AN EXPERIMENTAL INVESTIGATION OF THE BEHAVIOR OF COMPACTED CLAY/SAND MIXTURES

by

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ABSTRACT

Compacted clay/sand mixtures can be used as engineered fills when constructing earthen levees or embankment dams. They are also a design option available to engineers that are constructing liner systems or other types of impervious buffer zones for waste disposal projects. For geotechnical engineers that are designing these types of engineered fill systems, it is useful to have an understanding of the engineering behavior of these mixtures as a function of the soil mixture and compaction process that is utilized. This study investigated the effects of various soil mixtures and compaction conditions on the strength and compressibility characteristics of compacted clay/sand mixtures. The factors investigated include the: clay mineral type, clay content, dry unit weight, compaction moisture content, and compaction energy. To simulate the field compaction process, representative Proctor specimens were prepared for each of the clay/sand mixtures at low, standard, and modified Proctor compaction energy levels. Unconsolidated-undrained triaxial strength tests were conducted at various confining pressures on test specimens prepared from each of the compacted Proctor specimens. One dimensional compression tests were also performed on test specimens prepared from each of the compacted Proctor specimens, to determine the compressibility behavior of each of the compacted soil mixtures.

The experimental findings showed that the undrained strength of samples compacted at the same energy level decreased with increasing compaction moisture

content. Additionally, the undrained strength increased with increasing confining pressure and compaction energy. The results also indicated that the angles of shearing resistance increased with decreasing moisture content, and were largest for specimens compacted at a very low water content with high compaction energy. The values of the cohesion intercept increased with increasing dry density, clay content, and plasticity of the clay fraction. Due to their differences in soil mineral characteristics and as-compacted soil fabric, kaolinite/sand mixtures exhibited higher ϕ values and lower c values than bentonite/sand mixtures at the same water content relative to the optimum water content. The values of Young's modulus measured in the triaxial test at 50% of the strength increased with clay content and were higher for dry-of-optimum specimens. The compression test results further showed that a large percentage of compression occurred tended to occur within the first minute of loading. The compaction moisture content was found to have a more significant effect on a given mixture's compressibility behavior for samples having a high clay content.

Chapter 1

INTRODUCTION

Compacted clay/sand mixtures are currently used as engineered fills when constructing earthen levees or embankment dams (e.g., Fukue et al. 1986). For larger embankment dams, their use is typically confined to construction of a low permeability dam core, which is often used in conjunction with an engineered soil filter (e.g., Jafari and Shafiee 2004). It is also feasible to use a mixture of highly plastic clay (e.g., bentonite) with sand to construct liner systems or other types of impervious buffer zones for waste disposal projects (e.g., Chapuis 1990). In these cases, the undrained shear strength and compressibility behavior of the engineered clay/sand mixtures are dependent upon the soil compaction process. For geotechnical engineers that are designing these types of engineered fill systems, it is useful to have an understanding of the undrained shear strength and compressibility behavior of these mixtures as a function of the compaction process and compaction energy that is used. A review of past studies has revealed that the majority of previous research in this area has focused on the behavior of pure sands or clays, while research on clay/sand mixtures has been very limited.

This particular study investigated the "short-term" laboratory undrained shear strength and compressibility characteristics of laboratory-compacted clay/sand mixtures. The "short-term" refers to the characteristics of the fill material that are present immediately after compaction, before environmental factors have an opportunity to alter the as-compacted condition of the soil. Two types of clay were studied to investigate the effect of different clay mineralogy: sodium bentonite and pulverized kaolin. Test samples were prepared by mixing Ottawa sand with clay at different clay proportions (15%, 25% and 50%). A laboratory impact compaction approach (Proctor-type compaction) was utilized to create larger samples, with compaction efforts being varied to achieve three distinct energy levels. The resulting Proctor samples were extruded and trimmed to create triaxial test specimens and oedometer test specimens. The as-compacted strength of each of the clay/sand mixtures was measured using unconsolidated-undrained triaxial tests that employed three levels of confining pressure to simulate a variety of embankment heights. The as-compacted compressibility characteristics of each of the clay/sand mixtures was measured using a series of one-dimensional incremental compression tests.

The ultimate purpose of this research was to obtain data which can be used by engineers to predict the compaction properties, laboratory undrained shear strength and compressibility characteristics of partially saturated compacted clay/sand mixtures at different compaction conditions (i.e. compaction energy, molding water content). This will make it easier for engineers to better design earthern levees, embankment dams, and containment barrier systems that utilize these mixtures in their construction. The "low energy" test results provide a useful indicator about the effect of under-compaction on the associated strength and compressibility behavior of a compacted soil. And finally, the test results that are presented herein also provide useful insight into the fundamental principles of soil behavior that affect the mechanical behavior of clay/sand mixtures.

Chapter 2

LITERATURE REVIEW

The objective of this chapter is to summarize and synthesize the arguments and ideas presented by previous researchers on the strength, stress-strain, and compressibility characteristics of compacted unsaturated soils. To understand these engineering properties of soil, a knowledge of the major factor affecting them, the fabric of compacted soil, is required. Accordingly, this literature review will have a significant focus on the fabric of partially saturated compacted soils.

In the subsequent sections, the following categories of previous research are discussed:

- The fabric of compacted fine-grained soil and granular soil
- Unconsolidated-undrained strength of compacted clays
- Stress-strain characteristics of compacted clays
- Compressibility characteristics of compacted clays

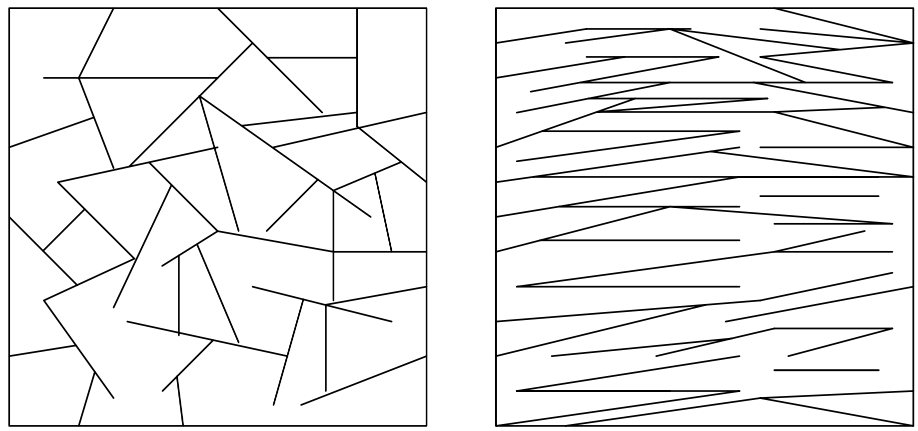
2.1 The Fabric of Compacted Fine-Grained Soil and Coarse-Grained Soil

2.1.1 Fine-Grained Soil Fabric

"Fine-grained" soil particles are generally characterized as those being finer than 0.075 mm (e.g., ASTM D422-63; Holtz and Kovacs, 1981). Fine-grained soils are those soil mixtures where 50% or more of the particles (by dry mass) in a given sample are finer than 0.075 mm. Typically, the fine-grained portion of a soil mixture is comprised of both silt- and clay-sized particles. The relative cutoff between these two particle-size ranges is commonly referred to as the *clay fraction*, which is often assumed to be either a particle size of 0.005 mm (ASTM D422-63) or a particle size of 0.002 mm (Taylor, 1948). This cutoff in particle size is somewhat arbitrary, as the behavior of clay particles is more appropriately associated with their plasticity (Holtz and Kovacs, 1981).

The interaction between coarse grained, or "granular" soil particles is controlled by the forces that are applied at the particle-to-particle contacts. In contrast, clay particles are small enough that their behavior is significantly affected by the molecular-level interactions that occur between individual particles. When examining the molecular structure of an individual clay particle, it can be observed that clay particles have a negatively charged surface. When in contact with water, positive cations (normally Na^+ together with their molecules of hydration water) are attracted onto this surface (Mitchell, 1976). Clay particles are then surrounded by a hydrosphere of adsorbed water, which contains soluble cations of different charges. These cations, called the exchangeable cations, balance the negative charges on the clay particles by forming a *diffuse double layer*. One effect of this diffuse double layer is that two clay particles will begin to repel each other when the double layer of each particle begins to overlap. In this way, the diffuse double layer controls both flocculation and dispersion. The smaller the clay particle size, the greater is the effect of the double layer.

One of the earliest theories of the arrangement of soil particles in a compacted clay soil was presented by Lambe (1958). This theory, often referred to as the Gouy-Chapman theory, was used to explain the different arrangements of clay particles that were believed to exist in compacted clays. For clay soils compacted dry of optimum, the relatively small amount of water that is present yields a high concentration of electrolytes, which prevents the full development of the double layer of ions surrounding each clay particle. This double layer depression results in a low inter particle repulsion, which thereby leads to a tendency towards a *flocculated* soil structure, which has a low degree of clay particle orientation (Fig. 2.1a). As the compaction water content approaches optimum, the electrolyte concentration is reduced, which causes an expansion of the double layer that increases the repulsive forces between particles and which also increases the degree of particle orientation. Wet of optimum, a sufficient amount of water exists to develop double layers with repulsive forces that are great enough to result in a *dispersed* soil structure, which has a high degree of clay particle orientation (Fig. 2.1b). It should be noted that these general behavioral observations were made based on samples that were compacted using a kneading-type compaction process in the Harvard miniature compaction apparatus (Wilson, 1950).



(a) Flocculated **(b) Dispersed**

Figure 2.1. Theoretical Clay Microstructure

Seed and Chan (1959) discussed the effect of soil structure in compacted clays on shrinkage, swelling, swell pressures, stress-deformation characteristics, undrained strength, pore-water pressures, and effective strength characteristics. The increase of water content from dry to wet of optimum was believed to play an important role in producing an increased degree of particle orientation and clay particle dispersion, which then had a significant effect on the associated clay behavior. More specifically, samples compacted dry of optimum (which tended to have more flocculated structures) exhibited less shrinkage, greater swelling tendency, greater swell pressures, and steeper stress-strain curves than samples of the same soil that were compacted wet of optimum (which tended to have more dispersed structures).

Seed and Chan (1959) showed that the influence of structure on the undrained strength of compacted clay soils depends on the deformation criterion that is adopted. For undrained strengths that are determined at low strains (e.g., 5%), the structure had a pronounced influence on the strength of compacted soils, with flocculated arrangements producing much higher strengths than dispersed arrangements. On the other hand, the structure had little or no influence on soil strength if a large strain failure criterion was used (e.g., 20 %). It should be noted that although soil structure may have a profound effect on the measured undrained strength, it appears to have almost no influence if the soil strength characteristics are instead determined in terms of effective stresses.

Seed and Chan (1959) conducted further tests on natural clay soils, validating the behavior proposed by Lambe's (1958) hypothesis on a wider array of clay soils. They also extended Lambe's hypothesis to encompass compaction methods which involved varying shear strains in the compaction process, including kneading compaction, impact compaction, vibratory compaction, and static compaction. For compacted clay soils, the shear strains that are applied during compaction were found to have a profound effect on the initial structure of the compacted soil, and its associated engineering behavior. For samples compacted dry of optimum, all of the aforementioned compaction methods produced no appreciable shear deformation in the soil, and consequently resulted in similar soil structures. Thus, the method of compaction had little effect on the strength of samples that were compacted dry of optimum.

For those samples that were compacted wet of optimum, the influence of the method of compaction was considerable. Those compaction methods which induced higher shearing strains during compaction produced a greater degree of dispersion and a higher degree of particle orientation. Therefore, for samples compacted at similar water contents and densities, those samples that were compacted wet of optimum using high strain-level compaction techniques (e.g., kneading compaction, impact compaction) exhibited more significant shrinkage and had lower undrained strengths than did those compaction methods which produced less shear deformation during compaction (e.g., vibratory compaction, static compaction). The effect of compaction method was more pronounced in the undrained strength test results if a small-strain failure criterion was used, and less if a large-strain failure criterion was used. When examining undrained strengths measured at small strain levels in the U-U triaxial test, it can be observed that the flocculated structure produced by low strain-level compaction techniques results in much higher strengths than the dispersed structure produced by high strain-level compaction techniques. However, for specimens subjected to shearing in the U-U triaxial test, the flocculated structure progressively changes to a dispersed arrangement as the strain level increases. As a result, at high strains in the U-U test, all samples at all water contents and densities had their fabrics reduced to a dispersed arrangement due to the shear strains that were applied. At high strains, only small differences were apparent for the undrained strengths that were measured in the U-U triaxial tests. Both initially flocculated samples and initially dispersed samples having the same compaction moisture content and initial dry density tended to exhibit approximately the same strength at high strain levels.

Compared to early studies in this area which used inferred or hypothesized mechanisms of behavior (e.g., Lambe, 1958; Seed and Chan, 1959), investigators in the 1960's and 1970's began to get a more accurate picture of the true structure of compacted soils through increasing use of electron microscopes. Sloane and Kell (1966) investigated the structure of compacted kaolin in a scanning electron microscope study. They found little or no oriented fabric of individual particles. Instead, the kaolin flakes were arranged into packets regardless of the compaction method that was used. Wet of optimum, impact and kneading compaction produced a fabric that consisted of trajectories of parallel packets. Wet of optimum, static compaction produced a fabric with packets oriented normal to the compaction axis. However, at molding water content below optimum, all compaction methods produced randomly oriented packets. An increase in the orientation of parallel packets was observed with increasing water content for all compaction methods.

Diamond (1971) examined the microstructures of impact-compacted kaolinite and illite clays (after drying) using X-ray orientation determinations and scanning electron microscopy. He found dried clay that was compacted dry of optimum exhibited a domain structure with adjacent domains that were largely separated by micrometer-size interdomain voids. These domains were randomly oriented and touched each other only at peripheral points. Wet of optimum, domains were indistinct and had few interdomain voids. However, unlike Sloane and Kell, he found that only a small degree of preferred orientation normal to the compaction axis existed for both dry and wet of optimum samples.

Mitchell (1993) stated that the large shear strains that are induced by the compaction rammer in impact compaction (e.g., Proctor compaction) have profound effects on the fabric that is formed in the resulting compacted fine-grained soil. The compaction method and water content are two major factors that affect the formation of the resulting compacted soil structure. If the compaction hammer, tamper, or piston does not produce appreciable shear deformation in the soil, which usually occurs when the soil is compacted dry of optimum, there may be a general alignment of particles or particle groups in the horizontal plane. If the soil is compacted wet of optimum, the hammer, tamper, or piston tends to penetrate the soil surface and produce larger shear strains, which leads to a greater alignment of particles along the failure surface. A folded or convoluted structure may result with repeated blows to the top of the soil layer.

2.1.2 Coarse-Grained Soil Fabric

Oda (1972a) defines the *fabric* of a granular soil as the spatial arrangement of particles and associated voids. In his study, Oda (1972a) investigated the spatial arrangement of granular particles using an optical microscope. Based on his test results, Oda made the following conclusions:

(1) The characteristics of the post-compaction fabric of granular materials (e.g., sand, gravel) are a function of both the shape of the individual grains in the matrix and the method of compaction.

(2) The initial fabric of a sand has important influences on its mechanical properties, such as mobilized strength, dilatancy rate, and secant deformation modulus at 50% strength.

(3) Sands which are composed of nonspheric particles have different fabric and mechanical anisotropy depending on the method of preparation.

In order to clarify the mechanism controlling the fabric reconstruction that occurs during the shear-induced deformation of a sand, Oda (1972b) performed a series of drained triaxial compression tests. He found that continuous reconstruction of the initial fabric occurs at increasing axial strain levels, which was attributed to both the sliding that occurs along unstable particle contacts among neighboring grain particles and the rotation of individual grains.

These more recent studies have illustrated the importance of a compacted soil's macrostructure, rather than its microstructure, in governing the resulting behavior of a compacted soil. For fine-grained soils in particular, the structure of particle groups is now considered more important than the fabric and structure that occurs at an individual particle level (e.g., Sloane and Kell, 1966; Diamond, 1971). Various authors have referred to these important collections of particles as domains, packets, or aggregates.

In general, the arrangement of these particle groups has been found by a variety of researchers to vary from dry to wet of optimum. Dry of optimum, the particle groups are distinct and relatively strong. There is a considerable quantity of void space between the particle groups (e.g., Diamond, 1971). As the compaction water content increases, the particle groups become weaker and more deformable. As a result, the particle groups distort and squeeze closer to each other. Wet of optimum, the particle groups become much less distinct and form a more homogeneous mass.

At a constant water content, increases in compactive effort also change the arrangement of particle groups. As the compaction energy increases, particle groups become more broken, deformable, and the quantity of large pores is reduced.

The arrangement of the particle groups, size and distribution of pores and the water content in these pores are useful in analyses of engineering properties of compacted soils. Thus, the above discussion will be useful in understanding and explaining the strength, compressibility and stress-strain behavior trends in the data that is presented later in this thesis.

2.2 Unconsolidated-Undrained Strength of Compacted Clays

Rutledege (1947) performed one of the first comprehensive surveys on the undrained strength of compacted clays using a series of unconsolidated-undrained (U-U) triaxial tests. He found that the major factors that influence the U-U strength of compacted soils were the compaction water content, dry density, and minor principal stress in the triaxial test. Rutledge's (1947) results lead to the following conclusions:

(1) The U-U strength of compacted clays decreased as the water content increased

(2) The U-U strength of compacted clays increased as the dry density increased

(3) The U-U strength of compacted clays increased as the minor principal stress increased, until the confining pressure became so high that the sample became fully saturated (or nearly fully saturated). This happened when the confining pressure was so high that the air in the sample voids dissolved in the water.

Holtz and Willard (1956) may have been the first to investigate the effect of gravel content on the shear strength of clayey gravel soils. They claimed that the angle of shearing resistance increased with the increasing gravel content, while at the same time the apparent cohesion decreased. The effect of the granular part of the mixture was predominant when the gravel fraction was greater than 50%.

Miller and Sowers (1957) used a series of U-U triaxial tests to investigate the effects of varying the proportions of coarse- and fine-grained soils on the strength of the resulting clay/sand mixtures. Various mixtures of clay (a low plasticity inorganic sandy clay) and sand were mixed ranging from 100 percent sand to 100 percent clay. The results revealed that the angle of shearing resistance stayed approximately the same until the fines content decreased to less than 33%. A sharp change occurred in the soil behavior for fines contents between 33% and 26%, where the angle of shearing resistance increased markedly and the cohesion decreased markedly.

Casagrande and Hirschfeld (1960, 1962) tested a silty clay soil compacted using kneading compaction to a constant dry unit weight, and reached a similar conclusion as Rutledge (1947). When the water content was very high and the sample was almost saturated, a small increment of additional pressure was all that was needed to dissolve the air in the pores. The failure envelope quickly became horizontal, and the ϕ approached zero. In this situation, further increases in confining pressure were taken up by the pore water and not the soil structure. As a result, the effective stress and strength stayed constant. For samples having a lower compaction water content, the failure envelope will continue to slope upward, as it is difficult to achieve 100% saturation, and significantly higher pressures are required compress the specimen voids enough to dissolve the air that is present in the specimen.

For samples that have a similar structure and compaction water content, undrained strength will increase with an increase in density (Seed and Chan, 1959). However, undrained strength may also decrease with increasing density at a constant water content, depending on the strength criterion that is adopted (Seed and Chan, 1959). Seed and Chan (1959) used a series of U-U triaxial compression tests on compacted (kneading) silty clay specimens to show that the undrained strength increased with increasing density if a failure criterion of 25% strain was adopted. On the other hand, if a failure criterion of 5% strain was utilized, the undrained strength increased with increasing density up to a point, and then decreased with further increases in density, as shown in Figure 2.2.

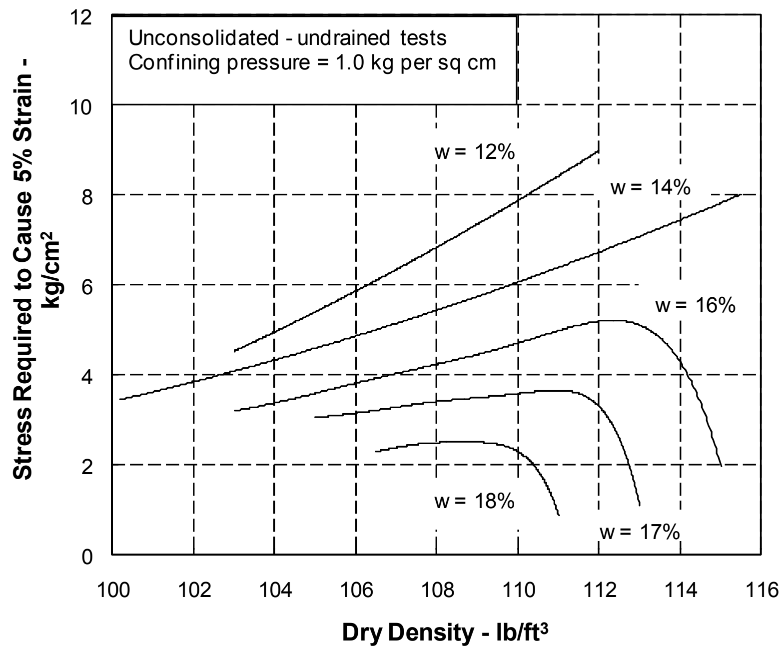


Figure 2.2. Relationship between Dry Density, Water Content, and Strength of a Compacted Silty Clay Specimen – Small Strain Failure Criterion Adopted (Developed after Seed and Chan, 1959)

Seed and Chan (1959) provided additional evidence on the importance of failure criterion. In their tests, kneading compaction was performed to prepare silty clay triaxial specimens, and the results from UU triaxial tests showed that the strength increased with density as long as the soil structure remained essentially the same, and as long as the undrained strength was determined at low strains. When significant changes in structure took place in the soil, the strength was significantly reduced despite the increase in density. However, if the undrained strength was determined at high strains, samples of silty clay having the same composition exhibited approximately equal strength whether the structure was flocculated or dispersed.

Consequently, for a given water content, the dry density and strength relationship showed no decrease in strength with increasing density (for strengths determined at high strain levels) (Figure 2.3). Seed and Chan pointed out that these behavioral observations likely do not apply to all soils. Some soils, such as a sandy clay, do not follow these considerations. In these soils, it is possible that the structure of the clay fraction that is compacted wet of optimum is considerably more dispersed than the structure of soil compacted dry of optimum. But the influence of the difference in structure is masked by other factors such as the high proportion of granular particles.

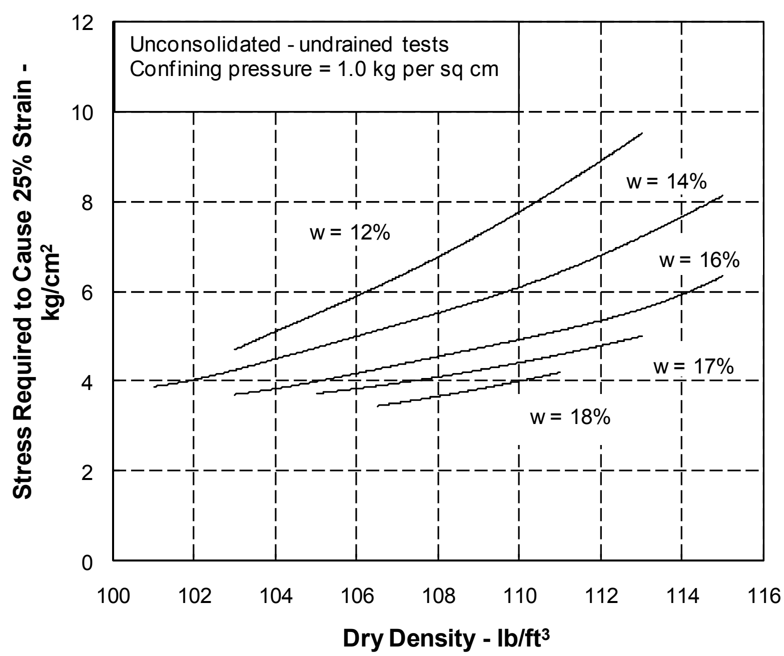


Figure 2.3. Relationship between Dry Density, Water Content, and Strength of a Compacted Silty Clay Specimen - Large Strain Failure Criterion Adopted (Developed from Seed and Chan, 1959)

Lee and Haley (1968) investigated the relative strength and deformation properties of a commercial kaolinite clay and a real silty clay compacted by kneading and static compaction. They found that in the U-U triaxial test, when samples were tested under very high confining pressures such as those that would be encountered in a high earth dam, even soils compacted at low water contents could become saturated. In general, all of the samples that were tested were observed to get stronger as the test confining pressure was increased, due to compression of the air voids. The samples that were compacted using static pressure were always stiffer and stronger than those samples that were compacted using kneading compaction. The samples that were compacted dry of optimum were stronger than samples of the same composition that were compacted wet of optimum.

Lambe (1961) and Olson and Langfelder (1965) showed the existence of highly negative pore water pressure in soils compacted dry of optimum. These negative pore water pressures would theoretically result in greater effective stress and hence greater strength. This explanation is typically given as the reason why dry of optimum samples are stronger than wet of optimum samples.

Yin (1999) examined the properties and behavior of Hong Kong marine deposits with different clay contents using a series of CU triaxial tests on compacted clay specimens. Test results indicated that the friction angle of Hong Kong marine deposits decreased with an increase in plasticity index. Young's modulus (E_{50}) values were observed to increase with increasing effective confining pressure, and decrease with increasing clay content.

2.3 Stress-Strain Characteristics of Compacted Clays

Seed and Chan (1959) used a series of UU triaxial tests to show the typical stress-strain behavior of silty clay specimens that had been prepared using kneading compaction. Samples having a higher water content, lower density, and dispersed soil structure tended to have a more "plastic" stress-strain behavior, typically reaching their ultimate strength at very high strains. On the dry side of optimum, as the compaction water content was decreased, the soil particles became more randomly oriented and the soil became more rigid. At very low water contents, the combined effect of randomly oriented soil particles and highly negative pore water pressures produced a steep stress-strain curve with very brittle characteristics. Similar results are seen in the stress-strain curves presented by Casagrande and Hirschfeld (1960, 1962). However, the stress-strain behavior is not the same for all compacted clay soils. Variations will depend on amount and type of clay proportion, dry unit weight, compaction method, water content and confining pressure (Seed and Chan, 1959).

Lee and Haley (1968) showed the stress-strain characteristics of a compacted kaolinite. They found that the wet of optimum kaolinite sample prepared by static compaction was considerably stronger, stiffer, and more brittle than the otherwise identical sample prepared by kneading compaction. Dry samples prepared by static compaction were considerably stronger and more brittle than the wet samples. The general shapes of the stress-strain curves for Higgins Clay (a real silty clay) were similar to those observed for the kaolinite specimens. The wet of optimum samples prepared by static compaction maintained their relatively high strength and brittleness compared to the wet samples prepared by kneading compaction. The samples prepared dry of optimum with static compaction were considerably stronger and more brittle than either of the wet samples. The samples with the flocculated structure exhibited relatively high strengths and brittle stress-strain characteristics. As the confining pressure increased, the samples compressed and became denser under the high pressure. This compression caused the air in the voids to become dissolved in the water, which in turn led to an increase in the degree of saturation, producing an increase in plasticity. Therefore, as the confining pressure increased, the flocculated samples lost some of their brittle stress-strain characteristics. The samples with a dispersed structure maintained their relatively low strengths and plastic stress-strain behavior at all confining pressures.

Daniel and Olson (1974) collected stress-strain data from more than 200 unconsolidated-undrained triaxial tests on specimens of three compacted clays and developed analytical expression for the stress-strain properties of these compacted soils. Their analyses of the stress-strain curves from tests showed that the initial tangent modulus was an exponential function of confining pressure.

Mitchell (1993) stated that stress-strain characteristics of different soils ranged from very brittle for some quick clays, cemented soils, heavily overconsolidated clays, and dense sands, to very plastic and ductile for insensitive and remolded clays and loose sands.

2.4 Compressibility Characteristics of Compacted Clays

It is difficult to define the fundamental relationships which govern the compressibility of compacted and/or unsaturated soils under load. As a result, unlike strength and stress-strain behavior, the compressibility of compacted and/or unsaturated soils has been covered in only a minimal fashion in the engineering literature.

Wilson (1952) investigated the effect of compaction water content on the compressibility of a compacted clayey sand. The results from his tests indicated that the wet of optimum samples were approximately 30 percent more compressible than the samples compacted dry of optimum. Wilson attributed this to the higher pore water pressures that are generated in the wet of optimum samples during loading. Based on this observation, Wilson recommended that cohesive highway embankments should be compacted dry of optimum, in order to obtain lower volume compressibility.

Using data obtained by Woodsum (1951), Leonards (1952) examined the compressibility of a highly plastic clay. He found that the compressibility of the clay was affected by the confining pressure that was applied prior to contact with water. However, this effect was minimized by using higher compaction energies. The data showed that a compacted sample wetted in the oedometer at a low confining pressure will compress more than a sample of the same composition that is confined and wetted at a higher pressure. In light of this, due to the lower confining pressure in the submerged condition, Leonards concluded that a change in water content resulting from the submergence of a compacted highway or airport pavement fill will be more severe than a corresponding change resulting from capillary action.

Lambe (1958) attributed the compressibility behavior of compacted clays in large part to the particle rearrangement that occurs under application of a load. When the consolidation pressure was relatively low, for dry of optimum samples, more pressure was required to reorient the particles of the flocculated structure. Therefore, the compression that occurs will be greater for a wet of optimum sample during the load increment. On the other hand, for larger consolidation pressures, a dry of optimum sample will compress more due to particle reorientation and void collapse. However, when the particles in a compacted clay matrix are highly dispersed, the dry of optimum sample will experience essentially the same compression as the wet of optimum sample.

Wahls, et al (1966) summarized all the conclusions concerning the compressibility of compacted soils made by former researchers. They stated that the soil type was undoubtedly one of the major factors influencing the compressibility characteristics of a compacted soil, but additional factors such as the compaction method, molding water content, and degree of saturation also had significant effects on the compressibility characteristics.

Hodek and Lovell (1978) presented convincing evidence of a strong relationship between pore size distribution and the compressibility characteristics of a compacted clayey soil. They concluded that the dry of optimum samples consisted mostly of large pores. The clay aggregates in the samples compacted dry of optimum were typically observed to be shrunken, stiff, and brittle. However, in the wet of optimum samples, there were few large pores and many small ones. The clay aggregates in the wet of optimum samples were swollen, weak, and plastic. Therefore, the dry of optimum samples were more brittle, compressing just a little under low load pressures and a great amount under high load pressures. On the other hand, the wet of optimum samples showed opposite compressibility behavior, compressing more under low load pressures and less amount under high load pressures, as compared to the dry of optimum samples. This behavior was believed to be caused by the lack of large voids in the wet of optimum ssamples.

Shroff and Shah (2003) stated that the flocculated structure developed on the dry side of optimum in compacted clays offers greater resistance to compression than the dispersed structure formed on the wet side. Consequently, soils on the wet side of optimum are generally more compressible. In general, the methods of compaction that have been utilized by various researchers to prepare the specimens have been shown to have a significant effect on the compressibility behavior. Methods which generate higher shear strains during compaction, such as kneading or impact compaction, produce greater dispersion and a higher degree of particle orientation, which yields a corresponding increase in compressibility under load. For those cases where the compaction rammer causes very large penetration deformations during compaction, the specimen compressibility tends to increase, which is believed to be caused by a breakdown of the soil's structure and a greater orientation of the particles during compaction.

Chapter 3

SOIL PROPERTIES AND SOIL PREPARATION TECHNIQUE

3.1 Soil Properties

3.1.1 Sand

The sand utilized in this study was Ottawa sand, which was purchased from ELE International, Inc. This sand conforms to the requirements for standard density testing sand outlined in ASTM D 1556-07, the Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method. To ensure that the sand that was used in this study remained consistent over time, sieve analysis tests were conducted on sand from each box of sand that was used (approximately every 22.7 kilograms), in general accordance with ASTM D 6913-04. Table 3.1 summarizes the results from these tests. The average coefficient of uniformity for this sand (C_u) is 1.97, and consequently this sand classifies as a poorly graded sand (SP) according to the Unified Soil Classification System (ASTM D 2487-06). Figure 3.1 presents the gradation distributions from each sieve test that was conducted on this sand, and it shows that the grain sizes of this sand are primarily in the range of "fine" to "medium" (0.075 mm < D < 2.0 mm). The specific gravity of this sand was measured as 2.65, in accordance with ASTM D 854-06. Detailed data sheets for the classification tests that were conducted on this sand can be found in Appendix A.

Table 3.1 Sieve Analysis Results from Tests Conducted on Ottawa Sand

Test No.	Percent Passing (%)							C_u	C_c
	Sieve No.								
	# 10	# 20	# 40	# 60	# 100	# 140	# 200		
1	100	100.0	26.5	0.9	0.2	0	0*	1.97	1.02
2	100	99.9	25.4	0.9	0.1	0*	0*	1.96	1.03
3	100	99.9	26.0	0.7	0.1	0.1	0.0	1.96	1.02
4	100	99.9	32.2	2.4	0.7	0.1	0.0	2.02	0.95
5	100	99.9	26.8	0.6	0.0	0.0	0.0	1.96	1.01
6	100	99.9	32.1	1.1	0.1	0.0	0.0	1.99	0.94
7	100	99.9	26.9	1.0	0.4	0.2	0.2	1.98	1.02
8	100	99.9	26.7	3.0	1.0	0.4	0.4	2.03	1.05
9	100	99.8	28.2	0.6	0*	0*	0*	1.97	0.99
10	100	99.7	25.2	0.6	0.0	0.0	0.0	1.96	1.03
11	100	99.9	24.2	0.2	0*	0*	0*	1.94	1.04
12	100	99.8	21.7	0.1	0.0	0.0	0	1.91	1.05
13	100	99.9	26.9	0.4	0.1	0.0	0	1.96	1.01
14	100	99.8	29.1	1.4	0.4	0.1	0	1.99	0.99
15	100	99.8	20.4	0.3	0.1	0.1	0.1	1.90	1.06
16	100	99.8	24.6	0.2	0.0	0.0	0	1.94	1.03
17	100	99.9	27.0	1.2	0.4	0.1	0.1	1.98	1.02
18	100	99.8	25.2	1.3	0.2	0.0	0	1.97	1.04
19	100	99.8	30.5	3.8	2.1	0.8	0.3	2.07	1.00
20	100	99.9	30.9	1.2	0.3	0.1	0*	1.99	0.96
Avg.	100	99.9	26.8	1.1	0.3	0.1	0.1	1.97	1.01
Stnd. Dev.	0.00	0.07	3.09	0.96	0.50	0.19	0.11	0.04	0.03

*Note: Small negative values of percent passing (e.g., -0.1 %) that are shown in the raw data sheets were caused by small +/- errors in balance measurements. During the analysis of the raw measured data, any small negative balances were zeroed prior to reporting in Table 3.1, as they are unrealistic measurements in a test of this type, and reflect a clear testing error.

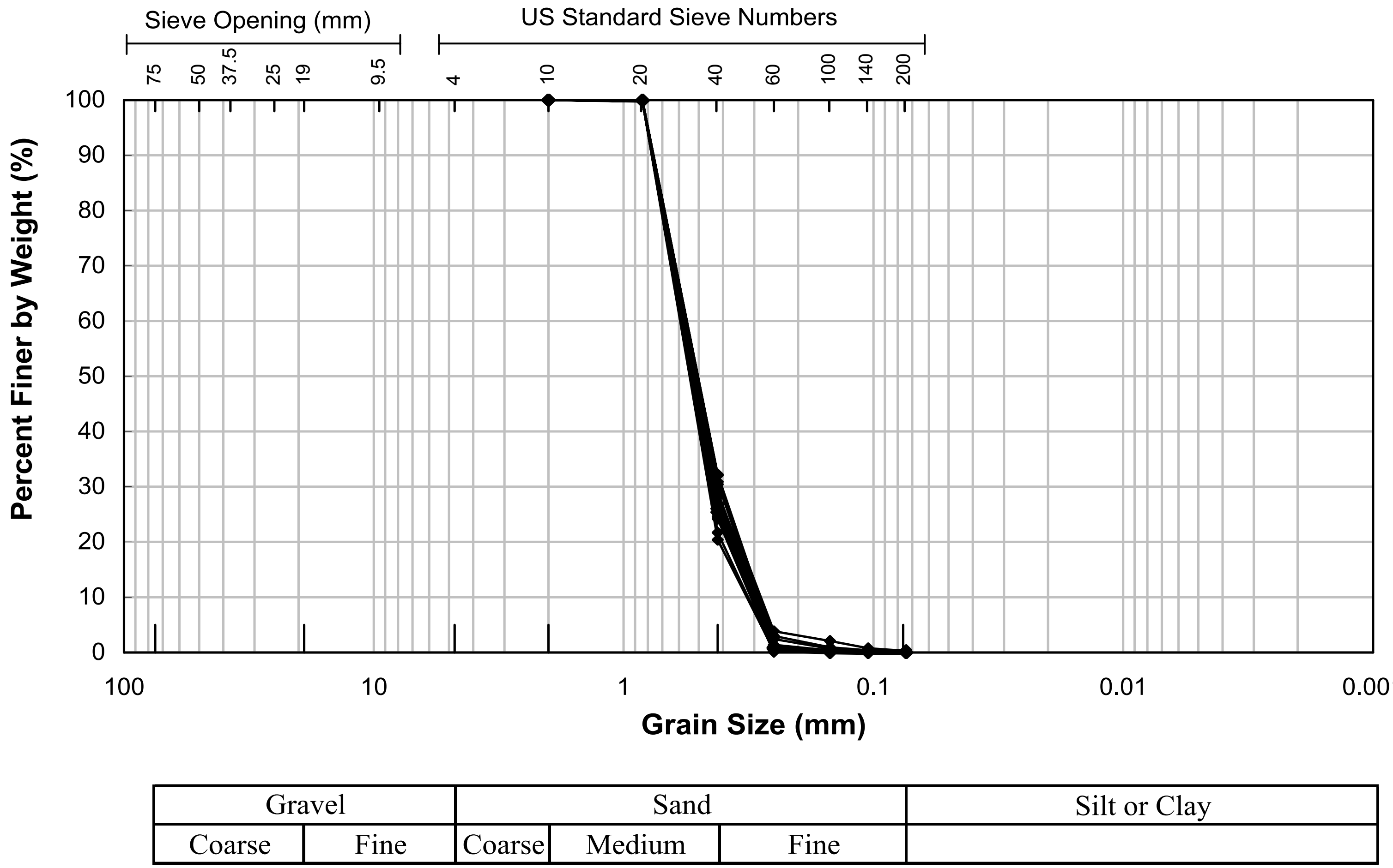


Figure 3.1. Grain Size Distributions of Ottawa Sand.

3.1.2 Clays

Two types of clays were used in this study, bentonite and kaolinite. The bentonite was General Purpose Granular sodium bentonite (GPG 30) from American Colloid Company, of Skokie, Illinois. The Kaolinite was Pulverized Kaolin, C.A.S No. 1332-58-7, Manufactured by the Feldspar Corporation in Edgar, Florida. The initial water content is about 7% for the air-dried bentonite, and is about 1% for the air-dried kaolinite.

Prior to compaction, strength, and compressibility testing, the Atterberg limits and specific gravities of the pure bentonite, the pure kaolinite, and the sand/clay mixtures that were used in this study were determined. Table 3.2 lists the Atterberg limits of the pure clays and sand/clay mixtures, which were measured according to ASTM D4318-05, The Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. Complete data sheets for Atterberg limit test of each soil are given in Appendix B.

Table 3.2 Atterberg Limits of Clay/Sand Mixtures

Percent Clay in Mixture with Sand	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)
15% Bentonite	20	135	115
25% Bentonite	21	252	231
50% Bentonite	32	365	333
100% Bentonite	46	499	453
15% Kaolinite	12	20	8
25% Kaolinite	15	24	9
50% Kaolinite	24	39	15
100% Kaolinite	34	57	23

Figures 3.2 and 3.3 show the Atterberg limits plotted versus the percent clay in the soil mixtures. Figure 3.2 shows that as the proportion of bentonite in the mixture increased, the liquid limit (LL) increased drastically while the plastic limit (PL) increased very little. As a result, the plasticity index (PI), which is the difference between the liquid limit and plastic limit, increased quickly as the proportion of bentonite in the mixture increased. Figure 3.3 shows that as the proportion of kaolinite in the mixture increased the liquid limit (LL) and the plastic limit (PL) increased gradually.

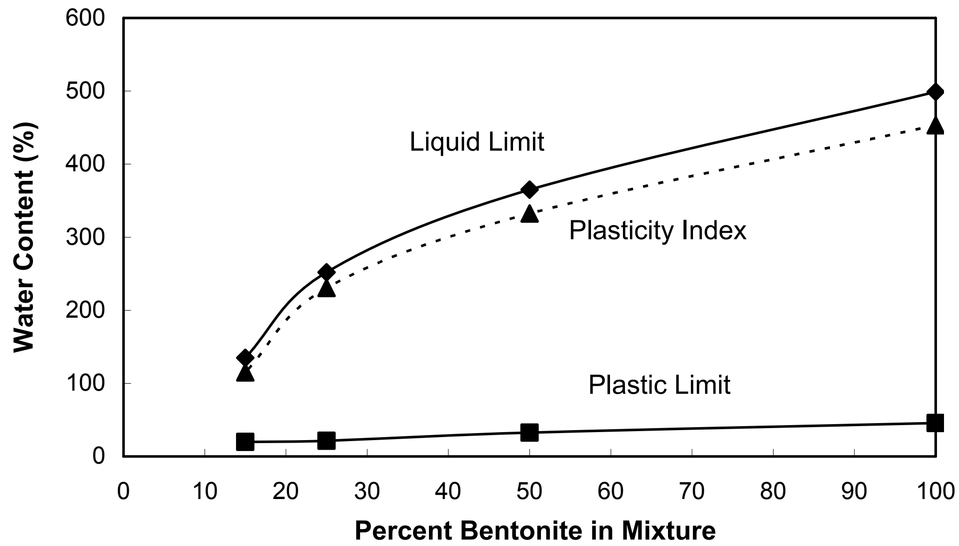


Figure 3.2. Liquid Limit, Plastic Limit, and Plasticity Index vs. % Bentonite.

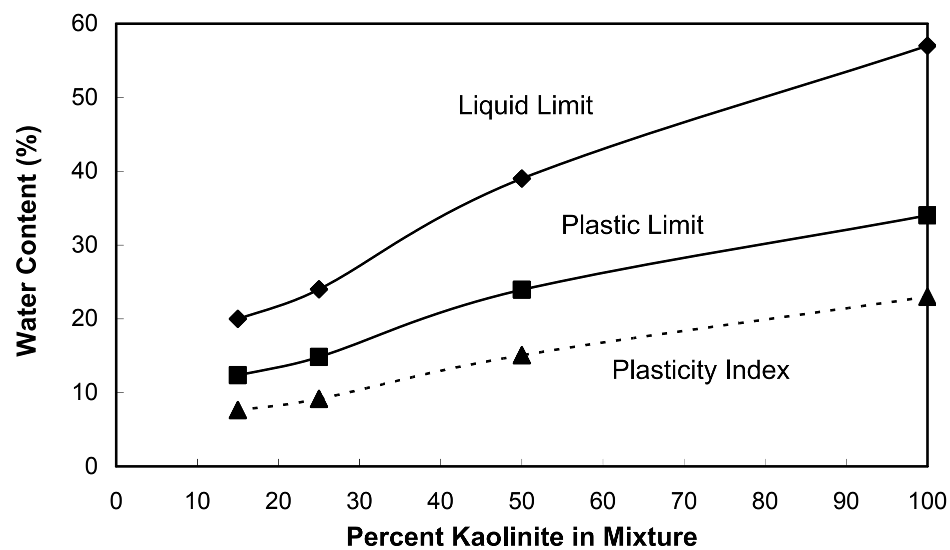


Figure 3.3. Liquid Limit, Plastic Limit, and Plasticity Index vs. % Kaolinite.

Table 3.3 lists the specific gravities for the sand and clays used in this study, which were determined using ASTM D 854-06, The Standard Test Method for Specific Gravity of Soil Solids by Water Pycnometer. Complete data sheets for specific gravity tests are given in Appendix C. The measured results for sand and kaolinite are near the values reported by Lambe and Whitman (1969), 2.65 for sand and 2.62-2.66 for kaolinite, respectively. The measured specific gravity of bentonite is within the range that has been reported by others: e.g., 2.5 (Daeman, 1997) to 2.74 (Akgun, 2006).

Table 3.3 Specific Gravities of Sand and Clay

Soil	Sand	Kaolinite	Bentonite
Specific Gravity	2.65	2.60	2.62

The specific gravities of the sand/clay mixtures used in this study, G_{ssc}, were calculated from the following equation:

$$G_{ssc} = \frac{\left(\frac{100}{\alpha}\right) G_{sc}}{1 + \left(\frac{100 - \alpha}{\alpha}\right)\left(\frac{G_{sc}}{G_{ss}}\right)} \tag{3.1}$$

where α is the clay content (in %, with numbers ranging from 0 to 100), G_{sc} is the specific gravity of clay, and G_{ss} is the specific gravity of sand. The derivation of Equation 3.1 is provided in Appendix D. The specific gravity of each sand/clay mixture calculated using Equation 3.1 is shown in Table 3.4. The specific gravity of soil mixtures were used for calculating the void ratio and degree of saturation of test specimens.

Table 3.4 Specific Gravity of Each Sand/Clay Mixture

Clay Content (%)	Clay Used for Mixture	
	Kaolinite	Bentonite
15	2.64	2.65
25	2.64	2.64
50	2.62	2.63

3.2 Soil Classification of Pure Clay and Sand/Clay Mixtures

The pure clay and sand/clay mixtures were classified according to the Unified Soil Classification System (USCS) using ASTM D 2487-06, The Standard for Classification of Soils for Engineering Purposes. The kaolinite used in this study classifies as an elastic silt (MH). These results are consistent with the classification reported by Richter (1991), who utilized the same kaolinite for an independent study. It should be noted that the USCS classification of "MH" includes soil types such as micaceous, diatomaceous, fine sandy and silty soils, elastic silts, clays and silty clays (Holtz and Kovacs, 1981). Therefore, although the classification of this soil is as an elastic *silt*, its behavior will be clay-like in nature, as it is comprised primarily of clay particles. The bentonite used in this study classifies as a fat clay (CH). The corresponding USCS classifications of the different sand/clay mixtures utilized in this study are listed in Table 3.5.

Table 3.5 Unified Soil Classifications

Clay Content (%)	Clay Used for Mixture	
	Kaolinite	Bentonite
100	MH (elastic silt)	CH (fat clay)
50	CL (sandy lean clay)	CH (sandy fat clay)
25	SM (silty sand)	SC (clayey sand)
15	SM (silty sand)	SC (clayey sand)

3.3 Soil Preparation Approach

In order to prepare specimens for compaction testing, the powdered clay was added to the dry sand and the resulting soil was mixed using a 12-quart Hobart Countertop Mixer, Model HL-120 (Figure 3.4). According to ASTM D 698-00, approximately 2.3 kg of soil were needed for each compaction test, and consequently this amount was prepared each time that a compaction test was performed (Figure 3.5). To ensure even distribution of the sand and clay particles, the soil was mixed in a dry state for 5 minutes using a stirring speed of 59 revolutions per minute.

Figure 3.4. Hobart's Legacy Countertop Mixer.

Figure 3.5. Mixing dry soil; (a) air-dried sand and bentonite, (b) with an empty bowl on the balance, press Re-Zero to zero the display, (c) as bentonite and sand is added to the bowl, the net weight is displayed, and (d) pouring the soil mixture into the mixer.

To prepare the soil specimens at the desired water content for each compaction test, it was necessary to adjust the water content of the sand/clay mixtures. The appropriate mass/volume of distilled water for each specimen was gradually added to the soil mixture using a squeeze bottle over the course of 5 minutes, while continuously mixing the soil at a mixer speed of 59 rpms. Figure 3.6 shows the procedure that was used to measure and add the distilled water. As hygroscopic water was retained in the pure clay minerals in their natural air-dried state, the amount of distilled water that was added to each "dry" soil mixture was calculated using the following equation:

$$M_w = M_t \times w_t - M_c \times w_c \tag{3.2}$$

where:

M_w = mass of water needed

M_t = mass of dry sand and clay

M_c = mass of clay

w_t = water content of soil mixture

w_c = water content of air - dried clay

The air-dried water contents of the clays that were used in this study were measured as 7 % for the bentonite and 1 % for the kaolinite, under ambient air conditions in the University of Delaware geotechnical laboratory.

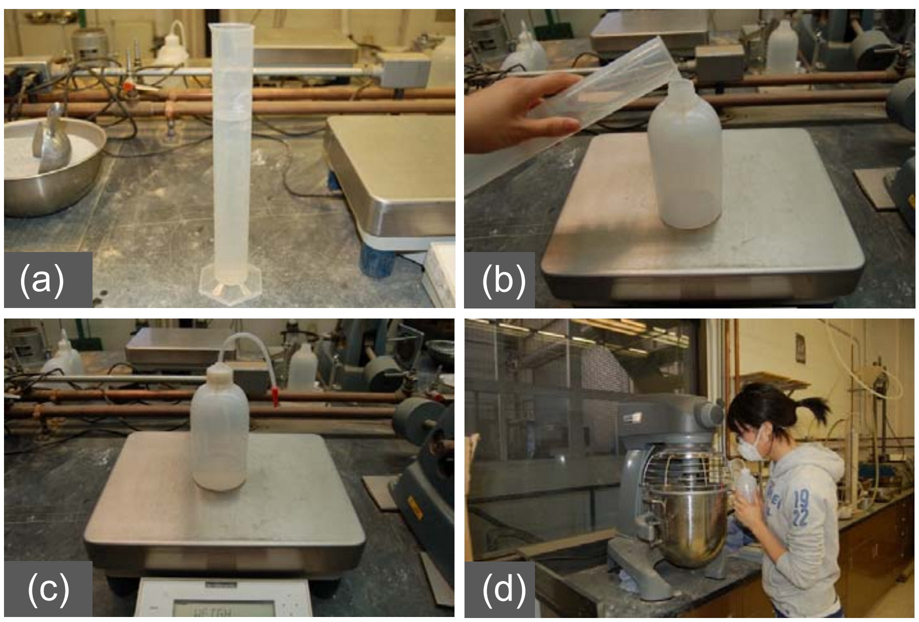


Figure 3.6. Adding distilled water; (a) measuring water with a graduated cylinder, (b) transferring water to a squeeze bottle, (c) measuring the exact weight of distilled water, and (d) squeezing water into the soil mixture.

For mixtures containing high clay contents (e.g., 50%), the clay minerals have the tendency to aggregate during mixing, as shown in Figure 3.7. When this behavior was observed, a mortar and pestle were utilized to grind the aggregates to ensure a more uniform mixture (Figure 3.8). The grinding process was performed as quickly as possible to minimize the possibility of a change in water content of the soil during the grinding process. Figure 3.9 shows the appearance of a typical sand/clay mixture after grinding.

Figure 3.7. Soil Aggregate in Mixture with 50% Kaolinite.

Figure 3.8. Soil Aggregate Grinding.

Figure 3.9. Appearance of Sand/Clay Mixture after Grinding.

Upon completion of the mixture preparation process, each specimen was manually mixed one final time to ensure even distribution of water throughout and then placed in an airtight container and allowed to stand for more than 16 hours to more evenly distribute the water in the clay (in accordance with the recommendations made by ASTM D 698-00).

Chapter 4

COMPACTION TESTING OF CLAY/SAND MIXTURES

4.1 Compaction Tests on Clay/Sand Mixtures

The laboratory tests described in this chapter were conducted to measure the maximum dry unit weight ($\gamma_{d,max}$) and optimum water content (w_{opt}) of different clay/sand mixtures that were subjected to specific compactive efforts. The results from these tests are also useful for determining the relationship between the compaction water content and the resulting dry unit weight of the clay/sand mixtures that were tested. To investigate the influence of different compactive efforts, three compaction energy levels were chosen.

The highest compactive effort that was applied corresponded to that imposed by the modified Proctor (MP) compaction test (ASTM D1557-07), Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort. Following this test procedure, the soil was compacted into a 102 mm (4 in.) diameter mold in five equal layers with each layer receiving 25 blows from a 44.5 N (10.0 lbf.) rammer dropped from a height of 457 mm (18 in.). The total compaction energy that is applied during a modified Proctor compaction test is 2,700 kN-m/m^3. Figure 4.1 is a photograph of the laboratory equipment required for conducting a modified Proctor test.

Figure 4.1. Modified Proctor Test Equipment

The intermediate compactive effort that was applied corresponded to that imposed by the standard Proctor (SP) compaction test (ASTM D698-00), Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort. Following this test procedure, the soil was compacted into a 102 mm (4 in.) diameter mold in three equal layers with each layer receiving 25 blows from a 24.4 N (5.5 lbf.) rammer dropped from a height of 305 mm (12 in.). The total compaction energy that is applied during a modified Proctor compaction test is 600 kN-m/m^3. Figure 4.2 is a photograph of the laboratory equipment required for conducting a standard Proctor test.

Figure 4.2. Standard Proctor Test Equipment

The lowest compactive effort that was applied corresponded to that imposed by a “low-energy” (LE) compaction test procedure that was performed following the general approach utilized by the standard Proctor compaction test (the same mold, hammer and procedure) with only fifteen blows on each of the three layers (e.g., the same procedure that was followed by Daniel & Benson, 1990). The total compaction energy that is applied during this type of low-energy compaction test is 360 kN-m/m^3. This “low energy” Proctor procedure is the same as the 15-blow compaction test described by the U.S. Army Corps of Engineers (1970). It is possible that on many projects, soil will be compacted at some locations in the field with energy levels that are less than those applied during the standard Proctor test. This low energy compaction test is expected to simulate poor quality compaction procedures that can occur in the field.

The test specifications for each energy level are summarized in Table 4.1.

Table 4.1 Specifications for Proctor Tests

Test Series	Diameter of Mold	Height of Hammer Drop	Number of Layers	Weight of Hammer	Number of Blows per Layer	Compaction Energy
	mm/in.	mm/in.		N/lbf.		kN-m/m^3
Modified Proctor	102/4	457/18	5	44.5/10	25	2,700
Standard Proctor	102/4	305/12	3	24.4/5.5	25	600
Low Energy Proctor	102/4	305/12	3	24.4/5.5	15	360

As discussed in Chapter 3, tests were conducted on prepared clay/sand mixtures having both bentonite and kaolinite as the clay mineral in the mixture. For each type of clay, soil samples with clay contents of 15%, 25%, and 50% were prepared and tested to examine the effect of clay content on the mixtures' compaction characteristics. For each clay/sand mixture (for both clay mineral types), a number of compaction test specimens (varying between 5 and 13) were prepared over a range of water contents from 4% dry of optimum to 4% wet of optimum at each energy level. Complete data sheets for Proctor compaction test of each specimen are given in Appendix E.

As the resulting matrix of test specimens was quite large, each sample was assigned an identification name for tracking purposes; each of these names provides useful information about each test specimen and its corresponding compaction conditions. Firstly, each sample was assigned a letter to signify at which energy level it was compacted: M, S, and L stood for modified Proctor, standard Proctor, and low energy Proctor respectively. Next, a number (15, 25, or 50) was then assigned to indicate the clay proportion in the soil mixture. Lastly, a K or B was assigned to signify which kind of clay was tested.

4.1.1 Compaction test results for kaolinite/sand mixtures

The dry unit weight-water content relationships for the kaolinite/sand mixtures are presented in Figures 4.3 and 4.4. In addition, each of these figures shows 60, 80, and 100% saturation curves, which were drawn using the average value of the specific gravity of the three kaolinite/sand mixtures (2.63). The compaction curves that are shown, as well as the maximum dry unit weight [$\gamma_{d,max}$ (kN/m^3)] and optimum water content [w_{opt} (%)] values for the data set of compaction curves, were determined by regression of the measured data with a third-order polynomial equation of the following form (Howell et al., 1997):

$$\gamma_{d,\max} = Aw_c^3 + Bw_c^2 + Cw_c + D \quad (4.1)$$

The values of the degree of saturation (S_r) at $\gamma_{d,max}$ and w_{opt} of almost all the kaolinite/sand mixtures are in the 60-90% range.

Figure 4.3 shows the effect of compaction energy on the compaction characteristics for mixtures containing the same proportion of kaolinite. As expected, for the same soil mixture, the maximum dry unit weight increased and the optimum water content decreased as the compaction energy was increased.

Figure 4.4 was prepared using the same compaction test results, to show the influence of kaolinite content on the compaction characteristics. The compaction data indicate that for samples compacted at the same energy level, the maximum dry unit weight increased first as the kaolinite content increased from 15% to 25%, and then decreased as the kaolinite content increased to 50%. However, the optimum water content increased continuously as the clay fraction increased.

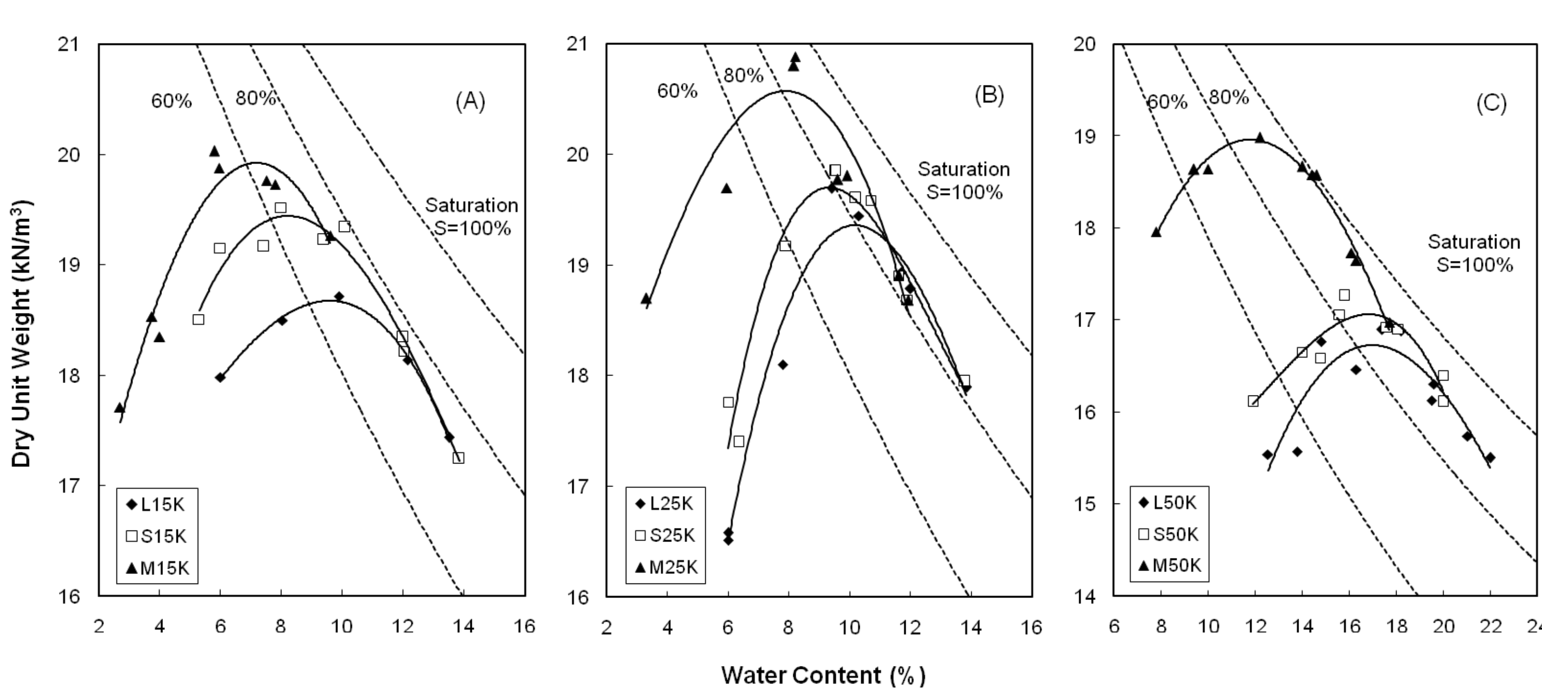


Figure 4.3. Compaction Curves of Kaolinite/Sand Mixtures (A) 15% Kaolinite, (B) 25% Kaolinite, (C) 50% Kaolinite

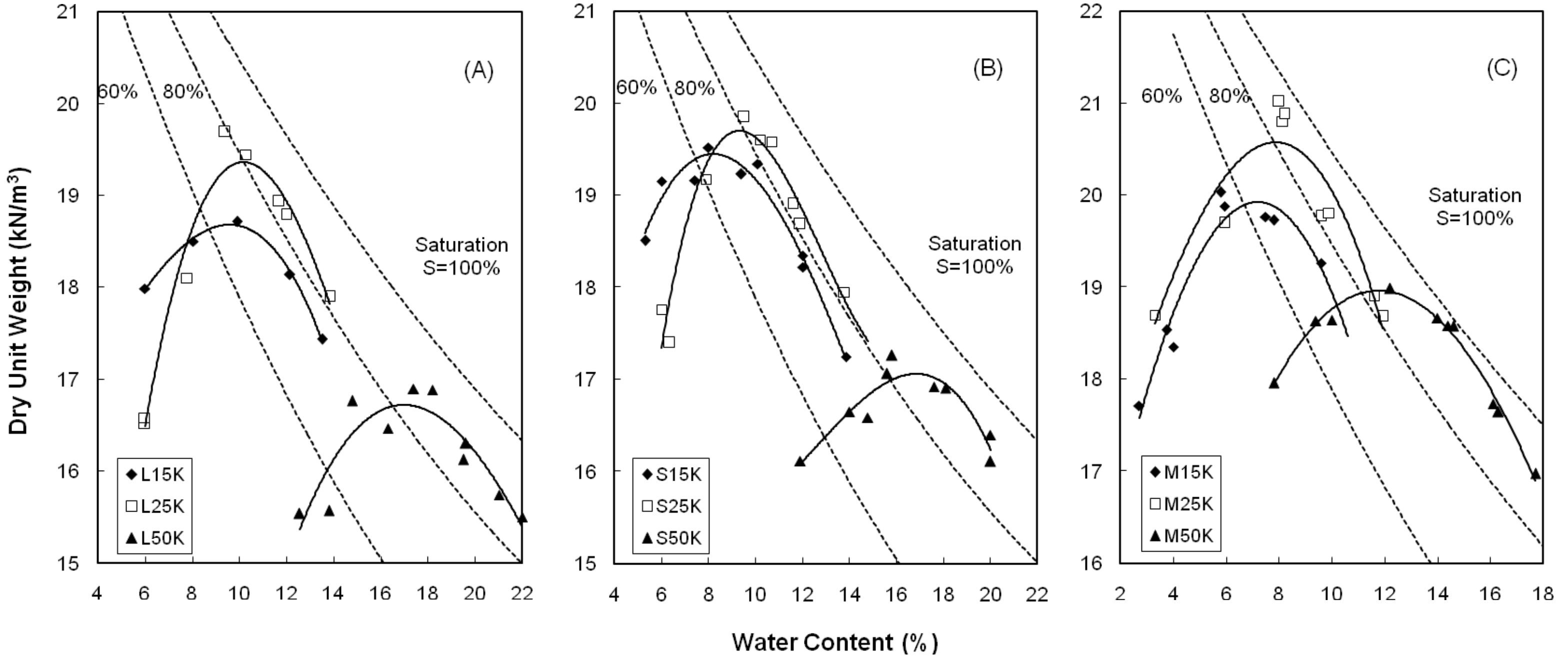


Figure 4.4. Compaction Curves of Kaolinite/Sand Mixtures (A) Low Energy Proctor, (B) Standard Proctor, (C) Modified Proctor

The optimum water contents and corresponding maximum dry unit weights that were determined for each of the kaolinite/sand mixtures that were tested are summarized in Table 4.2.

Table 4.2 Soil Properties of Kaolinite/Sand Mixtures

Kaolinite Content (%)	Low Energy Proctor		Standard Proctor		Modified Proctor	
	w_{opt} (%)	$\gamma_{d,\max}$ (kN/m^3)	w_{opt} (%)	$\gamma_{d,\max}$ (kN/m^3)	w_{opt} (%)	$\gamma_{d,\max}$ (kN/m^3)
15	9.6	18.7	8.2	19.4	7.2	19.9
25	10.2	19.4	9.3	19.7	7.9	20.6
50	17	16.7	16.8	17.1	11.8	19

Figure 4.5 is a semi-log plot that shows the relationship between the maximum dry unit weight and the compaction energy that is associated with each of the compaction tests shown in Table 4.2. Logarithmic regression analysis yielded an excellent fit with the measured data, with the coefficients of determination (R^2 values) ranging from 0.87 to 1, with an average of 0.95. The semi-log regression line of the mixture containing 25% kaolinite is above the 15% kaolinite line, which in turn is above the 50% kaolinite line. It means that as the kaolinite content increased from 15% to 25%, the maximum dry unit weight of the soil mixture first increased and then decreased as the kaolinite content increased to 50% by weight. The mixture with 25% kaolinite content has the largest maximum dry unit weight. As expected, for the same soil mixture, the maximum dry unit weight increased with increasing compaction

effort. For specimens compacted using the low energy Proctor method, the difference between specimens with high kaolinite content and specimen with lower kaolinite content is quite large. However, this difference became smaller as the compactive effort was increased. In other words, a high compactive effort reduces the difference in maximum dry unit weight between mixtures of varying kaolinite content.

In a similar fashion, Figure 4.6 shows the semi-log relationship between the optimum water content and the compaction energy that is associated with each compaction test. Logarithmic regression analysis yielded equations with R^2 values ranging from 0.87 to 0.98, with an average of 0.93. As expected, the optimum water content increases as the kaolinite content is increased. It also decreases as the compactive effort is increased.

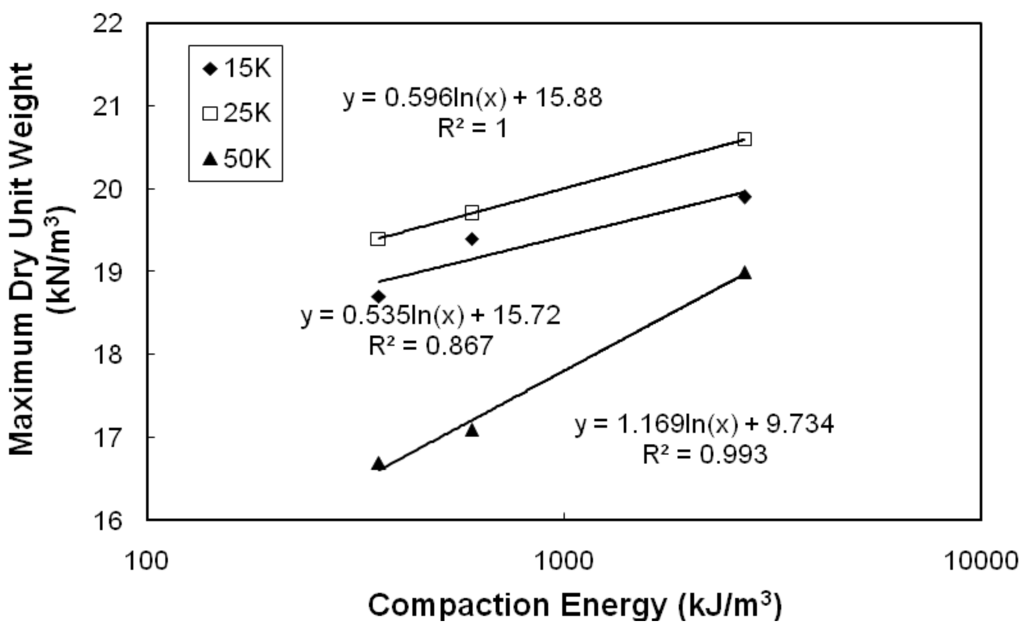


Figure 4.5. Semi-log relationships between $\gamma_{d, max}$ and *E* (kaolinite/sand mixtures)

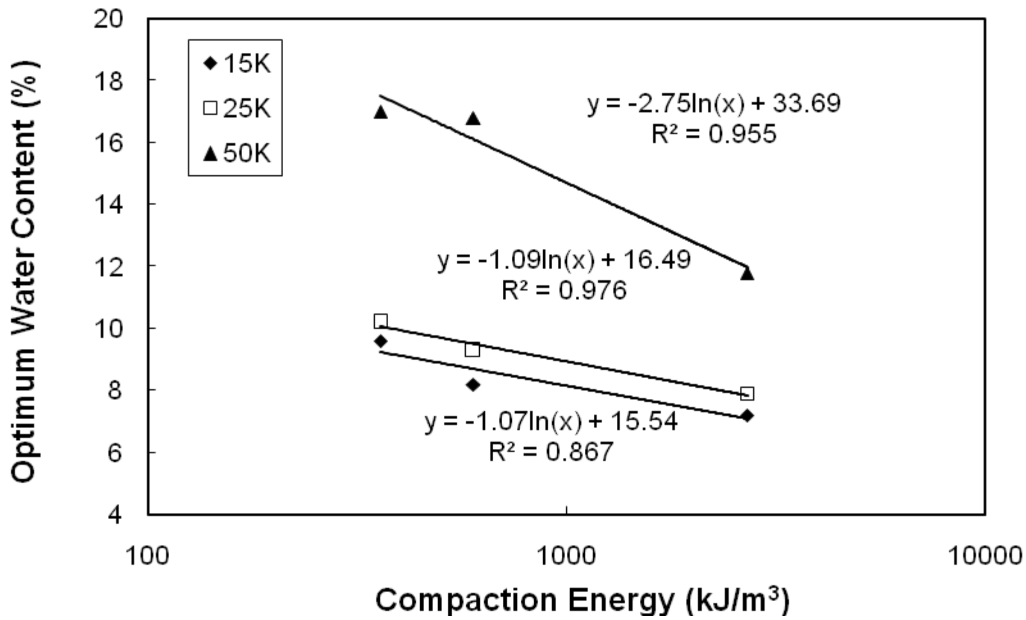


Figure 4.6. Semi-log relationships between w_{opt} and E (kaolinite/sand mixtures)

4.1.2 Compaction Test Results for Bentonite/Sand Mixtures

Figure 4.7 shows the dry unit weight-water content relationships for the bentonite/sand mixtures, together with 60, 80, and 100% saturation curves. These saturation curves were drawn using the average value of the specific gravity of the three bentonite/sand mixtures (2.64). As mentioned previously, the compaction curves were drawn by curve fitting a third-order polynomial to each data set. The values of the degree of saturation (S_r) at $\gamma_{d,max}$ and w_{opt} of all the bentonite/sand mixtures are in the 70-85% range. These results are in good agreement with the results shown in Ito (2008). Figure 4.7 shows the effect of compaction energy on the compaction characteristics for mixtures containing the same proportion of bentonite.

For the same soil mixture, the maximum dry unit weight increased and the optimum water content decreased as the compaction energy was increased.

Figure 4.8 was prepared using the same compaction test results, to show the influence of bentonite content for mixtures compacted with the same compaction energy. The compaction data indicate that for samples compacted at the same energy level, the dry unit weight decreased and the optimum water content increased as the percentage of bentonite in the mixtures increased.

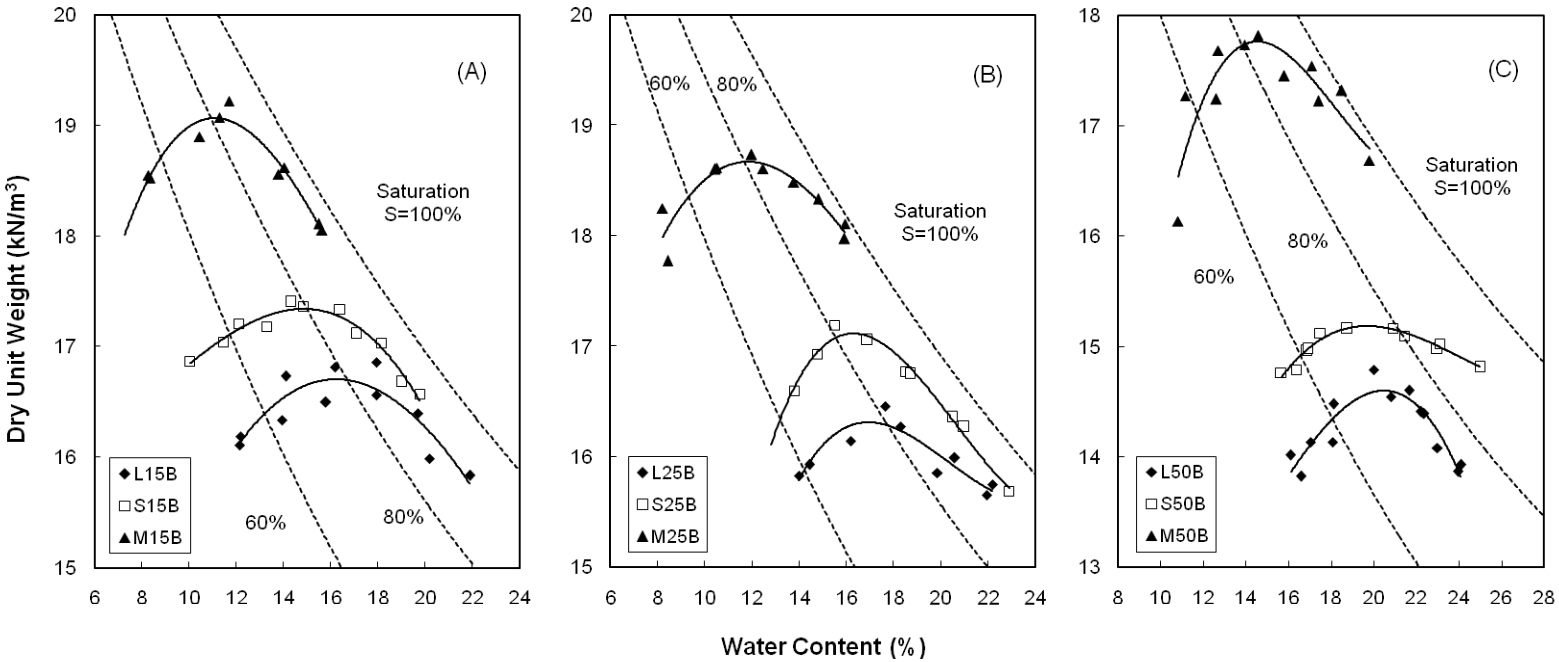


Figure 4.7. Compaction Curves of Bentonite/Sand Mixtures (A) 15% Bentonite, (B) 25% Bentonite, (C) 50% Bentonite

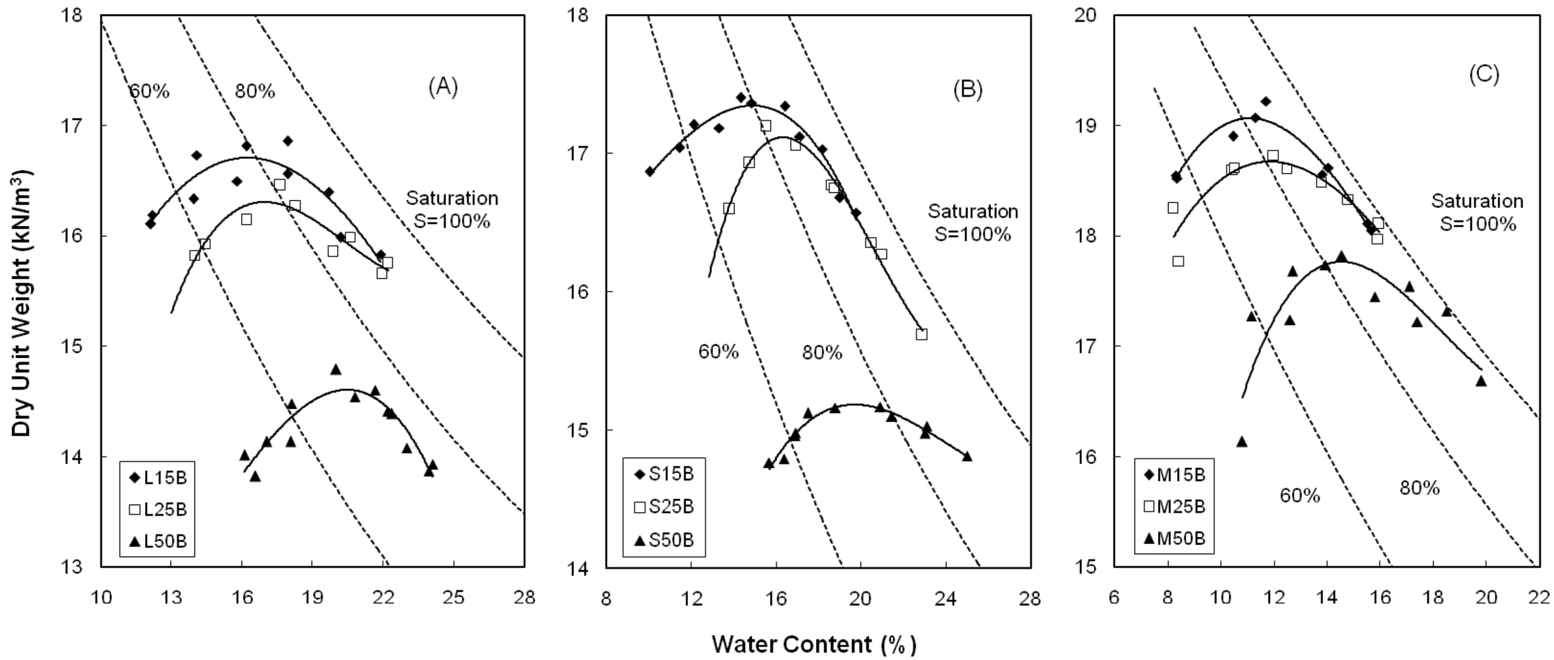


Figure 4.8. Compaction Curves of Bentonite/Sand Mixtures (A) Low Energy Proctor, (B) Standard Proctor, (C) Modified Proctor

The optimum water contents and corresponding maximum dry unit weights that were determined for each of the bentonite/sand mixtures that were tested are summarized in Table 4.3.

Table 4.3 Soil Properties of Bentonite/Sand Mixtures

Bentonite Content (%)	Low Energy Proctor		Standard Proctor		Modified Proctor	
	w_{opt} (%)	$\gamma_{d,\max}$ (kN/m^3)	w_{opt} (%)	$\gamma_{d,\max}$ (kN/m^3)	w_{opt} (%)	$\gamma_{d,\max}$ (kN/m^3))
15	16.2	16.7	15	17.3	11.1	19.1
25	17	16.3	16.1	17.2	11.8	18.7
50	20.5	14.6	19.7	15.2	14.5	17.8

Figure 4.9 is a semi-log plot that shows the relationship between the maximum dry unit weight and the compaction energy that is associated with each of the compaction tests shown in Table 4.3. Logarithmic regression analysis yielded an excellent fit with the measured data, with R^2 values ranging from 0.98 to 1, with an average of 0.99. As was observed with the kaolinite/sand mixtures, the maximum dry unit weight of the bentonite/sand mixtures increased with increasing compaction effort. However, unlike the kaolinite/sand mixtures, the maximum dry unit weight of the bentonite/sand mixtures decreased continuously with increasing bentonite content.

Figure 4.10 shows the semi-log relationship between w_{opt} and E for the bentonite/sand mixtures. Logarithmic regression analysis again yielded an excellent fit with the measured data, with R^2 values ranging from 0.98 to 1, with an average of 0.99. As expected, the optimum water content increased as bentonite content increased, while it decreased with increasing compaction effort.

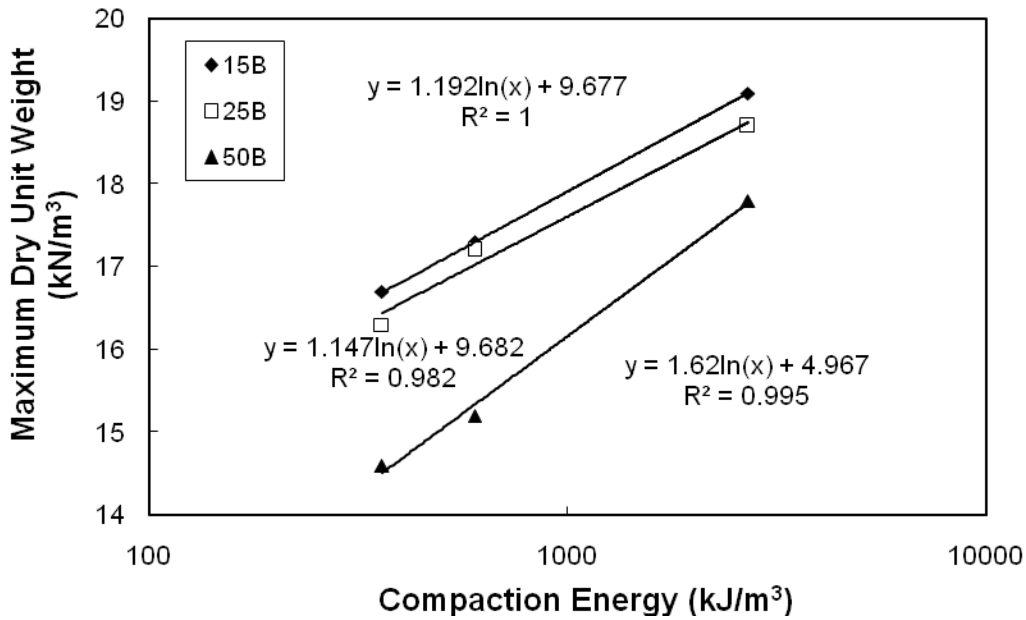


Figure 4.9. Linear relationships between $\gamma_{d,\max}$ and *E* (bentonite/sand mixtures)

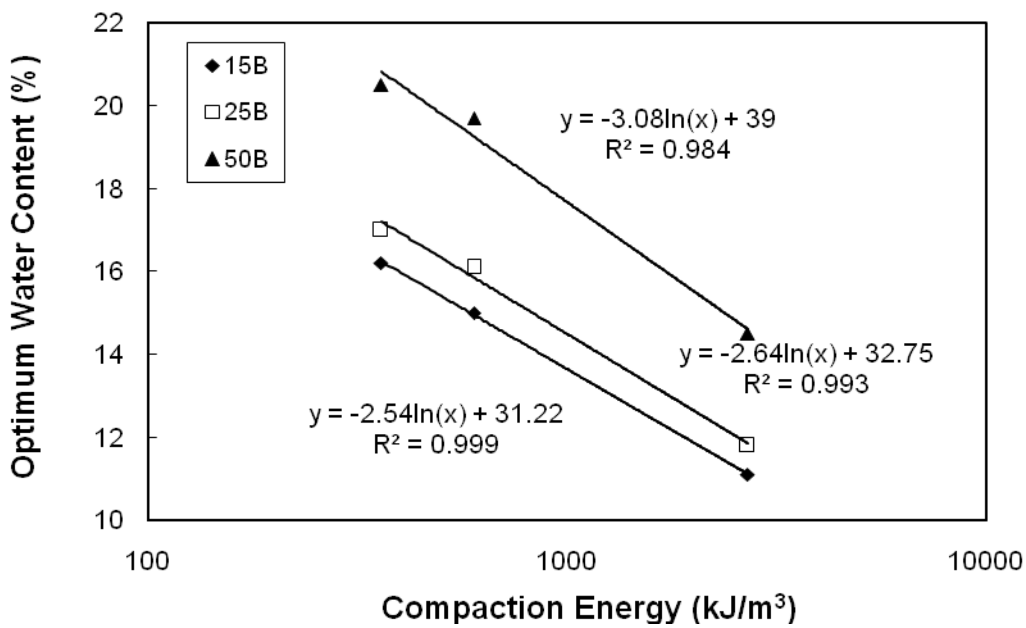


Figure 4.10. Linear relationships between wopt and E (bentonite/sand mixtures)

4.2 Summary of Compaction Test Results

This chapter describes a series of compaction tests that were conducted to determine the relationship between compaction water content and the resulting dry unit weight of the soil, for three different compactive efforts. The resulting compaction curves were also used to determine the optimum water content and maximum dry density values for the three compaction energies that were used. In addition to these important curves and values, the following conclusions were also reached as a result of the compaction tests that were performed:

(1) A semi-logarithmic relationship exists between the maximum dry unit weight and the compaction energy for both kaolinite/sand and bentonite/sand mixtures. Logarithmic regression analysis yielded R^2 values ranging from 0.87 to 0.99 for kaolinite and 0.98 to 1 for bentonite.

(2) A semi-logarithmic relationship also exists between the optimum water content and the compaction energy for both clay/sand mixtures. Logarithmic regression analysis yielded R^2 values ranging from 0.87 to 0.96 for kaolinite and 0.97 to 1 for bentonite.

(3) For the kaolinite/sand mixtures, at all compaction energy levels, the maximum dry unit weight was observed for the 25% kaolinite mixture. However, this was not true for the bentonite/sand mixtures, which exhibited a consistent trend of decreasing dry unit weight as the bentonite content increased.

(4) Higher compactive efforts minimize the difference in maximum dry unit weight between mixtures containing different clay contents.

Chapter 5

UU TRIAXIAL TESTING OF CLAY/SAND MIXTURES

5.1 Experimental Procedure

5.1.1 Specimen Preparation

At each combination of clay/sand mixture type (kaolinite, bentonite), clay mix proportion (15%, 25%, 50%), compaction method (low energy, standard proctor, modified proctor), and water content, three triaxial specimens were prepared from each compacted Proctor specimen. Sharpened, thin-walled stainless steel tubes were utilized for sampling from the Proctor mold (Figure 5.1). The sampling tubes that were used had the following dimensions: 160.0 mm (6.3 in.) long, 35.6 mm (1.4 in.) inside diameter, and a wall thickness of 1.5 mm (0.058 in.). During sampling, approximately half of the sampling tube would be pushed into the soil.

Figure 5.1. Sampling Tube

Figure 5.2. Sharpened Edge of Sampling Tube

In order to create triaxial specimens from a completed Proctor mold specimen, three sampling tubes were first placed on top of the compacted soil which was still in the Proctor mold, as shown in Figure 5.3a. To minimize sample disturbance, the sampling tubes were then pushed into the soil at a controlled speed (0.2 in./min). After the desired depth had been reached, the soil was extruded from the compaction mold together with all three sampling tubes using a hydraulic jack. Appropriately sized triaxial specimens were extruded from the sampling tubes using a close-fitting piston driven by a hydraulic jack and then sealed with plastic wrap to avoid changes in moisture content (Figure 5.4). The initial diameter of the specimen is equal to the inside diameter of the tube. Therefore, specimens obtained by tube sampling could be tested in the triaxial device without trimming, except for cutting the ends of the specimen to ensure appropriate specimen height. The specimen dimensions for each triaxial specimen before testing were approximately 35.5 mm (1.4 in.) in diameter and 71.1 mm (2.8 in.) in height.

After end cutting, the specimen was ready for setup in the triaxial chamber for UU triaxial testing. Because no drainage is allowed during a UU test, impermeable plastic plates were placed on the top and bottom of the specimen (ASTM D 2850). The plastic plates have the same diameter as the soil specimen. The specimen was then carefully encased in membranes. Two thin Trojan prophylactic membranes were installed using a membrane expander (Figure 5.5), and were sealed to the cap and base by four rubber “O” rings (Figure 5.6). O-rings at the top and bottom of the triaxial chamber were greased with silicon grease, and the triaxial test chamber was tightly sealed.

During the whole sampling and installation procedure, the soil specimen was handled extremely carefully in order to minimize disturbance and prevent any changes in moisture content.

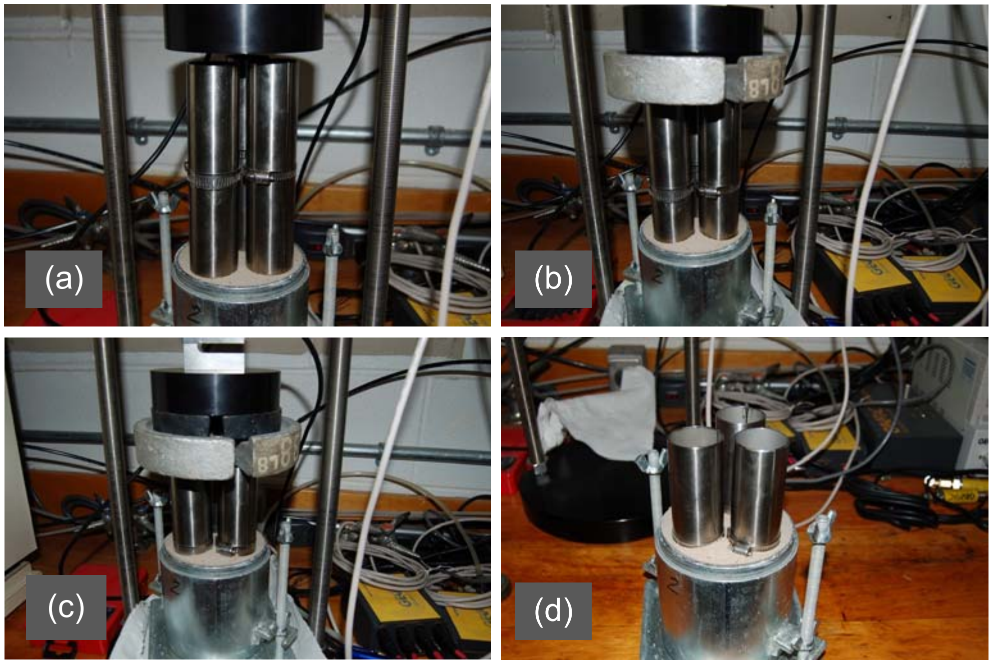
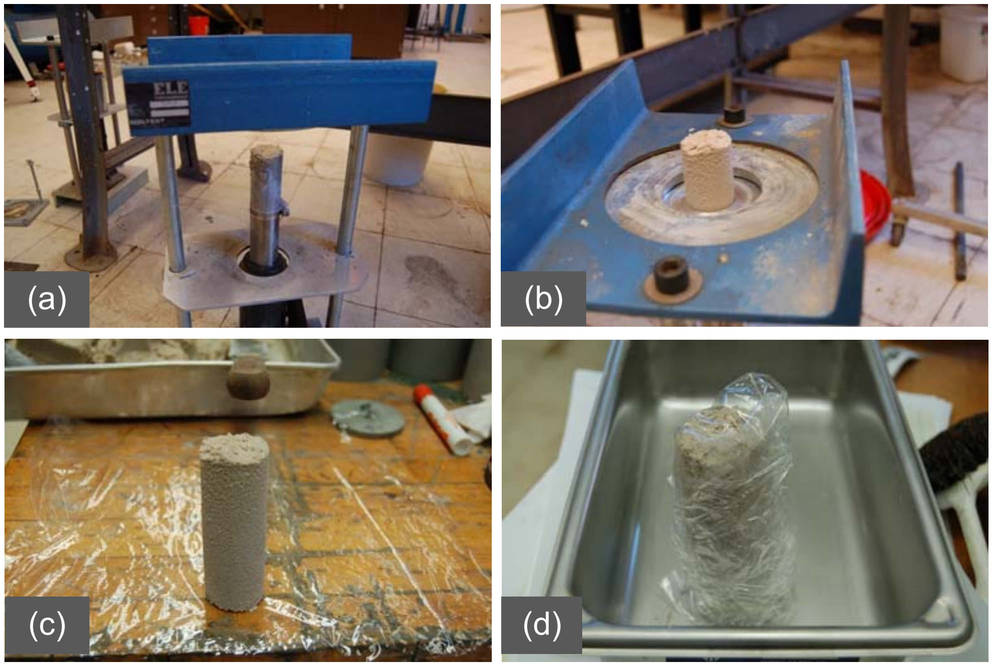


Figure 5.3. Sampling Procedure; (a) placing sampling tubes on top of the soil, (b) pushing sampling tubes into the soil, (c) attainment of the desired sampling depth, and (d) Proctor mold ready for extrusion.



5.4. Sampling Procedure; (a) placing tube on the close fitting piston, (b) extruding specimen out of the tube, (c) specimen extruded out of the tube, (d) sealing with plastic wrap.

Figure 5.5. Membranes Installed with an Expander

Figure 5.6. Specimen Encased in Membranes and Sealed with "O" Rings

In a few cases where the soil in the Proctor mold was very stiff, the sampling procedure that was used caused a loosening of the soil. Alternatively, some densification occurred for those specimens which were initially very loose. In order to investigate the effect of disturbance caused by the tube sampling procedure that was used, changes in density were checked as an indicator of disturbance. The average value of percent densification for all 206 samples that were prepared using the sampling tube approach was 4.3%. All observed densification values were less than 12%, and 83% of the values were less than 5%.

To compare sampling disturbance effects of the tube sampling method that was utilized with the more traditional hand-based wire saw trimming method, 18 specimens were prepared using a sample trimmer, as shown in Figure 5.7. The average value of percent densification for all samples prepared using the wire saw trimming method was 5%. All values were less than 13%, and 78% of the values were less than 5%. The results for each sample preparation method are summarized in Table 5.1; analysis of these numbers shows that the tube sampling method is more reliable and less time consuming than the wire saw trimming method.

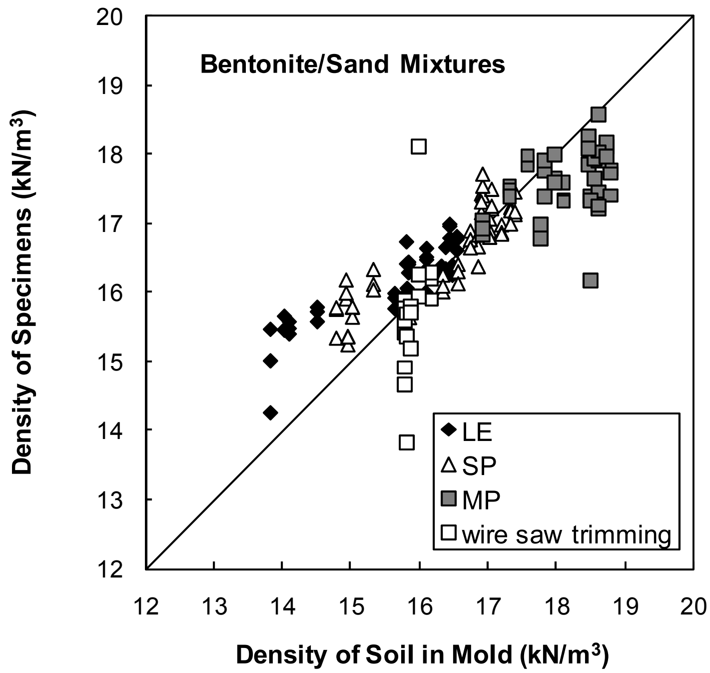
Table 5.1 Comparison of Two Sampling Method

Sampling Method	Approximate Preparation Time (min/specimen)	Average Densification (%)	Maximum Densification (%)	Specimens with measured Densification ≤ 5% (%)
Wire Saw	60	5	13	78
Tube	15	4.3	12	83

Figure 5.7. Trimming the specimen using the wire saw trimming method

Figure 5.8 provides a comparison of triaxial specimen density with the as-compacted soil density. As can be observed, the sampling process does have an effect on the initial state of the triaxial specimens. However, as shown for the bentonite specimens (both in Figure 5.8 and in Table 5.1), this effect can be even more pronounced for specimens that are prepared using traditional trimming methods.

Differences between triaxial specimens and the Proctor specimen can also be attributed to the smaller sample size. As demonstrated by Gau and Olson (1971), density variations occur throughout a mass of soil compacted in a Proctor mold. These are averaged out for the entire Proctor specimen. However, the sub-sampling that is performed to create small triaxial specimens may consequently yield more highly variable specimen densities, as a specimen can be taken from an area of local variation.



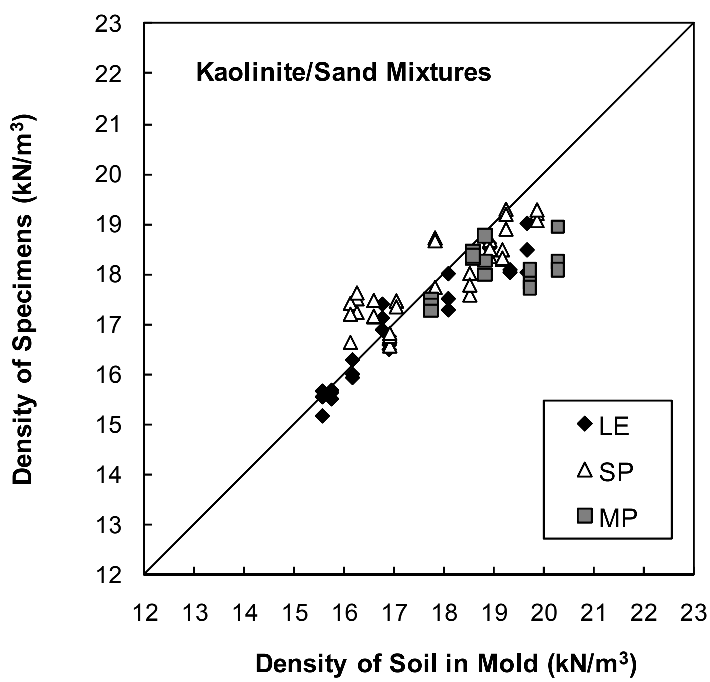


Figure 5.8. Comparison of Triaxial Specimen Density and As-Compacted Soil Density

5.1.2 UU Triaxial Test Procedure

The triaxial compression tests were conducted in accordance with ASTM D 2850-03a, Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils. After placing the triaxial chamber with a prepared specimen in place in the load frame, the chamber was filled with tap water. The specimen was then subjected to a cell pressure, and axially loaded to failure. For each Proctor mold, triaxial specimens were prepared and tested at confining pressures of 69, 138 and 276 kPa (10, 20 and 40 psi). The axial load was applied using a computer-based servomotor system, in conjunction with a strain-controlled approach to loading.

After application of the confining pressure, 10 minutes were allowed for the specimen to stabilize and equilibrate prior to application of the axial load. During the shearing stage, the triaxial specimen was subjected to axial displacements at a strain rate of 1%/minute, and the corresponding load on the specimen was recorded. For each specimen, shearing was continued until an axial strain of 15% was achieved. Because all of the tests were of the unconsolidated-undrained variety, the overall specimen water contents at failure were believed to be approximately the same as the specimen water content after compaction (although localized water content redistribution likely occurred in the specimens during shear). At the completion of the test, the cell was drained and the sample removed for water content determination.

Because the axial load-measuring device is located outside of the triaxial chamber, the chamber pressure produces an upward force on the piston that will thrust against the axial loading device. Therefore, the axial loading-measuring device was adjusted to compensate for piston friction and thrust using the following equation:

$$\text{Piston Force} = \text{Chamber Pressure} \times \text{Cross - Sectional Area of Piston}$$

$$= \text{Chamber Pressure} \times \frac{1}{4}\pi D^2$$

Where:

D = diameter of piston, which was 12.7 mm (0.5 in.)

5.1.3 Correction for Membrane Effects

According to ASTM D 2850-03a, the following equation was used to correct the principal stress difference for the effect of the membrane:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D$$

Where:

$\Delta(\sigma_1 - \sigma_3)$ = correction to be subtracted from the measured principal stress difference,

D = diameter of specimen,

E_m = Young's modulus for the membrane material which was 1.39 MPa,

t_m = thickness of membranes which was 0.14 mm for two layers of membranes,

ε_1 = axial strain.

5.2 Results and Discussion of Results

As mentioned previously in Chapter 4, the resulting matrix of test specimens was quite large, and for clarity it was necessary to assign each sample a name based on its compaction conditions and confining pressure. Firstly, each sample was assigned a letter to signify at which energy level it was compacted: M, S, and L stand for modified Proctor, standard Proctor, and low energy Proctor, respectively. Secondly, a number (15, 25, or 50) was assigned to indicate the clay proportion in the soil mixture. Thirdly, a K or B was assigned to signify the type of clay mineral that was tested. Fourthly, a number accompanying this letter was used to define the water content with negative numbers corresponding to dry of optimum, zero meaning at the optimum, and positive numbers signifying wet of optimum. Finally, the triaxial test confining pressure was denoted by the letter C and a number enclosed in parentheses and placed after the first four symbols. For example, a Standard Proctor specimen containing 15% bentonite compacted 2% dry of optimum and tested at 69 kPa would appear as S15B(-2)C(69).

5.2.1 Unconsolidated-Undrained Shear Strength

Complete data sheets for each UU triaxial test are given in Appendix F. The results of the unconsolidated-undrained triaxial tests are summarized in Table 5.2. Complete replication of the tests at all compaction levels and water contents were planned, although not all were carried out because some samples failed during the sampling procedure.

The relationship between strength, water content, dry unit weight and clay mineral may vary greatly depending on the manner in which the strength is determined, and this in turn will depend on the purpose for which the relationship is being used. For example, in pavement design tests, the strength index of a soil is usually determined at relatively low strains, e.g., on the order of 5% (Seed and Chan, 1959). On the other hand, engineers concerned with testing soil for foundation studies or earth dam design would like to determine strength at larger strains (Seed and Chan, 1959). For the UU tests that were conducted here, *failure* was defined as the maximum deviator stress occurring in the range of 0-15% axial strain. At failure, the points $p_f = (\sigma_1 + \sigma_3)/2$ are plotted vs. $q_f = (\sigma_1 - \sigma_3)/2$ in Figures 5.9 through 5.13.

Failure lines (K_f lines) were drawn through these points using linear least squares regression analysis. The failure lines for the bentonite/sand samples compacted at different energy levels are presented in Figures 5.9 through 5.11. The failure lines for the kaolinite/sand samples are presented in Figures 5.12 and 5.13, which show much the same behavior as the bentonite/sand mixtures. It should be noted that the results from the tests on the 15% kaolinite/sand mixtures are not shown because these specimens all failed during the sampling procedure.

As can be seen in Figures 5.9 through 5.13, the strength decreases with increasing water content for all samples. On the other hand, the strength increases with increasing confining pressure and compactive effort. The failure lines for Low Energy and Standard Proctor specimens at the highest water content are often close to horizontal, especially for the Low Energy specimens. These samples are almost saturated; any increase in confining pressure merely increases the pore water pressure but has little effect on the associated soil strength. However, exceptions are seen at the Modified Proctor energy level. The failure lines of the highest water content for this energy level do not reach a horizontal position in Figures 5.9 to 5.13. These samples are stiffer and stronger and require higher confining pressure to induce a nearly saturated condition.

The effect of confining pressure on strength is more obvious for samples at lower water contents. This is because these samples are partially saturated soils, which are more susceptible to change in void ratio as confining pressure is applied, due to compression of air voids (even under "unconsolidated" conditions where drainage cannot occur). As the void ratio decreases, the soil shear strength increases;

this is why specimens compacted dry of optimum exhibit the largest gains in strength with increases in confining pressure.

Table 5.2 Deviator Stress Values

Test Number	Max. Deviator Stress (kPa)	Test Number	Max. Deviator Stress (kPa)	Test Number	Max. Deviator Stress (kPa)
L15-B(-4)-C1	212.2	L25-B(+1)-C1	223.7	L50-B(+3)-C1	274.5
L15-B(-4)-C2	305.8	L25-B(+1)-C2	252.3	L50-B(+3)-C2	344.2
L15-B(-4)-C3	453.7	L25-B(+1)-C3	301.5	L50-B(+3)-C3	366.9
L15-B(-2)-C1	200.4	L25-B(+3)-C1	185.9	L50-B(+4)-C1	287.5
L15-B(-2)-C2	277.6	L25-B(+3)-C2	213.5	L50-B(+4)-C2	291.9
L15-B(-2)-C3	442.9	L25-B(+3)-C3	247.9	L50-B(+4)-C3	328.3
L15-B(0)-C1	201.7	L25-B(+5)-C1	150.9	S15-B(-5)-C1	241.9
L15-B(0)-C2	254.7	L25-B(+5)-C2	160.9	S15-B(-5)-C2	326.4
L15-B(0)-C3	424.1	L25-B(+5)-C3	174.0	S15-B(-5)-C3	587.8
L15-B(+2)-C1	202.1	L50-B(-4)-C1	386.5	S15-B(-3)-C1	225.1
L15-B(+2)-C2	244.3	L50-B(-4)-C2	470.0	S15-B(-3)-C2	279.9
L15-B(+2)-C3	356.9	L50-B(-4)-C3	602.0	S15-B(-3)-C3	532.3
L15-B(+4)-C1	151.4	L50-B(-2)-C1	432.9	S15-B(-1)-C1	211.4
L15-B(+4)-C2	180.4	L50-B(-2)-C2	447.8	S15-B(-1)-C2	358.7
L15-B(+4)-C3	210.2	L50-B(-2)-C3	610.5	S15-B(-1)-C3	502.1
L15-B(+5)-C1	76.3	L50-B(-1)-C1	417.3	S15-B(+1)-C1	220.5
L15-B(+5)-C2	94.0	L50-B(-1)-C2	470.4	S15-B(+1)-C2	270.0
L15-B(+5)-C3	102.1	L50-B(-1)-C3	550.3	S15-B(+1)-C3	395.7
L25-B(-3)-C1	262.5	L50-B(0)-C1	372.6	S15-B(+3)-C1	195.0
L25-B(-3)-C2	305.9	L50-B(0)-C2	425.3	S15-B(+3)-C2	230.1
L25-B(-3)-C3	498.1	L50-B(0)-C3	469.6	S15-B(+3)-C3	318.1
L25-B(-1)-C1	252.2	L50-B(+2)-C1	356.2	S15-B(+5)-C1	121.2
L25-B(-1)-C2	283.4	L50-B(+2)-C2	378.9	S15-B(+5)-C2	145.3
L25-B(-1)-C3	389.8	L50-B(+2)-C3	425.8	S15-B(+5)-C3	185.8

Table 5.2 (continued)

Test Number	Max. Deviator Stress (kPa)	Test Number	Max. Deviator Stress (kPa)	Test Number	Max. Deviator Stress (kPa)
S25-B(-4)-C1	311.7	S50-B(0)-C1	517.7	M25-B(-4)-C1	467.2
S25-B(-4)-C2	379.3	S50-B(0)-C2	549.6	M25-B(-4)-C2	672.1
S25-B(-4)-C3	576.1	S50-B(0)-C3	599.3	M25-B(-4)-C3	879.7
S25-B(-2)-C1	294.1	S50-B(+1)-C1	421.8	M25-B(-2)-C1	566.4
S25-B(-2)-C2	366.8	S50-B(+1)-C2	475.6	M25-B(-2)-C2	576.3
S25-B(-2)-C3	501.1	S50-B(+1)-C3	475.4	M25-B(-2)-C3	832.7
S25-B(0)-C1	230.0	S50-B(+3)-C1	348.6	M25-B(0)-C1	430.9
S25-B(0)-C2	286.0	S50-B(+3)-C2	338.3	M25-B(0)-C2	528.1
S25-B(0)-C3	352.0	S50-B(+3)-C3	379.4	M25-B(0)-C3	674.5
S25-B(+2)-C1	157.0	S50-B(+6)-C1	234.5	M25-B(+2)-C1	392.1
S25-B(+2)-C2	208.0	S50-B(+6)-C2	267.0	M25-B(+2)-C2	400.1
S25-B(+2)-C3	220.0	S50-B(+6)-C3	271.8	M25-B(+2)-C3	542.6
S25-B(+4)-C1	109.2	M15-B(-1)-C1	278.0	M25-B(+4)-C1	277.2
S25-B(+4)-C2	123.7	M15-B(-1)-C2	377.3	M25-B(+4)-C2	277.4
S25-B(+4)-C3	135.5	M15-B(-1)-C3	695.8	M25-B(+4)-C3	458.3
S25-B(+6)-C1	90.2	M15-B(+1)-C1	257.8	M50-B(-1)-C1	1051.6
S25-B(+6)-C2	95.8	M15-B(+1)-C2	477.0	M50-B(-1)-C2	1180.3
S25-B(+6)-C3	122.7	M15-B(+1)-C3	670.6	M50-B(-1)-C3	1295.6
S50-B(-3)-C1	522.8	M15-B(+3)-C1	299.8	M50-B(+2)-C1	1079.3
S50-B(-3)-C2	559.8	M15-B(+3)-C2	338.2	M50-B(+2)-C2	996.7
S50-B(-3)-C3	767.1	M15-B(+3)-C3	590.7	M50-B(+2)-C3	1232.6
S50-B(-2)-C1	523.0	M15-B(+5)-C1	189.5	M50-B(+4)-C1	646.7
S50-B(-2)-C2	619.2	M15-B(+5)-C2	304.7	M50-B(+4)-C2	713.3
S50-B(-2)-C3	729.5	M15-B(+5)-C3	337.2	M50-B(+4)-C3	762.3

Table 5.2 (continued)

Test Number	Max. Deviator Stress (kPa)	Test Number	Max. Deviator Stress (kPa)	Test Number	Max. Deviator Stress (kPa)
M50-B(+5)-C1	508.4	L50-K(+4)-C1	32.3	S50-K(+3)-C1	45.2
M50-B(+5)-C2	561.8	L50-K(+4)-C2	29.8	S50-K(+3)-C2	41.6
M50-B(+5)-C3	583.6	L50-K(+4)-C3	35.3	S50-K(+3)-C3	57.5
L25-K(-2)-C1	295.0	S25-K(-2)-C1	394.9	M25-K(0)-C1	240.2
L25-K(-2)-C2	404.0	S25-K(-2)-C2	475.6	M25-K(0)-C2	212.3
L25-K(-2)-C3	660.9	S25-K(-2)-C3	750.3	M25-K(0)-C3	688.6
L25-K(0)-C1	156.5	S25-K(0)-C1	211.6	M25-K(+2)-C1	122.7
L25-K(0)-C2	328.5	S25-K(0)-C2	256.3	M25-K(+2)-C2	216.1
L25-K(0)-C3	377.0	S25-K(0)-C3	355.2	M25-K(+2)-C3	468.8
L25-K(+2)-C1	60.0	S25-K(+2)-C1	59.0	M50-K(0)-C1	1132.3
L25-K(+2)-C2	75.8	S25-K(+2)-C2	77.3	M50-K(0)-C2	1203.5
L25-K(+2)-C3	116.8	S25-K(+2)-C3	113.1	M50-K(0)-C3	1553.7
L50-K(-4)-C1	470.7	S50-K(-5)-C1	598.40	M50-K(+2)-C1	576.1
L50-K(-4)-C2	575.9	S50-K(-5)-C2	797.60	M50-K(+2)-C2	643.7
L50-K(-4)-C3	767.9	S50-K(-5)-C3	1110.20	M50-K(+2)-C3	714.7
L50-K(-2)-C1	362.2	S50-K(-3)-C1	536.3	M50-K(+4)-C1	223.7
L50-K(-2)-C2	503.4	S50-K(-3)-C2	549.4	M50-K(+4)-C2	230.8
L50-K(-2)-C3	558.1	S50-K(-3)-C3	848.1	M50-K(+4)-C3	228.6
L50-K(0)-C1	104.6	S50-K(-2)-C1	309.2		
L50-K(0)-C2	132.1	S50-K(-2)-C2	312.0		
L50-K(0)-C3	141.9	S50-K(-2)-C3	358.8		
L50-K(+2)-C1	49.8	S50-K(+1)-C1	113.8		
L50-K(+2)-C2	53.0	S50-K(+1)-C2	122.1		
L50-K(+2)-C3	53.6	S50-K(+1)-C3	132.3		

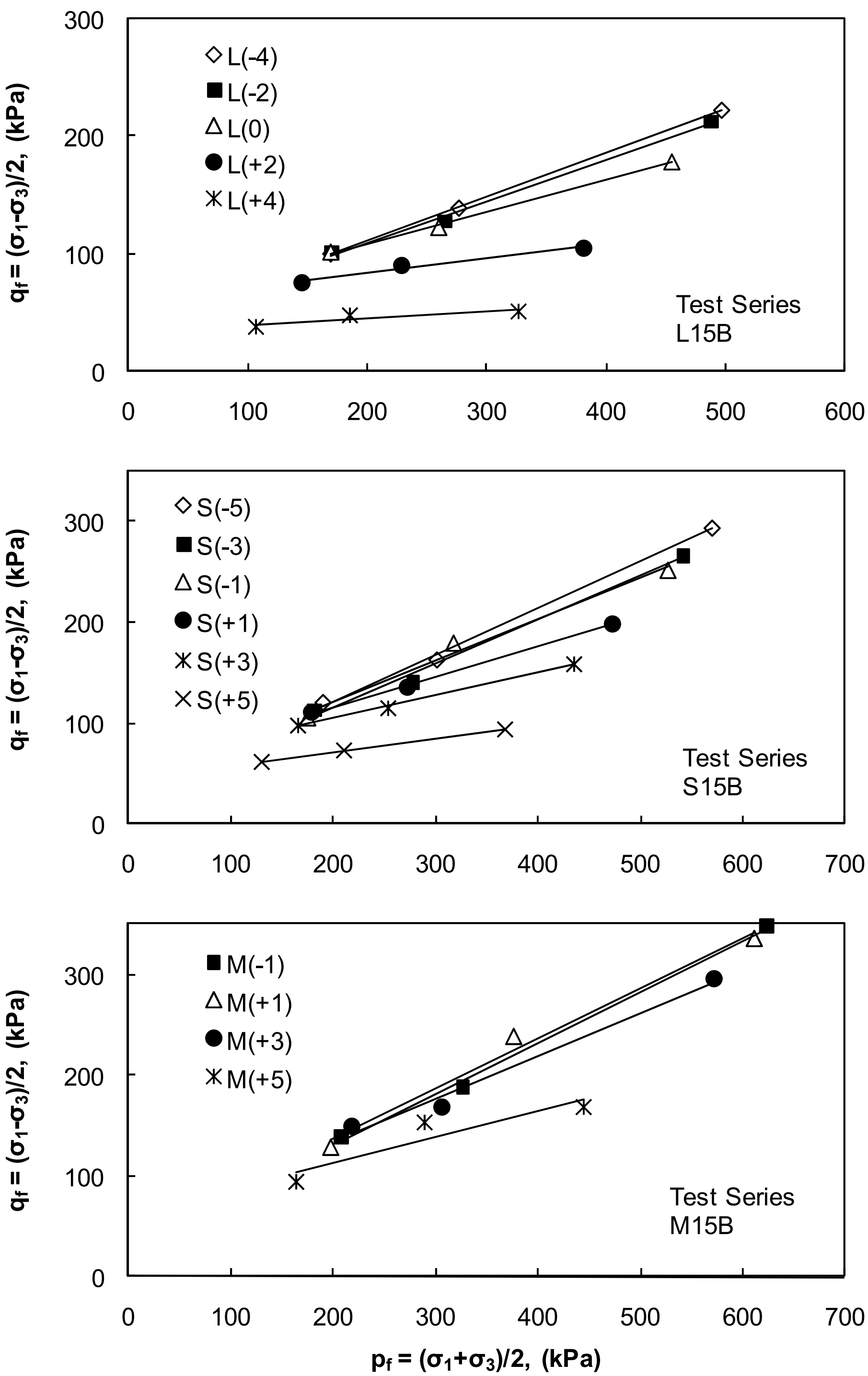


Figure 5.9. q_f vs. p_f Failure Plots with Failure Lines for Test Series B15

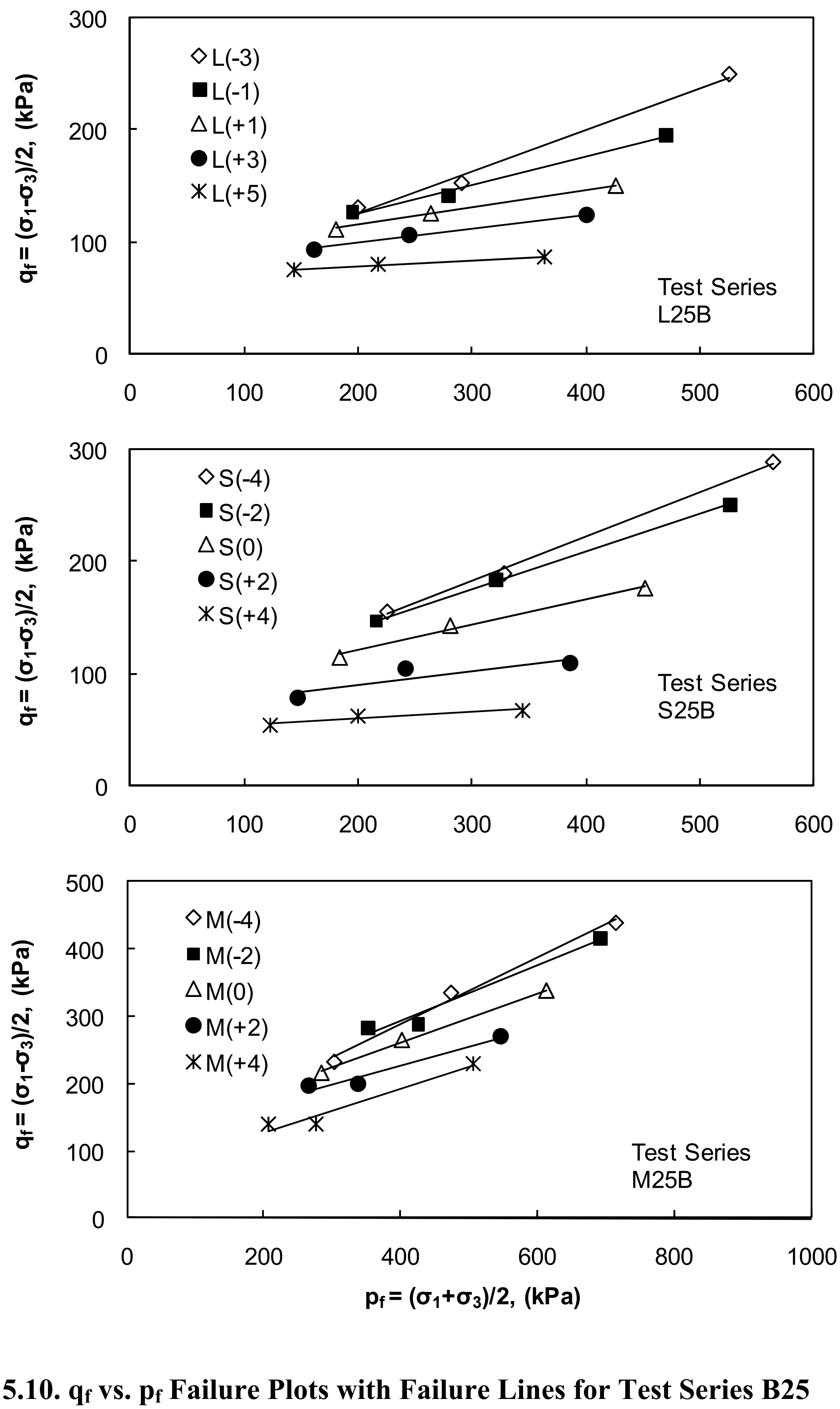


Figure 5.10. q_f vs. p_f Failure Plots with Failure Lines for Test Series B25

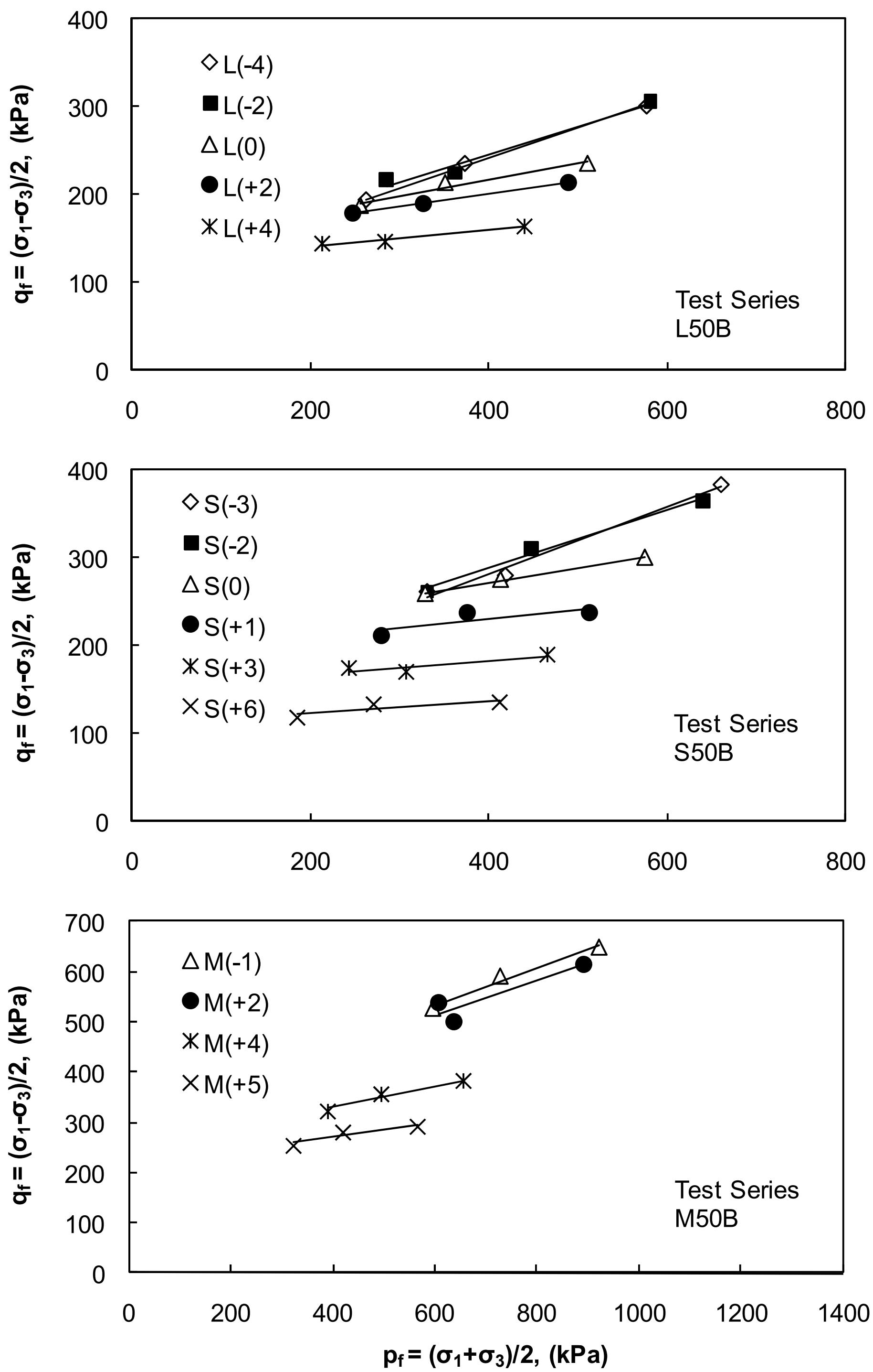


Figure 5.11. q_f vs. p_f Failure Plots with Failure Lines for Test Series B50

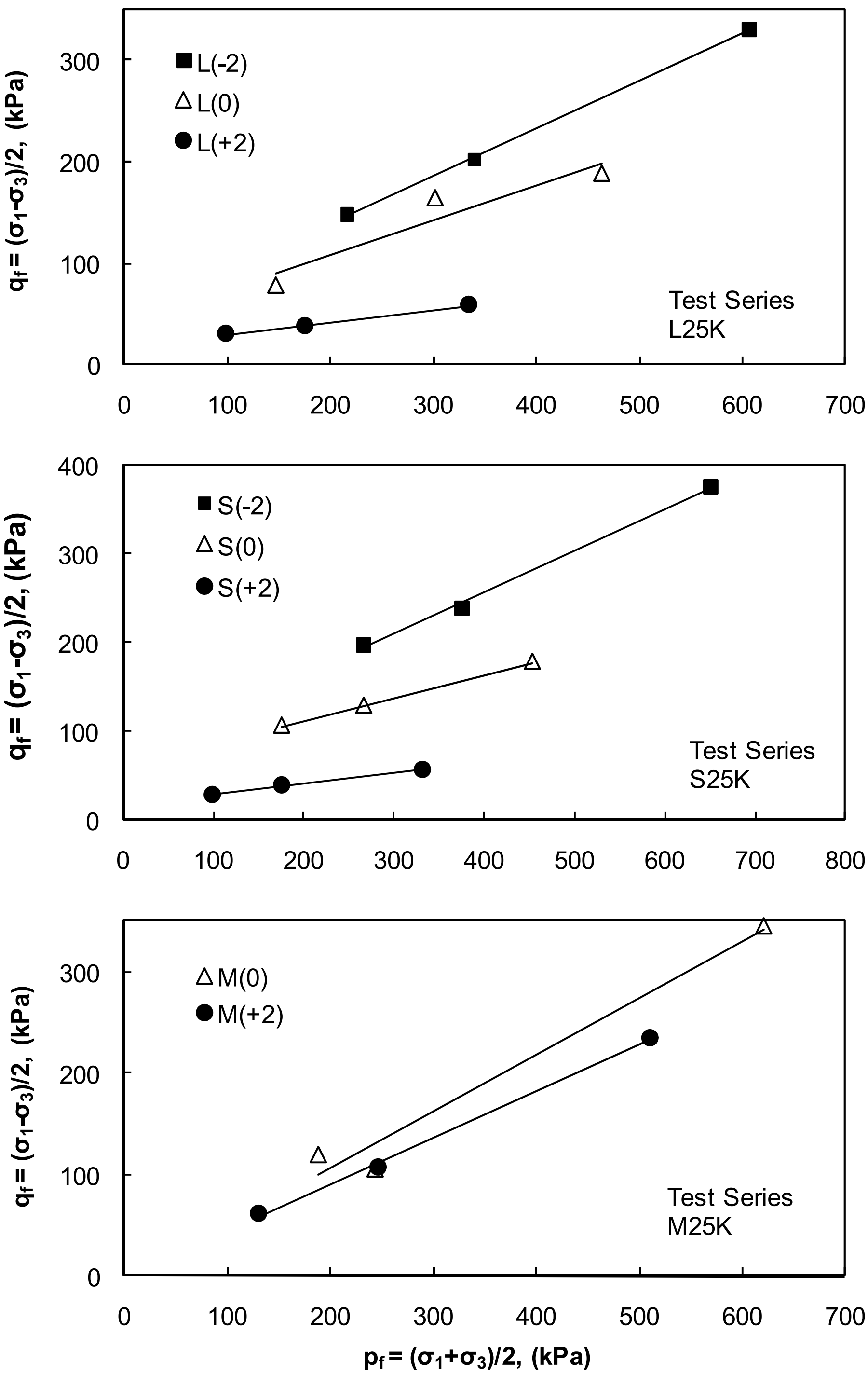


Figure 5.12. q_f vs. p_f Failure Plots with Failure Lines for Test Series K25

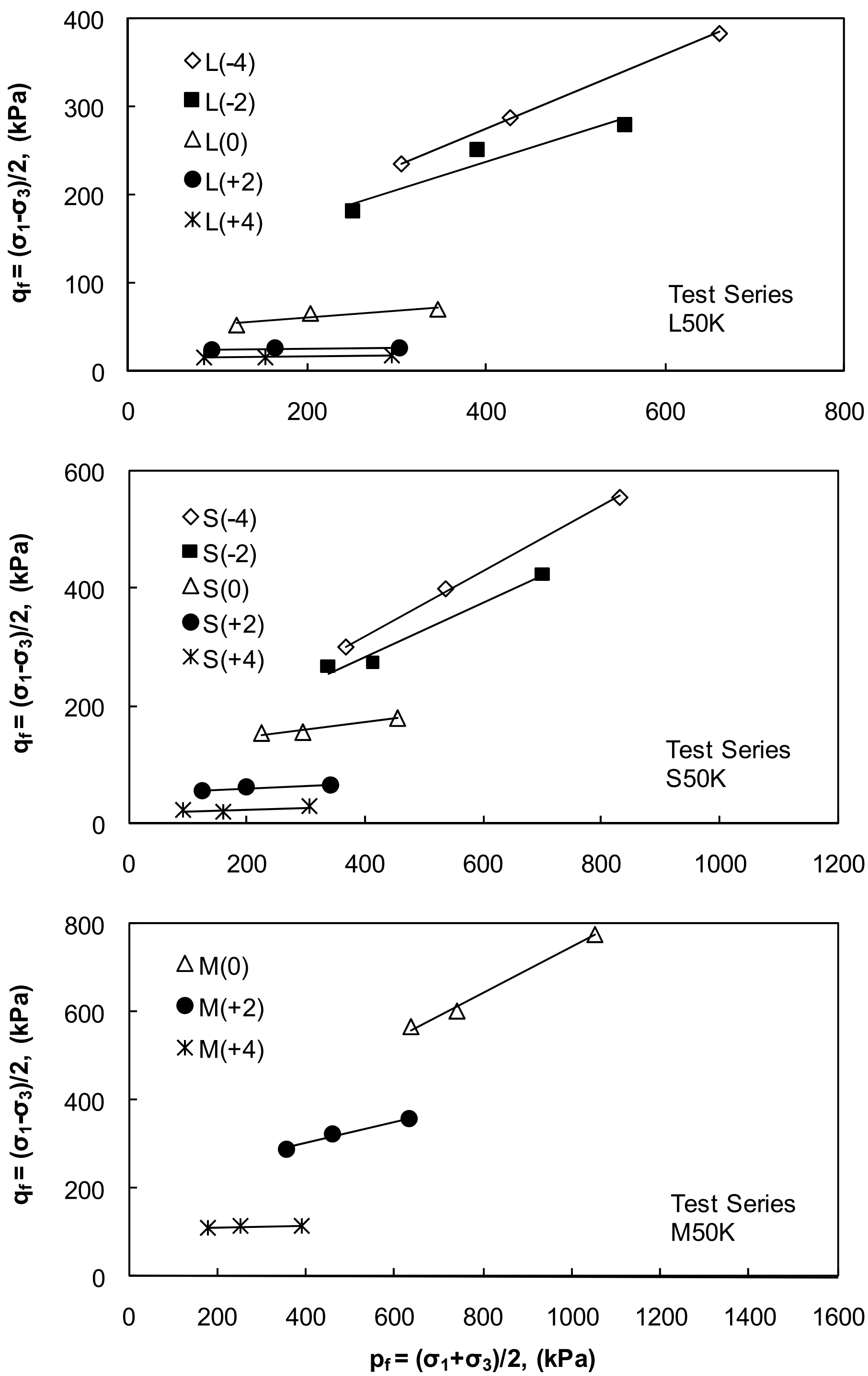


Figure 5.13. q_f vs. p_f Failure Plots with Failure Lines for Test Series K50

The effect of clay content and test confining pressure on the strengths measured for the bentonite/sand mixtures are shown more clearly in Figures 5.14 to 5.16. Each figure is for a separate nominal energy level. The change in maximum deviator stress under the influence of changing bentonite content is apparent. For a given compaction effort, increasing the clay proportion increases the maximum deviator stress of the soil mixture. Samples containing 50% bentonite have a maximum deviator stress that is considerably higher than those containing 15% and 25% bentonite. However, exceptions are seen at the highest confining pressure (C3 = 276 kPa), for which the compressive strength for samples containing 15% bentonite overlaps with those containing 25% bentonite. This is true at each nominal energy level. On the wet side of optimum the slopes of the trend lines are much the same and nearly coincide, regardless of the confining pressure. This is a consequence of the soil's nearly saturated condition. As the compaction water content decreases from the optimum, the slopes of the trend lines tend to diverge.

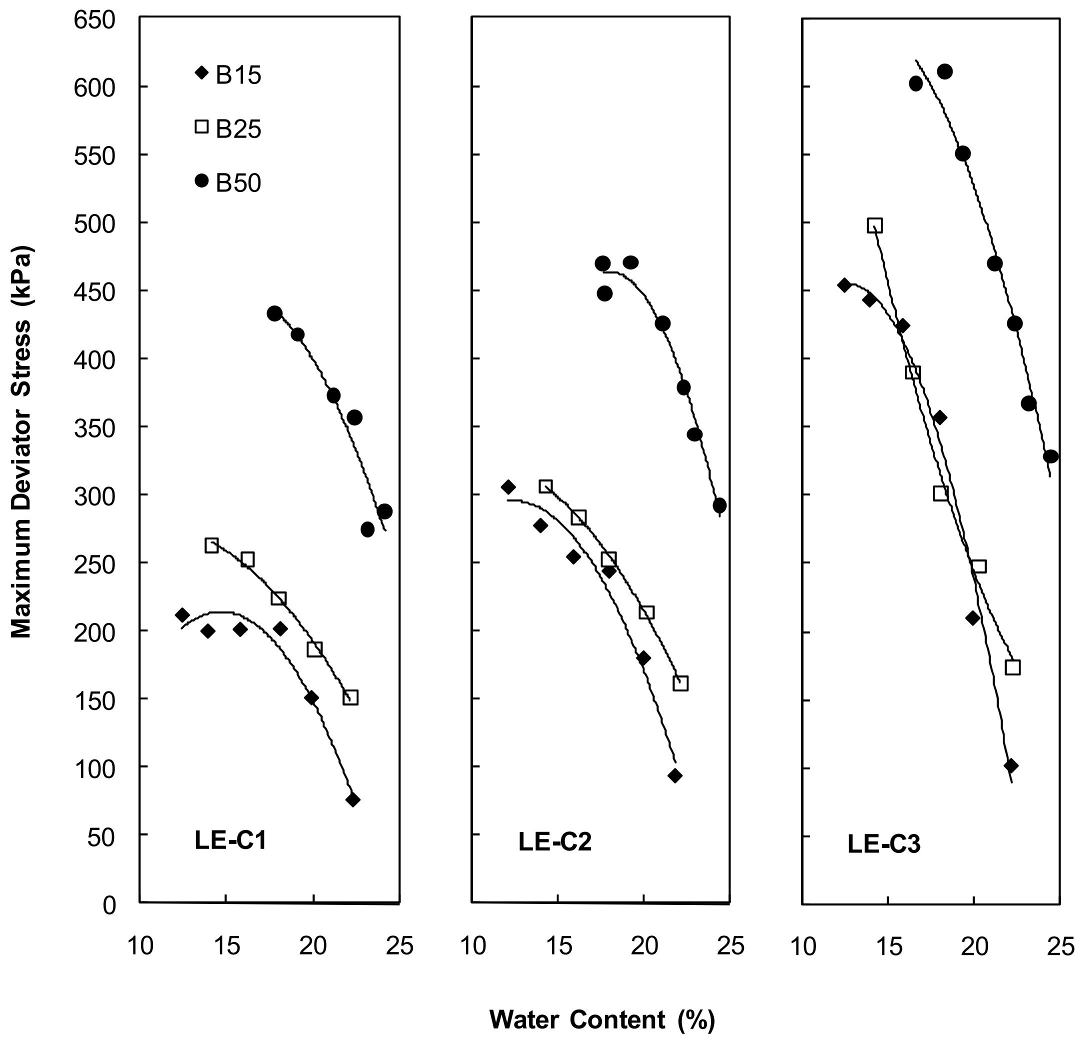


Figure 5.14. Maximum Deviator Stress of Bentonite/Sand Mixtures Compacted Using the Low Energy Proctor Method

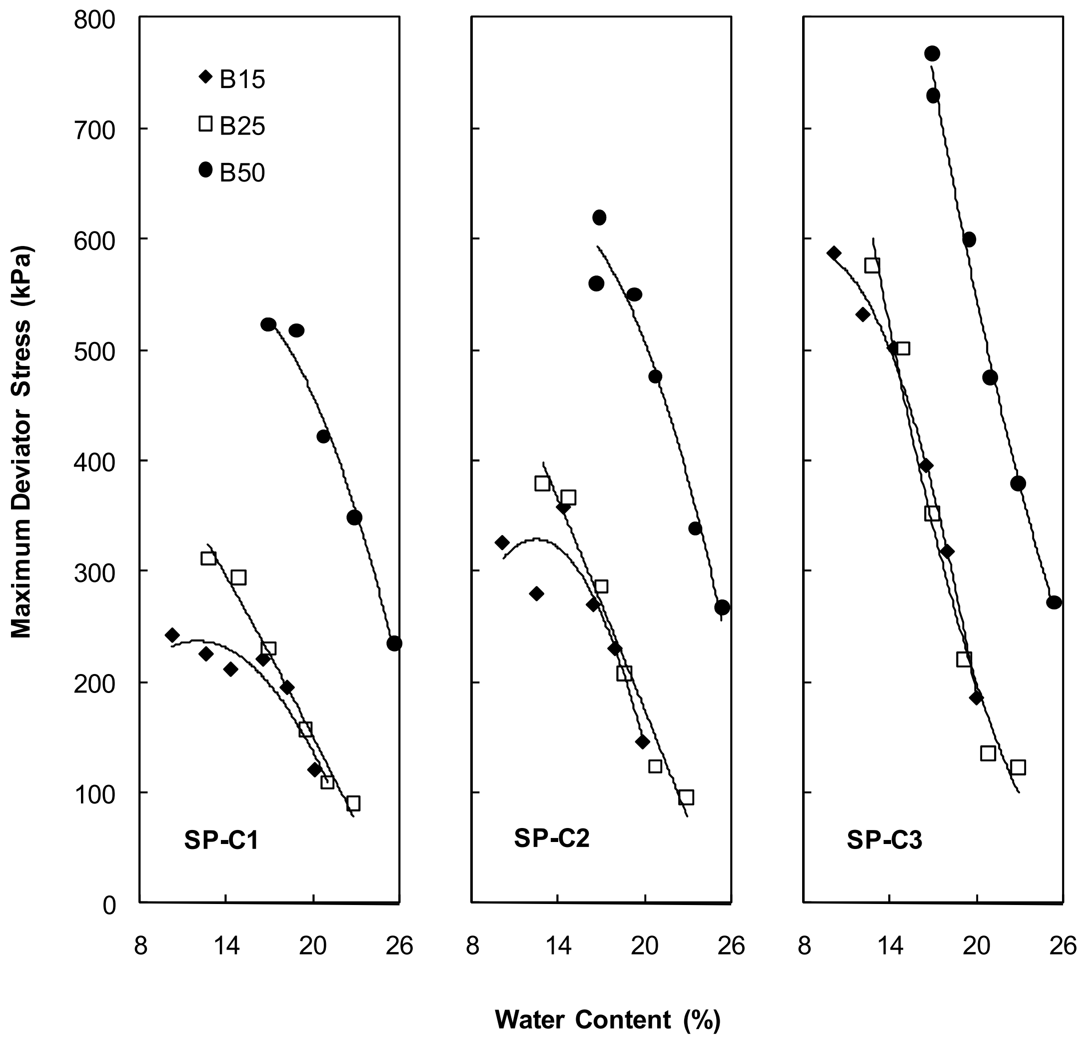


Figure 5.15. Maximum Deviator Stress of Bentonite/Sand Mixtures Compacted Using the Standard Proctor Method

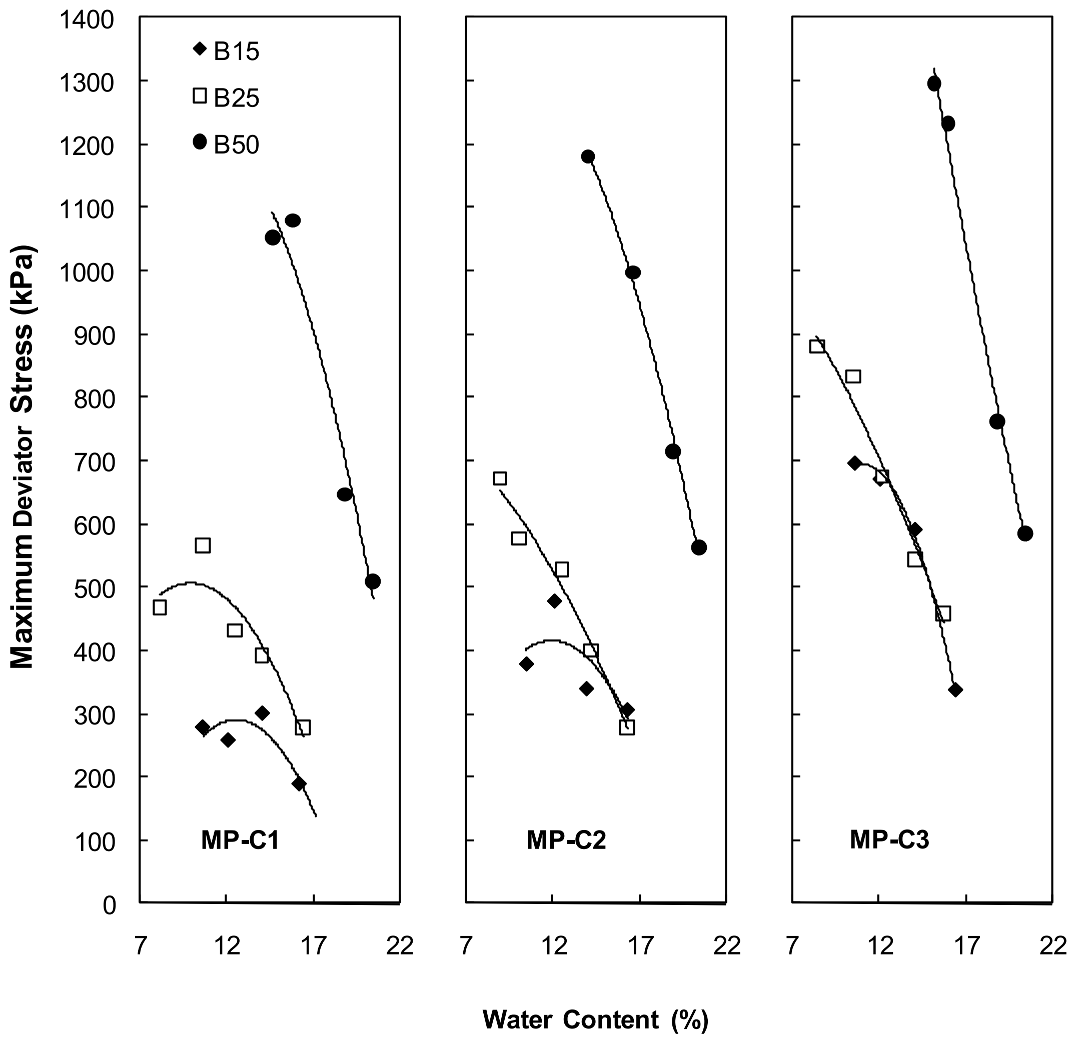


Figure 5.16. Maximum Deviator Stress of Bentonite/Sand Mixtures Compacted Using the Modified Proctor Method

The kaolinite/sand specimens that were tested exhibited much the same behavior as the bentonite/sand specimens, i.e., at the same water content, as the clay content increases, the maximum deviator stress increases. To better describe the effect of different clay minerals on the measured maximum deviator stresses, the test results from the kaolinite/sand mixtures were plotted together with the bentonite/sand mixtures in Figures 5.17 to 5.19. The effect of increasing water content on strength is more pronounced for the kaolinite/sand mixtures than for the bentonite/sand mixtures. At a water content 4% dry of optimum, the kaolinite/sand mixtures have a much higher strength than the bentonite/sand mixtures at the same clay content. The addition of a small amount of water produced a much sharper drop in the maximum deviator stress for the kaolinite/sand specimens. The change is so rapid that at 4% wet of optimum, the maximum deviator stress of the kaolinite/sand mixture has values that are relatively close to zero.

The bentonite utilized in this research study was comprised principally of the clay mineral montmorillonite (> 90% by mass, American Colloid Company, 1995). Compared to kaolinite, montmorillonite has a much smaller crystal size and a much larger specific surface. The relative sizes of kaolinite and montmorillonite and their specific surface are shown in Table 5.3 (Yong and Warkentin, 1975). Montmorillonite crystals have a stronger attraction for water, and have the tendency to adsorb much more water when forming a water layer surrounding each crystal. For the kaolinite/sand specimens, a water content that is 4% wet of optimum is very close to their liquid limit, while for bentonite/sand mixtures, a water content that is 4% wet of optimum is far from their liquid limit. For the kaolinite/sand mixtures, the addition of a small amount of water expands the water layer around the particles, which increases the repulsion between particles and gives a higher degree of dispersion and a lower strength for the resulting specimens that are prepared. However, the addition of this amount of water doesn't have nearly the same effect on the bentonite/sand mixtures.

Table 5.3 Relative Sizes and Specific Surfaces of Clay Minerals (after Yong and Warkentin, 1975)

Mineral	Typical Thickness (nm)	Typical Diameter (nm)	Specific Surface (km^2/kg)
Montmorillonite	3	100-1000	0.8
Kaolinite	50-2000	300-4000	0.015

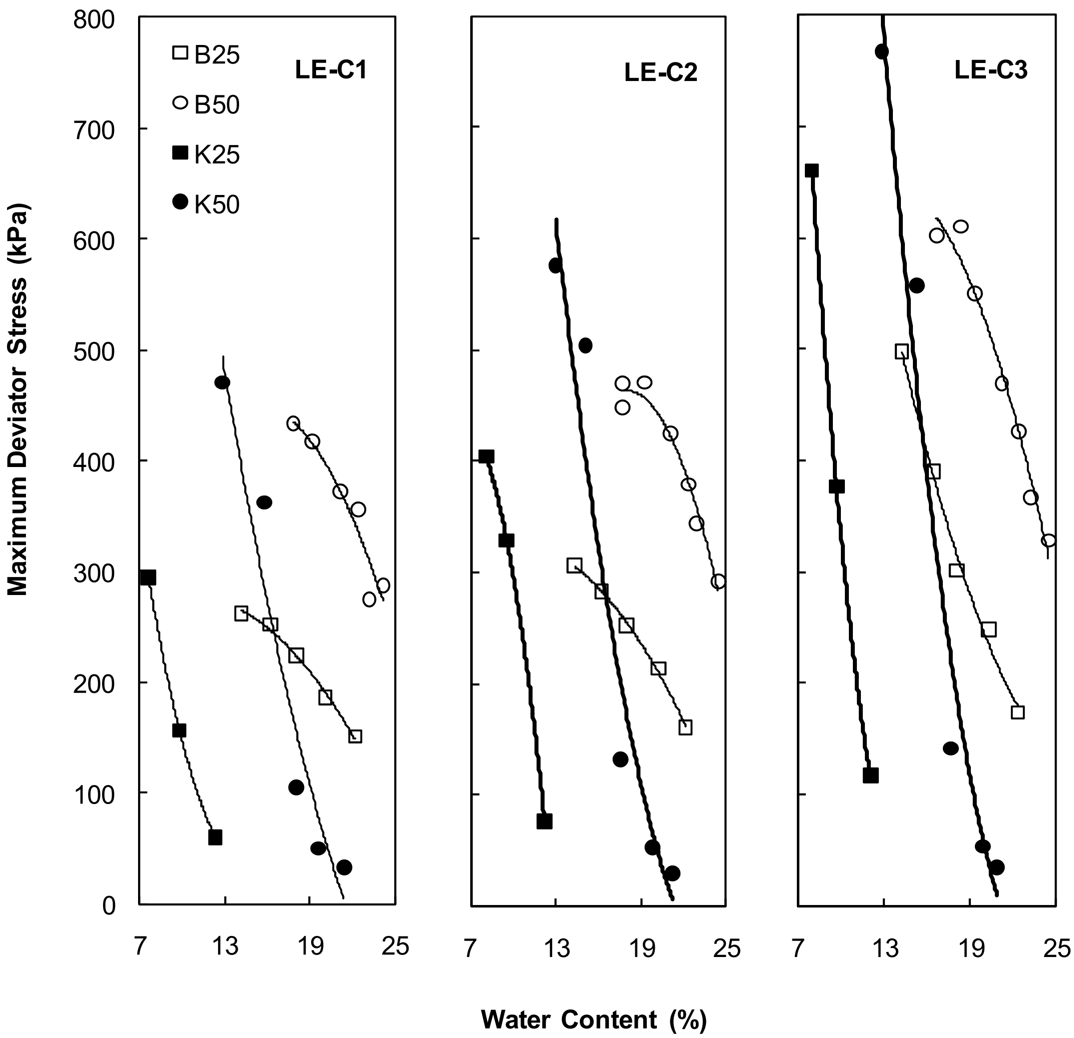


Figure 5.17. Maximum Deviator Stress of Clay/Sand Mixtures Compacted Using the Low Energy Proctor Method

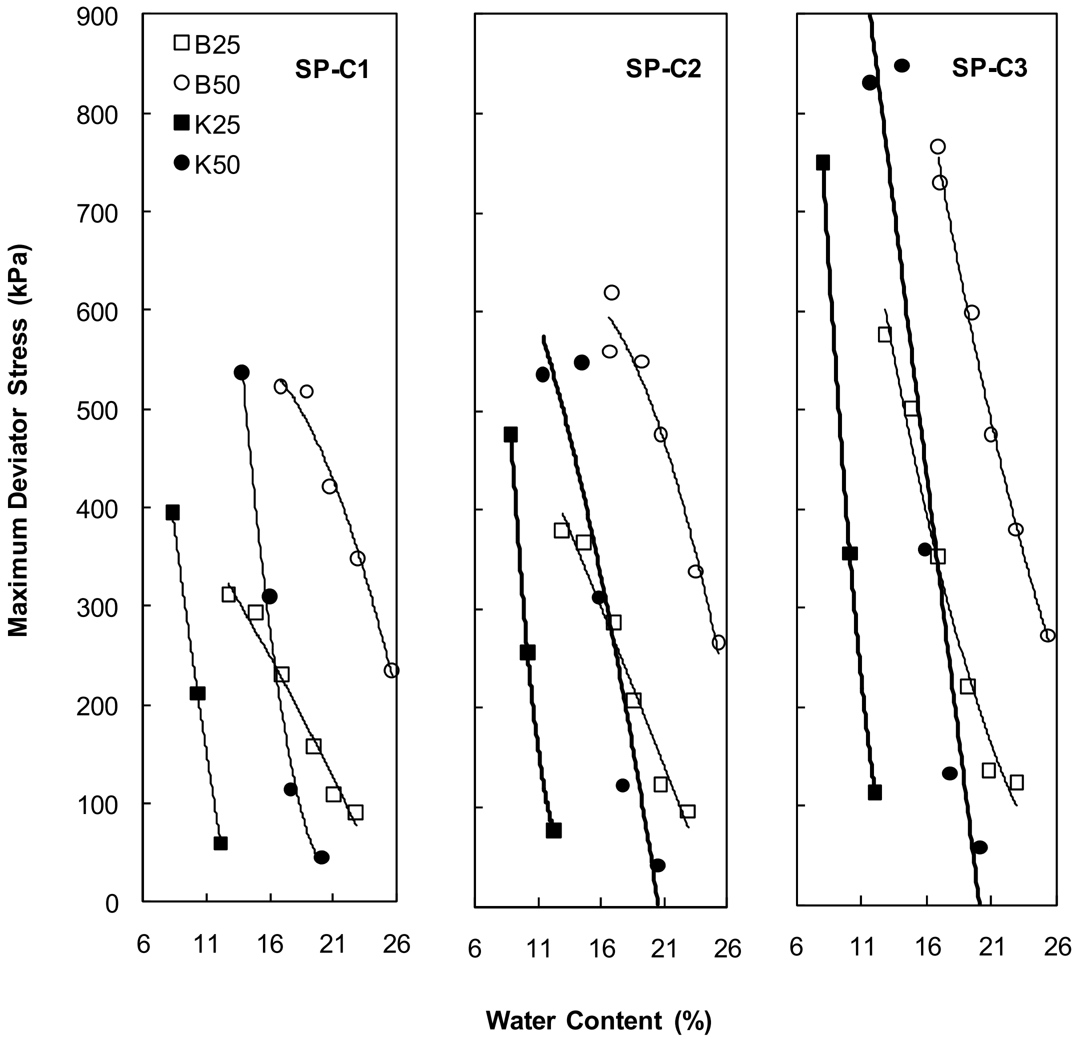


Figure 5.18. Maximum Deviator Stress of Clay/Sand Mixtures Compacted Using the Standard Proctor Method

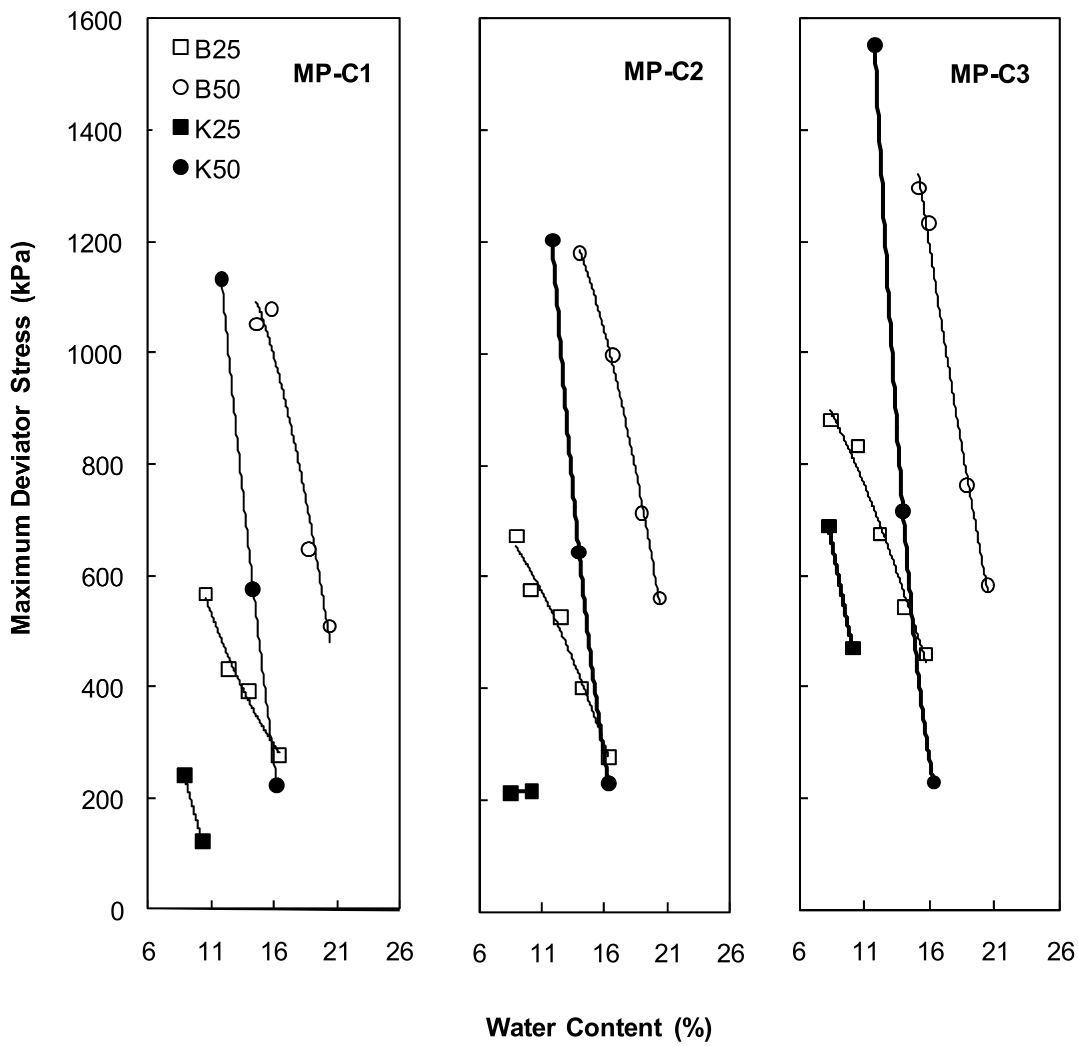


Figure 5.19. Maximum Deviator Stress of Clay/Sand Mixtures Compacted Using the Modified Proctor Method

5.2.2 Stress-Strain Behavior

Stress-strain curves from UU tests on bentonite/sand specimens at confining pressures up to 276 kPa are shown in Figure 5.20 to 5.28. For most of the specimens that were tested, there was strain hardening over the entire range of strains in the test rather than a definitive peak in the deviator stress.

The stress-strain curves of samples compacted dry-of-optimum are considerably steeper and more brittle than the curves of wet-of-optimum samples. From the relative position of these curves in each figure, it is evident that the dry-of-optimum specimens are stiffer, stronger and more brittle than their wet-of-optimum counterparts. The wet-of-optimum specimens have a greater tendency to exhibit increases in strength at very high strain levels. One possible mechanism to explain this behavior is capillarity (Carrier 2000). Samples at lower water content will tend to have a more highly negative pore water pressure, which in turn causes higher effective stresses between soil particles, and a greater specimen strength. Lambe and Whitman (1979) state that for a given compactive effort and dry density, the soil structure in compacted clays tends to be more flocculated for compaction on the dry side of optimum and more dispersive on the wet side. In general, for two specimens of the same clay at the same void ratio, an element of flocculated soil has a higher strength than the same element of soil in a dispersed state. As described herein, similar strength behavior as what has been observed for compacted clays is also observed for soils that contain an intermediate level of clayey fines, but that do not classify as "true" clays.

The stress-strain behavior of soils in the UU test also depends on the confining pressure that is used. As shown in Figures 5.20 to 5.28, the steepness of the initial portion of the stress-strain curves and the strength values both increase as the confining pressure employed in the tests increases. The effect of increased confining pressure is more pronounced in the dry-of-optimum samples, especially the samples at the lowest water content. For these samples, the strength continues to increase with increasing confining pressure. Due to the air in the voids, the higher confining pressure was able to compress the samples so that they became denser, producing an increase in undrained strength. On the other hand, the increase in confining pressure had very little effect on the wet-of-optimum samples.

Increases in confining pressure were also shown to lead to an increase in plasticity, as can be observed for M50B(-1) in Fig. 5.28. At a confining pressure of 69 kPa, the sample quickly reached its maximum deviator stress, failing in a brittle manner at an axial strain of 4%. However, at a confining pressure of 276 kPa, the failure strain was about 10%, and the strength did not reduce suddenly after reaching the peak condition.

