.613	15.507

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
	s-2-3-3	3.29	4	34		90	0.022	ML	1.073	0.020	1.906	1.072	15.026
	s-2-3-4	4.37	5	47	18	96	0.009	ML	1.034	0.018	1.839	1.022	15.468
	s-2-3-6	6.11	6	37	11	88	0.014	ML	3.445	0.044	1.399	4.042	14.751
L2-2	s-2-3-7	7	4	48.5	22	98	0.006	CH/ MH CL	1.909	0.020	1.247	1.894	15.035
	s-2-3-8	8.35	6	65	40	100	0.002	СН	0.755	0.025	3.251	0.789	15.636
	s-2-3-9	9.54	32			20	0.17	SM	12.012	0.073	0.623	11.998	14.421
	s-2-3-10	10.32	47			11	0.2	SP- SM	20.400	0.103	0.509	20.388	14.241
	s-3-3-1	1.64	3	29		84	0.023	ML	0.356	0.005	1.343	0.362	15.109
	s-3-3-3	3.2	4	35	15	90	0.018	ML-CL	0.907	0.019	2.147	0.902	15.323
	s-3-3-4	4.45	5	31		91	0.013	ML-CL	0.823	0.031	3.935	0.817	15.580
L3-1	s-3-3-6	6.29	14	34	10	98	0.014	ML	2.425	0.044	1.846	2.414	14.878
	s-3-3-7	7.39	12	35		95	0.022	ML	2.248	0.033	1.861	2.238	15.251
	s-3-3-8	8.09	5	53	27	99	0.002	СН	3.915	0.054	2.063	5.574	15.007
	s-3-3-9	9.32	7	43	15	100	0.008	ML-CL	1.118	0.041	3.726	1.120	15.621
	s-3-6-1	1.29	2	42	20	89	0.008	CL	0.448	0.019	5.203	0.453	14.890
	s-3-6-2	2.46	4	27		57	0.06	ML	1.027	0.008	0.792	1.026	15.238
	s-3-6-3	3.41	3	69	40	99	0.001	СН	2.147	0.018	1.146	2.146	14.891
	s-3-6-4	4.19	3	34	12	92	0.005	CL/ ML	0.729	0.020	2.779	0.729	15.381
L3-2	s-3-6-5	5.36	12			35	0.094	SM	0.797	0.016	2.102	0.833	15.366
	s-3-6-6	6.39	9	30		82	0.036	ML	1.538	0.021	1.394	1.531	15.240
	s-3-6-7	7.35	10	31		93	0.02	ML	1.926	0.026	1.556	1.922	15.362
	s-3-6-8	8.3	12	33		58	0.055	ML	2.051	0.028	1.459	2.047	15.106
	s-3-6-9	9.38	8	57	28	99	0.001	CH/ MH	2.773	0.038	1.429	2.769	15.050
L4-1	s-4-13-1	1.26	4	39	19	87	0.006	CL	0.556	0.025	4.430	0.542	15.363

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
	s-4-13-2	2.32	7			43	0.08	SM	2.611	0.019	1.057	2.602	14.814
	s-4-13-4	4.33	4	47	25	89	0.01	CH/CL	0.706	0.028	3.962	0.695	15.622
	s-4-13-5	5.26	9	33		91	0.022	ML	3.561	0.070	2.030	3.542	15.151
T 4 1	s-4-13-6	6.3	10			58	0.062	ML	12.818	0.038	0.440	14.630	14.918
L4-1	s-4-13-7	7.29	9	30		93	0.019	ML	1.544	0.035	2.300	1.545	15.114
	s-4-13-8	8.16	8	26		82	0.02	ML	12.237	0.073	0.746	15.500	15.124
	s-4-13-9	9.16	7	39		100	0.008	ML	1.632	0.033	2.250	1.641	15.107
	s-4-13-10	10.35	34			7	0.32	SP- SM	21.442	0.077	0.364	21.444	14.103
	s-4-22-1	1.2	4	53	30	99	0.004	CH/ CL	0.630	0.028	4.331	0.634	15.656
	s-4-22-2	2.01	4						1.329	0.013	1.025	1.319	
	s-4-22-3	2.87	4	29		72	0.044	ML	2.227	0.019	0.976	2.216	14.935
	s-4-22-4	3.95	3	55	28	100	0.005	СН	0.843	0.026	3.067	0.868	15.469
L4-3	s-4-22-5	5.05	3	34		97	0.018	ML	2.088	0.023	1.118	2.074	15.032
	s-4-22-6	6.05	4	40	15	99	0.009	ML-CL	1.040	0.019	1.884	1.064	15.291
	s-4-22-7	7	14	36		54	0.063	ML	4.791	0.037	0.989	6.553	14.207
	s-4-22-8	8.29	5	60	36	100	0.002	СН	1.158	0.042	3.934	1.194	15.605
	s-4-22-9	9.33	8	65	38	99	0.002	СН	1.183	0.046	3.905	1.191	15.629
	s-4-3-1	1.46	6			89	0.003	CL	0.794	0.052	6.491	0.788	15.803
	s-4-3-2	2.18	2						0.818	0.017	2.464	0.808	
	s-4-3-3	3	4						0.770	0.033	4.238	0.775	
L4-3	s-4-3-4	3.81	4	28		68	0.035	ML	1.540	0.025	2.019	1.539	15.305
	s-4-3-5	4.95	5	59	35	97	0.001	СН	0.732	0.038	5.290	0.740	15.728
	s-4-3-6	6.09	26			23	0.181	SM SP- SM	18.519	0.062	0.337	18.509	14.061
	s-4-3-7	7.3	8	29		84	0.014	ML	1.428	0.041	3.119	1.413	14.420

