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T000471

DOE/RL/12074--31 Rev. 0

0038314

ENGINEERING STUDY
LOAD/DEFORMATION CHARACTERISTICS OF POTENTIAL WASTE SOILS FOR THE ENVIRONMENTAL RESTORATION DISPOSAL FACILITY

April 1, 1994

Work Performed Under Master Interagency Agreement
No. DE-AI06-90RL12074
Task Order DE-AT06-93RL12107

SEP 1994
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Prepared for
U.S. Department of Energy
Field Office, Richland

RECEIVED
JUN 07 1994
ERDF DMC

Prepared by
DEPARTMENT OF THE ARMY
Walla Walla District, Corps of Engineers
Walla Walla, Washington 99362-9265

9413301.0313

CENPW INFORMATION RELEASE REQUEST (CEIRR)

1. Purpose.

Type of Information Release Document
Title Engineering Study, Load/Deformation Characteristics of Potential Waste Soils
Document No. DOE/RL/12074--31
Revision No. 0
Brief Description Load/Deformation Properties of ERDF Waste Soils

Unclassified Category N/A
Previous Clearance Approval Info N/A

2. CENPW Review.

Reviewer	Name/Title	Signature	Date
CENPW Peer Review, Tech Mgr	Greenwald/TM	[signature]	Apr 5 94
CENPW Peer Review, Div Chief	Kevin Oates	[signature]	4/10/94
CENPW ~~Special Assistant for~~ Quality Assessment auditor	Keith Neavor	[signature]	18 April 94
CENPW Editorial Review	Cpt. Rhoades	[signature]	20 Apr 94

3. CENPW Project Manager Request

Responsible Manager/Requester	Name/Title	Signature	Date
CENPW Project Manager	Cpt. Rhoades	[signature]	

4. DOE-RL Review

Reviewer	Name/Title	Signature	Date
~~DOE-RL Legal and Patent Review~~ CENPW-OC Release to Public review	BRENT/OC ~~Southworth/OGC~~	[signature]	5-2-94
DOE-RL Programmatic Review	Collins/PMD	[signature]	16 May 94

5. CENPW Document Clearance Approval

Approved for Release	Name/Title	Signature	Date
CENPW Project Mngr Approval	Cpt. Rhoades	[signature]	16 May 94

CENPW-OC (200) 28 April 1994

MEMORANDUM FOR CENPW-EN-EE (Wendell Greenwald)

SUBJECT: Engineering Study Load/Deformation Characteristics of Potential Waste Soils for the Environmental Restoration Disposal Facility

1. Pursuant to the Interagency Agreement (IA) between the U.S. Army Corps of Engineers (USACE) and the Department of Energy, Richland Operations Office (DOE-RL) and recent guidance from DOE-RL (document 94-EPB-041, 25 March 1994) stating that USACE Office of Counsel shall review "any documents prepared by USACE or it's contractors prior to release to the public," the above-referenced document has been reviewed for public release.

2. Document "Engineering Study Load/Deformation Characteristics of Potential Waste Soils for the Environmental Restoration Disposal Facility", DOE/RL/12074--31 Rev. 0, is approved for public release.

3. The approval for public release is only for document "Engineering Study Load/Deformation Characteristics of Potential Waste Soils for the Environmental Restoration Disposal Facility", DOE/RL/12074--31 Rev. 0. Further revisions of this document will need to be reviewed for public release as well. The review process may be expedited by highlighting the altered sections or additional language before submitting the revision to CENPW-OC for review.

4. If you have questions regarding CENPW-OC document review, you may contact me at (509) 522-6500.

JAMES C. BRENT
Assistant District Counsel

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ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
CBR	California Bearing Ratio
D	Constrained Modulus
D_r	Relative Density
DCDT	Direct Current Displacement Transducer
DOE	U.S. Department of Energy
e	Void Ratio
ERDF	Environmental Restoration Disposal Facility
H_0	Initial Thickness of Compressible Stratum
ID	Inside Diameter
IDO	Indefinite Delivery Order
lb	Pound
min	Minute
pcf	Pounds per Cubic Foot
psf	Pounds per Square Foot
S_c	Consolidation Settlement
S_i	Immediate Settlement
S_s	Secondary Compression (Creep) Settlement
S_T	Total Settlement
TEB	Trench and Engineered Barrier
USACE	U.S. Army Corps of Engineers
USCS	Unified Soil Classification System
WHC	Westinghouse Hanford Company
ϵ	Strain
ρ_d	Dry Density
σ_V	Vertical Stress

ENGINEERING STUDY
LOAD/DEFORMATION CHARACTERISTICS OF POTENTIAL WASTE SOILS FOR THE ENVIRONMENTAL RESTORATION DISPOSAL FACILITY

This study is one of a number of engineering studies conducted to develop the design concept for the Environmental Restoration Disposal Facility (ERDF) at Hanford. The objective of this engineering study is to determine the load/deformation characteristics of potential soil types that may be disposed of in the ERDF. From these characteristics, the amount of settlement can be estimated. If necessary, requirements for compaction of the waste soils to prevent excessive settlement that could damage the permanent closure cover for this facility will be identified.

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The U.S. Department of Energy (DOE) has tasked the U.S. Army Corps of Engineers (USACE) to perform detailed planning for the development of the conceptual design for the ERDF at the Hanford site near Richland, Washington. The production of plutonium and related activities since 1943 have resulted in significant environmental (primarily soil) contamination on the Hanford site. The ERDF will serve as the disposal facility for the majority of wastes excavated during remediation of waste management sites in the 100 and 300 areas of the Hanford facility. The overall project has been designated by Westinghouse Hanford Company (WHC) as project W-296, and is defined as the design and construction of the facility through the year 2001. The operation of the facility after the year 2001 will be performed under another project. The USACE has tasked Montgomery Watson to conduct this engineering study under Delivery Order No. 0026, under indefinite delivery order (IDO) contract number DACW68-92-D-0001 with the Walla Walla District.

As presently conceived (USACE, 1993a), the ERDF will consist of a single large disposal trench (landfill), approximately 70 feet deep and 1,000 feet wide across the floor. Eventually, the trench will be about 9,000 feet long to accommodate approximately 28.5 million cubic yards of waste. However, the trench will be constructed on an as-needed basis, and only a fraction of the ultimate length will be developed as part of Project W-296. The portion of the trench constructed for Project W-296 will be lined with a double composite liner system that satisfies the minimum technology requirements for RCRA Subtitle C hazardous waste facilities.

The ERDF will be permanently closed with the Hanford Barrier, a long-term cover developed by WHC, Pacific Northwest Laboratory, and Kaiser Engineers

Hanford. The Barrier is a multi-layered cover system that has several components designed to reduce infiltration of precipitation to negligible levels and to minimize the potential for human and biotic intrusion. The Hanford Barrier is approximately 15 feet thick and is constructed of natural materials, primarily soil and rock, to maximize its longevity (Wing, 1993). The load applied by the Barrier will be substantial and will cause settlement of the underlying waste. Excessive settlements could damage the Barrier or reduce its effectiveness. Consequently, although the Barrier is not part of Project W-296, it must be considered when developing waste placement procedures.

The purpose of this study is to evaluate compaction requirements for waste soils that may be disposed of in the ERDF. Compaction will be used to limit settlements to acceptable levels. Methods for limiting settlement were initially addressed in the Trench and Engineering Barrier (TEB) study (USACE, 1993b). This study concluded that waste settlement should be limited to about 3% and that mechanical compaction (for example, with a roller) was a potentially suitable method. The TEB study also recommended laboratory testing of actual soils to determine their compaction characteristics. Limited testing of one soil type (a sandy gravel) and a more detailed settlement analysis were performed in the Area Fill Study (USACE, 1993c). The results of this study indicated that settlements of this soil type could be limited to 1%, well within the acceptable range, using conventional compaction methods. The Area Fill study recommended that testing be performed on other soil types representative of the broader range of materials that might be expected in the ERDF.

The testing described in this document therefore represents a continuation of the earlier studies. For this reason, previous analyses will not be duplicated here in their entirety. The following sections of this report will:

- review settlement considerations (Section 2),
- describe the soils tested (Section 3),
- discuss the testing program (Section 4),
- present the test results (Section 5), and
- provide the conclusions of this study (Section 6).

Laboratory test data are included in an Appendix.

1.2 EXECUTIVE SUMMARY

Compressibility tests were performed on representative Hanford site soils to determine settlement potential and establish compaction requirements to limit settlements to acceptable levels. Excessive settlement could damage the permanent closure cover, the Hanford Barrier, and compromise its effectiveness in limiting infiltration.

Three types of soils were tested for this study: gravel, silty fine sand, and medium sand. These samples are considered representative of soil types that may be disposed of in the ERDF.

Minimum and maximum density tests were performed on the soils to determine the range of possible densities and to guide subsequent compressibility tests. Standard and Modified Proctor tests were also performed to correlate relative density requirements with standard construction (earthworks) practice.

One dimensional loading tests were performed on the soil samples at various densities and moisture contents. Modulus values were derived from the test data. These values were consistent with values reported in the literature for similar soil types. The compressibility testing also showed that:

- In a given test, the soil becomes stiffer as load increases.
- For a given soil type, modulus generally increases with increasing relative density.
- The effect of compaction moisture on modulus values is minimal.

The test data were also analyzed with respect to void ratio changes. This analysis showed that:

- Samples with lower initial densities compress more than samples with higher initial densities.
- The void ratios of looser samples remain above the void ratios of denser samples, even with repeated loading. This implies that purely static loading will be insufficient to densify the waste soils at the Hanford site and that some type of dynamic compaction is required.
- Compaction moisture content has little effect on test results.

The compressibility results were used to estimate settlements. Two methods were employed to calculate settlements. The first used the laboratory modulus values and the load applied by the Hanford Barrier to calculate immediate settlement. Additional long-term settlement after the Barrier is in place was estimated with empirical factors from the literature. This approach showed that soils compacted to a dense (70% to 85% relative density) state would experience maximum settlements of about 1%. This is well below the allowable settlement value of 3%.

The second method used to estimate settlement considered minimum void ratio as the limiting factor on ultimate settlement. This method is considered conservative in that it provides an upper bound estimate on potential settlement.

Using the maximum allowable settlement of 3%, a relative density of 80% is required for the waste soils.

Both methods for estimating settlement indicate that Hanford soils should be compacted to a dense condition, and a relative density of 80% is expected to satisfactorily limit ultimate settlement of the Hanford Barrier, regardless of soil type. This degree of compaction is roughly equal to 95% of Modified Proctor density (ASTM D 1557) and can be achieved with heavy vibrating compaction equipment that is typically used for earthwork construction. Testing should be performed prior to or early in the waste placement process to determine the appropriate equipment type, lift thickness, number of passes, and other parameters to achieve required densities.

2.0 SETTLEMENT

2.1 GENERAL

The primary purpose of the Hanford Barrier is to isolate contaminated wastes at the Hanford ERDF from surface water infiltration. Consequently, the long term integrity of the Barrier is vital for the facility to function successfully. Excessive settlement of the disposed waste materials could damage the Barrier, resulting in increased infiltration and leachate production. Two types of settlement should be considered:

- Uniform Settlement: settlement over a broad area that may reduce the final grade of the Barrier. A slope of 1% is considered the minimum necessary to provide adequate drainage within the Barrier. In the TEB Study (USACE, 1993b), analyses indicated that waste settlement should be no more than 3% to avoid unacceptable flattening of grades where the Barrier crosses the side slopes of the disposal trench.

- Differential Settlement: non-uniform settlement occurring over a relatively short distance. In this case, overlying materials could undergo substantial shear strain and possible disruption. In the Hanford Barrier, such strains could damage or possibly breach the asphalt layer that functions as a moisture barrier. Even limited shear offsets or flexural cracking could create preferential pathways for infiltration. Although difficult to model, it is believed that differential shear displacements should be limited to a maximum of 1 or 2 inches (USACE, 1993b). Differential settlement would result primarily from long-term collapse of waste containers that are not completely filled. This type of waste is expected to be less than 2% of the total volume of waste disposed of in the ERDF (USACE, 1993c). The remainder of the waste will be bulk soils which can be compacted to avoid differential settlement. In addition, containers can be filled with grout or other methods used to prevent collapse. A detailed discussion of the problems associated with containerized waste is presented in another engineering study (USACE, 1993c). The remainder of this study will focus on uniform settlement.

Considering that the ERDF is intended to provide permanent disposal and recognizing the uncertainties of long term settlement prediction, a conservative approach to limiting settlement of the Hanford Barrier is desirable.

2.2 SETTLEMENT COMPONENTS

In general, total settlement of a soil stratum, S_T, is the sum of the immediate settlement, S_i, the consolidation settlement, S_c, and the secondary compression (or creep) settlement, S_s (Holtz and Kovacs, 1981):

$$S_T = S_i + S_c + S_s \qquad (1)$$

Immediate settlement is time-independent settlement that occurs simultaneously with any increase in effective stress from overlying material. For the ERDF site, immediate settlement will take place as the waste soils and Barrier are placed. Immediate settlements can be estimated using a one-dimensional settlement equation (Holtz and Kovacs, 1981):

$$S_i = \frac{\Delta\sigma_V' \, H_0}{D} \qquad (2)$$

where:

	$\Delta\sigma_V'$	= increase in vertical effective stress
	H_0	= initial thickness of compressible stratum
	D	= one-dimensional constrained modulus ($\Delta\sigma_V'/\Delta\epsilon$)
	ϵ	= vertical strain

Consolidation settlement is time-dependent settlement that occurs as a result of the dissipation of excess pore pressure within a soil stratum. Because the waste soils will be unsaturated granular materials, excess pore pressures will not develop; therefore, consolidation settlement will not occur at the ERDF site.

Secondary compression settlement is ongoing creep that results from the time-dependent rearrangement of soil particles, particle crushing, changes in moisture content, and possibly other mechanisms under constant effective stress conditions. Although granular soils show significantly less creep effects than do clays, creep settlement can be important over the long term, especially for loose granular soils under high stress conditions (USACE, 1993c). This type of settlement may occur in ERDF waste soils.

2.3 SETTLEMENT OF GRANULAR SOILS

Several factors influence the compressibility of granular materials:

- Gradation: Well-graded soils are less compressible than uniform or gap-graded materials of the same composition, grain shape, and

relative density. For ERDF wastes, gradation will depend on the type of waste soil and for practical purposes cannot be changed.

- State of compaction or relative density: Dense soils will be less compressible than loose soils, other factors being equal. As an example of the relationship between relative density (see below) and compressibility, testing conducted by the Bureau of Reclamation (Hilf, 1991) showed that a sand was more than twice as compressible at a relative density of about 40% than at a relative density of 70% under a stress of 3,600 psf. This difference increased to a factor of three at a stress of 29,000 psf. It has been estimated that more than 90% of the compression in cohesionless soils occurs between relative densities of 10% and 70% (Holtz, 1991). The remainder of this study will estimate the compaction required to limit settlements to acceptable levels.

- Stress history: Granular soils that have been previously loaded to a given stress level will be several times less compressible than soils loaded to that stress level for the first time (Holtz, 1991). This phenomenon cannot be used to improve the settlement characteristics of ERDF waste unless large pre-loads are applied to the waste before installing the Hanford Barrier. Placement and removal of thick soil pre-loads is not planned at this time for practical reasons. In addition, pre-loading will not improve the ability of the waste to resist vibration-induced settlement (see below).

- Moisture: Introducing moisture into a granular soil fill can cause substantial amounts of settlement. According to Lawton et al. (1992), virtually all types of compacted soils, including clean sands and soils containing substantial gravel fractions, are subject to moisture-induced settlement. However, at the ERDF, several years will elapse between waste placement and construction of the Hanford Barrier. Most moisture-induced settlement in the waste fill is expected to occur during this time. After the Barrier is in place, infiltration will likely be reduced to negligible levels, and moisture-induced settlement will not be significant. Should the Barrier leak, however, this mechanism could be activated and cause local settlement.

- Vibration: Loose granular soil fills are susceptible to densification caused by vibrations such as seismic tremors. If the vibration is strong enough or repeated enough times, the soil structure will be disrupted and the particles will rearrange. This rearrangement leads to settlement. Although the ERDF site is not considered seismically active (USACE, 1993c), moderate seismic tremors may occur during the long design life of the Hanford Barrier (1000 years). This

suggests that loose soils should be avoided if for no other reason than susceptibility to vibration.

Regardless of the mechanism, settlement will be essentially limited by the minimum void ratio of the granular fill. Taking this fact into consideration, the density of the fill becomes a critical factor in computing the maximum settlement that may occur.

The density of a soil can be defined as either a percentage of some density related to a specified compactive effort or in relation to the "loosest" and "densest" state that the soil can exhibit. Relative compaction (i.e., percentage of maximum dry density as determined by Proctor testing) is generally used for cohesive soils or well-graded sands where a well-defined moisture-density relationship can be established (Ervin, 1993). However, for very coarse granular soils such as gravels, this approach is not practical because the relationship between moisture and density is poorly defined (Hilf, 1991). Therefore, for these soil types, relative density is used. Relative density is defined as follows:

$$D_r = \frac{e_{max} - e}{e_{max} - e_{min}} \; x \; 100\% = \frac{1/\rho_{dmin} - 1/\rho_d}{1/\rho_{dmin} - 1/\rho_{dmax}} \; x \; 100\% \qquad (3)$$

where:

e = void ratio
e_{max} = maximum void ratio
e_{min} = minimum void ratio
ρ_d = dry density
ρ_{dmax} = maximum dry density
ρ_{dmin} = minimum dry density

Relative density can also be determined for finer grained soils.

3.0 WASTE SOILS

The wastes to be placed in the ERDF are defined in the Project W-296 Functional Design Criteria (WHC, 1993a), which in turn cites the predesign guidance document for the 100 B/C Area remediation (WHC, 1993b). The waste disposed of in the ERDF will be predominantly contaminated granular soils (sands and gravels). Disposal of free liquids is not expected. In addition, compactible wastes (such as drums or pipes) will be volume reduced, and large irregular objects will be flood-grouted. These waste restrictions and placement methods will eliminate waste forms that are likely to cause large settlements or significant differential settlements.

Three types of soil, representing the range of soils that are expected to occur, were collected for testing. These include:

1. Sandy Gravels. Gravel samples were collected from a gravel pit located immediately to the north of the ERDF site. The grain-size distribution for these samples is shown on Figure 3-1. For comparison purposes, a grain-size distribution for 100 B/C Area soils (WHC, 1993b) has also been included. The two curves are similar, although the 100 B/C material is somewhat more uniformly graded. As noted above, well-graded soils are less compressible than poorly graded soils, other factors being equal. Hence, the samples tested in this study are expected to give comparable to slightly conservative results with respect to 100 B/C soils. The sampling location was selected because representative strata were easily accessible and were known to be uncontaminated. These samples are referred to as the 200E-200W gravels.

   For testing, all material greater than 1.5 inches in diameter was removed by screening. Although very coarse soil may form a significant fraction of the waste from some areas, this type of material tends to be relatively stiff. The bulk compressibility will be controlled by the finer grained matrix. Consequently, the effect on the test results of removing this material is expected to be negligible to slightly conservative.

2. Medium Sand. Sand samples were collected from the Solid Waste Landfill, located in the southeast part of the 200 Areas plateau. The grain-size distribution of this material is shown on Figure 3-2. This soil type is relatively uniform in size and consequently may have higher settlement potential than a more well-graded material. These samples are referred to as the SWL sand.

3. Silty Fine Sand. Silty fine sand samples were collected from the excavation for the Project W-025 Landfill, located in the 218-W-5 burial ground in the northwest corner of the 200W Area. This material is classified as an eolian deposit and is considered representative of the finest-grained type of soil that might be disposed of in significant quantities in the ERDF. The grain-size distribution of this soil is shown on Figure 3-3. These samples are referred to as the NDOLF sand.

Given the heterogeneous nature of the Hanford formation, which reflects its origin as a flood deposit, it is possible that any of the above materials, or combinations of them, could be encountered in a given remediation site. However, as discussed above, uniform soils are generally more compressible than well-graded soils. Therefore, testing of the individual soil types will provide a conservative estimate of the settlement potential of the waste soil placed in the ERDF.

Bulk samples were collected from a single location for each soil type to provide a consistent, uniform material for laboratory testing.

4.0 LABORATORY TESTING PROGRAM

The following tests were performed on the soil samples:

- Grain-size distribution (ASTM D 1140 / C 136)
- Maximum density (ASTM D 4253)
- Minimum density (ASTM D 4254)
- Standard Proctor density (ASTM D 698), sand samples only
- Modified Proctor density (ASTM D 1557), sand samples only
- One-dimensional compression testing (Golder Associates Inc. procedure).

The grain size and density tests were performed to characterize the soils and to define the possible range of densities. Proctor testing was not performed on the gravel samples because they are too coarse to provide meaningful results.

4.1 SOIL CLASSIFICATION

Grain-size distribution curves of each soil type are presented on Figures 3-1 through 3-3. Under the Unified Soil Classification System (USCS), the samples are classified and described as follows:

SOIL TYPE	USCS CLASSIFICATION	DESCRIPTION
200E-200W	GW	Well-graded sandy GRAVEL, trace silt
SWL	SW	Poorly-graded medium SAND, trace gravel and silt
NDOLF	SP-SM	Poorly-graded medium to fine silty SAND

4.2 DENSITY TESTING

The results of the density testing are presented in Table 4-1.

Proctor tests were conducted on the sands to assess the potential range of densities achievable in the field using standard compaction methods. Moisture-density curves from the Proctor tests are shown on Figures 4-1 through 4-4. Standard Proctor results simulate the effects of light to medium compaction equipment, and densities of 90% of Standard Proctor dry density are considered relatively easy to achieve in practice. Modified Proctor results simulate heavier equipment, and 95% of Modified Proctor dry density is considered the upper limit of what is readily achievable in practice.

Minimum and maximum densities were measured for all soils because relative density has proven to be a more significant parameter than Proctor dry density alone in predicting the engineering properties of granular soils. These values were used to determine test conditions for the compression tests, as discussed below. The maximum density can be measured using either dry or wet soil; the moisture content can in some cases significantly affect the results. The ASTM recommends that both dry and wet methods be performed when beginning a new project. The data for this study indicate that, with the exception of the 200E-200W gravel, the method used does not have a significantly affect the value obtained.

One result of the density testing was that the modified Proctor density exceeded the maximum density for both the SWL and NDOLF sands. The modified Proctor density is normally expected to fall near, but below, the maximum density. However, it should be noted that the maximum and minimum relative densities are not unique properties of a given soil. Rather, they are based on completion of arbitrary, yet standardized procedures and do not represent actual extremes (Ervin, 1993). In addition, soil particles can be crushed by the Proctor testing procedures, yielding higher overall densities.

4.3 COMPRESSIBILITY TESTING

The ERDF landfill will be relatively long and wide compared to its depth. Therefore, one-dimensional compressibility testing is well-suited for use in estimating the settlement potential of the waste soils. The objective of the laboratory testing program was to measure the one-dimensional constrained modulus, D, at various relative densities and compaction water content conditions.

Settlement characteristics of the Hanford soils were determined in the Geotechnical Laboratory of Golder Associates Inc. Redmond, Washington, office. There is no standard procedure for the compressibility test, so the following method was used:

- Compact the soil in a 6-inch ID California Bearing Ratio (CBR) mold at the desired moisture content and density.

- Load the sample at a constant strain rate to approximately 13,000 psf to simulate the load applied by the maximum depth of waste, interim cover, and the Hanford Barrier (a total of 100 feet at 120 pcf). Measure load and deformation at periodic increments during this process.

- Hold the maximum load for 15 minutes to qualitatively determine short-term creep behavior.

- Unload sample, measuring load and deformation at periodic increments.

- Repeat the loading cycle to 13,000 psf, again holding the load for 15 minutes.

- Tap the sample with a light hammer to simulate vibration and monitor for 15 minutes.

- Unload the sample as before.

- Subject the dense samples of each soil type (see below) to an additional 5 cycles, held for one minute each, to determine if there is any additional change in compressibility or void ratio due to repeated loading.

The samples were tested at a constant strain rate of 0.01 to 0.02 inches/min in a Wykeham Farrance 10- ton loading frame. Load was measured with a 2,000-lb capacity electronic strain gage load cell. Deformation was measured with an electrical displacement transducer (DCDT).

A total of 15 tests were performed, as summarized in Table 4-2. Each soil was tested over a range of relative densities in order to measure the effect of D_r on compressibility. In addition, the SWL and NDOLF samples were tested at two moisture contents. The lower value represents the likely incoming moisture content, based on experience at the Hanford site. The other value represents wet conditions, which simulate waste placed during rainfall events.

During testing of the gravel sample, it became apparent that densities lower than the measured minimum density were achievable. This was probably due to the use of a 6-inch mold for the one-dimensional compression testing versus an 11-inch mold for the minimum density. In order to obtain a conservative estimate of the settlement potential of the gravel, the lower density (118.5 pcf) was used to calculate D_r.

5.0 RESULTS

5.1 COMPRESSIBILITY

The results of the laboratory compressibility testing program are summarized in Table 5-1. Stress-strain curves for each test are shown on Figures 5-1 through 5-15.

Several general conclusions can be drawn from the test results:

(1) In a given test, modulus increases with applied load; i.e., the soil becomes stiffer.

(2) In a suite of tests, modulus generally increases with increasing relative density.

(3) The effect of initial compaction moisture is minimal for the silty fine sand and inconclusive for the medium sand.

(4) Strain from tapping was significantly higher for one sample with very low relative density.

These observations are typical for granular soils and indicate that the materials tested behave in a normal way.

The modulus results were compared with values from the literature. Commonly used designations associated with relative density values for granular soils are (Cernica, 1982):

DESIGNATION	RELATIVE DENSITY (%)
Very Loose	0 - 15
Loose	15 - 35
Medium Dense	35 - 70
Dense	70 - 85
Very Dense	85 - 100

Scott (1981) states that a value of D for dense sand under typical foundation pressures is 65 x 10^5 psf. Kezdi (1975) lists typical values for constrained modulus as:

- Loose sand: 2 x 10^5 to 5 x 10^5 psf,
- Dense sand: 10 x 10^5 to 17 x 10^5 psf for dense sand, and

- Dense sand and gravel: 20 x 10^5 to 40 x 10^5 psf for dense sand and gravel.

The results of this study are consistent with these values.

5.2 SETTLEMENT ESTIMATE FROM MODULUS VALUES

Much of the settlement in the waste soils will occur as the waste material is placed; this settlement is not a concern because it occurs before the Hanford Barrier is constructed. The settlement which is a concern is (1) the immediate settlement caused by the weight of the Barrier, and (2) the long-term settlement (secondary compression) of the entire waste fill. The immediate settlement may be calculated using the laboratory modulus values and the load applied by the Hanford Barrier. Secondary compression is more difficult to estimate, particularly over 1,000 years, the design life of the Hanford Barrier. According to Swiger (1974), data from settlement of medium dense to dense sands under 4000 to 8000 psf loads suggest that secondary settlement over a period of years will be approximately equal to the immediate settlement. This approach has been used here.

Estimated settlements are summarized in Table 5-2. The total long-term settlement after the Barrier is installed is the sum of the immediate settlement due the cover and the secondary compression. Settlements are generally in the range of 0.5% to 1.5%, except where the soil is very loose.

5.3 SETTLEMENT ESTIMATE FROM VOID RATIO

An alternative approach to estimating the ultimate total settlement involves the minimum void ratio (or the maximum density) of the granular materials. Provided that no particle crushing occurs, it is reasonable to assume that settlement is limited by the minimum void ratio. Crushing of sand grains occurs at pressures of about 200,000 psf (Hilf, 1991), well above the stress levels expected in the ERDF waste. Therefore, this approach is applicable to this study. One advantage of this method is that mechanisms for reducing void ratio, including immediate settlement, creep, and settlements due to vibration, are considered in aggregate and need not be well-understood. Results from this method are considered an upper bound on possible settlement.

Void ratios have been calculated for the compressibility tests performed during this study, using laboratory measurements of specific gravity. The results for each soil type in both low-moisture and high-moisture states are shown on Figures 5-16 through 5-20. On each figure, three loading curves are shown, corresponding to the three relative density conditions for each soil type, as summarized in Table 4-2. The curve with the highest void ratios represents the least dense soil sample, while

the curve with the lowest void ratio represents the greatest relative density. Test data are included in the Appendix.

The void ratio data show several features:

(1) Samples with lower initial densities compress more than samples with higher initial densities.

(2) The void ratios of looser samples remained above the void ratios of denser samples, even with repeated loading. This implies that purely static loading will be insufficient to sufficiently densify the waste soils at the Hanford site, and that some type of dynamic (vibrational) compaction will be required. This finding is consistent with previous work (Peck et al., 1974).

(3) Initial compaction moisture content has little effect on test results.

If the minimum void ratio (maximum density) of a soil is known and is assumed to represent the ultimate condition of the soil in response to long-term settlement mechanisms, then the settlement corresponding to higher void ratios, representing initial placement conditions, can be calculated. Assuming one-dimensional settlement, the relationship between strain (settlement) and change in void ratio is given by:

$$\epsilon = \frac{e_i - e_{100}}{1 + e_i} \tag{4}$$

where ϵ = strain
e_i = initial void ratio
e_{100} = void ratio at 100% maximum density

For this study, the strain was set equal to the maximum acceptable value of 3%. The appropriate value for maximum density of each soil type is more problematic. As discussed above and shown in Table 4-1, "maximum" density results can vary with the test method. To provide some insight on this question, another approach for estimating maximum density was employed. Using the compressibility test data as shown on Figures 5-16 through 5-20, the minimum final void ratio from each test condition was plotted as a function of initial relative density, as shown on Figure 5-21. The data were then extrapolated to determine the void ratio at 100% relative density. Because relative density results are used, this approach is not totally independent. However, it does allow use of additional data to check the consistency of other density measurements. Figure 5-21 shows generally

linear relationships, suggesting that both void ratio and relative density measurements are consistent with theoretically expected behavior. The maximum densities determined in this way are 138.2 pcf for the gravel, 103.6 pcf for the silty fine sand, and 117.0 pcf for the medium sand. For both the gravel and medium sand, these values are slightly higher than any of the corresponding values reported in Table 4-1. For the silty fine sand, the extrapolated value is higher than all except the Modified Proctor results. Because higher maximum densities will give more conservative results, the maximum densities calculated from Figure 5-21 were used to determine allowable initial void ratios.

Using the 100% relative density void ratios from Figure 5-21 and the allowable strain of 3%, the initial void ratios were calculated using equation 4 above. The relative densities corresponding to these initial void ratios (D_{ri}) were then determined from Figure 5-21. These calculations are summarized in the following table:

SOIL TYPE	e_{100}	e_i	D_{ri} (%)
Gravel	0.30	0.34	76
Silty Fine Sand	0.65	0.70	82
Medium Sand	0.51	0.56	82

For all soil types, the required relative density is about 80%, defined as dense soil (see Section 5.1).

6.0 CONCLUSIONS AND RECOMMENDATIONS

The settlement analyses indicate that waste soils disposed of in the ERDF should be compacted to a dense state in order to limit long-term uniform settlements to acceptable levels. A relative density of about 80% is expected to be adequate. Using the density test results discussed in Section 4.2, the comparison between required densities and compactive effort can be summarized as follows:

SOIL TYPE	80% D_{100} (PCF)	95% MODIFIED PROCTOR (PCF)	90% STANDARD PROCTOR (PCF)
Gravel	133.5	--	--
Silty Fine Sand	98.9	101.0	94.6
Medium Sand	111.3	110.6	104.6

This summary shows that compaction to 95% of Modified Proctor dry density will exceed the requirement for silty fine sand and be very close to satisfying the requirement for medium sand. Standard Proctor compaction, on the other hand, produces densities that are substantially less than required. Although Proctor testing is not applicable to gravels, industry practice has found that methods similar to those producing 95% Modified Proctor compaction in other soil types will limit settlements in gravel to acceptable levels. On this basis, waste in the ERDF should be compacted using heavy vibrating equipment and limited lift thickness (for example, 1 foot) in order to achieve required densities.

The test results do not show a strong correlation between initial moisture content and compressibility. Therefore, waste soils with a wide range of moisture contents are expected to be suitable for disposal in the ERDF. Compaction techniques should be selected to achieve the densities recommended in this study without addition of water to the soil. This will reduce the amount of leachate that might be generated and require treatment.

Prior to or during the early phases of waste filling, field density measurements should be taken to verify that proposed operational procedures such as equipment type, number of passes, and lift thickness can achieve the densities listed above. Appropriate field density methods include the sand cone method (ASTM D 1556) or rubber balloon method (ASTM D 2167) for finer soils and test pit methods (ASTM D 4914 or 5030) for coarser soils. If the soil types differ significantly from those tested for this study, minimum and maximum density tests should be performed to determine the target value corresponding to 80% relative density.

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TABLES

APPENDIX

LABORATORY TEST DATA

GOLDER ASSOCIATES INC., REDMOND, WA

LOAD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-12-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	GRAVEL
TEST No.:	G-1

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	426.50
AREA (sq ft):	0.1964	WET WT. + TARE (g):	4994.7
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	4899.9
MOLD + SOIL (g):	16843	MOISTURE CONTENT (%):	2.1
MOLD (g):	8758		
		WET DENSITY (pcf):	121.0
SPECIFIC GRAVITY:	2.88	DRY DENSITY (pcf):	118.5

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.012	0.00	0	0.5177
50	0.83	11.1	0.017	0.06	57	0.5169
100	1.67	22.4	0.025	0.14	114	0.5156
150	2.50	27.2	0.034	0.24	138	0.5140
200	3.33	37.8	0.042	0.33	192	0.5127
250	4.17	45.8	0.049	0.41	233	0.5115
300	5.00	54.2	0.057	0.50	276	0.5102
350	5.83	59.5	0.065	0.59	303	0.5088
400	6.67	69.1	0.073	0.68	352	0.5075
450	7.50	78.9	0.080	0.76	402	0.5063
500	8.33	86.9	0.088	0.84	442	0.5049
550	9.17	99.1	0.096	0.93	505	0.5036
600	10.00	110.2	0.104	1.02	561	0.5022
650	10.83	124.6	0.111	1.10	634	0.5011
700	11.67	138.1	0.119	1.19	703	0.4997
750	12.50	154.8	0.125	1.26	788	0.4987
800	13.33	169.8	0.132	1.33	864	0.4975
850	14.17	187.4	0.139	1.41	954	0.4963
900	15.00	200.0	0.147	1.50	1018	0.4950
950	15.83	223.2	0.155	1.59	1136	0.4936

1000	16.67	239.0	0.163	1.68	1217	0.4923
1050	17.50	258.4	0.171	1.77	1316	0.4909
1100	18.33	279.5	0.178	1.84	1423	0.4898
1150	19.17	295.1	0.186	1.93	1502	0.4884
1200	20.00	326.1	0.194	2.02	1660	0.4871
1250	20.83	350.6	0.201	2.10	1785	0.4859
1300	21.67	388.2	0.209	2.19	1976	0.4845
1350	22.50	415.9	0.217	2.28	2117	0.4832
1400	23.33	456.7	0.224	2.36	2325	0.4820
1450	24.17	494.2	0.232	2.44	2516	0.4807
1500	25.00	522.0	0.240	2.53	2658	0.4793
1550	25.83	554.6	0.247	2.61	2824	0.4781
1600	26.67	602.0	0.255	2.70	3065	0.4768
1650	27.50	649.3	0.262	2.78	3306	0.4756
1700	28.33	698.3	0.270	2.87	3555	0.4742
1750	29.17	739.1	0.277	2.94	3763	0.4731
1800	30.00	792.9	0.285	3.03	4037	0.4717
1850	30.83	851.7	0.292	3.11	4336	0.4705
1900	31.67	899.0	0.300	3.20	4577	0.4692
1950	32.50	964.3	0.307	3.28	4910	0.4680
2000	33.33	1045.9	0.315	3.37	5325	0.4667
2050	34.17	1114.4	0.323	3.45	5674	0.4653
2100	35.00	1184.6	0.330	3.53	6031	0.4641
2150	35.83	1256.4	0.338	3.62	6397	0.4628
2200	36.67	1328.2	0.344	3.69	6762	0.4618
2250	37.50	1385.3	0.352	3.78	7053	0.4604
2300	38.33	1475.1	0.360	3.87	7510	0.4591
2350	39.17	1584.5	0.368	3.95	8067	0.4577
2400	40.00	1664.4	0.375	4.03	8474	0.4565
2450	40.83	1770.5	0.383	4.12	9014	0.4552
2500	41.67	1865.2	0.391	4.21	9496	0.4538
2550	42.50	1974.5	0.398	4.29	10053	0.4527
2600	43.33	2075.7	0.406	4.38	10568	0.4513
2650	44.17	2167.1	0.414	4.47	11033	0.4500
2700	45.00	2297.7	0.421	4.54	11698	0.4488
2750	45.83	2405.4	0.429	4.63	12247	0.4474
2800	46.67	2513.1	0.436	4.71	12795	0.4463
2850	47.50	2539.2	0.441	4.77	12928	0.4454
2900	48.33	2527.8	0.443	4.79	12870	0.4451
2950	49.17	2598.0	0.445	4.81	13227	0.4447
3000	50.00	2578.4	0.446	4.82	13127	0.4446
3050	50.83	2594.7	0.447	4.83	13210	0.4444
3100	51.67	2535.9	0.447	4.83	12911	0.4444
3150	52.50	2553.9	0.448	4.84	13003	0.4442
3200	53.33	2537.6	0.448	4.84	12920	0.4442
3250	54.17	2545.7	0.449	4.85	12961	0.4441
3300	55.00	2542.5	0.449	4.85	12945	0.4441
3350	55.83	2560.4	0.450	4.87	13036	0.4439
3400	56.67	2532.7	0.450	4.87	12895	0.4439
3450	57.50	2580.0	0.450	4.87	13135	0.4439
3500	58.33	2552.3	0.450	4.87	12994	0.4439
3550	59.17	2531.0	0.450	4.87	12886	0.4439
3600	60.00	2519.6	0.450	4.87	12828	0.4439
3650	60.83	2570.2	0.451	4.88	13086	0.4437

Table 4-1. Density Test Results.