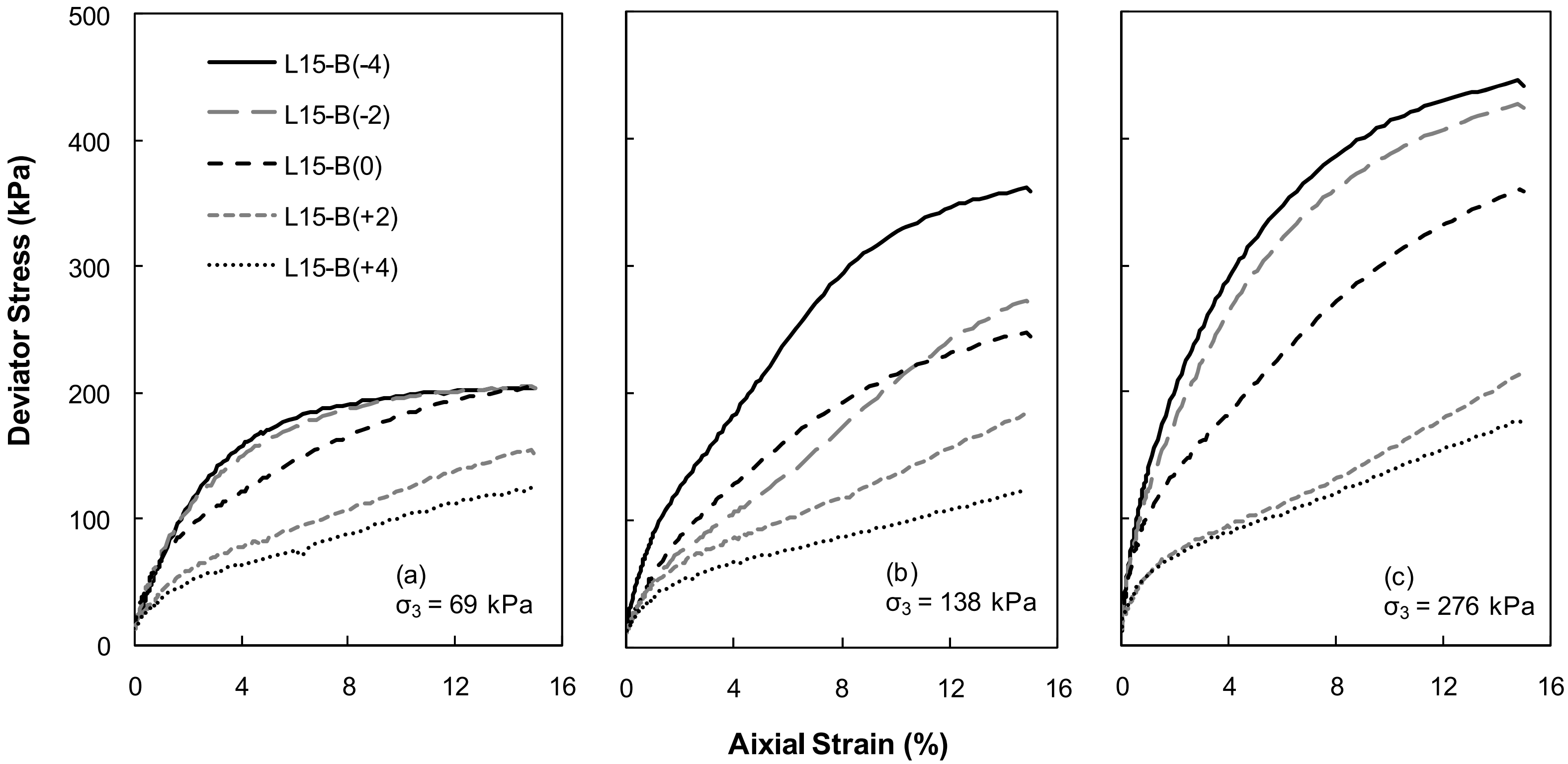


Figure 5.20. Stress-Strain Curves for Tests on Low Energy Proctor Compacted 15% Bentonite/Sand Specimens

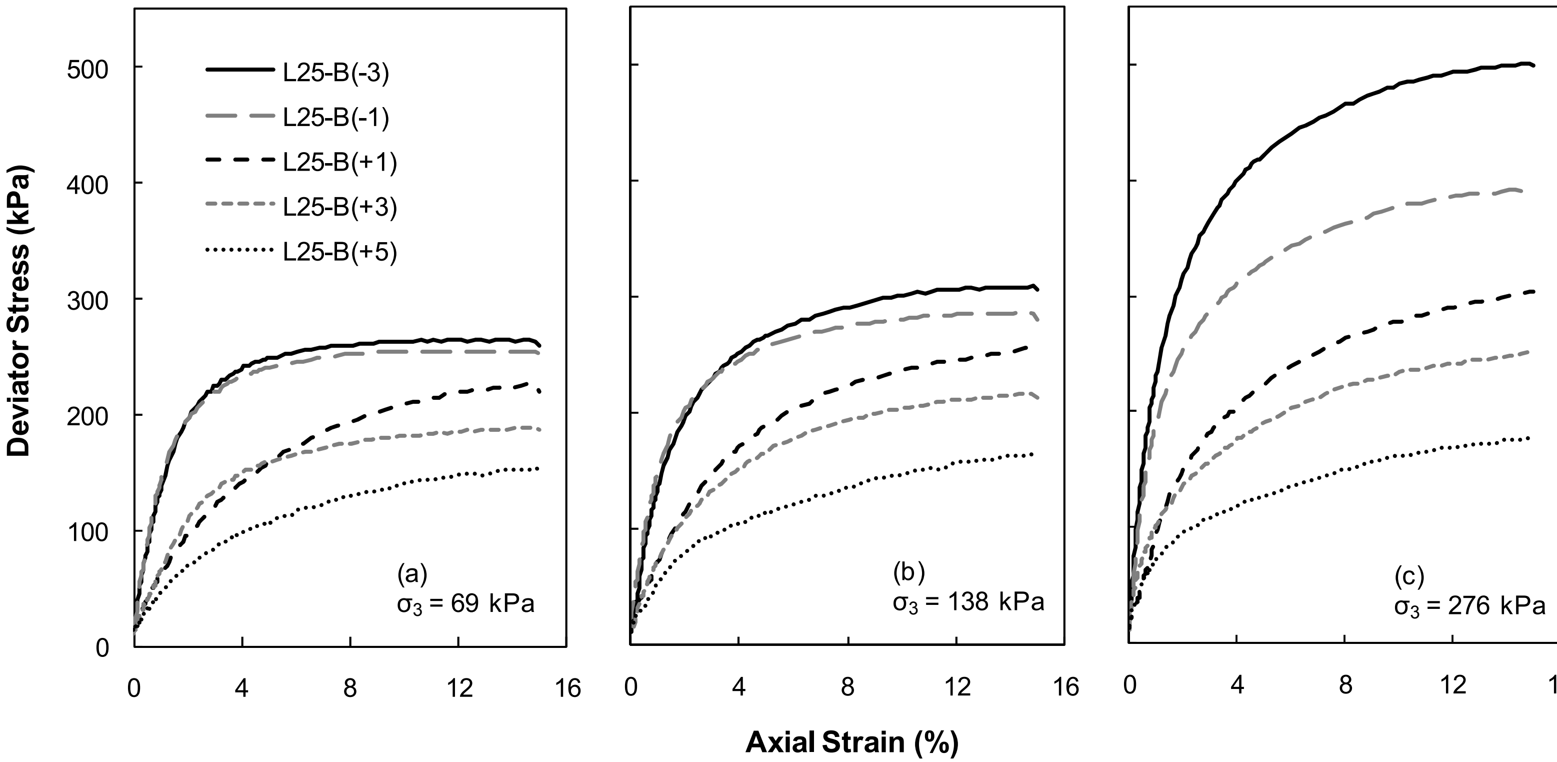


Figure 5.21. Stress-Strain Curves for Tests on Low Energy Proctor Compacted 25% Bentonite/Sand Specimens

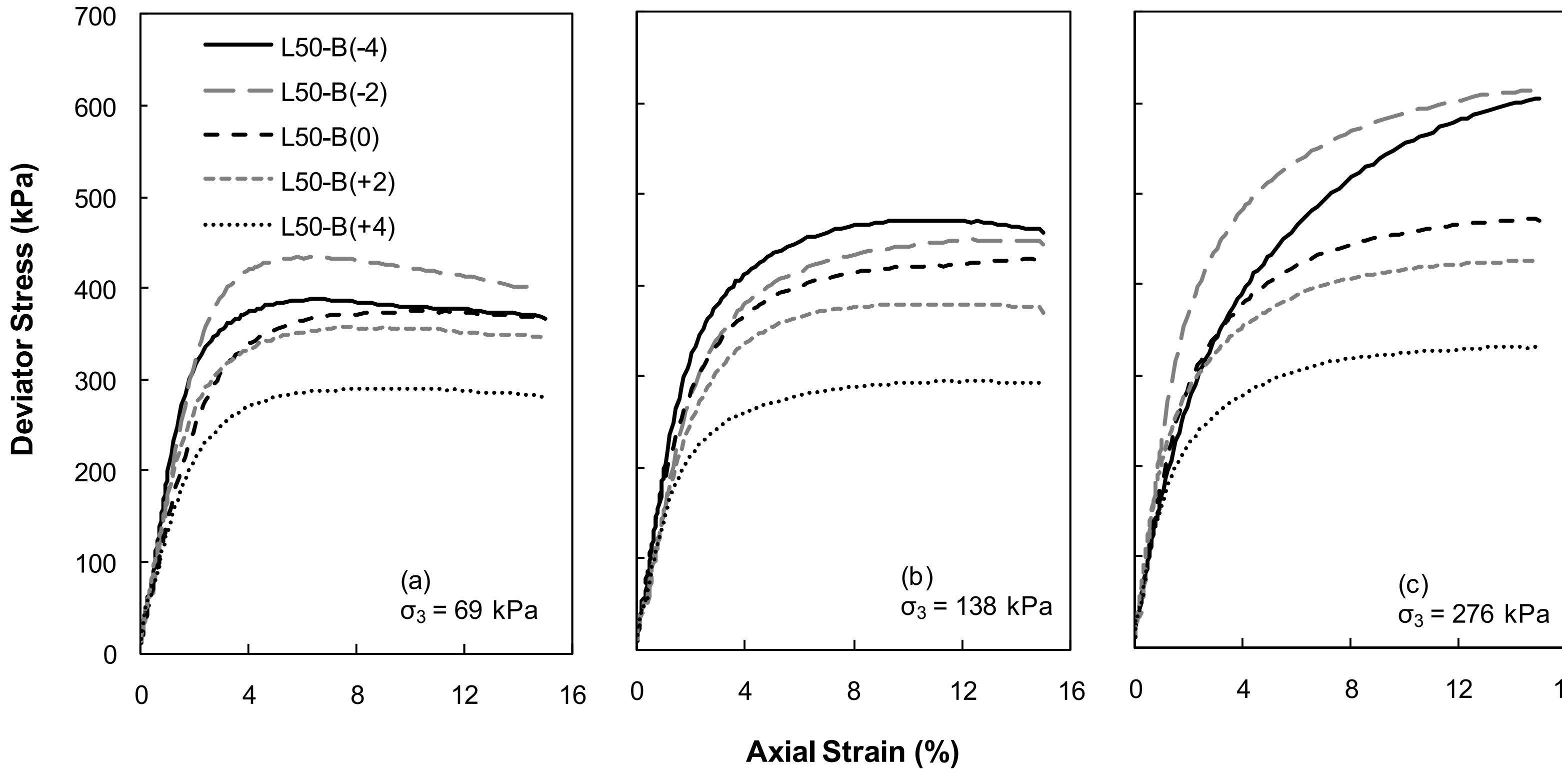


Figure 5.22. Stress-Strain Curves for Tests on Low Energy Proctor Compacted 50% Bentonite/Sand Specimens

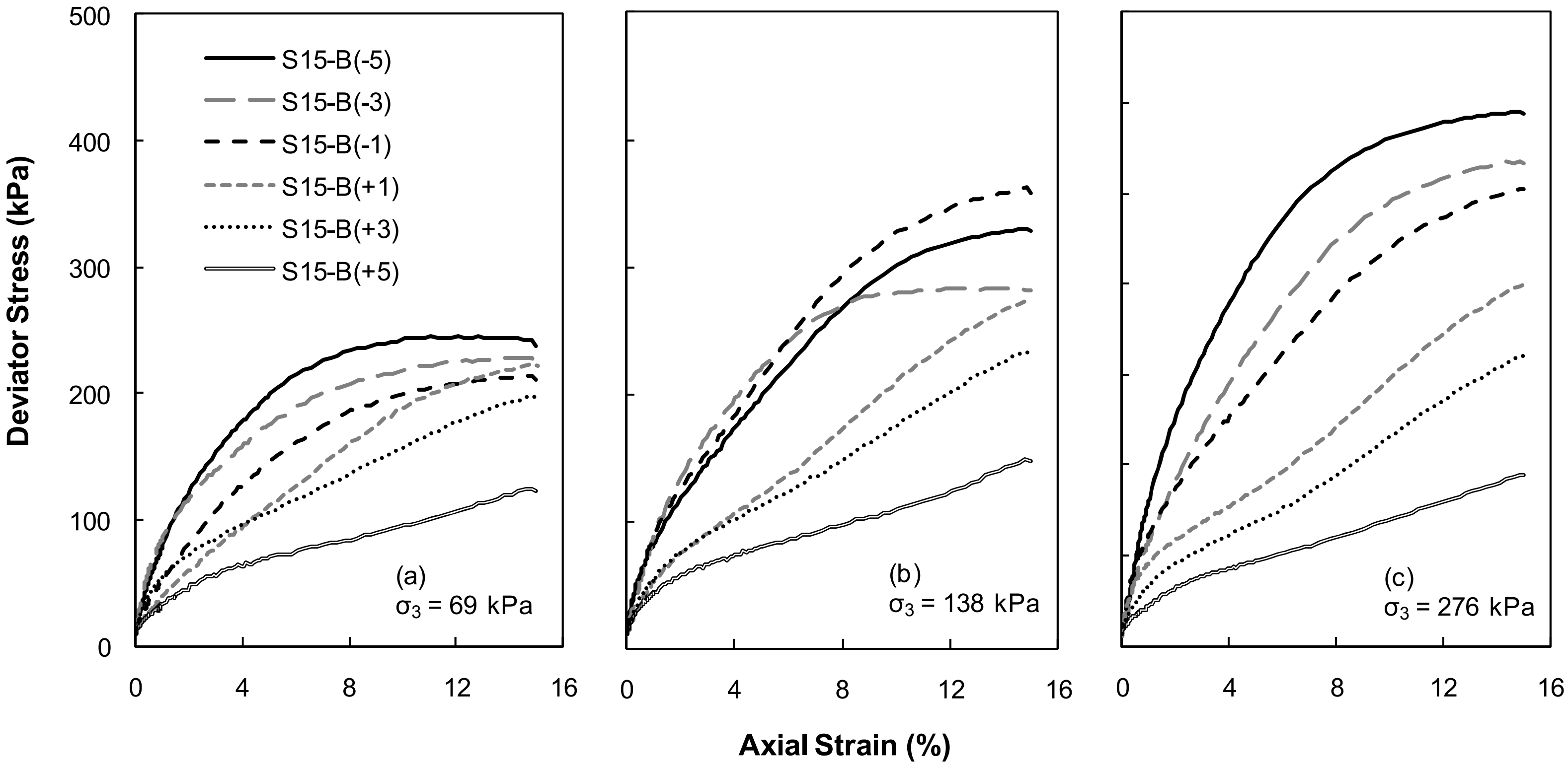


Figure 5.23. Stress-Strain Curves for Tests on Standard Proctor Compacted 15% Bentonite/Sand Specimens

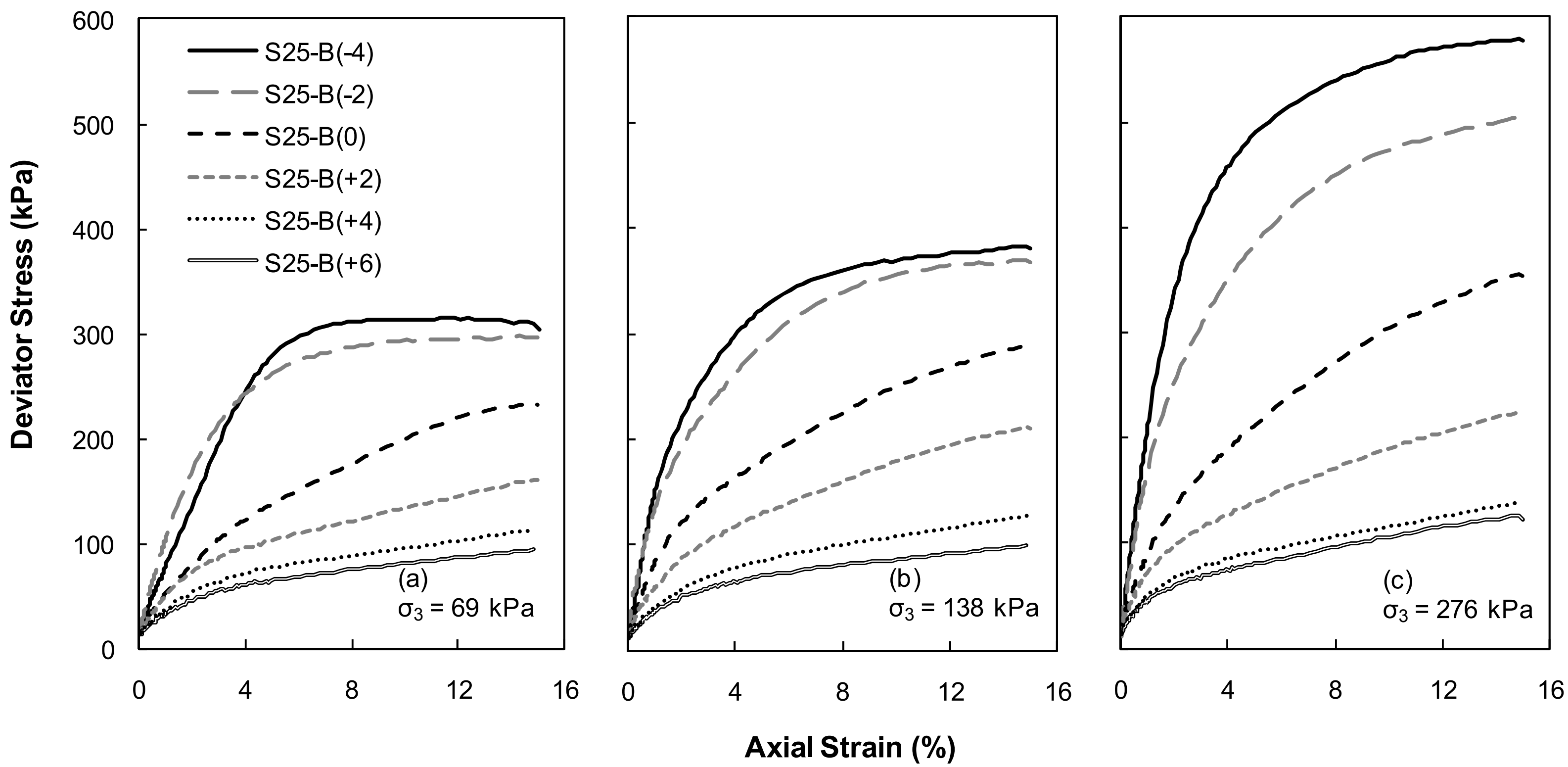


Figure 5.24. Stress-Strain Curves for Tests on Standard Proctor Compacted 25% Bentonite/Sand Specimens

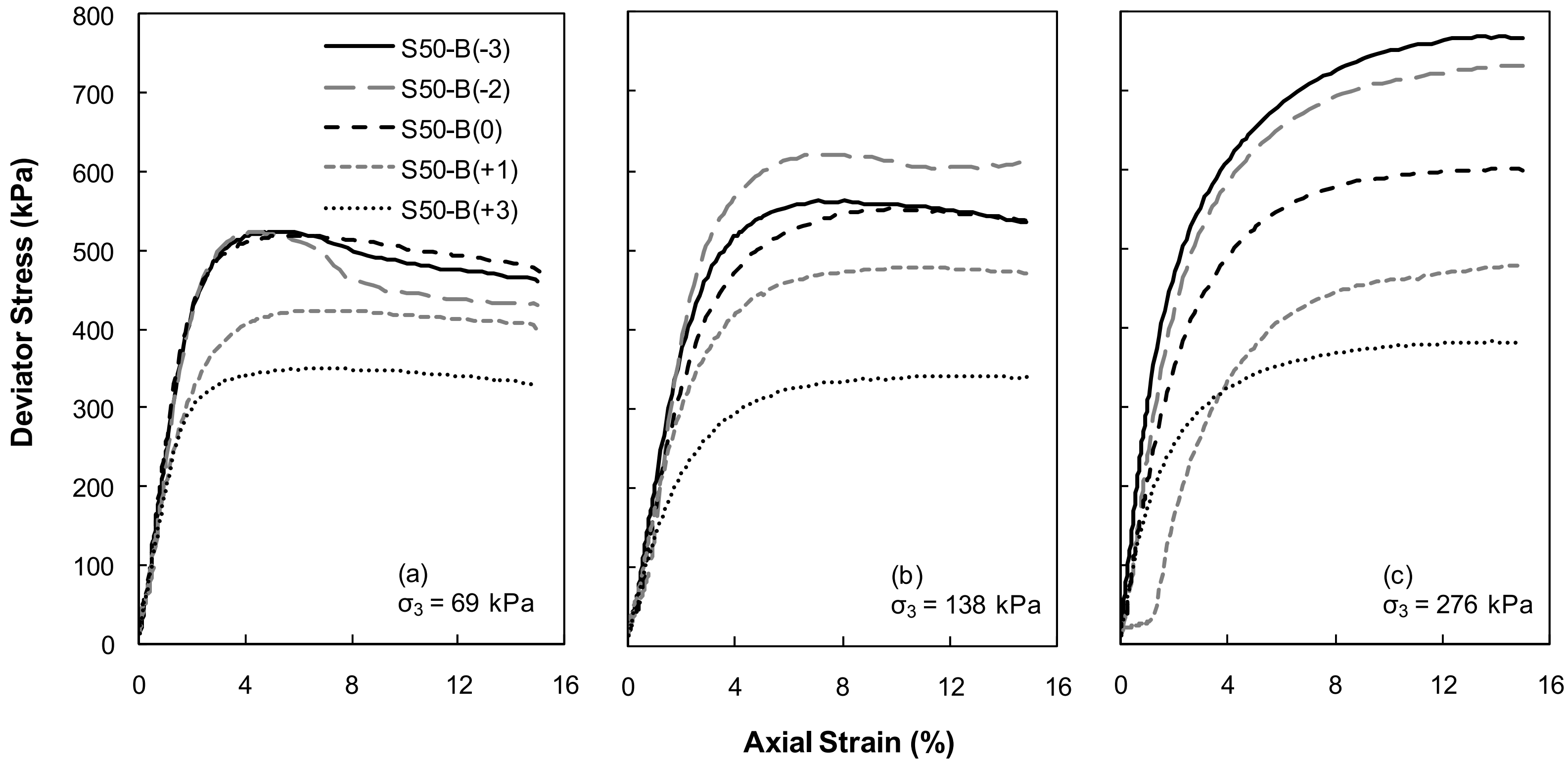


Figure 5.25. Stress-Strain Curves for Tests on Standard Proctor Compacted 50% Bentonite/Sand Specimens

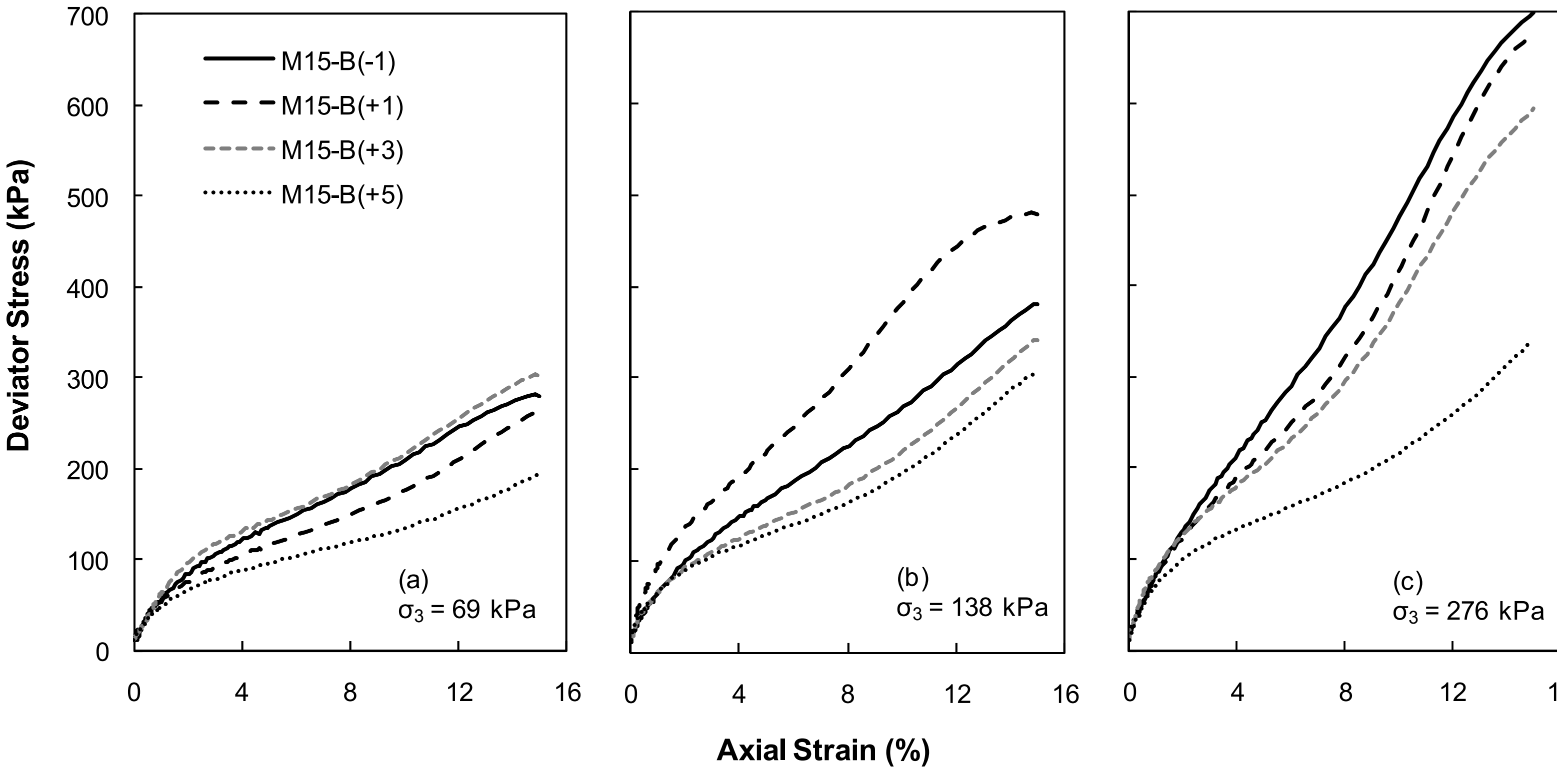


Figure 5.26. Stress-Strain Curves for Tests on Modified Proctor Compacted 15% Bentonite/Sand Specimens

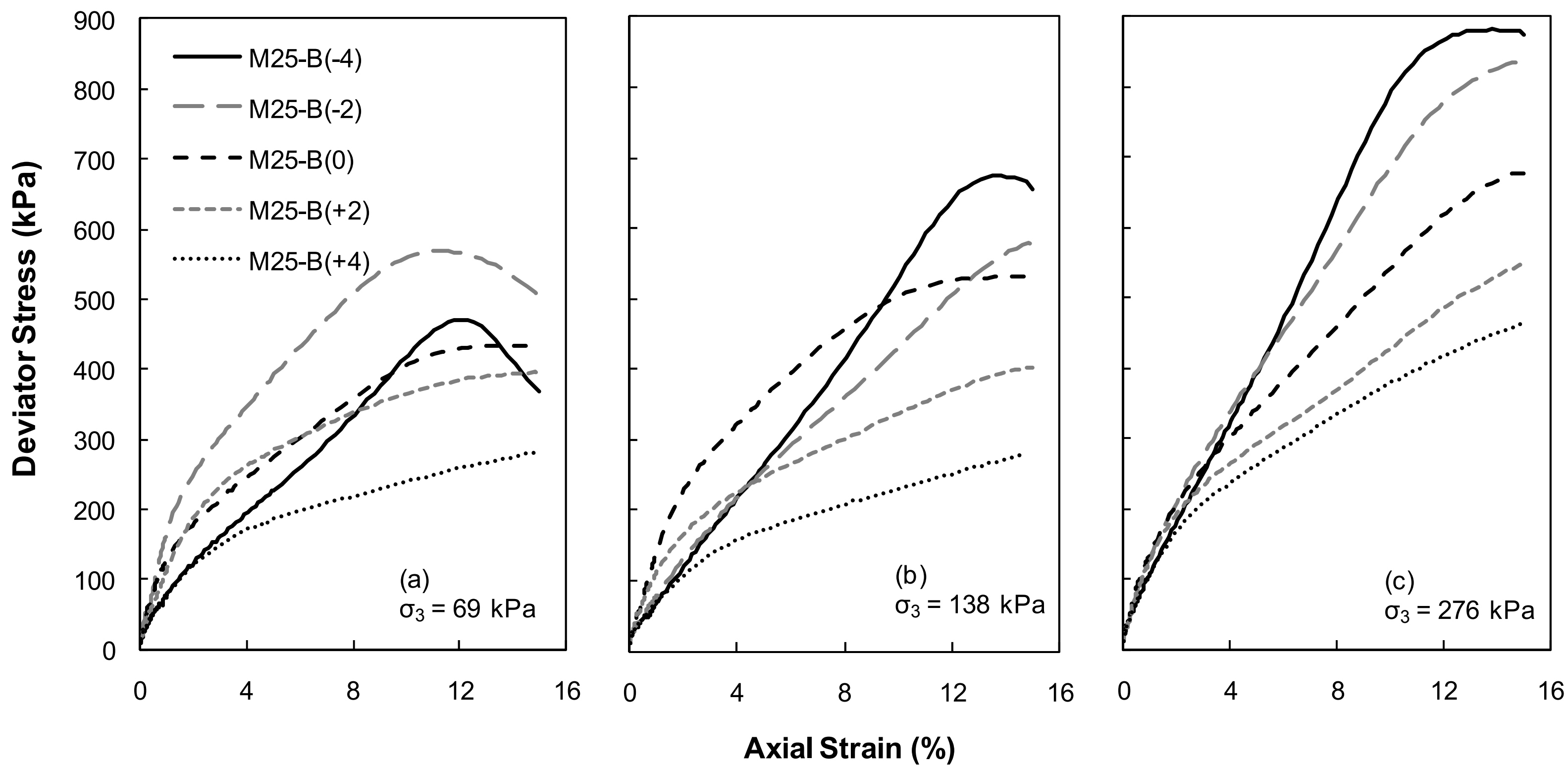


Figure 5.27. Stress-Strain Curves for Tests on Modified Proctor Compacted 25% Bentonite/Sand Specimens

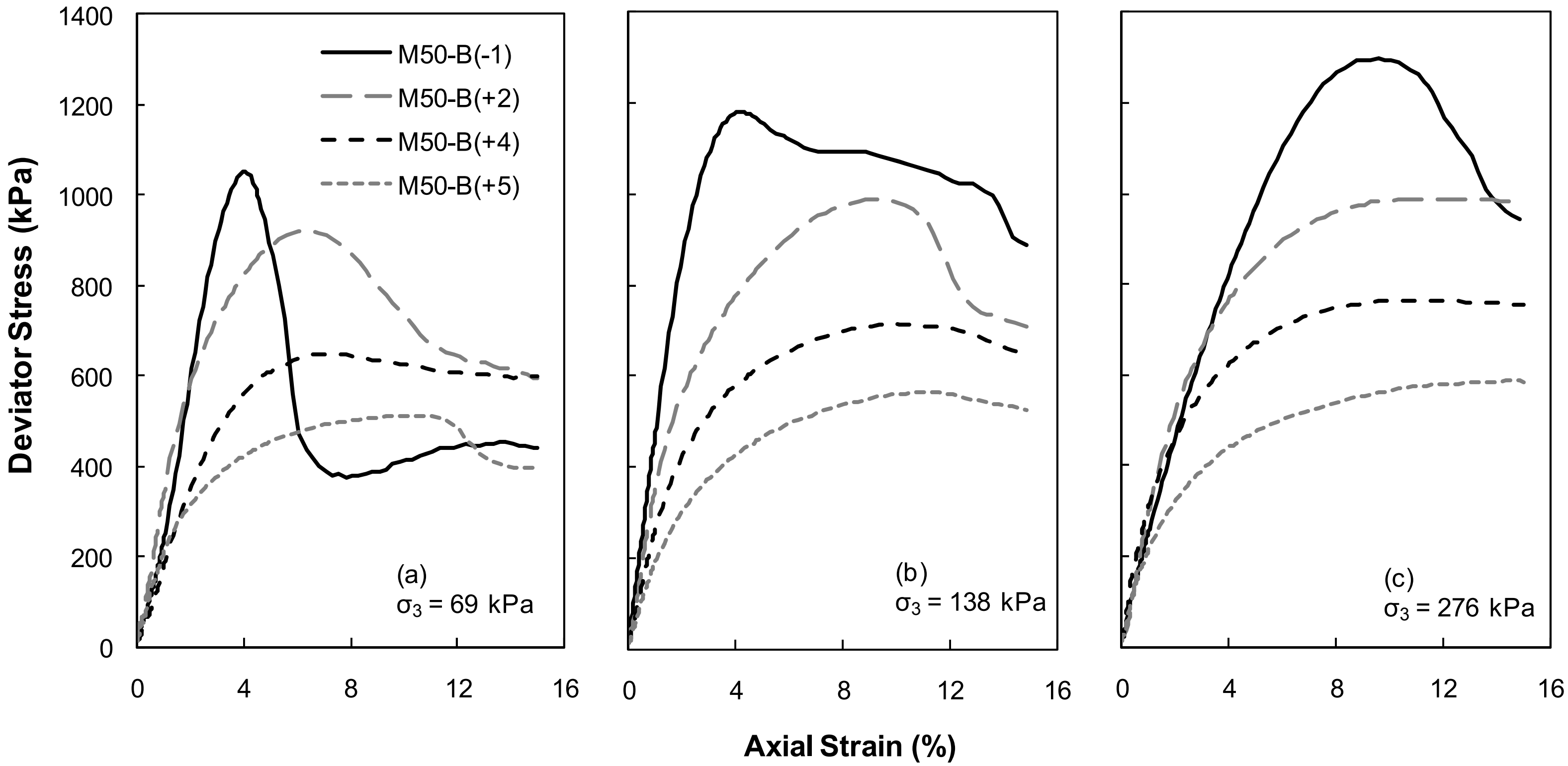


Figure 5.28. Stress-Strain Curves for Tests on Modified Proctor Compacted 50% Bentonite/Sand Specimens

Typical stress-strain curves from UU tests on bentonite/sand mixtures at confinement level 1 (69 kPa) are shown in Figures 5.29 to 5.31. The effect of clay content on the stress-strain behavior of the bentonite/sand specimens is shown more clearly in these figures. The relative shapes and positions of the curves for specimens tested at confinement level 2 (138 kPa) and level 3 (276 kPa) are similar to those observed in these figures, and are consequently not shown here. Each figure is for a separate nominal compactive effort. These data show that the specimens containing 50% bentonite are apparently stiffer, stronger and more brittle than specimens containing less bentonite. Definite peaks are seen in specimens containing 50% bentonite. These specimens developed a very steep stress-strain curve at the beginning of the test, and reached the maximum deviator stress at low strains. In contrast, specimens containing a lower bentonite proportion developed much flatter stress-strain curves.

The method of failure also presents an insight into the relative behavior that was observed for specimens prepared with different percentages of clay. All the specimens that contained less than 50% bentonite failed via a bulging-type mechanism. On the other hand, almost all the specimens containing 50% bentonite tested at confinement level 1 and level 2 failed on a well defined shear plane with a relatively small amount of bulging. For the specimens containing 50% bentonite, as confining pressure increased to confinement level 3, the specimens became more plastic, yielded more during the test, and typically failed via a bulging mechanism. For mixtures containing less than 50% bentonite, a high concentration of sand particles produced grain-to-grain contact and a large amount of voids among the sand particles (Figure 5.32). This type of soil matrix tended to deform by compressing voids or reorienting particles during shear, over a large portion of the specimen. As the clay content increased, the degree of void-filling by the clay also increased, which in some cases even caused the sand particles to float in a matrix of clay (Figure 5.33). At this point, specimens had a preference for developing a single shear plane. Figure 5.34 presents a picture of specimen M50-B(-1)-C1, which failed by a brittle-type failure mechanism. One of the specimens that failed by bulging, M25-B(-2)-C1, is shown in Figure 5.35.

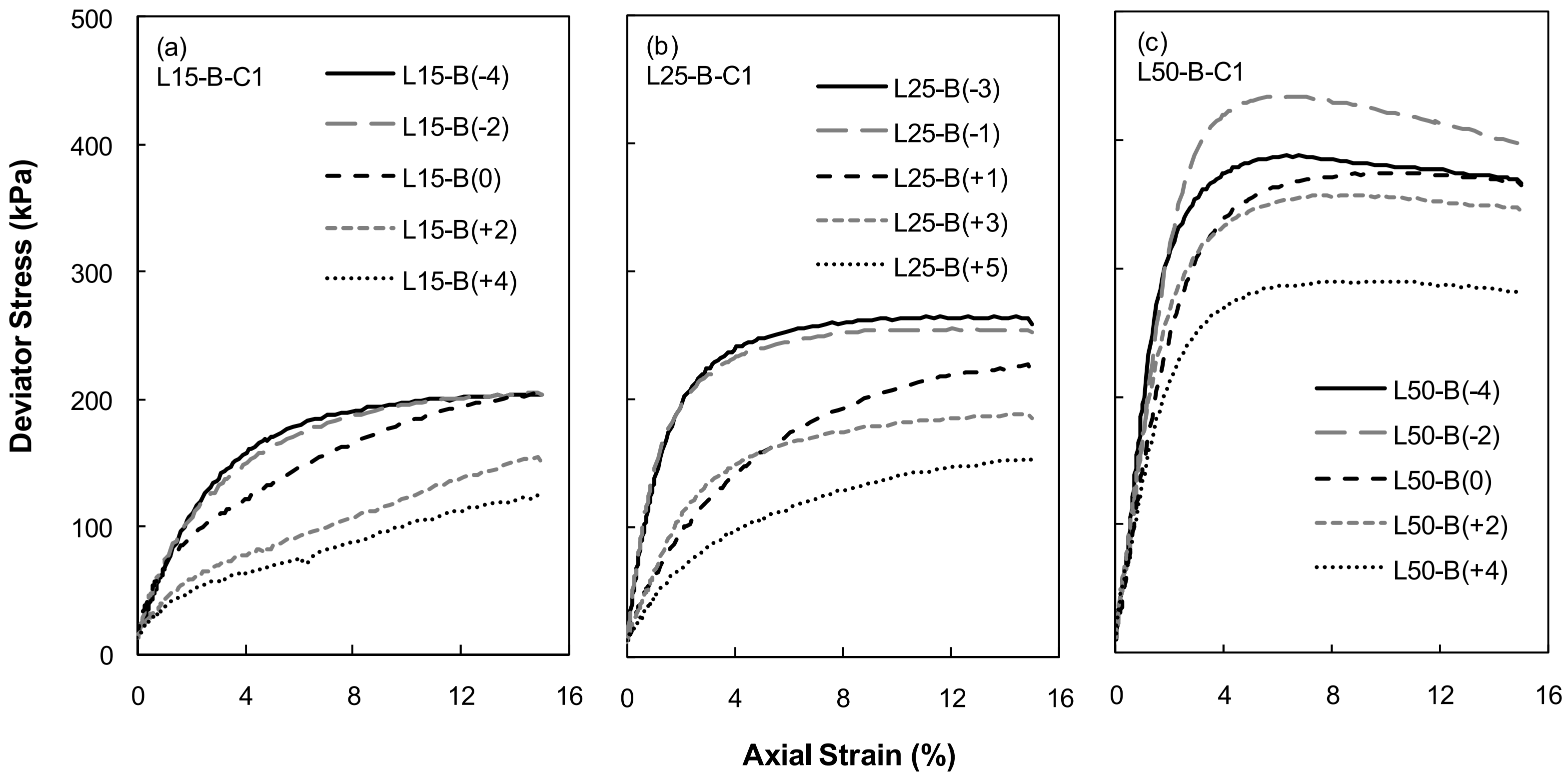


Figure 5.29. Stress-Strain Curves for Tests on Low Energy Proctor Compacted Bentonite/Sand Specimens at Confinement Level 1

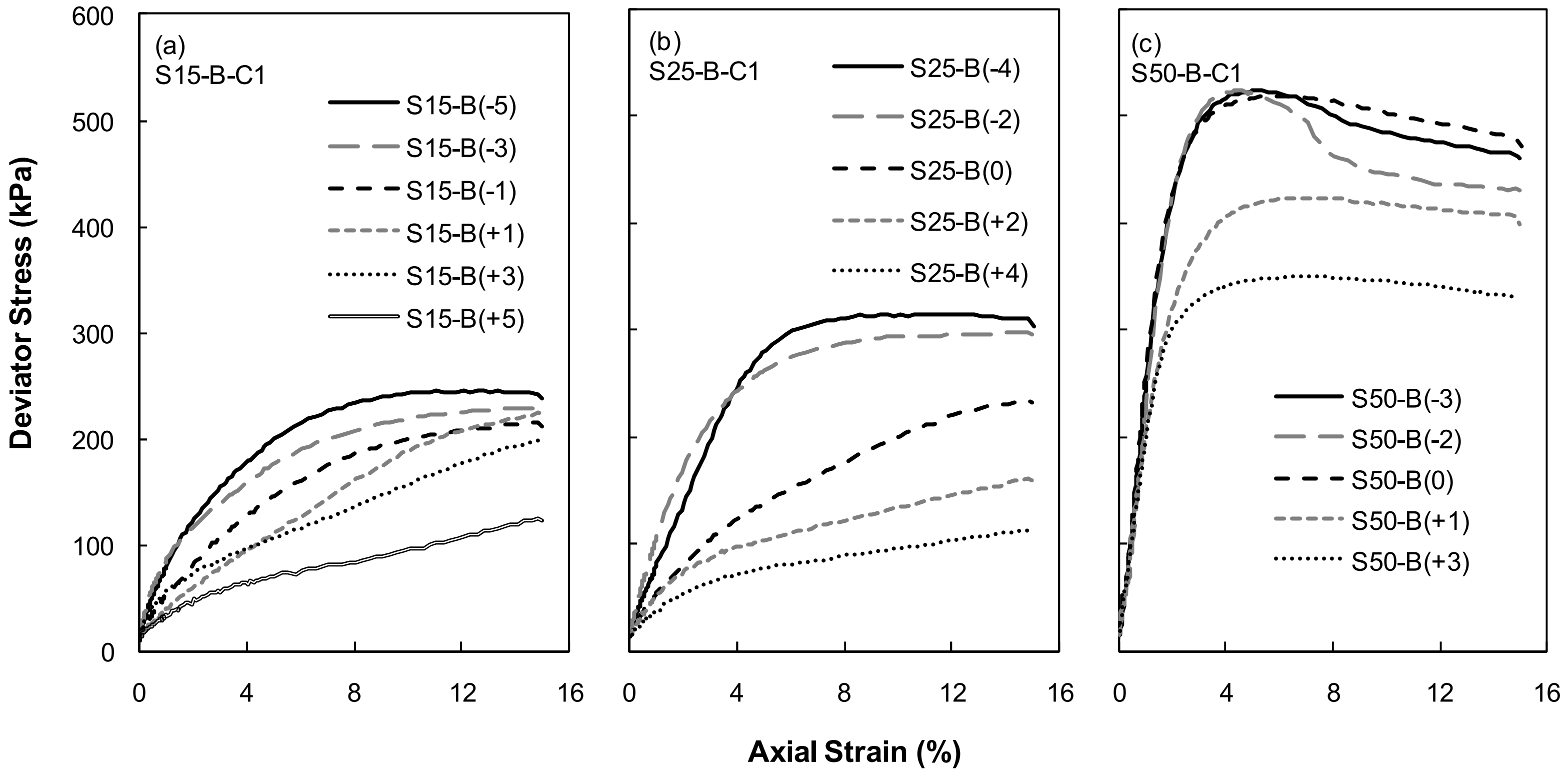


Figure 5.30. Stress-Strain Curves for Tests on Standard Proctor Compacted Bentonite/Sand Specimens at Confinement Level 1

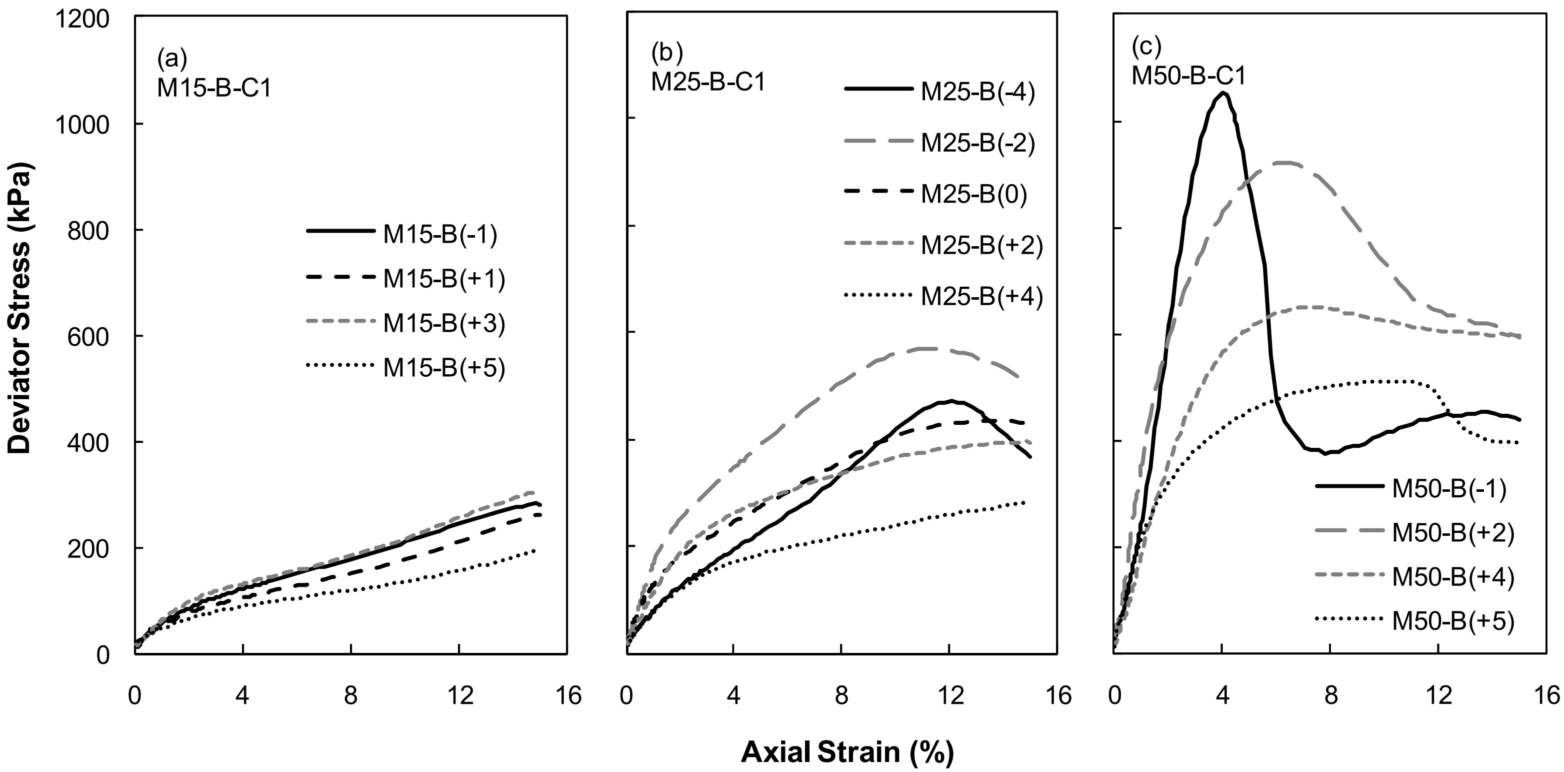


Figure 5.31. Stress-Strain Curves for Tests on Modified Proctor Compacted Bentonite/Sand Specimens at Confinement Level 1

Figure 5.32. Photograph of specimen S15-B(+1)-C1

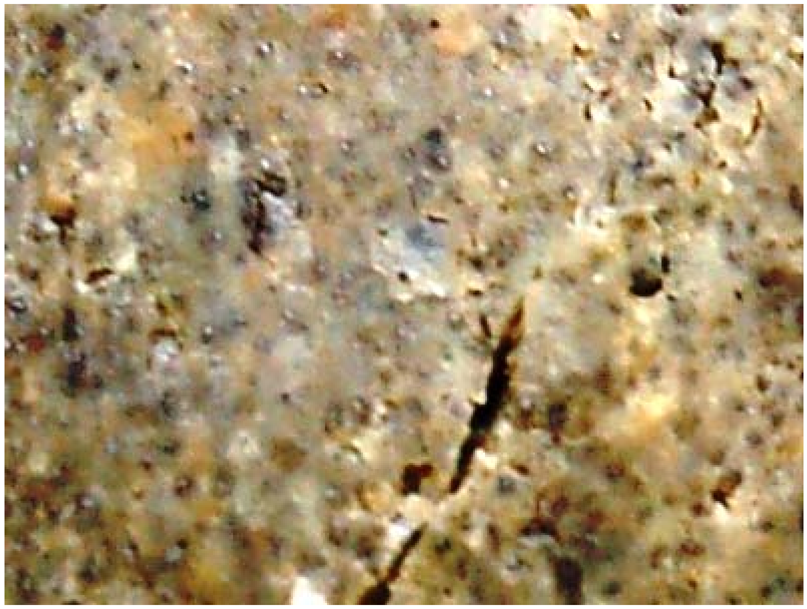


Figure 5.33. Photograph of specimen S50-B(+1)-C1

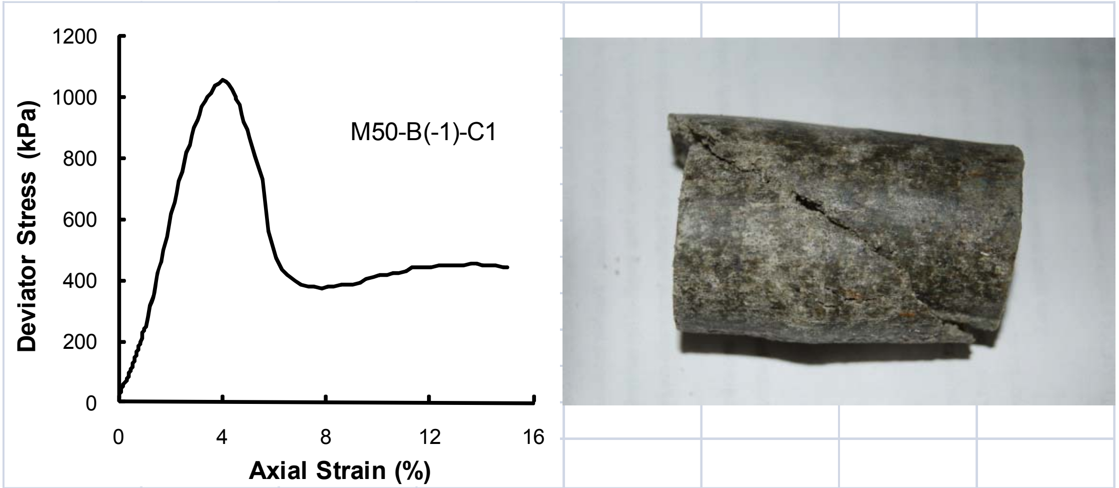


Figure 5.34. A Brittle-Type Failure: Specimen M50-B(-1)-C1

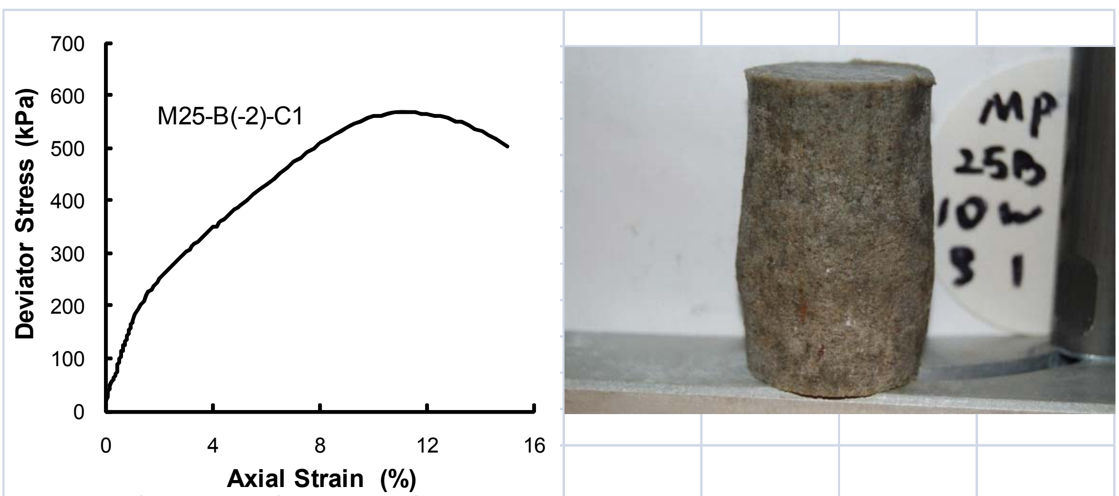


Figure 5.35. A Bulging-Type Failure: Specimen M25-B(-2)-C1

Stress-stain curves from UU triaxial tests on kaolinite/sand mixtures are shown in Figures 5.36 to 5.41. As mentioned previously, the results from tests on 15% kaolinite/sand mixtures are not shown due to sample failure during the UU specimen preparation process. The relative shapes of these stress-strain curves are similar to those observed for the bentonite/sand mixtures (Figure 5.20 to 5.28). The specimens compacted dry-of-optimum are considerably stronger, stiffer and more brittle than the otherwise identical specimens compacted wet-of-optimum. Unlike the bentonite/sand mixtures, the differences in undrained strength between dry-of-optimum specimens and wet-of-optimum specimens are quite large. As the compaction water content increased, the undrained strength dropped drastically and the stress-strain curves became quite flat.

Increasing the UU test confining pressure had very little (if any) effect on the specimens that had been prepared wet-of-optimum. The specimens compacted wet-of-optimum maintained their considerably low strengths and plastic stress-stain behavior at all confining pressures. The dry-of-optimum specimens maintained their relatively high strengths. However, as the confining pressure increased, the dry-of-optimum specimens lost some of their brittle stress-strain characteristics.

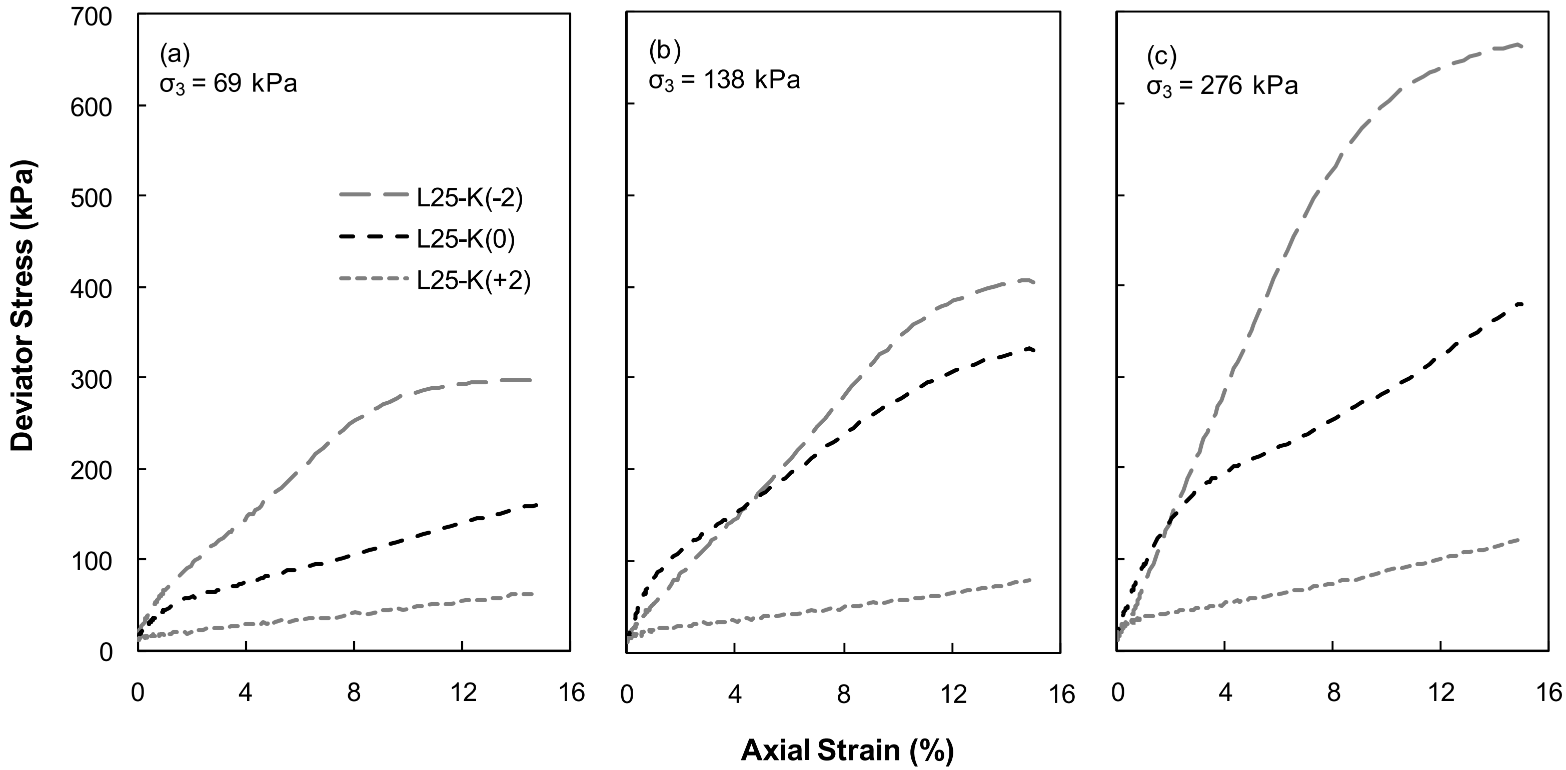


Figure 5.36. Stress-Strain Curves for Tests on Low Energy Proctor Compacted 25% Kaolinite/Sand Specimens

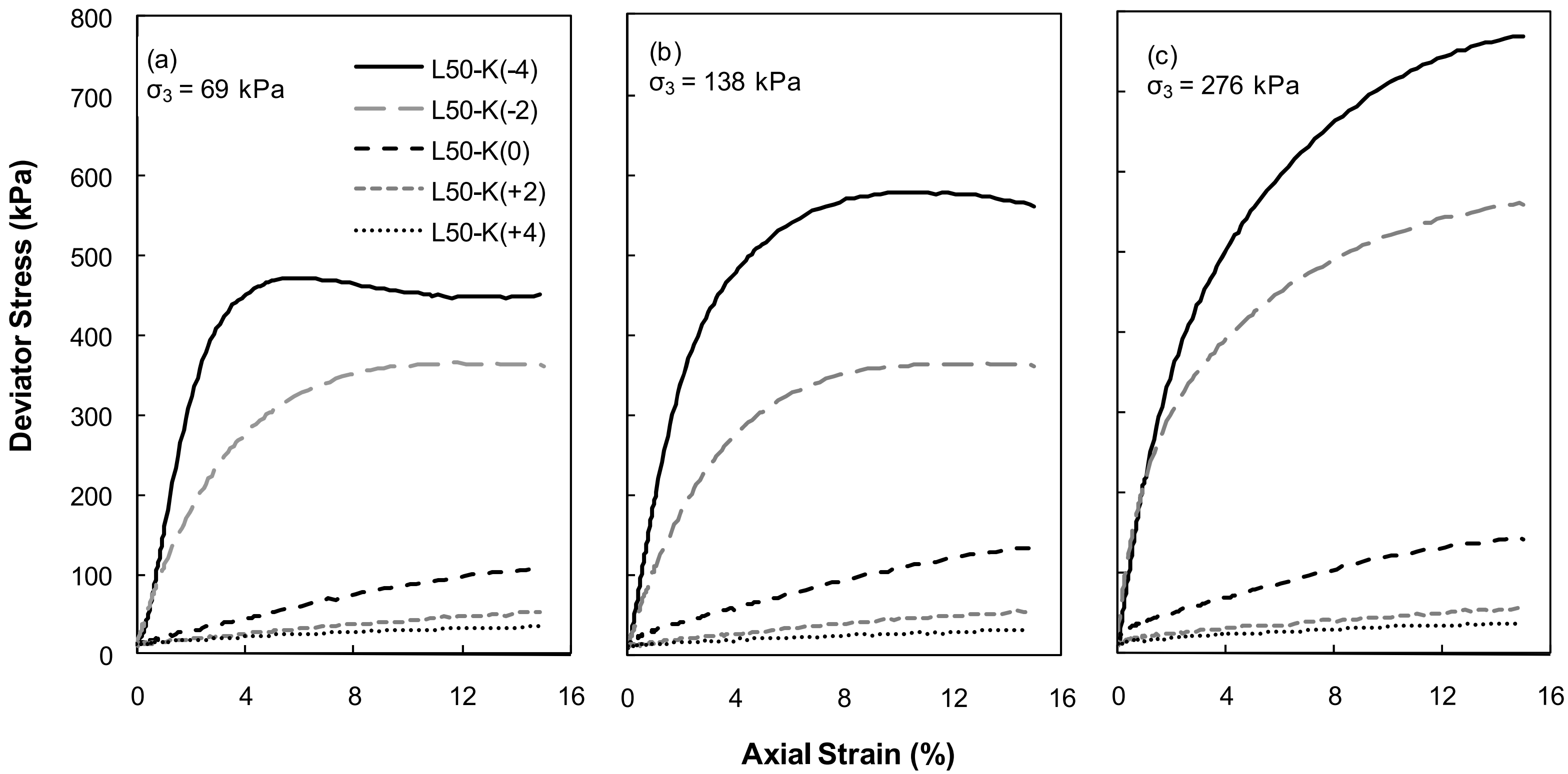


Figure 5.37. Stress-Strain Curves for Tests on Low Energy Proctor Compacted 50% Kaolinite/Sand Specimens

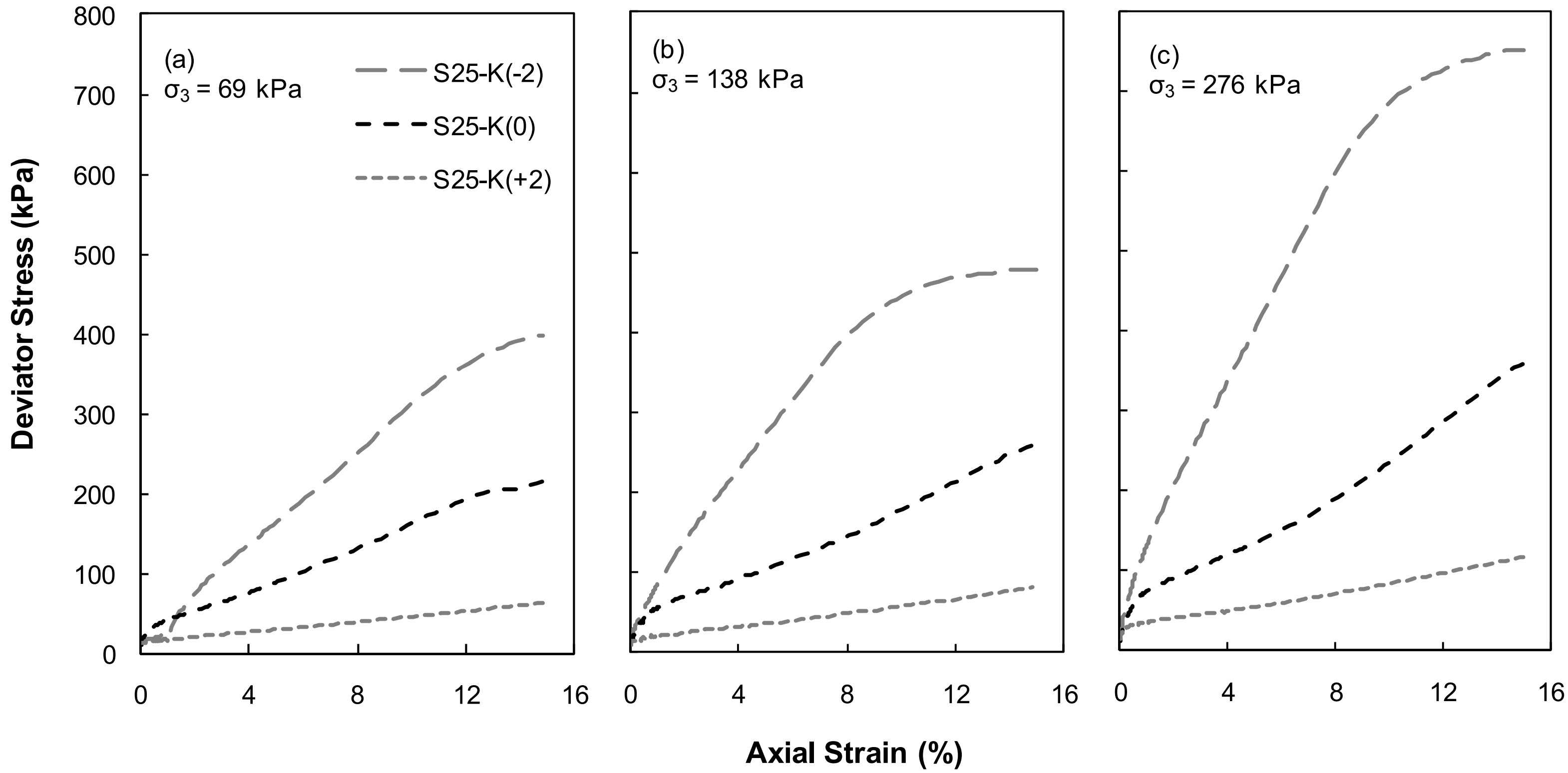


Figure 5.38. Stress-Strain Curves for Tests on Standard Proctor Compacted 25% Kaolinite/Sand Specimens

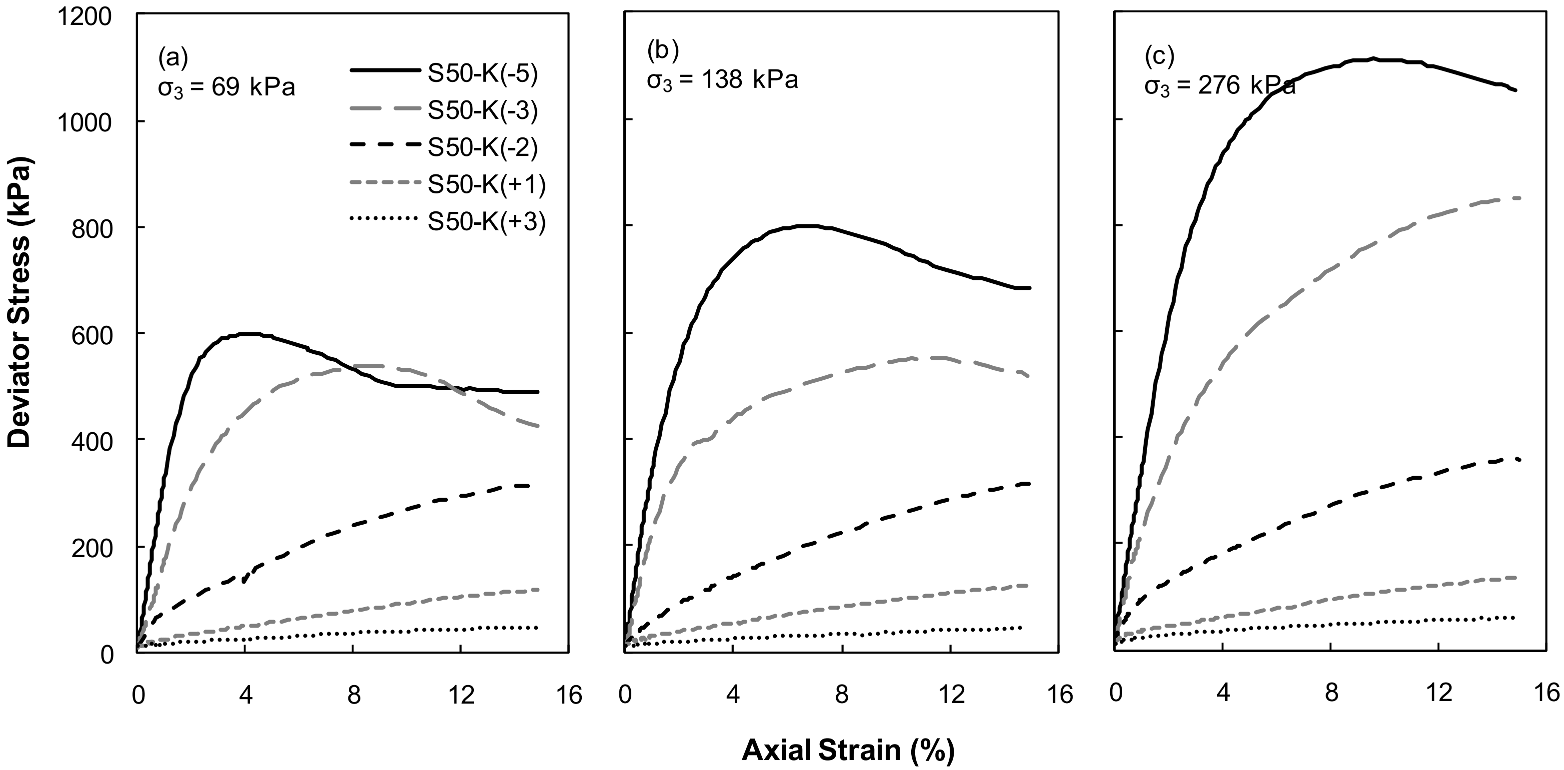


Figure 5.39. Stress-Strain Curves for Tests on Standard Proctor Compacted 50% Kaolinite/Sand Specimens

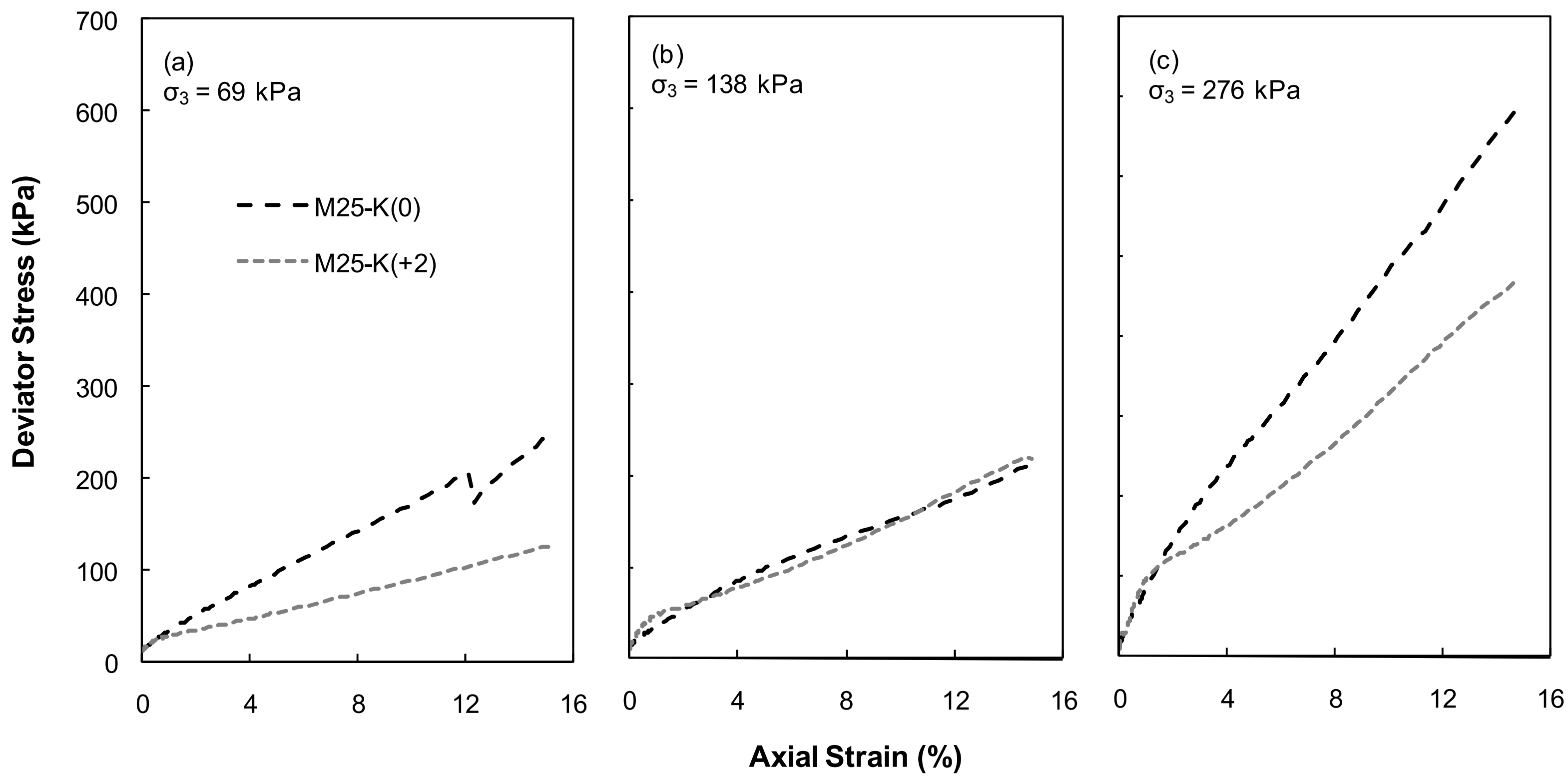


Figure 5.40. Stress-Strain Curves for Tests on Modified Proctor Compacted 25% Kaolinite/Sand Specimens

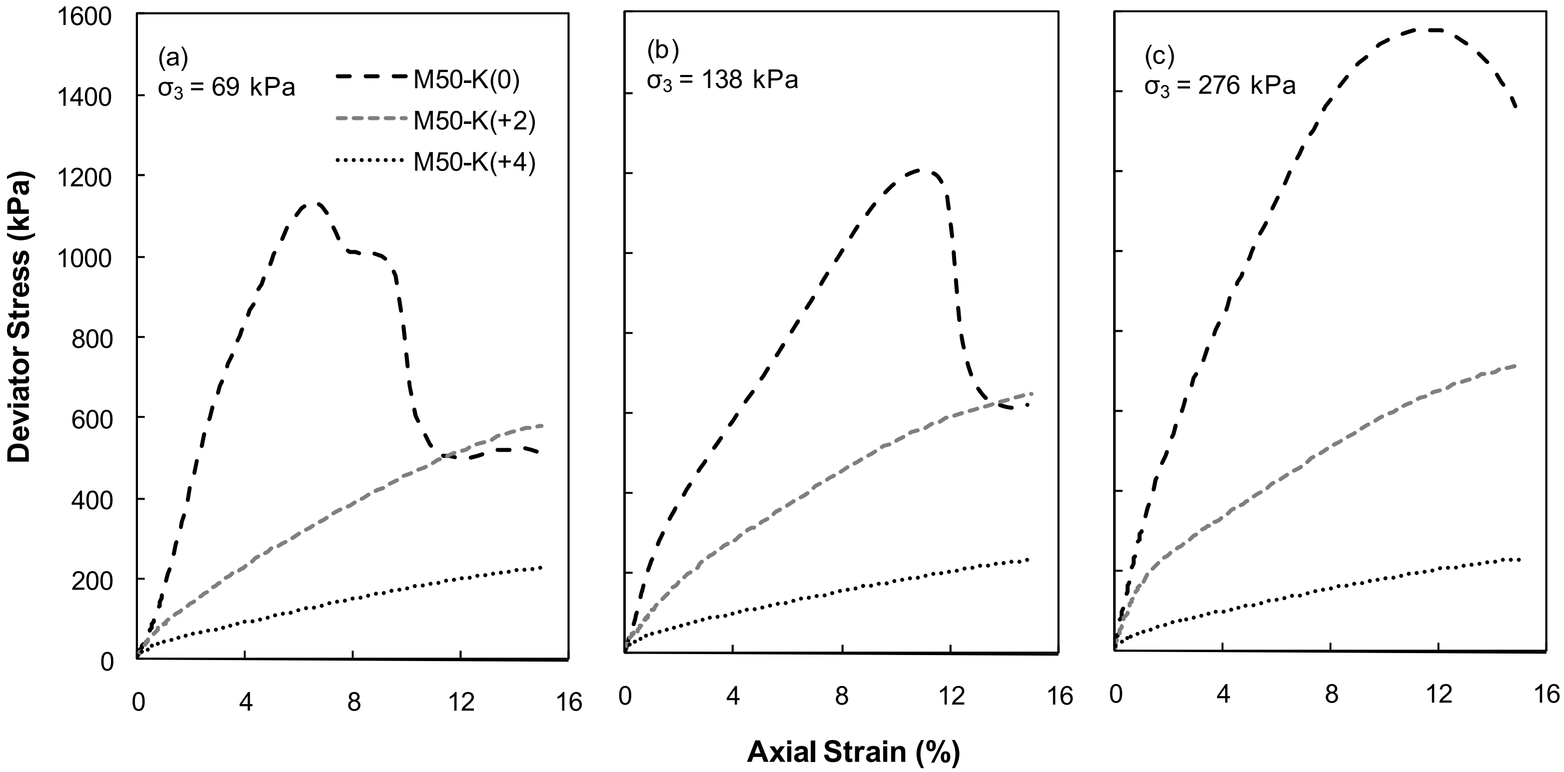


Figure 5.41. Stress-Strain Curves for Tests on Modified Proctor Compacted 50% Kaolinite/Sand Specimens

5.2.3 Undrained Strength Parameters

The K_f failure envelopes for the soil mixtures that were tested (Figures 5.9 to 5.13) exhibited relatively linear behavior over the range of confining pressures that were used in the UU tests. The values of the Mohr-Coulomb strength parameters c and ϕ were evaluated using the procedure recommended by Duncan et al. (1980), which is illustrated in Figure 5.42. At failure, the values of $p_f = (\sigma_1 + \sigma_3)/2$ are plotted vs. $q_f = (\sigma_1 - \sigma_3)/2$. Failure lines ($K_f$ lines) were drawn through these points using linear least squares regression analysis.

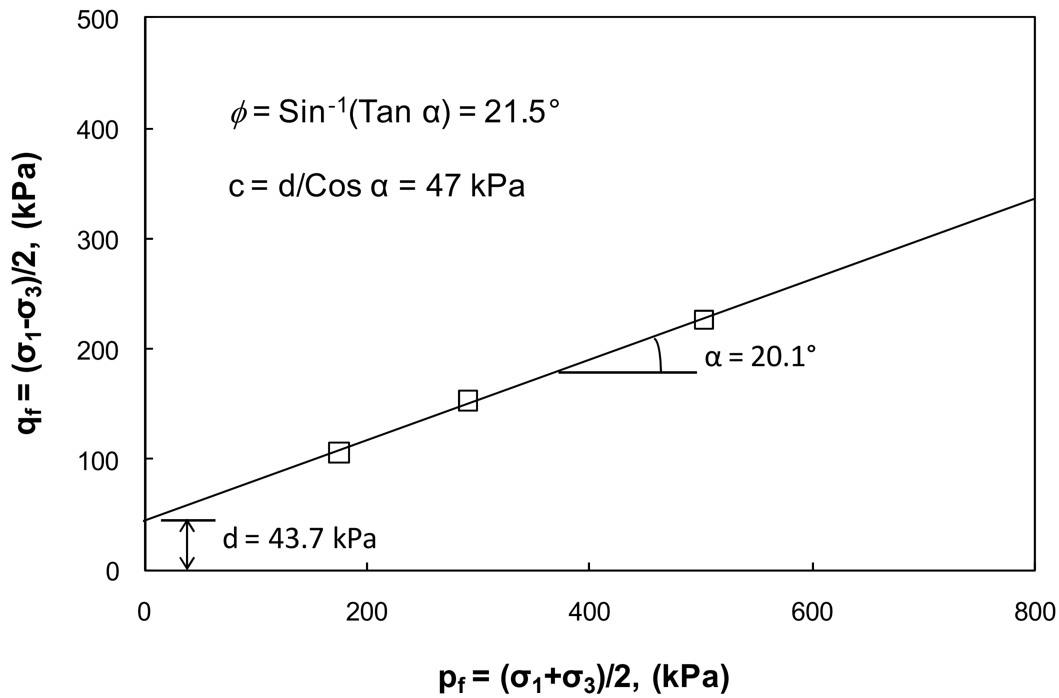


Figure 5.42. Kf line for UU-Triaxial Tests on Bentonite/Sand Specimen (Data from L15-B(-4))

The primary advantage of this method is that it is simpler to fit the "best" straight line through a series of points (which can be done using linear regression) than it is to draw the ideal Mohr-Coulomb failure envelope tangent to a series of circles which do not have a common tangent. To use this method, values of c and ϕ are calculated from the slope and intercept of the K_f line using the equations shown in Fig. 5.42. The resulting values of the Mohr-Coulomb strength parameters c and ϕ for all the soils that were tested are listed in Table 5.4.

Table 5.4 Mohr-Coulomb Strength Parameters

Soil Number	Proctor Mold Water Content (%)	Proctor Mold Dry Unit Weight (kN/m^3)	c (kPa)	ϕ (degrees)
L15-B(-4)	12.1	16.1	47	21.5
L15-B(-2)	13.9	16.3	39.9	21.7
L15-B(0)	15.8	16.5	40.1	20.8
L15-B(+2)	17.9	16.6	54.9	16
L15-B(+4)	19.7	16.4	60.3	6.9
L15-B(+5)	21.1	15.8	34.1	3.1
L25-B(-3)	14.0	15.8	55.7	21.9
L25-B(-1)	16.1	16.1	76.5	14.7
L25-B(+1)	17.6	16.5	85	9.1
L25-B(+3)	19.9	15.9	74.1	7.3
L25-B(+5)	22.0	15.7	68.5	3
L50-B(-4)	16.6	14	112.4	19.9
L50-B(-2)	18.3	14.4	125.6	18.4
L50-B(-1)	19.2	14.5	147.5	13.9
L50-B(0)	20.8	14.5	145	10.6
L50-B(+2)	22.2	14.4	143.9	8.3
L50-B(+3)	23.3	14.1	109	10.1
L50-B(+4)	24	13.8	122.4	5.4

Table 5.4 (continued)

Soil Number	Proctor Mold Water Content (%)	Proctor Mold Dry Unit Weight (kN/m^3)	*c* (kPa)	ϕ (degrees)
S15-B(-5)	10	16.9	33.5	27.5
S15-B(-3)	12.3	17.2	30	25.9
S15-B(-1)	14.3	17.4	44.1	24
S15-B(+1)	16.3	17.3	57.8	17.5
S15-B(+3)	18.2	17	59.7	13.4
S15-B(+5)	19.8	16.6	44.1	7.7
S25-B(-4)	12.6	16	70.1	23.2
S25-B(-2)	14.8	16.9	80.3	19.4
S25-B(0)	16.9	17.1	78.3	12.9
S25-B(+2)	18.7	16.8	65.8	7.2
S25-B(+4)	20.5	16.4	48.8	3.3
S50-B(-3)	16.4	14.9	139	22.6
S50-B(-2)	16.9	15	166	19.2
S50-B(0)	19.5	15.1	212	9.4
S50-B(+1)	20.3	15.2	188.3	6.1
S50-B(+3)	23.1	15	150.9	4.6
S50-B(+6)	25.3	14.8	107.2	4.4
M15-B(-1)	10.5	19	33.3	30.6
M15-B(+1)	12.1	19	44.5	29.7
M15-B(+3)	13.8	18.6	53.4	25.3
M15-B(+5)	15.8	18	63.6	14.9
M25-B(-4)	8.4	18	104.1	29.6
M25-B(-2)	10.4	18.6	138	24.6
M25-B(0)	12.0	18.7	121.5	21.6
M25-B(+2)	13.8	18.5	118.8	16.5
M25-B(+4)	15.9	18	64	19.1
M50-B(-1)	13.7	17.7	337.6	21.4
M50-B(+2)	16.2	17.6	325	20.3
M50-B(+4)	18.5	17.2	250.2	12.3
M50-B(+5)	19.9	16.7	213.8	8.4

Table 5.4 (continued)

Soil Number	Proctor Mold Water Content (%)	Proctor Mold Dry Unit Weight (kN/m^3)	c (kPa)	ϕ (degrees)
L25-K(-2)	7.8	18.5	49.9	28.1
L25-K(0)	9.4	19.3	40.8	20.3
L25-K(+2)	11.4	19.2	17.4	7
L50-K(-4)	12.6	15.5	120.1	24.6
L50-K(-2)	14.8	16.8	117.3	18.5
L50-K(0)	17.3	16.9	45.9	4.4
L50-K(+2)	19.5	16.1	24.5	0.5
L50-K(+4)	21	15.7	14.6	0.5
S25-K(-2)	7.9	19.3	76.9	28
S25-K(0)	10.0	19.6	62.1	15
S25-K(+2)	11.7	19	18.3	6.6
S50-K(-5)	11.4	16.1	118.7	33.4
S50-K(-3)	14.0	16.7	115.2	27.1
S50-K(-2)	15.1	17.9	127.3	6.5
S50-K(+1)	17.6	16.9	52	2.4
S50-K(+3)	19.8	16.1	19.9	1.7
M25-K(0)	8.2	20.6	24.6	31.3
M25-K(+2)	9.7	20.2	-	27.2
M50-K(0)	12.2	19	268.4	31.1
M50-K(+2)	14.0	18.7	209.5	13.8
M50-K(+4)	15.8	17.7	111.3	0.5

The variations in cohesion as a function of water content for each soil mixture are shown in Figures 5.43 to 5.45. Each figure is for a separate nominal energy level. As expected, the cohesion generally increased with increasing clay content. The cohesion also increased with increasing compactive effort. For specimens with higher clay contents, the cohesion increased considerably as the compactive effort was increased to that applied by the Modified Proctor procedure. In contrast, for specimens with lower clay contents, the cohesion increased only slightly as the compactive effort increased. For specimens compacted using the low energy Proctor method, the difference in cohesion values between specimens with high clay content and lower clay content is quite small. However, the samples developed markedly different cohesion when compacted using the modified Proctor method. In other words, a low compactive effort reduces the difference in cohesion between mixtures of varying clay content. At the same clay content, the bentonite/sand specimens tend to exhibit higher cohesion values than the kaolinite/sand specimens.

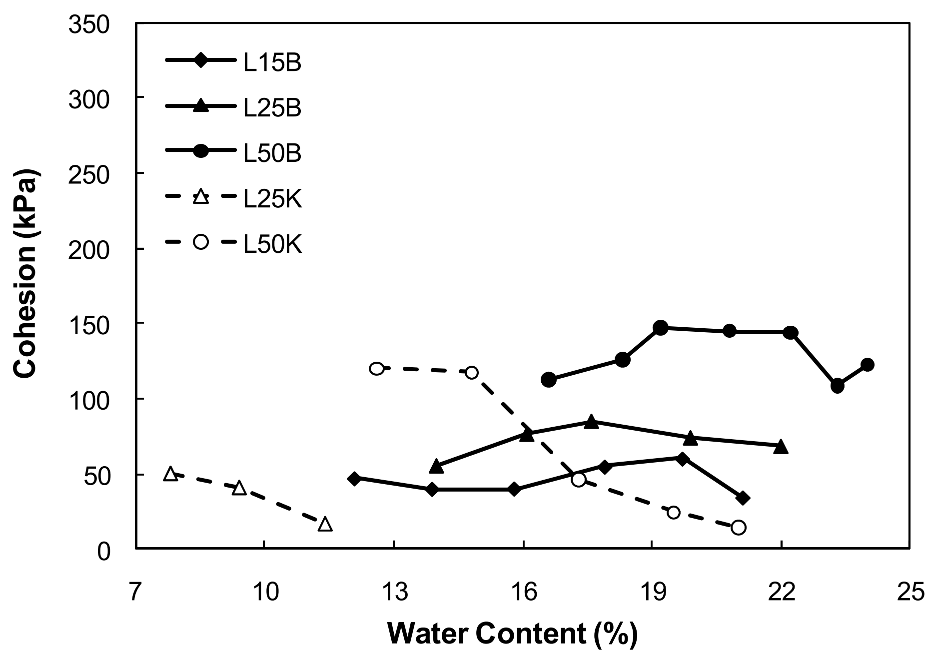


Figure 5.43. Cohesion of Low Energy Proctor Compacted Clay/Sand Specimens

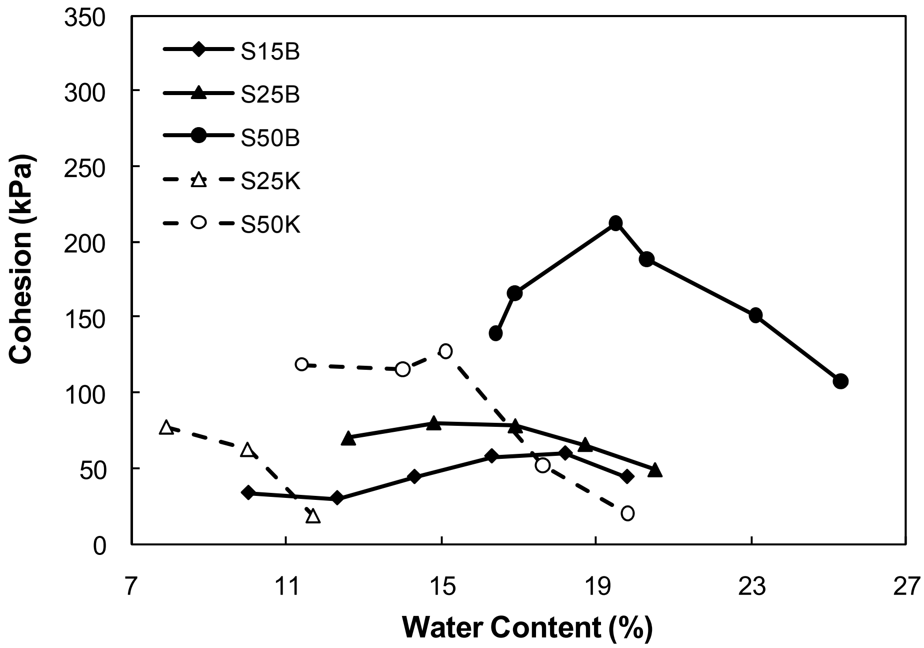


Figure 5.44. Cohesion of Standard Proctor Compacted Clay/Sand Specimens

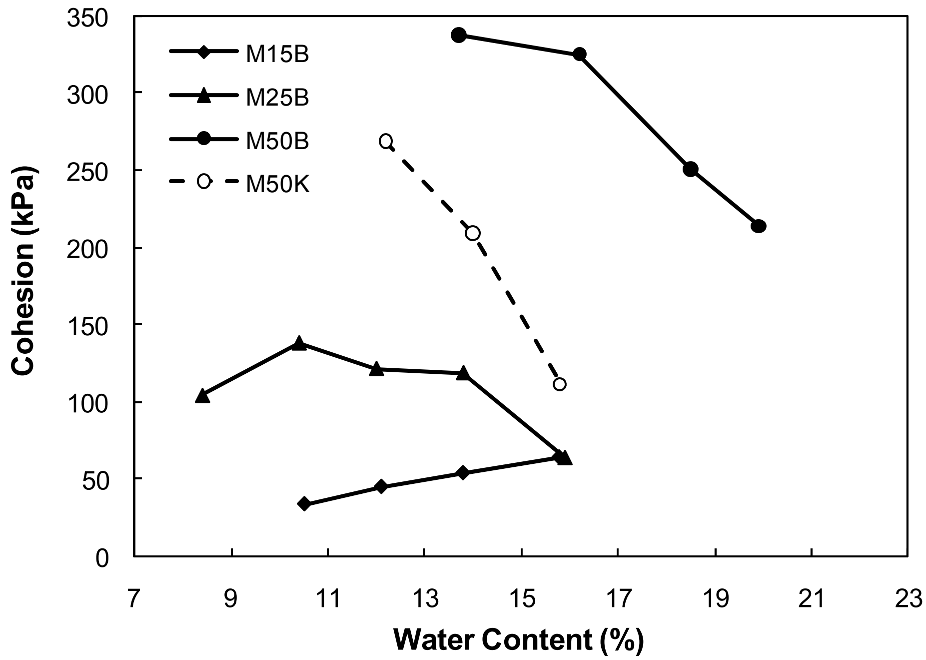


Figure 5.45. Cohesion of Modified Proctor Compacted Clay/Sand Specimens

If the total stress friction angles are plotted against the corresponding compaction water content values, it can be seen that there is a second-order polynomial correlation between the measured friction angle and compaction water content for each soil mixture that is compacted at a given energy level. Figures 5.46 to 5.50 indicate that the *w%* values are highly correlated with ϕ. Water contents corresponding to 5, 10, 15, 20, 25, and 30 degree friction angles are determined from these second-order polynomial equations and are summarized in Table 5.5. To be more accurate, only those values of water content within the tested range were calculated.

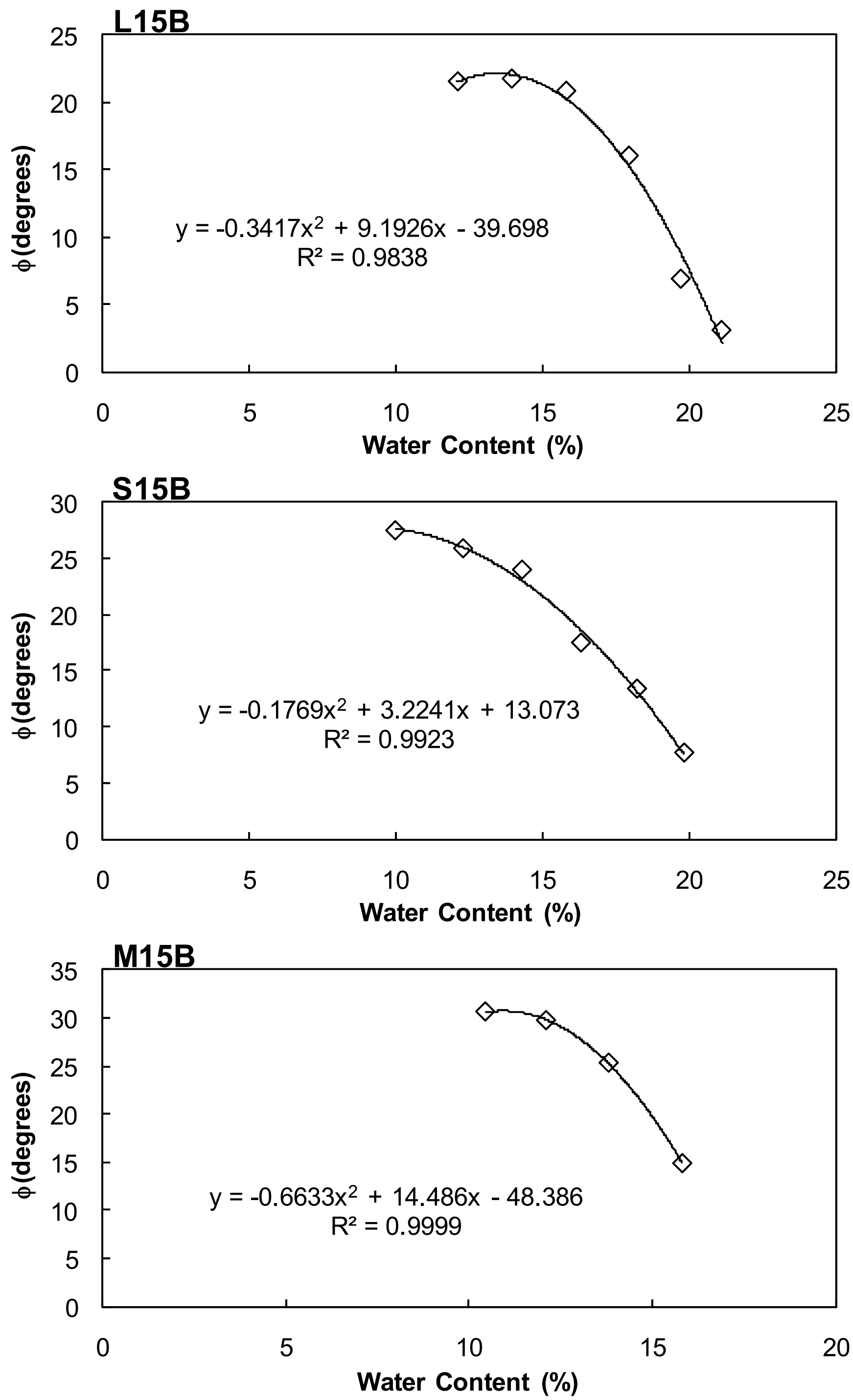


Figure 5.46. Relationship between ϕ and w% (15B)

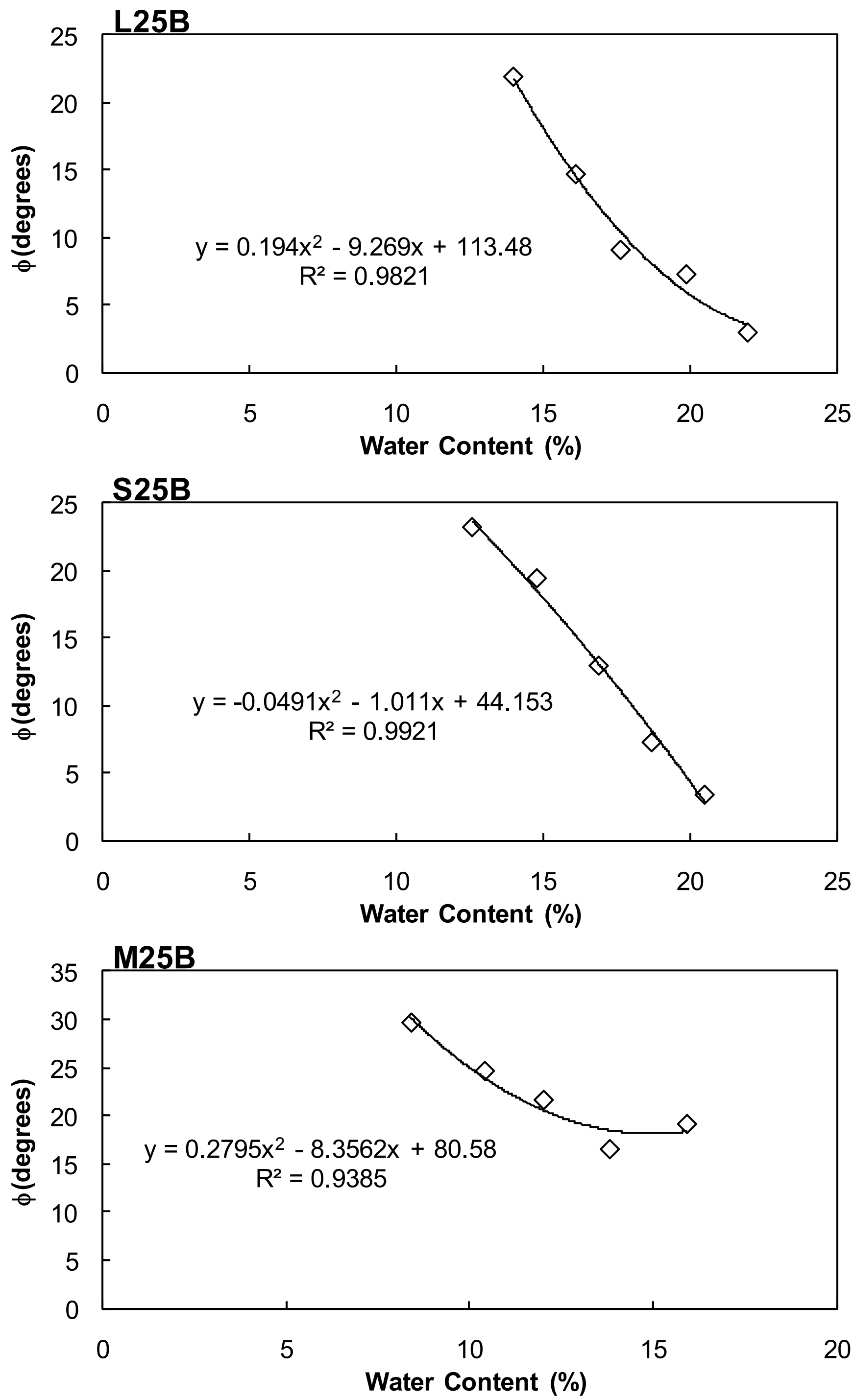


Figure 5.47. Relationship between ϕ and w% (25B)

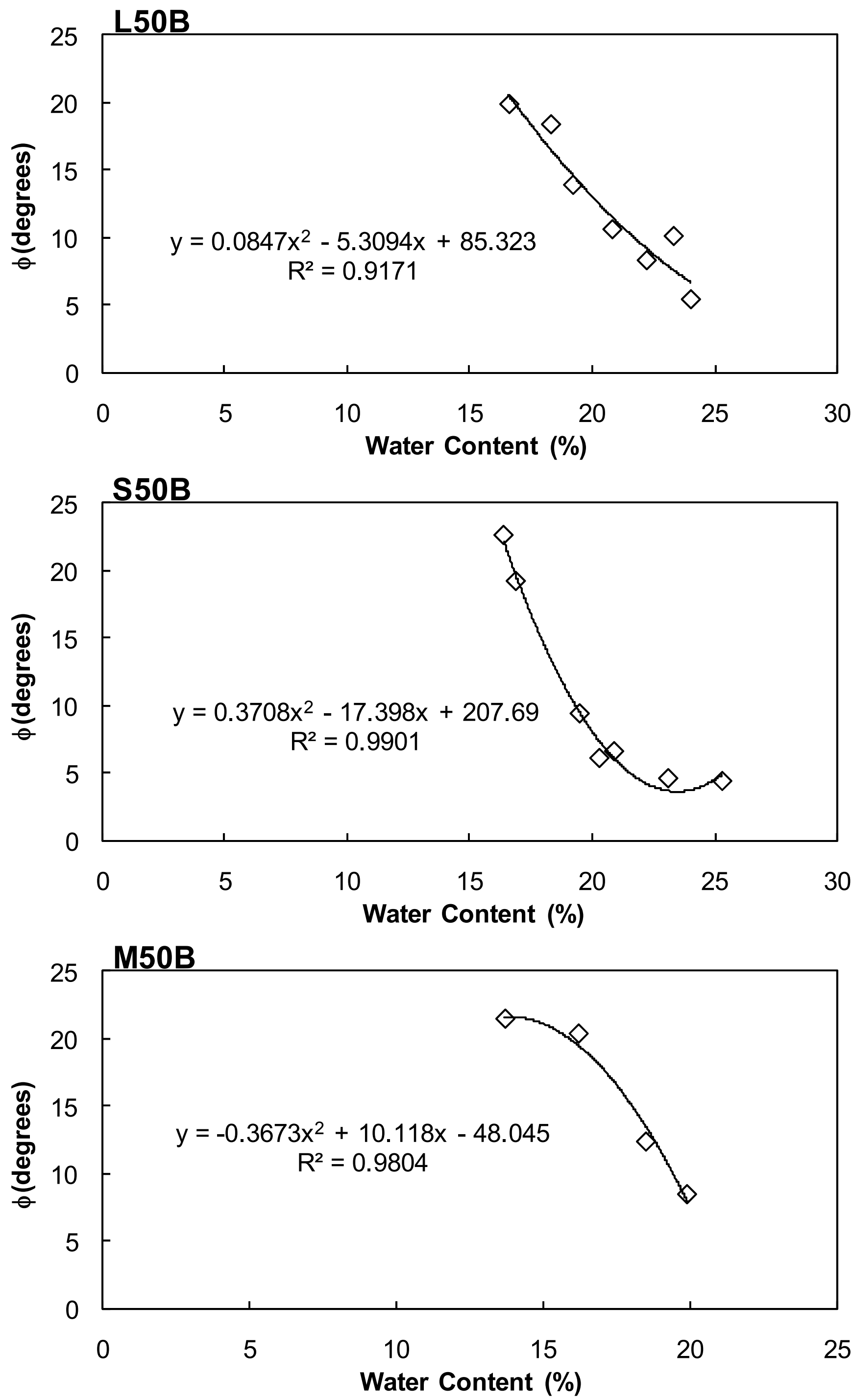


Figure 5.48. Relationship between ϕ and w% (50B)

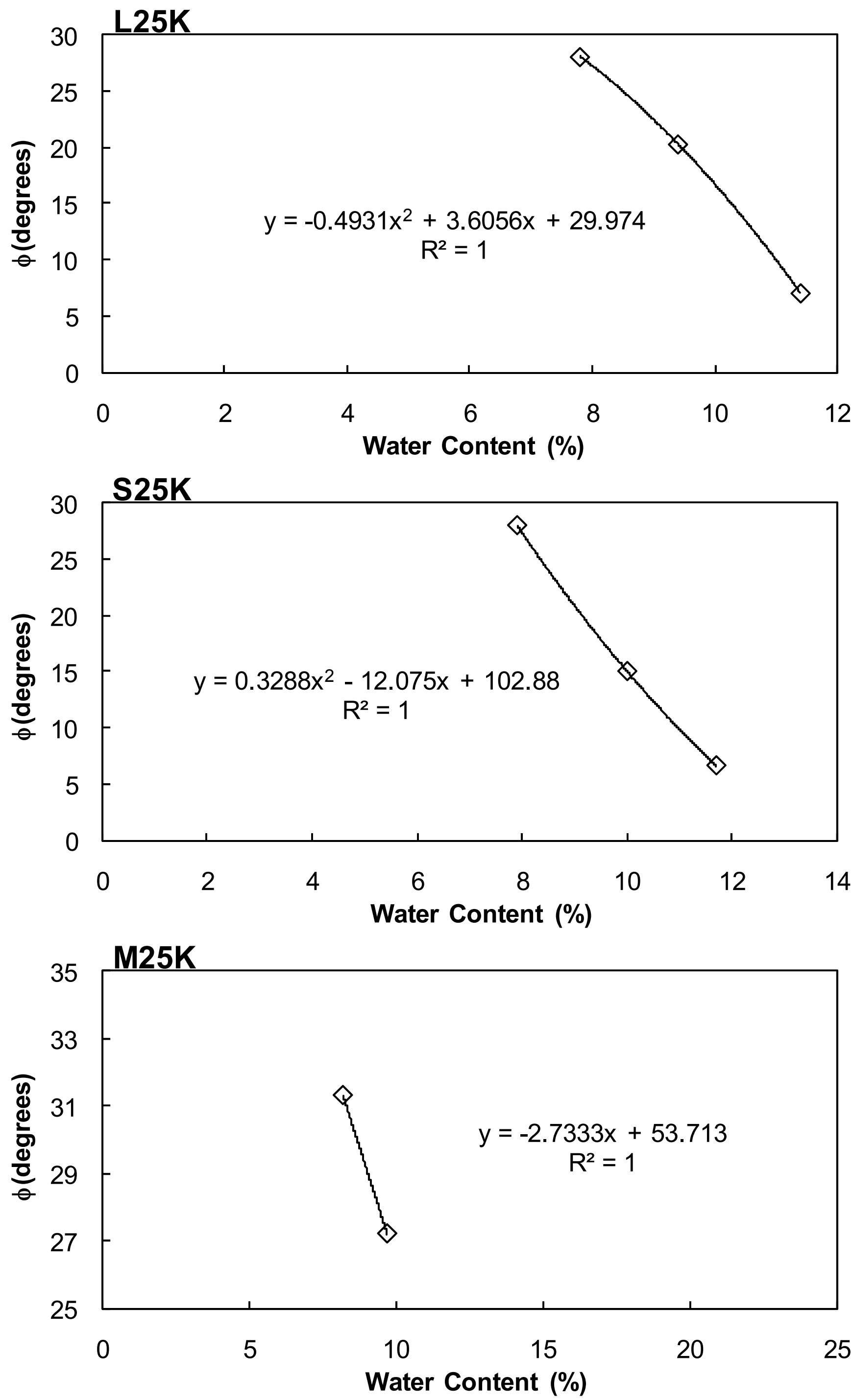


Figure 5.49. Relationship between ϕ and w% (25K)

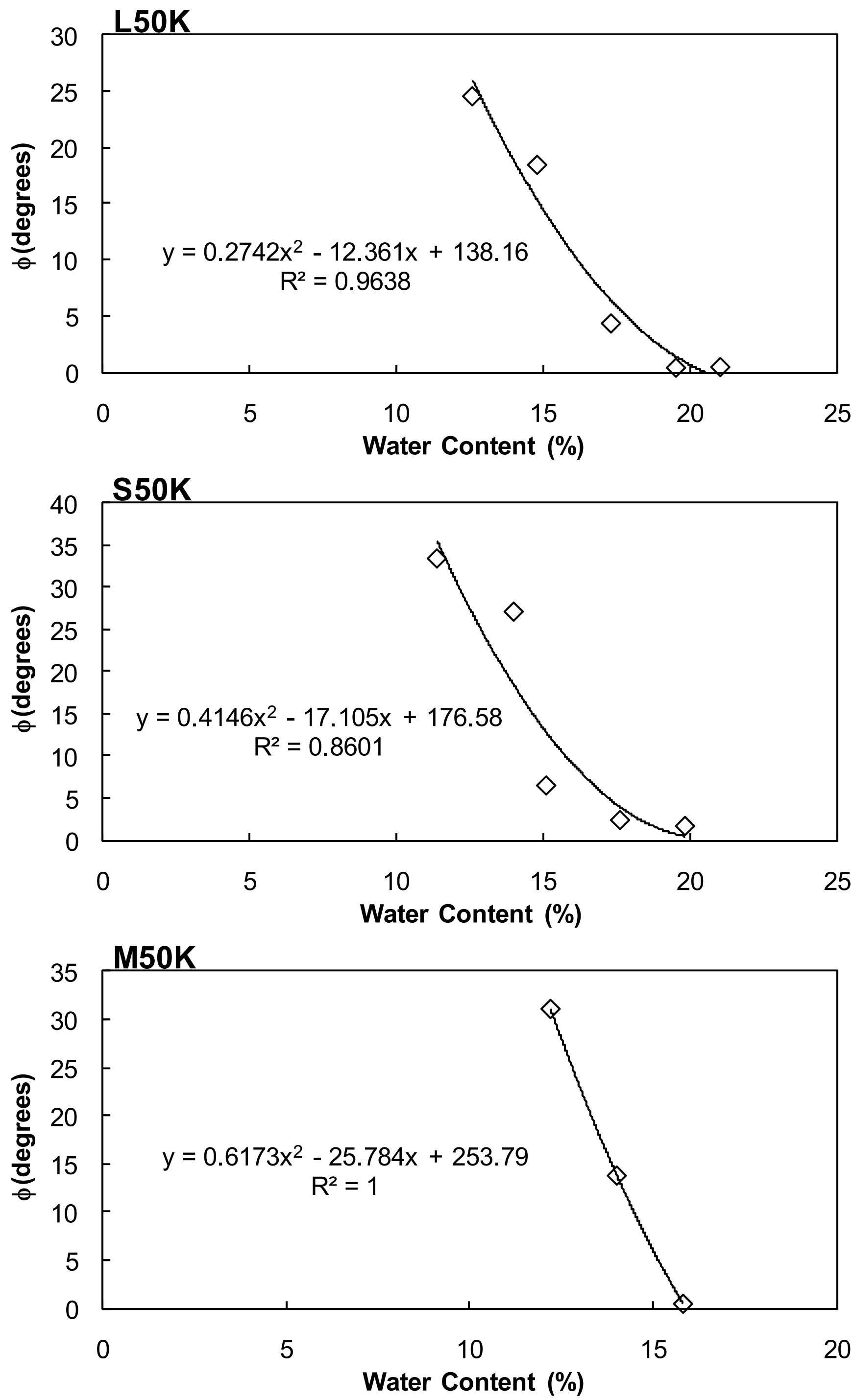


Figure 5.50. Relationship between ϕ and w% (50K)

Table 5.5 Water Content Values Calculated Using Second-Order Polynomial Regression Equations

ϕ (degrees)	Water Content (%)														
	L15B	S15B	M15B	L25B	S25B	M25B	L50B	S50B	M50B	L25K	S25K	M25K	L50K	S50K	M50K
35	-	-	-	-	-	-	-	-	-	-	-	6.8	-	12.2	11.9
30	-	9.0	11.5	-	10.3	7.8	-	-	-	7.4	7.6	8.7	-	12.4	12.3
25	11.1	12.7	14.2	13.7	12.4	10.9	-	-	-	8.5	8.3	-	13.0	12.9	12.8
20	15.2	15.7	15.6	14.4	14.4	13.4	16.9	16.0	15.4	9.5	9.1	-	13.8	13.6	13.3
15	18.2	17.9	15.8	15.8	16.3	15.3	19.3	16.3	17.9	10.3	10.0	-	14.9	14.5	13.9
10	20.0	19.3	-	17.9	18.1	-	21.8	18.7	19.5	11.0	11.0	-	16.4	15.7	14.5
5	20.7	19.8	-	20.7	19.8	-	24.2	22.9	20.0	11.6	12.1	-	18.1	17.2	15.2
0	-	-	-	-	-	-	-	-	-	-	-	-	20.1	18.9	15.9

In order to examine the relationship between compaction density, compaction water content, and the values of the undrained strength parameters c and ϕ, the UU test results are shown in the form of contours of c and ϕ in Figures 5.51 to 5.55. The cohesion (c) point locations are presented directly as measured from the test results. Cohesion trendlines were drawn through these point locations using linear interpolation and judgment. The friction angle (ϕ) point locations shown in Figures 5.51 to 5.55 are also presented directly as measured from the test results. In order to draw the friction angle contours, a slightly more sophisticated approach was utilized: For a given even-numbered total stress friction angle, the corresponding value of water content that corresponds to each contour point was calculated from the regression equations shown in Figures 5.46 to 5.50; the corresponding results are summarized in Table 5.5. The value of density that corresponds to each even-numbered ϕ was then calculated using Equation 4.1 in Chapter 4. Insufficient test data are available for the 25% kaolinite/sand mixture; thus, only the available values of cohesion are plotted in Figure 5.54 for this soil mixture.

On the basis of the results shown in Figures 5.51 to 5.55, it is possible to draw a number of conclusions:

(1) The values of cohesion increase with increasing dry unit weight, and are largest for specimens compacted at water contents near optimum with high compactive effort. However, exceptions are seen for modified Proctor compacted 15% bentonite/sand specimens, which exhibit different trends in behavior than the low energy Proctor and standard Proctor specimens. One possible explanation for this behavior may be the disturbance that occurs during sampling (Duncan et al. 1980). Referring to Figure 5.8, the dry unit

weights of modified Proctor compacted 15% bentonite/sand specimens were decreased markedly due to sampling disturbance. The 50% bentonite/sand specimens developed the largest values of cohesion due to their higher clay content.

(2) The values of ϕ increased with decreasing water content, and are largest for specimens compacted at very low water content with high compactive effort. The kaolinite/sand mixtures exhibited higher friction angles than what was observed for the bentonite/sand mixtures.

(3) The results of these tests indicate that the shear strength of compacted clay/sand mixtures under unconsolidated-undrained test conditions may vary widely depending on the compaction dry unit weight and water content. Previous studies have shown that the method of compaction may also have an important influence on the behavior of compacted soils (e.g., Seed, 1959, Mitchell and Chan, 1960). It is therefore desirable that samples that are used for determining parameters in this situation should be compacted using procedures similar to those used in the field, and it is essential that they should be compacted to the same dry unit weight, and at the same water content as the soil in the field.

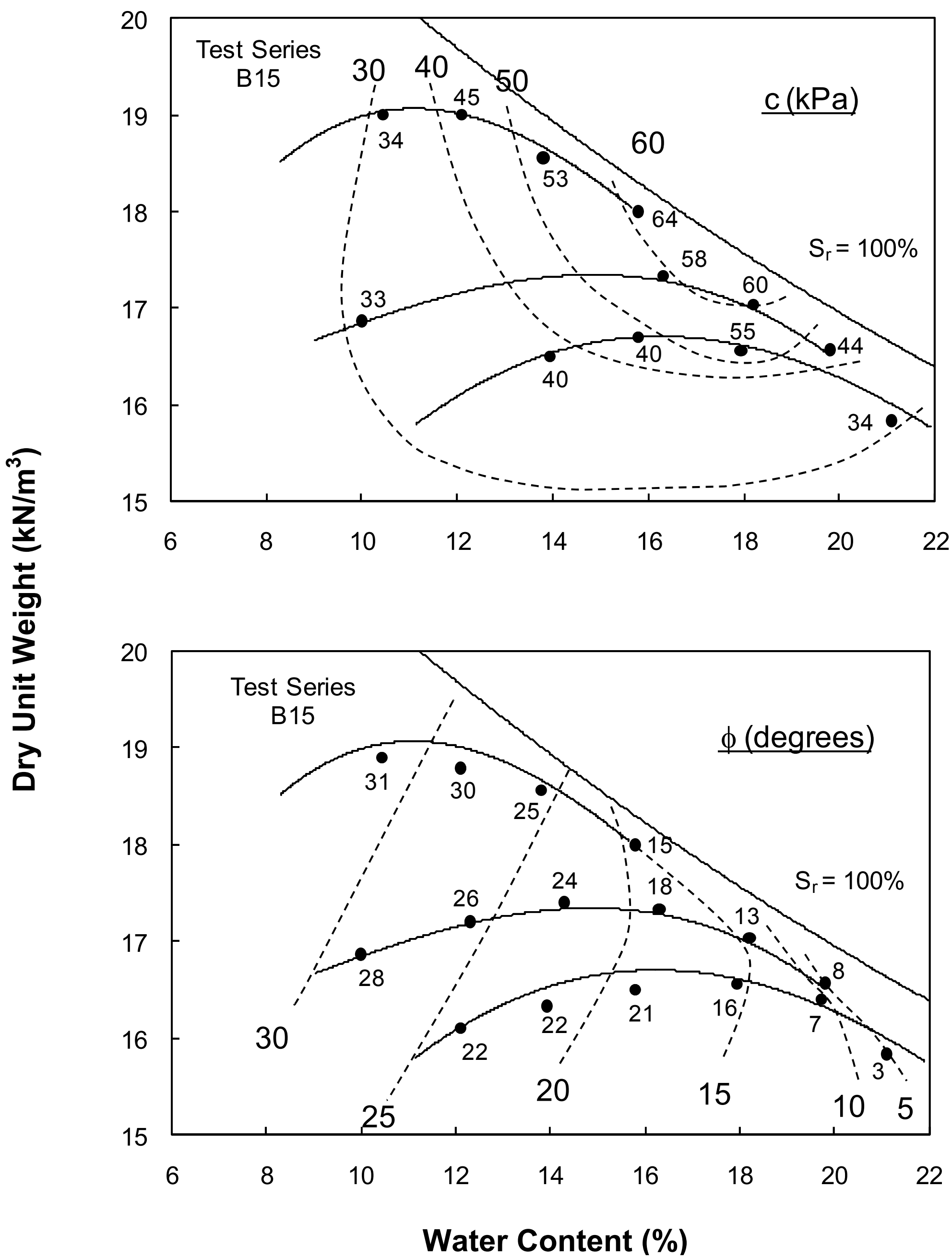


Figure 5.51. Strength Parameters for Compacted 15% Bentonite/Sand Specimens

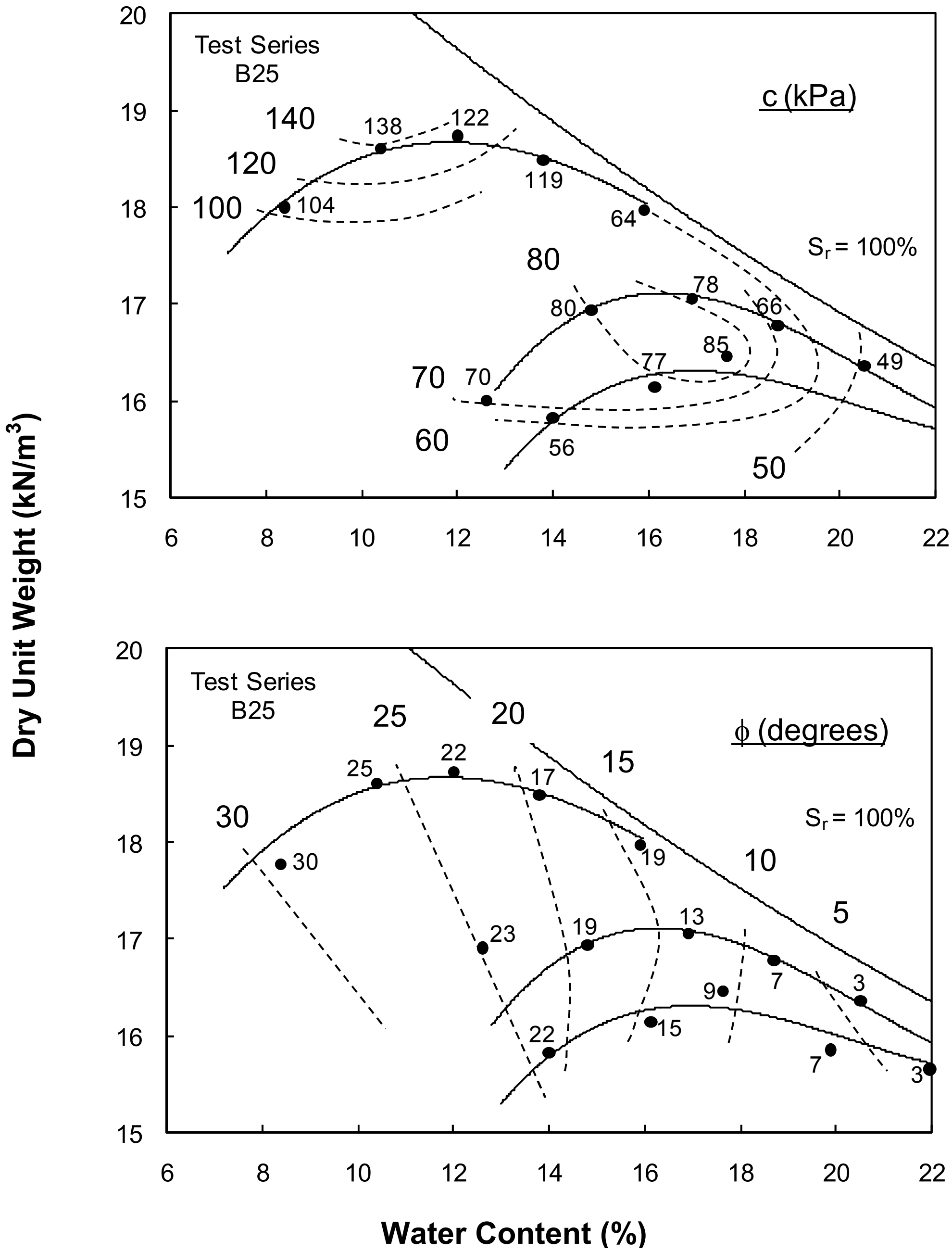


Figure 5.52. Strength Parameters for Compacted 25% Bentonite/Sand Specimens

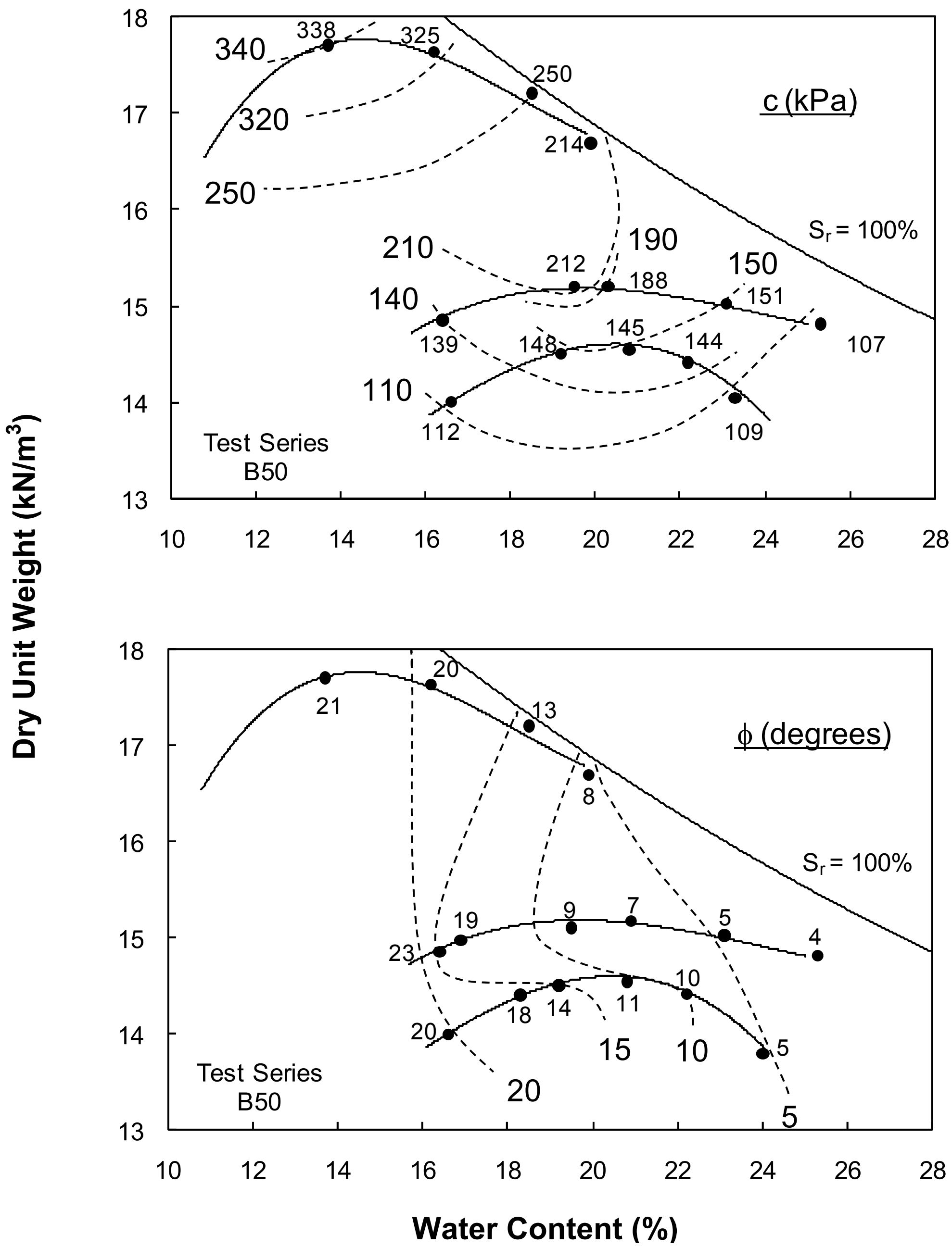


Figure 5.53. Strength Parameters for Compacted 50% Bentonite/Sand Specimens

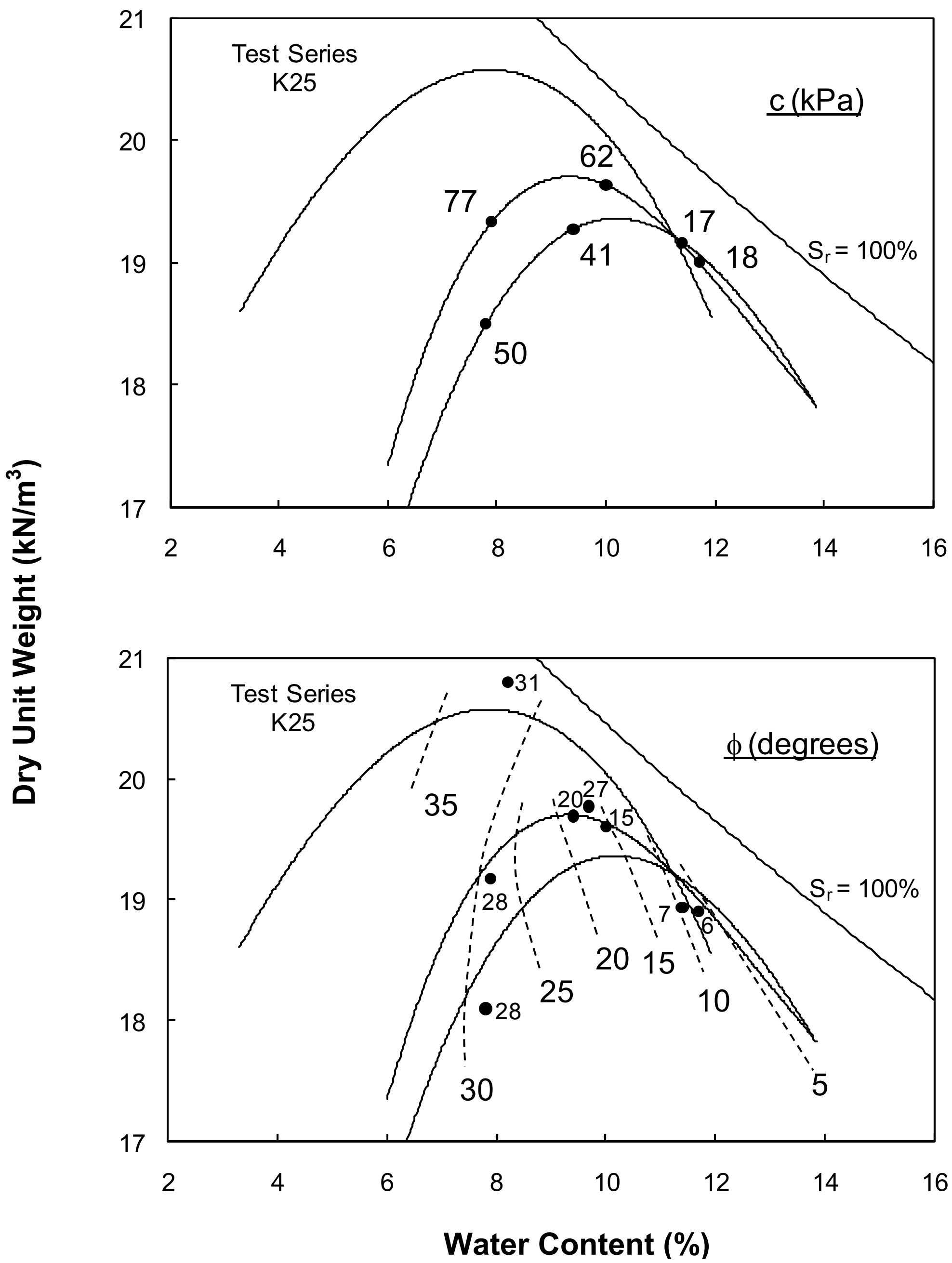


Figure 5.54. Strength Parameters for Compacted 25% Kaolinite/Sand Specimens

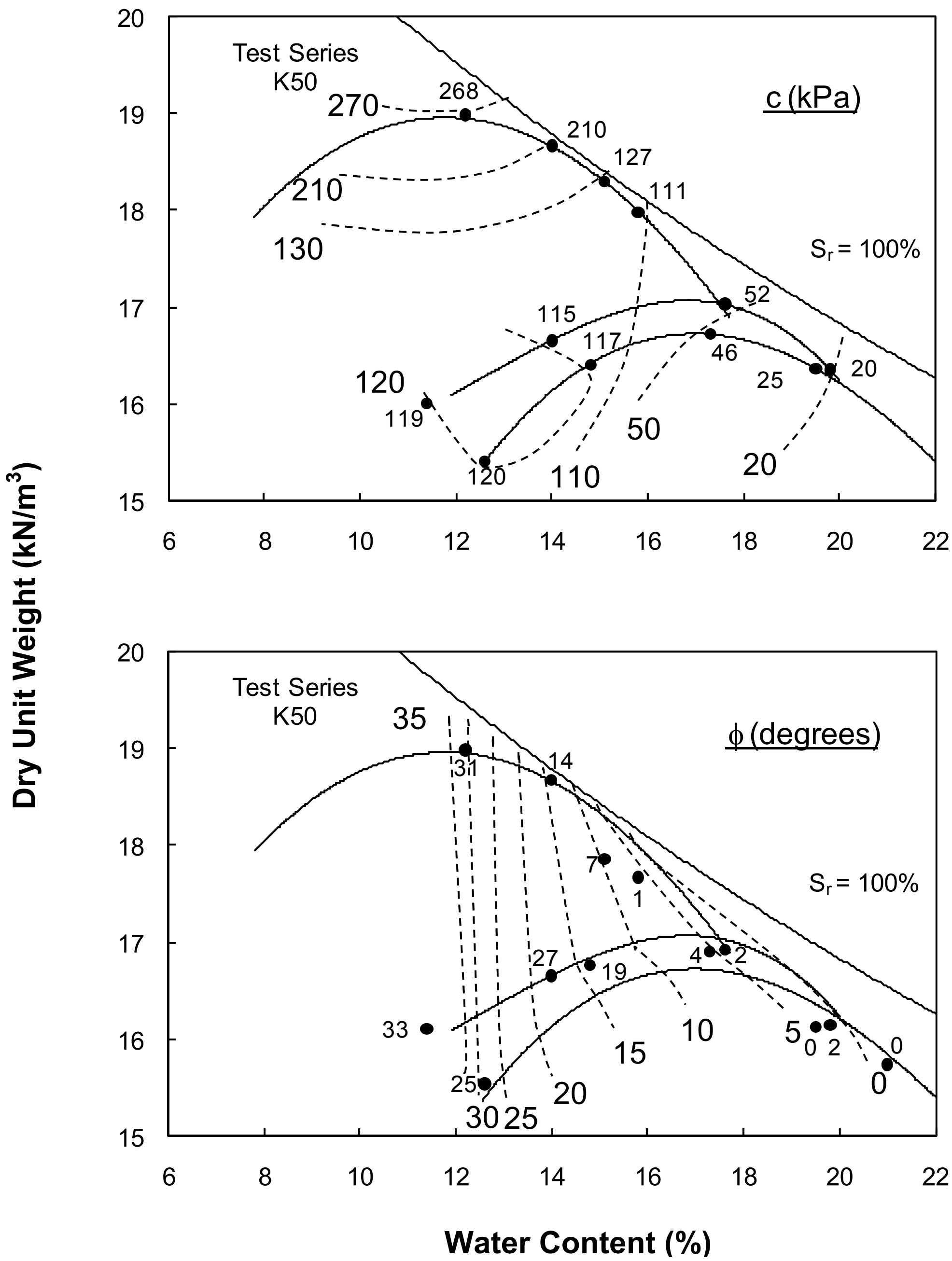


Figure 5.55. Strength Parameters for Compacted 50% Kaolinite/Sand Specimens

5.2.4 Secant Modulus

Strain-dependent soil stiffness is an important pre-failure property that controls soil deformations. To compare the deformation properties of different clay/sand mixtures that were tested in the UU triaxial, the secant modulus at 50% shear strength, E_{50}, is used here. It is common to infer the stiffness of soil specimens from measurements of the secant modulus E_{50} (e.g., Wiebe et al., 1998). The values of E_{50} calculated for each specimen are given in Table 5.6. Plots of E_{50} versus σ_3 are presented in Figure 5.56 for bentonite/sand mixtures and in Figure 5.57 for kaolinite/sand mixtures. From these plots it is clear that at the same compaction energy level, E_{50} increases with clay content. Specimens compacted dry-of-optimum are stiffer than specimens compacted wet-of-optimum at the same energy level.

Table 5.6 E_{50}

Test Number	E_{50} (kPa)	Test Number	E_{50} (kPa)	Test Number	E_{50} (kPa)
L15-B(-4)-C1	6011	L25-B(+1)-C1	4284	L50-B(+3)-C1	10932
L15-B(-4)-C2	7913	L25-B(+1)-C2	5468	L50-B(+3)-C2	13598
L15-B(-4)-C3	9394	L25-B(+1)-C3	7348	L50-B(+3)-C3	13469
L15-B(-2)-C1	5671	L25-B(+3)-C1	5917	L50-B(+4)-C1	12986
L15-B(-2)-C2	5251	L25-B(+3)-C2	5481	L50-B(+4)-C2	14212
L15-B(-2)-C3	9311	L25-B(+3)-C3	7698	L50-B(+4)-C3	15475
L15-B(0)-C1	5719	L25-B(+5)-C1	3182	S15-B(-5)-C1	6164
L15-B(0)-C2	5034	L25-B(+5)-C2	3885	S15-B(-5)-C2	4443
L15-B(0)-C3	7677	L25-B(+5)-C3	5281	S15-B(-5)-C3	11285
L15-B(+2)-C1	3887	L50-B(-4)-C1	19326	S15-B(-3)-C1	6090
L15-B(+2)-C2	3273	L50-B(-4)-C2	18929	S15-B(-3)-C2	6393
L15-B(+2)-C3	4699	L50-B(-4)-C3	12535	S15-B(-3)-C3	10207
L15-B(+4)-C1	1980	L50-B(-2)-C1	16977	S15-B(-1)-C1	3556
L15-B(+4)-C2	1909	L50-B(-2)-C2	14927	S15-B(-1)-C2	4611
L15-B(+4)-C3	1954	L50-B(-2)-C3	21110	S15-B(-1)-C3	6261
L15-B(+5)-C1	1794	L50-B(-1)-C1	22320	S15-B(+1)-C1	2188
L15-B(+5)-C2	1584	L50-B(-1)-C2	16515	S15-B(+1)-C2	2256
L15-B(+5)-C3	1555	L50-B(-1)-C3	16404	S15-B(+1)-C3	3138
L25-B(-3)-C1	13906	L50-B(0)-C1	13645	S15-B(+3)-C1	2305
L25-B(-3)-C2	12503	L50-B(0)-C2	17099	S15-B(+3)-C2	2158
L25-B(-3)-C3	21251	L50-B(0)-C3	16659	S15-B(+3)-C3	2429
L25-B(-1)-C1	15576	L50-B(+2)-C1	16725	S15-B(+5)-C1	1735
L25-B(-1)-C2	15407	L50-B(+2)-C2	14156	S15-B(+5)-C2	1793
L25-B(-1)-C3	17900	L50-B(+2)-C3	19857	S15-B(+5)-C3	1868

Table 5.6 (continued)

Test Number	E_{50} (kPa)	Test Number	E_{50} (kPa)	Test Number	E_{50} (kPa)
S25-B(-4)-C1	6638	S50-B(0)-C1	25460	M25-B(-4)-C1	4439
S25-B(-4)-C2	12661	S50-B(0)-C2	17042	M25-B(-4)-C2	5175
S25-B(-4)-C3	18701	S50-B(0)-C3	18683	M25-B(-4)-C3	7789
S25-B(-2)-C1	9081	S50-B(+1)-C1	19936	M25-B(-2)-C1	10721
S25-B(-2)-C2	10122	S50-B(+1)-C2	16345	M25-B(-2)-C2	4860
S25-B(-2)-C3	12704	S50-B(+1)-C3	8854	M25-B(-2)-C3	7741
S25-B(0)-C1	3198	S50-B(+3)-C1	19593	M25-B(0)-C1	7041
S25-B(0)-C2	4923	S50-B(+3)-C2	12638	M25-B(0)-C2	9985
S25-B(0)-C3	5118	S50-B(+3)-C3	16411	M25-B(0)-C3	6915
S25-B(+2)-C1	3223	S50-B(+6)-C1	5637	M25-B(+2)-C1	8986
S25-B(+2)-C2	3450	S50-B(+6)-C2	7580	M25-B(+2)-C2	6629
S25-B(+2)-C3	4046	S50-B(+6)-C3	11893	M25-B(+2)-C3	6384
S25-B(+4)-C1	2511	M15-B(-1)-C1	2638	M25-B(+4)-C1	5258
S25-B(+4)-C2	2632	M15-B(-1)-C2	3063	M25-B(+4)-C2	4494
S25-B(+4)-C3	3245	M15-B(-1)-C3	4685	M25-B(+4)-C3	6093
S25-B(+6)-C1	2175	M15-B(+1)-C1	2031	M50-B(-1)-C1	29104
S25-B(+6)-C2	2569	M15-B(+1)-C2	4149	M50-B(-1)-C2	46852
S25-B(+6)-C3	2735	M15-B(+1)-C3	3983	M50-B(-1)-C3	21790
S50-B(-3)-C1	24065	M15-B(+3)-C1	2655	M50-B(+2)-C1	30676
S50-B(-3)-C2	19761	M15-B(+3)-C2	2318	M50-B(+2)-C2	30511
S50-B(-3)-C3	27432	M15-B(+3)-C3	3655	M50-B(+2)-C3	23384
S50-B(-2)-C1	22811	M15-B(+5)-C1	1893	M50-B(+4)-C1	17861
S50-B(-2)-C2	18938	M15-B(+5)-C2	2102	M50-B(+4)-C2	23538
S50-B(-2)-C3	22474	M15-B(+5)-C3	2416	M50-B(+4)-C3	27056

Table 5.6 (continued)

Test Number	E_{50} (kPa)	Test Number	E_{50} (kPa)	Test Number	E_{50} (kPa)
M50-B(+5)-C1	19067	L50-K(+4)-C1	1614	S50-K(+3)-C1	754
M50-B(+5)-C2	15741	L50-K(+4)-C2	1697	S50-K(+3)-C2	752
M50-B(+5)-C3	17426	L50-K(+4)-C3	1604	S50-K(+3)-C3	1392
L25-K(-2)-C1	3559	S25-K(-2)-C1	3144	M25-K(0)-C1	1833
L25-K(-2)-C2	3482	S25-K(-2)-C2	5629	M25-K(0)-C2	-
L25-K(-2)-C3	7050	S25-K(-2)-C3	8165	M25-K(0)-C3	5088
L25-K(0)-C1	1715	S25-K(0)-C1	1656	M25-K(+2)-C1	972
L25-K(0)-C2	3543	S25-K(0)-C2	1837	M25-K(+2)-C2	1566
L25-K(0)-C3	5145	S25-K(0)-C3	2368	M25-K(+2)-C3	3401
L25-K(+2)-C1	593	S25-K(+2)-C1	552	M50-K(0)-C1	22463
L25-K(+2)-C2	738	S25-K(+2)-C2	640	M50-K(0)-C2	14439
L25-K(+2)-C3	1057	S25-K(+2)-C3	1016	M50-K(0)-C3	21803
L50-K(-4)-C1	16193	S50-K(-5)-C1	33457	M50-K(+2)-C1	5370
L50-K(-4)-C2	18447	S50-K(-5)-C2	32141	M50-K(+2)-C2	6563
L50-K(-4)-C3	16130	S50-K(-5)-C3	32103	M50-K(+2)-C3	8009
L50-K(-2)-C1	9041	S50-K(-3)-C1	16493	M50-K(+4)-C1	2084
L50-K(-2)-C2	17633	S50-K(-3)-C2	20657	M50-K(+4)-C2	2210
L50-K(-2)-C3	16439	S50-K(-3)-C3	16426	M50-K(+4)-C3	2317
L50-K(0)-C1	1034	S50-K(-2)-C1	3547		
L50-K(0)-C2	1396	S50-K(-2)-C2	3318		
L50-K(0)-C3	1678	S50-K(-2)-C3	4545		
L50-K(+2)-C1	636	S50-K(+1)-C1	1096		
L50-K(+2)-C2	726	S50-K(+1)-C2	1247		
L50-K(+2)-C3	929	S50-K(+1)-C3	1416		

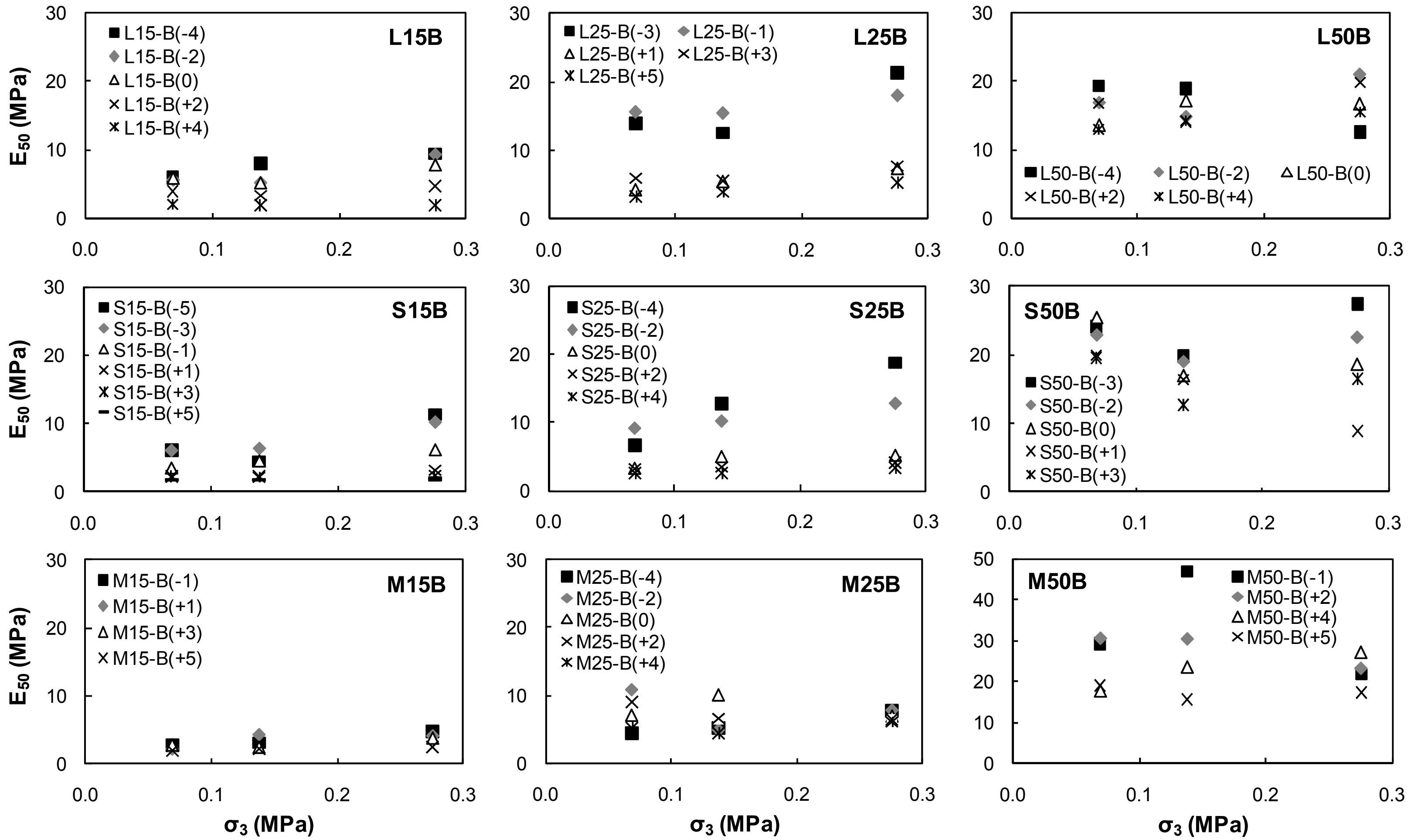


Figure 5.56. Relationship between E_{50}, Water Content, and Clay Content for Bentonite/Sand Specimens

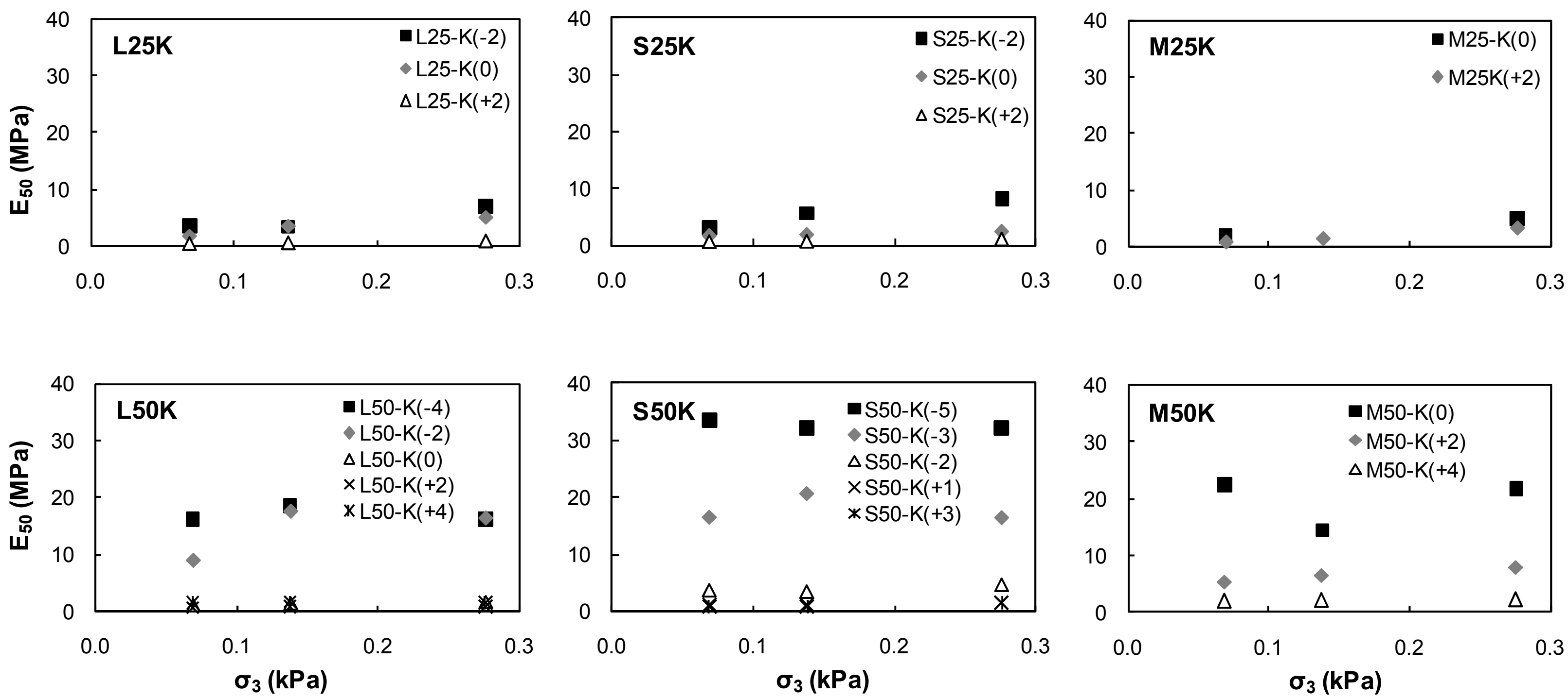


Figure 5.57. Relationship between E_{50}, Water Content, and Clay Content for Kaolinite/Sand Specimens

5.3 Summary of UU Triaxial test results

In this chapter the influence of clay/sand mix proportion, compaction moisture content, compaction energy, clay mineral type, and confining pressure on the strength and stress-strain characteristics of clay/sand materials was investigated using the UU Triaxial test. The test data support the following conclusions:

(1) It appears that for clay/sand specimens compacted at the same energy level and with the same clay content, the undrained strength decreases with increasing compaction moisture content and that variations in water content have a larger influence on kaolinite/sand specimens than they do on bentonite/sand specimens. On the other hand, the undrained strength increases with increasing confining pressure and compactive effort.

(2) At the same compaction energy level, dry-of-optimum specimens are stiffer, stronger and more brittle than wet-of-optimum specimens. In contrast, specimens containing a smaller amount of clay appear to be less stiff, weaker and less brittle than samples with a high clay content.

(3) At the same clay/sand mix proportion, the values of ϕ increase with decreasing water content and are largest for specimens compacted at a very low water content with high compactive effort. Kaolinite/sand specimens exhibit higher ϕ values than what was observed for bentonite/sand specimens at the same water content relative to the optimum water content (e.g., w_{opt} + 2%).

(4) The values of the cohesion intercept (c) increase with increasing dry unit weight, and are largest for specimens compacted at water contents near optimum with a high compactive effort. The values of c also increase with

increasing clay content. Bentonite/sand specimens exhibit higher *c* values than kaolinite/sand specimens.

(5) The values of E_{50} increase with clay content and are higher for dry-of-optimum specimens than wet-of-optimum specimens.

Chapter 6

ONE-DIMENSIONAL COMPRESSION TESTING OF CLAY/SAND MIXTURES

For compacted clay/sand mixtures, it is generally assumed that the coarser fraction of the mixture imparts relatively high density, high shear strength, and low compressibility, and the finer fraction fills the available pore space, further helping to achieve a high density and ensuring a low permeability (Jafari and Shafiee 2004). This type of behavior is ideal for certain high-strength/low-permeability applications, and consequently compacted clay/sand mixtures are commonly used as engineered fills when constructing embankment dams (Jafari and Shafiee 2004). They are also widely used as engineered barriers to construct liner systems for radioactive waste disposal facilities (Chapuis 1990). Yet, our understanding of the mechanics of compacted soils, which are by their nature partially saturated, lags far behind our understanding of saturated soil behavior. In addition, only limited experimental data have been reported in the literature that can be used to quantify the effect of the type and percentage of fines, compaction moisture content, and compactive effort on the compressibility characteristics of compacted, unsaturated clay/sand mixtures.

In the one-dimensional compression tests described in this chapter, specimens were subjected to pressures up to 1300 kPa to examine the settlement characteristics of compacted unsaturated soils. The pressure-deformation relationship of the compacted unsaturated bentonite/sand specimens were compared with the compacted kaolinite/sand specimens. The effects of initial compaction conditions, clay mineralogy, and the vertical pressure on the compressibility of clay/sand mixtures are investigated.

6.1 Specimen Preparation

One compression specimen was produced from each compacted Proctor specimen, as shown in Figure 6.1. The compression specimens were prepared using a trimming turntable and a brass trimming ring, 63.5 mm (2.5 in.) in diameter and 20 mm (0.79 in.) in height (Figure 6.1a). Complete perimeter cuts were made to gradually reduce the specimen diameter until it reached the inside diameter of the consolidation ring (Figure 6.1b). As the trimming progressed, each specimen was carefully inserted into the consolidation ring using only minimal force. This trimming process was continued until a mid-height condition in the compaction mold was reached; the goal of this process was to ensure that each compression specimen was taken from the middle of the Proctor compaction specimen. Once the compression specimen was completely contained within the trimming ring, a straight knife with a sharp cutting edge was utilized for trimming the top and bottom of the specimen (Figure 6.1c). Filter papers were positioned on the top and bottom of the specimen to prevent intrusion of the soil particles into the pores of the porous stones placed on both sides of the specimen (Figure 6.1d).

Figure 6.2 provides a comparison of compression test specimen density with the as-compacted soil density from the corresponding Proctor mold. As can be observed, the trimming procedure has a slight effect on the intial state of the compression test specimens.

Figure 6.1. Compression specimen preparation procedure; (a) placing the compacted Proctor sample on a turntable, (b) trimming specimen into the consolidation ring, (c) trimming the top and bottom of the specimen flush with the consolidation ring, (d) placing filter papers on the top and bottom of the specimen.

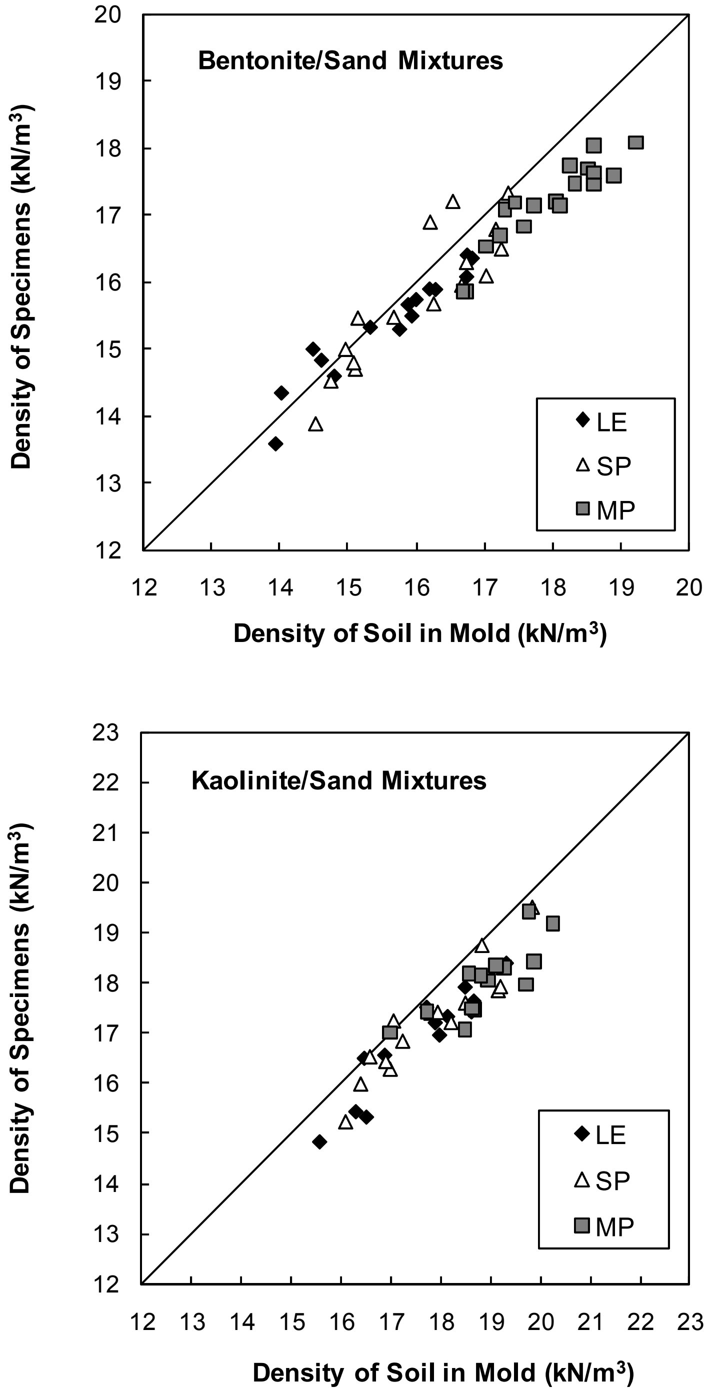


Figure 6.2. Comparison of Compression Test Specimen Density and As-Compacted Soil Density from the Corresponding Proctor Mold

6.2 One-Dimensional Compression Test Procedure

The one-dimensional compression tests described in this chapter were intended to evaluate the compressibility of samples at the molding moisture content in a compacted field situation. Consequently, the compression tests were performed without soaking or otherwise wetting the samples during the test. Specimens were tested in standard fixed-ring consolidometers, manufactured by ELE International, Model No. EI25-0479 (Figure 6.3). A brass consolidation ring with an internal diameter of 63.5 mm (2.5 inch) and a height of 20 mm (0.79 inch) was utilized during each test (Figure 6.3a). Each compression test specimen was trimmed into the consolidation ring following the procedure described in the previous section, and the ring and specimen were placed into the consolidation load frame. After placement of the top loading platen and loading ball, the vertical deflection dial gauge was adjusted and fixed into position to give a proper dial reading under application of load (Figure 6.3c). A loading frame that utilizes a lever arm-weight type loading system was used to compress the test specimens (Figure 6.3d). During each test, compressive displacements were measured with a dial gauge having a 0.0001 inch precision. A load-increment ratio of unity was adopted, in accordance with ASTM D 2435-04, Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading. Each specimen was loaded in stages to a maximum of 1300 kPa. The total loading duration for each load step was selected to be 20 minutes. Deformation data were collected at time intervals of 0.1, 0.25, 0.5, 1, 2, 4, 8, 15, and 20 minutes using an automated data acquisition system.

The final specimen water content was determined by oven-drying at 110 °C for 24 hours. Complete data sheets for each compression test are given in Appendix G.

6.3 Calibration

Flexibility of the test apparatus under load was investigated by setting a hard steel specimen in the consolidometer and loading it as in the test. The deformation was measured and recorded for each load step. It was found that the calibration correction exceeded 5% of the measured deformation in tests. Based on the pressure-deformation characteristic of the apparatus, the measured deformation at each loading step was consequently corrected in accordance with ASTM D 2435-04.

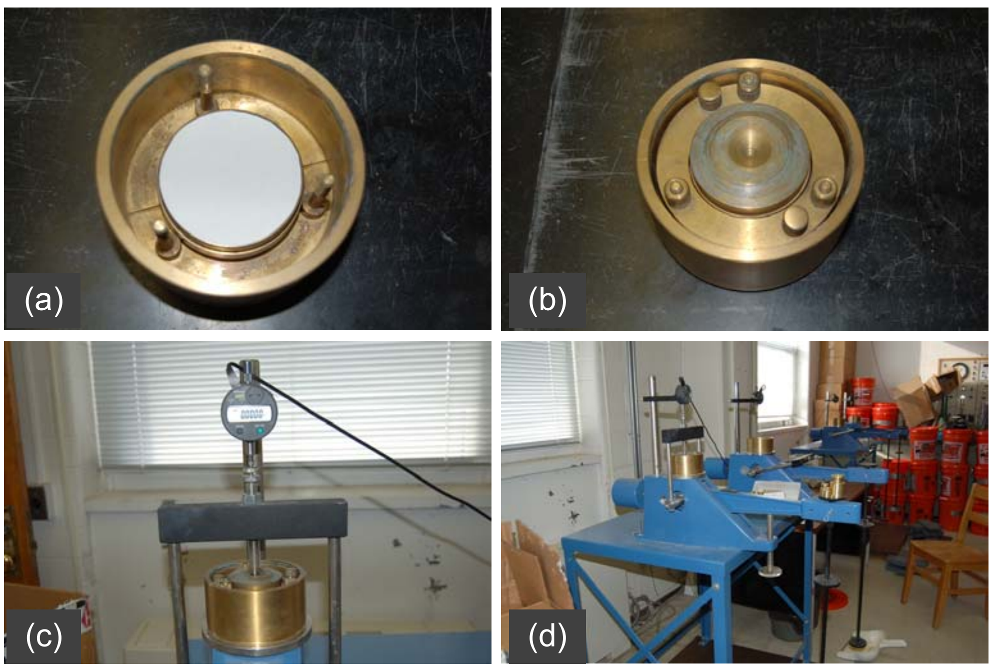


Figure 6.3. Compression test setup procedure; (a) placing the specimen and consolidation ring into a consolidation cell, (b) placing the metal jacket over the consolidation ring to center it in the consolidation cell, (c) placing the consolidation cell on a loading frame with the dial gauge properly adjusted, (d) starting the compression test.

6.4 Results and Discussion of Results

6.4.1 Time-Compression Behaviour

Typical time-compression behaviour of bentonite/sand specimens compacted at their respective optimum water contents are shown in Figures 6.4 through 6.12. Typical time-compression behavior of kaolinite/sand specimens compacted at their respective optimum water contents are shown in Figures 6.13 through 6.21. For each load increment shown, a large amount of compression occurred within the first minute of loading, followed by very little compression in subsequent minutes. Yoshimi (1958) attributed this initial rapid compression to the extremely rapid dissipation of excess pore air pressure, as well as the initial compression of the pore air and soil skeleton. The time-compression behavior for specimens compacted at other water contents were found to be generally similar to that of specimens compacted at the optimum water content (as shown in Appendix G). For comparison purposes, the one-dimensional compression test results of bentonite/sand specimens compacted at their respective optimum water contents are summarized in Figure 6.22, and the test results of kaolinite/sand specimens are summarized in Figure 6.23. The test results clearly show that the compressibility of the compacted specimens was greatly affected by the compactive effort that was applied, which is not surprising, as the compactive effort has a significant effect on the resulting specimen density. At the same clay/sand mix proportion, the soil compressibility decreased as the compactive effort increased, with the lowest compressibility being observed for specimens that were compacted at the Modified Proctor energy level.

All the Low Energy Proctor and Standard Proctor compacted 50% bentonite/sand (Figures 6.10, 6.11) and kaolinite/sand (Figures 6.19, 6.20) specimens exhibited "critical pressure" behavior (Wallace, 1973), which can be characterized by a sudden increase in deformation that occurs when the applied pressure passes beyond a certain value. At low applied pressures, the compressibility of the Low Energy Proctor and Standard Proctor compacted 50% bentonite/sand mixture was quite low, even lower than the 15% bentonite/sand mixture and 25% bentonite/sand mixture. However, when the applied pressure exceeded a certain "critical pressure" the compressibility of the soil became very high. This was also true for Low Energy Proctor and Standard Proctor compacted 50% kaolinite/sand mixtures. The compressibility of the Low Energy Proctor and Standard Proctor compacted 50% kaolinite/sand mixtures was also very high, but was lower than that of the 50% bentonite/sand mixtures that are compacted at the same energy level and subjected to pressures exceeding the critical pressure.

For both the 50% bentonite/sand and 50% kaolinite/sand mixtures, the observed "critical pressure" was around 300 kPa. Gradwell and Birrell (1954) report values of critical pressure ranging from 105-259 kPa for a wide range of volcanic clays. Vargas (1953) reports that for residual clays in Southern Brazil, the magnitude of the critical pressures are widely scattered between 57 and 431 kPa. Sowers (1963) shows that for residual soils in the south-eastern US the values are between 96 and 527 kPa. These diverse results, which all correspond to the observed sudden increase in compressibility of natural soils, show that the values of critical pressure that were measured for compacted clay/sand mixtures have the same order of magnitude as what has been observed for natural clay soils.

The fabric of the 50% clay/sand mixtures are composed of clay as the main body with sand floating in the clay matrix (Shafiee et al., 2008). In the low consolidation pressure range, the initially randomly oriented clay particles produced a high resistance to deformation. As the consolidation pressure increased, the strains that occurred under load produced a higher degree of particle orientation which lead to a lower resistance to deformation and a higher compressibility (Seed and Chan, 1959). At lower clay contents, the soil structure was composed of a primarily sand soil skeleton that contained clay particles trapped in the intergranular void spaces between the sand particles (Thevanayagam and Mohan, 2000). Consequently, the compression behavior of these lower clay content mixtures was mainly controlled by the interaction that occurred between the sand grains. At higher strain levels, the initial fabric can be restructured by sliding along the unstable contacts, and by rotation of individual particles. Thus, there is no obvious sudden increase in compressibility for mixtures that have a lower clay percentage. As higher compaction energies (e.g., the Modified Proctor level), the samples' densities increased significantly, which lead to a marked decrease in compressibility. This may be the reason why the Modified Proctor compacted clay/sand specimens didn't exhibit "critical pressure" behavior; the current range of applied pressures may be less than what is required for this behavior to occur.