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
L4-3	s-4-3-8	8.59	10	35	18	96	0.017	ML-CL	3.353	0.044	1.474	3.353	15.009
	s-a1-1	1.3	3	41	13	90		ML	0.794	0.031	3.807	0.791	15.558
	s-a1-2	2.1	5	53	23	94		MH/ CH	0.614	0.011	1.839	0.612	15.256
	s-a1-3	2.91	5	65	35	100	0.0035	СН	0.692	0.025	3.612	0.686	15.580
	s-a1-4	3.67	4	46	23	87		CL	0.781	0.025	3.168	0.784	15.001
A_1	s-a1-5	4.5	4	29	6	74	0.045	ML-CL	1.329	0.020	1.513	1.325	15.107
A-1	s-a1-6	5.3	3	55	28	92		СН	0.919	0.021	2.334	0.922	15.363
	s-a1-7	6.29	3	47	20	97	0.012	CL/ ML	1.220	0.016	1.367	1.219	14.931
	s-a1-8	7.31	16	30		70	0.057	ML	2.798	0.050	1.874	2.782	15.225
	s-a1-9	8.31	24	29		58		ML	9.197	0.079	0.913	9.181	15.341
	s-a1-9	8.31	24	29		58		ML	9.197	0.079	0.913	9.181	14.689
	s-a2-1	1.28	2	31	8	74		ML-CL	0.909	0.011	1.221	0.899	15.104
	s-a2-2	2.11	4	35	8	86		ML	0.499	0.014	2.773	0.501	15.171
	s-a2-3	2.85		51	23	100	0.001	CH/ MH	0.755	0.026	3.401	0.748	15.537
	s-a2-4	3.6	2	49	25	85		CL/ CH	0.646	0.013	1.974	0.642	15.959
A-2	s-a2-5	4.5	8	35	7	93	0.018	ML	1.143	0.023	1.876	1.127	15.177
	s-a2-6	5.26		43	20	95		CL	0.750	0.011	1.538	0.740	14.896
	s-a2-7	6.3	3	51	22	99	0.007	MH/ CH	1.103	0.015	1.392	1.101	14.742
	s-a2-8	7.29	10	39	11	85	0.026	ML	2.412	0.042	2.386	2.394	15.558
	s-a2-9	8.8	37			8	0.12	SP- SM	23.171	0.101	0.436	23.155	14.137
	s-b1-1	1.91	2	37		96	0.012	ML	0.664	0.006	0.896	0.664	15.102
P 1	s-b1-2	2.88	2	35		87	0.03	ML	1.007	0.009	1.065	1.007	14.607
D-1	s-b1-3	3.75	8			40	0.12	SM-ML	6.811	0.028	0.409	6.811	14.344
	s-b1-4	4.49	10	27		40	0.09	SM-ML	16.186	0.049	0.305	16.186	14.058

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
	s-b1-6	6.5	32			5	1.7	SW- SM	29.792	0.103	0.346	29.792	14.004
	s-b1-7	8.3	35			5	0.6	SP- SM	27.311	0.120	0.439	27.311	14.130
B-1	s-b1-8	10.8	9	62	40	100	0.001	СН	1.676	0.075	4.460	1.676	15.668
	s-b1-9	12.7	14						2.363	0.057	2.606	2.363	
	s-b1-11	16.32	13	58	34	100	0.001	СН	7.197	0.147	2.235	7.345	15.123
	s-b2-1	1.7	3	42	18	87	0.014	CL	0.777	0.026	3.450	0.777	15.504
	s-b2-2	2.5	3						0.552	0.026	4.995	0.552	
	s-b2-3	3.28	2	37	9	91	0.038	ML	1.007	0.017	1.667	1.007	15.552
B_2	s-b2-4	4.19	12			5	0.4	SP- SM	1.371	0.014	1.379	1.371	15.100
D-2	s-b2-5	5	21			5	0.48	SP- SM	17.248	0.068	0.398	17.248	14.136
	s-b2-6	5.8	34						30.597	0.121	0.397	30.597	
	s-b2-7	7.31	32			3	1	SW	30.752	0.109	0.356	30.752	14.004
	s-b2-8	8.3	35			4	0.9	SW	29.235	0.095	0.325	29.235	13.990
	s-c1-1	2.1	2	44	17	99		ML-CL	0.757	0.013	1.721	0.757	15.276
	s-c1-2	2.86	3	64	42	99	0.002	CH	1.044	0.040	3.819	1.052	15.501
C-3	s-c1-3	3.67							1.103	0.018	1.686	1.107	
	s-c1-4	4.49	8	33	8	94	0.027	ML	3.583	0.032	1.273	3.576	15.203
	s-c1-5	5.34	15	26		67		ML	1.103	0.038	2.684	1.094	15.196
	s-c2-1	1.99	2	40	15	97		CL/ ML	1.175	0.002	0.106	1.175	15.293
	s-c2-2	2.71		42	15	94	0.013	ML-CL	0.661	0.009	1.396	0.661	15.235
C-1	s-c2-3	3.56	7	74	45	99		CH	0.961	0.037	3.774	0.961	15.520
C-1	s-c2-4	4.36		73	28	99	0.003	MH	1.120	0.026	2.389	1.120	14.895
	s-c2-5	5.21	9	42	15	87		ML-CL	0.709	0.017	2.405	0.709	15.460
	s-c2-7	6.79	14	34		92		ML	1.500	0.024	1.715	1.585	15.225