SOIL TYPE	MAXIMUM DRY DENSITY (ASTM D 4253)		MINIMUM DRY DENSITY (ASTM D 4254) (PCF)	STANDARD PROCTOR (ASTM D 698)		MODIFIED PROCTOR (ASTM D 1557)	
	TESTED WET (PCF)	TESTED DRY (PCF)		DRY DENSITY (PCF)	OPTIMUM MOISTURE (%)	DRY DENSITY (PCF)	OPTIMUM MOISTURE (%)
NDOLF Sand	101.8	102.9	85.8	99.6	18.1	106.3	15.1
SWL Sand	115.1	114.3	98.4	110.1	18.3	116.4	16.0
200E-200W Gravel	137.9	133.3	123.5	N/A	N/A	N/A	N/A

Table 4-2. Compressibility Test Parameters.

SOIL TYPE	TEST NO.	DRY DENSITY (PCF)	RELATIVE DENSITY (%)	MOISTURE CONTENT (%)
Gravel	G-1	118.5	0[1]	2.1
	G-2	126.3	44	2.1
	G-3	133.1	78	2.1
NDOLF Sand	NS-1D	89.5	25	5.4
	NS-2D	95.8	63	5.4
	NS-3D	100.8	90	5.0
	NS-1W	89.7	26	18.8
	NS-2W	95.4	61	18.7
	NS-3W	98.9	80	20.2
SWL Sand	SS-1D	100.9	17	5.1
	SS-2D	107.0	55	5.0
	SS-3D	111.7	82	5.0
	SS-1W	101.3	20	13.6
	SS-2W	108.2	62	14.0
	SS-3W	112.7	87	13.8

(1) Values for gravel based on a minimum density of 118.5 pcf.

Table 5-1. Compressibility Test Results.

TEST NO.	STRAIN AFTER FIRST CYCLE (%)	SECANT D, 0 TO 13,000 PSF (x 10^5 PSF)	TANGENT D @ 0 PSF (x 10^5 PSF)	TANGENT D @ 12,000 PSF (x 10^5 PSF)	STRAIN FROM TAPPING (%)
G-1	4.88	2.7	0.5	7.5	0.70
G-2	1.50	9.0	1.8	15.7	0.07
G-3	1.28	10.6	2.0	18.8	0.05
NS-1D	2.63	5.2	0.9	8.6	0.10
NS-2D	1.76	7.8	1.3	13.4	0.12
NS-3D	0.97	14.1	1.4	22.0	0.05
NS-1W	2.39	5.8	0.1	9.3	0.17
NS-2W	1.21	11.6	2.7	16.7	0.06
NS-3W	1.11	12.2	0.2	22.1	0.06
SS-1D	1.98	7.1	1.3	8.2	0.09
SS-2D	1.52	9.3	0.5	15.1	0.09
SS-3D	1.13	11.8	1.3	22.0	0.04
SS-1W	1.18	11.8	1.4	17.6	0.05
SS-2W	1.07	12.9	2.5	21.6	0.07
SS-3W	1.38	9.7	1.4	14.8	0.05

Secant modulus represents an average modulus value over the entire loading range and was used for all settlement calculations. Tangent modulus represents an "instantaneous" modulus value at a specific load and is presented here to illustrate strain-stiffening behavior.

Table 5-2. Estimated Total Settlement.

(1) TEST NO.	(2) SECANT MODULUS (x 10^5 PSF)	(3) IMMEDIATE SETTLEMENT OF WASTE (%)	(4) IMMEDIATE SETTLEMENT FROM BARRIER (%)	(5) TOTAL IMMEDIATE SETTLEMENT (%)	(6) SECONDARY COMPRESSION (%)	(7) TOTAL POST-BARRIER SETTLEMENT (%)
G-1	2.7	1.78	0.67	2.44	2.44	3.11
G-2	9.0	0.53	0.20	0.73	0.73	0.93
G-3	10.6	0.45	0.17	0.62	0.62	0.79
NS-1D	5.2	0.92	0.35	1.27	1.27	1.62
NS-2D	7.8	0.62	0.23	0.85	0.85	1.08
NS-3D	14.1	0.34	0.13	0.47	0.47	0.60
NS-1W	5.8	0.83	0.31	1.14	1.14	1.45
NS-2W	11.6	0.41	0.16	0.57	0.57	0.72
NS-3W	12.2	0.39	0.15	0.54	0.54	0.69
SS-1D	7.1	0.68	0.25	0.93	0.93	1.18
SS-2D	9.3	0.52	0.19	0.71	0.71	0.90
SS-3D	11.8	0.41	0.15	0.56	0.56	0.71
SS-1W	11.8	0.41	0.15	0.56	0.56	0.71
SS-2W	12.9	0.37	0.14	0.51	0.51	0.65
SS-3W	9.7	0.49	0.19	0.68	0.68	0.87

(3) Average stress in waste = maximum waste depth (80 ft) times the unit weight (120 pcf) divided by 2. Immediate settlement = average stress divided by modulus.

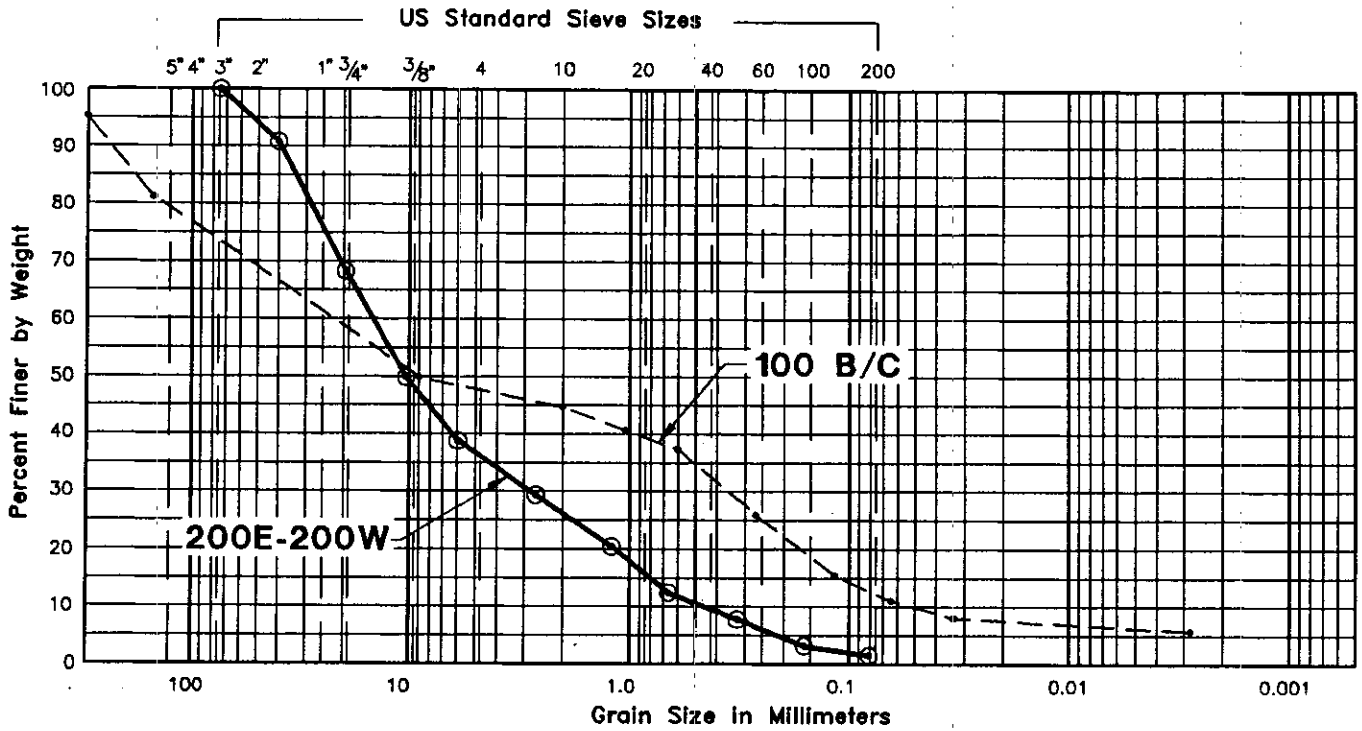
(4) Load from cover = thickness of cover (15 feet) times unit weight (120 pcf). Immediate settlement = cover load divided by modulus.

(5) Total immediate settlement = Immediate settlement of waste (3) plus immediate settlement due to cover (4).

(6) Secondary compression = total immediate settlement (empirical relationship, see Section 5.2).

(7) Total settlement after cover construction = immediate settlement from cover (4) plus secondary compression (6).

FIGURES



Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
–	–	–	–	–	–	GRAVEL

GRAIN SIZE DISTRIBUTION

Project WRW-COE/TESTING/WA
Project No. 923-A026 Date 10/28/93 Tested By – Reviewed By FSS

Golder Associates

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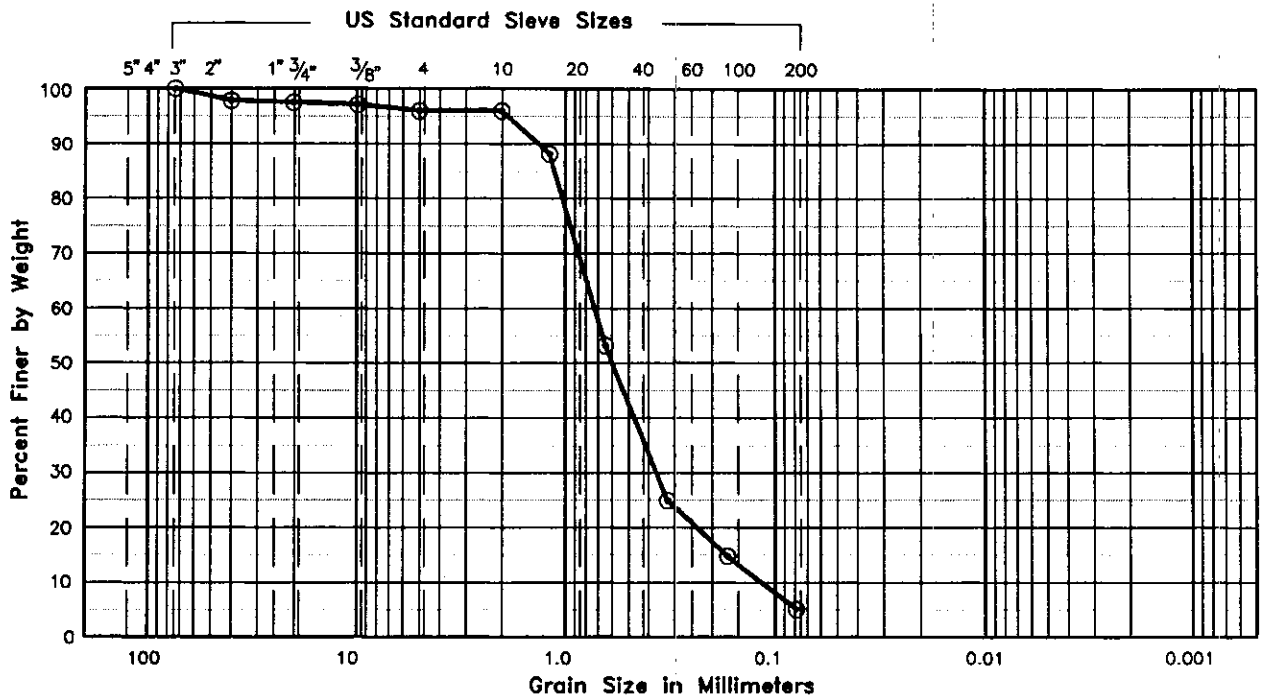
Figure 3-1. Grain-Size Distribution - Gravel.



Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_P	I_P	Description
SWL Sample 1	–	–	–	–	–	Medium SAND

GRAIN SIZE DISTRIBUTION

Project MW-GOE/TESTING/WA
Project No. 923-A026 Date 10/28/93 Tested By --- Reviewed By FSS

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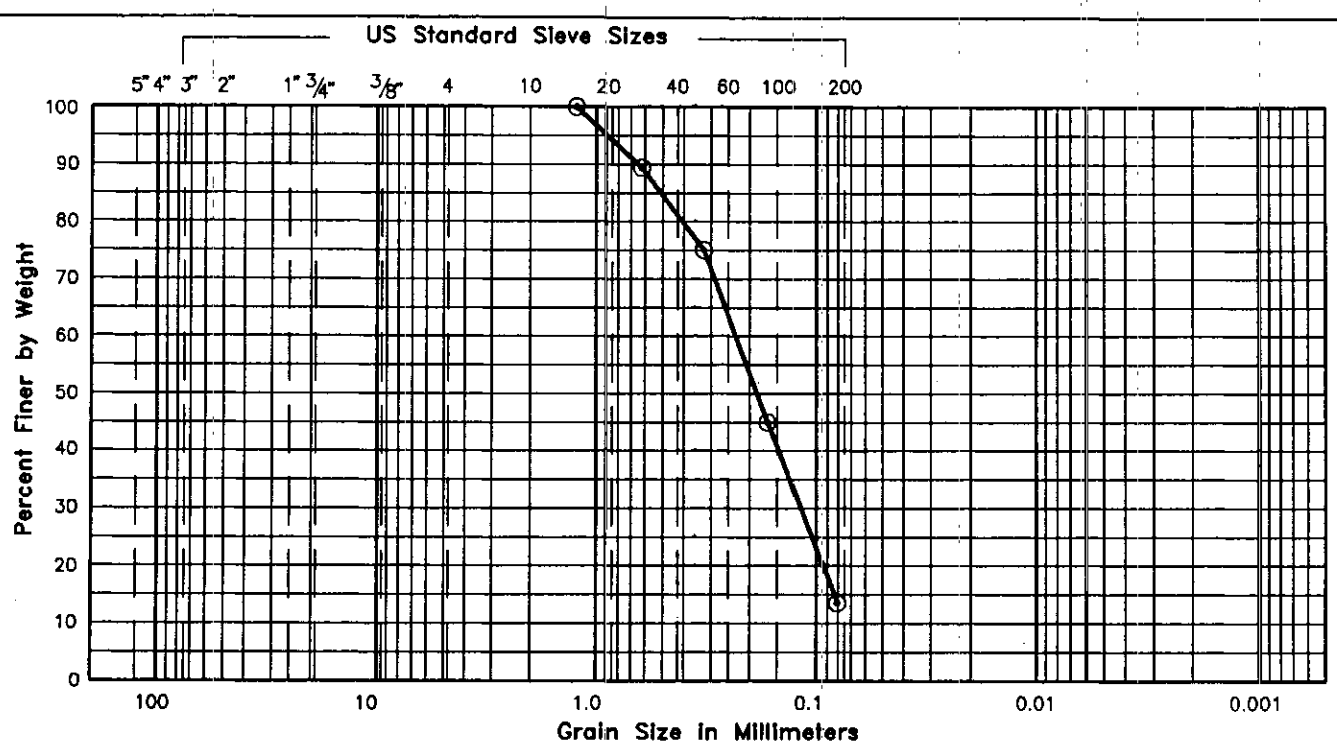
Figure 3-2. Grain-Size Distribution - Medium Sand.



Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_P	I_P	Description
NDOLF Sample 4	–	–	–	–	–	Silty fine SAND

GRAIN SIZE DISTRIBUTION

Project MW-COE/TESTING/WA
Project No. 923-A026 Date 10/28/93 Tested By – Reviewed By FSS

Golder Associates

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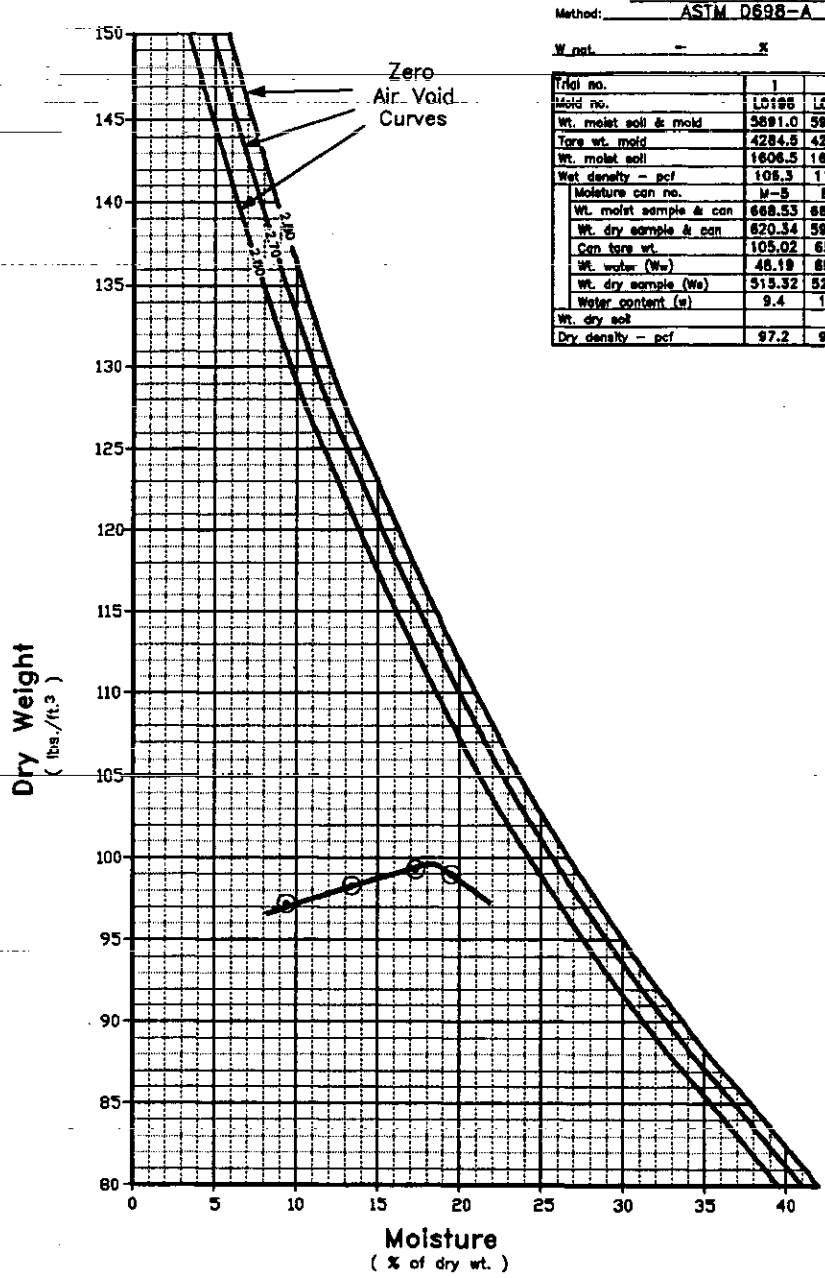
Figure 3-3. Grain-Size Distribution - Silty Fine Sand.

Sample Number: NDOLF
Description: Silty fine SAND

Method: ASTM D698-A

W nat. - % MOLD volume 0.03333 cf

Trial no.	1	2	3	4		
Mold no.	L0195	L0195	L0195	L0198		
Wt. moist soil & mold	5891.0	5970.5	6045.5	6072.4		
Tare wt. mold	4284.5	4284.5	4284.5	4284.5		
Wt. moist soil	1606.5	1686.0	1761.0	1787.9		
Wet density - pcf	106.3	111.5	116.5	118.3		
Moisture can no.	M-5	B-1	D-8	36		
Wt. moist sample & can	668.53	681.15	704.66	593.4		
Wt. dry sample & can	620.34	591.40	611.31	508.66		
Can tare wt.	105.02	65.49	73.26	74.29		
Wt. water (Ww)	48.19	89.75	93.35	84.74		
Wt. dry sample (Ws)	515.32	525.91	538.05	434.37		
Water content (w)	9.4	13.4	17.3	19.5		
Wt. dry soil						
Dry density - pcf	97.2	98.3	99.5	99.0		



SUMMARY	
Maximum Density (pcf)	99.6
Optimum Moisture (%)	18.1

MOISTURE-DENSITY RELATIONSHIP OF SOIL

Project MW-COE/TESTING/WA
Project No. 923-A026 Date 10/29/93 Tested By KPS Approved By DPO

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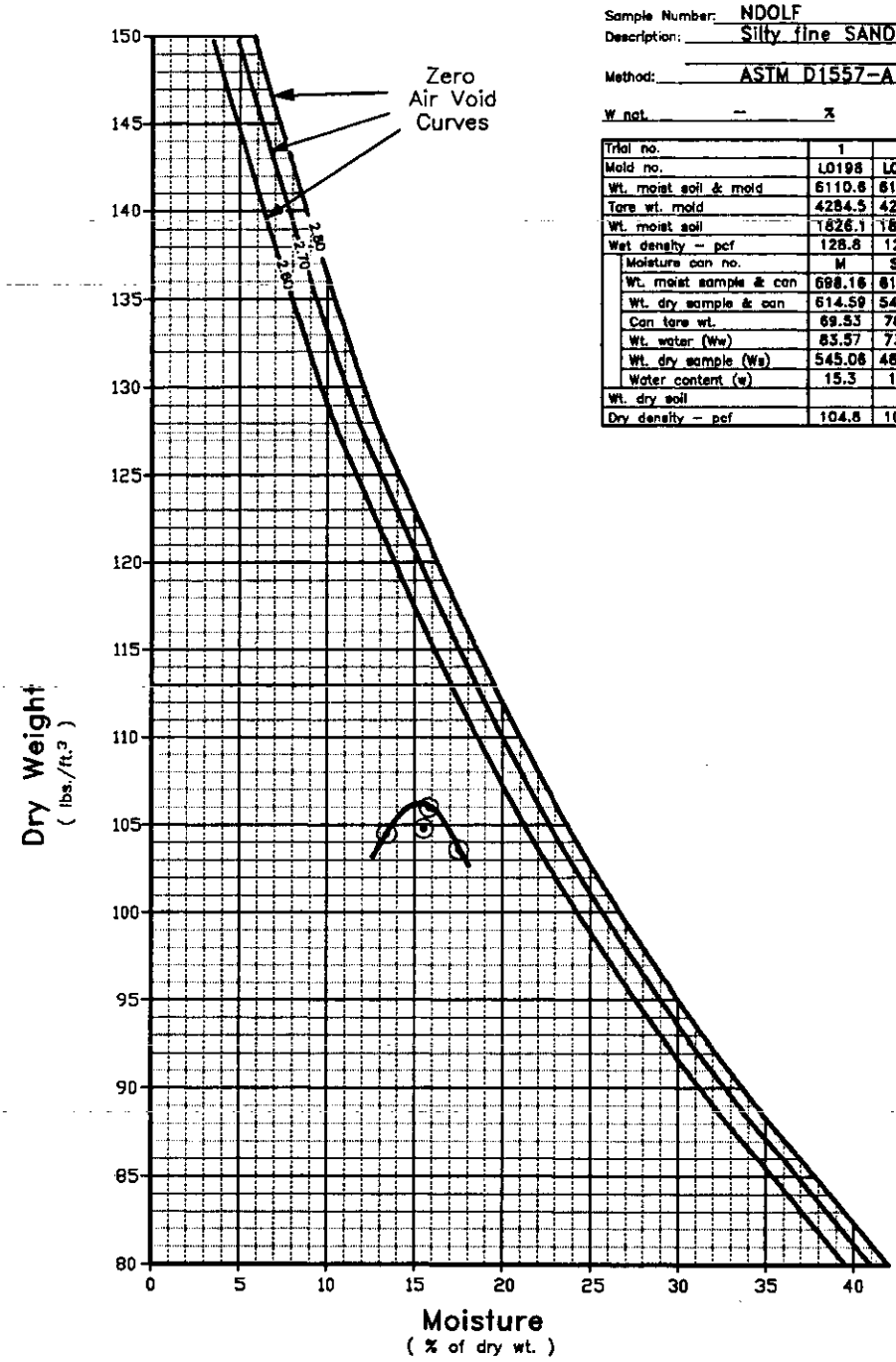
Figure 4-1. Standard Proctor Results - Silty Fine Sand.



Sample Number: NDOLF
Description: Silty fine SAND

Method: ASTM D1557-A

W nat. -- % MOLD volume 0.03333 cf

Trial no.	1	2	3	4		
Mold no.	L0198	L0198	L0198	L0198		
Wt. moist soil & mold	6110.6	6141.4	6076.3	6124.0		
Tare wt. mold	4284.5	4284.5	4284.5	4284.5		
Wt. moist soil	1826.1	1856.9	1791.8	1839.5		
Wet density -- pcf	128.8	122.8	118.5	131.7		
Moisture can no.	M	S-3	D-14	15		
Wt. moist sample & can	698.16	614.72	744.37	702.71		
Wt. dry sample & can	614.59	540.73	667.56	609.88		
Can tare wt.	69.53	76.20	89.58	78.36		
Wt. water (Ww)	83.57	73.99	76.81	92.83		
Wt. dry sample (Ws)	545.06	467.53	577.98	531.52		
Water content (w)	15.3	15.8	13.4	17.5		
Wt. dry soil						
Dry density -- pcf	104.8	106.0	104.5	103.6		

SUMMARY	
Maximum Density (pcf)	106.3
Optimum Moisture (%)	15.1

MOISTURE-DENSITY RELATIONSHIP OF SOIL

Project MW-COE/TESTING/WA
Project No. 923-A026 Date 10/29/93 Tested By KPS Approved By DPO

Golder Associates

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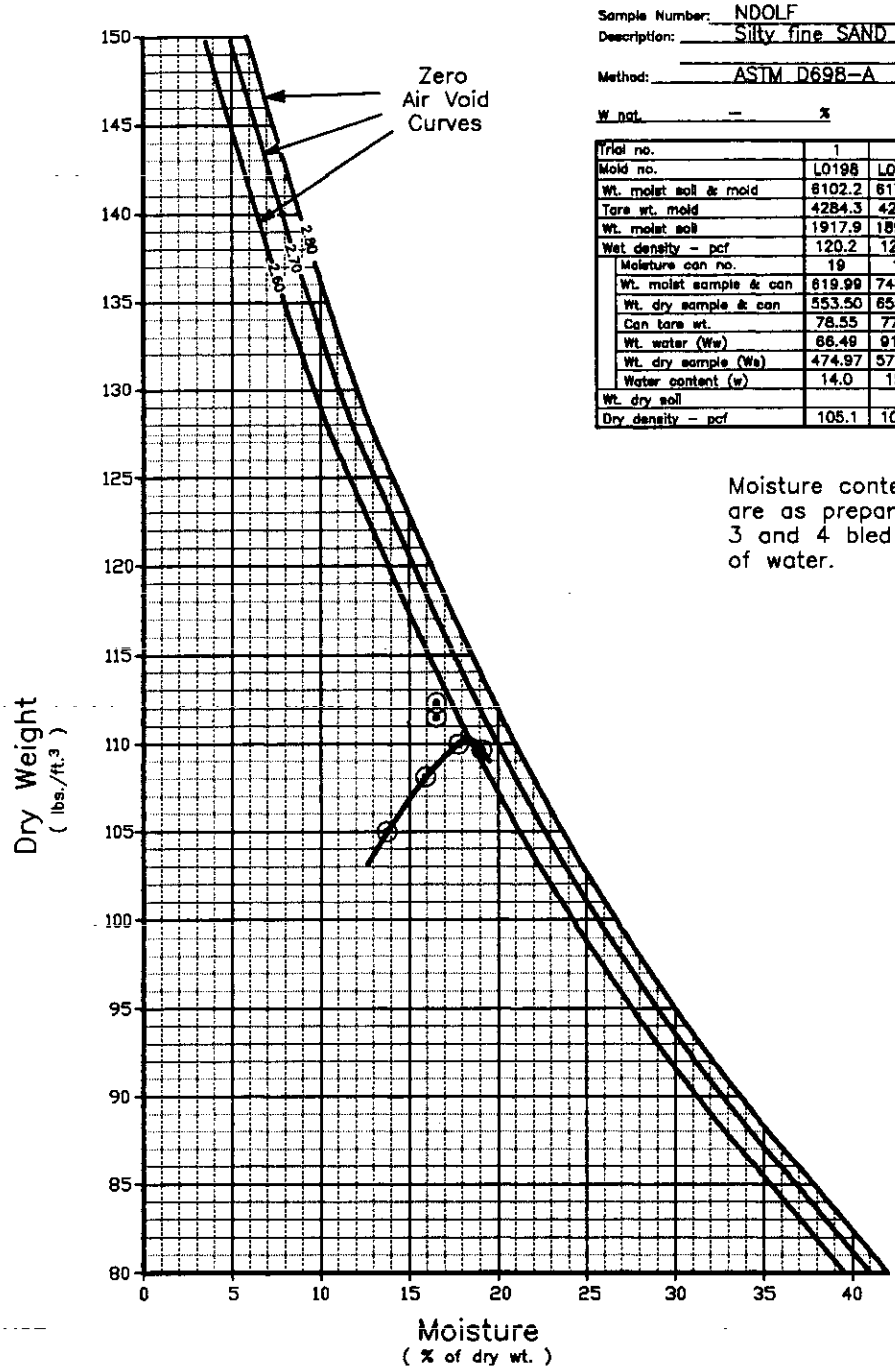
Figure 4-2. Modified Proctor Results - Silty Fine Sand.



Sample Number: NDOLF
Description: Silty fine SAND
Method: ASTM D698-A
W nat. — % MOLD volume 0.03333 cf

Trial no.	1	2	3	4	3A	4A
Mold no.	L0198	L0198	L0198	L0198		
Wt. moist soil & mold	6102.2	6177.0	6243.1	6258.4		
Tare wt. mold	4284.3	4284.3	4284.3	4284.3		
Wt. moist soil	1917.9	1892.7	1958.8	1974.1		
Wet density - pcf	120.2	125.2	129.6	130.8		
Moisture can no.	19	12	11	100	69	25
Wt. moist sample & can	819.99	747.57	751.61	692.23	135.56	133.13
Wt. dry sample & can	553.50	655.63	656.43	604.92	119.79	115.14
Can tare wt.	78.55	77.86	78.94	77.90	30.95	21.28
Wt. water (Ww)	66.49	91.94	95.18	87.68		
Wt. dry sample (Ws)	474.97	577.77	577.49	526.73		
Water content (w)	14.0	15.9	16.5	16.6	17.8	19.2
Wt. dry soil						
Dry density - pcf	105.1	108.0	111.2	112.0	110.0	109.6

Moisture contents for 3A and 4A are as prepared. Proctor samples 3 and 4 bled significant amounts of water.

SUMMARY	
Maximum Density (pcf)	110.1
Optimum Moisture (%)	18.3

MOISTURE-DENSITY RELATIONSHIP OF SOIL

Project MW-COE/TESTING/WA
Project No. 923-A026 Date 10/29/93 Tested By KPS Approved By DPO

Golder Associates

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Figure 4-3. Standard Proctor Results - Medium Sand.

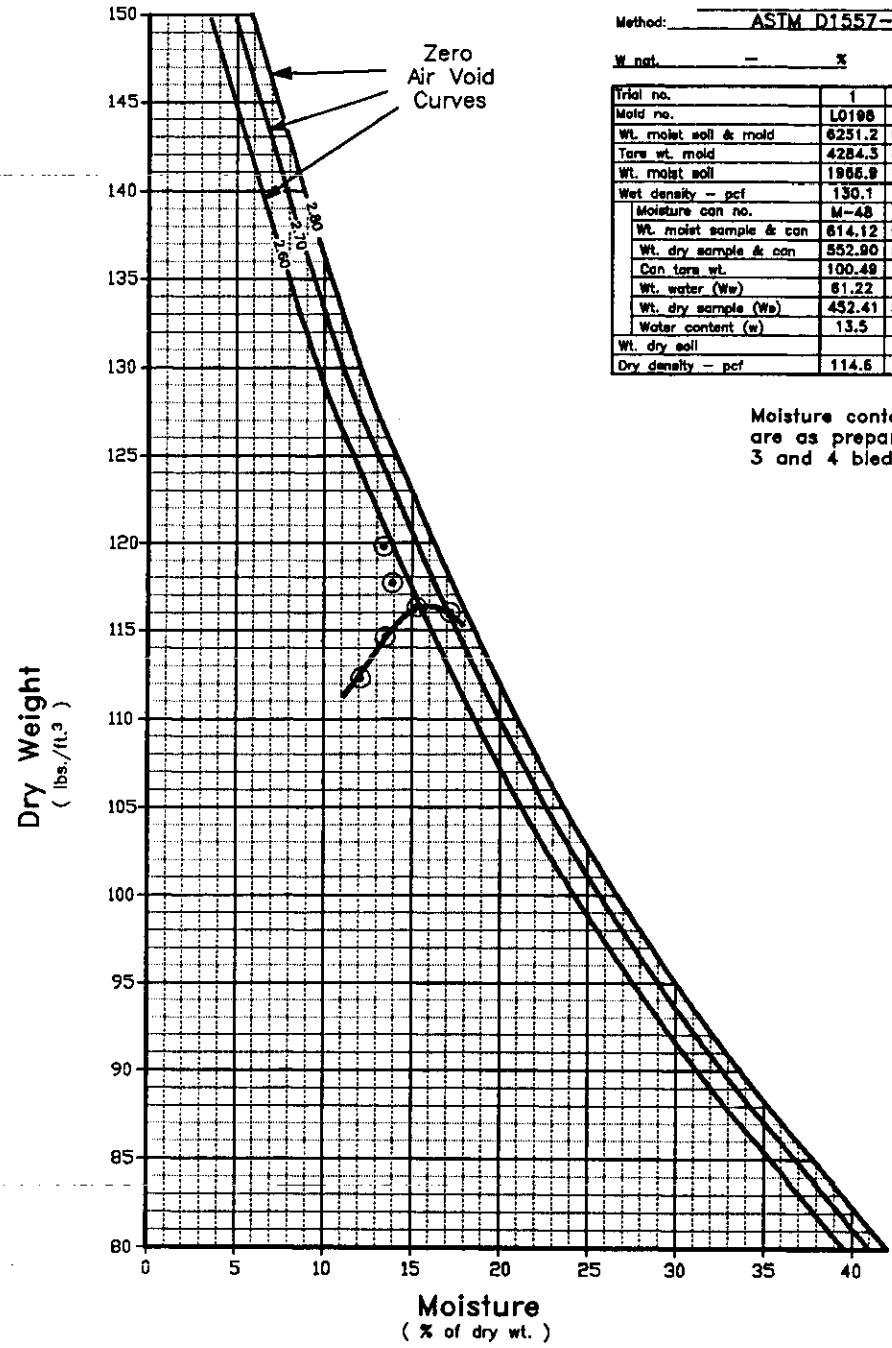
Sample Number: SWL
Description: Medium SAND

Method: ASTM D1557-A

W nat. — % MOLD volume 0.03333 cf

Trial no.	1	2	3	4	3A	4A
Mold no.	L0198	L0198	L0198	L0198		
Wt. moist soil & mold	6251.2	6187.6	6312.4	6338.5		
Tare wt. mold	4284.3	4284.3	4284.3	4284.3		
Wt. moist soil	1966.9	1903.3	2028.1	2054.3		
Wet density — pcf	130.1	125.9	134.1	135.9		
Moisture can no.	M-48	26	D-4	32		3
Wt. moist sample & can	614.12	637.10	663.86	697.09		127.27
Wt. dry sample & can	552.90	576.57	594.12	623.44		118.22
Can tare wt.	100.49	76.28	91.96	75.36		24.95
Wt. water (Ww)	61.22	60.53	69.74	73.65		
Wt. dry sample (Ws)	452.41	500.29	502.16	548.08		
Water content (w)	13.5	12.1	13.9	13.4	15.3	17.2
Wt. dry soil						
Dry density — pcf	114.6	112.3	117.7	119.8	116.3	116.0

Moisture contents for 3A and 4A are as prepared. Proctor samples 3 and 4 bled significant amounts of water.