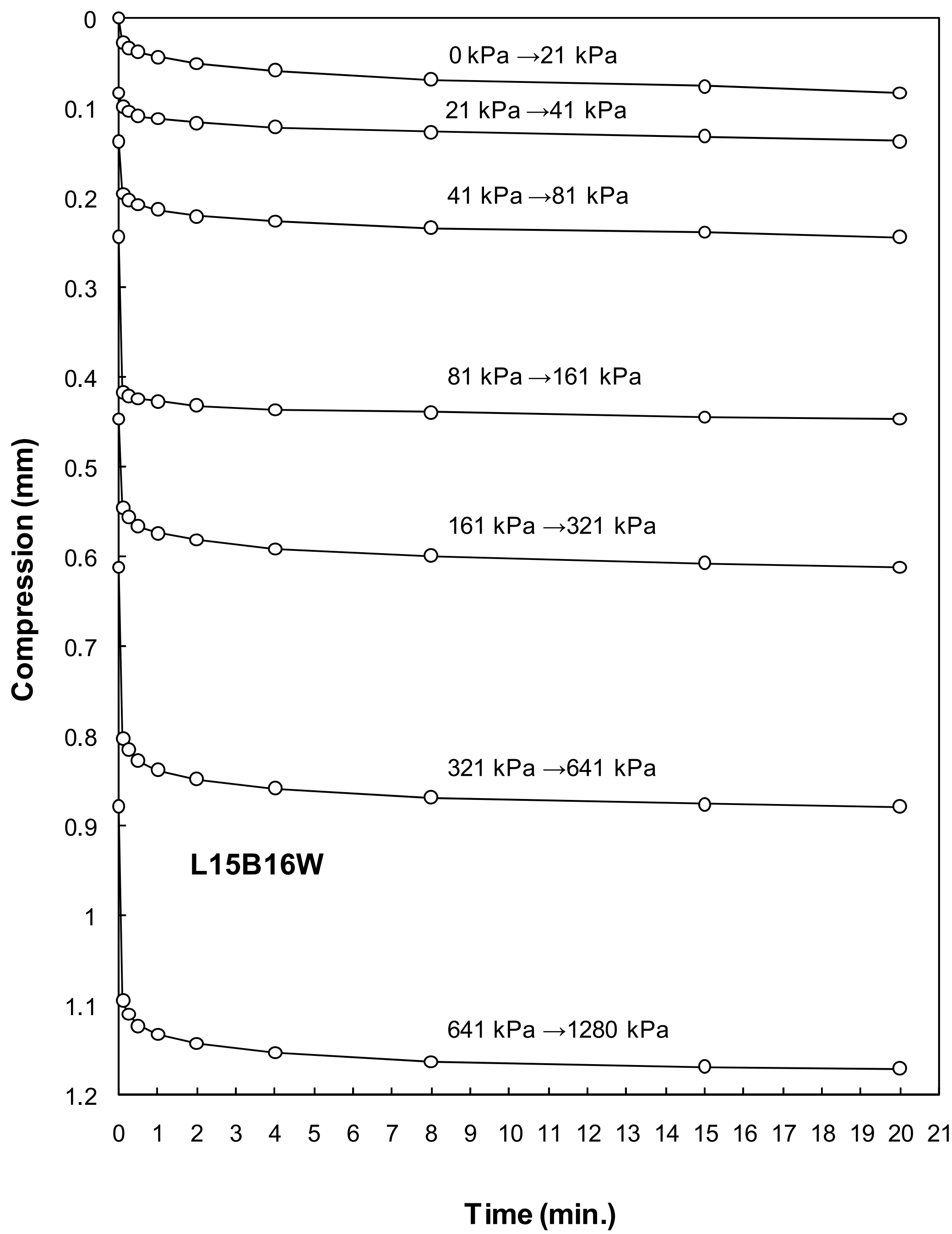


Figure 6.4. Compression vs. Time (L15B16W)

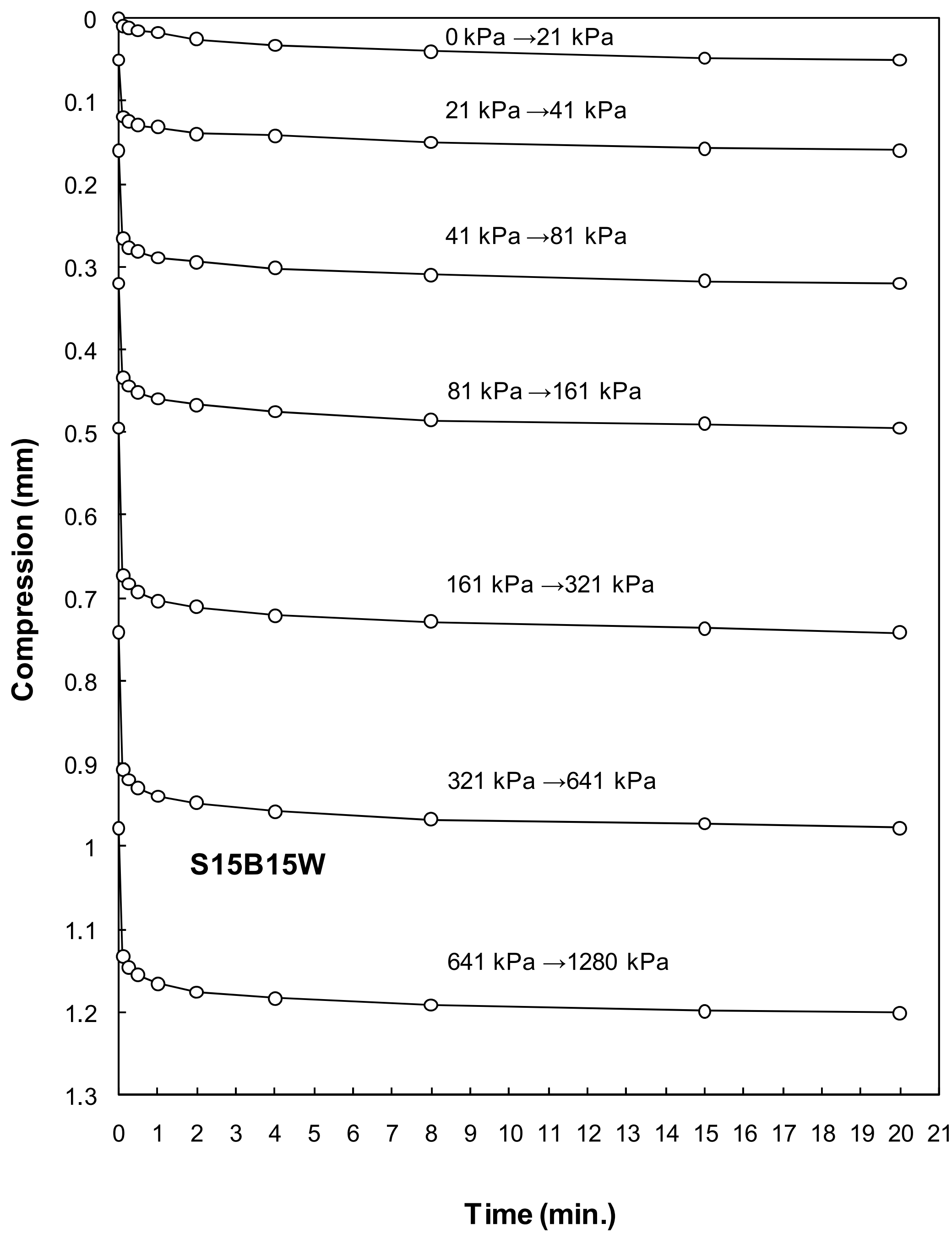


Figure 6.5. Compression vs. Time (S15B15W)

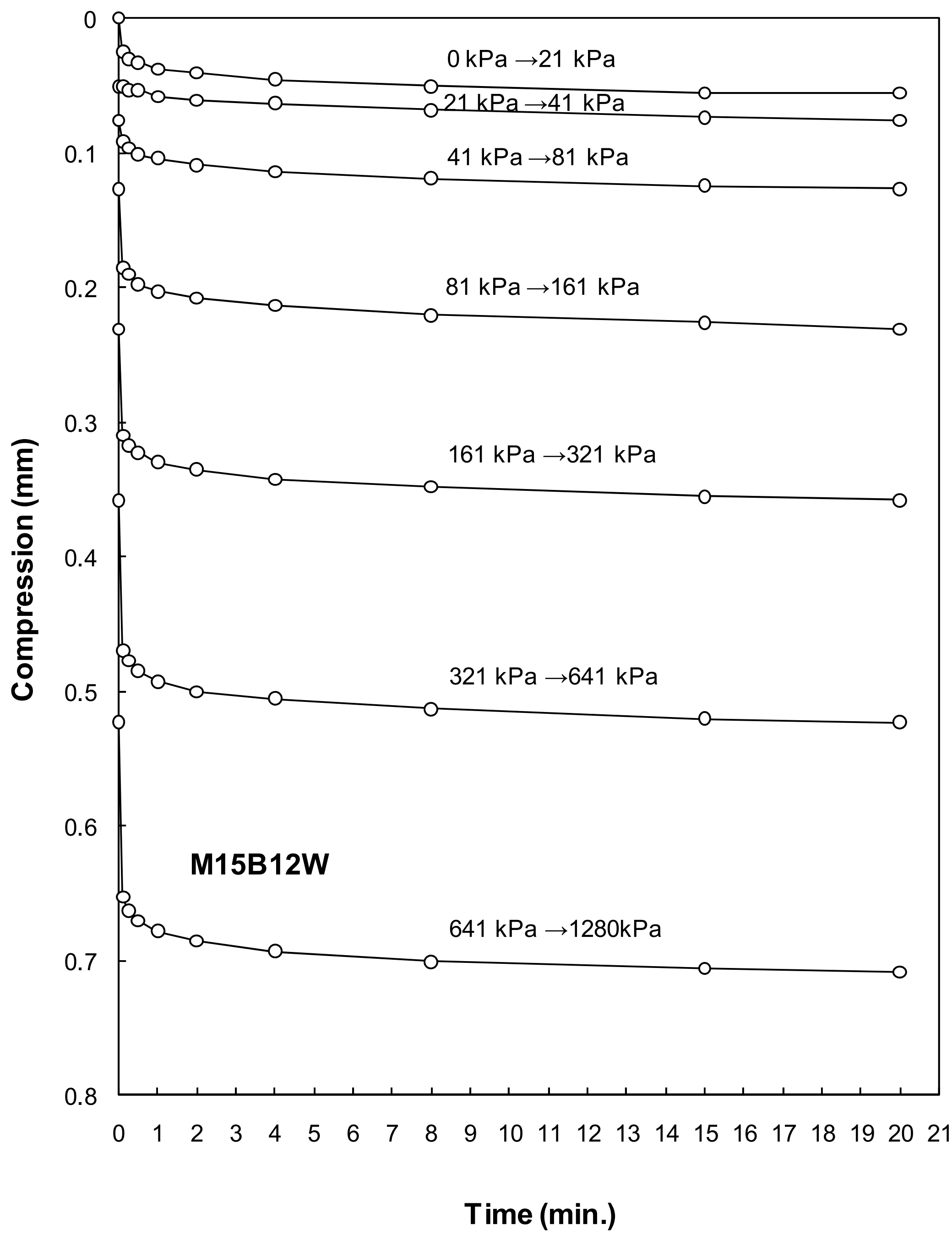


Figure 6.6. Compression vs. Time (M15B12W)

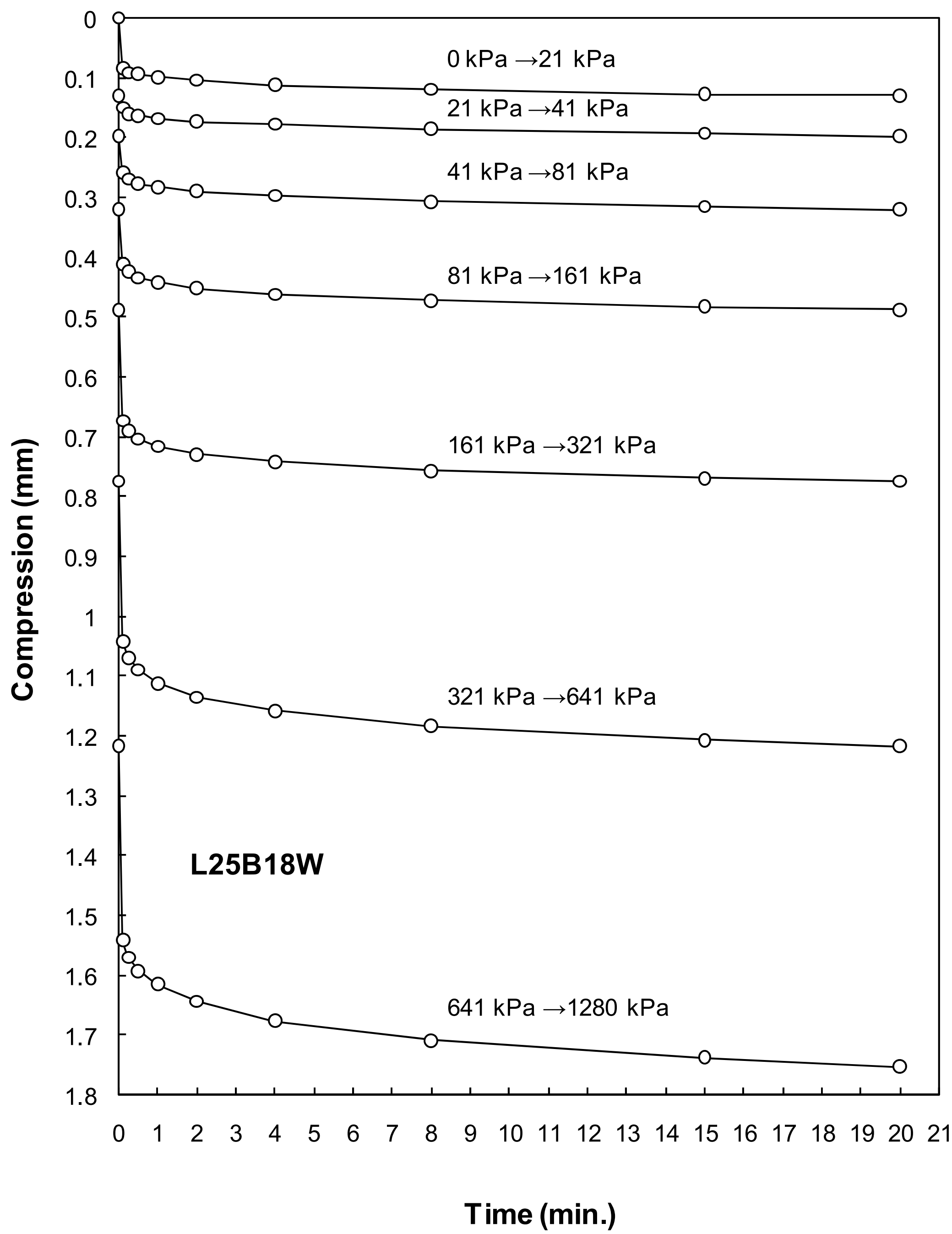


Figure 6.7. Compression vs. Time (L25B18W)

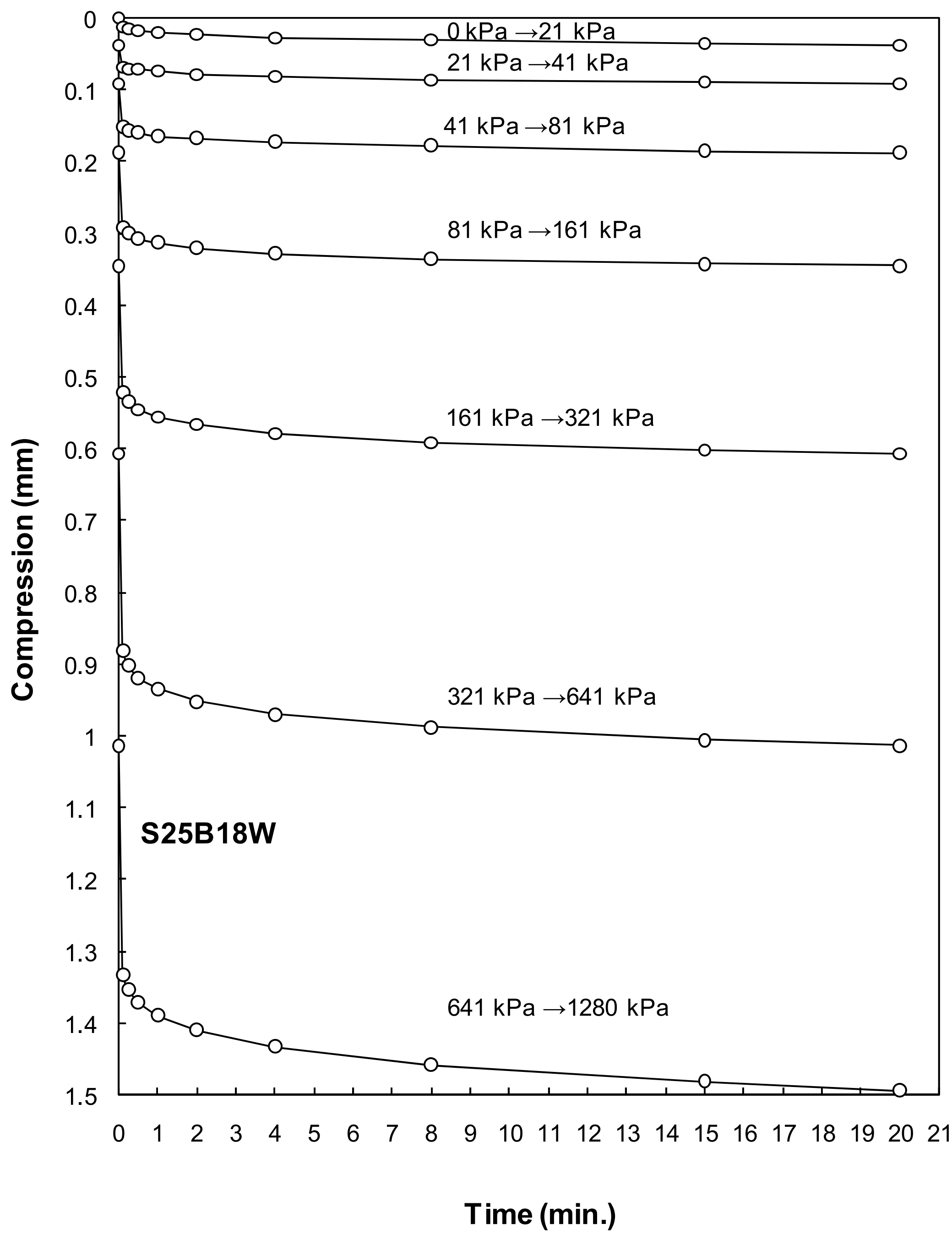


Figure 6.8. Compression vs. Time (S25B18W)

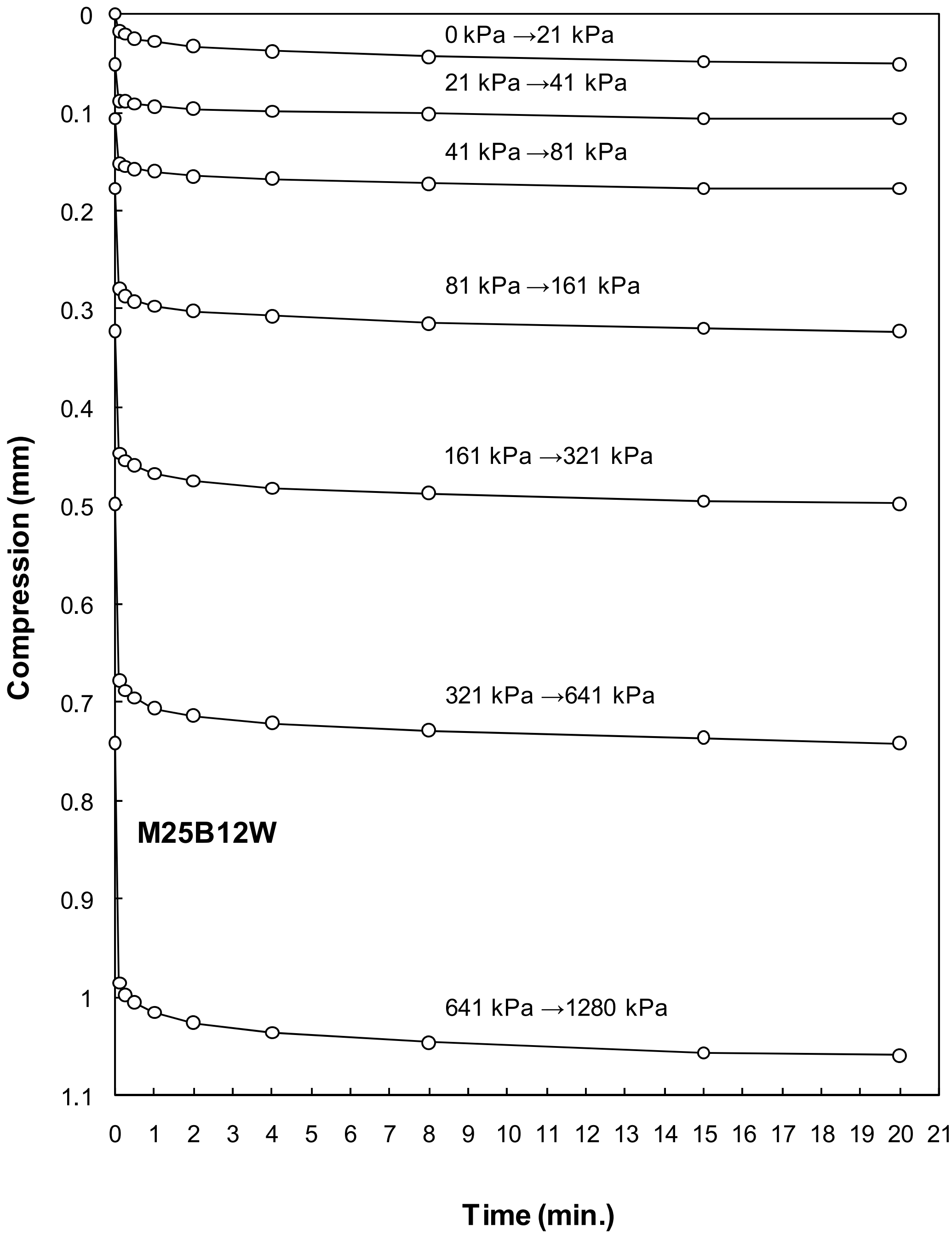


Figure 6.9. Compression vs. Time (M25B12W)

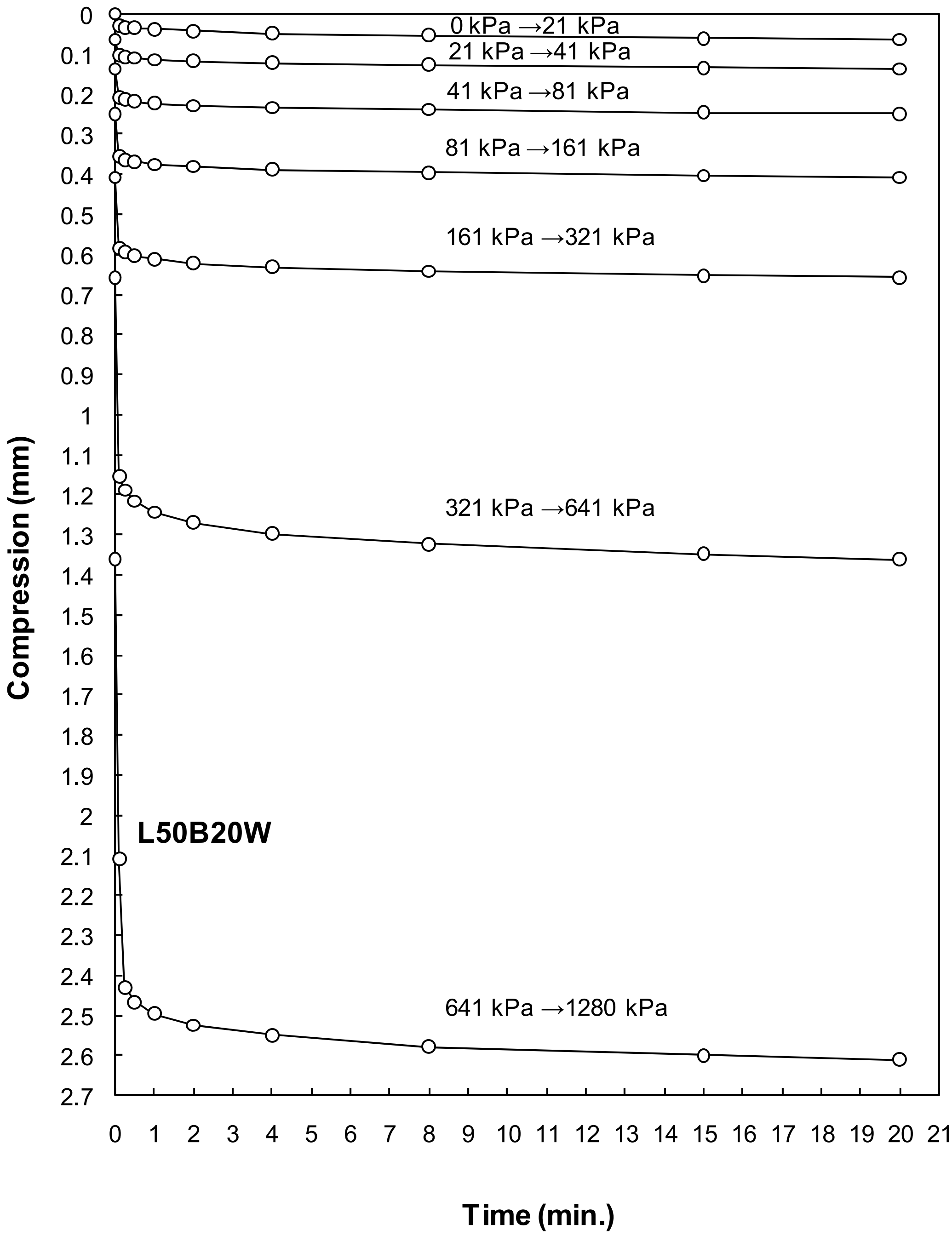


Figure 6.10. Compression vs. Time (L50B20W)

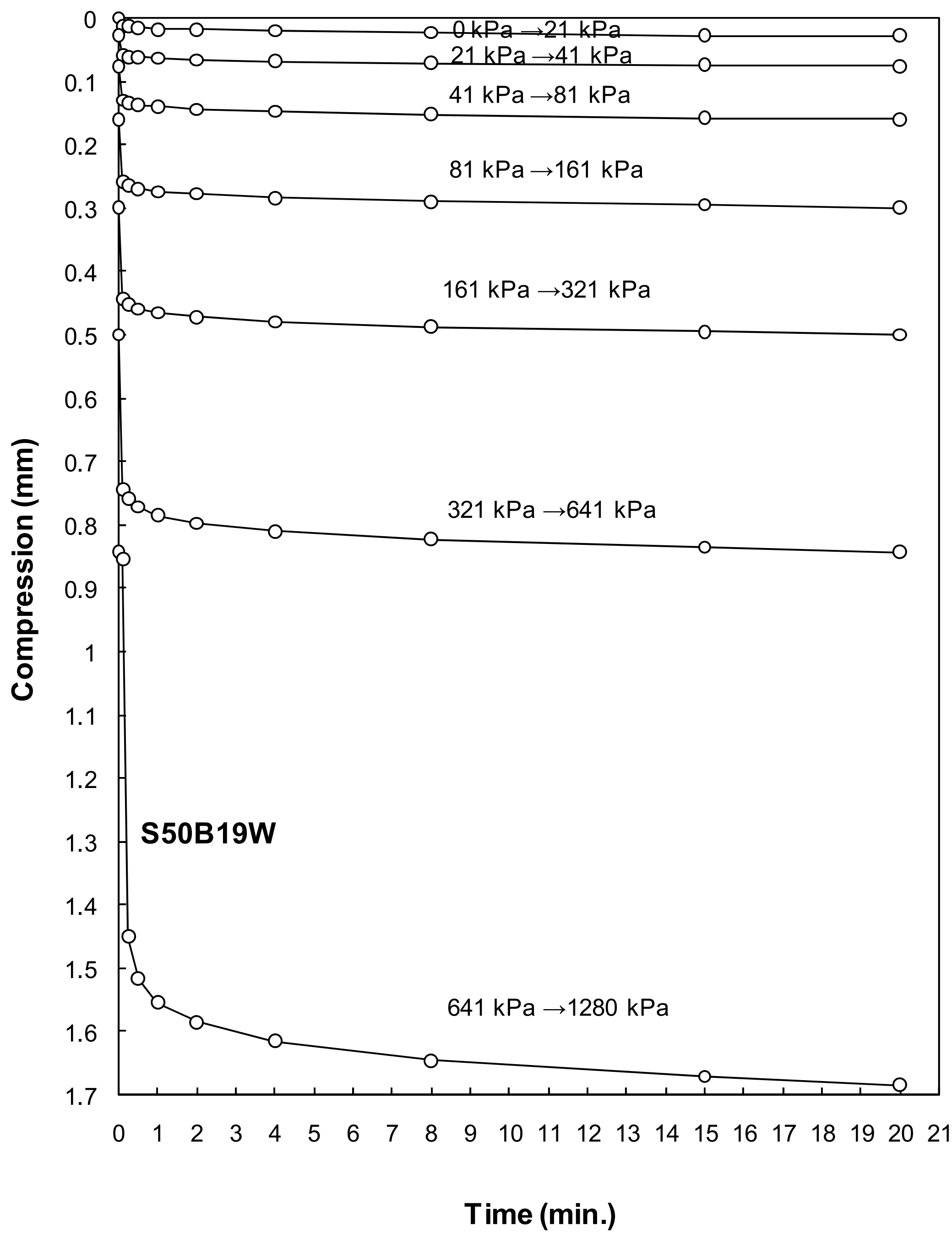


Figure 6.11. Compression vs. Time (S50B19W)

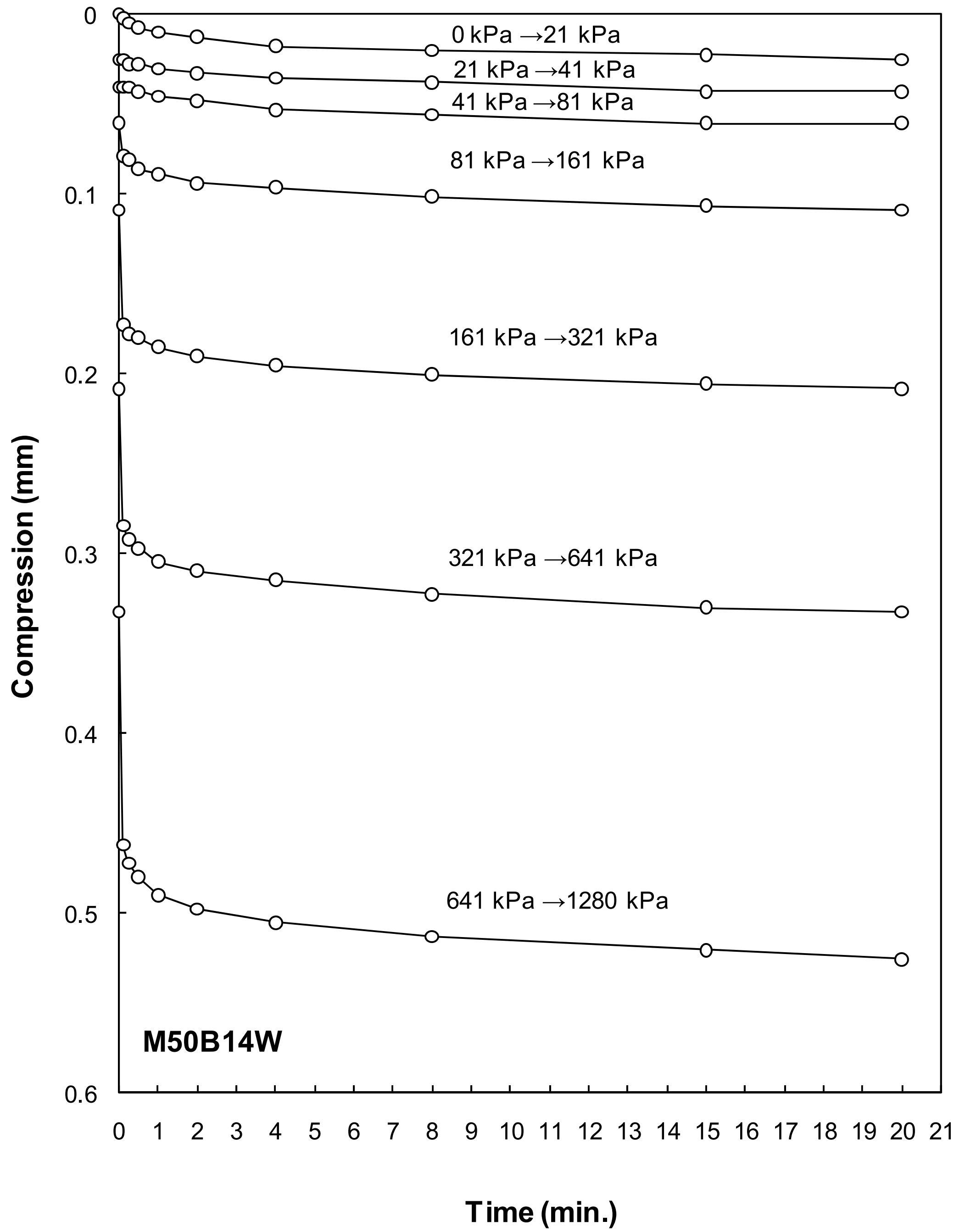


Figure 6.12. Compression vs. Time (M50B14W)

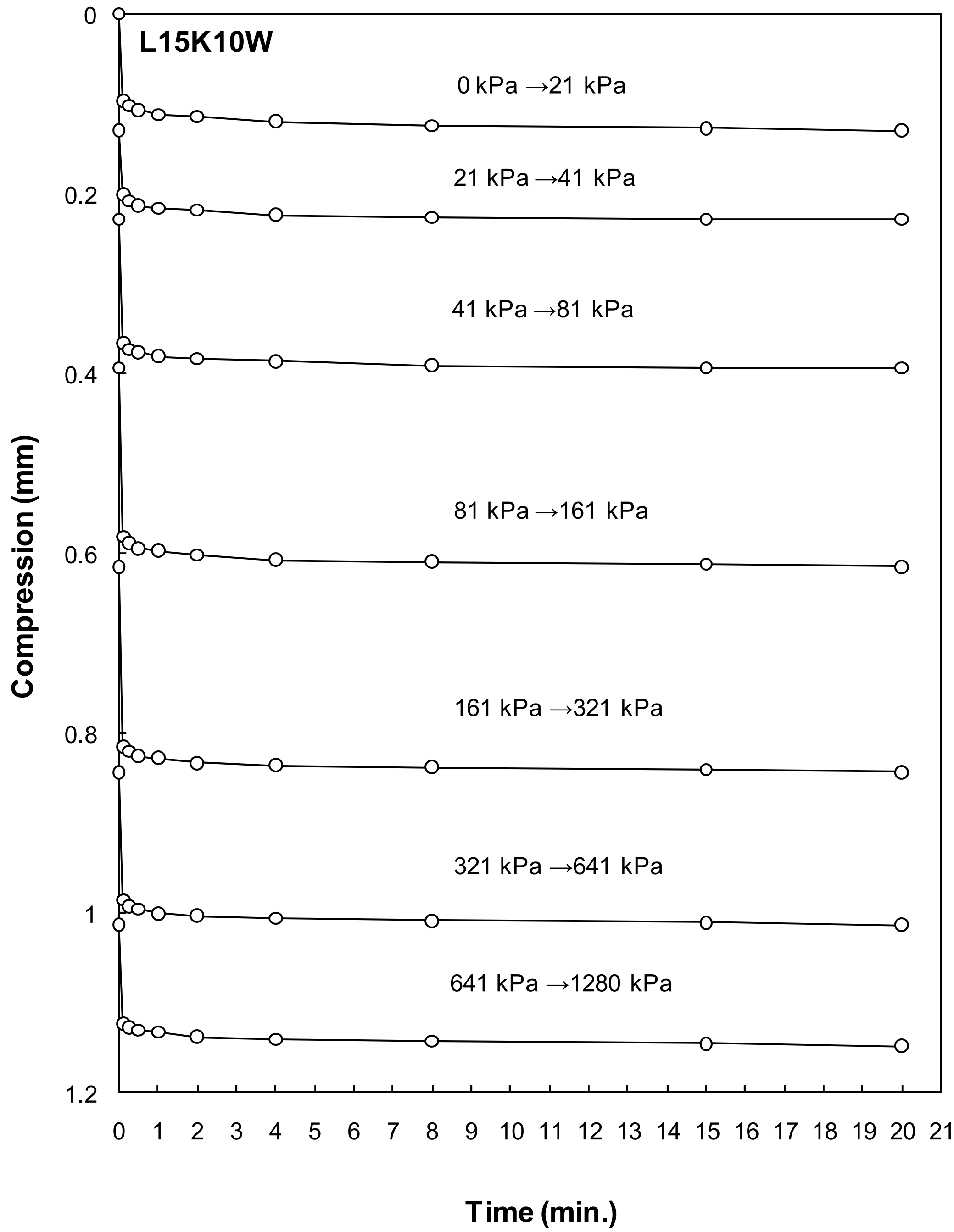


Figure 6.13. Compression vs. Time (L15K10W)

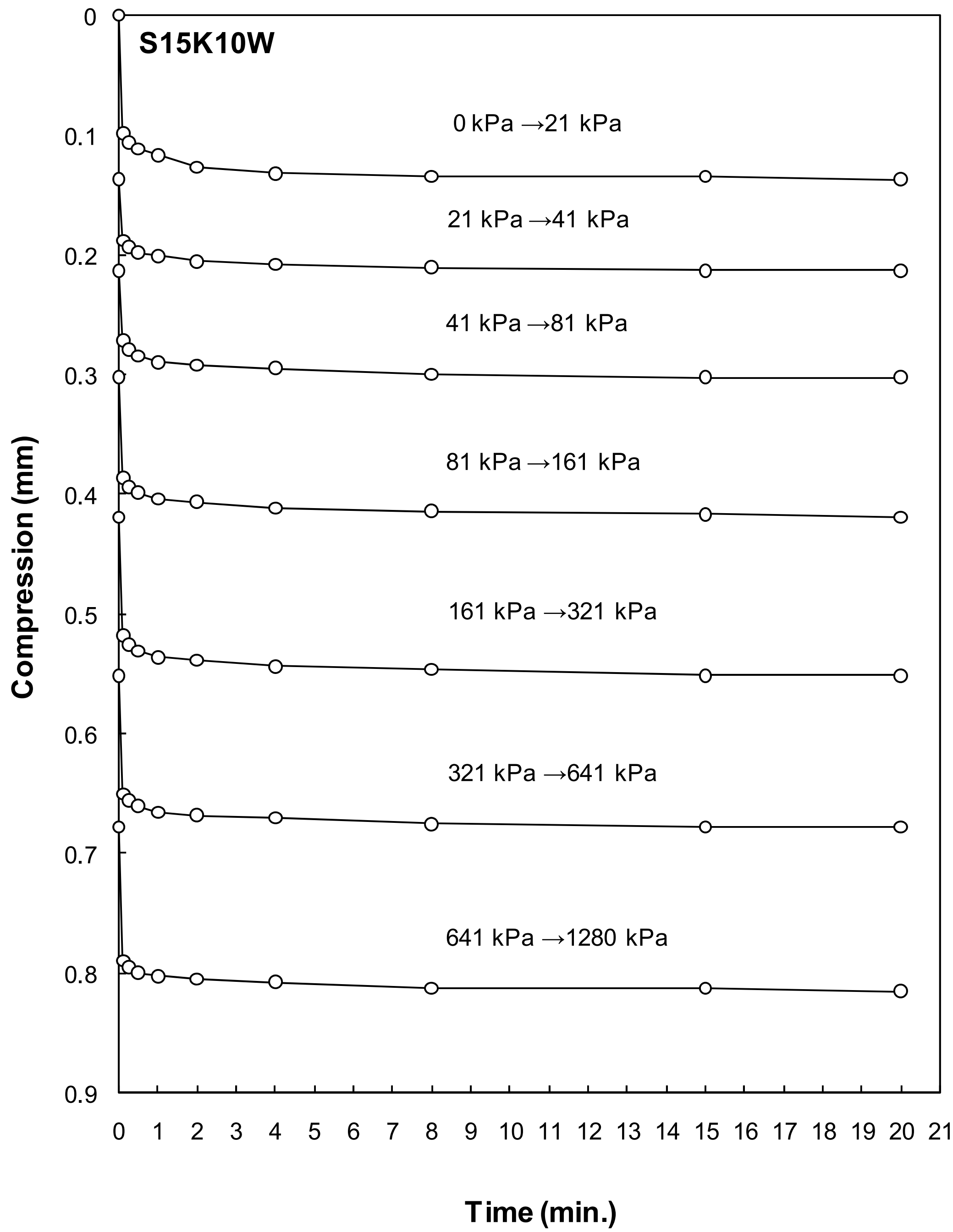


Figure 6.14. Compression vs. Time (S15K10W)

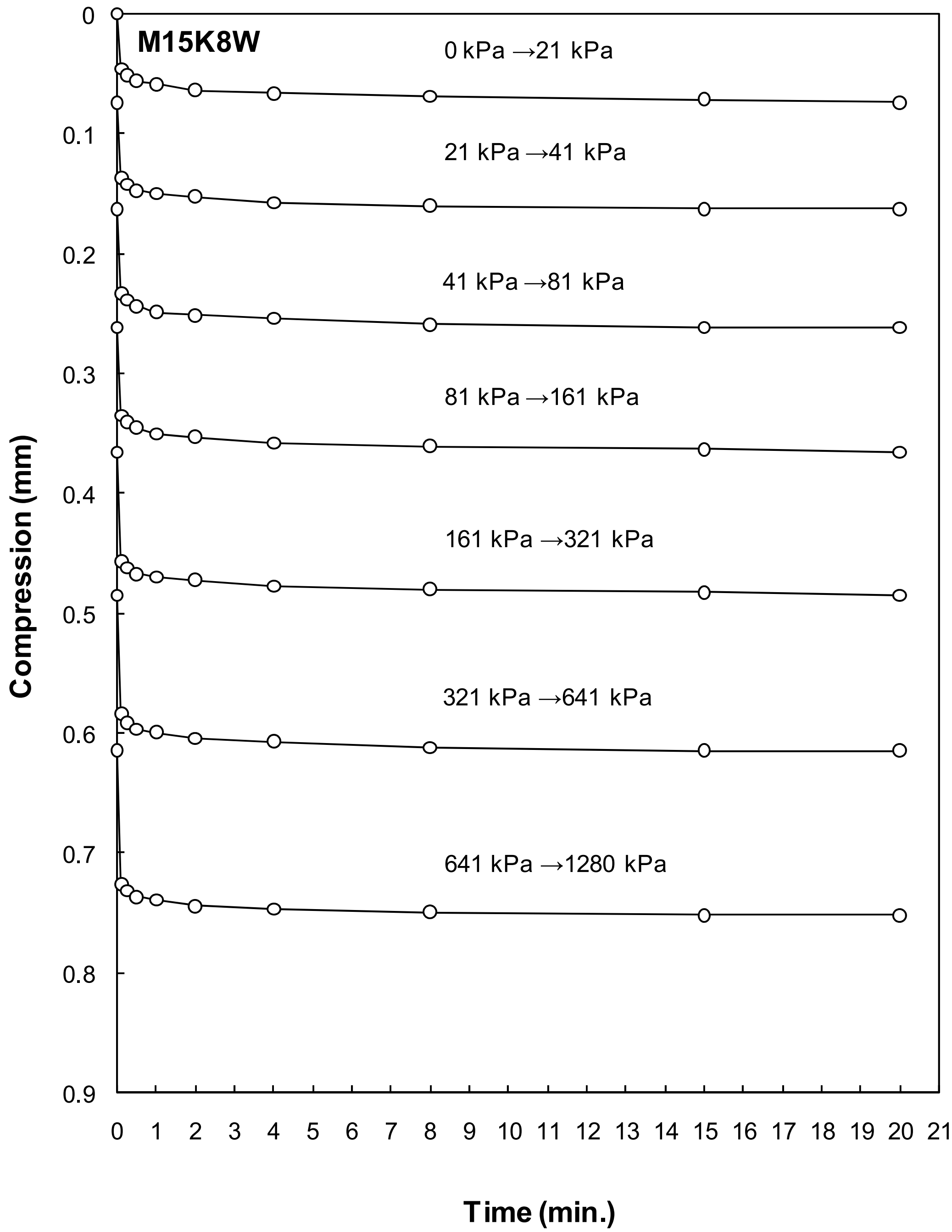


Figure 6.15. Compression vs. Time (M15K8W)

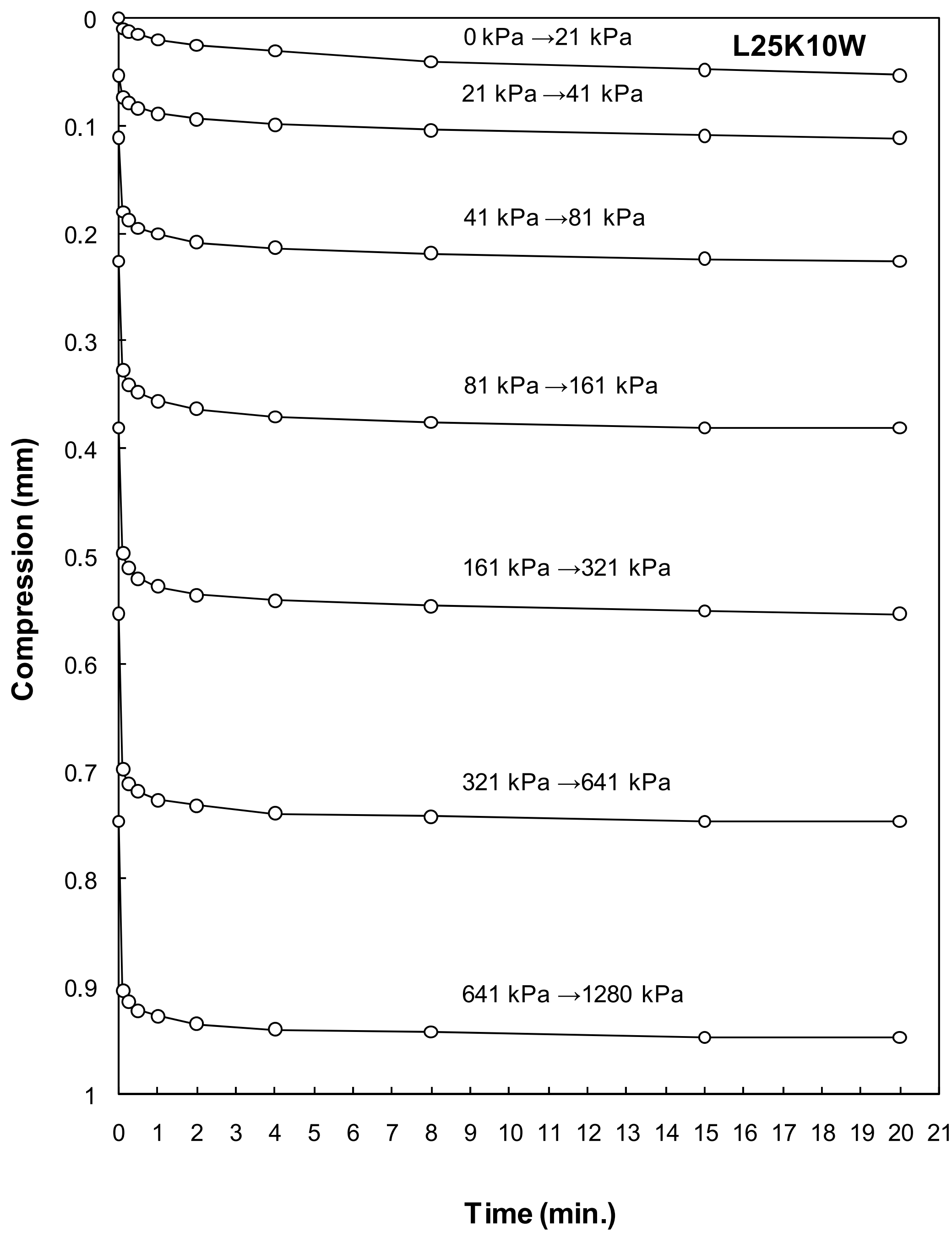


Figure 6.16. Compression vs. Time (L25K10W)

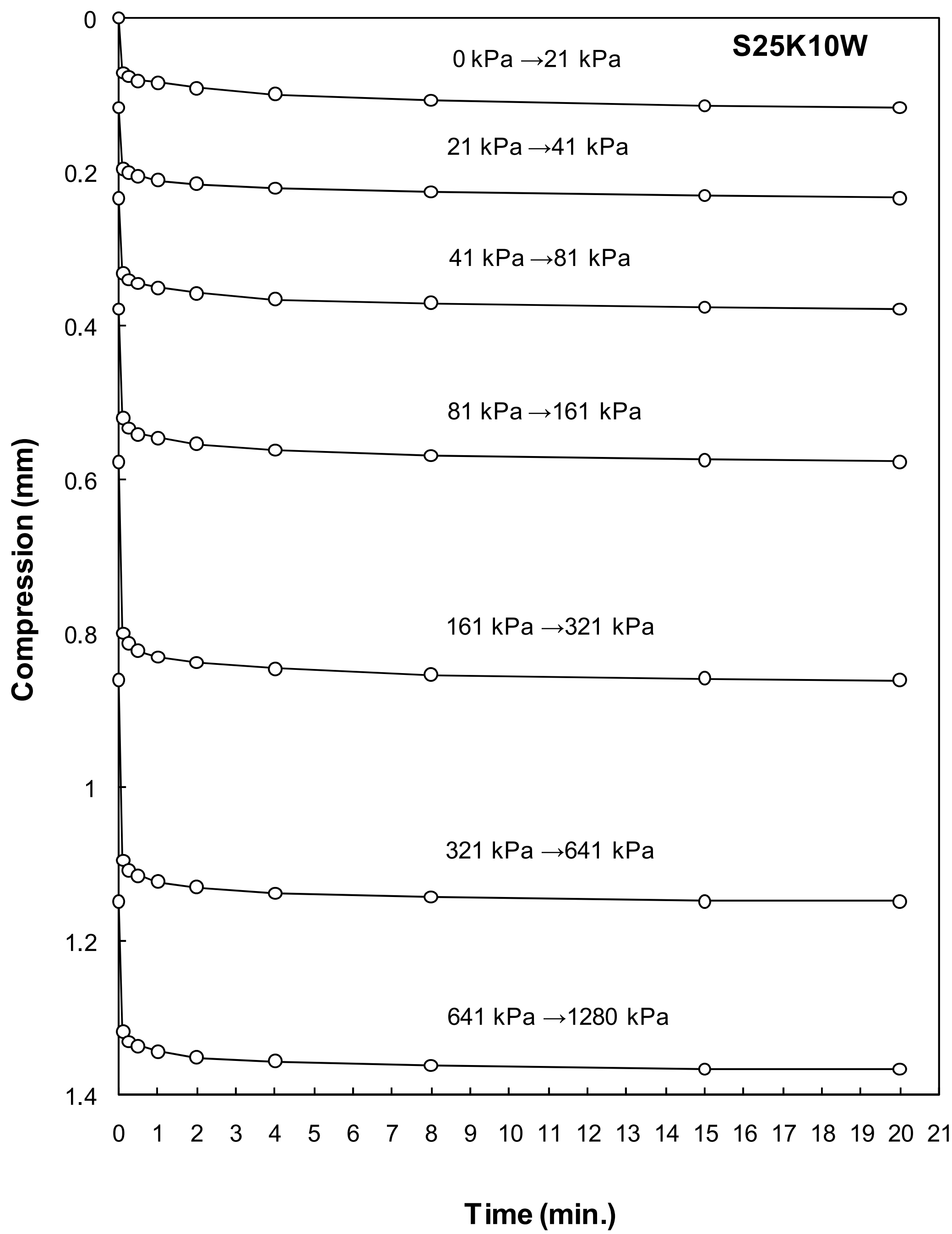


Figure 6.17. Compression vs. Time (S25K10W)

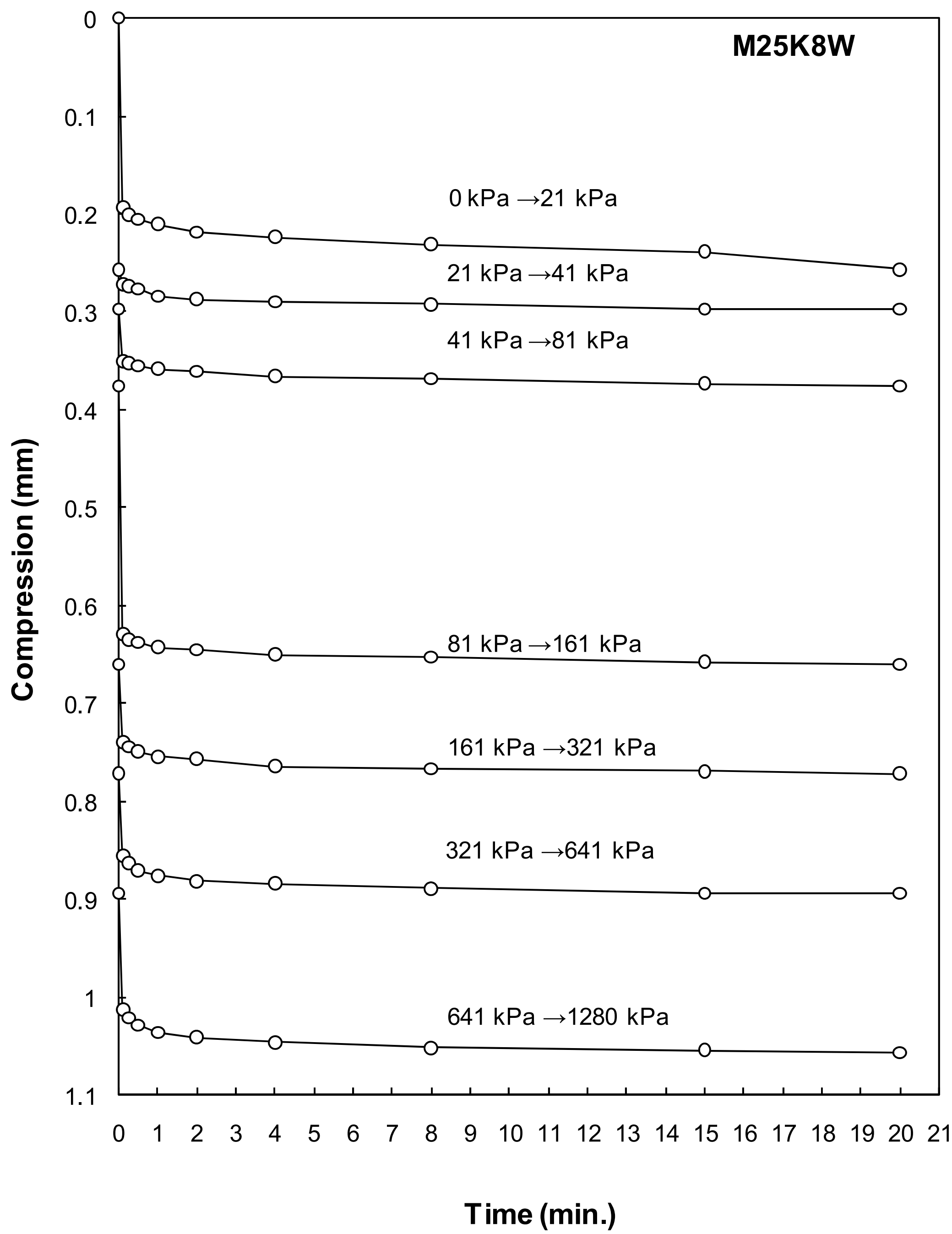


Figure 6.18. Compression vs. Time (M25K8W)

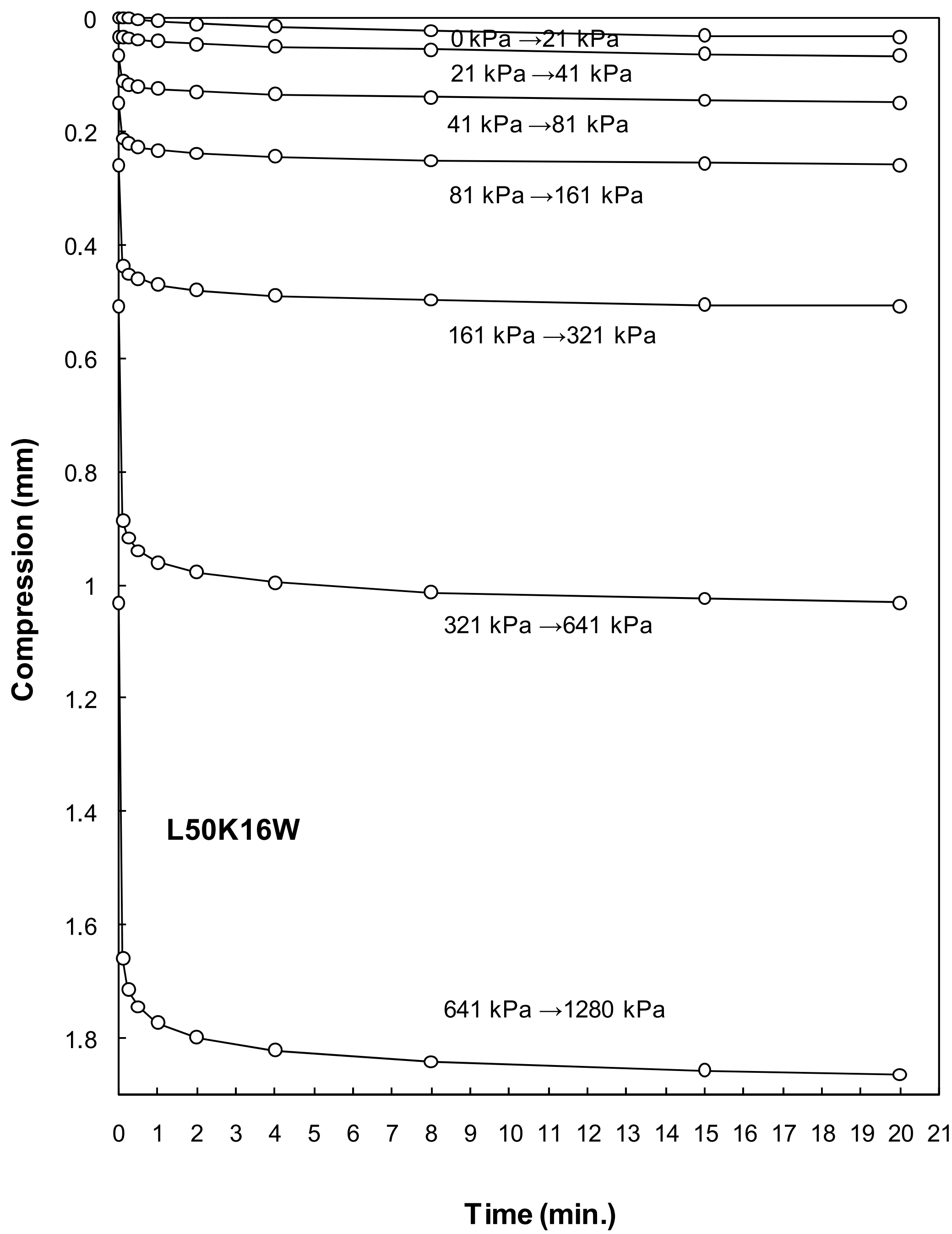


Figure 6.19. Compression vs. Time (L50K16W)

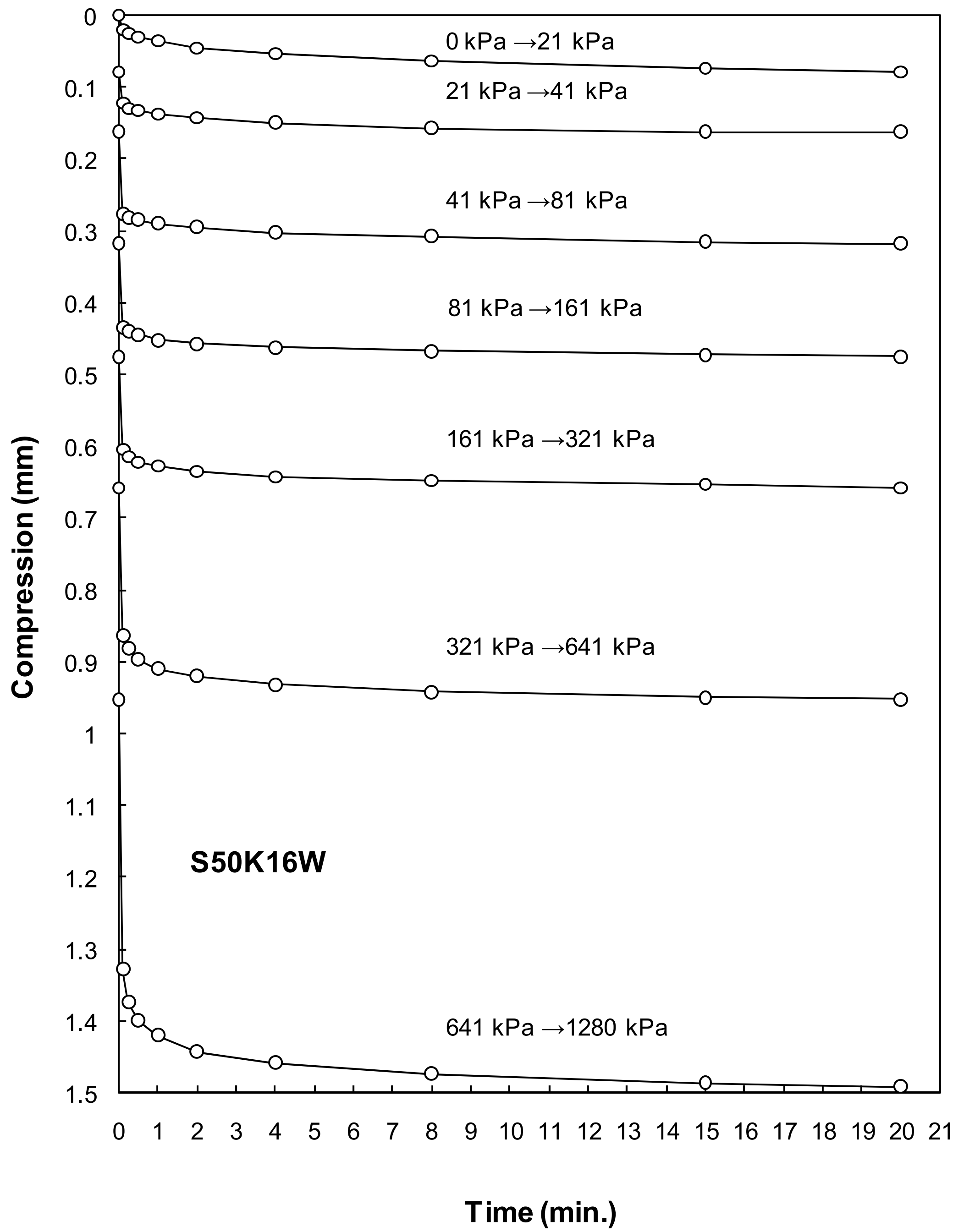


Figure 6.20. Compression vs. Time (S50K16W)

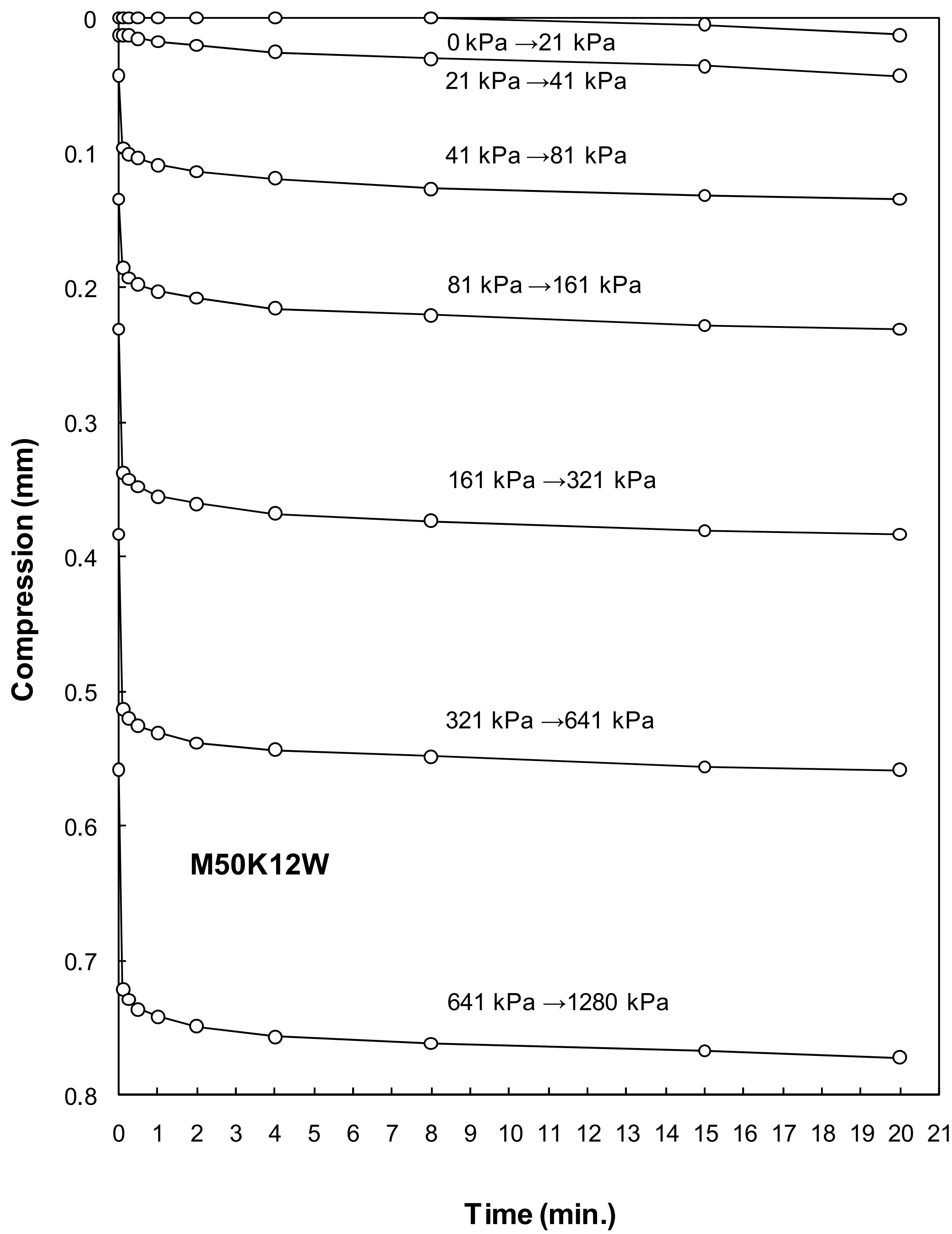


Figure 6.21. Compression vs. Time (M50K12W)

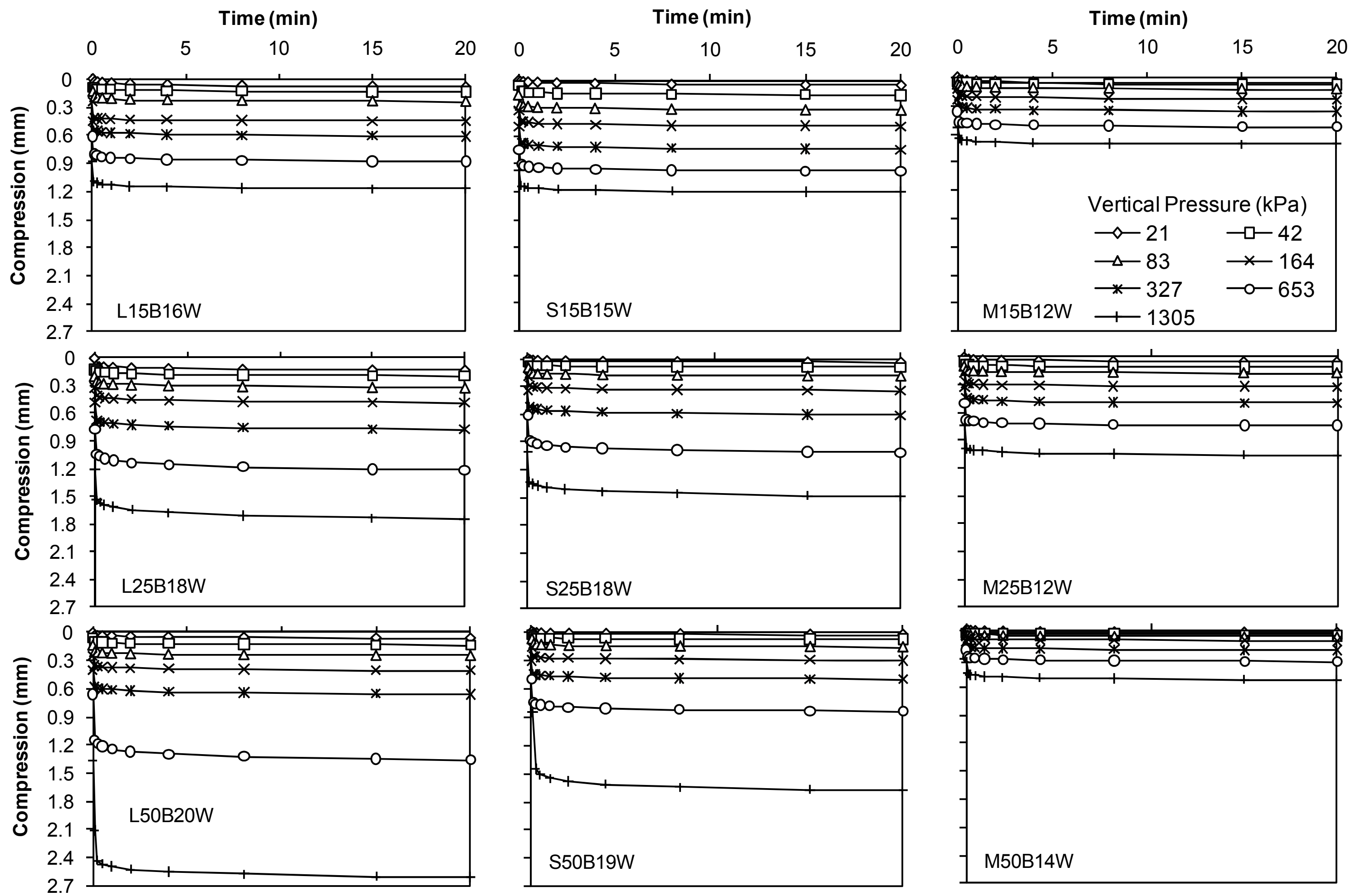


Figure 6.22. Typical Plots of Time-Compression for Bentonite/Sand Specimens Compacted at w_{opt}

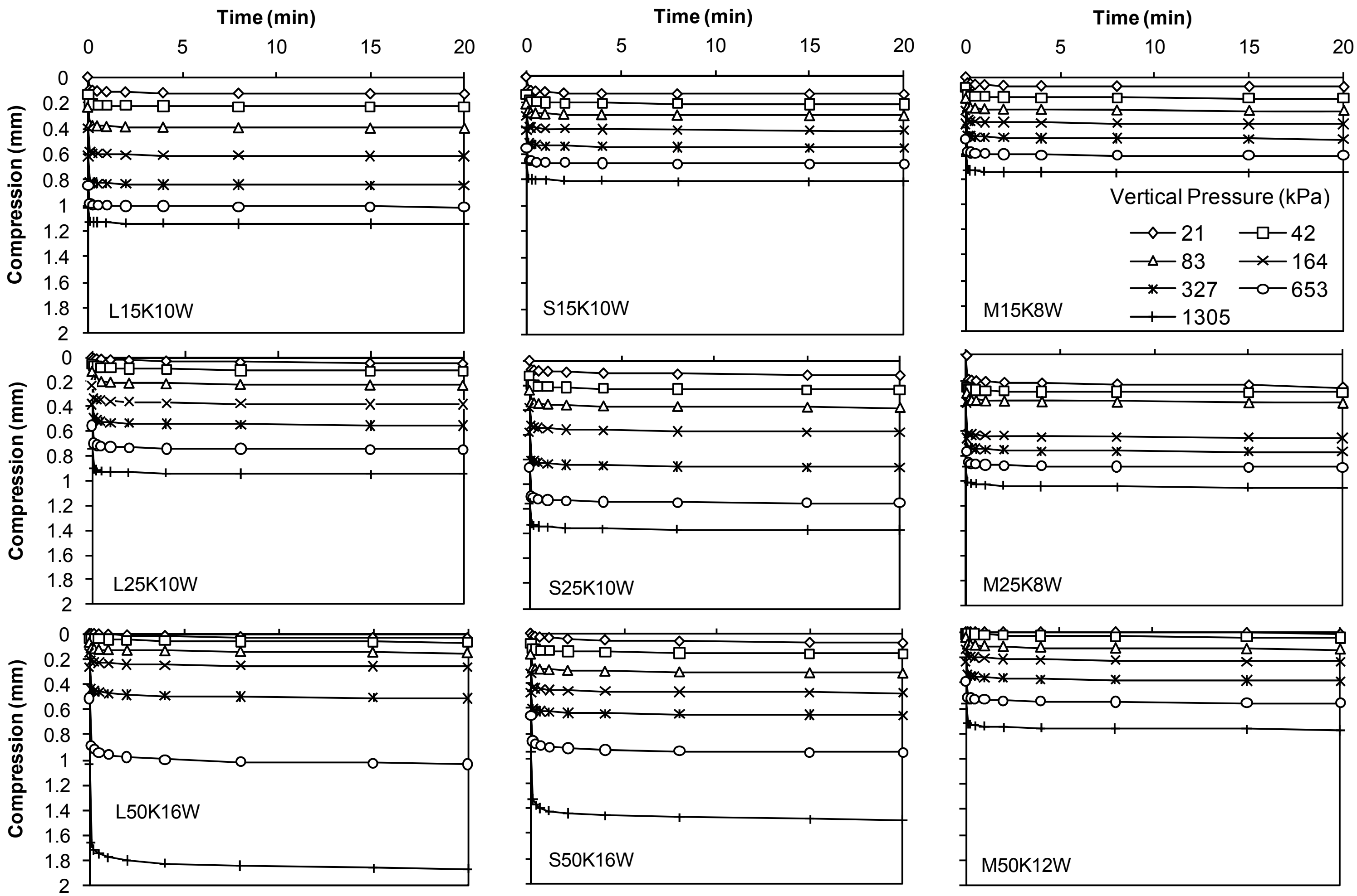


Figure 6.23. Typical Plots of Time-Compression for Kaolinite/Sand Specimens Compacted at wopt

6.4.2 ε_v versus log σ_v Curves

To more clearly illustrate the effects of clay proportion, clay mineralogy, water content, and compactive effort on the compressibility of clay/sand mixtures, the oedometer test data are replotted as vertical strain (ε_v) versus vertical applied stress (σ_v) in Figures 6.24-6.29. Each figure is for a separate nominal energy level, and the applied stress is plotted on a logarithmic-scale axis.

Figures 6.24-6.26 present the ε_v vs σ_v curves that were measured for the bentonite/sand mixtures. These figures demonstrate that, at a given compaction energy level, the compressibility decreased as the sand content increased. However, this decrease in compressibility became relatively insignificant at higher levels of compactive effort. At the Modified Proctor energy level, samples with varying sand content exhibited almost the same degree of compressibility. As mentioned previously, the compactive effort also had a significant influence on the observed compressibility. At the same clay/sand mix proportion, the soil became less compressible as the compactive effort increased. The compaction water content was found to be important for samples with a high clay content, and relatively unimportant for samples having a low clay content. As can be observed from Figures 6.24-6.26, soils having a higher clay content that were compacted wet-of-optimum underwent significantly more compression than those with a lower clay content. Final vertical strains for samples containing a higher percentage of clay exhibited significant scatter. Conversely, the final vertical strains for samples having a low clay proportion exhibited a narrower band of results.

Figures 6.27-6.29 show the compressibility behavior that was observed for the kaolinite/sand mixtures. From these figures, it can be seen that the kaolinite/sand mixtures exhibited almost the same general trends in compressibility behavior as the bentonite/sand mixtures.

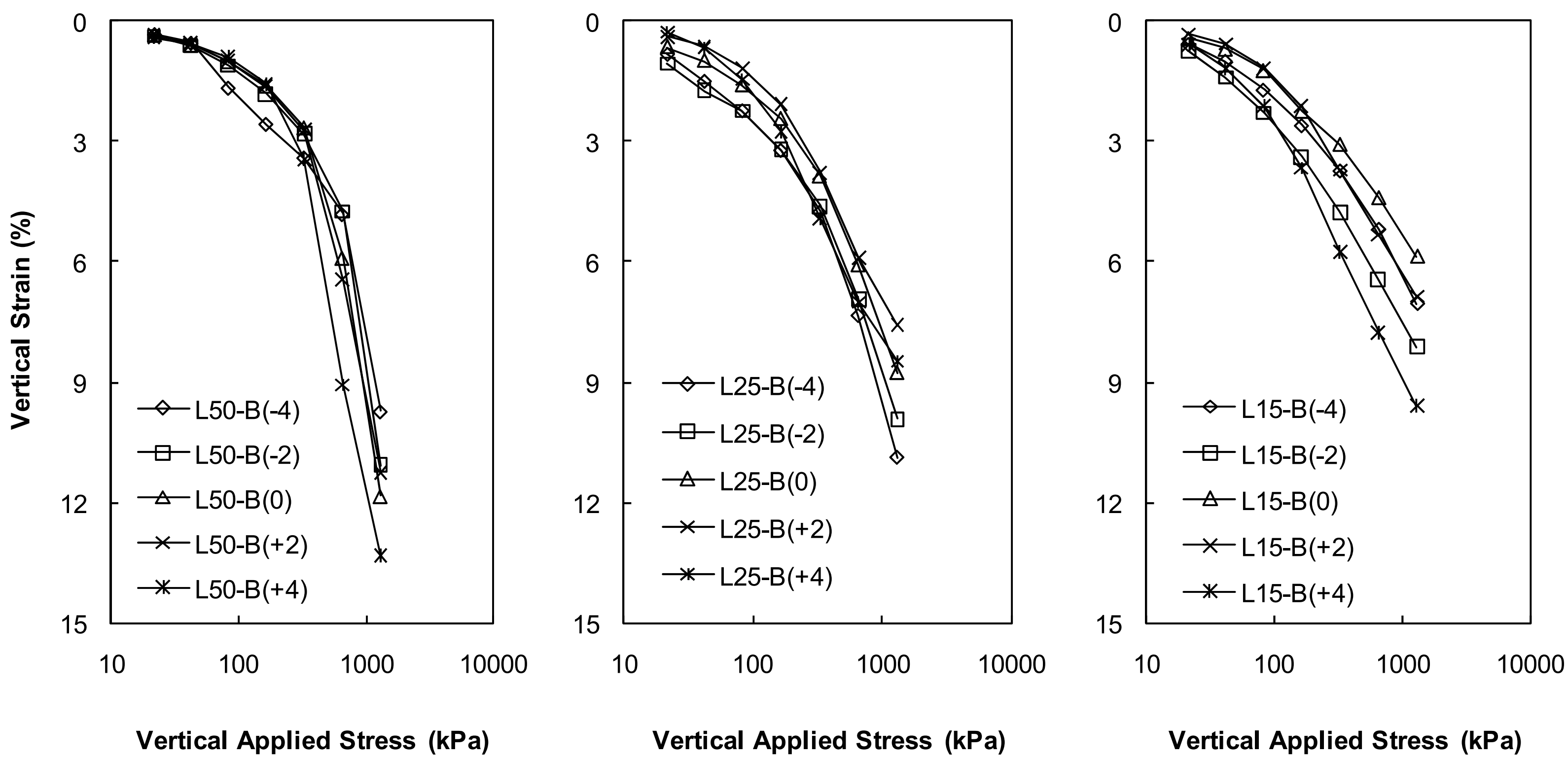


Figure 6.24. Vertical Strain versus Vertical Applied Stress for Low Energy Compacted Bentonite/Sand Mixtures

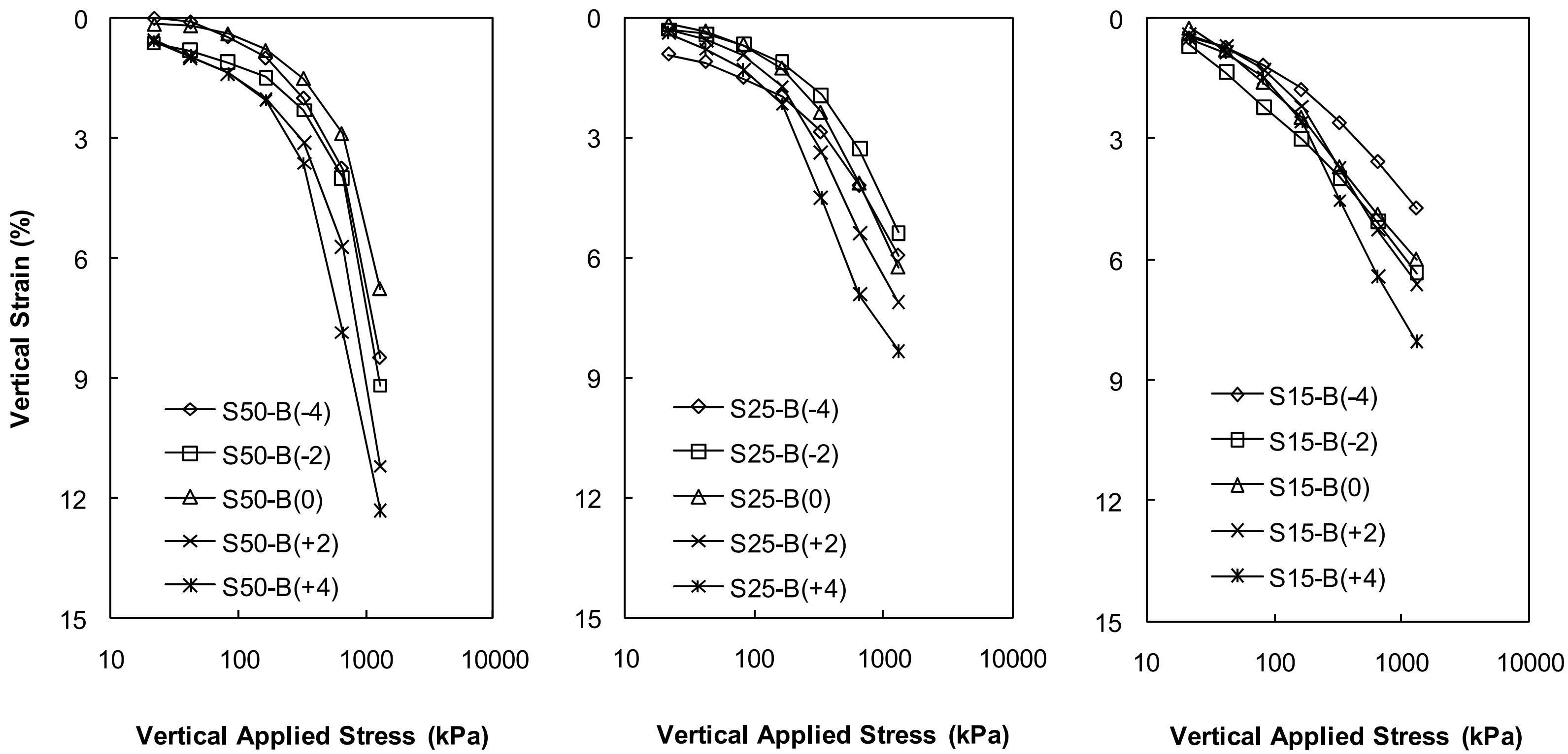


Figure 6.25. Vertical Strain versus Vertical Applied Stress for Standard Proctor Compacted Bentonite/Sand Mixtures

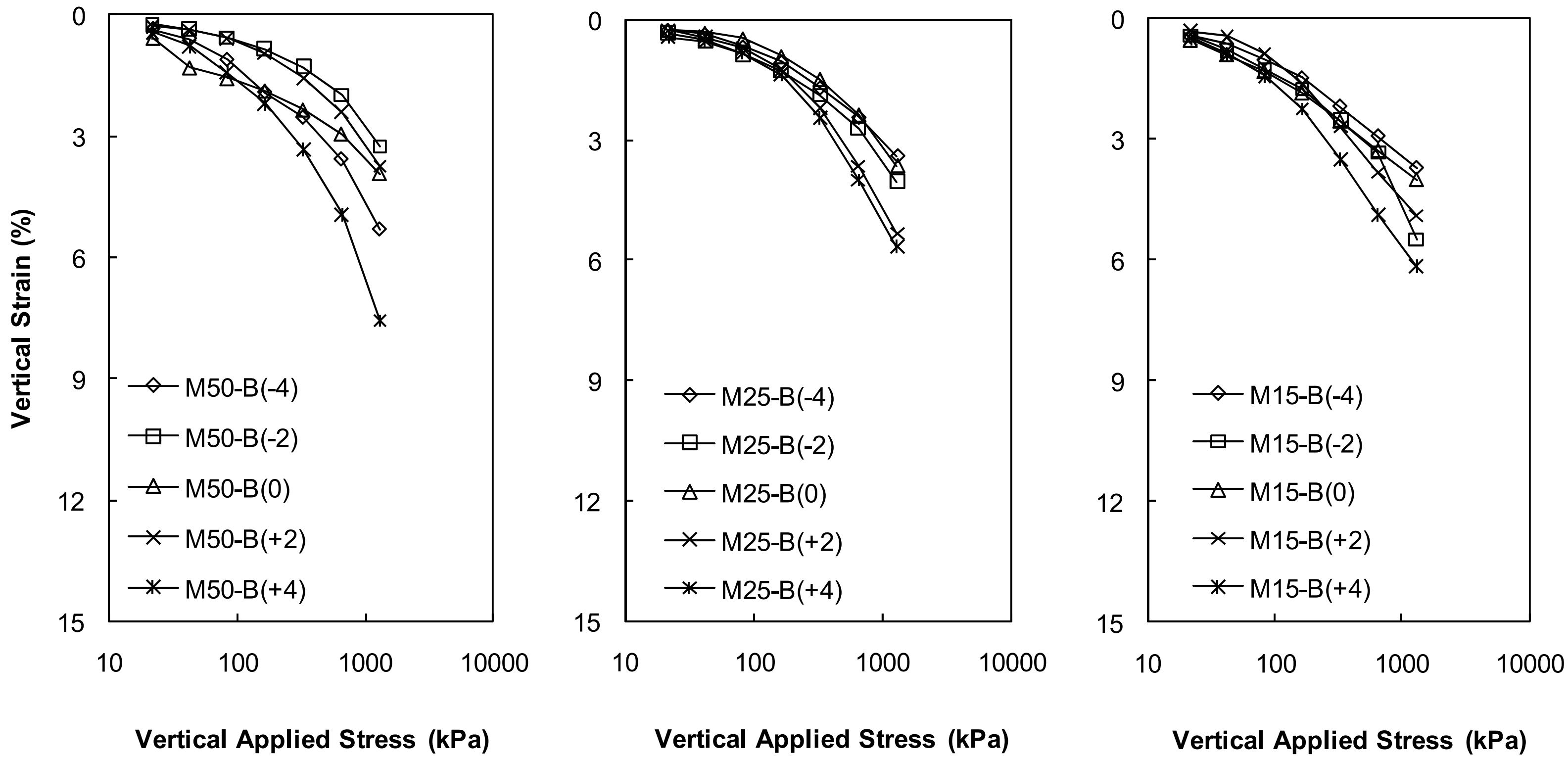


Figure 6.26. Vertical Strain versus Vertical Applied Stress for Modified Proctor Compacted Bentonite/Sand Mixtures

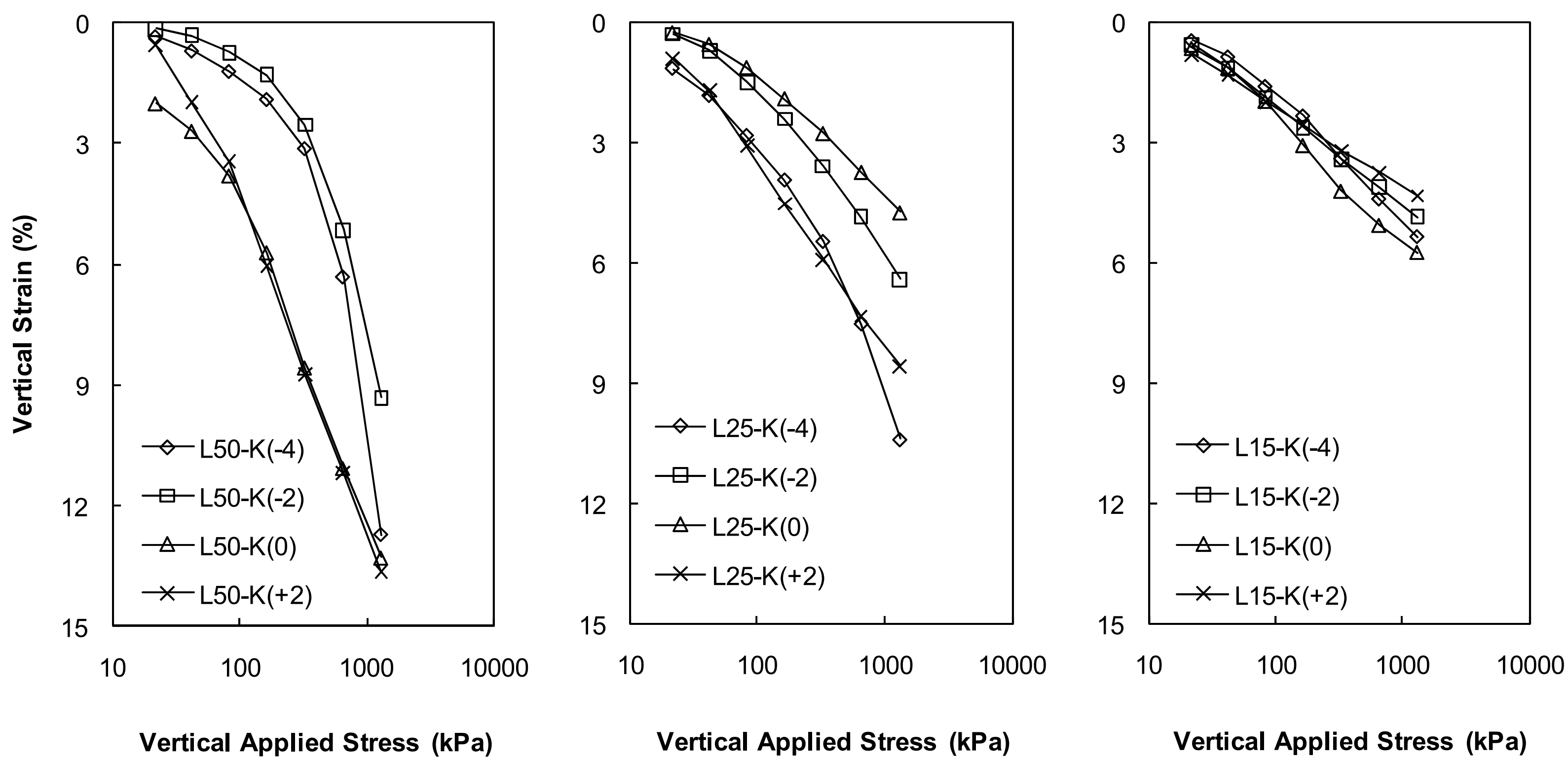


Figure 6.27. Vertical Strain versus Vertical Applied Stress for Low Energy Compacted Kaolinite/Sand Mixtures

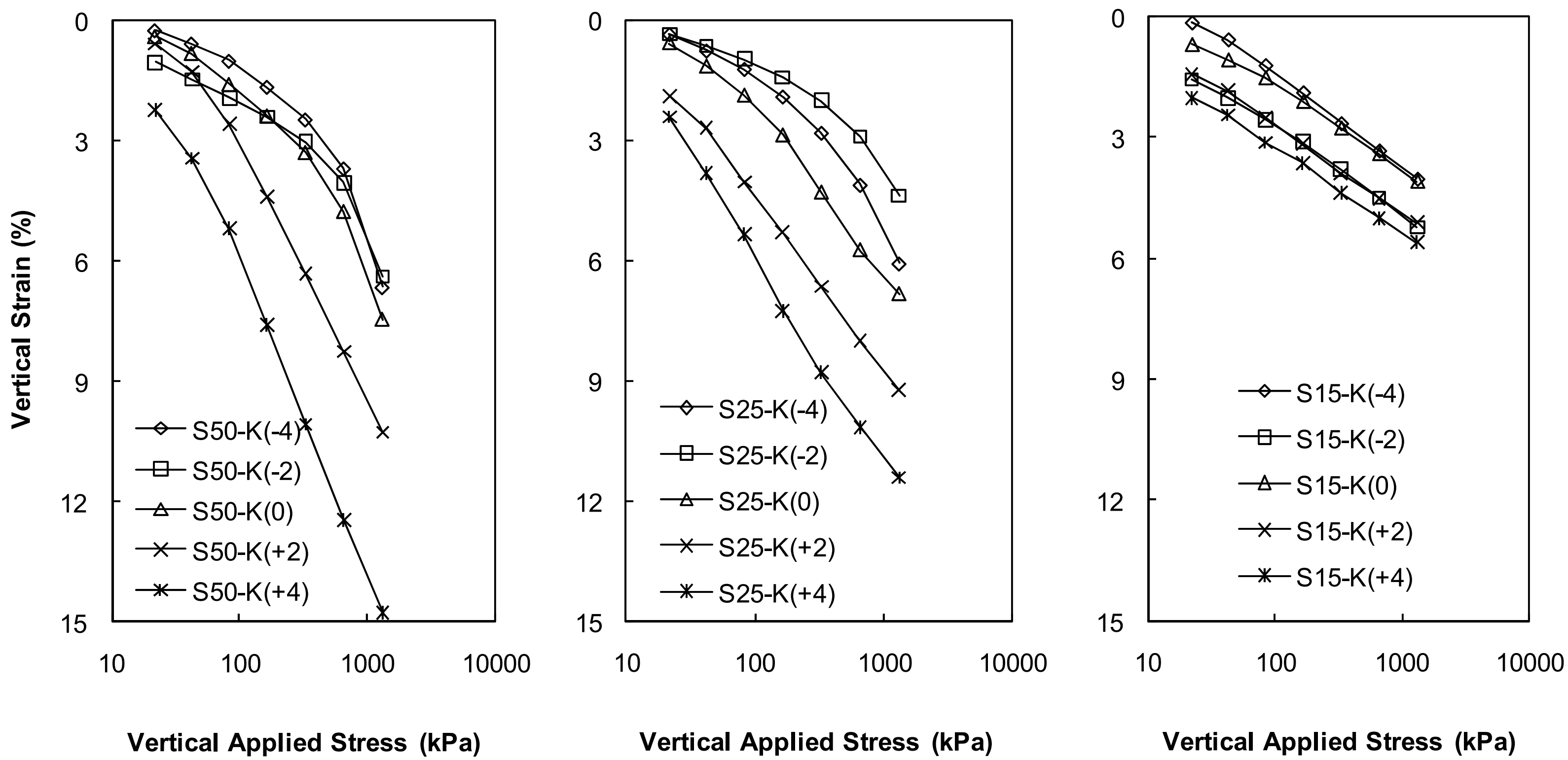


Figure 6.28. Vertical Strain versus Vertical Applied Stress for Standard Proctor Compacted Kaolinite/Sand Mixtures

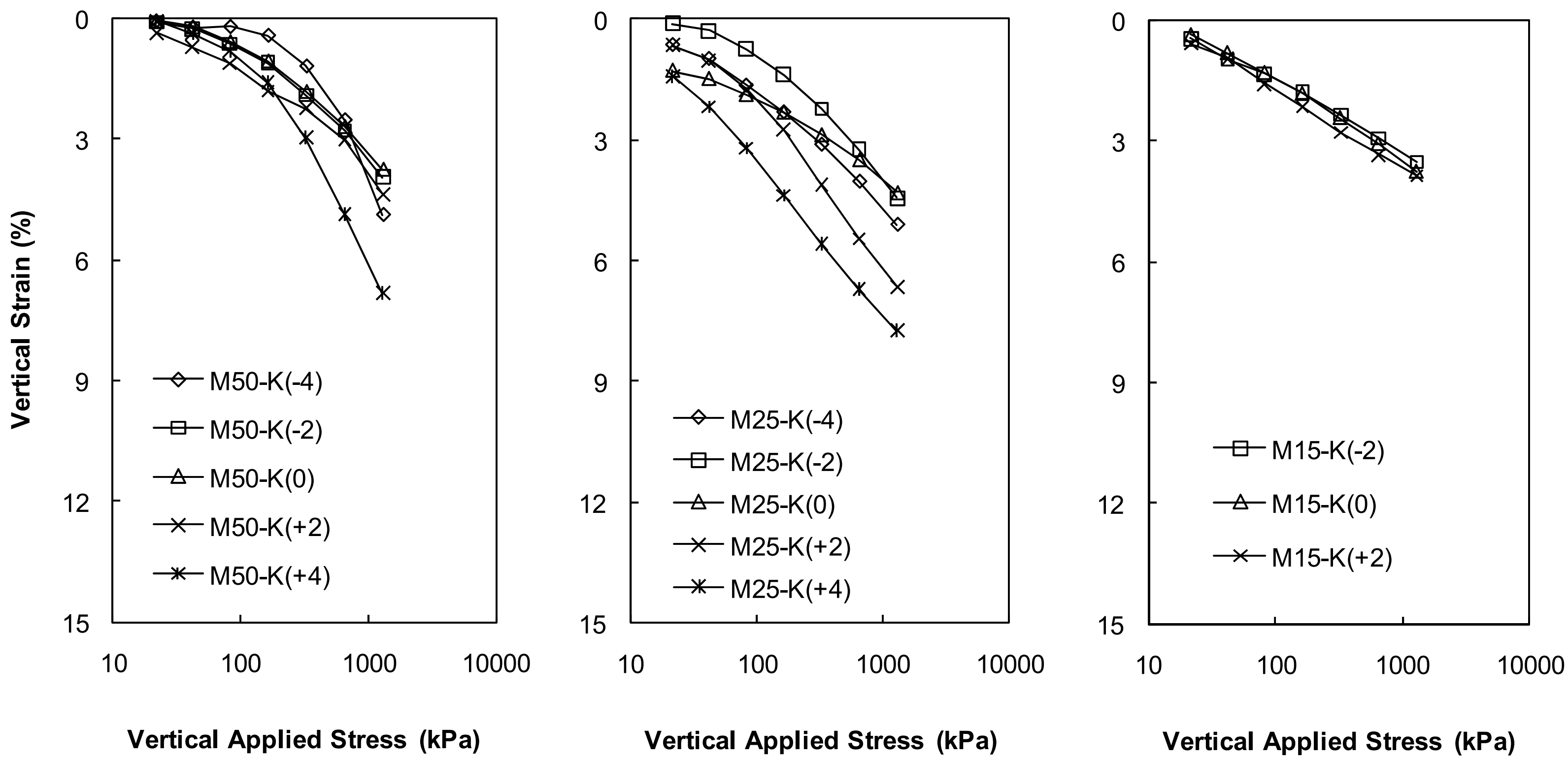


Figure 6.29. Vertical Strain versus Vertical Applied Stress for Modified Proctor Compacted Kaolinite/Sand Mixtures

6.5 Summary of One-Dimensional Test Results

This chapter describes a series of 1-D compression tests that were conducted to determine the relationship between compaction condition (compaction moisture content, compactive effort, clay mineral type, and clay/sand mix proportion) and the compressibility behavior of clay/sand mixtures. The following conclusions were drawn from the tests that were conducted:

(1) The 50% clay/sand samples compacted at either the Low Energy Proctor or Standard Proctor energy level exhibited a “critical pressure”-type behavior, which was characterized by a sudden increase in compressibility when the applied pressure passed beyond a certain point.

(2) For each of the clay/sand mixtures, at a given compaction energy level, the compressibility decreased as the percentage of sand in the mixture increased. The effect of changes in sand content on the compressibility behavior was reduced at higher levels of compactive effort (e.g., the Modified Proctor compaction energy level).

(3) Increases in compactive effort led to an increase in soil density, which in turn resulted in a decrease in soil compressibility.

(4) The compaction water content was found to have a significant effect for samples with a high clay content, and was observed to be relatively unimportant for samples with a low clay content.

Chapter 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

This thesis examines the undrained strength, stress-strain, and compressibility behavior of compacted clay/sand mixtures containing various clay proportions. A laboratory impact compaction approach (Proctor-type compaction) was used to prepare both the triaxial test specimens and the one-dimensional compression test specimens that were utilized in this study, with three different compaction energy levels being utilized during specimen preparation. A detailed explanation of the experimental apparatus and procedures that were utilized is presented herein. The experimental results of this study lead to the following important conclusions:

(6) A semi-logarithmic relationship exists between the maximum dry unit weight and the compaction energy for both kaolinite/sand and bentonite/sand mixtures. Logarithmic regression analysis yielded R^2 values ranging from 0.87 to 0.99 for kaolinite and 0.98 to 1 for bentonite.

(7) A semi-logarithmic relationship also exists between the optimum water content and the compaction energy for both clay/sand mixtures. Logarithmic regression analysis yielded R^2 values ranging from 0.87 to 0.96 for kaolinite and 0.97 to 1 for bentonite.

(8) For the kaolinite/sand mixtures, at all compaction energy levels, the maximum dry unit weight was observed to occur for the 25% kaolinite mixture. However, this was not true for the bentonite/sand mixtures, which

exhibited a consistent trend of decreasing dry unit weight as the bentonite content increased.

(9) Higher compactive efforts minimize the difference in maximum dry unit weight between mixtures containing different clay contents.

(10) It appears that for clay/sand specimens compacted at the same energy level and with the same clay content, the undrained strength determined in unconsolidated undrained (UU) triaxial tests at the maximum deviator stress decreases with increasing compaction moisture content. Variations in water content have a larger influence on the undrained strength of kaolinite/sand specimens than they do on bentonite/sand specimens. In general, for both of the clay minerals that were examined in this study, the UU triaxial undrained strength increases with increasing confining pressure and compactive effort.

(11) At the same compaction energy level, dry-of-optimum UU triaxial specimens are stiffer, stronger and more brittle than wet-of-optimum specimens. In contrast, specimens containing a smaller amount of clay appear to be less stiff, weaker and less brittle than samples with a high clay content.

(12) At the same clay/sand mix proportion, the values of ϕ measured in the UU triaxial device increase with decreasing water content and are largest for specimens compacted at a very low water content with high compactive effort. Kaolinite/sand specimens exhibit higher ϕ values than what was observed for bentonite/sand specimens at the same water content relative to the optimum water content (e.g., w_{opt} + 2%).

(13) The values of the cohesion intercept (c) measured in the UU triaxial device increase with increasing dry unit weight, and are largest for specimens compacted at water contents near optimum with a high compactive effort.

The values of c also increase with increasing clay content. Bentonite/sand specimens exhibited higher c values than kaolinite/sand specimens.

(14) The values of the secant modulus measured at 50% shear strength in the UU triaxial device (E_{50}) increase with clay content and are higher for dry-of-optimum specimens than wet-of-optimum specimens.

(15) The 50% clay/sand samples compacted at either the Low Energy Proctor or Standard Proctor energy level exhibited a "critical pressure"-type behavior in the one-dimensional compressibility tests that were conducted, which was characterized by a sudden increase in compressibility when the applied pressure passed beyond a certain point.

(16) For each of the clay/sand mixtures, at a given compaction energy level, the one-dimensional compressibility decreased as the percentage of sand in the mixture increased. The effect of changes in sand content on the compressibility behavior was reduced at higher levels of compactive effort (e.g., the Modified Proctor compaction energy level).

(17) Increases in compactive effort led to an increase in soil density, which in turn resulted in a decrease in one-dimensional soil compressibility.

(18) The compaction water content was found to have a significant effect on the one-dimensional compressibility behavior of samples with a high clay content, and was observed to be relatively unimportant for samples with a low clay content.

7.2 Recommendations for Future Research

(1) Compaction conditions in the field are different than those in the laboratory. Therefore, if the results of this study are to be of the most value for prediction

of field behavior, these results should be correlated with similar tests on field compacted soil.

(2) Laboratory studies that focus on the effects of different methods of compaction (e.g., static, impact, kneading, and vibratory compaction) on the resulting strength and compressibility behavior of compacted clay/sand mixtures may also prove useful.

(3) The influence of wetting induced collapse settlement and swell behavior resulting from postconstruction increases in moisture content from precipitation, capillary water, and flooding, should be examined.

APPENDIX A

SAND SIEVE ANALYSIS

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set:	Single-Set Sieving
Method:	B	Sampling Procedure Used: Air-Dried	Sample No.: 20
Soak Time:	-	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min
Total Dry Mass of Sample, (g):	153.4	Separating Sieve:	N/A
Total Dry Mass after #200 wash, (g):	-	Tested by:	Yueru Chen
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	731.5	731.5	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	629.5	629.7	0.2	0.13	0.13	99.87
0.59	No.30						
0.42	No.40	375.0	480.8	105.8	68.97	68.97	30.90
0.297	No.50						
0.250	No.60	371.5	417.0	45.5	29.66	29.66	1.24
0.210	No.70						
0.149	No.100	509.9	511.3	1.4	0.91	0.91	0.33
0.105	No.140	306.0	306.4	0.4	0.26	0.26	0.07
0.074	No.200	334.4	334.6	0.2	0.13	0.13	-0.07
Pan		373.3	373.3	0.0	0.00	0.00	-0.07
Total Dry Weight in grams				153.5			
Percent Lost (-) / Gained(+)				0.07			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set:	Single-Set Sieving
Method:	B	Sampling Procedure Used: Air-Dried	Sample No.: 19
Soak Time:	-	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min
Total Dry Mass of Sample, (g):	172.4	Separating Sieve:	N/A
Total Dry Mass after #200 wash, (g):	-	Tested by:	Yueru Chen
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	451.5	451.5	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	408.9	409.3	0.4	0.23	0.23	99.77
0.59	No.30						
0.42	No.40	340.2	459.7	119.5	69.32	69.32	30.45
0.297	No.50						
0.250	No.60	316.0	361.9	45.9	26.62	26.62	3.83
0.210	No.70						
0.149	No.100	308.0	311.0	3.0	1.74	1.74	2.09
0.105	No.140	486.9	489.2	2.3	1.33	1.33	0.75
0.074	No.200	292.6	293.4	0.8	0.46	0.46	0.29
Pan		374.6	375.1	0.5	0.29	0.29	0.00
Total Dry Weight in grams				172.4			
Percent Lost (-) / Gained(+)				0.00			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set: Single-Set Sieving	
Method: B	Sampling Procedure Used: Air-Dried	Sample No.: 18	
Soak Time: -	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min	
Total Dry Mass of Sample, (g):	169.6	Separating Sieve: N/A	
Total Dry Mass after #200 wash, (g):	-	Tested by: Yueru Chen	
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	451.5	451.5	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	409.1	409.4	0.3	0.18	0.18	99.82
0.59	No.30						
0.42	No.40	340.8	467.4	126.6	74.65	74.65	25.18
0.297	No.50						
0.250	No.60	316.1	356.6	40.5	23.88	23.88	1.30
0.210	No.70						
0.149	No.100	308.1	309.9	1.8	1.06	1.06	0.24
0.105	No.140	486.9	487.3	0.4	0.24	0.24	0.00
0.074	No.200	292.6	292.6	0.0	0.00	0.00	0.00
Pan		374.5	374.5	0.0	0.00	0.00	0.00
Total Dry Weight in grams				169.6			
Percent Lost (-) / Gained(+)				0.00			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set:	Single-Set Sieving
Method: B	Sampling Procedure Used: Air-Dried	Sample No.:	17
Soak Time: -	Dispersing Agent/Apparatus: N/A	Sieve Time:	10 min
Total Dry Mass of Sample, (g):	173.9	Separating Sieve:	N/A
Total Dry Mass after #200 wash, (g):	-	Tested by:	Yueru Chen
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings (mm)	U.S. Standard	Pan Weight	Soil+Pan Weight	Soil Weight	Percent Retained Partial	Percent Retained Total	Percent Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	451.5	451.5	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	409.1	409.3	0.2	0.12	0.12	99.88
0.59	No.30						
0.42	No.40	340.4	467.1	126.7	72.86	72.86	27.03
0.297	No.50						
0.250	No.60	316.0	360.9	44.9	25.82	25.82	1.21
0.210	No.70						
0.149	No.100	308.1	309.5	1.4	0.81	0.81	0.40
0.105	No.140	486.9	487.4	0.5	0.29	0.29	0.12
0.074	No.200	292.6	292.7	0.1	0.06	0.06	0.06
Pan		374.5	374.7	0.2	0.12	0.12	-0.06
Total Dry Weight in grams				174.0			
Percent Lost (-) / Gained(+)				0.06			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set:	Single-Set Sieving
Method:	B	Sampling Procedure Used: Air-Dried	Sample No.: 16
Soak Time:	-	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min
Total Dry Mass of Sample, (g):	179.1	Separating Sieve:	N/A
Total Dry Mass after #200 wash, (g):	-	Tested by:	Yueru Chen
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	451.5	451.5	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	409.1	409.5	0.4	0.22	0.22	99.78
0.59	No.30						
0.42	No.40	340.3	475.0	134.7	75.21	75.21	24.57
0.297	No.50						
0.250	No.60	316.0	359.6	43.6	24.34	24.34	0.22
0.210	No.70						
0.149	No.100	308.0	308.4	0.4	0.22	0.22	0.00
0.105	No.140	486.9	486.9	0.0	0.00	0.00	0.00
0.074	No.200	292.6	292.6	0.0	0.00	0.00	0.00
Pan		374.5	374.5	0.0	0.00	0.00	0.00
Total Dry Weight in grams				179.1			
Percent Lost (-) / Gained(+)				0.00			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set:	Single-Set Sieving
Method: B	Sampling Procedure Used: Air-Dried		Sample No.: 15
Soak Time: -	Dispersing Agent/Apparatus: N/A		Sieve Time: 10 min
Total Dry Mass of Sample, (g):	178	Separating Sieve:	N/A
Total Dry Mass after #200 wash, (g):	-	Tested by:	Yueru Chen
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	451.5	451.5	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	409.3	409.7	0.4	0.22	0.22	99.78
0.59	No.30						
0.42	No.40	340.5	481.8	141.3	79.38	79.38	20.39
0.297	No.50						
0.250	No.60	316.2	351.9	35.7	20.06	20.06	0.34
0.210	No.70						
0.149	No.100	308.0	308.5	0.5	0.28	0.28	0.06
0.105	No.140	487.0	487.0	0.0	0.00	0.00	0.06
0.074	No.200	292.6	292.6	0.0	0.00	0.00	0.06
Pan		374.5	374.5	0.0	0.00	0.00	0.06
Total Dry Weight in grams				177.9			
Percent Lost (-) / Gained(+)				-0.06			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set: Single-Set Sieving	
Method: B	Sampling Procedure Used: Air-Dried	Sample No.: 14	
Soak Time: -	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min	
Total Dry Mass of Sample, (g):	160	Separating Sieve: N/A	
Total Dry Mass after #200 wash, (g):	-	Tested by: Yueru Chen	
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	451.5	451.5	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	409.3	409.6	0.3	0.19	0.19	99.81
0.59	No.30						
0.42	No.40	339.7	452.8	113.1	70.69	70.69	29.13
0.297	No.50						
0.250	No.60	316.1	360.5	44.4	27.75	27.75	1.38
0.210	No.70						
0.149	No.100	308.0	309.6	1.6	1.00	1.00	0.37
0.105	No.140	487.0	487.5	0.5	0.31	0.31	0.06
0.074	No.200	292.6	292.7	0.1	0.06	0.06	0.00
Pan		374.6	374.6	0.0	0.00	0.00	0.00
Total Dry Weight in grams				160.0			
Percent Lost (-) / Gained(+)				0.00			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set:	Single-Set Sieving
Method:	B	Sampling Procedure Used: Air-Dried	Sample No.: 13
Soak Time:	-	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min
Total Dry Mass of Sample, (g):	175.1	Separating Sieve:	N/A
Total Dry Mass after #200 wash, (g):	-	Tested by:	Yueru Chen
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings (mm)	U.S. Standard	Pan Weight	Soil+Pan Weight	Soil Weight	Percent Retained Partial	Percent Retained Total	Percent Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	451.6	451.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	409.6	409.8	0.2	0.11	0.11	99.89
0.59	No.30						
0.42	No.40	340.0	467.8	127.8	72.99	72.99	26.90
0.297	No.50						
0.250	No.60	316.2	362.6	46.4	26.50	26.50	0.40
0.210	No.70						
0.149	No.100	308.0	308.6	0.6	0.34	0.34	0.06
0.105	No.140	487.0	487.1	0.1	0.06	0.06	0.00
0.074	No.200	292.7	292.7	0.0	0.00	0.00	0.00
Pan		374.6	374.6	0.0	0.00	0.00	0.00
Total Dry Weight in grams				175.1			
Percent Lost (-) / Gained(+)				0.00			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set: Single-Set Sieving	
Method: B	Sampling Procedure Used: Air-Dried	Sample No.: 12	
Soak Time: -	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min	
Total Dry Mass of Sample, (g):	181.6	Separating Sieve: N/A	
Total Dry Mass after #200 wash, (g):	-	Tested by: Yueru Chen	
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	451.6	451.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	409.6	410.0	0.4	0.22	0.22	99.78
0.59	No.30						
0.42	No.40	339.7	481.5	141.8	78.08	78.08	21.70
0.297	No.50						
0.250	No.60	316.3	355.5	39.2	21.59	21.59	0.11
0.210	No.70						
0.149	No.100	308.0	308.2	0.2	0.11	0.11	0.00
0.105	No.140	486.9	486.9	0.0	0.00	0.00	0.00
0.074	No.200	292.7	292.7	0.0	0.00	0.00	0.00
Pan		374.6	374.6	0.0	0.00	0.00	0.00
Total Dry Weight in grams				181.6			
Percent Lost (-) / Gained(+)				0.00			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set: Single-Set Sieving	
Method: B	Sampling Procedure Used: Air-Dried	Sample No.: 11	
Soak Time: -	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min	
Total Dry Mass of Sample, (g):	165.1	Separating Sieve: N/A	
Total Dry Mass after #200 wash, (g):	-	Tested by: Yueru Chen	
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	451.6	451.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	410.6	410.8	0.2	0.12	0.12	99.88
0.59	No.30						
0.42	No.40	339.9	464.9	125.0	75.71	75.71	24.17
0.297	No.50						
0.250	No.60	316.3	355.8	39.5	23.92	23.92	0.24
0.210	No.70						
0.149	No.100	308.1	308.7	0.6	0.36	0.36	-0.12
0.105	No.140	487.0	487.2	0.2	0.12	0.12	-0.24
0.074	No.200	292.7	292.7	0.0	0.00	0.00	-0.24
Pan		374.6	374.6	0.0	0.00	0.00	-0.24
Total Dry Weight in grams				165.5			
Percent Lost (-) / Gained(+)				0.24			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set:	Single-Set Sieving
Method: B	Sampling Procedure Used: Air-Dried	Sample No.:	10
Soak Time: -	Dispersing Agent/Apparatus: N/A	Sieve Time:	10 min
Total Dry Mass of Sample, (g):	141.5	Separating Sieve:	N/A
Total Dry Mass after #200 wash, (g):	-	Tested by:	Yueru Chen
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings (mm)	U.S. Standard	Pan Weight	Soil+Pan Weight	Soil Weight	Percent Retained Partial	Percent Retained Total	Percent Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	731.6	731.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	629.5	629.9	0.4	0.28	0.28	99.72
0.59	No.30						
0.42	No.40	374.7	480.2	105.5	74.56	74.56	25.16
0.297	No.50						
0.250	No.60	371.5	406.3	34.8	24.59	24.59	0.57
0.210	No.70						
0.149	No.100	509.8	510.6	0.8	0.57	0.57	0.00
0.105	No.140	306.0	306.0	0.0	0.00	0.00	0.00
0.074	No.200	334.4	334.4	0.0	0.00	0.00	0.00
Pan		373.3	373.3	0.0	0.00	0.00	0.00
Total Dry Weight in grams				141.5			
Percent Lost (-) / Gained(+)				0.00			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set:	Single-Set Sieving
Method:	B	Sampling Procedure Used: Air-Dried	Sample No.: 9
Soak Time:	-	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min
Total Dry Mass of Sample, (g):	163.9	Separating Sieve:	N/A
Total Dry Mass after #200 wash, (g):	-	Tested by:	Yueru Chen
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings (mm)	U.S. Standard	Pan Weight	Soil+Pan Weight	Soil Weight	Percent Retained Partial	Percent Retained Total	Percent Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	731.6	731.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	629.4	629.8	0.4	0.24	0.24	99.76
0.59	No.30						
0.42	No.40	375.3	492.6	117.3	71.57	71.57	28.19
0.297	No.50						
0.250	No.60	371.6	416.9	45.3	27.64	27.64	0.55
0.210	No.70						
0.149	No.100	509.9	510.9	1.0	0.61	0.61	-0.06
0.105	No.140	306.1	306.2	0.1	0.06	0.06	-0.12
0.074	No.200	334.4	334.4	0.0	0.00	0.00	-0.12
Pan		373.3	373.3	0.0	0.00	0.00	-0.12
Total Dry Weight in grams				164.1			
Percent Lost (-) / Gained(+)				0.12			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set:	Single-Set Sieving
Method:	B	Sampling Procedure Used: Air-Dried	Sample No.: 8
Soak Time:	-	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min
Total Dry Mass of Sample, (g):	178.8	Separating Sieve:	N/A
Total Dry Mass after #200 wash, (g):	-	Tested by:	Yueru Chen
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	731.6	731.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	629.6	629.8	0.2	0.11	0.11	99.89
0.59	No.30						
0.42	No.40	375.1	505.9	130.8	73.15	73.15	26.73
0.297	No.50						
0.250	No.60	371.5	414.0	42.5	23.77	23.77	2.96
0.210	No.70						
0.149	No.100	509.9	513.5	3.6	2.01	2.01	0.95
0.105	No.140	306.1	307.1	1.0	0.56	0.56	0.39
0.074	No.200	334.6	334.6	0.0	0.00	0.00	0.39
Pan		373.3	373.3	0.0	0.00	0.00	0.39
Total Dry Weight in grams				178.1			
Percent Lost (-) / Gained(+)				-0.39			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set:	Single-Set Sieving
Method:	B	Sampling Procedure Used: Air-Dried	Sample No.: 7
Soak Time:	-	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min
Total Dry Mass of Sample, (g):	165	Separating Sieve:	N/A
Total Dry Mass after #200 wash, (g):	-	Tested by:	Yueru Chen
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings (mm)	U.S. Standard	Pan Weight	Soil+Pan Weight	Soil Weight	Percent Retained Partial	Percent Retained Total	Percent Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	731.6	731.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	629.6	629.7	0.1	0.06	0.06	99.94
0.59	No.30						
0.42	No.40	374.6	495.2	120.6	73.09	73.09	26.85
0.297	No.50						
0.250	No.60	371.5	414.1	42.6	25.82	25.82	1.03
0.210	No.70						
0.149	No.100	509.9	510.9	1.0	0.61	0.61	0.42
0.105	No.140	306.1	306.4	0.3	0.18	0.18	0.24
0.074	No.200	334.4	334.5	0.1	0.06	0.06	0.18
Pan		373.3	373.3	0.0	0.00	0.00	0.18
Total Dry Weight in grams				164.7			
Percent Lost (-) / Gained(+)				-0.18			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set: Single-Set Sieving	
Method: B	Sampling Procedure Used: Air-Dried		Sample No.: 6
Soak Time: -	Dispersing Agent/Apparatus: N/A		Sieve Time: 10 min
Total Dry Mass of Sample, (g):	168.2	Separating Sieve: N/A	
Total Dry Mass after #200 wash, (g):	-	Tested by: Yueru Chen	
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	731.6	731.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	629.5	629.7	0.2	0.12	0.12	99.88
0.59	No.30						
0.42	No.40	374.8	488.9	114.1	67.84	67.84	32.05
0.297	No.50						
0.250	No.60	371.5	423.5	52.0	30.92	30.92	1.13
0.210	No.70						
0.149	No.100	509.9	511.6	1.7	1.01	1.01	0.12
0.105	No.140	306.1	306.3	0.2	0.12	0.12	0.00
0.074	No.200	334.5	334.5	0.0	0.00	0.00	0.00
Pan		373.3	373.3	0.0	0.00	0.00	0.00
Total Dry Weight in grams				168.2			
Percent Lost (-) / Gained(+)				0.00			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set: Single-Set Sieving	
Method: B	Sampling Procedure Used: Air-Dried		Sample No.: 5
Soak Time: -	Dispersing Agent/Apparatus: N/A		Sieve Time: 10 min
Total Dry Mass of Sample, (g):	171.8	Separating Sieve: N/A	
Total Dry Mass after #200 wash, (g):	-	Tested by: Yueru Chen	
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	731.6	731.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	629.5	629.7	0.2	0.12	0.12	99.88
0.59	No.30						
0.42	No.40	374.6	500.2	125.6	73.11	73.11	26.78
0.297	No.50						
0.250	No.60	371.5	416.5	45.0	26.19	26.19	0.58
0.210	No.70						
0.149	No.100	510.0	511.0	1.0	0.58	0.58	0.00
0.105	No.140	306.1	306.1	0.0	0.00	0.00	0.00
0.074	No.200	334.5	334.5	0.0	0.00	0.00	0.00
Pan		373.3	373.3	0.0	0.00	0.00	0.00
Total Dry Weight in grams				171.8			
Percent Lost (-) / Gained(+)				0.00			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set:	Single-Set Sieving
Method:	B	Sampling Procedure Used: Air-Dried	Sample No.: 4
Soak Time:	-	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min
Total Dry Mass of Sample, (g):	160.5	Separating Sieve:	N/A
Total Dry Mass after #200 wash, (g):	-	Tested by:	Yueru Chen
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	731.6	731.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	629.6	629.7	0.1	0.06	0.06	99.94
0.59	No.30						
0.42	No.40	374.6	483.3	108.7	67.73	67.73	32.21
0.297	No.50						
0.250	No.60	371.5	419.3	47.8	29.78	29.78	2.43
0.210	No.70						
0.149	No.100	510.0	512.8	2.8	1.74	1.74	0.69
0.105	No.140	306.1	307.1	1.0	0.62	0.62	0.06
0.074	No.200	334.5	334.6	0.1	0.06	0.06	0.00
Pan		373.3	373.3	0.0	0.00	0.00	0.00
Total Dry Weight in grams				160.5			
Percent Lost (-) / Gained(+)				0.00			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set:	Single-Set Sieving
Method: B	Sampling Procedure Used: Air-Dried		Sample No.: 3
Soak Time: -	Dispersing Agent/Apparatus: N/A		Sieve Time: 10 min
Total Dry Mass of Sample, (g):	183.7	Separating Sieve:	N/A
Total Dry Mass after #200 wash, (g):	-	Tested by:	Yueru Chen
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	731.6	731.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	629.7	629.9	0.2	0.11	0.11	99.89
0.59	No.30						
0.42	No.40	374.6	510.3	135.7	73.87	73.87	26.02
0.297	No.50						
0.250	No.60	371.6	418.2	46.6	25.37	25.37	0.65
0.210	No.70						
0.149	No.100	510.0	511.0	1.0	0.54	0.54	0.11
0.105	No.140	306.2	306.3	0.1	0.05	0.05	0.05
0.074	No.200	334.4	334.5	0.1	0.05	0.05	0.00
Pan		373.3	373.3	0.0	0.00	0.00	0.00
Total Dry Weight in grams				183.7			
Percent Lost (-) / Gained(+)				0.00			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures			
V-M Class:	Light tan medium to fine sand		Sieve Set:	Single-Set Sieving
Method:	B	Sampling Procedure Used: Air-Dried	Sample No.:	1
Soak Time:	-	Dispersing Agent/Apparatus: N/A	Sieve Time:	10 min
Total Dry Mass of Sample, (g):	201.6	Separating Sieve: N/A		
Total Dry Mass after #200 wash, (g):	-	Tested by: Yueru Chen		
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished:	2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	731.6	731.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	629.9	630.0	0.1	0.05	0.05	99.95
0.59	No.30						
0.42	No.40	374.7	522.8	148.1	73.46	73.46	26.49
0.297	No.50						
0.250	No.60	371.5	423.0	51.5	25.55	25.55	0.94
0.210	No.70						
0.149	No.100	510.3	511.9	1.6	0.79	0.79	0.15
0.105	No.140	306.3	306.6	0.3	0.15	0.15	0.00
0.074	No.200	334.4	334.6	0.2	0.10	0.10	-0.10
Pan		380.0	380.1	0.1	0.05	0.05	-0.15
Total Dry Weight in grams				201.9			
Percent Lost (-) / Gained(+)				0.15			

Notes: No problems were encountered.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Sieve Analysis: ASTM D 6913-04

Project:	An experimental investigation of the behavior of compacted clay/sand mixtures		
V-M Class:	Light tan medium to fine sand	Sieve Set: Single-Set Sieving	
Method: B	Sampling Procedure Used: Air-Dried	Sample No.: 2	
Soak Time: -	Dispersing Agent/Apparatus: N/A	Sieve Time: 10 min	
Total Dry Mass of Sample, (g):	156.5	Separating Sieve: N/A	
Total Dry Mass after #200 wash, (g):	-	Tested by: Yueru Chen	
Total Dry Mass > No.4 Sieve (g):	-	Started: 2/27/2009	Finished: 2/27/2009

Sieve Openings	U.S.	Pan	Soil+Pan	Soil	Percent Retained		Percent
(mm)	Standard	Weight	Weight	Weight	Partial	Total	Finer
76.20	3-in.						
50.80	2-in.						
38.10	1-1/2-in.						
25.40	1-in.						
19.10	3/4-in.						
12.70	1/2-in.						
9.52	3/8-in.						
6.35	No.3						
4.76	No.4						
Pan							
3.36	No.6						
2.38	No.8						
2.00	No.10	731.6	731.6	0.0	0.00	0.00	100.00
1.19	No.16						
0.84	No.20	629.8	629.9	0.1	0.06	0.06	99.94
0.59	No.30						
0.42	No.40	375.3	492.0	116.7	74.57	74.57	25.37
0.297	No.50						
0.250	No.60	371.4	409.7	38.3	24.47	24.47	0.89
0.210	No.70						
0.149	No.100	510.1	511.4	1.3	0.83	0.83	0.06
0.105	No.140	306.2	306.5	0.3	0.19	0.19	-0.13
0.074	No.200	334.5	334.5	0.0	0.00	0.00	-0.13
Pan		380.2	380.2	0.0	0.00	0.00	-0.13
Total Dry Weight in grams				156.7			
Percent Lost (-) / Gained(+)				0.13			

Notes: No problems were encountered.

APPENDIX B

ATTERBERG LIMIT

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Atterberg Limits Determination: ASTM D 4318 - 05

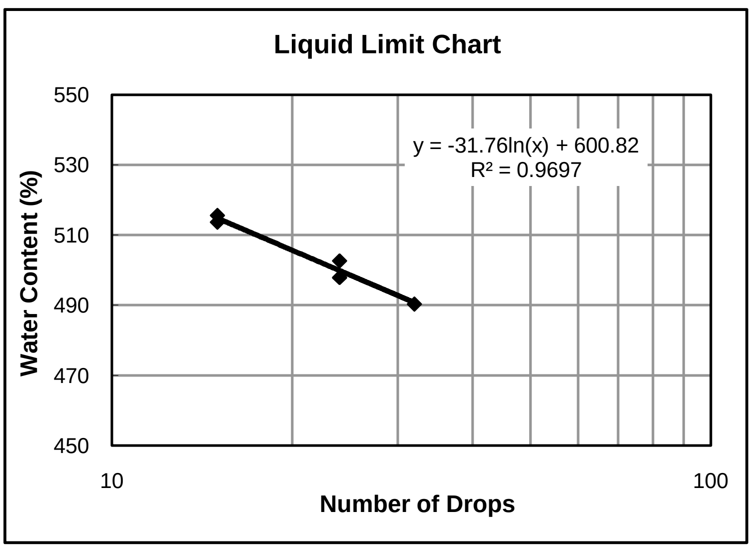
Project Name: An experimental investigation of the behavior of compacted clay/sand mixtures		
Sample: Bentonite	Location: N/A	Mixing Water: Distilled
Specimen Type: Air-dried	Date: 7/31/2009	Tested By: Yueru Chen

Liquid Limit Determintation						
Sample No.	1	2	3	4	5	
Can No.	majid	4	31	1	121	
Wt. of can (g)	28.66	28.71	28.37	28.07	30.94	
Wt. of can + wet soil (g)	51.5	45.71	44.99	47.77	49.47	
Wt. of can + dry soil (g)	32.45	31.59	31.15	31.28	33.95	
Wt. of dry soil (g)	3.79	2.88	2.78	3.21	3.01	
Wt. of water (g)	19.05	14.12	13.84	16.49	15.52	
Water Content (%)	502.64	490.28	497.84	513.71	515.61	
No. of Drops	24	32	24	15	15	

Plastic Limit Determination		
Sample No.	1	2
Can No.	FJ-3	405
Wt. of can (g)	39.4	38.1
Wt. of can + wet soil (g)	45.5	44.1
Wt. of can + dry soil (g)	43.6	42.2
Wt. of dry soil (g)	4.2	4.1
Wt. of water (g)	1.9	1.9
Water Content (%)	45.2	46.3
Plastic limit	46	

Testing Equipment Used		
Plastic Limit:	Hand Rolled	X
	Mechanical Device	
Liquid Limit:	Manual	X
	Mechanical	

Test Method			
A	X	B	
Specimen preparation Method			
Wet	X	Dry	



Liquid Limit
499

Plastic Limit
46

Plastic Index
453

PL Standard Deviation
0.55

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Atterberg Limits Determination: ASTM D 4318 - 05

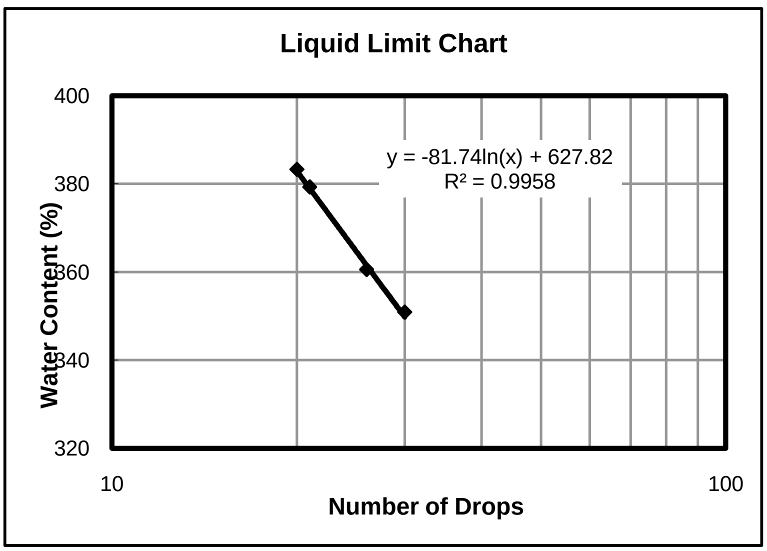
Project Name: An experimental investigation of the behavior of compacted clay/sand mixtures		
Sample: 50%bentonite & 50% sand	Location: N/A	Mixing Water: Distilled
Specimen Type: Air-dried	Date: 10/15/2009	Tested By: Yueru Chen

Liquid Limit Determintation						
Sample No.	1	2	3	4		
Can No.	FJ-3	Y-1	FJ-1	410		
Wt. of can (g)	29.06	28.37	28.1	28.4		
Wt. of can + wet soil (g)	43.22	42.98	39.2	44.6		
Wt. of can + dry soil (g)	31.99	31.61	30.51	31.78		
Wt. of dry soil (g)	2.93	3.24	2.41	3.38		
Wt. of water (g)	11.23	11.37	8.69	12.82		
Water Content (%)	383.28	350.93	360.58	379.29		
No. of Drops	20	30	26	21		

Plastic Limit Determination		
Sample No.	1	2
Can No.	405	404
Wt. of can (g)	38.1	38.94
Wt. of can + wet soil (g)	45.28	45.62
Wt. of can + dry soil (g)	43.5	44
Wt. of dry soil (g)	5.4	5.06
Wt. of water (g)	1.78	1.62
Water Content (%)	33.0	32.0
Plastic limit	32	

Testing Equipment Used		
Plastic Limit:	Hand Rolled	X
	Mechanical Device	
Liquid Limit:	Manual	X
	Mechanical	

Test Method			
A	X	B	
Specimen preparation Method			
Wet	X	Dry	



Liquid Limit
365

Plastic Limit
32

Plastic Index
333

PL Standard Deviation
0.47

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Atterberg Limits Determination: ASTM D 4318 - 05

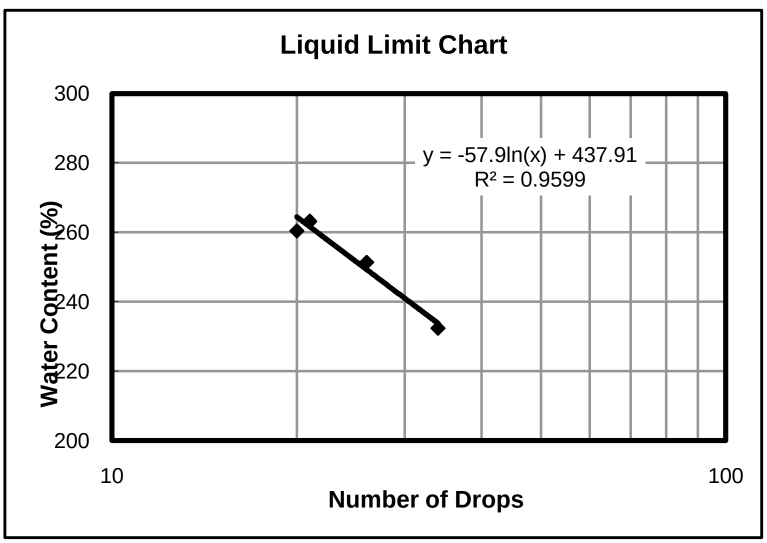
Project Name: An experimental investigation of the behavior of compacted clay/sand mixtures		
Sample: 25%bentonite & 75% sand	Location: N/A	Mixing Water: Distilled
Specimen Type: Air-dried	Date: 10/22/2009	Tested By: Yueru Chen

Liquid Limit Determintation						
Sample No.	1	2	3	4		
Can No.	4	FJ-5	46	201		
Wt. of can (g)	28.72	28.04	28.89	28.88		
Wt. of can + wet soil (g)	41.35	41.57	40.15	44.38		
Wt. of can + dry soil (g)	32.52	31.89	31.99	33.18		
Wt. of dry soil (g)	3.8	3.85	3.1	4.3		
Wt. of water (g)	8.83	9.68	8.16	11.2		
Water Content (%)	232.37	251.43	263.23	260.47		
No. of Drops	34	26	21	20		

Plastic Limit Determination		
Sample No.	1	2
Can No.	405	404
Wt. of can (g)	38.09	38.94
Wt. of can + wet soil (g)	45.81	46.5
Wt. of can + dry soil (g)	44.44	45.17
Wt. of dry soil (g)	6.35	6.23
Wt. of water (g)	1.37	1.33
Water Content (%)	21.6	21.3
Plastic limit	21	

Testing Equipment Used		
Plastic Limit:	Hand Rolled	X
	Mechanical Device	
Liquid Limit:	Manual	X
	Mechanical	

Test Method			
A	X	B	
Specimen preparation Method			
Wet	X	Dry	



Liquid Limit
252

Plastic Limit
21

Plastic Index
231

PL Standard Deviation
0.11

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Atterberg Limits Determination: ASTM D 4318 - 05

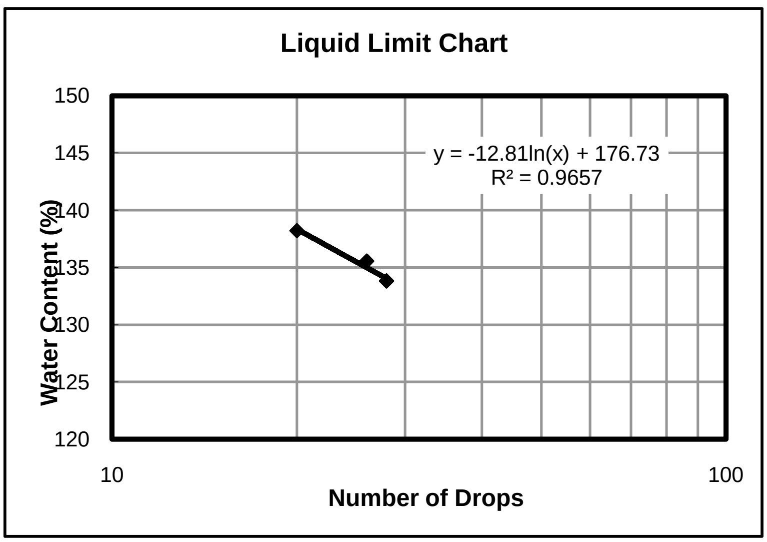
Project Name: An experimental investigation of the behavior of compacted clay/sand mixtures		
Sample: 15%bentonite & 85% sand	Location: N/A	Mixing Water: Distilled
Specimen Type: Air-dried	Date: 11/2/2009	Tested By: Yueru Chen

Liquid Limit Determintation						
Sample No.	1	2	3			
Can No.	209	31	59			
Wt. of can (g)	28.17	28.36	28.33			
Wt. of can + wet soil (g)	39.39	40.02	41.47			
Wt. of can + dry soil (g)	32.88	33.31	33.95			
Wt. of dry soil (g)	4.71	4.95	5.62			
Wt. of water (g)	6.51	6.71	7.52			
Water Content (%)	138.22	135.56	133.81			
No. of Drops	20	26	28			

Plastic Limit Determination		
Sample No.	1	2
Can No.	46	31
Wt. of can (g)	39.17	38.44
Wt. of can + wet soil (g)	46.09	45.9
Wt. of can + dry soil (g)	44.91	44.7
Wt. of dry soil (g)	5.74	6.26
Wt. of water (g)	1.18	1.2
Water Content (%)	20.6	19.2
Plastic limit	20	

Testing Equipment Used		
Plastic Limit:	Hand Rolled	X
	Mechanical Device	
Liquid Limit:	Manual	X
	Mechanical	

Test Method			
A	X	B	
Specimen preparation Method			
Wet	X	Dry	



Liquid Limit
135

Plastic Limit
20

Plastic Index
115

PL Standard Deviation
0.69

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Atterberg Limits Determination: ASTM D 4318 - 05

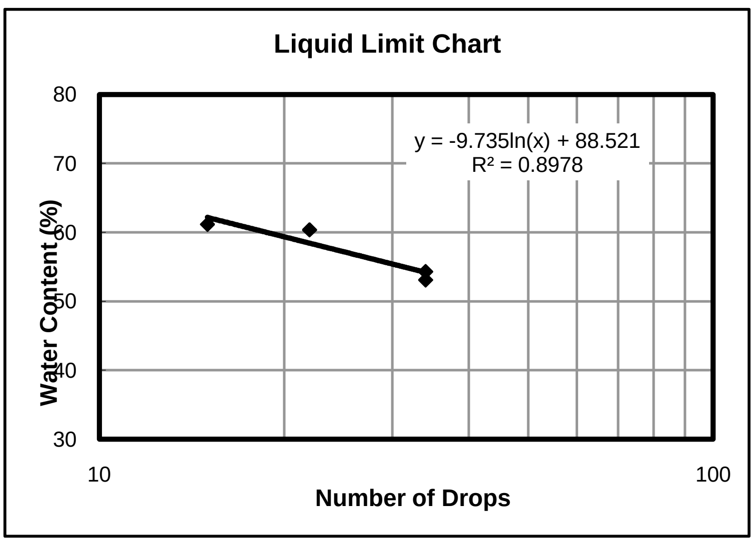
Project Name: An experimental investigation of the behavior of compacted clay/sand mixtures		
Sample: Kaolinite	Location: N/A	Mixing Water: Distilled
Specimen Type: Air-dried	Date: 9/22/2009	Tested By: Yueru Chen

Liquid Limit Determintation						
Sample No.	1	2	3	4		
Can No.	59	410	B-14	FJ-1		
Wt. of can (g)	28.32	28.42	29.08	28.07		
Wt. of can + wet soil (g)	34.06	38.54	36.98	36.23		
Wt. of can + dry soil (g)	31.9	34.7	34.2	33.4		
Wt. of dry soil (g)	3.58	6.28	5.12	5.33		
Wt. of water (g)	2.16	3.84	2.78	2.83		
Water Content (%)	60.34	61.15	54.30	53.10		
No. of Drops	22	15	34	34		

Plastic Limit Determination		
Sample No.	1	2
Can No.	405	404
Wt. of can (g)	38.1	38.9
Wt. of can + wet soil (g)	44.7	47.3
Wt. of can + dry soil (g)	43	45.2
Wt. of dry soil (g)	4.9	6.3
Wt. of water (g)	1.7	2.1
Water Content (%)	34.7	33.3
Plastic limit	34	

Testing Equipment Used		
Plastic Limit:	Hand Rolled	X
	Mechanical Device	
Liquid Limit:	Manual	X
	Mechanical	

Test Method			
A	X	B	
Specimen preparation Method			
Wet	X	Dry	



Liquid Limit
57

Plastic Limit
34

Plastic Index
23

PL Standard Deviation
0.68

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Atterberg Limits Determination: ASTM D 4318 - 05

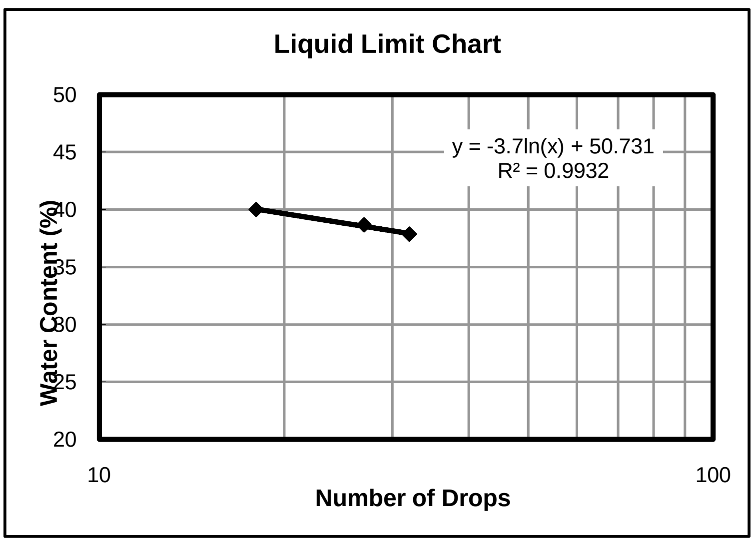
Project Name: An experimental investigation of the behavior of compacted clay/sand mixtures		
Sample: 50% kaolinite & 50% sand	Location: N/A	Mixing Water: Distilled
Specimen Type: Air-dried	Date: 11/4/2009	Tested By: Yueru Chen

Liquid Limit Determintation						
Sample No.	1	2	3			
Can No.	2010	201	FJ-5			
Wt. of can (g)	28.63	28.9	28.06			
Wt. of can + wet soil (g)	38.43	41.74	40.84			
Wt. of can + dry soil (g)	35.63	38.16	37.33			
Wt. of dry soil (g)	7	9.26	9.27			
Wt. of water (g)	2.8	3.58	3.51			
Water Content (%)	40.00	38.66	37.86			
No. of Drops	18	27	32			

Plastic Limit Determination		
Sample No.	1	2
Can No.	404	405
Wt. of can (g)	38.95	38.1
Wt. of can + wet soil (g)	46.27	46.88
Wt. of can + dry soil (g)	44.86	45.18
Wt. of dry soil (g)	5.91	7.08
Wt. of water (g)	1.41	1.7
Water Content (%)	23.9	24.0
Plastic limit	24	

Testing Equipment Used		
Plastic Limit:	Hand Rolled	X
	Mechanical Device	
Liquid Limit:	Manual	X
	Mechanical	

Test Method			
A	X	B	
Specimen preparation Method			
Wet	X	Dry	



Liquid Limit
39

Plastic Limit
24

Plastic Index
15

PL Standard Deviation
0.08

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Atterberg Limits Determination: ASTM D 4318 - 05

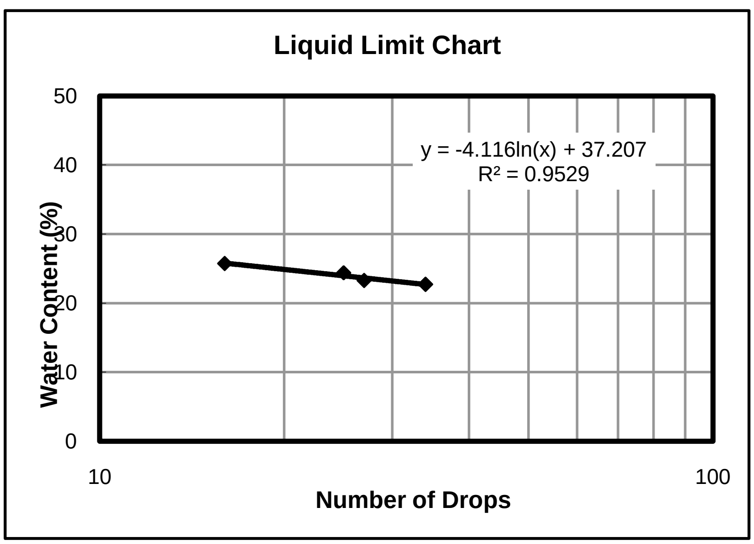
Project Name: An experimental investigation of the behavior of compacted clay/sand mixtures		
Sample: 25% kaolinite & 75% sand	Location: N/A	Mixing Water: Distilled
Specimen Type: Air-dried	Date: 11/5/2009	Tested By: Yueru Chen

Liquid Limit Determintation						
Sample No.	1	2	3	4		
Can No.	59	211	FJ-3	4		
Wt. of can (g)	28.34	28.18	29.06	28.74		
Wt. of can + wet soil (g)	40.89	41.03	42.36	44.42		
Wt. of can + dry soil (g)	38.43	38.4	39.9	41.46		
Wt. of dry soil (g)	10.09	10.22	10.84	12.72		
Wt. of water (g)	2.46	2.63	2.46	2.96		
Water Content (%)	24.38	25.73	22.69	23.27		
No. of Drops	25	16	34	27		

Plastic Limit Determination		
Sample No.	1	2
Can No.	31	46
Wt. of can (g)	38.44	39.16
Wt. of can + wet soil (g)	45.72	47.82
Wt. of can + dry soil (g)	44.78	46.7
Wt. of dry soil (g)	6.34	7.54
Wt. of water (g)	0.94	1.12
Water Content (%)	14.8	14.9
Plastic limit	15	

Testing Equipment Used		
Plastic Limit:	Hand Rolled	X
	Mechanical Device	
Liquid Limit:	Manual	X
	Mechanical	

Test Method			
A	X	B	
Specimen preparation Method			
Wet	X	Dry	



Liquid Limit
24

Plastic Limit
15

Plastic Index
9

PL Standard Deviation
0.01

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Atterberg Limits Determination: ASTM D 4318 - 05

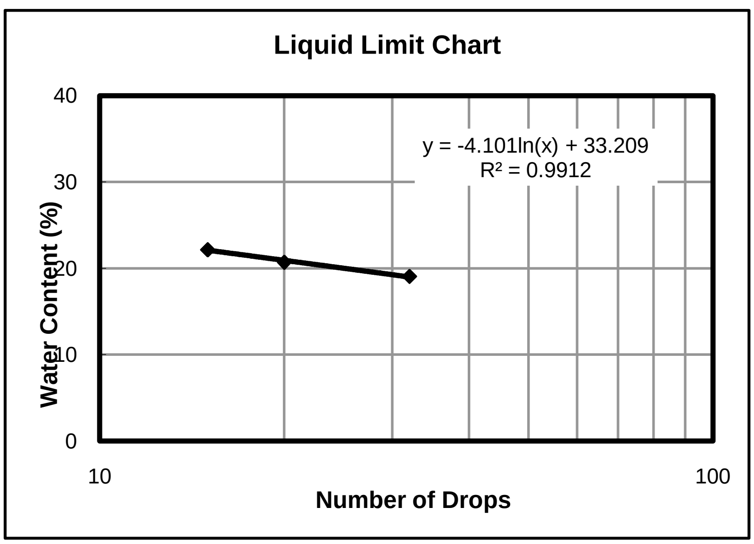
Project Name: An experimental investigation of the behavior of compacted clay/sand mixtures		
Sample: 15% kaolinite & 85% sand	Location: N/A	Mixing Water: Distilled
Specimen Type: Air-dried	Date: 11/6/2009	Tested By: Yueru Chen

Liquid Limit Determintation						
Sample No.	1	2	3			
Can No.	209	59	211			
Wt. of can (g)	28.17	28.33	28.17			
Wt. of can + wet soil (g)	38.22	41.79	40.79			
Wt. of can + dry soil (g)	36.61	39.48	38.5			
Wt. of dry soil (g)	8.44	11.15	10.33			
Wt. of water (g)	1.61	2.31	2.29			
Water Content (%)	19.08	20.72	22.17			
No. of Drops	32	20	15			

Plastic Limit Determination		
Sample No.	1	2
Can No.	31	46
Wt. of can (g)	38.42	39.14
Wt. of can + wet soil (g)	47.28	45.44
Wt. of can + dry soil (g)	46.3	44.75
Wt. of dry soil (g)	7.88	5.61
Wt. of water (g)	0.98	0.69
Water Content (%)	12.4	12.3
Plastic limit	12	

Testing Equipment Used		
Plastic Limit:	Hand Rolled	X
	Mechanical Device	
Liquid Limit:	Manual	X
	Mechanical	

Test Method			
A	X	B	
Specimen preparation Method			
Wet	X	Dry	



Liquid Limit
20

Plastic Limit
12

Plastic Index
8

PL Standard Deviation
0.07

APPENDIX C

SPECIFIC GRAVITY

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

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Specific Gravity of Soil Solids: ASTM D 854 - 06

Project Name: An experimental investigation of the behavior of compacted clay/sand mixtures		
Sample Description: Light tan poorly graded medium to fine sand (SP)		Date: 11/12/2009
Percent Passing No. 4 Sieve: 100%	Method Used: A	Tested By: Yueru Chen

Specimen No.	1	2	3
Wt. of empty, clean pycnometer (g)	91.37	92.02	92.51
Wt. of pycnometer + water (g)	340.44	341.14	341.39
Wt. of pycnometer + dry soil + water (g)	377.82	378.40	378.81

Pan No.	1	2	3
Wt. of pan (g)	156.76	159.90	156.77
Wt. of Pan + dry soil	216.80	219.73	216.76
Wt. of dry soil (g)	60.04	59.83	59.99

Temperature (ºC)	23.9	24.0	24.0
Temperature Coefficient (K)	0.99912	0.99909	0.99909
G_s at test temperature (G_t)	2.65	2.65	2.66
G_s at 20ºC ($G_{20°C}$)	2.65	2.65	2.66
Average G_s	2.65		
Standard Deviation	0.0036		

Equation Used:

$$G_t = \frac{\rho_s}{\rho_{w,t}} = \frac{M_s}{\left(M_{pw,t} - \left(M_{pws,t} - M_s\right)\right)}$$

$$G_{20°C} = K \times G_t$$

Note: A vacuum was used to deair the soil slurry. The pycnometer was periodically (every 20 minutes) agitated under vacuum for 2 hours, and was then allowed to stand overnight under constant vacuum.

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Specific Gravity of Soil Solids: ASTM D 854 - 06

Project Name: An experimental investigation of the behavior of compacted clay/sand mixtures		
Sample Description: Bentonite		Date: 12/2/2009
Percent Passing No. 4 Sieve: 100%	Method Used: A	Tested By: Yueru Chen

Specimen No.	1	2	3
Wt. of empty, clean pycnometer (g)	92.61	91.37	91.37
Wt. of pycnometer + water (g)	345.42	344.18	344.24
Wt. of pycnometer + dry soil + water (g)	354.38	353.26	356.08

Pan No.	3	2	4
Wt. of pan (g)	159.76	156.69	159.72
Wt. of Pan + dry soil	174.25	171.36	178.90
Wt. of dry soil (g)	14.49	14.67	19.18

Temperature (ºC)	23.0	23.1	23.9
Temperature Coefficient (K)	0.99933	0.99931	0.99912
G_s at test temperature (G_t)	2.62	2.62	2.61
G_s at 20ºC ($G_{20°C}$)	2.6185	2.6225	2.6108
Average G_s	2.62		
Standard Deviation	0.0049		

Equation Used:

$$G_t = \frac{\rho_s}{\rho_{w,t}} = \frac{M_s}{\left(M_{pw,t} - \left(M_{pws,t} - M_s\right)\right)}$$

$$G_{20°C} = K \times G_t$$

Note: A vacuum was used to deair the soil slurry. The pycnometer was periodically (every 20 minutes) agitated under vacuum for 2 hours. A solution of sodium hexametaphosphate was used to disperse the sample, at the rate of 40 g of sodium hexametaphosphate/liter of solution. To avoid forming highly viscous fluid during the deairing process, the amount of soil solids being tested was less than the mass recommended by ASTM.

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Specific Gravity of Soil Solids: ASTM D 854 - 06

Project Name: An experimental investigation of the behavior of compacted clay/sand mixtures		
Sample Description: Kaolinite		Date: 11/17/2009
Percent Passing No. 4 Sieve: 100%	Method Used: A	Tested By: Yueru Chen

Specimen No.	1	2	3
Wt. of empty, clean pycnometer (g)	91.37	92.02	92.51
Wt. of pycnometer + water (g)	340.13	340.68	341.3
Wt. of pycnometer + dry soil + water (g)	361.61	362.04	361.37

Pan No.	1	2	3
Wt. of pan (g)	156.73	159.72	156.72
Wt. of Pan + dry soil	191.57	194.41	189.30
Wt. of dry soil (g)	34.84	34.69	32.58

Temperature (ºC)	27.1	27.1	26.9
Temperature Coefficient (K)	0.99828	0.99828	0.99833
G_s at test temperature (G_t)	2.61	2.60	2.60
G_s at 20ºC ($G_{20°C}$)	2.6033	2.5979	2.6000
Average G_s	2.60		
Standard Deviation	0.0022		

Equation Used:

$$G_t = \frac{\rho_s}{\rho_{w,t}} = \frac{M_s}{\left(M_{pw,t} - \left(M_{pws,t} - M_s\right)\right)}$$

$$G_{20°C} = K \times G_t$$

Note: A vacuum was used to deair the soil slurry. The pycnometer was periodically (every 20 minutes) agitated under vacuum for 2 hours, and was then allowed to stand overnight under constant vacuum. Air bubbles accumulated at the top of the water surface of the pycnometer. One possible source of error in the test is the effect of the air bubbles on the volume measurements.

APPENDIX D

DERIVATION OF THE EQUATION FOR CALCULATING THE SPECIFIC GRAVITY OF SAND/CLAY MIXTURES

W, W_{clay}, and W_{sand} represent the weights of sand/clay mixture, clay and sand respectively. V, V_{clay}, and V_{sand} represent the volumes of sand/clay mixture, clay, and sand respectively. The particle densities of clay, ρ_{clay} (g/cm3), sand, ρ_{sand} (g/cm3), and the clay content, α (%) are expressed in the following equations:

$$\rho_{clay} = \frac{W_{clay}}{V_{clay}}$$

$$\rho_{sand} = \frac{W_{sand}}{V_{sand}}$$

$$\alpha = \frac{W_{clay}}{W_{sand} + W_{clay}} \times 100 \qquad \text{(C - 1)}$$

Equation (B-1) can be rewritten as

$$W_{sand} = \frac{W_{clay}}{\frac{\alpha}{100}} - W_{clay} = W_{clay}\left(\frac{100}{\alpha} - 1\right) = W_{clay}\left(\frac{100-\alpha}{\alpha}\right) \qquad \text{(C - 2)}$$

Since, $\rho_{cs} = \frac{W}{V} = \frac{W_{clay} + W_{sand}}{V_{clay} + V_{sand}} = \frac{\left(\frac{W_{clay}}{W_{sand}}\right)+1}{\left(\frac{V_{clay}}{W_{sand}}\right) + \left(\frac{V_{sand}}{W_{sand}}\right)} = \frac{\left(\frac{W_{clay}}{W_{sand}}\right)+1}{\left(\frac{W_{clay}}{W_{sand}}\right)\left(\frac{1}{\rho_{clay}}\right) + \left(\frac{1}{\rho_{sand}}\right)}$

From equation (B-2), $\frac{W_{clay}}{W_{sand}} = \frac{\alpha}{100-\alpha}$

Therefore,

$$\rho_{cs} = \frac{\left(\frac{\alpha}{100-\alpha}\right)+1}{\left(\frac{\alpha}{100-\alpha}\right)\left(\frac{1}{\rho_{clay}}\right) + \left(\frac{1}{\rho_{sand}}\right)}$$

$$\rho_{cs} = \frac{\rho_{clay} + \left(\frac{100-\alpha}{\alpha}\right)\rho_{clay}}{1 + \left(\frac{100-\alpha}{\alpha}\right)\left(\frac{\rho_{clay}}{\rho_{sand}}\right)}$$

$$\rho_{cs} = \frac{\left(\frac{100}{\alpha}\right)\rho_{clay}}{1+\left(\frac{100-\alpha}{\alpha}\right)\left(\frac{\rho_{clay}}{\rho_{sand}}\right)}$$

Since $G_s = \frac{\rho_{cs}}{\rho_w}$,

For $\rho_w = 1\, g/cm^3$,

$$G_s = \rho_{cs} = \frac{\left(\frac{100}{\alpha}\right)\rho_{clay}}{1+\left(\frac{100-\alpha}{\alpha}\right)\left(\frac{\rho_{clay}}{\rho_{sand}}\right)} \qquad \text{(C-3)}$$

The specific gravity for each sand/clay mixture is Chapter 3 was calculated from equation (C-3).