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
C 1	s-c2-8	7.85	7	49	26	99	0.006	CL/ CH	6.553	0.056	1.166	6.553	15.290
C-1	s-c2-9	9.25	8	37		99	0.002	ML	10.669	0.122	1.191	10.669	15.216
	s-c3-3	4.89	3	40	15	88		CL/ ML	1.221	0.025	2.280	1.222	15.148
	s-c3-5	7.03	12	31		83	0.027	ML	4.646	0.023	0.762	4.633	14.692
C 4	s-c3-6	7.98	5	67	36	98		CH/ MH	1.597	0.029	1.885	1.598	15.252
C-4	s-c3-7	10.12	23	28		75	0.033	ML	14.493	0.074	0.549	14.478	15.090
	s-c4-1	2.76	2	45	22	99	0.003	CL	0.704	0.032	4.559	0.702	15.530
	s-c5-4	4.59		48	27	91		CL	0.748	0.024	3.255	0.752	15.267
	s-c5-5	5.39	4	42	18	100	0.002	CL	1.224	0.023	2.065	1.230	15.528
C-2	s-c6-1	1.36	1	40		94	0.014	ML	1.275	0.018	1.449	1.265	15.064
	s-c6-2	2.1	1	31		87	0.015	ML	3.925	0.011	0.276	3.915	15.068
	s-d1-1	1.38	1	33	14	81	0.011	CL	0.906	0.006	0.937	0.904	15.271
	s-d1-2	2.2	2	28		68	0.06	ML	1.680	0.007	0.709	1.667	14.858
D 2	s-d1-3	3.01	2	50	26	99	0.004	CH/ CL	0.302	0.005	1.885	0.309	15.547
D-2	s-d1-4	3.7	7	28		89		ML	2.264	0.018	0.877	2.248	15.391
	s-d1-5	4.74	25			4	1.1	SW	15.271	0.045	0.322	15.282	14.070
	s-d1-6	5.76	27			3	1.7	SW	24.267	0.081	0.341	24.278	14.012
	s-d2-1	1.56							1.418	0.011	0.794	1.418	
	s-d2-2	2.37		36	12	94	0.02	ML-CL	0.756	0.013	1.626	0.756	15.257
D-1	s-d2-3	2.81	2	42	13	99		ML	0.476	0.006	1.180	0.476	14.233
D-1	s-d2-4	3.6	3	35	12	95	0.021	CL/ ML	0.694	0.013	1.935	0.694	14.165
	s-d2-6	5.5	26			4	1.3	SW	28.469	0.110	0.387	28.469	14.032
	s-d2-7	7.3	32			5	0.4	SW- SM	27.750	0.110	0.397	27.750	14.070
D-3	s-d3-1	2.51	4						0.687	0.008	1.185	0.687	