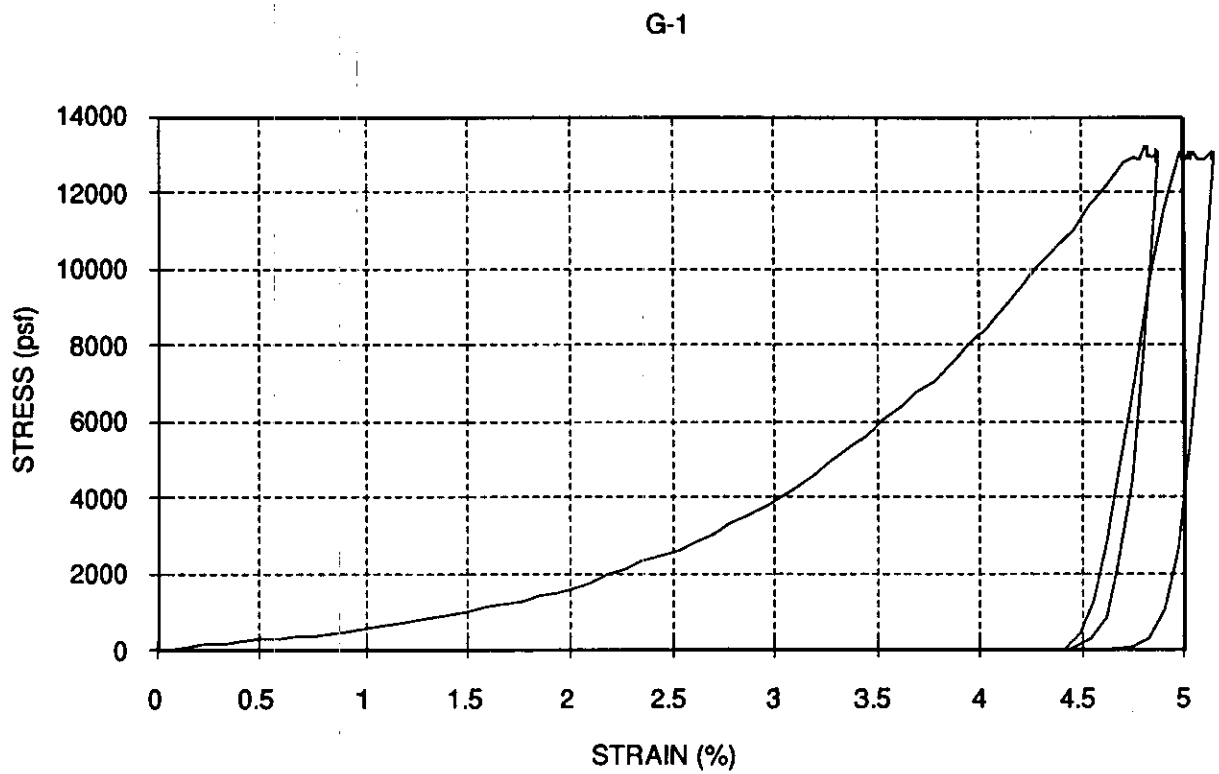
SUMMARY	
Maximum Density (pcf)	116.4
Optimum Moisture (%)	16.0

MOISTURE-DENSITY RELATIONSHIP OF SOIL

Project MW-COE/TESTING/WA
Project No. 923-A026 Date 10/29/93 Tested By KPS Approved By DPO **Golder Associates**

12-6-93 12:37 \JSS\923A026\42717

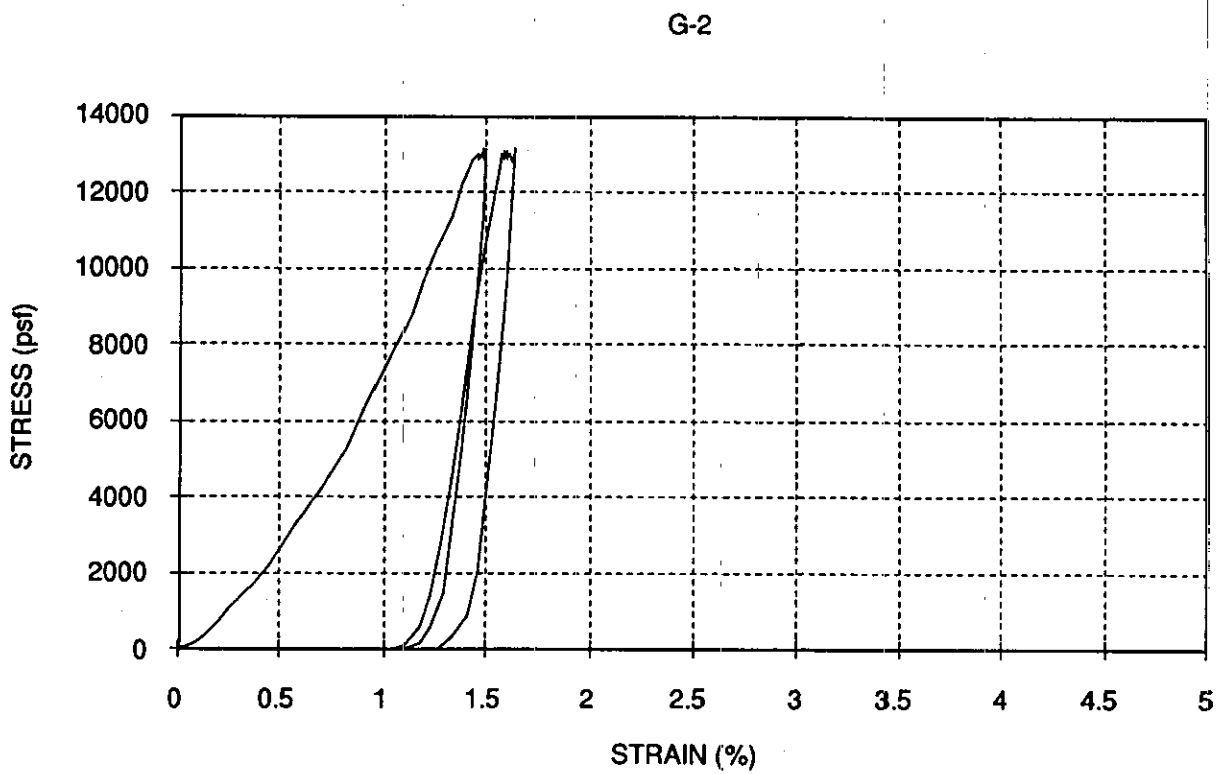
Figure 4-4. Modified Proctor Results - Medium Sand.



Soil Type: Gravel
Moisture Content: 2.1%
Relative Density: 0%

923 A026/47691/11-24-93

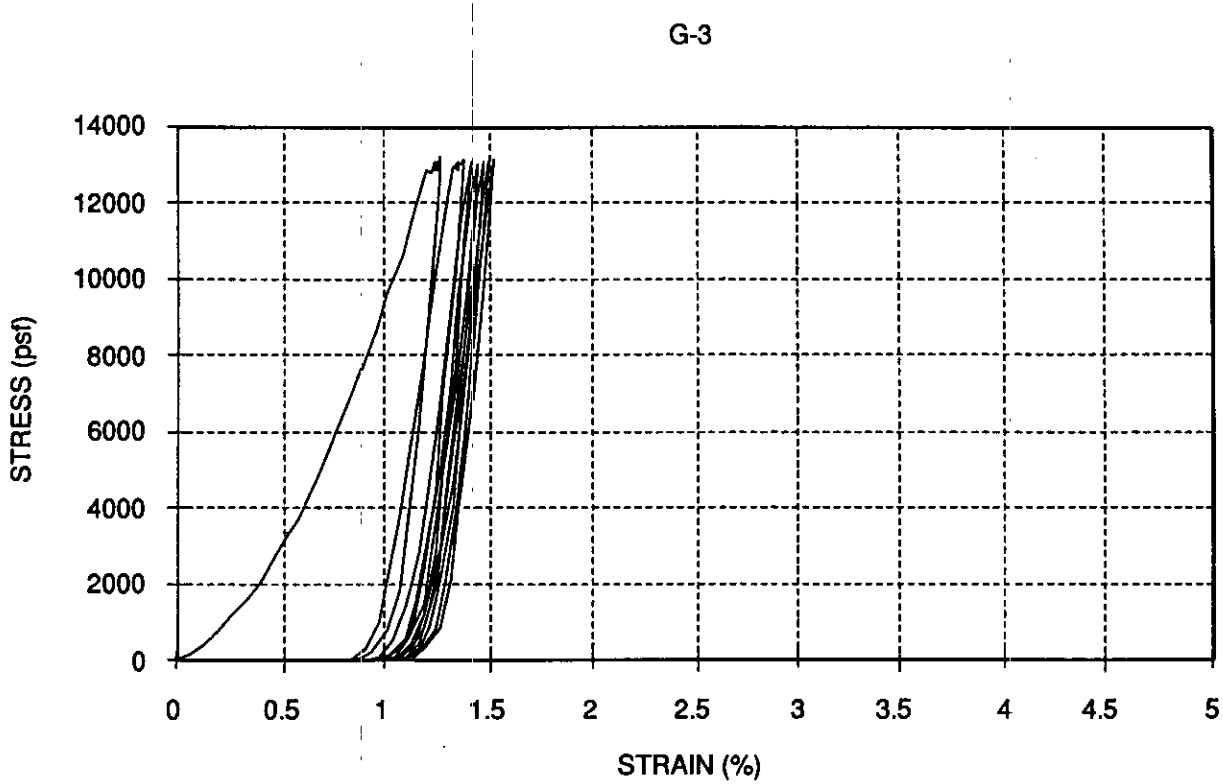
Figure 5-1. Loading Curve - Sample G-1.



Soil Type: Gravel
Moisture Content: 2.1%
Relative Density: 44%

923 A026/47692/12-3-93

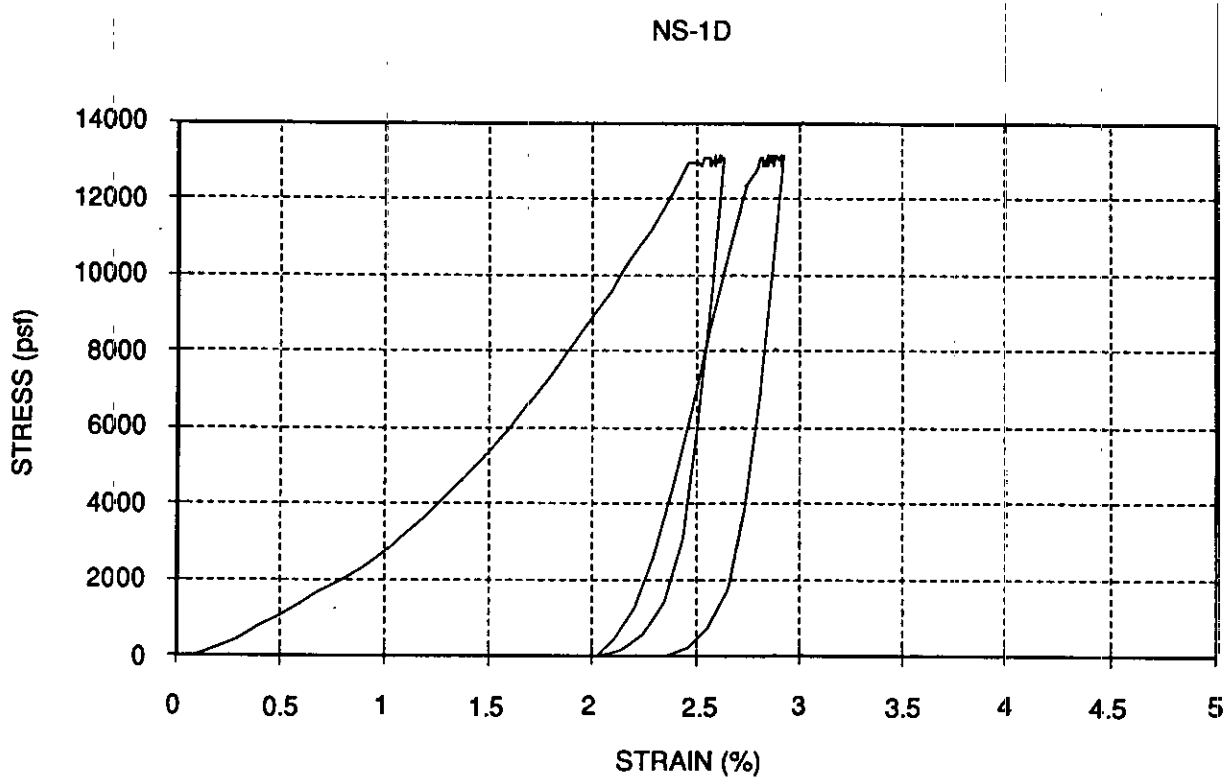
Figure 5-2. Loading Curve - Sample G-2.



Soil Type: Gravel
Moisture Content: 2.1%
Relative Density: 78%

923 A026/47694/12-3-93

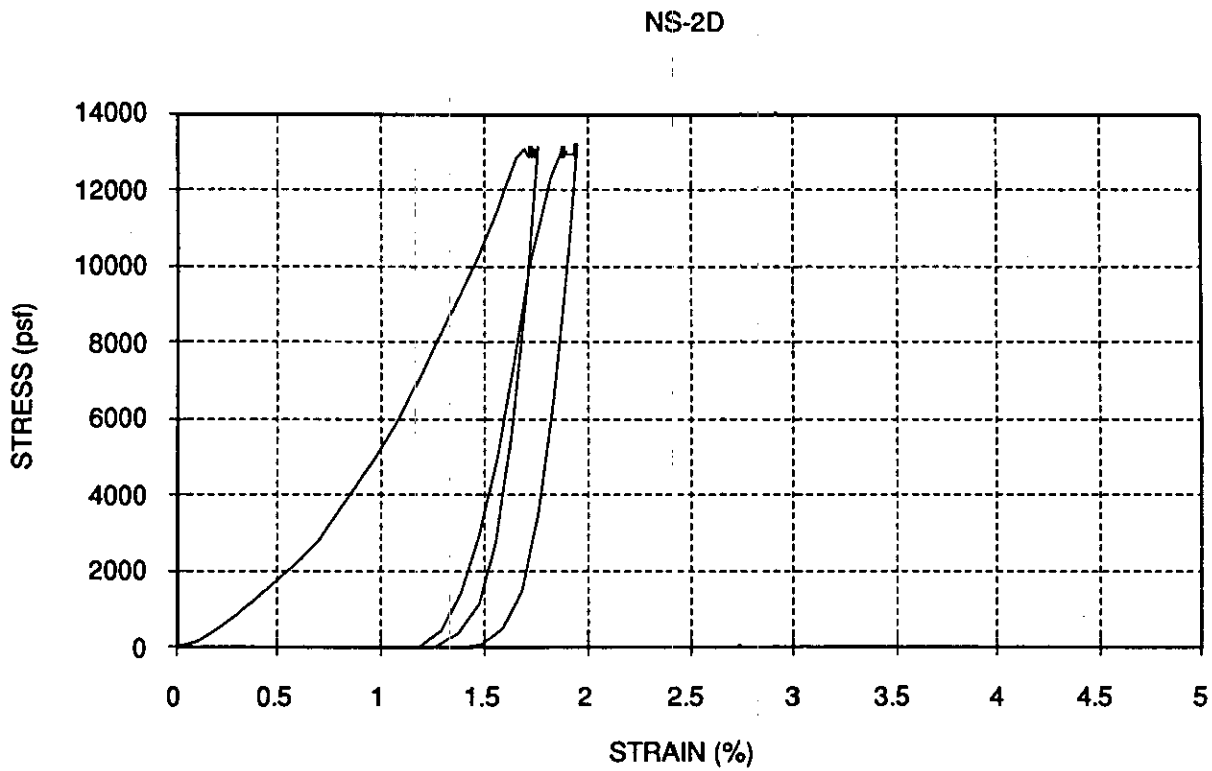
Figure 5-3. Loading Curve - Sample G-3.



Soil Type: Silty Fine Sand
Moisture Content: 5.4%
Relative Density: 25%

923 A026/47695/12-3-93

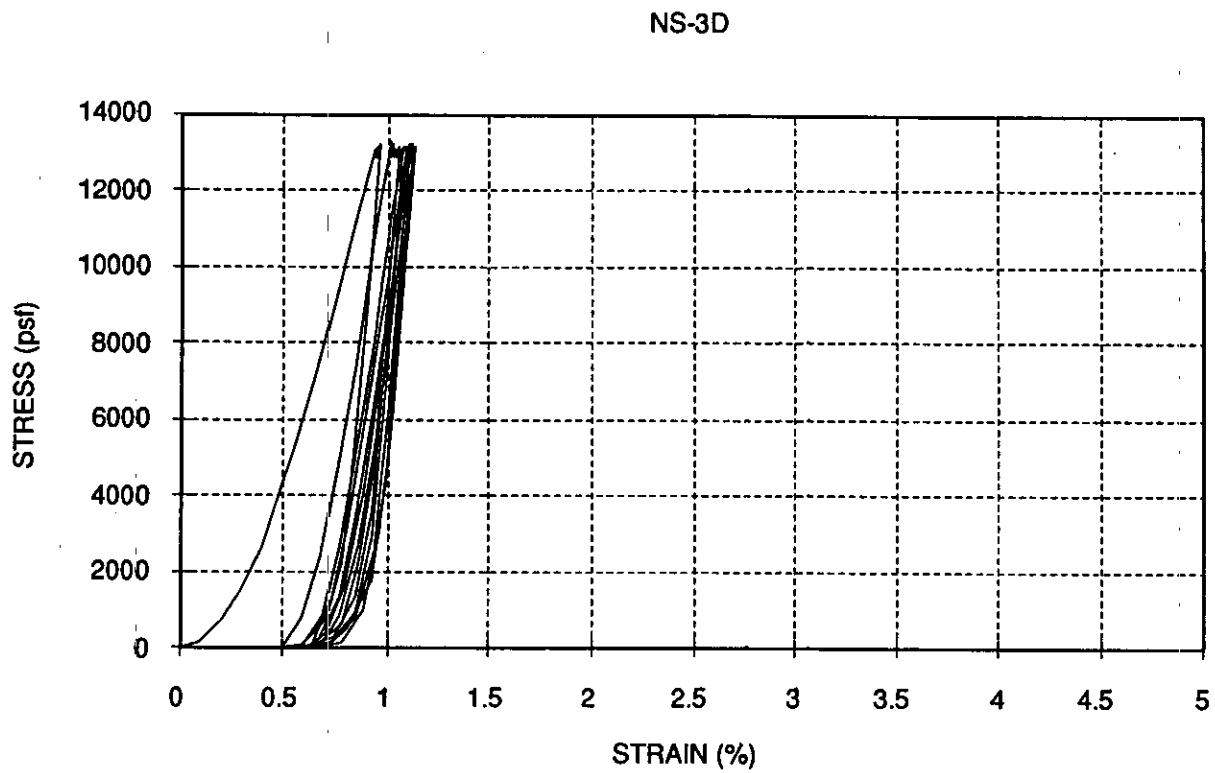
Figure 5-4. Loading Curve - Sample NS-1D.



Soil Type: Silty Fine Sand
Moisture Content: 5.4%
Relative Density: 63%

923 A026/47696/12-3-93

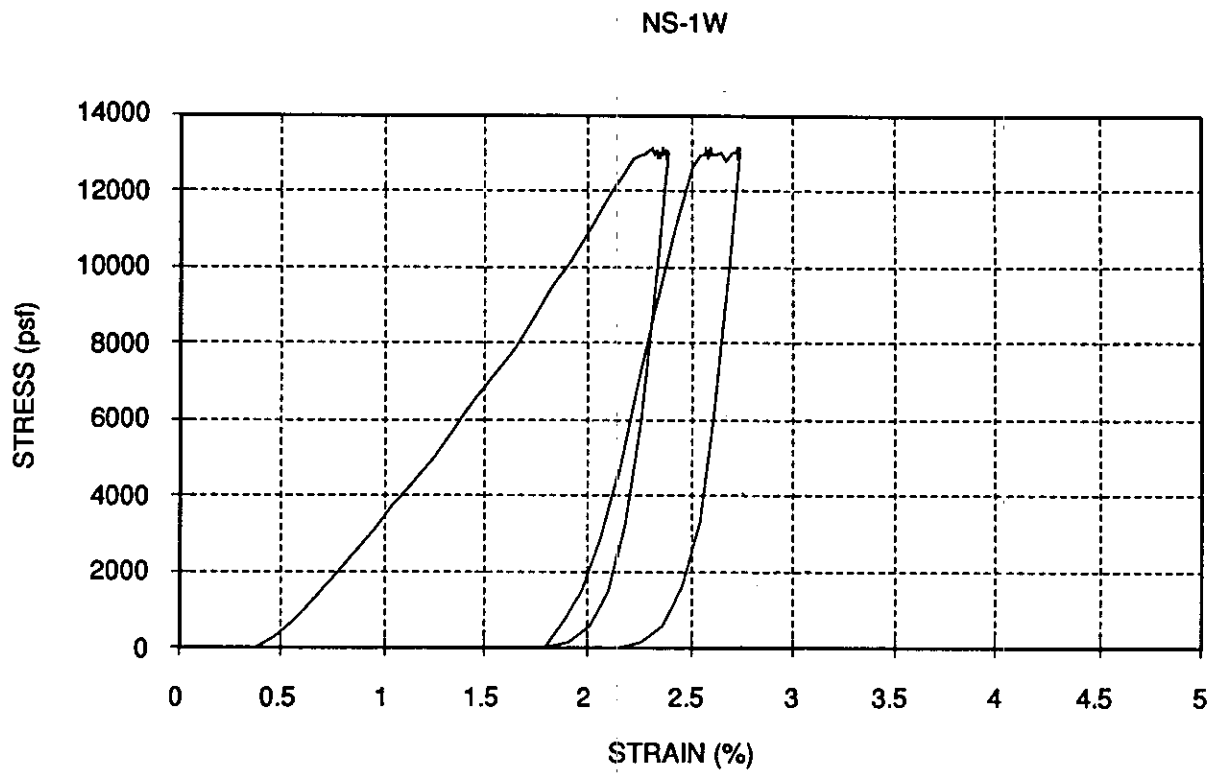
Figure 5-5. Loading Curve - Sample NS-2D.



Soil Type: Silty Fine Sand
Moisture Content: 5.0%
Relative Density: 90%

923 A026/47697/12-3-93

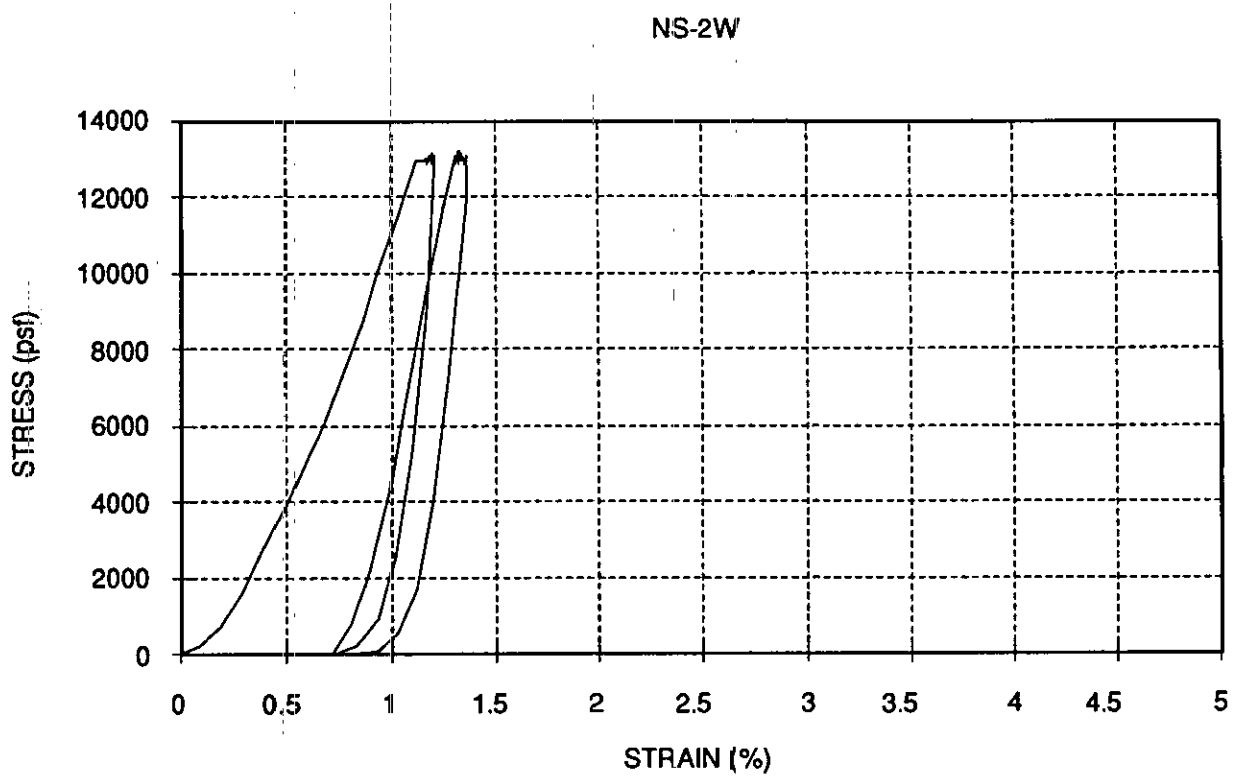
Figure 5-6. Loading Curve - Sample NS-3D.



Soil Type: Silty Fine Sand
Moisture Content: 18.8%
Relative Density: 26%

923 A026/47698/12-3-93

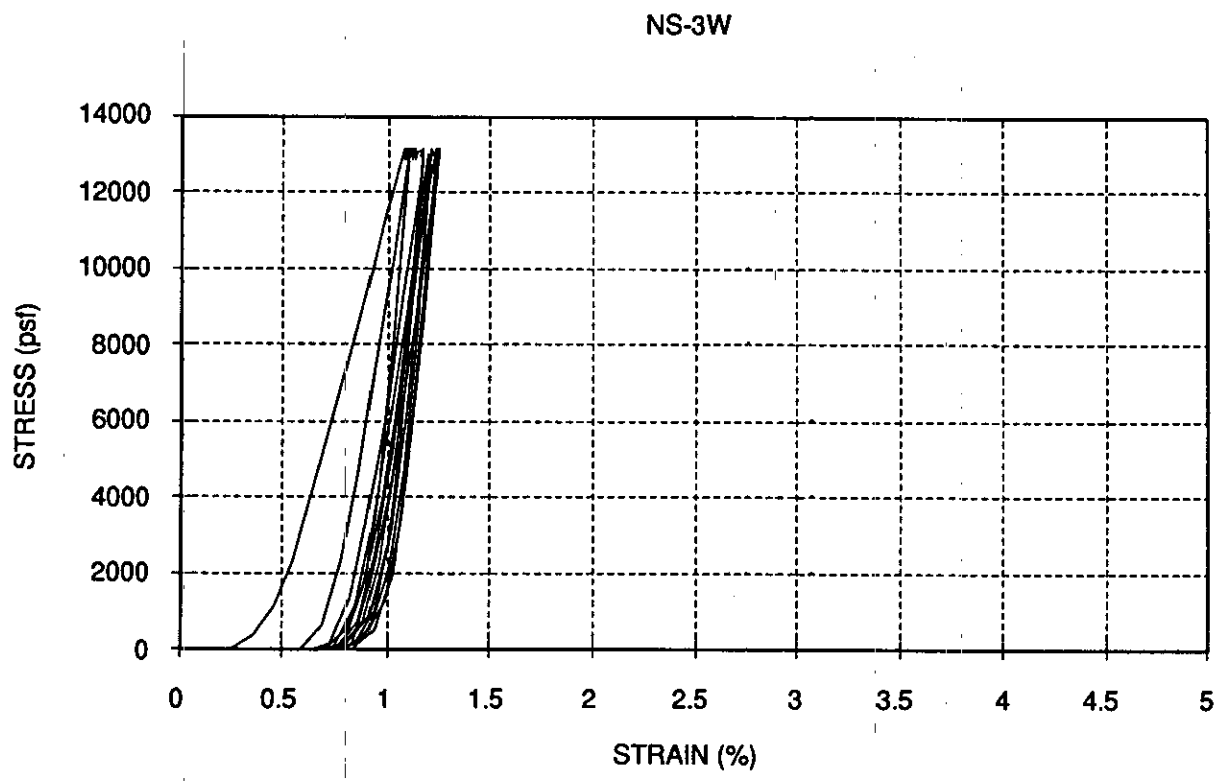
Figure 5-7. Loading Curve - Sample NS-1W.



Soil Type: Silty Fine Sand
Moisture Content: 18.7%
Relative Density: 61%

923 A026/47699/12-3-93

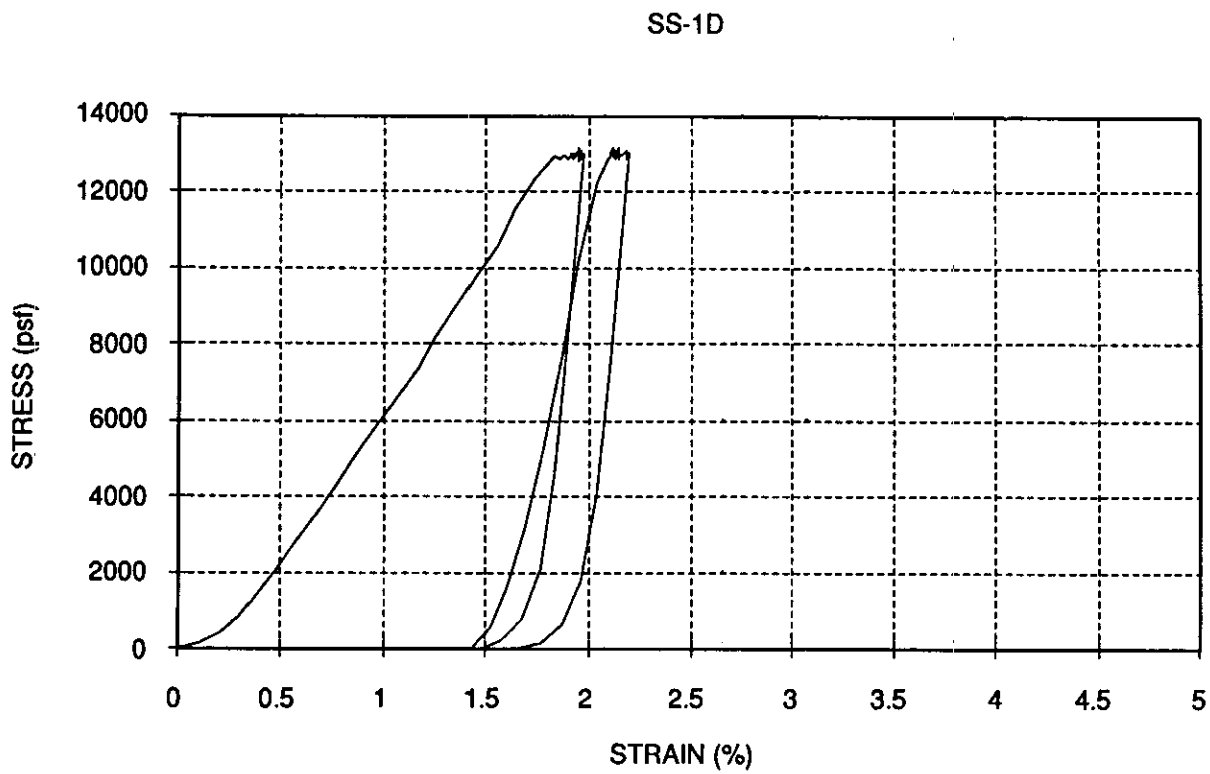
Figure 5-8. Loading Curve - Sample NS-2W.



Soil Type: Silty Fine Sand
Moisture Content: 20.2%
Relative Density: 80%

923 A026/47700/12-3-93

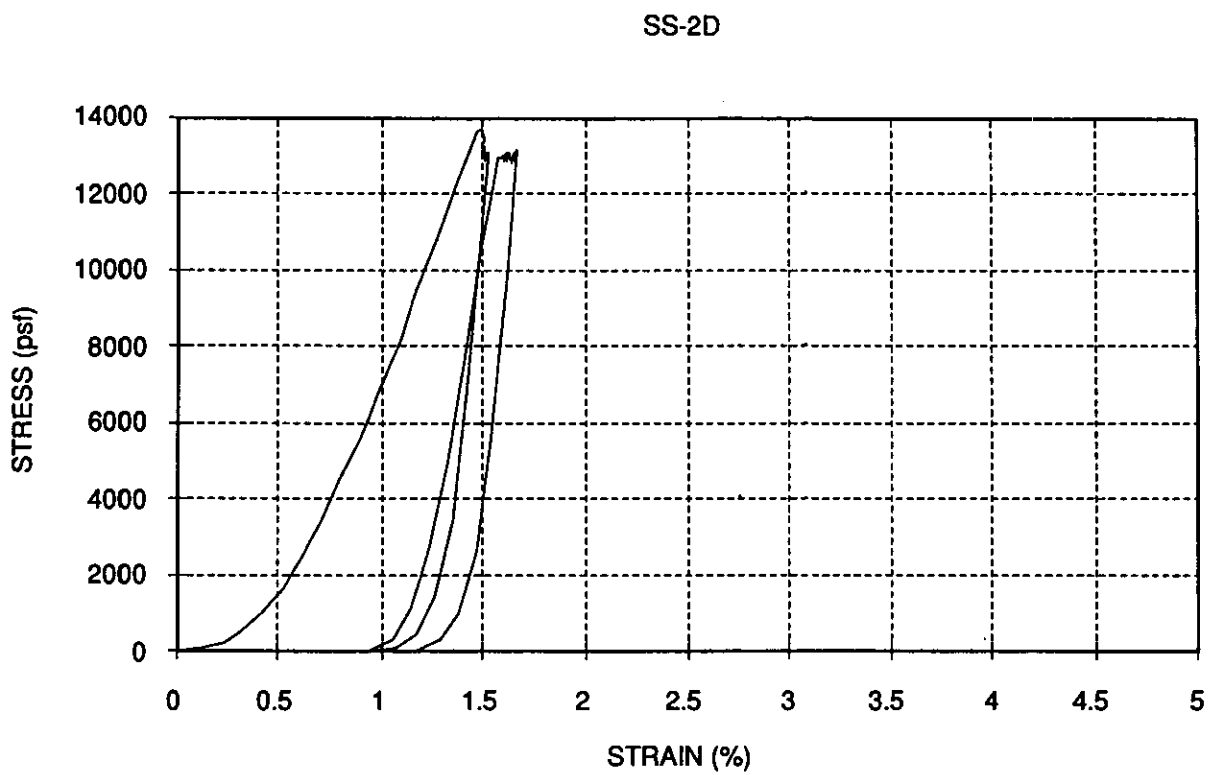
Figure 5-9. Loading Curve - Sample NS-3W.