APPENDIX E

PROCTOR COMPATION TEST DATA

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Low Energy Proctor Test

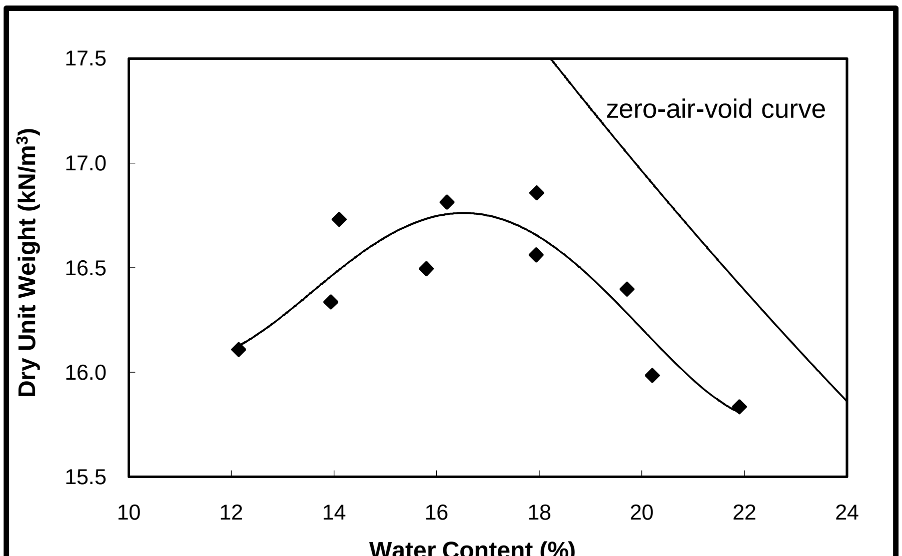
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures				
Method Used: A	Preparation Method Used:	Moist	Rammer:	Manual	
Material Description:	L15B	Oversize Fraction:	0%	G_s: 2.65	
Location: N/A		Tested By:	Yueru Chen	Test Date:	9/15/2009

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9	10
Water content, w%	12.1	13.9	14.1	15.8	16.2	17.9	18.0	19.7	20.2	21.9
Mold volume (cm^3)	940.7	937.2	937.2	937.2	940.7	940.7	937.2	940.7	937.2	937.2
Wt. of mold (g)	4226.7	4213.5	4232.0	4213.7	4227.3	4226.6	4217.2	4226.6	4217.1	4213.4
Wt. of mold + soil (g)	5959.0	5991.6	6055.7	6038.5	6100.8	6099.7	6116.7	6109.0	6052.6	6057.4
Wt. of wet soil (g)	1732.3	1778.1	1823.7	1824.8	1873.5	1873.1	1899.5	1882.4	1835.5	1844.0
Wet density (g/cm^3)	1.8	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0
Dry density (g/cm^3)	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6
Wet unit weight (kN/m^3)	18.1	18.6	19.1	19.1	19.5	19.5	19.9	19.6	19.2	19.3
Dry unit weight (kN/m^3)	16.1	16.3	16.7	16.5	16.8	16.6	16.9	16.4	16.0	15.8

Determination of zero-air-void curve

Water content, w%	18.0	20.0	22.0	24.0	26.0					
Dry density (g/cm^3)	1.8	1.7	1.7	1.6	1.6					
Dry unit weight (kN/m^3)	17.6	17.0	16.4	15.9	15.4					



Optimum water content (%)
16.2
Maximum dry unit weight (kN/m^3)
16.7

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Low Energy Proctor Test

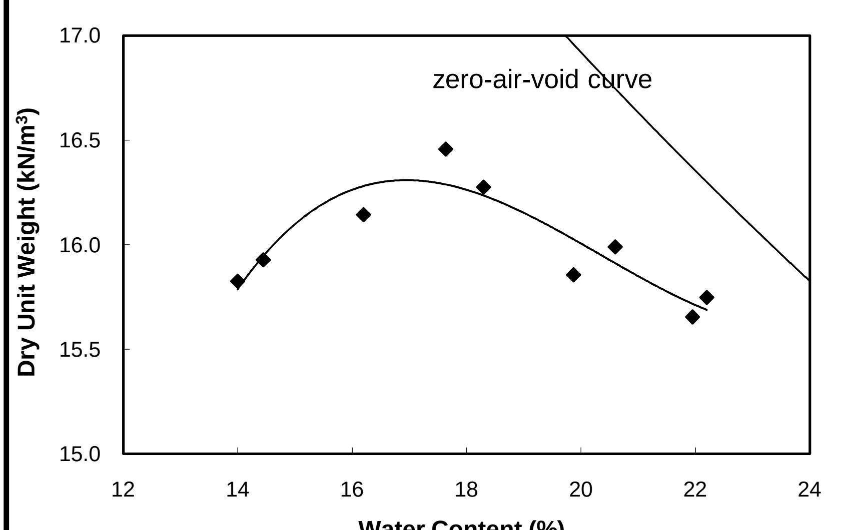
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures		
Method Used: A	Preparation Method Used: Moist	Rammer:	Manual
Material Description: L25B	Oversize Fraction: 0%		G_s: 2.64
Location: N/A	Tested By: Yueru Chen	Test Date: 8/21/2009	

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9
Water content, w%	14.0	14.5	16.2	17.6	18.3	19.9	20.6	22.0	22.2
Mold volume (cm^3)	937.2	940.7	943.8	942.9	942.9	937.2	942.9	942.9	937.2
Wt. of mold (g)	4213.5	4227.1	4217.1	4207.7	4207.8	4213.5	4207.7	4207.8	4213.5
Wt. of mold + soil (g)	5937.0	5975.2	6021.9	6068.5	6058.4	6029.2	6061.2	6042.8	6051.9
Wt. of wet soil (g)	1723.5	1748.1	1804.8	1860.8	1850.6	1815.7	1853.5	1835.0	1838.4
Wet density (g/cm^3)	1.8	1.9	1.9	2.0	2.0	1.9	2.0	1.9	2.0
Dry density (g/cm^3)	1.6	1.6	1.6	1.7	1.7	1.6	1.6	1.6	1.6
Wet unit weight (kN/m^3)	18.0	18.2	18.8	19.4	19.3	19.0	19.3	19.1	19.2
Dry unit weight (kN/m^3)	15.8	15.9	16.1	16.5	16.3	15.9	16.0	15.7	15.7

Determination of zero-air-void curve

Water content, w%	18.0	20.0	22.0	24.0					
Dry density (g/cm^3)	1.8	1.7	1.7	1.6					
Dry unit weight (kN/m^3)	17.5	16.9	16.4	15.8					



Optimum water content (%)
17
Maximum dry unit weight (kN/m^3)
16.3

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Low Energy Proctor Test

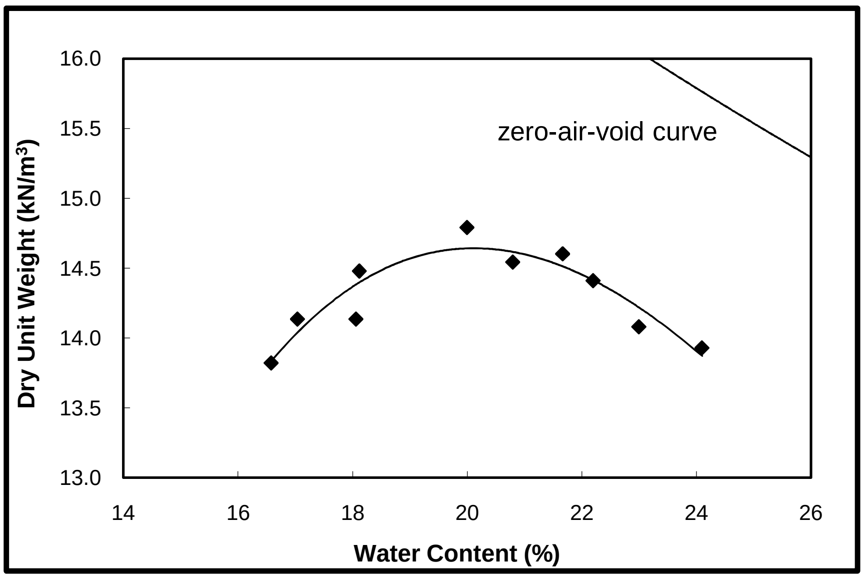
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures		
Method Used: A	Preparation Method Used: Moist		Rammer: Manual
Material Description: L50B	Oversize Fraction: 0%		G_s: 2.63
Location: N/A	Tested By: Yueru Chen		Test Date: 9/18/2009

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9	10
Water content, w%	16.6	17.0	18.1	18.1	20.0	20.8	21.7	22.2	23.0	24.1
Mold volume (cm^3)	942.9	937.2	942.9	942.9	940.7	937.2	943.8	942.9	940.7	943.8
Wt. of mold (g)	4207.8	4213.7	4207.9	4208.0	4227.2	4212.7	4217.4	4207.6	4225.8	4199.7
Wt. of mold + soil (g)	5756.6	5794.2	5812.0	5851.8	5929.2	5890.9	5926.6	5900.1	5886.7	5862.9
Wt. of wet soil (g)	1548.8	1580.5	1604.1	1643.8	1702.0	1678.2	1709.2	1692.5	1660.9	1663.2
Wet density (g/cm^3)	1.6	1.7	1.7	1.7	1.8	1.8	1.8	1.8	1.8	1.8
Dry density (g/cm^3)	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.4	1.4
Wet unit weight (kN/m^3)	16.1	16.5	16.7	17.1	17.7	17.6	17.8	17.6	17.3	17.3
Dry unit weight (kN/m^3)	13.8	14.1	14.1	14.5	14.8	14.5	14.6	14.4	14.1	13.9

Determination of zero-air-void curve

Water content, w%	20.0	22.0	24.0	26.0	28.0					
Dry density (g/cm^3)	1.7	1.7	1.6	1.6	1.5					
Dry unit weight (kN/m^3)	16.9	16.3	15.8	15.3	14.8					



Optimum water content (%)
20.5
Maximum dry unit weight (kN/m^3)
14.6

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Standard Proctor Test: ASTM D 698 - 00a

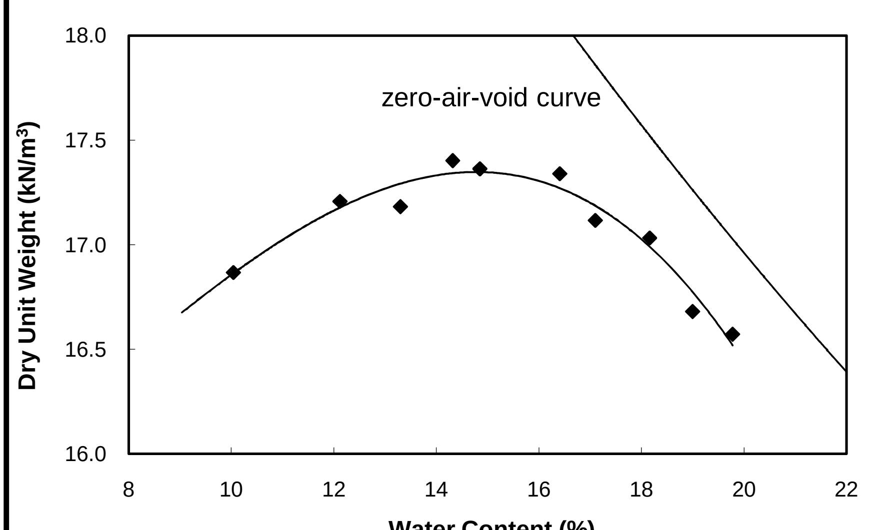
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures		
Method Used: A	Preparation Method Used: Moist		Rammer: Manual
Material Description: S15B	Oversize Fraction: 0%		G_s: 2.65
Location: N/A	Tested By: Yueru Chen		Test Date: 1/26/2009

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9	10
Water content, w%	10.0	12.1	13.3	14.3	14.9	16.4	17.1	18.2	19.0	19.8
Mold volume (cm^3)	940.7	943.8	940.7	940.7	940.7	942.9	940.7	943.8	942.9	940.7
Wt. of mold (g)	4227.1	4217.3	4227.5	4227.3	4227.2	4208.0	4227.5	4217.2	4205.0	4227.0
Wt. of mold + soil (g)	6006.9	6073.4	6094.3	6135.1	6139.5	6148.1	6149.5	6153.4	6112.9	6130.4
Wt. of wet soil (g)	1779.8	1856.1	1866.8	1907.8	1912.3	1940.1	1922.0	1936.2	1907.9	1903.4
Wet density (g/cm^3)	1.9	2.0	2.0	2.0	2.0	2.1	2.0	2.1	2.0	2.0
Dry density (g/cm^3)	1.7	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7
Wet unit weight (kN/m^3)	18.6	19.3	19.5	19.9	19.9	20.2	20.0	20.1	19.8	19.8
Dry unit weight (kN/m^3)	16.9	17.2	17.2	17.4	17.4	17.3	17.1	17.0	16.7	16.6

Determination of zero-air-void curve

Water content, w%	16.0	18.0	20.0	22.0	24.0					
Dry density (g/cm^3)	1.9	1.8	1.7	1.7	1.6					
Dry unit weight (kN/m^3)	18.2	17.6	17.0	16.4	15.9					



Optimum water content (%)	15
Maximum dry unit weight (kN/m^3)	17.3

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Standard Proctor Test: ASTM D 698 - 00a

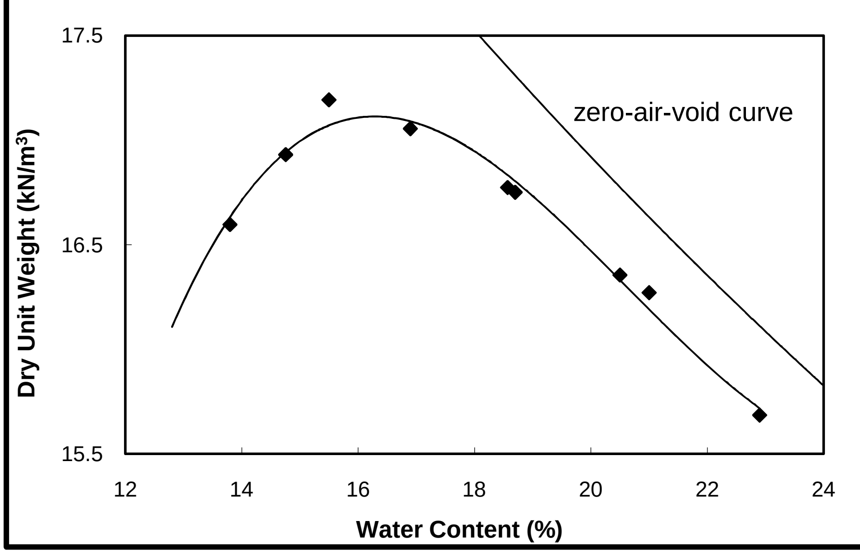
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures		
Method Used: A	Preparation Method Used: Moist	Rammer: Manual	
Material Description: S25B	Oversize Fraction: 0%		G_s: 2.64
Location: N/A	Tested By: Yueru Chen	Test Date: 8/6/2009	

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9
Water content, w%	13.8	14.8	15.5	16.9	18.6	18.7	20.5	21.0	22.9
Mold volume (cm^3)	940.7	940.7	937.2	940.7	940.7	942.9	942.9	942.9	940.7
Wt. of mold (g)	4225.4	4227.3	4213.2	4227.2	4227.3	4205.4	4208.1	4205.0	4227.2
Wt. of mold + soil (g)	6036.5	6090.5	6110.2	6139.1	6134.5	6116.5	6102.4	6097.3	6075.8
Wt. of wet soil (g)	1811.1	1863.2	1897.0	1911.9	1907.2	1911.1	1894.3	1892.3	1848.6
Wet density (g/cm^3)	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Dry density (g/cm^3)	1.7	1.7	1.8	1.7	1.7	1.7	1.7	1.7	1.6
Wet unit weight (kN/m^3)	18.9	19.4	19.9	19.9	19.9	19.9	19.7	19.7	19.3
Dry unit weight (kN/m^3)	16.6	16.9	17.2	17.1	16.8	16.8	16.4	16.3	15.7

Determination of zero-air-void curve

Water content, w%	18.0	20.0	22.0	24.0					
Dry density (g/cm^3)	1.8	1.7	1.7	1.6					
Dry unit weight (kN/m^3)	17.5	16.9	16.4	15.8					



Optimum water content (%)
16.1
Maximum dry unit weight (kN/m^3)
17.2

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Standard Proctor Test: ASTM D 698 - 00a

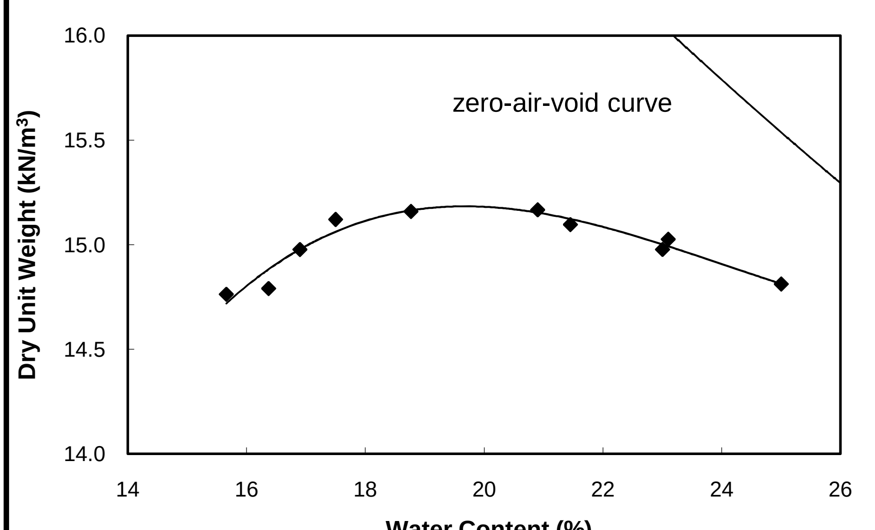
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures		
Method Used: A	Preparation Method Used: Moist	Rammer: Manual	
Material Description: S50B	Oversize Fraction: 0%	G_s: 2.63	
Location: N/A	Tested By: Yueru Chen	Test Date: 10/18/2009	

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9	10
Water content, w%	15.7	16.4	16.9	17.5	18.8	20.9	21.5	23.0	23.1	25.0
Mold volume (cm^3)	940.7	940.7	937.2	942.9	942.9	940.7	940.7	942.9	940.7	937.2
Wt. of mold (g)	4227.4	4227.4	4213.8	4208.0	4208.0	4225.8	4227.2	4208.0	4225.7	4213.7
Wt. of mold + soil (g)	5864.8	5878.0	5886.4	5915.7	5938.5	5984.2	5985.4	5978.6	5999.5	5982.4
Wt. of wet soil (g)	1637.4	1650.6	1672.6	1707.7	1730.5	1758.4	1758.2	1770.6	1773.8	1768.7
Wet density (g/cm^3)	1.7	1.8	1.8	1.8	1.8	1.9	1.9	1.9	1.9	1.9
Dry density (g/cm^3)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Wet unit weight (kN/m^3)	17.1	17.2	17.5	17.8	18.0	18.3	18.3	18.4	18.5	18.5
Dry unit weight (kN/m^3)	14.8	14.8	15.0	15.1	15.2	15.2	15.1	15.0	15.0	14.8

Determination of zero-air-void curve

Water content, w%	20.0	22.0	24.0	26.0	28.0					
Dry density (g/cm^3)	1.7	1.7	1.6	1.6	1.5					
Dry unit weight (kN/m^3)	16.9	16.3	15.8	15.3	14.8					



Optimum water content (%)
19.7
Maximum dry unit weight (kN/m^3)
15.2

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Modified Proctor Test: ASTM D 1557

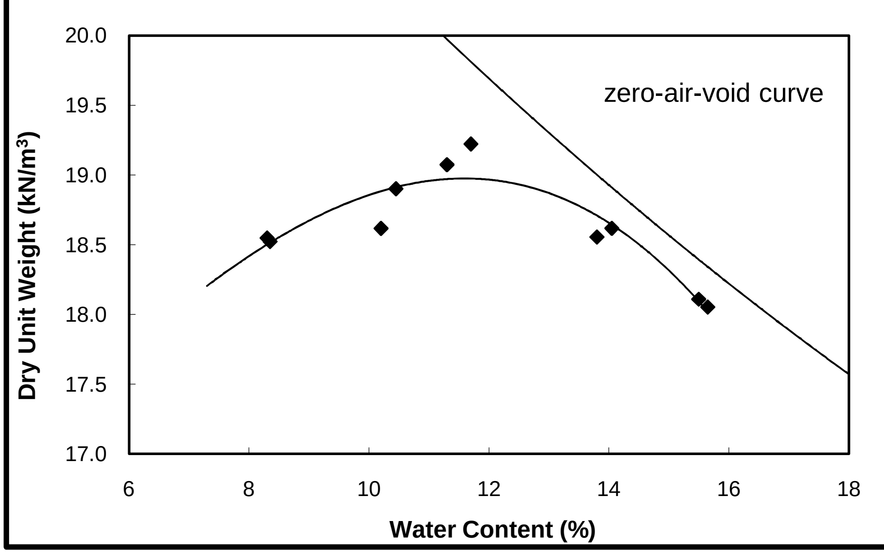
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures		
Method Used: A	Preparation Method Used: Moist		Rammer: Manual
Material Description: M15B	Oversize Fraction: 0%		G_s: 2.65
Location: N/A	Tested By: Yueru Chen		Test Date: 9/18/2009

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9	10
Water content, w%	8.3	8.4	10.2	10.5	11.3	11.7	13.8	14.1	15.5	15.7
Mold volume (cm^3)	937.2	940.7	937.2	937.2	943.8	937.2	937.2	940.7	940.7	937.2
Wt. of mold (g)	4213.3	4227.5	4213.3	4217.1	4216.5	4217.2	4213.3	4227.1	4226.4	4214.5
Wt. of mold + soil (g)	6132.3	6152.0	6173.2	6211.3	6258.9	6268.3	6230.5	6263.3	6232.2	6209.0
Wt. of wet soil (g)	1919.0	1924.5	1959.9	1994.2	2042.4	2051.1	2017.2	2036.2	2005.8	1994.5
Wet density (g/cm^3)	2.0	2.0	2.1	2.1	2.2	2.2	2.2	2.2	2.1	2.1
Dry density (g/cm^3)	1.9	1.9	1.9	1.9	1.9	2.0	1.9	1.9	1.8	1.8
Wet unit weight (kN/m^3)	20.1	20.1	20.5	20.9	21.2	21.5	21.1	21.2	20.9	20.9
Dry unit weight (kN/m^3)	18.5	18.52	18.6	18.9	19.1	19.2	18.56	18.62	18.11	18.1

Determination of zero-air-void curve

Water content, w%	10.0	12.0	14.0	16.0	18.0					
Dry density (g/cm^3)	2.1	2.0	1.9	1.9	1.8					
Dry unit weight (kN/m^3)	20.5	19.7	18.9	18.2	17.6					



Optimum water content (%)
11.1
Maximum dry unit weight (kN/m^3)
19.1

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Modified Proctor Test: ASTM D 1557

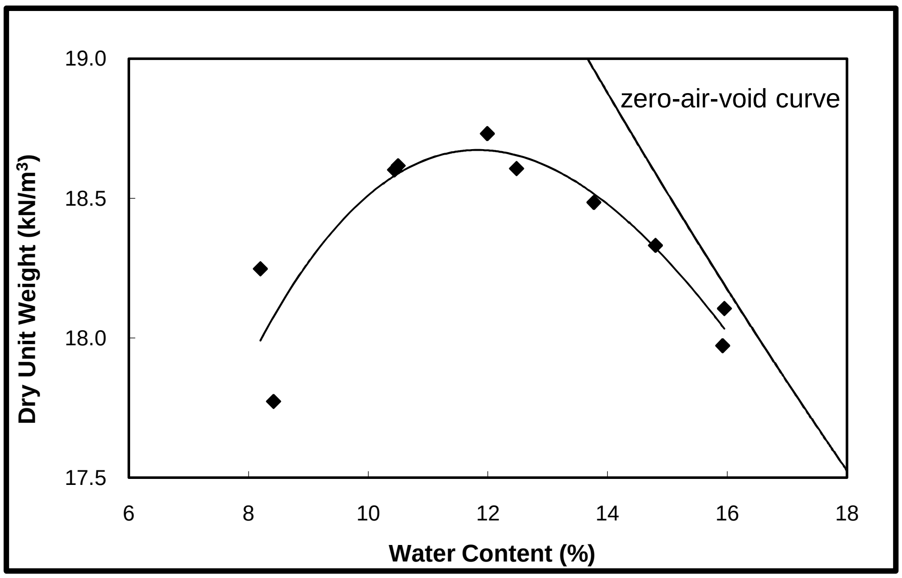
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures				
Method Used: A	Preparation Method Used:	Moist	Rammer:	Manual	
Material Description: M25B	Oversize Fraction:	0%	G_s: 2.64		
Location: N/A	Tested By:	Yueru Chen	Test Date:	10/2/2009	

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9	10
Water content, w%	8.2	8.4	10.4	10.5	12.0	12.5	13.8	14.8	15.9	15.95
Mold volume (cm^3)	940.7	940.7	940.7	942.9	937.2	942.9	940.7	942.9	937.2	937.15
Wt. of mold (g)	4227.4	4226.2	4226.5	4207.8	4213.1	4205.2	4226.0	4205.4	4212.9	4216.9
Wt. of mold + soil (g)	6120.8	6074.1	6196.6	6185.1	6217.1	6216.8	6242.8	6228.2	6203.2	6222.4
Wt. of wet soil (g)	1893.4	1847.9	1970.1	1977.3	2004.0	2011.6	2016.8	2022.8	1990.3	2006
Wet density (g/cm^3)	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.14
Dry density (g/cm^3)	1.9	1.8	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.85
Wet unit weight (kN/m^3)	19.7	19.3	20.5	20.6	21.0	20.9	21.0	21.0	20.8	20.99
Dry unit weight (kN/m^3)	18.2	17.8	18.6	18.6	18.7	18.6	18.5	18.3	18.0	18.11

Determination of zero-air-void curve

Water content, w%	12.0	14.0	16.0	18.0						
Dry density (g/cm^3)	2.0	1.9	1.9	1.8						
Dry unit weight (kN/m^3)	19.6	18.9	18.2	17.5						



Optimum water content (%)
11.8
Maximum dry unit weight (kN/m^3)
18.7

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Modified Proctor Test: ASTM D 1557

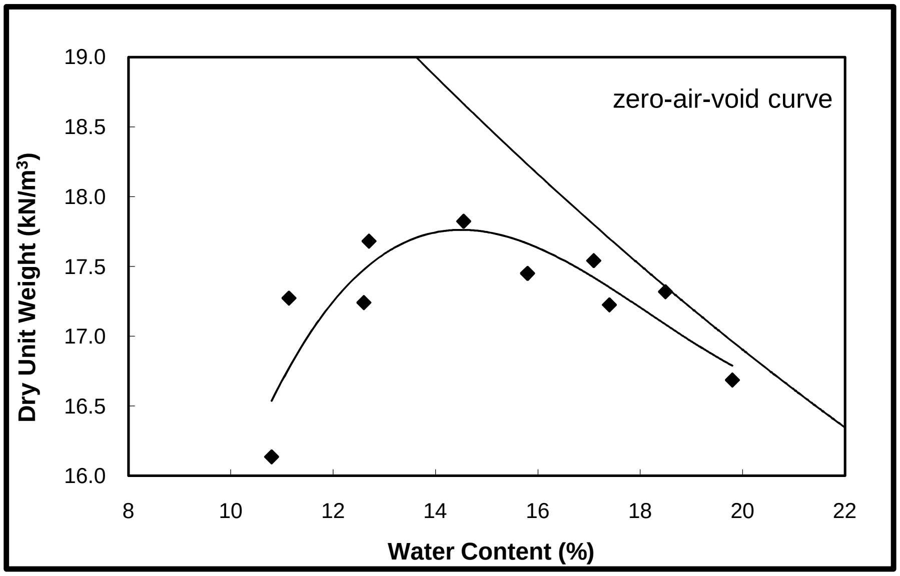
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures				
Method Used: A	Preparation Method Used:	Moist	Rammer:	Manual	
Material Description:	M50B	Oversize Fraction:	0%	G_s: 2.63	
Location: N/A		Tested By:	Yueru Chen	Test Date:	10/7/2009

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9	10
Water content, w%	10.8	11.1	12.6	12.7	14.6	15.8	17.1	17.4	18.5	19.8
Mold volume (cm^3)	942.9	940.7	940.7	940.7	937.2	940.7	940.7	937.2	937.2	940.7
Wt. of mold (g)	4207.7	4226.0	4227.1	4225.7	4213.2	4227.6	4226.3	4217.2	4213.0	4219.6
Wt. of mold + soil (g)	5926.0	6066.9	6088.7	6136.5	6163.5	6165.3	6195.7	6148.9	6173.2	6136.5
Wt. of wet soil (g)	1718.3	1840.9	1861.6	1910.8	1950.3	1937.7	1969.4	1931.7	1960.2	1916.9
Wet density (g/cm^3)	1.8	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.0
Dry density (g/cm^3)	1.6	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7
Wet unit weight (kN/m^3)	17.9	19.2	19.4	19.9	20.4	20.2	20.5	20.2	20.5	20.0
Dry unit weight (kN/m^3)	16.1	17.3	17.2	17.7	17.8	17.4	17.5	17.2	17.3	16.7

Determination of zero-air-void curve

Water content, w%	12.0	14.0	16.0	18.0	20.0	22.0				
Dry density (g/cm^3)	2.0	1.9	1.9	1.8	1.7	1.7				
Dry unit weight (kN/m^3)	19.6	18.9	18.2	17.5	16.9	16.3				



Optimum water content (%)
14.5
Maximum dry unit weight (kN/m^3)
17.8

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Low Energy Proctor Test

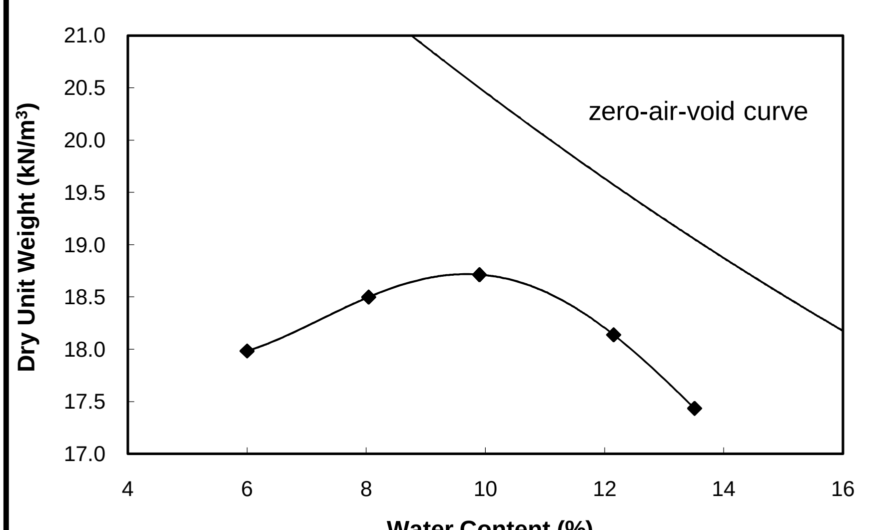
Project Name: An experimental investigation of the behavior of compacted clay/sand mixtures			
Method Used: A	Preparation Method Used: Moist		Rammer: Manual
Material Description: L15K	Oversize Fraction: 0%		G_s: 2.64
Location: N/A	Tested By: Yueru Chen		Test Date: 2/9/2009

Determination of dry unit weight

Specimen No.	1	2	3	4	5	
Water content, w%	6.0	8.0	9.9	12.2	13.5	
Mold volume (cm^3)	942.9	940.7	937.2	942.9	942.9	
Wt. of mold (g)	4205.4	4227.5	4227.5	4205.4	4205.4	
Wt. of mold + soil (g)	6037.7	6144.1	6192.2	6160.7	6107.6	
Wt. of wet soil (g)	1832.3	1916.6	1964.7	1955.3	1902.2	
Wet density (g/cm^3)	1.9	2.0	2.1	2.1	2.0	
Dry density (g/cm^3)	1.8	1.9	1.9	1.8	1.8	
Wet unit weight (kN/m^3)	19.1	20.0	20.6	20.3	19.8	
Dry unit weight (kN/m^3)	18.0	18.5	18.7	18.1	17.4	

Determination of zero-air-void curve

Water content, w%	8.0	10.0	12.0	14.0	16.0	
Dry density (g/cm^3)	2.2	2.1	2.0	1.9	1.9	
Dry unit weight (kN/m^3)	21.3	20.5	19.6	18.9	18.2	



Optimum water content (%)
9.6
Maximum dry unit weight (kN/m^3)
18.7

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Low Energy Proctor Test

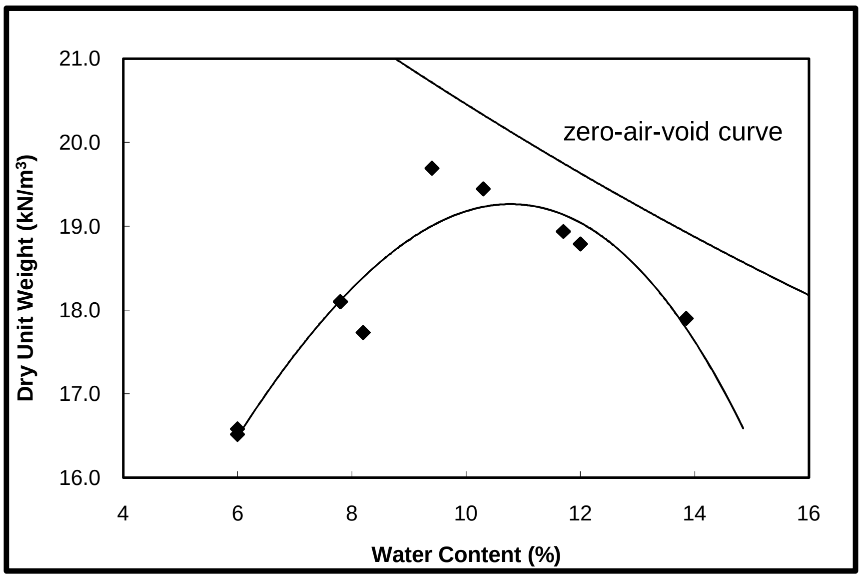
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures		
Method Used: A	Preparation Method Used: Moist	Rammer: Manual	
Material Description: L25K	Oversize Fraction: 0%		G_s: 2.64
Location: N/A	Tested By: Yueru Chen	Test Date: 2/10/2009	

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9
Water content, w%	6.0	6.0	7.8	8.2	9.4	10.3	11.7	12	13.85
Mold volume (cm^3)	940.7	937.2	940.7	940.9	937.2	937.15	937.15	937.15	940.74
Wt. of mold (g)	4227.5	4214.0	4227.2	4205.4	4213.9	4205.4	4214.0	4205.4	4227.5
Wt. of mold + soil (g)	5906.3	5892.9	6098.2	6045.4	6271.8	6254.2	6234.6	6215.5	6181.5
Wt. of wet soil (g)	1678.8	1678.9	1871.0	1840.0	2057.9	2049	2021	2010	1954
Wet density (g/cm^3)	1.8	1.8	2.0	2.0	2.2	2.19	2.16	2.14	2.08
Dry density (g/cm^3)	1.7	1.7	1.8	1.8	2.0	1.98	1.93	1.92	1.82
Wet unit weight (kN/m^3)	17.5	17.6	19.5	19.2	21.5	21.45	21.15	21.04	20.38
Dry unit weight (kN/m^3)	16.5	16.6	18.1	17.7	19.7	19.44	18.94	18.79	17.90

Determination of zero-air-void curve

Water content, w%	8.0	10.0	12.0	14.0	16.0				
Dry density (g/cm^3)	2.2	2.1	2.0	1.9	1.9				
Dry unit weight (kN/m^3)	21.3	20.5	19.6	18.9	18.2				



Optimum water content (%)	10.2
Maximum dry unit weight (kN/m^3)	19.4

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Low Energy Proctor Test

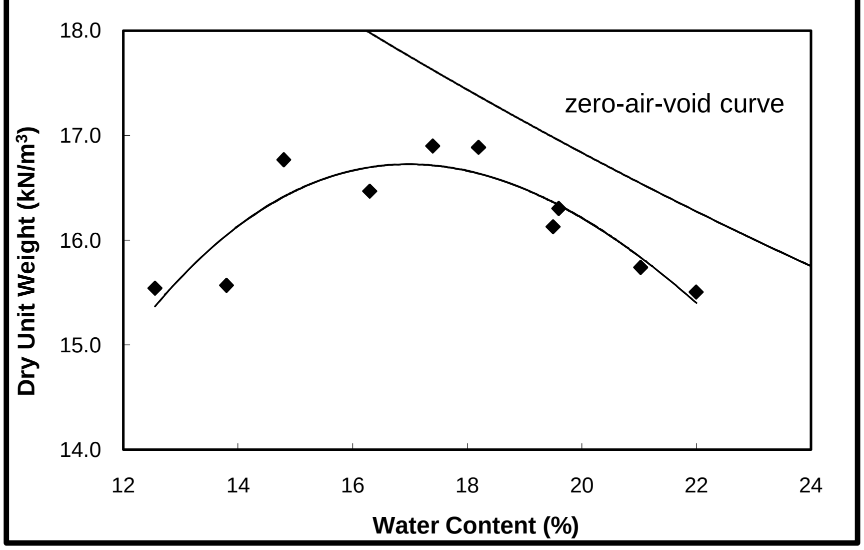
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures		
Method Used: A	Preparation Method Used: Moist		Rammer: Manual
Material Description: L50K	Oversize Fraction: 0%		G_s: 2.62
Location: N/A	Tested By: Yueru Chen		Test Date: 2/11/2009

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9	10
Water content, w%	12.55	13.80	14.80	16.30	17.40	18.20	19.50	19.60	21.03	22.00
Mold volume (cm^3)	940.7	940.7	940.7	940.7	940.7	942.9	940.7	940.7	942.9	940.7
Wt. of mold (g)	4227.1	4227.5	4227.2	4227.5	4227.1	4205.4	4227.4	4227.5	4207.7	4227.5
Wt. of mold + soil (g)	5904.5	5926.6	6073.0	6063.9	6129.5	6123.6	6075.5	6097.3	6038.9	6041.5
Wt. of wet soil (g)	1677.4	1699.1	1845.8	1836.4	1902.4	1918.2	1848.1	1869.8	1831.2	1814.0
Wet density (g/cm^3)	1.8	1.8	2.0	2.0	2.0	2.0	2.0	2.0	1.9	1.9
Dry density (g/cm^3)	1.6	1.6	1.7	1.7	1.7	1.7	1.6	1.7	1.6	1.6
Wet unit weight (kN/m^3)	17.5	17.7	19.2	19.1	19.8	20.0	19.3	19.5	19.1	18.9
Dry unit weight (kN/m^3)	15.5	15.6	16.8	16.5	16.9	16.9	16.1	16.3	15.7	15.5

Determination of zero-air-void curve

Water content, w%	16.0	18.0	20.0	22.0	24.0					
Dry density (g/cm^3)	1.8	1.8	1.7	1.7	1.6					
Dry unit weight (kN/m^3)	18.1	17.4	16.8	16.3	15.8					



Optimum water content (%)
17
Maximum dry unit weight (kN/m^3)
16.7

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Standard Proctor Test: ASTM D 698 - 00a

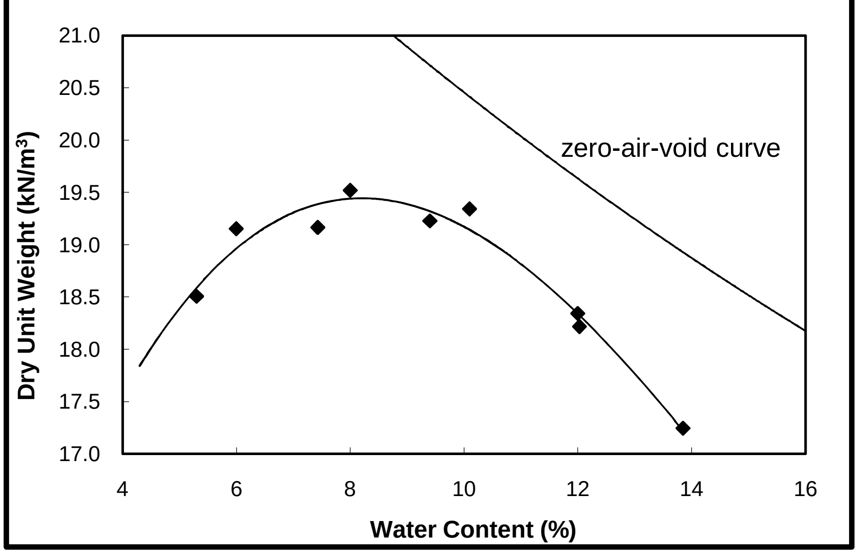
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures		
Method Used: A	Preparation Method Used: Moist	Rammer: Manual	
Material Description: S15K	Oversize Fraction: 0%		G_s: 2.64
Location: N/A	Tested By: Yueru Chen	Test Date: 1/26/2009	

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9
Water content, w%	5.3	6.0	7.4	8.0	9.4	10.1	12.0	12.0	13.9
Mold volume (cm^3)	942.9	937.2	942.9	937.2	942.9	942.9	942.9	940.7	942.9
Wt. of mold (g)	4205.4	4213.8	4205.4	4213.9	4205.4	4207.8	4205.4	4227.3	4205.4
Wt. of mold + soil (g)	6078.5	6153.3	6184.4	6227.9	6227.3	6254.7	6167.2	6197.5	6092.5
Wt. of wet soil (g)	1873.1	1939.5	1979.0	2014.0	2021.9	2046.9	1961.8	1970.2	1887.1
Wet density (g/cm^3)	2.0	2.1	2.1	2.1	2.1	2.2	2.1	2.1	2.0
Dry density (g/cm^3)	1.9	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.8
Wet unit weight (kN/m^3)	19.5	20.3	20.6	21.1	21.0	21.3	20.4	20.5	19.6
Dry unit weight (kN/m^3)	18.5	19.2	19.2	19.5	19.2	19.3	18.2	18.3	17.2

Determination of zero-air-void curve

Water content, w%	8.0	10.0	12.0	14.0	16.0				
Dry density (g/cm^3)	2.2	2.1	2.0	1.9	1.9				
Dry unit weight (kN/m^3)	21.3	20.5	19.6	18.9	18.2				



Optimum water content (%)	8.2
Maximum dry unit weight (kN/m^3)	19.4

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
Standard Proctor Test: ASTM D 698 - 00a

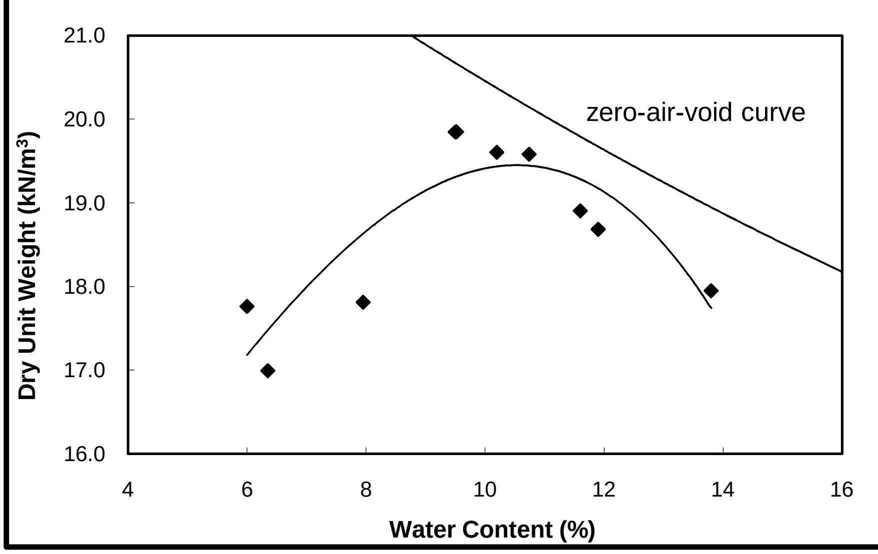
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures				
Method Used: A		Preparation Method Used: Moist		Rammer:	Manual
Material Description:	S25K	Oversize Fraction:	0%		G_s: 2.64
Location:	N/A	Tested By:	Yueru Chen	Test Date:	1/23/2009

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9	10
Water content, w%	6.0	6.4	8.0	9.5	9.5	10.2	10.7	11.6	11.9	13.8
Mold volume (cm^3)	937.2	942.9	942.9	940.7	942.9	937.2	943.8	942.9	940.7	942.9
Wt. of mold (g)	4214.0	4205.4	4205.4	4227.0	4205.4	4214.1	4216.5	4205.4	4227.3	4205.4
Wt. of mold + soil (g)	6012.6	5942.6	6053.6	6311.1	6295.0	6278.0	6302.7	6233.3	6232.4	6168.8
Wt. of wet soil (g)	1798.6	1737.2	1848.2	2084.1	2089.6	2063.9	2086.2	2027.9	2005.1	1963.4
Wet density (g/cm^3)	1.9	1.8	2.0	2.2	2.2	2.2	2.2	2.2	2.1	2.1
Dry density (g/cm^3)	1.8	1.7	1.8	2.0	2.0	2.0	2.0	1.9	1.9	1.8
Wet unit weight (kN/m^3)	18.8	18.1	19.2	21.7	21.7	21.6	21.7	21.1	20.9	20.4
Dry unit weight (kN/m^3)	17.8	17.0	17.8	19.8	19.9	19.6	19.6	18.9	18.7	17.9

Determination of zero-air-void curve

Water content, w%	8.0	10.0	12.0	14.0	16.0					
Dry density (g/cm^3)	2.2	2.1	2.0	1.9	1.9					
Dry unit weight (kN/m^3)	21.3	20.5	19.6	18.9	18.2					



Optimum water content (%)
9.3
Maximum dry unit weight (kN/m^3)
19.7

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Standard Proctor Test: ASTM D 698 - 00a

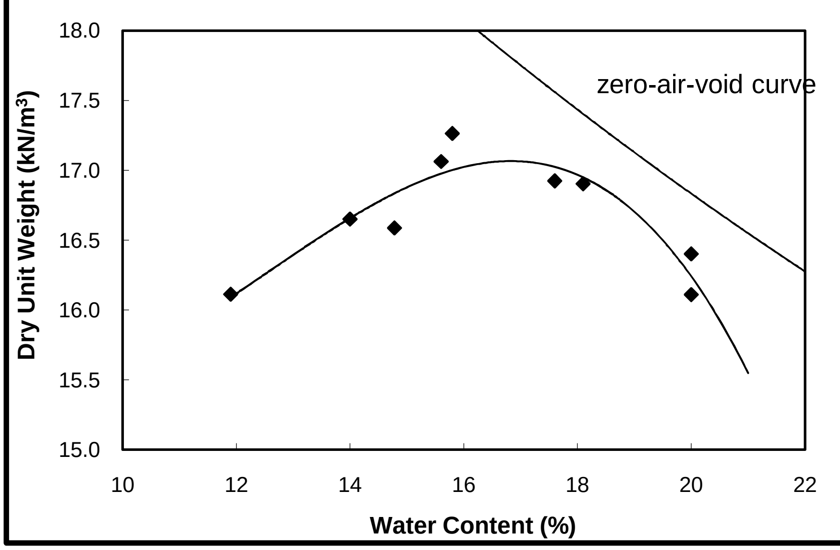
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures		
Method Used: A	Preparation Method Used: Moist	Rammer:	Manual
Material Description: S50K	Oversize Fraction:	0%	G_s: 2.62
Location: N/A	Tested By: Yueru Chen	Test Date:	1/29/2009

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9
Water content, w%	11.9	14.0	14.8	15.6	15.8	17.6	18.1	20.0	20.0
Mold volume (cm^3)	942.9	937.2	942.9	942.9	940.7	940.7	942.9	942.9	937.2
Wt. of mold (g)	4205.4	4214.0	4205.4	4205.4	4227.2	4227.2	4205.4	4205.4	4214.0
Wt. of mold + soil (g)	5938.4	6027.3	6035.3	6101.3	6144.3	6135.8	6124.3	6097.1	6060.8
Wt. of wet soil (g)	1733.0	1813.3	1829.9	1895.9	1917.1	1908.6	1918.9	1891.7	1846.8
Wet density (g/cm^3)	1.8	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0
Dry density (g/cm^3)	1.6	1.7	1.7	1.7	1.8	1.7	1.7	1.7	1.6
Wet unit weight (kN/m^3)	18.0	19.0	19.0	19.7	20.0	19.9	20.0	19.7	19.3
Dry unit weight (kN/m^3)	16.1	16.7	16.6	17.1	17.3	16.9	16.9	16.4	16.1

Determination of zero-air-void curve

Water content, w%	14.0	16.0	18.0	20.0	22.0				
Dry density (g/cm^3)	1.9	1.8	1.8	1.7	1.7				
Dry unit weight (kN/m^3)	18.8	18.1	17.4	16.8	16.3				



Optimum water content (%)
16.8
Maximum dry unit weight (kN/m^3)
17.1

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Modified Proctor Test: ASTM D 1557

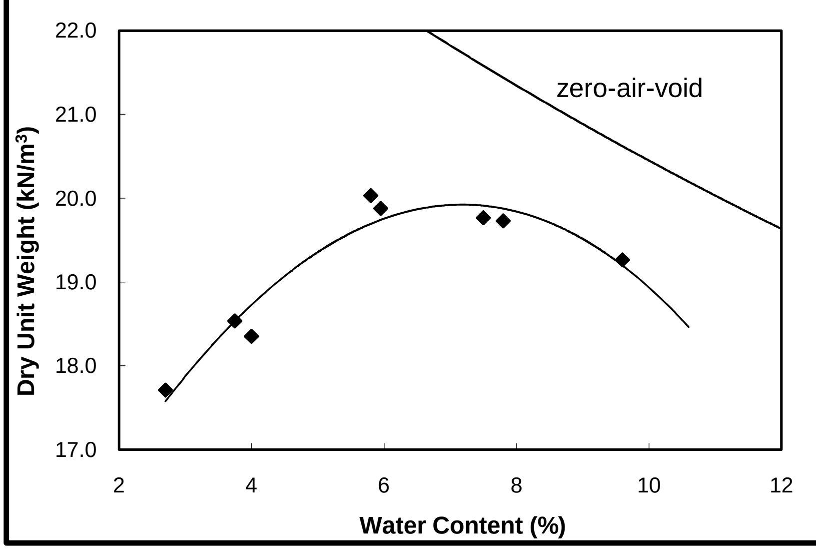
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures				
Method Used: A	Preparation Method Used:	Moist	Rammer:	Manual	
Material Description:	M15K	Oversize Fraction:	0%	G_s: 2.64	
Location: N/A	Tested By:	Yueru Chen	Test Date:	1/30/2009	

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8
Water content, w%	2.7	3.8	4.0	5.8	6.0	7.5	7.8	9.6
Mold volume (cm^3)	942.9	942.9	937.2	940.7	940.7	937.2	940.7	940.7
Wt. of mold (g)	4205.4	4205.2	4213.6	4227.1	4227.8	4213.7	4227.5	4227.5
Wt. of mold + soil (g)	5953.6	6053.5	6036.8	6259.4	6247.4	6243.5	6266.9	6252.2
Wt. of wet soil (g)	1748.2	1848.3	1823.2	2032.3	2019.6	2029.8	2039.4	2024.7
Wet density (g/cm^3)	1.9	2.0	1.9	2.2	2.1	2.2	2.2	2.2
Dry density (g/cm^3)	1.8	1.9	1.9	2.0	2.0	2.0	2.0	2.0
Wet unit weight (kN/m^3)	18.2	19.2	19.1	21.2	21.1	21.2	21.3	21.1
Dry unit weight (kN/m^3)	17.7	18.53	18.4	20.0	19.9	19.8	19.73	19.3

Determination of zero-air-void curve

Water content, w%	4.0	6.0	8.0	10.0	12.0			
Dry density (g/cm^3)	2.4	2.3	2.2	2.1	2.0			
Dry unit weight (kN/m^3)	23.4	22.3	21.3	20.5	19.6			



Optimum water content (%)
7.2
Maximum dry unit weight (kN/m^3)
19.9

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Modified Proctor Test: ASTM D 1557

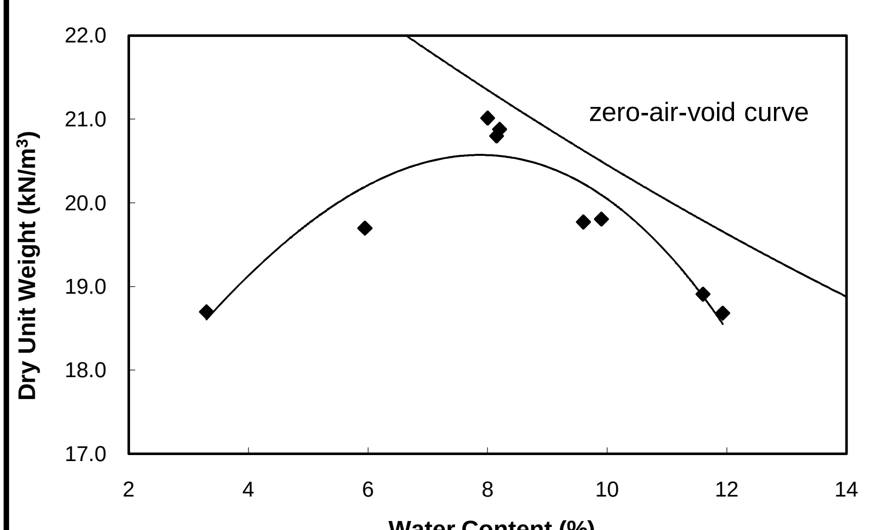
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures				
Method Used: A	Preparation Method Used:	Moist	Rammer:	Manual	
Material Description:	M25K	Oversize Fraction:	0%	G_s: 2.64	
Location: N/A		Tested By:	Yueru Chen	Test Date:	1/29/2009

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9	
Water content, w%	3.3	6.0	8.0	8.2	8.2	9.6	9.9	11.6	11.9	
Mold volume (cm^3)	942.9	937.2	937.2	940.7	940.7	940.7	937.2	942.9	937.2	
Wt. of mold (g)	4205.4	4213.7	4213.7	4225.5	4227.2	4228.3	4213.8	4205.3	4213.6	
Wt. of mold + soil (g)	6061.8	6207.3	6381.8	6382.7	6393.8	6306.2	6293.2	6233.6	6211.1	
Wt. of wet soil (g)	1856.4	1993.6	2168.1	2157.2	2166.6	2077.9	2079.4	2028.3	1997.5	
Wet density (g/cm^3)	2.0	2.1	2.3	2.3	2.3	2.2	2.2	2.2	2.1	
Dry density (g/cm^3)	1.9	2.0	2.1	2.1	2.1	2.0	2.0	1.9	1.9	
Wet unit weight (kN/m^3)	19.3	20.9	22.7	22.5	22.6	21.7	21.8	21.1	20.9	
Dry unit weight (kN/m^3)	18.7	19.7	21.0	20.8	20.9	19.8	19.8	18.9	18.7	

Determination of zero-air-void curve

Water content, w%	6.0	8.0	10.0	12.0	14.0					
Dry density (g/cm^3)	2.3	2.2	2.1	2.0	1.9					
Dry unit weight (kN/m^3)	22.3	21.3	20.5	19.6	18.9					



Optimum water content (%)
7.9
Maximum dry unit weight (kN/m^3)
20.6

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

Modified Proctor Test: ASTM D 1557

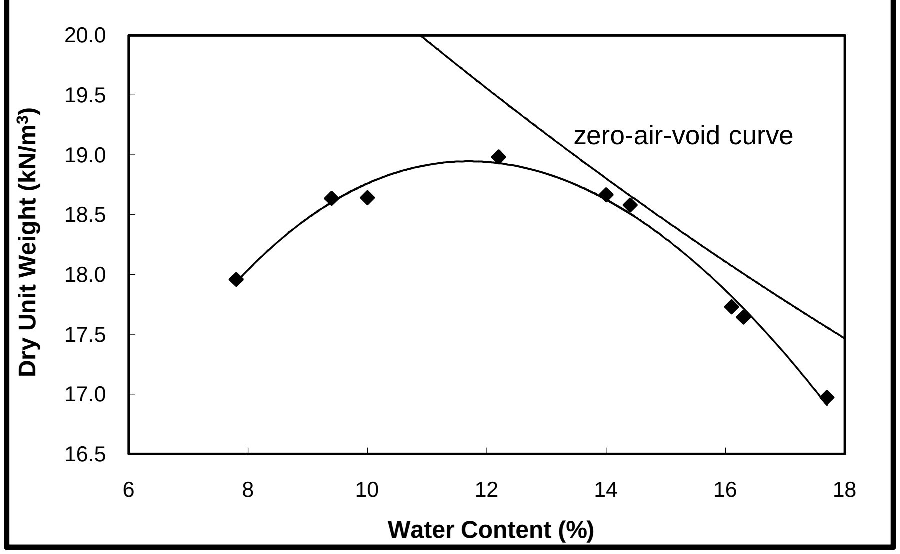
Project Name:	An experimental investigation of the behavior of compacted clay/sand mixtures				
Method Used: A	Preparation Method Used:	Moist	Rammer:	Manual	
Material Description:	M50K	Oversize Fraction:	0%	G_s: 2.62	
Location: N/A		Tested By:	Yueru Chen	Test Date:	2/2/2009

Determination of dry unit weight

Specimen No.	1	2	3	4	5	6	7	8	9	
Water content, w%	7.8	9.4	10.0	12.2	14.0	14.4	16.1	16.3	17.7	
Mold volume (cm^3)	942.9	940.7	940.7	940.7	937.2	942.9	942.9	937.2	940.7	
Wt. of mold (g)	4205.3	4227.3	4227.5	4227.0	4213.7	4205.4	4205.8	4213.9	4227.5	
Wt. of mold + soil (g)	6066.2	6182.4	6193.9	6269.4	6246.5	6248.5	6184.4	6174.2	6143.4	
Wt. of wet soil (g)	1860.9	1955.1	1966.4	2042.4	2032.8	2043.1	1978.6	1960.3	1915.9	
Wet density (g/cm^3)	2.0	2.1	2.1	2.2	2.2	2.2	2.1	2.1	2.0	
Dry density (g/cm^3)	1.8	1.9	1.9	1.9	1.9	1.9	1.8	1.8	1.7	
Wet unit weight (kN/m^3)	19.4	20.4	20.5	21.3	21.3	21.3	20.6	20.5	20.0	
Dry unit weight (kN/m^3)	18.0	18.6	18.6	19.0	18.7	18.6	17.7	17.6	17.0	

Determination of zero-air-void curve

Water content, w%	10.0	12.0	14.0	16.0	18.0	20.0	22.0			
Dry density (g/cm^3)	2.1	2.0	1.9	1.8	1.8	1.7	1.7			
Dry unit weight (kN/m^3)	20.4	19.6	18.8	18.1	17.5	16.9	16.3			



Optimum water content (%)	11.8
Maximum dry unit weight (kN/m^3)	19.0

APPENDIX F

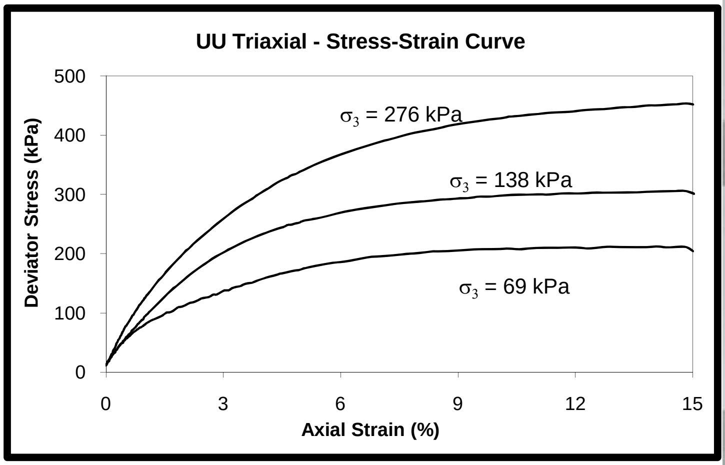
UU TRIAXIAL DATA

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 85% sand 15% bentonite, 12% water content (L15B12W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/15/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28.0	28.9	28.9	28.2	28.4
Wt. of Tin + Wet soil (g)	119.6	93.2	147.6	161.1	156.9	155.8
Wt. of Tin + Dry soil (g)	109.7	86.1	134.9	146.5	143.0	141.7
Wt. of Dry Soil (g)	81.0	58.1	106.0	117.6	114.8	113.3
Wt. of Water (g)	9.9	7.1	12.7	14.6	13.9	14.1
Water Content (%)	12.2	12.2	12.0	12.4	12.1	12.4
Average Water Content (%)		12.1			12.3	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.09	7.09
Average Diameter, D (cm)	3.56	3.52	3.53
Dry Unit Weight (kN/m^3)	16.32	16.30	15.99
Initial Void ratio	0.59	0.60	0.63
Saturation (%)	0.55	0.54	0.53
Strain at Failure (%)	14.06	14.81	14.83
Max Deviator Stress (kPa)	215.3	309.1	457.0
Membrane Correction (kPa)	3.1	3.3	3.3
Corrected Deviator Stress (kPa)	212.2	305.8	453.7
Corrected Major Stress (kPa)	281.1	443.7	729.5

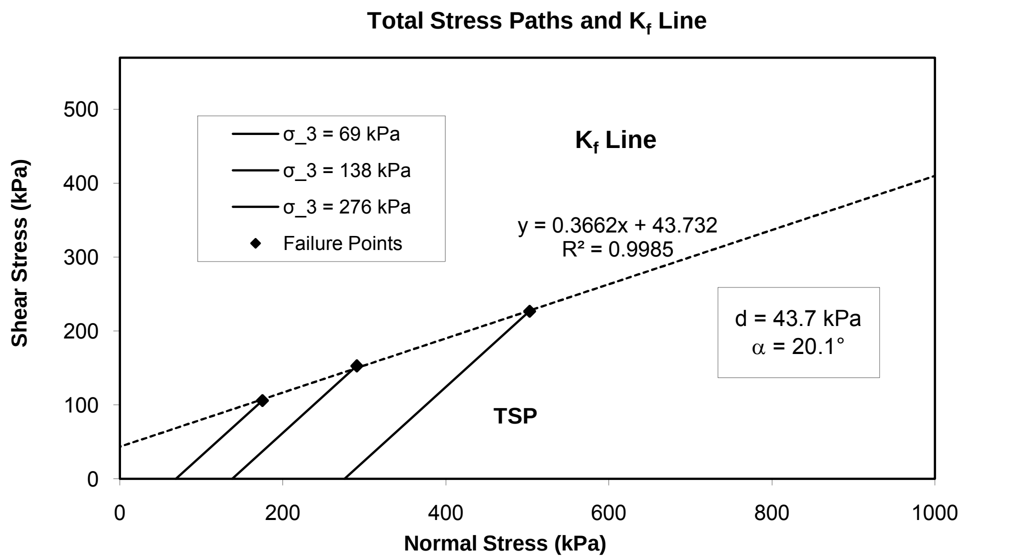


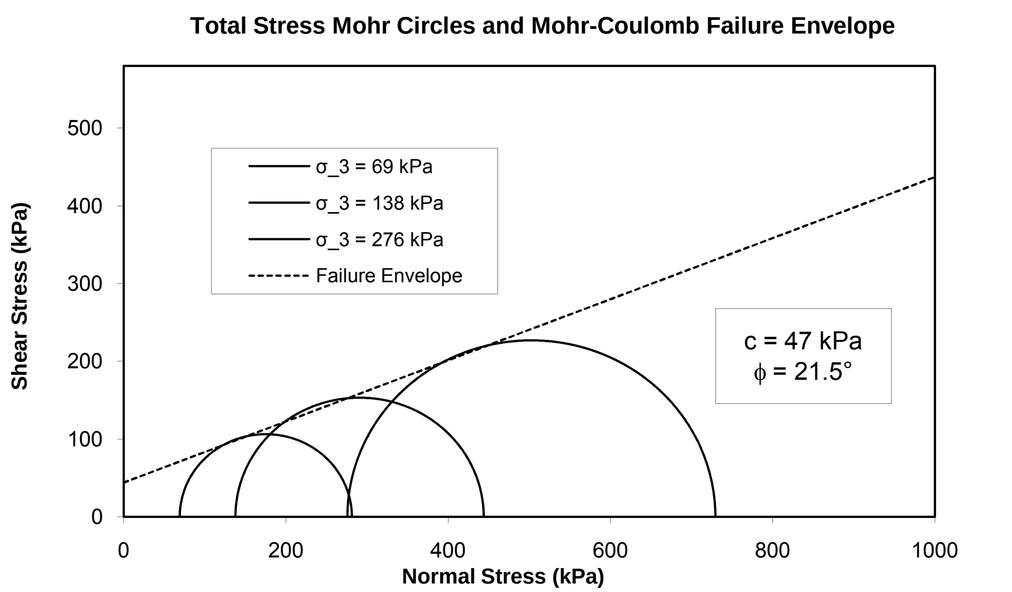
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1-\sigma_3)=4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 85% sand 15% bentonite,12% water content (L15B12W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/15/2009



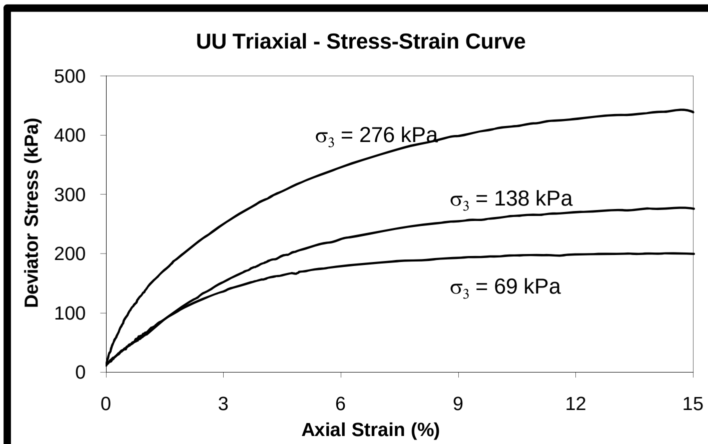


DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 85% sand 15% bentonite, 14% water content (L15B14W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/15/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B-19	101	7
Wt. of Tin (g)	28.5	27.9	28.1	27.4	28.0	28.2
Wt. of Tin + Wet soil (g)	143.2	102.9	108.2	158.6	159.2	160.9
Wt. of Tin + Dry soil (g)	129.2	93.7	98.4	142.6	143.1	144.7
Wt. of Dry Soil (g)	100.70	65.80	70.30	115.2	115.1	116.5
Wt. of Water (g)	14.00	9.20	9.80	16.0	16.1	16.2
Water Content (%)	13.90	13.98	13.94	13.9	14.0	13.9
Average Water Content (%)	13.9			13.9		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.11	7.10	7.15
Average Diameter, D (cm)	3.52	3.52	3.54
Dry Unit Weight (kN/m^3)	16.32	16.37	16.24
Initial Void ratio	0.59	0.59	0.60
Saturation (%)	0.62	0.63	0.61
Strain at Failure (%)	14.33	14.58	14.81
Max Deviator Stress (kPa)	203.6	280.9	446.1
Membrane Correction (kPa)	3.2	3.2	3.3
Corrected Deviator Stress (kPa)	200.4	277.6	442.9
Corrected Major Stress (kPa)	269.4	415.5	718.7

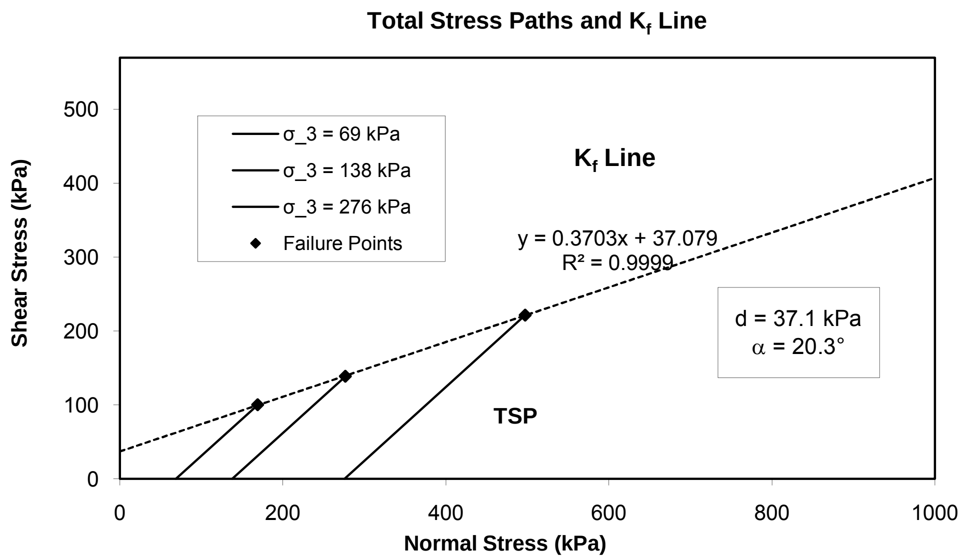


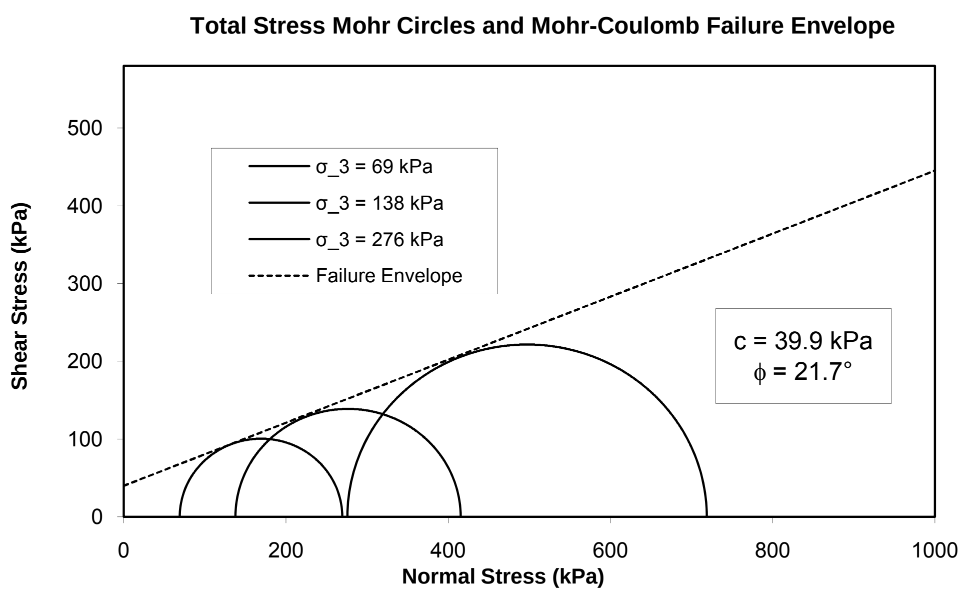
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 85% sand 15% bentonite,14% water content (L15B14W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/15/2009





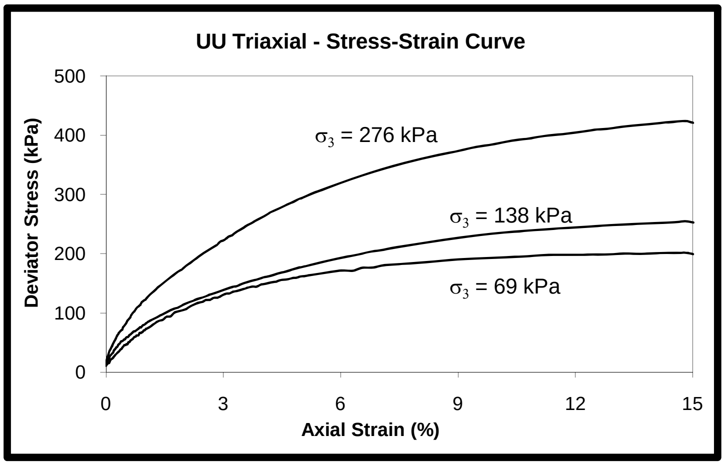
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 85% sand 15% bentonite, 16% water content (L15B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/16/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28.0	28.9	28.9	28.2	28.4
Wt. of Tin + Wet soil (g)	151.6	146.6	127.9	164.1	161.5	164.4
Wt. of Tin + Dry soil (g)	134.9	130.2	114.4	145.7	143.2	145.8
Wt. of Dry Soil (g)	106.2	102.2	85.5	116.8	115.0	117.4
Wt. of Water (g)	16.7	16.4	13.5	18.4	18.3	18.6
Water Content (%)	15.7	16.0	15.8	15.8	15.9	15.8
Average Water Content (%)		15.9			15.8	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.07	7.10	7.10
Average Diameter, D (cm)	3.55	3.53	3.52
Dry Unit Weight (kN/m^3)	16.38	16.24	16.71
Initial Void ratio	0.59	0.60	0.56
Saturation (%)	0.71	0.70	0.76
Strain at Failure (%)	14.83	14.84	14.81
Max Deviator Stress (kPa)	204.9	258.0	427.4
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	201.7	254.7	424.1
Corrected Major Stress (kPa)	270.6	392.6	699.9



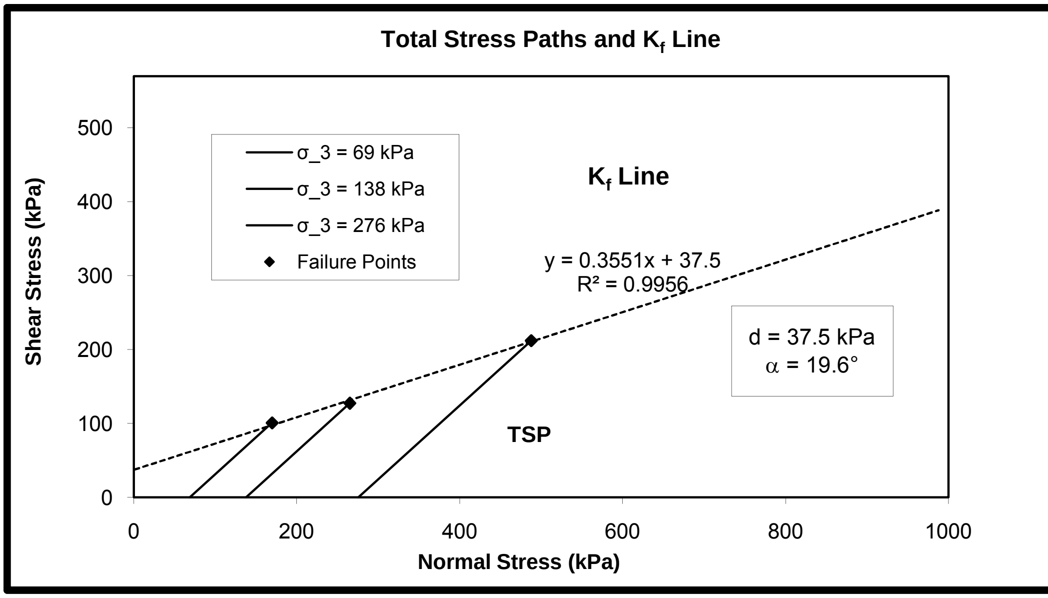


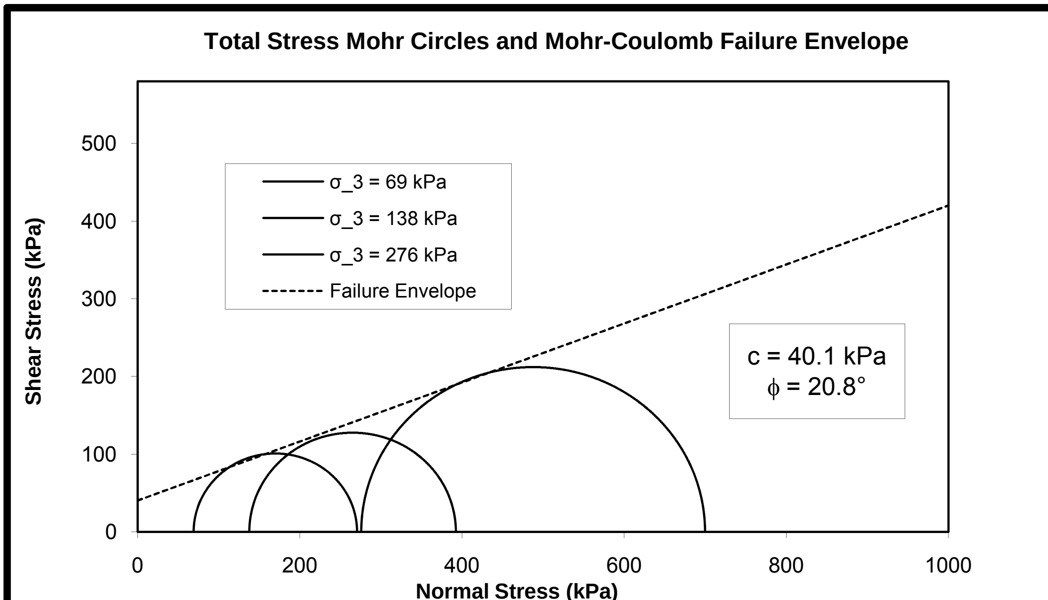
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1-\sigma_3)=4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 85% sand 15% bentonite,16% water content (L15B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/16/2009



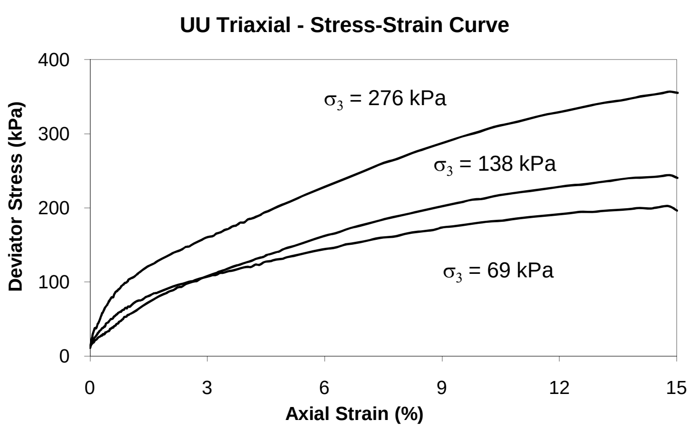


DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 85% sand 15% bentonite, 18% water content (L15B18W)				
Specimen Type:	Compacted	USCS:	Clayey sand (SC)	Gs:	2.65
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	9/16/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B-19	101	7
Wt. of Tin (g)	28.5	27.9	28.1	27.4	28.0	28.2
Wt. of Tin + Wet soil (g)	158.9	108.0	102.4	167.9	166.4	165.8
Wt. of Tin + Dry soil (g)	139.0	95.9	91.2	146.4	145.3	144.8
Wt. of Dry Soil (g)	110.5	68.0	63.1	119.0	117.3	116.6
Wt. of Water (g)	19.9	12.1	11.2	21.5	21.1	21.0
Water Content (%)	18.0	17.8	17.7	18.1	18.0	18.0
Average Water Content (%)		17.9			18.0	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.10	7.09	7.09
Average Diameter, D (cm)	3.54	3.51	3.52
Dry Unit Weight (kN/m^3)	16.75	16.80	16.59
Initial Void ratio	0.55	0.55	0.57
Saturation (%)	0.87	0.87	0.84
Strain at Failure (%)	14.80	14.81	14.83
Max Deviator Stress (kPa)	205.4	247.5	360.2
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	202.1	244.3	356.9
Corrected Major Stress (kPa)	271.1	382.2	632.7

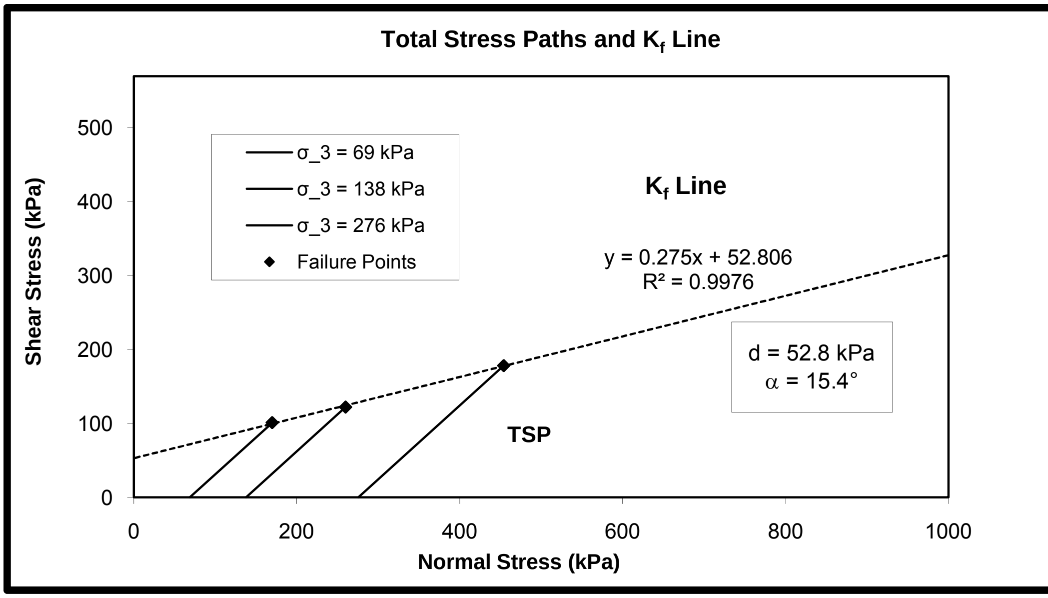


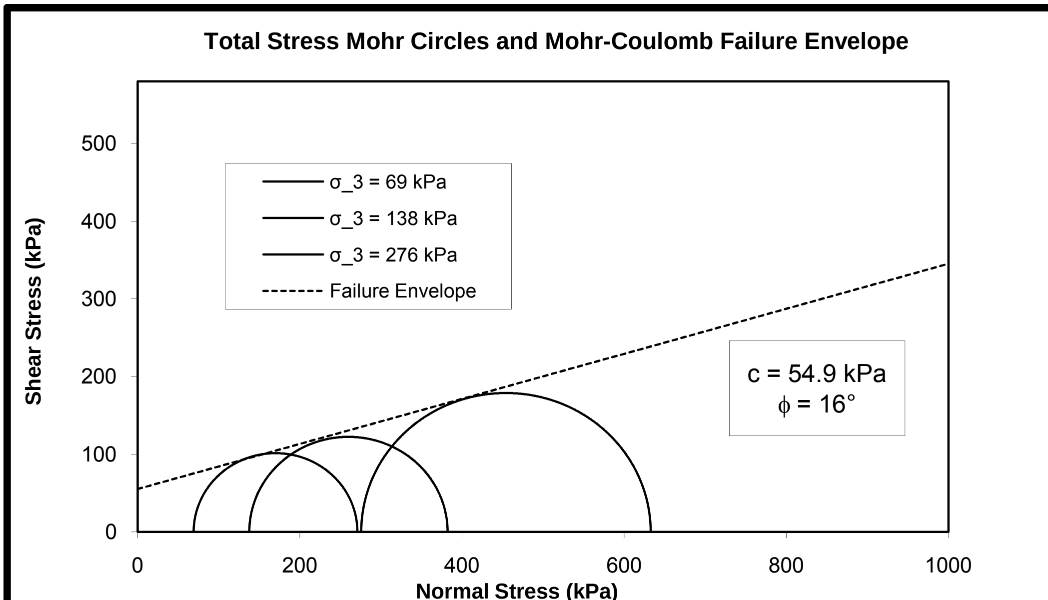
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 85% sand 15% bentonite,18% water content (L15B18W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/16/2009





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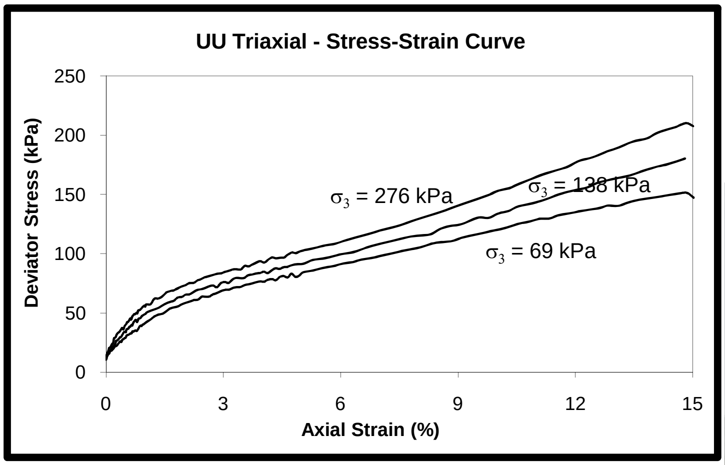
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 85% sand 15% bentonite, 20% water content (L15B20W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/17/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28.0	28.9	28.9	28.2	28.4
Wt. of Tin + Wet soil (g)	103.5	124.0	156.2	169.5	168.6	168.0
Wt. of Tin + Dry soil (g)	91.2	108.2	135.2	146.2	145.2	144.8
Wt. of Dry Soil (g)	62.5	80.2	106.3	117.3	117.0	116.4
Wt. of Water (g)	12.3	15.8	21.0	23.3	23.4	23.2
Water Content (%)	19.7	19.7	19.8	19.9	20.0	19.9
Average Water Content (%)		19.7			19.9	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.14	7.13
Average Diameter, D (cm)	3.55	3.54	3.50
Dry Unit Weight (kN/m^3)	16.32	16.33	16.64
Initial Void ratio	0.59	0.59	0.56
Saturation (%)	0.89	0.90	0.94
Strain at Failure (%)	14.84	14.80	14.83
Max Deviator Stress (kPa)	154.7	183.7	213.4
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	151.4	180.4	210.2
Corrected Major Stress (kPa)	220.3	318.3	485.9



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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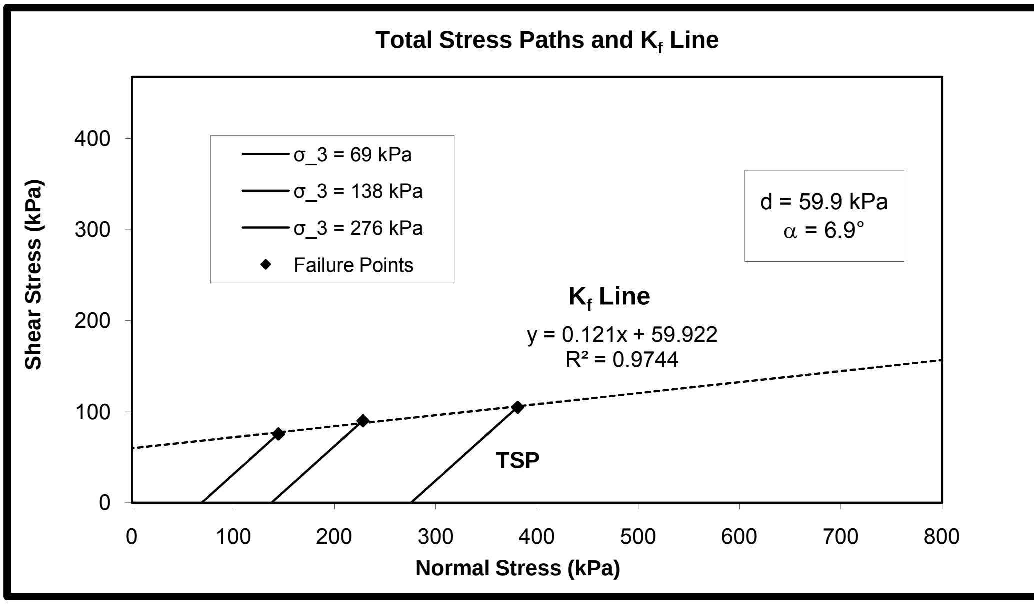
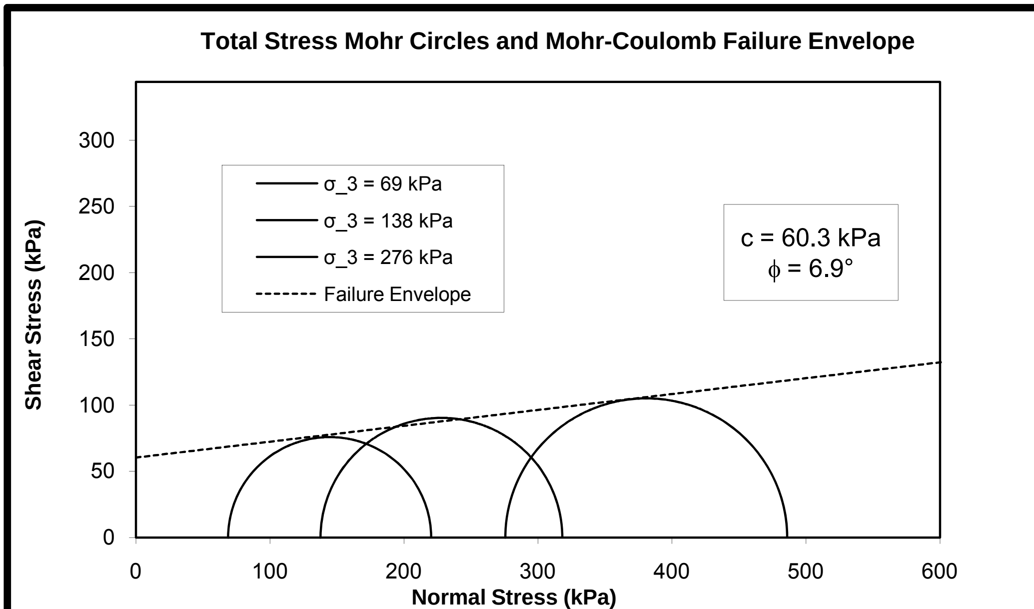
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 85% sand 15% bentonite, 20% water content (L15B20W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/17/2009





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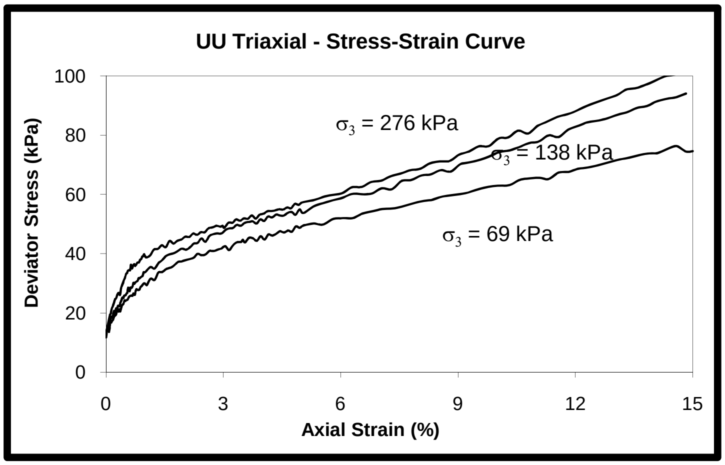
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 85% sand 15% bentonite, 22% water content (L15B22W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 11/20/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	209	FJ-3	211	B-19	101	7
Wt. of Tin (g)	28.2	29.1	28.2	27.4	28.0	28.2
Wt. of Tin + Wet soil (g)	129.4	127.7	121.3	162.0	164.7	163.2
Wt. of Tin + Dry soil (g)	112.0	110.3	105.1	137.5	140.2	138.7
Wt. of Dry Soil (g)	83.8	81.2	76.9	110.1	112.2	110.5
Wt. of Water (g)	17.4	17.4	16.2	24.5	24.5	24.5
Water Content (%)	20.8	21.4	21.1	22.3	21.8	22.2
Average Water Content (%)		21.1			22.1	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.10	7.10	7.09
Average Diameter, D (cm)	3.50	3.52	3.53
Dry Unit Weight (kN/m^3)	15.81	15.93	15.62
Initial Void ratio	0.64	0.63	0.66
Saturation (%)	0.92	0.92	0.88
Strain at Failure (%)	14.59	14.83	15.00
Max Deviator Stress (kPa)	79.6	97.3	105.4
Membrane Correction (kPa)	3.2	3.3	3.3
Corrected Deviator Stress (kPa)	76.3	94.0	102.1
Corrected Major Stress (kPa)	145.3	231.9	377.9



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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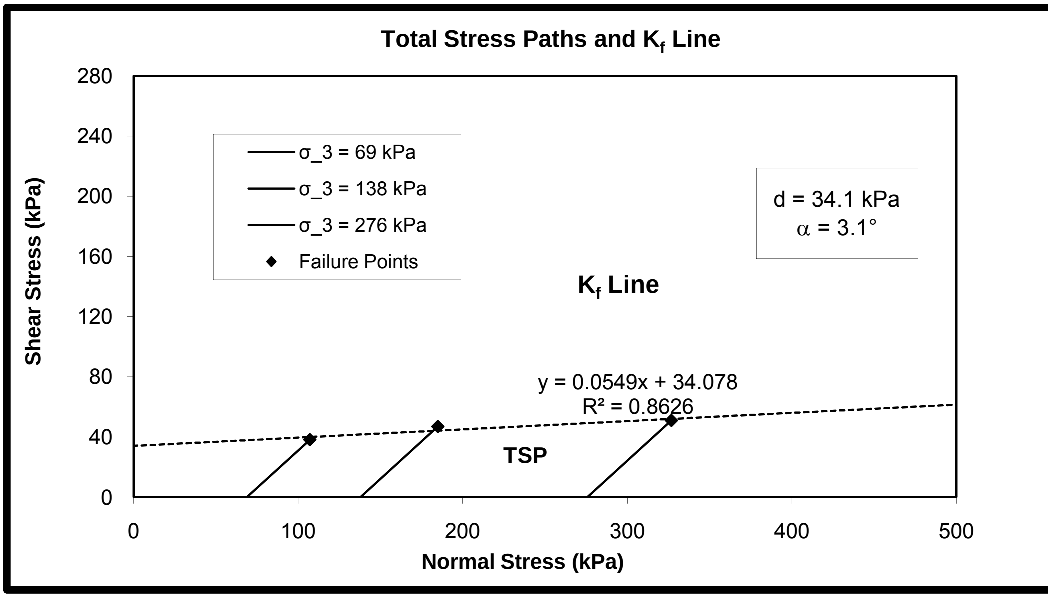
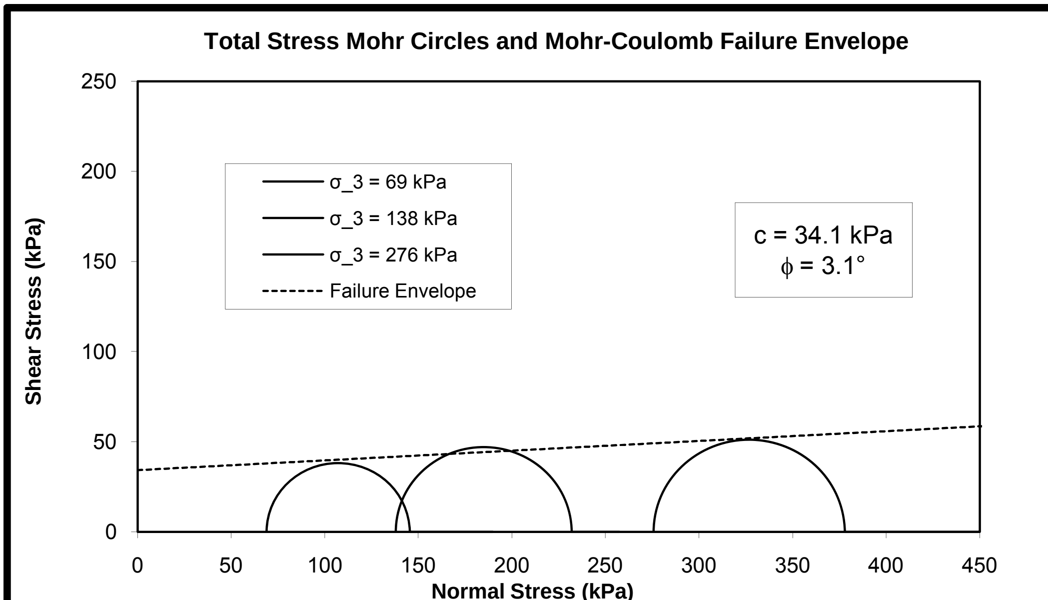
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 85% sand 15% bentonite, 22% water content (L15B22W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 11/20/2009





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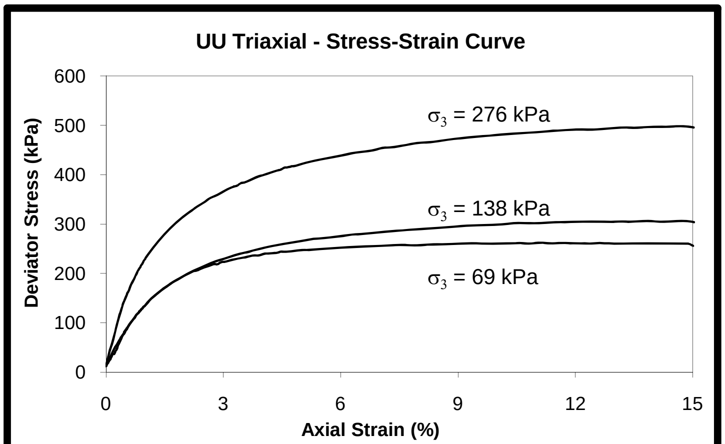
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% bentonite, 14% water content (L25B14W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/28/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	7
Wt. of Tin (g)	28.7	28	28.9	28.9	28.1	28.3
Wt. of Tin + Wet soil (g)	83.1	102.5	110.2	162.1	158.2	164.0
Wt. of Tin + Dry soil (g)	76.4	93.3	100.3	145.6	141.9	147.1
Wt. of Dry Soil (g)	47.70	65.30	71.40	116.7	113.8	118.8
Wt. of Water (g)	6.70	9.20	9.90	16.5	16.3	16.9
Water Content (%)	14.05	14.09	13.87	14.1	14.3	14.2
Average Water Content (%)	14.0			14.2		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.13	7.13
Average Diameter, D (cm)	3.53	3.53	3.53
Dry Unit Weight (kN/m^3)	16.40	15.98	16.72
Initial Void ratio	0.58	0.62	0.55
Saturation (%)	0.64	0.61	0.68
Strain at Failure (%)	11.10	14.86	14.57
Max Deviator Stress (kPa)	265.0	309.2	501.3
Membrane Correction (kPa)	2.4	3.3	3.2
Corrected Deviator Stress (kPa)	262.5	305.9	498.1
Corrected Major Stress (kPa)	331.5	443.8	773.9



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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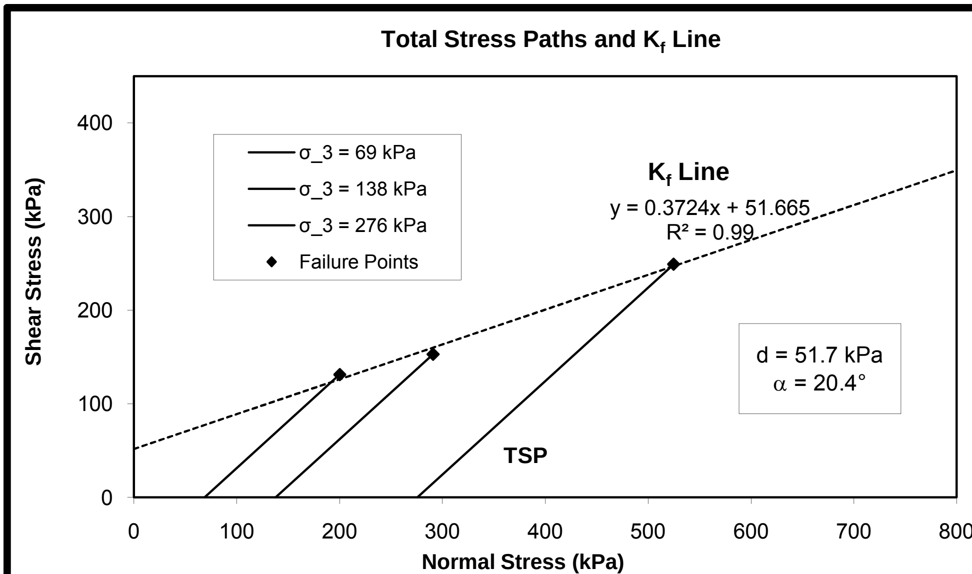
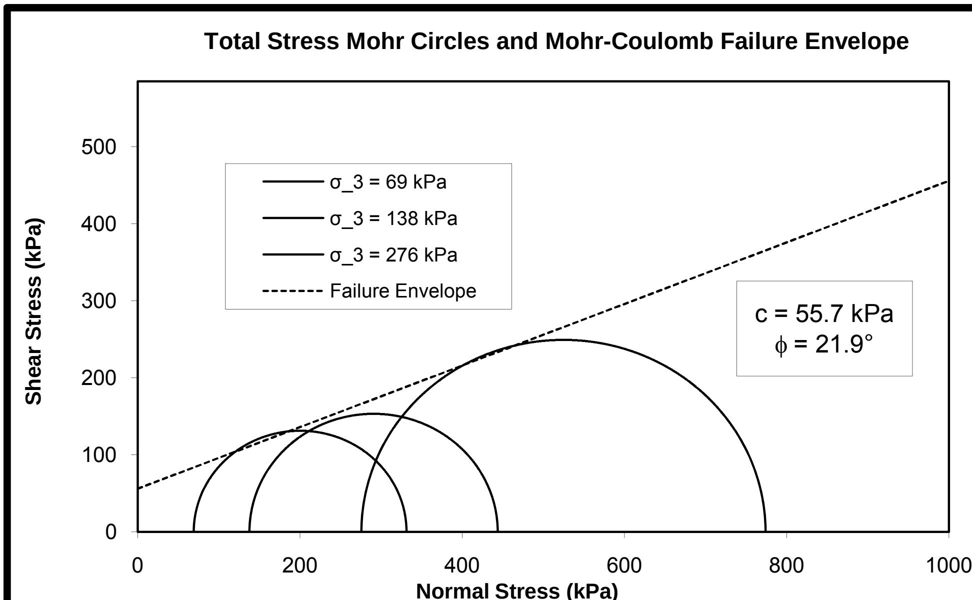
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% bentonite, 14% water content (L25B14W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/28/2009





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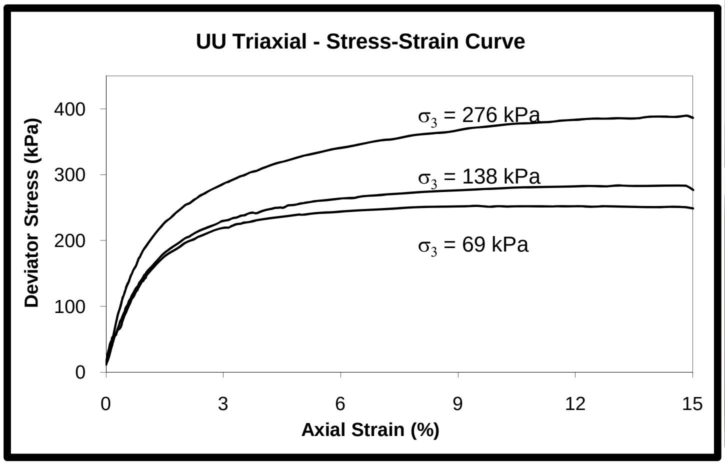
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% bentonite, 16% water content (L25B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/21/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B-19	101	7
Wt. of Tin (g)	28.4	27.9	28.1	27.4	28.0	28.2
Wt. of Tin + Wet soil (g)	99.6	116.9	84.8	165.8	163.6	164.9
Wt. of Tin + Dry soil (g)	89.8	104.4	76.9	146.5	144.7	145.6
Wt. of Dry Soil (g)	61.40	76.50	48.80	119.1	116.7	117.4
Wt. of Water (g)	9.80	12.50	7.90	19.3	18.9	19.3
Water Content (%)	15.96	16.34	16.19	16.2	16.2	16.4
Average Water Content (%)		16.2			16.3	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.15	7.15	7.13
Average Diameter, D (cm)	3.54	3.52	3.53
Dry Unit Weight (kN/m^3)	16.63	16.46	16.50
Initial Void ratio	0.56	0.57	0.57
Saturation (%)	0.77	0.75	0.76
Strain at Failure (%)	12.81	14.58	14.84
Max Deviator Stress (kPa)	255.0	286.6	393.1
Membrane Correction (kPa)	2.8	3.2	3.3
Corrected Deviator Stress (kPa)	252.2	283.4	389.8
Corrected Major Stress (kPa)	321.1	421.3	665.6



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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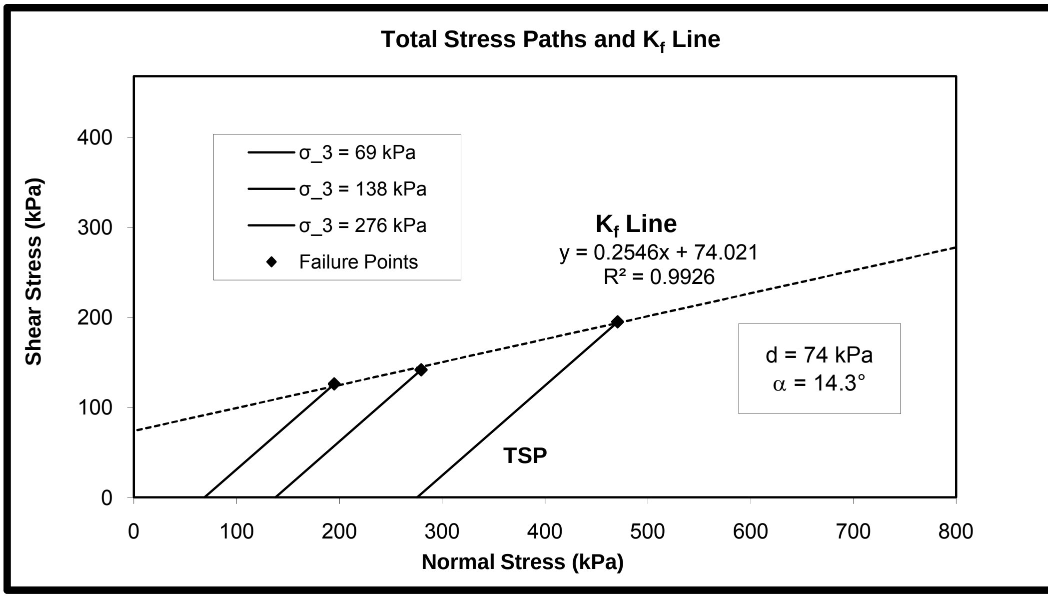
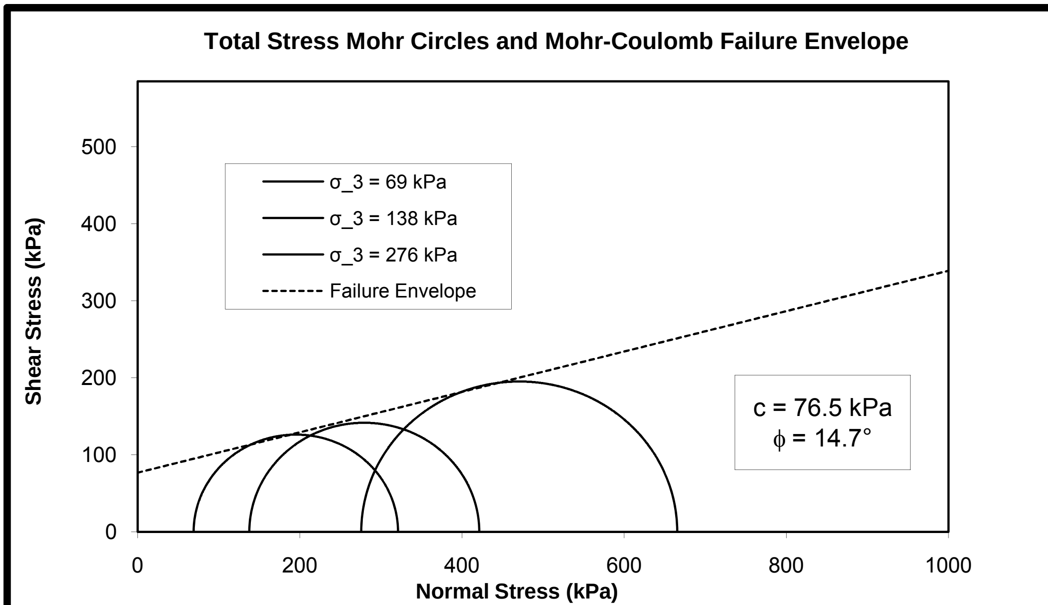
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% bentonite, 16% water content (L25B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/21/2009





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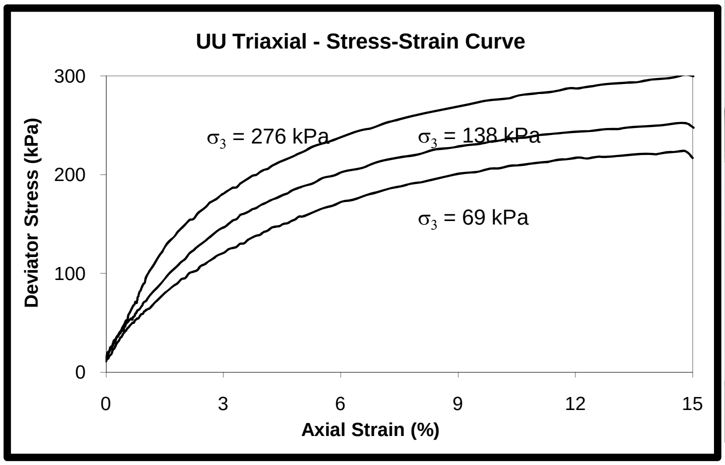
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% bentonite, 18% water content (L25B18W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/27/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	7
Wt. of Tin (g)	28.7	28	28.9	28.9	28.1	28.3
Wt. of Tin + Wet soil (g)	109.2	128	110.6	170.5	169.7	172.2
Wt. of Tin + Dry soil (g)	97.1	113.1	98.3	148.9	148.1	150.2
Wt. of Dry Soil (g)	68.40	85.10	69.40	120.0	120.0	121.9
Wt. of Water (g)	12.10	14.90	12.30	21.6	21.6	22.0
Water Content (%)	17.69	17.51	17.72	18.0	18.0	18.0
Average Water Content (%)		17.6			18.0	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.10	7.11	7.13
Average Diameter, D (cm)	3.53	3.55	3.55
Dry Unit Weight (kN/m^3)	16.97	16.77	16.94
Initial Void ratio	0.53	0.54	0.53
Saturation (%)	0.90	0.87	0.90
Strain at Failure (%)	14.81	14.59	14.82
Max Deviator Stress (kPa)	227.0	255.5	304.7
Membrane Correction (kPa)	3.3	3.2	3.2
Corrected Deviator Stress (kPa)	223.7	252.3	301.5
Corrected Major Stress (kPa)	292.6	390.2	577.2



Notes: Membrane correction according to ASTM D 2850-03a:

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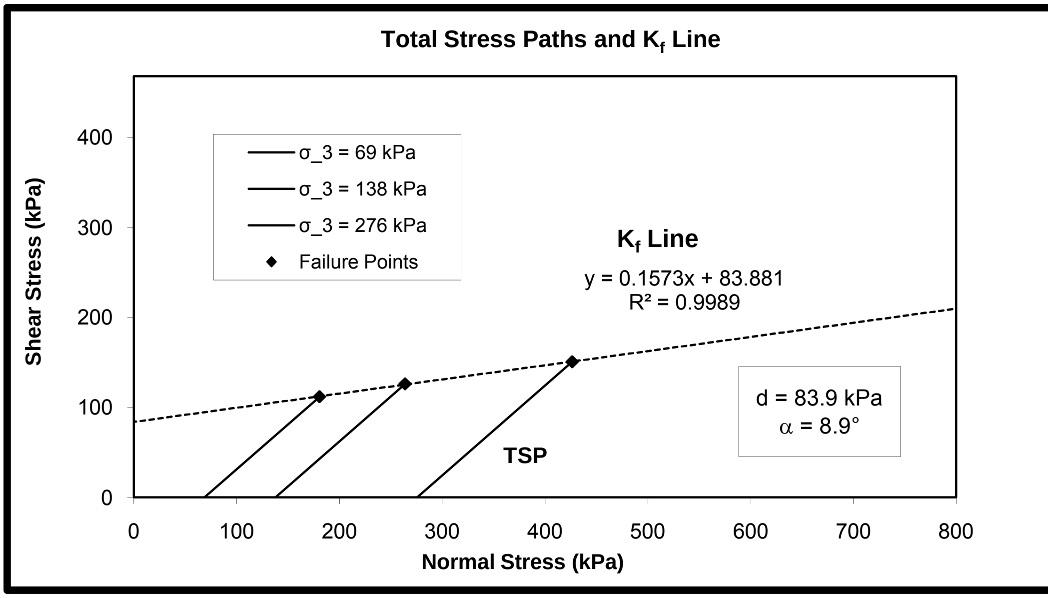
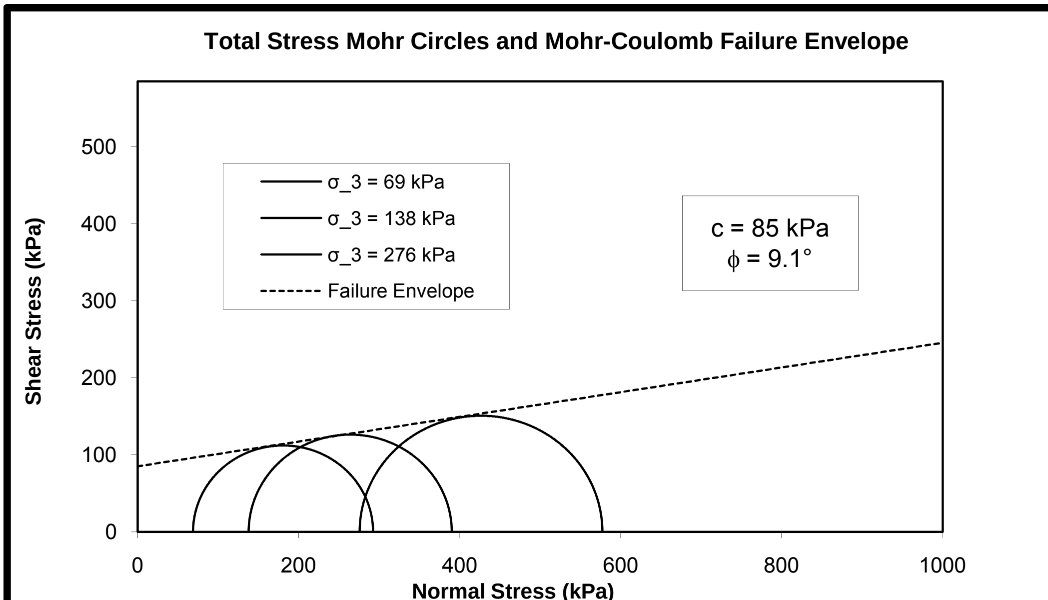
Sample:	Low energy compacted, 75% sand 25% bentonite, 18% water content (L25B18W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/27/2009





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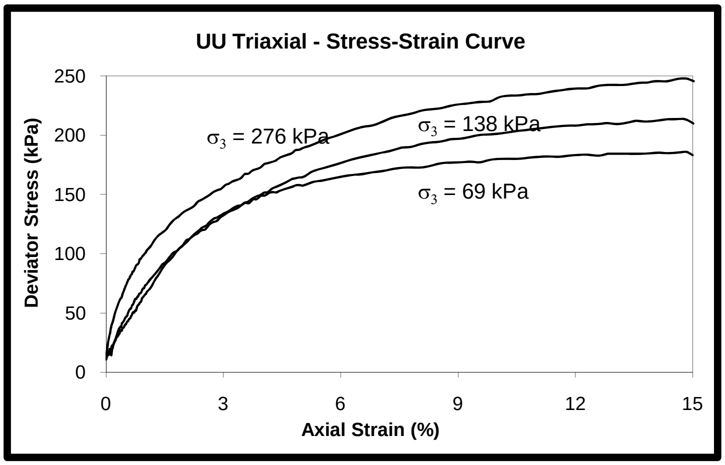
Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% bentonite, 20% water content (L25B20W)		
Specimen Type: Compacted	USCS: Clayey sand (SC)	Gs: 2.64	
Strain Rate: 1%/min	Tested By: Yueru Chen	Date: 8/27/2009	

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B-19	101	7
Wt. of Tin (g)	28.4	27.9	28.1	27.4	28.0	28.2
Wt. of Tin + Wet soil (g)	87.9	86.4	119	166.1	168.4	168.6
Wt. of Tin + Dry soil (g)	78	76.7	104	142.9	144.8	144.9
Wt. of Dry Soil (g)	49.60	48.80	75.90	115.5	116.8	116.7
Wt. of Water (g)	9.90	9.70	15.00	23.2	23.6	23.7
Water Content (%)	19.96	19.88	19.76	20.1	20.2	20.3
Average Water Content (%)		19.9			20.2	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.10	7.11	7.13
Average Diameter, D (cm)	3.53	3.53	3.53
Dry Unit Weight (kN/m^3)	16.27	16.43	16.40
Initial Void ratio	0.59	0.58	0.58
Saturation (%)	0.90	0.93	0.93
Strain at Failure (%)	14.84	14.81	14.82
Max Deviator Stress (kPa)	189.1	216.8	251.2
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	185.9	213.5	247.9
Corrected Major Stress (kPa)	254.8	351.4	523.7



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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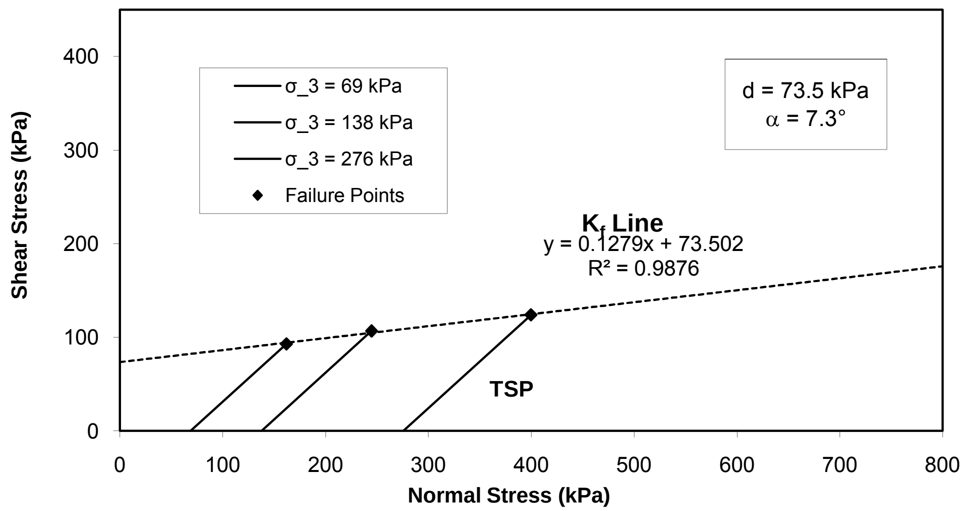
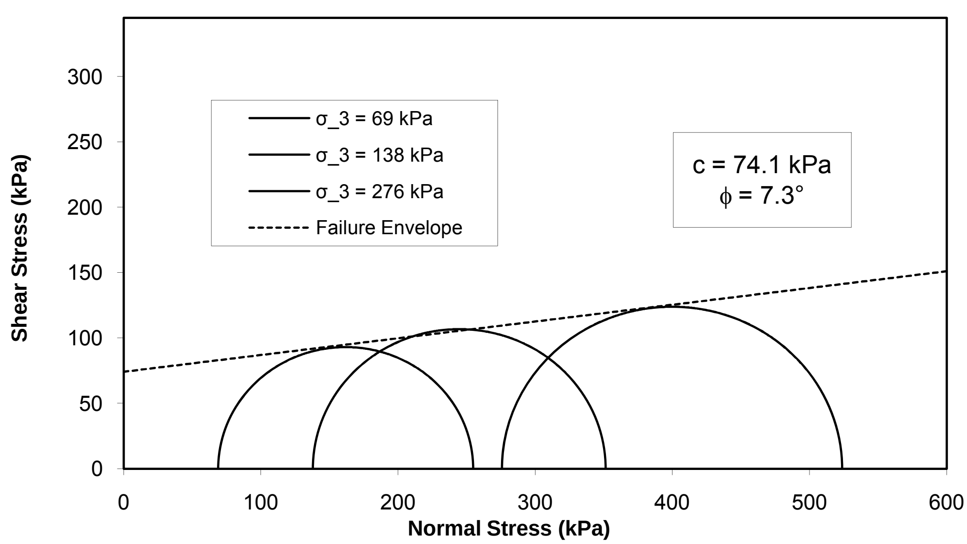
Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 75% sand 25% bentonite, 20% water content (L25B20W)				
Specimen Type:	Compacted	USCS:	Clayey sand (SC)	Gs:	2.64
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	8/27/2009

Total Stress Paths and K_f Line



Total Stress Mohr Circles and Mohr-Coulomb Failure Envelope

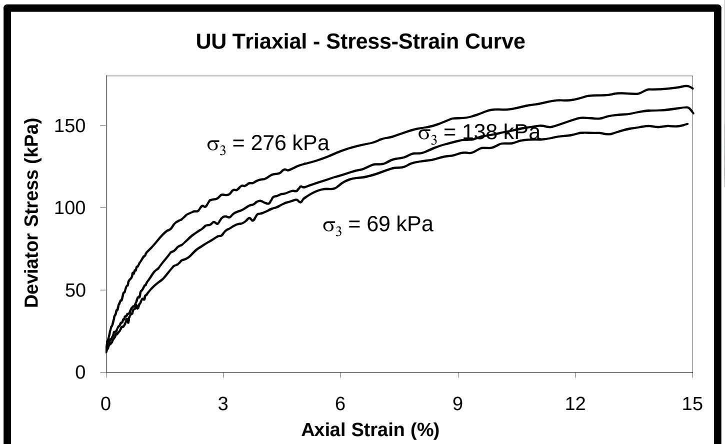


DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% bentonite, 22% water content (L25B22W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/28/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B-19	101	7
Wt. of Tin (g)	28.4	27.9	28.1	27.4	28.0	28.2
Wt. of Tin + Wet soil (g)	126.7	75.9	113.2	164.7	167.0	165.9
Wt. of Tin + Dry soil (g)	108.9	67.3	97.9	139.8	141.8	140.8
Wt. of Dry Soil (g)	80.50	39.40	69.80	112.4	113.8	112.6
Wt. of Water (g)	17.80	8.60	15.30	24.9	25.2	25.1
Water Content (%)	22.11	21.83	21.92	22.2	22.1	22.3
Average Water Content (%)		22.0			22.2	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.13	7.14	7.12
Average Diameter, D (cm)	3.52	3.53	3.54
Dry Unit Weight (kN/m^3)	15.91	15.98	15.76
Initial Void ratio	0.63	0.62	0.64
Saturation (%)	0.93	0.94	0.91
Strain at Failure (%)	14.87	14.87	14.86
Max Deviator Stress (kPa)	154.2	164.2	177.3
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	150.9	160.9	174.0
Corrected Major Stress (kPa)	219.8	298.8	449.8



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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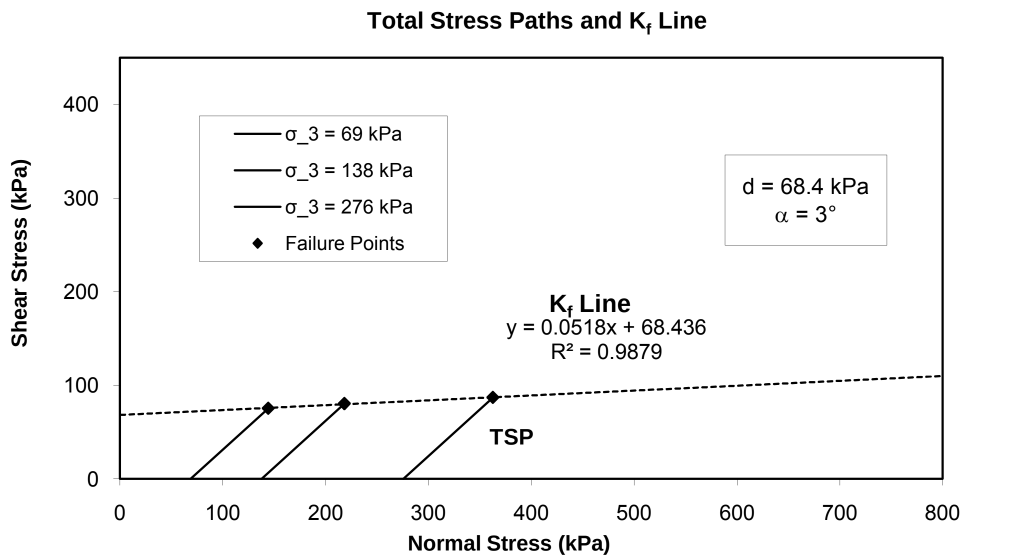
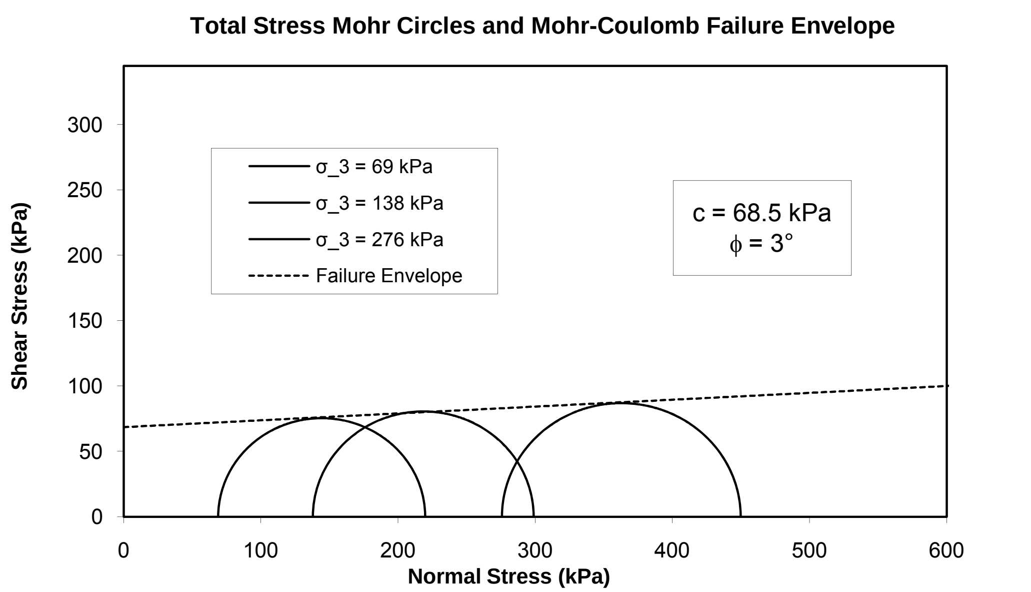
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% bentonite, 22% water content (L25B22W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/28/2009





DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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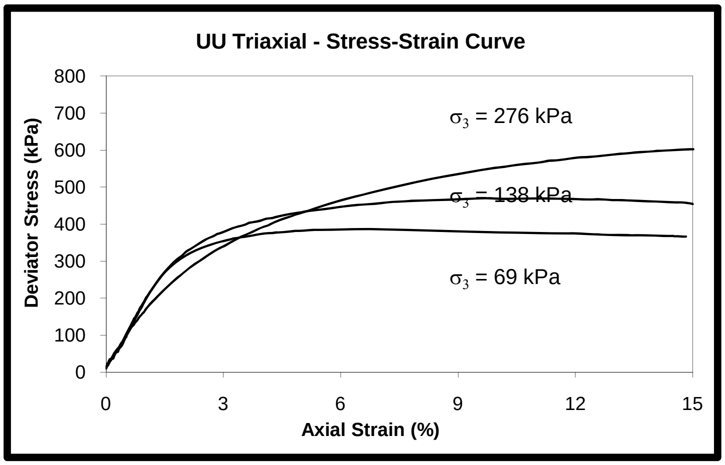
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 16% water content (L50B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/19/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28.0	28.8	28.9	28.2	28.3
Wt. of Tin + Wet soil (g)	77.4	64.3	54.2	151.4	144.2	139.8
Wt. of Tin + Dry soil (g)	70.5	59.1	50.6	134.1	126.8	123.9
Wt. of Dry Soil (g)	41.8	31.1	21.8	105.2	98.6	95.6
Wt. of Water (g)	6.9	5.2	3.6	17.3	17.4	15.9
Water Content (%)	16.5	16.7	16.5	16.4	17.6	16.6
Average Water Content (%)		16.6			16.9	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.14	6.76	6.66
Average Diameter, D (cm)	3.53	3.53	3.52
Dry Unit Weight (kN/m^3)	14.75	14.62	14.47
Initial Void ratio	0.75	0.76	0.78
Saturation (%)	0.58	0.61	0.56
Strain at Failure (%)	6.80	9.57	15.01
Max Deviator Stress (kPa)	388.0	472.1	605.3
Membrane Correction (kPa)	1.5	2.1	3.3
Corrected Deviator Stress (kPa)	386.5	470.0	602.0
Corrected Major Stress (kPa)	455.5	607.9	877.8



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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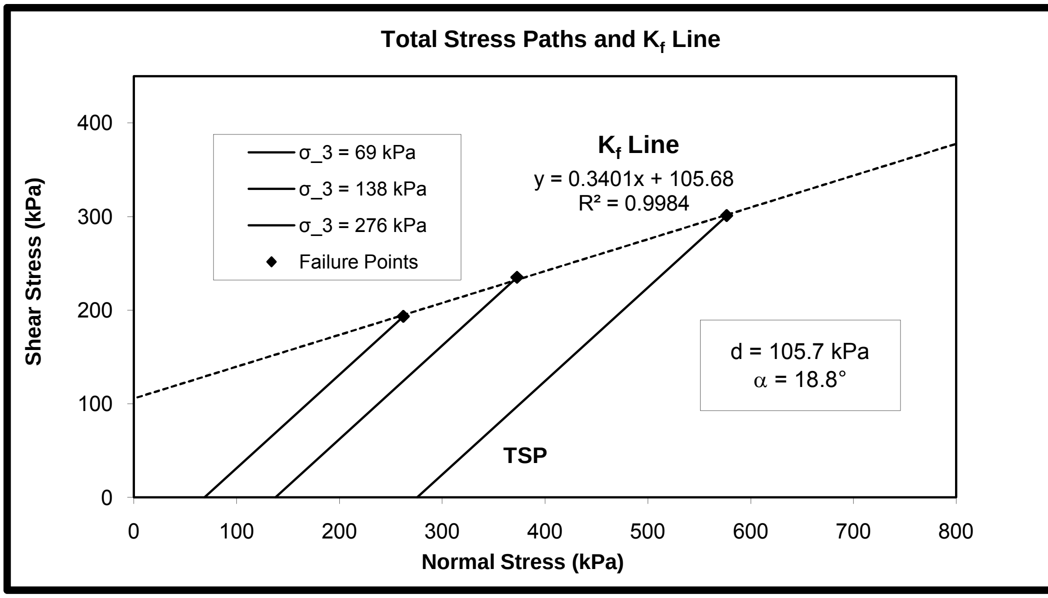
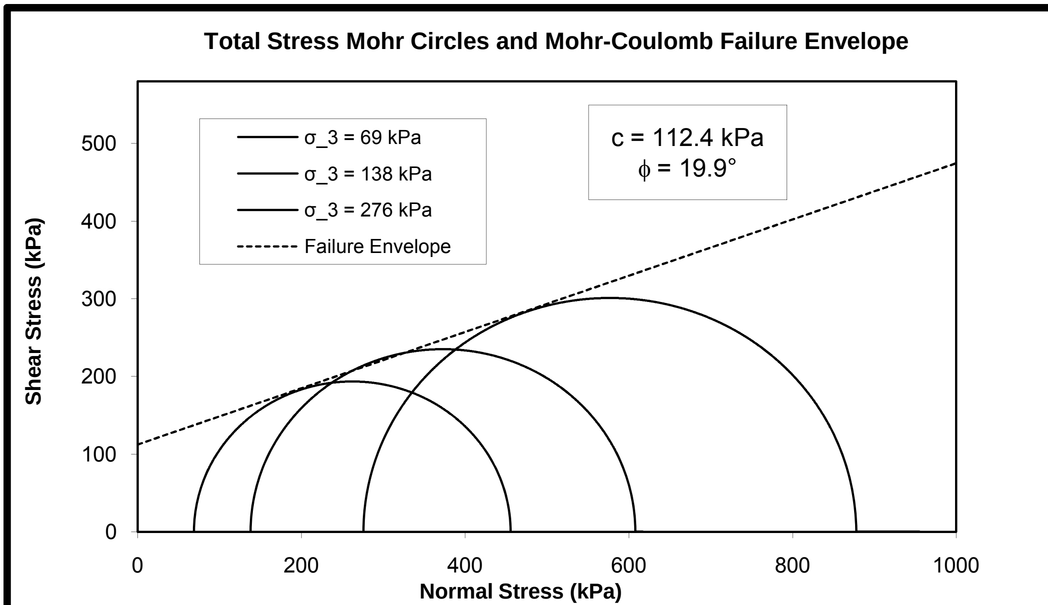
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 16% water content (L50B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/19/2009





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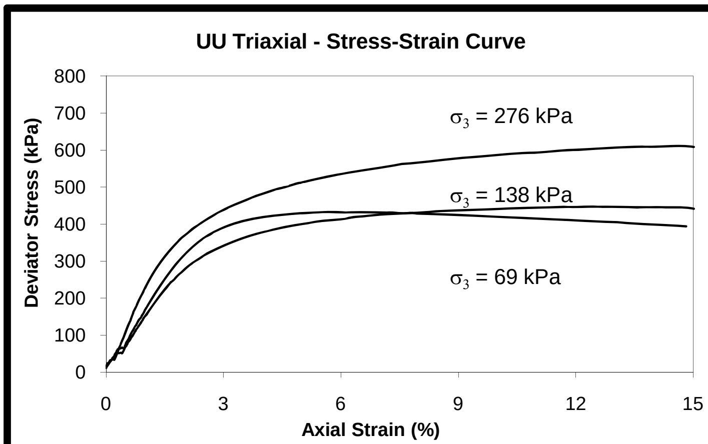
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 18% water content (L50B18W)		
Specimen Type: Compacted		USCS: Clayey sand (SC)	Gs: 2.63
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 8/20/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28.0	28.9	28.9	28.1	28.3
Wt. of Tin + Wet soil (g)	92.2	59.8	70.4	147.3	141.6	152.3
Wt. of Tin + Dry soil (g)	82.5	54.8	64.0	129.4	124.5	133.1
Wt. of Dry Soil (g)	53.8	26.8	35.1	100.5	96.4	104.8
Wt. of Water (g)	9.7	5.0	6.4	17.9	17.1	19.2
Water Content (%)	18.0	18.7	18.2	17.8	17.7	18.3
Average Water Content (%)	18.3			18.0		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	6.68	6.66	6.93
Average Diameter, D (cm)	3.54	3.55	3.55
Dry Unit Weight (kN/m^3)	15.00	14.35	14.99
Initial Void ratio	0.72	0.80	0.72
Saturation (%)	0.65	0.58	0.67
Strain at Failure (%)	5.80	12.32	14.84
Max Deviator Stress (kPa)	434.2	450.5	613.7
Membrane Correction (kPa)	1.3	2.7	3.3
Corrected Deviator Stress (kPa)	432.9	447.8	610.5
Corrected Major Stress (kPa)	501.9	585.7	886.3



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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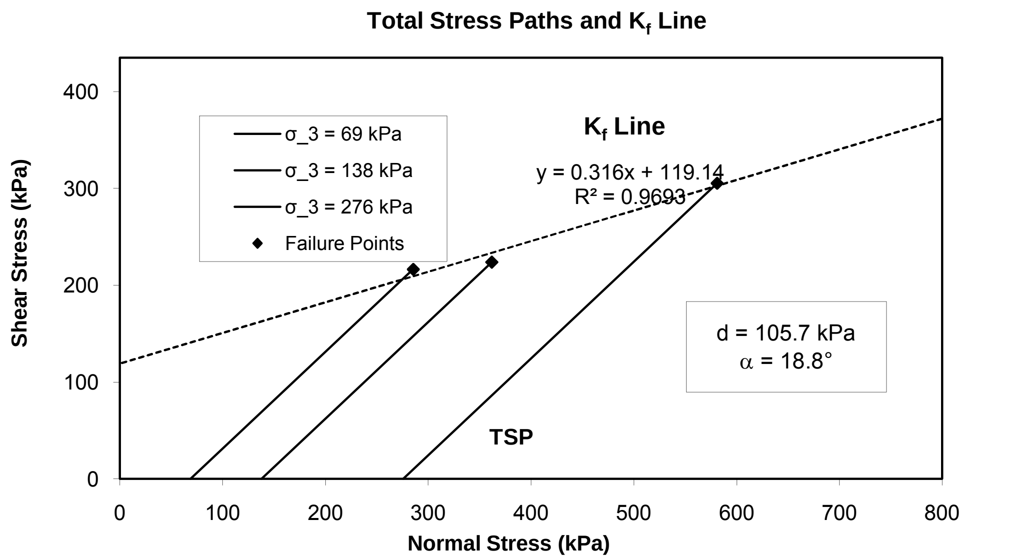
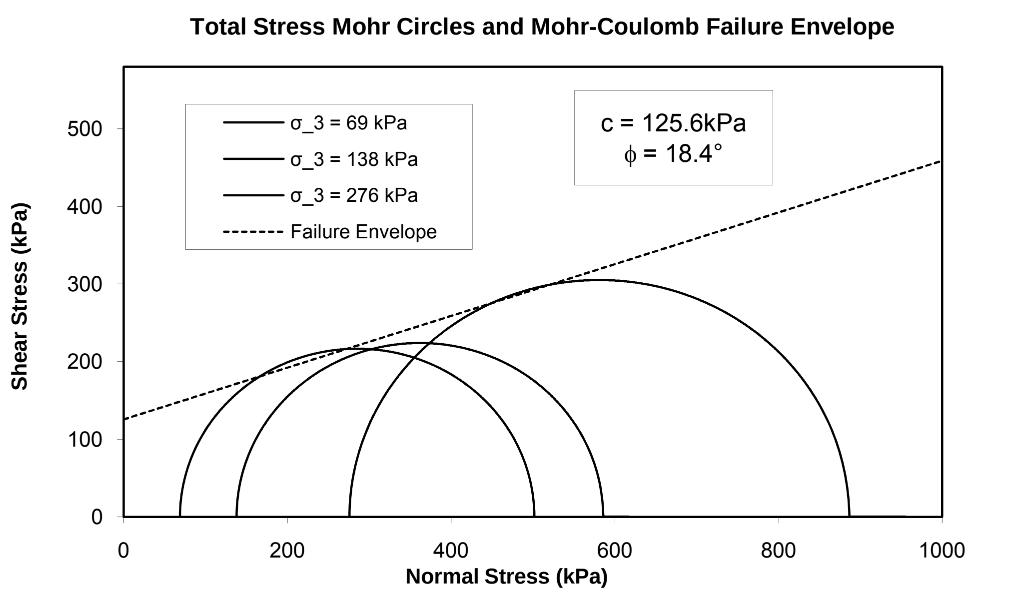
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 16% water content (L50B18W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/20/2009





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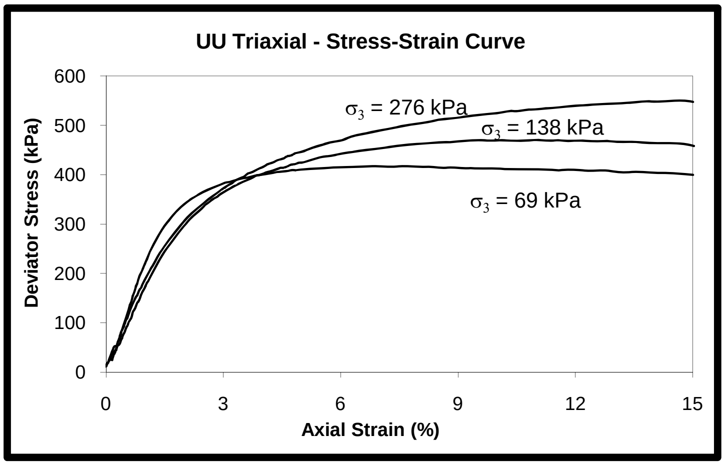
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 19% water content (L50B19W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/16/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28.0	28.9	28.9	28.2	28.4
Wt. of Tin + Wet soil (g)	109.4	101.0	103.8	158.5	154.2	151.3
Wt. of Tin + Dry soil (g)	96.4	89.3	91.7	137.7	133.9	131.4
Wt. of Dry Soil (g)	67.7	61.3	62.8	108.8	105.7	103.0
Wt. of Water (g)	13.0	11.7	12.1	20.8	20.3	19.9
Water Content (%)	19.2	19.1	19.3	19.1	19.2	19.3
Average Water Content (%)		19.2			19.2	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.09	6.88	6.74
Average Diameter, D (cm)	3.51	3.53	3.51
Dry Unit Weight (kN/m^3)	15.57	15.39	15.47
Initial Void ratio	0.66	0.68	0.67
Saturation (%)	0.77	0.75	0.76
Strain at Failure (%)	7.57	11.06	14.57
Max Deviator Stress (kPa)	419.0	472.9	553.5
Membrane Correction (kPa)	1.7	2.4	3.2
Corrected Deviator Stress (kPa)	417.3	470.4	550.3
Corrected Major Stress (kPa)	486.2	608.3	826.1



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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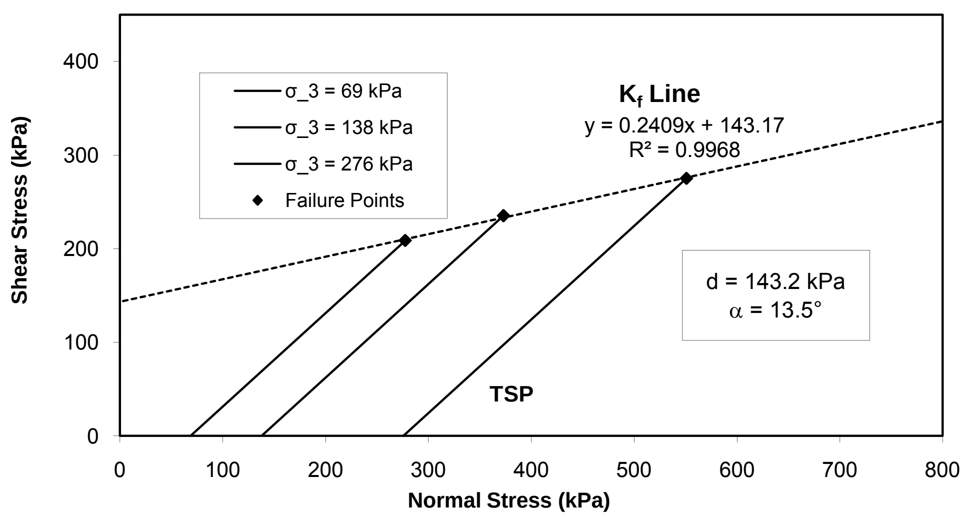
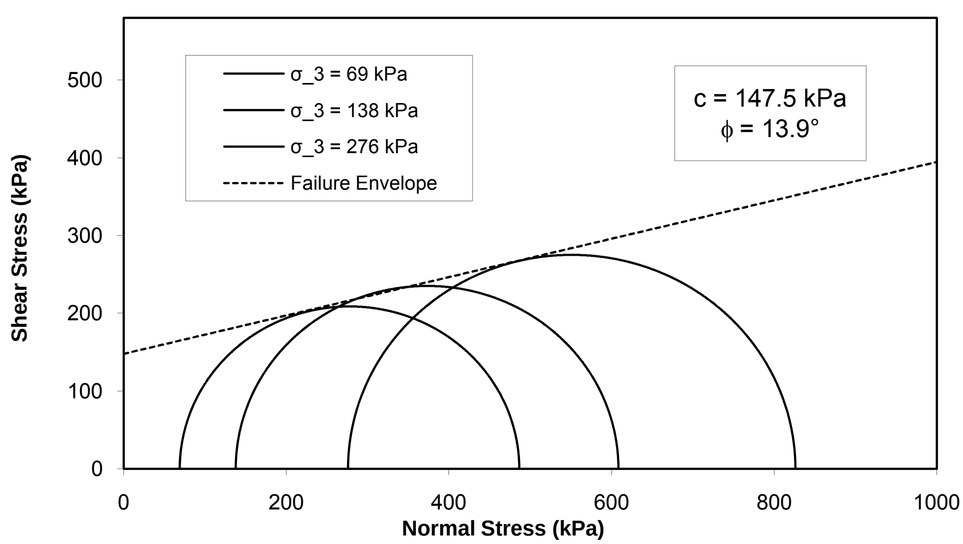
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 19% water content (L50B19W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/16/2009

Total Stress Paths and K_f Line



Total Stress Mohr Circles and Mohr-Coulomb Failure Envelope



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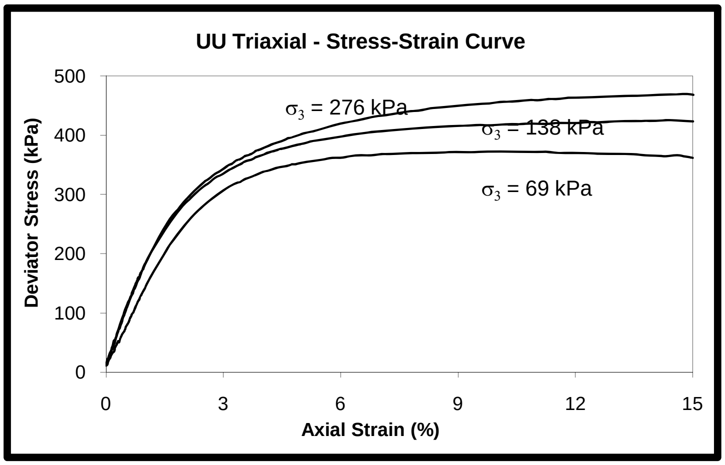
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 20% water content (L50B20W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/15/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B-19	101	7
Wt. of Tin (g)	28.5	27.9	28.1	27.4	28.0	28.2
Wt. of Tin + Wet soil (g)	83.3	97.7	114.9	160.2	153.8	159.8
Wt. of Tin + Dry soil (g)	74.0	85.6	99.8	137.0	131.9	136.8
Wt. of Dry Soil (g)	45.5	57.7	71.7	109.6	103.9	108.6
Wt. of Water (g)	9.3	12.1	15.1	23.2	21.9	23.0
Water Content (%)	20.4	21.0	21.1	21.2	21.1	21.2
Average Water Content (%)		20.8			21.1	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.03	6.64	6.89
Average Diameter, D (cm)	3.54	3.52	3.54
Dry Unit Weight (kN/m^3)	15.57	15.78	15.71
Initial Void ratio	0.66	0.64	0.64
Saturation (%)	0.85	0.87	0.87
Strain at Failure (%)	10.05	14.31	14.83
Max Deviator Stress (kPa)	374.8	428.4	472.9
Membrane Correction (kPa)	2.2	3.2	3.3
Corrected Deviator Stress (kPa)	372.6	425.3	469.6
Corrected Major Stress (kPa)	441.5	563.2	745.4



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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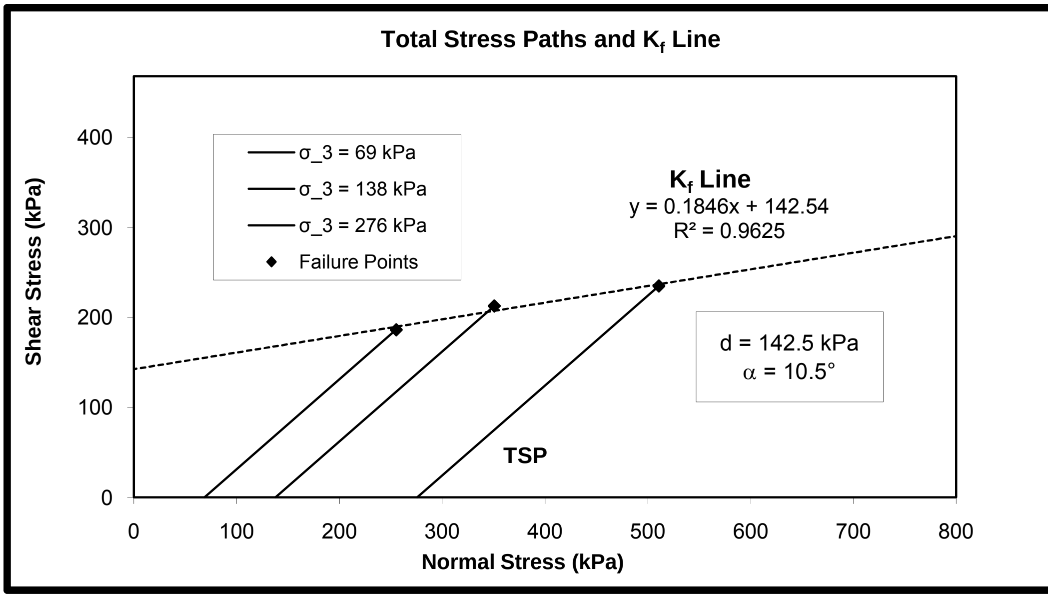
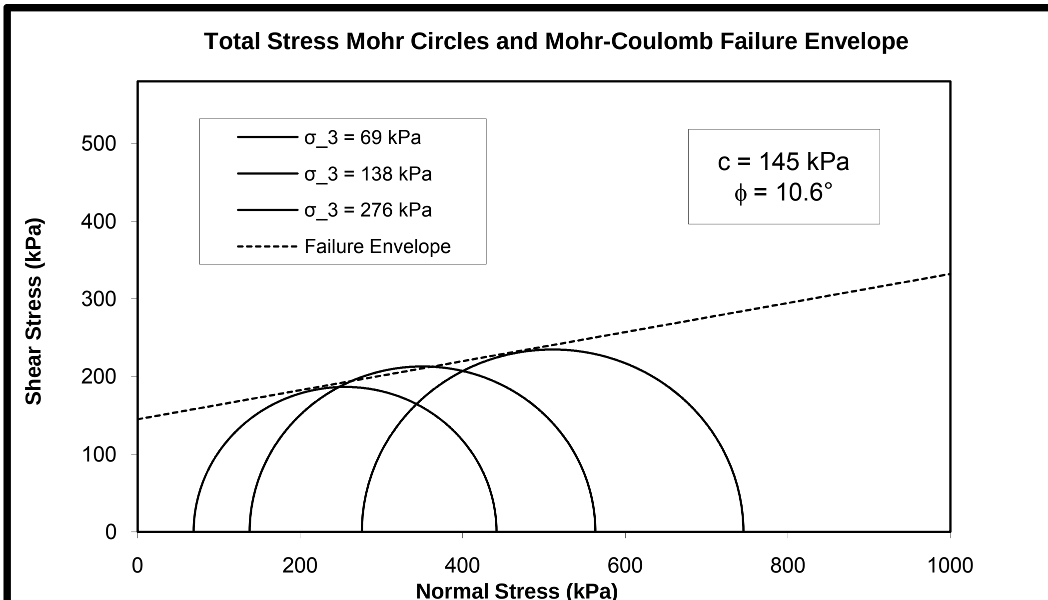
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 20% water content (L50B20W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/15/2009





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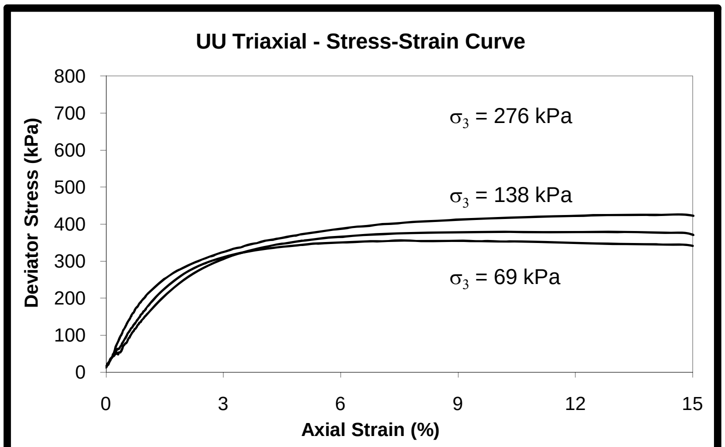
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 18% water content (L50B22W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/26/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B-19	101	7
Wt. of Tin (g)	28.4	27.9	28.1	27.4	28.0	28.2
Wt. of Tin + Wet soil (g)	85.7	101.9	79.1	158.2	162.3	158.4
Wt. of Tin + Dry soil (g)	75.3	88.5	69.8	134.3	137.8	134.6
Wt. of Dry Soil (g)	46.9	60.6	41.7	106.9	109.8	106.4
Wt. of Water (g)	10.4	13.4	9.3	23.9	24.5	23.8
Water Content (%)	22.2	22.1	22.3	22.4	22.3	22.4
Average Water Content (%)		22.2			22.3	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	6.84	7.00	6.77
Average Diameter, D (cm)	3.55	3.54	3.54
Dry Unit Weight (kN/m^3)	15.49	15.63	15.66
Initial Void ratio	0.67	0.65	0.65
Saturation (%)	0.88	0.90	0.91
Strain at Failure (%)	7.55	12.58	14.58
Max Deviator Stress (kPa)	357.5	381.6	429.0
Membrane Correction (kPa)	1.3	2.7	3.3
Corrected Deviator Stress (kPa)	356.2	378.9	425.8
Corrected Major Stress (kPa)	425.1	516.8	701.5



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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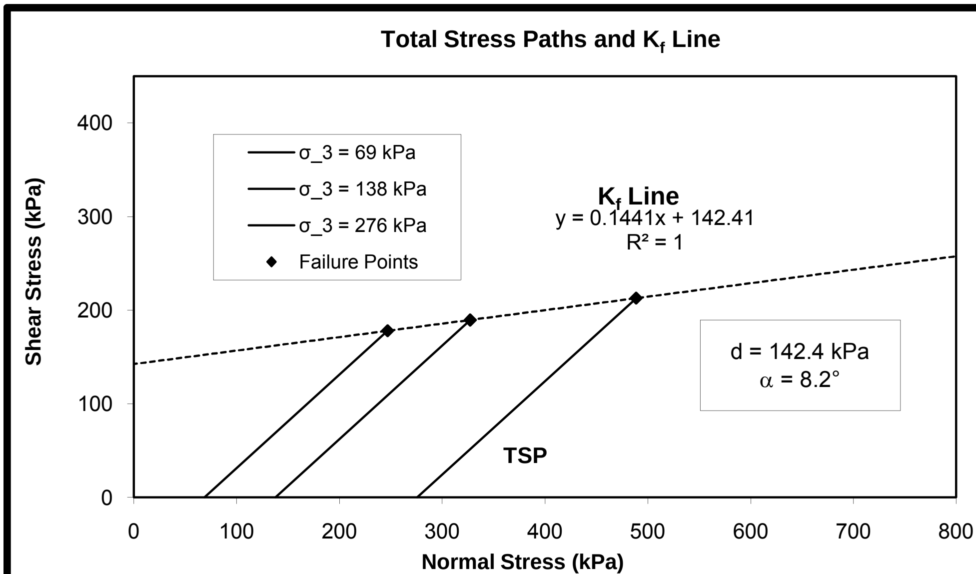
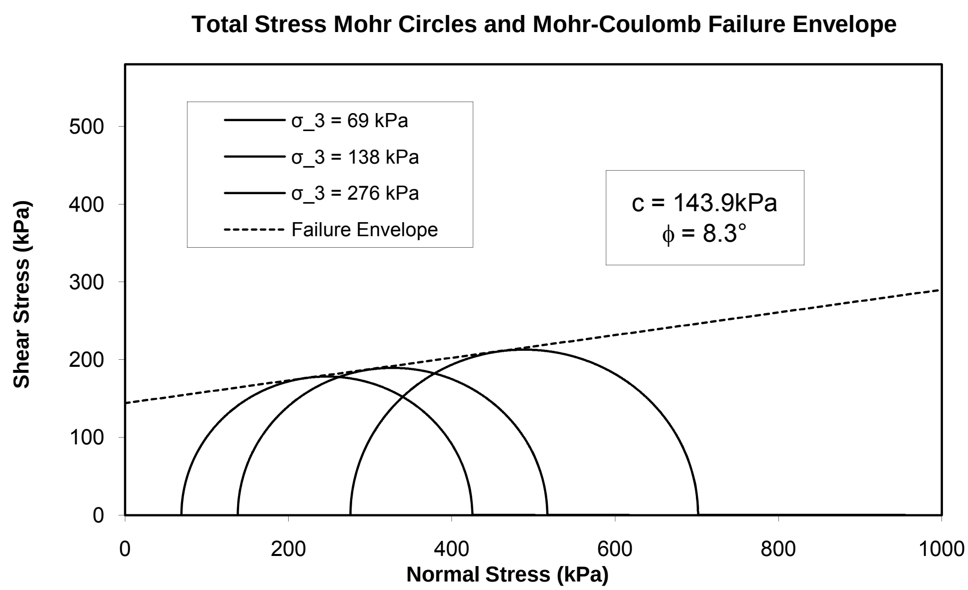
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 16% water content (L50B22W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/26/2009





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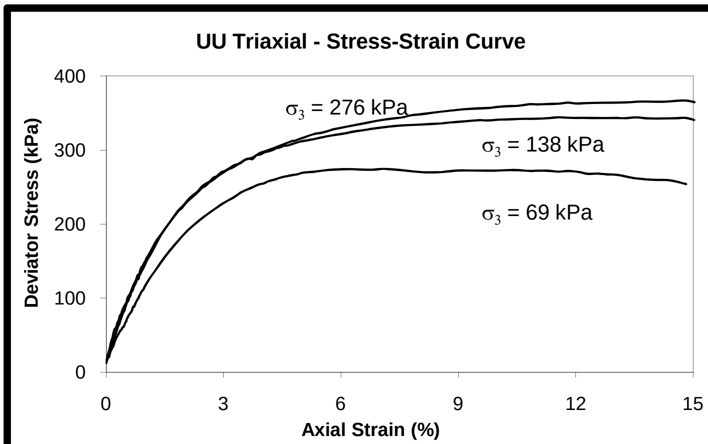
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 23% water content (L50B23W)		
Specimen Type: Compacted		USCS: Clayey sand (SC)	Gs: 2.63
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 10/15/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28.0	28.9	28.9	28.2	28.4
Wt. of Tin + Wet soil (g)	59.6	89.0	116.1	159.2	162.7	158.6
Wt. of Tin + Dry soil (g)	53.7	77.5	99.7	134.7	137.6	134.1
Wt. of Dry Soil (g)	25.0	49.5	70.8	105.8	109.4	105.7
Wt. of Water (g)	5.9	11.5	16.4	24.5	25.1	24.5
Water Content (%)	23.6	23.2	23.2	23.2	22.9	23.2
Average Water Content (%)		23.3			23.1	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	6.80	7.08	6.90
Average Diameter, D (cm)	3.55	3.51	3.52
Dry Unit Weight (kN/m^3)	15.46	15.65	15.45
Initial Void ratio	0.67	0.65	0.67
Saturation (%)	0.91	0.93	0.91
Strain at Failure (%)	7.05	13.56	14.81
Max Deviator Stress (kPa)	276.1	347.2	370.2
Membrane Correction (kPa)	1.5	3.0	3.3
Corrected Deviator Stress (kPa)	274.5	344.2	366.9
Corrected Major Stress (kPa)	343.5	482.1	642.7

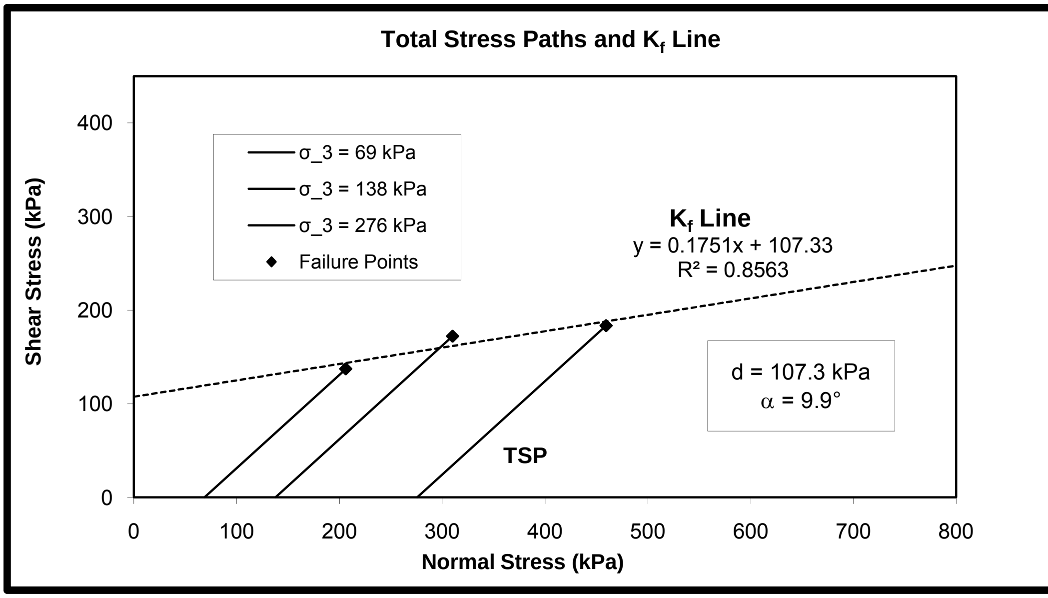


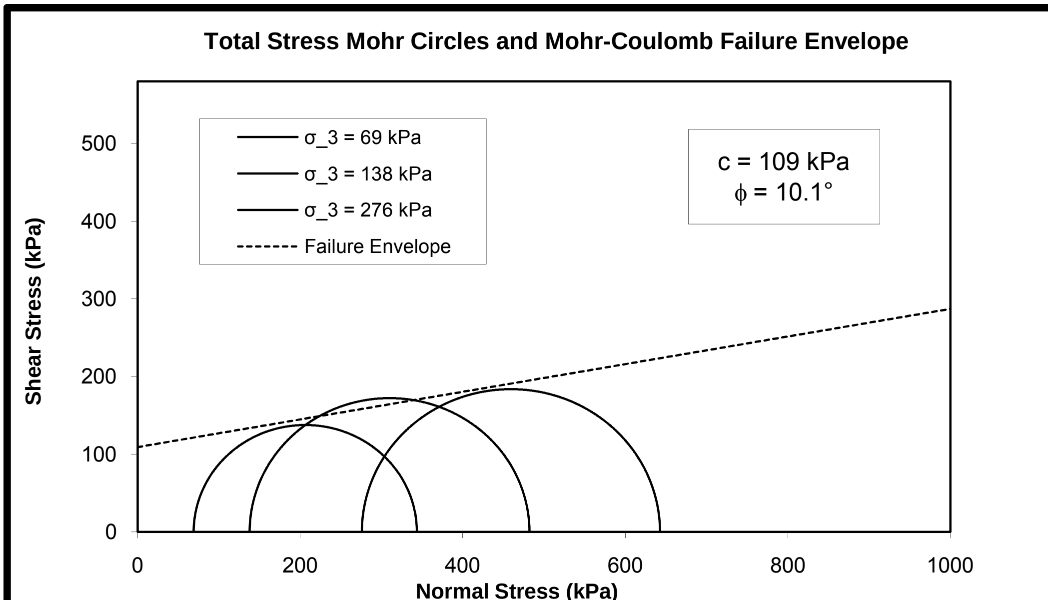
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 50% sand 50% bentonite, 23% water content (L50B23W)				
Specimen Type:	Compacted	USCS:	Clayey sand (SC)	Gs:	2.63
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	10/15/2009





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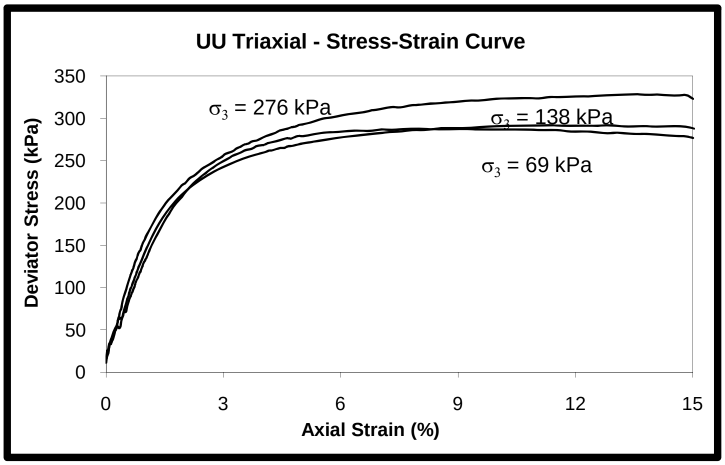
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 24% water content (L50B24W)		
Specimen Type: Compacted		USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 8/21/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28.0	28.9	28.9	28.1	28.3
Wt. of Tin + Wet soil (g)	84.5	101.8	91.1	161.1	159.1	159.1
Wt. of Tin + Dry soil (g)	73.6	87.8	79.0	135.4	133.4	133.4
Wt. of Dry Soil (g)	44.9	59.8	50.1	106.5	105.3	105.1
Wt. of Water (g)	10.9	14.0	12.1	25.7	25.7	25.7
Water Content (%)	24.3	23.4	24.2	24.1	24.4	24.5
Average Water Content (%)		23.9			24.3	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	6.86	7.08	6.95
Average Diameter, D (cm)	3.54	3.56	3.54
Dry Unit Weight (kN/m^3)	15.52	14.63	15.11
Initial Void ratio	0.66	0.76	0.71
Saturation (%)	0.96	0.84	0.91
Strain at Failure (%)	9.06	12.83	13.59
Max Deviator Stress (kPa)	289.5	294.7	331.3
Membrane Correction (kPa)	2.0	2.8	3.0
Corrected Deviator Stress (kPa)	287.5	291.9	328.3
Corrected Major Stress (kPa)	356.4	429.8	604.1



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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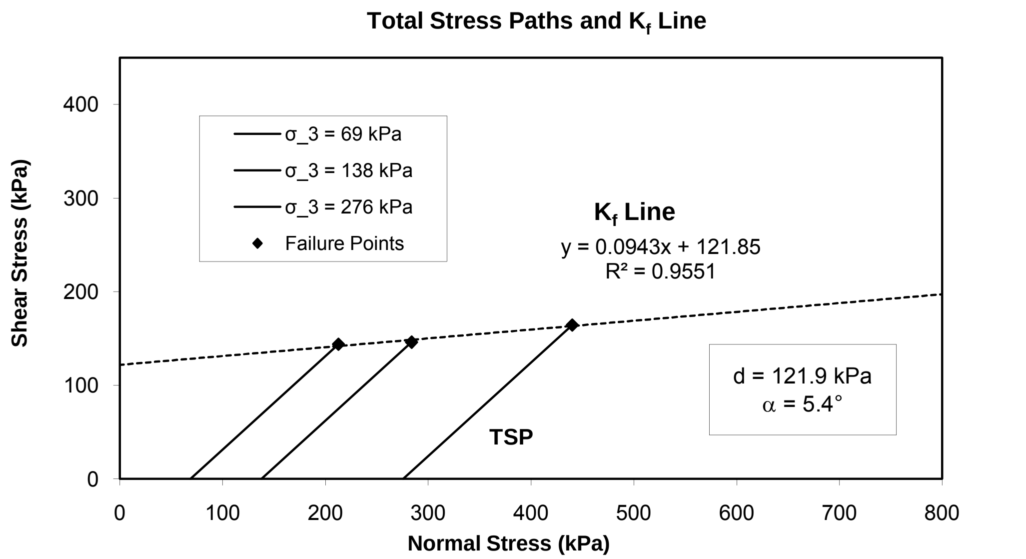
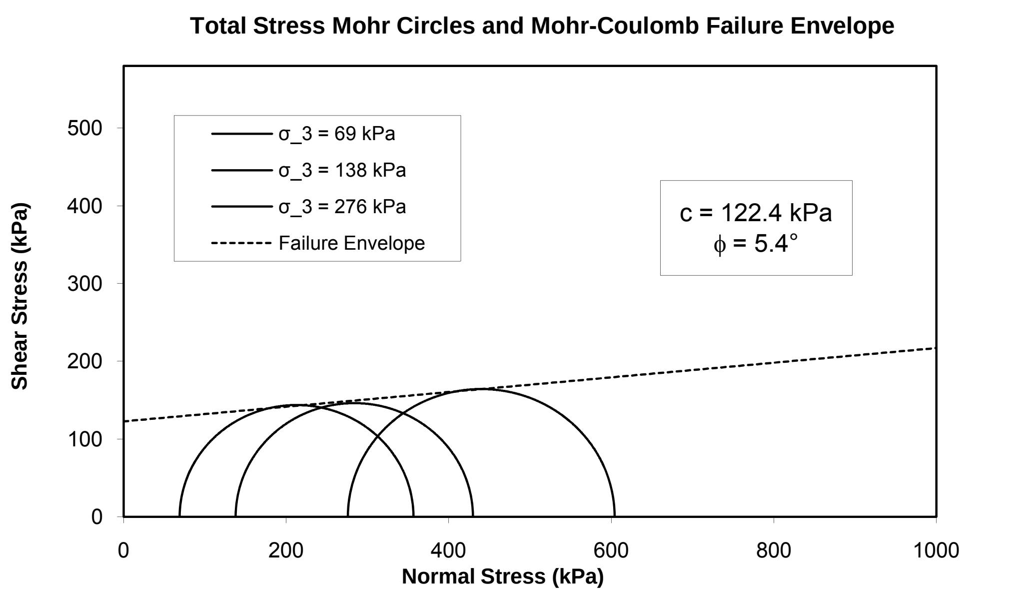
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% bentonite, 24% water content (L50B24W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/21/2009