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
	s-d3-2	3.48	4	30		52	0.07	ML	1.032	0.014	1.353	1.032	14.672
D-3	s-d3-3	4.09	9	31	12	96	0.011	ML-CL	2.864	0.022	1.237	2.864	14.922
	s-d3-4	4.86	18			4	1.5	SW	23.552	0.077	0.328	23.552	14.006
	s-dn1-1	2.09	7	NP	NP	20	2.9	SM	6.051	0.098	1.704	6.046	14.817
	s-dn1-3	4.5	15	NP	NP	40	0.12	SM	8.755	0.117	1.510	8.762	14.767
	s-dn1-4	6.13	24	NP	NP	14	2.6	SM	11.717	0.054	0.471	11.715	14.301
DN-1	s-dn1-5	7.51	23	NP	NP	10	4.1	SW- SM	10.093	0.061	0.617	10.091	14.452
	s-dn1-6	8.63	16	NP	NP	9	2.6	SP- SM	19.238	0.119	0.621	19.225	14.331
	s-dn1-7	9.6	17	NP	NP	8	3.7	SW- SM	14.408	0.082	0.580	14.401	14.374
	s-dn1-8	10.64	16	NP	NP	17	1.9	SM	15.904	0.110	0.691	15.894	14.429
	s-dn2-1	1.65	8	NP	NP	12	4.5	SM	0.135	0.003		0.135	15.845
	s-dn2-2	2.73	12	NP	NP	14	3	SM	7.828	0.087	1.220	7.828	14.695
	s-dn2-3	3.68	14	NP	NP	11	4.1	SP- SM	7.914	0.085	1.105	7.914	14.677
DN 2	s-dn2-4	4.55	16	NP	NP	13	2.6	SM	8.918	0.153	1.729	8.918	14.831
DIN-2	s-dn2-5	6.56	29	NP	NP	10	5.2	SW- SM	15.066	0.134	0.873	15.066	14.502
	s-dn2-6	7.57	26	NP	NP	6	2.6	SW- SM	8.562	0.068	0.793	8.562	14.596
	s-dn2-7	8.61	34	NP	NP	17	1.3	SM	25.123	0.170	0.680	25.123	14.321
	s-dn2-8	9.9	31	NP	NP	10	3	SW- SM	12.171	0.155	1.492	12.171	14.789
	s-e1-1	1.94	5			2	0.51	SP	3.088	0.015	0.492	3.086	14.488
	s-e1-2	3.21	4	30		70	0.04	ML	3.180	0.014	0.493	3.878	14.341
E-1	s-e1-3	4.05	3	52	22	99		MH/ CH	0.938	0.016	1.820	0.979	15.316
	s-e1-4	4.77		61	33	95	0.005	СН	0.863	0.027	3.086	0.878	15.473
	s-e1-7	7.69	35						21.715	0.055	0.256	21.702	
F-1	s-f1-1	1.34	4	28		72	0.06	ML	0.541	0.031	5.986	0.543	15.257

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
	s-f1-2	2.1	4	27		68	0.048	ML	2.198	0.007	0.292	2.195	14.767
	s-f1-3	2.88	4	31		92	0.008	ML	1.628	0.013	0.799	1.623	14.818
	s-f1-4	3.86	3	47	19	97	0.008	ML-CL	0.597	0.008	1.252	0.603	15.233
E 1	s-f1-5	4.73	10	33	13	81	0.03	ML-CL	1.493	0.018	1.327	1.502	15.074
1'-1	s-f1-6	5.7	16	28		51	0.07	ML	8.305	0.052	0.643	8.298	15.156
	s-f1-9	8.3	12	31		74	0.034	ML	7.268	0.047	0.699	9.498	14.474
	s-f1-10	9.3	11	53	27	100	0.006	CH/CL/ ML	1.542	0.029	2.028	1.536	15.339
	s-f1-11	10.29	10	48	29	98	0.013	CH/ MH	2.028	0.034	1.773	2.037	15.237
	s-g1-1	1.81	3	41	16	97	0.013	ML	1.269	0.009	0.795	1.258	15.719
	s-g1-2	2.59	6	29		69		ML	2.149	0.014	0.743	2.138	14.675
	s-g1-3	3.39	4	33		95		ML	0.550	0.009	1.693	0.548	15.607
G-2	s-g1-4	4.28	4	53	33	97	0.005	СН	1.086	0.011	1.610	1.089	15.175
0-2	s-g1-5	5.05	10	37	25	78	0.009	ML	3.006	0.021	0.829	2.994	15.121
	s-g1-7	7.29	10	27		67		ML	1.708	0.030	2.105	1.705	14.671
	s-g1-8	8.37	6	58	22	99	0.005	MH	1.368	0.032	2.461	1.373	15.476
	s-g1-9	9.32	8	52	22	99		MH/ CH	1.234	0.041	3.427	1.237	15.384
	s-g2-1	1.59	4						1.661	0.005	0.316	1.649	
	s-g2-2	2.8	9	25		65	0.04	ML	2.546	0.018	0.718	2.531	15.814
	s-g2-3	4.05		37	10	77	0.022	ML	0.660	0.024	3.694	0.660	14.405
G 1	s-g2-4	5.51	6	30		75		ML	4.354	0.029	0.813	4.343	14.835
0-1	s-g2-5	6.29	14	44	13	99	0.007	ML	6.930	0.042	0.602	6.916	14.479
	s-g2-6	7.75		58	31	99	0.001	СН	1.490	0.030	2.123	1.482	15.291
	s-g2-7	8.81	9	40	18	95	0.02	CL/ ML	1.230	0.024	1.976	1.251	15.294
	s-g2-8	9.76		48	24	99	0.006	CL	1.181	0.029	2.446	1.177	15.661