Soil Type: Medium Sand
Moisture Content: 5.1%
Relative Density: 17%

923 A026/47701/12-3-93

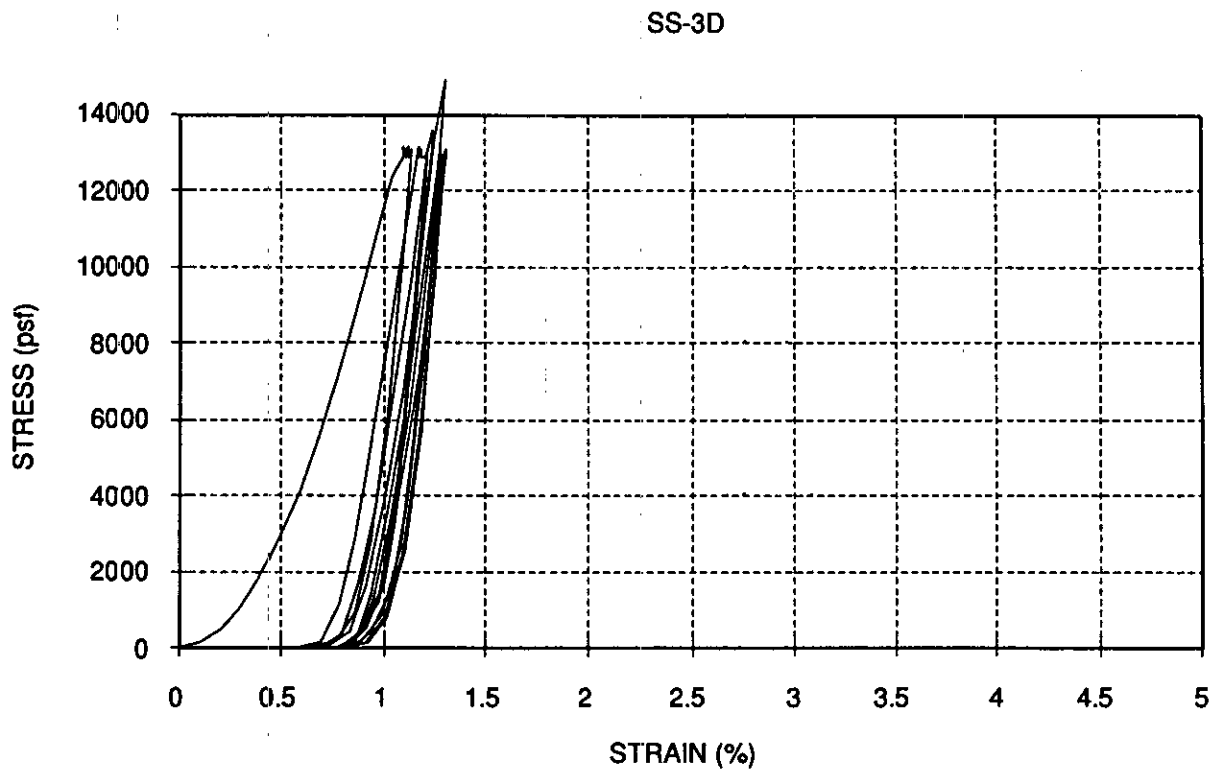
Figure 5-10. Loading Curve - Sample SS-1D.



Soil Type: Medium Sand
Moisture Content: 5.0%
Relative Density: 55%

923 A026/47702/12-3-93

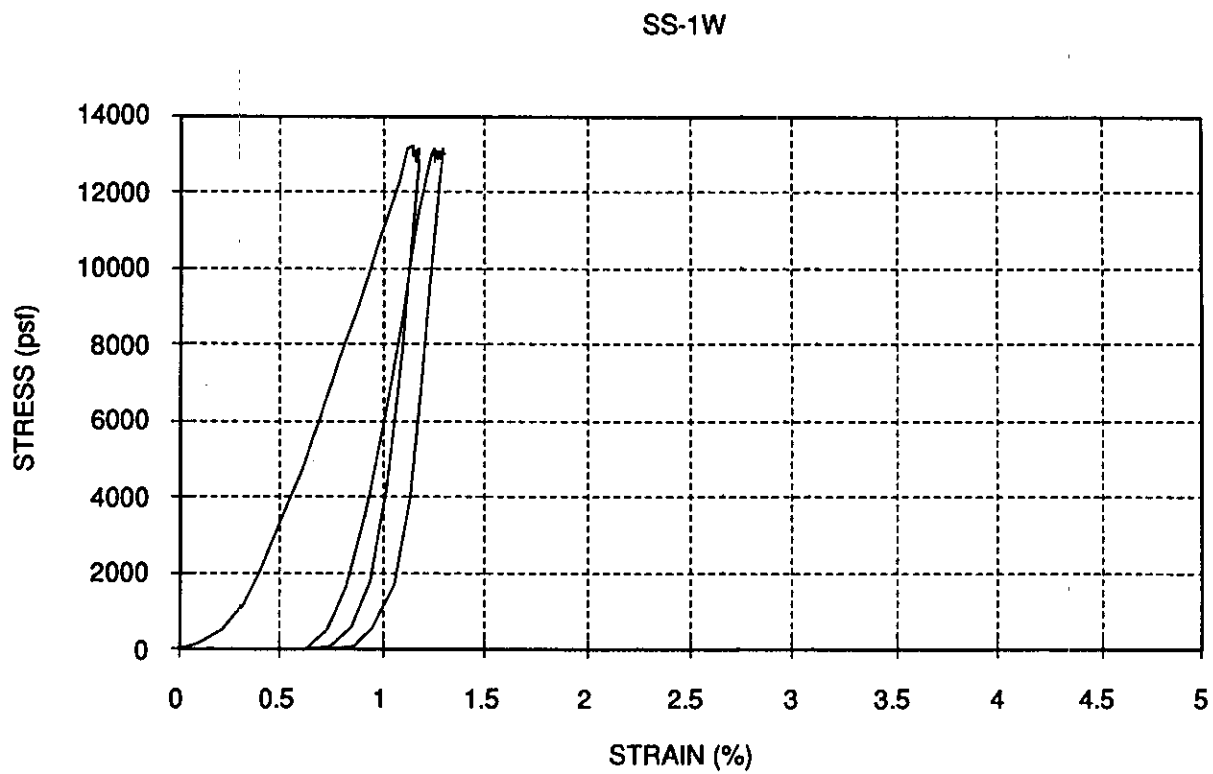
Figure 5-11. Loading Curve - Sample SS-2D.



Soil Type: Medium Sand
Moisture Content: 5.0%
Relative Density: 82%

923 A026/47703/12-6-93

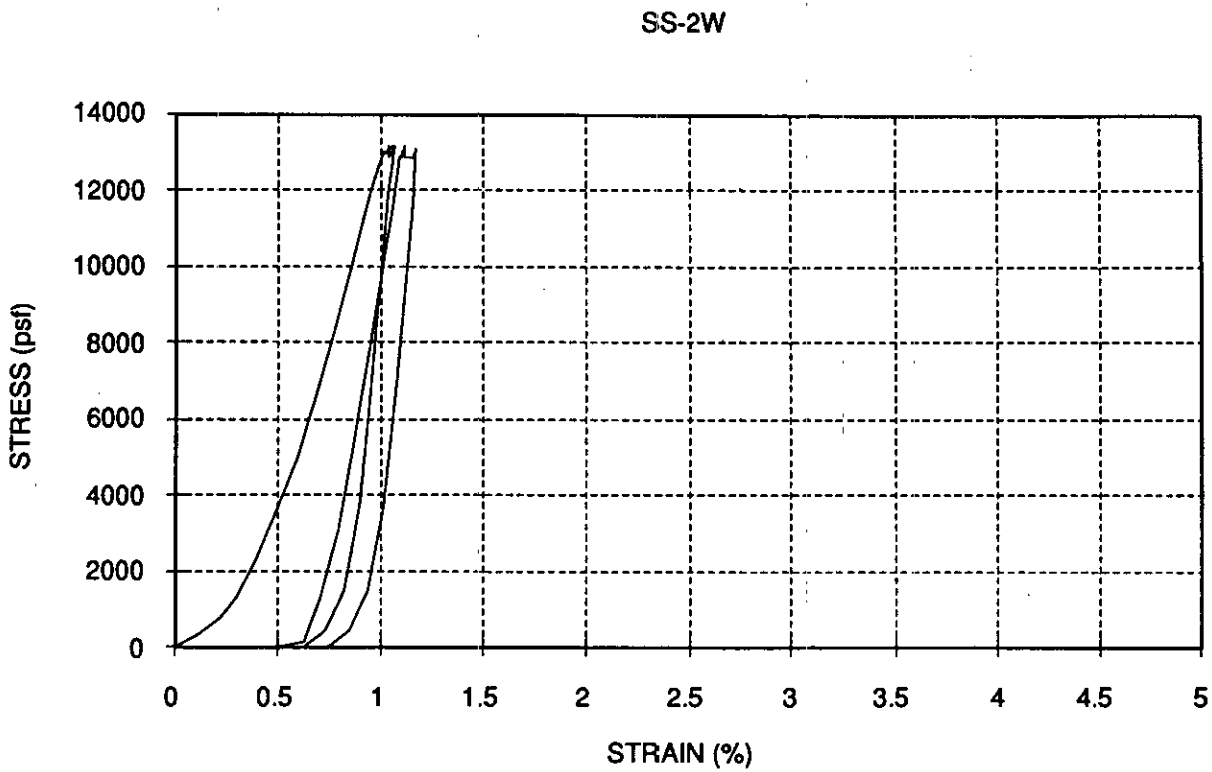
Figure 5-12. Loading Curve - Sample SS-3D.



Soil Type: Medium Sand
Moisture Content: 13.6%
Relative Density: 20%

923 A026/47704/12-3-93

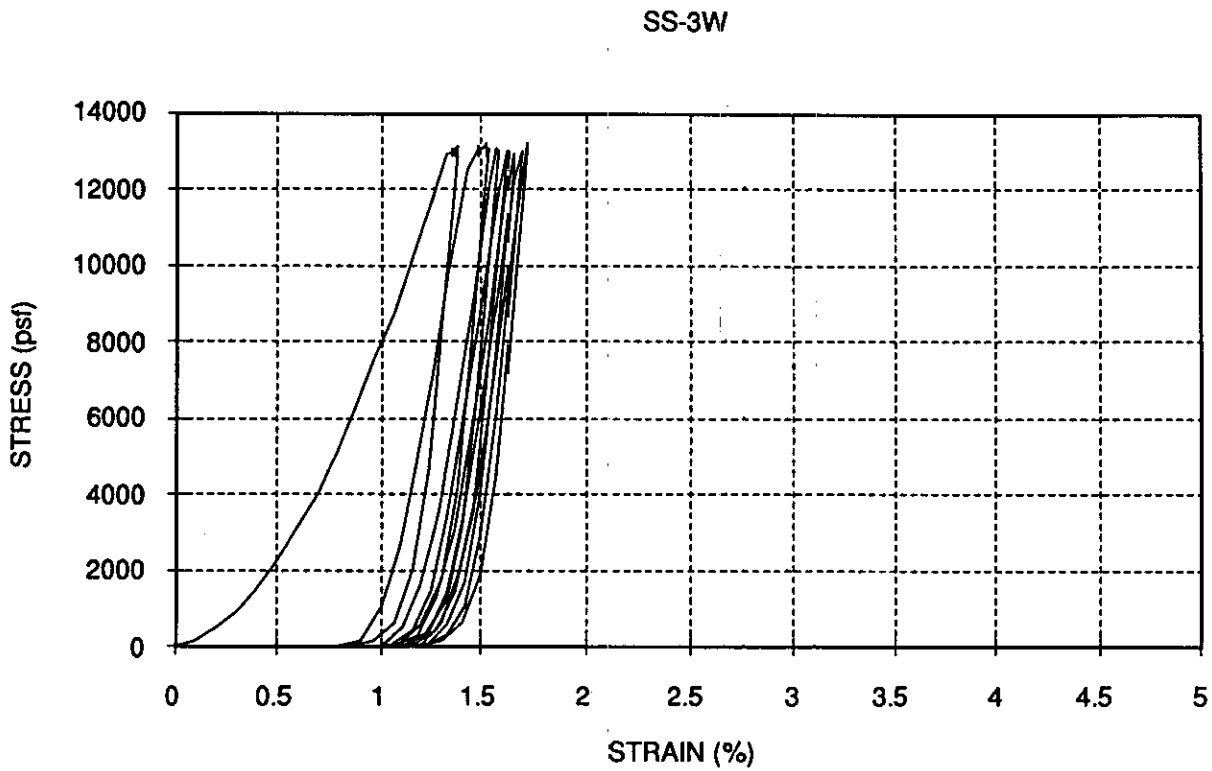
Figure 5-13. Loading Curve - Sample SS-1W.



Soil Type: Medium Sand
Moisture Content: 14.0%
Relative Density: 62%

923 A026/47705/12-3-93

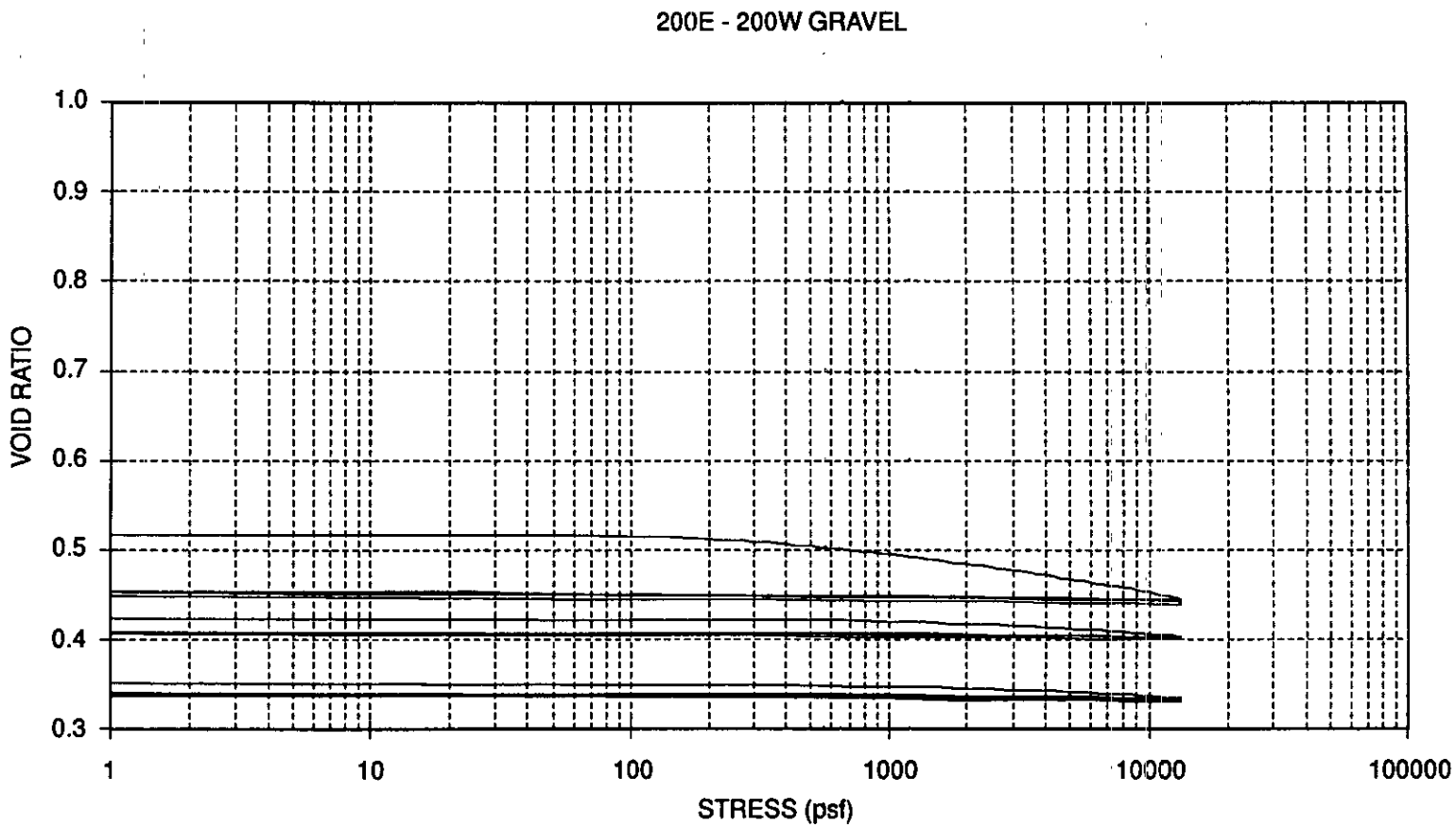
Figure 5-14. Loading Curve - Sample SS-2W.



Soil Type: Medium Sand
Moisture Content: 13.8%
Relative Density: 87%

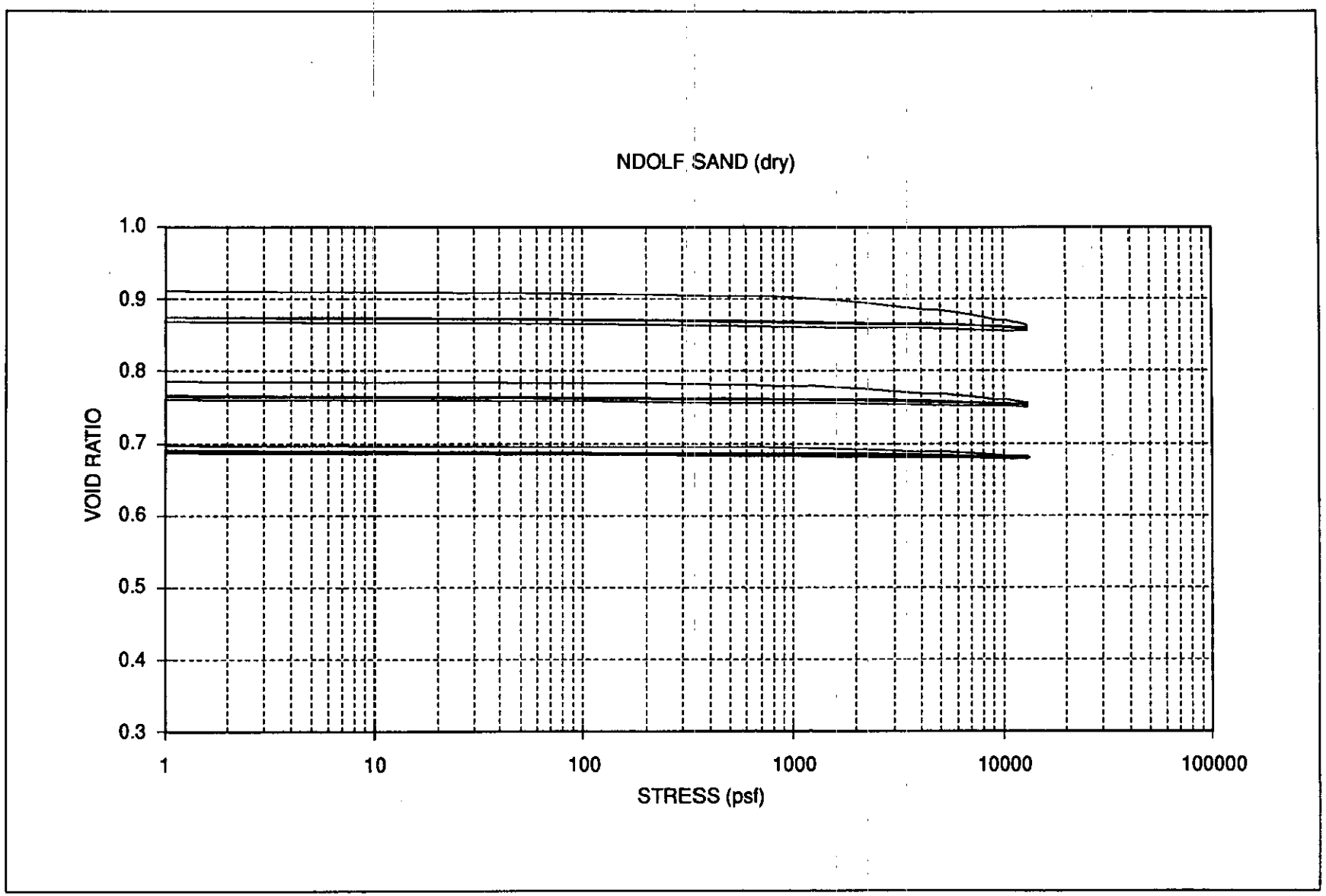
923 A026/47706/12-3-93

Figure 5-15. Loading Curve - Sample SS-3W.



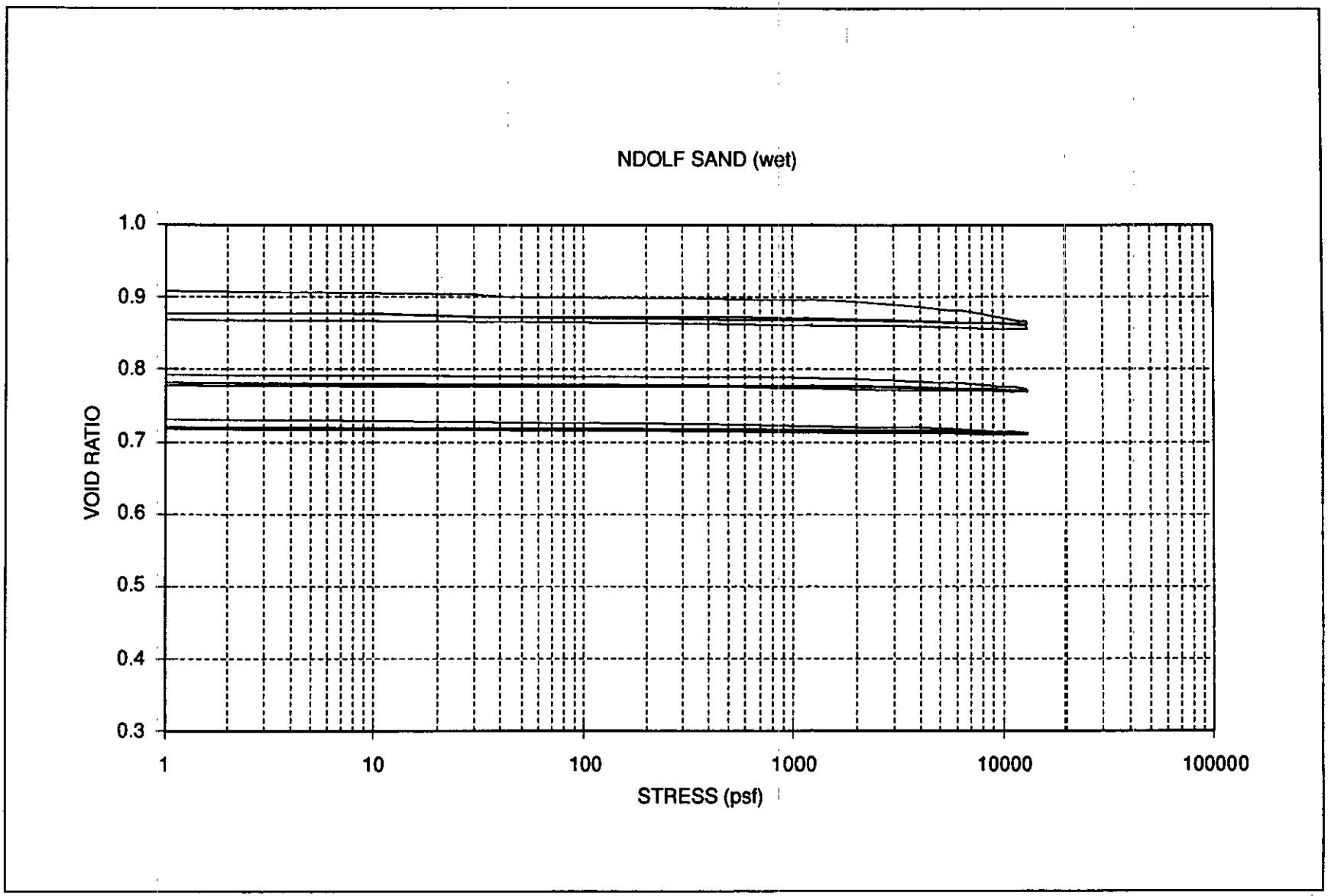
923 A026/47394/12-3-93

Figure 5-16. Void Ratio Curve - Gravel



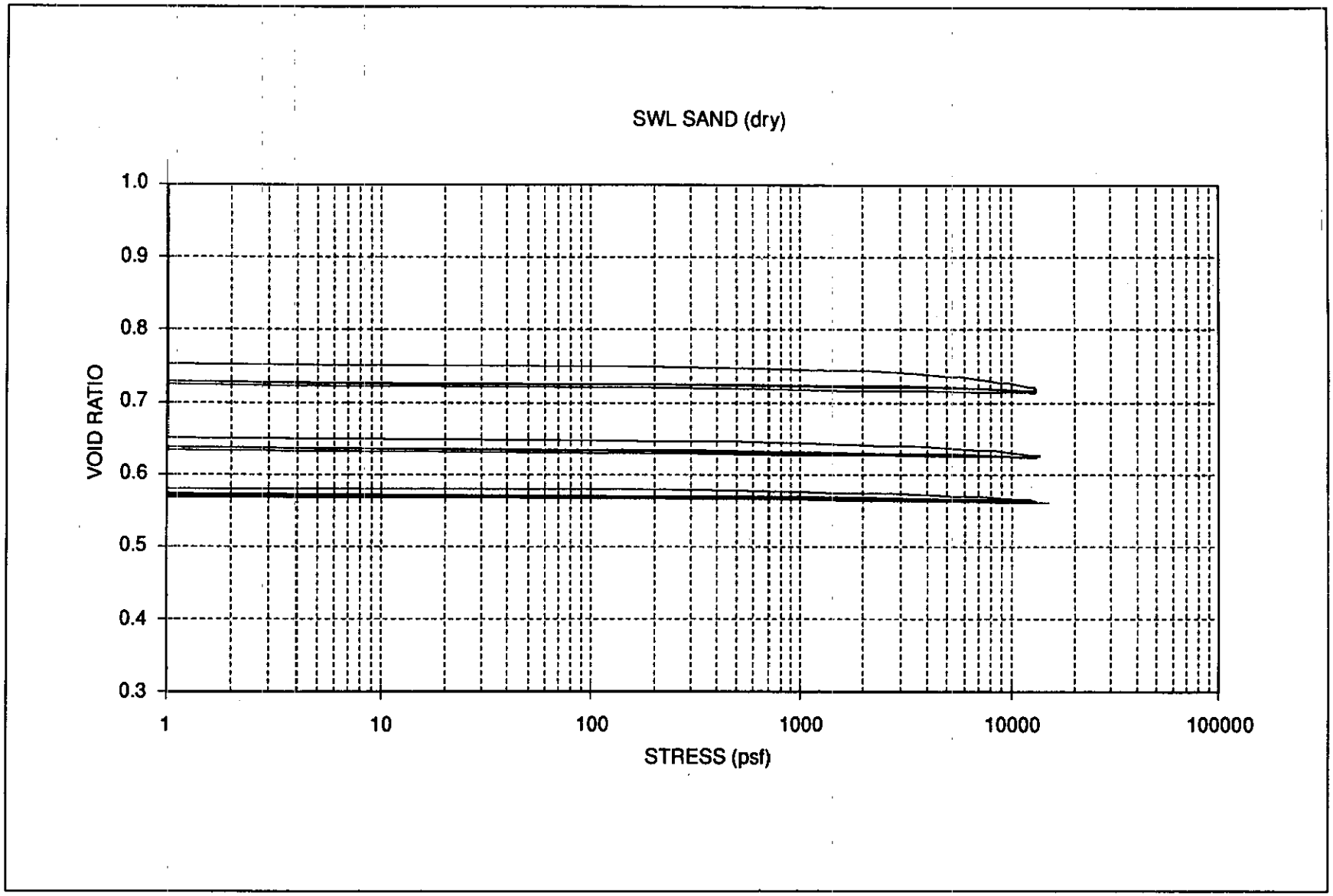
923 A026/47397/12-3-93

Figure 5-17. Void Ratio Curve - Silty Fine Sand (Dry)



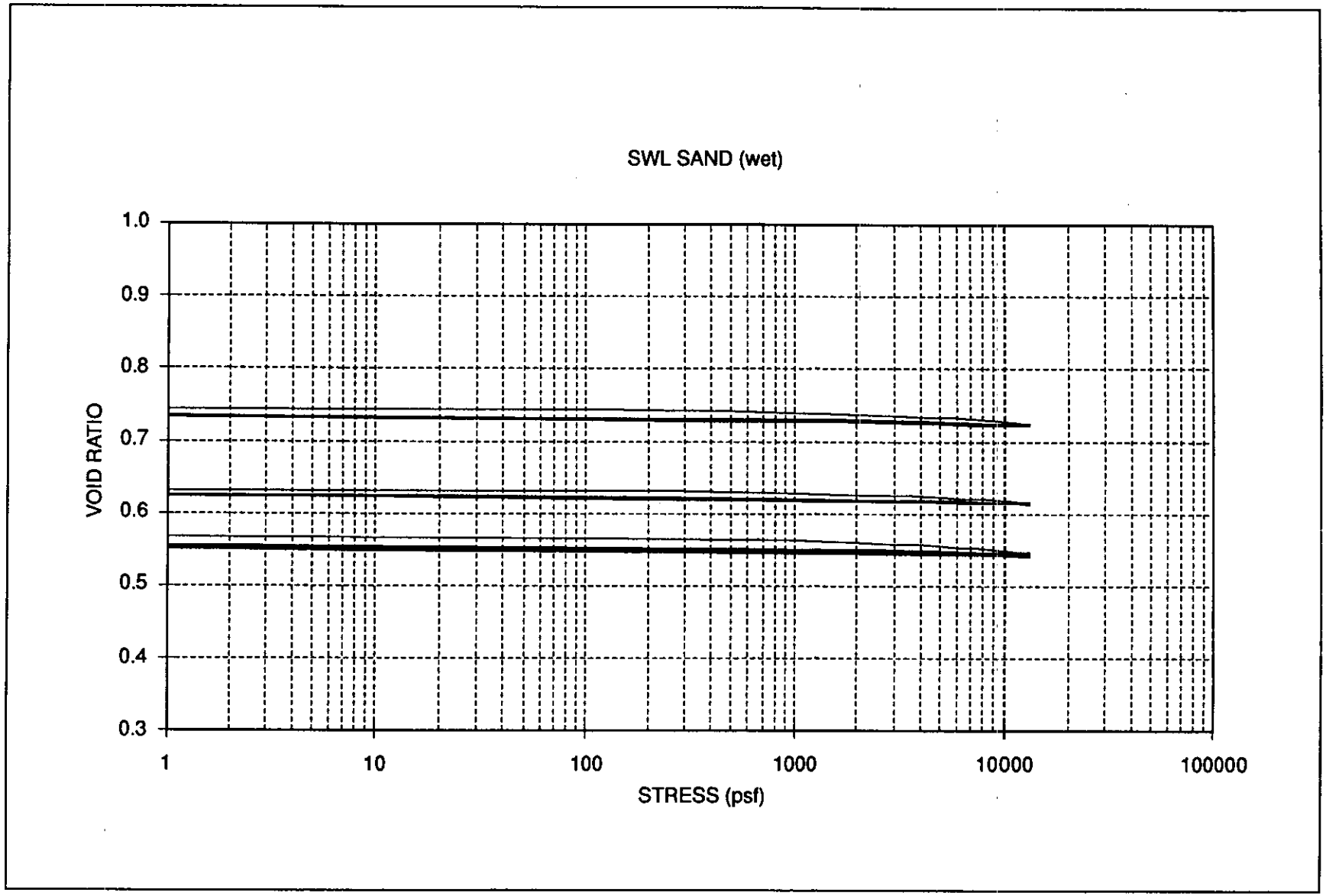
923 A026/47398/12-3-93

Figure 5-18. Void Ratio Curve - Silty Fine Sand (Wet)



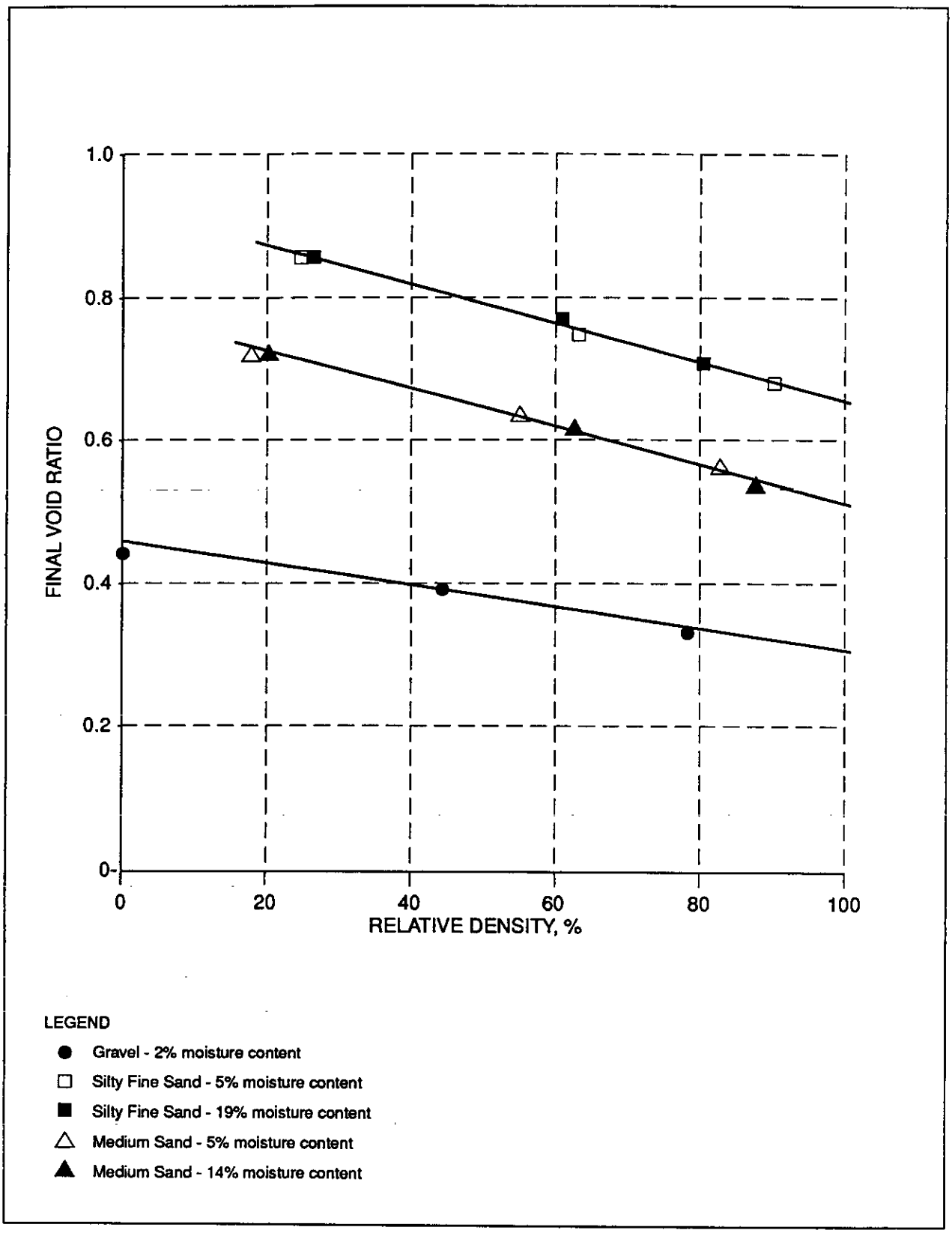
923 A026/47395/12-3-93

Figure 5-19. Void Ratio Curve - Medium Sand (Dry)



923 A026/47396/12-3-93

Figure 5-20. Void Ratio Curve - Medium Sand (Wet)