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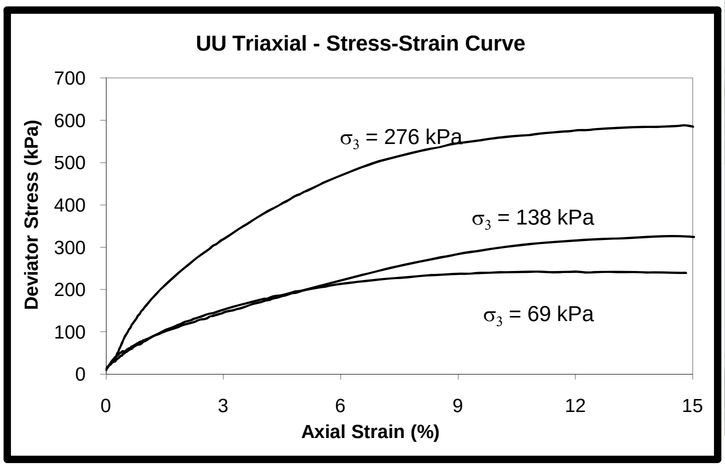
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85% sand 15% bentonite, 10% water content (S15B10W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/18/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28	28.8	28.9	28.1	28.3
Wt. of Tin + Wet soil (g)	83	108.9	98.3	158.5	156.9	159.6
Wt. of Tin + Dry soil (g)	78.1	101.4	92	146.5	145.0	147.5
Wt. of Dry Soil (g)	49.40	73.40	63.20	117.60	116.90	119.20
Wt. of Water (g)	4.90	7.50	6.30	12.00	11.90	12.10
Water Content (%)	9.92	10.22	9.97	10.20	10.18	10.15
Average Water Content (%)		10.0			10.2	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.11	7.12	7.11
Average Diameter, D (cm)	3.52	3.54	3.53
Dry Unit Weight (kN/m^3)	16.66	16.37	16.83
Initial Void ratio	0.56	0.59	0.54
Saturation (%)	0.48	0.46	0.49
Strain at Failure (%)	12.82	14.58	14.82
Max Deviator Stress (kPa)	244.8	329.6	591.0
Membrane Correction (kPa)	2.8	3.2	3.3
Corrected Deviator Stress (kPa)	241.9	326.4	587.8
Corrected Major Stress (kPa)	310.9	464.3	863.6



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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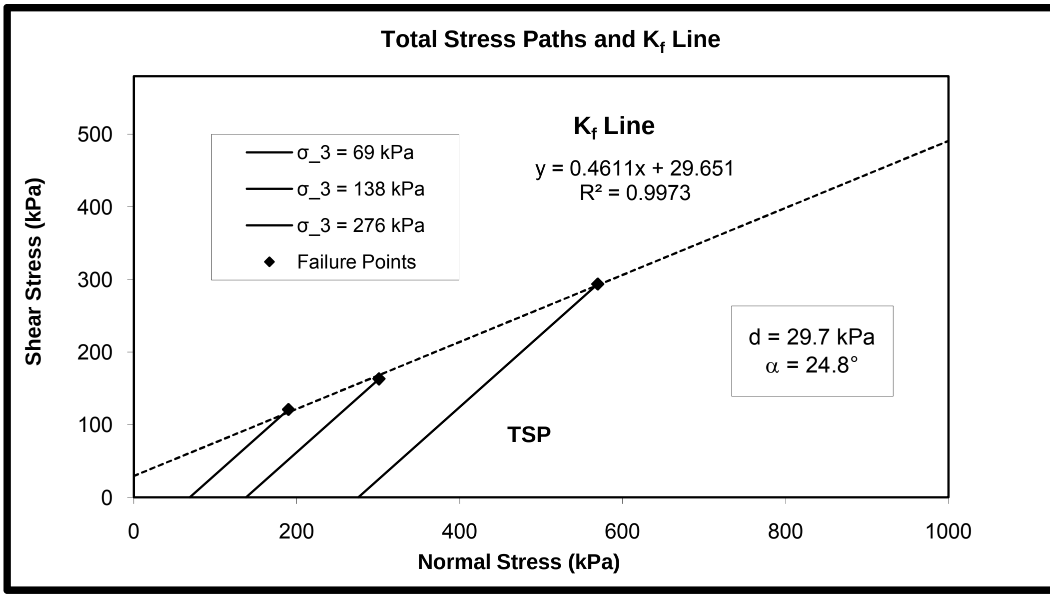
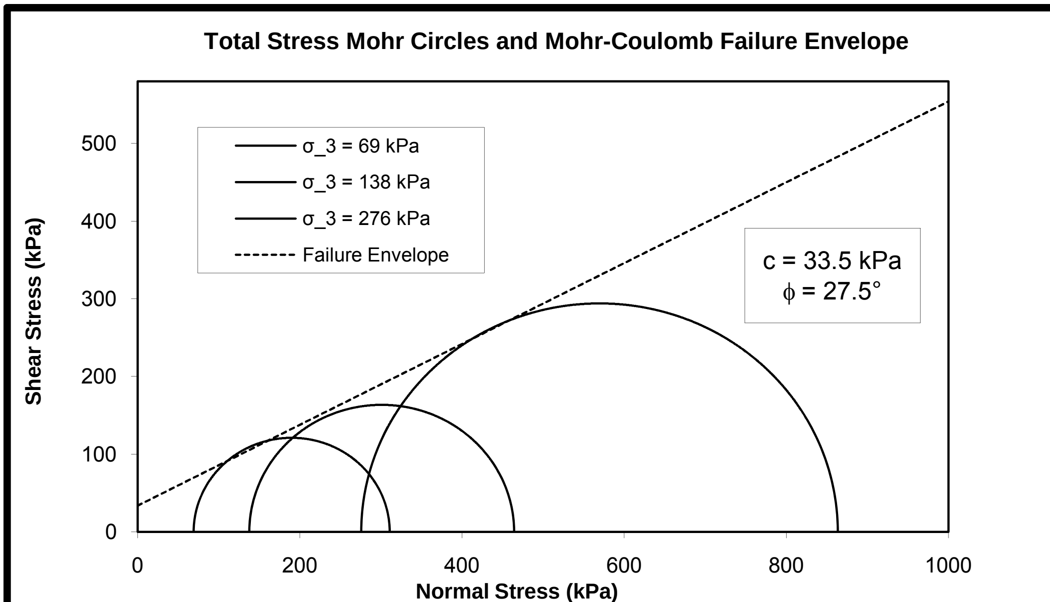
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85% sand 15% bentonite,10% water content (S15B10W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/18/2009





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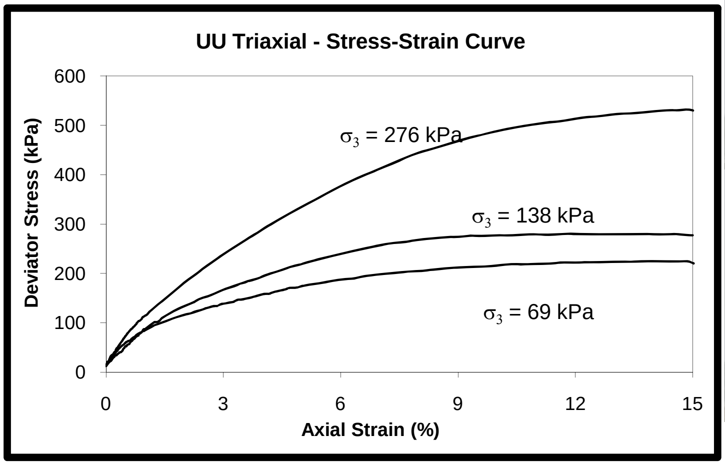
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 85% sand 15% bentonite, 12% water content (S15B12W)				
Specimen Type:	Compacted	USCS:	Clayey sand (SC)	Gs:	2.65
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	8/13/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B14	2010	410	majid	FJ-1	59
Wt. of Tin (g)	29.1	28.6	28.4	28.7	28.1	28.3
Wt. of Tin + Wet soil (g)	133	144	112.6	165.1	164.4	163.1
Wt. of Tin + Dry soil (g)	121.8	131.4	103.3	149.9	149.2	148.5
Wt. of Dry Soil (g)	92.70	102.80	74.90	121.20	121.10	120.20
Wt. of Water (g)	11.20	12.60	9.30	15.20	15.20	14.60
Water Content (%)	12.08	12.26	12.42	12.54	12.55	12.15
Average Water Content (%)		12.3			12.4	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.13	7.13	7.12
Average Diameter, D (cm)	3.54	3.55	3.54
Dry Unit Weight (kN/m^3)	16.98	16.87	16.84
Initial Void ratio	0.53	0.54	0.54
Saturation (%)	0.63	0.61	0.59
Strain at Failure (%)	13.86	13.83	14.86
Max Deviator Stress (kPa)	228.2	283.0	535.6
Membrane Correction (kPa)	3.1	3.0	3.3
Corrected Deviator Stress (kPa)	225.1	279.9	532.3
Corrected Major Stress (kPa)	294.1	417.8	808.1



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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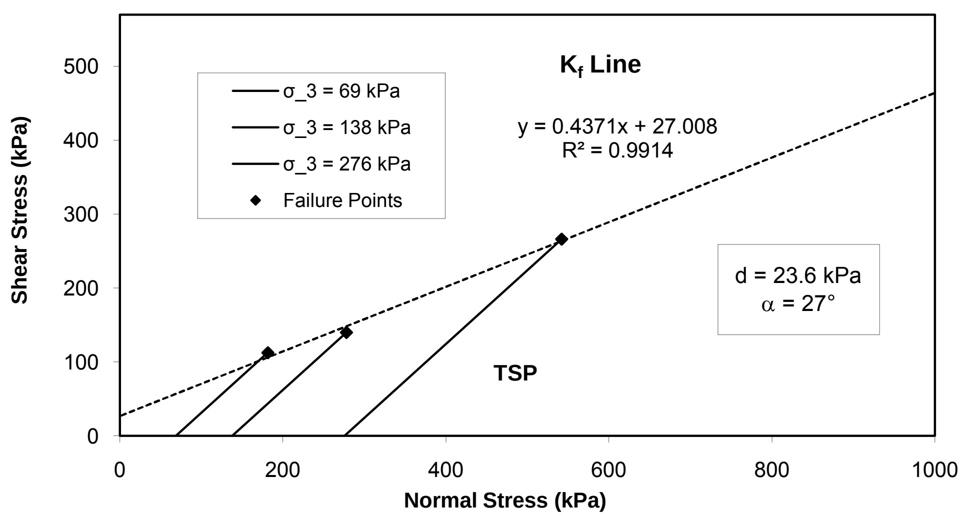
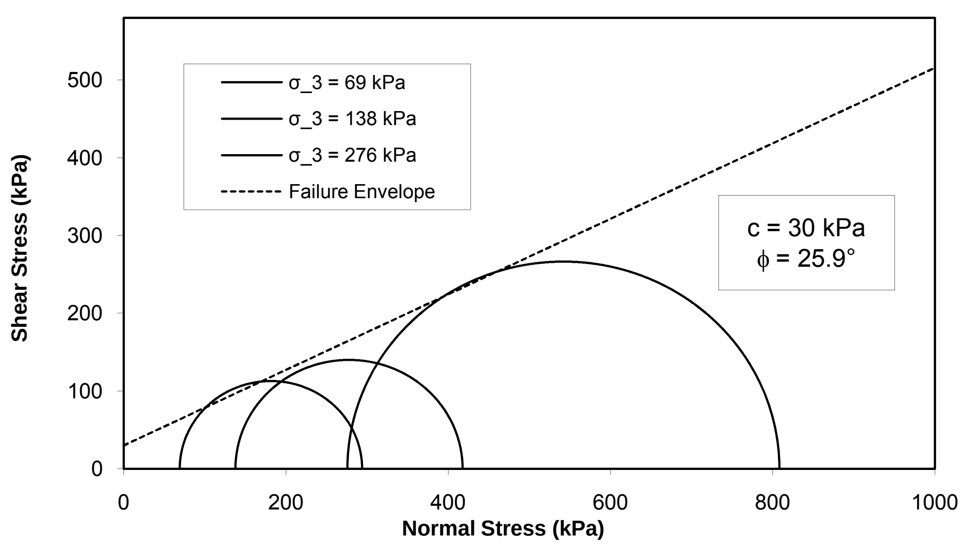
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 85% sand 15% bentonite,12% water content (S15B12W)				
Specimen Type:	Compacted	USCS:	Clayey sand (SC)	Gs:	2.65
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	8/13/2009

Total Stress Paths and K_f Line



Total Stress Mohr Circles and Mohr-Coulomb Failure Envelope



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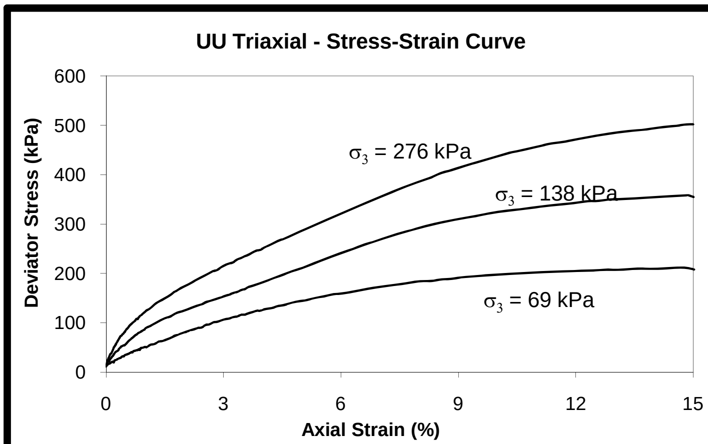
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85% sand 15% bentonite, 14% water content (S15B14W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/13/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	31	209	201
Wt. of Tin (g)	28.7	28	28.8	28.3	28.1	28.9
Wt. of Tin + Wet soil (g)	127	104.8	133.1	165.4	170.3	167.3
Wt. of Tin + Dry soil (g)	114.7	95.2	120	148.3	152.4	150.0
Wt. of Dry Soil (g)	86.00	67.20	91.20	120.00	124.30	121.10
Wt. of Water (g)	12.30	9.60	13.10	17.10	17.90	17.30
Water Content (%)	14.30	14.29	14.36	14.25	14.40	14.29
Average Water Content (%)	14.3			14.3		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.09	7.13	7.14
Average Diameter, D (cm)	3.51	3.53	3.51
Dry Unit Weight (kN/m^3)	17.13	17.46	17.17
Initial Void ratio	0.52	0.49	0.51
Saturation (%)	0.73	0.78	0.74
Strain at Failure (%)	14.58	14.84	15.00
Max Deviator Stress (kPa)	214.6	362.0	505.4
Membrane Correction (kPa)	3.2	3.3	3.3
Corrected Deviator Stress (kPa)	211.4	358.7	502.1
Corrected Major Stress (kPa)	280.3	496.6	777.9



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1-\sigma_3)=4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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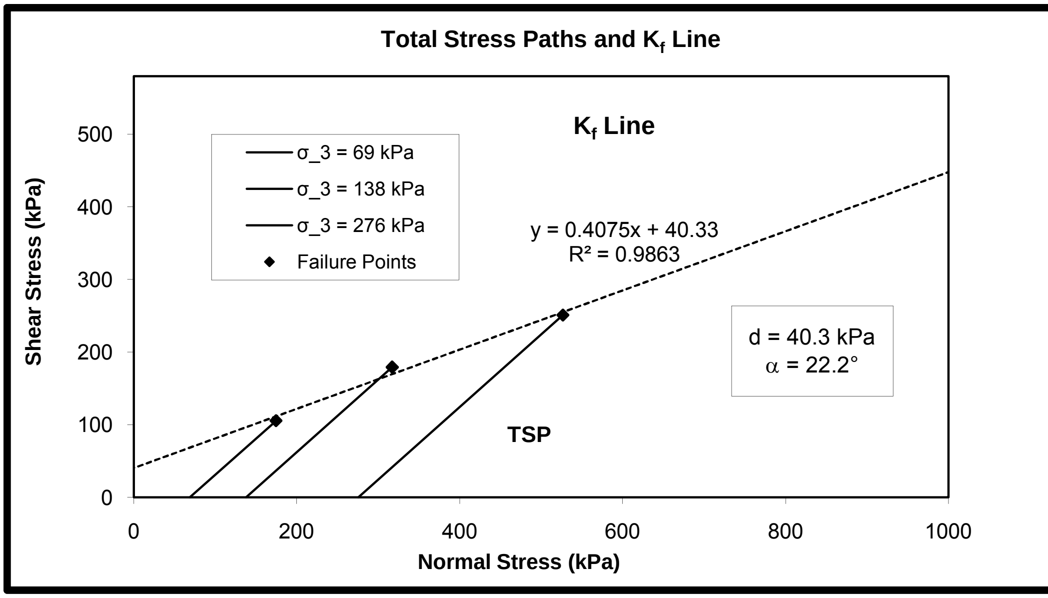
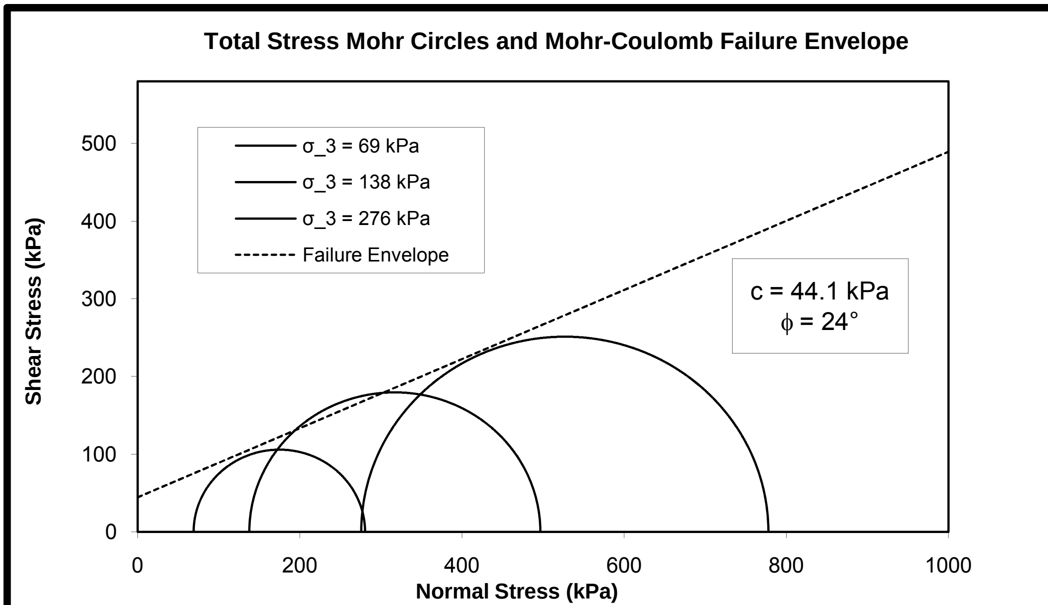
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85% sand 15% bentonite,14% water content (S15B14W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/13/2009





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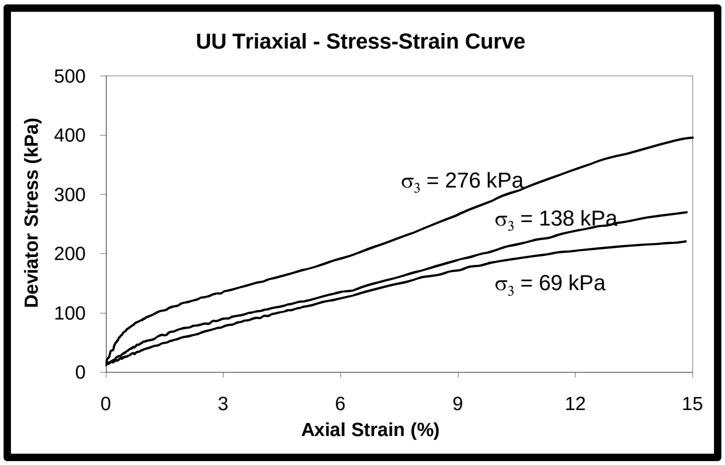
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85% sand 15% bentonite, 16% water content (S15B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/13/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	7	101	B-19
Wt. of Tin (g)	28.4	27.9	28.1	28.2	28.0	27.4
Wt. of Tin + Wet soil (g)	103.4	116.2	105.4	170.2	170.2	168.6
Wt. of Tin + Dry soil (g)	92.9	103.7	94.6	150.1	150.1	148.6
Wt. of Dry Soil (g)	64.50	75.80	66.50	121.90	122.10	121.20
Wt. of Water (g)	10.50	12.50	10.80	20.10	20.10	20.00
Water Content (%)	16.28	16.49	16.24	16.49	16.46	16.50
Average Water Content (%)	16.3			16.5		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.11	7.11	7.13
Average Diameter, D (cm)	3.53	3.53	3.54
Dry Unit Weight (kN/m^3)	17.23	17.18	16.99
Initial Void ratio	0.51	0.51	0.53
Saturation (%)	0.86	0.85	0.83
Strain at Failure (%)	14.82	14.84	15.00
Max Deviator Stress (kPa)	223.8	273.3	399.0
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	220.5	270.0	395.7
Corrected Major Stress (kPa)	289.5	407.9	671.5



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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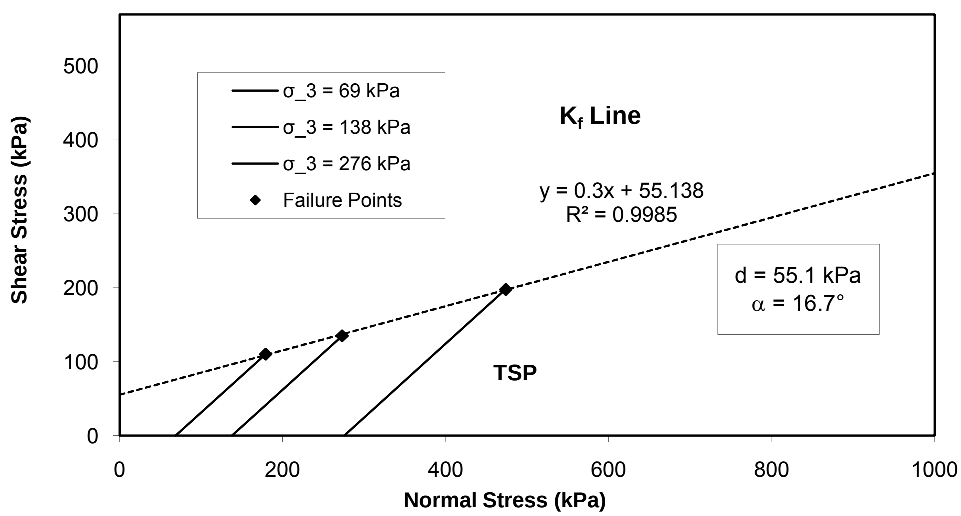
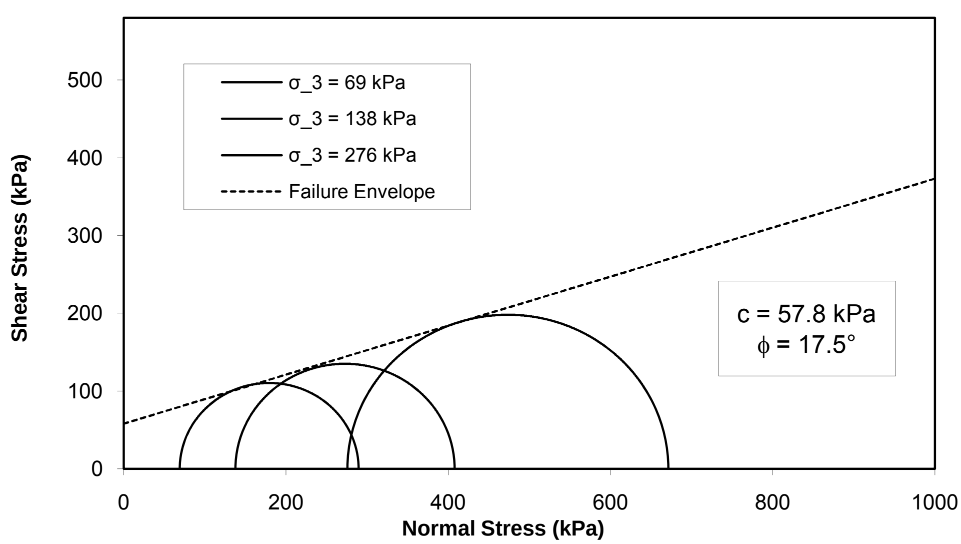
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85% sand 15% bentonite,16% water content (S15B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/13/2009

Total Stress Paths and K_f Line



Total Stress Mohr Circles and Mohr-Coulomb Failure Envelope



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UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 85% sand 15% bentonite, 18% water content (S15B18W)				
Specimen Type:	Compacted	USCS:	Clayey sand (SC)	Gs:	2.65
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	8/14/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	31	209	201
Wt. of Tin (g)	28.7	28	28.8	28.3	28.1	28.9
Wt. of Tin + Wet soil (g)	95.2	131.8	119.2	171.5	170.0	170.1
Wt. of Tin + Dry soil (g)	84.9	116	105.3	149.5	148.4	148.6
Wt. of Dry Soil (g)	56.20	88.00	76.50	121.20	120.30	119.70
Wt. of Water (g)	10.30	15.80	13.90	22.00	21.60	21.50
Water Content (%)	18.33	17.95	18.17	18.15	17.96	17.96
Average Water Content (%)		18.2			18.0	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.14	7.10	7.11
Average Diameter, D (cm)	3.53	3.54	3.54
Dry Unit Weight (kN/m^3)	17.06	16.89	16.80
Initial Void ratio	0.52	0.54	0.55
Saturation (%)	0.92	0.88	0.87
Strain at Failure (%)	14.83	14.82	15.02
Max Deviator Stress (kPa)	198.3	233.4	321.4
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	195.0	230.1	318.1
Corrected Major Stress (kPa)	264.0	368.0	593.9

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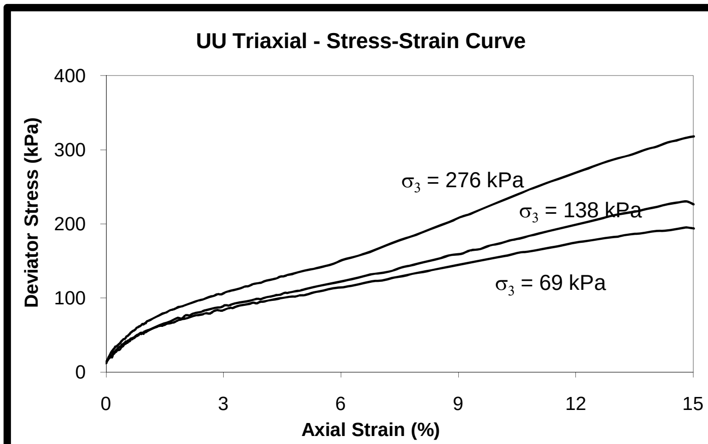

Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1-\sigma_3)=4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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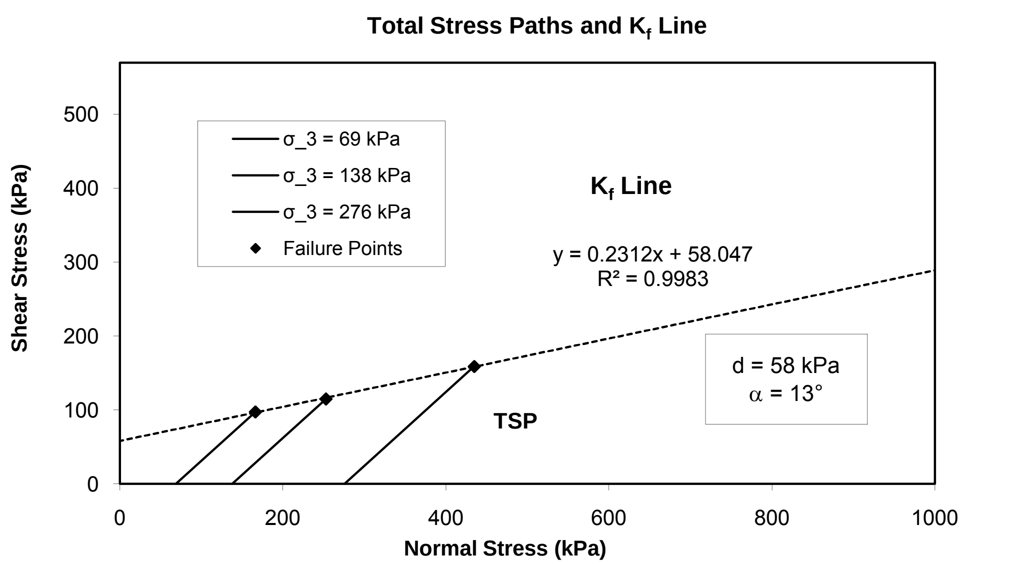
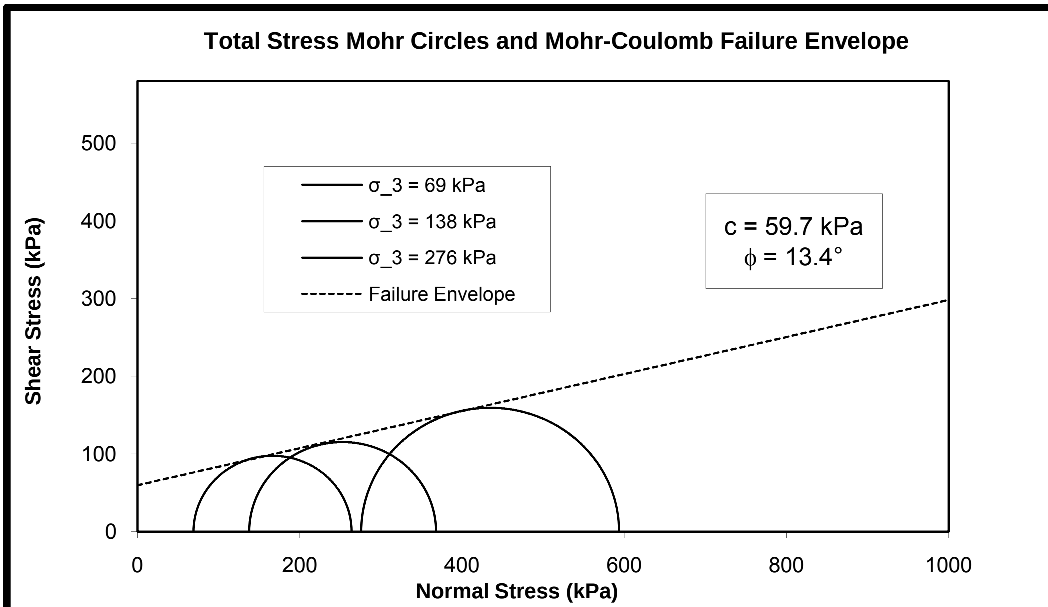
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85% sand 15% bentonite,18% water content (S15B18W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/14/2009





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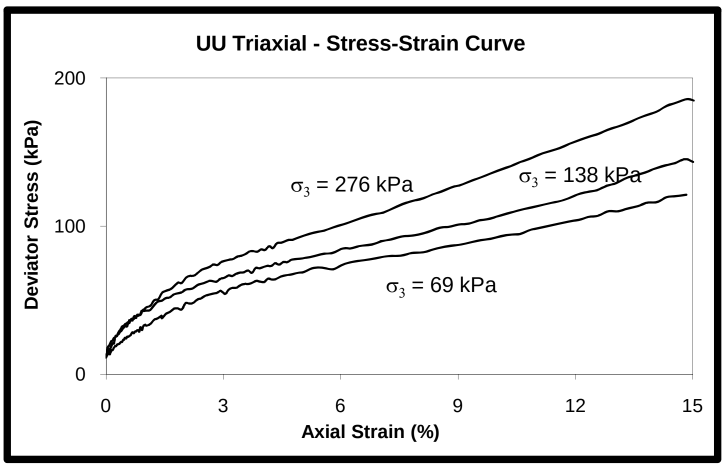
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 85% sand 15% bentonite, 20% water content (S15B20W)				
Specimen Type:	Compacted	USCS:	Clayey sand (SC)	Gs:	2.65
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	8/14/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	7	101	B-19
Wt. of Tin (g)	28.4	27.9	28.1	28.2	28.0	27.3
Wt. of Tin + Wet soil (g)	113.6	121.5	132	168.2	167.4	164.8
Wt. of Tin + Dry soil (g)	99.6	106	114.8	144.8	144.3	141.9
Wt. of Dry Soil (g)	71.20	78.10	86.70	116.60	116.30	114.60
Wt. of Water (g)	14.00	15.50	17.20	23.40	23.10	22.90
Water Content (%)	19.66	19.85	19.84	20.07	19.86	19.98
Average Water Content (%)	19.8			20.0		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.11	7.08
Average Diameter, D (cm)	3.53	3.54	3.54
Dry Unit Weight (kN/m^3)	16.40	16.30	16.12
Initial Void ratio	0.58	0.60	0.61
Saturation (%)	0.91	0.88	0.86
Strain at Failure (%)	14.84	14.81	14.85
Max Deviator Stress (kPa)	124.5	148.5	189.0
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	121.2	145.3	185.8
Corrected Major Stress (kPa)	190.2	283.2	461.6

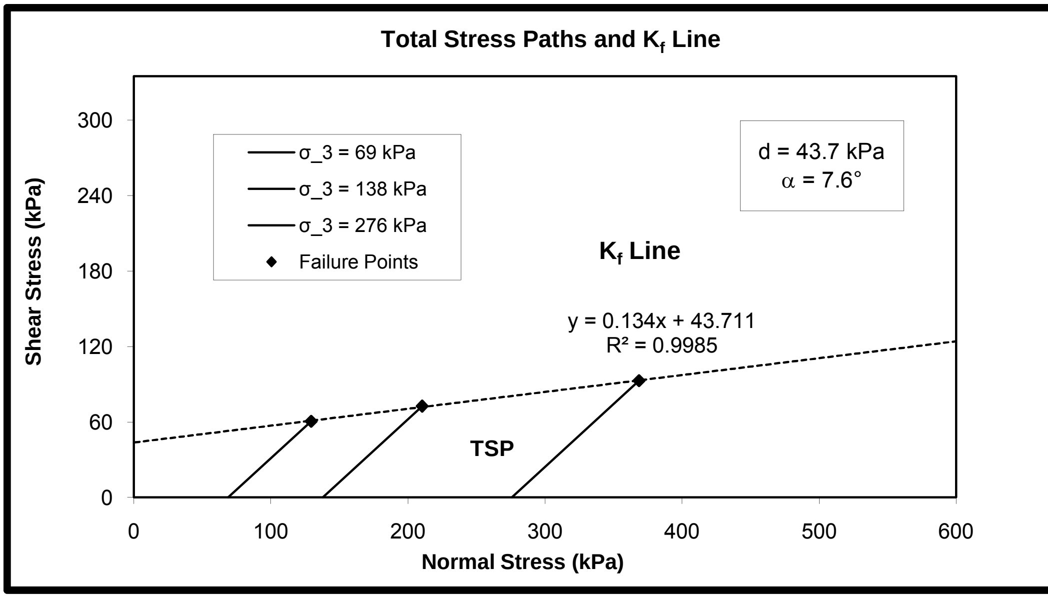


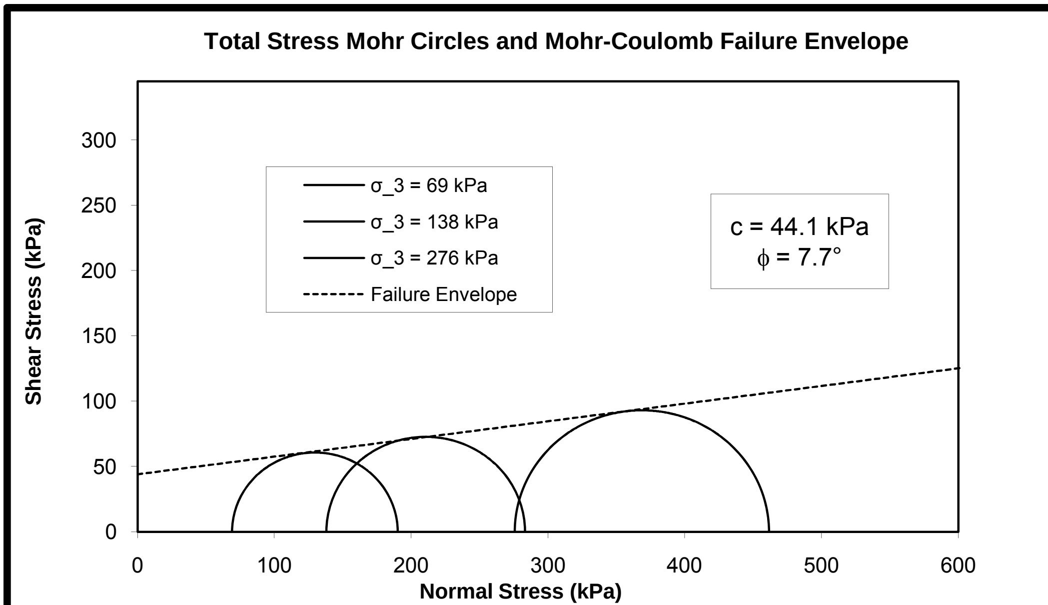
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1-\sigma_3)=4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85% sand 15% bentonite,20% water content (S15B20W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/14/2009





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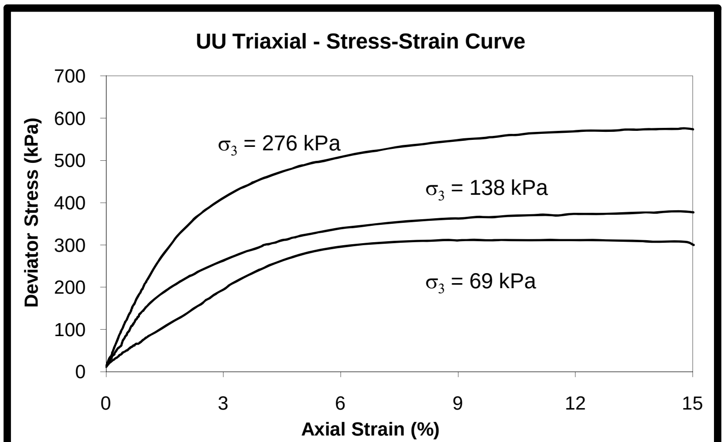
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 12% water content (S25B12W)		
Specimen Type: Compacted		USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 8/12/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	31	209	201
Wt. of Tin (g)	28.7	28	28.9	28.4	28.2	28.9
Wt. of Tin + Wet soil (g)	80.5	83.4	98.9	164.5	165.4	167.3
Wt. of Tin + Dry soil (g)	74.8	77.2	91	149.1	149.7	151.6
Wt. of Dry Soil (g)	46.10	49.20	62.10	120.70	121.50	122.70
Wt. of Water (g)	5.70	6.20	7.90	15.40	15.70	15.70
Water Content (%)	12.36	12.60	12.72	12.76	12.92	12.80
Average Water Content (%)		12.6			12.8	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.08	7.13	7.11
Average Diameter, D (cm)	3.50	3.52	3.53
Dry Unit Weight (kN/m^3)	17.43	17.16	17.31
Initial Void ratio	0.49	0.51	0.50
Saturation (%)	0.69	0.67	0.68
Strain at Failure (%)	12.36	14.82	14.82
Max Deviator Stress (kPa)	314.5	382.6	579.3
Membrane Correction (kPa)	2.8	3.3	3.3
Corrected Deviator Stress (kPa)	311.7	379.3	576.1
Corrected Major Stress (kPa)	380.7	517.2	851.9



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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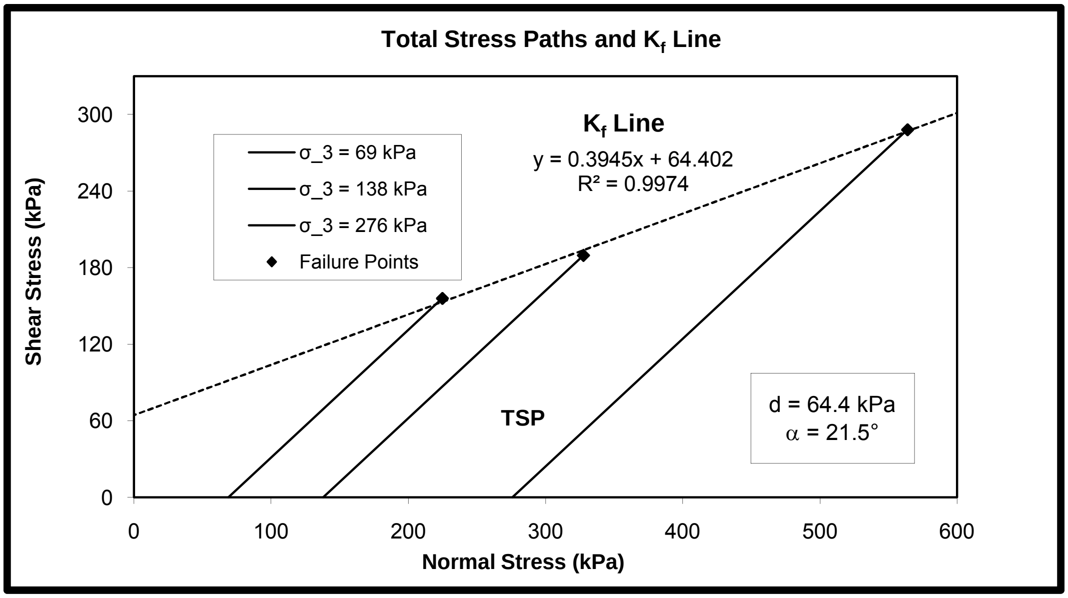
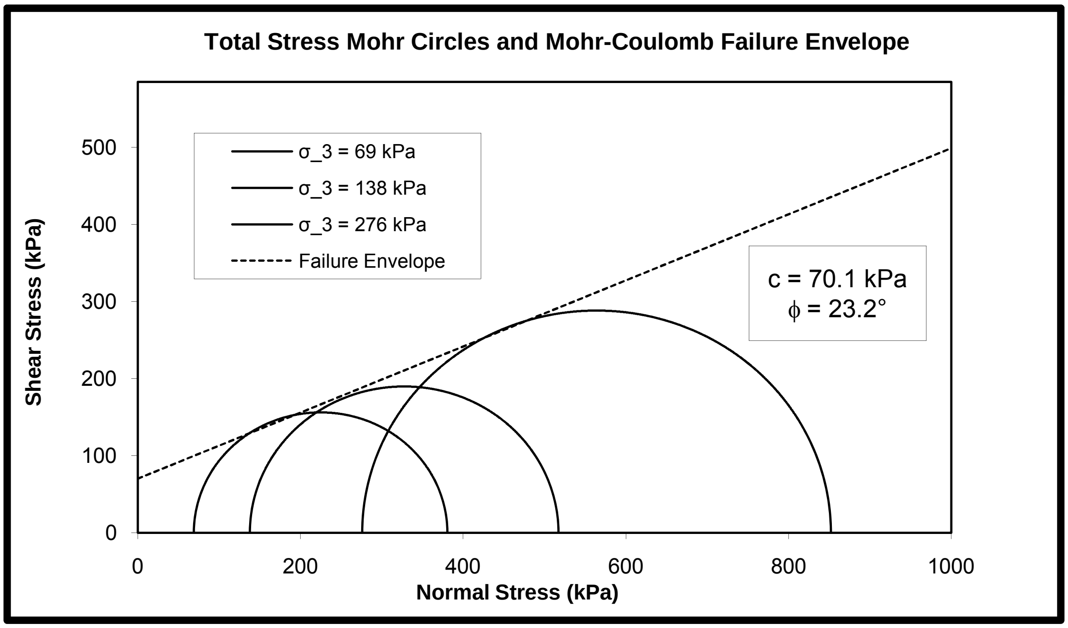
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% bentonite,12% water content (S25B12W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/12/2009





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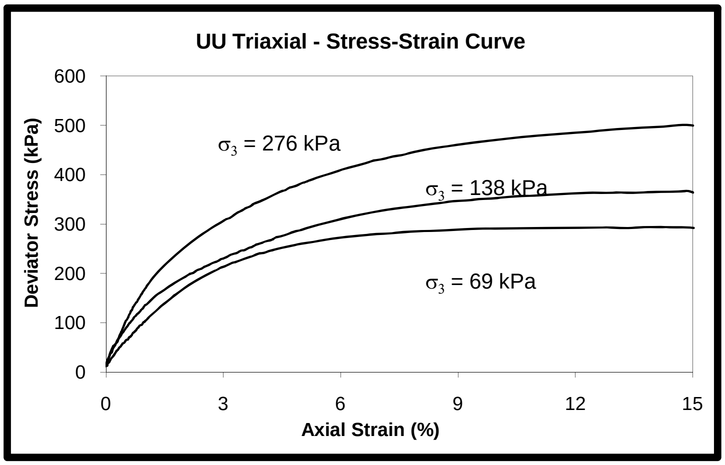
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 14% water content (S25B14W)				
Specimen Type:	Compacted	USCS:	Clayey sand (SC)	Gs:	2.64
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	8/12/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	7	101	B-19
Wt. of Tin (g)	28.4	27.9	28.1	28.2	28.0	27.4
Wt. of Tin + Wet soil (g)	105.2	96.9	118.8	170.2	170.3	170.8
Wt. of Tin + Dry soil (g)	95.3	88	107.2	151.8	152.1	152.2
Wt. of Dry Soil (g)	66.90	60.10	79.10	123.60	124.10	124.80
Wt. of Water (g)	9.90	8.90	11.60	18.40	18.20	18.60
Water Content (%)	14.80	14.81	14.66	14.89	14.67	14.90
Average Water Content (%)		14.8			14.8	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.14	7.12	7.13
Average Diameter, D (cm)	3.53	3.52	3.51
Dry Unit Weight (kN/m^3)	17.40	17.54	17.72
Initial Void ratio	0.49	0.48	0.46
Saturation (%)	0.81	0.81	0.85
Strain at Failure (%)	14.31	14.87	14.89
Max Deviator Stress (kPa)	297.2	370.1	504.4
Membrane Correction (kPa)	3.2	3.3	3.3
Corrected Deviator Stress (kPa)	294.1	366.8	501.1
Corrected Major Stress (kPa)	363.0	504.7	776.9



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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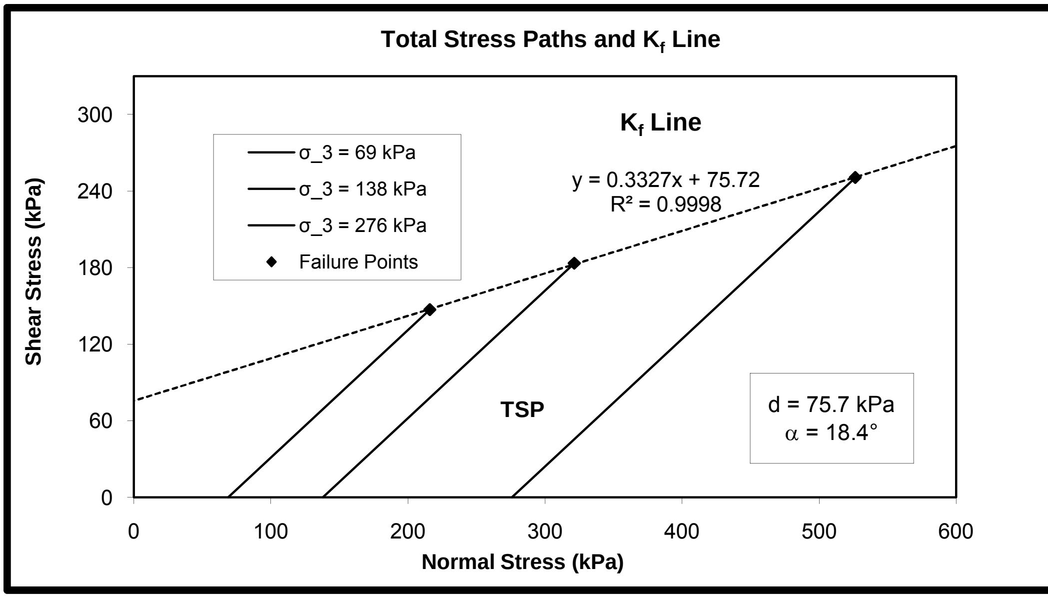
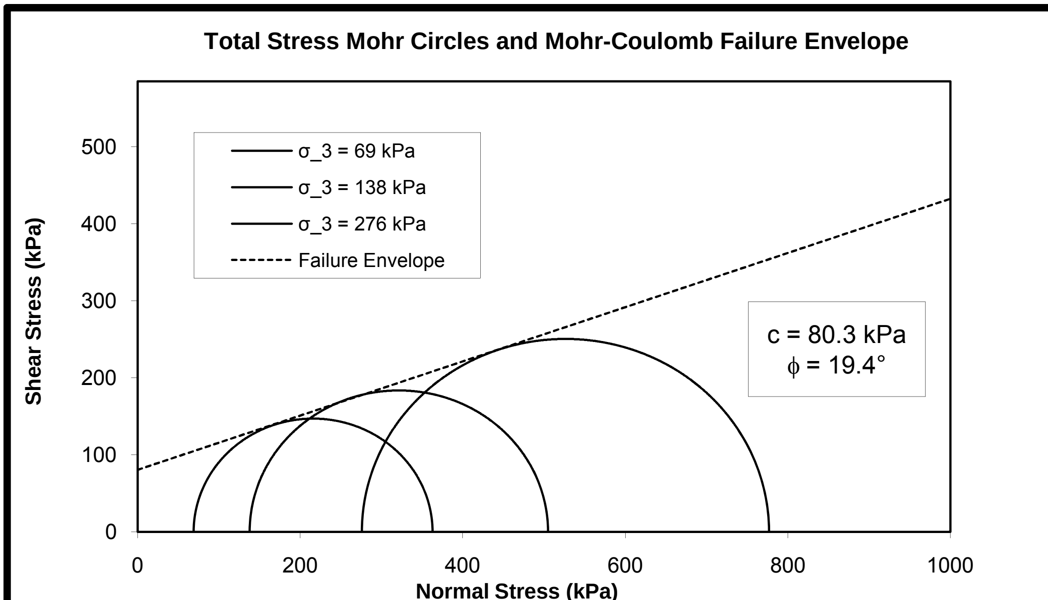
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% bentonite,14% water content (S25B14W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/12/2009





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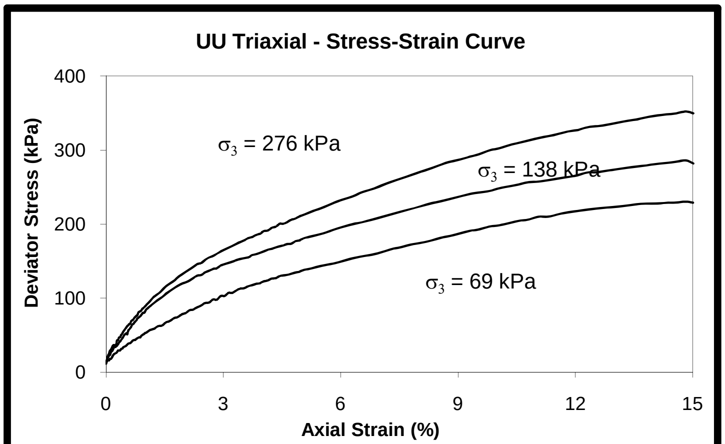
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 16% water content (S25B16W)				
Specimen Type:	Compacted	USCS:	Clayey sand (SC)	Gs:	2.64
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	8/6/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	31	209
Wt. of Tin (g)	28.8	28.1	28.9	28.9	28.4	28.2
Wt. of Tin + Wet soil (g)	118.2	110.3	113.9	172.1	174.3	170.0
Wt. of Tin + Dry soil (g)	105.3	98.4	101.7	151.4	153.1	149.5
Wt. of Dry Soil (g)	76.50	70.30	72.80	122.50	124.70	121.30
Wt. of Water (g)	12.90	11.90	12.20	20.70	21.20	20.50
Water Content (%)	16.86	16.93	16.76	16.90	17.00	16.90
Average Water Content (%)		16.8			16.9	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.09	7.16	7.10
Average Diameter, D (cm)	3.51	3.56	3.52
Dry Unit Weight (kN/m^3)	17.50	17.21	17.25
Initial Void ratio	0.48	0.50	0.50
Saturation (%)	0.93	0.89	0.89
Strain at Failure (%)	14.81	14.82	14.83
Max Deviator Stress (kPa)	233.3	289.3	355.3
Membrane Correction (kPa)	3.3	3.2	3.3
Corrected Deviator Stress (kPa)	230.0	286.0	352.0
Corrected Major Stress (kPa)	298.9	423.9	627.8



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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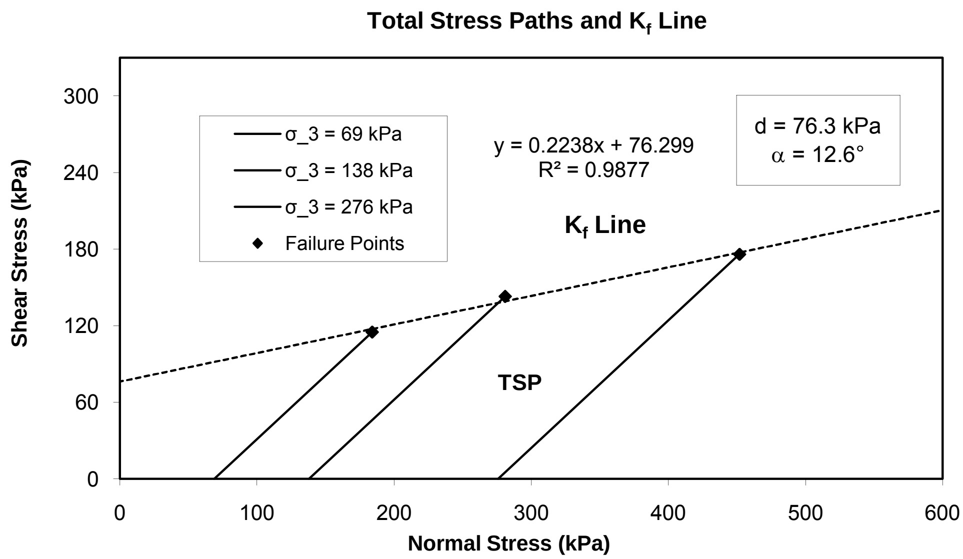
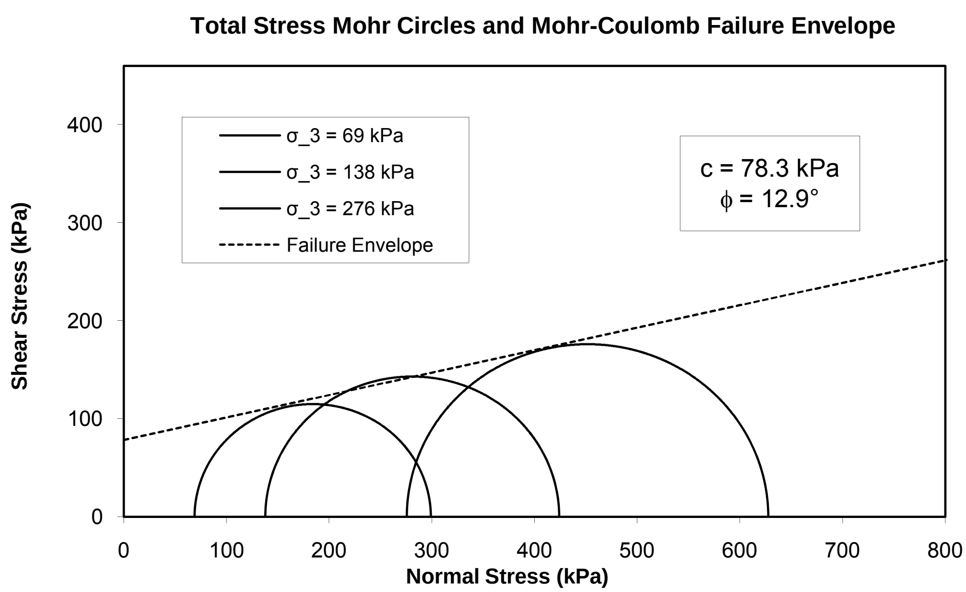
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% bentonite,16% water content (S25B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/6/2009





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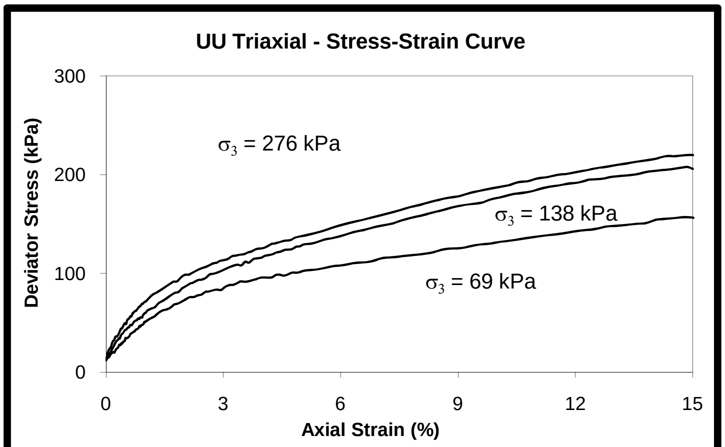
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 18% water content (S25B18W)		
Specimen Type: Compacted		USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 8/7/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	209	31	201
Wt. of Tin (g)	28.7	28	28.9	28.1	28.3	28.9
Wt. of Tin + Wet soil (g)	92.1	121.1	104.4	171.1	170.4	170.6
Wt. of Tin + Dry soil (g)	82.1	106.4	92.5	147.8	148.1	147.8
Wt. of Dry Soil (g)	53.40	78.40	63.60	119.70	119.80	118.90
Wt. of Water (g)	10.00	14.70	11.90	23.30	22.30	22.80
Water Content (%)	18.73	18.75	18.71	19.47	18.61	19.18
Average Water Content (%)	18.7			19.1		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.13	7.11	7.14
Average Diameter, D (cm)	3.52	3.54	3.54
Dry Unit Weight (kN/m^3)	16.89	16.76	16.64
Initial Void ratio	0.53	0.54	0.56
Saturation (%)	0.96	0.90	0.91
Strain at Failure (%)	14.82	14.85	15.01
Max Deviator Stress (kPa)	160.3	211.2	223.3
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	157.0	208.0	220.0
Corrected Major Stress (kPa)	226.0	345.9	495.8



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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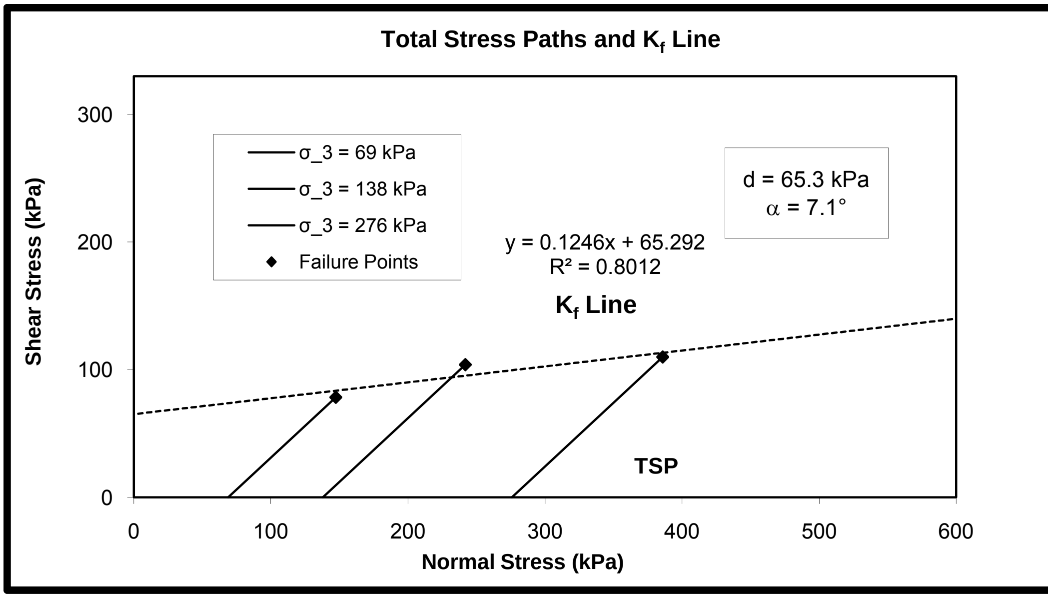
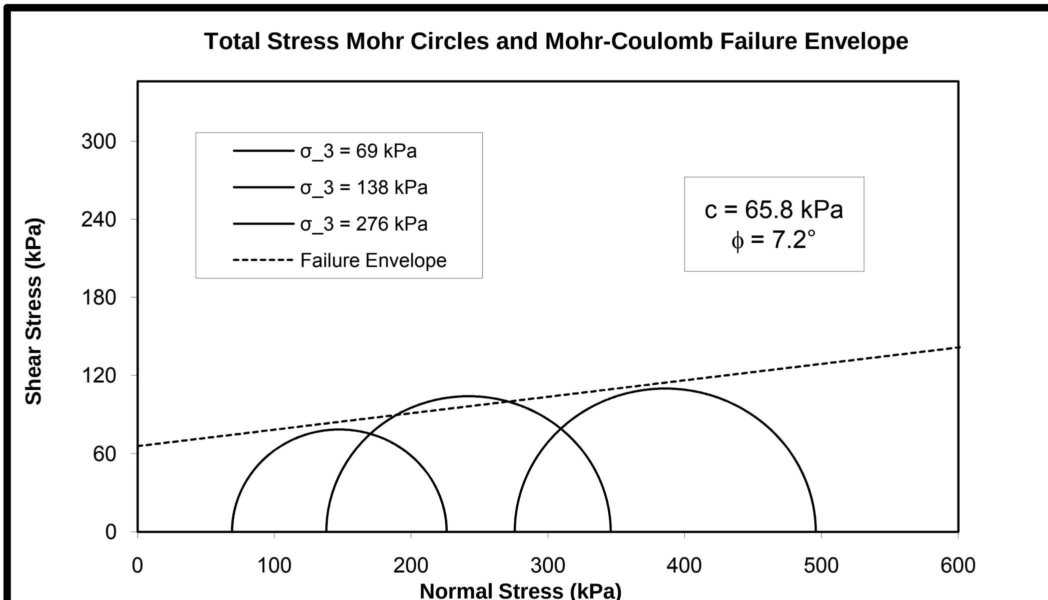
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 75% sand 25% bentonite,18% water content (S25B18W)				
Specimen Type:	Compacted	USCS:	Clayey sand (SC)	Gs:	2.64
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	8/7/2009





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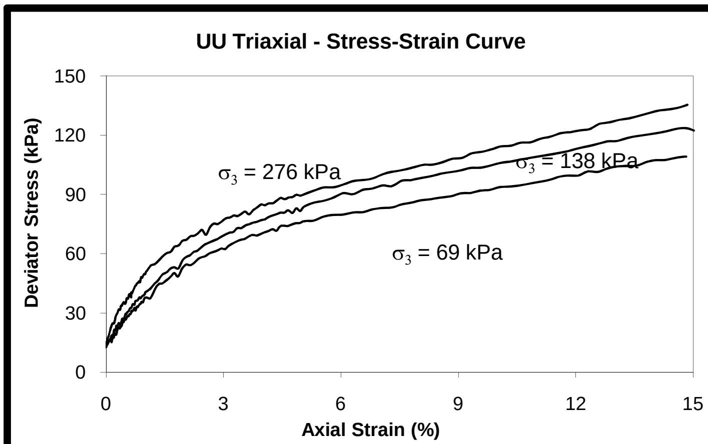
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 20% water content (S25B20W)		
Specimen Type: Compacted		USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 8/12/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	FJ-1	59	410	majid	B14	2010
Wt. of Tin (g)	28	28.3	28.4	28.7	29.1	28.6
Wt. of Tin + Wet soil (g)	113.1	120.3	77.1	168.1	166.5	166.4
Wt. of Tin + Dry soil (g)	98.6	104.6	68.8	143.9	142.9	142.7
Wt. of Dry Soil (g)	70.60	76.30	40.40	115.20	113.80	114.10
Wt. of Water (g)	14.50	15.70	8.30	24.20	23.60	23.70
Water Content (%)	20.54	20.58	20.54	21.01	20.74	20.77
Average Water Content (%)	20.6			20.8		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.07	7.12
Average Diameter, D (cm)	3.53	3.54	3.53
Dry Unit Weight (kN/m^3)	16.25	16.00	16.09
Initial Void ratio	0.59	0.62	0.61
Saturation (%)	0.93	0.89	0.90
Strain at Failure (%)	14.82	14.82	14.85
Max Deviator Stress (kPa)	112.5	127.0	138.8
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	109.2	123.7	135.5
Corrected Major Stress (kPa)	178.2	261.6	411.3



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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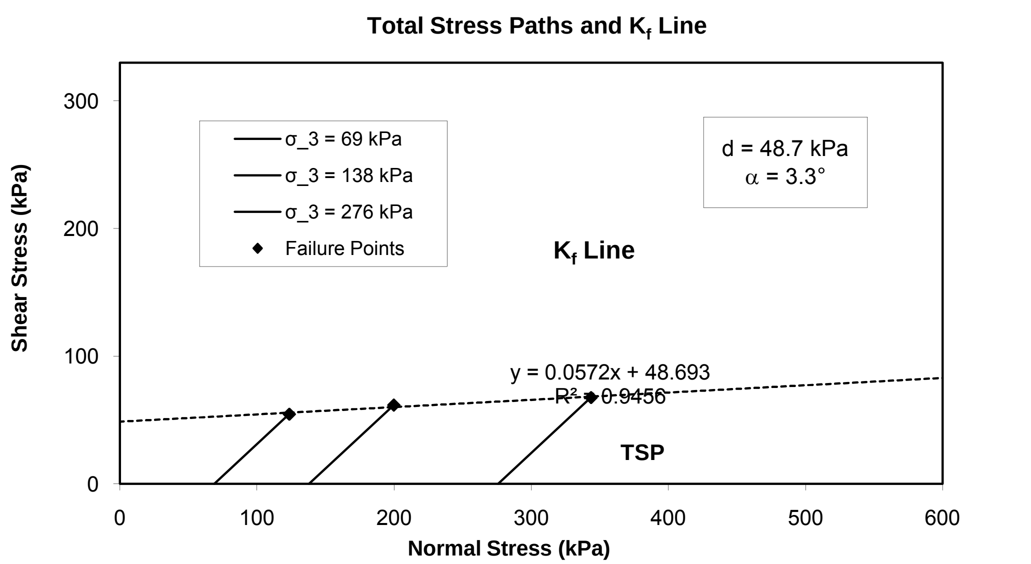
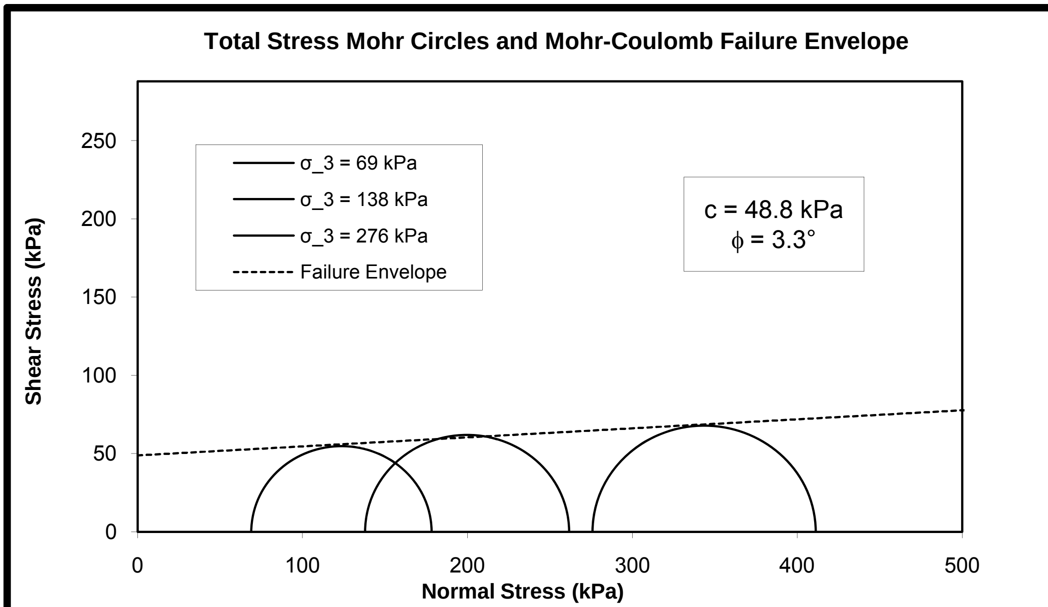
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 20% water content (S25B20W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/12/2009





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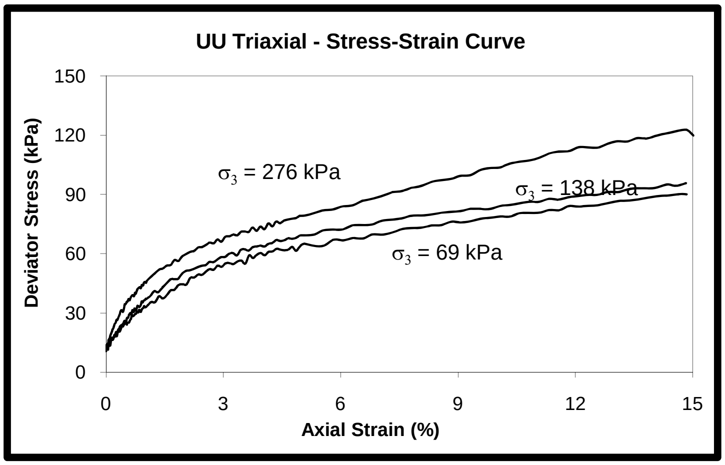
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 22% water content (S25B22W)		
Specimen Type: Compacted		USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 8/7/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	7	101	B-19
Wt. of Tin (g)	28.4	27.9	28.1	28.2	28.0	27.4
Wt. of Tin + Wet soil (g)	71.8	93.7	84.5	165.0	165.3	164.8
Wt. of Tin + Dry soil (g)	63.8	81.7	74.1	139.6	139.7	139.2
Wt. of Dry Soil (g)	35.40	53.80	46.00	111.40	111.70	111.80
Wt. of Water (g)	8.00	12.00	10.40	25.40	25.60	25.60
Water Content (%)	22.60	22.30	22.61	22.80	22.92	22.90
Average Water Content (%)		22.5			22.9	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.11	7.12	7.10
Average Diameter, D (cm)	3.53	3.54	3.52
Dry Unit Weight (kN/m^3)	15.73	15.63	15.87
Initial Void ratio	0.65	0.66	0.63
Saturation (%)	0.93	0.92	0.96
Strain at Failure (%)	14.84	14.83	14.84
Max Deviator Stress (kPa)	93.5	99.0	126.0
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	90.2	95.8	122.7
Corrected Major Stress (kPa)	159.1	233.7	398.5



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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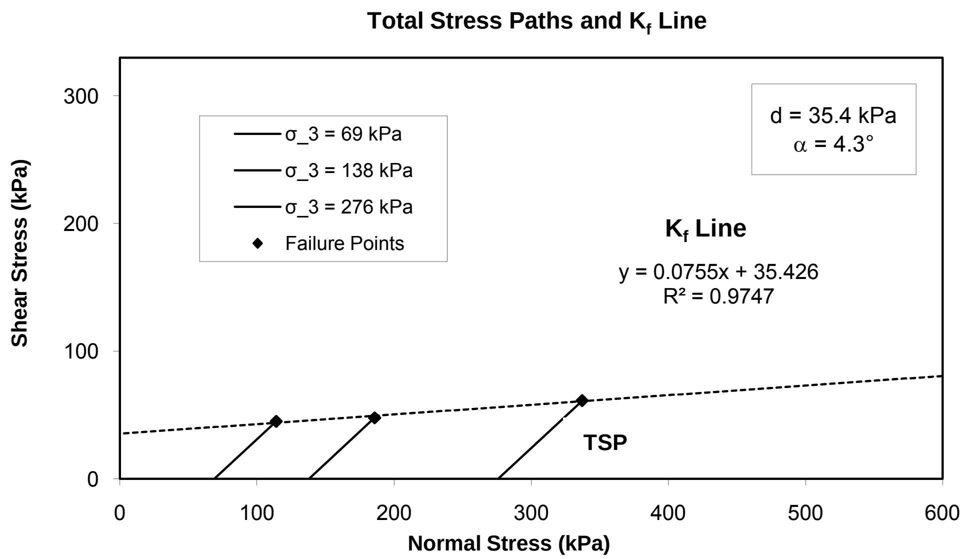
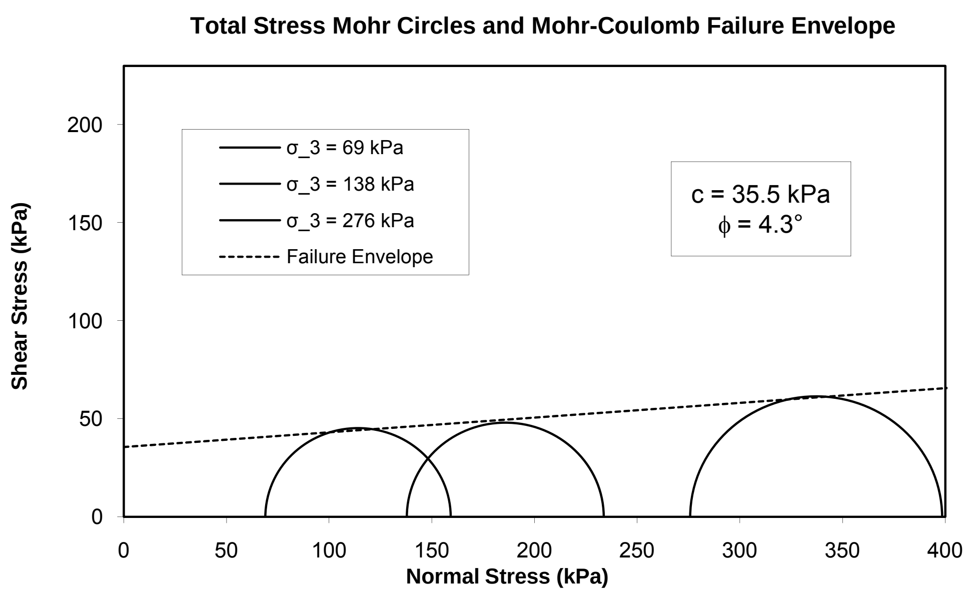
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 22% water content (S25B22W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/7/2009



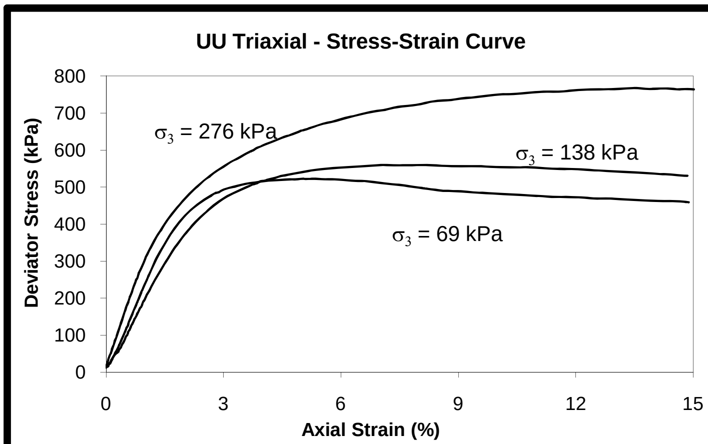


DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 16% water content (S50B16W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/4/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	46	FJ-5	4	7	101	B-19
Wt. of Tin (g)	28.9	28.1	28.7	28.8	28.0	27.4
Wt. of Tin + Wet soil (g)	101.1	100.4	88.5	159.0	152.6	156.2
Wt. of Tin + Dry soil (g)	90.8	90.2	80.2	140.2	134.8	137.6
Wt. of Dry Soil (g)	61.9	62.2	51.5	111.4	106.8	110.2
Wt. of Water (g)	10.3	10.2	8.3	18.8	17.8	18.6
Water Content (%)	16.6	16.4	16.1	16.9	16.7	16.9
Average Water Content (%)		16.4			16.8	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.11	6.99	7.00
Average Diameter, D (cm)	3.53	3.53	3.53
Dry Unit Weight (kN/m^3)	15.75	15.33	15.77
Initial Void ratio	0.64	0.68	0.64
Saturation (%)	0.70	0.64	0.70
Strain at Failure (%)	5.00	8.08	13.58
Max Deviator Stress (kPa)	523.9	561.6	770.1
Membrane Correction (kPa)	1.1	1.8	3.0
Corrected Deviator Stress (kPa)	522.8	559.8	767.1
Corrected Major Stress (kPa)	591.7	697.7	1042.9



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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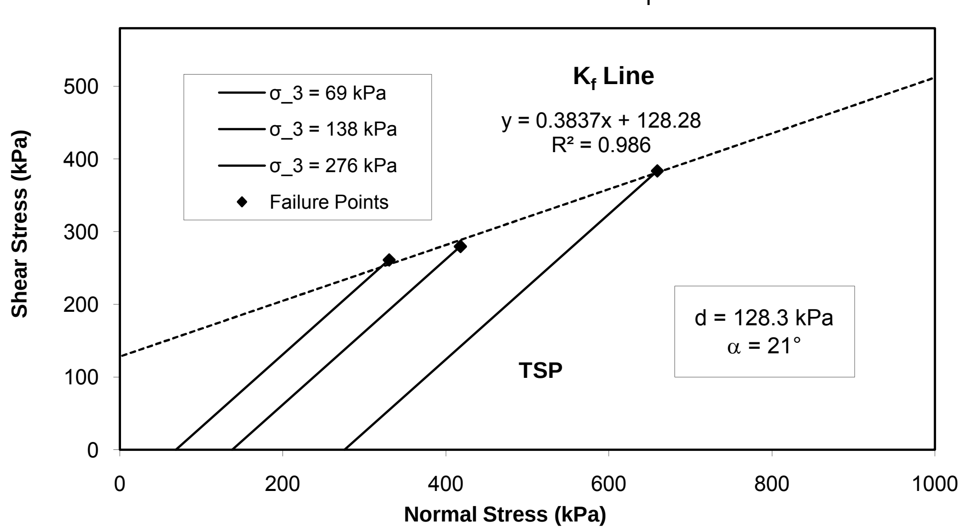
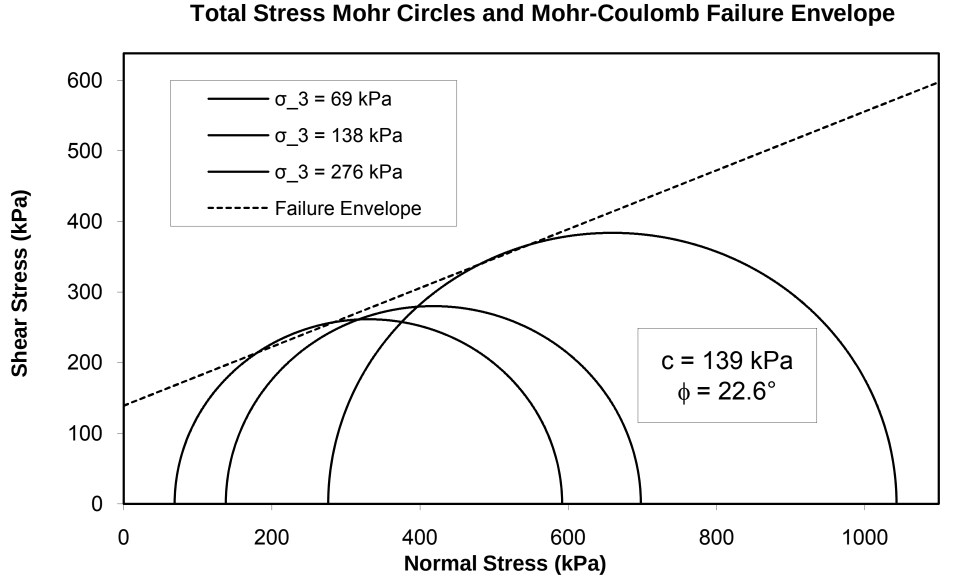
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 16% water content (S50B16W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 8/4/2009





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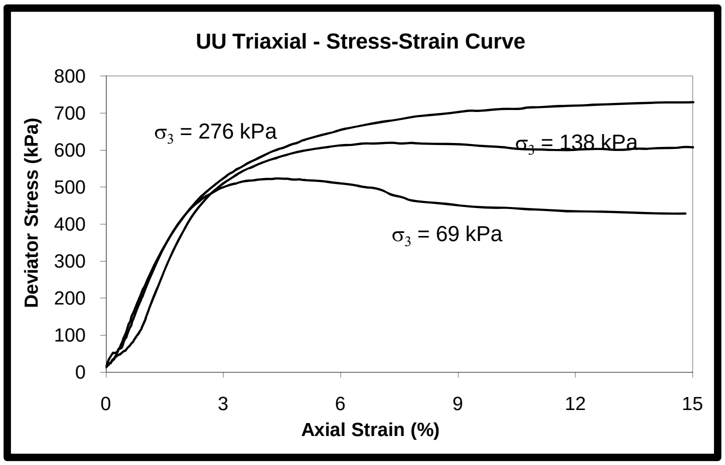
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 17% water content (S50B17W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/21/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	majid	59	211	2010	FJ-3	Y-1
Wt. of Tin (g)	28.7	28.3	28.2	28.6	29.1	28.3
Wt. of Tin + Wet soil (g)	89.4	89.2	77.4	161.0	160.8	156.5
Wt. of Tin + Dry soil (g)	80.7	80.6	70.1	141.9	141.8	137.9
Wt. of Dry Soil (g)	52.0	52.3	41.9	113.3	112.7	109.6
Wt. of Water (g)	8.7	8.6	7.3	19.1	19.0	18.6
Water Content (%)	16.7	16.4	17.4	16.9	16.9	17.0
Average Water Content (%)		16.9			16.9	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.06	7.02
Average Diameter, D (cm)	3.52	3.52	3.55
Dry Unit Weight (kN/m^3)	16.08	16.14	15.52
Initial Void ratio	0.62	0.61	0.68
Saturation (%)	0.72	0.73	0.67
Strain at Failure (%)	4.34	7.31	15.02
Max Deviator Stress (kPa)	524.0	620.8	732.8
Membrane Correction (kPa)	1.0	1.6	3.3
Corrected Deviator Stress (kPa)	523.0	619.2	729.5
Corrected Major Stress (kPa)	592.0	757.1	1005.2



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1-\sigma_3)=4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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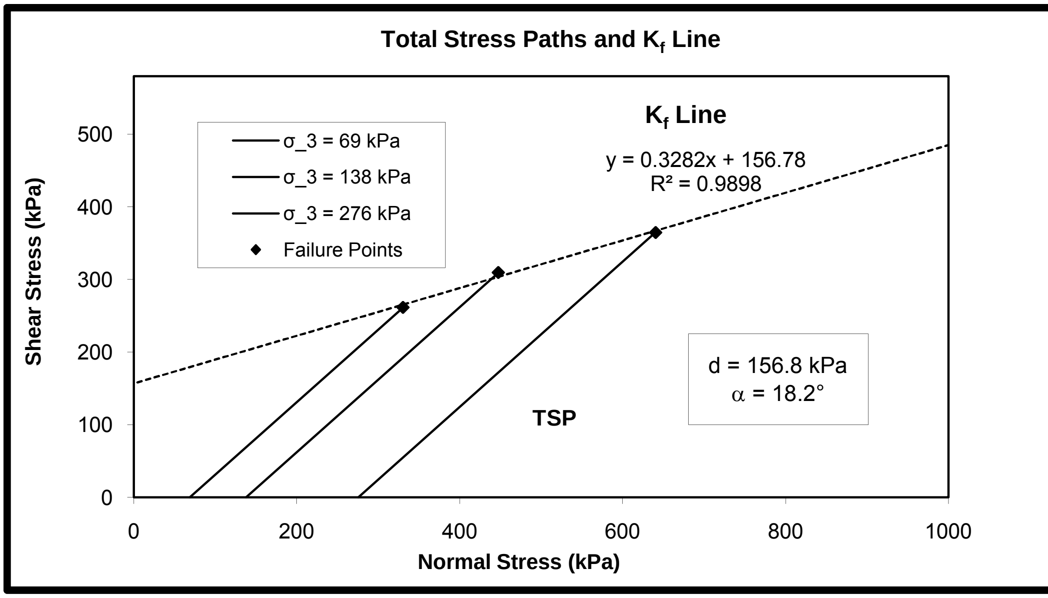
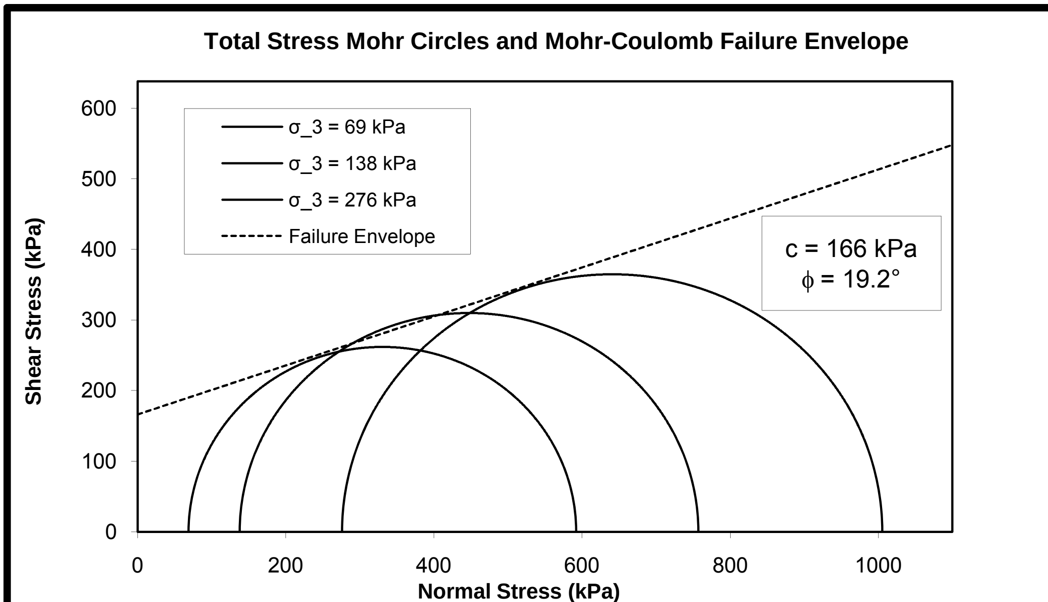
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 17% water content (S50B17W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/21/2009





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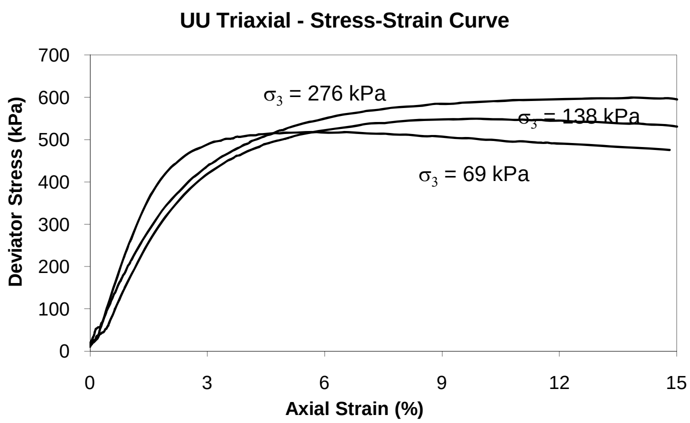
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 19% water content (S50B19W)		
Specimen Type: Compacted		USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 10/19/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B-19	101	7
Wt. of Tin (g)	28.5	27.9	28.1	27.4	28.0	28.2
Wt. of Tin + Wet soil (g)	96.6	85.7	86.4	157.1	159.4	156.9
Wt. of Tin + Dry soil (g)	85.5	76.4	76.8	136.5	138.2	135.9
Wt. of Dry Soil (g)	57.0	48.5	48.7	109.1	110.2	107.7
Wt. of Water (g)	11.1	9.3	9.6	20.6	21.2	21.0
Water Content (%)	19.5	19.2	19.7	18.9	19.2	19.5
Average Water Content (%)		19.5			19.2	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	6.75	6.98	6.74
Average Diameter, D (cm)	3.54	3.52	3.53
Dry Unit Weight (kN/m^3)	16.15	15.96	15.99
Initial Void ratio	0.60	0.62	0.61
Saturation (%)	0.83	0.82	0.84
Strain at Failure (%)	6.55	9.80	13.83
Max Deviator Stress (kPa)	519.1	551.8	602.3
Membrane Correction (kPa)	1.4	2.2	3.0
Corrected Deviator Stress (kPa)	517.7	549.6	599.3
Corrected Major Stress (kPa)	586.6	687.5	875.1



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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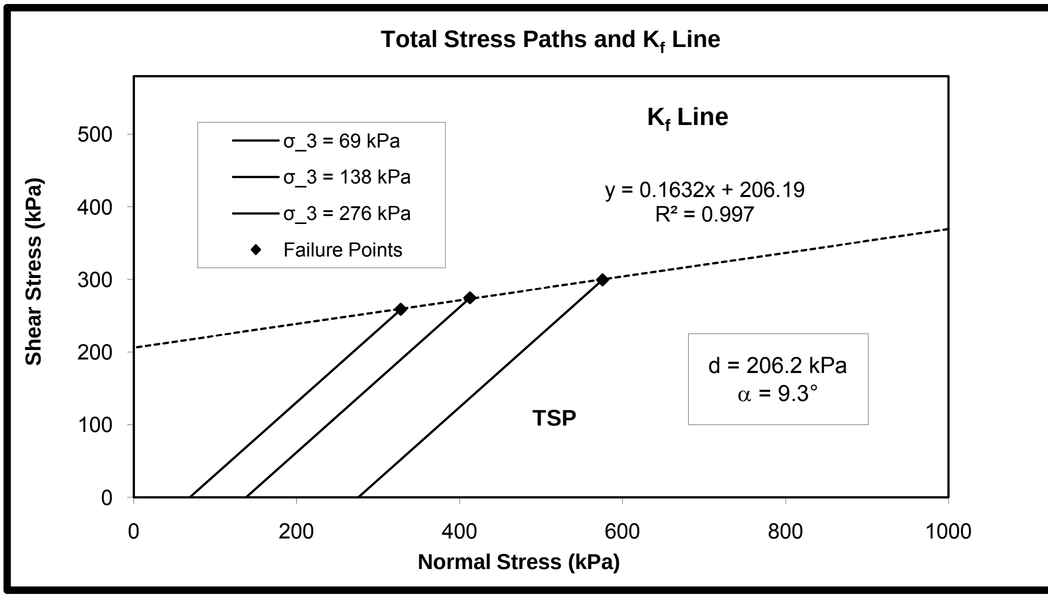
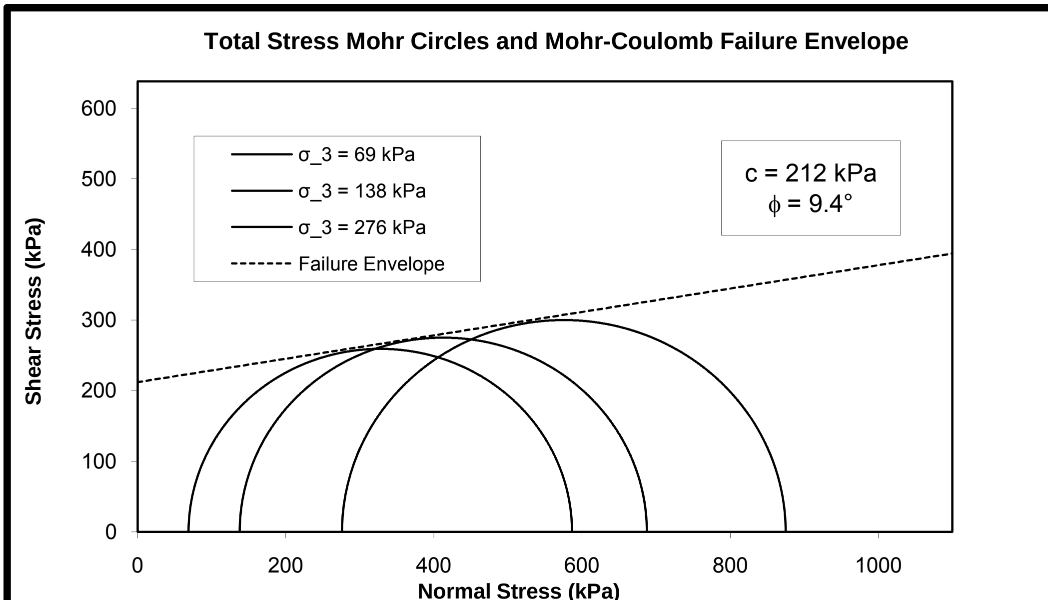
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 19% water content (S50B19W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/19/2009





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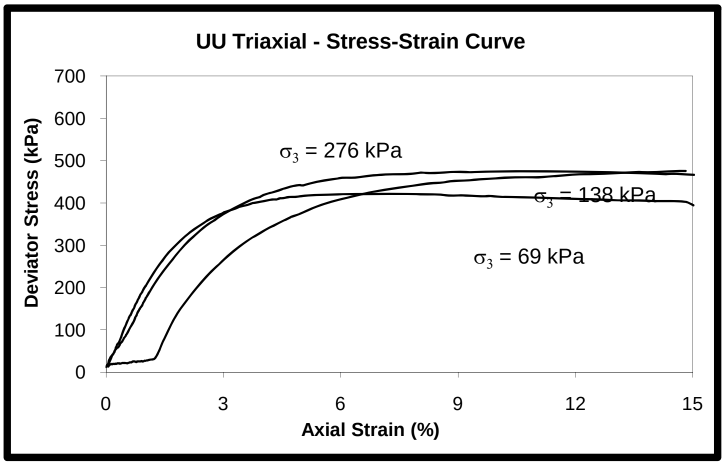
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 20% water content (S50B20W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/22/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28.0	28.9	28.9	28.2	28.4
Wt. of Tin + Wet soil (g)	109.4	126.8	90.1	168.0	165.6	164.7
Wt. of Tin + Dry soil (g)	95.9	110.2	79.7	144.1	142.0	141.1
Wt. of Dry Soil (g)	67.2	82.2	50.8	115.2	113.8	112.7
Wt. of Water (g)	13.5	16.6	10.4	23.9	23.6	23.6
Water Content (%)	20.1	20.2	20.5	20.7	20.7	20.9
Average Water Content (%)		20.3			20.8	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.13	7.00	7.04
Average Diameter, D (cm)	3.54	3.53	3.53
Dry Unit Weight (kN/m^3)	16.12	16.33	16.03
Initial Void ratio	0.60	0.58	0.61
Saturation (%)	0.91	0.94	0.90
Strain at Failure (%)	7.56	10.55	14.82
Max Deviator Stress (kPa)	423.5	477.9	478.7
Membrane Correction (kPa)	1.7	2.3	3.3
Corrected Deviator Stress (kPa)	421.8	475.6	475.4
Corrected Major Stress (kPa)	490.7	613.5	751.2



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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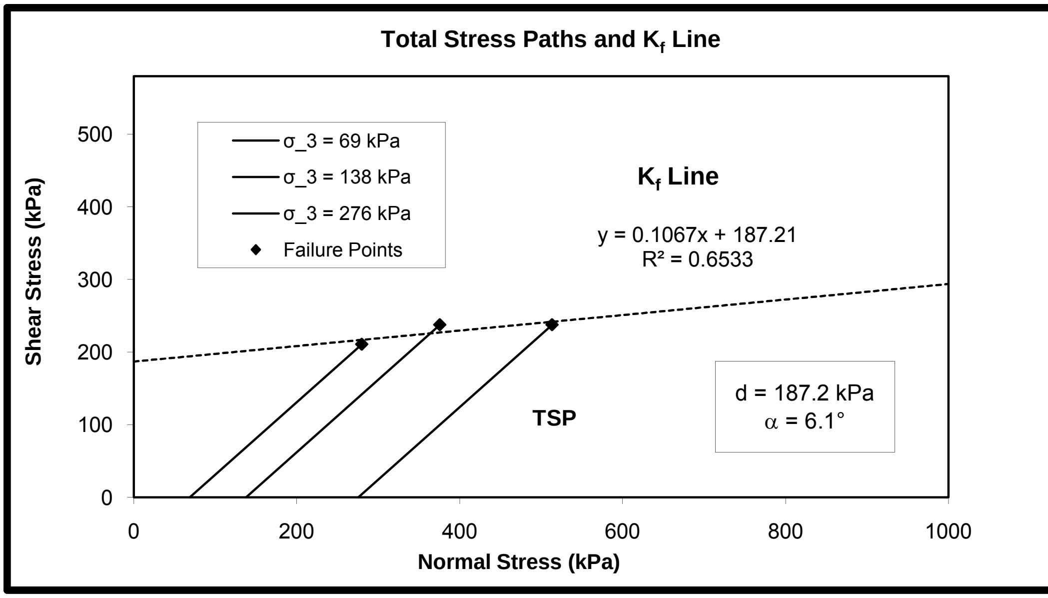
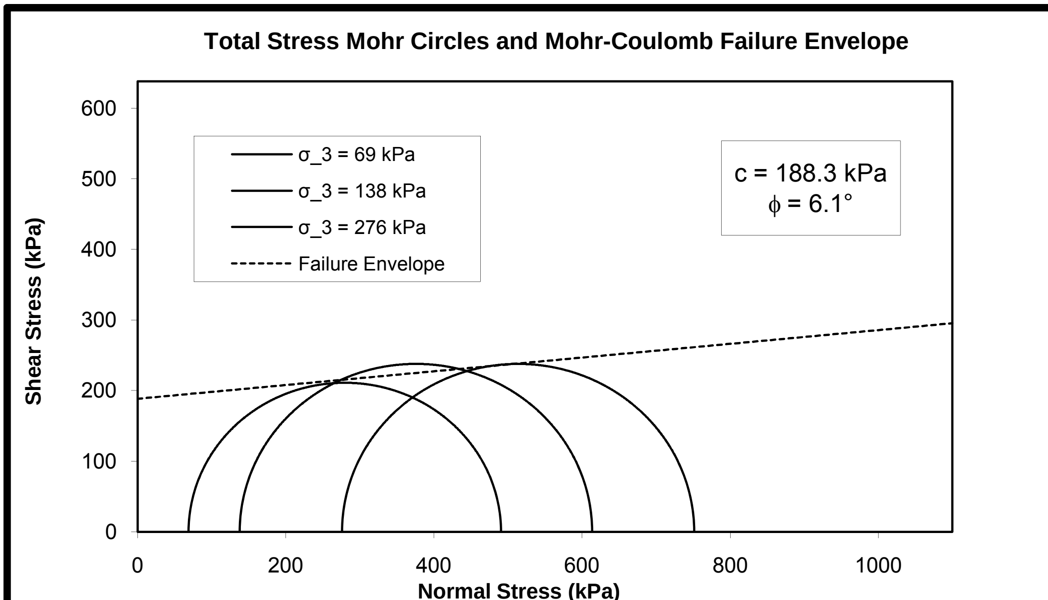
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 20% water content (S50B20W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/22/2009





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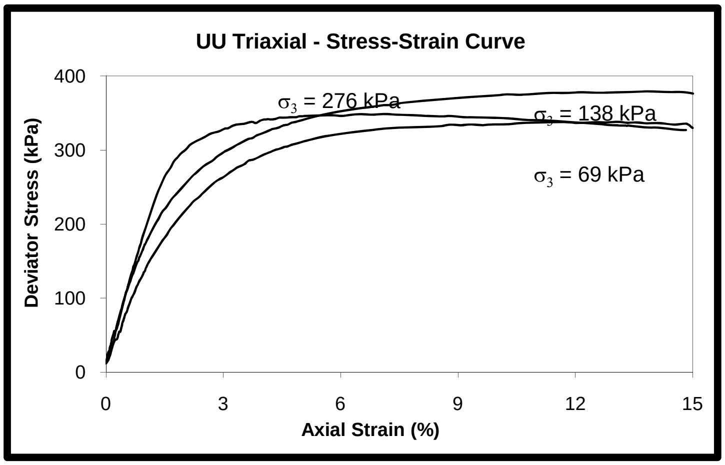
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 22% water content (S50B22W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/21/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28.0	28.9	28.9	28.2	28.4
Wt. of Tin + Wet soil (g)	105.0	110.5	100.0	167.3	167.4	166.1
Wt. of Tin + Dry soil (g)	91.0	94.6	86.7	141.5	140.9	140.5
Wt. of Dry Soil (g)	62.3	66.6	57.8	112.6	112.7	112.1
Wt. of Water (g)	14.0	15.9	13.3	25.8	26.5	25.6
Water Content (%)	22.5	23.9	23.0	22.9	23.5	22.8
Average Water Content (%)		23.1			23.1	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.14	7.14	7.15
Average Diameter, D (cm)	3.53	3.55	3.52
Dry Unit Weight (kN/m^3)	15.78	15.64	15.78
Initial Void ratio	0.64	0.65	0.63
Saturation (%)	0.95	0.95	0.95
Strain at Failure (%)	7.04	13.09	13.82
Max Deviator Stress (kPa)	350.2	341.2	382.5
Membrane Correction (kPa)	1.5	2.9	3.0
Corrected Deviator Stress (kPa)	348.6	338.3	379.4
Corrected Major Stress (kPa)	417.6	476.2	655.2



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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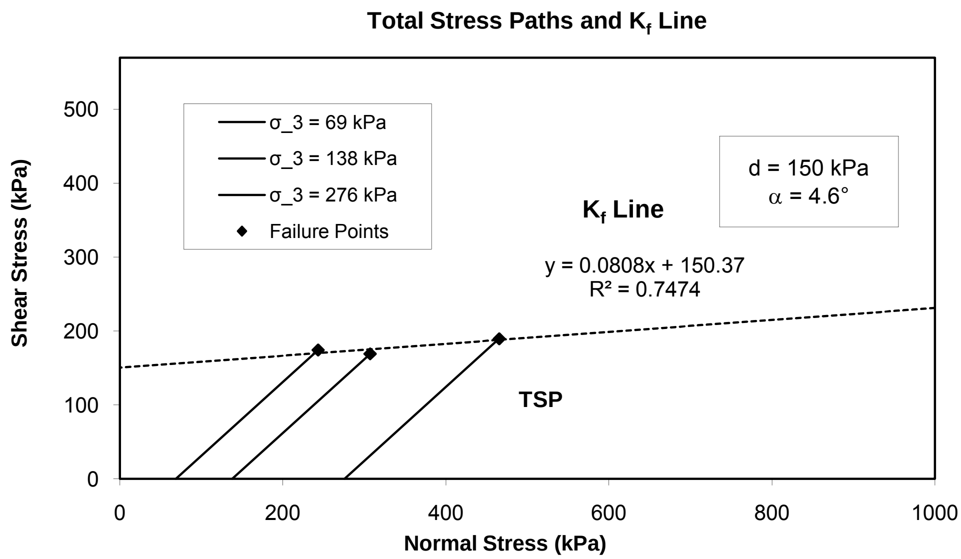
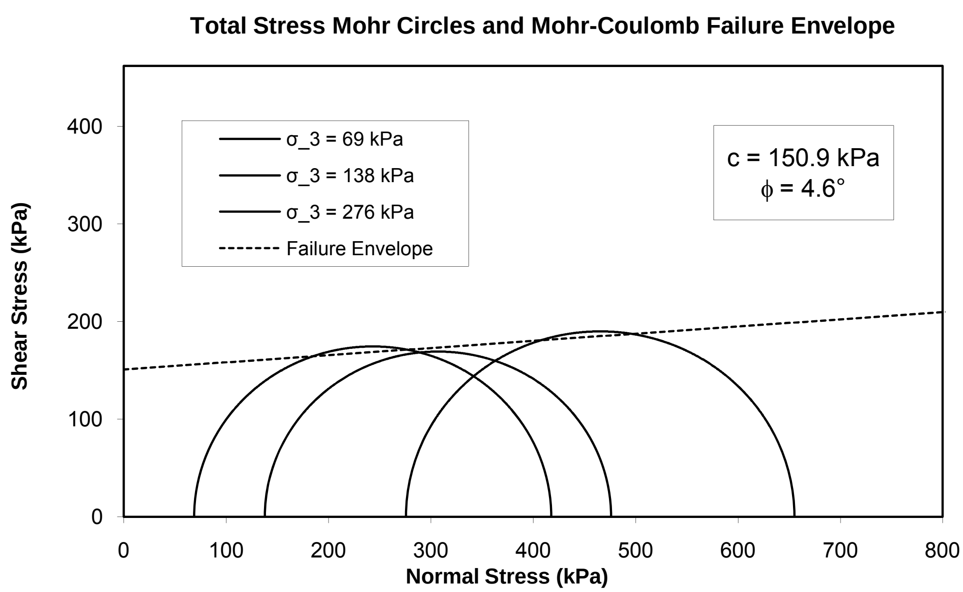
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 22% water content (S50B22W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/21/2009





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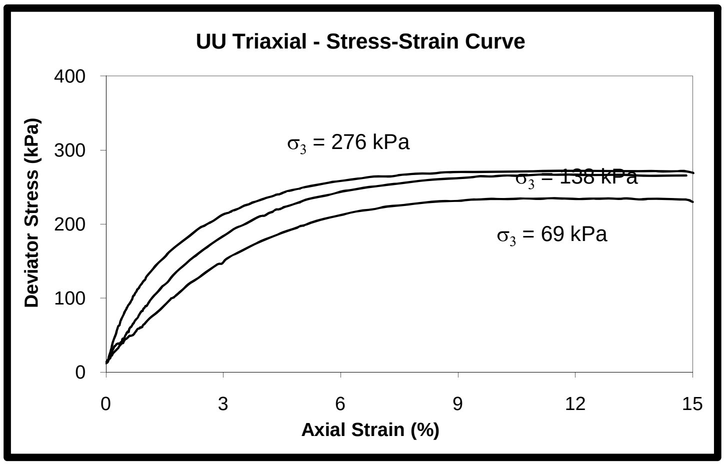
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 25% water content (S50B25W)		
Specimen Type: Compacted		USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 11/13/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	209	FJ-3	211	B19	101	7
Wt. of Tin (g)	28.2	29.1	28.2	27.3	28.0	28.1
Wt. of Tin + Wet soil (g)	119.4	93.3	122.8	160.2	161.1	165.6
Wt. of Tin + Dry soil (g)	100.8	80.5	103.7	133.1	134.2	137.8
Wt. of Dry Soil (g)	72.6	51.4	75.5	105.8	106.2	109.7
Wt. of Water (g)	18.6	12.8	19.1	27.1	26.9	27.8
Water Content (%)	25.6	24.9	25.3	25.6	25.3	25.3
Average Water Content (%)	25.3			25.4		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	6.95	6.92	7.16
Average Diameter, D (cm)	3.54	3.55	3.53
Dry Unit Weight (kN/m^3)	15.17	15.21	15.36
Initial Void ratio	0.70	0.70	0.68
Saturation (%)	0.96	0.96	0.98
Strain at Failure (%)	13.35	11.83	14.80
Max Deviator Stress (kPa)	237.5	269.6	275.0
Membrane Correction (kPa)	2.9	2.6	3.3
Corrected Deviator Stress (kPa)	234.5	267.0	271.8
Corrected Major Stress (kPa)	303.5	404.9	547.5



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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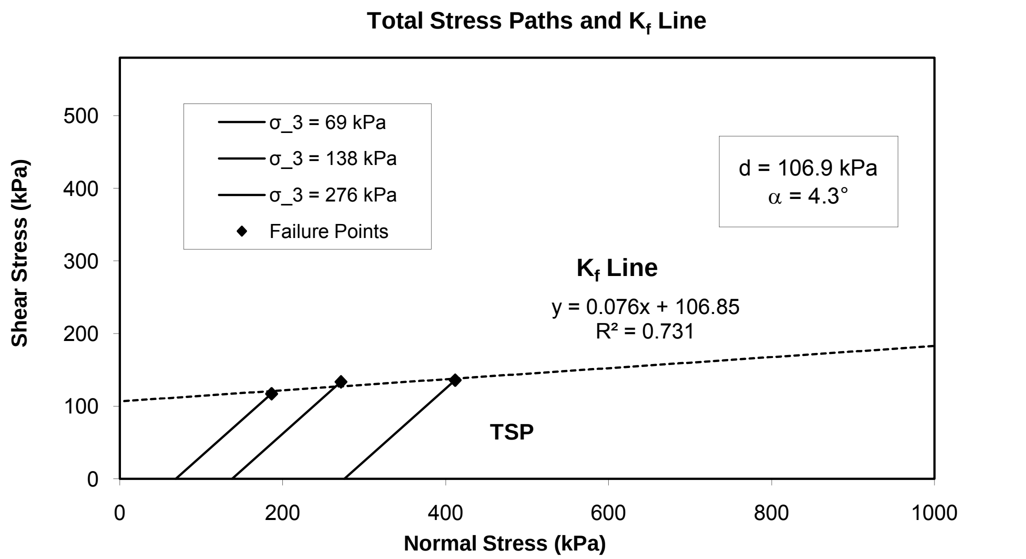
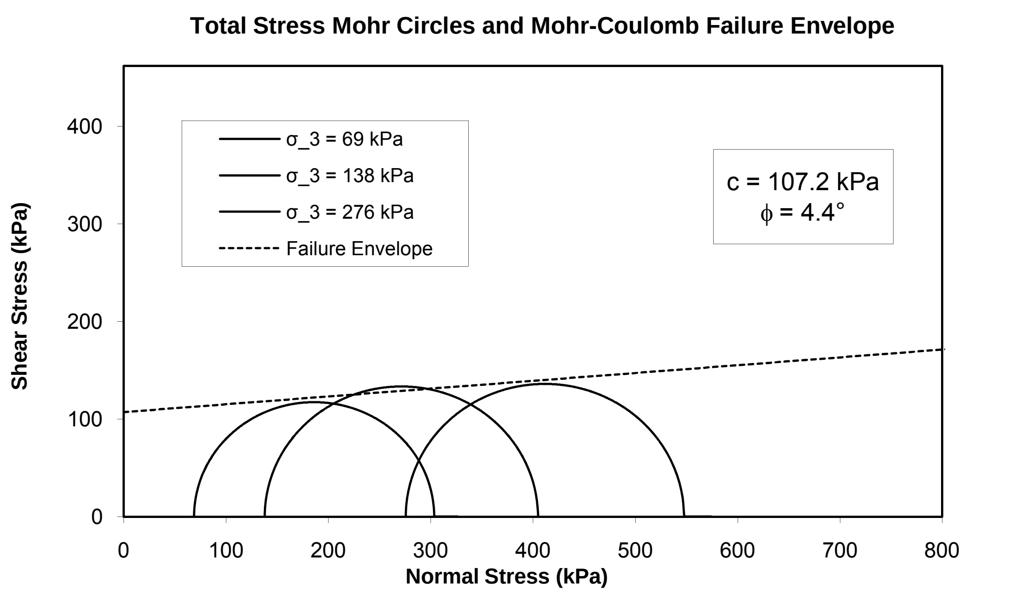
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 25% water content (S50B25W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 11/13/009





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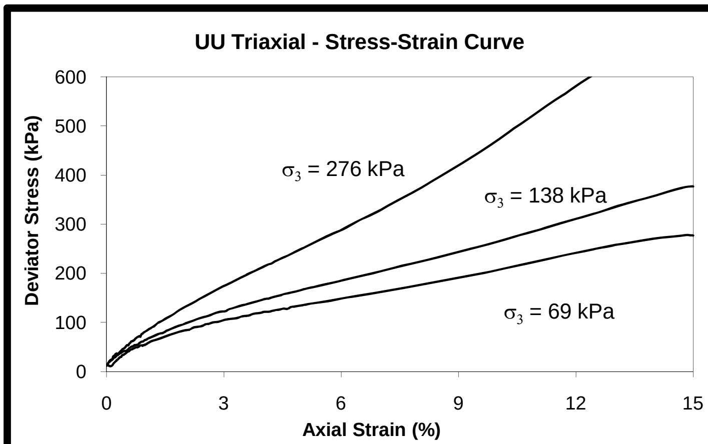
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 10% water content (M15B10W)		
Specimen Type: Compacted		USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 11/21/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	410	4	FJ1	B8	213	1
Wt. of Tin (g)	28.4	28.7	28	28.5	27.9	28.1
Wt. of Tin + Wet soil (g)	80.9	112.3	84.8	163.5	161.2	163.8
Wt. of Tin + Dry soil (g)	76	104.3	79.5	150.5	148.6	150.8
Wt. of Dry Soil (g)	47.60	75.60	51.50	122.0	120.7	122.7
Wt. of Water (g)	4.90	8.00	5.30	13.0	12.6	13.0
Water Content (%)	10.29	10.58	10.29	10.7	10.4	10.6
Average Water Content (%)		10.4			10.6	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.13	7.13	7.11
Average Diameter, D (cm)	3.50	3.53	3.52
Dry Unit Weight (kN/m^3)	17.45	16.97	17.40
Initial Void ratio	0.49	0.53	0.49
Saturation (%)	0.58	0.52	0.57
Strain at Failure (%)	15.03	15.01	15.00
Max Deviator Stress (kPa)	281.3	380.6	699.1
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	278.0	377.3	695.8
Corrected Major Stress (kPa)	347.0	515.2	971.6

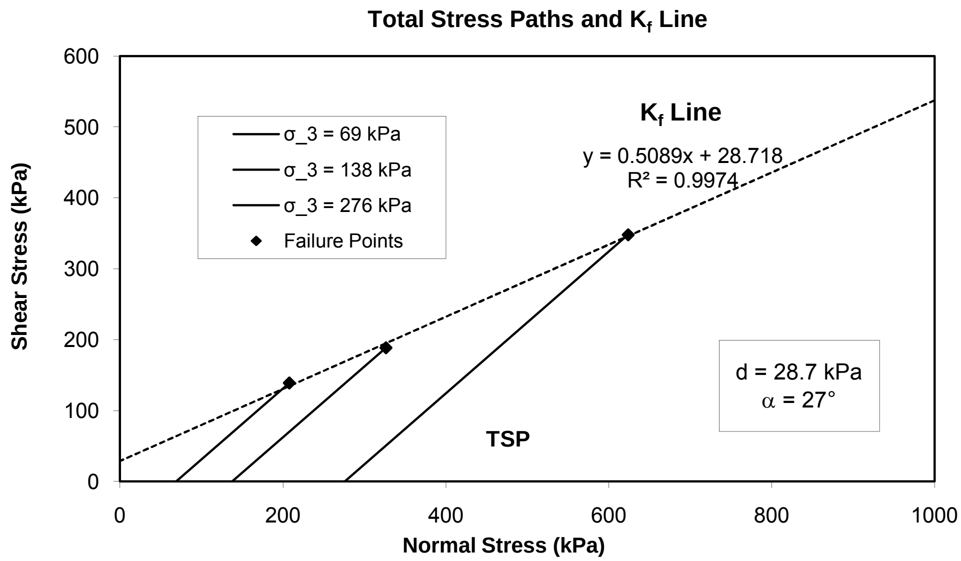


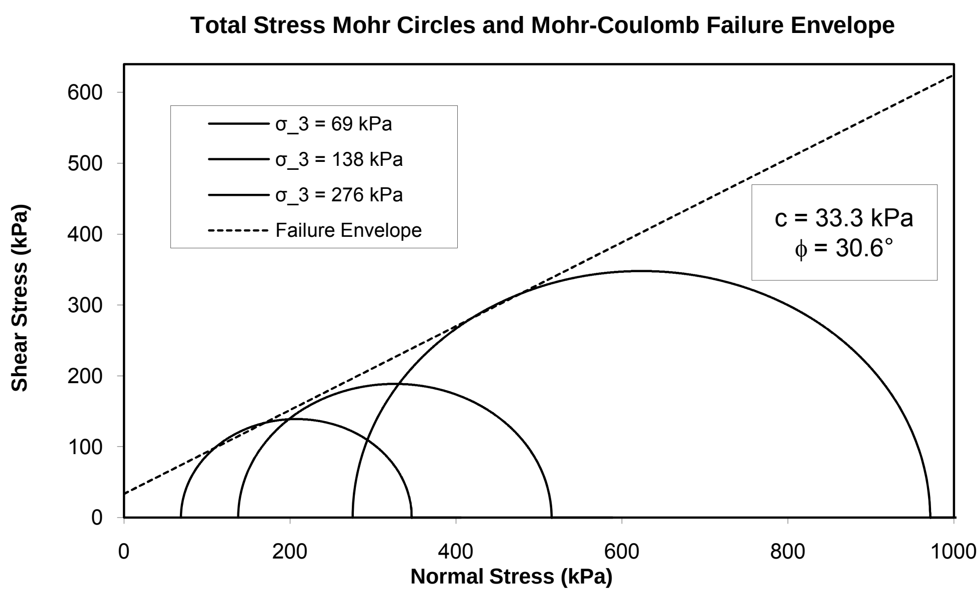
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 10% water content (M15B10W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 11/21/2009





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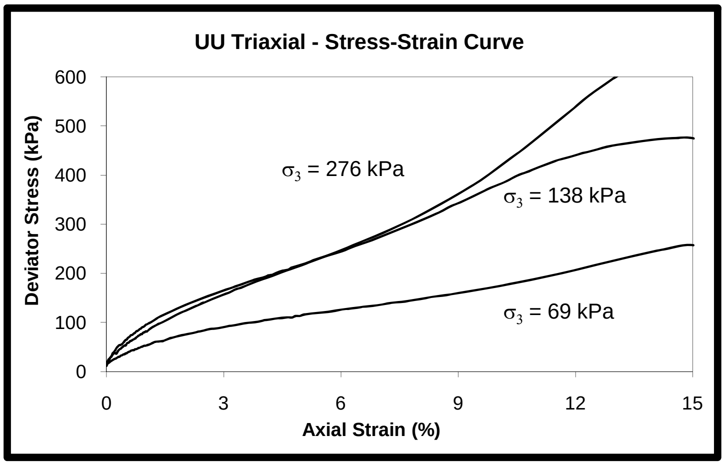
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 12% water content (M15B12W)		
Specimen Type: Compacted		USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 9/21/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B19	101	7
Wt. of Tin (g)	28.5	27.9	28.1	27.4	28	28.2
Wt. of Tin + Wet soil (g)	100.5	105.5	109.1	164.4	170.0	166.8
Wt. of Tin + Dry soil (g)	92.7	97.1	100.5	149.6	154.7	151.9
Wt. of Dry Soil (g)	64.20	69.20	72.40	122.2	126.7	123.7
Wt. of Water (g)	7.80	8.40	8.60	14.8	15.3	14.9
Water Content (%)	12.15	12.14	11.88	12.1	12.1	12.0
Average Water Content (%)		12.1			12.1	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.13	7.15	7.14
Average Diameter, D (cm)	3.50	3.53	3.50
Dry Unit Weight (kN/m^3)	17.48	17.76	17.67
Initial Void ratio	0.49	0.46	0.47
Saturation (%)	0.66	0.69	0.68
Strain at Failure (%)	14.83	14.81	15.03
Max Deviator Stress (kPa)	261.1	480.2	674.0
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	257.8	477.0	670.6
Corrected Major Stress (kPa)	326.8	614.9	946.4



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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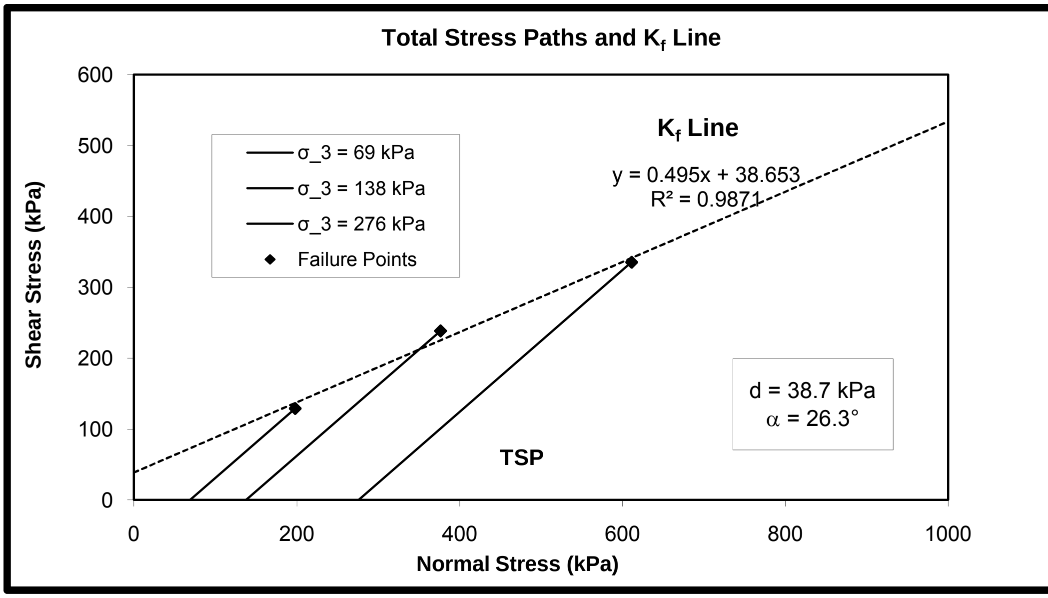
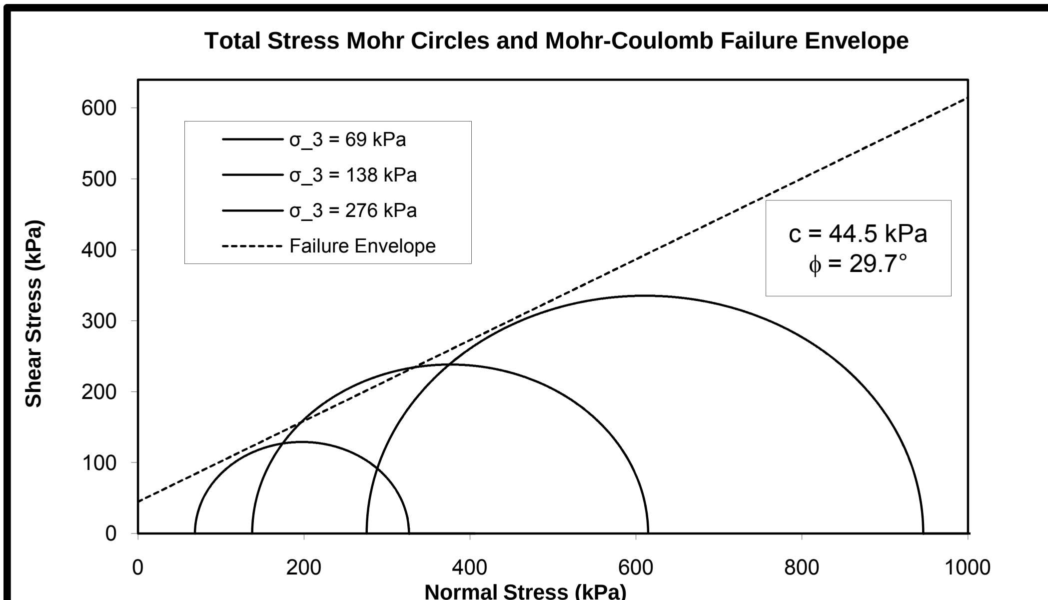
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 12% water content (M15B12W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/21/2009





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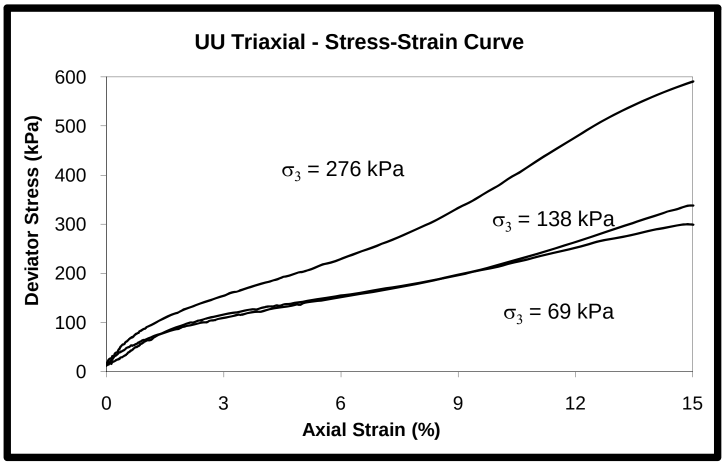
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 14% water content (M15B14W)		
Specimen Type: Compacted	USCS: Clayey sand (SC)	Gs: 2.65	
Strain Rate: 1%/min	Tested By: Yueru Chen	Date: 9/22/2009	

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ5	46	201	209	31
Wt. of Tin (g)	28.7	28	28.9	28.9	28.2	28.4
Wt. of Tin + Wet soil (g)	113.6	102.9	121.9	172.5	169.5	168.9
Wt. of Tin + Dry soil (g)	103.2	93.8	110.7	154.8	152.2	151.6
Wt. of Dry Soil (g)	74.50	65.80	81.80	125.9	124.0	123.2
Wt. of Water (g)	10.40	9.10	11.20	17.7	17.3	17.3
Water Content (%)	13.96	13.83	13.69	14.1	14.0	14.0
Average Water Content (%)		13.8			14.0	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.13	7.13
Average Diameter, D (cm)	3.51	3.51	3.47
Dry Unit Weight (kN/m^3)	17.93	17.63	17.92
Initial Void ratio	0.45	0.47	0.45
Saturation (%)	0.83	0.78	0.83
Strain at Failure (%)	15.03	15.01	15.00
Max Deviator Stress (kPa)	303.1	341.5	594.0
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	299.8	338.2	590.7
Corrected Major Stress (kPa)	368.7	476.1	866.5



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1-\sigma_3)=4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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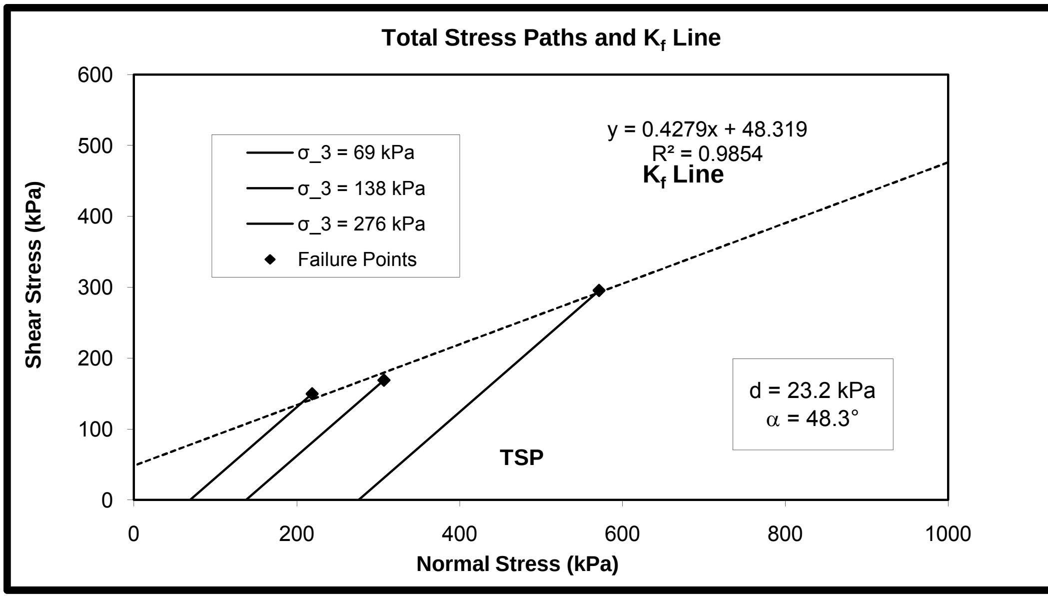
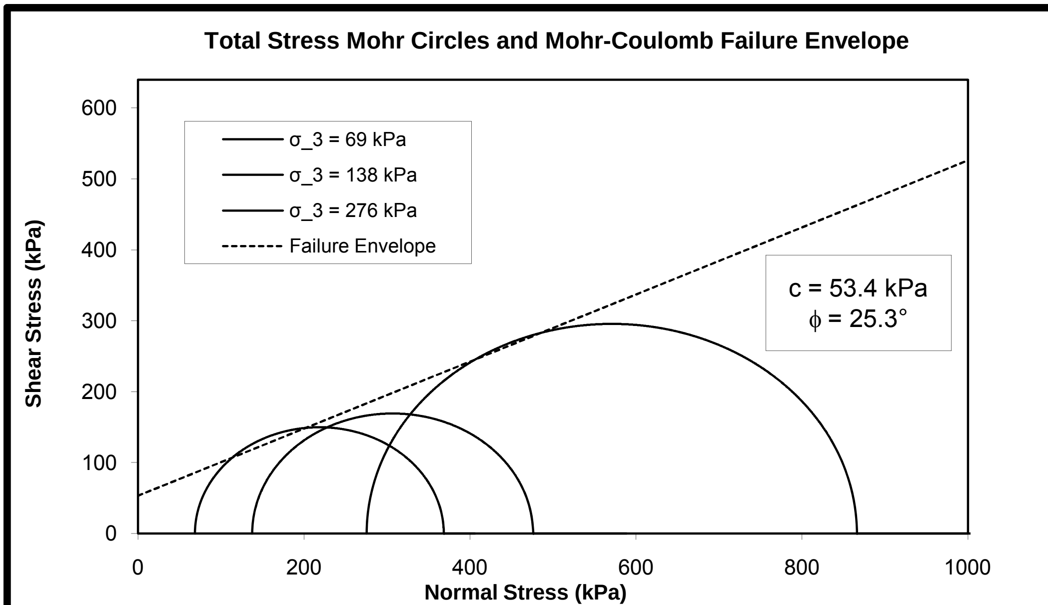
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 14% water content (M15B14W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/22/2009





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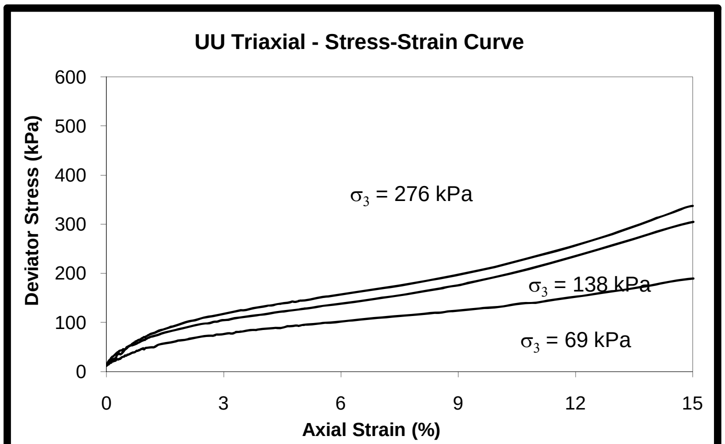
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 16% water content (M15B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 11/24/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	410	4	FJ1	B8	213	1
Wt. of Tin (g)	28.4	28.7	28.1	28.5	27.9	28.1
Wt. of Tin + Wet soil (g)	117.3	117.1	115.8	171.6	169.7	169.6
Wt. of Tin + Dry soil (g)	105.1	105.1	103.8	151.7	149.8	149.7
Wt. of Dry Soil (g)	76.70	76.40	75.70	123.2	121.9	121.6
Wt. of Water (g)	12.20	12.00	12.00	19.9	19.9	19.9
Water Content (%)	15.91	15.71	15.85	16.2	16.3	16.4
Average Water Content (%)	15.8			16.3		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.12	7.14
Average Diameter, D (cm)	3.51	3.50	3.50
Dry Unit Weight (kN/m^3)	17.54	17.48	17.37
Initial Void ratio	0.48	0.49	0.50
Saturation (%)	0.89	0.89	0.87
Strain at Failure (%)	15.02	15.02	15.00
Max Deviator Stress (kPa)	192.9	308.1	340.5
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	189.5	304.7	337.2
Corrected Major Stress (kPa)	258.5	442.6	613.0



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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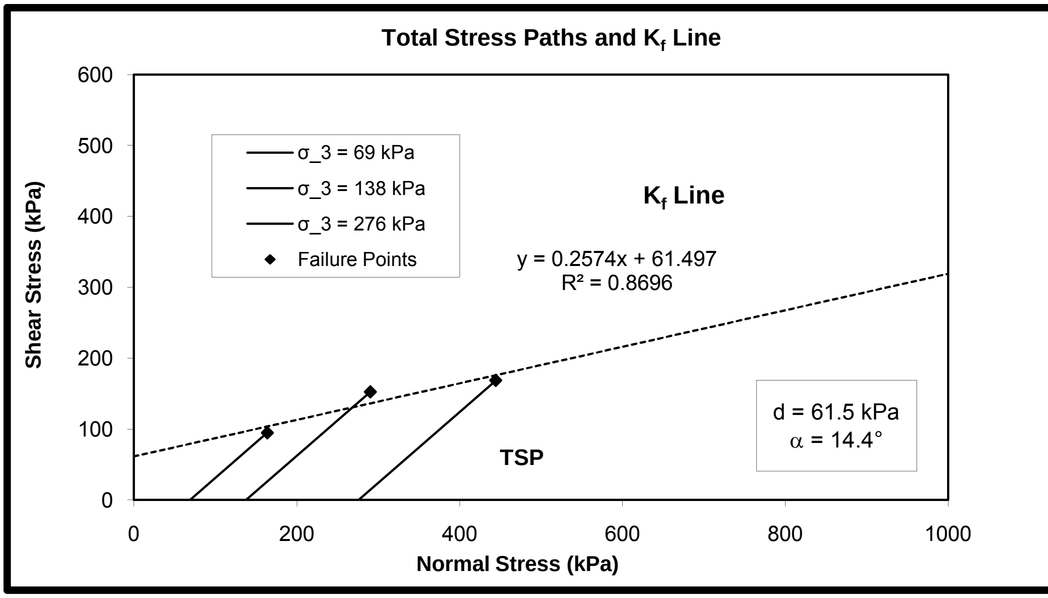
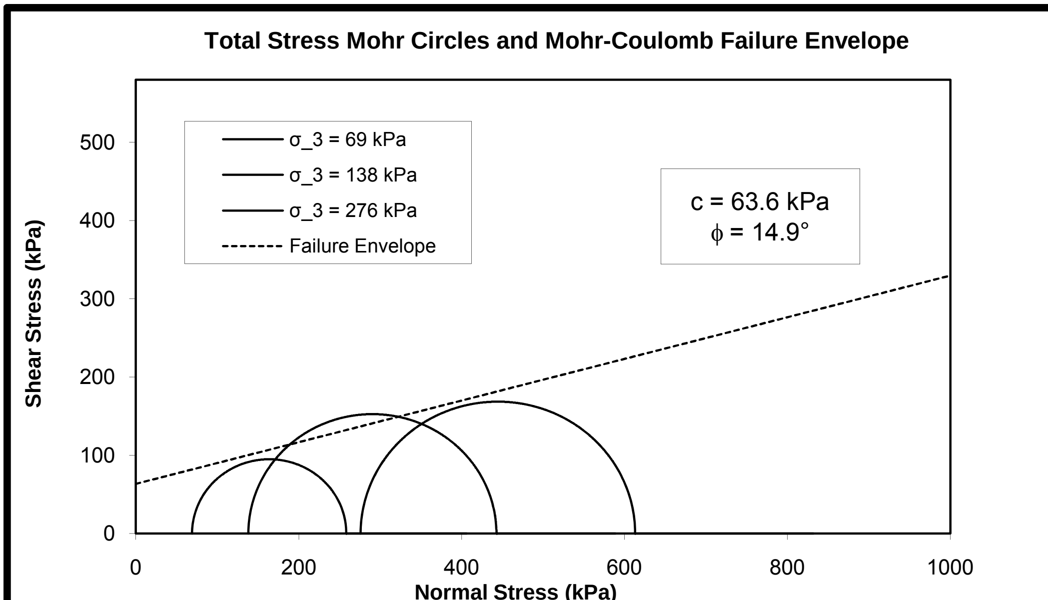
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 16% water content (M15B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.65
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 11/24/2009





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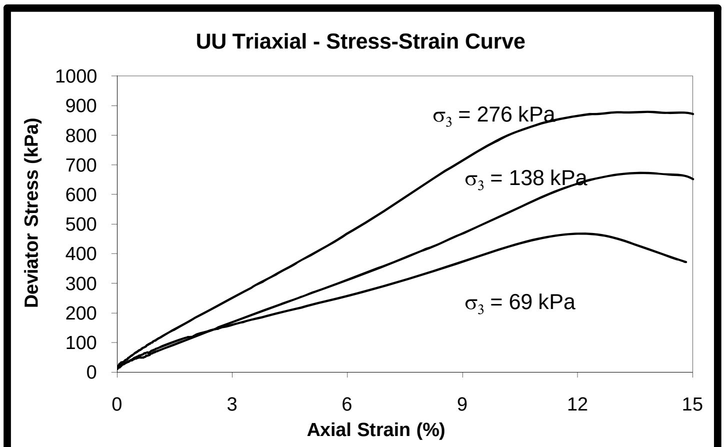
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 8% water content (M25B8W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/2/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B-19	B8	101
Wt. of Tin (g)	28.5	27.9	28.1	27.4	28.5	28
Wt. of Tin + Wet soil (g)	76.8	69.8	92	156.2	161.4	158.0
Wt. of Tin + Dry soil (g)	72.9	66.7	87	146.5	150.5	147.9
Wt. of Dry Soil (g)	44.40	38.80	58.90	119.1	122.0	119.9
Wt. of Water (g)	3.90	3.10	5.00	9.7	10.9	10.1
Water Content (%)	8.78	7.99	8.49	8.1	8.9	8.4
Average Water Content (%)	8.4			8.5		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.14	7.11	7.13
Average Diameter, D (cm)	3.50	3.54	3.54
Dry Unit Weight (kN/m^3)	16.98	17.13	16.78
Initial Void ratio	0.53	0.51	0.54
Saturation (%)	0.41	0.46	0.41
Strain at Failure (%)	12.07	13.81	13.83
Max Deviator Stress (kPa)	469.9	675.1	882.7
Membrane Correction (kPa)	2.7	3.0	3.0
Corrected Deviator Stress (kPa)	467.2	672.1	879.7
Corrected Major Stress (kPa)	536.2	810.0	1155.5



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1-\sigma_3)=4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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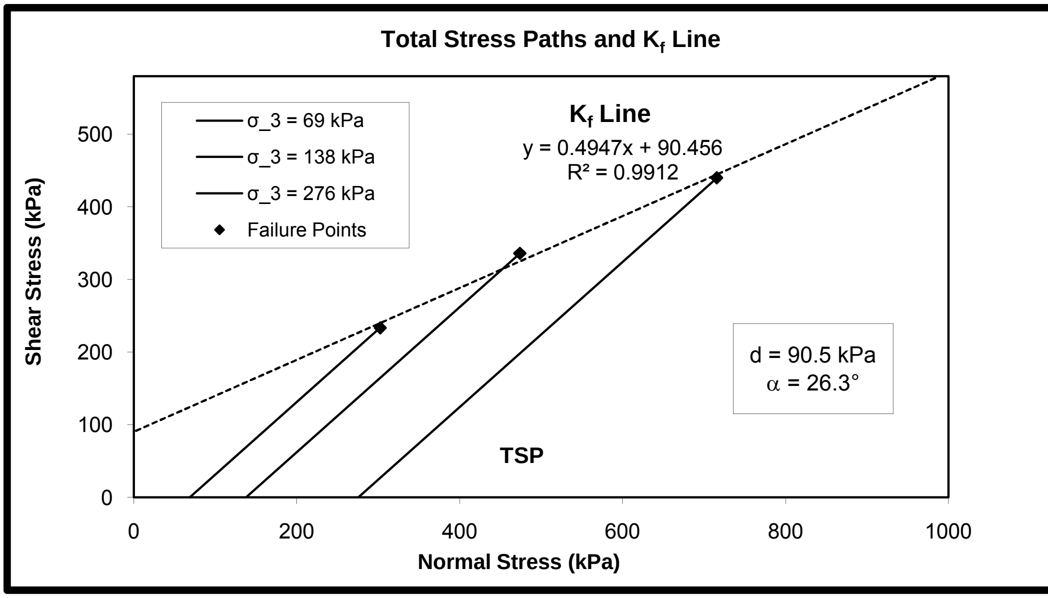
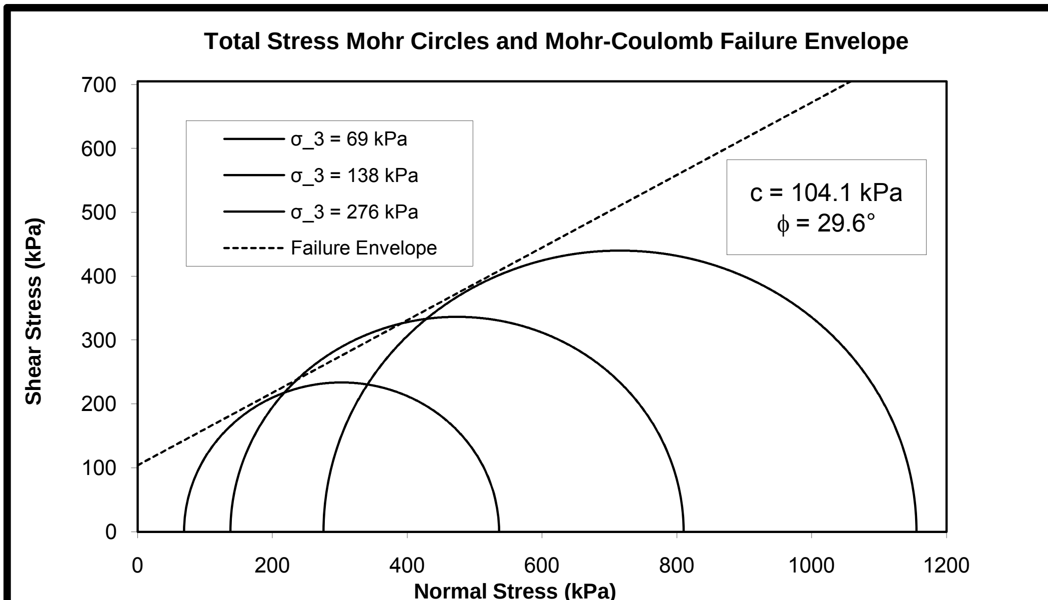
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 8% water content (M25B8W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/2/2009





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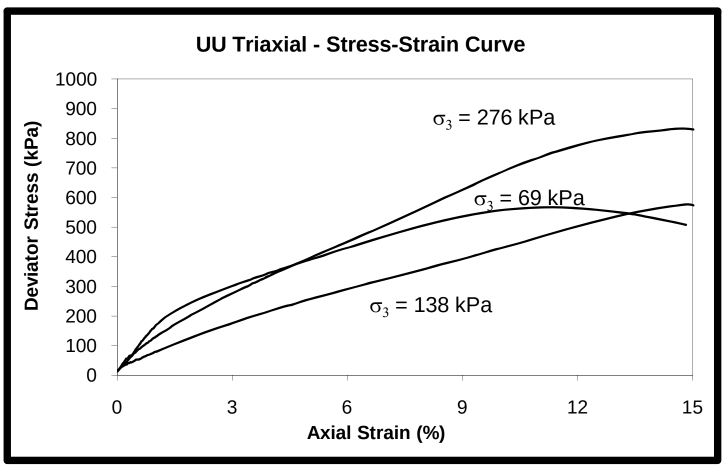
Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 10% water content (M25B10W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/23/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28	28.9	28.9	28.2	28.4
Wt. of Tin + Wet soil (g)	78.1	70.8	93.9	171.9	163.8	168.3
Wt. of Tin + Dry soil (g)	73.5	66.6	87.9	158.2	151.4	155.0
Wt. of Dry Soil (g)	44.80	38.60	59.00	129.3	123.2	126.6
Wt. of Water (g)	4.60	4.20	6.00	13.7	12.4	13.3
Water Content (%)	10.27	10.88	10.17	10.6	10.1	10.5
Average Water Content (%)	10.4			10.4		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.13	7.15	7.13
Average Diameter, D (cm)	3.49	3.53	3.51
Dry Unit Weight (kN/m^3)	18.60	17.27	18.00
Initial Void ratio	0.39	0.50	0.44
Saturation (%)	0.71	0.53	0.63
Strain at Failure (%)	11.32	14.88	14.80
Max Deviator Stress (kPa)	568.9	579.5	836.0
Membrane Correction (kPa)	2.5	3.3	3.3
Corrected Deviator Stress (kPa)	566.4	576.3	832.7
Corrected Major Stress (kPa)	635.3	714.2	1108.5



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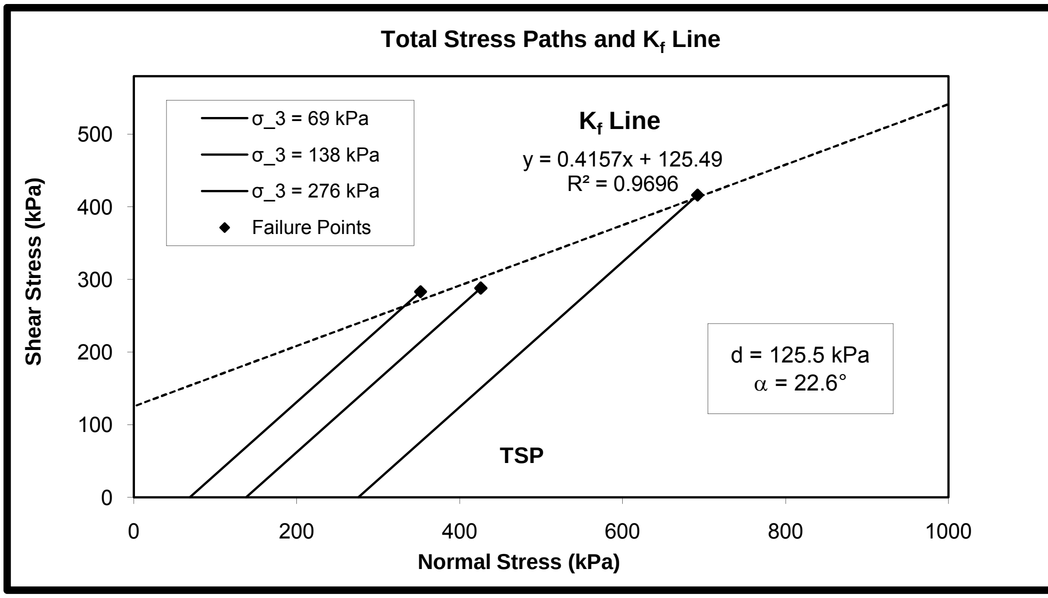
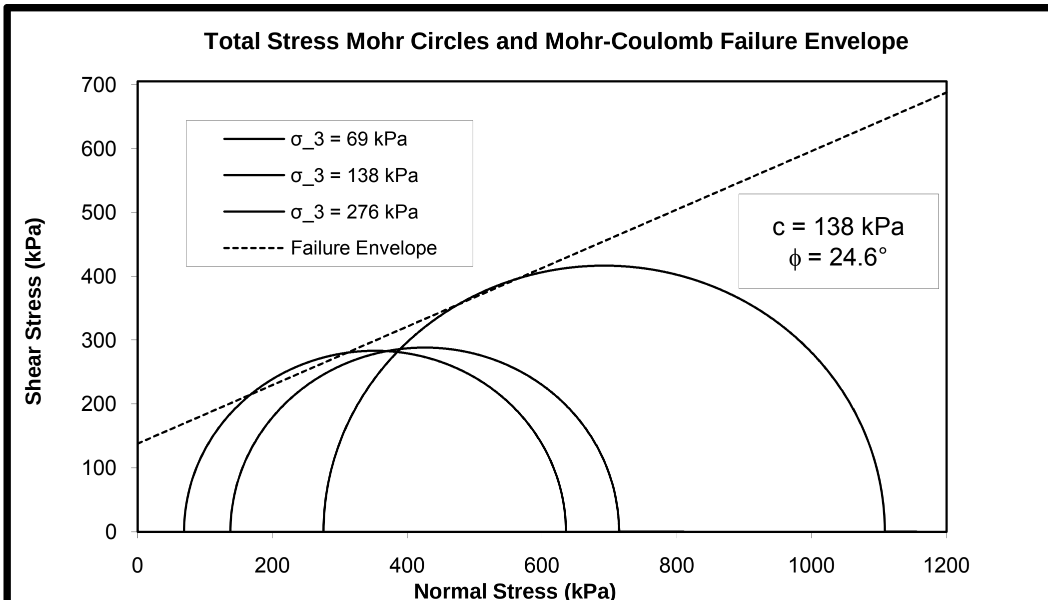
Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 10% water content (M25B10W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 9/23/2009





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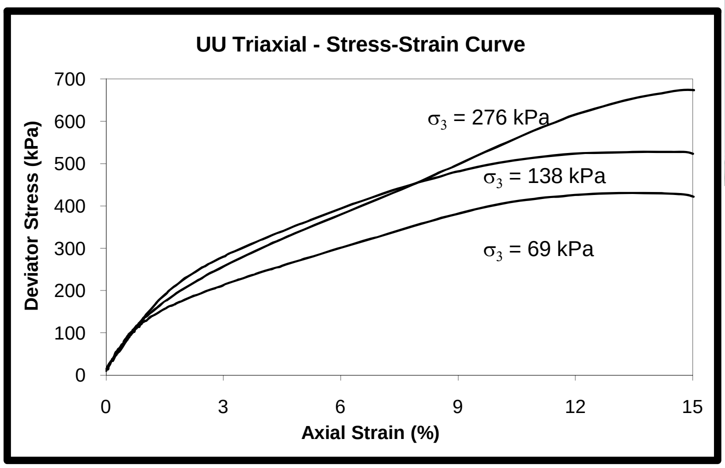
Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 12% water content (M25B12W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/2/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28	28.9	28.9	28.2	28.4
Wt. of Tin + Wet soil (g)	81.4	76.6	83.8	172.5	173.0	170.2
Wt. of Tin + Dry soil (g)	75.9	71.2	78	156.6	156.9	154.8
Wt. of Dry Soil (g)	47.20	43.20	49.10	127.7	128.7	126.4
Wt. of Water (g)	5.50	5.40	5.80	15.9	16.1	15.4
Water Content (%)	11.65	12.50	11.81	12.5	12.5	12.2
Average Water Content (%)	12.0			12.4		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.10	7.12	7.13
Average Diameter, D (cm)	3.52	3.53	3.51
Dry Unit Weight (kN/m^3)	18.13	18.12	17.97
Initial Void ratio	0.43	0.43	0.44
Saturation (%)	0.77	0.77	0.73
Strain at Failure (%)	13.58	13.82	14.84
Max Deviator Stress (kPa)	433.9	531.2	677.8
Membrane Correction (kPa)	3.0	3.0	3.3
Corrected Deviator Stress (kPa)	430.9	528.1	674.5
Corrected Major Stress (kPa)	499.8	666.0	950.3



Notes: Membrane correction according to ASTM D 2850-03a:

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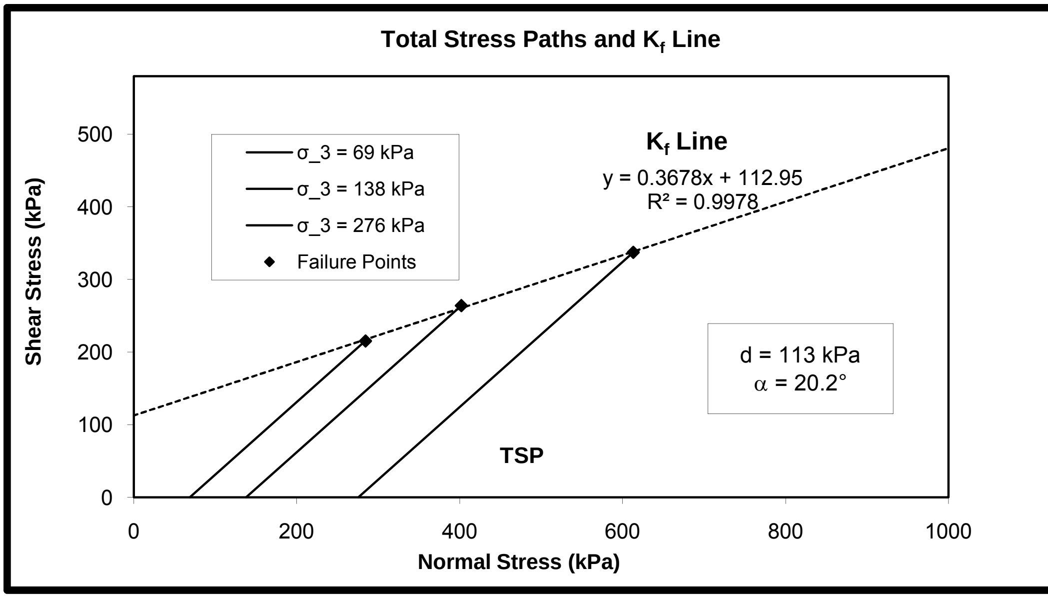
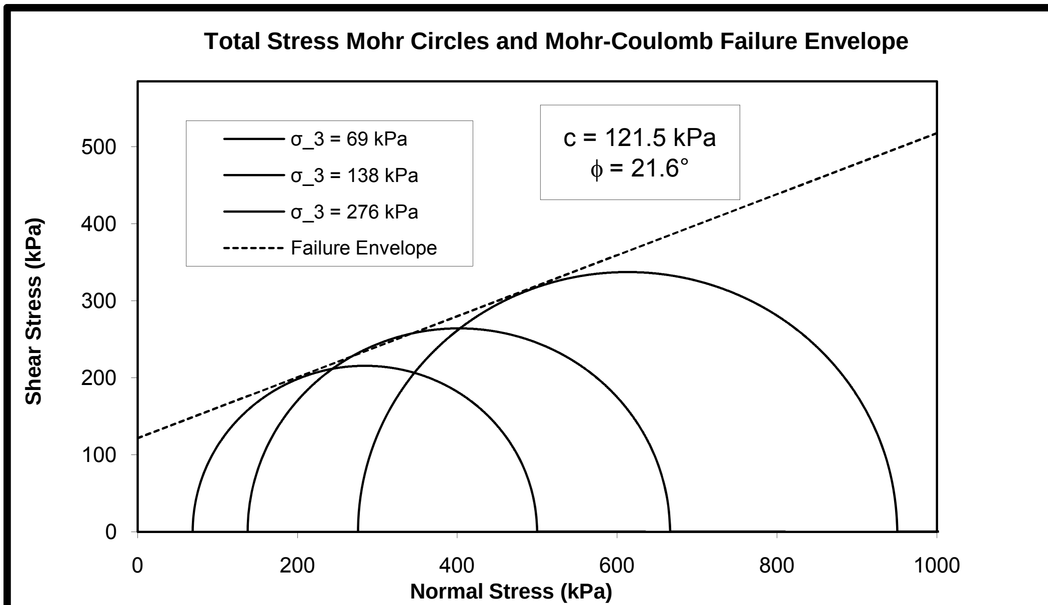
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 12% water content (M25B12W)		
Specimen Type: Compacted		USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 10/2/2009





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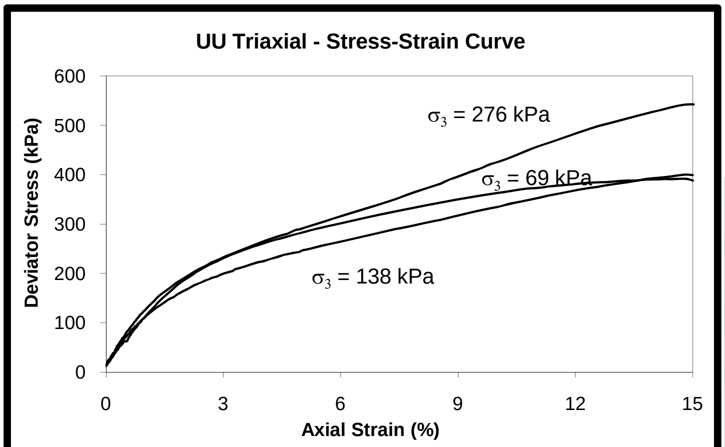
Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 14% water content (M25B14W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/5/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28	28.9	28.9	28.2	28.4
Wt. of Tin + Wet soil (g)	109.5	99.9	83.3	176.8	172.4	174.2
Wt. of Tin + Dry soil (g)	99.7	91.1	76.8	158.6	154.5	156.2
Wt. of Dry Soil (g)	71.00	63.10	47.90	129.7	126.3	127.8
Wt. of Water (g)	9.80	8.80	6.50	18.2	17.9	18.0
Water Content (%)	13.80	13.95	13.57	14.0	14.2	14.1
Average Water Content (%)		13.8			14.1	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.13	7.13	7.14
Average Diameter, D (cm)	3.53	3.52	3.52
Dry Unit Weight (kN/m^3)	18.23	17.86	18.04
Initial Void ratio	0.42	0.45	0.44
Saturation (%)	0.88	0.83	0.85
Strain at Failure (%)	14.82	14.80	14.84
Max Deviator Stress (kPa)	395.4	403.3	545.9
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	392.1	400.1	542.6
Corrected Major Stress (kPa)	461.1	538.0	818.4

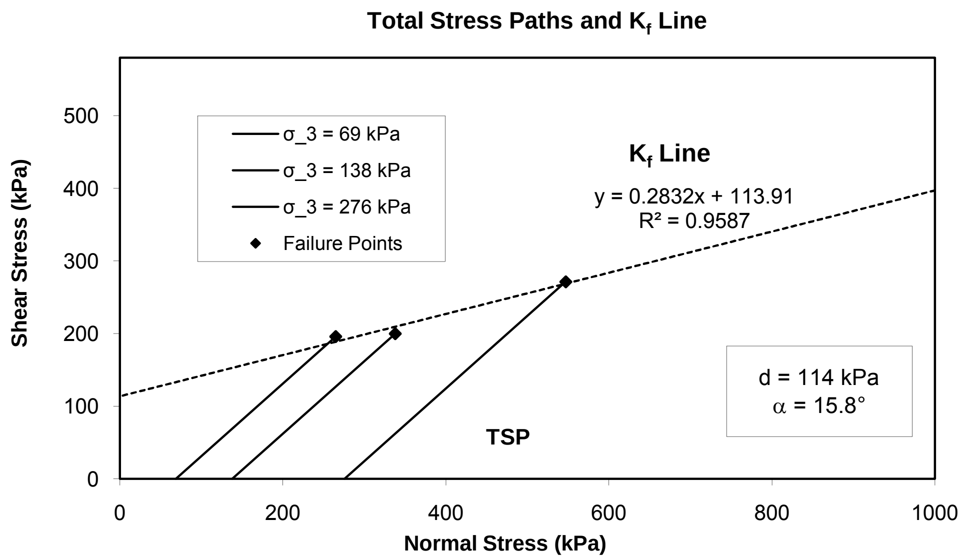


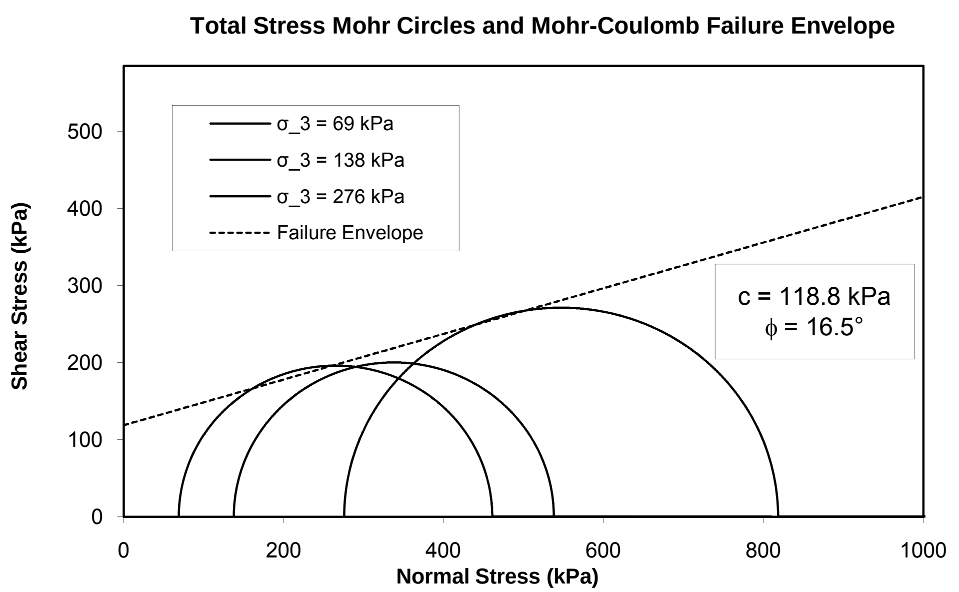
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 14% water content (M25B14W)				
Specimen Type:	Compacted	USCS:	Clayey sand (SC)	Gs:	2.64
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	10/5/2009





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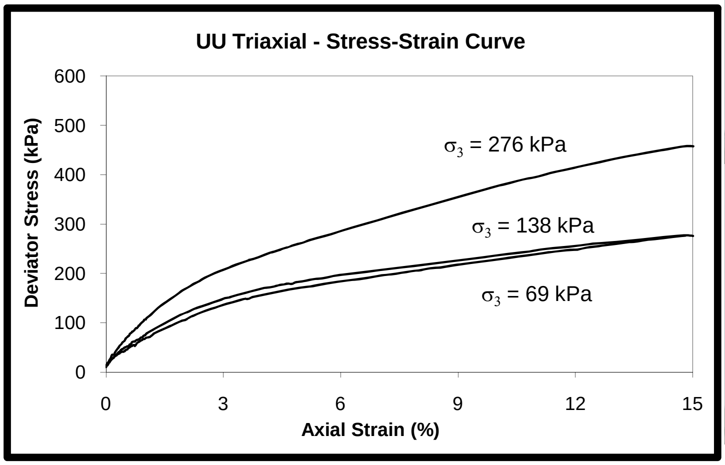
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 16% water content (M25B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/5/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B19	101	7
Wt. of Tin (g)	28.5	27.9	28.1	27.4	28	28.2
Wt. of Tin + Wet soil (g)	86.3	104.2	90.9	174.1	172.1	173.8
Wt. of Tin + Dry soil (g)	78.2	93.9	82.3	153.4	151.9	154.0
Wt. of Dry Soil (g)	49.70	66.00	54.20	126.0	123.9	125.8
Wt. of Water (g)	8.10	10.30	8.60	20.7	20.2	19.8
Water Content (%)	16.30	15.61	15.87	16.4	16.3	15.7
Average Water Content (%)		15.9			16.2	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.14	7.08	7.12
Average Diameter, D (cm)	3.53	3.53	3.50
Dry Unit Weight (kN/m^3)	17.69	17.54	18.02
Initial Void ratio	0.46	0.48	0.44
Saturation (%)	0.93	0.90	0.95
Strain at Failure (%)	14.83	15.01	14.83
Max Deviator Stress (kPa)	280.5	280.7	461.6
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	277.2	277.4	458.3
Corrected Major Stress (kPa)	346.2	415.3	734.1