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
	s-g2-9	11.24	9	51	30	98	0.001	CH/ CL	1.411	0.039	2.796	1.399	15.491
G-1	s-g2-10	12.28	29	30		97	0.021	ML	9.266	0.095	1.033	9.269	14.515
	s-g2-11	14.25	13	47	18	99	0.006	ML-CL	3.865	0.047	1.510	3.856	15.059
	SK101-1	1.8	7	70	50	95		СН	1.069	0.054	5.088	1.069	15.601
BCP-7	SK101-2	3.8	8	NP	NP	54		ML	2.005	0.034	1.914	2.005	14.905
	SK101-5	9.8	10	NP	NP	50	0.074	SM-ML	17.493	0.071	0.405	17.493	14.194
	s-h1-1	1.39	2	43	23	75	0.038	CL	0.535	0.025	4.843	0.531	15.005
	s-h1-3	3.3	2	43	17	98	0.009	CL/ ML	0.652	0.013	2.020	0.648	15.350
	s-h1-4	4.13	3	70	37	100	0.002	CH/ MH	0.742	0.016	2.113	0.745	15.369
	s-h1-5	5.23	5	36	17	90	0.03	CL/ ML	1.975	0.033	1.917	1.973	15.333
H-1	s-h1-6	5.98	12	33		80	0.04	ML	5.176	0.056	1.360	5.158	14.481
	s-h1-7	6.86	7	41	21	90	0.008	MH-ML	1.841	0.026	1.757	1.829	15.246
	s-h1-8	7.6	8	49	22	99	0.008	CL/MH	1.643	0.031	2.147	1.639	14.768
	s-h1-9	8.81	7	68	32	98	0.004	MH	1.076	0.031	2.911	1.075	15.154
	s-h1-11	11.29	7	70	46	98	0.001	СН	1.526	0.053	3.519	1.524	15.579
	s-i1-1	1.29	5	73	48	99	0.001	СН	0.933	0.034	3.512	0.927	15.491
	s-i1-2	2.01	6						1.161	0.039	3.374	1.150	
	s-i1-3	3.17	4	29		64	0.02	ML	1.677	0.011	0.708	1.662	14.690
	s-i1-4	4.34	4	39	13	92	0.019	ML-CL	1.598	0.015	0.968	1.582	14.913
I-1	s-i1-5	5.1	9	43	33	94	0.013	ML	3.048	0.040	1.286	3.035	15.712
	s-i1-6	6.39	10	35		96	0.01	ML	2.430	0.024	1.197	2.414	14.725
	s-i1-7	7.3	29			8	0.3	SP- SM	16.574	0.060	0.363	16.554	14.119
	s-i1-8	8.19	42			9	0.25	SP- SM	25.699	0.093	0.367	25.683	14.044
	s-i1-9	9.12	44			5	0.32	SP- SM	23.430	0.094	0.407	23.423	14.113

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
	s-j1-1	1.55	1	43	15	97	0.01	ML-CL	0.571	0.007	1.145	0.572	15.189
	s-j1-2	2.35	4	37	10	93		ML	1.470	0.021	1.410	1.456	14.766
	s-j1-3	3.11	6	32		84	0.02	ML	1.437	0.017	1.201	1.423	14.949
J-2	s-j1-4	3.96	2	55	29	96	0.005	СН	0.650	0.019	2.846	0.652	15.511
	s-j1-5	4.7	4	62	32	94		CH/ MH	1.145	0.033	3.029	1.156	15.399
	s-j1-7	6.29	30	28		88		ML	14.044	0.081	0.580	14.028	14.626
	s-j1-9	8.79	9	30		91	0.013	ML	1.263	0.024	1.873	1.260	14.696
	s-j2-1	2.1	2	32		81		ML	1.703	0.007	0.495	1.689	15.358
	s-j2-2	2.99	8	28		53	0.07	ML	2.029	0.012	0.648	2.010	15.247
J-1	s-j2-3	4.34	3	75	44	99	0.002	СН	0.840	0.031	3.648	0.824	15.548
	s-j2-6	7.43	11	36		98	0.013	ML	2.599	0.028	1.540	2.604	14.847
	s-j2-7	8.8	11	66	40	100	0.002	СН	1.162	0.034	2.916	1.162	15.506
	SK102-4	7.85	4	26	7	39	0.1	SM-SC	5.830	0.034	0.615	5.830	14.587
PCD 2	SK102-5	9.65	11	NP	NP	8	1	SW-SM	15.365	0.058	0.379	15.365	14.210
BCF-5	SK102-7	13.85	17	19	5	33	0.31	SM-SC	15.653	0.086	0.638	15.653	14.434
	SK102-8	15.85	17	NP	NP	16	0.9	SM	19.459	0.104	0.535	19.459	14.333
	SK103-3	5.8	6	35	15	74		CL	1.014	0.048	4.893	1.014	15.623
	SK103-4	7.8	7	NP	NP	19	0.17	SM	11.918	0.039	0.328	11.918	14.182
BCD 5	SK103-5	9.8	7	28	13	56		CL	10.490	0.054	0.890	10.490	15.776
BCI-5	SK103-7	13.8	8	NP	NP	44	0.08	SM	21.841	0.108	0.508	21.841	14.270
	SK103-8	15.8	7	NP	NP	42	0.1	SM	10.849	0.042	0.472	10.849	14.405
	SK103-11	21.75	8	NP	NP	13		SM	10.194	0.105	1.200	10.194	14.835
PCD 2	sk104-1	1.85	4	42	27	77		CL	0.648	0.017	2.729	0.648	15.315
DCP-2	sk104-2	3.85	7	30	11	68	0.014	CL	1.736	0.061	3.841	1.736	15.421