923 A026/47710/12-17-93

Figure 5-21. Final Void Ratio vs. Relative Density from Compressibility Tests

3700	61.67	2552.3	0.451	4.88	12994	0.4437
3750	62.50	2348.3	0.450	4.87	11956	0.4439
3800	63.33	1525.7	0.444	4.80	7768	0.4449
3850	64.17	882.7	0.439	4.74	4494	0.4458
3900	65.00	424.1	0.433	4.68	2159	0.4468
3950	65.83	164.2	0.428	4.62	836	0.4476
4000	66.67	59.1	0.421	4.54	301	0.4488
4050	67.50	6.3	0.411	4.43	32	0.4505
4100	68.33	1.3	0.401	4.32	7	0.4522
4150	69.17	0.0	0.392	4.22	0	0.4537
4200	70.00	0.0	0.392	4.22	0	0.4537
4250	70.83	0.0	0.392	4.22	0	0.4537
4300	71.67	0.0	0.392	4.22	0	0.4537
4350	72.50	0.0	0.392	4.22	0	0.4537
4400	73.33	0.0	0.392	4.22	0	0.4537
4450	74.17	0.0	0.392	4.22	0	0.4537
4500	75.00	4.8	0.399	4.30	24	0.4525
4550	75.83	10.2	0.409	4.41	52	0.4508
4600	76.67	93.4	0.416	4.49	476	0.4496
4650	77.50	259.9	0.422	4.55	1323	0.4486
4700	78.33	556.3	0.428	4.62	2832	0.4476
4750	79.17	946.3	0.434	4.69	4818	0.4466
4800	80.00	1401.7	0.441	4.77	7136	0.4454
4850	80.83	1863.5	0.447	4.83	9488	0.4444
4900	81.67	2269.9	0.454	4.91	11557	0.4432
4950	82.50	2573.5	0.461	4.99	13102	0.4420
5000	83.33	2521.3	0.462	5.00	12837	0.4419
5050	84.17	2545.7	0.463	5.01	12961	0.4417
5100	85.00	2526.1	0.463	5.01	12861	0.4417
5150	85.83	2553.9	0.464	5.02	13003	0.4415
5200	86.67	2531.0	0.464	5.02	12886	0.4415
5250	87.50	2575.1	0.464	5.02	13111	0.4415
5300	88.33	2552.3	0.464	5.02	12994	0.4415
5350	89.17	2537.6	0.464	5.02	12920	0.4415
5400	90.00	2527.8	0.464	5.02	12870	0.4415
5450	90.83	2570.2	0.465	5.03	13086	0.4414
5500	91.67	2555.5	0.465	5.03	13011	0.4414
5550	92.50	2555.5	0.465	5.03	13011	0.4414
5600	93.33	2537.6	0.465	5.03	12920	0.4414
5650	94.17	2527.8	0.465	5.03	12870	0.4414
5700	95.00	2563.7	0.465	5.03	13052	0.4414
5750	95.83	2555.5	0.465	5.03	13011	0.4414
5800	96.67	2545.7	0.465	5.03	12961	0.4414
5850	97.50	2563.7	0.466	5.04	13052	0.4412
5900	98.33	2531.0	0.469	5.08	12886	0.4407
5950	99.17	2521.3	0.471	5.10	12837	0.4404
6000	100.00	2565.3	0.474	5.13	13061	0.4398
6050	100.83	2570.2	0.475	5.14	13086	0.4397
6100	101.67	2555.5	0.475	5.14	13011	0.4397
6150	102.50	2549.0	0.475	5.14	12978	0.4397
6200	103.33	2540.8	0.475	5.14	12936	0.4397
6250	104.17	2537.6	0.475	5.14	12920	0.4397
6300	105.00	2534.3	0.475	5.14	12903	0.4397
6350	105.83	2566.9	0.475	5.14	13069	0.4397

6400	106.67	2565.3	0.475	5.14	13061	0.4397
6450	107.50	2555.5	0.475	5.14	13011	0.4397
6500	108.33	2553.9	0.475	5.14	13003	0.4397
6550	109.17	2550.6	0.475	5.14	12986	0.4397
6600	110.00	2545.7	0.475	5.14	12961	0.4397
6650	110.83	2544.1	0.475	5.14	12953	0.4397
6700	111.67	2540.8	0.475	5.14	12936	0.4397
6750	112.50	2537.6	0.475	5.14	12920	0.4397
6800	113.33	2535.9	0.475	5.14	12911	0.4397
6850	114.17	2532.7	0.475	5.14	12895	0.4397
6900	115.00	2566.9	0.476	5.15	13069	0.4395
6950	115.83	2557.2	0.476	5.15	13019	0.4395
7000	116.67	1731.3	0.470	5.09	8815	0.4405
7050	117.50	1039.4	0.464	5.02	5292	0.4415
7100	118.33	528.5	0.459	4.97	2691	0.4424
7150	119.17	208.6	0.453	4.90	1062	0.4434
7200	120.00	66.6	0.447	4.83	339	0.4444
7250	120.83	15.3	0.439	4.74	78	0.4458
7300	121.67	2.6	0.428	4.62	13	0.4476
7350	122.50	0.0	0.419	4.52	0	0.4491

GOLDER ASSOCIATES INC., REDMOND, WA

LOAD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-13-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	GRAVEL
TEST No.:	G-2

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	426.50
AREA (sq ft):	0.1964	WET WT. + TARE (g):	4994.7
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	4899.9
MOLD + SOIL (g):	17379	MOISTURE CONTENT (%):	2.1
MOLD (g):	8758		
		WET DENSITY (pcf):	129.0
SPECIFIC GRAVITY:	2.88	DRY DENSITY (pcf):	126.3

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.055	0.00	0	0.4234
40	0.67	28.2	0.062	0.08	144	0.4223
80	1.33	80.0	0.067	0.13	407	0.4215
120	2.00	141.2	0.073	0.20	719	0.4205
160	2.67	209.5	0.078	0.26	1067	0.4197
200	3.33	282.2	0.084	0.32	1437	0.4188
240	4.00	355.5	0.089	0.38	1810	0.4180
280	4.67	433.9	0.095	0.44	2209	0.4171
320	5.33	522.0	0.100	0.50	2658	0.4163
360	6.00	621.5	0.106	0.57	3164	0.4153
400	6.67	716.2	0.112	0.63	3646	0.4144
440	7.33	814.1	0.117	0.69	4145	0.4136
480	8.00	925.1	0.123	0.76	4710	0.4126
520	8.67	1044.2	0.129	0.82	5316	0.4117
560	9.33	1169.9	0.134	0.88	5956	0.4109
600	10.00	1308.6	0.140	0.94	6662	0.4099
640	10.67	1455.5	0.145	1.00	7410	0.4091
680	11.33	1595.9	0.151	1.07	8125	0.4082
720	12.00	1733.0	0.157	1.13	8823	0.4073
760	12.67	1892.9	0.162	1.19	9637	0.4065

800	13.33	2052.9	0.168	1.26	10452	0.4055
840	14.00	2219.3	0.174	1.32	11299	0.4046
880	14.67	2400.5	0.179	1.38	12222	0.4038
920	15.33	2532.7	0.184	1.43	12895	0.4030
960	16.00	2560.4	0.186	1.46	13036	0.4027
1000	16.67	2529.4	0.186	1.46	12878	0.4027
1040	17.33	2545.7	0.187	1.47	12961	0.4025
1080	18.00	2565.3	0.188	1.48	13061	0.4023
1120	18.67	2532.7	0.188	1.48	12895	0.4023
1160	19.33	2553.9	0.188	1.48	13003	0.4023
1200	20.00	2534.3	0.188	1.48	12903	0.4023
1240	20.67	2573.5	0.189	1.49	13102	0.4022
1280	21.33	2547.4	0.189	1.49	12969	0.4022
1320	22.00	2534.3	0.189	1.49	12903	0.4022
1360	22.67	2580.0	0.189	1.49	13135	0.4022
1400	23.33	2563.7	0.189	1.49	13052	0.4022
1440	24.00	2547.4	0.189	1.49	12969	0.4022
1480	24.67	2537.6	0.189	1.49	12920	0.4022
1520	25.33	2531.0	0.189	1.49	12886	0.4022
1560	26.00	2522.9	0.189	1.49	12845	0.4022
1600	26.67	2576.7	0.190	1.50	13119	0.4020
1640	27.33	2565.3	0.190	1.50	13061	0.4020
1680	28.00	2555.5	0.190	1.50	13011	0.4020
1720	28.67	2549.0	0.190	1.50	12978	0.4020
1760	29.33	2539.2	0.190	1.50	12928	0.4020
1800	30.00	2558.8	0.190	1.50	13028	0.4020
1840	30.67	2238.9	0.188	1.48	11399	0.4023
1880	31.33	1594.2	0.184	1.43	8116	0.4030
1920	32.00	1047.5	0.179	1.38	5333	0.4038
1960	32.67	605.2	0.175	1.33	3081	0.4044
2000	33.33	295.1	0.171	1.29	1502	0.4050
2040	34.00	114.0	0.165	1.22	580	0.4060
2080	34.67	35.8	0.160	1.17	182	0.4068
2120	35.33	1.3	0.154	1.10	7	0.4077
2160	36.00	0.0	0.149	1.04	0	0.4085
2200	36.67	0.0	0.149	1.04	0	0.4085
2240	37.33	0.0	0.149	1.04	0	0.4085
2280	38.00	0.0	0.149	1.04	0	0.4085
2320	38.67	0.0	0.149	1.04	0	0.4085
2360	39.33	0.0	0.149	1.04	0	0.4085
2400	40.00	0.0	0.149	1.04	0	0.4085
2440	40.67	0.0	0.149	1.04	0	0.4085
2480	41.33	15.5	0.154	1.10	79	0.4077
2520	42.00	111.0	0.160	1.17	565	0.4068
2560	42.67	287.6	0.165	1.22	1464	0.4060
2600	43.33	546.5	0.170	1.28	2782	0.4052
2640	44.00	877.8	0.174	1.32	4469	0.4046
2680	44.67	1264.6	0.179	1.38	6438	0.4038
2720	45.33	1687.3	0.184	1.43	8590	0.4030
2760	46.00	2093.7	0.190	1.50	10660	0.4020
2800	46.67	2456.0	0.195	1.56	12504	0.4012
2840	47.33	2535.9	0.197	1.58	12911	0.4009
2880	48.00	2549.0	0.197	1.58	12978	0.4009
2920	48.67	2529.4	0.198	1.59	12878	0.4008

2960	49.33	2563.7	0.198	1.59	13052	0.4008
3000	50.00	2549.0	0.198	1.59	12978	0.4008
3040	50.67	2539.2	0.198	1.59	12928	0.4008
3080	51.33	2534.3	0.198	1.59	12903	0.4008
3120	52.00	2573.5	0.198	1.59	13102	0.4008
3160	52.67	2566.9	0.198	1.59	13069	0.4008
3200	53.33	2553.9	0.199	1.60	13003	0.4006
3240	54.00	2540.8	0.198	1.59	12936	0.4008
3280	54.67	2539.2	0.199	1.60	12928	0.4006
3320	55.33	2534.3	0.199	1.60	12903	0.4006
3360	56.00	2531.0	0.199	1.60	12886	0.4006
3400	56.67	2566.9	0.199	1.60	13069	0.4006
3440	57.33	2562.1	0.199	1.60	13044	0.4006
3480	58.00	2555.5	0.199	1.60	13011	0.4006
3520	58.67	2550.6	0.199	1.60	12986	0.4006
3560	59.33	2545.7	0.199	1.60	12961	0.4006
3600	60.00	2540.8	0.199	1.60	12936	0.4006
3640	60.67	2539.2	0.199	1.60	12928	0.4006
3680	61.33	2537.6	0.199	1.60	12920	0.4006
3720	62.00	2545.7	0.199	1.60	12961	0.4006
3760	62.67	2550.6	0.200	1.61	12986	0.4005
3800	63.33	2519.6	0.201	1.62	12828	0.4003
3840	64.00	2550.6	0.202	1.63	12986	0.4001
3880	64.67	2550.6	0.203	1.64	12986	0.4000
3920	65.33	2576.7	0.203	1.64	13119	0.4000
3960	66.00	2570.2	0.203	1.64	13086	0.4000
4000	66.67	2568.6	0.203	1.64	13077	0.4000
4040	67.33	2560.4	0.203	1.64	13036	0.4000
4080	68.00	2557.2	0.203	1.64	13019	0.4000
4120	68.67	2553.9	0.203	1.64	13003	0.4000
4160	69.33	2552.3	0.203	1.64	12994	0.4000
4200	70.00	2550.6	0.203	1.64	12986	0.4000
4240	70.67	2549.0	0.203	1.64	12978	0.4000
4280	71.33	2545.7	0.203	1.64	12961	0.4000
4320	72.00	2542.5	0.203	1.64	12945	0.4000
4360	72.67	2540.8	0.203	1.64	12936	0.4000
4400	73.33	2537.6	0.203	1.64	12920	0.4000
4440	74.00	2537.6	0.203	1.64	12920	0.4000
4480	74.67	2535.9	0.203	1.64	12911	0.4000
4520	75.33	2540.8	0.203	1.64	12936	0.4000
4560	76.00	2537.6	0.203	1.64	12920	0.4000
4600	76.67	2532.7	0.203	1.64	12895	0.4000
4640	77.33	2532.7	0.203	1.64	12895	0.4000
4680	78.00	2532.7	0.203	1.64	12895	0.4000
4720	78.67	2565.3	0.203	1.64	13061	0.4000
4760	79.33	2560.4	0.203	1.64	13036	0.4000
4800	80.00	2558.8	0.203	1.64	13028	0.4000
4840	80.67	1906.0	0.199	1.60	9704	0.4006
4880	81.33	1300.5	0.194	1.54	6621	0.4014
4920	82.00	794.5	0.190	1.50	4045	0.4020
4960	82.67	411.0	0.186	1.46	2093	0.4027
5000	83.33	169.3	0.181	1.40	862	0.4035
5040	84.00	55.4	0.175	1.33	282	0.4044
5080	84.67	11.0	0.169	1.27	56	0.4054

5120	85.33	0.0	0.162	1.19	0	0.4065

GOLDER ASSOCIATES INC., REDMOND, WA

LOAD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-13-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	GRAVEL
TEST No.:	G-3

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	426.50
AREA (sq ft):	0.1964	WET WT. + TARE (g):	4994.7
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	4899.9
MOLD + SOIL (g):	17840	MOISTURE CONTENT (%):	2.1
MOLD (g):	8758		
		WET DENSITY (pcf):	135.9
SPECIFIC GRAVITY:	2.88	DRY DENSITY (pcf):	133.1

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.039	0.00	0	0.3511
40	0.67	27.6	0.045	0.07	141	0.3502
80	1.33	84.4	0.052	0.14	430	0.3492
120	2.00	151.7	0.058	0.21	772	0.3483
160	2.67	226.8	0.063	0.27	1155	0.3475
200	3.33	307.2	0.069	0.33	1564	0.3466
240	4.00	398.0	0.075	0.40	2026	0.3457
280	4.67	494.2	0.080	0.46	2516	0.3450
320	5.33	613.4	0.086	0.52	3123	0.3441
360	6.00	732.5	0.092	0.59	3729	0.3432
400	6.67	863.1	0.097	0.64	4394	0.3424
440	7.33	1013.2	0.103	0.71	5158	0.3415
480	8.00	1173.2	0.109	0.78	5973	0.3406
520	8.67	1338.0	0.114	0.83	6812	0.3399
560	9.33	1525.7	0.120	0.90	7768	0.3390
600	10.00	1693.8	0.126	0.97	8624	0.3381
640	10.67	1892.9	0.131	1.02	9637	0.3373
680	11.33	2090.4	0.137	1.09	10643	0.3364
720	12.00	2297.7	0.142	1.14	11698	0.3357
760	12.67	2529.4	0.148	1.21	12878	0.3348

800	13.33	2516.4	0.150	1.23	12812	0.3345
840	14.00	2562.1	0.151	1.24	13044	0.3343
880	14.67	2527.8	0.151	1.24	12870	0.3343
920	15.33	2547.4	0.152	1.26	12969	0.3342
960	16.00	2526.1	0.152	1.26	12861	0.3342
1000	16.67	2562.1	0.152	1.26	13044	0.3342
1040	17.33	2545.7	0.152	1.26	12961	0.3342
1080	18.00	2531.0	0.153	1.27	12886	0.3340
1120	18.67	2589.8	0.153	1.27	13185	0.3340
1160	19.33	2575.1	0.153	1.27	13111	0.3340
1200	20.00	2560.4	0.153	1.27	13036	0.3340
1240	20.67	2549.0	0.153	1.27	12978	0.3340
1280	21.33	2540.8	0.153	1.27	12936	0.3340
1320	22.00	2540.8	0.153	1.27	12936	0.3340
1360	22.67	2534.3	0.153	1.27	12903	0.3340
1400	23.33	2566.9	0.154	1.28	13069	0.3339
1440	24.00	2557.2	0.154	1.28	13019	0.3339
1480	24.67	2550.6	0.154	1.28	12986	0.3339
1520	25.33	2545.7	0.154	1.28	12961	0.3339
1560	26.00	2537.6	0.154	1.28	12920	0.3339
1600	26.67	2565.3	0.154	1.28	13061	0.3339
1640	27.33	2557.2	0.154	1.28	13019	0.3339
1680	28.00	2487.0	0.154	1.28	12662	0.3339
1720	28.67	1808.0	0.149	1.22	9205	0.3346
1760	29.33	1223.8	0.144	1.17	6231	0.3354
1800	30.00	740.7	0.140	1.12	3771	0.3360
1840	30.67	363.7	0.136	1.08	1852	0.3366
1880	31.33	158.5	0.130	1.01	807	0.3375
1920	32.00	50.3	0.124	0.94	256	0.3384
1960	32.67	9.6	0.118	0.88	49	0.3393
2000	33.33	0.0	0.112	0.81	0	0.3402
2040	34.00	0.0	0.109	0.78	0	0.3406
2080	34.67	0.0	0.110	0.79	0	0.3405
2120	35.33	0.0	0.110	0.79	0	0.3405
2160	36.00	0.0	0.110	0.79	0	0.3405
2200	36.67	0.0	0.109	0.78	0	0.3406
2240	37.33	0.0	0.110	0.79	0	0.3405
2280	38.00	0.0	0.109	0.78	0	0.3406
2320	38.67	0.0	0.110	0.79	0	0.3405
2360	39.33	11.9	0.115	0.84	61	0.3397
2400	40.00	66.8	0.121	0.91	340	0.3388
2440	40.67	192.5	0.127	0.98	980	0.3379
2480	41.33	424.1	0.131	1.02	2159	0.3373
2520	42.00	745.6	0.136	1.08	3796	0.3366
2560	42.67	1121.0	0.141	1.13	5707	0.3358
2600	43.33	1550.2	0.146	1.19	7892	0.3351
2640	44.00	1982.7	0.151	1.24	10094	0.3343
2680	44.67	2382.5	0.157	1.31	12130	0.3334
2720	45.33	2539.2	0.159	1.33	12928	0.3331
2760	46.00	2539.2	0.160	1.34	12928	0.3330
2800	46.67	2575.1	0.161	1.36	13111	0.3328
2840	47.33	2560.4	0.160	1.34	13036	0.3330
2880	48.00	2542.5	0.160	1.34	12945	0.3330
2920	48.67	2532.7	0.161	1.36	12895	0.3328

2960	49.33	2539.2	0.161	1.36	12928	0.3328
3000	50.00	2568.6	0.161	1.36	13077	0.3328
3040	50.67	2562.1	0.161	1.36	13044	0.3328
3080	51.33	2555.5	0.161	1.36	13011	0.3328
3120	52.00	2547.4	0.161	1.36	12969	0.3328
3160	52.67	2544.1	0.161	1.36	12953	0.3328
3200	53.33	2539.2	0.161	1.36	12928	0.3328
3240	54.00	2535.9	0.161	1.36	12911	0.3328
3280	54.67	2532.7	0.161	1.36	12895	0.3328
3320	55.33	2570.2	0.161	1.36	13086	0.3328
3360	56.00	2566.9	0.161	1.36	13069	0.3328
3400	56.67	2562.1	0.161	1.36	13044	0.3328
3440	57.33	2557.2	0.161	1.36	13019	0.3328
3480	58.00	2560.4	0.161	1.36	13036	0.3328
3520	58.67	2550.6	0.161	1.36	12986	0.3328
3560	59.33	2547.4	0.161	1.36	12969	0.3328
3600	60.00	2545.7	0.161	1.36	12961	0.3328
3640	60.67	2552.3	0.162	1.37	12994	0.3327
3680	61.33	2549.0	0.163	1.38	12978	0.3325
3720	62.00	2558.8	0.163	1.38	13028	0.3325
3760	62.67	2555.5	0.163	1.38	13011	0.3325
3800	63.33	2578.4	0.164	1.39	13127	0.3324
3840	64.00	2573.5	0.164	1.39	13102	0.3324
3880	64.67	2568.6	0.164	1.39	13077	0.3324
3920	65.33	2565.3	0.164	1.39	13061	0.3324
3960	66.00	2565.3	0.164	1.39	13061	0.3324
4000	66.67	2560.4	0.164	1.39	13036	0.3324
4040	67.33	2560.4	0.164	1.39	13036	0.3324
4080	68.00	2557.2	0.164	1.39	13019	0.3324
4120	68.67	2557.2	0.164	1.39	13019	0.3324
4160	69.33	2557.2	0.164	1.39	13019	0.3324
4200	70.00	2553.9	0.164	1.39	13003	0.3324
4240	70.67	2550.6	0.164	1.39	12986	0.3324
4280	71.33	2550.6	0.164	1.39	12986	0.3324
4320	72.00	2550.6	0.164	1.39	12986	0.3324
4360	72.67	2545.7	0.164	1.39	12961	0.3324
4400	73.33	2545.7	0.164	1.39	12961	0.3324
4440	74.00	2545.7	0.164	1.39	12961	0.3324
4480	74.67	2544.1	0.164	1.39	12953	0.3324
4520	75.33	2544.1	0.164	1.39	12953	0.3324
4560	76.00	2542.5	0.164	1.39	12945	0.3324
4600	76.67	2542.5	0.164	1.39	12945	0.3324
4640	77.33	2540.8	0.164	1.39	12936	0.3324
4680	78.00	2539.2	0.164	1.39	12928	0.3324
4720	78.67	1995.7	0.160	1.34	10161	0.3330
4760	79.33	1378.8	0.155	1.29	7020	0.3337
4800	80.00	866.4	0.151	1.24	4411	0.3343
4840	80.67	468.1	0.147	1.20	2383	0.3349
4880	81.33	199.3	0.142	1.14	1015	0.3357
4920	82.00	71.1	0.137	1.09	362	0.3364
4960	82.67	15.9	0.131	1.02	81	0.3373
5000	83.33	5.0	0.124	0.94	25	0.3384
5040	84.00	0.0	0.119	0.89	0	0.3391
5080	84.67	0.0	0.119	0.89	0	0.3391

5120	85.33	6.2	0.122	0.92	32	0.3387
5160	86.00	23.5	0.127	0.98	120	0.3379
5200	86.67	107.3	0.133	1.04	546	0.3370
5240	87.33	279.0	0.139	1.11	1420	0.3361
5280	88.00	556.3	0.144	1.17	2832	0.3354
5320	88.67	916.9	0.149	1.22	4668	0.3346
5360	89.33	1341.3	0.153	1.27	6829	0.3340
5400	90.00	1804.8	0.158	1.32	9189	0.3333
5440	90.67	2281.3	0.163	1.38	11615	0.3325
5480	91.33	2573.5	0.167	1.42	13102	0.3319
5520	92.00	2545.7	0.167	1.42	12961	0.3319
5560	92.67	2154.0	0.164	1.39	10967	0.3324
5600	93.33	1515.9	0.160	1.34	7718	0.3330
5640	94.00	967.5	0.155	1.29	4926	0.3337
5680	94.67	541.6	0.151	1.24	2757	0.3343
5720	95.33	244.5	0.147	1.20	1245	0.3349
5760	96.00	94.2	0.141	1.13	480	0.3358
5800	96.67	23.6	0.135	1.07	120	0.3367
5840	97.33	3.9	0.128	0.99	20	0.3378
5880	98.00	0.0	0.123	0.93	0	0.3385
5920	98.67	0.0	0.123	0.93	0	0.3385
5960	99.33	7.2	0.126	0.97	37	0.3381
6000	100.00	28.2	0.132	1.03	144	0.3372
6040	100.67	122.3	0.138	1.10	623	0.3363
6080	101.33	312.3	0.143	1.16	1590	0.3355
6120	102.00	606.9	0.148	1.21	3090	0.3348
6160	102.67	983.9	0.153	1.27	5009	0.3340
6200	103.33	1427.8	0.158	1.32	7269	0.3333
6240	104.00	1912.5	0.162	1.37	9737	0.3327
6280	104.67	2397.2	0.167	1.42	12205	0.3319
6320	105.33	2555.5	0.170	1.46	13011	0.3315
6360	106.00	2535.9	0.170	1.46	12911	0.3315
6400	106.67	1914.1	0.166	1.41	9745	0.3321
6440	107.33	1305.4	0.161	1.36	6646	0.3328
6480	108.00	799.4	0.156	1.30	4070	0.3336
6520	108.67	412.6	0.152	1.26	2101	0.3342
6560	109.33	170.6	0.147	1.20	869	0.3349
6600	110.00	57.2	0.141	1.13	291	0.3358
6640	110.67	10.6	0.135	1.07	54	0.3367
6680	111.33	0.0	0.129	1.00	0	0.3376
6720	112.00	0.0	0.127	0.98	0	0.3379
6760	112.67	1.5	0.128	0.99	8	0.3378
6800	113.33	21.8	0.134	1.06	111	0.3369
6840	114.00	111.7	0.140	1.12	569	0.3360
6880	114.67	298.6	0.146	1.19	1520	0.3351
6920	115.33	587.3	0.150	1.23	2990	0.3345
6960	116.00	965.9	0.155	1.29	4918	0.3337
7000	116.67	1413.1	0.160	1.34	7194	0.3330
7040	117.33	1906.0	0.165	1.40	9704	0.3322
7080	118.00	2405.4	0.170	1.46	12247	0.3315
7120	118.67	2566.9	0.172	1.48	13069	0.3312
7160	119.33	2555.5	0.172	1.48	13011	0.3312
7200	120.00	1930.4	0.168	1.43	9828	0.3318
7240	120.67	1320.1	0.163	1.38	6721	0.3325

7280	121.33	807.6	0.159	1.33	4112	0.3331
7320	122.00	419.2	0.154	1.28	2134	0.3339
7360	122.67	170.8	0.149	1.22	870	0.3346
7400	123.33	57.3	0.144	1.17	292	0.3354
7440	124.00	9.5	0.137	1.09	48	0.3364
7480	124.67	0.0	0.131	1.02	0	0.3373
7520	125.33	0.0	0.129	1.00	0	0.3376
7560	126.00	0.0	0.130	1.01	0	0.3375
7600	126.67	19.5	0.136	1.08	99	0.3366
7640	127.33	108.3	0.143	1.16	551	0.3355
7680	128.00	288.8	0.148	1.21	1470	0.3348
7720	128.67	577.5	0.153	1.27	2940	0.3340
7760	129.33	957.7	0.157	1.31	4876	0.3334
7800	130.00	1409.8	0.162	1.37	7178	0.3327
7840	130.67	1906.0	0.167	1.42	9704	0.3319
7880	131.33	2413.5	0.172	1.48	12288	0.3312
7920	132.00	2563.7	0.174	1.50	13052	0.3309
7960	132.67	2547.4	0.174	1.50	12969	0.3309
8000	133.33	1891.3	0.170	1.46	9629	0.3315
8040	134.00	1284.2	0.165	1.40	6538	0.3322
8080	134.67	781.5	0.160	1.34	3979	0.3330
8120	135.33	399.6	0.156	1.30	2034	0.3336
8160	136.00	159.3	0.151	1.24	811	0.3343
8200	136.67	57.3	0.145	1.18	292	0.3352
8240	137.33	6.4	0.139	1.11	33	0.3361
8280	138.00	0.0	0.134	1.06	0	0.3369
8320	138.67	0.0	0.134	1.06	0	0.3369
8360	139.33	13.6	0.138	1.10	69	0.3363
8400	140.00	93.3	0.144	1.17	475	0.3354
8440	140.67	269.8	0.149	1.22	1374	0.3346
8480	141.33	551.4	0.154	1.28	2807	0.3339
8520	142.00	926.7	0.159	1.33	4718	0.3331
8560	142.67	1375.6	0.164	1.39	7004	0.3324
8600	143.33	1879.9	0.169	1.44	9571	0.3316
8640	144.00	2392.3	0.174	1.50	12180	0.3309
8680	144.67	2576.7	0.176	1.52	13119	0.3306
8720	145.33	2557.2	0.176	1.52	13019	0.3306
8760	146.00	1935.3	0.172	1.48	9853	0.3312
8800	146.67	1325.0	0.167	1.42	6746	0.3319
8840	147.33	809.2	0.162	1.37	4120	0.3327
8880	148.00	420.8	0.158	1.32	2142	0.3333
8920	148.67	170.9	0.153	1.27	870	0.3340
8960	149.33	55.7	0.147	1.20	284	0.3349
9000	150.00	6.7	0.141	1.13	34	0.3358
9040	150.67	0.0	0.135	1.07	0	0.3367

GOLDER ASSOCIATES INC., REDMOND, WA

LOAD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-14-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	NDOLF SAND
TEST No.:	NS-1D

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	90.86
AREA (sq ft):	0.1964	WET WT. + TARE (g):	543.94
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	520.59
MOLD + SOIL (g):	15065	MOISTURE CONTENT (%):	5.4
MOLD (g):	8758		
		WET DENSITY (pcf):	94.4
SPECIFIC GRAVITY:	2.74	DRY DENSITY (pcf):	89.5

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0	0.078	0.00	0	0.9111
30	0.50	9.4	0.087	0.10	48	0.9092
60	1.00	40.6	0.096	0.20	207	0.9073
90	1.50	86.1	0.105	0.30	438	0.9054
120	2.00	152.5	0.114	0.40	776	0.9035
150	2.50	211.4	0.123	0.50	1076	0.9016
180	3.00	264.3	0.132	0.60	1346	0.8996
210	3.50	329.4	0.141	0.70	1677	0.8977
240	4.00	388.2	0.150	0.80	1976	0.8958
270	4.50	464.9	0.159	0.90	2367	0.8939
300	5.00	544.8	0.168	1.00	2774	0.8920
330	5.50	633.0	0.177	1.10	3223	0.8901
360	6.00	726.0	0.186	1.20	3696	0.8882
390	6.50	827.2	0.195	1.30	4211	0.8863
420	7.00	941.4	0.204	1.40	4793	0.8844
450	7.50	1052.4	0.213	1.50	5358	0.8824
480	8.00	1171.5	0.222	1.60	5964	0.8805
510	8.50	1305.4	0.230	1.69	6646	0.8788
540	9.00	1429.4	0.239	1.79	7277	0.8769
570	9.50	1579.6	0.248	1.89	8042	0.8750

600	10.00	1726.4	0.257	1.99	8790	0.8731
630	10.50	1879.9	0.266	2.09	9571	0.8712
660	11.00	2041.4	0.274	2.18	10393	0.8695
690	11.50	2198.1	0.283	2.28	11191	0.8676
720	12.00	2366.2	0.292	2.38	12047	0.8657
750	12.50	2542.5	0.300	2.47	12945	0.8640
780	13.00	2544.1	0.304	2.51	12953	0.8631
810	13.50	2531.0	0.305	2.52	12886	0.8629
840	14.00	2565.3	0.307	2.54	13061	0.8625
870	14.50	2568.6	0.308	2.55	13077	0.8623
900	15.00	2563.7	0.308	2.55	13052	0.8623
930	15.50	2570.2	0.309	2.57	13086	0.8621
960	16.00	2526.1	0.309	2.57	12861	0.8621
990	16.50	2537.6	0.310	2.58	12920	0.8619
1020	17.00	2552.3	0.310	2.58	12994	0.8619
1050	17.50	2540.8	0.311	2.59	12936	0.8616
1080	18.00	2544.1	0.311	2.59	12953	0.8616
1110	18.50	2580.0	0.311	2.59	13135	0.8616
1140	19.00	2547.4	0.311	2.59	12969	0.8616
1170	19.50	2527.8	0.311	2.59	12870	0.8616
1200	20.00	2557.2	0.312	2.60	13019	0.8614
1230	20.50	2539.2	0.312	2.60	12928	0.8614
1260	21.00	2581.6	0.313	2.61	13144	0.8612
1290	21.50	2552.3	0.313	2.61	12994	0.8612
1320	22.00	2535.9	0.313	2.61	12911	0.8612
1350	22.50	2580.0	0.313	2.61	13135	0.8612
1380	23.00	2552.3	0.314	2.62	12994	0.8610
1410	23.50	2539.2	0.314	2.62	12928	0.8610
1440	24.00	2529.4	0.314	2.62	12878	0.8610
1470	24.50	2565.3	0.314	2.62	13061	0.8610
1500	25.00	2547.4	0.314	2.62	12969	0.8610
1530	25.50	2537.6	0.314	2.62	12920	0.8610
1560	26.00	2529.4	0.314	2.62	12878	0.8610
1590	26.50	2563.7	0.315	2.63	13052	0.8608
1620	27.00	2549.0	0.315	2.63	12978	0.8608
1650	27.50	2539.2	0.315	2.63	12928	0.8608
1680	28.00	1904.3	0.310	2.58	9695	0.8619
1710	28.50	1150.3	0.303	2.50	5856	0.8633
1740	29.00	615.0	0.297	2.43	3131	0.8646
1770	29.50	282.1	0.289	2.34	1436	0.8663
1800	30.00	115.8	0.280	2.24	590	0.8682
1830	30.50	35.3	0.271	2.14	180	0.8701
1860	31.00	3.9	0.262	2.04	20	0.8720
1890	31.50	0.0	0.253	1.94	0	0.8740
1920	32.00	0.0	0.245	1.86	0	0.8757
1950	32.50	0.0	0.245	1.86	0	0.8757
1980	33.00	0.0	0.245	1.86	0	0.8757
2010	33.50	0.0	0.245	1.86	0	0.8757
2040	34.00	0.0	0.245	1.86	0	0.8757
2070	34.50	0.0	0.245	1.86	0	0.8757
2100	35.00	0.0	0.245	1.86	0	0.8757
2130	35.50	0.0	0.245	1.86	0	0.8757
2160	36.00	0.0	0.245	1.86	0	0.8757
2190	36.50	0.0	0.245	1.86	0	0.8757

2220	37.00	1.5	0.251	1.92	8	0.8744
2250	37.50	12.4	0.260	2.02	63	0.8725
2280	38.00	104.0	0.269	2.12	529	0.8706
2310	38.50	258.3	0.277	2.21	1315	0.8689
2340	39.00	508.9	0.285	2.30	2591	0.8672
2370	39.50	854.9	0.293	2.39	4353	0.8655
2400	40.00	1261.3	0.301	2.48	6422	0.8638
2430	40.50	1682.4	0.309	2.57	8566	0.8621
2460	41.00	2072.4	0.317	2.65	10551	0.8604
2490	41.50	2429.9	0.325	2.74	12371	0.8587
2520	42.00	2514.7	0.330	2.80	12803	0.8576
2550	42.50	2563.7	0.331	2.81	13052	0.8574
2580	43.00	2568.6	0.332	2.82	13077	0.8572
2610	43.50	2534.3	0.332	2.82	12903	0.8572
2640	44.00	2562.1	0.332	2.82	13044	0.8572
2670	44.50	2539.2	0.332	2.82	12928	0.8572
2700	45.00	2526.1	0.332	2.82	12861	0.8572
2730	45.50	2558.8	0.333	2.83	13028	0.8570
2760	46.00	2544.1	0.333	2.83	12953	0.8570
2790	46.50	2529.4	0.333	2.83	12878	0.8570
2820	47.00	2581.6	0.334	2.84	13144	0.8568
2850	47.50	2562.1	0.334	2.84	13044	0.8568
2880	48.00	2550.6	0.334	2.84	12986	0.8568
2910	48.50	2544.1	0.334	2.84	12953	0.8568
2940	49.00	2532.7	0.334	2.84	12895	0.8568
2970	49.50	2586.5	0.334	2.84	13169	0.8568
3000	50.00	2566.9	0.334	2.84	13069	0.8568
3030	50.50	2560.4	0.334	2.84	13036	0.8568
3060	51.00	2549.0	0.334	2.84	12978	0.8568
3090	51.50	2544.1	0.334	2.84	12953	0.8568
3120	52.00	2539.2	0.334	2.84	12928	0.8568
3150	52.50	2529.4	0.334	2.84	12878	0.8568
3180	53.00	2578.4	0.335	2.85	13127	0.8565
3210	53.50	2568.6	0.335	2.85	13077	0.8565
3240	54.00	2560.4	0.335	2.85	13036	0.8565
3270	54.50	2555.5	0.335	2.85	13011	0.8565
3300	55.00	2549.0	0.335	2.85	12978	0.8565
3330	55.50	2542.5	0.335	2.85	12945	0.8565
3360	56.00	2539.2	0.335	2.85	12928	0.8565
3390	56.50	2535.9	0.335	2.85	12911	0.8565
3420	57.00	2537.6	0.336	2.87	12920	0.8563
3450	57.50	2581.6	0.337	2.88	13144	0.8561
3480	58.00	2526.1	0.337	2.88	12861	0.8561
3510	58.50	2576.7	0.338	2.89	13119	0.8559
3540	59.00	2549.0	0.339	2.90	12978	0.8557
3570	59.50	2583.3	0.340	2.91	13152	0.8555
3600	60.00	2542.5	0.340	2.91	12945	0.8555
3630	60.50	2534.3	0.340	2.91	12903	0.8555
3660	61.00	2532.7	0.340	2.91	12895	0.8555
3690	61.50	2588.2	0.340	2.91	13177	0.8555
3720	62.00	2580.0	0.340	2.91	13135	0.8555
3750	62.50	2573.5	0.340	2.91	13102	0.8555
3780	63.00	2570.2	0.340	2.91	13086	0.8555
3810	63.50	2563.7	0.340	2.91	13052	0.8555