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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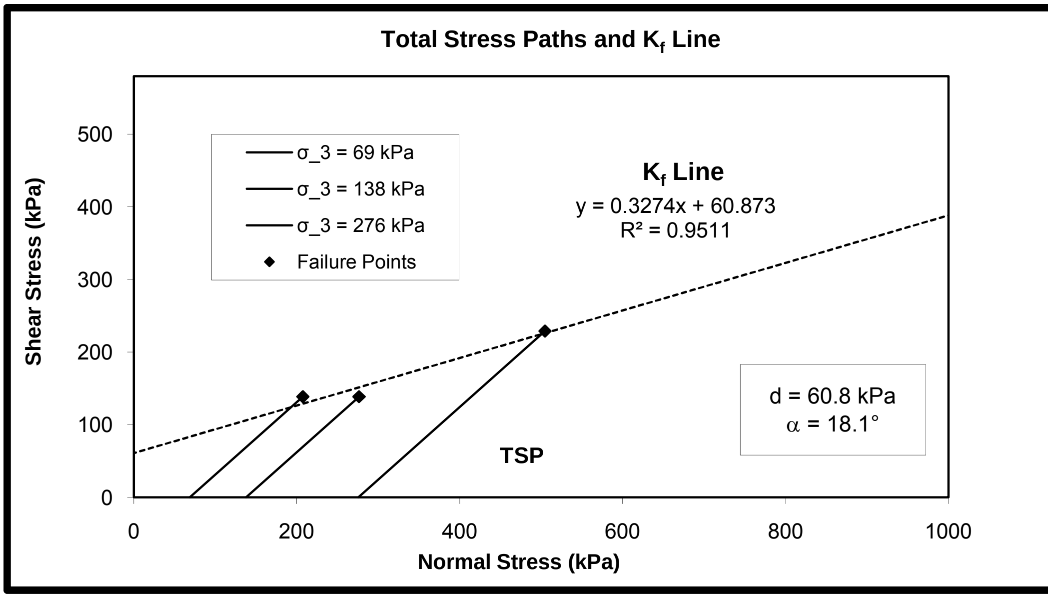
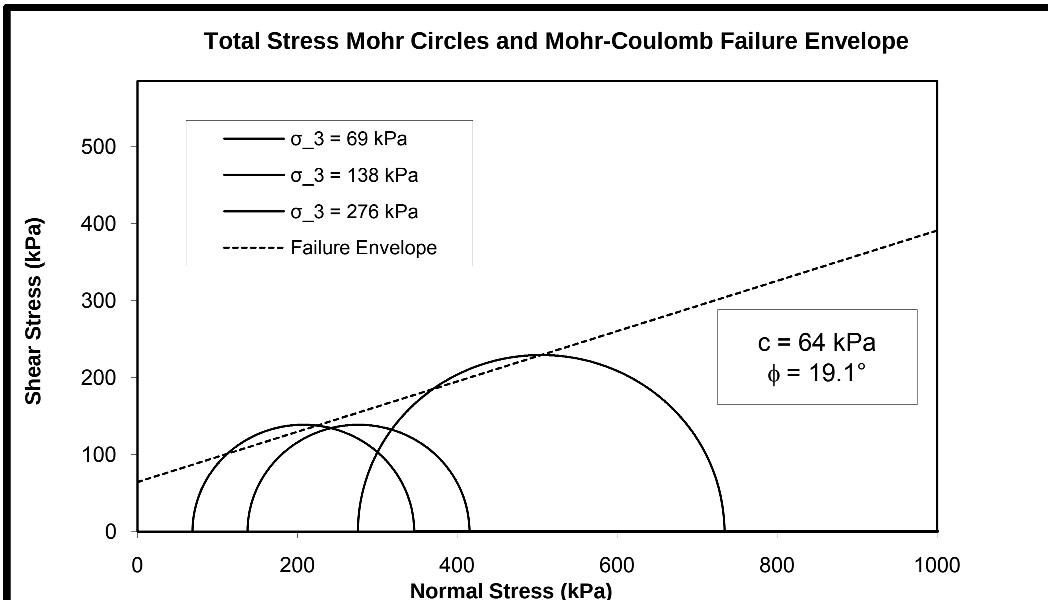
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 16% water content (M25B16W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/5/2009





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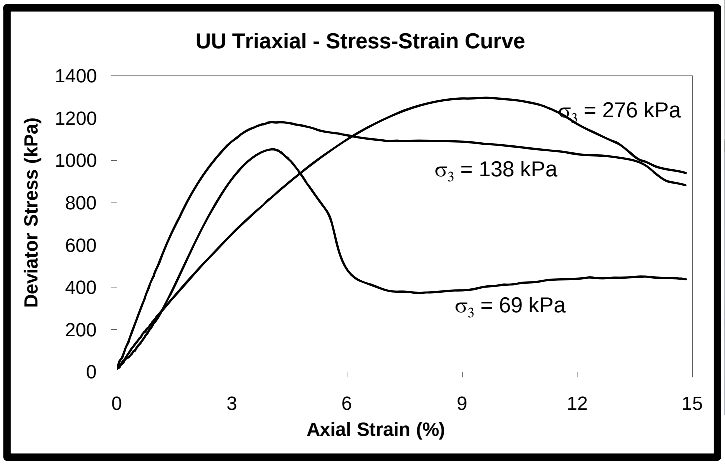
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 14% water content (M50B14W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/7/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	201
Wt. of Tin (g)	28.7	28	28.9	28.9	28.2	28.9
Wt. of Tin + Wet soil (g)	106.1	159.6	126	168.3	170.4	171.6
Wt. of Tin + Dry soil (g)	96.9	143	114.7	150.5	152.9	152.8
Wt. of Dry Soil (g)	68.20	115.00	85.80	121.6	124.7	123.9
Wt. of Water (g)	9.20	16.60	11.30	17.8	17.5	18.8
Water Content (%)	13.49	14.43	13.17	14.6	14.0	15.2
Average Water Content (%)	13.7			14.6		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.14	7.13
Average Diameter, D (cm)	3.47	3.49	3.53
Dry Unit Weight (kN/m^3)	17.72	17.91	17.42
Initial Void ratio	0.46	0.44	0.48
Saturation (%)	0.84	0.84	0.83
Strain at Failure (%)	4.04	4.23	9.56
Max Deviator Stress (kPa)	1052.5	1181.2	1297.7
Membrane Correction (kPa)	0.9	0.9	2.1
Corrected Deviator Stress (kPa)	1051.6	1180.3	1295.6
Corrected Major Stress (kPa)	1120.5	1318.2	1571.4



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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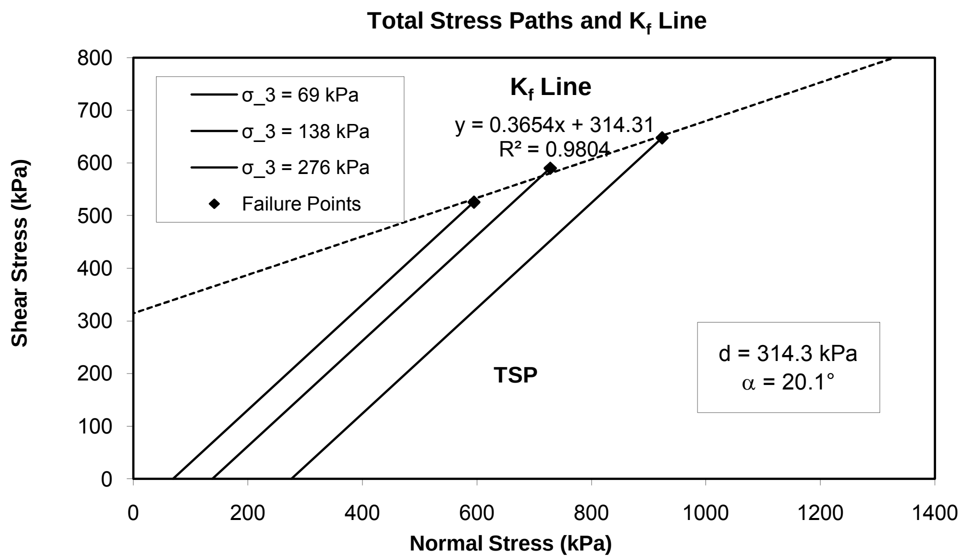
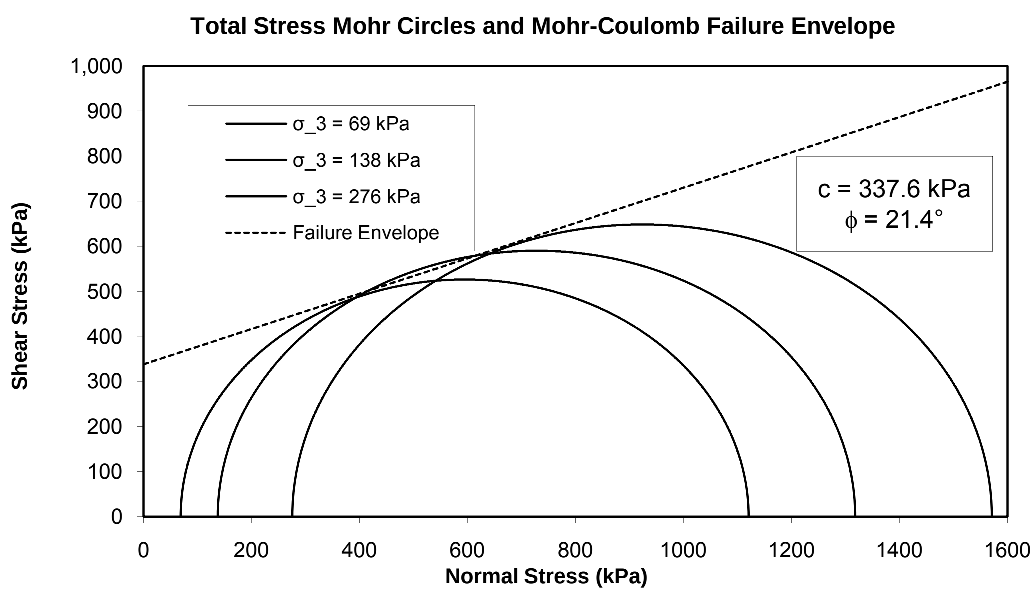
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 14% water content (M50B14W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/7/2009





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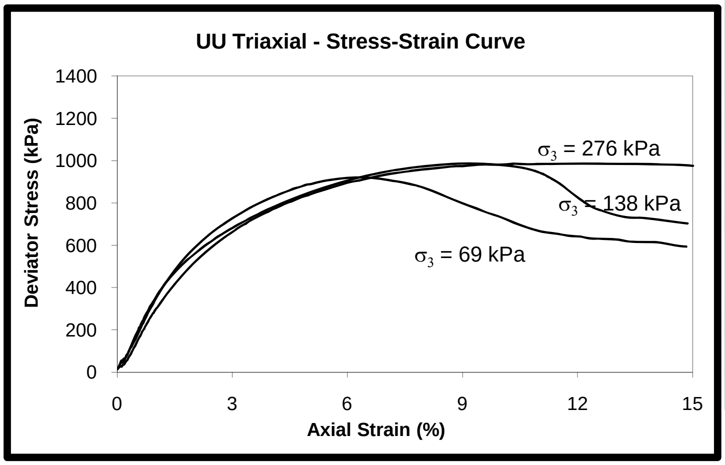
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 16% water content (M50B16W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/7/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B19	101	7
Wt. of Tin (g)	28.5	27.9	28.1	27.4	28	28.2
Wt. of Tin + Wet soil (g)	95	87	61	174.4	173.8	173.3
Wt. of Tin + Dry soil (g)	85.5	78.8	56.5	154.3	153.0	153.3
Wt. of Dry Soil (g)	57.00	50.90	28.40	126.9	125.0	125.1
Wt. of Water (g)	9.50	8.20	4.50	20.1	20.8	20.0
Water Content (%)	16.67	16.11	15.85	15.8	16.6	16.0
Average Water Content (%)		16.2			16.2	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.14	7.14	7.13
Average Diameter, D (cm)	3.53	3.50	3.49
Dry Unit Weight (kN/m^3)	17.82	17.85	17.99
Initial Void ratio	0.45	0.45	0.43
Saturation (%)	0.93	0.98	0.97
Strain at Failure (%)	4.63	6.54	7.04
Max Deviator Stress (kPa)	1080.4	998.2	1234.2
Membrane Correction (kPa)	1.0	1.5	1.6
Corrected Deviator Stress (kPa)	1079.3	996.7	1232.6
Corrected Major Stress (kPa)	1148.3	1134.6	1508.4



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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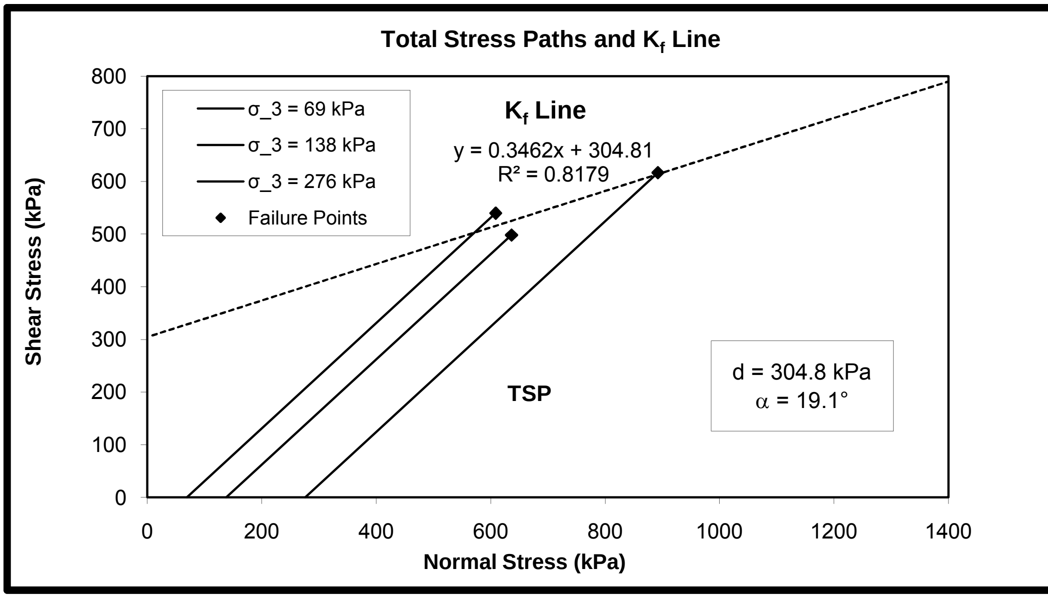
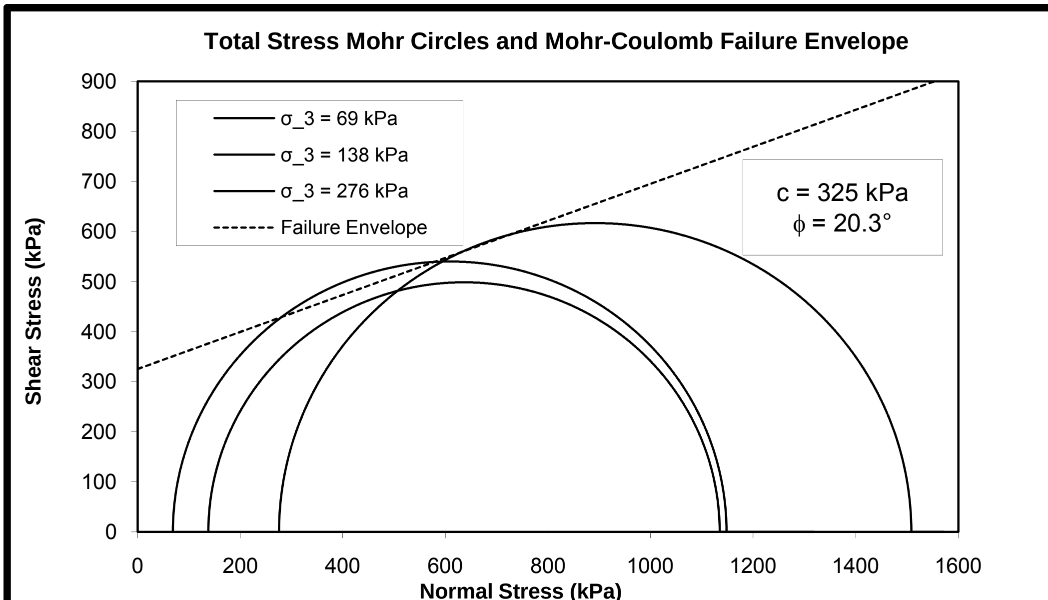
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 16% water content (M50B16W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/7/2009





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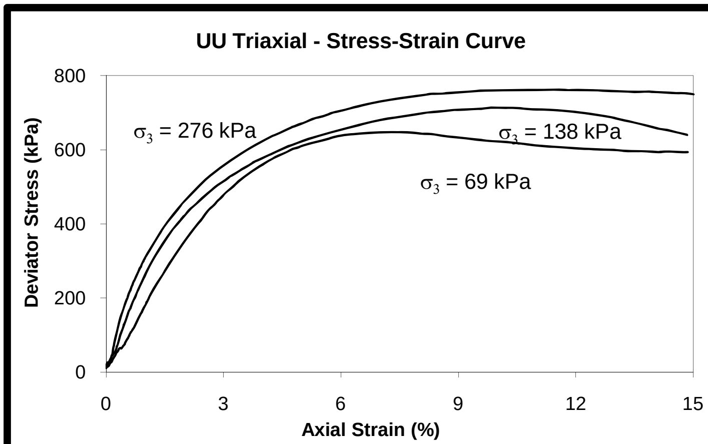
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 18% water content (M50B18W)		
Specimen Type: Compacted		USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 10/8/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	FJ-5	46	201	209	31
Wt. of Tin (g)	28.7	28	28.9	28.9	28.2	28.4
Wt. of Tin + Wet soil (g)	114.3	98.9	94.5	174.8	175.7	175.5
Wt. of Tin + Dry soil (g)	100.8	87.8	84.4	151.7	152.2	152.2
Wt. of Dry Soil (g)	72.10	59.80	55.50	122.8	124.0	123.8
Wt. of Water (g)	13.50	11.10	10.10	23.1	23.5	23.3
Water Content (%)	18.72	18.56	18.20	18.8	19.0	18.8
Average Water Content (%)	18.5			18.9		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.13	7.13	7.18
Average Diameter, D (cm)	3.50	3.53	3.52
Dry Unit Weight (kN/m^3)	17.56	17.43	17.38
Initial Void ratio	0.47	0.48	0.48
Saturation (%)	105.45	103.84	102.20
Strain at Failure (%)	7.33	9.83	11.56
Max Deviator Stress (kPa)	648.3	715.4	764.8
Membrane Correction (kPa)	1.6	2.2	2.6
Corrected Deviator Stress (kPa)	646.7	713.3	762.3
Corrected Major Stress (kPa)	715.6	851.2	1038.1



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Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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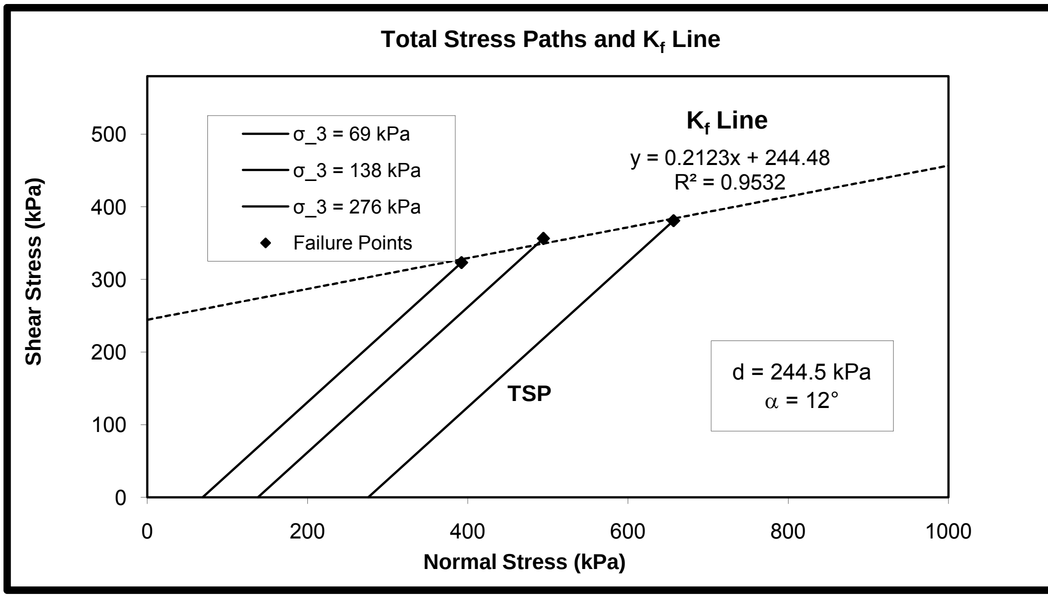
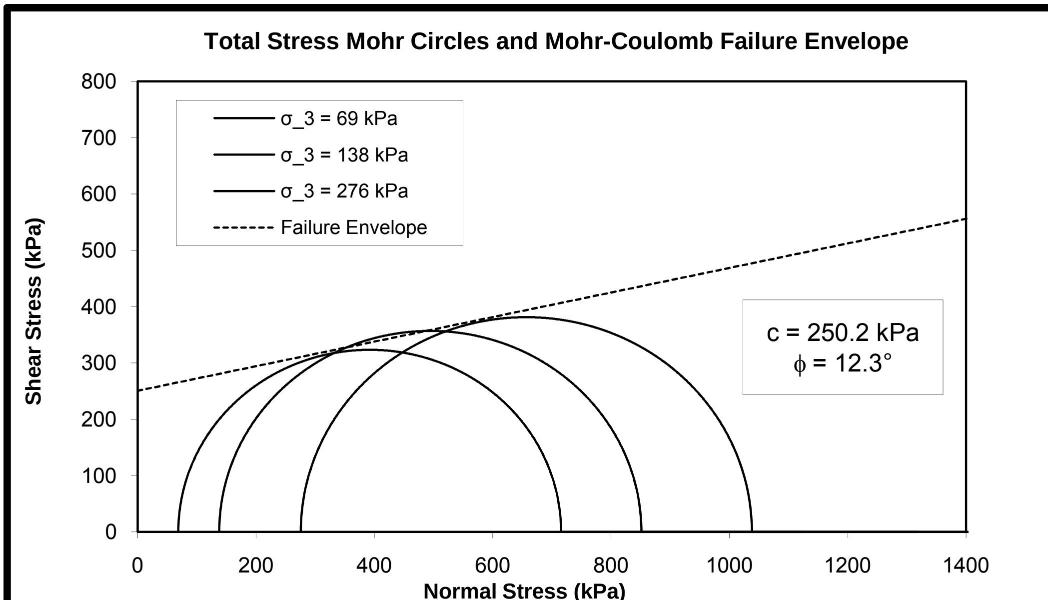
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 18% water content (M50B18W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/8/2009





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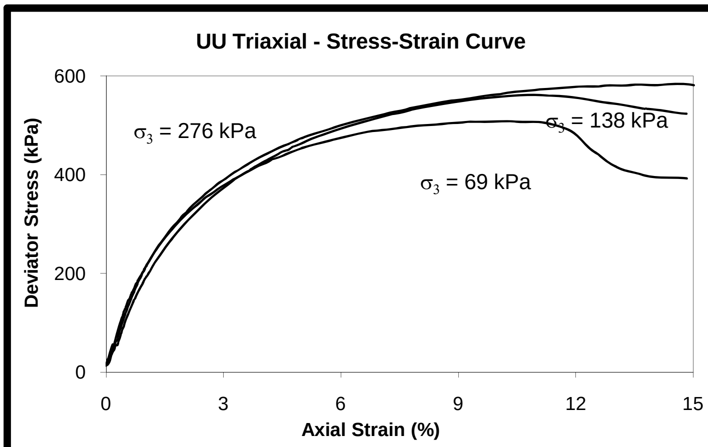
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 20% water content (M50B20W)		
Specimen Type: Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63	
Strain Rate: 1%/min	Tested By: Yueru Chen	Date: 10/8/2009	

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B8	213	1	B-19	101	7
Wt. of Tin (g)	28.5	27.9	28.1	27.4	28	28.2
Wt. of Tin + Wet soil (g)	97.4	92	88.9	172.3	170.8	172.5
Wt. of Tin + Dry soil (g)	85.9	81.4	78.8	147.7	146.6	148.0
Wt. of Dry Soil (g)	57.40	53.50	50.70	120.3	118.6	119.8
Wt. of Water (g)	11.50	10.60	10.10	24.6	24.2	24.5
Water Content (%)	20.03	19.81	19.92	20.4	20.4	20.5
Average Water Content (%)		19.9			20.4	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.14	7.10	7.12
Average Diameter, D (cm)	3.51	3.52	3.53
Dry Unit Weight (kN/m^3)	17.08	16.84	16.87
Initial Void ratio	0.51	0.53	0.53
Saturation (%)	105.37	100.84	101.53
Strain at Failure (%)	10.31	11.07	14.59
Max Deviator Stress (kPa)	510.7	564.2	586.8
Membrane Correction (kPa)	2.3	2.4	3.2
Corrected Deviator Stress (kPa)	508.4	561.8	583.6
Corrected Major Stress (kPa)	577.4	699.7	859.4



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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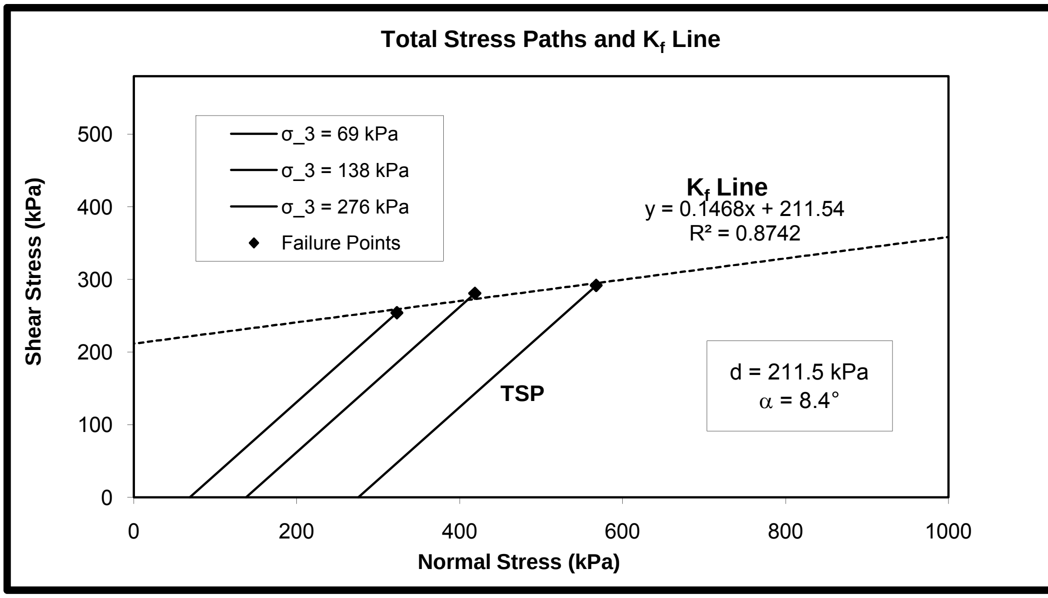
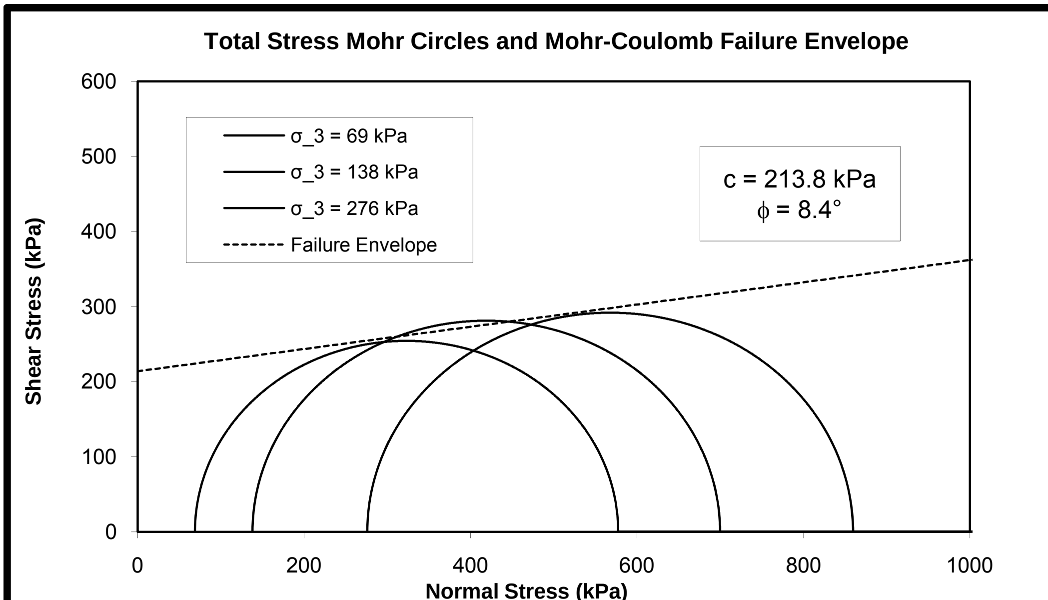
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 20% water content (M50B20W)		
Specimen Type:	Compacted	USCS: Sandy fat clay (CH)	Gs: 2.63
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 10/8/2009





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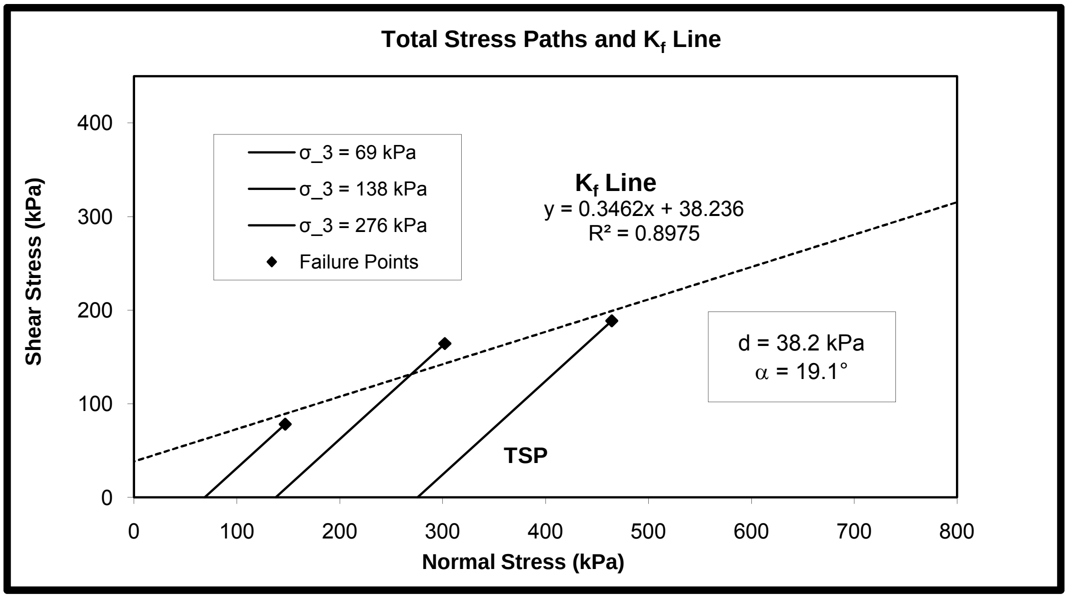
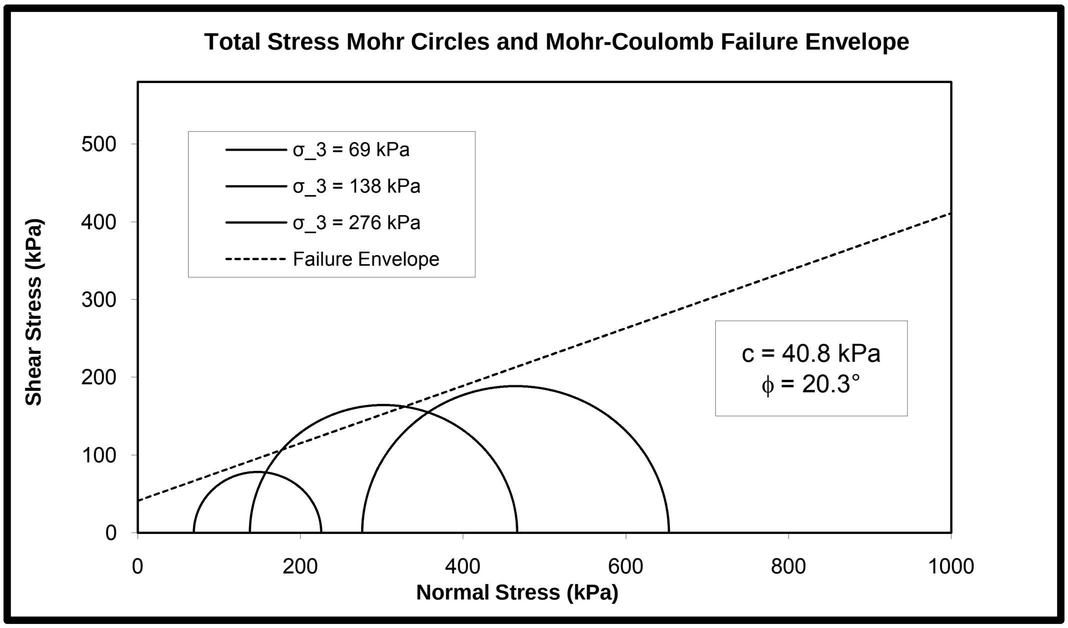
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% kaolinite, 10% water content (L25K10W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 5/26/2009





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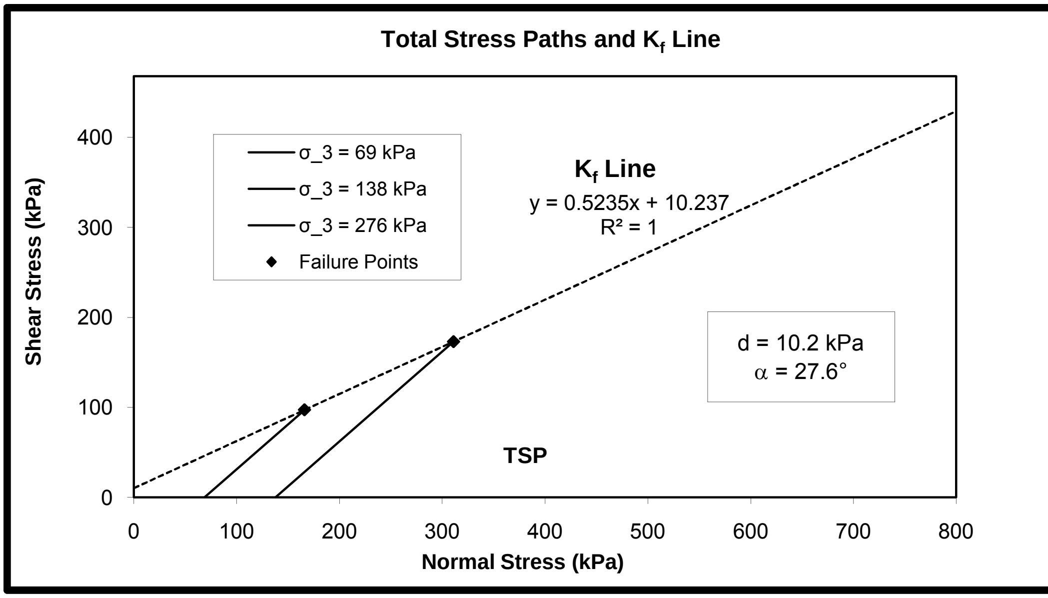
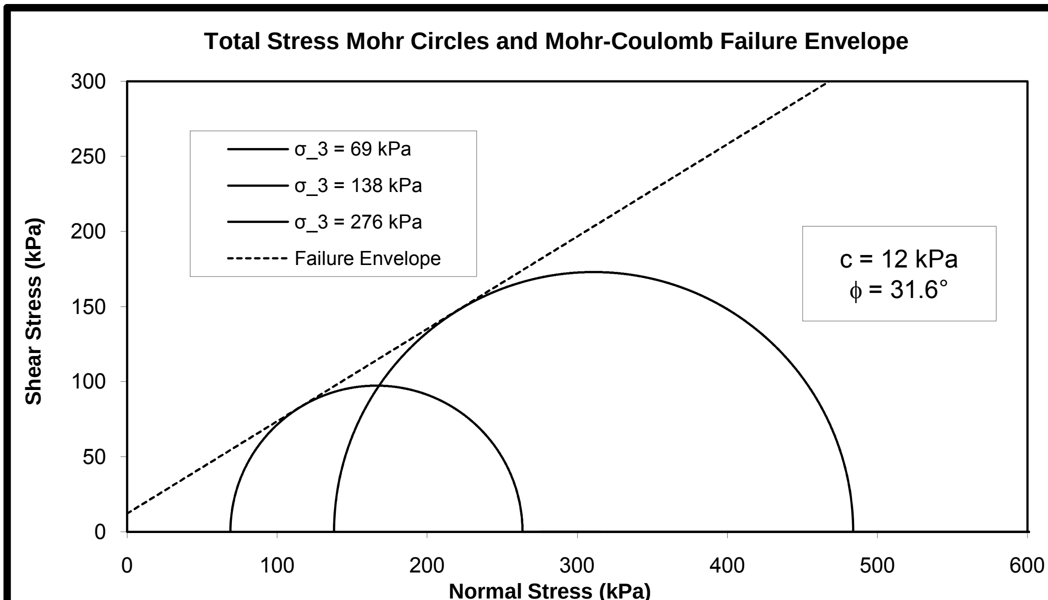
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 85% sand 15% kaolinite, 10% water content (L15K10W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 5/28/2009





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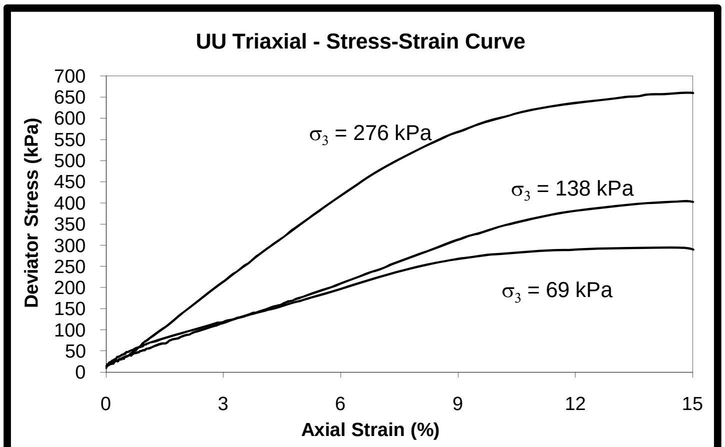
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% kaolinite, 8% water content (L25K8W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 5/28/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	213	205	B8	404	405	4
Wt. of Tin (g)	27.91	29.7	28.44	28.7	27.7	28.7
Wt. of Tin + Wet soil (g)	111.58	99.55	91.07	161.3	159.1	164.4
Wt. of Tin + Dry soil (g)	105.5	94.52	86.5	151.9	149.3	154.4
Wt. of Dry Soil (g)	77.59	64.82	58.06	123.1	121.6	125.7
Wt. of Water (g)	6.08	5.03	4.57	9.4	9.8	10.0
Water Content (%)	7.84	7.76	7.87	7.6	8.1	8.0
Average Water Content (%)	7.8			7.9		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.09	7.12
Average Diameter, D (cm)	3.53	3.50	3.50
Dry Unit Weight (kN/m^3)	17.29	17.52	18.01
Initial Void ratio	0.50	0.48	0.44
Saturation (%)	0.41	0.45	0.48
Strain at Failure (%)	14.36	14.84	14.83
Max Deviator Stress (kPa)	298.2	407.3	664.2
Membrane Correction (kPa)	3.2	3.3	3.3
Corrected Deviator Stress (kPa)	295.0	404.0	660.9
Corrected Major Stress (kPa)	364.0	541.9	936.7

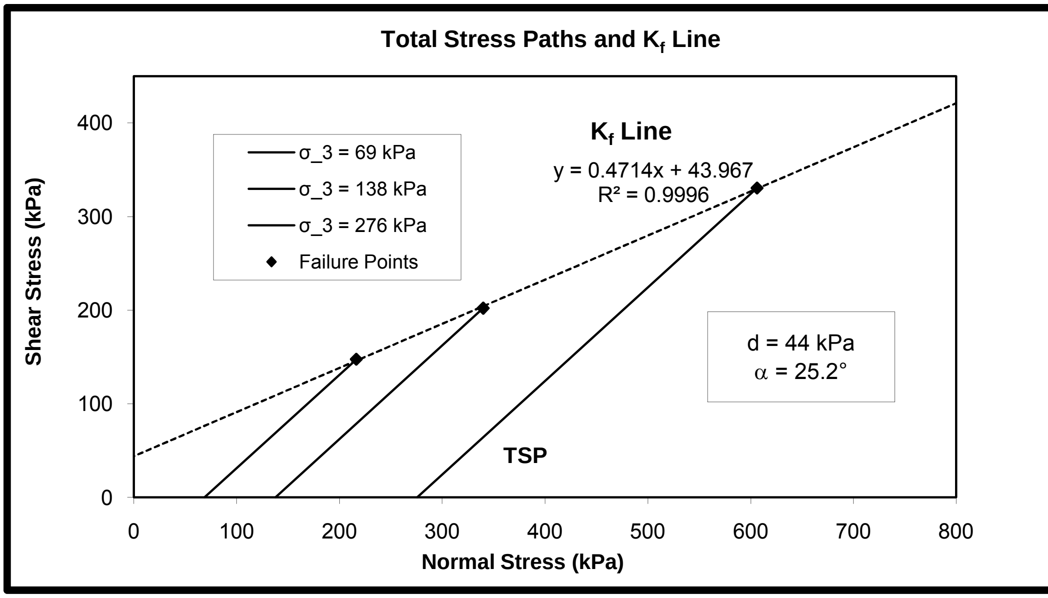


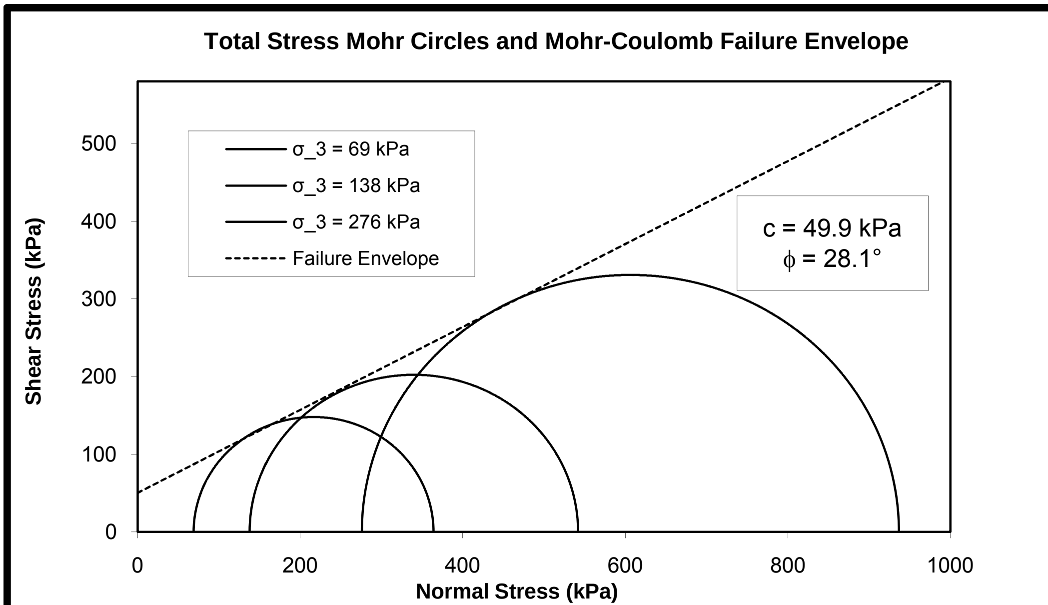
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% kaolinite, 8% water content (L25K8W)		
Specimen Type: Compacted		USCS: Silty sand (SM)	Gs: 2.64
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 5/28/2009





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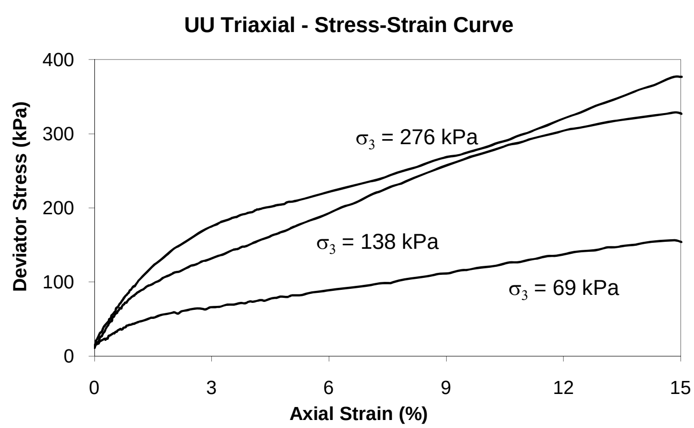
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% kaolinite, 10% water content (L25K10W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 5/26/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	213	205	B8	201	7	B-19
Wt. of Tin (g)	27.89	29.69	28.44	28.9	28.2	27.4
Wt. of Tin + Wet soil (g)	65.23	128.07	110.98	165.7	177.1	173.1
Wt. of Tin + Dry soil (g)	61.99	119.62	103.95	153.4	164.1	160.3
Wt. of Dry Soil (g)	34.10	89.93	75.51	124.6	135.9	132.9
Wt. of Water (g)	3.24	8.45	7.03	12.2	13.0	12.8
Water Content (%)	9.50	9.40	9.31	9.8	9.6	9.7
Average Water Content (%)	9.4			9.7		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	6.81	7.13	7.12
Average Diameter, D (cm)	3.56	3.54	3.55
Dry Unit Weight (kN/m^3)	18.04	19.02	18.49
Initial Void ratio	0.44	0.36	0.40
Saturation (%)	0.60	0.70	0.64
Strain at Failure (%)	14.84	14.87	14.83
Max Deviator Stress (kPa)	159.7	331.8	380.3
Membrane Correction (kPa)	3.2	3.3	3.3
Corrected Deviator Stress (kPa)	156.5	328.5	377.0
Corrected Major Stress (kPa)	225.4	466.4	652.8



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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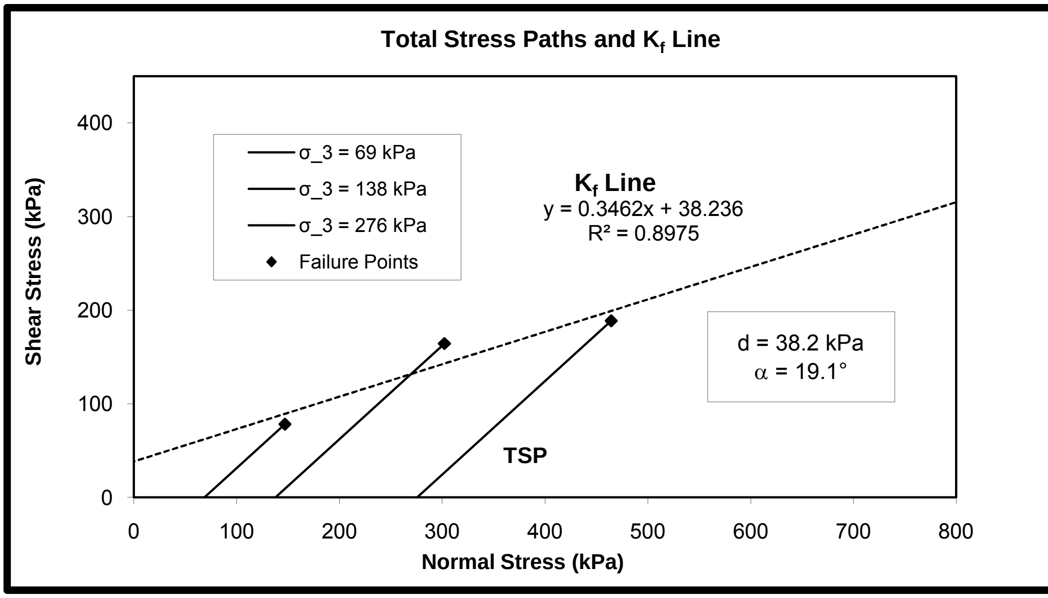
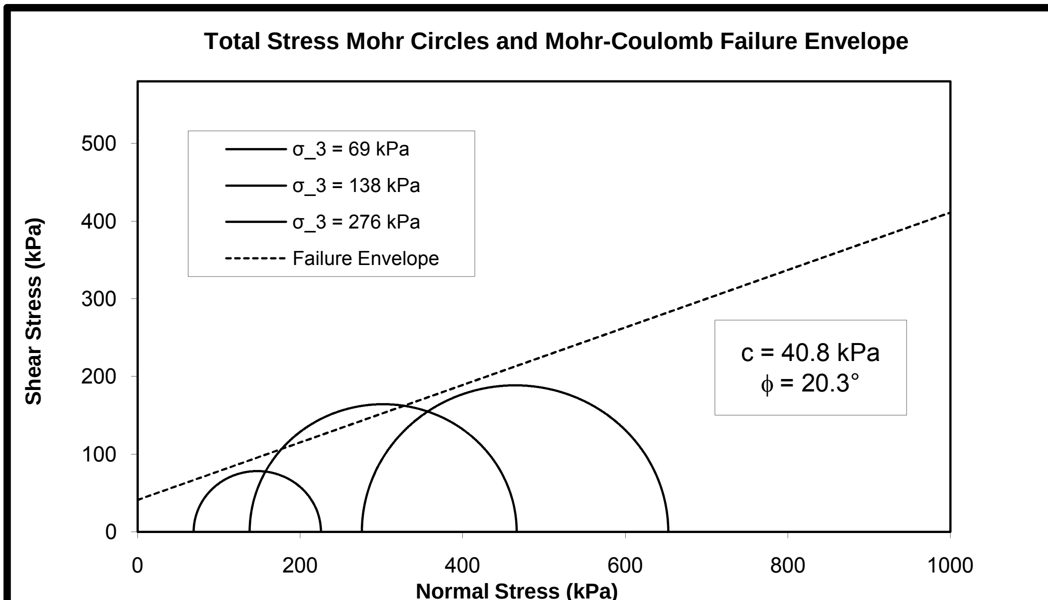
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% kaolinite, 10% water content (L25K10W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 5/26/2009





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UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% kaolinite, 12% water content (L25K12W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/2/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	405	404	2	420	418
Wt. of Tin (g)	28.71	27.69	28.7	29.0	27.6	28.8
Wt. of Tin + Wet soil (g)	108.85	111.5	124.06	177.0	176.0	178.3
Wt. of Tin + Dry soil (g)	100.85	102.88	114.17	160.7	159.8	162.2
Wt. of Dry Soil (g)	72.14	75.19	85.47	131.7	132.2	133.4
Wt. of Water (g)	8.00	8.62	9.89	16.3	16.2	16.0
Water Content (%)	11.09	11.46	11.57	12.4	12.2	12.0
Average Water Content (%)		11.4			12.2	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.10	7.10	7.14
Average Diameter, D (cm)	3.54	3.53	3.56
Dry Unit Weight (kN/m^3)	18.53	18.62	18.38
Initial Void ratio	0.40	0.39	0.41
Saturation (%)	0.82	0.83	0.78
Strain at Failure (%)	14.86	14.85	14.83
Max Deviator Stress (kPa)	63.3	79.1	120.1
Membrane Correction (kPa)	3.3	3.3	3.2
Corrected Deviator Stress (kPa)	60.0	75.8	116.8
Corrected Major Stress (kPa)	129.0	213.7	392.6

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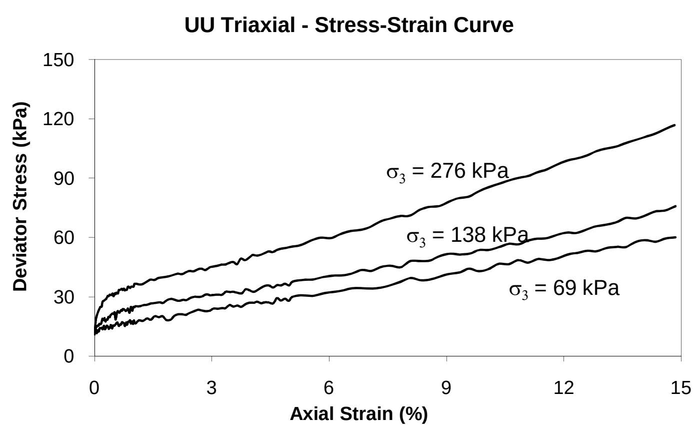

Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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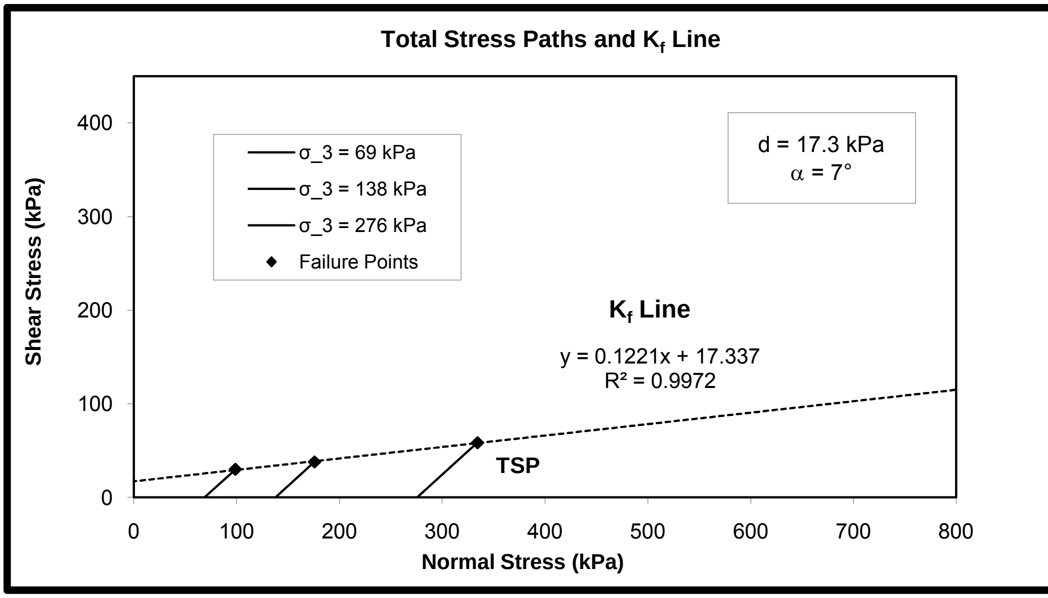
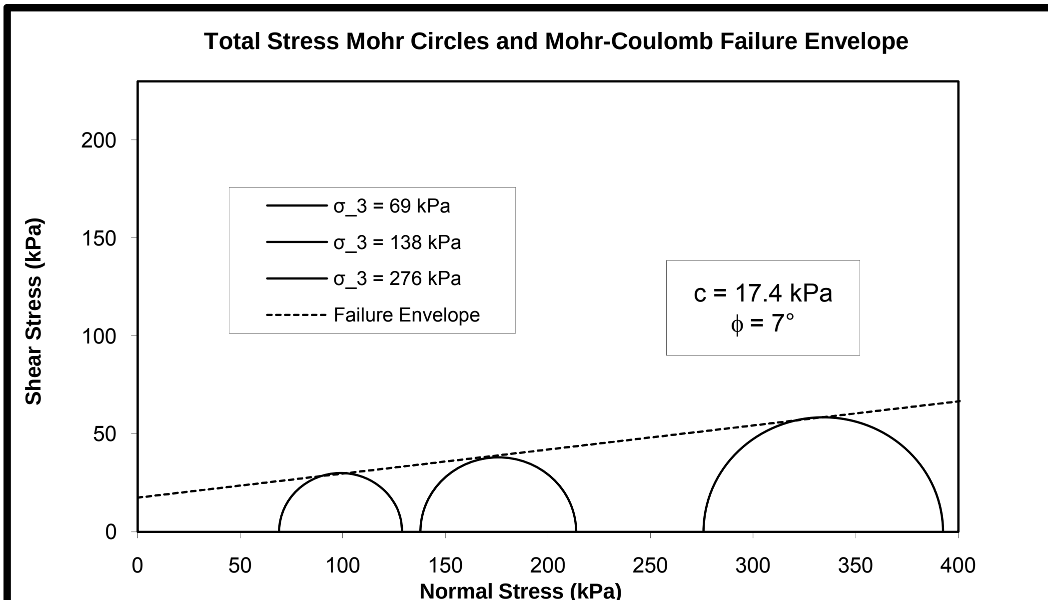
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 75% sand 25% kaolinite, 12% water content (L25K12W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/2/2009





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UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% kaolinite, 13% water content (L50K13W)		
Specimen Type: Compacted		USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 5/27/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	46	121	101	31	7	B-19
Wt. of Tin (g)	28.84	30.91	28.02	28.3	28.2	27.4
Wt. of Tin + Wet soil (g)	101.78	90.97	95.25	159.0	156.8	151.7
Wt. of Tin + Dry soil (g)	93.72	84.37	87.54	144.2	142.0	137.6
Wt. of Dry Soil (g)	64.88	53.46	59.52	115.8	113.8	110.2
Wt. of Water (g)	8.06	6.60	7.71	14.9	14.8	14.2
Water Content (%)	12.42	12.35	12.95	12.8	13.0	12.8
Average Water Content (%)	12.6			12.9		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.12	7.13
Average Diameter, D (cm)	3.55	3.55	3.53
Dry Unit Weight (kN/m^3)	16.08	15.86	15.51
Initial Void ratio	0.60	0.62	0.66
Saturation (%)	0.56	0.55	0.51
Strain at Failure (%)	6.07	11.61	14.84
Max Deviator Stress (kPa)	472.0	578.5	771.2
Membrane Correction (kPa)	1.3	2.5	3.3
Corrected Deviator Stress (kPa)	470.7	575.9	767.9
Corrected Major Stress (kPa)	539.6	713.8	1043.7

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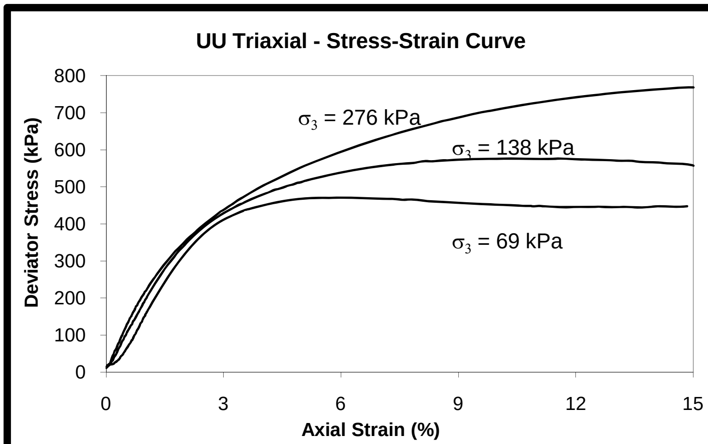

Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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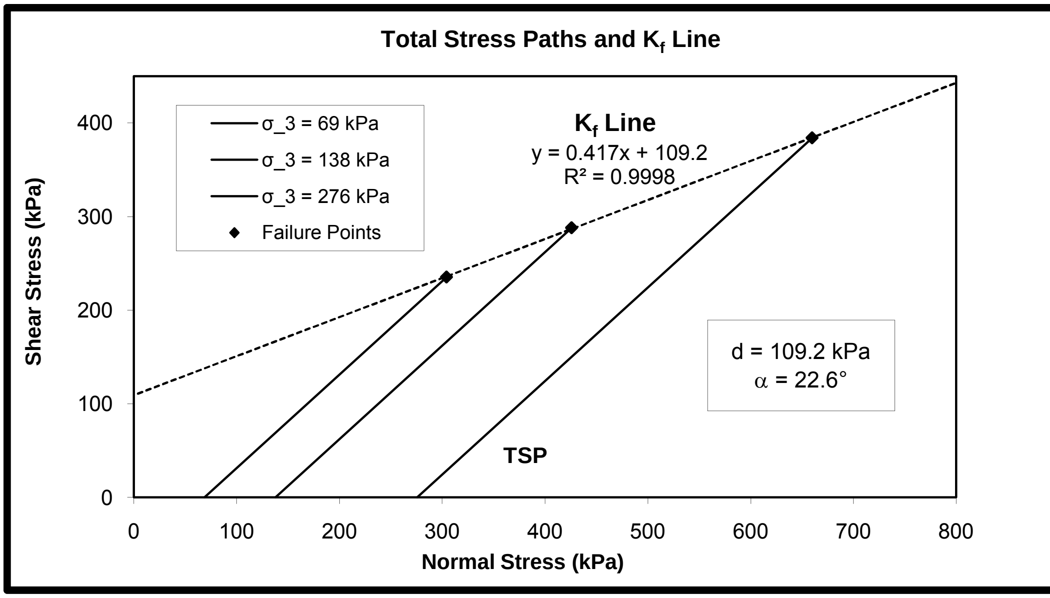
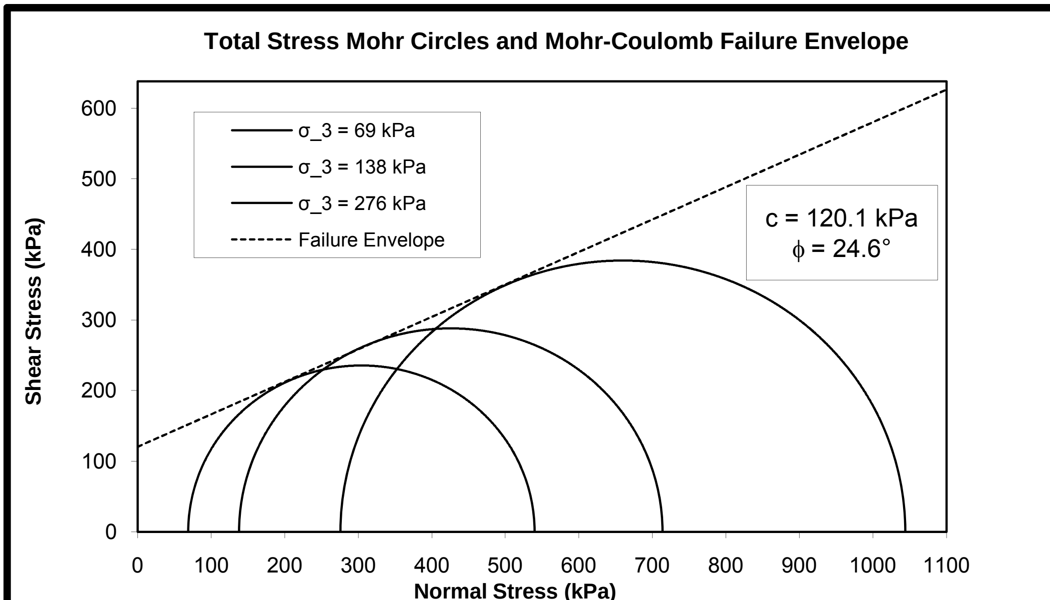
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% kaolinite, 13% water content (L50K13W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 5/27/2009





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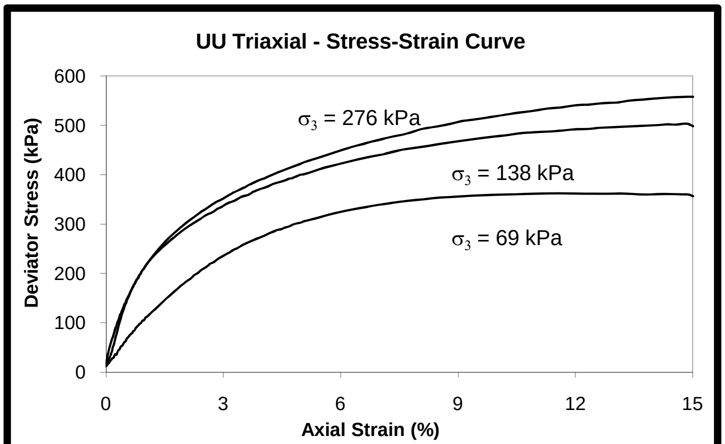
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% kaolinite, 15% water content (L50K15W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 5/26/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	404	405	4	2	420	418
Wt. of Tin (g)	28.7	27.69	28.7	29.0	27.6	28.8
Wt. of Tin + Wet soil (g)	77.12	77.62	89.38	170.3	168.9	169.7
Wt. of Tin + Dry soil (g)	70.93	71.06	81.64	151.1	150.3	151.0
Wt. of Dry Soil (g)	42.23	43.37	52.94	122.1	122.8	122.2
Wt. of Water (g)	6.19	6.56	7.74	19.2	18.6	18.7
Water Content (%)	14.66	15.13	14.62	15.8	15.1	15.3
Average Water Content (%)		14.8			15.4	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.11	7.12	7.11
Average Diameter, D (cm)	3.51	3.57	3.54
Dry Unit Weight (kN/m^3)	17.41	16.90	17.13
Initial Void ratio	0.48	0.52	0.50
Saturation (%)	0.87	0.76	0.80
Strain at Failure (%)	13.12	14.84	14.86
Max Deviator Stress (kPa)	365.1	506.7	561.3
Membrane Correction (kPa)	2.9	3.2	3.3
Corrected Deviator Stress (kPa)	362.2	503.4	558.1
Corrected Major Stress (kPa)	431.2	641.3	833.9



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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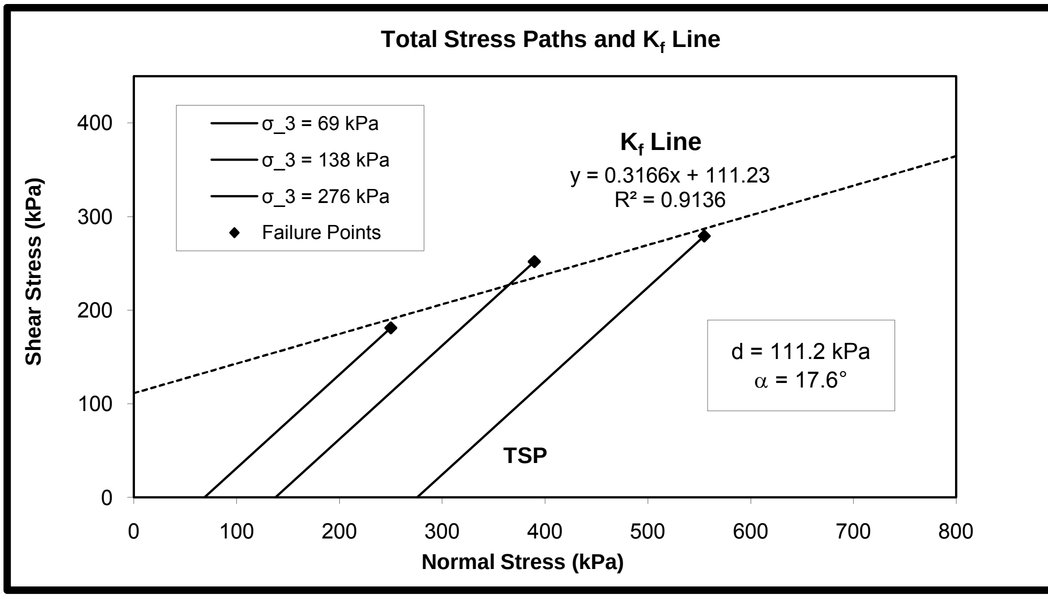
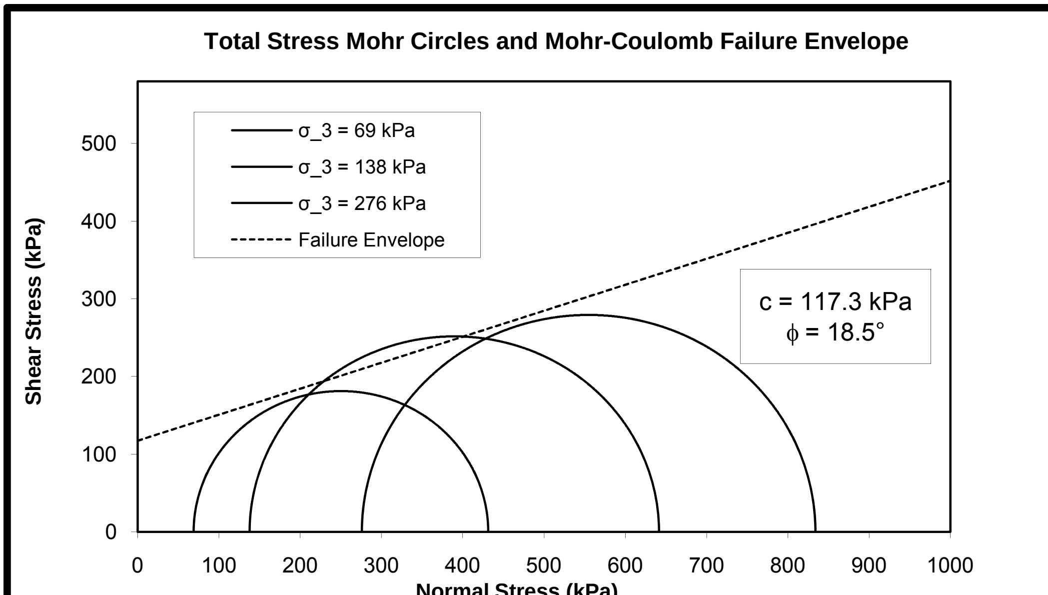
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% kaolinite, 15% water content (L50K15W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 5/26/2009





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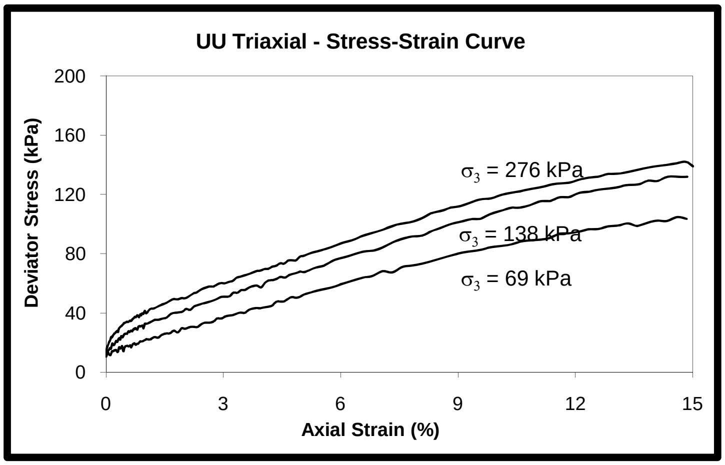
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 50% sand 50% kaolinite, 17% water content (L50K17W)				
Specimen Type:	Compacted	USCS:	Sandy lean clay (CL)	Gs:	2.62
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	5/21/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	7	201	B-19	46	1 2 1	101
Wt. of Tin (g)	28.18	28.89	27.41	28.8	30.9	28.0
Wt. of Tin + Wet soil (g)	92.77	93.87	116.97	169.8	171.7	169.2
Wt. of Tin + Dry soil (g)	83.31	84.34	103.61	148.3	150.7	148.0
Wt. of Dry Soil (g)	55.13	55.45	76.20	119.5	119.8	120.0
Wt. of Water (g)	9.46	9.53	13.36	21.5	21.0	21.2
Water Content (%)	17.16	17.19	17.53	18.0	17.5	17.6
Average Water Content (%)		17.3			17.7	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.20	7.14	7.16
Average Diameter, D (cm)	3.54	3.55	3.53
Dry Unit Weight (kN/m^3)	16.51	16.59	16.76
Initial Void ratio	0.56	0.55	0.53
Saturation (%)	0.85	0.84	0.87
Strain at Failure (%)	15.02	14.86	14.83
Max Deviator Stress (kPa)	107.9	135.4	145.2
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	104.6	132.1	141.9
Corrected Major Stress (kPa)	173.6	270.0	417.7



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1-\sigma_3)=4E_m t_m \varepsilon_1/D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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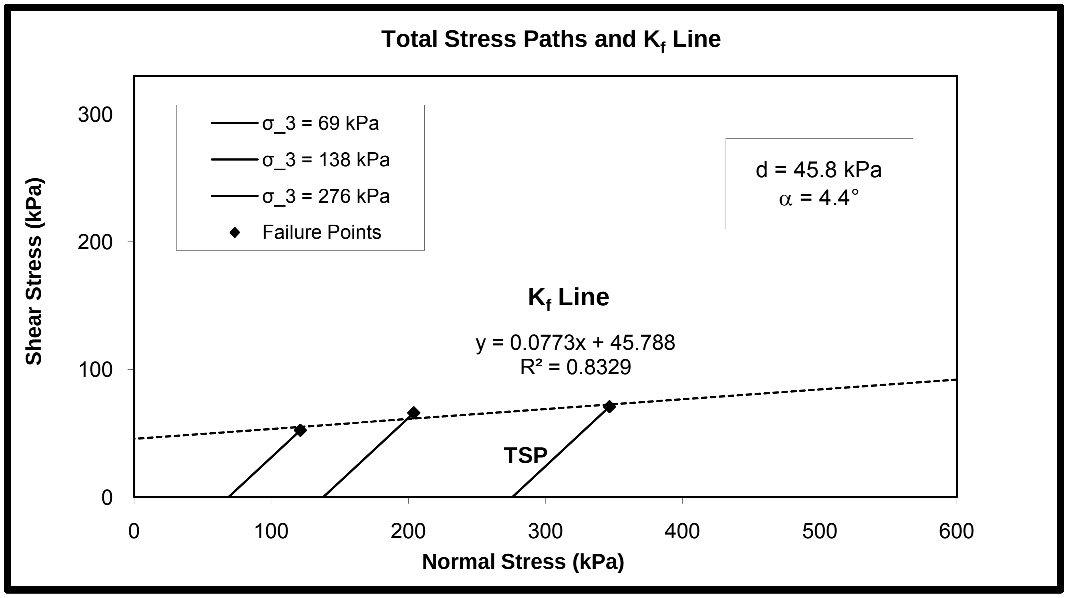
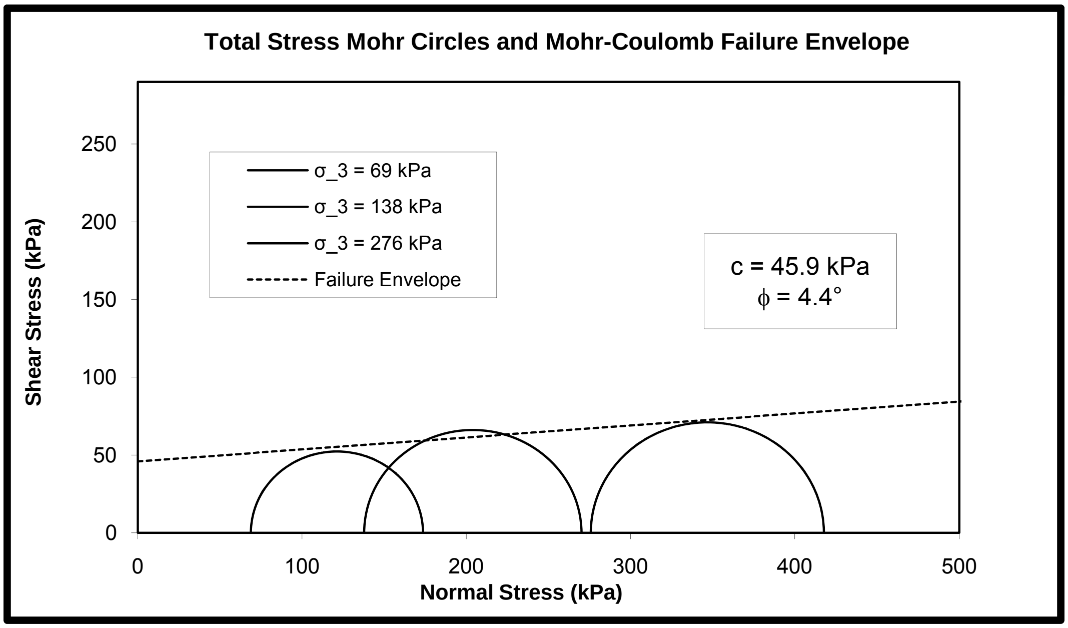
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 50% sand 50% kaolinite, 17% water content (L50K17W)				
Specimen Type:	Compacted	USCS:	Sandy lean clay (CL)	Gs:	2.62
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	5/21/2009





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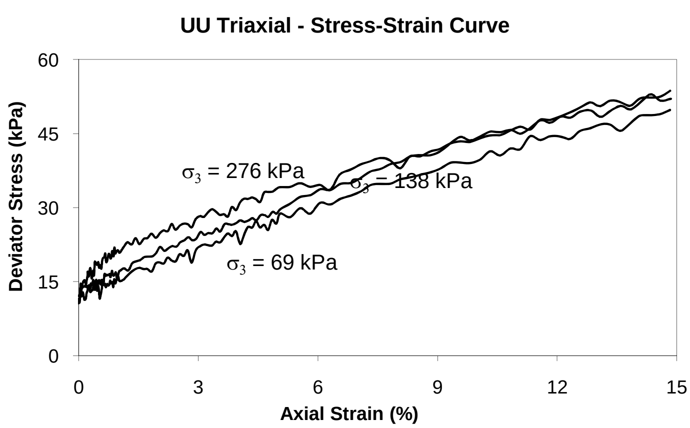
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% kaolinite, 20% water content (L50K20W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/1/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	101	121	46	404	405	4
Wt. of Tin (g)	28.01	30.93	28.83	28.7	27.7	28.7
Wt. of Tin + Wet soil (g)	134.3	92.02	103.43	166.1	166.0	166.8
Wt. of Tin + Dry soil (g)	116.92	82	91.27	143.6	143.1	143.9
Wt. of Dry Soil (g)	88.91	51.07	62.44	114.9	115.4	115.2
Wt. of Water (g)	17.38	10.02	12.16	22.5	22.9	22.9
Water Content (%)	19.55	19.62	19.47	19.6	19.8	19.9
Average Water Content (%)	19.5			19.8		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.11	7.14	7.12
Average Diameter, D (cm)	3.56	3.55	3.52
Dry Unit Weight (kN/m^3)	15.95	16.01	16.30
Initial Void ratio	0.61	0.61	0.58
Saturation (%)	0.84	0.86	0.90
Strain at Failure (%)	14.83	14.35	14.84
Max Deviator Stress (kPa)	53.1	56.1	56.9
Membrane Correction (kPa)	3.2	3.1	3.3
Corrected Deviator Stress (kPa)	49.8	53.0	53.6
Corrected Major Stress (kPa)	118.8	190.9	329.4



Notes: Membrane correction according to ASTM D 2850-03a:

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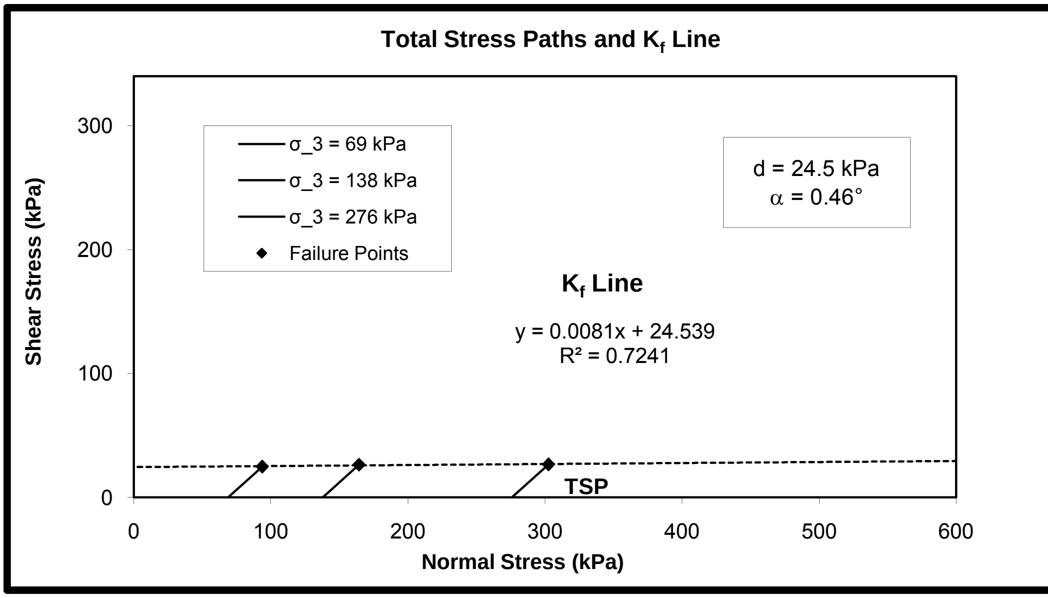
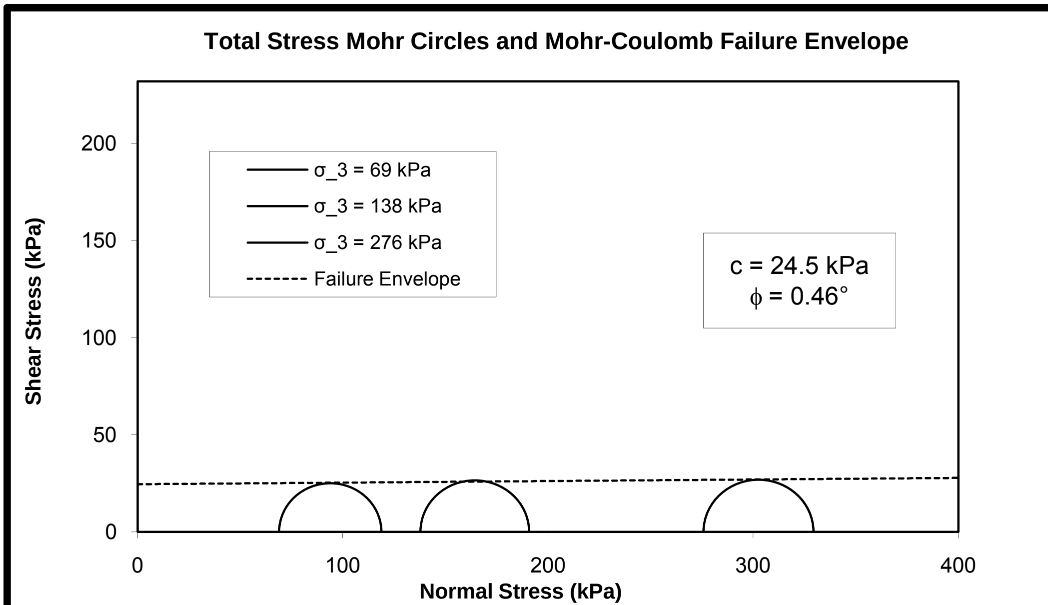
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% kaolinite, 20% water content (L50K20W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/1/2009





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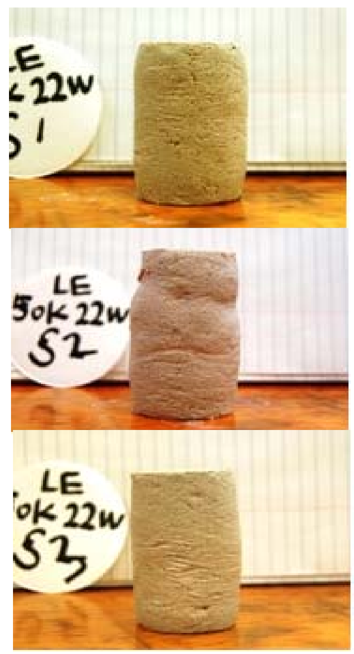
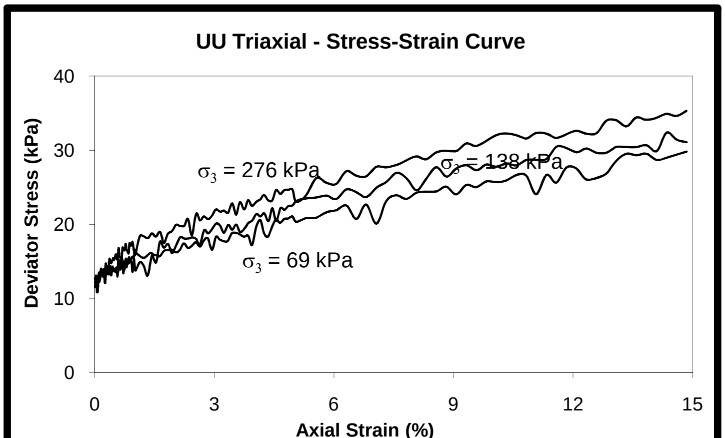
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% kaolinite, 21% water content (L50K21W)		
Specimen Type: Compacted		USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 6/1/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	2	420	418	B-19	7	31
Wt. of Tin (g)	28.97	27.57	28.88	27.3	28.2	28.3
Wt. of Tin + Wet soil (g)	148.61	120.91	81.82	162.4	164.5	165.5
Wt. of Tin + Dry soil (g)	127.73	104.69	72.65	138.6	140.7	141.8
Wt. of Dry Soil (g)	98.76	77.12	43.77	111.3	112.5	113.5
Wt. of Water (g)	20.88	16.22	9.17	23.8	23.9	23.7
Water Content (%)	21.14	21.03	20.95	21.4	21.2	20.9
Average Water Content (%)		21.0			21.1	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.23	7.20	7.23
Average Diameter, D (cm)	3.51	3.55	3.54
Dry Unit Weight (kN/m^3)	15.65	15.52	15.69
Initial Void ratio	0.64	0.66	0.64
Saturation (%)	0.87	0.85	0.86
Strain at Failure (%)	14.34	14.85	14.84
Max Deviator Stress (kPa)	35.5	33.0	38.6
Membrane Correction (kPa)	3.2	3.3	3.3
Corrected Deviator Stress (kPa)	32.3	29.8	35.3
Corrected Major Stress (kPa)	101.3	167.7	311.1





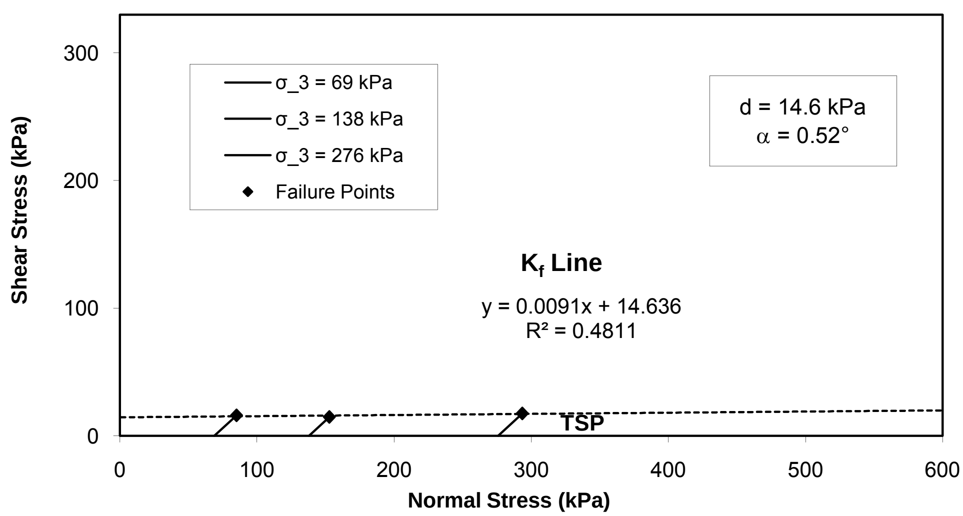
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

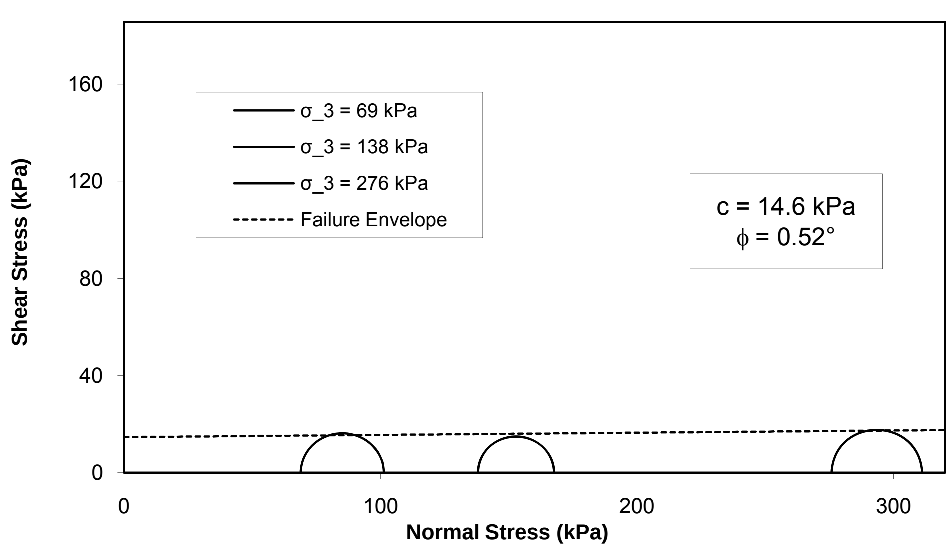
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Low energy compacted, 50% sand 50% kaolinite, 21% water content (L50K21W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/1/2009

Total Stress Paths and K_f Line



Total Stress Mohr Circles and Mohr-Coulomb Failure Envelope



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UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85% sand 15% kaolinite, 6% water content (S15K6W)		
Specimen Type: Compacted	USCS: Silty sand (SM)	Gs: 2.64	
Strain Rate: 1%/min	Tested By: Yueru Chen	Date: 6/15/2009	

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	101	46	B-19	405	4	404
Wt. of Tin (g)	28.02	28.84	27.4	27.7	28.7	28.7
Wt. of Tin + Wet soil (g)	95.88	82.48	82.35	162.1	161.0	161.0
Wt. of Tin + Dry soil (g)	92.07	79.44	79.26	154.2	153.2	153.3
Wt. of Dry Soil (g)	64.05	50.60	51.86	126.5	124.5	124.6
Wt. of Water (g)	3.81	3.04	3.09	7.9	7.7	7.7
Water Content (%)	5.95	6.01	5.96	6.3	6.2	6.2
Average Water Content (%)		6.0			6.2	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.11	7.08	7.06
Average Diameter, D (cm)	3.51	3.54	3.52
Dry Unit Weight (kN/m^3)	18.00	17.57	17.77
Initial Void ratio	0.44	0.47	0.46
Saturation (%)	0.38	0.35	0.36
Strain at Failure (%)	14.86	15.03	14.83
Max Deviator Stress (kPa)	177.2	292.2	609.2
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	173.9	288.9	605.9
Corrected Major Stress (kPa)	242.8	426.8	881.7

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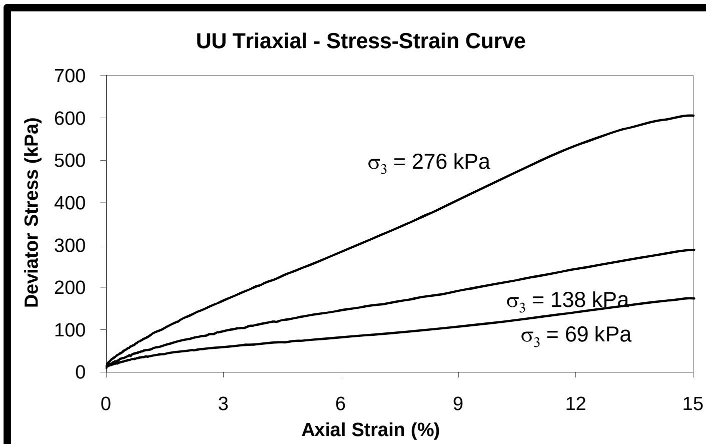

Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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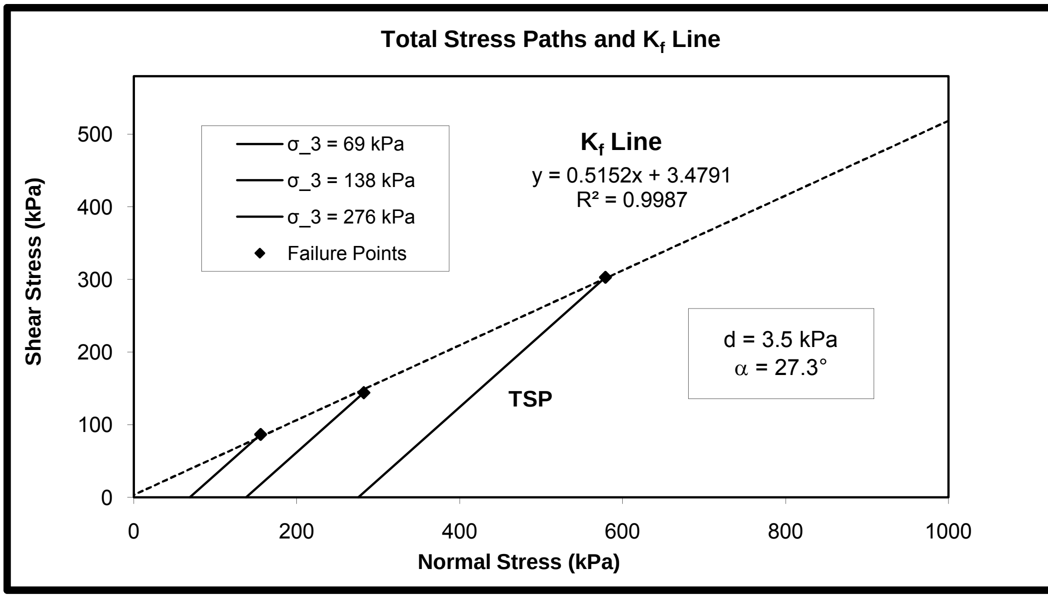
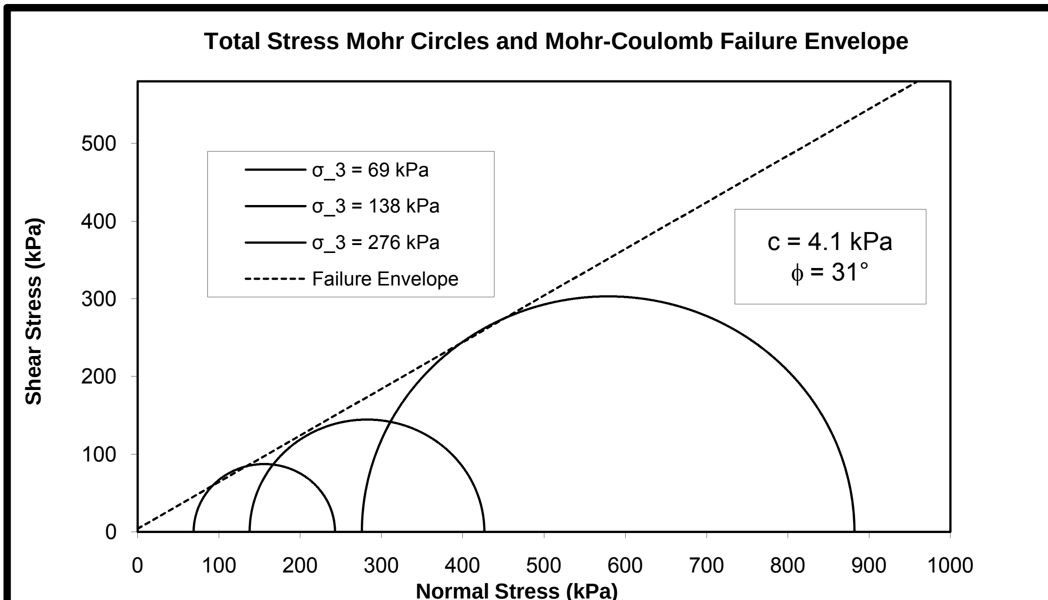
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85%sand 15% kaolinite, 6% water content (S15K6W)		
Specimen Type: Compacted		USCS: Silty sand (SM)	Gs: 2.64
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 6/15/2009





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UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85% sand 15% kaolinite, 8% water content (S15K8W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/16/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	Majid	FJ-3	5	Majid	7	201
Wt. of Tin (g)	28.66	29.03	28.89	28.7	28.2	28.9
Wt. of Tin + Wet soil (g)	73.09	94.26	97.12	169.1	168.0	168.3
Wt. of Tin + Dry soil (g)	69.84	89.4	92.3	158.2	157.5	157.7
Wt. of Dry Soil (g)	41.18	60.37	63.41	129.6	129.3	128.8
Wt. of Water (g)	3.25	4.86	4.82	10.8	10.5	10.7
Water Content (%)	7.89	8.05	7.60	8.4	8.1	8.3
Average Water Content (%)	7.8			8.3		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.00	7.13	7.10
Average Diameter, D (cm)	3.54	3.52	3.52
Dry Unit Weight (kN/m^3)	18.48	18.28	18.31
Initial Void ratio	0.40	0.42	0.41
Saturation (%)	0.55	0.51	0.53
Strain at Failure (%)	14.84	15.01	15.02
Max Deviator Stress (kPa)	175.8	295.7	629.0
Membrane Correction (kPa)	3.2	3.3	3.3
Corrected Deviator Stress (kPa)	172.6	292.4	625.6
Corrected Major Stress (kPa)	241.5	430.3	901.4

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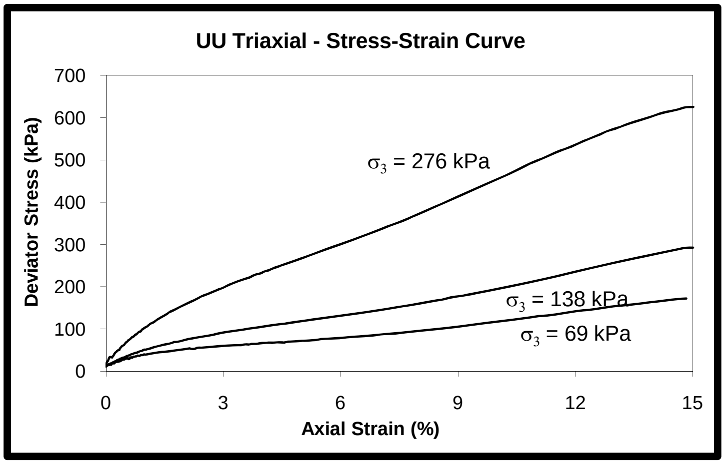

Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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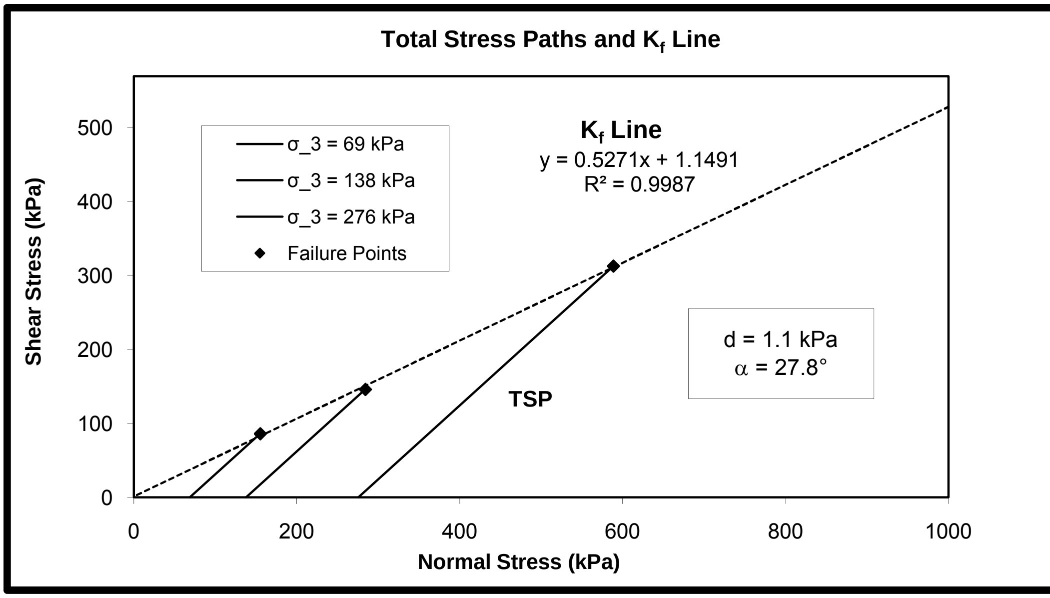
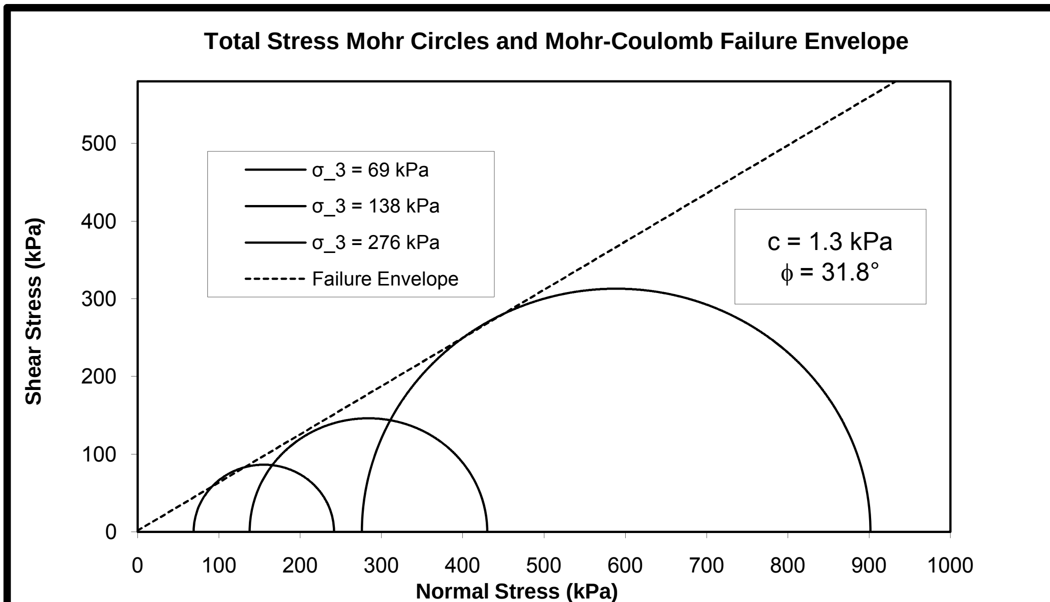
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85%sand 15% kaolinite, 8% water content (S15K8W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/16/2009





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UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 85% sand 15% kaolinite, 10% water content (S15K10W)		
Specimen Type:	Compacted	USCS: Clayey sand (SC)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/14/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	213	B8	31	4	405	404
Wt. of Tin (g)	27.9	28.45	38.34	28.7	27.7	28.7
Wt. of Tin + Wet soil (g)	95.31	136.28	118.04	178.9	179.3	179.2
Wt. of Tin + Dry soil (g)	89.02	126.61	109.8	164.7	164.6	164.9
Wt. of Dry Soil (g)	61.12	98.16	71.46	136.0	136.9	136.2
Wt. of Water (g)	6.29	9.67	8.24	14.2	14.7	14.4
Water Content (%)	10.29	9.85	11.53	10.4	10.7	10.5
Average Water Content (%)		10.6			10.6	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.11	7.11	7.11
Average Diameter, D (cm)	3.56	3.53	3.53
Dry Unit Weight (kN/m^3)	18.89	19.29	19.19
Initial Void ratio	0.37	0.34	0.35
Saturation (%)	0.74	0.83	0.80
Strain at Failure (%)	14.87	14.86	14.35
Max Deviator Stress (kPa)	209.4	356.1	722.6
Membrane Correction (kPa)	3.3	3.3	3.2
Corrected Deviator Stress (kPa)	206.2	352.9	719.4
Corrected Major Stress (kPa)	275.1	490.8	995.2

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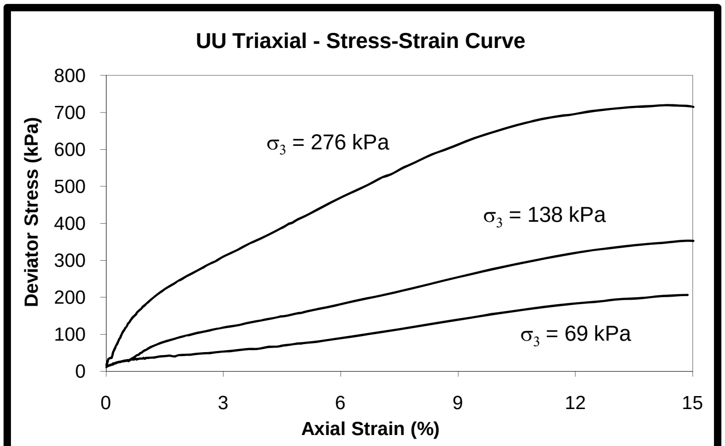

Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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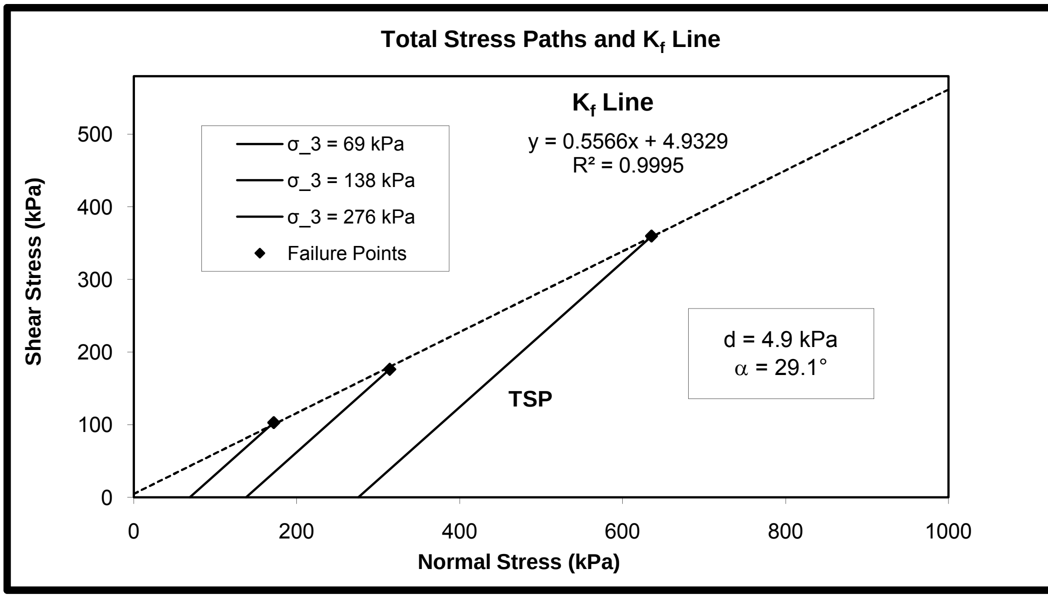
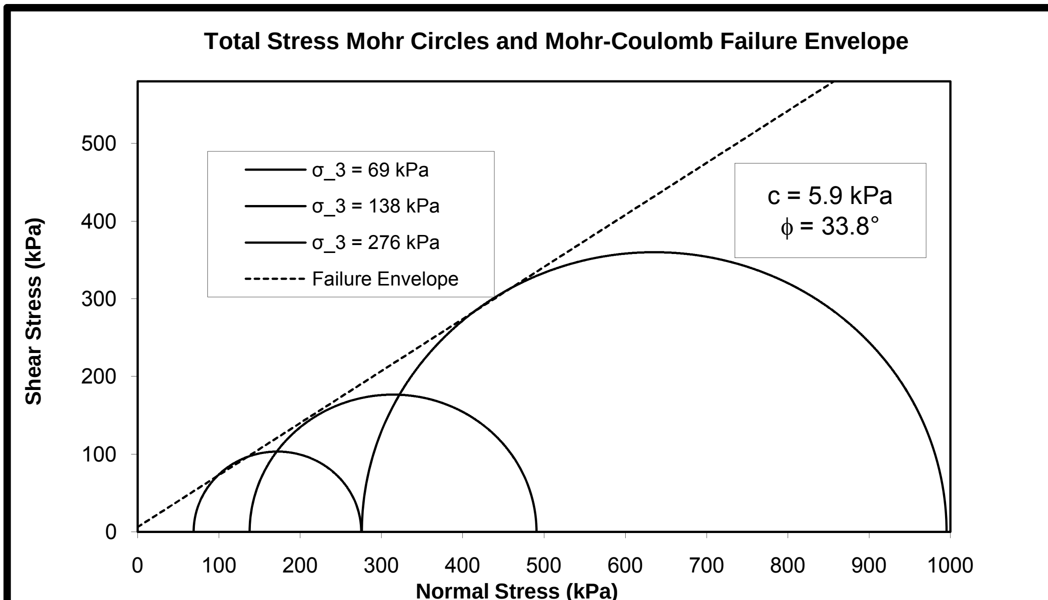
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 85%sand 15% kaolinite, 10% water content (S15K10W)				
Specimen Type:	Compacted	USCS:	Clayey sand (SC)	Gs:	2.64
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	6/14/2009





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UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% kaolinite, 8% water content (S25K8W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/10/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	213	205	B8	46	121	101
Wt. of Tin (g)	27.9	29.7	28.46	28.8	30.9	28.0
Wt. of Tin + Wet soil (g)	93.69	89.23	79.38	168.3	167.3	172.3
Wt. of Tin + Dry soil (g)	88.88	84.9	75.68	157.6	156.2	161.6
Wt. of Dry Soil (g)	60.98	55.20	47.22	128.7	125.3	133.6
Wt. of Water (g)	4.81	4.33	3.70	10.8	11.1	10.7
Water Content (%)	7.89	7.84	7.84	8.4	8.9	8.0
Average Water Content (%)		7.9			8.4	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.06	7.08	7.15
Average Diameter, D (cm)	3.49	3.53	3.54
Dry Unit Weight (kN/m^3)	18.71	17.72	18.66
Initial Void ratio	0.38	0.46	0.39
Saturation (%)	0.57	0.51	0.55
Strain at Failure (%)	14.86	14.86	14.59
Max Deviator Stress (kPa)	398.3	478.9	753.5
Membrane Correction (kPa)	3.3	3.3	3.2
Corrected Deviator Stress (kPa)	394.9	475.6	750.3
Corrected Major Stress (kPa)	463.9	613.5	1026.1

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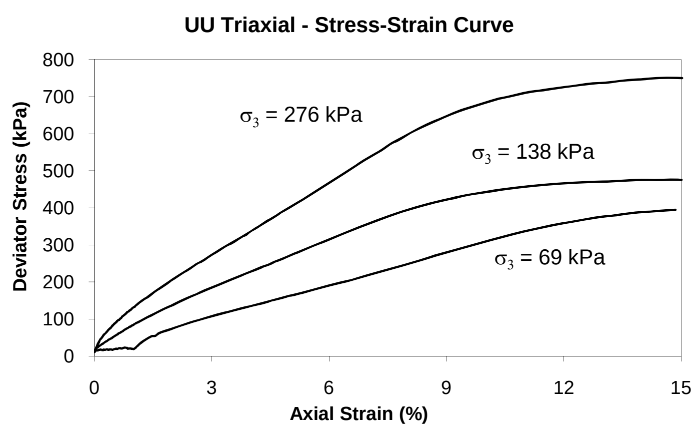

Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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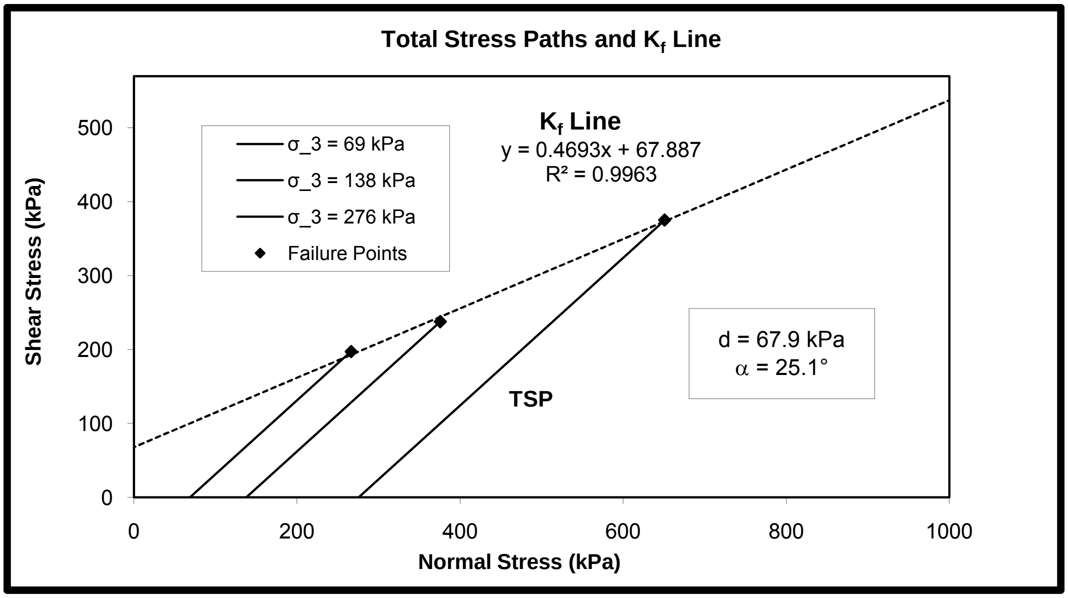
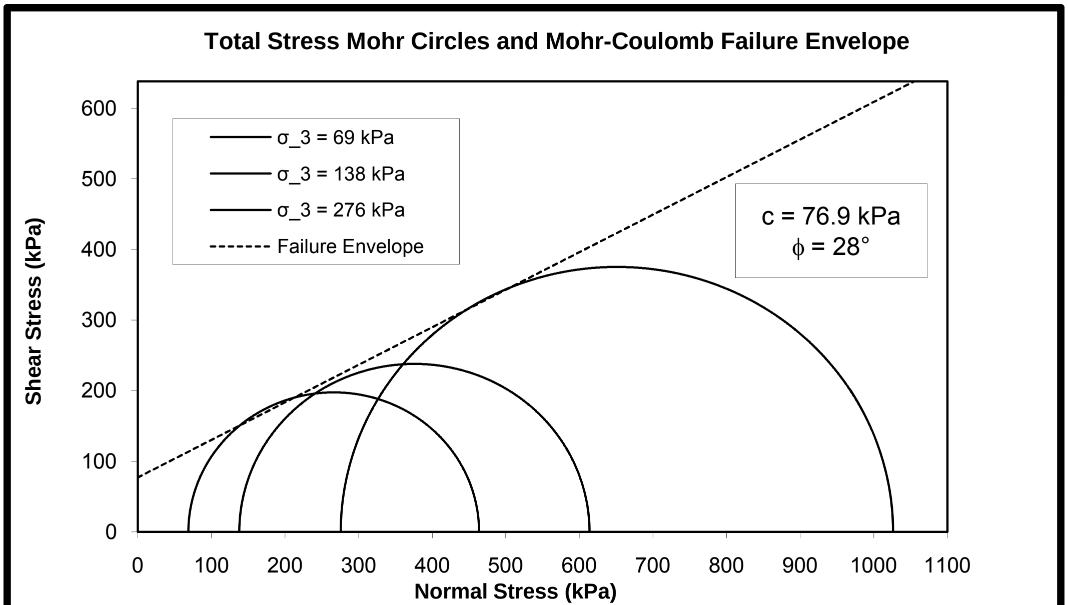
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% kaolinite, 8% water content (S25K8W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/10/2009





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UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% kaolinite, 10% water content (S25K10W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/10/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B-19	46	101	31	B8	213
Wt. of Tin (g)	27.41	28.84	28.02	28.4	28.5	27.9
Wt. of Tin + Wet soil (g)	88.29	107.26	103.5	177.1	177.8	178.2
Wt. of Tin + Dry soil (g)	82.69	100.17	96.75	163.2	164.0	164.5
Wt. of Dry Soil (g)	55.28	71.33	68.73	134.8	135.5	136.6
Wt. of Water (g)	5.60	7.09	6.75	13.9	13.8	13.8
Water Content (%)	10.13	9.94	9.82	10.3	10.2	10.1
Average Water Content (%)		10.0			10.2	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.08	7.11	7.12
Average Diameter, D (cm)	3.52	3.53	3.53
Dry Unit Weight (kN/m^3)	19.21	19.06	19.28
Initial Void ratio	0.35	0.36	0.34
Saturation (%)	0.78	0.75	0.77
Strain at Failure (%)	14.86	14.86	15.01
Max Deviator Stress (kPa)	214.9	259.6	358.5
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	211.6	256.3	355.2
Corrected Major Stress (kPa)	280.5	394.2	631.0

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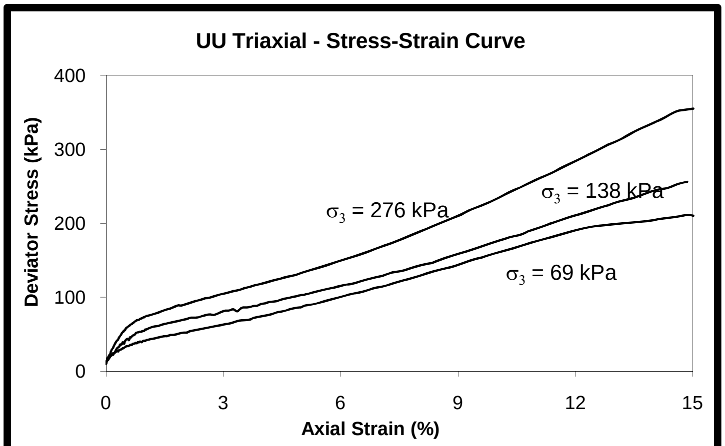

Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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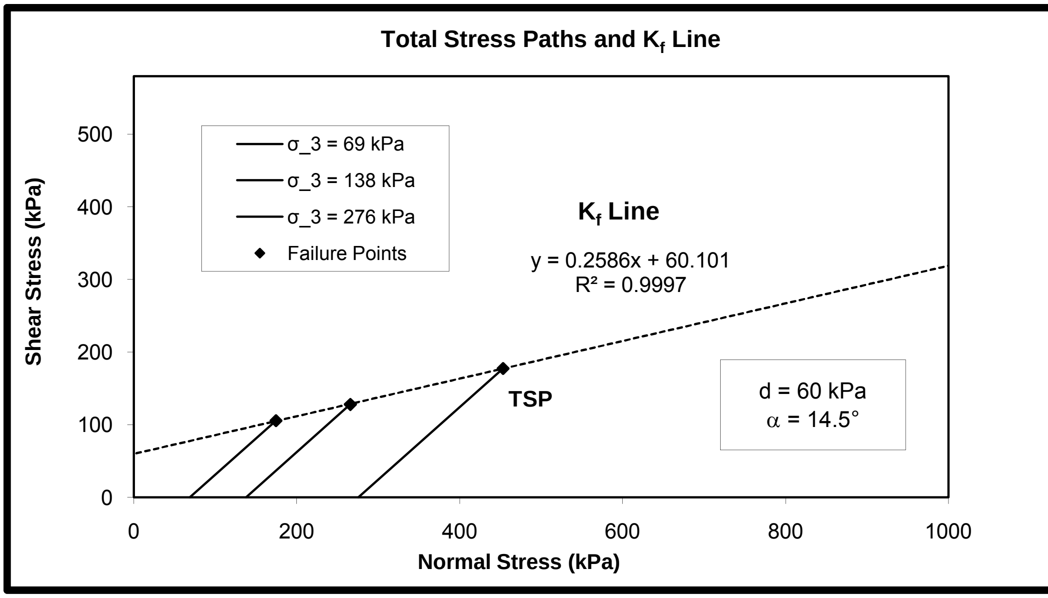
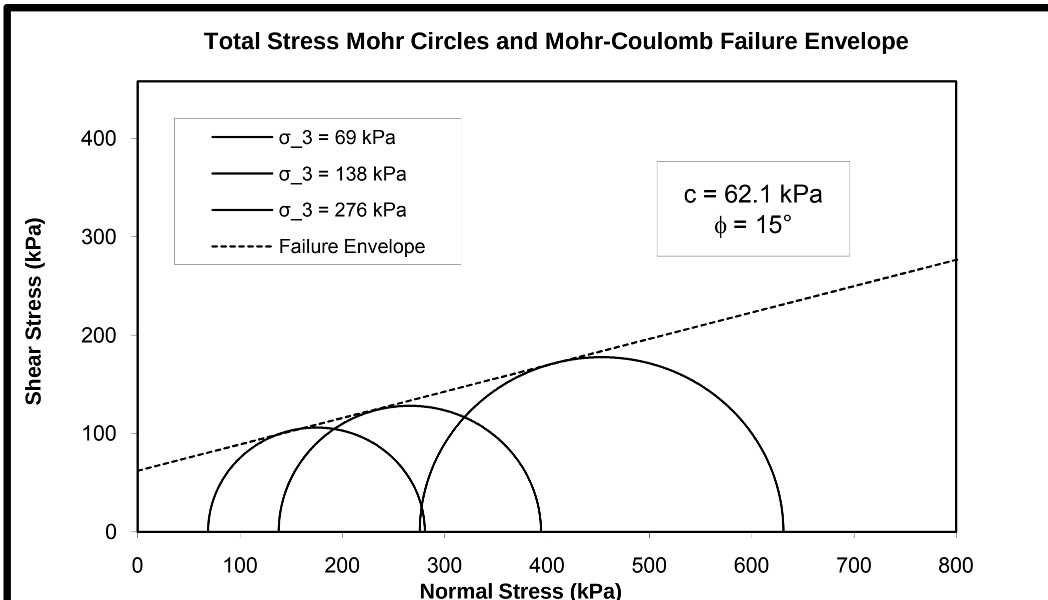
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% kaolinite, 10% water content (S25K10W)		
Specimen Type: Compacted		USCS: Silty sand (SM)	Gs: 2.64
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 6/10/2009





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UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% kaolinite, 12% water content (S25K12W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/16/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	101	46	B-19	31	B8	213
Wt. of Tin (g)	28.03	28.84	27.4	28.4	28.5	27.9
Wt. of Tin + Wet soil (g)	121.6	115.09	137.1	176.0	177.0	177.1
Wt. of Tin + Dry soil (g)	111.8	106.1	125.5	159.9	160.8	161.1
Wt. of Dry Soil (g)	83.77	77.26	98.10	131.6	132.4	133.2
Wt. of Water (g)	9.80	8.99	11.60	16.0	16.2	16.0
Water Content (%)	11.70	11.64	11.82	12.2	12.3	12.0
Average Water Content (%)		11.7			12.2	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.13	7.11
Average Diameter, D (cm)	3.52	3.56	3.56
Dry Unit Weight (kN/m^3)	18.67	18.34	18.49
Initial Void ratio	0.39	0.41	0.40
Saturation (%)	0.83	0.78	0.79
Strain at Failure (%)	14.85	14.85	14.85
Max Deviator Stress (kPa)	62.2	80.5	116.3
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	59.0	77.3	113.1
Corrected Major Stress (kPa)	127.9	215.2	388.9

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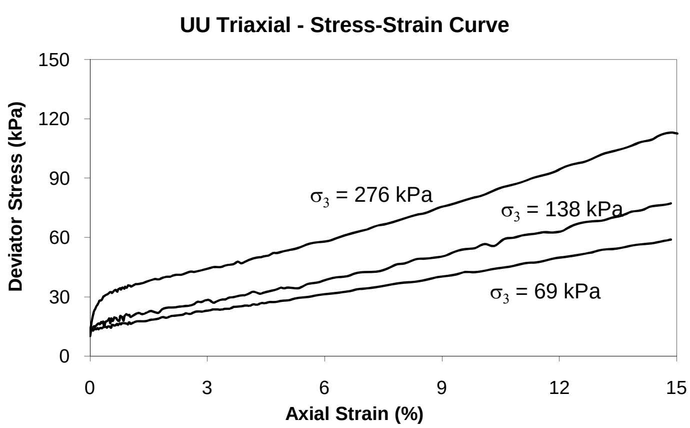
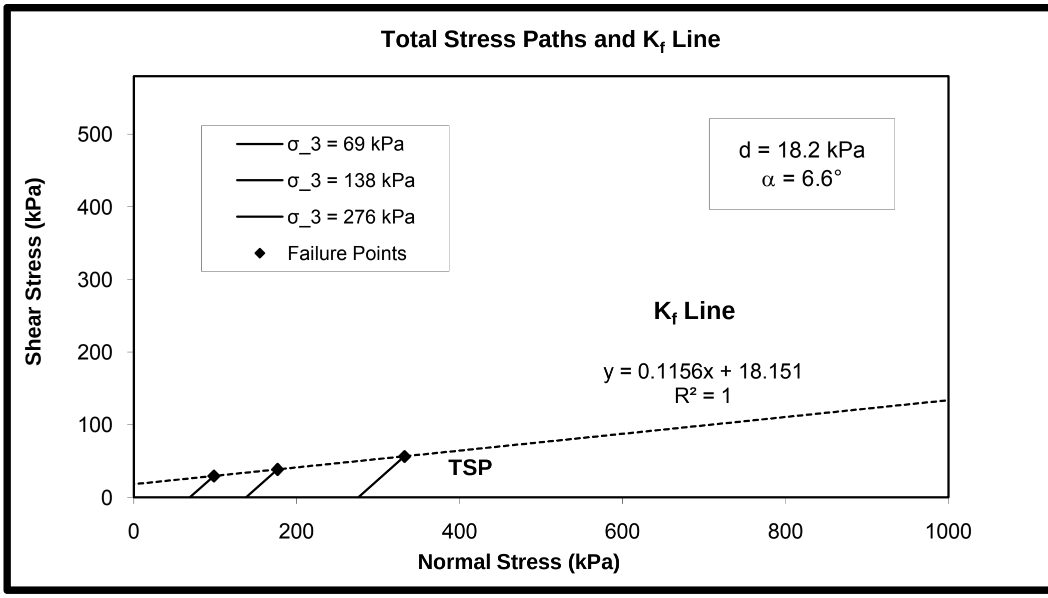


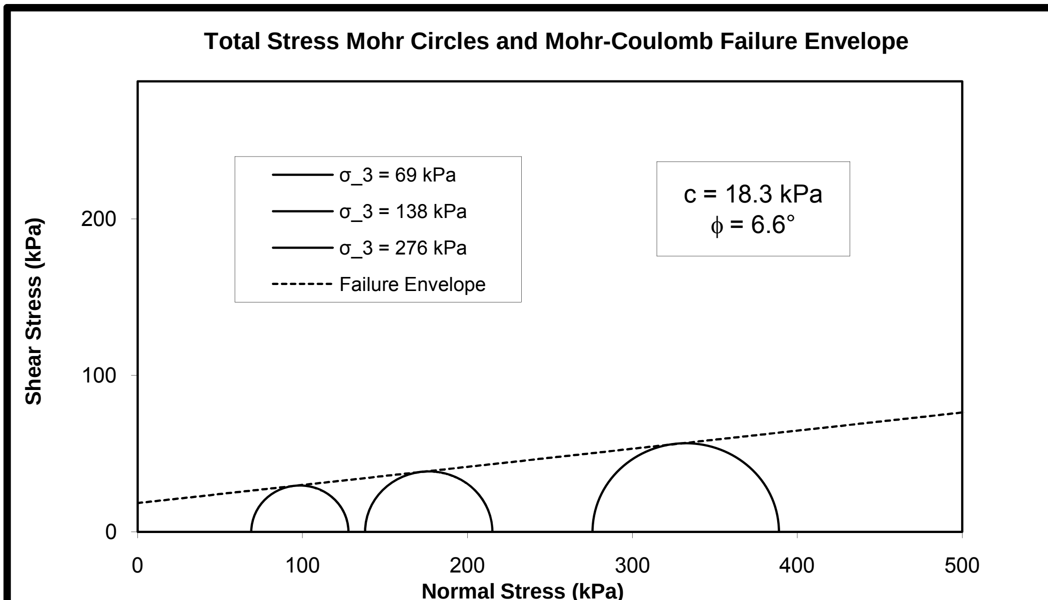
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 75% sand 25% kaolinite, 12% water content (S25K12W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/16/2009





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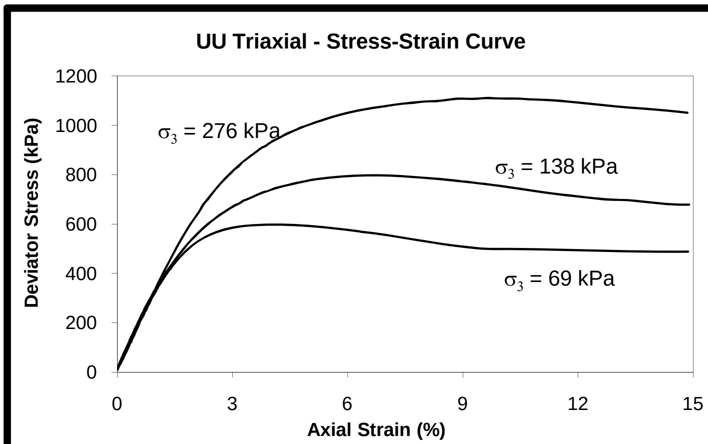
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 12% water content (S50K12W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/9/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	213	205	B 8	majid	FJ-3	5
Wt. of Tin (g)	27.89	29.7	28.45	28.7	29.0	28.9
Wt. of Tin + Wet soil (g)	92.4	85.99	108.02	161.3	165.4	159.1
Wt. of Tin + Dry soil (g)	85.86	80.12	100.05	147.4	151.4	145.6
Wt. of Dry Soil (g)	57.97	50.42	71.60	118.7	122.4	116.7
Wt. of Water (g)	6.54	5.87	7.97	13.9	13.9	13.5
Water Content (%)	11.28	11.64	11.13	11.7	11.4	11.6
Average Water Content (%)	11.4			11.6		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.16	7.17	6.89
Average Diameter, D (cm)	3.53	3.50	3.51
Dry Unit Weight (kN/m^3)	16.62	17.40	17.19
Initial Void ratio	0.55	0.48	0.50
Saturation (%)	0.56	0.63	0.61
Strain at Failure (%)	4.06	6.87	9.58
Max Deviator Stress (kPa)	599.3	799.1	1112.3
Membrane Correction (kPa)	0.9	1.5	2.1
Corrected Deviator Stress (kPa)	598.4	797.6	1110.2
Corrected Major Stress (kPa)	667.3	935.5	1386.0



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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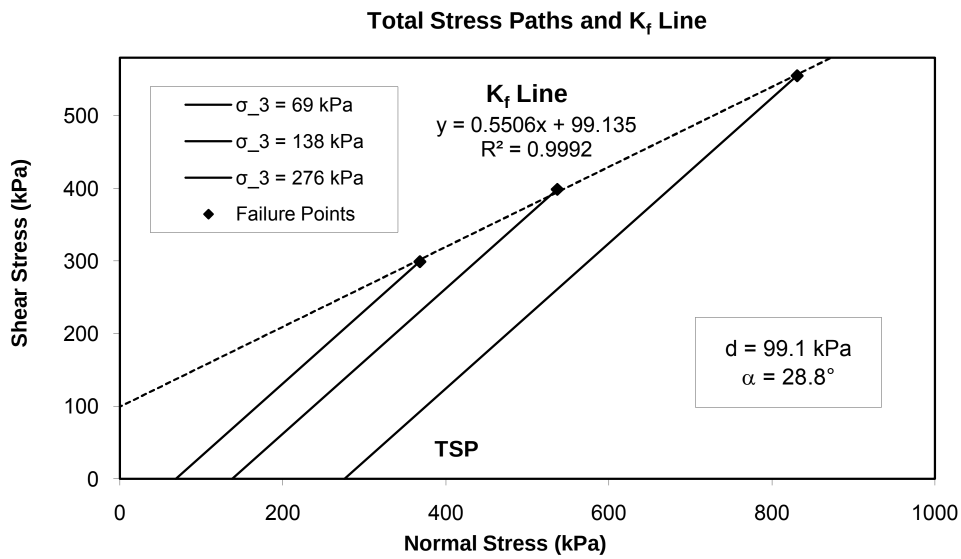
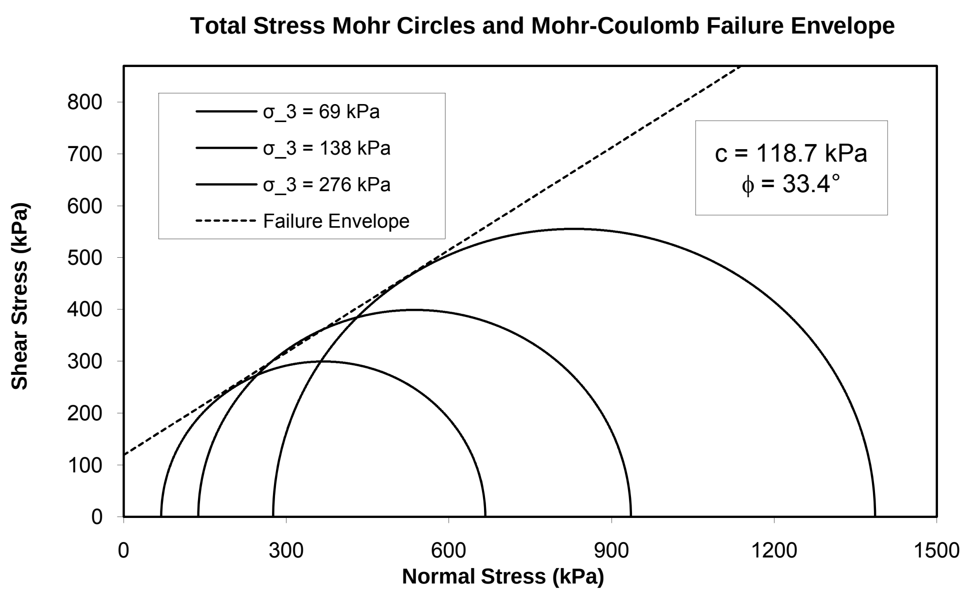
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 12% water content (S50K12W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/9/2009





DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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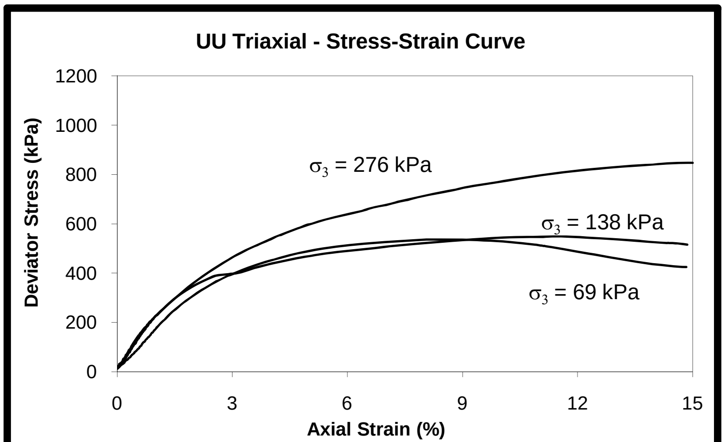
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 14% water content (S50K14W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/3/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	404	405	4	2	420	418
Wt. of Tin (g)	28.71	27.7	28.71	29.0	27.6	28.9
Wt. of Tin + Wet soil (g)	122.13	123.88	105.16	161.6	156.5	159.2
Wt. of Tin + Dry soil (g)	110.93	112.17	95.48	145.5	140.2	143.1
Wt. of Dry Soil (g)	82.22	84.47	66.77	116.5	112.6	114.2
Wt. of Water (g)	11.20	11.71	9.68	16.1	16.3	16.2
Water Content (%)	13.62	13.86	14.50	13.8	14.5	14.1
Average Water Content (%)		14.0			14.1	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	6.85	6.63	6.62
Average Diameter, D (cm)	3.52	3.52	3.51
Dry Unit Weight (kN/m^3)	17.13	17.15	17.46
Initial Void ratio	0.50	0.50	0.47
Saturation (%)	0.72	0.76	0.79
Strain at Failure (%)	8.56	11.35	14.84
Max Deviator Stress (kPa)	538.2	551.9	851.4
Membrane Correction (kPa)	1.9	2.5	3.3
Corrected Deviator Stress (kPa)	536.3	549.4	848.1
Corrected Major Stress (kPa)	605.2	687.3	1123.9



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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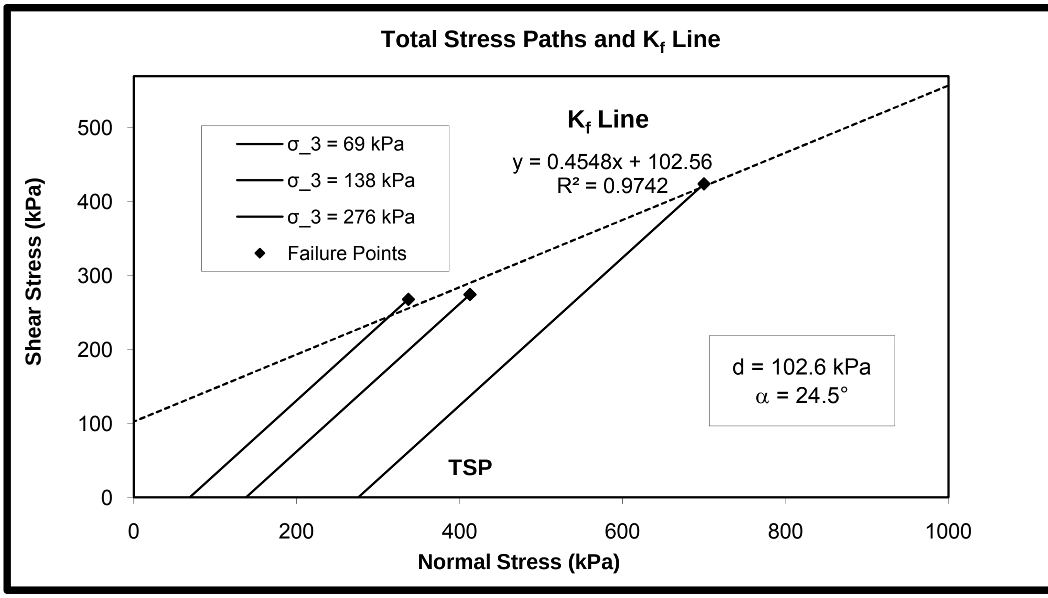
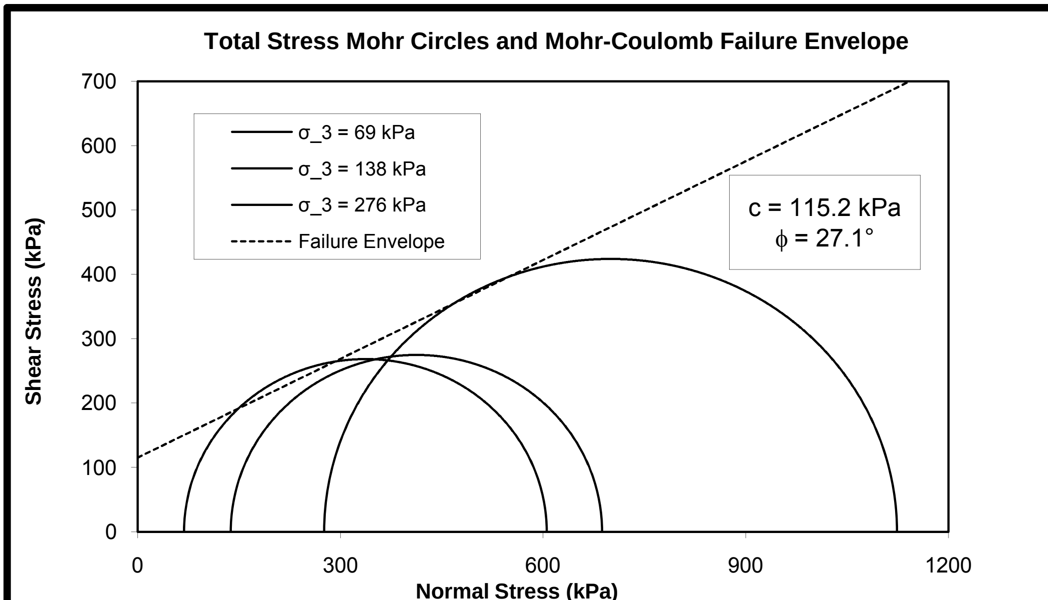
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 14% water content (S50K14W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/3/2009





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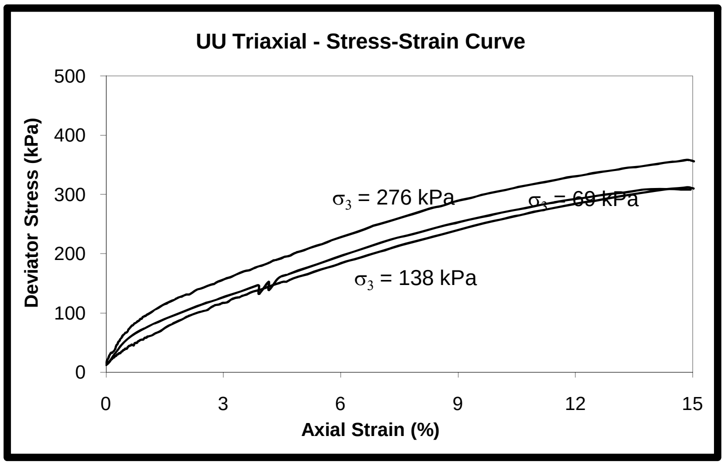
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 16% water content (S50K16W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/8/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	4	405	404	418	420	2
Wt. of Tin (g)	28.71	27.7	28.71	28.9	27.6	29.0
Wt. of Tin + Wet soil (g)	96.36	107.04	105.41	174.5	171.6	175.4
Wt. of Tin + Dry soil (g)	87.34	96.64	95.46	154.5	151.9	155.3
Wt. of Dry Soil (g)	58.63	68.94	66.75	125.6	124.3	126.3
Wt. of Water (g)	9.02	10.40	9.95	20.1	19.7	20.1
Water Content (%)	15.38	15.09	14.91	16.0	15.8	15.9
Average Water Content (%)		15.1			15.9	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.14	7.13	7.15
Average Diameter, D (cm)	3.53	3.51	3.52
Dry Unit Weight (kN/m^3)	17.68	17.68	17.81
Initial Void ratio	0.45	0.45	0.44
Saturation (%)	0.92	0.91	0.94
Strain at Failure (%)	14.45	14.89	14.86
Max Deviator Stress (kPa)	312.4	315.3	362.1
Membrane Correction (kPa)	3.2	3.3	3.3
Corrected Deviator Stress (kPa)	309.2	312.0	358.8
Corrected Major Stress (kPa)	378.1	449.9	634.6



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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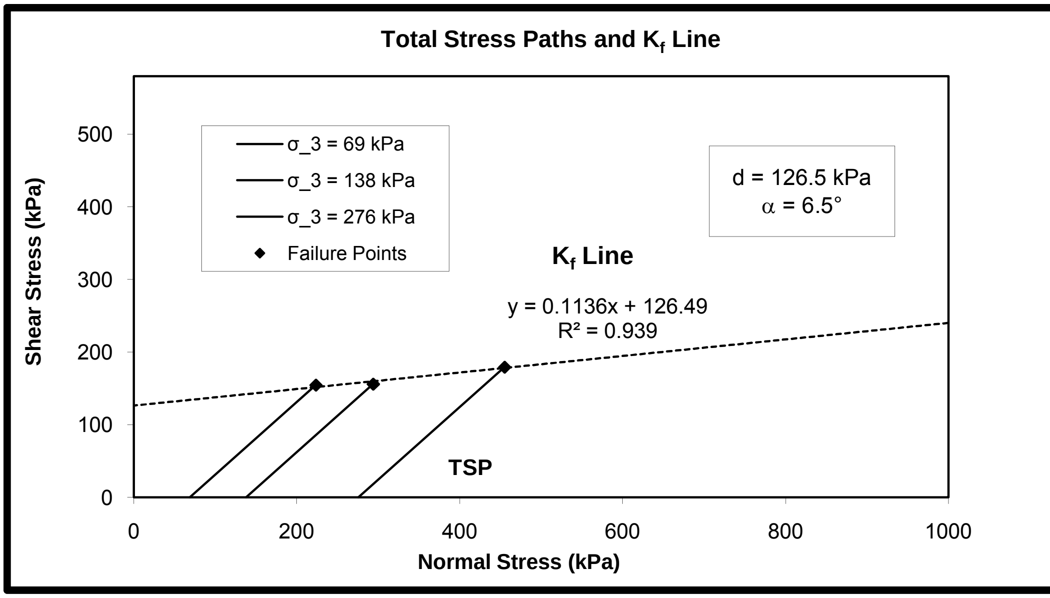
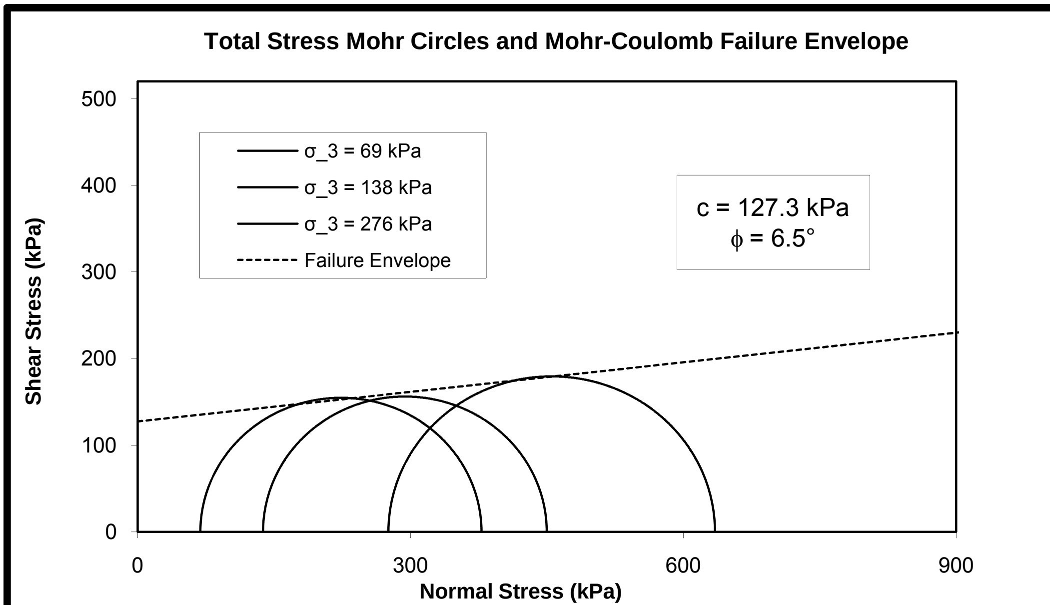
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 16% water content (S50K16W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/8/2009





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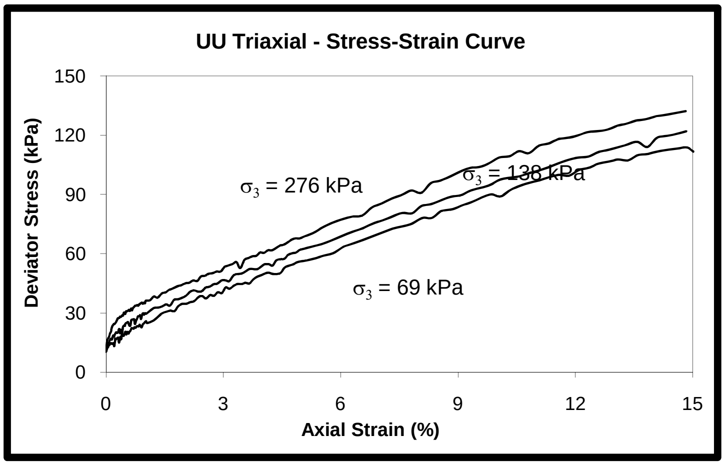
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 18% water content (S50K18W)		
Specimen Type: Compacted		USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 6/4/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	213	205	B 8	majid	FJ-3	5
Wt. of Tin (g)	27.9	29.72	28.45	28.7	29.0	28.9
Wt. of Tin + Wet soil (g)	99.96	113.13	145.46	168.8	167.8	168.9
Wt. of Tin + Dry soil (g)	89.23	100.71	127.89	147.8	146.8	147.8
Wt. of Dry Soil (g)	61.33	70.99	99.44	119.2	117.8	119.0
Wt. of Water (g)	10.73	12.42	17.57	21.0	20.9	21.1
Water Content (%)	17.50	17.50	17.67	17.6	17.7	17.7
Average Water Content (%)		17.6			17.7	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.09	7.11
Average Diameter, D (cm)	3.55	3.52	3.53
Dry Unit Weight (kN/m^3)	16.55	16.74	16.80
Initial Void ratio	0.55	0.54	0.53
Saturation (%)	0.84	0.87	0.88
Strain at Failure (%)	14.86	14.84	14.82
Max Deviator Stress (kPa)	117.0	125.3	135.6
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	113.8	122.1	132.3
Corrected Major Stress (kPa)	182.7	260.0	408.1



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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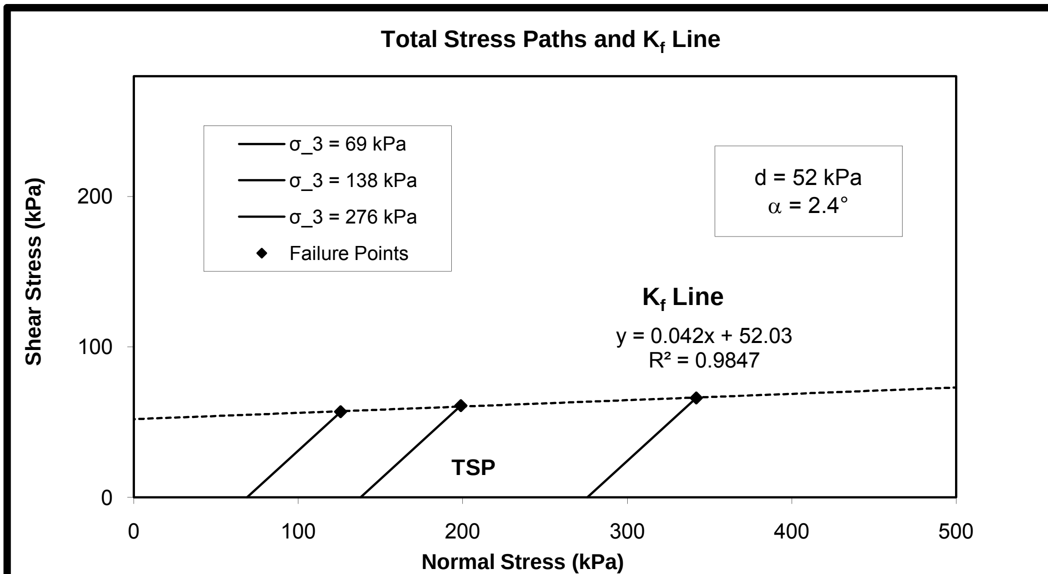
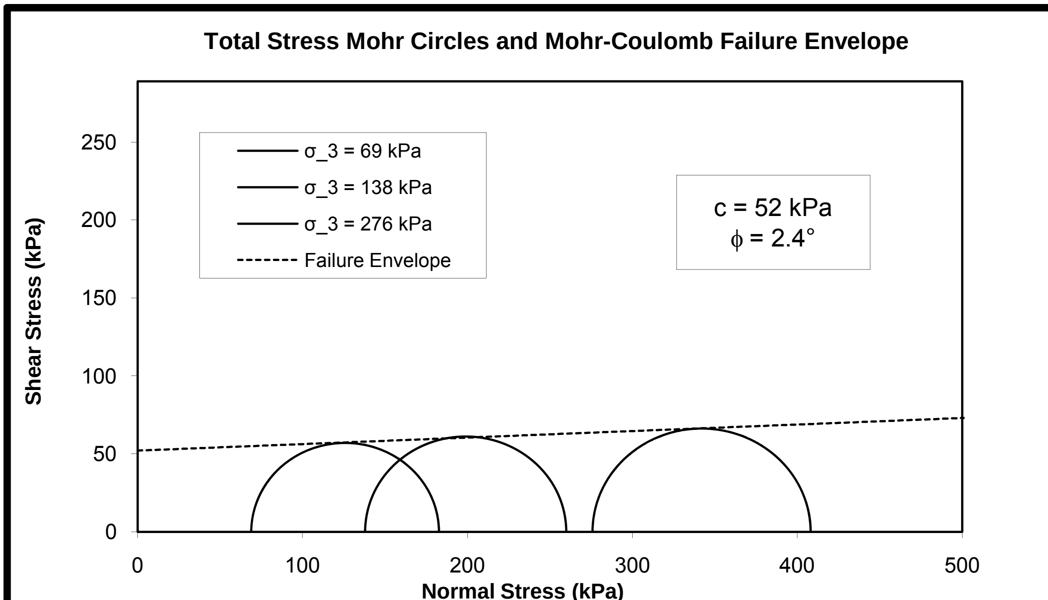
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 18% water content (S50K18W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/3/2009





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UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 20% water content (S50K20W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/9/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	101	121	46	2	420	418
Wt. of Tin (g)	28.02	30.92	28.85	29.0	27.6	28.9
Wt. of Tin + Wet soil (g)	120.18	116.21	112.4	166.1	166.2	166.1
Wt. of Tin + Dry soil (g)	104.98	102.12	98.57	143.2	142.6	143.1
Wt. of Dry Soil (g)	76.96	71.20	69.72	114.2	115.0	114.3
Wt. of Water (g)	15.20	14.09	13.83	22.9	23.6	23.0
Water Content (%)	19.75	19.79	19.84	20.1	20.6	20.1
Average Water Content (%)	19.8			20.2		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.03	7.07	7.11
Average Diameter, D (cm)	3.57	3.57	3.55
Dry Unit Weight (kN/m^3)	15.92	15.93	15.92
Initial Void ratio	0.61	0.61	0.61
Saturation (%)	0.86	0.88	0.86
Strain at Failure (%)	14.61	14.61	14.84
Max Deviator Stress (kPa)	48.4	44.8	60.7
Membrane Correction (kPa)	3.2	3.2	3.3
Corrected Deviator Stress (kPa)	45.2	41.6	57.5
Corrected Major Stress (kPa)	114.1	179.5	333.2

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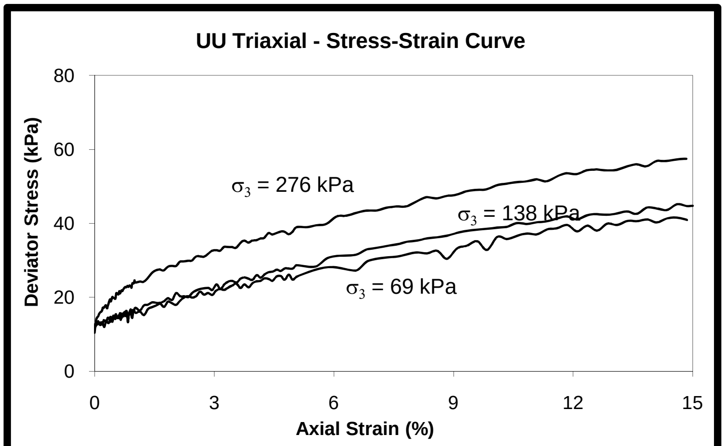

Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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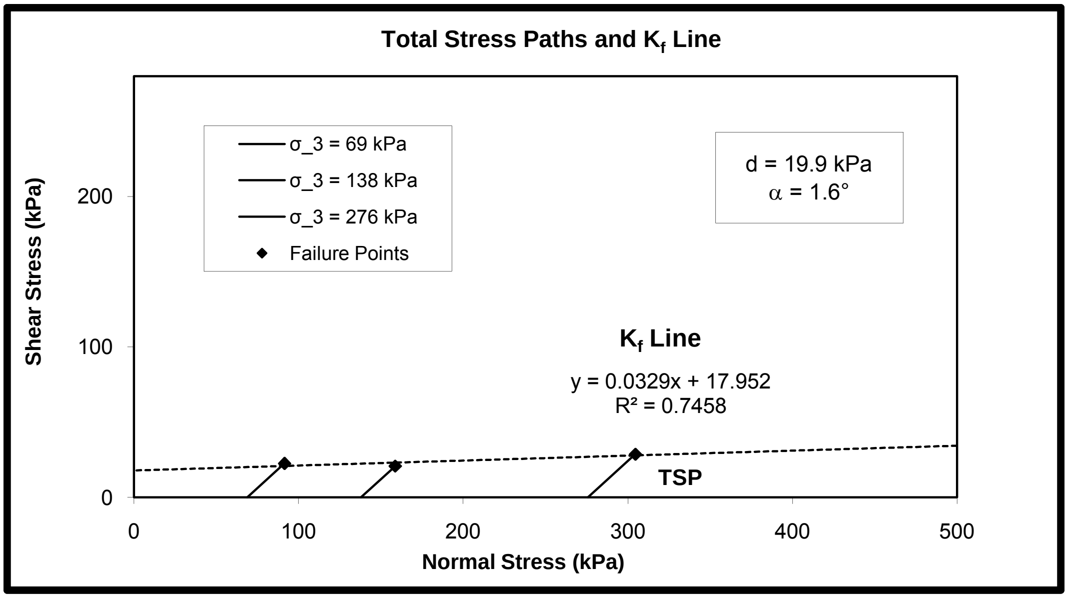
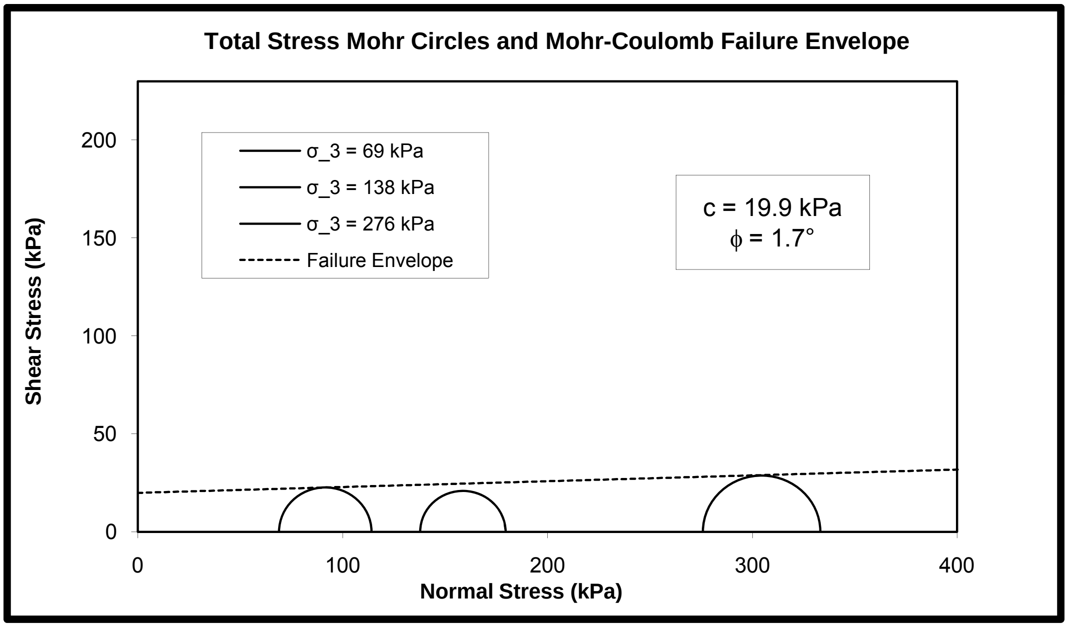
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 20% water content (S50K20W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/9/2009





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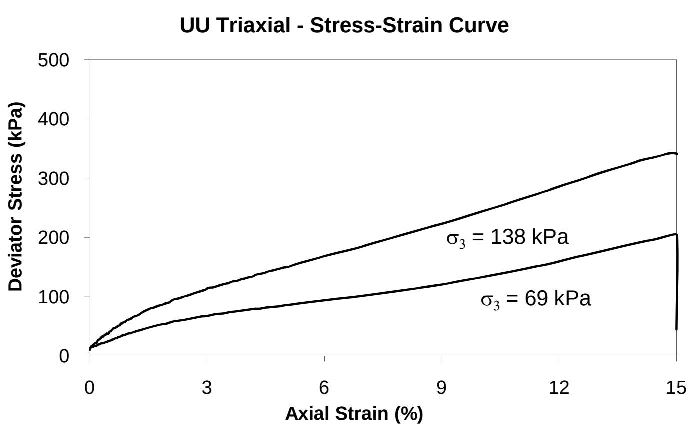
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 85% sand 15% kaolinite, 6% water content (M15K6W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/30/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	
Tin No.	213	31	B-8	5	FJ-3	
Wt. of Tin (g)	27.9	28.38	28.46	28.9	29.0	
Wt. of Tin + Wet soil (g)	91.21	100.5	102.83	164.6	165.3	
Wt. of Tin + Dry soil (g)	87.75	96.52	98.75	157.0	157.5	
Wt. of Dry Soil (g)	59.85	68.14	70.29	128.1	128.5	
Wt. of Water (g)	3.46	3.98	4.08	7.6	7.8	
Water Content (%)	5.78	5.84	5.80	5.9	6.1	
Average Water Content (%)		5.8			6.0	

Sample No.	1	2	
Cell Pressure (kPa)	68.95	137.90	
Average Height, L (cm)	7.14	7.15	
Average Diameter, D (cm)	3.49	3.53	
Dry Unit Weight (kN/m^3)	18.40	18.01	
Initial Void ratio	0.41	0.44	
Saturation (%)	0.38	0.37	
Strain at Failure (%)	14.86	14.85	
Max Deviator Stress (kPa)	207.6	345.6	
Membrane Correction (kPa)	3.3	3.3	
Corrected Deviator Stress (kPa)	204.3	342.3	
Corrected Major Stress (kPa)	273.2	480.2	



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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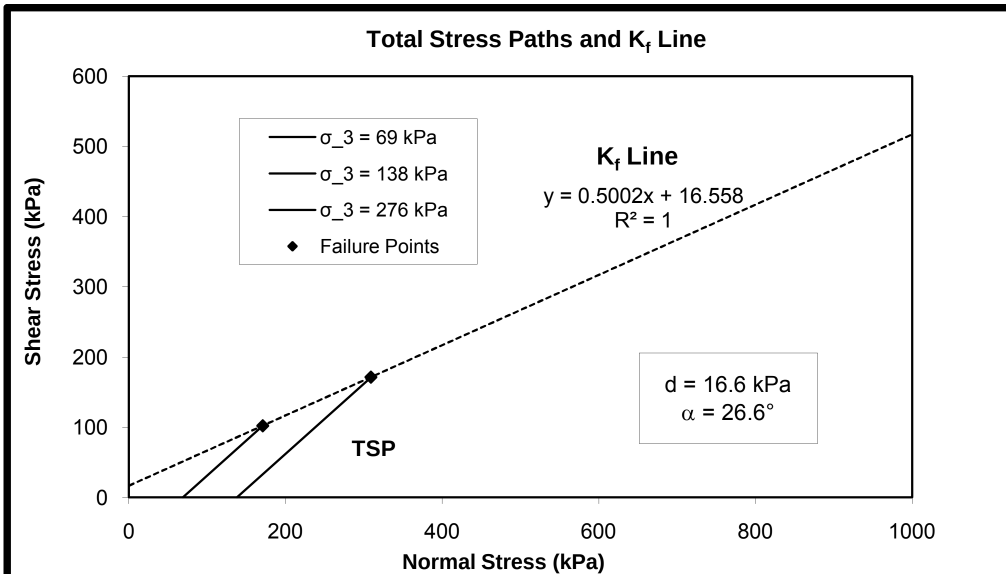
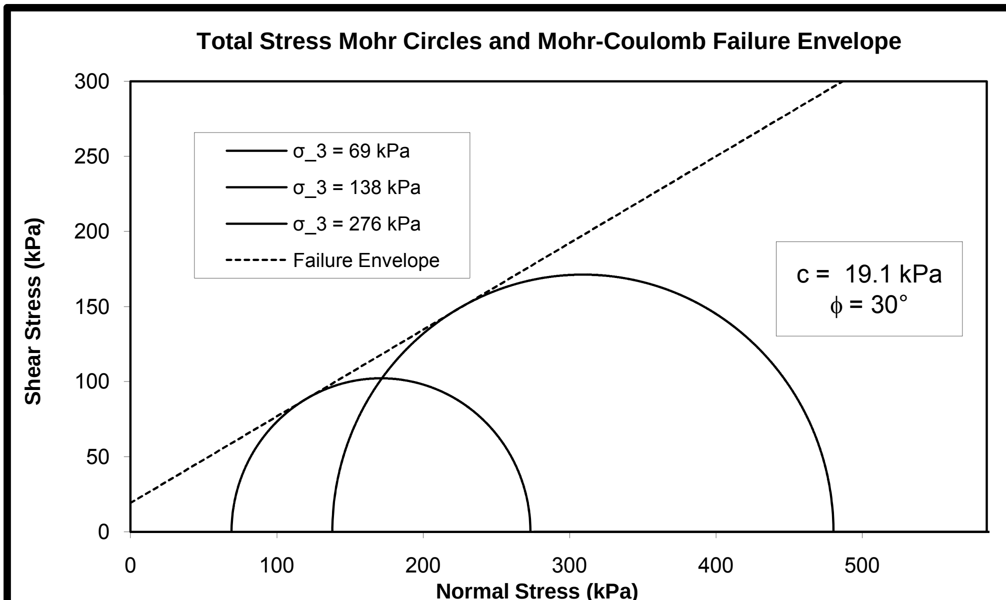
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 85% sand 15% kaolinite, 6% water content (M15K6W)				
Specimen Type:	Compacted	USCS:	Silty sand (SM)	Gs:	2.64
Strain Rate:	1%/min	Tested By:	Yueru Chen	Date:	6/30/2009