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
	sk104-3	5.85	6	NP	NP	29	0.14	SM	1.073	0.019	1.790	1.073	15.307
BCD 2	sk104-4	7.85	7	48	33	86	0.001	CL	0.722	0.020	2.731	0.722	15.482
BCI-2	sk104-5	9.85	14	21	6	27	0.4	SM-SC	16.354	0.050	0.305	16.354	14.103
	sk104-6	11.85	14	NP	NP	18	0.33	SM	3.086	0.057	2.148	3.086	15.247
	SK105-1	1.8	7	32	11	65		CL	1.044	0.077	7.967	1.044	15.417
	SK105-2	3.8	6	NP	NP	13	0.28	SM	5.347	0.063	1.252	5.347	14.782
BCD 4	SK105-3	5.8	5	NP	NP	18	0.28	SM	2.723	0.048	1.820	2.723	15.097
BCI-4	SK105-5	9.8	12	NP	NP	32	0.17	SM	9.548	0.056	0.615	9.548	14.483
	SK105-7	13.8	12	17	6	37	0.18	SM-SC	7.611	0.069	1.151	7.611	14.814
	SK105-8	15.8	11	NP	NP	28	0.22	SM	4.079	0.079	2.486	4.079	15.291
	SK106-1	1.8	7	74	52	98		СН	0.784	0.037	4.761	0.784	15.646
	SK106-2	3.85	5	45	29	88	0.001	CL	2.103	0.034	1.721	2.103	14.609
BCP-8	SK106-3	5.85	5	NP	NP	17	0.49	SM	6.105	0.015	0.260	6.105	14.213
	SK106-4	7.85	9	NP	NP	11	0.5	SW-SM	8.034	0.020	0.260	8.034	14.180
	SK106-5	9.85	7	20	6	21	0.55	SM-SC	16.238	0.059	0.360	16.238	14.171
BCD 10	SK107-1	1.85	4	61	40	95		СН	0.741	0.047	6.294	0.741	15.764
BCF-10	SK107-2	3.85	5	40	24	76		CL	0.691	0.042	6.066	0.691	15.814
	SK108-1	1.85	5	40	22	80		CL	0.862	0.047	5.406	0.862	15.074
	SK108-2	3.85	4	44	25	88	0.001	CL	0.739	0.030	4.032	0.739	15.796
BCP-11	SK108-3	5.85	4	40	25	75	0.001	CL	1.206	0.071	5.865	1.206	15.672
	SK108-5	9.85	6	NP	NP	13	0.39	SM	15.058	0.064	0.434	15.058	14.253
BCP-8 BCP-10 BCP-11 BCP-13	SK108-7	13.85	8	NP	NP	4	3.3	SW	15.218	0.064	0.422	15.218	14.272
PCD 12	SK109-1	1.8	4	33	15	70		CL	0.823	0.069	8.361	0.823	15.621
DCP-15	SK109-2	3.8	4	38	20	70		CL	0.654	0.034	5.248	0.654	15.711