3840	64.00	2563.7	0.340	2.91	13052	0.8555
3870	64.50	2558.8	0.340	2.91	13028	0.8555
3900	65.00	2555.5	0.340	2.91	13011	0.8555
3930	65.50	2553.9	0.340	2.91	13003	0.8555
3960	66.00	2550.6	0.340	2.91	12986	0.8555
3990	66.50	2549.0	0.340	2.91	12978	0.8555
4020	67.00	2544.1	0.340	2.91	12953	0.8555
4050	67.50	2544.1	0.340	2.91	12953	0.8555
4080	68.00	2542.5	0.340	2.91	12945	0.8555
4110	68.50	2540.8	0.340	2.91	12936	0.8555
4140	69.00	2537.6	0.340	2.91	12920	0.8555
4170	69.50	2537.6	0.340	2.91	12920	0.8555
4200	70.00	2534.3	0.340	2.91	12903	0.8555
4230	70.50	2534.3	0.340	2.91	12903	0.8555
4260	71.00	2537.6	0.340	2.91	12920	0.8555
4290	71.50	2527.8	0.340	2.91	12870	0.8555
4320	72.00	2527.8	0.340	2.91	12870	0.8555
4350	72.50	2580.0	0.341	2.92	13135	0.8553
4380	73.00	2581.6	0.341	2.92	13144	0.8553
4410	73.50	2576.7	0.341	2.92	13119	0.8553
4440	74.00	2573.5	0.341	2.92	13102	0.8553
4470	74.50	2571.8	0.341	2.92	13094	0.8553
4500	75.00	2183.4	0.338	2.89	11116	0.8559
4530	75.50	1349.4	0.331	2.81	6870	0.8574
4560	76.00	743.9	0.324	2.73	3787	0.8589
4590	76.50	352.3	0.317	2.65	1794	0.8604
4620	77.00	143.5	0.308	2.55	731	0.8623
4650	77.50	46.6	0.300	2.47	237	0.8640
4680	78.00	7.5	0.290	2.36	38	0.8661
4710	78.50	0.0	0.281	2.26	0	0.8680

600	10.00	2532.7	0.204	1.71	12895	0.7550
630	10.50	2549.0	0.204	1.71	12978	0.7550
660	11.00	2584.9	0.205	1.72	13160	0.7548
690	11.50	2542.5	0.205	1.72	12945	0.7548
720	12.00	2581.6	0.206	1.73	13144	0.7546
750	12.50	2547.4	0.206	1.73	12969	0.7546
780	13.00	2529.4	0.206	1.73	12878	0.7546
810	13.50	2570.2	0.206	1.73	13086	0.7546
840	14.00	2550.6	0.206	1.73	12986	0.7546
870	14.50	2570.2	0.207	1.74	13086	0.7544
900	15.00	2571.8	0.207	1.74	13094	0.7544
930	15.50	2555.5	0.207	1.74	13011	0.7544
960	16.00	2545.7	0.207	1.74	12961	0.7544
990	16.50	2534.3	0.207	1.74	12903	0.7544
1020	17.00	2526.1	0.207	1.74	12861	0.7544
1050	17.50	2573.5	0.208	1.76	13102	0.7542
1080	18.00	2562.1	0.208	1.76	13044	0.7542
1110	18.50	2552.3	0.208	1.76	12994	0.7542
1140	19.00	2542.5	0.208	1.76	12945	0.7542
1170	19.50	2534.3	0.208	1.76	12903	0.7542
1200	20.00	2534.3	0.208	1.76	12903	0.7542
1230	20.50	2583.3	0.208	1.76	13152	0.7542
1260	21.00	2570.2	0.208	1.76	13086	0.7542
1290	21.50	2560.4	0.208	1.76	13036	0.7542
1320	22.00	2550.6	0.208	1.76	12986	0.7542
1350	22.50	2542.5	0.208	1.76	12945	0.7542
1380	23.00	2539.2	0.208	1.76	12928	0.7542
1410	23.50	2539.2	0.208	1.76	12928	0.7542
1440	24.00	1870.1	0.203	1.70	9521	0.7552
1470	24.50	1093.2	0.196	1.62	5566	0.7566
1500	25.00	546.5	0.189	1.54	2782	0.7580
1530	25.50	221.7	0.182	1.47	1129	0.7593
1560	26.00	70.6	0.173	1.37	359	0.7611
1590	26.50	9.9	0.164	1.27	50	0.7629
1620	27.00	0.0	0.152	1.13	0	0.7653
1650	27.50	0.0	0.142	1.02	0	0.7673
1680	28.00	0.0	0.133	0.92	0	0.7691
1710	28.50	0.0	0.124	0.82	0	0.7708
1740	29.00	0.0	0.116	0.73	0	0.7724
1770	29.50	0.0	0.116	0.73	0	0.7724
1800	30.00	0.0	0.116	0.73	0	0.7724
1830	30.50	0.0	0.116	0.73	0	0.7724
1860	31.00	0.0	0.116	0.73	0	0.7724
1890	31.50	0.0	0.116	0.73	0	0.7724
1920	32.00	0.0	0.116	0.73	0	0.7724
1950	32.50	0.0	0.116	0.73	0	0.7724
1980	33.00	0.0	0.116	0.73	0	0.7724
2010	33.50	0.0	0.116	0.73	0	0.7724
2040	34.00	0.0	0.117	0.74	0	0.7722
2070	34.50	0.0	0.126	0.84	0	0.7705
2100	35.00	0.0	0.136	0.96	0	0.7685
2130	35.50	0.0	0.145	1.06	0	0.7667
2160	36.00	3.3	0.157	1.19	17	0.7643
2190	36.50	94.2	0.166	1.29	480	0.7625

GOLDER ASSOCIATES INC., REDMOND, WA

LOAD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-14-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	NDOLF SAND
TEST No.:	NS-2D

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	78.45
AREA (sq ft):	0.1964	WET WT. + TARE (g):	527.58
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	504.66
MOLD + SOIL (g):	15505	MOISTURE CONTENT (%):	5.4
MOLD (g):	8758		
		WET DENSITY (pcf):	101.0
SPECIFIC GRAVITY:	2.74	DRY DENSITY (pcf):	95.8

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.050	0.00	0	0.7855
30	0.50	28.2	0.060	0.11	144	0.7835
60	1.00	107.6	0.069	0.21	548	0.7818
90	1.50	172.2	0.077	0.30	877	0.7802
120	2.00	246.8	0.086	0.40	1257	0.7784
150	2.50	332.7	0.094	0.49	1694	0.7768
180	3.00	433.9	0.103	0.59	2209	0.7750
210	3.50	546.5	0.112	0.69	2782	0.7732
240	4.00	678.7	0.121	0.79	3455	0.7714
270	4.50	820.7	0.129	0.88	4178	0.7699
300	5.00	990.4	0.138	0.98	5042	0.7681
330	5.50	1166.7	0.147	1.08	5940	0.7663
360	6.00	1359.2	0.155	1.17	6920	0.7647
390	6.50	1568.1	0.164	1.27	7984	0.7629
420	7.00	1790.1	0.173	1.37	9114	0.7611
450	7.50	2030.0	0.182	1.47	10335	0.7593
480	8.00	2269.9	0.190	1.56	11557	0.7578
510	8.50	2527.8	0.199	1.66	12870	0.7560
540	9.00	2563.7	0.202	1.69	13052	0.7554
570	9.50	2537.6	0.203	1.70	12920	0.7552

2220	37.00	287.3	0.174	1.38	1463	0.7609
2250	37.50	587.3	0.182	1.47	2990	0.7593
2280	38.00	993.7	0.190	1.56	5059	0.7578
2310	38.50	1471.8	0.198	1.64	7493	0.7562
2340	39.00	1961.5	0.205	1.72	9987	0.7548
2370	39.50	2413.5	0.214	1.82	12288	0.7530
2400	40.00	2550.6	0.218	1.87	12986	0.7522
2430	40.50	2576.7	0.218	1.87	13119	0.7522
2460	41.00	2542.5	0.218	1.87	12945	0.7522
2490	41.50	2549.0	0.218	1.87	12978	0.7522
2520	42.00	2568.6	0.219	1.88	13077	0.7520
2550	42.50	2555.5	0.219	1.88	13011	0.7520
2580	43.00	2542.5	0.219	1.88	12945	0.7520
2610	43.50	2534.3	0.219	1.88	12903	0.7520
2640	44.00	2526.1	0.219	1.88	12861	0.7520
2670	44.50	2583.3	0.220	1.89	13152	0.7518
2700	45.00	2568.6	0.220	1.89	13077	0.7518
2730	45.50	2560.4	0.220	1.89	13036	0.7518
2760	46.00	2553.9	0.220	1.89	13003	0.7518
2790	46.50	2547.4	0.220	1.89	12969	0.7518
2820	47.00	2544.1	0.220	1.89	12953	0.7518
2850	47.50	2535.9	0.220	1.89	12911	0.7518
2880	48.00	2532.7	0.220	1.89	12895	0.7518
2910	48.50	2529.4	0.220	1.89	12878	0.7518
2940	49.00	2526.1	0.220	1.89	12861	0.7518
2970	49.50	2581.6	0.220	1.89	13144	0.7518
3000	50.00	2573.5	0.220	1.89	13102	0.7518
3030	50.50	2568.6	0.220	1.89	13077	0.7518
3060	51.00	2560.4	0.220	1.89	13036	0.7518
3090	51.50	2557.2	0.220	1.89	13019	0.7518
3120	52.00	2553.9	0.221	1.90	13003	0.7516
3150	52.50	2550.6	0.220	1.89	12986	0.7518
3180	53.00	2544.1	0.220	1.89	12953	0.7518
3210	53.50	2542.5	0.220	1.89	12945	0.7518
3240	54.00	2540.8	0.220	1.89	12936	0.7518
3270	54.50	2537.6	0.220	1.89	12920	0.7518
3300	55.00	2540.8	0.221	1.90	12936	0.7516
3330	55.50	2542.5	0.223	1.92	12945	0.7512
3360	56.00	2555.5	0.224	1.93	13011	0.7510
3390	56.50	2594.7	0.224	1.93	13210	0.7510
3420	57.00	2560.4	0.224	1.93	13036	0.7510
3450	57.50	2532.7	0.224	1.93	12895	0.7510
3480	58.00	2575.1	0.225	1.94	13111	0.7508
3510	58.50	2568.6	0.225	1.94	13077	0.7508
3540	59.00	2568.6	0.225	1.94	13077	0.7508
3570	59.50	2562.1	0.225	1.94	13044	0.7508
3600	60.00	2558.8	0.225	1.94	13028	0.7508
3630	60.50	2555.5	0.225	1.94	13011	0.7508
3660	61.00	2552.3	0.225	1.94	12994	0.7508
3690	61.50	2547.4	0.225	1.94	12969	0.7508
3720	62.00	2549.0	0.225	1.94	12978	0.7508
3750	62.50	2547.4	0.225	1.94	12969	0.7508
3780	63.00	2544.1	0.225	1.94	12953	0.7508
3810	63.50	2540.8	0.225	1.94	12936	0.7508

3840	64.00	2540.8	0.225	1.94	12936	0.7508
3870	64.50	2540.8	0.225	1.94	12936	0.7508
3900	65.00	2537.6	0.225	1.94	12920	0.7508
3930	65.50	2537.6	0.225	1.94	12920	0.7508
3960	66.00	2535.9	0.225	1.94	12911	0.7508
3990	66.50	2535.9	0.225	1.94	12911	0.7508
4020	67.00	2532.7	0.225	1.94	12895	0.7508
4050	67.50	2531.0	0.225	1.94	12886	0.7508
4080	68.00	2529.4	0.225	1.94	12878	0.7508
4110	68.50	2598.0	0.226	1.96	13227	0.7506
4140	69.00	2596.3	0.226	1.96	13218	0.7506
4170	69.50	2591.4	0.225	1.94	13193	0.7508
4200	70.00	2589.8	0.226	1.96	13185	0.7506
4230	70.50	2588.2	0.226	1.96	13177	0.7506
4260	71.00	2584.9	0.226	1.96	13160	0.7506
4290	71.50	2584.9	0.225	1.94	13160	0.7508
4320	72.00	2586.5	0.225	1.94	13169	0.7508
4350	72.50	2580.0	0.226	1.96	13135	0.7506
4380	73.00	2105.1	0.222	1.91	10718	0.7514
4410	73.50	1282.5	0.215	1.83	6530	0.7528
4440	74.00	677.0	0.208	1.76	3447	0.7542
4470	74.50	295.1	0.201	1.68	1502	0.7556
4500	75.00	100.6	0.193	1.59	512	0.7572
4530	75.50	22.4	0.184	1.49	114	0.7589
4560	76.00	0.0	0.176	1.40	0	0.7605

GOLDER ASSOCIATES INC., REDMOND, WA

LOAD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-15-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	NDOLF SAND
TEST No.:	NS-3D

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	76.93
AREA (sq ft):	0.1964	WET WT. + TARE (g):	451.31
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	433.32
MOLD + SOIL (g):	15834	MOISTURE CONTENT (%):	5.0
MOLD (g):	8758		
		WET DENSITY (pcf):	105.9
SPECIFIC GRAVITY:	2.74	DRY DENSITY (pcf):	100.8

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.047	0.00	0	0.6972
30	0.50	28.2	0.056	0.10	144	0.6955
60	1.00	141.7	0.065	0.20	721	0.6938
90	1.50	296.4	0.073	0.29	1509	0.6923
120	2.00	508.9	0.082	0.39	2591	0.6906
150	2.50	775.0	0.090	0.48	3946	0.6891
180	3.00	1065.5	0.098	0.57	5425	0.6876
210	3.50	1401.7	0.106	0.66	7136	0.6861
240	4.00	1767.2	0.114	0.74	8997	0.6845
270	4.50	2155.7	0.122	0.83	10975	0.6830
300	5.00	2566.9	0.131	0.93	13069	0.6813
330	5.50	2566.9	0.132	0.94	13069	0.6812
360	6.00	2531.0	0.132	0.94	12886	0.6812
390	6.50	2563.7	0.133	0.96	13052	0.6810
420	7.00	2545.7	0.133	0.96	12961	0.6810
450	7.50	2531.0	0.133	0.96	12886	0.6810
480	8.00	2581.6	0.133	0.96	13144	0.6810
510	8.50	2566.9	0.133	0.96	13069	0.6810
540	9.00	2560.4	0.133	0.96	13036	0.6810
570	9.50	2547.4	0.133	0.96	12969	0.6810

600	10.00	2540.8	0.133	0.96	12936	0.6810
630	10.50	2534.3	0.133	0.96	12903	0.6810
660	11.00	2529.4	0.133	0.96	12878	0.6810
690	11.50	2576.7	0.134	0.97	13119	0.6808
720	12.00	2568.6	0.134	0.97	13077	0.6808
750	12.50	2560.4	0.134	0.97	13036	0.6808
780	13.00	2555.5	0.134	0.97	13011	0.6808
810	13.50	2550.6	0.134	0.97	12986	0.6808
840	14.00	2545.7	0.134	0.97	12961	0.6808
870	14.50	2544.1	0.134	0.97	12953	0.6808
900	15.00	2539.2	0.134	0.97	12928	0.6808
930	15.50	2535.9	0.134	0.97	12911	0.6808
960	16.00	2537.6	0.134	0.97	12920	0.6808
990	16.50	2531.0	0.134	0.97	12886	0.6808
1020	17.00	2591.4	0.134	0.97	13193	0.6808
1050	17.50	2578.4	0.134	0.97	13127	0.6808
1080	18.00	2576.7	0.134	0.97	13119	0.6808
1110	18.50	2571.8	0.134	0.97	13094	0.6808
1140	19.00	2565.3	0.134	0.97	13061	0.6808
1170	19.50	2565.3	0.134	0.97	13061	0.6808
1200	20.00	2562.1	0.134	0.97	13044	0.6808
1230	20.50	1747.7	0.128	0.90	8898	0.6819
1260	21.00	982.2	0.122	0.83	5001	0.6830
1290	21.50	445.3	0.117	0.78	2267	0.6840
1320	22.00	138.6	0.110	0.70	706	0.6853
1350	22.50	21.3	0.100	0.59	108	0.6872
1380	23.00	0.0	0.089	0.47	0	0.6893
1410	23.50	0.0	0.086	0.43	0	0.6898
1440	24.00	0.0	0.085	0.42	0	0.6900
1470	24.50	0.0	0.086	0.43	0	0.6898
1500	25.00	0.0	0.085	0.42	0	0.6900
1530	25.50	0.0	0.086	0.43	0	0.6898
1560	26.00	0.0	0.086	0.43	0	0.6898
1590	26.50	0.0	0.086	0.43	0	0.6898
1620	27.00	0.0	0.086	0.43	0	0.6898
1650	27.50	0.0	0.086	0.43	0	0.6898
1680	28.00	0.0	0.086	0.43	0	0.6898
1710	28.50	5.1	0.092	0.50	26	0.6887
1740	29.00	152.7	0.100	0.59	777	0.6872
1770	29.50	471.4	0.108	0.68	2400	0.6857
1800	30.00	910.4	0.115	0.76	4635	0.6844
1830	30.50	1452.3	0.123	0.84	7394	0.6829
1860	31.00	2039.8	0.130	0.92	10385	0.6815
1890	31.50	2609.4	0.138	1.01	13285	0.6800
1920	32.00	2573.5	0.139	1.02	13102	0.6798
1950	32.50	2558.8	0.138	1.01	13028	0.6800
1980	33.00	2549.0	0.139	1.02	12978	0.6798
2010	33.50	2524.5	0.138	1.01	12853	0.6800
2040	34.00	2531.0	0.138	1.01	12886	0.6800
2070	34.50	2537.6	0.138	1.01	12920	0.6800
2100	35.00	2583.3	0.139	1.02	13152	0.6798
2130	35.50	2576.7	0.139	1.02	13119	0.6798
2160	36.00	2568.6	0.139	1.02	13077	0.6798
2190	36.50	2565.3	0.139	1.02	13061	0.6798

2220	37.00	2560.4	0.139	1.02	13036	0.6798
2250	37.50	2557.2	0.139	1.02	13019	0.6798
2280	38.00	2553.9	0.139	1.02	13003	0.6798
2310	38.50	2550.6	0.139	1.02	12986	0.6798
2340	39.00	2555.5	0.139	1.02	13011	0.6798
2370	39.50	2544.1	0.139	1.02	12953	0.6798
2400	40.00	2544.1	0.139	1.02	12953	0.6798
2430	40.50	2542.5	0.139	1.02	12945	0.6798
2460	41.00	2539.2	0.139	1.02	12928	0.6798
2490	41.50	2539.2	0.139	1.02	12928	0.6798
2520	42.00	2537.6	0.139	1.02	12920	0.6798
2550	42.50	2535.9	0.139	1.02	12911	0.6798
2580	43.00	2534.3	0.139	1.02	12903	0.6798
2610	43.50	2531.0	0.139	1.02	12886	0.6798
2640	44.00	2531.0	0.139	1.02	12886	0.6798
2670	44.50	2535.9	0.139	1.02	12911	0.6798
2700	45.00	2591.4	0.140	1.03	13193	0.6796
2730	45.50	2591.4	0.140	1.03	13193	0.6796
2760	46.00	2584.9	0.140	1.03	13160	0.6796
2790	46.50	2580.0	0.140	1.03	13135	0.6796
2820	47.00	2531.0	0.140	1.03	12886	0.6796
2850	47.50	2568.6	0.141	1.04	13077	0.6795
2880	48.00	2547.4	0.141	1.04	12969	0.6795
2910	48.50	2524.5	0.142	1.06	12853	0.6793
2940	49.00	2566.9	0.141	1.04	13069	0.6795
2970	49.50	2547.4	0.141	1.04	12969	0.6795
3000	50.00	2542.5	0.141	1.04	12945	0.6795
3030	50.50	2540.8	0.141	1.04	12936	0.6795
3060	51.00	2539.2	0.141	1.04	12928	0.6795
3090	51.50	2535.9	0.141	1.04	12911	0.6795
3120	52.00	2537.6	0.141	1.04	12920	0.6795
3150	52.50	2534.3	0.141	1.04	12903	0.6795
3180	53.00	2532.7	0.141	1.04	12895	0.6795
3210	53.50	2532.7	0.141	1.04	12895	0.6795
3240	54.00	2581.6	0.142	1.06	13144	0.6793
3270	54.50	2580.0	0.142	1.06	13135	0.6793
3300	55.00	2578.4	0.142	1.06	13127	0.6793
3330	55.50	2580.0	0.142	1.06	13135	0.6793
3360	56.00	2573.5	0.142	1.06	13102	0.6793
3390	56.50	2575.1	0.142	1.06	13111	0.6793
3420	57.00	2575.1	0.142	1.06	13111	0.6793
3450	57.50	2573.5	0.142	1.06	13102	0.6793
3480	58.00	2568.6	0.142	1.06	13077	0.6793
3510	58.50	2578.4	0.142	1.06	13127	0.6793
3540	59.00	2571.8	0.142	1.06	13094	0.6793
3570	59.50	2566.9	0.142	1.06	13069	0.6793
3600	60.00	2568.6	0.142	1.06	13077	0.6793
3630	60.50	2563.7	0.142	1.06	13052	0.6793
3660	61.00	2568.6	0.142	1.06	13077	0.6793
3690	61.50	2566.9	0.142	1.06	13069	0.6793
3720	62.00	2563.7	0.142	1.06	13052	0.6793
3750	62.50	2565.3	0.142	1.06	13061	0.6793
3780	63.00	2565.3	0.142	1.06	13061	0.6793
3810	63.50	2560.4	0.142	1.06	13036	0.6793

3840	64.00	2563.7	0.142	1.06	13052	0.6793
3870	64.50	2560.4	0.142	1.06	13036	0.6793
3900	65.00	1703.6	0.136	0.99	8673	0.6804
3930	65.50	962.6	0.131	0.93	4901	0.6813
3960	66.00	435.5	0.125	0.87	2217	0.6825
3990	66.50	129.5	0.117	0.78	659	0.6840
4020	67.00	18.0	0.107	0.67	92	0.6859
4050	67.50	3.8	0.096	0.54	19	0.6879
4080	68.00	0.0	0.093	0.51	0	0.6885
4110	68.50	0.0	0.093	0.51	0	0.6885
4140	69.00	1.5	0.100	0.59	8	0.6872
4170	69.50	175.0	0.109	0.69	891	0.6855
4200	70.00	528.5	0.116	0.77	2691	0.6842
4230	70.50	1010.0	0.123	0.84	5142	0.6829
4260	71.00	1592.6	0.131	0.93	8108	0.6813
4290	71.50	2225.8	0.139	1.02	11332	0.6798
4320	72.00	2584.9	0.144	1.08	13160	0.6789
4350	72.50	2563.7	0.143	1.07	13052	0.6791
4380	73.00	2256.9	0.142	1.06	11490	0.6793
4410	73.50	1362.5	0.135	0.98	6937	0.6806
4440	74.00	704.8	0.130	0.92	3588	0.6815
4470	74.50	267.4	0.123	0.84	1361	0.6829
4500	75.00	63.5	0.114	0.74	323	0.6845
4530	75.50	0.4	0.104	0.63	2	0.6864
4560	76.00	0.0	0.099	0.58	0	0.6874
4590	76.50	0.0	0.099	0.58	0	0.6874
4620	77.00	23.1	0.105	0.64	118	0.6862
4650	77.50	233.6	0.113	0.73	1189	0.6847
4680	78.00	624.8	0.120	0.81	3181	0.6834
4710	78.50	1138.9	0.127	0.89	5798	0.6821
4740	79.00	1747.7	0.135	0.98	8898	0.6806
4770	79.50	2400.5	0.143	1.07	12222	0.6791
4800	80.00	2581.6	0.145	1.09	13144	0.6787
4830	80.50	2565.3	0.145	1.09	13061	0.6787
4860	81.00	2003.9	0.141	1.04	10202	0.6795
4890	81.50	1171.5	0.135	0.98	5964	0.6806
4920	82.00	567.7	0.130	0.92	2890	0.6815
4950	82.50	189.2	0.123	0.84	963	0.6829
4980	83.00	37.3	0.113	0.73	190	0.6847
5010	83.50	0.0	0.102	0.61	0	0.6868
5040	84.00	0.0	0.100	0.59	0	0.6872
5070	84.50	0.0	0.100	0.59	0	0.6872
5100	85.00	28.2	0.107	0.67	144	0.6859
5130	85.50	269.7	0.116	0.77	1373	0.6842
5160	86.00	675.4	0.123	0.84	3439	0.6829
5190	86.50	1209.1	0.130	0.92	6156	0.6815
5220	87.00	1835.8	0.138	1.01	9347	0.6800
5250	87.50	2508.2	0.145	1.09	12770	0.6787
5280	88.00	2589.8	0.147	1.11	13185	0.6783
5310	88.50	2580.0	0.147	1.11	13135	0.6783
5340	89.00	1888.0	0.142	1.06	9612	0.6793
5370	89.50	1086.7	0.136	0.99	5533	0.6804
5400	90.00	505.7	0.131	0.93	2575	0.6813
5430	90.50	160.3	0.123	0.84	816	0.6829

5460	91.00	26.5	0.113	0.73	135	0.6847
5490	91.50	0.0	0.103	0.62	0	0.6866
5520	92.00	0.0	0.102	0.61	0	0.6868
5550	92.50	0.0	0.102	0.61	0	0.6868
5580	93.00	80.2	0.111	0.71	408	0.6851
5610	93.50	328.9	0.119	0.80	1675	0.6836
5640	94.00	809.2	0.127	0.89	4120	0.6821
5670	94.50	1377.2	0.134	0.97	7012	0.6808
5700	95.00	2028.4	0.141	1.04	10327	0.6795
5730	95.50	2598.0	0.148	1.12	13227	0.6781
5760	96.00	2568.6	0.148	1.12	13077	0.6781
5790	96.50	2514.7	0.148	1.12	12803	0.6781
5820	97.00	1566.5	0.141	1.04	7975	0.6795
5850	97.50	845.1	0.136	0.99	4303	0.6804
5880	98.00	350.6	0.130	0.92	1785	0.6815
5910	98.50	96.0	0.120	0.81	489	0.6834
5940	99.00	4.7	0.110	0.70	24	0.6853
5970	99.50	0.0	0.104	0.63	0	0.6864
6000	100.00	0.0	0.104	0.63	0	0.6864
6030	100.50	1.5	0.108	0.68	8	0.6857
6060	101.00	169.1	0.116	0.77	861	0.6842
6090	101.50	531.8	0.124	0.86	2708	0.6827
6120	102.00	1032.8	0.131	0.93	5258	0.6813
6150	102.50	1648.1	0.138	1.01	8391	0.6800
6180	103.00	2333.6	0.146	1.10	11881	0.6785
6210	103.50	2586.5	0.149	1.13	13169	0.6780
6240	104.00	2570.2	0.149	1.13	13086	0.6780
6270	104.50	2065.9	0.145	1.09	10518	0.6787
6300	105.00	1215.6	0.140	1.03	6189	0.6796
6330	105.50	597.1	0.134	0.97	3040	0.6808
6360	106.00	203.7	0.127	0.89	1037	0.6821
6390	106.50	36.0	0.117	0.78	183	0.6840
6420	107.00	0.0	0.107	0.67	0	0.6859

GOLDER ASSOCIATES INC., REDMOND, WA

LOAD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-15-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	NDOLF SAND
TEST No.:	NS-1W

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	73.06
AREA (sq ft):	0.1964	WET WT. + TARE (g):	485.98
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	420.60
MOLD + SOIL (g):	15878	MOISTURE CONTENT (%):	18.8
MOLD (g):	8758		
		WET DENSITY (pcf):	106.5
SPECIFIC GRAVITY:	2.74	DRY DENSITY (pcf):	89.7

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.017	0.00	0	0.9077
30	0.50	5.6	0.029	0.13	29	0.9052
60	1.00	6.8	0.040	0.26	35	0.9028
90	1.50	8.5	0.051	0.38	43	0.9005
120	2.00	64.9	0.060	0.48	330	0.8986
150	2.50	157.2	0.069	0.58	800	0.8967
180	3.00	269.5	0.077	0.67	1372	0.8950
210	3.50	383.3	0.085	0.76	1951	0.8933
240	4.00	497.5	0.094	0.86	2533	0.8914
270	4.50	613.4	0.103	0.96	3123	0.8895
300	5.00	732.5	0.111	1.04	3729	0.8878
330	5.50	854.9	0.120	1.14	4353	0.8859
360	6.00	983.9	0.129	1.24	5009	0.8840
390	6.50	1116.1	0.138	1.34	5682	0.8821
420	7.00	1259.7	0.146	1.43	6413	0.8804
450	7.50	1393.5	0.155	1.53	7095	0.8785
480	8.00	1540.4	0.164	1.63	7843	0.8765
510	8.50	1687.3	0.173	1.73	8590	0.8746
540	9.00	1850.5	0.181	1.82	9421	0.8729
570	9.50	2010.4	0.190	1.92	10235	0.8710

600	10.00	2178.5	0.199	2.02	11091	0.8691
630	10.50	2345.0	0.208	2.12	11939	0.8672
660	11.00	2522.9	0.217	2.22	12845	0.8653
690	11.50	2539.2	0.220	2.26	12928	0.8647
720	12.00	2545.7	0.222	2.28	12961	0.8643
750	12.50	2575.1	0.224	2.30	13111	0.8638
780	13.00	2565.3	0.225	2.31	13061	0.8636
810	13.50	2580.0	0.225	2.31	13135	0.8636
840	14.00	2534.3	0.226	2.32	12903	0.8634
870	14.50	2550.6	0.226	2.32	12986	0.8634
900	15.00	2562.1	0.227	2.33	13044	0.8632
930	15.50	2555.5	0.227	2.33	13011	0.8632
960	16.00	2539.2	0.227	2.33	12928	0.8632
990	16.50	2562.1	0.228	2.34	13044	0.8630
1020	17.00	2539.2	0.228	2.34	12928	0.8630
1050	17.50	2526.1	0.228	2.34	12861	0.8630
1080	18.00	2560.4	0.229	2.36	13036	0.8628
1110	18.50	2542.5	0.229	2.36	12945	0.8628
1140	19.00	2529.4	0.229	2.36	12878	0.8628
1170	19.50	2565.3	0.230	2.37	13061	0.8626
1200	20.00	2549.0	0.230	2.37	12978	0.8626
1230	20.50	2535.9	0.230	2.37	12911	0.8626
1260	21.00	2580.0	0.230	2.37	13135	0.8626
1290	21.50	2557.2	0.230	2.37	13019	0.8626
1320	22.00	2544.1	0.230	2.37	12953	0.8626
1350	22.50	2534.3	0.230	2.37	12903	0.8626
1380	23.00	2575.1	0.231	2.38	13111	0.8623
1410	23.50	2558.8	0.231	2.38	13028	0.8623
1440	24.00	2544.1	0.231	2.38	12953	0.8623
1470	24.50	2539.2	0.231	2.38	12928	0.8623
1500	25.00	2531.0	0.231	2.38	12886	0.8623
1530	25.50	2565.3	0.231	2.38	13061	0.8623
1560	26.00	2552.3	0.232	2.39	12994	0.8621
1590	26.50	1956.6	0.227	2.33	9962	0.8632
1620	27.00	1191.1	0.220	2.26	6064	0.8647
1650	27.50	641.1	0.214	2.19	3264	0.8660
1680	28.00	300.0	0.206	2.10	1527	0.8676
1710	28.50	120.7	0.198	2.01	615	0.8693
1740	29.00	33.4	0.189	1.91	170	0.8712
1770	29.50	5.8	0.178	1.79	30	0.8736
1800	30.00	4.5	0.175	1.76	23	0.8742
1830	30.50	2.1	0.164	1.63	11	0.8765
1860	31.00	0.0	0.159	1.58	0	0.8776
1890	31.50	0.0	0.159	1.58	0	0.8776
1920	32.00	0.0	0.159	1.58	0	0.8776
1950	32.50	0.0	0.159	1.58	0	0.8776
1980	33.00	0.0	0.159	1.58	0	0.8776
2010	33.50	0.0	0.159	1.58	0	0.8776
2040	34.00	0.0	0.159	1.58	0	0.8776
2070	34.50	0.0	0.159	1.58	0	0.8776
2100	35.00	0.0	0.159	1.58	0	0.8776
2130	35.50	0.0	0.159	1.58	0	0.8776
2160	36.00	1.5	0.165	1.64	8	0.8763
2190	36.50	7.1	0.178	1.79	36	0.8736

2220	37.00	117.4	0.186	1.88	598	0.8719
2250	37.50	294.5	0.195	1.98	1499	0.8700
2280	38.00	567.7	0.203	2.07	2890	0.8683
2310	38.50	923.5	0.211	2.16	4702	0.8666
2340	39.00	1333.1	0.218	2.23	6787	0.8651
2370	39.50	1746.0	0.226	2.32	8889	0.8634
2400	40.00	2124.7	0.234	2.41	10817	0.8617
2430	40.50	2472.3	0.243	2.51	12587	0.8598
2460	41.00	2535.9	0.246	2.54	12911	0.8592
2490	41.50	2535.9	0.247	2.55	12911	0.8590
2520	42.00	2550.6	0.248	2.57	12986	0.8587
2550	42.50	2580.0	0.248	2.57	13135	0.8587
2580	43.00	2555.5	0.248	2.57	13011	0.8587
2610	43.50	2537.6	0.248	2.57	12920	0.8587
2640	44.00	2580.0	0.249	2.58	13135	0.8585
2670	44.50	2555.5	0.249	2.58	13011	0.8585
2700	45.00	2544.1	0.249	2.58	12953	0.8585
2730	45.50	2534.3	0.249	2.58	12903	0.8585
2760	46.00	2571.8	0.250	2.59	13094	0.8583
2790	46.50	2557.2	0.250	2.59	13019	0.8583
2820	47.00	2549.0	0.250	2.59	12978	0.8583
2850	47.50	2539.2	0.250	2.59	12928	0.8583
2880	48.00	2532.7	0.250	2.59	12895	0.8583
2910	48.50	2575.1	0.250	2.59	13111	0.8583
2940	49.00	2563.7	0.250	2.59	13052	0.8583
2970	49.50	2553.9	0.250	2.59	13003	0.8583
3000	50.00	2547.4	0.250	2.59	12969	0.8583
3030	50.50	2545.7	0.250	2.59	12961	0.8583
3060	51.00	2537.6	0.250	2.59	12920	0.8583
3090	51.50	2531.0	0.250	2.59	12886	0.8583
3120	52.00	2580.0	0.251	2.60	13135	0.8581
3150	52.50	2568.6	0.251	2.60	13077	0.8581
3180	53.00	2558.8	0.251	2.60	13028	0.8581
3210	53.50	2555.5	0.251	2.60	13011	0.8581
3240	54.00	2550.6	0.251	2.60	12986	0.8581
3270	54.50	2544.1	0.251	2.60	12953	0.8581
3300	55.00	2573.5	0.251	2.60	13102	0.8581
3330	55.50	2565.3	0.251	2.60	13061	0.8581
3360	56.00	2540.8	0.252	2.61	12936	0.8579
3390	56.50	2560.4	0.255	2.64	13036	0.8573
3420	57.00	2519.6	0.258	2.68	12828	0.8566
3450	57.50	2557.2	0.260	2.70	13019	0.8562
3480	58.00	2549.0	0.261	2.71	12978	0.8560
3510	58.50	2565.3	0.263	2.73	13061	0.8556
3540	59.00	2545.7	0.263	2.73	12961	0.8556
3570	59.50	2539.2	0.263	2.73	12928	0.8556
3600	60.00	2539.2	0.263	2.73	12928	0.8556
3630	60.50	2531.0	0.263	2.73	12886	0.8556
3660	61.00	2588.2	0.263	2.73	13177	0.8556
3690	61.50	2580.0	0.263	2.73	13135	0.8556
3720	62.00	2578.4	0.264	2.74	13127	0.8554
3750	62.50	2575.1	0.263	2.73	13111	0.8556
3780	63.00	2571.8	0.263	2.73	13094	0.8556
3810	63.50	2570.2	0.264	2.74	13086	0.8554