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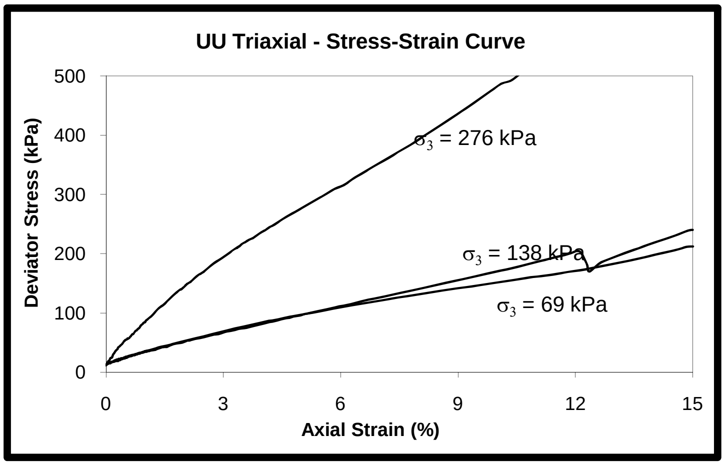
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 75% sand 25% kaolinite, 8% water content (M25K8W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/23/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	7	201	205	5	FJ-3	MAJID
Wt. of Tin (g)	28.18	28.88	29.69	28.9	29.0	28.7
Wt. of Tin + Wet soil (g)	90.94	80.89	93.58	160.4	163.6	174.4
Wt. of Tin + Dry soil (g)	86.19	76.94	88.72	149.6	153.1	163.3
Wt. of Dry Soil (g)	58.01	48.06	59.03	120.7	124.1	134.6
Wt. of Water (g)	4.75	3.95	4.86	10.7	10.5	11.1
Water Content (%)	8.19	8.22	8.23	8.9	8.5	8.3
Average Water Content (%)		8.2			8.5	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.12	7.16	7.14
Average Diameter, D (cm)	3.52	3.46	3.53
Dry Unit Weight (kN/m^3)	17.09	18.08	18.90
Initial Void ratio	0.52	0.43	0.37
Saturation (%)	0.46	0.52	0.59
Strain at Failure (%)	15.00	0.00	15.02
Max Deviator Stress (kPa)	243.5	0.0	692.0
Membrane Correction (kPa)	3.3	0.0	3.3
Corrected Deviator Stress (kPa)	240.2	0.0	688.6
Corrected Major Stress (kPa)	309.2	0.0	964.4

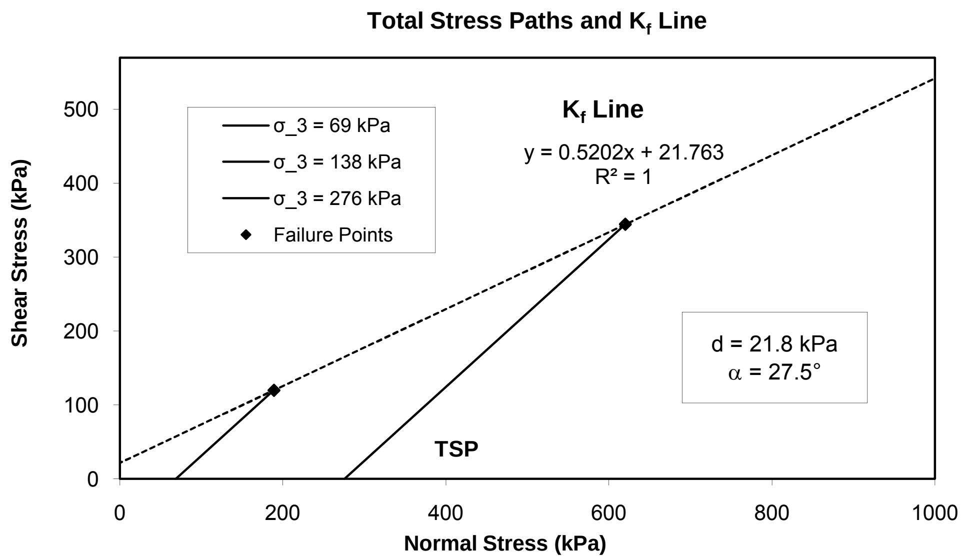


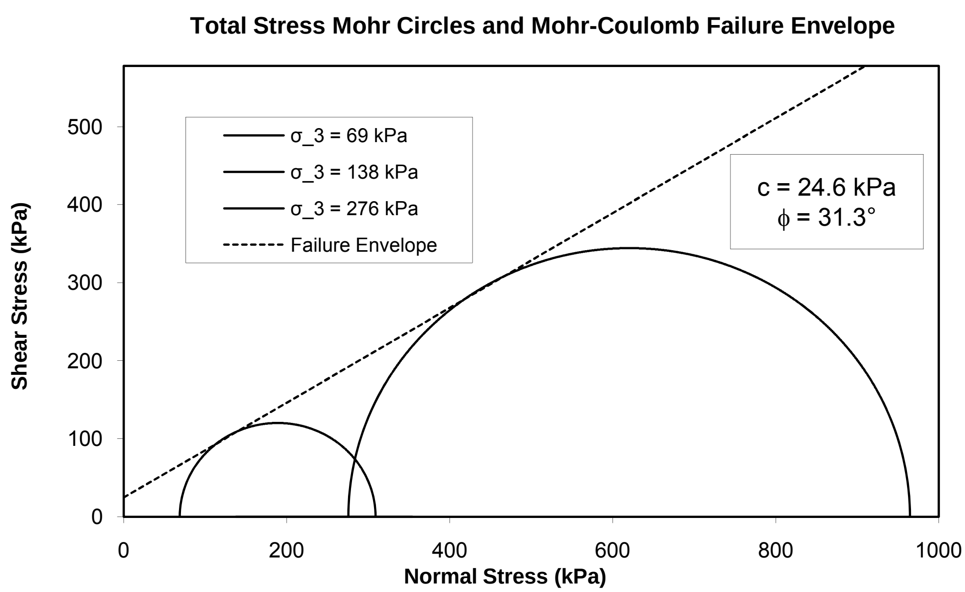
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 75% sand 25% kaolinite, 8% water content (M25K8W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/23/2009





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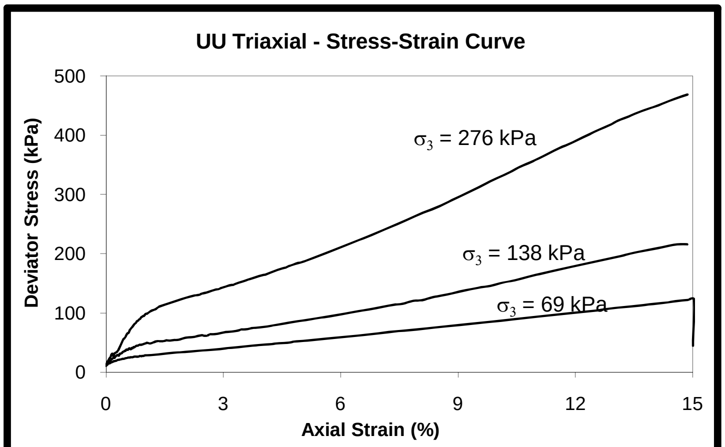
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 75% sand 25% kaolinite, 10% water content (M25K10W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/23/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B-19	46	101	31	B8	213
Wt. of Tin (g)	27.41	28.84	28.02	28.4	28.5	27.9
Wt. of Tin + Wet soil (g)	88.29	107.26	103.5	177.1	177.8	178.2
Wt. of Tin + Dry soil (g)	87.34	96.64	95.46	163.2	164.0	164.5
Wt. of Dry Soil (g)	59.93	67.80	67.44	134.8	135.5	136.6
Wt. of Water (g)	0.95	10.62	8.04	13.9	13.8	13.8
Water Content (%)	1.59	15.66	11.92	10.3	10.2	10.1
Average Water Content (%)	9.7			10.2		

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.07	7.08	7.12
Average Diameter, D (cm)	3.53	3.51	3.52
Dry Unit Weight (kN/m^3)	19.08	19.46	19.38
Initial Void ratio	0.36	0.33	0.34
Saturation (%)	0.76	0.81	0.79
Strain at Failure (%)	15.03	14.61	14.87
Max Deviator Stress (kPa)	126.0	219.4	472.1
Membrane Correction (kPa)	3.3	3.2	3.3
Corrected Deviator Stress (kPa)	122.7	216.1	468.8
Corrected Major Stress (kPa)	191.7	354.0	744.6



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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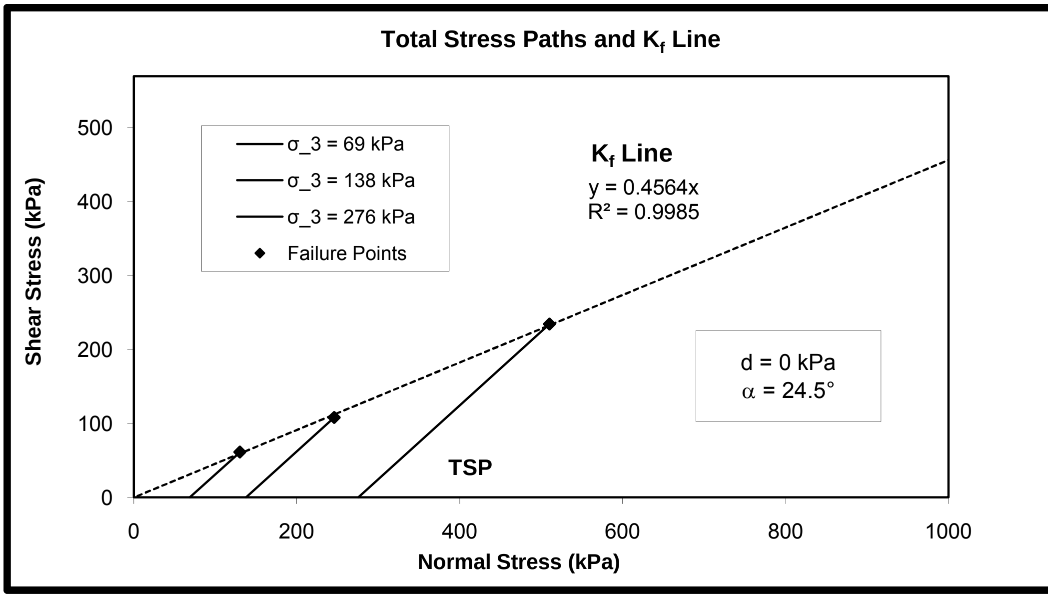
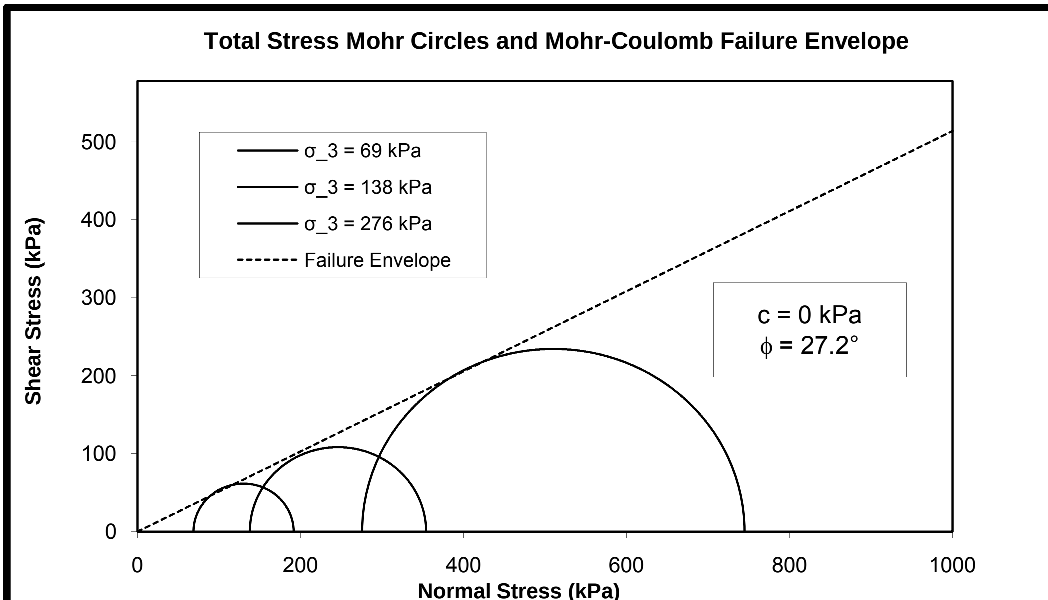
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 75% sand 25% kaolinite, 10% water content (M25K10W)		
Specimen Type:	Compacted	USCS: Silty sand (SM)	Gs: 2.64
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/23/2009





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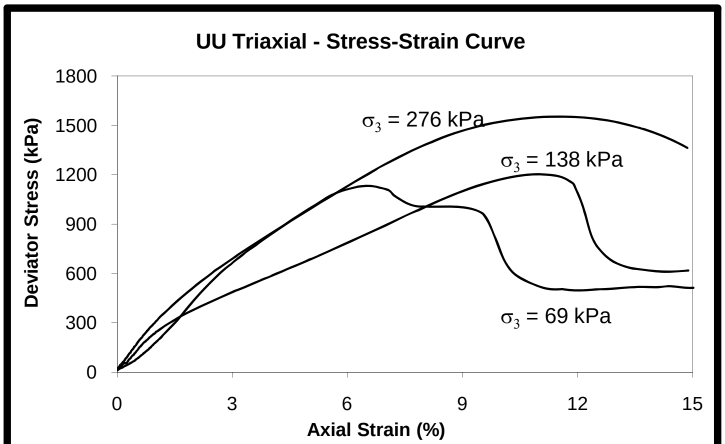
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% kaolinite, 12% water content (M50K12W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/17/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	404	4	405	majid	FJ-3	5
Wt. of Tin (g)	28.72	28.72	27.71	28.7	29.0	28.9
Wt. of Tin + Wet soil (g)	102.53	91.25	111.78	178.4	176.1	179.3
Wt. of Tin + Dry soil (g)	94.26	84.54	102.76	162.5	160.6	163.4
Wt. of Dry Soil (g)	65.54	55.82	75.05	133.8	131.5	134.5
Wt. of Water (g)	8.27	6.71	9.02	15.9	15.6	15.9
Water Content (%)	12.62	12.02	12.02	11.9	11.8	11.8
Average Water Content (%)		12.2			11.8	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.17	7.19	7.13
Average Diameter, D (cm)	3.51	3.51	3.51
Dry Unit Weight (kN/m^3)	18.89	18.58	19.14
Initial Void ratio	0.36	0.38	0.34
Saturation (%)	0.86	0.81	0.90
Strain at Failure (%)	6.58	10.87	11.34
Max Deviator Stress (kPa)	1133.8	1205.9	1556.2
Membrane Correction (kPa)	1.5	2.4	2.5
Corrected Deviator Stress (kPa)	1132.3	1203.5	1553.7
Corrected Major Stress (kPa)	1201.3	1341.4	1829.5



Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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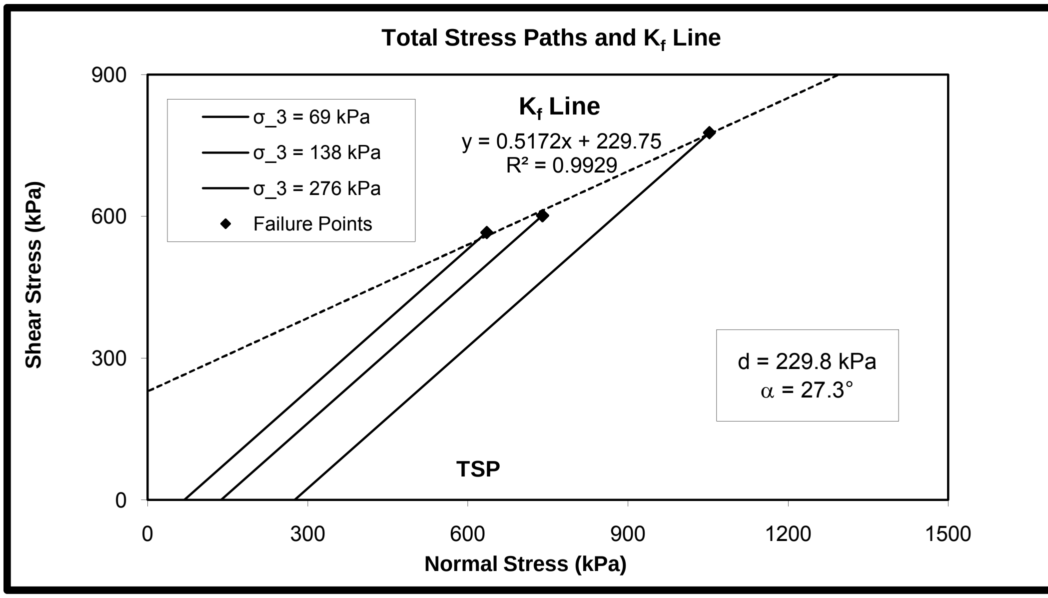
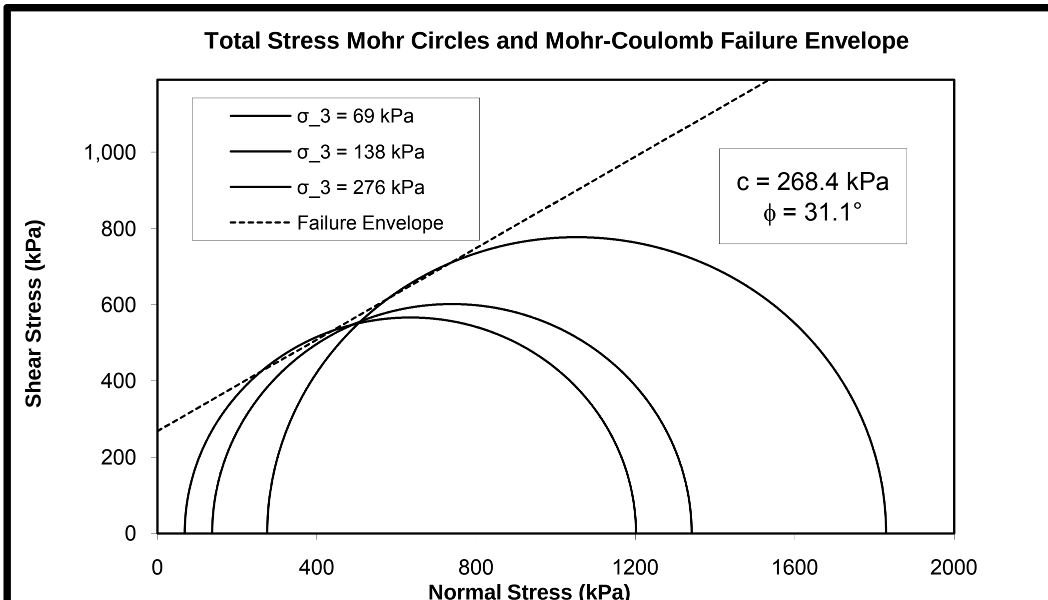
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% kaolinite, 12% water content (M50K12W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/17/2009





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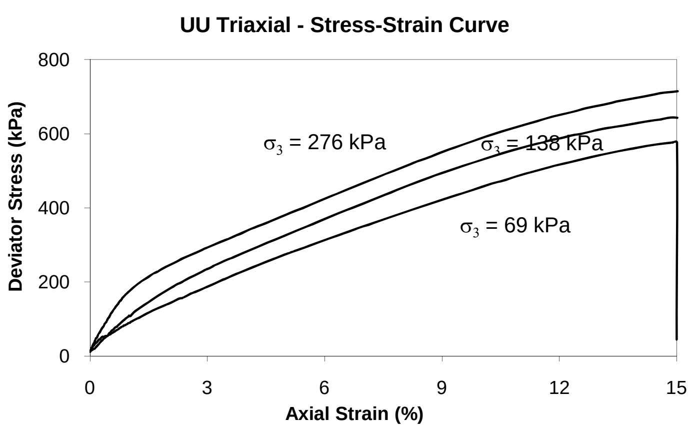
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% kaolinite, 14% water content (M50K14W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/22/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	B-19	46	101	205	201	7
Wt. of Tin (g)	27.4	28.83	28.01	29.6	28.9	28.2
Wt. of Tin + Wet soil (g)	93.68	93.06	117.3	176.1	176.6	178.5
Wt. of Tin + Dry soil (g)	85.28	85.16	106.7	157.7	158.6	160.0
Wt. of Dry Soil (g)	57.88	56.33	78.69	128.1	129.7	131.9
Wt. of Water (g)	8.40	7.90	10.60	18.4	18.1	18.4
Water Content (%)	14.51	14.02	13.47	14.4	14.0	14.0
Average Water Content (%)		14.0			14.1	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.08	7.12	7.16
Average Diameter, D (cm)	3.51	3.51	3.54
Dry Unit Weight (kN/m^3)	18.32	18.44	18.36
Initial Void ratio	0.40	0.39	0.40
Saturation (%)	0.93	0.93	0.92
Strain at Failure (%)	15.01	14.85	15.03
Max Deviator Stress (kPa)	579.4	647.0	718.0
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	576.1	643.7	714.7
Corrected Major Stress (kPa)	645.1	781.6	990.5





Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

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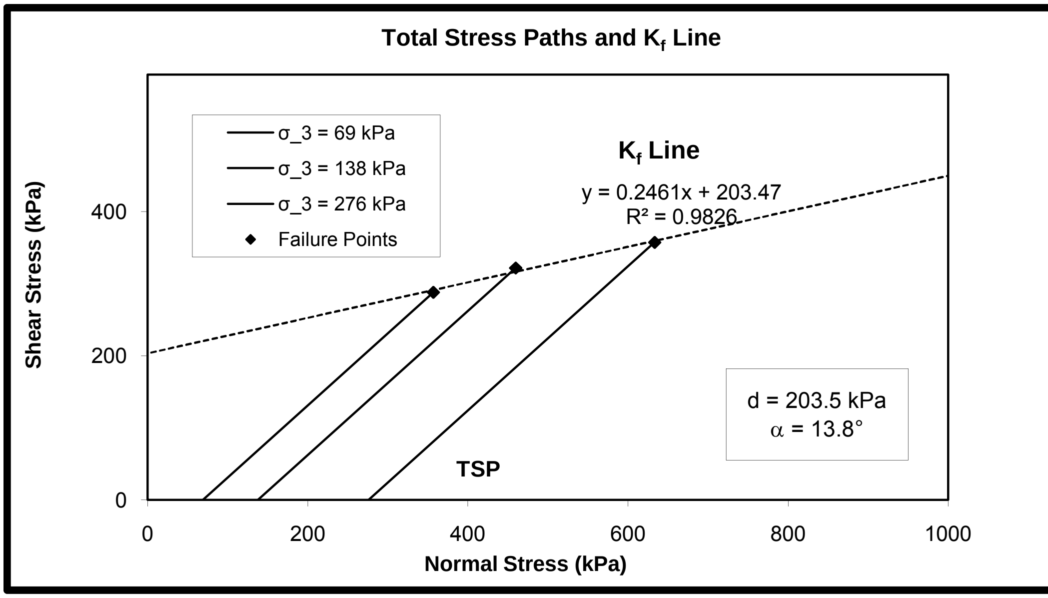
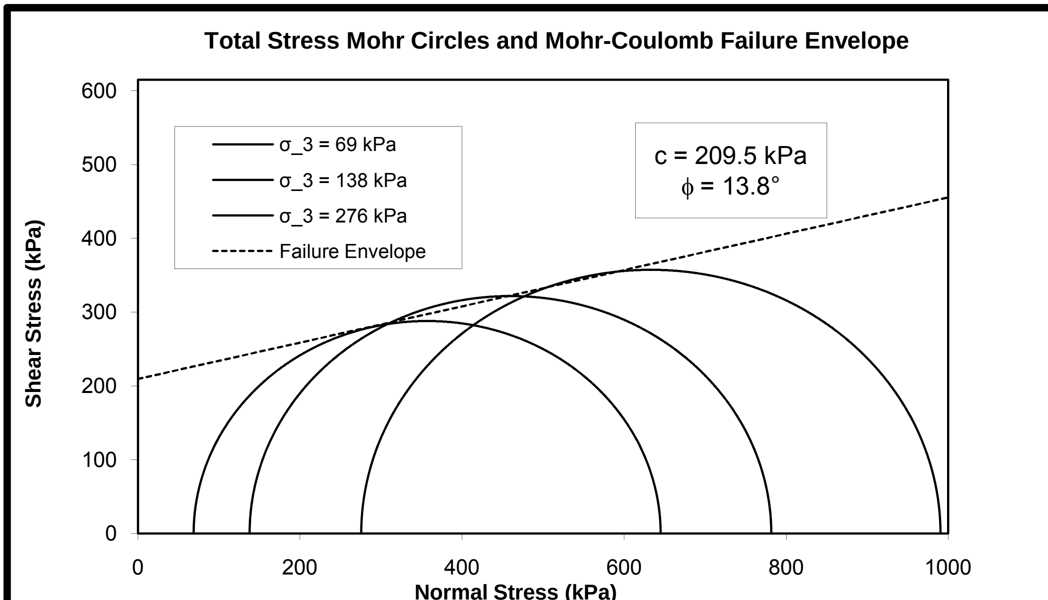
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% kaolinite, 14% water content (M50K14W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/22/2009





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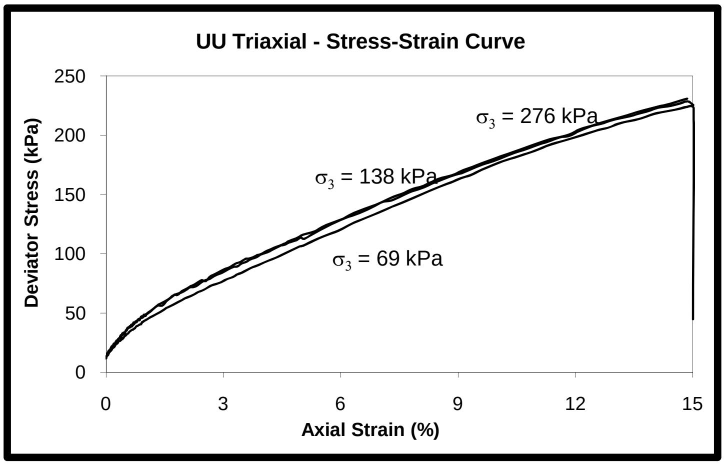
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% kaolinite, 16% water content (M50K16W)		
Specimen Type:	Compacted	USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate:	1%/min	Tested By: Yueru Chen	Date: 6/29/2009

Sample No.	Trimming			Specimen		
	1	2	3	1	2	3
Tin No.	7	201	205	418	420	2
Wt. of Tin (g)	28.18	28.88	29.69	28.8	27.6	29.0
Wt. of Tin + Wet soil (g)	105.12	119.43	112.08	172.5	171.4	169.9
Wt. of Tin + Dry soil (g)	94.63	107.13	100.84	152.4	151.2	150.1
Wt. of Dry Soil (g)	66.45	78.25	71.15	123.6	123.6	121.1
Wt. of Water (g)	10.49	12.30	11.24	20.1	20.2	19.8
Water Content (%)	15.79	15.72	15.80	16.3	16.3	16.3
Average Water Content (%)		15.8			16.3	

Sample No.	1	2	3
Cell Pressure (kPa)	68.95	137.90	275.79
Average Height, L (cm)	7.13	7.13	7.11
Average Diameter, D (cm)	3.53	3.52	3.51
Dry Unit Weight (kN/m^3)	17.37	17.48	17.27
Initial Void ratio	0.48	0.47	0.49
Saturation (%)	0.89	0.91	0.88
Strain at Failure (%)	14.84	14.86	14.86
Max Deviator Stress (kPa)	227.0	234.0	231.9
Membrane Correction (kPa)	3.3	3.3	3.3
Corrected Deviator Stress (kPa)	223.7	230.8	228.6
Corrected Major Stress (kPa)	292.6	368.7	504.4

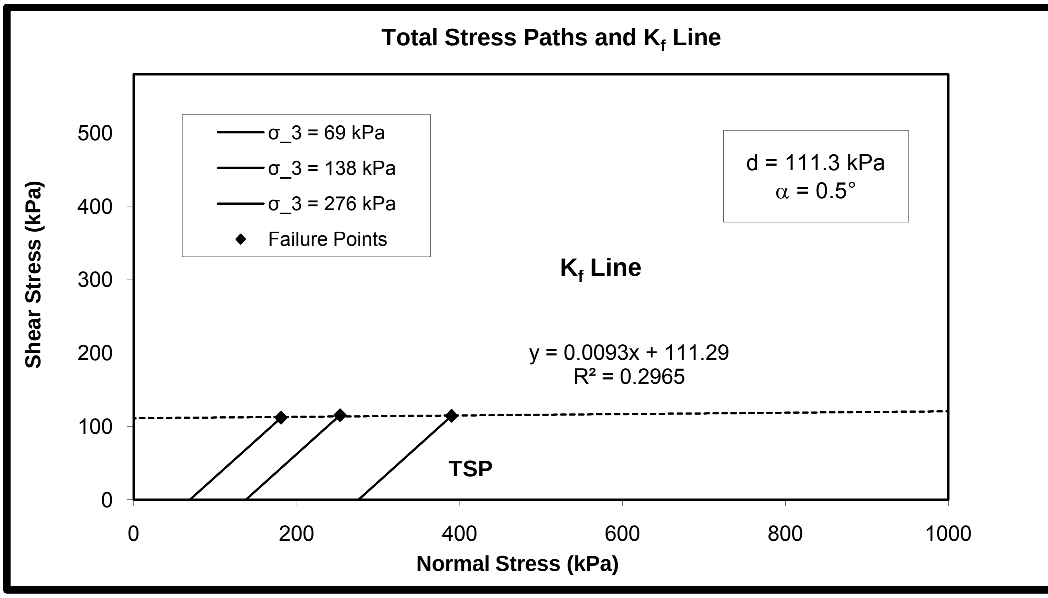


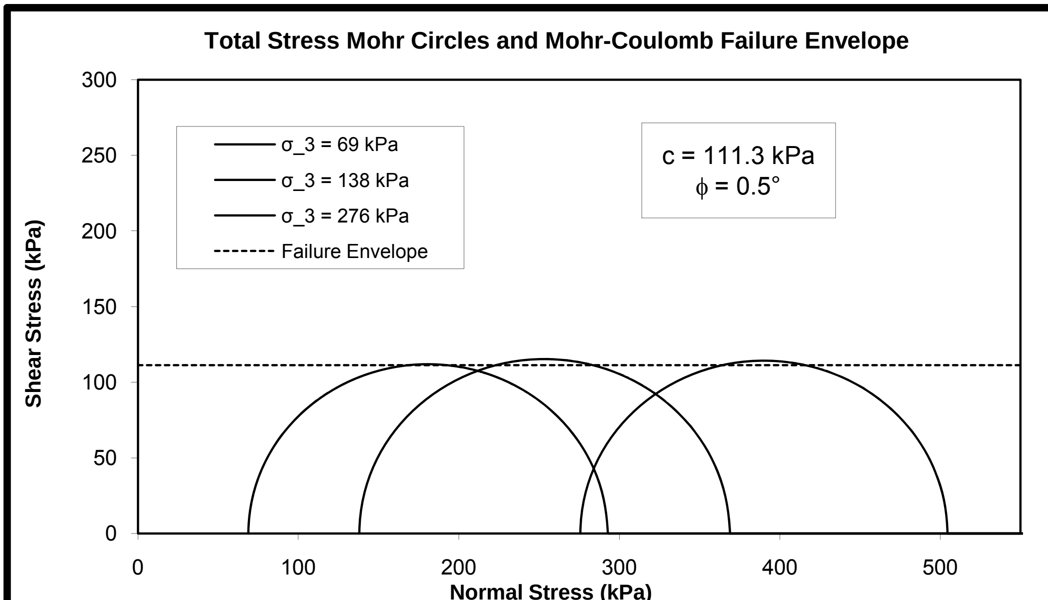
Notes: Membrane correction according to ASTM D 2850-03a:

$$\Delta(\sigma_1 - \sigma_3) = 4E_m t_m \varepsilon_1 / D \qquad E_m = 1.39\ MPa\ ;\ t_m = 0.14\ mm$$

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB
UU Triaxial Compression Test: ASTM D 2850 - 03

Project Name:	An experimental investigation of the behavior of compacted sand/clay mixtures		
Sample:	Modified Proctor compacted, 50% sand 50% kaolinite, 16% water content (M50K16W)		
Specimen Type: Compacted		USCS: Sandy lean clay (CL)	Gs: 2.62
Strain Rate: 1%/min		Tested By: Yueru Chen	Date: 6/29/2009





APPENDIX G

ONE – DIMENSIONAL COMPRESSION DATA

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 85% sand 15% bentonite, 12% water content (L15B12W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	133.6 g	Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen	Date	3/11/2009

Trimmings	1	2
Tin No.	213	B8
Wt. of Tin (g)	27.9	28.4
Wt. of Tin + Wet Soil (g)	145.8	169.9
Wt. of Tin + Dry Soil (g)	132.9	154.6
Wt. of Dry Soil (g)	105	126.2
Wt. of Water (g)	12.9	15.3
Water Content (%)	12.3	12.1
Average Water Content (%)	12.2	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	205
Wt. of Tare + Wet Soil (g)	316.9	145.8
Wt. of Tare + Dry Soil (g)	-	132.6
Wt. of Tare (g)	200.20	29.7
Wt. of Wet Soil (g)	116.70	116.1
Wt. of Dry Soil (g)	102.90	102.9
Wt. of Water (g)	13.80	13.2
Water Content (%)	13.4	12.8

Initial Dry Density	ρ_d	1.62	g/cm^3	Final Dry Density	ρ_d	1.78	g/cm^3
Initial Dry Unit Weight	γ_d	15.9	kN/m^3	Final Dry Unit Weight	γ_d	17.4	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1140	0.2390	0.4270	0.6600	0.9470	1.3100	1.7400

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 85% sand 15% bentonite, 14% water content (L15B14W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	63 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen	Date	3/11/2009

Trimmings	1	2
Tin No.	7	201
Wt. of Tin (g)	28.2	28.9
Wt. of Tin + Wet Soil (g)	158.8	153.2
Wt. of Tin + Dry Soil (g)	142.6	137.9
Wt. of Dry Soil (g)	114.4	109
Wt. of Water (g)	16.2	15.3
Water Content (%)	14.2	14.0
Average Water Content (%)	14.1	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B-19
Wt. of Tare + Wet Soil (g)	309.1	151.4
Wt. of Tare + Dry Soil (g)	-	131.3
Wt. of Tare (g)	191.60	27.4
Wt. of Wet Soil (g)	117.50	124
Wt. of Dry Soil (g)	103.90	103.9
Wt. of Water (g)	13.60	20.1
Water Content (%)	13.1	19.3

Initial Dry Density	ρ_d	1.64	g/cm^3	Final Dry Density	ρ_d	1.79	g/cm^3
Initial Dry Unit Weight	γ_d	16.1	kN/m^3	Final Dry Unit Weight	γ_d	17.5	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1499	0.2819	0.4572	0.6782	0.9525	1.2900	1.6230

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UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 85% sand 15% bentonite, 16% water content (L15B16W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	67.5 g	Wt. of Stone	133.6 g	Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen	Date	3/5/2009

Trimmings	1	2
Tin No.	7	201
Wt. of Tin (g)	28.1	28.9
Wt. of Tin + Wet Soil (g)	160.7	164.2
Wt. of Tin + Dry Soil (g)	142.2	145.3
Wt. of Dry Soil (g)	114.1	116.4
Wt. of Water (g)	18.5	18.9
Water Content (%)	16.2	16.2
Average Water Content (%)	16.2	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B-19
Wt. of Tare + Wet Soil (g)	324.7	150
Wt. of Tare + Dry Soil (g)	-	133.1
Wt. of Tare (g)	201.40	27.4
Wt. of Wet Soil (g)	123.30	122.6
Wt. of Dry Soil (g)	105.70	105.7
Wt. of Water (g)	17.60	16.9
Water Content (%)	16.7	16.0

Initial Dry Density	ρ_d	1.67	g/cm^3	Final Dry Density	ρ_d	1.77	g/cm^3
Initial Dry Unit Weight	γ_d	16.4	kN/m^3	Final Dry Unit Weight	γ_d	17.4	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0838	0.1370	0.2440	0.4470	0.6120	0.8790	1.1700

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UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 85% sand 15% bentonite, 18% water content (L15B18W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	133.7 g	Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen	Date	3/6/2009

Trimmings	1	2
Tin No.	404	405
Wt. of Tin (g)	28.7	27.7
Wt. of Tin + Wet Soil (g)	155	155.8
Wt. of Tin + Dry Soil (g)	135.8	136.3
Wt. of Dry Soil (g)	107.1	108.6
Wt. of Water (g)	19.2	19.5
Water Content (%)	17.9	18.0
Average Water Content (%)	17.9	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	101
Wt. of Tare + Wet Soil (g)	325.8	152.7
Wt. of Tare + Dry Soil (g)	-	134
Wt. of Tare (g)	200.30	28
Wt. of Wet Soil (g)	125.50	124.7
Wt. of Dry Soil (g)	106.00	106
Wt. of Water (g)	19.50	18.7
Water Content (%)	18.4	17.6

Initial Dry Density	ρ_d	1.67	g/cm^3	Final Dry Density	ρ_d	1.80	g/cm^3
Initial Dry Unit Weight	γ_d	16.4	kN/m^3	Final Dry Unit Weight	γ_d	17.6	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0660	0.1140	0.2340	0.4270	0.7420	1.0700	1.3700

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Low energy compacted, 85% sand 15% bentonite, 20% water content (L15B20W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	63 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g		
Specific Gravity	2.65	Tested By	Yueru Chen	Date	3/6/2009		

Trimmings	1	2
Tin No.	313	B8
Wt. of Tin (g)	27.9	28.4
Wt. of Tin + Wet Soil (g)	147.3	180.4
Wt. of Tin + Dry Soil (g)	127.3	154.7
Wt. of Dry Soil (g)	99.4	126.3
Wt. of Water (g)	20	25.7
Water Content (%)	20.1	20.3
Average Water Content (%)	20.2	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	205
Wt. of Tare + Wet Soil (g)	314	151.4
Wt. of Tare + Dry Soil (g)	-	130.9
Wt. of Tare (g)	193.30	29.7
Wt. of Wet Soil (g)	120.70	121.7
Wt. of Dry Soil (g)	101.20	101.2
Wt. of Water (g)	19.50	20.5
Water Content (%)	19.3	20.3

Initial Dry Density ρ_d 1.60 g/cm^3 Final Dry Density ρ_d 1.79 g/cm^3

Initial Dry Unit Weight γ_d 15.7 kN/m^3 Final Dry Unit Weight γ_d 17.6 kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1170	0.2540	0.4780	0.8230	1.2800	1.7300	2.1600

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 75% sand 25% bentonite, 14% water content (L25B14W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	7/21/2009

Trimmings	1	2
Tin No.	404	405
Wt. of Tin (g)	28.71	27.7
Wt. of Tin + Wet Soil (g)	156.61	162.69
Wt. of Tin + Dry Soil (g)	140.5	145.58
Wt. of Dry Soil (g)	111.79	117.88
Wt. of Water (g)	16.11	17.11
Water Content (%)	14.4	14.5
Average Water Content (%)	14.5	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	4
Wt. of Tare + Wet Soil (g)	308.21	143.2
Wt. of Tare + Dry Soil (g)	-	128.8
Wt. of Tare (g)	193.14	28.7
Wt. of Wet Soil (g)	115.07	114.5
Wt. of Dry Soil (g)	100.10	100.1
Wt. of Water (g)	14.97	14.4
Water Content (%)	15.0	14.4

Initial Dry Density	ρ_d	1.58	g/cm^3	Final Dry Density	ρ_d	1.77	g/cm^3
Initial Dry Unit Weight	γ_d	15.5	kN/m^3	Final Dry Unit Weight	γ_d	17.4	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1630	0.2970	0.4445	0.6430	0.9530	1.4680	2.1770

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 75% sand 25% bentonite, 16% water content (L25B16W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	7/20/2009

Trimmings	1	2
Tin No.	201	7
Wt. of Tin (g)	28.88	28.18
Wt. of Tin + Wet Soil (g)	152.82	153.82
Wt. of Tin + Dry Soil (g)	135.98	135.95
Wt. of Dry Soil (g)	107.1	107.77
Wt. of Water (g)	16.84	17.87
Water Content (%)	15.7	16.6
Average Water Content (%)	16.2	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	31
Wt. of Tare + Wet Soil (g)	304.26	135.73
Wt. of Tare + Dry Soil (g)	-	120.98
Wt. of Tare (g)	196.55	29.7
Wt. of Wet Soil (g)	107.71	106.03
Wt. of Dry Soil (g)	91.28	91.28
Wt. of Water (g)	16.43	14.75
Water Content (%)	18.0	16.2

Initial Dry Density	ρ_d	1.44	g/cm^3	Final Dry Density	ρ_d	1.62	g/cm^3
Initial Dry Unit Weight	γ_d	14.1	kN/m^3	Final Dry Unit Weight	γ_d	15.9	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.2130	0.3680	0.5000	0.7290	1.0500	1.5700	2.2300

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 75% sand 25% bentonite, 18% water content (L25B18W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	7/21/2009

Trimmings	1	2
Tin No.	201	7
Wt. of Tin (g)	28.85	28.17
Wt. of Tin + Wet Soil (g)	160.39	144.1
Wt. of Tin + Dry Soil (g)	140.01	126.14
Wt. of Dry Soil (g)	111.16	97.97
Wt. of Water (g)	20.38	17.96
Water Content (%)	18.3	18.3
Average Water Content (%)	18.3	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	31
Wt. of Tare + Wet Soil (g)	323.7	151.18
Wt. of Tare + Dry Soil (g)	-	132.37
Wt. of Tare (g)	200.22	29.7
Wt. of Wet Soil (g)	123.48	121.48
Wt. of Dry Soil (g)	102.67	102.67
Wt. of Water (g)	20.81	18.81
Water Content (%)	20.3	18.3

Initial Dry Density	ρ_d	1.62	g/cm^3	Final Dry Density	ρ_d	1.78	g/cm^3
Initial Dry Unit Weight	γ_d	15.9	kN/m^3	Final Dry Unit Weight	γ_d	17.4	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1300	0.1980	0.3200	0.4880	0.7750	1.2200	1.7500

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Low energy compacted, 75% sand 25% bentonite, 20% water content (L25B20W)						
Consolid. Type	EI25-0479			Consolid. Type		Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.		63.5 mm		Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone		- g		Wt. of Paper	- g
Specific Gravity	2.64	Tested By		Yueru Chen		Date	7/21/2009

Trimmings	1	2
Tin No.	MAJID	213
Wt. of Tin (g)	28.65	27.9
Wt. of Tin + Wet Soil (g)	125.57	132.3
Wt. of Tin + Dry Soil (g)	109.18	114.25
Wt. of Dry Soil (g)	80.53	86.35
Wt. of Water (g)	16.39	18.05
Water Content (%)	20.4	20.9
Average Water Content (%)	20.6	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	FJ-3
Wt. of Tare + Wet Soil (g)	320.54	151.13
Wt. of Tare + Dry Soil (g)	-	130.79
Wt. of Tare (g)	197.75	29.1
Wt. of Wet Soil (g)	122.79	122.03
Wt. of Dry Soil (g)	101.69	101.69
Wt. of Water (g)	21.10	20.34
Water Content (%)	20.7	20.0

Initial Dry Density	ρ_d	1.61	g/cm^3	Final Dry Density	ρ_d	1.77	g/cm^3
Initial Dry Unit Weight	γ_d	15.7	kN/m^3	Final Dry Unit Weight	γ_d	17.3	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0787	0.1680	0.3180	0.5560	0.9580	1.4500	1.8500

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 75% sand 25% bentonite, 22% water content (L25B22W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	7/21/2009

Trimmings	1	2
Tin No.	46	101
Wt. of Tin (g)	28.85	28.03
Wt. of Tin + Wet Soil (g)	130.48	115.31
Wt. of Tin + Dry Soil (g)	112.15	99.33
Wt. of Dry Soil (g)	83.3	71.3
Wt. of Water (g)	18.33	15.98
Water Content (%)	22.0	22.4
Average Water Content (%)	22.2	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	316.3	148.73
Wt. of Tare + Dry Soil (g)	-	127.26
Wt. of Tare (g)	194.84	28.45
Wt. of Wet Soil (g)	121.46	120.28
Wt. of Dry Soil (g)	98.81	98.81
Wt. of Water (g)	22.65	21.47
Water Content (%)	22.9	21.7

Initial Dry Density	ρ_d	1.56	g/cm^3	Final Dry Density	ρ_d	-1.07	g/cm^3
Initial Dry Unit Weight	γ_d	15.3	kN/m^3	Final Dry Unit Weight	γ_d	-10.4	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0560	0.1550	0.3400	0.6400	1.1200	1.5800	1.9400

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 75% sand 25% bentonite, 24% water content (L25B24W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	3/6/2009

Trimmings	1	2
Tin No.	7	201
Wt. of Tin (g)	28.2	28.9
Wt. of Tin + Wet Soil (g)	153.5	146
Wt. of Tin + Dry Soil (g)	129.5	123.7
Wt. of Dry Soil (g)	101.3	94.8
Wt. of Water (g)	24	22.3
Water Content (%)	23.7	23.5
Average Water Content (%)	23.6	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B-19
Wt. of Tare + Wet Soil (g)	319.4	149.1
Wt. of Tare + Dry Soil (g)	-	126.4
Wt. of Tare (g)	196.60	27.4
Wt. of Wet Soil (g)	122.80	121.7
Wt. of Dry Soil (g)	99.00	99
Wt. of Water (g)	23.80	22.7
Water Content (%)	24.0	22.9

Initial Dry Density	ρ_d	1.56	g/cm^3	Final Dry Density	ρ_d	1.73	g/cm^3
Initial Dry Unit Weight	γ_d	15.3	kN/m^3	Final Dry Unit Weight	γ_d	16.9	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1650	0.2970	0.4650	0.7240	1.1200	1.6400	1.9200

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 50% sand 50% bentonite, 16% water content (L50B16W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.63	Tested By	Yueru Chen	Date	7/20/2009

Trimmings	1	2
Tin No.	201	7
Wt. of Tin (g)	28.88	28.18
Wt. of Tin + Wet Soil (g)	152.82	153.82
Wt. of Tin + Dry Soil (g)	135.98	135.95
Wt. of Dry Soil (g)	107.1	107.77
Wt. of Water (g)	16.84	17.87
Water Content (%)	15.7	16.6
Average Water Content (%)	16.2	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	31
Wt. of Tare + Wet Soil (g)	304.26	135.73
Wt. of Tare + Dry Soil (g)	-	120.98
Wt. of Tare (g)	196.55	28.35
Wt. of Wet Soil (g)	107.71	107.38
Wt. of Dry Soil (g)	92.63	92.63
Wt. of Water (g)	15.08	14.75
Water Content (%)	16.3	15.9

Initial Dry Density	ρ_d	1.46	g/cm^3	Final Dry Density	ρ_d	1.65	g/cm^3
Initial Dry Unit Weight	γ_d	14.3	kN/m^3	Final Dry Unit Weight	γ_d	16.2	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0660	0.1500	0.4200	0.6500	0.8800	1.2300	2.2800

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 50% sand 50% bentonite, 18% water content (L50B18W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.63	Tested By	Yueru Chen	Date	7/17/2009

Trimmings	1	2
Tin No.	46	101
Wt. of Tin (g)	28.85	28.02
Wt. of Tin + Wet Soil (g)	129.29	132.85
Wt. of Tin + Dry Soil (g)	114.16	116.7
Wt. of Dry Soil (g)	85.31	88.68
Wt. of Water (g)	15.13	16.15
Water Content (%)	17.7	18.2
Average Water Content (%)	18.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	311.51	143.06
Wt. of Tare + Dry Soil (g)	-	125.32
Wt. of Tare (g)	196.55	28.44
Wt. of Wet Soil (g)	114.96	114.62
Wt. of Dry Soil (g)	96.88	96.88
Wt. of Water (g)	18.08	17.74
Water Content (%)	18.7	18.3

Initial Dry Density	ρ_d	1.53	g/cm^3	Final Dry Density	ρ_d	1.75	g/cm^3
Initial Dry Unit Weight	γ_d	15.0	kN/m^3	Final Dry Unit Weight	γ_d	17.2	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0762	0.1650	0.3050	0.5030	0.7620	1.2200	2.5400

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 50% sand 50% bentonite, 20% water content (L50B20W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.63	Tested By	Yueru Chen	Date	7/17/2009

Trimmings	1	2
Tin No.	201	7
Wt. of Tin (g)	28.88	28.17
Wt. of Tin + Wet Soil (g)	119.24	121.45
Wt. of Tin + Dry Soil (g)	104.26	105.96
Wt. of Dry Soil (g)	75.38	77.79
Wt. of Water (g)	14.98	15.49
Water Content (%)	19.9	19.9
Average Water Content (%)	19.9	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	31
Wt. of Tare + Wet Soil (g)	305.16	141.66
Wt. of Tare + Dry Soil (g)	-	122.7
Wt. of Tare (g)	191.45	28.44
Wt. of Wet Soil (g)	113.71	113.22
Wt. of Dry Soil (g)	94.26	94.26
Wt. of Water (g)	19.45	18.96
Water Content (%)	20.6	20.1

Initial Dry Density	ρ_d	1.49	g/cm^3	Final Dry Density	ρ_d	1.71	g/cm^3
Initial Dry Unit Weight	γ_d	14.6	kN/m^3	Final Dry Unit Weight	γ_d	16.8	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0635	0.1370	0.2490	0.4090	0.6580	1.3600	2.6100

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 50% sand 50% bentonite, 22% water content (L50B22W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.63	Tested By	Yueru Chen	Date	7/16/2009

Trimmings	1	2
Tin No.	MAJID	213
Wt. of Tin (g)	28.65	27.9
Wt. of Tin + Wet Soil (g)	159.19	163.39
Wt. of Tin + Dry Soil (g)	135.84	139.37
Wt. of Dry Soil (g)	107.19	111.47
Wt. of Water (g)	23.35	24.02
Water Content (%)	21.8	21.5
Average Water Content (%)	21.7	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	FJ-3
Wt. of Tare + Wet Soil (g)	311.39	145.31
Wt. of Tare + Dry Soil (g)	-	124.84
Wt. of Tare (g)	194.82	29.03
Wt. of Wet Soil (g)	116.57	116.28
Wt. of Dry Soil (g)	95.81	95.81
Wt. of Water (g)	20.76	20.47
Water Content (%)	21.7	21.4

Initial Dry Density	ρ_d	1.51	g/cm^3	Final Dry Density	ρ_d	1.70	g/cm^3
Initial Dry Unit Weight	γ_d	14.8	kN/m^3	Final Dry Unit Weight	γ_d	16.7	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0660	0.1170	0.2010	0.3280	0.5440	1.2900	2.2500

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 50% sand 50% bentonite, 24% water content (L50B24W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	62.9 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.63	Tested By	Yueru Chen	Date	3/13/2009

Trimmings	1	2
Tin No.	213	B8
Wt. of Tin (g)	27.9	28.4
Wt. of Tin + Wet Soil (g)	161.8	151
Wt. of Tin + Dry Soil (g)	135.9	127.1
Wt. of Dry Soil (g)	108	98.7
Wt. of Water (g)	25.9	23.9
Water Content (%)	24.0	24.2
Average Water Content (%)	24.1	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	205
Wt. of Tare + Wet Soil (g)	303.2	139.1
Wt. of Tare + Dry Soil (g)	-	117.4
Wt. of Tare (g)	193.20	29.7
Wt. of Wet Soil (g)	110.00	109.4
Wt. of Dry Soil (g)	87.70	87.7
Wt. of Water (g)	22.30	21.7
Water Content (%)	25.4	24.7

Initial Dry Density	ρ_d	1.38	g/cm^3	Final Dry Density	ρ_d	1.60	g/cm^3
Initial Dry Unit Weight	γ_d	13.6	kN/m^3	Final Dry Unit Weight	γ_d	15.7	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0838	0.1120	0.1800	0.3120	0.6880	1.8100	2.6600

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Standard Proctor compacted, 85% sand 15% bentonite, 12% water content (S15B12W)						
Consolid. Type	EI25-0479			Consolid. Type		Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.		63.5 mm		Area of Spec.	3166.9 mm^2
Weight of Ring	66.4 g	Wt. of Stone		130 g		Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By		Yueru Chen		Date	3/3/2009

Trimmings	1	2
Tin No.	213	B8
Wt. of Tin (g)	27.9	28.4
Wt. of Tin + Wet Soil (g)	177.3	174.7
Wt. of Tin + Dry Soil (g)	162.1	159.5
Wt. of Dry Soil (g)	134.2	131.1
Wt. of Water (g)	15.2	15.2
Water Content (%)	11.3	11.6
Average Water Content (%)	11.5	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	205
Wt. of Tare + Wet Soil (g)	313.2	145.7
Wt. of Tare + Dry Soil (g)	-	133.6
Wt. of Tare (g)	196.70	29.7
Wt. of Wet Soil (g)	116.50	116
Wt. of Dry Soil (g)	103.90	103.9
Wt. of Water (g)	12.60	12.1
Water Content (%)	12.1	11.6

Initial Dry Density	ρ_d	1.64	g/cm^3	Final Dry Density	ρ_d	1.72	g/cm^3
Initial Dry Unit Weight	γ_d	16.1	kN/m^3	Final Dry Unit Weight	γ_d	16.9	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0965	0.1420	0.2310	0.3530	0.5180	0.7110	0.9420

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 85% sand 15% bentonite, 13% water content (S15B13W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	128.2 g	Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen	Date	2/19/2009

Trimmings	1	2
Tin No.	404	405
Wt. of Tin (g)	28.6	27.7
Wt. of Tin + Wet Soil (g)	178.3	171.1
Wt. of Tin + Dry Soil (g)	160.7	154.2
Wt. of Dry Soil (g)	132.1	126.5
Wt. of Water (g)	17.6	16.9
Water Content (%)	13.3	13.4
Average Water Content (%)	13.3	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	101
Wt. of Tare + Wet Soil (g)	318.3	151
Wt. of Tare + Dry Soil (g)	-	136.4
Wt. of Tare (g)	194.80	28
Wt. of Wet Soil (g)	123.50	123
Wt. of Dry Soil (g)	108.40	108.4
Wt. of Water (g)	15.10	14.6
Water Content (%)	13.9	13.5

Initial Dry Density	ρ_d	1.71	g/cm^3	Final Dry Density	ρ_d	1.83	g/cm^3
Initial Dry Unit Weight	γ_d	16.8	kN/m^3	Final Dry Unit Weight	γ_d	17.9	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1370	0.2690	0.4420	0.6020	0.7950	1.0100	1.2700

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 85% sand 15% bentonite, 15% water content (S15B15W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	67.5 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen	Date	2/18/2009

Trimmings	1	2
Tin No.	410	5
Wt. of Tin (g)	28.4	30.8
Wt. of Tin + Wet Soil (g)	151.6	138.5
Wt. of Tin + Dry Soil (g)	136	124.3
Wt. of Dry Soil (g)	107.6	93.5
Wt. of Water (g)	15.6	14.2
Water Content (%)	14.5	15.2
Average Water Content (%)	14.8	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	327.1	163.4
Wt. of Tare + Dry Soil (g)	-	146.6
Wt. of Tare (g)	197.80	34.7
Wt. of Wet Soil (g)	129.30	128.7
Wt. of Dry Soil (g)	111.90	111.9
Wt. of Water (g)	17.40	16.8
Water Content (%)	15.5	15.0

Initial Dry Density ρ_d 1.77 g/cm^3 Final Dry Density ρ_d 1.88 g/cm^3

Initial Dry Unit Weight γ_d 17.3 kN/m^3 Final Dry Unit Weight γ_d 18.4 kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0508	0.1600	0.3200	0.4950	0.7420	0.9780	1.2000

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 85% sand 15% bentonite, 17% water content (S15B17W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	133.7 g	Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen	Date	3/3/2009

Trimmings	1	2
Tin No.	201	7
Wt. of Tin (g)	28.9	28.1
Wt. of Tin + Wet Soil (g)	158.7	202.7
Wt. of Tin + Dry Soil (g)	139.7	177
Wt. of Dry Soil (g)	110.8	148.9
Wt. of Water (g)	19	25.7
Water Content (%)	17.1	17.3
Average Water Content (%)	17.2	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B-19
Wt. of Tare + Wet Soil (g)	325.9	152.3
Wt. of Tare + Dry Soil (g)	-	133.9
Wt. of Tare (g)	200.30	27.4
Wt. of Wet Soil (g)	125.60	124.9
Wt. of Dry Soil (g)	106.50	106.5
Wt. of Water (g)	19.10	18.4
Water Content (%)	17.9	17.3

Initial Dry Density	ρ_d	1.68	g/cm^3	Final Dry Density	ρ_d	1.80	g/cm^3
Initial Dry Unit Weight	γ_d	16.5	kN/m^3	Final Dry Unit Weight	γ_d	17.6	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0838	0.1420	0.2570	0.4390	0.7490	1.0500	1.3200

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 85% sand 15% bentonite, 19% water content (S15B19W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	67.5 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen	Date	3/4/2009

Trimmings	1	2
Tin No.	404	405
Wt. of Tin (g)	28.7	27.7
Wt. of Tin + Wet Soil (g)	176.5	194.2
Wt. of Tin + Dry Soil (g)	152.8	167.7
Wt. of Dry Soil (g)	124.1	140
Wt. of Water (g)	23.7	26.5
Water Content (%)	19.1	18.9
Average Water Content (%)	19.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	101
Wt. of Tare + Wet Soil (g)	321.2	150.4
Wt. of Tare + Dry Soil (g)	-	131
Wt. of Tare (g)	197.80	28
Wt. of Wet Soil (g)	123.40	122.4
Wt. of Dry Soil (g)	103.00	103
Wt. of Water (g)	20.40	19.4
Water Content (%)	19.8	18.8

Initial Dry Density ρ_d 1.63 g/cm^3 Final Dry Density ρ_d 1.77 g/cm^3

Initial Dry Unit Weight γ_d 15.9 kN/m^3 Final Dry Unit Weight γ_d 17.3 kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1020	0.1730	0.2950	0.5180	0.9090	1.2800	1.6100

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 14% water content (S25B14W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.2 g	Wt. of Stone	133.7 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	5/16/2009

Trimmings	1		2
Tin No.	410		B8
Wt. of Tin (g)	28.4		28.5
Wt. of Tin + Wet Soil (g)	108.1		112
Wt. of Tin + Dry Soil (g)	98.6		101.6
Wt. of Dry Soil (g)	70.2		73.1
Wt. of Water (g)	9.5		10.4
Water Content (%)	13.5		14.2
Average Water Content (%)		13.9	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B19
Wt. of Tare + Wet Soil (g)	319.4	146.1
Wt. of Tare + Dry Soil (g)	-	132
Wt. of Tare (g)	200.20	27.4
Wt. of Wet Soil (g)	119.20	118.7
Wt. of Dry Soil (g)	104.60	104.6
Wt. of Water (g)	14.60	14.1
Water Content (%)	14.0	13.5

Initial Dry Density	ρ_d	1.65	g/cm^3	Final Dry Density	ρ_d	1.76	g/cm^3
Initial Dry Unit Weight	γ_d	16.2	kN/m^3	Final Dry Unit Weight	γ_d	17.2	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1880	0.2260	0.3050	0.3990	0.5770	0.8430	1.1900

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 16% water content (S25B16W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.2 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	7/20/2009

Trimmings	1	2
Tin No.	FJ-3	213
Wt. of Tin (g)	29	27.9
Wt. of Tin + Wet Soil (g)	136.9	131.2
Wt. of Tin + Dry Soil (g)	122.4	117.4
Wt. of Dry Soil (g)	93.4	89.5
Wt. of Water (g)	14.5	13.8
Water Content (%)	15.5	15.4
Average Water Content (%)	15.5	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	101
Wt. of Tare + Wet Soil (g)	323.1	154.2
Wt. of Tare + Dry Soil (g)	-	137.1
Wt. of Tare (g)	196.50	28
Wt. of Wet Soil (g)	126.60	126.2
Wt. of Dry Soil (g)	109.10	109.1
Wt. of Water (g)	17.50	17.1
Water Content (%)	16.0	15.7

Initial Dry Density	ρ_d	1.72	g/cm^3	Final Dry Density	ρ_d	1.85	g/cm^3
Initial Dry Unit Weight	γ_d	16.9	kN/m^3	Final Dry Unit Weight	γ_d	18.2	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0635	0.1270	0.2210	0.3680	0.5920	0.9250	1.4100

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 18% water content (S25B18W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	62.9 g	Wt. of Stone	129.9 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/18/2009

Trimmings	1	2
Tin No.	201	7
Wt. of Tin (g)	28.85	28.17
Wt. of Tin + Wet Soil (g)	160.39	144.1
Wt. of Tin + Dry Soil (g)	140.01	126.14
Wt. of Dry Soil (g)	111.16	97.97
Wt. of Water (g)	20.38	17.96
Water Content (%)	18.3	18.3
Average Water Content (%)	18.3	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	404
Wt. of Tare + Wet Soil (g)	324.6	159.1
Wt. of Tare + Dry Soil (g)	-	139.8
Wt. of Tare (g)	193.10	28.7
Wt. of Wet Soil (g)	131.50	130.4
Wt. of Dry Soil (g)	111.10	111.1
Wt. of Water (g)	20.40	19.3
Water Content (%)	18.4	17.4

Initial Dry Density	ρ_d	1.75	g/cm^3	Final Dry Density	ρ_d	1.90	g/cm^3
Initial Dry Unit Weight	γ_d	17.2	kN/m^3	Final Dry Unit Weight	γ_d	18.6	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0381	0.0914	0.1880	0.3450	0.6070	1.0100	1.4900

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 19% water content (S25B19W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	67.5 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/20/2009

Trimmings	1	2
Tin No.	410	5
Wt. of Tin (g)	28.3	30.8
Wt. of Tin + Wet Soil (g)	164.2	148.2
Wt. of Tin + Dry Soil (g)	142.9	129.7
Wt. of Dry Soil (g)	114.6	98.9
Wt. of Water (g)	21.3	18.5
Water Content (%)	18.6	18.7
Average Water Content (%)	18.6	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	323	159.2
Wt. of Tare + Dry Soil (g)	-	139.9
Wt. of Tare (g)	197.80	34.7
Wt. of Wet Soil (g)	125.20	124.5
Wt. of Dry Soil (g)	105.20	105.2
Wt. of Water (g)	20.00	19.3
Water Content (%)	19.0	18.3

Initial Dry Density	ρ_d	1.66	g/cm^3	Final Dry Density	ρ_d	1.67	g/cm^3
Initial Dry Unit Weight	γ_d	16.3	kN/m^3	Final Dry Unit Weight	γ_d	16.3	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0025	0.0045	0.0074	0.0137	0.0266	0.0425	0.0561

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 21% water content (S25B21W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	67.5 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	3/3/2009

Trimmings	1	2
Tin No.	404	405
Wt. of Tin (g)	28.7	27.7
Wt. of Tin + Wet Soil (g)	165.9	180.5
Wt. of Tin + Dry Soil (g)	142.1	154
Wt. of Dry Soil (g)	113.4	126.3
Wt. of Water (g)	23.8	26.5
Water Content (%)	21.0	21.0
Average Water Content (%)	21.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	101
Wt. of Tare + Wet Soil (g)	319.1	150
Wt. of Tare + Dry Soil (g)	-	129.2
Wt. of Tare (g)	196.10	28
Wt. of Wet Soil (g)	123.00	122
Wt. of Dry Soil (g)	101.20	101.2
Wt. of Water (g)	21.80	20.8
Water Content (%)	21.5	20.6

Initial Dry Density	ρ_d	1.60	g/cm^3	Final Dry Density	ρ_d	1.74	g/cm^3
Initial Dry Unit Weight	γ_d	15.7	kN/m^3	Final Dry Unit Weight	γ_d	17.1	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0813	0.1600	0.2620	0.4370	0.9040	1.3870	1.6660

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 75% sand 25% bentonite, 24% water content (S25B23W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	63 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	3/4/2009

Trimmings	1	2
Tin No.	201	7
Wt. of Tin (g)	28.9	28.2
Wt. of Tin + Wet Soil (g)	167.8	164.9
Wt. of Tin + Dry Soil (g)	141.9	139.5
Wt. of Dry Soil (g)	113	111.3
Wt. of Water (g)	25.9	25.4
Water Content (%)	22.9	22.8
Average Water Content (%)	22.9	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B-19
Wt. of Tare + Wet Soil (g)	315.1	149.9
Wt. of Tare + Dry Soil (g)	-	127.3
Wt. of Tare (g)	191.60	27.4
Wt. of Wet Soil (g)	123.50	122.5
Wt. of Dry Soil (g)	99.90	99.9
Wt. of Water (g)	23.60	22.6
Water Content (%)	23.6	22.6

Initial Dry Density ρ_d 1.58 g/cm^3 Final Dry Density ρ_d 1.76 g/cm^3

Initial Dry Unit Weight γ_d 15.5 kN/m^3 Final Dry Unit Weight γ_d 17.3 kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1730	0.3200	0.5410	0.8740	1.4100	1.8500	2.1200

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 16% water content (S50B16W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.63	Tested By	Yueru Chen	Date	7/16/2009

Trimmings	1	2
Tin No.	201	31
Wt. of Tin (g)	28.88	28.35
Wt. of Tin + Wet Soil (g)	97.19	137.34
Wt. of Tin + Dry Soil (g)	87.81	122.08
Wt. of Dry Soil (g)	58.93	93.73
Wt. of Water (g)	9.38	15.26
Water Content (%)	15.9	16.3
Average Water Content (%)	16.1	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	31
Wt. of Tare + Wet Soil (g)	309.64	137.34
Wt. of Tare + Dry Soil (g)	-	122.08
Wt. of Tare (g)	200.23	28.35
Wt. of Wet Soil (g)	109.41	108.99
Wt. of Dry Soil (g)	93.73	93.73
Wt. of Water (g)	15.68	15.26
Water Content (%)	16.7	16.3

Initial Dry Density	ρ_d	1.48	g/cm^3	Final Dry Density	ρ_d	1.64	g/cm^3
Initial Dry Unit Weight	γ_d	14.5	kN/m^3	Final Dry Unit Weight	γ_d	16.1	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1300	0.2540	0.3910	0.5380	0.7370	1.0700	1.9800

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 18% water content (S50B18W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.63	Tested By	Yueru Chen	Date	7/20/2009

Trimmings	1	2
Tin No.	404	405
Wt. of Tin (g)	28.73	27.71
Wt. of Tin + Wet Soil (g)	139.28	142.94
Wt. of Tin + Dry Soil (g)	122.62	125.95
Wt. of Dry Soil (g)	93.89	98.24
Wt. of Water (g)	16.66	16.99
Water Content (%)	17.7	17.3
Average Water Content (%)	17.5	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	4
Wt. of Tare + Wet Soil (g)	306.9	140.39
Wt. of Tare + Dry Soil (g)	-	123.59
Wt. of Tare (g)	194.82	28.71
Wt. of Wet Soil (g)	112.08	111.68
Wt. of Dry Soil (g)	94.88	94.88
Wt. of Water (g)	17.20	16.8
Water Content (%)	18.1	17.7

Initial Dry Density	ρ_d	1.50	g/cm^3	Final Dry Density	ρ_d	1.65	g/cm^3
Initial Dry Unit Weight	γ_d	14.7	kN/m^3	Final Dry Unit Weight	γ_d	16.2	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1270	0.1650	0.2240	0.2970	0.4620	0.8000	1.8400

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 19% water content (S50B19W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.63	Tested By	Yueru Chen	Date	7/17/2009

Trimmings	1	2
Tin No.	101	46
Wt. of Tin (g)	28.03	28.85
Wt. of Tin + Wet Soil (g)	158.72	135.11
Wt. of Tin + Dry Soil (g)	138	118.31
Wt. of Dry Soil (g)	109.97	89.46
Wt. of Water (g)	20.72	16.8
Water Content (%)	18.8	18.8
Average Water Content (%)	18.8	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	316.5	146.83
Wt. of Tare + Dry Soil (g)	-	128.27
Wt. of Tare (g)	197.73	28.45
Wt. of Wet Soil (g)	118.77	118.38
Wt. of Dry Soil (g)	99.82	99.82
Wt. of Water (g)	18.95	18.56
Water Content (%)	19.0	18.6

Initial Dry Density	ρ_d	1.58	g/cm^3	Final Dry Density	ρ_d	1.72	g/cm^3
Initial Dry Unit Weight	γ_d	15.4	kN/m^3	Final Dry Unit Weight	γ_d	16.9	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0279	0.0762	0.1600	0.3000	0.5000	0.8430	1.6800

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 22% water content (S50B22W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.63	Tested By	Yueru Chen	Date	7/20/2009

Trimmings	1		2
Tin No.	46		101
Wt. of Tin (g)	28.87		28.03
Wt. of Tin + Wet Soil (g)	160.05		165.33
Wt. of Tin + Dry Soil (g)	137.2		140.7
Wt. of Dry Soil (g)	108.33		112.67
Wt. of Water (g)	22.85		24.63
Water Content (%)	21.1		21.9
Average Water Content (%)		21.5	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	309.01	143.83
Wt. of Tare + Dry Soil (g)	-	123.96
Wt. of Tare (g)	193.15	28.46
Wt. of Wet Soil (g)	115.86	115.37
Wt. of Dry Soil (g)	95.50	95.5
Wt. of Water (g)	20.36	19.87
Water Content (%)	21.3	20.8

Initial Dry Density	ρ_d	1.51	g/cm^3	Final Dry Density	ρ_d	1.70	g/cm^3
Initial Dry Unit Weight	γ_d	14.8	kN/m^3	Final Dry Unit Weight	γ_d	16.6	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1090	0.2010	0.2790	0.4060	0.6220	1.1400	2.2400

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 50% sand 50% bentonite, 24% water content (S50B24W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	62.9 g	Wt. of Stone	129.9 g	Wt. of Paper	0.3 g
Specific Gravity	2.63	Tested By	Yueru Chen	Date	3/3/2009

Trimmings	1	2
Tin No.	MAJID	FJ-3
Wt. of Tin (g)	28.6	29
Wt. of Tin + Wet Soil (g)	176.6	146.7
Wt. of Tin + Dry Soil (g)	148.5	123.8
Wt. of Dry Soil (g)	119.9	94.8
Wt. of Water (g)	28.1	22.9
Water Content (%)	23.4	24.2
Average Water Content (%)	23.8	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	5
Wt. of Tare + Wet Soil (g)	304.8	140
Wt. of Tare + Dry Soil (g)	-	118.5
Wt. of Tare (g)	193.10	28.9
Wt. of Wet Soil (g)	111.70	111.1
Wt. of Dry Soil (g)	89.60	89.6
Wt. of Water (g)	22.10	21.5
Water Content (%)	24.7	24.0

Initial Dry Density ρ_d 1.41 g/cm^3 Final Dry Density ρ_d 1.61 g/cm^3

Initial Dry Unit Weight γ_d 13.9 kN/m^3 Final Dry Unit Weight γ_d 15.8 kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1190	0.1930	0.2770	0.4110	0.7260	1.5700	2.4600

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 8% water content (M15B8W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	67.48 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen	Date	3/30/2009

Trimmings	1	2
Tin No.	7	201
Wt. of Tin (g)	28.17	28.91
Wt. of Tin + Wet Soil (g)	142.09	159.55
Wt. of Tin + Dry Soil (g)	133.14	149.33
Wt. of Dry Soil (g)	104.97	120.42
Wt. of Water (g)	8.95	10.22
Water Content (%)	8.5	8.5
Average Water Content (%)	8.5	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B-19
Wt. of Tare + Wet Soil (g)	322.72	151.77
Wt. of Tare + Dry Soil (g)	-	141.7
Wt. of Tare (g)	197.78	27.4
Wt. of Wet Soil (g)	124.94	124.37
Wt. of Dry Soil (g)	114.30	114.3
Wt. of Water (g)	10.64	10.07
Water Content (%)	9.3	8.8

Initial Dry Density	ρ_d	1.80	g/cm^3	Final Dry Density	ρ_d	1.87	g/cm^3
Initial Dry Unit Weight	γ_d	17.7	kN/m^3	Final Dry Unit Weight	γ_d	18.4	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0914	0.1300	0.2080	0.2970	0.4370	0.5840	0.7420

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 10% water content (M15B10W)						
Consolid. Type	EI25-0479			Consolid. Type		Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm			Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	128.3 g			Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen			Date	3/31/2009

Trimmings	1	2
Tin No.	7	201
Wt. of Tin (g)	28.16	28.89
Wt. of Tin + Wet Soil (g)	186.6	189.81
Wt. of Tin + Dry Soil (g)	171.65	174.54
Wt. of Dry Soil (g)	143.49	145.65
Wt. of Water (g)	14.95	15.27
Water Content (%)	10.4	10.5
Average Water Content (%)	10.5	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B-19
Wt. of Tare + Wet Soil (g)	320.9	152.87
Wt. of Tare + Dry Soil (g)	-	141.08
Wt. of Tare (g)	194.90	27.39
Wt. of Wet Soil (g)	126.00	125.48
Wt. of Dry Soil (g)	113.69	113.69
Wt. of Water (g)	12.31	11.79
Water Content (%)	10.8	10.4

Initial Dry Density	ρ_d	1.79	g/cm^3	Final Dry Density	ρ_d	1.87	g/cm^3
Initial Dry Unit Weight	γ_d	17.6	kN/m^3	Final Dry Unit Weight	γ_d	18.3	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0864	0.1600	0.2570	0.3530	0.5050	0.6650	0.8260

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 12% water content (M15B12W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen	Date	3/26/2009

Trimmings	1	2
Tin No.	213	B8
Wt. of Tin (g)	27.87	28.43
Wt. of Tin + Wet Soil (g)	159.37	189.77
Wt. of Tin + Dry Soil (g)	145.6	172.8
Wt. of Dry Soil (g)	117.73	144.37
Wt. of Water (g)	13.77	16.97
Water Content (%)	11.7	11.8
Average Water Content (%)	11.7	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	205
Wt. of Tare + Wet Soil (g)	326.1	160.4
Wt. of Tare + Dry Soil (g)	-	146.5
Wt. of Tare (g)	194.90	29.68
Wt. of Wet Soil (g)	131.20	130.72
Wt. of Dry Soil (g)	116.82	116.82
Wt. of Water (g)	14.38	13.9
Water Content (%)	12.3	11.9

Initial Dry Density	ρ_d	1.84	g/cm^3	Final Dry Density	ρ_d	1.91	g/cm^3
Initial Dry Unit Weight	γ_d	18.1	kN/m^3	Final Dry Unit Weight	γ_d	18.7	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0559	0.0762	0.1270	0.2310	0.3580	0.5230	0.7090

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 14% water content (M15B14W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	133.7 g	Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen	Date	3/24/2009

Trimmings	1	2
Tin No.	7	201
Wt. of Tin (g)	28.1	28.9
Wt. of Tin + Wet Soil (g)	195.6	152.8
Wt. of Tin + Dry Soil (g)	174.9	137.6
Wt. of Dry Soil (g)	146.8	108.7
Wt. of Water (g)	20.7	15.2
Water Content (%)	14.1	14.0
Average Water Content (%)	14.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B-19
Wt. of Tare + Wet Soil (g)	329.5	156
Wt. of Tare + Dry Soil (g)	-	140.2
Wt. of Tare (g)	200.30	27.4
Wt. of Wet Soil (g)	129.20	128.6
Wt. of Dry Soil (g)	112.80	112.8
Wt. of Water (g)	16.40	15.8
Water Content (%)	14.5	14.0

Initial Dry Density	ρ_d	1.78	g/cm^3	Final Dry Density	ρ_d	1.87	g/cm^3
Initial Dry Unit Weight	γ_d	17.5	kN/m^3	Final Dry Unit Weight	γ_d	18.4	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0635	0.0889	0.1750	0.3250	0.5380	0.7650	0.9800

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 85% sand 15% bentonite, 16% water content (M15B16W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	67.5 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.65	Tested By	Yueru Chen	Date	3/25/2009

Trimmings	1	2
Tin No.	404	405
Wt. of Tin (g)	28.7	27.7
Wt. of Tin + Wet Soil (g)	200	205.3
Wt. of Tin + Dry Soil (g)	176.9	181.2
Wt. of Dry Soil (g)	148.2	153.5
Wt. of Water (g)	23.1	24.1
Water Content (%)	15.6	15.7
Average Water Content (%)	15.6	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	101
Wt. of Tare + Wet Soil (g)	326.9	156.4
Wt. of Tare + Dry Soil (g)	-	139.1
Wt. of Tare (g)	197.80	28
Wt. of Wet Soil (g)	129.10	128.4
Wt. of Dry Soil (g)	111.10	111.1
Wt. of Water (g)	18.00	17.3
Water Content (%)	16.2	15.6

Initial Dry Density	ρ_d	1.75	g/cm^3	Final Dry Density	ρ_d	1.90	g/cm^3
Initial Dry Unit Weight	γ_d	17.2	kN/m^3	Final Dry Unit Weight	γ_d	18.6	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0991	0.2210	0.3710	0.5920	0.8990	1.2400	1.5600

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 8% water content (M25B8W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	66.3 g	Wt. of Stone	133.69 g	Wt. of Paper	0.3 g		
Specific Gravity	2.64	Tested By	Yueru Chen	Date	4/1/2009		

Trimmings	1	2
Tin No.	7	201
Wt. of Tin (g)	28.16	28.87
Wt. of Tin + Wet Soil (g)	177.02	170.28
Wt. of Tin + Dry Soil (g)	165.72	159.57
Wt. of Dry Soil (g)	137.56	130.7
Wt. of Water (g)	11.3	10.71
Water Content (%)	8.2	8.2
Average Water Content (%)	8.2	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B-19
Wt. of Tare + Wet Soil (g)	325.1	151.86
Wt. of Tare + Dry Soil (g)	-	141.97
Wt. of Tare (g)	200.29	27.38
Wt. of Wet Soil (g)	124.81	124.48
Wt. of Dry Soil (g)	114.59	114.59
Wt. of Water (g)	10.22	9.89
Water Content (%)	8.9	8.6

Initial Dry Density	ρ_d	1.81	g/cm^3	Final Dry Density	ρ_d	1.87	g/cm^3
Initial Dry Unit Weight	γ_d	17.7	kN/m^3	Final Dry Unit Weight	γ_d	18.4	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0508	0.0711	0.1350	0.2110	0.3400	0.4880	0.6810

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 10% water content (M25B10W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	66.3 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g		
Specific Gravity	2.64	Tested By	Yueru Chen	Date	4/2/2009		

Trimmings	1	2
Tin No.	MAJID	FJ-3
Wt. of Tin (g)	28.66	29
Wt. of Tin + Wet Soil (g)	151.51	150
Wt. of Tin + Dry Soil (g)	139.8	138.58
Wt. of Dry Soil (g)	111.14	109.58
Wt. of Water (g)	11.71	11.42
Water Content (%)	10.5	10.4
Average Water Content (%)	10.5	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	5
Wt. of Tare + Wet Soil (g)	326.04	157.92
Wt. of Tare + Dry Soil (g)	-	145.48
Wt. of Tare (g)	196.60	28.89
Wt. of Wet Soil (g)	129.44	129.03
Wt. of Dry Soil (g)	116.59	116.59
Wt. of Water (g)	12.85	12.44
Water Content (%)	11.0	10.7

Initial Dry Density	ρ_d	1.84	g/cm^3	Final Dry Density	ρ_d	1.92	g/cm^3
Initial Dry Unit Weight	γ_d	18.0	kN/m^3	Final Dry Unit Weight	γ_d	18.8	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0686	0.1040	0.1730	0.2540	0.3780	0.5460	0.8080

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 12% water content (M25B12W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	63 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	3/31/2009

Trimmings	1	2
Tin No.	213	205
Wt. of Tin (g)	27.88	29.68
Wt. of Tin + Wet Soil (g)	176.99	170.89
Wt. of Tin + Dry Soil (g)	160.25	155.35
Wt. of Dry Soil (g)	132.37	125.67
Wt. of Water (g)	16.74	15.54
Water Content (%)	12.6	12.4
Average Water Content (%)	12.5	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	321.13	155.94
Wt. of Tare + Dry Soil (g)	-	142.37
Wt. of Tare (g)	193.30	28.43
Wt. of Wet Soil (g)	127.83	127.51
Wt. of Dry Soil (g)	113.94	113.94
Wt. of Water (g)	13.89	13.57
Water Content (%)	12.2	11.9

Initial Dry Density	ρ_d	1.80	g/cm^3	Final Dry Density	ρ_d	1.90	g/cm^3
Initial Dry Unit Weight	γ_d	17.6	kN/m^3	Final Dry Unit Weight	γ_d	18.6	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0508	0.1070	0.1780	0.3230	0.4980	0.7420	1.0600

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 15% water content (M25B15W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	3/30/2009

Trimmings	1	2
Tin No.	213	205
Wt. of Tin (g)	27.89	29.69
Wt. of Tin + Wet Soil (g)	166.54	155.21
Wt. of Tin + Dry Soil (g)	148.62	139.03
Wt. of Dry Soil (g)	120.73	109.34
Wt. of Water (g)	17.92	16.18
Water Content (%)	14.8	14.8
Average Water Content (%)	14.8	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	325.18	158.15
Wt. of Tare + Dry Soil (g)	-	141.36
Wt. of Tare (g)	194.90	28.44
Wt. of Wet Soil (g)	130.28	129.71
Wt. of Dry Soil (g)	112.92	112.92
Wt. of Water (g)	17.36	16.79
Water Content (%)	15.4	14.9

Initial Dry Density	ρ_d	1.78	g/cm^3	Final Dry Density	ρ_d	1.88	g/cm^3
Initial Dry Unit Weight	γ_d	17.5	kN/m^3	Final Dry Unit Weight	γ_d	18.5	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0021	0.0864	0.1450	0.2510	0.4390	0.7320	1.0700

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 16% water content (M25B16W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	3/27/2009

Trimmings	1	2
Tin No.	MAJID	FJ-3
Wt. of Tin (g)	28.67	29.03
Wt. of Tin + Wet Soil (g)	137.45	165.28
Wt. of Tin + Dry Soil (g)	122.55	146.5
Wt. of Dry Soil (g)	93.88	117.47
Wt. of Water (g)	14.9	18.78
Water Content (%)	15.9	16.0
Average Water Content (%)	15.9	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	5
Wt. of Tare + Wet Soil (g)	325.62	157.33
Wt. of Tare + Dry Soil (g)	-	139.58
Wt. of Tare (g)	196.60	28.89
Wt. of Wet Soil (g)	129.02	128.44
Wt. of Dry Soil (g)	110.69	110.69
Wt. of Water (g)	18.33	17.75
Water Content (%)	16.6	16.0

Initial Dry Density ρ_d 1.75 g/cm^3 Final Dry Density ρ_d 1.85 g/cm^3

Initial Dry Unit Weight γ_d 17.1 kN/m^3 Final Dry Unit Weight γ_d 18.2 kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0034	0.1090	0.1680	0.2740	0.4880	0.8000	1.1300

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 17% water content (M25B17W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	3/25/2009

Trimmings	1	2
Tin No.	MAJID	FJ-3
Wt. of Tin (g)	28.65	29
Wt. of Tin + Wet Soil (g)	159.2	158.38
Wt. of Tin + Dry Soil (g)	140	139.3
Wt. of Dry Soil (g)	111.35	110.3
Wt. of Water (g)	19.2	19.08
Water Content (%)	17.2	17.3
Average Water Content (%)	17.3	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	5
Wt. of Tare + Wet Soil (g)	323.2	154.7
Wt. of Tare + Dry Soil (g)	-	136.1
Wt. of Tare (g)	196.60	27.4
Wt. of Wet Soil (g)	126.60	127.3
Wt. of Dry Soil (g)	108.70	108.7
Wt. of Water (g)	17.90	18.6
Water Content (%)	16.5	17.1

Initial Dry Density	ρ_d	1.72	g/cm^3	Final Dry Density	ρ_d	1.87	g/cm^3
Initial Dry Unit Weight	γ_d	16.8	kN/m^3	Final Dry Unit Weight	γ_d	18.3	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1170	0.2310	0.3860	0.5610	0.8920	1.3100	1.6600

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 75% sand 25% bentonite, 19% water content (M25B19W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	63 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	3/25/2009

Trimmings	1	2
Tin No.	213	B8
Wt. of Tin (g)	27.9	28.4
Wt. of Tin + Wet Soil (g)	162.8	171.4
Wt. of Tin + Dry Soil (g)	140.8	148.2
Wt. of Dry Soil (g)	112.9	119.8
Wt. of Water (g)	22	23.2
Water Content (%)	19.5	19.4
Average Water Content (%)	19.4	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	205
Wt. of Tare + Wet Soil (g)	314.87	152
Wt. of Tare + Dry Soil (g)	-	132.2
Wt. of Tare (g)	191.60	29.7
Wt. of Wet Soil (g)	123.27	122.3
Wt. of Dry Soil (g)	102.50	102.5
Wt. of Water (g)	20.77	19.8
Water Content (%)	20.3	19.3

Initial Dry Density	ρ_d	1.62	g/cm^3	Final Dry Density	ρ_d	-0.96	g/cm^3
Initial Dry Unit Weight	γ_d	15.9	kN/m^3	Final Dry Unit Weight	γ_d	-9.4	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1730	0.3330	0.5540	0.8560	1.3700	1.8400	2.1200

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 13% water content (M50B13W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.27 g	Wt. of Stone	128.35 g	Wt. of Paper	0.3 g
Specific Gravity	2.63	Tested By	Yueru Chen	Date	4/3/2009

Trimmings	1	2
Tin No.	404	405
Wt. of Tin (g)	28.71	27.7
Wt. of Tin + Wet Soil (g)	145.47	189.7
Wt. of Tin + Dry Soil (g)	132.52	171.11
Wt. of Dry Soil (g)	103.81	143.41
Wt. of Water (g)	12.95	18.59
Water Content (%)	12.5	13.0
Average Water Content (%)	12.7	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	101
Wt. of Tare + Wet Soil (g)	315.63	148
Wt. of Tare + Dry Soil (g)	-	134.81
Wt. of Tare (g)	194.92	28.02
Wt. of Wet Soil (g)	120.71	119.98
Wt. of Dry Soil (g)	106.79	106.79
Wt. of Water (g)	13.92	13.19
Water Content (%)	13.0	12.4

Initial Dry Density ρ_d 1.69 g/cm^3 Final Dry Density ρ_d 1.74 g/cm^3

Initial Dry Unit Weight γ_d 16.5 kN/m^3 Final Dry Unit Weight γ_d 17.1 kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0508	0.0737	0.1140	0.1700	0.2570	0.3990	0.6530

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 14% water content (M50B14W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	62.91 g	Wt. of Stone	134.64 g	Wt. of Paper	0.3 g
Specific Gravity	2.63	Tested By	Yueru Chen	Date	4/28/2009

Trimmings	1	2
Tin No.	7	201
Wt. of Tin (g)	28.1	28.88
Wt. of Tin + Wet Soil (g)	141.47	171.07
Wt. of Tin + Dry Soil (g)	126.87	154.65
Wt. of Dry Soil (g)	98.77	125.77
Wt. of Water (g)	14.6	16.42
Water Content (%)	14.8	13.1
Average Water Content (%)	13.9	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B-19
Wt. of Tare + Wet Soil (g)	324.24	153.96
Wt. of Tare + Dry Soil (g)	-	138.18
Wt. of Tare (g)	197.85	27.4
Wt. of Wet Soil (g)	126.39	126.56
Wt. of Dry Soil (g)	110.78	110.78
Wt. of Water (g)	15.61	15.78
Water Content (%)	14.1	14.2

Initial Dry Density	ρ_d	1.75	g/cm^3	Final Dry Density	ρ_d	1.80	g/cm^3
Initial Dry Unit Weight	γ_d	17.1	kN/m^3	Final Dry Unit Weight	γ_d	17.6	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0254	0.0432	0.0610	0.1090	0.2080	0.3330	0.5260

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 15% water content (M50B15W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	66.3 g	Wt. of Stone	133.6 g	Wt. of Paper	0.3 g		
Specific Gravity	2.63	Tested By	Yueru Chen	Date	3/31/2009		

Trimmings	1	2
Tin No.	404	405
Wt. of Tin (g)	28.7	27.7
Wt. of Tin + Wet Soil (g)	151.21	169.24
Wt. of Tin + Dry Soil (g)	134.93	151.15
Wt. of Dry Soil (g)	106.23	123.45
Wt. of Water (g)	16.28	18.09
Water Content (%)	15.3	14.7
Average Water Content (%)	15.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	101
Wt. of Tare + Wet Soil (g)	327.48	154.81
Wt. of Tare + Dry Soil (g)	-	138.41
Wt. of Tare (g)	200.20	28.01
Wt. of Wet Soil (g)	127.28	126.8
Wt. of Dry Soil (g)	110.40	110.4
Wt. of Water (g)	16.88	16.4
Water Content (%)	15.3	14.9

Initial Dry Density	ρ_d	1.74	g/cm^3	Final Dry Density	ρ_d	1.81	g/cm^3
Initial Dry Unit Weight	γ_d	17.1	kN/m^3	Final Dry Unit Weight	γ_d	17.8	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1140	0.2620	0.3150	0.3760	0.4700	0.5890	0.7850

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 16% water content (M50B16W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	66.3 g	Wt. of Stone	133.74 g	Wt. of Paper	0.3 g		
Specific Gravity	2.63	Tested By	Yueru Chen	Date	4/3/2009		

Trimmings	1	2
Tin No.	213	205
Wt. of Tin (g)	27.92	29.73
Wt. of Tin + Wet Soil (g)	160.97	142.17
Wt. of Tin + Dry Soil (g)	142.76	127.02
Wt. of Dry Soil (g)	114.84	97.29
Wt. of Water (g)	18.21	15.15
Water Content (%)	15.9	15.6
Average Water Content (%)	15.7	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	329.18	157.01
Wt. of Tare + Dry Soil (g)	-	139.49
Wt. of Tare (g)	200.34	28.45
Wt. of Wet Soil (g)	128.84	128.56
Wt. of Dry Soil (g)	111.04	111.04
Wt. of Water (g)	17.80	17.52
Water Content (%)	16.0	15.8

Initial Dry Density	ρ_d	1.75	g/cm^3	Final Dry Density	ρ_d	1.82	g/cm^3
Initial Dry Unit Weight	γ_d	17.2	kN/m^3	Final Dry Unit Weight	γ_d	17.9	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0254	0.0533	0.1220	0.2180	0.3380	0.5130	0.7720

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 17% water content (M50B17W)						
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring			
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	62.9 g	Wt. of Stone	130.03 g	Wt. of Paper	0.3 g		
Specific Gravity	2.63	Tested By	Yueru Chen	Date	3/30/2009		

Trimmings	1	2
Tin No.	404	405
Wt. of Tin (g)	28.71	27.7
Wt. of Tin + Wet Soil (g)	151.72	146.43
Wt. of Tin + Dry Soil (g)	133.83	128.45
Wt. of Dry Soil (g)	105.12	100.75
Wt. of Water (g)	17.89	17.98
Water Content (%)	17.0	17.8
Average Water Content (%)	17.4	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	101
Wt. of Tare + Wet Soil (g)	320.79	155.2
Wt. of Tare + Dry Soil (g)	-	135.81
Wt. of Tare (g)	193.23	28.02
Wt. of Wet Soil (g)	127.56	127.18
Wt. of Dry Soil (g)	107.79	107.79
Wt. of Water (g)	19.77	19.39
Water Content (%)	18.3	18.0

Initial Dry Density	ρ_d	1.70	g/cm^3	Final Dry Density	ρ_d	1.80	g/cm^3
Initial Dry Unit Weight	γ_d	16.7	kN/m^3	Final Dry Unit Weight	γ_d	17.6	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0584	0.1170	0.2030	0.3330	0.5130	0.7490	1.0800

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Modified Proctor compacted, 50% sand 50% bentonite, 20% water content (M50B20W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	62.9 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g		
Specific Gravity	2.63	Tested By	Yueru Chen	Date	3/26/2009		

Trimmings	1	2
Tin No.	7	201
Wt. of Tin (g)	28.16	28.88
Wt. of Tin + Wet Soil (g)	145.08	157.24
Wt. of Tin + Dry Soil (g)	125.9	135.9
Wt. of Dry Soil (g)	97.74	107.02
Wt. of Water (g)	19.18	21.34
Water Content (%)	19.6	19.9
Average Water Content (%)	19.8	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B-19
Wt. of Tare + Wet Soil (g)	317.05	150.78
Wt. of Tare + Dry Soil (g)	-	129.8
Wt. of Tare (g)	193.20	27.39
Wt. of Wet Soil (g)	123.85	123.39
Wt. of Dry Soil (g)	102.41	102.41
Wt. of Water (g)	21.44	20.98
Water Content (%)	20.9	20.5

Initial Dry Density	ρ_d	1.62	g/cm^3	Final Dry Density	ρ_d	1.75	g/cm^3
Initial Dry Unit Weight	γ_d	15.8	kN/m^3	Final Dry Unit Weight	γ_d	17.1	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0889	0.1570	0.2870	0.4420	0.6650	0.9880	1.5100

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 85% sand 15% kaolinite, 6% water content (L15K6W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.4 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/12/2009

Trimmings	1	2
Tin No.	MAJID	FJ-3
Wt. of Tin (g)	28.6	29
Wt. of Tin + Wet Soil (g)	186.7	193.9
Wt. of Tin + Dry Soil (g)	177.7	184.6
Wt. of Dry Soil (g)	149.1	155.6
Wt. of Water (g)	9	9.3
Water Content (%)	6.0	6.0
Average Water Content (%)	6.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	313.1	150.6
Wt. of Tare + Dry Soil (g)	-	144.3
Wt. of Tare (g)	196.70	34.7
Wt. of Wet Soil (g)	116.40	115.9
Wt. of Dry Soil (g)	109.60	109.6
Wt. of Water (g)	6.80	6.3
Water Content (%)	6.2	5.7

Initial Dry Density	ρ_d	1.73	g/cm^3	Final Dry Density	ρ_d	1.83	g/cm^3
Initial Dry Unit Weight	γ_d	17.0	kN/m^3	Final Dry Unit Weight	γ_d	17.9	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0940	0.1750	0.3230	0.4700	0.6830	0.8840	1.0700

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Low energy compacted, 85% sand 15% kaolinite, 8% water content (L15K8W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm		Area of Spec.	3166.9 mm^2	
Weight of Ring	66.3 g	Wt. of Stone	133.6 g		Wt. of Paper	0.3 g	
Specific Gravity	2.64	Tested By	Yueru Chen		Date	2/11/2009	

Trimmings	1	2
Tin No.	418	415
Wt. of Tin (g)	28.8	28.8
Wt. of Tin + Wet Soil (g)	222.7	186.8
Wt. of Tin + Dry Soil (g)	208.2	175.1
Wt. of Dry Soil (g)	179.4	146.3
Wt. of Water (g)	14.5	11.7
Water Content (%)	8.1	8.0
Average Water Content (%)	8.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	324.7	151.9
Wt. of Tare + Dry Soil (g)	-	143.2
Wt. of Tare (g)	200.20	27.4
Wt. of Wet Soil (g)	124.50	124.5
Wt. of Dry Soil (g)	115.80	115.8
Wt. of Water (g)	8.70	8.7
Water Content (%)	7.5	7.5

Initial Dry Density ρ_d 1.83 g/cm^3 Final Dry Density ρ_d 1.92 g/cm^3

Initial Dry Unit Weight γ_d 17.9 kN/m^3 Final Dry Unit Weight γ_d 18.8 kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1143	0.2340	0.3760	0.5280	0.6830	0.8250	0.9730

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 85% sand 15% kaolinite, 10% water content (L15K10W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	67.5 g	Wt. of Stone	129.9 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/11/2009

Trimmings	1	2
Tin No.	213	205
Wt. of Tin (g)	27.9	29.7
Wt. of Tin + Wet Soil (g)	209.6	209.7
Wt. of Tin + Dry Soil (g)	193.1	193.5
Wt. of Dry Soil (g)	165.2	163.8
Wt. of Water (g)	16.5	16.2
Water Content (%)	10.0	9.9
Average Water Content (%)	9.9	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B7
Wt. of Tare + Wet Soil (g)	322.2	151.6
Wt. of Tare + Dry Soil (g)	-	141.3
Wt. of Tare (g)	197.70	28.7
Wt. of Wet Soil (g)	124.50	122.9
Wt. of Dry Soil (g)	112.60	112.6
Wt. of Water (g)	11.90	10.3
Water Content (%)	10.6	9.1

Initial Dry Density	ρ_d	1.78	g/cm^3	Final Dry Density	ρ_d	1.89	g/cm^3
Initial Dry Unit Weight	γ_d	17.4	kN/m^3	Final Dry Unit Weight	γ_d	18.5	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1295	0.2286	0.3937	0.6147	0.8433	1.0130	1.1480

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Low energy compacted, 85% sand 15% kaolinite, 12% water content (L15K12W)						
Consolid. Type	EI25-0479			Consolid. Type		Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.		63.5 mm	Area of Spec.		3166.9 mm^2
Weight of Ring	67.6 g	Wt. of Stone		132 g	Wt. of Paper		0.3 g
Specific Gravity	2.64	Tested By		Yueru Chen	Date		2/10/2009

Trimmings	1	2
Tin No.	B7	205
Wt. of Tin (g)	28.7	29.6
Wt. of Tin + Wet Soil (g)	157.4	210.8
Wt. of Tin + Dry Soil (g)	143.5	191.1
Wt. of Dry Soil (g)	114.8	161.5
Wt. of Water (g)	13.9	19.7
Water Content (%)	12.1	12.2
Average Water Content (%)	12.2	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	213
Wt. of Tare + Wet Soil (g)	325.3	151.4
Wt. of Tare + Dry Soil (g)	-	139.9
Wt. of Tare (g)	199.90	27.9
Wt. of Wet Soil (g)	125.40	123.5
Wt. of Dry Soil (g)	112.00	112
Wt. of Water (g)	13.40	11.5
Water Content (%)	12.0	10.3

Initial Dry Density	ρ_d	1.77	g/cm^3	Final Dry Density	ρ_d	1.85	g/cm^3
Initial Dry Unit Weight	γ_d	17.3	kN/m^3	Final Dry Unit Weight	γ_d	18.1	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1651	0.2642	0.3988	0.5156	0.6426	0.7518	0.8687

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 75% sand 25% kaolinite, 6% water content (L25K6W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	67.5 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/13/2009

Trimmings	1	2
Tin No.	213	205
Wt. of Tin (g)	27.9	29.7
Wt. of Tin + Wet Soil (g)	189.6	196.5
Wt. of Tin + Dry Soil (g)	180.1	187.3
Wt. of Dry Soil (g)	152.2	157.6
Wt. of Water (g)	9.5	9.2
Water Content (%)	6.2	5.8
Average Water Content (%)	6.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	301	133
Wt. of Tare + Dry Soil (g)	-	127.4
Wt. of Tare (g)	196.10	28.4
Wt. of Wet Soil (g)	104.90	104.6
Wt. of Dry Soil (g)	99.00	99
Wt. of Water (g)	5.90	5.6
Water Content (%)	6.0	5.7

Initial Dry Density	ρ_d	1.56	g/cm^3	Final Dry Density	ρ_d	1.74	g/cm^3
Initial Dry Unit Weight	γ_d	15.3	kN/m^3	Final Dry Unit Weight	γ_d	17.1	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.2360	0.3710	0.5690	0.7900	1.0900	1.5000	2.0800

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Low energy compacted, 75% sand 25% kaolinite, 8% water content (L25K8W)						
Consolid. Type	EI25-0479			Consolid. Type		Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm		Area of Spec.	3166.9 mm^2	
Weight of Ring	63 g	Wt. of Stone	133.7 g		Wt. of Paper	0.3 g	
Specific Gravity	2.64	Tested By	Yueru Chen		Date	2/13/2009	

Trimmings	1	2
Tin No.	7	201
Wt. of Tin (g)	28.1	28.8
Wt. of Tin + Wet Soil (g)	181	181.2
Wt. of Tin + Dry Soil (g)	169.6	169.5
Wt. of Dry Soil (g)	141.5	140.7
Wt. of Water (g)	11.4	11.7
Water Content (%)	8.1	8.3
Average Water Content (%)	8.2	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B19
Wt. of Tare + Wet Soil (g)	319.3	149.4
Wt. of Tare + Dry Soil (g)	-	140.6
Wt. of Tare (g)	197.00	27.4
Wt. of Wet Soil (g)	122.30	122
Wt. of Dry Soil (g)	113.20	113.2
Wt. of Water (g)	9.10	8.8
Water Content (%)	8.0	7.8

Initial Dry Density	ρ_d	1.79	g/cm^3	Final Dry Density	ρ_d	1.91	g/cm^3
Initial Dry Unit Weight	γ_d	17.5	kN/m^3	Final Dry Unit Weight	γ_d	18.7	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0610	0.1450	0.3000	0.4830	0.7210	0.9700	1.2800

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 75% sand 25% kaolinite, 10% water content (L25K10W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	67.5 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/12/2009

Trimmings	1	2
Tin No.	7	201
Wt. of Tin (g)	28.2	28.9
Wt. of Tin + Wet Soil (g)	221.7	205.5
Wt. of Tin + Dry Soil (g)	203.4	189.1
Wt. of Dry Soil (g)	175.2	160.2
Wt. of Water (g)	18.3	16.4
Water Content (%)	10.4	10.2
Average Water Content (%)	10.3	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B19
Wt. of Tare + Wet Soil (g)	327.6	157.8
Wt. of Tare + Dry Soil (g)	-	146.3
Wt. of Tare (g)	196.10	27.4
Wt. of Wet Soil (g)	131.50	130.4
Wt. of Dry Soil (g)	118.90	118.9
Wt. of Water (g)	12.60	11.5
Water Content (%)	10.6	9.7

Initial Dry Density	ρ_d	1.88	g/cm^3	Final Dry Density	ρ_d	1.97	g/cm^3
Initial Dry Unit Weight	γ_d	18.4	kN/m^3	Final Dry Unit Weight	γ_d	19.3	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0533	0.1118	0.2260	0.3810	0.5537	0.7468	0.9474

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures					
Sample:	Low energy compacted, 75% sand 25% kaolinite, 12% water content (L25K12W)					
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2	
Weight of Ring	63 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g	
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/11/2009	

Trimmings	1	2
Tin No.	MAJID	FJ-3
Wt. of Tin (g)	28.6	29
Wt. of Tin + Wet Soil (g)	196	183
Wt. of Tin + Dry Soil (g)	178.3	166.3
Wt. of Dry Soil (g)	149.7	137.3
Wt. of Water (g)	17.7	16.7
Water Content (%)	11.8	12.2
Average Water Content (%)	12.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	319.5	160.6
Wt. of Tare + Dry Soil (g)	-	148.7
Wt. of Tare (g)	191.60	34.7
Wt. of Wet Soil (g)	127.90	125.9
Wt. of Dry Soil (g)	114.00	114
Wt. of Water (g)	13.90	11.9
Water Content (%)	12.2	10.4

Initial Dry Density	ρ_d	1.80	g/cm^3	Final Dry Density	ρ_d	1.97	g/cm^3
Initial Dry Unit Weight	γ_d	17.6	kN/m^3	Final Dry Unit Weight	γ_d	19.3	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1829	0.3429	0.6198	0.9068	1.1836	1.4656	1.7145

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Low energy compacted, 75% sand 25% kaolinite, 14% water content (L25K14W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	63 g	Wt. of Stone	132.7 g	Wt. of Paper	0.3 g		
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/10/2009		

Trimmings	1	2
Tin No.	FJ-3	MAJID
Wt. of Tin (g)	29	28.6
Wt. of Tin + Wet Soil (g)	166.2	233.3
Wt. of Tin + Dry Soil (g)	149.5	208.5
Wt. of Dry Soil (g)	120.5	179.9
Wt. of Water (g)	16.7	24.8
Water Content (%)	13.9	13.8
Average Water Content (%)	13.8	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	323	158.6
Wt. of Tare + Dry Soil (g)	-	145.9
Wt. of Tare (g)	196.00	34.7
Wt. of Wet Soil (g)	127.00	123.9
Wt. of Dry Soil (g)	111.20	111.2
Wt. of Water (g)	15.80	12.7
Water Content (%)	14.2	11.4

Initial Dry Density	ρ_d	1.76	g/cm^3	Final Dry Density	ρ_d	1.98	g/cm^3
Initial Dry Unit Weight	γ_d	17.2	kN/m^3	Final Dry Unit Weight	γ_d	19.4	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.4420	0.6960	1.0300	1.4100	1.7700	2.0400	2.2900

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 50% sand 50% kaolinite, 14% water content (L50K14W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	62.9 g	Wt. of Stone	129.9 g	Wt. of Paper	0.3 g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	2/12/2009

Trimmings	1	2
Tin No.	418	415
Wt. of Tin (g)	28.8	28.8
Wt. of Tin + Wet Soil (g)	177.2	166.6
Wt. of Tin + Dry Soil (g)	159.4	149.8
Wt. of Dry Soil (g)	130.6	121
Wt. of Water (g)	17.8	16.8
Water Content (%)	13.6	13.9
Average Water Content (%)	13.8	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B7
Wt. of Tare + Wet Soil (g)	302.2	137.2
Wt. of Tare + Dry Soil (g)	-	124.5
Wt. of Tare (g)	193.10	28.7
Wt. of Wet Soil (g)	109.10	108.5
Wt. of Dry Soil (g)	95.80	95.8
Wt. of Water (g)	13.30	12.7
Water Content (%)	13.9	13.3

Initial Dry Density	ρ_d	1.51	g/cm^3	Final Dry Density	ρ_d	1.76	g/cm^3
Initial Dry Unit Weight	γ_d	14.8	kN/m^3	Final Dry Unit Weight	γ_d	17.2	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0686	0.1600	0.2920	0.4700	0.7540	1.4500	2.7900

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 50% sand 50% kaolinite, 16% water content (L50K16W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	133.6 g	Wt. of Paper	0.3 g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	2/12/2009

Trimmings	1	2
Tin No.	213	205
Wt. of Tin (g)	27.9	29.7
Wt. of Tin + Wet Soil (g)	152.4	163.3
Wt. of Tin + Dry Soil (g)	135.1	144.5
Wt. of Dry Soil (g)	107.2	114.8
Wt. of Water (g)	17.3	18.8
Water Content (%)	16.1	16.4
Average Water Content (%)	16.3	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	324.2	151.7
Wt. of Tare + Dry Soil (g)	-	135
Wt. of Tare (g)	200.20	28.4
Wt. of Wet Soil (g)	124.00	123.3
Wt. of Dry Soil (g)	106.60	106.6
Wt. of Water (g)	17.40	16.7
Water Content (%)	16.3	15.7

Initial Dry Density	ρ_d	1.68	g/cm^3	Final Dry Density	ρ_d	1.86	g/cm^3
Initial Dry Unit Weight	γ_d	16.5	kN/m^3	Final Dry Unit Weight	γ_d	18.2	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0330	0.0660	0.1500	0.2590	0.5080	1.0300	1.8600

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 50% sand 50% kaolinite, 18% water content (L50K18W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.4 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	2/11/2009

Trimmings	1	2
Tin No.	7	201
Wt. of Tin (g)	28.1	28.8
Wt. of Tin + Wet Soil (g)	172	172.7
Wt. of Tin + Dry Soil (g)	149.7	150.6
Wt. of Dry Soil (g)	121.6	121.8
Wt. of Water (g)	22.3	22.1
Water Content (%)	18.3	18.1
Average Water Content (%)	18.2	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B19
Wt. of Tare + Wet Soil (g)	323.2	151.4
Wt. of Tare + Dry Soil (g)	-	134.3
Wt. of Tare (g)	196.70	27.3
Wt. of Wet Soil (g)	126.50	124.1
Wt. of Dry Soil (g)	107.00	107
Wt. of Water (g)	19.50	17.1
Water Content (%)	18.2	16.0

Initial Dry Density	ρ_d	1.69	g/cm^3	Final Dry Density	ρ_d	1.98	g/cm^3
Initial Dry Unit Weight	γ_d	16.6	kN/m^3	Final Dry Unit Weight	γ_d	19.4	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.4040	0.5610	0.8130	1.2300	1.8400	2.4000	2.9000

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Low energy compacted, 50% sand 50% kaolinite, 20% water content (L50K20W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	134.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	2/10/2009

Trimmings	1	2
Tin No.	418	415
Wt. of Tin (g)	28.8	28.8
Wt. of Tin + Wet Soil (g)	207.3	201.7
Wt. of Tin + Dry Soil (g)	178.5	172.9
Wt. of Dry Soil (g)	149.7	144.1
Wt. of Water (g)	28.8	28.8
Water Content (%)	19.2	20.0
Average Water Content (%)	19.6	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B19
Wt. of Tare + Wet Soil (g)	321.6	144.2
Wt. of Tare + Dry Soil (g)	-	127.1
Wt. of Tare (g)	200.90	27.4
Wt. of Wet Soil (g)	120.70	116.8
Wt. of Dry Soil (g)	99.70	99.7
Wt. of Water (g)	21.00	17.1
Water Content (%)	21.1	17.2

Initial Dry Density	ρ_d	1.57	g/cm^3	Final Dry Density	ρ_d	1.82	g/cm^3
Initial Dry Unit Weight	γ_d	15.4	kN/m^3	Final Dry Unit Weight	γ_d	17.9	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1140	0.3990	0.6910	1.2100	1.7500	2.2400	2.7300

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 85% sand 15% kaolinite, 5% water content (S15K5W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	63.1 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	1/27/2009

Trimmings	1	2
Tin No.	5	FJ-3
Wt. of Tin (g)	28.9	29.1
Wt. of Tin + Wet Soil (g)	126.9	143.5
Wt. of Tin + Dry Soil (g)	122	137.7
Wt. of Dry Soil (g)	93.1	108.6
Wt. of Water (g)	4.9	5.8
Water Content (%)	5.3	5.3
Average Water Content (%)	5.3	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B7
Wt. of Tare + Wet Soil (g)	313.6	148.3
Wt. of Tare + Dry Soil (g)	-	142.4
Wt. of Tare (g)	193.40	28.7
Wt. of Wet Soil (g)	120.20	119.6
Wt. of Dry Soil (g)	113.70	113.7
Wt. of Water (g)	6.50	5.9
Water Content (%)	5.7	5.2

Initial Dry Density	ρ_d	1.80	g/cm^3	Final Dry Density	ρ_d	1.87	g/cm^3
Initial Dry Unit Weight	γ_d	17.6	kN/m^3	Final Dry Unit Weight	γ_d	18.3	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0305	0.1140	0.2410	0.3760	0.5280	0.6630	0.8030

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 85% sand 15% kaolinite, 8% water content (S15K8W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	1/22/2009

Trimmings	1	2
Tin No.	213	B7
Wt. of Tin (g)	27.9	28.7
Wt. of Tin + Wet Soil (g)	174	192.1
Wt. of Tin + Dry Soil (g)	163.8	180.8
Wt. of Dry Soil (g)	135.9	152.1
Wt. of Water (g)	10.2	11.3
Water Content (%)	7.5	7.4
Average Water Content (%)	7.5	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	321.1	158.3
Wt. of Tare + Dry Soil (g)	-	150
Wt. of Tare (g)	197.00	34.7
Wt. of Wet Soil (g)	124.10	123.6
Wt. of Dry Soil (g)	115.30	115.3
Wt. of Water (g)	8.80	8.3
Water Content (%)	7.6	7.2

Initial Dry Density	ρ_d	1.82	g/cm^3	Final Dry Density	ρ_d	1.92	g/cm^3
Initial Dry Unit Weight	γ_d	17.8	kN/m^3	Final Dry Unit Weight	γ_d	18.8	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.3124	0.4013	0.5105	0.6223	0.7569	0.8992	1.0465

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UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Standard Proctor compacted, 85% sand 15% kaolinite, 10% water content (S15K10W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm		Area of Spec.	3166.9 mm^2	
Weight of Ring	63 g	Wt. of Stone	130 g		Wt. of Paper	0.3 g	
Specific Gravity	2.64	Tested By	Yueru Chen		Date	1/26/2009	

Trimmings	1	2
Tin No.	415	418
Wt. of Tin (g)	28.8	28.8
Wt. of Tin + Wet Soil (g)	194.1	204.9
Wt. of Tin + Dry Soil (g)	179.8	189.9
Wt. of Dry Soil (g)	151	161.1
Wt. of Water (g)	14.3	15
Water Content (%)	9.5	9.3
Average Water Content (%)	9.4	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	5
Wt. of Tare + Wet Soil (g)	320.8	155.1
Wt. of Tare + Dry Soil (g)	-	144.7
Wt. of Tare (g)	193.30	28.9
Wt. of Wet Soil (g)	127.50	126.2
Wt. of Dry Soil (g)	115.80	115.8
Wt. of Water (g)	11.70	10.4
Water Content (%)	10.1	9.0

Initial Dry Density	ρ_d	1.83	g/cm^3	Final Dry Density	ρ_d	1.91	g/cm^3
Initial Dry Unit Weight	γ_d	17.9	kN/m^3	Final Dry Unit Weight	γ_d	18.7	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1372	0.2134	0.3023	0.4191	0.5512	0.6782	0.8153

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 85% sand 15% kaolinite, 12% water content (S15K12W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	63.1 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	1/28/2009

Trimmings	1	2
Tin No.	B7	MAJID
Wt. of Tin (g)	28.7	28.4
Wt. of Tin + Wet Soil (g)	261.7	248.3
Wt. of Tin + Dry Soil (g)	236.8	224.6
Wt. of Dry Soil (g)	208.1	196.2
Wt. of Water (g)	24.9	23.7
Water Content (%)	12.0	12.1
Average Water Content (%)	12.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	213
Wt. of Tare + Wet Soil (g)	318.2	150.5
Wt. of Tare + Dry Soil (g)	-	139.1
Wt. of Tare (g)	193.40	27.9
Wt. of Wet Soil (g)	124.80	122.6
Wt. of Dry Soil (g)	111.20	111.2
Wt. of Water (g)	13.60	11.4
Water Content (%)	12.2	10.3

Initial Dry Density	ρ_d	1.76	g/cm^3	Final Dry Density	ρ_d	1.85	g/cm^3
Initial Dry Unit Weight	γ_d	17.2	kN/m^3	Final Dry Unit Weight	γ_d	18.1	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.2870	0.3680	0.5000	0.6300	0.7820	0.9020	1.0200

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Standard Proctor compacted, 85% sand 15% kaolinite, 14% water content (S15K14W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	$3166.9\ mm^2$		
Weight of Ring	63 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g		
Specific Gravity	2.64	Tested By	Yueru Chen	Date	1/29/2009		

Trimmings	1	2
Tin No.	415	MAJID
Wt. of Tin (g)	28.7	28.6
Wt. of Tin + Wet Soil (g)	235.6	211.4
Wt. of Tin + Dry Soil (g)	210.3	189.2
Wt. of Dry Soil (g)	181.6	160.6
Wt. of Water (g)	25.3	22.2
Water Content (%)	13.9	13.8
Average Water Content (%)	13.9	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	317.7	155.7
Wt. of Tare + Dry Soil (g)	-	143.5
Wt. of Tare (g)	193.30	34.7
Wt. of Wet Soil (g)	124.40	121
Wt. of Dry Soil (g)	108.80	108.8
Wt. of Water (g)	15.60	12.2
Water Content (%)	14.3	11.2

Initial Dry Density	ρ_d	1.72	g/cm^3	Final Dry Density	ρ_d	1.82	g/cm^3
Initial Dry Unit Weight	γ_d	16.8	kN/m^3	Final Dry Unit Weight	γ_d	17.8	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.4039	0.4877	0.6248	0.7239	0.8738	1.0008	1.1200

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 75% sand 25% kaolinite, 6% water content (S25K6W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.4 g	Wt. of Stone	128.2 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	1/29/2009

Trimmings	1	2
Tin No.	213	B7
Wt. of Tin (g)	28	28.8
Wt. of Tin + Wet Soil (g)	181.8	190.1
Wt. of Tin + Dry Soil (g)	172.6	180.5
Wt. of Dry Soil (g)	144.6	151.7
Wt. of Water (g)	9.2	9.6
Water Content (%)	6.4	6.3
Average Water Content (%)	6.3	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	FJ-3
Wt. of Tare + Wet Soil (g)	306.9	140.6
Wt. of Tare + Dry Soil (g)	-	134.3
Wt. of Tare (g)	194.90	29.1
Wt. of Wet Soil (g)	112.00	111.5
Wt. of Dry Soil (g)	105.20	105.2
Wt. of Water (g)	6.80	6.3
Water Content (%)	6.5	6.0

Initial Dry Density	ρ_d	1.66	g/cm^3	Final Dry Density	ρ_d	1.77	g/cm^3
Initial Dry Unit Weight	γ_d	16.3	kN/m^3	Final Dry Unit Weight	γ_d	17.3	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0737	0.1550	0.2460	0.3840	0.5640	0.8230	1.2100

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures					
Sample:	Standard Proctor compacted, 75% sand 25% kaolinite, 8% water content (S25K8W)					
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2	
Weight of Ring	66.4 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g	
Specific Gravity	2.64	Tested By	Yueru Chen	Date	1/27/2009	

Trimmings	1	2
Tin No.	MAJID	415
Wt. of Tin (g)	28.6	28.7
Wt. of Tin + Wet Soil (g)	196.5	201.3
Wt. of Tin + Dry Soil (g)	184.3	188.4
Wt. of Dry Soil (g)	155.7	159.7
Wt. of Water (g)	12.2	12.9
Water Content (%)	7.8	8.1
Average Water Content (%)	8.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	315.9	155.3
Wt. of Tare + Dry Soil (g)	-	147.1
Wt. of Tare (g)	195.00	34.7
Wt. of Wet Soil (g)	120.90	120.6
Wt. of Dry Soil (g)	112.40	112.4
Wt. of Water (g)	8.50	8.2
Water Content (%)	7.6	7.3

Initial Dry Density	ρ_d	1.77	g/cm^3	Final Dry Density	ρ_d	1.86	g/cm^3
Initial Dry Unit Weight	γ_d	17.4	kN/m^3	Final Dry Unit Weight	γ_d	18.2	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0711	0.1321	0.1981	0.2896	0.4039	0.5817	0.8763

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 75% sand 25% kaolinite, 10% water content (S25K10W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.4 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	1/23/2009

Trimmings	1	2
Tin No.	MAJID	B8
Wt. of Tin (g)	28.5	28.4
Wt. of Tin + Wet Soil (g)	129.9	131.8
Wt. of Tin + Dry Soil (g)	121	122.9
Wt. of Dry Soil (g)	92.5	94.5
Wt. of Water (g)	8.9	8.9
Water Content (%)	9.6	9.4
Average Water Content (%)	9.5	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	5
Wt. of Tare + Wet Soil (g)	335	166.3
Wt. of Tare + Dry Soil (g)	-	154.9
Wt. of Tare (g)	196.70	28.9
Wt. of Wet Soil (g)	138.30	137.4
Wt. of Dry Soil (g)	126.00	126
Wt. of Water (g)	12.30	11.4
Water Content (%)	9.8	9.0

Initial Dry Density	ρ_d	1.99	g/cm^3	Final Dry Density	ρ_d	2.14	g/cm^3
Initial Dry Unit Weight	γ_d	19.5	kN/m^3	Final Dry Unit Weight	γ_d	20.9	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1168	0.2337	0.3785	0.5766	0.8611	1.1481	1.3665

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Standard Proctor compacted, 75% sand 25% kaolinite, 12% water content (S25K12W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	66.4 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g		
Specific Gravity	2.64	Tested By	Yueru Chen	Date	1/26/2009		

Trimmings	1	2
Tin No.	MAJID	B8
Wt. of Tin (g)	28.6	28.5
Wt. of Tin + Wet Soil (g)	183.7	177.9
Wt. of Tin + Dry Soil (g)	167.5	162.5
Wt. of Dry Soil (g)	138.9	134
Wt. of Water (g)	16.2	15.4
Water Content (%)	11.7	11.5
Average Water Content (%)	11.6	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	FJ-3
Wt. of Tare + Wet Soil (g)	330.5	162.2
Wt. of Tare + Dry Soil (g)	-	150.1
Wt. of Tare (g)	195.00	29
Wt. of Wet Soil (g)	135.50	133.2
Wt. of Dry Soil (g)	121.10	121.1
Wt. of Water (g)	14.40	12.1
Water Content (%)	11.9	10.0

Initial Dry Density	ρ_d	1.91	g/cm^3	Final Dry Density	ρ_d	2.11	g/cm^3
Initial Dry Unit Weight	γ_d	18.7	kN/m^3	Final Dry Unit Weight	γ_d	20.6	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.3810	0.5410	0.8080	1.0600	1.3300	1.6000	1.8500

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 75% sand 25% kaolinite, 14% water content (S25K14W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.4 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	1/28/2009

Trimmings	1	2
Tin No.	415	FJ-3
Wt. of Tin (g)	28.7	29
Wt. of Tin + Wet Soil (g)	223.7	190.4
Wt. of Tin + Dry Soil (g)	200	170.8
Wt. of Dry Soil (g)	171.3	141.8
Wt. of Water (g)	23.7	19.6
Water Content (%)	13.8	13.8
Average Water Content (%)	13.8	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	5
Wt. of Tare + Wet Soil (g)	323.3	154
Wt. of Tare + Dry Soil (g)	-	141.4
Wt. of Tare (g)	195.00	28.9
Wt. of Wet Soil (g)	128.30	125.1
Wt. of Dry Soil (g)	112.50	112.5
Wt. of Water (g)	15.80	12.6
Water Content (%)	14.0	11.2

Initial Dry Density	ρ_d	1.78	g/cm^3	Final Dry Density	ρ_d	2.00	g/cm^3
Initial Dry Unit Weight	γ_d	17.4	kN/m^3	Final Dry Unit Weight	γ_d	19.6	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.4850	0.7650	1.0700	1.4500	1.7600	2.0300	2.2800

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 12% water content (S50K12W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	63 g	Wt. of Stone	128.2 g	Wt. of Paper	0.3 g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	1/23/2009

Trimmings	1	2
Tin No.	FJ-3	415
Wt. of Tin (g)	29	28.7
Wt. of Tin + Wet Soil (g)	178.8	154.6
Wt. of Tin + Dry Soil (g)	163	141.2
Wt. of Dry Soil (g)	134	112.5
Wt. of Water (g)	15.8	13.4
Water Content (%)	11.8	11.9
Average Water Content (%)	11.9	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	418
Wt. of Tare + Wet Soil (g)	301.4	137.9
Wt. of Tare + Dry Soil (g)	-	126.8
Wt. of Tare (g)	191.50	28.35
Wt. of Wet Soil (g)	109.90	109.55
Wt. of Dry Soil (g)	98.45	98.45
Wt. of Water (g)	11.45	11.1
Water Content (%)	11.6	11.3

Initial Dry Density	ρ_d	1.55	g/cm^3	Final Dry Density	ρ_d	1.67	g/cm^3
Initial Dry Unit Weight	γ_d	15.2	kN/m^3	Final Dry Unit Weight	γ_d	16.3	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0483	0.1140	0.2010	0.3300	0.4930	0.7370	1.3300

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 14% water content (S50K14W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.4 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	1/29/2009

Trimmings	1	2
Tin No.	418	B8
Wt. of Tin (g)	28.9	28.5
Wt. of Tin + Wet Soil (g)	164.4	184.2
Wt. of Tin + Dry Soil (g)	146.9	164.2
Wt. of Dry Soil (g)	118	135.7
Wt. of Water (g)	17.5	20
Water Content (%)	14.8	14.7
Average Water Content (%)	14.8	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	5
Wt. of Tare + Wet Soil (g)	317.1	150.6
Wt. of Tare + Dry Soil (g)	-	135.7
Wt. of Tare (g)	195.00	28.9
Wt. of Wet Soil (g)	122.10	121.7
Wt. of Dry Soil (g)	106.80	106.8
Wt. of Water (g)	15.30	14.9
Water Content (%)	14.3	14.0

Initial Dry Density	ρ_d	1.69	g/cm^3	Final Dry Density	ρ_d	1.80	g/cm^3
Initial Dry Unit Weight	γ_d	16.5	kN/m^3	Final Dry Unit Weight	γ_d	17.7	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.2080	0.2950	0.3860	0.4800	0.6050	0.8080	1.2800

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 16% water content (S50K16W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	- g	Wt. of Stone	- g	Wt. of Paper	- g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	1/26/2009

Trimmings	1	2
Tin No.	B7	213
Wt. of Tin (g)	28.7	27.9
Wt. of Tin + Wet Soil (g)	145.7	157.5
Wt. of Tin + Dry Soil (g)	129.9	139.7
Wt. of Dry Soil (g)	101.2	111.8
Wt. of Water (g)	15.8	17.8
Water Content (%)	15.6	15.9
Average Water Content (%)	15.8	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	325.9	163.2
Wt. of Tare + Dry Soil (g)	-	146.1
Wt. of Tare (g)	196.70	34.7
Wt. of Wet Soil (g)	129.20	128.5
Wt. of Dry Soil (g)	111.40	111.4
Wt. of Water (g)	17.80	17.1
Water Content (%)	16.0	15.4

Initial Dry Density	ρ_d	1.76	g/cm^3	Final Dry Density	ρ_d	1.90	g/cm^3
Initial Dry Unit Weight	γ_d	17.2	kN/m^3	Final Dry Unit Weight	γ_d	18.6	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0787	0.1630	0.3180	0.4750	0.6580	0.9530	1.4900

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 18% water content (S50K18W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.4 g	Wt. of Stone	129.6 g	Wt. of Paper	0.3 g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	1/28/2009

Trimmings	1	2
Tin No.	3A	418
Wt. of Tin (g)	34.8	28.9
Wt. of Tin + Wet Soil (g)	202.1	174.3
Wt. of Tin + Dry Soil (g)	176.2	152.2
Wt. of Dry Soil (g)	141.4	123.3
Wt. of Water (g)	25.9	22.1
Water Content (%)	18.3	17.9
Average Water Content (%)	18.1	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	322	151.5
Wt. of Tare + Dry Soil (g)	-	134.7
Wt. of Tare (g)	196.30	28.5
Wt. of Wet Soil (g)	125.70	123
Wt. of Dry Soil (g)	106.20	106.2
Wt. of Water (g)	19.50	16.8
Water Content (%)	18.4	15.8

Initial Dry Density	ρ_d	1.68	g/cm^3	Final Dry Density	ρ_d	1.87	g/cm^3
Initial Dry Unit Weight	γ_d	16.4	kN/m^3	Final Dry Unit Weight	γ_d	18.3	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1170	0.2570	0.5180	0.8760	1.2600	1.6500	2.0500

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Standard Proctor compacted, 50% sand 50% kaolinite, 20% water content (S50K20W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	66.4 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g		
Specific Gravity	2.62	Tested By	Yueru Chen	Date	1/27/2009		

Trimmings	1	2
Tin No.	213	418
Wt. of Tin (g)	27.9	28.8
Wt. of Tin + Wet Soil (g)	173.6	196.5
Wt. of Tin + Dry Soil (g)	149.3	168.7
Wt. of Dry Soil (g)	121.4	139.9
Wt. of Water (g)	24.3	27.8
Water Content (%)	20.0	19.9
Average Water Content (%)	19.9	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	319.1	148.6
Wt. of Tare + Dry Soil (g)	-	131.8
Wt. of Tare (g)	195.00	28.5
Wt. of Wet Soil (g)	124.10	120.1
Wt. of Dry Soil (g)	103.30	103.3
Wt. of Water (g)	20.80	16.8
Water Content (%)	20.1	16.3

Initial Dry Density	ρ_d	1.63	g/cm^3	Final Dry Density	ρ_d	1.91	g/cm^3
Initial Dry Unit Weight	γ_d	16.0	kN/m^3	Final Dry Unit Weight	γ_d	18.7	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.4496	0.6880	1.0363	1.5164	2.0117	2.4867	2.9489

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Modified Proctor compacted, 85% sand 15% kaolinite, 4% water content (M15K4W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	66.4 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g		
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/3/2009		

Trimmings	1	2
Tin No.	MAJID	418
Wt. of Tin (g)	28.7	28.8
Wt. of Tin + Wet Soil (g)	219	209.1
Wt. of Tin + Dry Soil (g)	212.3	202.3
Wt. of Dry Soil (g)	183.6	173.5
Wt. of Water (g)	6.7	6.8
Water Content (%)	3.6	3.9
Average Water Content (%)	3.8	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	213
Wt. of Tare + Wet Soil (g)	312	143.4
Wt. of Tare + Dry Soil (g)	-	139.1
Wt. of Tare (g)	196.70	28.7
Wt. of Wet Soil (g)	115.30	114.7
Wt. of Dry Soil (g)	110.40	110.4
Wt. of Water (g)	4.90	4.3
Water Content (%)	4.4	3.9

Initial Dry Density	ρ_d	1.74	g/cm^3	Final Dry Density	ρ_d	1.84	g/cm^3
Initial Dry Unit Weight	γ_d	17.1	kN/m^3	Final Dry Unit Weight	γ_d	18.0	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1350	0.2260	0.3760	0.5330	0.7290	0.8940	1.0600

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Modified Proctor compacted, 85% sand 15% kaolinite, 6% water content (M15K6W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm		Area of Spec.	3166.9 mm^2	
Weight of Ring	63 g	Wt. of Stone	128.3 g		Wt. of Paper	0.3 g	
Specific Gravity	2.64	Tested By	Yueru Chen		Date	1/30/2009	

Trimmings	1	2
Tin No.	MAJID	-
Wt. of Tin (g)	28.7	-
Wt. of Tin + Wet Soil (g)	158.6	-
Wt. of Tin + Dry Soil (g)	151.3	-
Wt. of Dry Soil (g)	122.6	-
Wt. of Water (g)	7.3	-
Water Content (%)	6.0	-
Average Water Content (%)	6.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	317.9	160.6
Wt. of Tare + Dry Soil (g)	-	153.8
Wt. of Tare (g)	191.60	34.7
Wt. of Wet Soil (g)	126.30	125.9
Wt. of Dry Soil (g)	119.10	119.1
Wt. of Water (g)	7.20	6.8
Water Content (%)	6.0	5.7

Initial Dry Density	ρ_d	1.88	g/cm^3	Final Dry Density	ρ_d	1.95	g/cm^3
Initial Dry Unit Weight	γ_d	18.4	kN/m^3	Final Dry Unit Weight	γ_d	19.1	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0914	0.1956	0.2667	0.3581	0.4699	0.5867	0.7061

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UNIVERSITY OF DELAWARE - GEOTECHNICAL LAB

One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 85% sand 15% kaolinite, 8% water content (M15K8W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.4 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/1/2009

Trimmings	1	2
Tin No.	B-19	201
Wt. of Tin (g)	27.4	28.8
Wt. of Tin + Wet Soil (g)	179.5	203.3
Wt. of Tin + Dry Soil (g)	168.4	190.6
Wt. of Dry Soil (g)	141	161.8
Wt. of Water (g)	11.1	12.7
Water Content (%)	7.9	7.8
Average Water Content (%)	7.9	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	205
Wt. of Tare + Wet Soil (g)	320.6	154.6
Wt. of Tare + Dry Soil (g)	-	145.8
Wt. of Tare (g)	195.00	29.7
Wt. of Wet Soil (g)	125.60	124.9
Wt. of Dry Soil (g)	116.10	116.1
Wt. of Water (g)	9.50	8.8
Water Content (%)	8.2	7.6

Initial Dry Density	ρ_d	1.83	g/cm^3	Final Dry Density	ρ_d	1.90	g/cm^3
Initial Dry Unit Weight	γ_d	18.0	kN/m^3	Final Dry Unit Weight	γ_d	18.7	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0737	0.1626	0.2616	0.3658	0.4851	0.6147	0.7518

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Modified Proctor compacted, 85% sand 15% kaolinite, 10% water content (M15K10W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	66.4 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g		
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/5/2009		

Trimmings	1	2
Tin No.	415	418
Wt. of Tin (g)	28.8	28.8
Wt. of Tin + Wet Soil (g)	187.6	213.2
Wt. of Tin + Dry Soil (g)	173.9	196.9
Wt. of Dry Soil (g)	145.1	168.1
Wt. of Water (g)	13.7	16.3
Water Content (%)	9.4	9.7
Average Water Content (%)	9.6	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B7
Wt. of Tare + Wet Soil (g)	325.2	157.6
Wt. of Tare + Dry Soil (g)	-	147
Wt. of Tare (g)	195.00	28.7
Wt. of Wet Soil (g)	130.20	128.9
Wt. of Dry Soil (g)	118.30	118.3
Wt. of Water (g)	11.90	10.6
Water Content (%)	10.1	9.0

Initial Dry Density	ρ_d	1.87	g/cm^3	Final Dry Density	ρ_d	1.94	g/cm^3
Initial Dry Unit Weight	γ_d	18.3	kN/m^3	Final Dry Unit Weight	γ_d	19.0	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1170	0.1910	0.3180	0.4290	0.5590	0.6680	0.7720

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Modified Proctor compacted, 75% sand 25% kaolinite, 3% water content (M25K3W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2		
Weight of Ring	66.3 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g		
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/6/2009		

Trimmings	1	2
Tin No.	418	415
Wt. of Tin (g)	28.8	28.7
Wt. of Tin + Wet Soil (g)	205.2	207.8
Wt. of Tin + Dry Soil (g)	199.4	202.1
Wt. of Dry Soil (g)	170.6	173.4
Wt. of Water (g)	5.8	5.7
Water Content (%)	3.4	3.3
Average Water Content (%)	3.3	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	312.5	145.2
Wt. of Tare + Dry Soil (g)	-	141.4
Wt. of Tare (g)	194.90	28.5
Wt. of Wet Soil (g)	117.60	116.7
Wt. of Dry Soil (g)	112.90	112.9
Wt. of Water (g)	4.70	3.8
Water Content (%)	4.2	3.4

Initial Dry Density	ρ_d	1.78	g/cm^3	Final Dry Density	ρ_d	1.88	g/cm^3
Initial Dry Unit Weight	γ_d	17.5	kN/m^3	Final Dry Unit Weight	γ_d	18.4	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1300	0.1980	0.3300	0.4620	0.6220	0.8050	1.0200

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures						
Sample:	Modified Proctor compacted, 75% sand 25% kaolinite, 6% water content (M25K6W)						
Consolid. Type	EI25-0479			Consolid. Type	Fixed Ring		
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	$3166.9\ mm^2$		
Weight of Ring	63 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g		
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/3/2009		

Trimmings	1	2
Tin No.	415	FJ-3
Wt. of Tin (g)	28.7	29
Wt. of Tin + Wet Soil (g)	198.5	192
Wt. of Tin + Dry Soil (g)	188.8	182.4
Wt. of Dry Soil (g)	160.1	153.4
Wt. of Water (g)	9.7	9.6
Water Content (%)	6.1	6.3
Average Water Content (%)	6.2	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	317.7	160.7
Wt. of Tare + Dry Soil (g)	-	153.3
Wt. of Tare (g)	191.60	34.7
Wt. of Wet Soil (g)	126.10	126
Wt. of Dry Soil (g)	118.60	118.6
Wt. of Water (g)	7.50	7.4
Water Content (%)	6.3	6.2

Initial Dry Density ρ_d 1.87 g/cm^3 Final Dry Density ρ_d 1.96 g/cm^3

Initial Dry Unit Weight γ_d 18.4 kN/m^3 Final Dry Unit Weight γ_d 19.2 kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0203	0.0559	0.1500	0.2770	0.4450	0.6480	0.8890

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 75% sand 25% kaolinite, 8% water content (M25K8W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.4 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	1/30/2009

Trimmings	1	2
Tin No.	415	FJ-3
Wt. of Tin (g)	28.7	29
Wt. of Tin + Wet Soil (g)	144.2	147.1
Wt. of Tin + Dry Soil (g)	135.5	138.2
Wt. of Dry Soil (g)	106.8	109.2
Wt. of Water (g)	8.7	8.9
Water Content (%)	8.1	8.2
Average Water Content (%)	8.1	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	418
Wt. of Tare + Wet Soil (g)	330.8	162.5
Wt. of Tare + Dry Soil (g)	-	152.9
Wt. of Tare (g)	196.70	28.9
Wt. of Wet Soil (g)	134.10	133.6
Wt. of Dry Soil (g)	124.00	124
Wt. of Water (g)	10.10	9.6
Water Content (%)	8.1	7.7

Initial Dry Density	ρ_d	1.96	g/cm^3	Final Dry Density	ρ_d	2.07	g/cm^3
Initial Dry Unit Weight	γ_d	19.2	kN/m^3	Final Dry Unit Weight	γ_d	20.3	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.2565	0.2972	0.3759	0.6604	0.7722	0.8941	1.0566

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 75% sand 25% kaolinite, 10% water content (M25K10W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66.3 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/2/2009

Trimmings	1	2
Tin No.	418	FJ-3
Wt. of Tin (g)	28.8	29
Wt. of Tin + Wet Soil (g)	176.6	172.2
Wt. of Tin + Dry Soil (g)	163.3	159.4
Wt. of Dry Soil (g)	134.5	130.4
Wt. of Water (g)	13.3	12.8
Water Content (%)	9.9	9.8
Average Water Content (%)	9.9	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B7
Wt. of Tare + Wet Soil (g)	334.8	165.7
Wt. of Tare + Dry Soil (g)	-	154.3
Wt. of Tare (g)	196.60	28.7
Wt. of Wet Soil (g)	138.20	137
Wt. of Dry Soil (g)	125.60	125.6
Wt. of Water (g)	12.60	11.4
Water Content (%)	10.0	9.1

Initial Dry Density	ρ_d	1.98	g/cm^3	Final Dry Density	ρ_d	2.12	g/cm^3
Initial Dry Unit Weight	γ_d	19.4	kN/m^3	Final Dry Unit Weight	γ_d	20.8	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1300	0.2030	0.3510	0.5490	0.8230	1.0900	1.3300

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 75% sand 25% kaolinite, 12% water content (M25K12W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	63 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.64	Tested By	Yueru Chen	Date	2/5/2009

Trimmings	1	2
Tin No.	FJ-3	MAJID
Wt. of Tin (g)	29	28.6
Wt. of Tin + Wet Soil (g)	186.2	212.8
Wt. of Tin + Dry Soil (g)	170	193.7
Wt. of Dry Soil (g)	141	165.1
Wt. of Water (g)	16.2	19.1
Water Content (%)	11.5	11.6
Average Water Content (%)	11.5	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	323.3	163.4
Wt. of Tare + Dry Soil (g)	-	151.4
Wt. of Tare (g)	193.30	34.8
Wt. of Wet Soil (g)	130.00	128.6
Wt. of Dry Soil (g)	116.60	116.6
Wt. of Water (g)	13.40	12
Water Content (%)	11.5	10.3

Initial Dry Density ρ_d 1.84 g/cm^3 Final Dry Density ρ_d 2.00 g/cm^3

Initial Dry Unit Weight γ_d 18.0 kN/m^3 Final Dry Unit Weight γ_d 19.6 kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.2820	0.4340	0.6400	0.8760	1.1200	1.3400	1.5500

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 50% sand 50% kaolinite, 10% water content (M50K10W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	63 g	Wt. of Stone	130 g	Wt. of Paper	0.3 g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	2/6/2009

Trimmings	1	2
Tin No.	205	213
Wt. of Tin (g)	29.6	27.8
Wt. of Tin + Wet Soil (g)	140	153.3
Wt. of Tin + Dry Soil (g)	130.4	142.6
Wt. of Dry Soil (g)	100.8	114.8
Wt. of Water (g)	9.6	10.7
Water Content (%)	9.5	9.3
Average Water Content (%)	9.4	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B7
Wt. of Tare + Wet Soil (g)	318.2	153
Wt. of Tare + Dry Soil (g)	-	141.7
Wt. of Tare (g)	193.30	28.7
Wt. of Wet Soil (g)	124.90	124.3
Wt. of Dry Soil (g)	113.00	113
Wt. of Water (g)	11.90	11.3
Water Content (%)	10.5	10.0

Initial Dry Density	ρ_d	1.78	g/cm^3	Final Dry Density	ρ_d	1.86	g/cm^3
Initial Dry Unit Weight	γ_d	17.5	kN/m^3	Final Dry Unit Weight	γ_d	18.2	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0203	0.0508	0.1270	0.2210	0.3810	0.5588	0.7899

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 50% sand 50% kaolinite, 12% water content (M50K12W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	66 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	2/5/2009

Trimmings	1	2
Tin No.	213	205
Wt. of Tin (g)	27.8	29.6
Wt. of Tin + Wet Soil (g)	176	168.2
Wt. of Tin + Dry Soil (g)	159.6	153
Wt. of Dry Soil (g)	131.8	123.4
Wt. of Water (g)	16.4	15.2
Water Content (%)	12.4	12.3
Average Water Content (%)	12.4	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	B8
Wt. of Tare + Wet Soil (g)	326.2	159.1
Wt. of Tare + Dry Soil (g)	-	145.7
Wt. of Tare (g)	194.60	28.5
Wt. of Wet Soil (g)	131.60	130.6
Wt. of Dry Soil (g)	117.20	117.2
Wt. of Water (g)	14.40	13.4
Water Content (%)	12.3	11.4

Initial Dry Density	ρ_d	1.85	g/cm^3	Final Dry Density	ρ_d	1.92	g/cm^3
Initial Dry Unit Weight	γ_d	18.1	kN/m^3	Final Dry Unit Weight	γ_d	18.9	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0127	0.0432	0.1346	0.2311	0.3835	0.5588	0.7722

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 50% sand 50% kaolinite, 14% water content (M50K14W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	63 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	1/30/2009

Trimmings	1	2
Tin No.	B7	213
Wt. of Tin (g)	28.7	27.9
Wt. of Tin + Wet Soil (g)	128.6	147.9
Wt. of Tin + Dry Soil (g)	116.3	132.5
Wt. of Dry Soil (g)	87.6	104.6
Wt. of Water (g)	12.3	15.4
Water Content (%)	14.0	14.7
Average Water Content (%)	14.4	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	325.6	169
Wt. of Tare + Dry Soil (g)	-	152.2
Wt. of Tare (g)	191.60	34.7
Wt. of Wet Soil (g)	134.00	134.3
Wt. of Dry Soil (g)	117.50	117.5
Wt. of Water (g)	16.50	16.8
Water Content (%)	14.0	14.3

Initial Dry Density	ρ_d	1.86	g/cm^3	Final Dry Density	ρ_d	1.94	g/cm^3
Initial Dry Unit Weight	γ_d	18.2	kN/m^3	Final Dry Unit Weight	γ_d	19.0	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (in.)	0.0711	0.1448	0.2261	0.3632	0.4470	0.6020	0.8738

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 50% sand 50% kaolinite, 16% water content (M50K16W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	63 g	Wt. of Stone	128.3 g	Wt. of Paper	0.3 g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	2/2/2009

Trimmings	1	2
Tin No.	415	MAJID
Wt. of Tin (g)	28.7	28.4
Wt. of Tin + Wet Soil (g)	172.4	194.7
Wt. of Tin + Dry Soil (g)	152.7	171.5
Wt. of Dry Soil (g)	124	143.1
Wt. of Water (g)	19.7	23.2
Water Content (%)	15.9	16.2
Average Water Content (%)	16.0	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	3A
Wt. of Tare + Wet Soil (g)	321.9	163.6
Wt. of Tare + Dry Soil (g)	-	147.3
Wt. of Tare (g)	191.60	34.7
Wt. of Wet Soil (g)	130.30	128.9
Wt. of Dry Soil (g)	112.60	112.6
Wt. of Water (g)	17.70	16.3
Water Content (%)	15.7	14.5

Initial Dry Density	ρ_d	1.78	g/cm^3	Final Dry Density	ρ_d	1.93	g/cm^3
Initial Dry Unit Weight	γ_d	17.4	kN/m^3	Final Dry Unit Weight	γ_d	18.9	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.1651	0.2616	0.3505	0.5080	0.7798	1.1633	1.5545

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One-Dimentional Compression Test: ASTM D 2435 - 04

Project:	An experimental investigation of the behavior of compacted sand/clay mixtures				
Sample:	Modified Proctor compacted, 50% sand 50% kaolinite, 18% water content (M50K18W)				
Consolid. Type	EI25-0479		Consolid. Type	Fixed Ring	
Height of Spec.	20 mm	Dia. of Spec.	63.5 mm	Area of Spec.	3166.9 mm^2
Weight of Ring	63 g	Wt. of Stone	130.4 g	Wt. of Paper	0.3 g
Specific Gravity	2.62	Tested By	Yueru Chen	Date	2/5/2009

Trimmings	1	2
Tin No.	201	B-19
Wt. of Tin (g)	28.8	27.4
Wt. of Tin + Wet Soil (g)	179.2	179.8
Wt. of Tin + Dry Soil (g)	156.5	157
Wt. of Dry Soil (g)	127.7	129.6
Wt. of Water (g)	22.7	22.8
Water Content (%)	17.8	17.6
Average Water Content (%)	17.7	

Specimen	Before Test	After Test
Tare I.D. No.	Ring, Stone, Paper	7
Wt. of Tare + Wet Soil (g)	322.8	155.1
Wt. of Tare + Dry Soil (g)	-	138
Wt. of Tare (g)	193.70	28.1
Wt. of Wet Soil (g)	129.10	127
Wt. of Dry Soil (g)	109.90	109.9
Wt. of Water (g)	19.20	17.1
Water Content (%)	17.5	15.6

Initial Dry Density	ρ_d	1.74	g/cm^3	Final Dry Density	ρ_d	1.94	g/cm^3
Initial Dry Unit Weight	γ_d	17.0	kN/m^3	Final Dry Unit Weight	γ_d	19.0	kN/m^3

End of load deformation results

Load Step No.	1	2	3	4	5	6	7
Corrected Def (mm)	0.0610	0.1930	0.4600	0.8430	1.2700	1.7200	2.1400

APPENDIX H

DEFORMATION – TIME CURVES

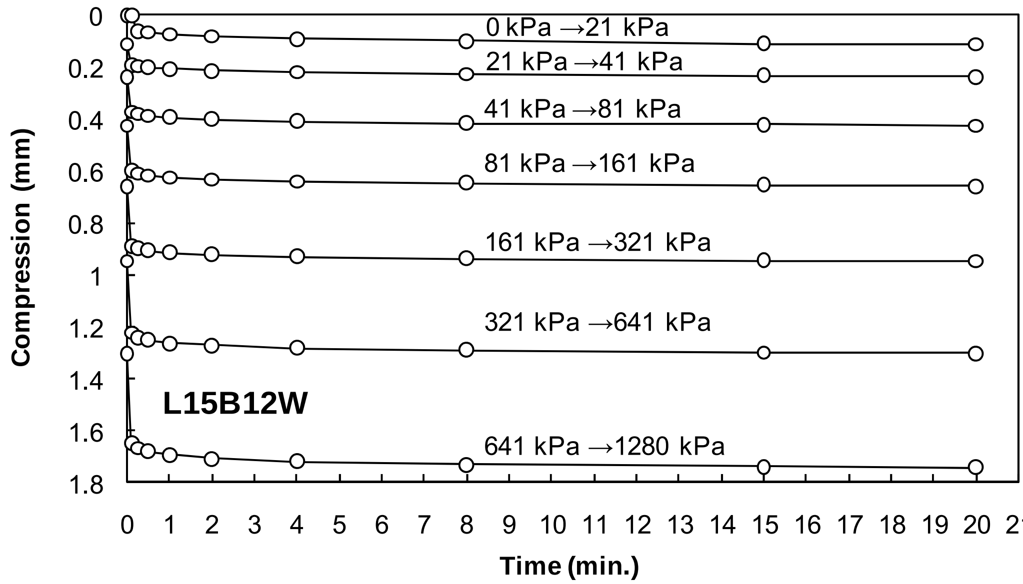


Figure H.1. Compression VS. Time (L15B12W)

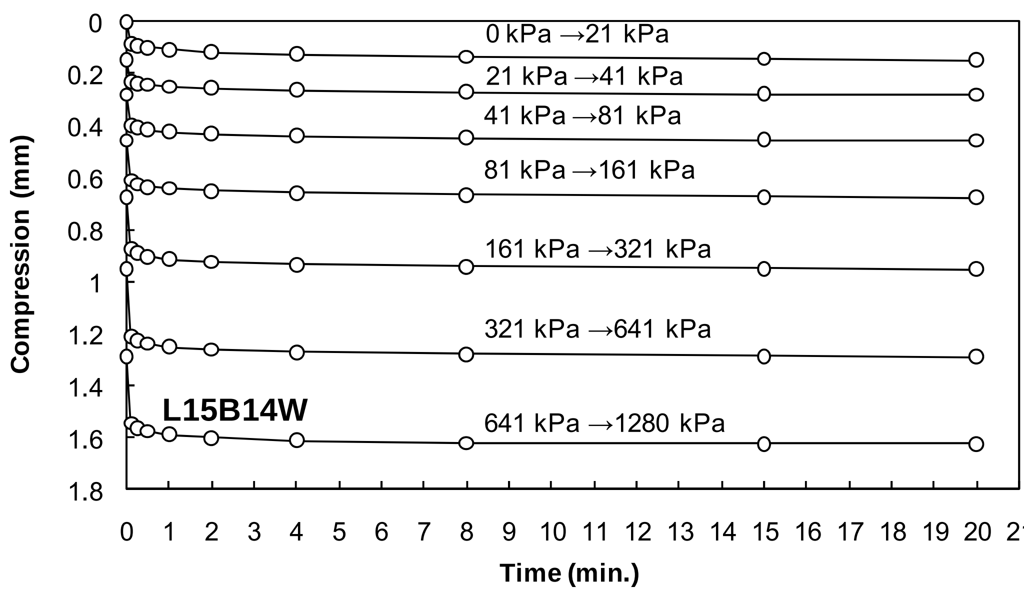


Figure H.2. Compression VS. Time (L15B14W)

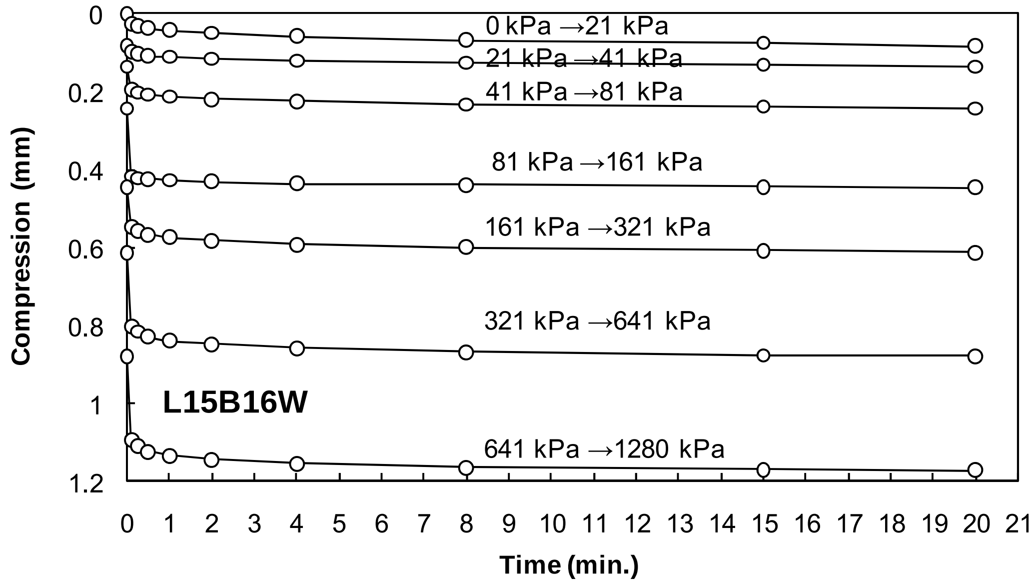


Figure H.3. Compression VS. Time (L15B16W)

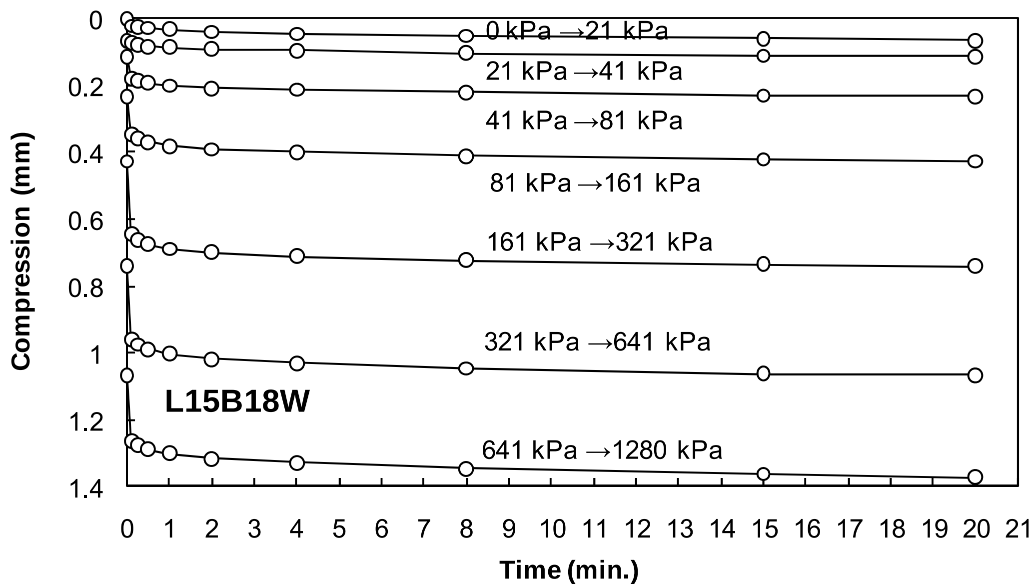


Figure H.4. Compression VS. Time (L15B18W)

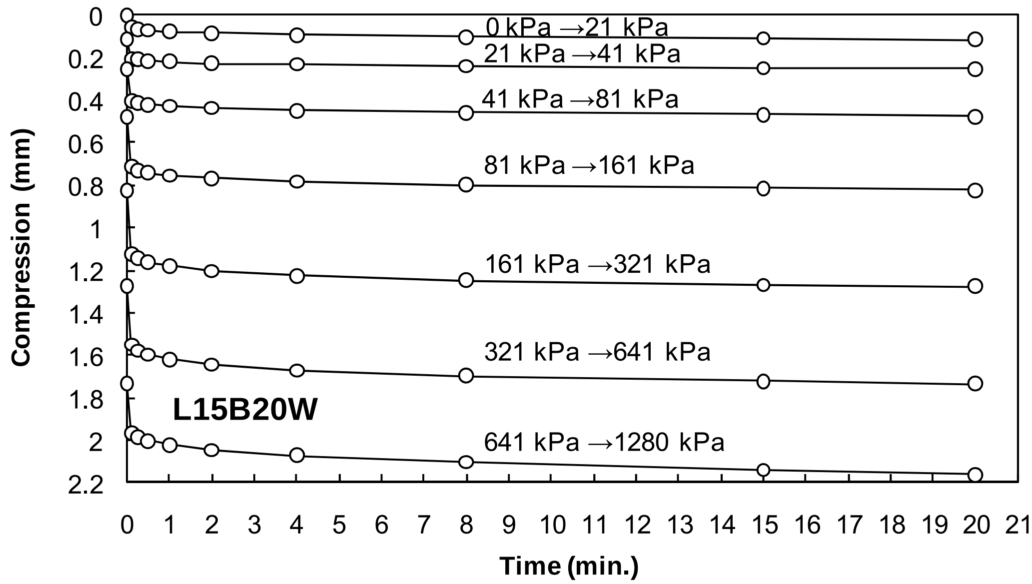


Figure H.5. Compression VS. Time (L15B20W)

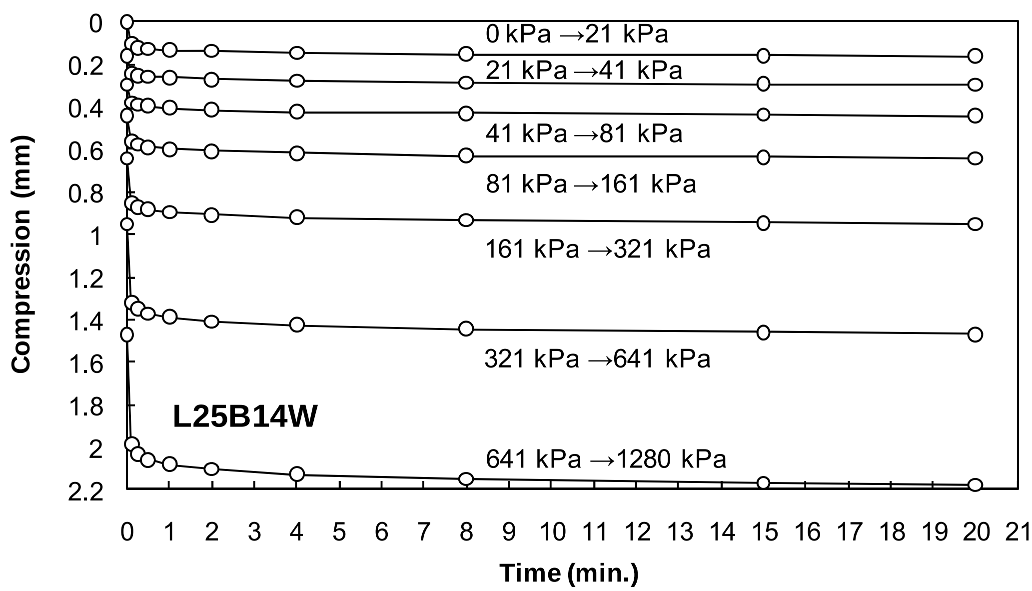


Figure H.6. Compression VS. Time (L25B14W)

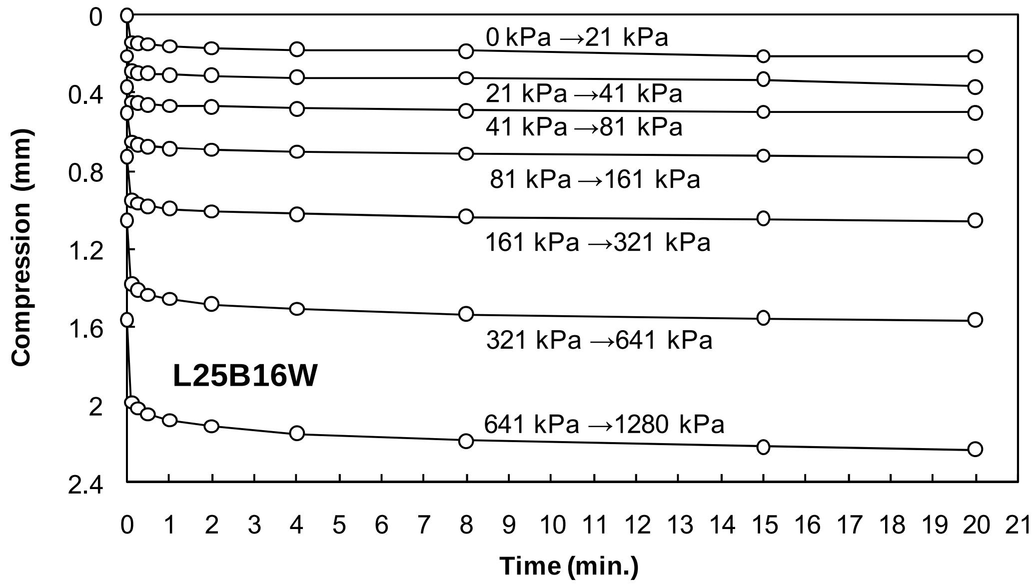


Figure H.7. Compression VS. Time (L25B16W)

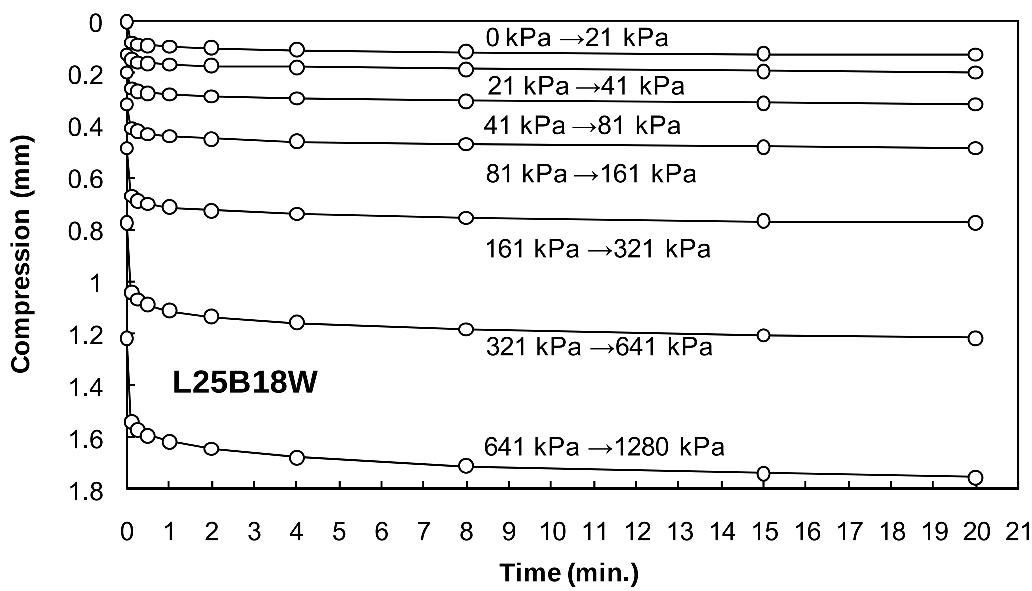


Figure H.8. Compression VS. Time (L25B18W)