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
	SK109-4	7.8	10	NP	NP	14	0.27	SM	11.296	0.029	0.268	11.296	14.108
PCD 12	SK109-5	9.8	12	NP	NP	5	0.5	SW	11.040	0.041	0.374	11.040	14.261
DCF-15	SK109-6	11.8	8	NP	NP	7	0.55	SW-SM	4.779	0.032	0.746	4.779	14.731
	SK109-7	13.8	10	27	6	43	0.09	SM-SC	10.900	0.085	1.181	10.900	14.742
	SK110-1	1.85	5	35	17	88		CL	0.952	0.080	8.355	0.952	15.695
BCP-6	SK110-4	7.85	5	23	5	26	0.24	SM-SC	7.978	0.038	0.541	7.978	14.448
BCI-0	SK110-7	13.85	7	NP	NP	13	0.52	SM	7.415	0.046	1.769	7.415	14.988
	SK110-8	15.85	8	NP	NP	18	0.5	SM	14.198	0.102	0.727	14.198	14.506
	s-k1-1	1.39	3	46	23	99	0.004	CL	0.644	0.024	3.735	0.650	15.452
	s-k1-2	2.41	4						1.136	0.012	1.243	1.128	
	s-k1-3	3.3	4	35	9	85	0.028	ML	1.435	0.016	1.138	1.425	15.049
K-1	s-k1-4	4.1	3	41	14	95	0.019	ML-CL	0.655	0.014	2.194	0.647	15.417
	s-k1-5	4.9	3	46	21	98	0.003	CL	0.819	0.022	2.693	0.810	15.740
	s-k1-7	6.85	32			8	0.024	SP- SM	17.879	0.081	0.449	17.867	14.179
	s-k1-9	9.35	14	37	10	81	0.005	ML	6.798	0.044	1.304	8.758	15.051
BCP-12	SK1-5	7.8	9	23		38	0.2	SM	11.766	0.023	0.193	11.766	14.004
	SK5-12	18.3		34	16	53	0.004	CL	1.182	0.062	5.224	1.182	15.847
BCF-9	SK5-5	7.8	15			9	0.7	SM	16.207	0.046	0.288	16.207	14.083
BCP-1	SK7-4	6.8				39	0.14	SM	9.718	0.039	0.405	9.718	14.307
	s-11-1	1.27	3	46	24	77	0.009	CL	0.684	0.020	3.250	0.684	15.596
	s-11-2	2.61	5	26		74	0.06	ML	1.477	0.009	0.632	1.477	14.999
L-1	s-11-3	3.35	2	41	15	93	0.003	ML-CL	0.482	0.013	2.819	0.482	15.582
	s-11-6	5.85	9	33	6	87	0.03	ML	2.415	0.020	0.881	2.415	14.319
	s-11-8	7.9	31			8	0.43	SP- SM	26.633	0.095	0.356	26.633	14.024

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
L-1	s-11-9	8.85	14	51	22	98	0.01	MH/ CH	1.786	0.031	1.793	1.786	15.541
	s-ps3-1	1.8	46	NP	NP	24	1.1	SM	1.350	0.014	1.022	1.337	14.949
DC 1	s-ps3-2	2.65	3	NP	NP	36	0.13	SM	1.143	0.016	1.478	1.132	15.128
F3-1	s-ps3-3	4.15		45	23	89	0.02	CL	0.466	0.010	2.053	0.516	15.759
Pair Name L-1 PS-1 PS-2 SF-1 HS-4	s-ps3-4	6.12		41	18	99	0.014	CL	0.532	0.009	1.656	0.601	15.519
	s-ps4-2	3.15		NP	NP	78	0.04	ML	0.450	0.012	2.726	0.437	15.453
DS 2	s-ps4-3	4.36	1	39	17	93	0.01	CL	0.587	0.011	1.902	0.578	15.453
F3-2	s-ps4-4	5.05		39	19	96	9.9	CL	0.551	0.013	2.396	0.545	15.406
	s-ps4-6	10.07		39	19	82	0.009	CL	1.690	0.106	6.292	1.680	15.396
	s-sf5-1	2.07	4	NP	NP	16	1.3	SM	0.696	0.014	2.048	0.683	15.365
	s-sf5-2	3.11	3	NP	NP	66		ML	0.304	0.005	1.545	0.294	15.054
	s-sf5-3	4.13		57	32	96	0.009	СН	0.386	0.004	1.132	0.382	15.317
SF-1	s-sf5-4	5.23	1	58	32	86	0.011	СН	0.370	0.006	1.617	0.376	15.484
	s-sf5-5	6.14							0.370	0.010	2.632	0.400	
	s-sf5-6	7.34	1	56	32	96	0.009	СН	0.399	0.008	2.117	0.445	15.622
	s-sf5-7	8.55		55	34	96	0.009	СН	0.402	0.009	2.237	0.457	15.680
	s-sh11-1	1.88	9	NP	NP	14	1.9	SM	1.289	0.006	0.502	1.292	14.697
	s-sh11-4	4.77	2	NP	NP				6.148	0.068	1.144	6.159	
	s-sh11-5	5.8	12	NP	NP	11	1.9	SW- SM	7.588	0.030	0.403	7.591	14.332
ЦС <i>А</i>	s-sh11-6	6.81	12	NP	NP	8	3	SW- SM	3.852	0.041	1.052	3.854	14.850
п5-4	s-sh11-7	7.79	12	NP	NP	12	1.1	SM	1.829	0.015	0.804	1.845	14.941
	s-sh11-8	8.67	6	NP	NP	7	2.4	SW- SM	9.271	0.060	0.649	9.290	14.506
	s-sh11-9	9.7	12	NP	NP	21	0.42	SM	9.353	0.048	0.497	9.374	14.414
	s-sh11-10	10.88	19	NP	NP				8.278	0.051	0.608	8.302	