3840	64.00	2565.3	0.263	2.73	13061	0.8556
3870	64.50	2563.7	0.263	2.73	13052	0.8556
3900	65.00	2560.4	0.263	2.73	13036	0.8556
3930	65.50	2558.8	0.263	2.73	13028	0.8556
3960	66.00	2558.8	0.264	2.74	13028	0.8554
3990	66.50	2555.5	0.263	2.73	13011	0.8556
4020	67.00	2553.9	0.263	2.73	13003	0.8556
4050	67.50	2550.6	0.264	2.74	12986	0.8554
4080	68.00	2549.0	0.263	2.73	12978	0.8556
4110	68.50	2549.0	0.263	2.73	12978	0.8556
4140	69.00	2547.4	0.264	2.74	12969	0.8554
4170	69.50	2544.1	0.263	2.73	12953	0.8556
4200	70.00	2542.5	0.263	2.73	12945	0.8556
4230	70.50	2544.1	0.263	2.73	12953	0.8556
4260	71.00	2537.6	0.263	2.73	12920	0.8556
4290	71.50	2542.5	0.264	2.74	12945	0.8554
4320	72.00	2537.6	0.264	2.74	12920	0.8554
4350	72.50	2537.6	0.263	2.73	12920	0.8556
4380	73.00	2537.6	0.263	2.73	12920	0.8556
4410	73.50	2534.3	0.264	2.74	12903	0.8554
4440	74.00	1977.8	0.259	2.69	10069	0.8564
4470	74.50	1207.5	0.252	2.61	6148	0.8579
4500	75.00	654.2	0.246	2.54	3331	0.8592
4530	75.50	303.3	0.238	2.46	1544	0.8609
4560	76.00	121.0	0.230	2.37	616	0.8626
4590	76.50	35.8	0.221	2.27	182	0.8645
4620	77.00	4.5	0.211	2.16	23	0.8666
4650	77.50	0.0	0.199	2.02	0	0.8691

GOLDER ASSOCIATES INC., REDMOND, WA

' ^AD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-15-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	NDOLF SAND
TEST No.:	NS-2W

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	75.89
AREA (sq ft):	0.1964	WET WT. + TARE (g):	357.54
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	313.23
MOLD + SOIL (g):	16325	MOISTURE CONTENT (%):	18.7
MOLD (g):	8758		
		WET DENSITY (pcf):	113.2
^CIFIC GRAVITY:	2.74	DRY DENSITY (pcf):	95.4

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.043	0.00	0	0.7928
30	0.50	48.5	0.052	0.10	247	0.7911
60	1.00	149.1	0.061	0.20	759	0.7893
90	1.50	314.1	0.070	0.30	1599	0.7875
120	2.00	513.8	0.078	0.39	2616	0.7859
150	2.50	729.3	0.087	0.49	3713	0.7841
180	3.00	956.1	0.095	0.58	4868	0.7825
210	3.50	1192.8	0.104	0.68	6073	0.7807
240	4.00	1444.1	0.112	0.77	7352	0.7791
270	4.50	1705.2	0.121	0.87	8682	0.7773
300	5.00	1976.1	0.128	0.94	10061	0.7759
330	5.50	2253.6	0.136	1.03	11474	0.7743
360	6.00	2545.7	0.144	1.12	12961	0.7727
390	6.50	2539.2	0.146	1.14	12928	0.7723
420	7.00	2534.3	0.147	1.16	12903	0.7721
450	7.50	2555.5	0.148	1.17	13011	0.7719
480	8.00	2529.4	0.148	1.17	12878	0.7719
510	8.50	2553.9	0.149	1.18	13003	0.7717
540	9.00	2535.9	0.149	1.18	12911	0.7717
570	9.50	2575.1	0.149	1.18	13111	0.7717

600	10.00	2553.9	0.150	1.19	13003	0.7715
630	10.50	2539.2	0.150	1.19	12928	0.7715
660	11.00	2529.4	0.150	1.19	12878	0.7715
690	11.50	2570.2	0.150	1.19	13086	0.7715
720	12.00	2557.2	0.150	1.19	13019	0.7715
750	12.50	2545.7	0.150	1.19	12961	0.7715
780	13.00	2535.9	0.150	1.19	12911	0.7715
810	13.50	2529.4	0.150	1.19	12878	0.7715
840	14.00	2580.0	0.151	1.20	13135	0.7713
870	14.50	2565.3	0.151	1.20	13061	0.7713
900	15.00	2560.4	0.151	1.20	13036	0.7713
930	15.50	2549.0	0.151	1.20	12978	0.7713
960	16.00	2545.7	0.151	1.20	12961	0.7713
990	16.50	2535.9	0.151	1.20	12911	0.7713
1020	17.00	2534.3	0.151	1.20	12903	0.7713
1050	17.50	2529.4	0.151	1.20	12878	0.7713
1080	18.00	2573.5	0.152	1.21	13102	0.7711
1110	18.50	2565.3	0.152	1.21	13061	0.7711
1140	19.00	2558.8	0.152	1.21	13028	0.7711
1170	19.50	2553.9	0.152	1.21	13003	0.7711
1200	20.00	2547.4	0.152	1.21	12969	0.7711
1230	20.50	2542.5	0.152	1.21	12945	0.7711
1260	21.00	2539.2	0.152	1.21	12928	0.7711
1290	21.50	1801.5	0.148	1.17	9172	0.7719
1320	22.00	1029.6	0.141	1.09	5242	0.7733
1350	22.50	495.9	0.134	1.01	2525	0.7747
1380	23.00	179.1	0.127	0.93	912	0.7761
1410	23.50	48.2	0.118	0.83	245	0.7779
1440	24.00	1.3	0.109	0.73	7	0.7797
1470	24.50	0.0	0.104	0.68	0	0.7807
1500	25.00	0.0	0.104	0.68	0	0.7807
1530	25.50	0.0	0.104	0.68	0	0.7807
1560	26.00	0.0	0.104	0.68	0	0.7807
1590	26.50	0.0	0.104	0.68	0	0.7807
1620	27.00	0.0	0.104	0.68	0	0.7807
1650	27.50	0.0	0.104	0.68	0	0.7807
1680	28.00	0.0	0.104	0.68	0	0.7807
1710	28.50	0.0	0.104	0.68	0	0.7807
1740	29.00	0.0	0.104	0.68	0	0.7807
1770	29.50	8.7	0.108	0.72	44	0.7799
1800	30.00	159.2	0.116	0.81	811	0.7783
1830	30.50	438.8	0.124	0.90	2234	0.7767
1860	31.00	832.1	0.132	0.99	4236	0.7751
1890	31.50	1303.7	0.139	1.07	6637	0.7737
1920	32.00	1812.9	0.147	1.16	9230	0.7721
1950	32.50	2296.0	0.155	1.24	11690	0.7705
1980	33.00	2565.3	0.161	1.31	13061	0.7693
2010	33.50	2526.1	0.161	1.31	12861	0.7693
2040	34.00	2560.4	0.161	1.31	13036	0.7693
2070	34.50	2542.5	0.161	1.31	12945	0.7693
2100	35.00	2531.0	0.161	1.31	12886	0.7693
2130	35.50	2591.4	0.162	1.32	13193	0.7691
2160	36.00	2570.2	0.162	1.32	13086	0.7691
2190	36.50	2563.7	0.162	1.32	13052	0.7691

2220	37.00	2552.3	0.162	1.32	12994	0.7691
2250	37.50	2544.1	0.162	1.32	12953	0.7691
2280	38.00	2542.5	0.162	1.32	12945	0.7691
2310	38.50	2535.9	0.162	1.32	12911	0.7691
2340	39.00	2534.3	0.162	1.32	12903	0.7691
2370	39.50	2529.4	0.162	1.32	12878	0.7691
2400	40.00	2549.0	0.162	1.32	12978	0.7691
2430	40.50	2576.7	0.163	1.33	13119	0.7690
2460	41.00	2571.8	0.163	1.33	13094	0.7690
2490	41.50	2566.9	0.163	1.33	13069	0.7690
2520	42.00	2563.7	0.163	1.33	13052	0.7690
2550	42.50	2555.5	0.163	1.33	13011	0.7690
2580	43.00	2553.9	0.163	1.33	13003	0.7690
2610	43.50	2550.6	0.163	1.33	12986	0.7690
2640	44.00	2547.4	0.163	1.33	12969	0.7690
2670	44.50	2542.5	0.163	1.33	12945	0.7690
2700	45.00	2540.8	0.163	1.33	12936	0.7690
2730	45.50	2539.2	0.163	1.33	12928	0.7690
2760	46.00	2539.2	0.163	1.33	12928	0.7690
2790	46.50	2542.5	0.163	1.33	12945	0.7690
2820	47.00	2570.2	0.163	1.33	13086	0.7690
2850	47.50	2566.9	0.163	1.33	13069	0.7690
2880	48.00	2557.2	0.164	1.34	13019	0.7688
2910	48.50	2526.1	0.164	1.34	12861	0.7688
2940	49.00	2540.8	0.165	1.36	12936	0.7686
2970	49.50	2527.8	0.165	1.36	12870	0.7686
3000	50.00	2549.0	0.166	1.37	12978	0.7684
3030	50.50	2532.7	0.166	1.37	12895	0.7684
3060	51.00	2575.1	0.166	1.37	13111	0.7684
3090	51.50	2571.8	0.166	1.37	13094	0.7684
3120	52.00	2571.8	0.166	1.37	13094	0.7684
3150	52.50	2566.9	0.166	1.37	13069	0.7684
3180	53.00	2565.3	0.166	1.37	13061	0.7684
3210	53.50	2562.1	0.166	1.37	13044	0.7684
3240	54.00	2562.1	0.166	1.37	13044	0.7684
3270	54.50	2560.4	0.166	1.37	13036	0.7684
3300	55.00	2558.8	0.166	1.37	13028	0.7684
3330	55.50	2557.2	0.166	1.37	13019	0.7684
3360	56.00	2555.5	0.166	1.37	13011	0.7684
3390	56.50	2553.9	0.166	1.37	13003	0.7684
3420	57.00	2552.3	0.166	1.37	12994	0.7684
3450	57.50	2552.3	0.166	1.37	12994	0.7684
3480	58.00	2552.3	0.166	1.37	12994	0.7684
3510	58.50	2552.3	0.166	1.37	12994	0.7684
3540	59.00	2549.0	0.166	1.37	12978	0.7684
3570	59.50	2547.4	0.166	1.37	12969	0.7684
3600	60.00	2545.7	0.166	1.37	12961	0.7684
3630	60.50	2545.7	0.166	1.37	12961	0.7684
3660	61.00	2544.1	0.166	1.37	12953	0.7684
3690	61.50	2545.7	0.166	1.37	12961	0.7684
3720	62.00	2544.1	0.166	1.37	12953	0.7684
3750	62.50	2547.4	0.166	1.37	12969	0.7684
3780	63.00	2542.5	0.166	1.37	12945	0.7684
3810	63.50	2537.6	0.166	1.37	12920	0.7684

3840	64.00	2542.5	0.166	1.37	12945	0.7684
3870	64.50	2540.8	0.166	1.37	12936	0.7684
3900	65.00	2540.8	0.166	1.37	12936	0.7684
3930	65.50	2537.6	0.166	1.37	12920	0.7684
3960	66.00	2331.9	0.165	1.36	11872	0.7686
3990	66.50	1437.6	0.158	1.28	7319	0.7699
4020	67.00	778.2	0.151	1.20	3962	0.7713
4050	67.50	342.5	0.144	1.12	1744	0.7727
4080	68.00	110.2	0.136	1.03	561	0.7743
4110	68.50	22.1	0.127	0.93	113	0.7761
4140	69.00	0.0	0.118	0.83	0	0.7779

GOLDER ASSOCIATES INC., REDMOND, WA

D DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-15-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	NDOLF SAND
TEST No.:	NS-3W

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	91.87
AREA (sq ft):	0.1964	WET WT. + TARE (g):	501.38
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	432.55
MOLD + SOIL (g):	16700	MOISTURE CONTENT (%):	20.2
MOLD (g):	8758		
		WET DENSITY (pcf):	118.8
:IFIC GRAVITY:	2.74	DRY DENSITY (pcf):	98.9

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.032	0.00	0	0.7303
30	0.50	2.7	0.043	0.12	14	0.7282
60	1.00	10.2	0.055	0.26	52	0.7259
90	1.50	80.5	0.064	0.36	410	0.7241
120	2.00	225.8	0.073	0.46	1150	0.7224
150	2.50	456.7	0.081	0.54	2325	0.7209
180	3.00	760.3	0.089	0.63	3871	0.7193
210	3.50	1107.9	0.097	0.72	5641	0.7178
240	4.00	1471.8	0.105	0.81	7493	0.7163
270	4.50	1852.1	0.113	0.90	9430	0.7147
300	5.00	2232.4	0.121	0.99	11366	0.7132
330	5.50	2581.6	0.129	1.08	13144	0.7116
360	6.00	2562.1	0.129	1.08	13044	0.7116
390	6.50	2531.0	0.129	1.08	12886	0.7116
420	7.00	2560.4	0.130	1.09	13036	0.7114
450	7.50	2542.5	0.130	1.09	12945	0.7114
480	8.00	2534.3	0.130	1.09	12903	0.7114
510	8.50	2583.3	0.131	1.10	13152	0.7113
540	9.00	2562.1	0.131	1.10	13044	0.7113
570	9.50	2553.9	0.131	1.10	13003	0.7113

600	10.00	2545.7	0.131	1.10	12961	0.7113
630	10.50	2545.7	0.131	1.10	12961	0.7113
660	11.00	2531.0	0.131	1.10	12886	0.7113
690	11.50	2531.0	0.131	1.10	12886	0.7113
720	12.00	2578.4	0.131	1.10	13127	0.7113
750	12.50	2568.6	0.131	1.10	13077	0.7113
780	13.00	2560.4	0.131	1.10	13036	0.7113
810	13.50	2557.2	0.132	1.11	13019	0.7111
840	14.00	2552.3	0.131	1.10	12994	0.7113
870	14.50	2547.4	0.132	1.11	12969	0.7111
900	15.00	2547.4	0.132	1.11	12969	0.7111
930	15.50	2540.8	0.131	1.10	12936	0.7113
960	16.00	2545.7	0.131	1.10	12961	0.7113
990	16.50	2537.6	0.132	1.11	12920	0.7111
1020	17.00	2532.7	0.131	1.10	12895	0.7113
1050	17.50	2580.0	0.132	1.11	13135	0.7111
1080	18.00	2560.4	0.132	1.11	13036	0.7111
1110	18.50	2570.2	0.132	1.11	13086	0.7111
1140	19.00	2566.9	0.132	1.11	13069	0.7111
1170	19.50	2563.7	0.132	1.11	13052	0.7111
1200	20.00	2558.8	0.132	1.11	13028	0.7111
1230	20.50	2555.5	0.132	1.11	13011	0.7111
1260	21.00	1618.7	0.125	1.03	8241	0.7124
1290	21.50	876.1	0.119	0.97	4460	0.7136
1320	22.00	373.5	0.113	0.90	1902	0.7147
1350	22.50	102.6	0.105	0.81	522	0.7163
1380	23.00	9.2	0.095	0.70	47	0.7182
1410	23.50	0.0	0.083	0.57	0	0.7205
1440	24.00	0.0	0.083	0.57	0	0.7205
1470	24.50	0.0	0.083	0.57	0	0.7205
1500	25.00	0.0	0.083	0.57	0	0.7205
1530	25.50	0.0	0.083	0.57	0	0.7205
1560	26.00	0.0	0.083	0.57	0	0.7205
1590	26.50	0.0	0.083	0.57	0	0.7205
1620	27.00	0.0	0.083	0.57	0	0.7205
1650	27.50	0.0	0.083	0.57	0	0.7205
1680	28.00	0.0	0.083	0.57	0	0.7205
1710	28.50	0.8	0.085	0.59	4	0.7201
1740	29.00	132.6	0.094	0.69	675	0.7184
1770	29.50	458.3	0.102	0.78	2333	0.7168
1800	30.00	910.4	0.109	0.86	4635	0.7155
1830	30.50	1447.4	0.117	0.94	7369	0.7139
1860	31.00	2023.5	0.125	1.03	10302	0.7124
1890	31.50	2573.5	0.132	1.11	13102	0.7111
1920	32.00	2534.3	0.133	1.12	12903	0.7109
1950	32.50	2581.6	0.133	1.12	13144	0.7109
1980	33.00	2565.3	0.133	1.12	13061	0.7109
2010	33.50	2555.5	0.133	1.12	13011	0.7109
2040	34.00	2549.0	0.133	1.12	12978	0.7109
2070	34.50	2544.1	0.133	1.12	12953	0.7109
2100	35.00	2539.2	0.133	1.12	12928	0.7109
2130	35.50	2535.9	0.133	1.12	12911	0.7109
2160	36.00	2532.7	0.133	1.12	12895	0.7109
2190	36.50	2526.1	0.133	1.12	12861	0.7109

2220	37.00	2578.4	0.134	1.13	13127	0.7107
2250	37.50	2571.8	0.134	1.13	13094	0.7107
2280	38.00	2575.1	0.134	1.13	13111	0.7107
2310	38.50	2565.3	0.134	1.13	13061	0.7107
2340	39.00	2563.7	0.134	1.13	13052	0.7107
2370	39.50	2560.4	0.134	1.13	13036	0.7107
2400	40.00	2557.2	0.134	1.13	13019	0.7107
2430	40.50	2553.9	0.134	1.13	13003	0.7107
2460	41.00	2552.3	0.134	1.13	12994	0.7107
2490	41.50	2549.0	0.134	1.13	12978	0.7107
2520	42.00	2550.6	0.134	1.13	12986	0.7107
2550	42.50	2547.4	0.134	1.13	12969	0.7107
2580	43.00	2542.5	0.134	1.13	12945	0.7107
2610	43.50	2542.5	0.134	1.13	12945	0.7107
2640	44.00	2542.5	0.134	1.13	12945	0.7107
2670	44.50	2542.5	0.134	1.13	12945	0.7107
2700	45.00	2540.8	0.134	1.13	12936	0.7107
2730	45.50	2537.6	0.134	1.13	12920	0.7107
2760	46.00	2535.9	0.134	1.13	12911	0.7107
2790	46.50	2526.1	0.134	1.13	12861	0.7107
2820	47.00	2573.5	0.135	1.14	13102	0.7105
2850	47.50	2570.2	0.137	1.17	13086	0.7101
2880	48.00	2540.8	0.136	1.16	12936	0.7103
2910	48.50	2576.7	0.137	1.17	13119	0.7101
2940	49.00	2555.5	0.137	1.17	13011	0.7101
2970	49.50	2529.4	0.137	1.17	12878	0.7101
3000	50.00	2581.6	0.138	1.18	13144	0.7099
3030	50.50	2580.0	0.138	1.18	13135	0.7099
3060	51.00	2583.3	0.138	1.18	13152	0.7099
3090	51.50	2575.1	0.138	1.18	13111	0.7099
3120	52.00	2573.5	0.138	1.18	13102	0.7099
3150	52.50	2571.8	0.138	1.18	13094	0.7099
3180	53.00	2571.8	0.138	1.18	13094	0.7099
3210	53.50	2570.2	0.138	1.18	13086	0.7099
3240	54.00	2568.6	0.138	1.18	13077	0.7099
3270	54.50	2566.9	0.138	1.18	13069	0.7099
3300	55.00	2565.3	0.138	1.18	13061	0.7099
3330	55.50	2565.3	0.138	1.18	13061	0.7099
3360	56.00	2565.3	0.138	1.18	13061	0.7099
3390	56.50	2562.1	0.138	1.18	13044	0.7099
3420	57.00	2563.7	0.138	1.18	13052	0.7099
3450	57.50	2562.1	0.138	1.18	13044	0.7099
3480	58.00	2562.1	0.138	1.18	13044	0.7099
3510	58.50	2568.6	0.138	1.18	13077	0.7099
3540	59.00	2560.4	0.138	1.18	13036	0.7099
3570	59.50	2558.8	0.138	1.18	13028	0.7099
3600	60.00	2557.2	0.138	1.18	13019	0.7099
3630	60.50	2558.8	0.138	1.18	13028	0.7099
3660	61.00	2560.4	0.138	1.18	13036	0.7099
3690	61.50	2558.8	0.138	1.18	13028	0.7099
3720	62.00	2555.5	0.138	1.18	13011	0.7099
3750	62.50	2555.5	0.138	1.18	13011	0.7099
3780	63.00	2555.5	0.138	1.18	13011	0.7099
3810	63.50	2552.3	0.138	1.18	12994	0.7099

3840	64.00	2552.3	0.138	1.18	12994	0.7099
3870	64.50	2553.9	0.138	1.18	13003	0.7099
3900	65.00	1762.3	0.132	1.11	8972	0.7111
3930	65.50	1000.2	0.126	1.04	5092	0.7122
3960	66.00	455.1	0.119	0.97	2317	0.7136
3990	66.50	137.2	0.112	0.89	699	0.7149
4020	67.00	22.9	0.102	0.78	117	0.7168
4050	67.50	0.0	0.092	0.67	0	0.7187
4080	68.00	0.0	0.091	0.66	0	0.7189
4110	68.50	0.0	0.091	0.66	0	0.7189
4140	69.00	28.2	0.098	0.73	144	0.7176
4170	69.50	271.8	0.106	0.82	1384	0.7161
4200	70.00	675.4	0.113	0.90	3439	0.7147
4230	70.50	1192.8	0.121	0.99	6073	0.7132
4260	71.00	1778.7	0.128	1.07	9056	0.7118
4290	71.50	2403.7	0.136	1.16	12238	0.7103
4320	72.00	2555.5	0.138	1.18	13011	0.7099
4350	72.50	2544.1	0.138	1.18	12953	0.7099
4380	73.00	1974.5	0.134	1.13	10053	0.7107
4410	73.50	1140.5	0.128	1.07	5807	0.7118
4440	74.00	544.8	0.122	1.00	2774	0.7130
4470	74.50	176.5	0.114	0.91	899	0.7145
4500	75.00	29.8	0.105	0.81	152	0.7163
4530	75.50	0.7	0.095	0.70	4	0.7182
4560	76.00	0.0	0.092	0.67	0	0.7187
4590	76.50	0.0	0.092	0.67	0	0.7187
4620	77.00	1.5	0.099	0.74	8	0.7174
4650	77.50	228.9	0.108	0.84	1165	0.7157
4680	78.00	623.2	0.115	0.92	3173	0.7143
4710	78.50	1135.6	0.122	1.00	5782	0.7130
4740	79.00	1731.3	0.130	1.09	8815	0.7114
4770	79.50	2376.0	0.137	1.17	12097	0.7101
4800	80.00	2558.8	0.140	1.20	13028	0.7095
4830	80.50	2545.7	0.140	1.20	12961	0.7095
4860	81.00	2072.4	0.137	1.17	10551	0.7101
4890	81.50	1212.3	0.130	1.09	6172	0.7114
4920	82.00	592.2	0.124	1.02	3015	0.7126
4950	82.50	202.1	0.117	0.94	1029	0.7139
4980	83.00	39.4	0.108	0.84	201	0.7157
5010	83.50	0.0	0.098	0.73	0	0.7176
5040	84.00	0.0	0.096	0.71	0	0.7180
5070	84.50	1.0	0.096	0.71	5	0.7180
5100	85.00	28.2	0.104	0.80	144	0.7164
5130	85.50	328.9	0.112	0.89	1675	0.7149
5160	86.00	797.8	0.120	0.98	4062	0.7134
5190	86.50	1346.2	0.127	1.06	6854	0.7120
5220	87.00	1984.3	0.134	1.13	10103	0.7107
5250	87.50	2586.5	0.141	1.21	13169	0.7093
5280	88.00	2557.2	0.142	1.22	13019	0.7091
5310	88.50	2545.7	0.141	1.21	12961	0.7093
5340	89.00	1664.4	0.135	1.14	8474	0.7105
5370	89.50	910.4	0.129	1.08	4635	0.7116
5400	90.00	388.2	0.122	1.00	1976	0.7130
5430	90.50	106.3	0.114	0.91	541	0.7145

5460	91.00	7.6	0.105	0.81	39	0.7163
5490	91.50	0.0	0.097	0.72	0	0.7178
5520	92.00	0.0	0.097	0.72	0	0.7178
5550	92.50	0.0	0.100	0.76	0	0.7172
5580	93.00	140.7	0.109	0.86	716	0.7155
5610	93.50	482.8	0.116	0.93	2458	0.7141
5640	94.00	967.5	0.123	1.01	4926	0.7128
5670	94.50	1551.8	0.131	1.10	7901	0.7113
5700	95.00	2207.9	0.138	1.18	11241	0.7099
5730	95.50	2576.7	0.143	1.23	13119	0.7089
5760	96.00	2562.1	0.143	1.23	13044	0.7089
5790	96.50	2232.4	0.141	1.21	11366	0.7093
5820	97.00	1336.4	0.134	1.13	6804	0.7107
5850	97.50	678.7	0.128	1.07	3455	0.7118
5880	98.00	251.1	0.121	0.99	1278	0.7132
5910	98.50	53.9	0.112	0.89	274	0.7149
5940	99.00	0.7	0.102	0.78	4	0.7168
5970	99.50	0.0	0.100	0.76	0	0.7172
6000	100.00	0.0	0.100	0.76	0	0.7172
6030	100.50	28.2	0.107	0.83	144	0.7159
6060	101.00	324.8	0.114	0.91	1654	0.7145
6090	101.50	761.9	0.122	1.00	3879	0.7130
6120	102.00	1310.3	0.129	1.08	6671	0.7116
6150	102.50	1950.0	0.137	1.17	9928	0.7101
6180	103.00	2586.5	0.144	1.24	13169	0.7088
6210	103.50	2557.2	0.144	1.24	13019	0.7088
6240	104.00	2547.4	0.144	1.24	12969	0.7088
6270	104.50	1657.9	0.138	1.18	8441	0.7099
6300	105.00	903.9	0.131	1.10	4602	0.7113
6330	105.50	384.9	0.125	1.03	1960	0.7124
6360	106.00	103.5	0.117	0.94	527	0.7139
6390	106.50	7.1	0.107	0.83	36	0.7159
6420	107.00	0.0	0.101	0.77	0	0.7170

GOLDER ASSOCIATES INC., REDMOND, WA

)AD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-16-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	SWL SAND
TEST No.:	SS-1D

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	65.44
AREA (sq ft):	0.1964	WET WT. + TARE (g):	412.55
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	395.73
MOLD + SOIL (g):	15844	MOISTURE CONTENT (%):	5.1
MOLD (g):	8758		
		WET DENSITY (pcf):	106.0
ECIFIC GRAVITY:	2.83	DRY DENSITY (pcf):	100.9

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.059	0.00	0	0.7512
30	0.50	27.6	0.069	0.11	141	0.7493
60	1.00	83.9	0.078	0.21	427	0.7475
90	1.50	171.8	0.086	0.30	875	0.7459
120	2.00	295.0	0.094	0.39	1502	0.7444
150	2.50	424.1	0.103	0.49	2159	0.7426
180	3.00	562.8	0.111	0.58	2865	0.7411
210	3.50	706.4	0.120	0.68	3596	0.7393
240	4.00	845.1	0.128	0.77	4303	0.7378
270	4.50	993.7	0.137	0.87	5059	0.7360
300	5.00	1143.8	0.146	0.97	5823	0.7343
330	5.50	1297.2	0.155	1.07	6604	0.7325
360	6.00	1452.3	0.164	1.17	7394	0.7308
390	6.50	1607.3	0.172	1.26	8183	0.7292
420	7.00	1764.0	0.181	1.36	8981	0.7275
450	7.50	1928.8	0.190	1.46	9820	0.7257
480	8.00	2090.4	0.199	1.56	10643	0.7240
510	8.50	2260.1	0.207	1.64	11507	0.7224
540	9.00	2426.6	0.216	1.74	12354	0.7207
570	9.50	2535.9	0.224	1.83	12911	0.7191

600	10.00	2532.7	0.226	1.86	12895	0.7187
630	10.50	2539.2	0.228	1.88	12928	0.7183
660	11.00	2545.7	0.229	1.89	12961	0.7181
690	11.50	2522.9	0.230	1.90	12845	0.7179
720	12.00	2534.3	0.231	1.91	12903	0.7177
750	12.50	2560.4	0.231	1.91	13036	0.7177
780	13.00	2526.1	0.232	1.92	12861	0.7175
810	13.50	2553.9	0.232	1.92	13003	0.7175
840	14.00	2526.1	0.232	1.92	12861	0.7175
870	14.50	2557.2	0.233	1.93	13019	0.7173
900	15.00	2534.3	0.233	1.93	12903	0.7173
930	15.50	2570.2	0.234	1.94	13086	0.7172
960	16.00	2547.4	0.234	1.94	12969	0.7172
990	16.50	2531.0	0.234	1.94	12886	0.7172
1020	17.00	2565.3	0.234	1.94	13061	0.7172
1050	17.50	2547.4	0.234	1.94	12969	0.7172
1080	18.00	2532.7	0.234	1.94	12895	0.7172
1110	18.50	2581.6	0.235	1.96	13144	0.7170
1140	19.00	2562.1	0.235	1.96	13044	0.7170
1170	19.50	2549.0	0.235	1.96	12978	0.7170
1200	20.00	2535.9	0.235	1.96	12911	0.7170
1230	20.50	2532.7	0.235	1.96	12895	0.7170
1260	21.00	2518.0	0.235	1.96	12820	0.7170
1290	21.50	2571.8	0.236	1.97	13094	0.7168
1320	22.00	2552.3	0.236	1.97	12994	0.7168
1350	22.50	2544.1	0.236	1.97	12953	0.7168
1380	23.00	2537.6	0.236	1.97	12920	0.7168
1410	23.50	2527.8	0.236	1.97	12870	0.7168
1440	24.00	2558.8	0.237	1.98	13028	0.7166
1470	24.50	2545.7	0.237	1.98	12961	0.7166
1500	25.00	1608.9	0.230	1.90	8191	0.7179
1530	25.50	899.0	0.224	1.83	4577	0.7191
1560	26.00	420.8	0.218	1.77	2142	0.7203
1590	26.50	153.0	0.210	1.68	779	0.7218
1620	27.00	45.9	0.201	1.58	234	0.7236
1650	27.50	3.1	0.192	1.48	16	0.7253
1680	28.00	0.0	0.180	1.34	0	0.7277
1710	28.50	0.0	0.179	1.33	0	0.7279
1740	29.00	0.0	0.179	1.33	0	0.7279
1770	29.50	0.0	0.179	1.33	0	0.7279
1800	30.00	0.0	0.180	1.34	0	0.7277
1830	30.50	0.0	0.180	1.34	0	0.7277
1860	31.00	0.0	0.179	1.33	0	0.7279
1890	31.50	0.0	0.180	1.34	0	0.7277
1920	32.00	0.0	0.180	1.34	0	0.7277
1950	32.50	0.0	0.179	1.33	0	0.7279
1980	33.00	0.0	0.180	1.34	0	0.7277
2010	33.50	1.5	0.188	1.43	8	0.7261
2040	34.00	108.9	0.196	1.52	554	0.7245
2070	34.50	309.8	0.203	1.60	1577	0.7232
2100	35.00	628.1	0.211	1.69	3198	0.7216
2130	35.50	1039.4	0.219	1.78	5292	0.7201
2160	36.00	1519.2	0.227	1.87	7735	0.7185
2190	36.50	1999.0	0.235	1.96	10177	0.7170

2220	37.00	2408.6	0.243	2.04	12263	0.7154
2250	37.50	2532.7	0.247	2.09	12895	0.7146
2280	38.00	2539.2	0.248	2.10	12928	0.7144
2310	38.50	2568.6	0.249	2.11	13077	0.7142
2340	39.00	2539.2	0.249	2.11	12928	0.7142
2370	39.50	2578.4	0.250	2.12	13127	0.7140
2400	40.00	2550.6	0.250	2.12	12986	0.7140
2430	40.50	2537.6	0.250	2.12	12920	0.7140
2460	41.00	2557.2	0.250	2.12	13019	0.7140
2490	41.50	2566.9	0.250	2.12	13069	0.7140
2520	42.00	2553.9	0.251	2.13	13003	0.7138
2550	42.50	2542.5	0.251	2.13	12945	0.7138
2580	43.00	2535.9	0.250	2.12	12911	0.7140
2610	43.50	2529.4	0.251	2.13	12878	0.7138
2640	44.00	2571.8	0.251	2.13	13094	0.7138
2670	44.50	2562.1	0.251	2.13	13044	0.7138
2700	45.00	2549.0	0.251	2.13	12978	0.7138
2730	45.50	2545.7	0.251	2.13	12961	0.7138
2760	46.00	2540.8	0.251	2.13	12936	0.7138
2790	46.50	2534.3	0.251	2.13	12903	0.7138
2820	47.00	2529.4	0.251	2.13	12878	0.7138
2850	47.50	2578.4	0.252	2.14	13127	0.7137
2880	48.00	2566.9	0.252	2.14	13069	0.7137
2910	48.50	2560.4	0.252	2.14	13036	0.7137
2940	49.00	2553.9	0.252	2.14	13003	0.7137
2970	49.50	2549.0	0.252	2.14	12978	0.7137
3000	50.00	2545.7	0.252	2.14	12961	0.7137
3030	50.50	2539.2	0.252	2.14	12928	0.7137
3060	51.00	2534.3	0.252	2.14	12903	0.7137
3090	51.50	2532.7	0.252	2.14	12895	0.7137
3120	52.00	2560.4	0.252	2.14	13036	0.7137
3150	52.50	2537.6	0.253	2.16	12920	0.7135
3180	53.00	2550.6	0.254	2.17	12986	0.7133
3210	53.50	2570.2	0.255	2.18	13086	0.7131
3240	54.00	2531.0	0.255	2.18	12886	0.7131
3270	54.50	2537.6	0.255	2.18	12920	0.7131
3300	55.00	2560.4	0.256	2.19	13036	0.7129
3330	55.50	2535.9	0.256	2.19	12911	0.7129
3360	56.00	2529.4	0.256	2.19	12878	0.7129
3390	56.50	2522.9	0.256	2.19	12845	0.7129
3420	57.00	2573.5	0.256	2.19	13102	0.7129
3450	57.50	2570.2	0.256	2.19	13086	0.7129
3480	58.00	2565.3	0.256	2.19	13061	0.7129
3510	58.50	2562.1	0.256	2.19	13044	0.7129
3540	59.00	2557.2	0.256	2.19	13019	0.7129
3570	59.50	2553.9	0.256	2.19	13003	0.7129
3600	60.00	2558.8	0.256	2.19	13028	0.7129
3630	60.50	2553.9	0.256	2.19	13003	0.7129
3660	61.00	2547.4	0.256	2.19	12969	0.7129
3690	61.50	2544.1	0.256	2.19	12953	0.7129
3720	62.00	2545.7	0.256	2.19	12961	0.7129
3750	62.50	2544.1	0.256	2.19	12953	0.7129
3780	63.00	2540.8	0.256	2.19	12936	0.7129
3810	63.50	2537.6	0.256	2.19	12920	0.7129