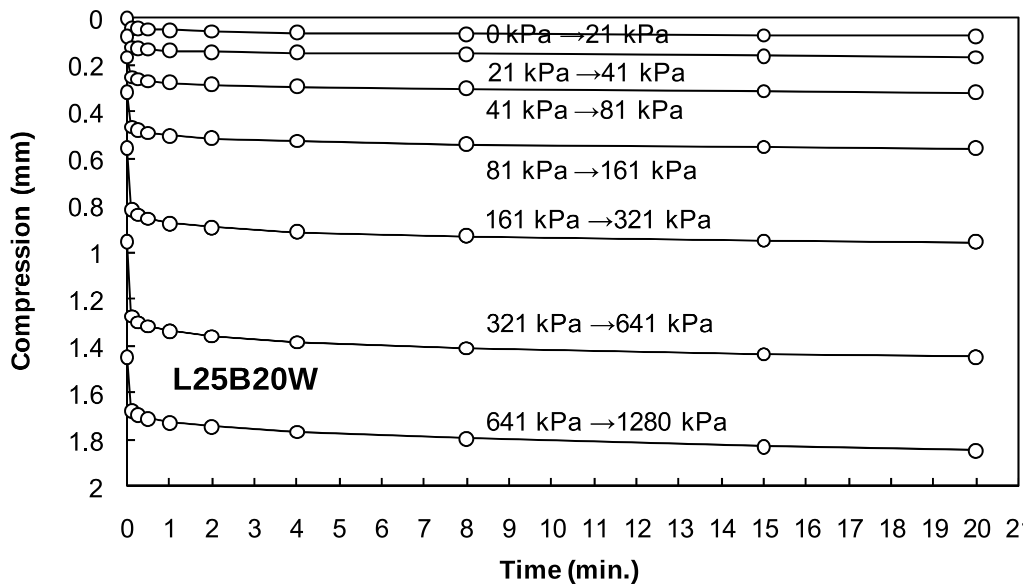


Figure H.9. Compression VS. Time (L25B20W)

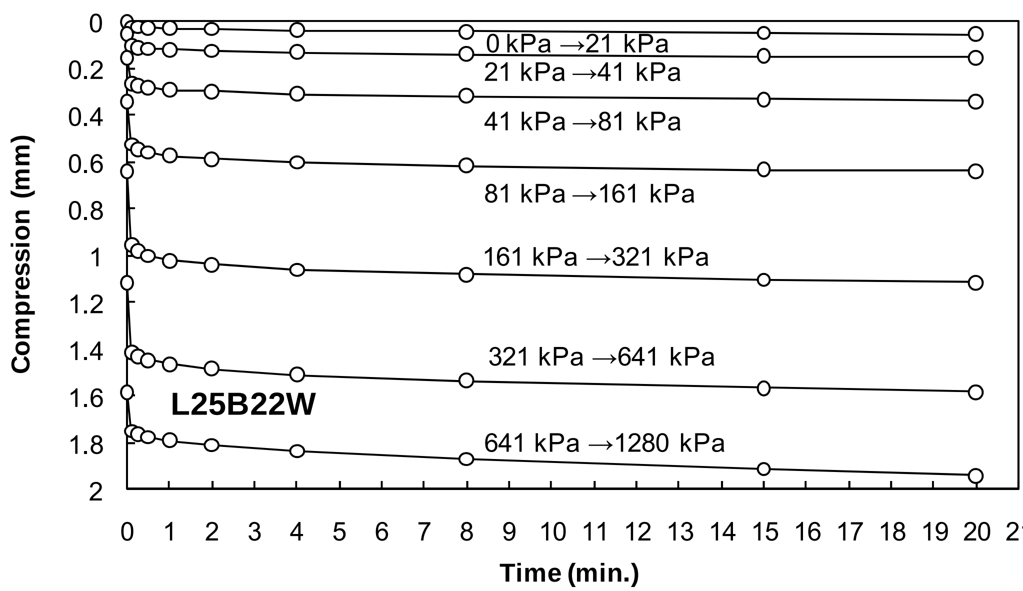


Figure H.10. Compression VS. Time (L25B22W)

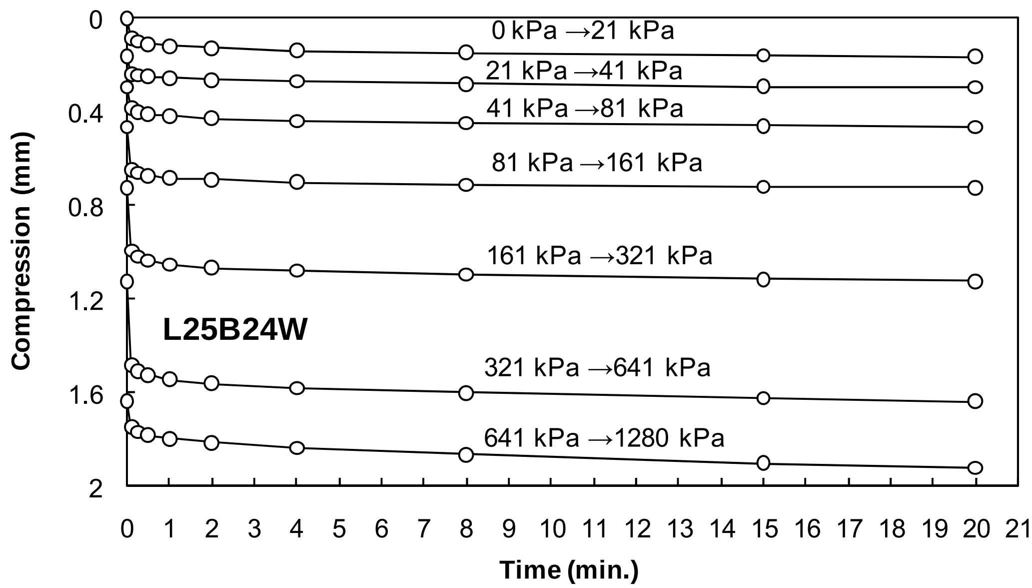


Figure H.11. Compression VS. Time (L25B24W)

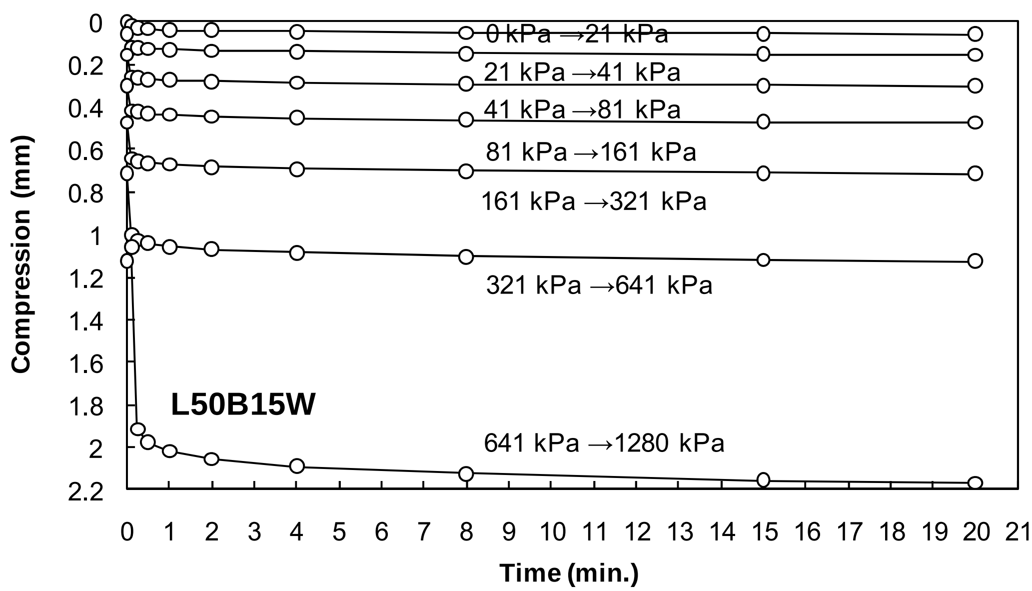


Figure H.12. Compression VS. Time (L50B15W)

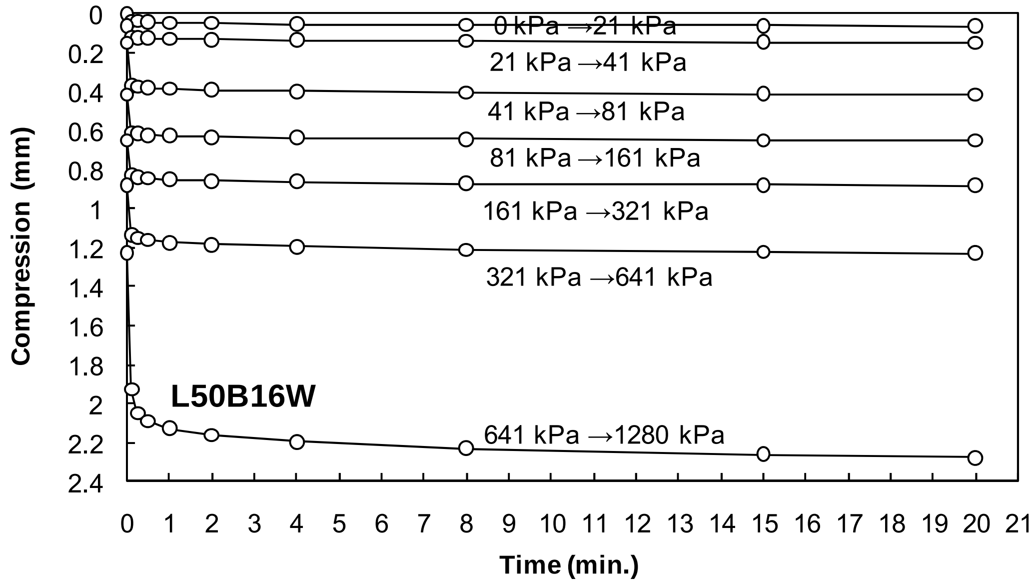


Figure H.13. Compression VS. Time (L50B16W)

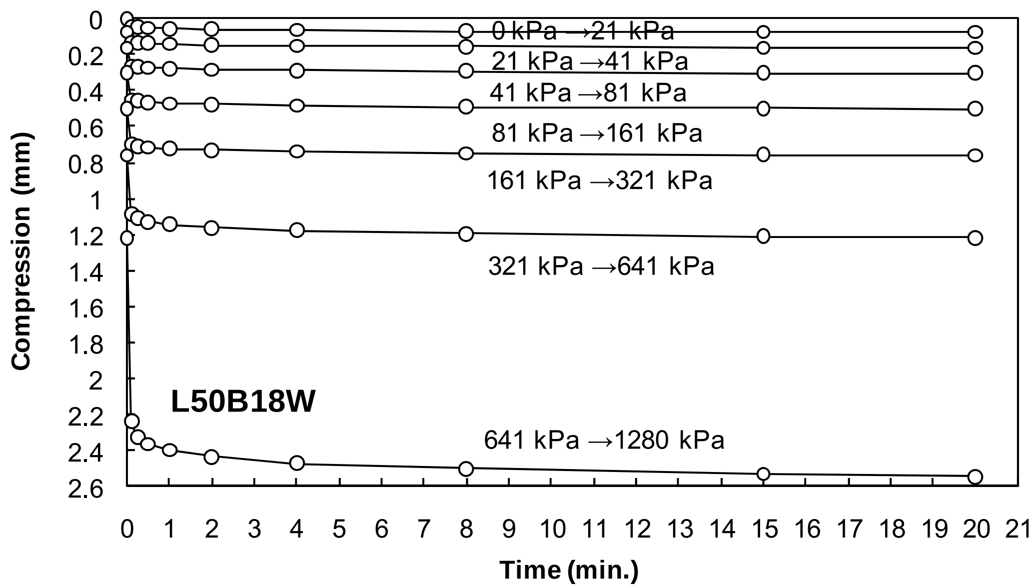


Figure H.14. Compression VS. Time (L50B18W)

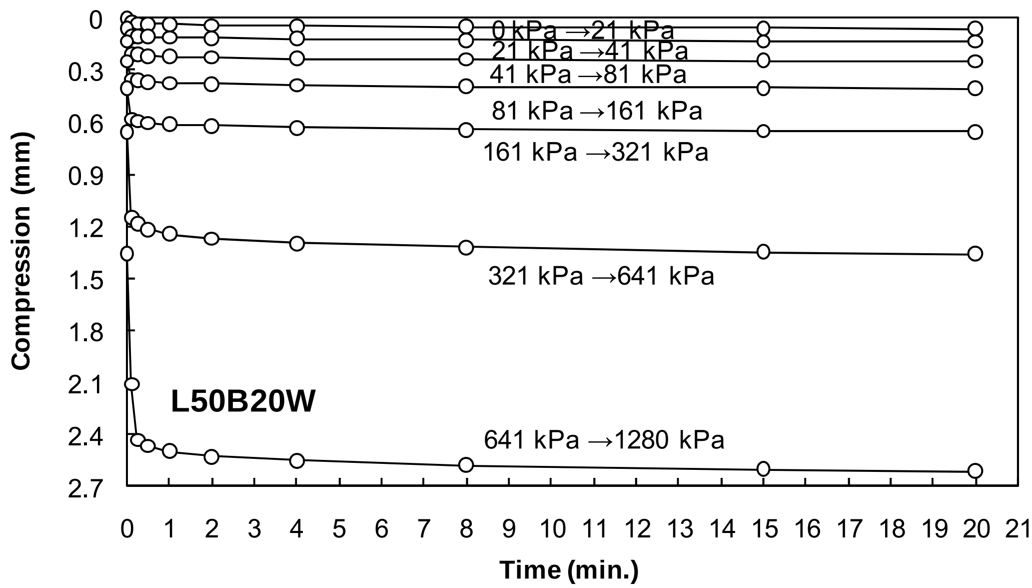


Figure H.15. Compression VS. Time (L50B20W)

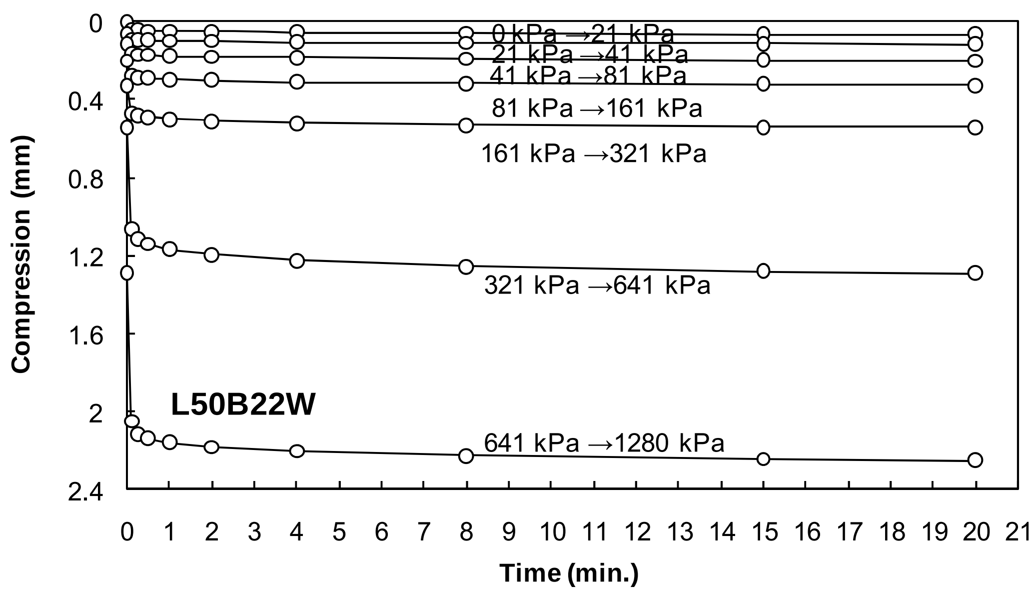


Figure H.16. Compression VS. Time (L50B22W)

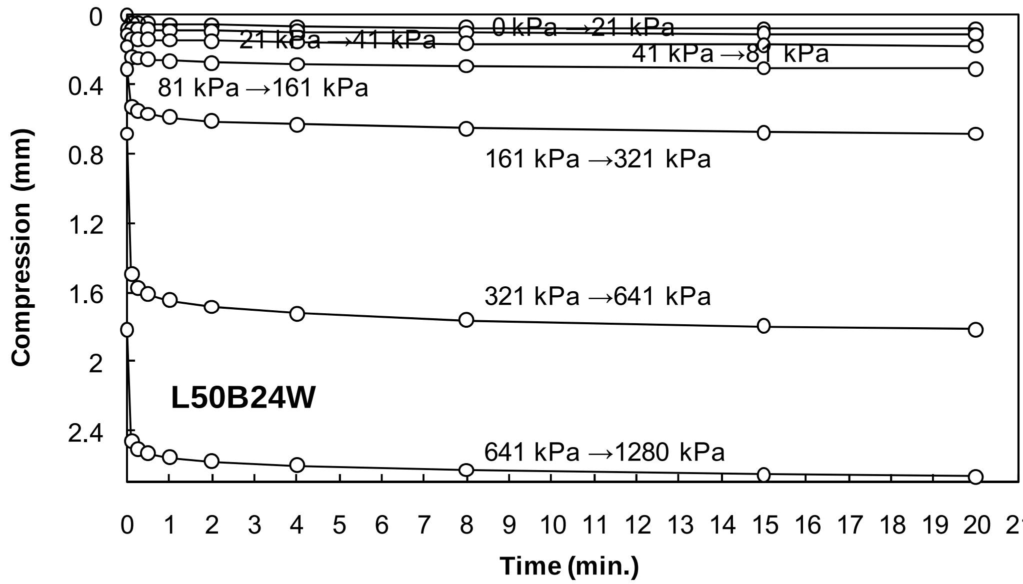


Figure H.17. Compression VS. Time (L50B24W)

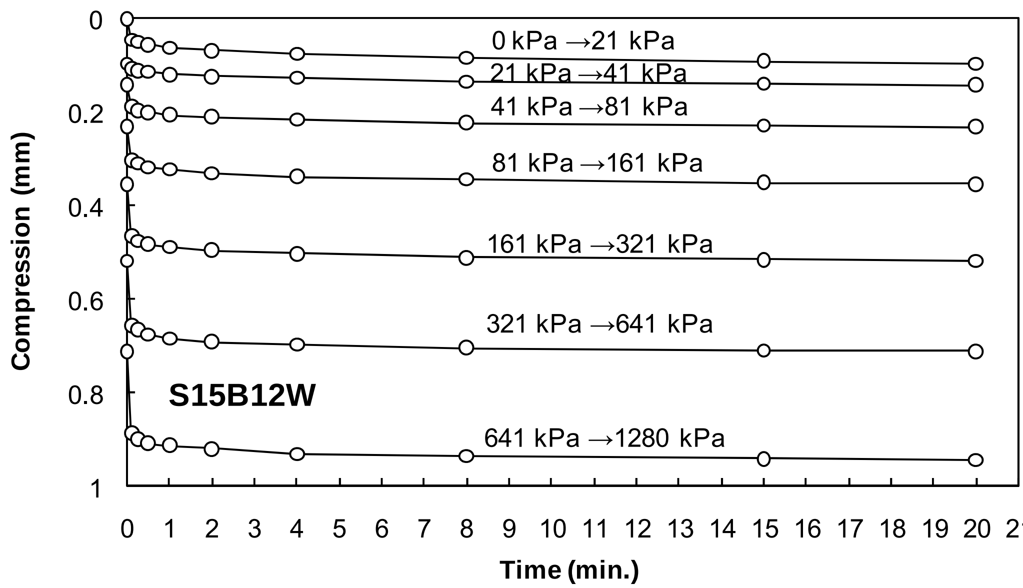


Figure H.18. Compression VS. Time (S15B12W)

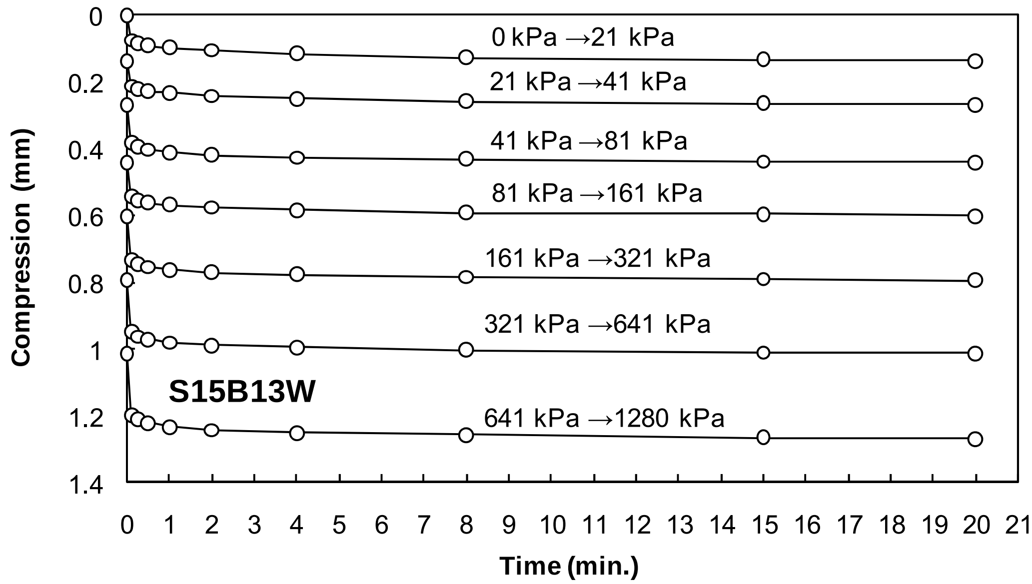


Figure H.19. Compression VS. Time (S15B13W)

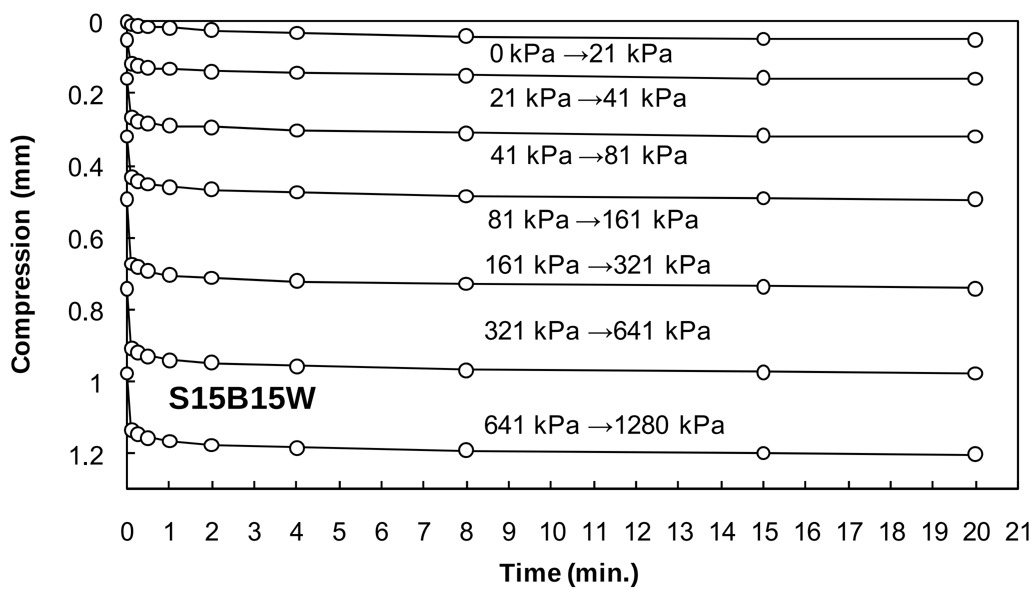


Figure H.20. Compression VS. Time (S15B15W)

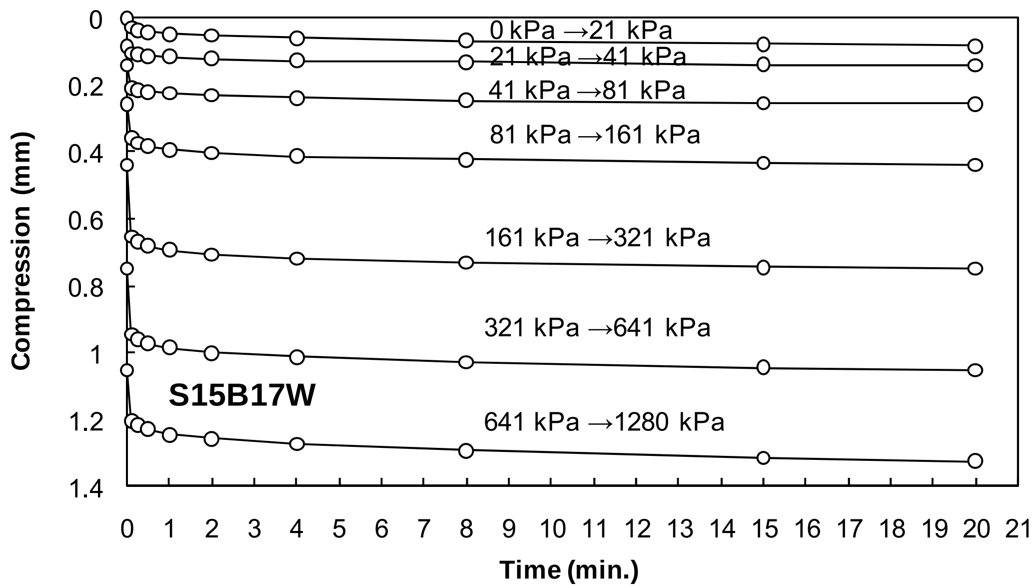


Figure H.21. Compression VS. Time (S15B17W)

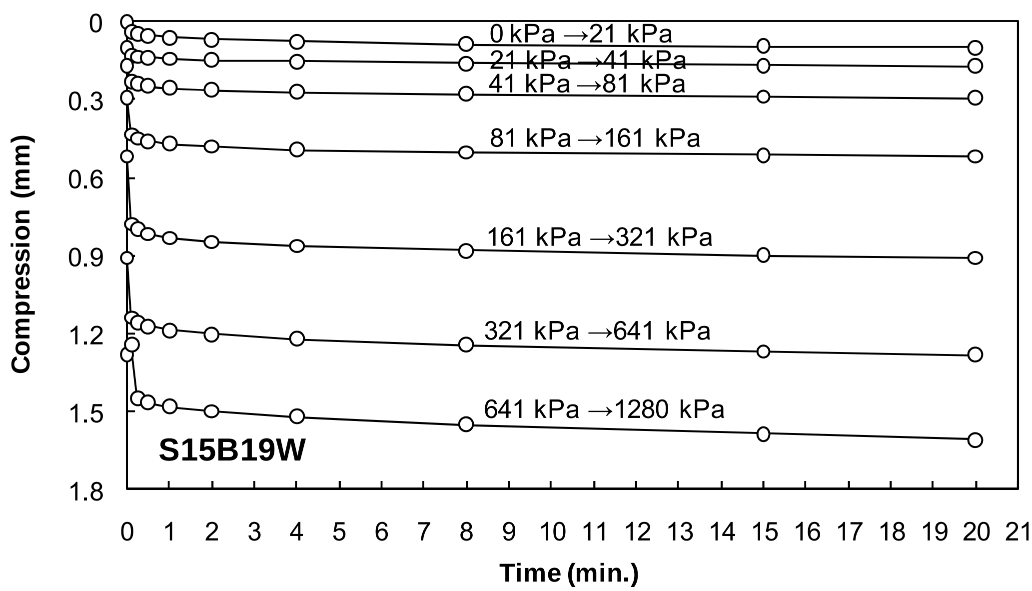


Figure H.22. Compression VS. Time (S15B19W)

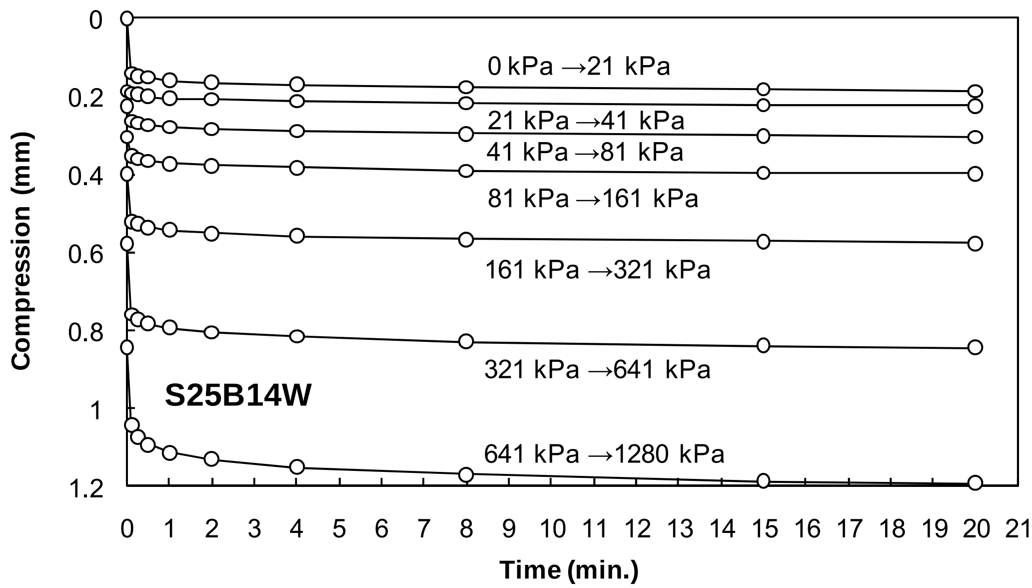


Figure H.23. Compression VS. Time (S25B14W)

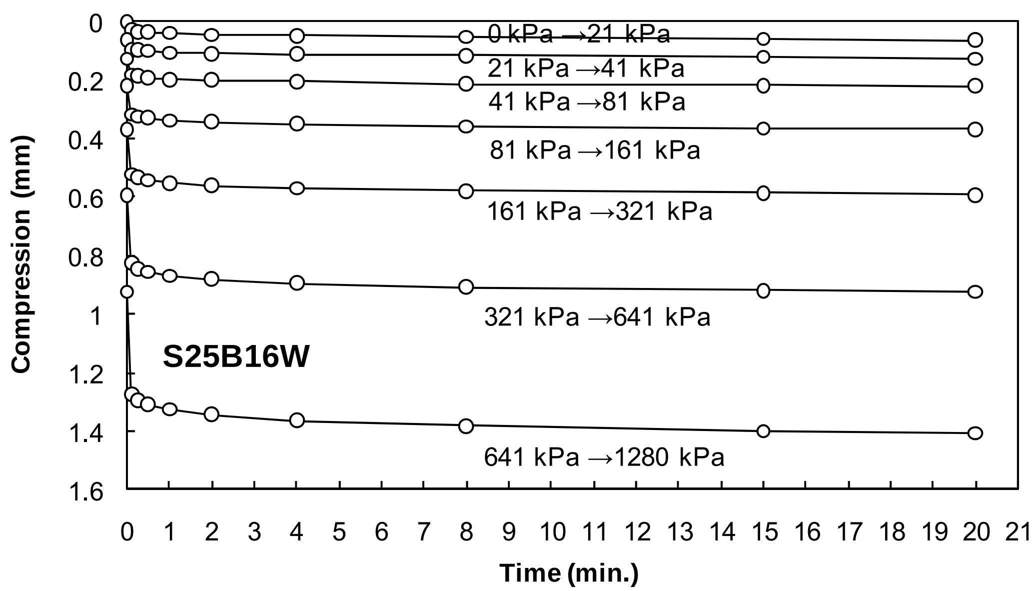


Figure H.24. Compression VS. Time (S25B16W)

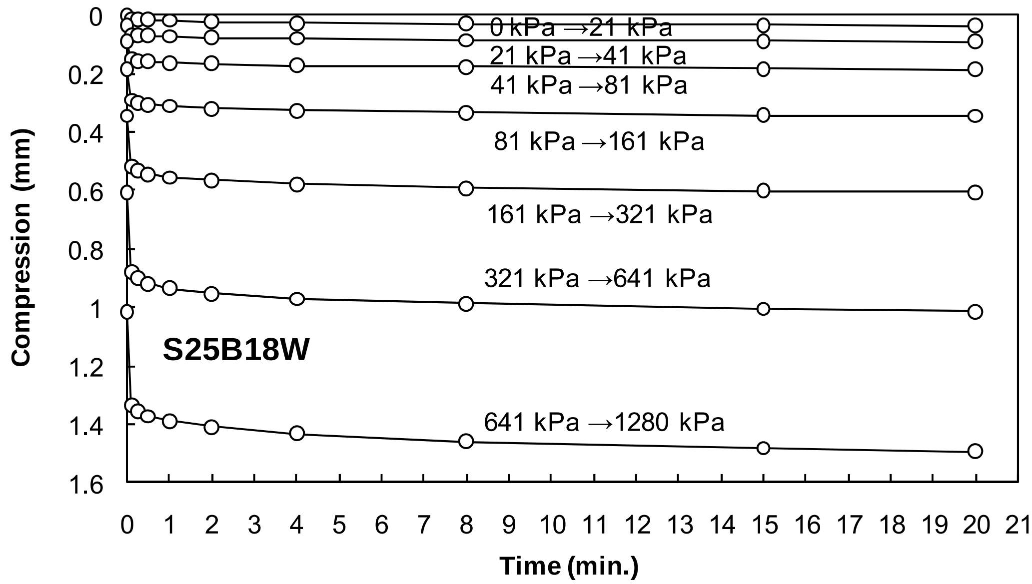


Figure H.25. Compression VS. Time (S25B18W)

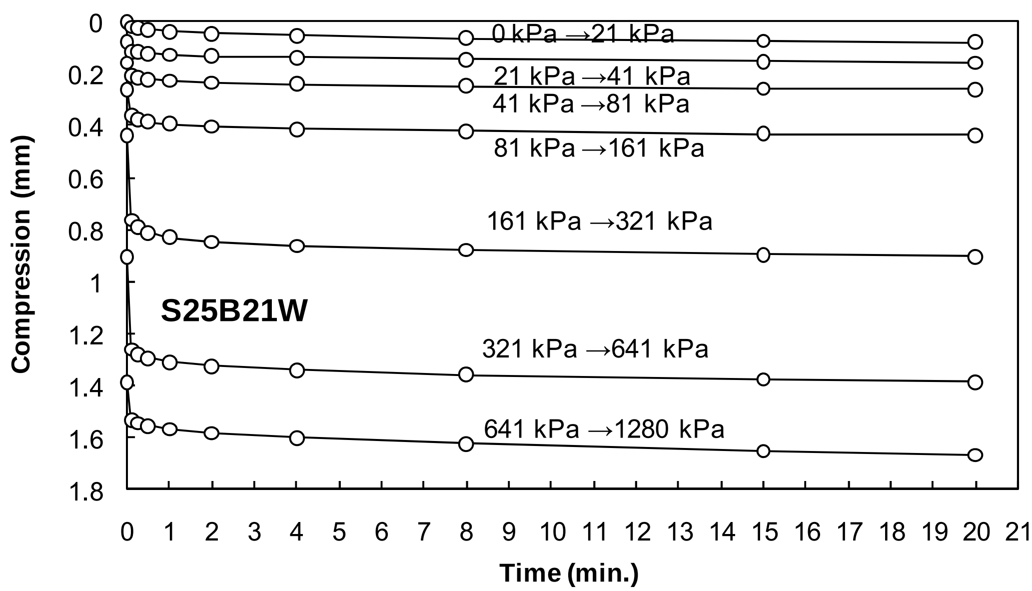


Figure H.26. Compression VS. Time (S25B21W)

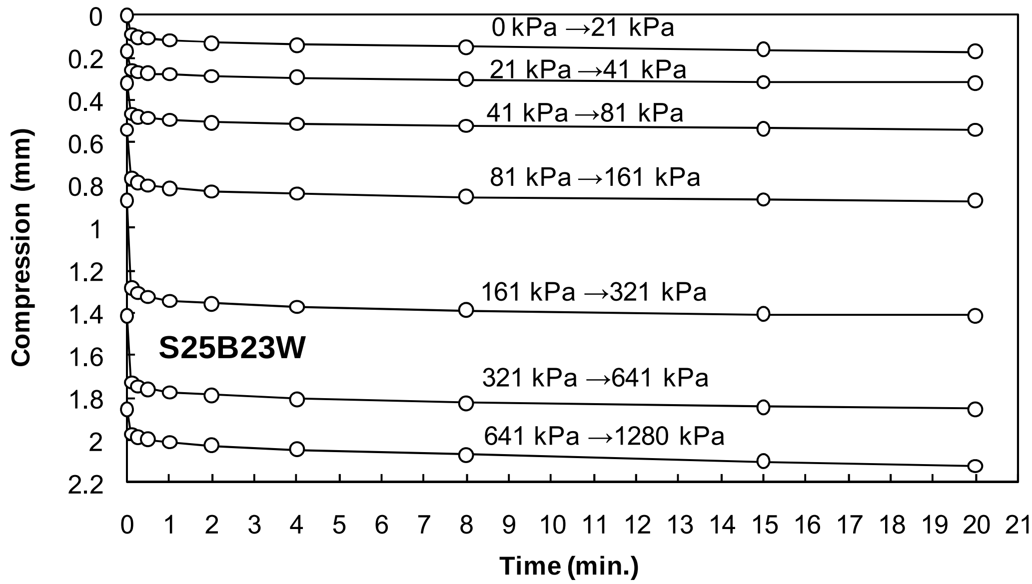


Figure H.27. Compression VS. Time (S25B23W)

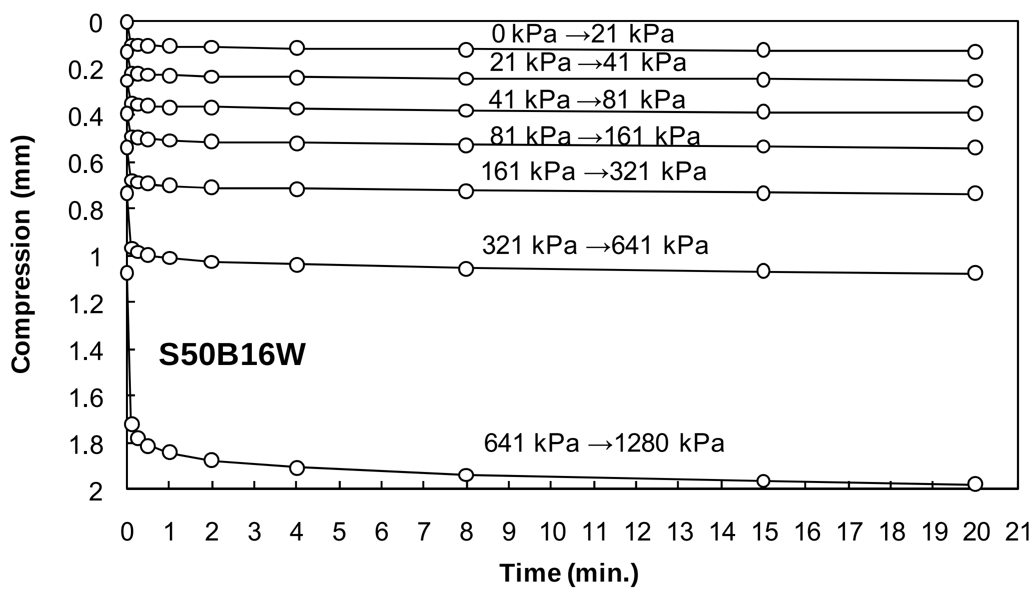


Figure H.28. Compression VS. Time (S50B16W)

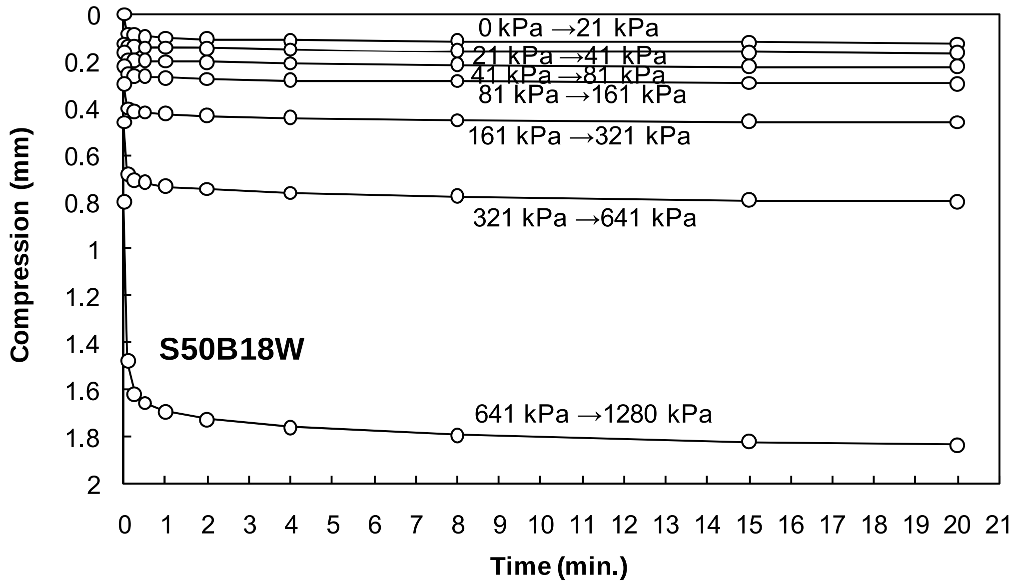


Figure H.29. Compression VS. Time (S50B18W)

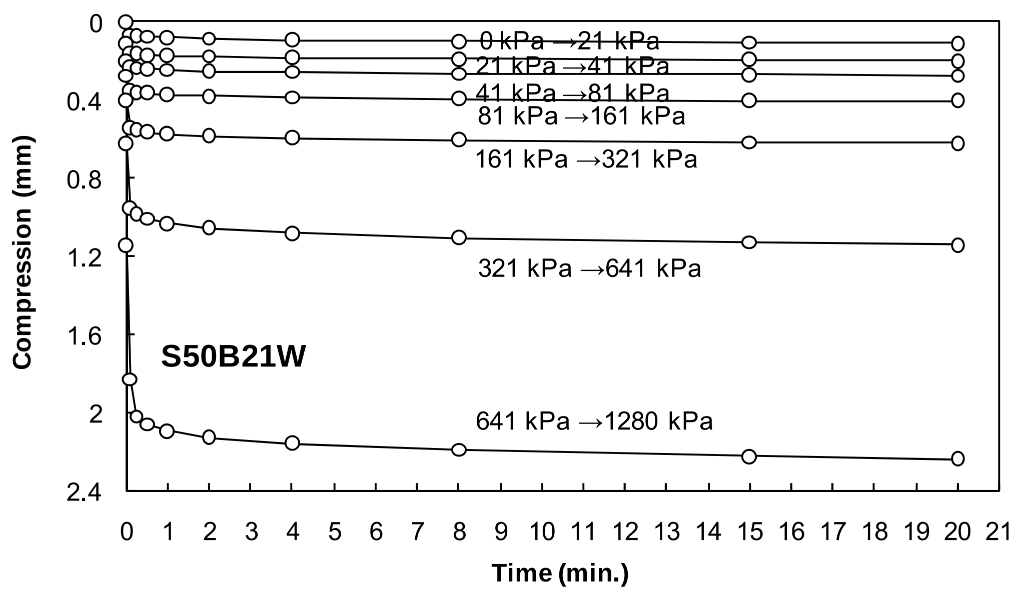


Figure H.30. Compression VS. Time (S50B21W)

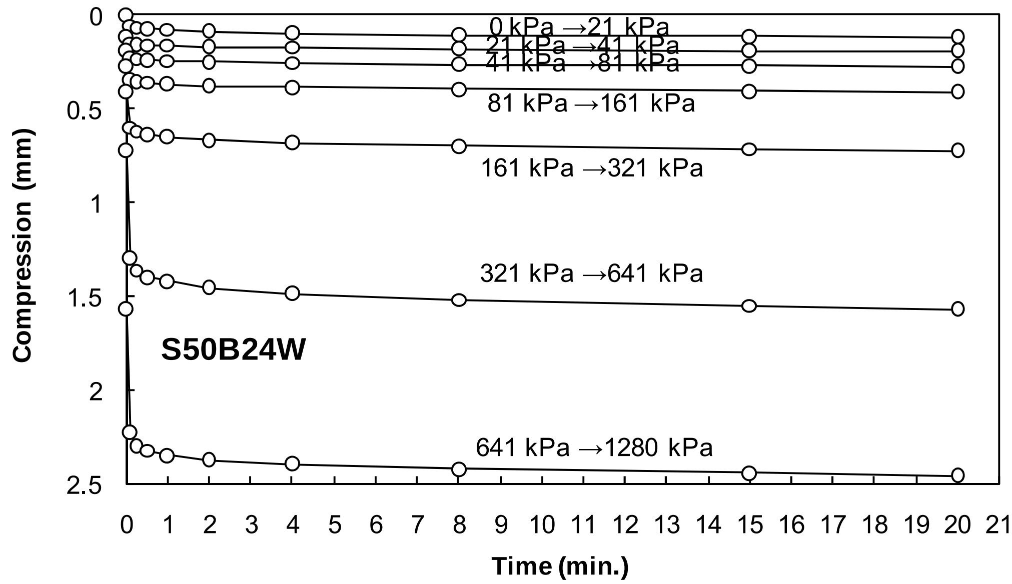


Figure H.31. Compression VS. Time (S50B24W)

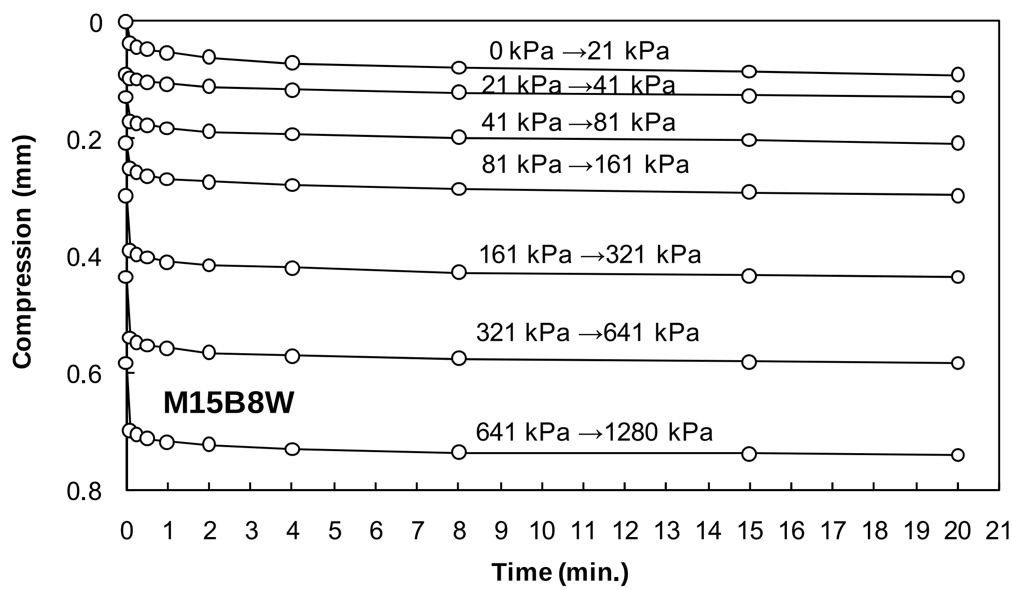


Figure H.32. Compression VS. Time (M15B8W)

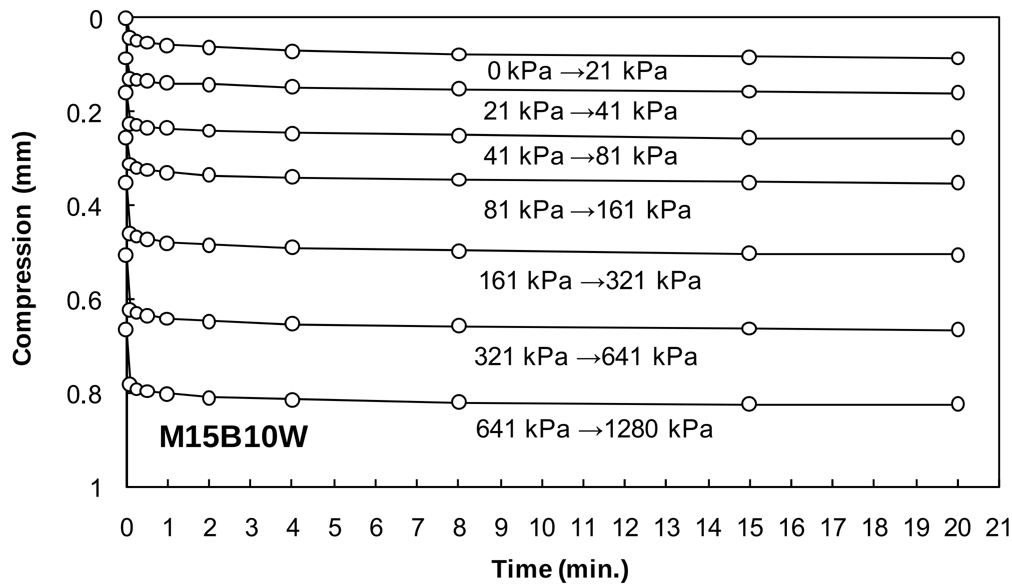


Figure H.33. Compression VS. Time (M15B10W)

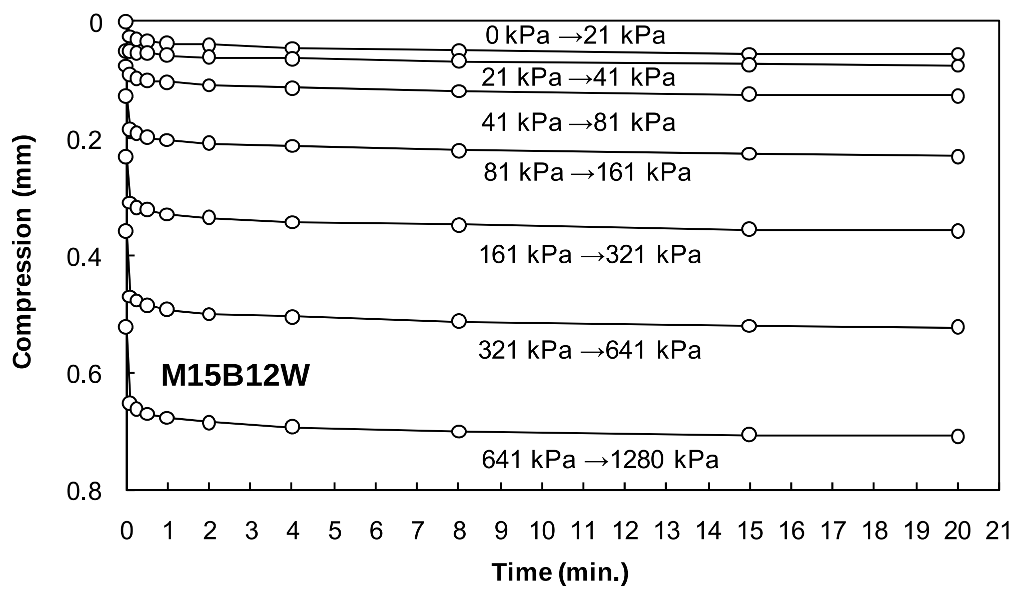


Figure H.34. Compression VS. Time (M15B12W)

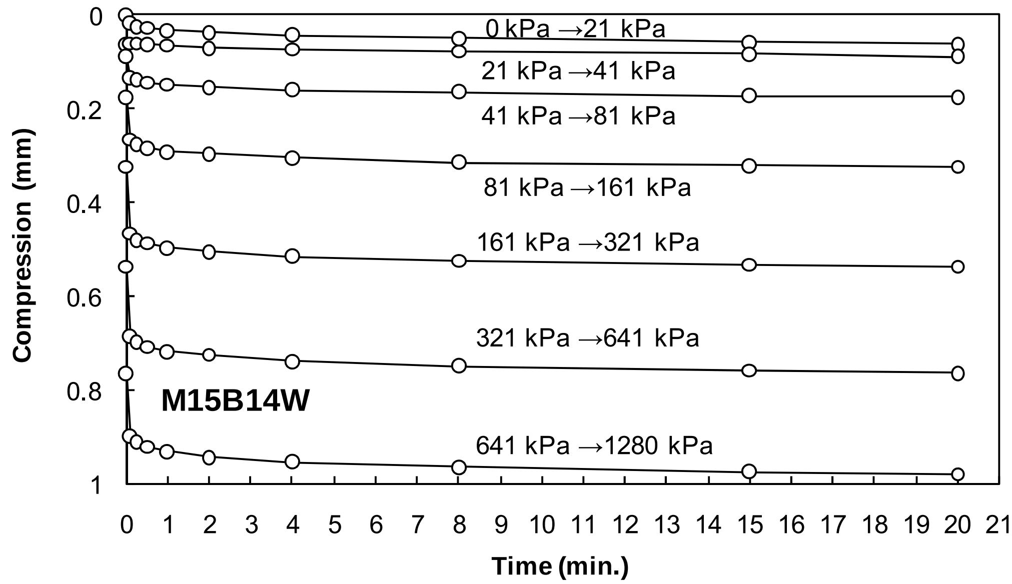


Figure H.35. Compression VS. Time (M15B14W)

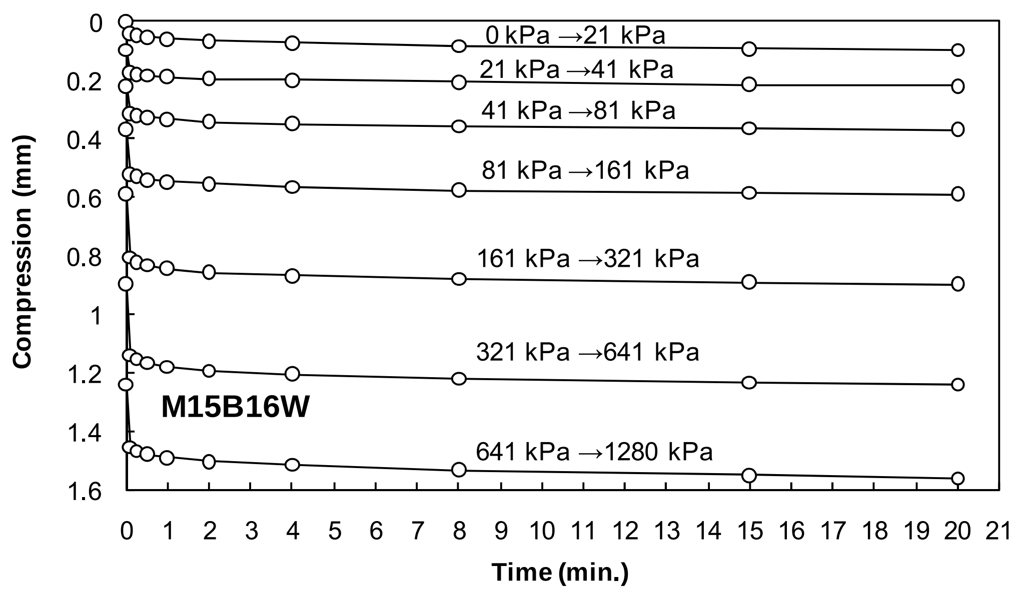


Figure H.36. Compression VS. Time (M15B16W)

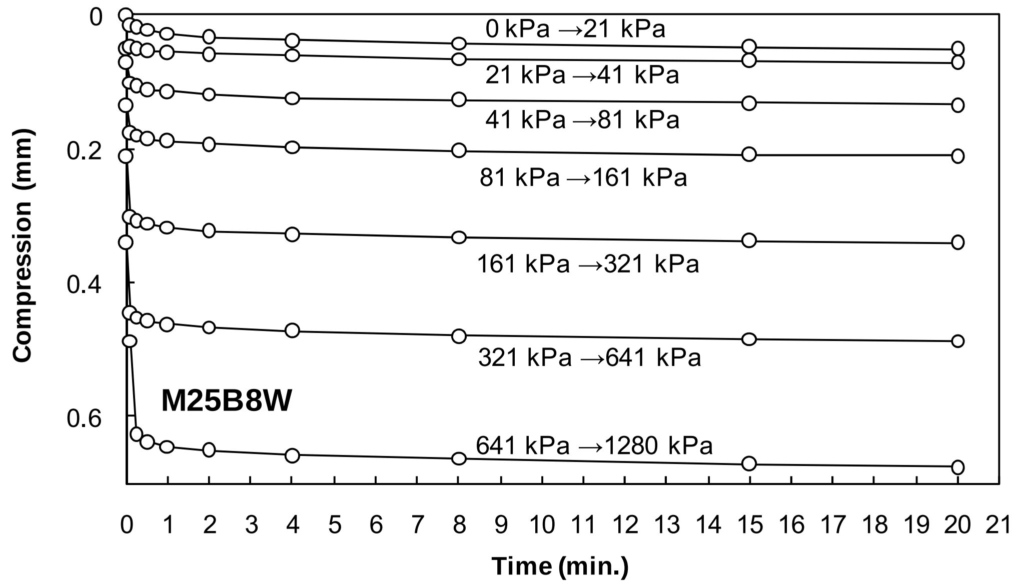


Figure H.37. Compression VS. Time (M25B8W)

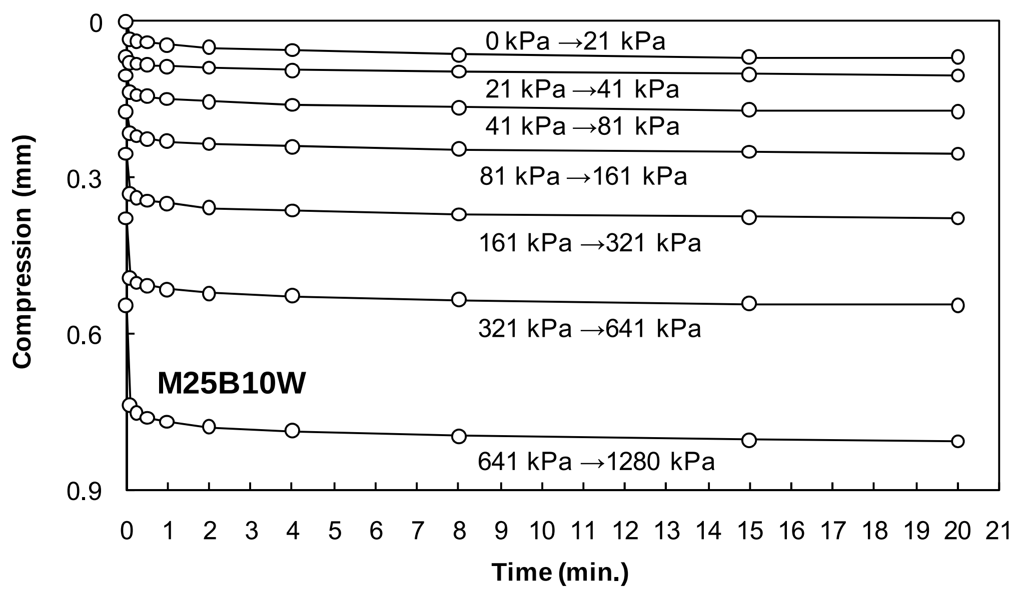


Figure H.38. Compression VS. Time (M25B10W)

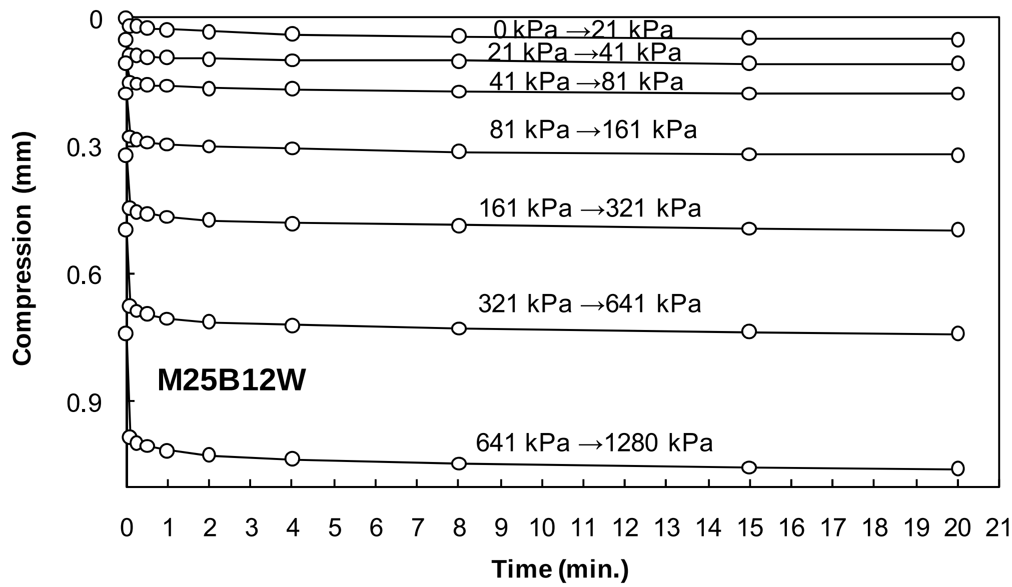


Figure H.39. Compression VS. Time (M25B12W)

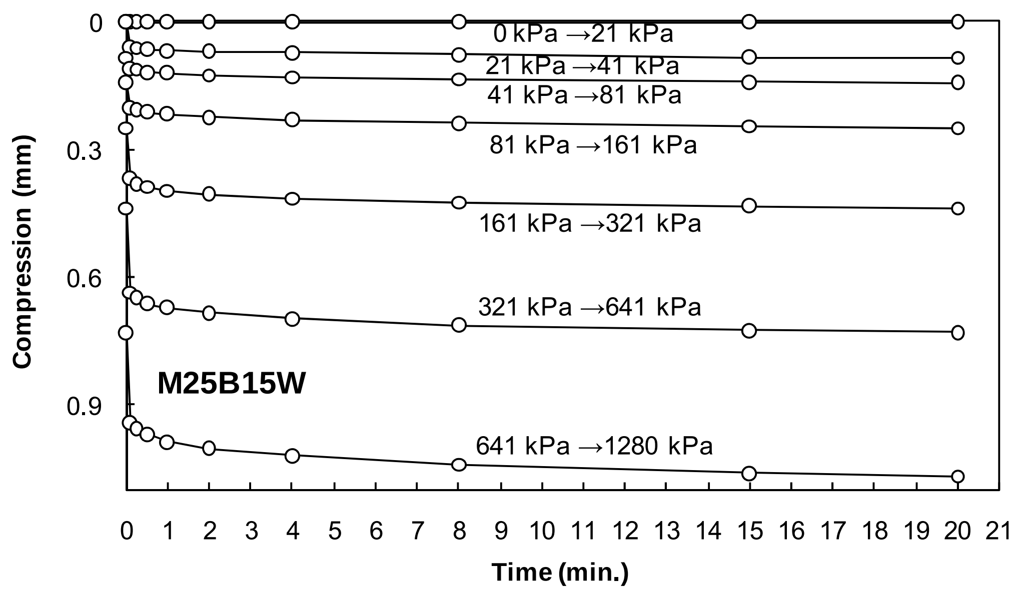


Figure H.40. Compression VS. Time (M25B15W)

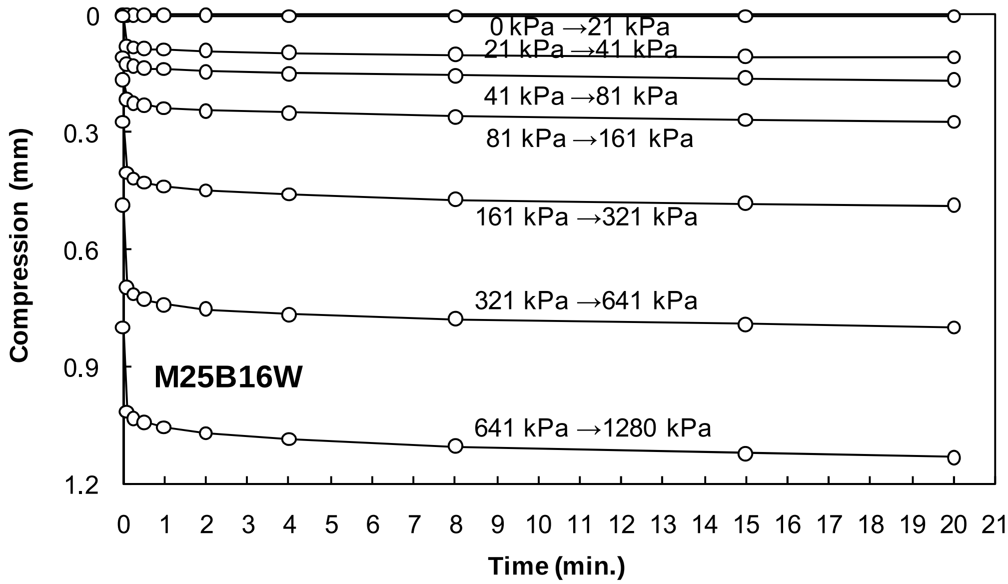


Figure H.41. Compression VS. Time (M25B16W)

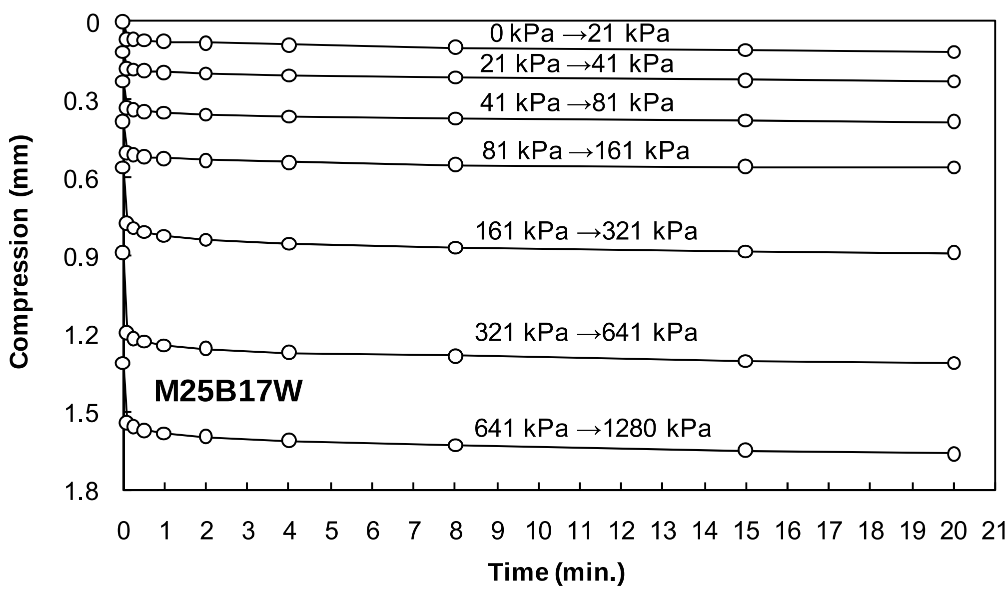


Figure H.42. Compression VS. Time (M25B17W)

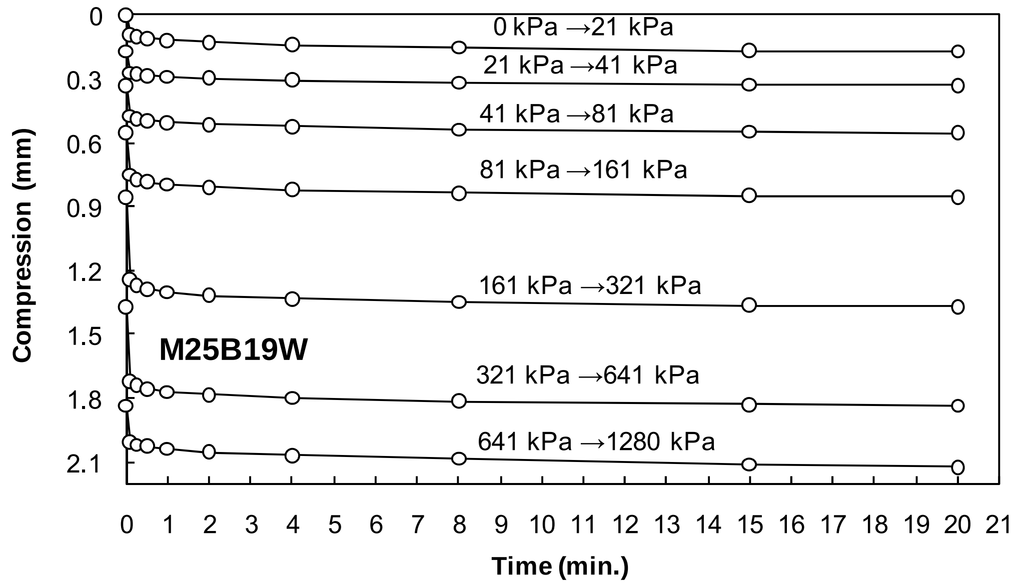


Figure H.43. Compression VS. Time (M25B19W)

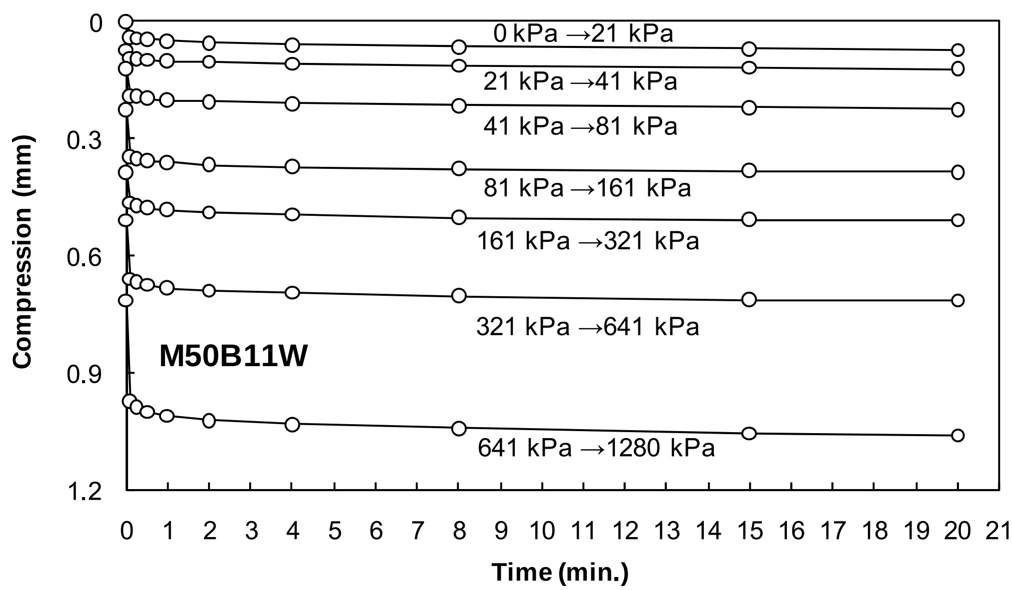


Figure H.44. Compression VS. Time (M50B11W)

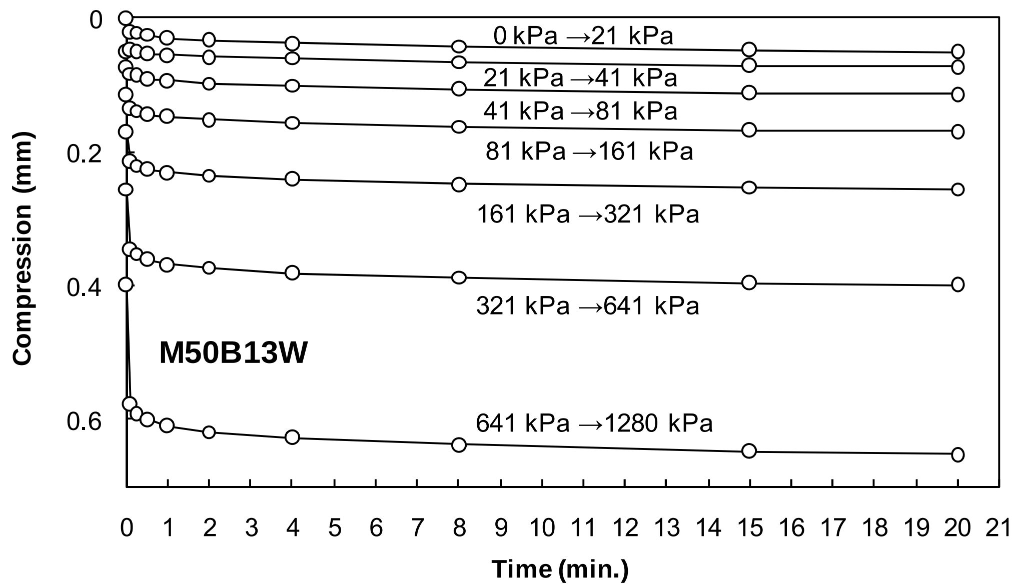


Figure H.45. Compression VS. Time (M50B13W)

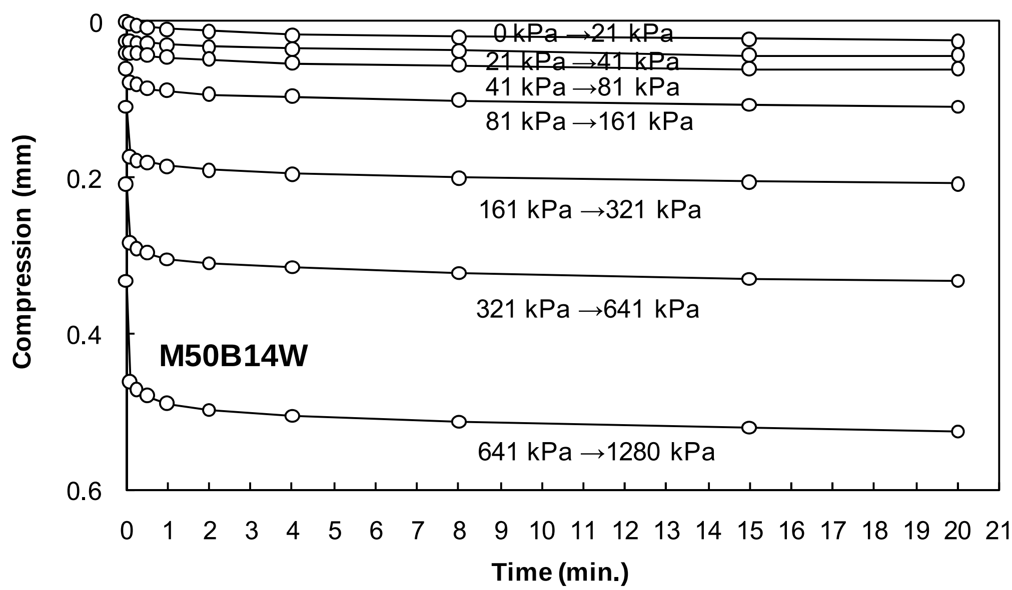


Figure H.46. Compression VS. Time (M50B14W)

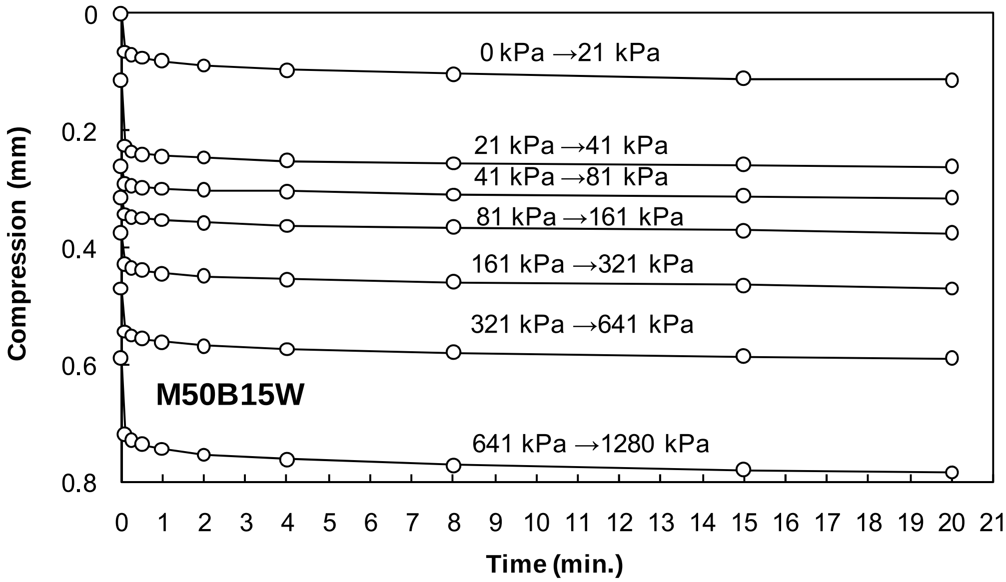


Figure H.47. Compression VS. Time (M50B15W)

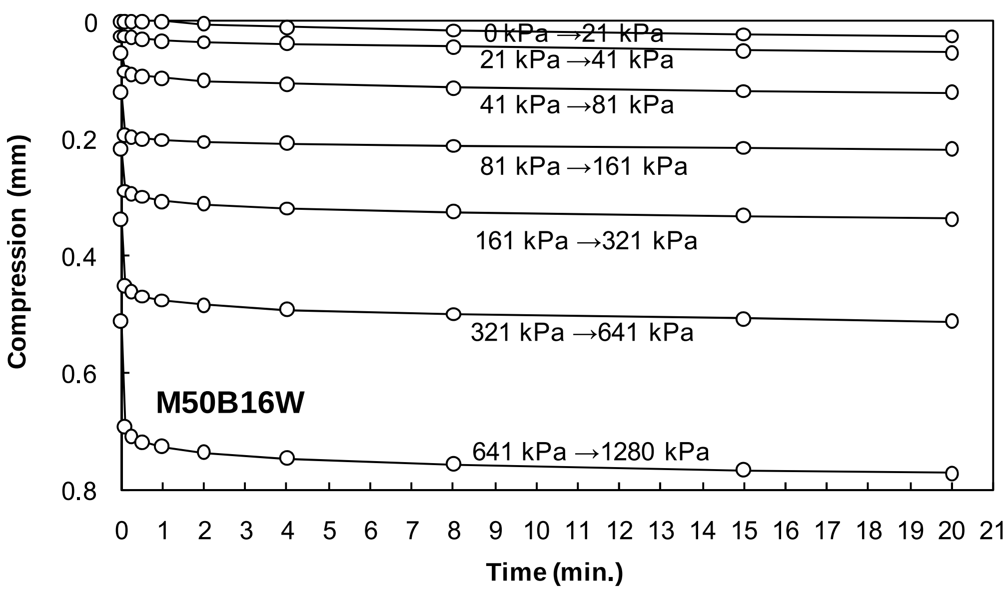


Figure H.48. Compression VS. Time (M50B16W)

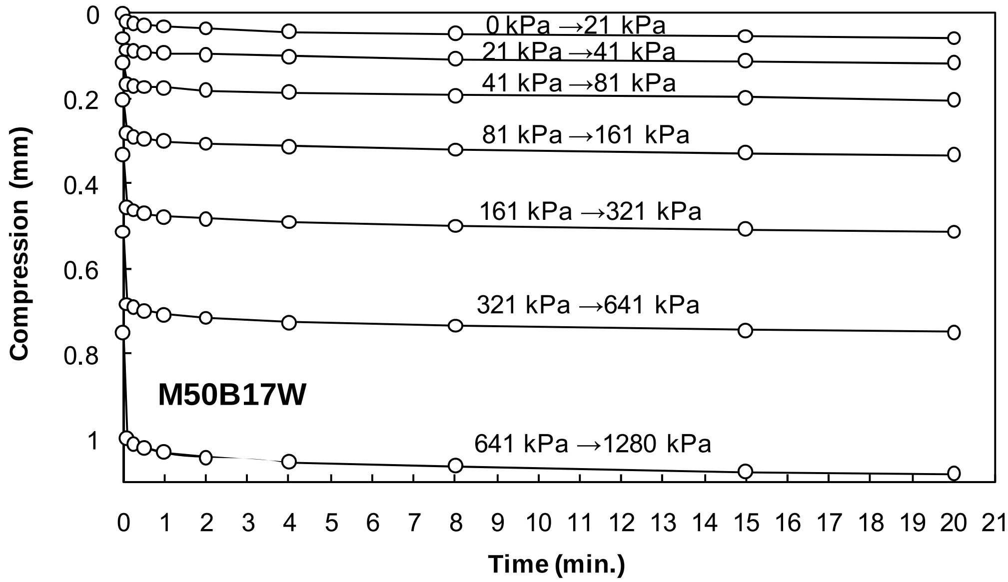


Figure H.49. Compression VS. Time (M50B17W)

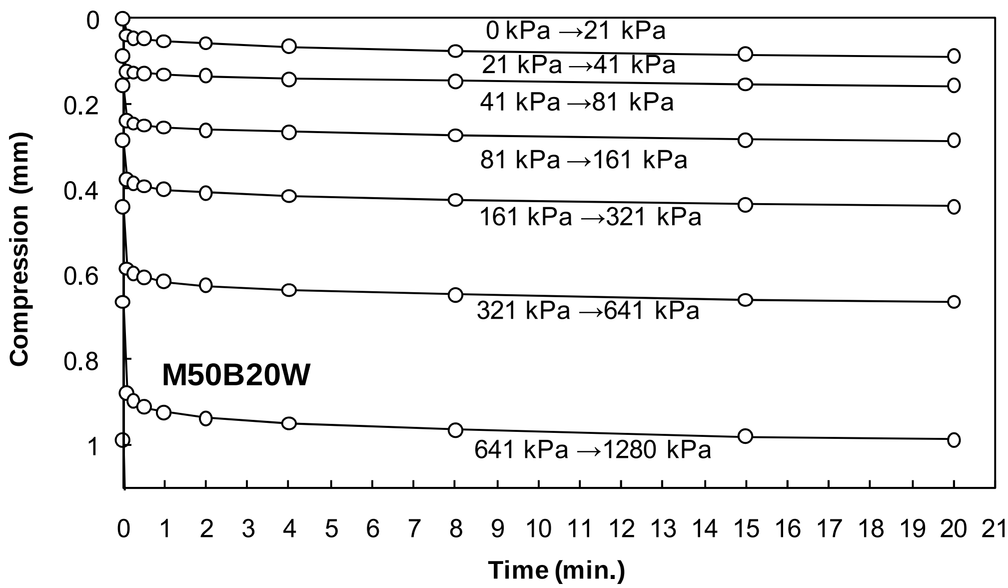


Figure H.50. Compression VS. Time (M50B20W)

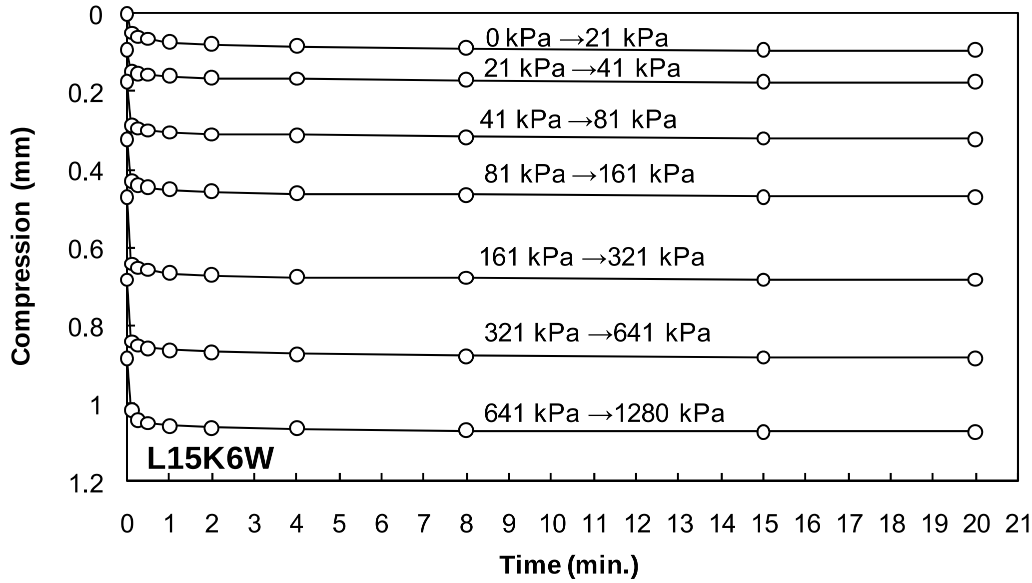


Figure H.51. Compression VS. Time (L15K6W)

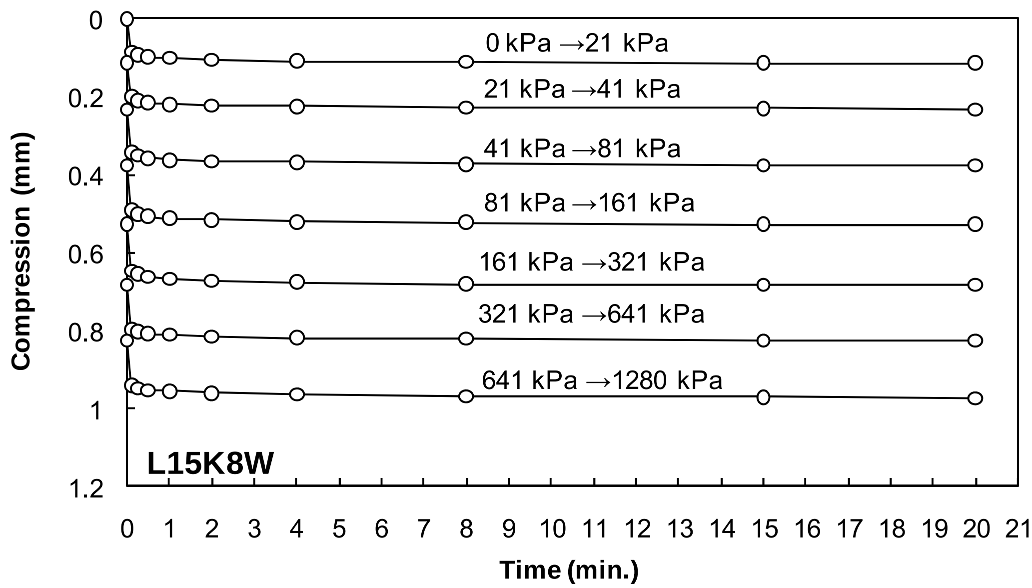


Figure H.52. Compression VS. Time (L15K8W)

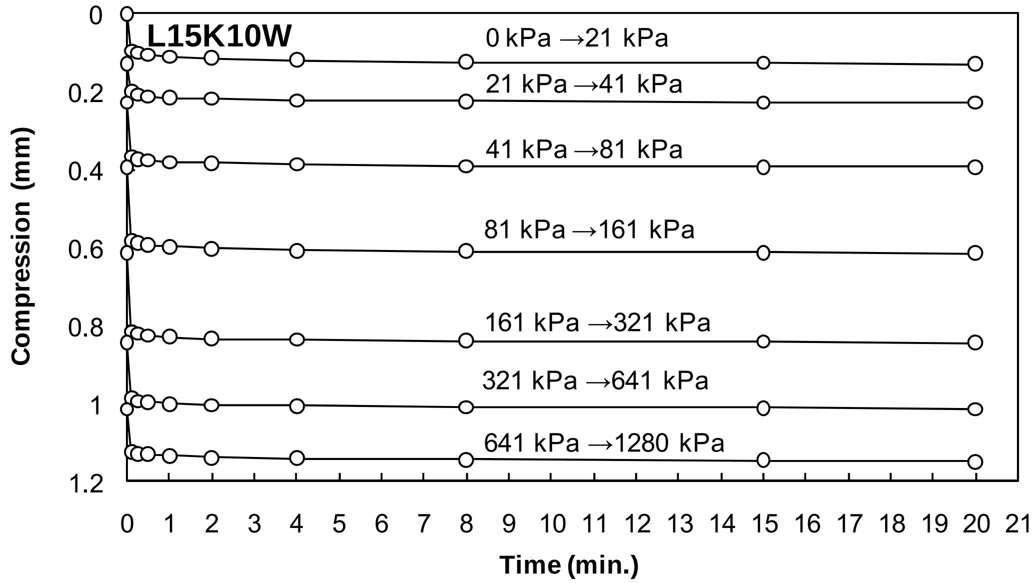


Figure H.53. Compression VS. Time (L15K10W)

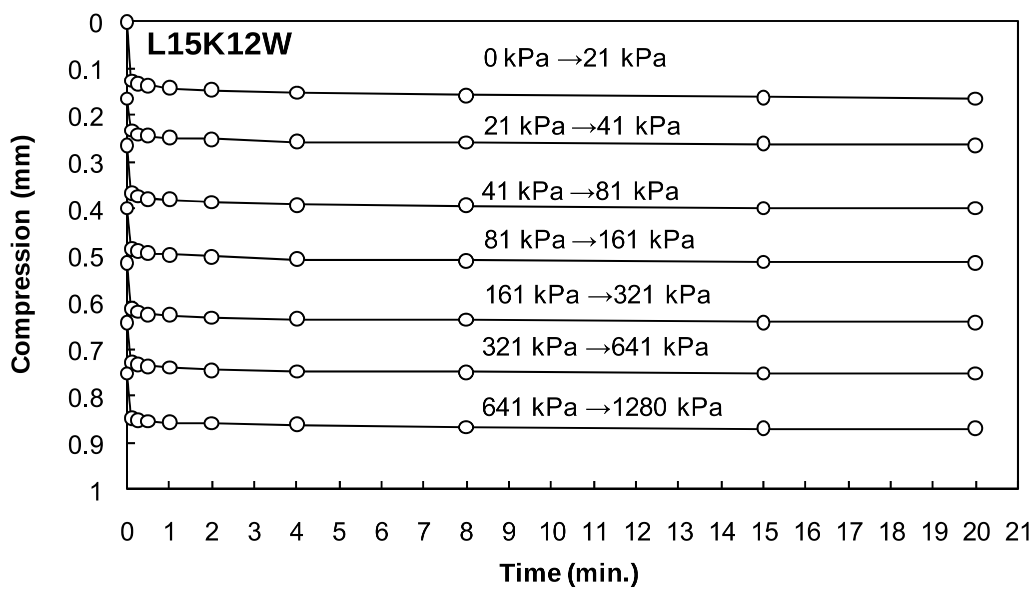


Figure H.54. Compression VS. Time (L15K12W)

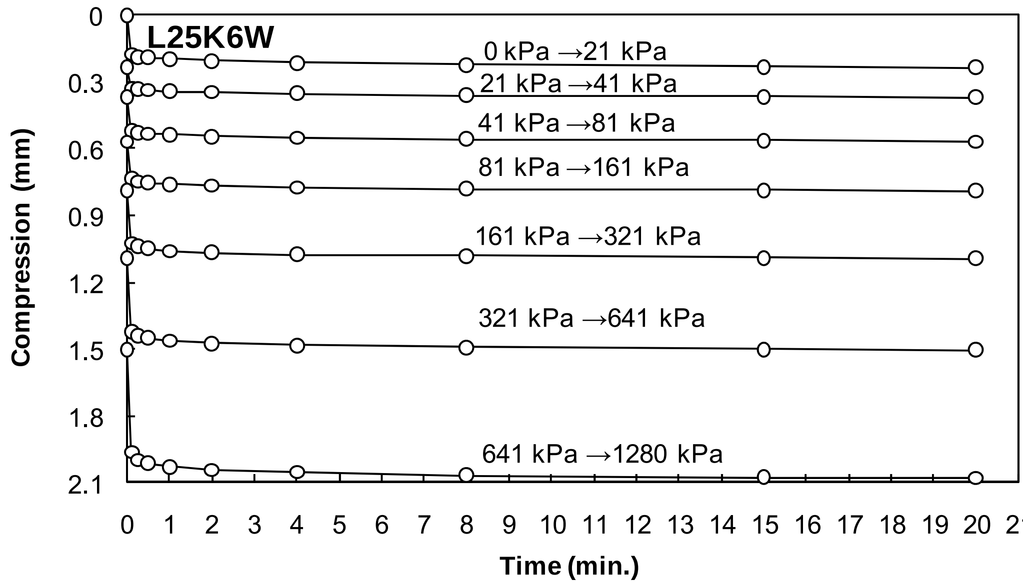
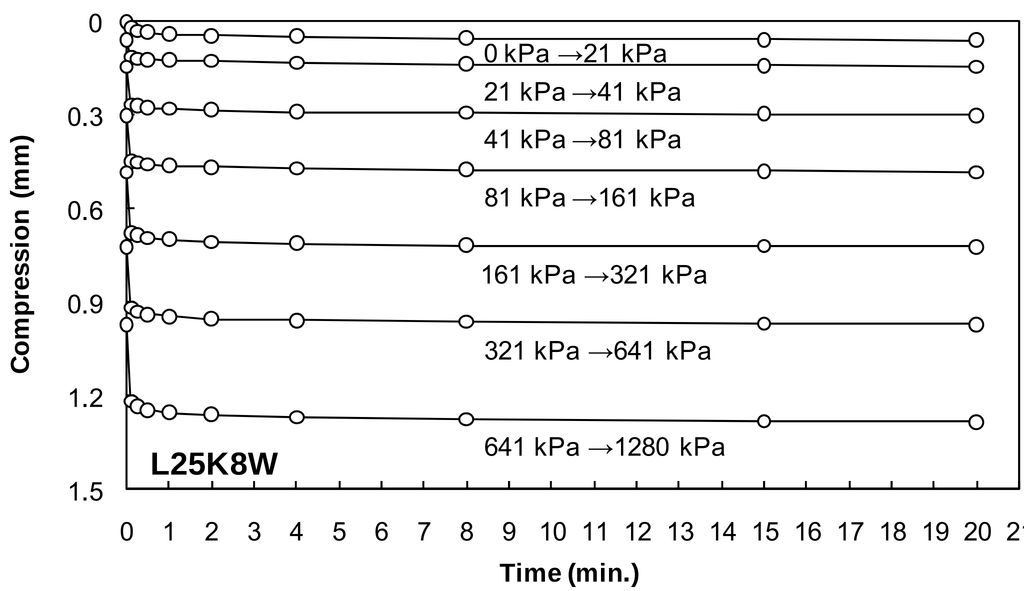


Figure H.55. Compression VS. Time (L25K6W)



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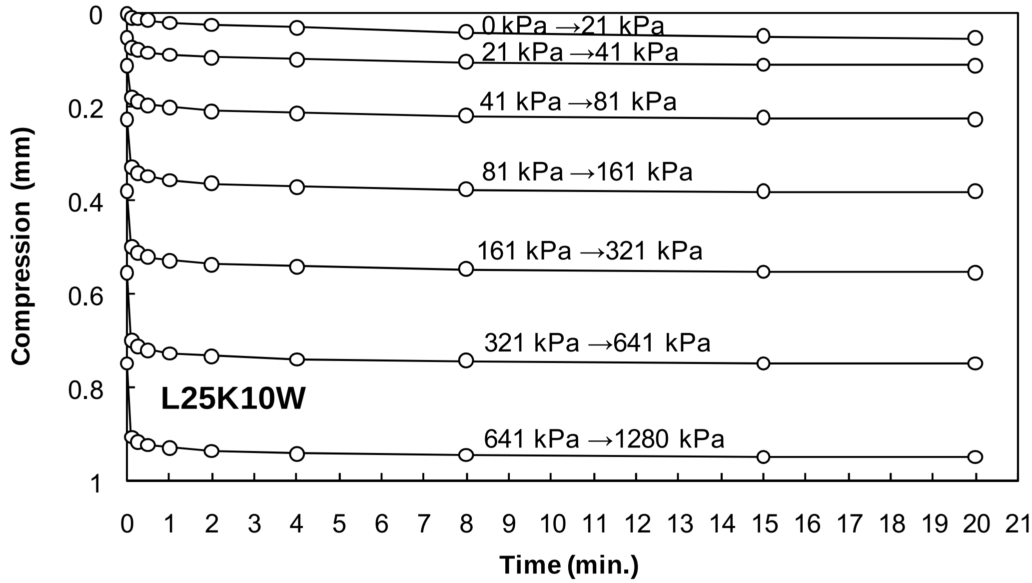
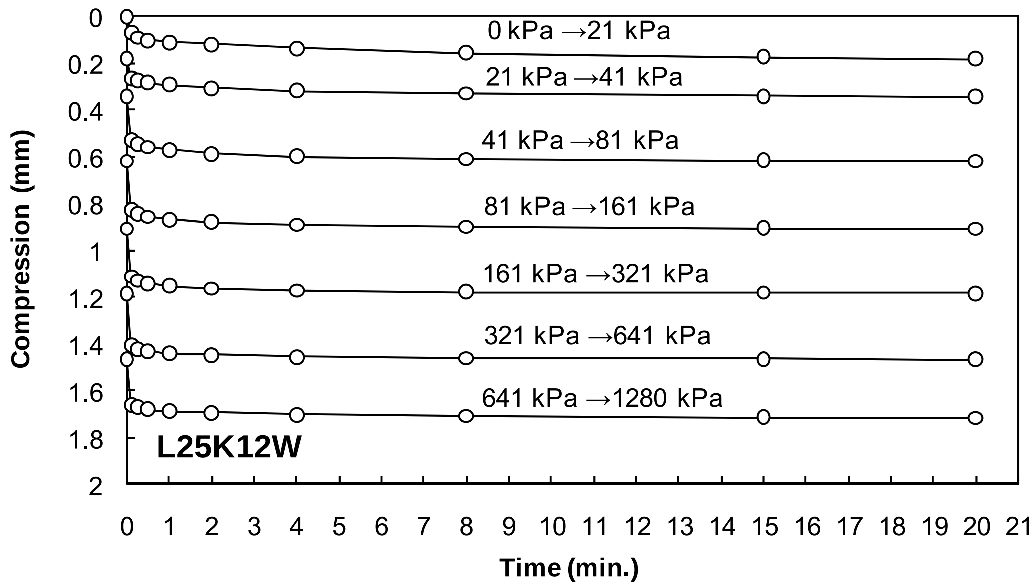


Figure H.57. Compression VS. Time (L25K10W)



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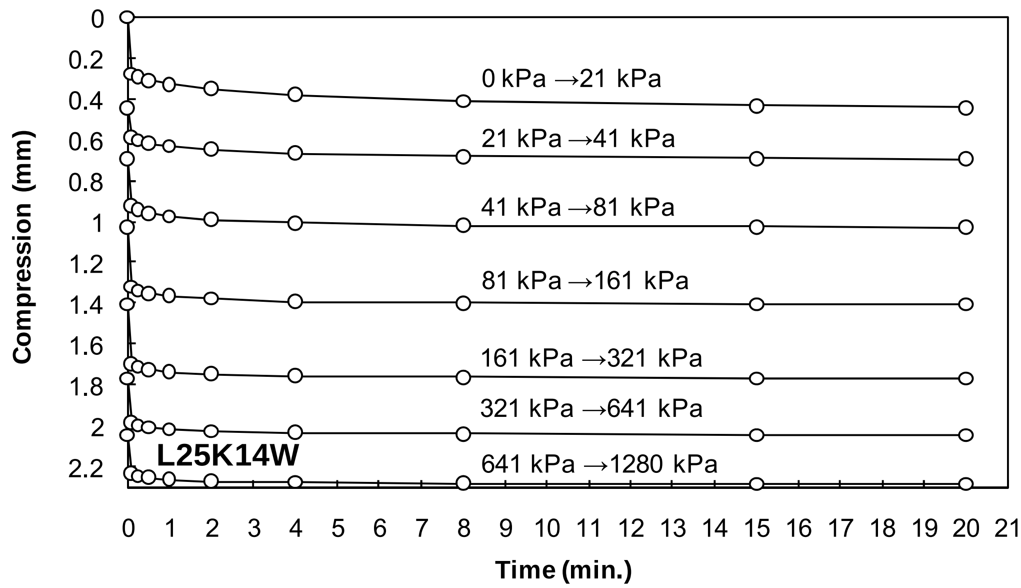


Figure H.59. Compression VS. Time (L25K14W)

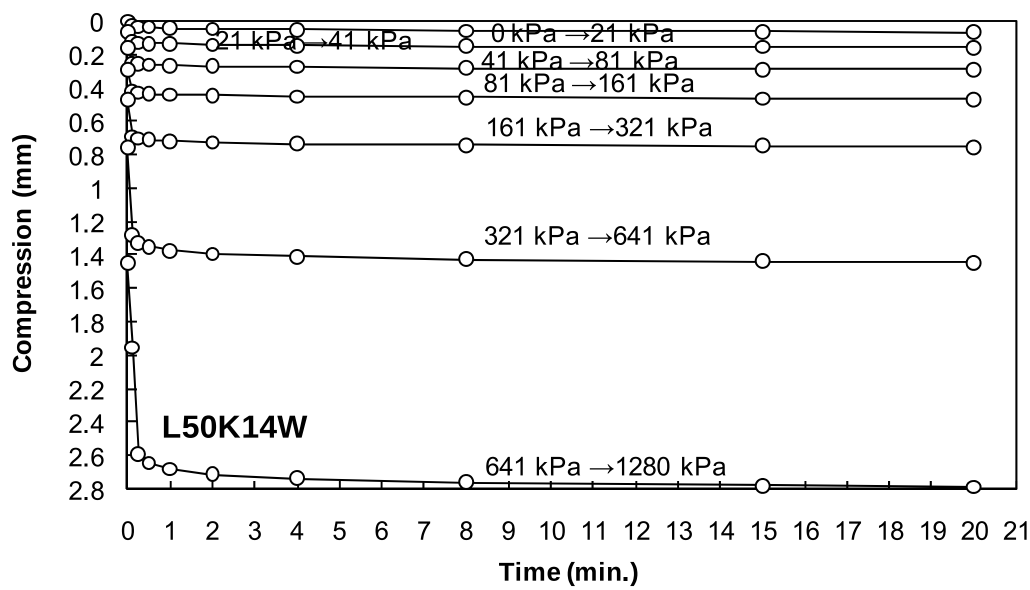


Figure H.60. Compression VS. Time (L50K14W)

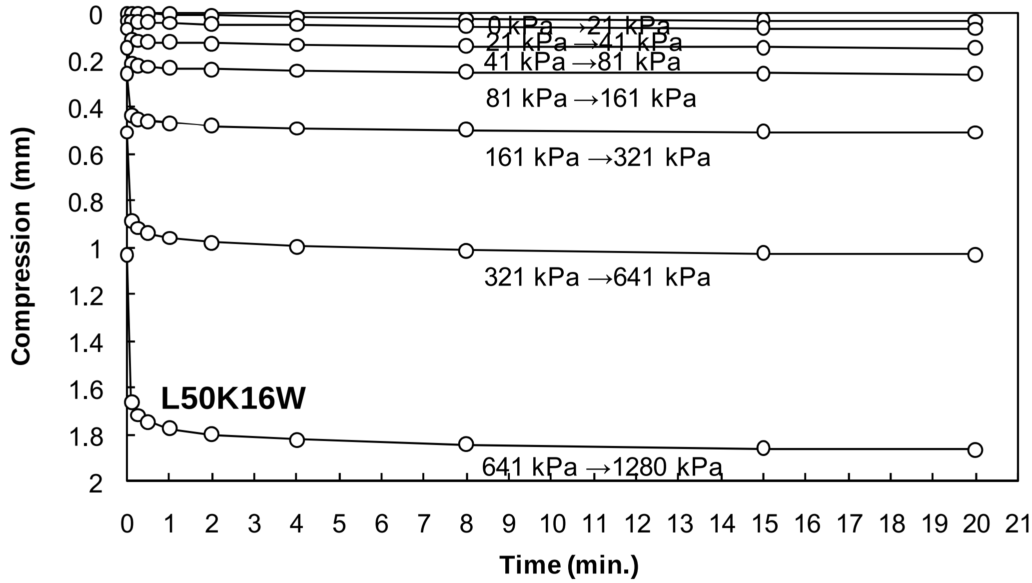


Figure H.61. Compression VS. Time (L50K16W)

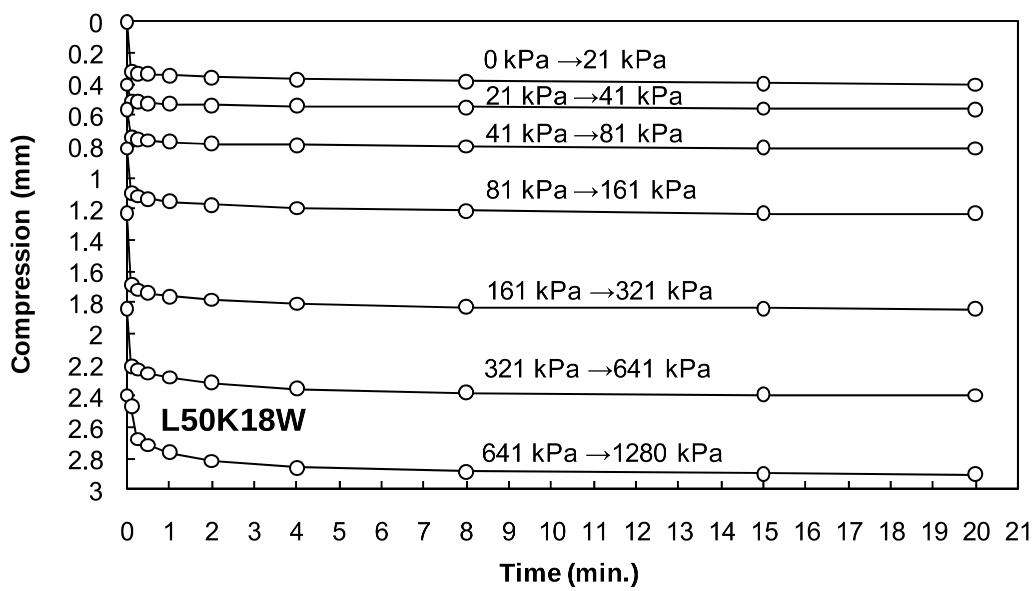


Figure H.62. Compression VS. Time (L50K18W)

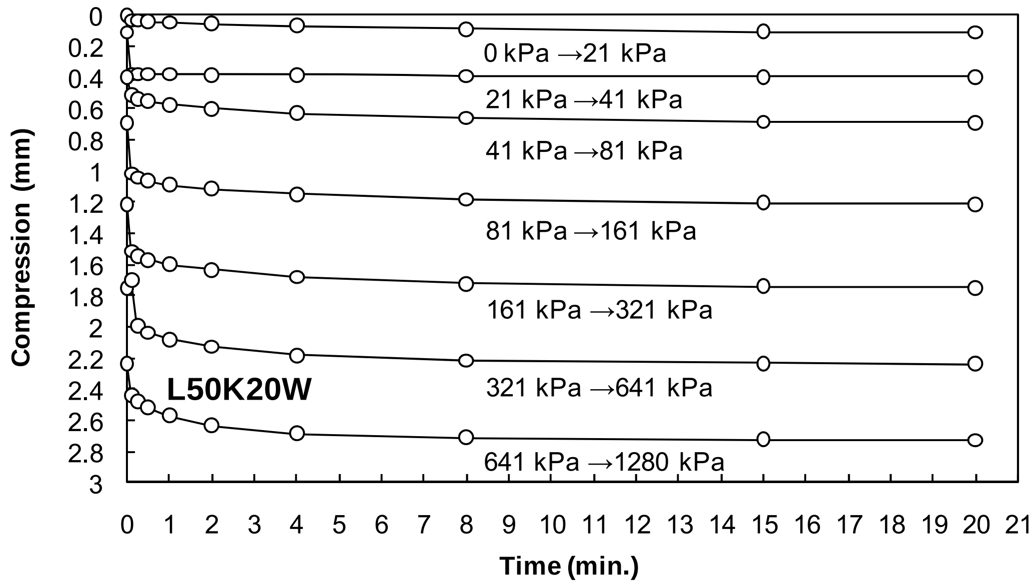


Figure H.63. Compression VS. Time (L50K20W)

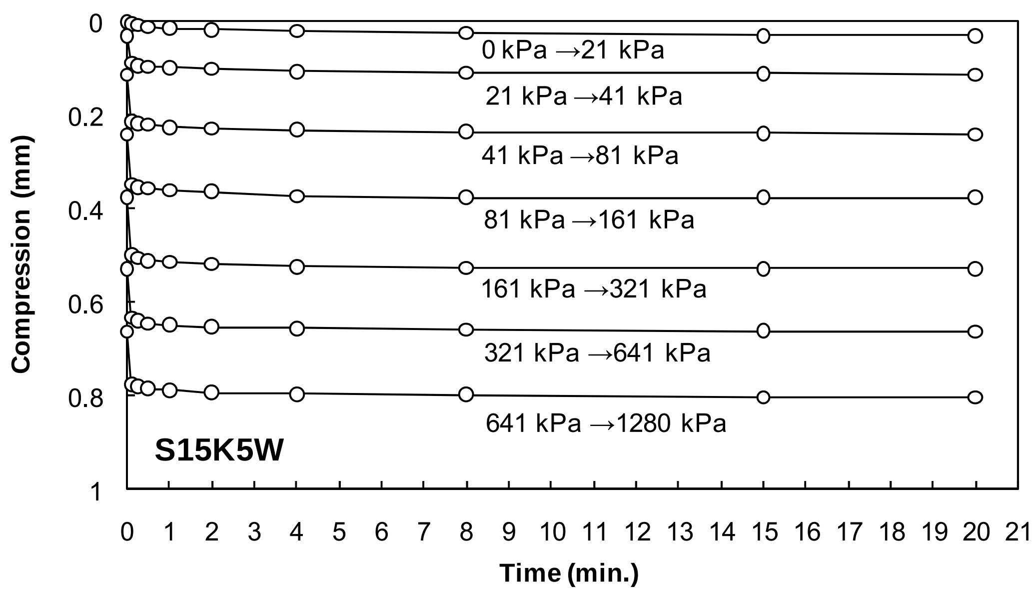


Figure H.64. Compression VS. Time (S15K5W)

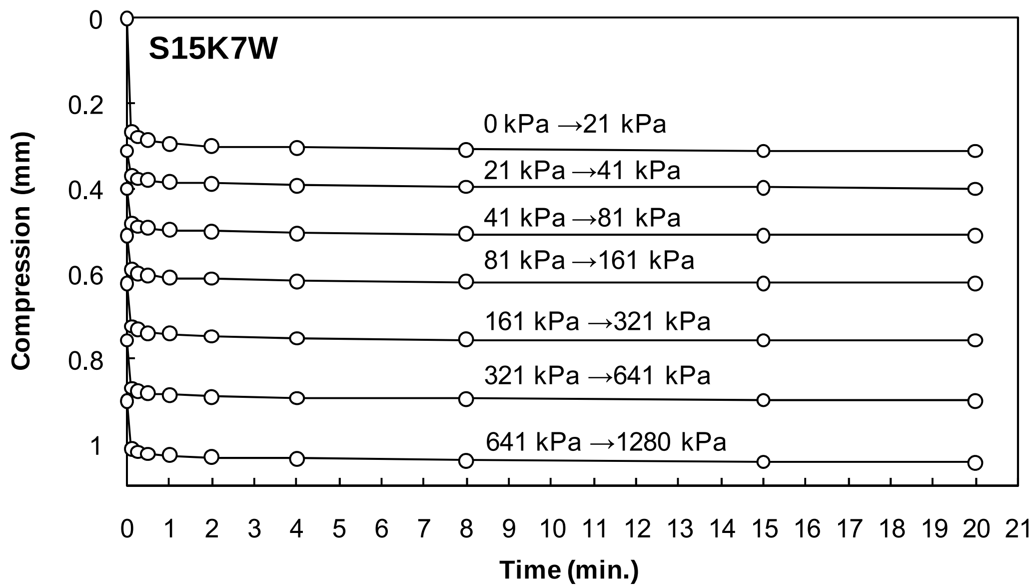


Figure H.65. Compression VS. Time (S15K7W)

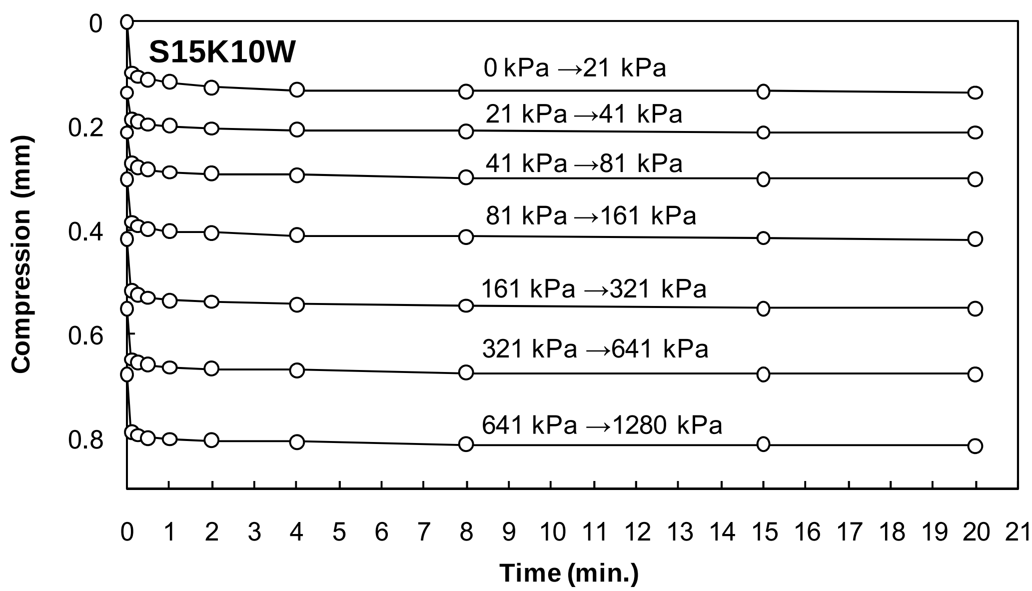


Figure H.66. Compression VS. Time (S15K10W)

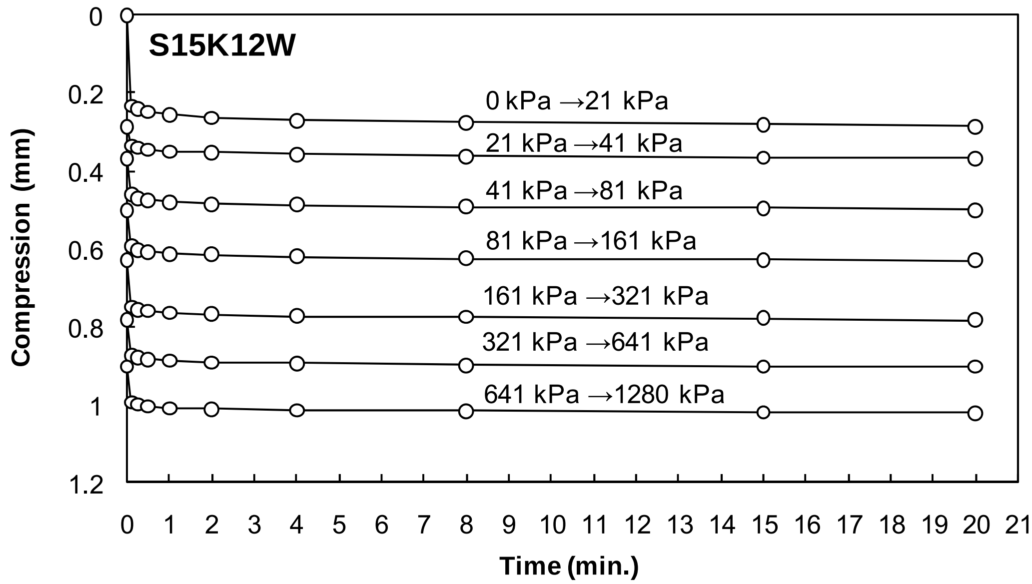


Figure H.67. Compression VS. Time (S15K12W)

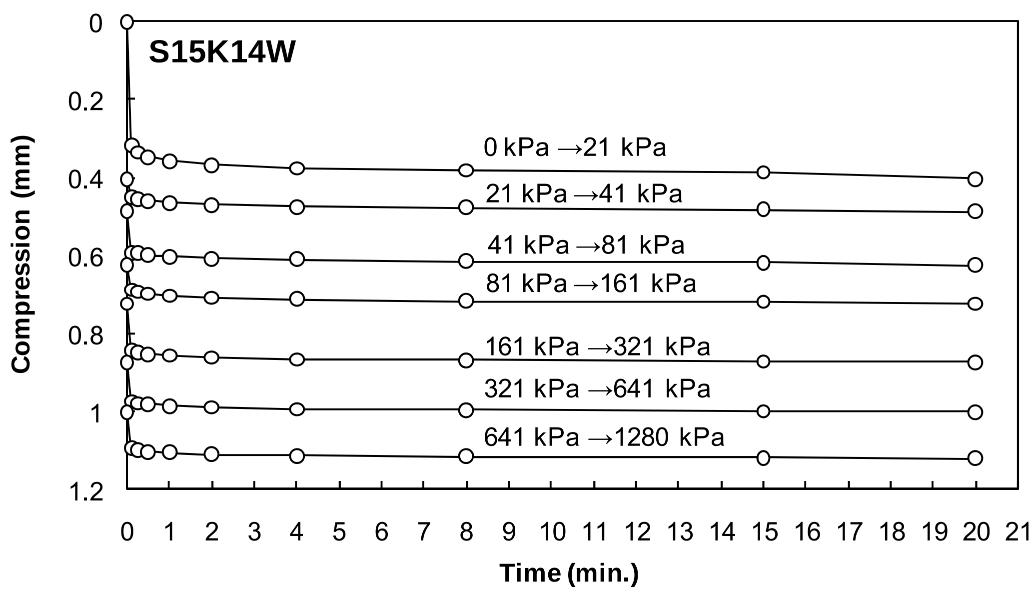


Figure H.68. Compression VS. Time (S15K14W)

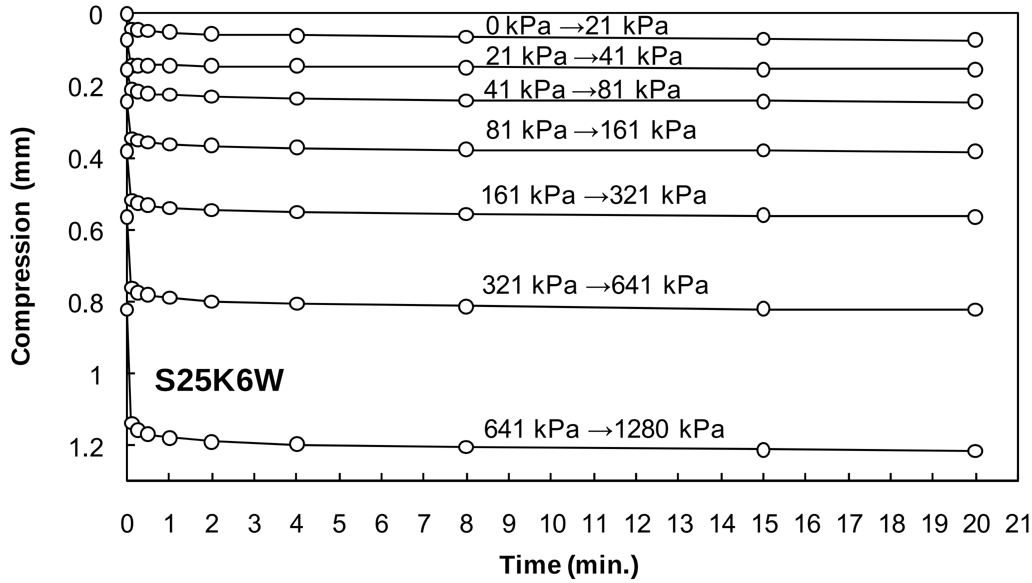


Figure H.69. Compression VS. Time (S25K6W)

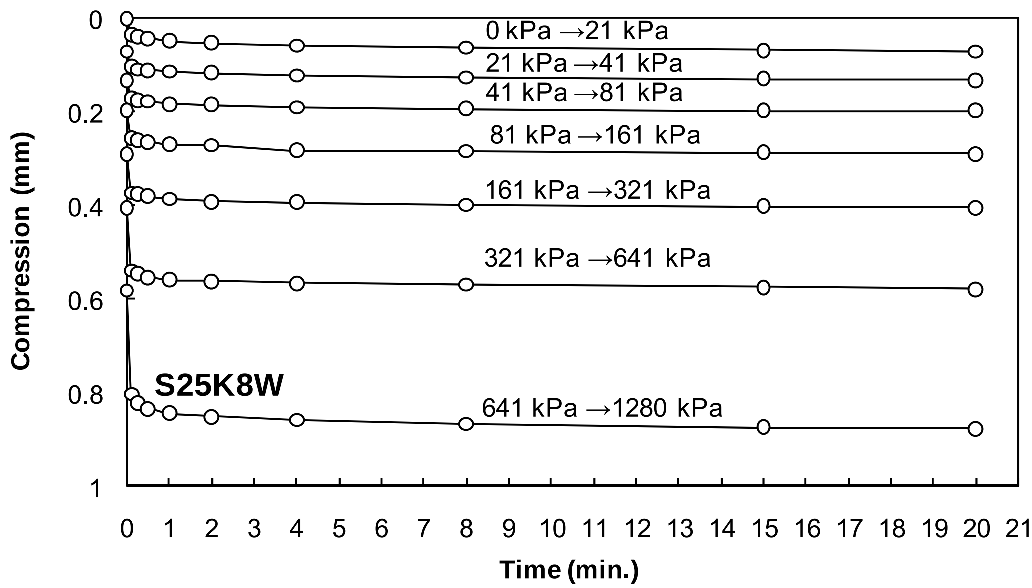
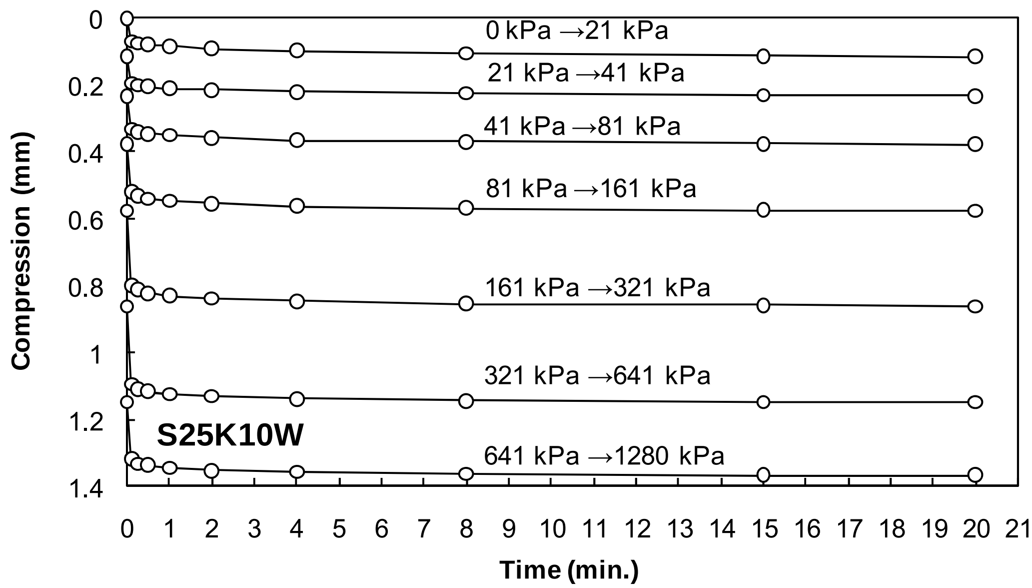


Figure H.70. Compression VS. Time (S25K8W)



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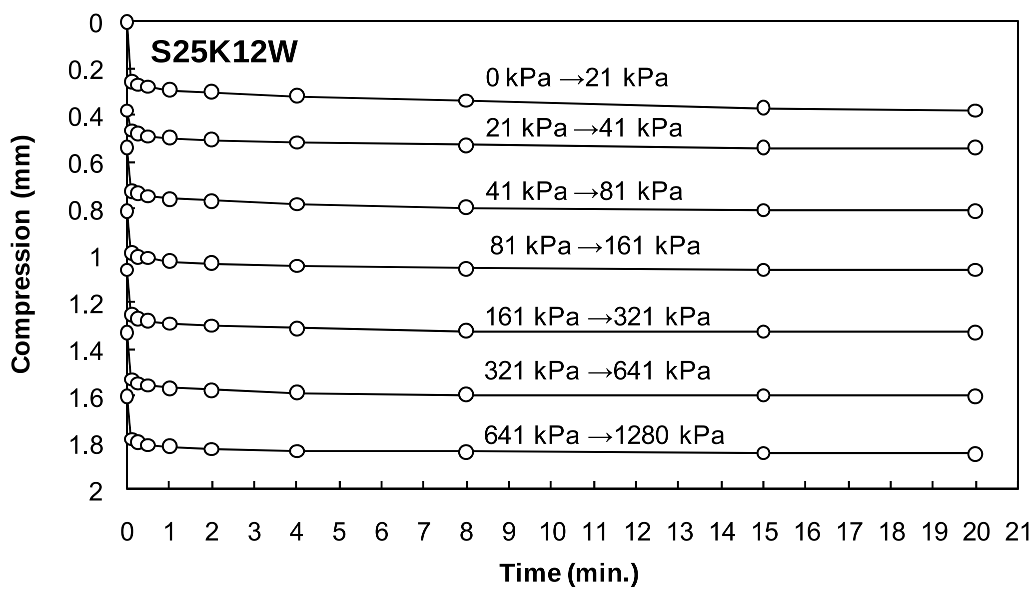

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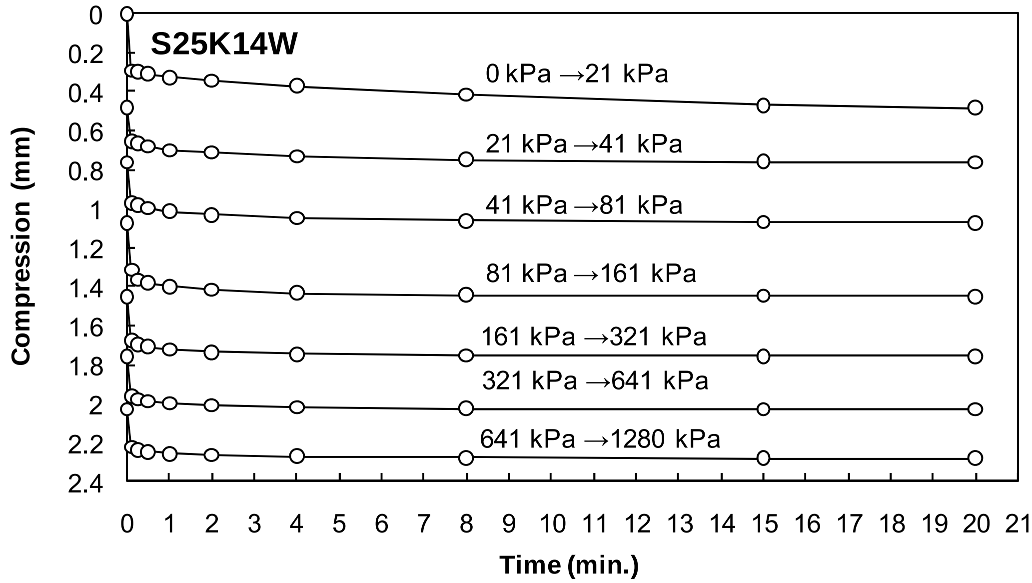

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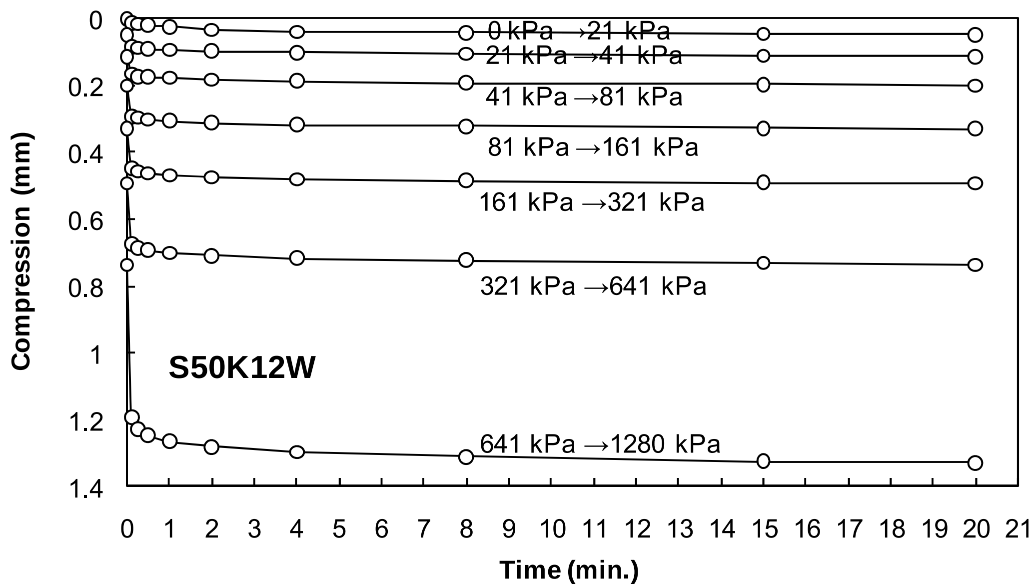
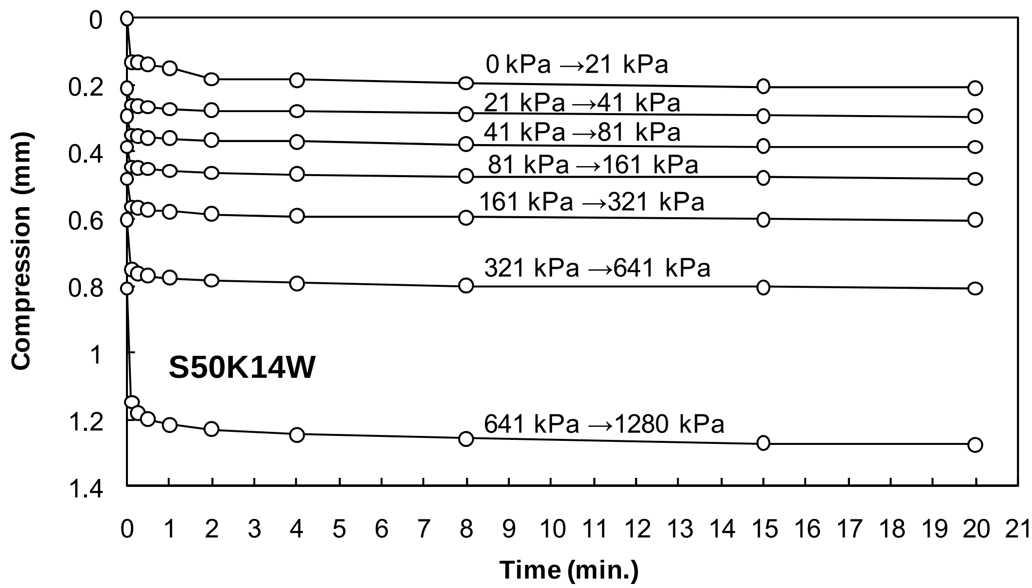


Figure H.74. Compression VS. Time (S50K12W)



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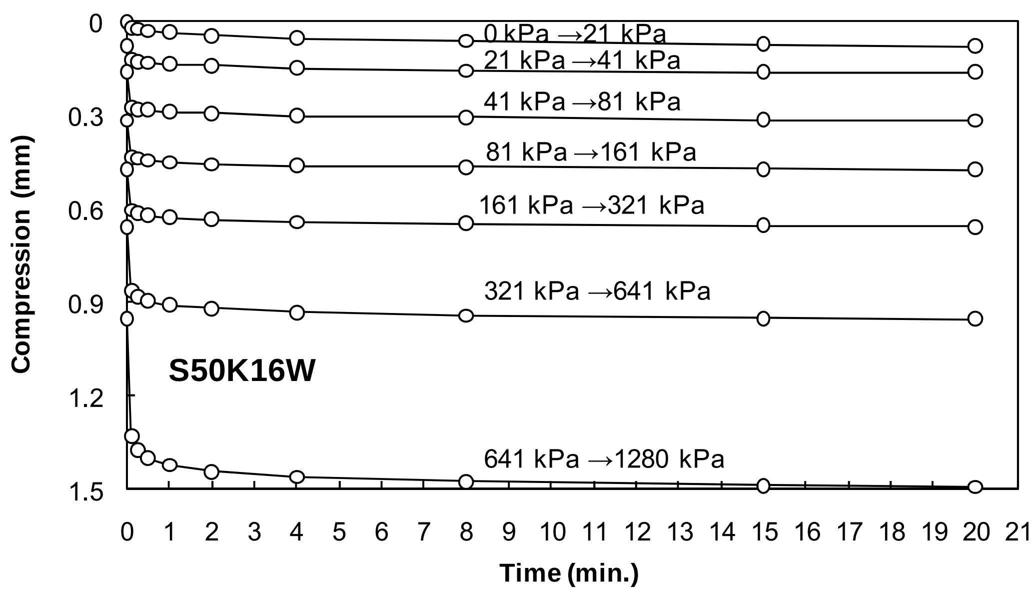

Figure H.76. Compression VS. Time (S50K16W)

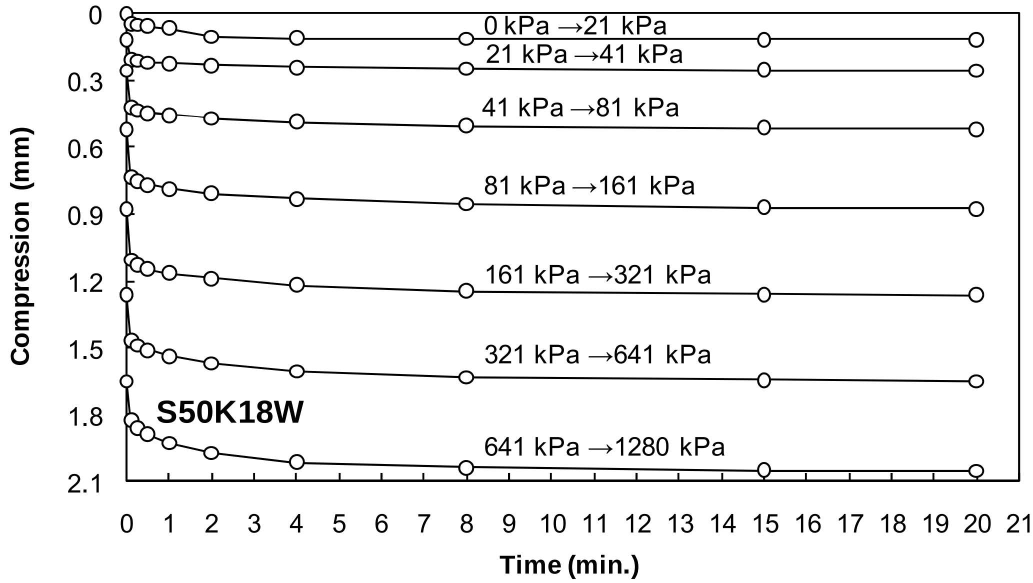

Figure H.77. Compression VS. Time (S50K18W)

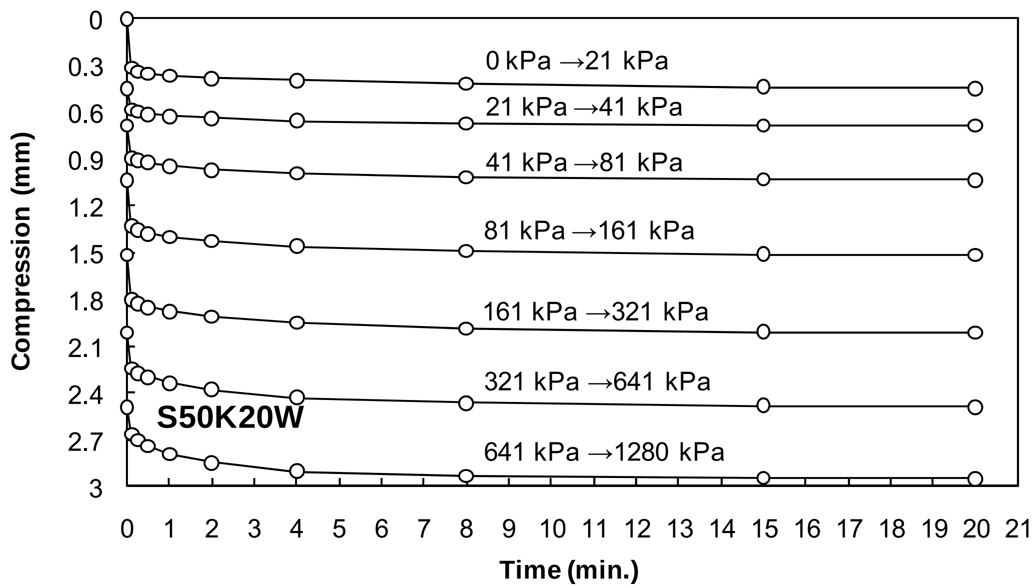

Figure H.78. Compression VS. Time (S50K20W)

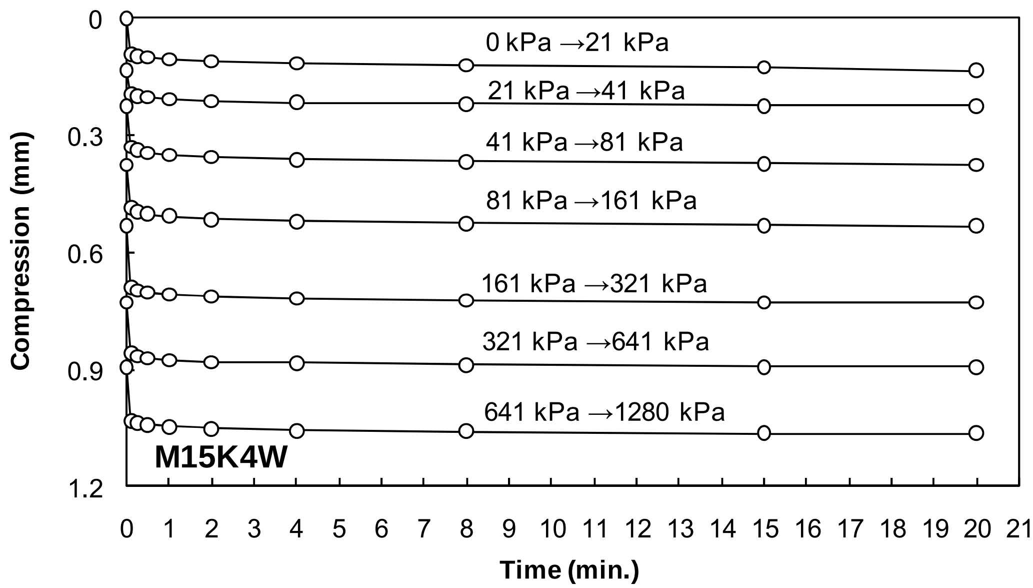

Figure H.79. Compression VS. Time (M15K4W)

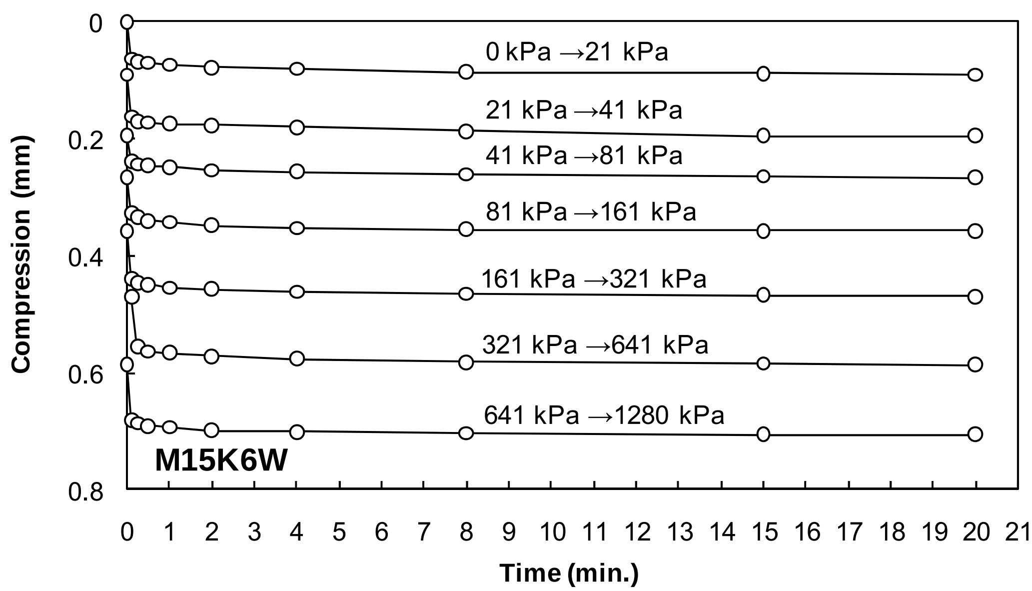

Figure H.80. Compression VS. Time (M15K6W)

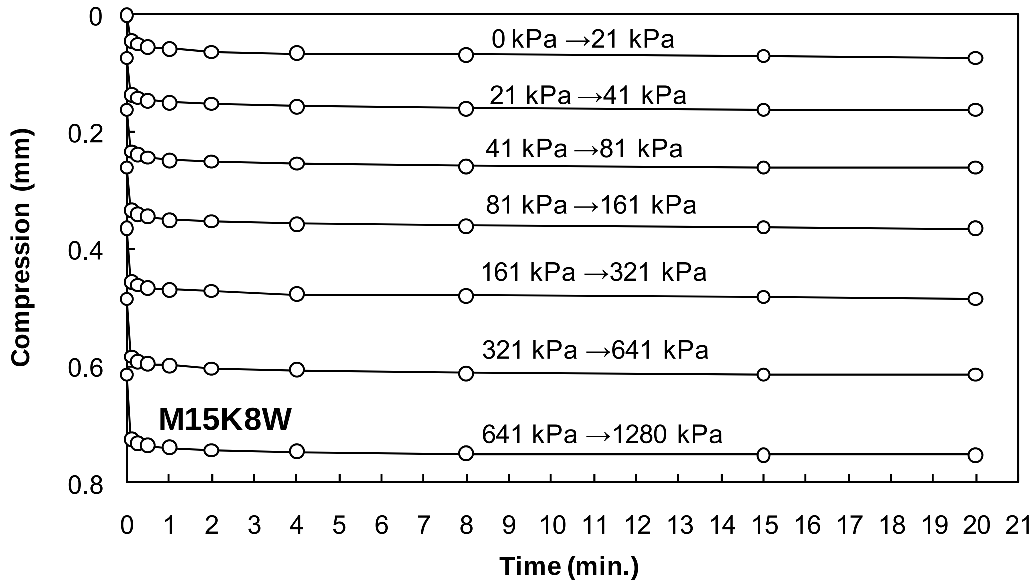

Figure H.81. Compression VS. Time (M15K8W)

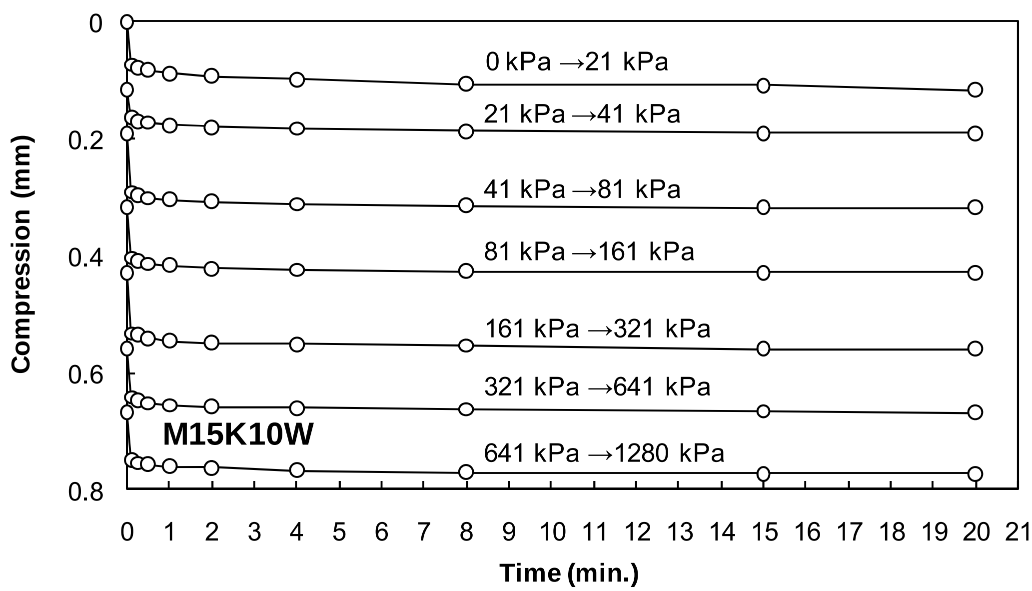

Figure H.82. Compression VS. Time (M15K10W)

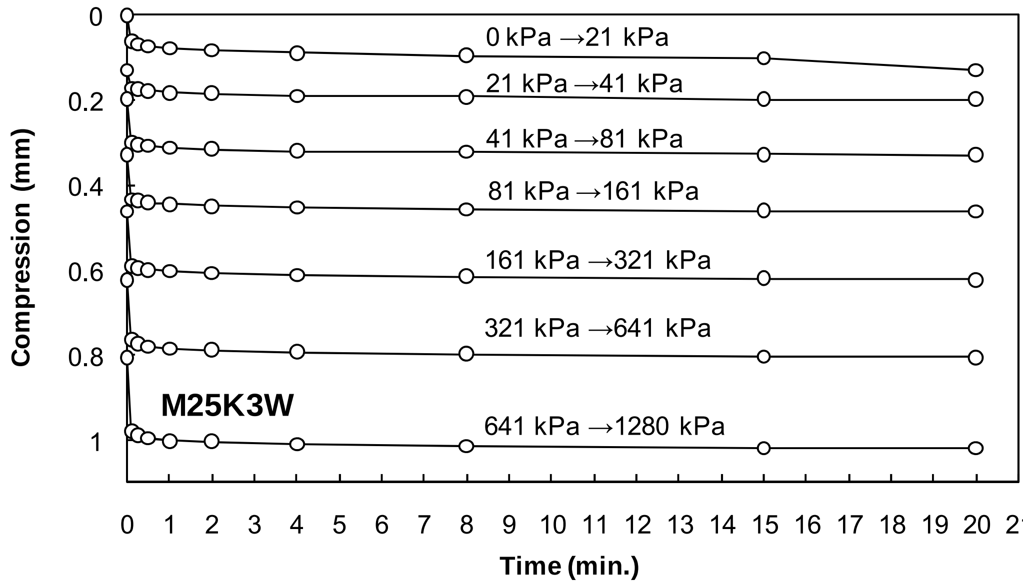

Figure H.83. Compression VS. Time (M25K3W)

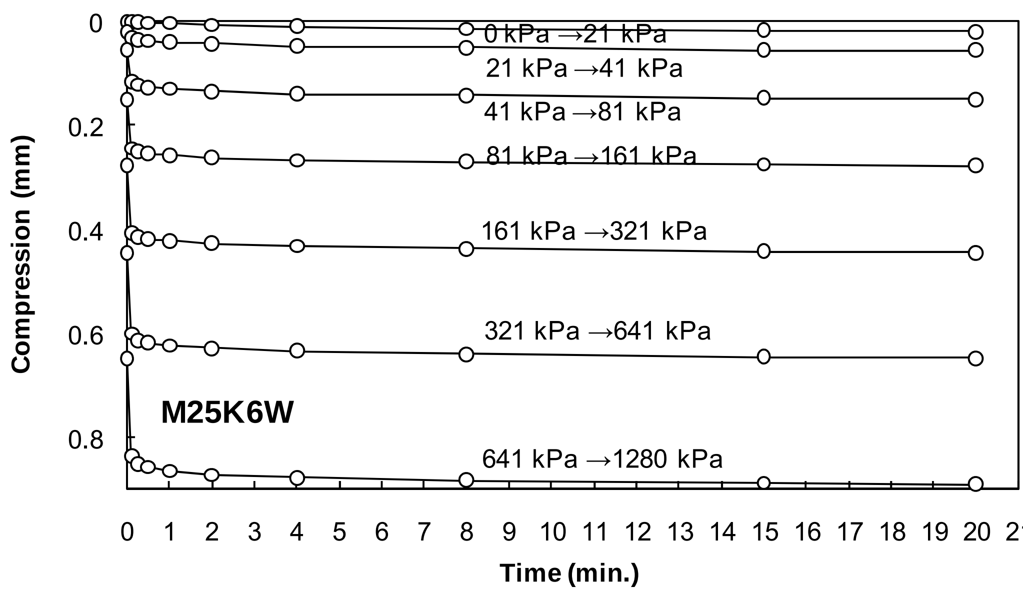

Figure H.84. Compression VS. Time (M25K6W)

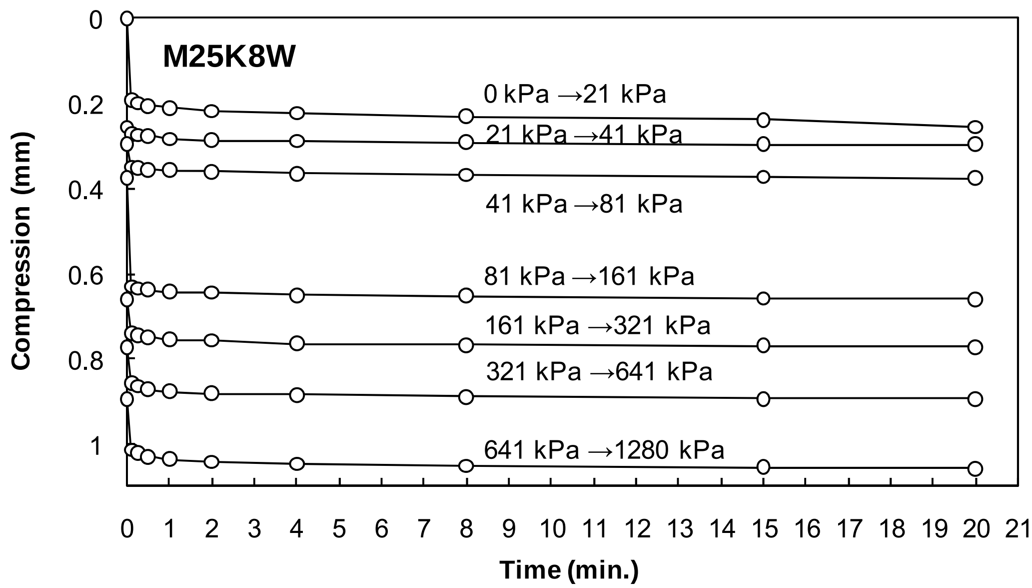

Figure H.85. Compression VS. Time (M25K8W)

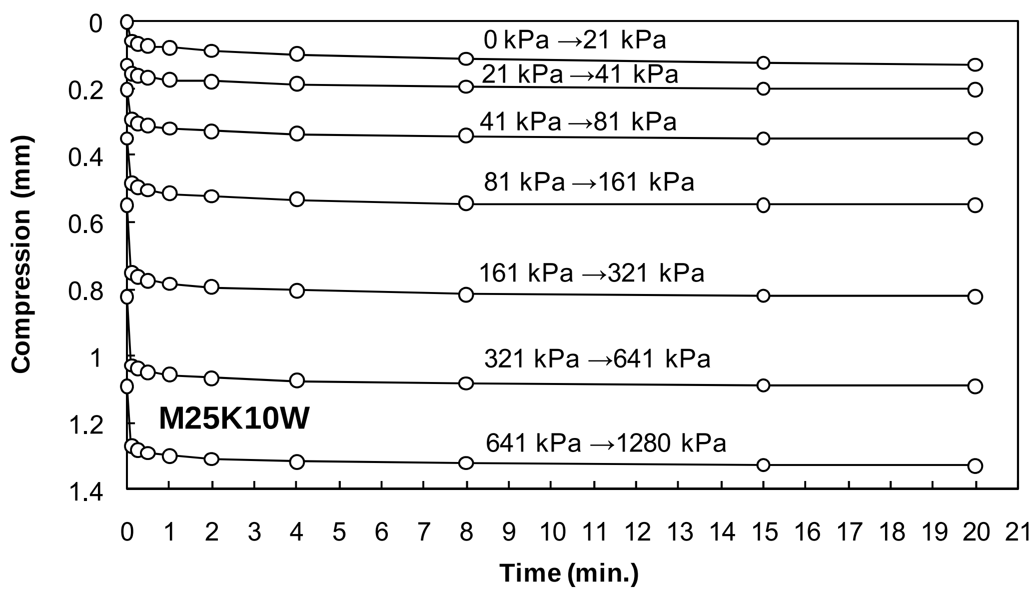

Figure H.86. Compression VS. Time (M25K10W)

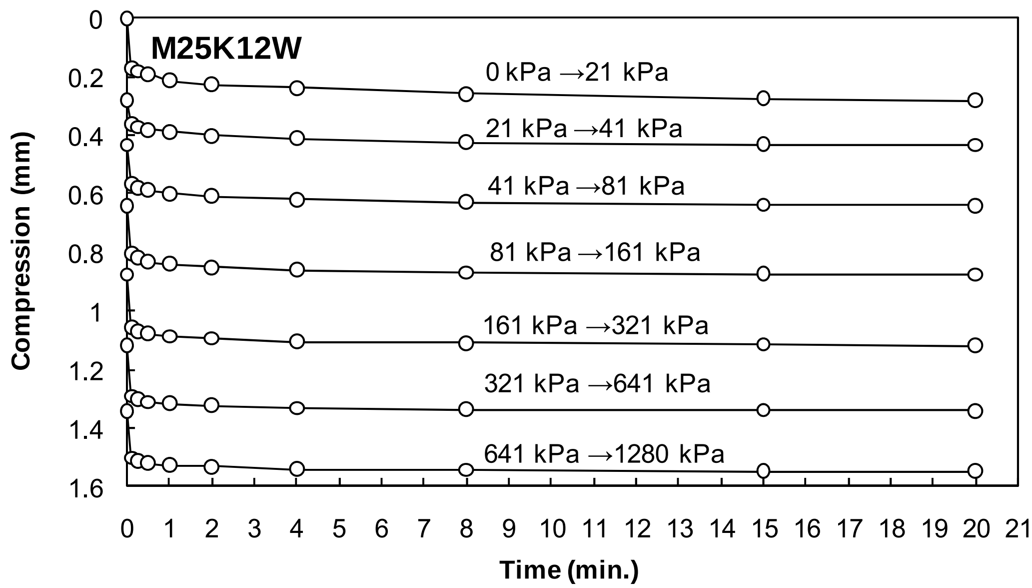

Figure H.87. Compression VS. Time (M25K12W)

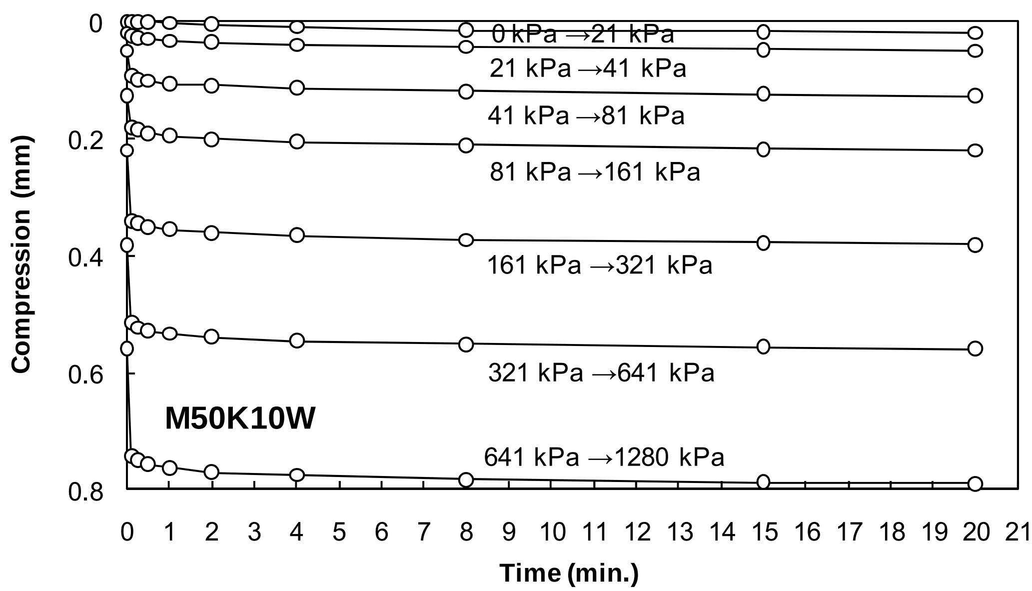

Figure H.88. Compression VS. Time (M50K10W)

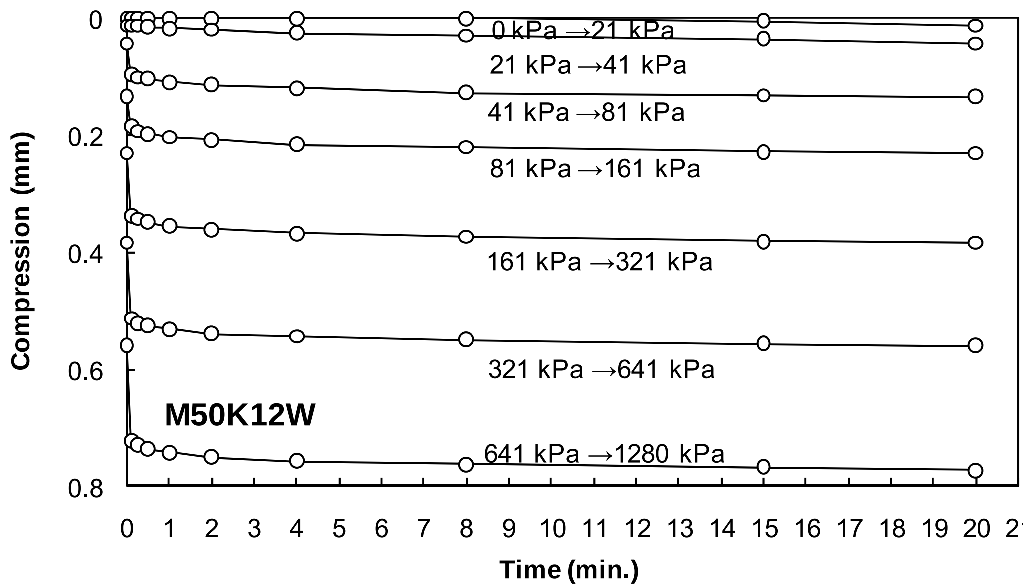

Figure H.89. Compression VS. Time (M50K12W)

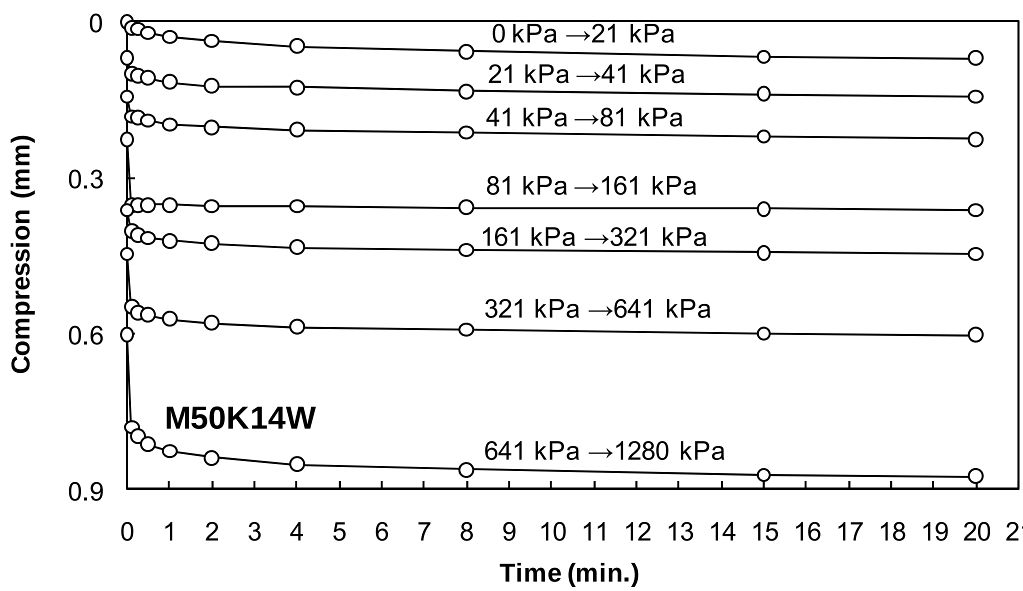

Figure H.90. Compression VS. Time (M50K14W)

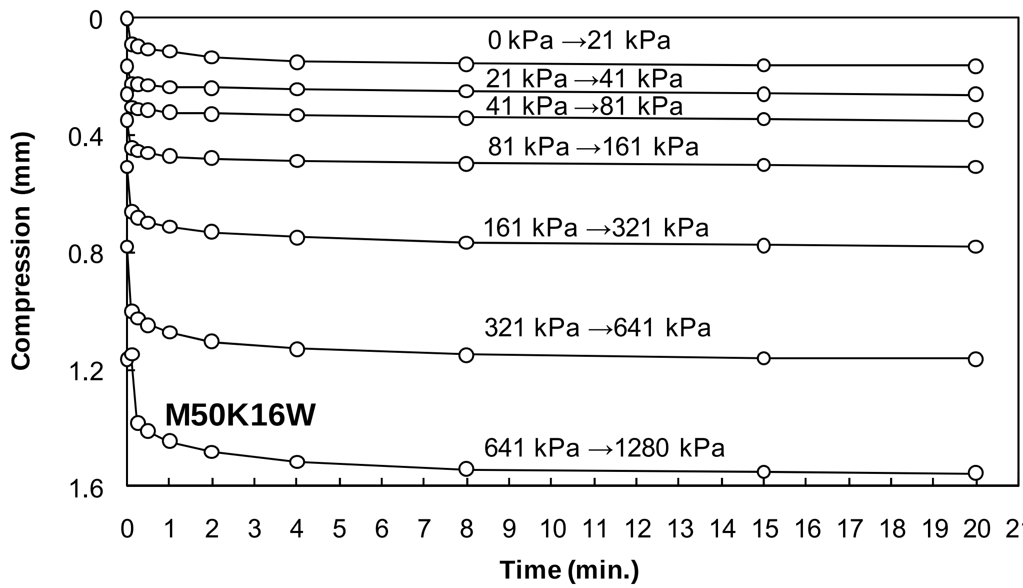

Figure H.91. Compression VS. Time (M50K16W)

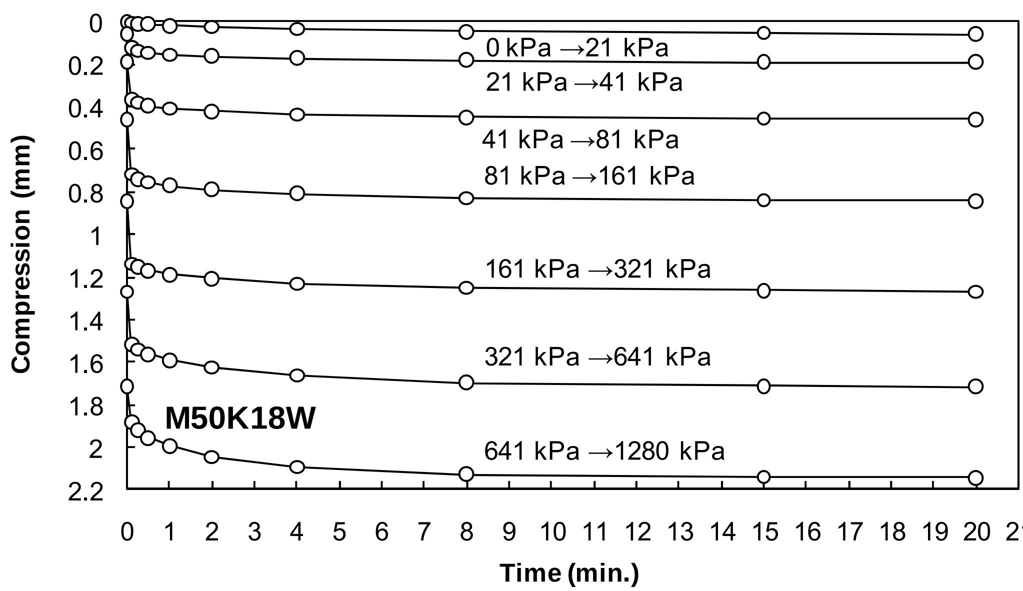

Figure H.92. Compression VS. Time (M50K18W)

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