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
HS-1	s-sh2-1	3.33	12	NP	NP	9	4.1	SW- SM	5.117	0.028	0.556	5.125	14.484
	s-sh4-2	2.5	5	NP	NP				3.307	0.010	0.287	3.312	
	s-sh4-5	4.95	9	NP	NP	7	4.7	SW- SM	7.593	0.047	0.633	7.604	14.470
	s-sh4-6	5.74	7	NP	NP	4	3.2	SW	7.369	0.032	0.432	7.370	14.346
HS-2	s-sh4-7	6.75	10	NP	NP				4.772	0.044	1.000	4.774	
	s-sh4-8	8.25	12	NP	NP	11	3	SW- SM	8.141	0.027	0.340	8.160	14.270
	s-sh4-9	9.59	12	NP	NP	7	3.9	SW- SM	8.930	0.030	0.332	8.949	14.255
	s-sh4-10	11.45	22	NP	NP	7	4.5	SW- SM	10.772	0.105	1.009	10.793	14.655
	s-sh7-3	2.92	5	NP	NP	5	3	SW	8.361	0.050	0.717	8.363	14.471
	s-sh7-4	3.89	8	NP	NP	4	3.9	SW	10.398	0.101	1.038	10.402	14.585
	s-sh7-5	4.7	10	NP	NP	6	4.5	SW	12.588	0.096	0.731	12.591	14.431
	s-sh7-6	5.5	10	NP	NP				7.540	0.034	0.428	7.542	
	s-sh7-7	6.31	16	NP	NP	13	1.5	SM	11.094	0.090	0.822	11.100	14.528
HS-3	s-sh7-8	7.3	19	NP	NP	11	1.6	SW- SM	7.041	0.018	0.253	7.053	14.194
	s-sh7-9	8.3	14	NP	NP	12	2	SW- SM	7.934	0.027	0.348	7.936	14.300
	s-sh7-10	9.27	13	NP	NP	6	3.1	SW- SM	11.927	0.046	0.393	11.938	14.267
	s-sh7-11	10.52	11	NP	NP	9	2	SW- SM	9.052	0.070	0.770	9.070	14.596
	s-sh7-12	11.94	11	NP	NP	5	0.84	SP- SM	8.288	0.054	0.630	8.306	14.551
	s-sh7-13	13.44	14	NP	NP	14	0.84	SM	6.894	0.035	0.519	6.909	14.532
	s-yh1-1	1.61	37	NP	NP	11	7.9	SP- SM	3.787	0.018	0.481	3.787	14.434
	s-yh1-2	3.13	4	NP	NP	9	0.27	SP- SM	5.186	0.025	0.474	5.194	14.399
YH-2	s-yh1-3	4.24	10	NP	NP	9	0.29	SP- SM	4.742	0.019	0.403	4.754	14.386
	s-yh1-4	5.67	8	NP	NP	10	0.23	SP- SM	7.087	0.032	0.458	7.074	14.375
	s-yh1-5	6.8	11	NP	NP	14	0.2	SP- SM	3.038	0.017	1.070	3.026	14.884

Table D.1 (cont.): Compiled Database used for this study

Pair Name	Boring Name	Depth (m)	N ₆₀	LL	PI	%FC	D ₅₀ (mm)	USCS	q _c (MPa)	f _s (MPa)	R _f	q _t (MPa)	R
VII 2	s-yh1-7	9.25	3	41	21	77	0.017	CL	0.686	0.021	3.104	0.693	15.332
111-2	s-yh1-8	9.97		43	24	72	0.018	CL	0.785	0.021	2.635	0.823	15.506
	s-yh3-1	3	7	NP	NP	16	0.2	SM	2.529	0.032	1.210	2.522	14.873
	s-yh3-2	3.68	12	NP	NP	11	0.26	SM SP- SM	3.128	0.011	0.361	3.120	14.427
	s-yh3-3	4.76	9	NP	NP	10	0.25	SP- SM	4.952	0.016	0.324	4.947	14.307
	s-yh3-4	5.65	12	NP	NP	11	0.23	SM	5.320	0.014	0.268	5.328	14.237
YH-1	s-yh3-5	6.68	14	NP	NP	17	0.18	SM	5.656	0.015	0.271	5.666	14.244
	s-yh3-6	7.72	12	NP	NP	33	0.1	SM	5.505	0.026	0.471	5.495	14.473
	s-yh3-7	8.71	5	31	19	56	0.074	CL	2.030	0.027	1.496	2.019	15.497
	s-yh3-8	9.65		35	17	90	0.026	CL	0.985	0.014	1.479	1.004	15.263
	s-yh3-9	10.64		36	18	80	0.028	CL	0.821	0.016	1.996	0.874	15.138
	tsk1-1	1.8	5	34	8	89.9		ML	3.068	0.037	1.480	3.068	15.079
	tsk1-10	15.3	27	39	12	86.9		ML	1.297	0.045	3.462	1.297	15.558
TD-1	tsk1-11	16.8	23	36	11	90		ML	1.362	0.047	3.445	1.362	15.193
	tsk1-12	18.3	28	52	25	99.8		СН	1.703	0.058	3.392	1.703	15.669
	tsk1-3	4.8	7	33	9	87		ML	4.103	0.071	2.310	4.103	14.610

Table D.1 (cont.): Compiled Database used for this study

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