3840	64.00	2535.9	0.256	2.19	12911	0.7129
3870	64.50	2535.9	0.256	2.19	12911	0.7129
3900	65.00	2534.3	0.256	2.19	12903	0.7129
3930	65.50	2534.3	0.256	2.19	12903	0.7129
3960	66.00	2531.0	0.256	2.19	12886	0.7129
3990	66.50	2542.5	0.256	2.19	12945	0.7129
4020	67.00	2558.8	0.257	2.20	13028	0.7127
4050	67.50	2549.0	0.256	2.19	12978	0.7129
4080	68.00	2547.4	0.256	2.19	12969	0.7129
4110	68.50	2547.4	0.256	2.19	12969	0.7129
4140	69.00	2544.1	0.256	2.19	12953	0.7129
4170	69.50	2540.8	0.257	2.20	12936	0.7127
4200	70.00	2539.2	0.257	2.20	12928	0.7127
4230	70.50	2390.7	0.255	2.18	12172	0.7131
4260	71.00	1481.6	0.249	2.11	7543	0.7142
4290	71.50	802.7	0.243	2.04	4087	0.7154
4320	72.00	353.9	0.236	1.97	1802	0.7168
4350	72.50	124.9	0.227	1.87	636	0.7185
4380	73.00	34.8	0.218	1.77	177	0.7203
4410	73.50	0.8	0.208	1.66	4	0.7222
4440	74.00	0.0	0.199	1.56	0	0.7240

GOLDER ASSOCIATES INC., REDMOND, WA

)AD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-16-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	SWL SAND
TEST No.:	SS-2D

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	90.72
AREA (sq ft):	0.1964	WET WT. + TARE (g):	425.45
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	409.46
MOLD + SOIL (g):	16271	MOISTURE CONTENT (%):	5.0
MOLD (g):	8758		
		WET DENSITY (pcf):	112.4
ECIFIC GRAVITY:	2.83	DRY DENSITY (pcf):	107.0

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.060	0.00	0	0.6505
30	0.50	12.5	0.071	0.12	64	0.6485
60	1.00	45.3	0.081	0.23	231	0.6466
90	1.50	97.5	0.089	0.32	496	0.6452
120	2.00	191.7	0.098	0.42	976	0.6435
150	2.50	317.7	0.107	0.52	1617	0.6419
180	3.00	482.8	0.115	0.61	2458	0.6404
210	3.50	672.1	0.123	0.70	3422	0.6389
240	4.00	882.7	0.132	0.80	4494	0.6373
270	4.50	1104.6	0.141	0.90	5624	0.6356
300	5.00	1360.9	0.149	0.99	6929	0.6342
330	5.50	1605.7	0.158	1.09	8175	0.6325
360	6.00	1866.8	0.166	1.18	9504	0.6310
390	6.50	2131.2	0.175	1.28	10850	0.6294
420	7.00	2403.7	0.183	1.37	12238	0.6279
450	7.50	2684.5	0.192	1.47	13667	0.6263
480	8.00	2686.1	0.195	1.50	13676	0.6257
510	8.50	2638.8	0.196	1.51	13435	0.6255
540	9.00	2614.3	0.195	1.50	13310	0.6257
570	9.50	2599.6	0.196	1.51	13235	0.6255

600	10.00	2583.3	0.195	1.50	13152	0.6257
630	10.50	2571.8	0.196	1.51	13094	0.6255
660	11.00	2562.1	0.196	1.51	13044	0.6255
690	11.50	2550.6	0.196	1.51	12986	0.6255
720	12.00	2547.4	0.196	1.51	12969	0.6255
750	12.50	2539.2	0.196	1.51	12928	0.6255
780	13.00	2534.3	0.196	1.51	12903	0.6255
810	13.50	2581.6	0.196	1.51	13144	0.6255
840	14.00	2570.2	0.196	1.51	13086	0.6255
870	14.50	2563.7	0.196	1.51	13052	0.6255
900	15.00	2555.5	0.196	1.51	13011	0.6255
930	15.50	2549.0	0.196	1.51	12978	0.6255
960	16.00	2542.5	0.196	1.51	12945	0.6255
990	16.50	2539.2	0.196	1.51	12928	0.6255
1020	17.00	2534.3	0.196	1.51	12903	0.6255
1050	17.50	2527.8	0.196	1.51	12870	0.6255
1080	18.00	2526.1	0.196	1.51	12861	0.6255
1110	18.50	2573.5	0.197	1.52	13102	0.6254
1140	19.00	2566.9	0.197	1.52	13069	0.6254
1170	19.50	2560.4	0.197	1.52	13036	0.6254
1200	20.00	2553.9	0.197	1.52	13003	0.6254
1230	20.50	2552.3	0.197	1.52	12994	0.6254
1260	21.00	2547.4	0.197	1.52	12969	0.6254
1290	21.50	2540.8	0.197	1.52	12936	0.6254
1320	22.00	2537.6	0.197	1.52	12920	0.6254
1350	22.50	2532.7	0.197	1.52	12895	0.6254
1380	23.00	2201.4	0.195	1.50	11208	0.6257
1410	23.50	1329.9	0.188	1.42	6771	0.6270
1440	24.00	681.9	0.182	1.36	3472	0.6281
1470	24.50	277.2	0.174	1.27	1411	0.6296
1500	25.00	87.2	0.166	1.18	444	0.6310
1530	25.50	13.9	0.156	1.07	71	0.6329
1560	26.00	1.6	0.145	0.94	8	0.6349
1590	26.50	0.0	0.135	0.83	0	0.6367
1620	27.00	0.0	0.134	0.82	0	0.6369
1650	27.50	0.0	0.134	0.82	0	0.6369
1680	28.00	0.0	0.134	0.82	0	0.6369
1710	28.50	0.0	0.134	0.82	0	0.6369
1740	29.00	0.0	0.134	0.82	0	0.6369
1770	29.50	0.0	0.134	0.82	0	0.6369
1800	30.00	0.0	0.135	0.83	0	0.6367
1830	30.50	0.0	0.134	0.82	0	0.6369
1860	31.00	0.0	0.135	0.83	0	0.6367
1890	31.50	0.0	0.134	0.82	0	0.6369
1920	32.00	3.1	0.145	0.94	16	0.6349
1950	32.50	64.0	0.155	1.06	326	0.6331
1980	33.00	230.5	0.163	1.14	1174	0.6316
2010	33.50	543.2	0.171	1.23	2766	0.6301
2040	34.00	977.3	0.179	1.32	4976	0.6287
2070	34.50	1483.3	0.186	1.40	7552	0.6274
2100	35.00	2036.5	0.194	1.49	10368	0.6259
2130	35.50	2537.6	0.202	1.58	12920	0.6244
2160	36.00	2534.3	0.203	1.59	12903	0.6243
2190	36.50	2558.8	0.204	1.60	13028	0.6241

2220	37.00	2539.2	0.204	1.60	12928	0.6241
2250	37.50	2524.5	0.204	1.60	12853	0.6241
2280	38.00	2566.9	0.205	1.61	13069	0.6239
2310	38.50	2550.6	0.205	1.61	12986	0.6239
2340	39.00	2545.7	0.205	1.61	12961	0.6239
2370	39.50	2535.9	0.205	1.61	12911	0.6239
2400	40.00	2531.0	0.205	1.61	12886	0.6239
2430	40.50	2526.1	0.205	1.61	12861	0.6239
2460	41.00	2570.2	0.205	1.61	13086	0.6239
2490	41.50	2565.3	0.205	1.61	13061	0.6239
2520	42.00	2553.9	0.205	1.61	13003	0.6239
2550	42.50	2550.6	0.205	1.61	12986	0.6239
2580	43.00	2544.1	0.205	1.61	12953	0.6239
2610	43.50	2542.5	0.205	1.61	12945	0.6239
2640	44.00	2537.6	0.205	1.61	12920	0.6239
2670	44.50	2535.9	0.205	1.61	12911	0.6239
2700	45.00	2531.0	0.205	1.61	12886	0.6239
2730	45.50	2557.2	0.205	1.61	13019	0.6239
2760	46.00	2573.5	0.206	1.62	13102	0.6237
2790	46.50	2568.6	0.206	1.62	13077	0.6237
2820	47.00	2563.7	0.206	1.62	13052	0.6237
2850	47.50	2558.8	0.206	1.62	13028	0.6237
2880	48.00	2557.2	0.206	1.62	13019	0.6237
2910	48.50	2555.5	0.206	1.62	13011	0.6237
2940	49.00	2557.2	0.206	1.62	13019	0.6237
2970	49.50	2547.4	0.206	1.62	12969	0.6237
3000	50.00	2542.5	0.206	1.62	12945	0.6237
3030	50.50	2542.5	0.206	1.62	12945	0.6237
3060	51.00	2529.4	0.207	1.63	12878	0.6235
3090	51.50	2516.4	0.208	1.64	12812	0.6233
3120	52.00	2547.4	0.208	1.64	12969	0.6233
3150	52.50	2573.5	0.209	1.66	13102	0.6232
3180	53.00	2547.4	0.209	1.66	12969	0.6232
3210	53.50	2558.8	0.209	1.66	13028	0.6232
3240	54.00	2550.6	0.209	1.66	12986	0.6232
3270	54.50	2545.7	0.209	1.66	12961	0.6232
3300	55.00	2542.5	0.209	1.66	12945	0.6232
3330	55.50	2537.6	0.209	1.66	12920	0.6232
3360	56.00	2537.6	0.209	1.66	12920	0.6232
3390	56.50	2535.9	0.209	1.66	12911	0.6232
3420	57.00	2534.3	0.209	1.66	12903	0.6232
3450	57.50	2534.3	0.209	1.66	12903	0.6232
3480	58.00	2529.4	0.209	1.66	12878	0.6232
3510	58.50	2527.8	0.209	1.66	12870	0.6232
3540	59.00	2578.4	0.210	1.67	13127	0.6230
3570	59.50	2573.5	0.210	1.67	13102	0.6230
3600	60.00	2573.5	0.210	1.67	13102	0.6230
3630	60.50	2570.2	0.210	1.67	13086	0.6230
3660	61.00	2566.9	0.210	1.67	13069	0.6230
3690	61.50	2566.9	0.210	1.67	13069	0.6230
3720	62.00	2568.6	0.210	1.67	13077	0.6230
3750	62.50	2563.7	0.210	1.67	13052	0.6230
3780	63.00	2562.1	0.210	1.67	13044	0.6230
3810	63.50	2562.1	0.210	1.67	13044	0.6230

3840	64.00	2566.9	0.210	1.67	13069	0.6230
3870	64.50	2557.2	0.210	1.67	13019	0.6230
3900	65.00	2557.2	0.210	1.67	13019	0.6230
3930	65.50	2557.2	0.210	1.67	13019	0.6230
3960	66.00	2553.9	0.210	1.67	13003	0.6230
3990	66.50	2553.9	0.210	1.67	13003	0.6230
4020	67.00	2552.3	0.210	1.67	12994	0.6230
4050	67.50	2550.6	0.210	1.67	12986	0.6230
4080	68.00	2552.3	0.210	1.67	12994	0.6230
4110	68.50	2549.0	0.210	1.67	12978	0.6230
4140	69.00	1892.9	0.205	1.61	9637	0.6239
4170	69.50	1091.6	0.198	1.53	5558	0.6252
4200	70.00	523.6	0.192	1.47	2666	0.6263
4230	70.50	193.5	0.184	1.38	985	0.6277
4260	71.00	58.2	0.176	1.29	296	0.6292
4290	71.50	7.4	0.166	1.18	38	0.6310
4320	72.00	0.0	0.154	1.04	0	0.6332

GOLDER ASSOCIATES INC., REDMOND, WA

AD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-16-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	SWL SAND
TEST No.:	SS-3D

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	78.89
AREA (sq ft):	0.1964	WET WT. + TARE (g):	400.33
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	384.99
MOLD + SOIL (g):	16599	MOISTURE CONTENT (%):	5.0
MOLD (g):	8758		
		WET DENSITY (pcf):	117.3
:CIFIC GRAVITY:	2.83	DRY DENSITY (pcf):	111.7

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.052	0.00	0	0.5814
30	0.50	28.2	0.062	0.11	144	0.5796
60	1.00	103.7	0.071	0.21	528	0.5780
90	1.50	207.8	0.079	0.30	1058	0.5766
120	2.00	362.1	0.088	0.40	1844	0.5750
150	2.50	557.9	0.096	0.49	2840	0.5736
180	3.00	799.4	0.105	0.59	4070	0.5720
210	3.50	1076.9	0.113	0.68	5483	0.5706
240	4.00	1380.4	0.121	0.77	7028	0.5692
270	4.50	1713.4	0.129	0.86	8723	0.5678
300	5.00	2065.9	0.138	0.96	10518	0.5662
330	5.50	2433.1	0.146	1.04	12388	0.5648
360	6.00	2532.7	0.150	1.09	12895	0.5641
390	6.50	2581.6	0.151	1.10	13144	0.5640
420	7.00	2535.9	0.151	1.10	12911	0.5640
450	7.50	2570.2	0.152	1.11	13086	0.5638
480	8.00	2547.4	0.152	1.11	12969	0.5638
510	8.50	2531.0	0.152	1.11	12886	0.5638
540	9.00	2578.4	0.153	1.12	13127	0.5636
570	9.50	2562.1	0.153	1.12	13044	0.5636

600	10.00	2550.6	0.153	1.12	12986	0.5636
630	10.50	2539.2	0.153	1.12	12928	0.5636
660	11.00	2532.7	0.153	1.12	12895	0.5636
690	11.50	2524.5	0.153	1.12	12853	0.5636
720	12.00	2581.6	0.153	1.12	13144	0.5636
750	12.50	2565.3	0.153	1.12	13061	0.5636
780	13.00	2565.3	0.153	1.12	13061	0.5636
810	13.50	2549.0	0.153	1.12	12978	0.5636
840	14.00	2544.1	0.153	1.12	12953	0.5636
870	14.50	2537.6	0.153	1.12	12920	0.5636
900	15.00	2534.3	0.153	1.12	12903	0.5636
930	15.50	2531.0	0.153	1.12	12886	0.5636
960	16.00	2526.1	0.153	1.12	12861	0.5636
990	16.50	2575.1	0.154	1.13	13111	0.5634
1020	17.00	2568.6	0.154	1.13	13077	0.5634
1050	17.50	2563.7	0.154	1.13	13052	0.5634
1080	18.00	2557.2	0.154	1.13	13019	0.5634
1110	18.50	2553.9	0.154	1.13	13003	0.5634
1140	19.00	2549.0	0.154	1.13	12978	0.5634
1170	19.50	2545.7	0.154	1.13	12961	0.5634
1200	20.00	2542.5	0.154	1.13	12945	0.5634
1230	20.50	2539.2	0.154	1.13	12928	0.5634
1260	21.00	2018.6	0.150	1.09	10277	0.5641
1290	21.50	1160.1	0.144	1.02	5906	0.5652
1320	22.00	553.0	0.137	0.94	2815	0.5664
1350	22.50	181.7	0.130	0.87	925	0.5677
1380	23.00	43.3	0.121	0.77	220	0.5692
1410	23.50	3.6	0.111	0.66	18	0.5710
1440	24.00	2.1	0.100	0.53	11	0.5729
1470	24.50	0.0	0.097	0.50	0	0.5735
1500	25.00	0.0	0.097	0.50	0	0.5735
1530	25.50	0.0	0.097	0.50	0	0.5735
1560	26.00	0.0	0.097	0.50	0	0.5735
1590	26.50	0.0	0.097	0.50	0	0.5735
1620	27.00	0.0	0.097	0.50	0	0.5735
1650	27.50	0.0	0.097	0.50	0	0.5735
1680	28.00	0.0	0.097	0.50	0	0.5735
1710	28.50	0.0	0.097	0.50	0	0.5735
1740	29.00	0.0	0.097	0.50	0	0.5735
1770	29.50	4.1	0.104	0.58	21	0.5722
1800	30.00	28.2	0.114	0.69	144	0.5705
1830	30.50	220.9	0.122	0.78	1125	0.5691
1860	31.00	575.8	0.129	0.86	2932	0.5678
1890	31.50	1055.7	0.137	0.94	5375	0.5664
1920	32.00	1626.9	0.145	1.03	8283	0.5650
1950	32.50	2238.9	0.153	1.12	11399	0.5636
1980	33.00	2586.5	0.158	1.18	13169	0.5627
2010	33.50	2555.5	0.158	1.18	13011	0.5627
2040	34.00	2540.8	0.158	1.18	12936	0.5627
2070	34.50	2531.0	0.158	1.18	12886	0.5627
2100	35.00	2580.0	0.158	1.18	13135	0.5627
2130	35.50	2568.6	0.158	1.18	13077	0.5627
2160	36.00	2562.1	0.158	1.18	13044	0.5627
2190	36.50	2553.9	0.158	1.18	13003	0.5627

2220	37.00	2549.0	0.158	1.18	12978	0.5627
2250	37.50	2544.1	0.159	1.19	12953	0.5626
2280	38.00	2540.8	0.159	1.19	12936	0.5626
2310	38.50	2535.9	0.158	1.18	12911	0.5627
2340	39.00	2531.0	0.158	1.18	12886	0.5627
2370	39.50	2531.0	0.158	1.18	12886	0.5627
2400	40.00	2527.8	0.158	1.18	12870	0.5627
2430	40.50	2563.7	0.159	1.19	13052	0.5626
2460	41.00	2558.8	0.159	1.19	13028	0.5626
2490	41.50	2557.2	0.159	1.19	13019	0.5626
2520	42.00	2552.3	0.159	1.19	12994	0.5626
2550	42.50	2550.6	0.159	1.19	12986	0.5626
2580	43.00	2549.0	0.159	1.19	12978	0.5626
2610	43.50	2547.4	0.159	1.19	12969	0.5626
2640	44.00	2545.7	0.159	1.19	12961	0.5626
2670	44.50	2540.8	0.159	1.19	12936	0.5626
2700	45.00	2539.2	0.159	1.19	12928	0.5626
2730	45.50	2537.6	0.159	1.19	12920	0.5626
2760	46.00	2534.3	0.159	1.19	12903	0.5626
2790	46.50	2534.3	0.159	1.19	12903	0.5626
2820	47.00	2534.3	0.159	1.19	12903	0.5626
2850	47.50	2531.0	0.159	1.19	12886	0.5626
2880	48.00	2529.4	0.160	1.20	12878	0.5624
2910	48.50	2526.1	0.160	1.20	12861	0.5624
2940	49.00	2552.3	0.161	1.21	12994	0.5622
2970	49.50	2527.8	0.161	1.21	12870	0.5622
3000	50.00	2563.7	0.161	1.21	13052	0.5622
3030	50.50	2549.0	0.161	1.21	12978	0.5622
3060	51.00	2537.6	0.161	1.21	12920	0.5622
3090	51.50	2532.7	0.161	1.21	12895	0.5622
3120	52.00	2575.1	0.161	1.21	13111	0.5622
3150	52.50	2565.3	0.161	1.21	13061	0.5622
3180	53.00	2562.1	0.161	1.21	13044	0.5622
3210	53.50	2562.1	0.161	1.21	13044	0.5622
3240	54.00	2560.4	0.161	1.21	13036	0.5622
3270	54.50	2557.2	0.161	1.21	13019	0.5622
3300	55.00	2553.9	0.161	1.21	13003	0.5622
3330	55.50	2553.9	0.161	1.21	13003	0.5622
3360	56.00	2555.5	0.161	1.21	13011	0.5622
3390	56.50	2549.0	0.161	1.21	12978	0.5622
3420	57.00	2550.6	0.161	1.21	12986	0.5622
3450	57.50	2547.4	0.161	1.21	12969	0.5622
3480	58.00	2549.0	0.161	1.21	12978	0.5622
3510	58.50	2547.4	0.161	1.21	12969	0.5622
3540	59.00	2547.4	0.161	1.21	12969	0.5622
3570	59.50	2545.7	0.161	1.21	12961	0.5622
3600	60.00	2544.1	0.161	1.21	12953	0.5622
3630	60.50	2544.1	0.161	1.21	12953	0.5622
3660	61.00	2544.1	0.161	1.21	12953	0.5622
3690	61.50	2542.5	0.161	1.21	12945	0.5622
3720	62.00	2540.8	0.161	1.21	12936	0.5622
3750	62.50	2540.8	0.161	1.21	12936	0.5622
3780	63.00	2540.8	0.161	1.21	12936	0.5622
3810	63.50	2540.8	0.161	1.21	12936	0.5622

3840	64.00	2539.2	0.161	1.21	12928	0.5622
3870	64.50	2539.2	0.161	1.21	12928	0.5622
3900	65.00	2535.9	0.161	1.21	12911	0.5622
3930	65.50	2544.1	0.161	1.21	12953	0.5622
3960	66.00	2333.6	0.160	1.20	11881	0.5624
3990	66.50	1418.0	0.153	1.12	7219	0.5636
4020	67.00	735.8	0.147	1.06	3746	0.5647
4050	67.50	280.4	0.140	0.98	1428	0.5659
4080	68.00	76.1	0.131	0.88	387	0.5675
4110	68.50	7.6	0.122	0.78	39	0.5691
4140	69.00	0.0	0.111	0.66	0	0.5710
4170	69.50	0.0	0.110	0.64	0	0.5712
4200	70.00	0.0	0.111	0.66	0	0.5710
4230	70.50	5.2	0.114	0.69	26	0.5705
4260	71.00	76.9	0.124	0.80	392	0.5687
4290	71.50	318.3	0.131	0.88	1621	0.5675
4320	72.00	739.1	0.139	0.97	3763	0.5661
4350	72.50	1271.1	0.146	1.04	6472	0.5648
4380	73.00	1892.9	0.154	1.13	9637	0.5634
4410	73.50	2560.4	0.161	1.21	13036	0.5622
4440	74.00	2669.8	0.163	1.23	13593	0.5619
4470	74.50	2584.9	0.163	1.23	13160	0.5619
4500	75.00	2209.5	0.160	1.20	11249	0.5624
4530	75.50	1326.6	0.153	1.12	6754	0.5636
4560	76.00	655.8	0.147	1.06	3339	0.5647
4590	76.50	238.0	0.140	0.98	1212	0.5659
4620	77.00	60.9	0.131	0.88	310	0.5675
4650	77.50	3.0	0.121	0.77	15	0.5692
4680	78.00	0.0	0.112	0.67	0	0.5708
4710	78.50	0.0	0.105	0.59	0	0.5720
4740	79.00	0.0	0.105	0.59	0	0.5720
4770	79.50	0.0	0.108	0.62	0	0.5715
4800	80.00	0.8	0.117	0.72	4	0.5699
4830	80.50	81.5	0.127	0.83	415	0.5682
4860	81.00	328.9	0.134	0.91	1675	0.5670
4890	81.50	761.9	0.142	1.00	3879	0.5655
4920	82.00	1311.9	0.150	1.09	6679	0.5641
4950	82.50	1950.0	0.157	1.17	9928	0.5629
4980	83.00	2635.5	0.165	1.26	13418	0.5615
5010	83.50	2929.3	0.169	1.30	14914	0.5608
5040	84.00	2573.5	0.167	1.28	13102	0.5612
5070	84.50	2578.4	0.167	1.28	13127	0.5612
5100	85.00	2571.8	0.167	1.28	13094	0.5612
5130	85.50	1894.5	0.162	1.22	9645	0.5620
5160	86.00	1101.4	0.155	1.14	5608	0.5633
5190	86.50	508.9	0.149	1.08	2591	0.5643
5220	87.00	168.2	0.141	0.99	856	0.5657
5250	87.50	38.9	0.132	0.89	198	0.5673
5280	88.00	1.0	0.122	0.78	5	0.5691
5310	88.50	0.0	0.121	0.77	0	0.5692
5340	89.00	0.0	0.121	0.77	0	0.5692
5370	89.50	28.2	0.129	0.86	144	0.5678
5400	90.00	285.2	0.137	0.94	1452	0.5664
5430	90.50	688.5	0.144	1.02	3505	0.5652

5460	91.00	1227.0	0.152	1.11	6247	0.5638
5490	91.50	1866.8	0.159	1.19	9504	0.5626
5520	92.00	2563.7	0.167	1.28	13052	0.5612
5550	92.50	2588.2	0.167	1.28	13177	0.5612
5580	93.00	2578.4	0.167	1.28	13127	0.5612
5610	93.50	2423.3	0.167	1.28	12338	0.5612
5640	94.00	1496.3	0.160	1.20	7618	0.5624
5670	94.50	784.8	0.153	1.12	3996	0.5636
5700	95.00	304.9	0.146	1.04	1552	0.5648
5730	95.50	83.6	0.137	0.94	426	0.5664
5760	96.00	7.6	0.128	0.84	39	0.5680
5790	96.50	0.0	0.120	0.76	0	0.5694
5820	97.00	0.0	0.119	0.74	0	0.5696
5850	97.50	0.0	0.120	0.76	0	0.5694
5880	98.00	28.2	0.129	0.86	144	0.5678
5910	98.50	252.1	0.138	0.96	1284	0.5662
5940	99.00	642.8	0.145	1.03	3273	0.5650
5970	99.50	1174.8	0.153	1.12	5981	0.5636
6000	100.00	1812.9	0.160	1.20	9230	0.5624
6030	100.50	2522.9	0.167	1.28	12845	0.5612
6060	101.00	2539.2	0.168	1.29	12928	0.5610
6090	101.50	2529.4	0.168	1.29	12878	0.5610
6120	102.00	1907.6	0.164	1.24	9712	0.5617
6150	102.50	1080.2	0.157	1.17	5500	0.5629
6180	103.00	482.8	0.151	1.10	2458	0.5640
6210	103.50	150.5	0.142	1.00	766	0.5655
6240	104.00	29.1	0.134	0.91	148	0.5670
6270	104.50	1.4	0.124	0.80	7	0.5687
6300	105.00	0.0	0.121	0.77	0	0.5692
6330	105.50	0.0	0.121	0.77	0	0.5692
6360	106.00	1.0	0.125	0.81	5	0.5685
6390	106.50	99.5	0.134	0.91	507	0.5670
6420	107.00	328.9	0.142	1.00	1675	0.5655
6450	107.50	833.7	0.149	1.08	4245	0.5643
6480	108.00	1411.5	0.157	1.17	7186	0.5629
6510	108.50	2090.4	0.164	1.24	10643	0.5617
6540	109.00	2562.1	0.169	1.30	13044	0.5608
6570	109.50	2539.2	0.169	1.30	12928	0.5608
6600	110.00	2532.7	0.169	1.30	12895	0.5608
6630	110.50	2535.9	0.169	1.30	12911	0.5608
6660	111.00	2524.5	0.169	1.30	12853	0.5608
6690	111.50	2521.3	0.169	1.30	12837	0.5608
6720	112.00	1968.0	0.165	1.26	10020	0.5615
6750	112.50	1125.8	0.159	1.19	5732	0.5626
6780	113.00	510.6	0.152	1.11	2600	0.5638
6810	113.50	161.6	0.144	1.02	823	0.5652
6840	114.00	34.2	0.135	0.92	174	0.5668
6870	114.50	0.0	0.126	0.82	0	0.5684

GOLDER ASSOCIATES INC., REDMOND, WA

AD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-17-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	SWL SAND
TEST No.:	SS-1W

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	90.82
AREA (sq ft):	0.1964	WET WT. + TARE (g):	491.48
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	443.45
MOLD + SOIL (g):	16450	MOISTURE CONTENT (%):	13.6
MOLD (g):	8758		
		WET DENSITY (pcf):	115.1
CIFIC GRAVITY:	2.83	DRY DENSITY (pcf):	101.3

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.023	0.00	0	0.7441
30	0.50	26.9	0.032	0.10	137	0.7424
60	1.00	98.3	0.042	0.21	500	0.7405
90	1.50	227.7	0.051	0.31	1159	0.7387
120	2.00	420.8	0.060	0.41	2142	0.7370
150	2.50	652.6	0.068	0.50	3323	0.7354
180	3.00	908.8	0.077	0.60	4627	0.7337
210	3.50	1186.2	0.085	0.69	6039	0.7321
240	4.00	1475.1	0.094	0.79	7510	0.7304
270	4.50	1778.7	0.103	0.89	9056	0.7286
300	5.00	2096.9	0.111	0.98	10676	0.7271
330	5.50	2421.7	0.120	1.08	12330	0.7253
360	6.00	2584.9	0.124	1.12	13160	0.7246
390	6.50	2599.6	0.126	1.14	13235	0.7242
420	7.00	2540.8	0.126	1.14	12936	0.7242
450	7.50	2581.6	0.126	1.14	13144	0.7242
480	8.00	2552.3	0.127	1.16	12994	0.7240
510	8.50	2537.6	0.127	1.16	12920	0.7240
540	9.00	2547.4	0.127	1.16	12969	0.7240
570	9.50	2568.6	0.127	1.16	13077	0.7240

600	10.00	2562.1	0.127	1.16	13044	0.7240
630	10.50	2544.1	0.127	1.16	12953	0.7240
660	11.00	2535.9	0.127	1.16	12911	0.7240
690	11.50	2531.0	0.127	1.16	12886	0.7240
720	12.00	2521.3	0.127	1.16	12837	0.7240
750	12.50	2516.4	0.127	1.16	12812	0.7240
780	13.00	2513.1	0.127	1.16	12795	0.7240
810	13.50	2581.6	0.128	1.17	13144	0.7238
840	14.00	2568.6	0.128	1.17	13077	0.7238
870	14.50	2560.4	0.128	1.17	13036	0.7238
900	15.00	2553.9	0.128	1.17	13003	0.7238
930	15.50	2549.0	0.128	1.17	12978	0.7238
960	16.00	2544.1	0.128	1.17	12953	0.7238
990	16.50	2539.2	0.128	1.17	12928	0.7238
1020	17.00	2535.9	0.128	1.17	12911	0.7238
1050	17.50	2531.0	0.128	1.17	12886	0.7238
1080	18.00	2529.4	0.128	1.17	12878	0.7238
1110	18.50	2578.4	0.129	1.18	13127	0.7236
1140	19.00	2568.6	0.129	1.18	13077	0.7236
1170	19.50	2562.1	0.129	1.18	13044	0.7236
1200	20.00	2558.8	0.129	1.18	13028	0.7236
1230	20.50	2552.3	0.129	1.18	12994	0.7236
1260	21.00	2470.7	0.128	1.17	12579	0.7238
1290	21.50	1530.6	0.121	1.09	7793	0.7252
1320	22.00	819.0	0.115	1.02	4170	0.7263
1350	22.50	347.4	0.108	0.94	1769	0.7277
1380	23.00	111.7	0.099	0.84	569	0.7294
1410	23.50	21.3	0.090	0.74	108	0.7312
1440	24.00	4.0	0.079	0.62	20	0.7333
1470	24.50	0.0	0.068	0.50	0	0.7354
1500	25.00	0.0	0.063	0.44	0	0.7364
1530	25.50	0.0	0.063	0.44	0	0.7364
1560	26.00	0.0	0.063	0.44	0	0.7364
1590	26.50	0.0	0.063	0.44	0	0.7364
1620	27.00	0.0	0.063	0.44	0	0.7364
1650	27.50	0.0	0.063	0.44	0	0.7364
1680	28.00	0.0	0.063	0.44	0	0.7364
1710	28.50	0.0	0.063	0.44	0	0.7364
1740	29.00	0.0	0.063	0.44	0	0.7364
1770	29.50	0.0	0.063	0.44	0	0.7364
1800	30.00	0.0	0.063	0.44	0	0.7364
1830	30.50	0.0	0.069	0.51	0	0.7352
1860	31.00	1.5	0.080	0.63	8	0.7331
1890	31.50	99.3	0.089	0.73	506	0.7314
1920	32.00	327.5	0.097	0.82	1667	0.7298
1950	32.50	696.6	0.105	0.91	3547	0.7283
1980	33.00	1165.0	0.113	1.00	5931	0.7267
2010	33.50	1706.9	0.121	1.09	8690	0.7252
2040	34.00	2253.6	0.128	1.17	11474	0.7238
2070	34.50	2550.6	0.134	1.23	12986	0.7226
2100	35.00	2580.0	0.135	1.24	13135	0.7224
2130	35.50	2547.4	0.135	1.24	12969	0.7224
2160	36.00	2535.9	0.135	1.24	12911	0.7224
2190	36.50	2526.1	0.135	1.24	12861	0.7224

2220	37.00	2568.6	0.135	1.24	13077	0.7224
2250	37.50	2557.2	0.135	1.24	13019	0.7224
2280	38.00	2550.6	0.135	1.24	12986	0.7224
2310	38.50	2545.7	0.135	1.24	12961	0.7224
2340	39.00	2542.5	0.135	1.24	12945	0.7224
2370	39.50	2540.8	0.136	1.26	12936	0.7222
2400	40.00	2529.4	0.135	1.24	12878	0.7224
2430	40.50	2527.8	0.135	1.24	12870	0.7224
2460	41.00	2534.3	0.136	1.26	12903	0.7222
2490	41.50	2566.9	0.136	1.26	13069	0.7222
2520	42.00	2560.4	0.136	1.26	13036	0.7222
2550	42.50	2558.8	0.136	1.26	13028	0.7222
2580	43.00	2553.9	0.136	1.26	13003	0.7222
2610	43.50	2550.6	0.136	1.26	12986	0.7222
2640	44.00	2553.9	0.136	1.26	13003	0.7222
2670	44.50	2545.7	0.136	1.26	12961	0.7222
2700	45.00	2542.5	0.136	1.26	12945	0.7222
2730	45.50	2540.8	0.136	1.26	12936	0.7222
2760	46.00	2537.6	0.136	1.26	12920	0.7222
2790	46.50	2537.6	0.136	1.26	12920	0.7222
2820	47.00	2519.6	0.136	1.26	12828	0.7222
2850	47.50	2532.7	0.136	1.26	12895	0.7222
2880	48.00	2529.4	0.136	1.26	12878	0.7222
2910	48.50	2527.8	0.136	1.26	12870	0.7222
2940	49.00	2570.2	0.137	1.27	13086	0.7221
2970	49.50	2529.4	0.137	1.27	12878	0.7221
3000	50.00	2555.5	0.138	1.28	13011	0.7219
3030	50.50	2568.6	0.138	1.28	13077	0.7219
3060	51.00	2524.5	0.138	1.28	12853	0.7219
3090	51.50	2568.6	0.139	1.29	13077	0.7217
3120	52.00	2537.6	0.139	1.29	12920	0.7217
3150	52.50	2581.6	0.139	1.29	13144	0.7217
3180	53.00	2573.5	0.139	1.29	13102	0.7217
3210	53.50	2578.4	0.139	1.29	13127	0.7217
3240	54.00	2570.2	0.139	1.29	13086	0.7217
3270	54.50	2566.9	0.139	1.29	13069	0.7217
3300	55.00	2562.1	0.139	1.29	13044	0.7217
3330	55.50	2565.3	0.139	1.29	13061	0.7217
3360	56.00	2565.3	0.139	1.29	13061	0.7217
3390	56.50	2560.4	0.139	1.29	13036	0.7217
3420	57.00	2558.8	0.139	1.29	13028	0.7217
3450	57.50	2555.5	0.139	1.29	13011	0.7217
3480	58.00	2557.2	0.139	1.29	13019	0.7217
3510	58.50	2557.2	0.139	1.29	13019	0.7217
3540	59.00	2553.9	0.140	1.30	13003	0.7215
3570	59.50	2553.9	0.139	1.29	13003	0.7217
3600	60.00	2552.3	0.139	1.29	12994	0.7217
3630	60.50	2542.5	0.139	1.29	12945	0.7217
3660	61.00	2550.6	0.139	1.29	12986	0.7217
3690	61.50	2549.0	0.139	1.29	12978	0.7217
3720	62.00	2549.0	0.139	1.29	12978	0.7217
3750	62.50	2547.4	0.139	1.29	12969	0.7217
3780	63.00	2547.4	0.139	1.29	12969	0.7217
3810	63.50	2545.7	0.139	1.29	12961	0.7217

3840	64.00	2544.1	0.139	1.29	12953	0.7217
3870	64.50	2545.7	0.139	1.29	12961	0.7217
3900	65.00	2544.1	0.139	1.29	12953	0.7217
3930	65.50	2544.1	0.139	1.29	12953	0.7217
3960	66.00	2544.1	0.139	1.29	12953	0.7217
3990	66.50	2542.5	0.139	1.29	12945	0.7217
4020	67.00	2540.8	0.139	1.29	12936	0.7217
4050	67.50	2418.4	0.138	1.28	12313	0.7219
4080	68.00	1493.1	0.131	1.20	7602	0.7232
4110	68.50	796.2	0.125	1.13	4054	0.7244
4140	69.00	335.9	0.118	1.06	1710	0.7257
4170	69.50	109.2	0.109	0.96	556	0.7275
4200	70.00	21.6	0.100	0.86	110	0.7292
4230	70.50	2.7	0.089	0.73	14	0.7314
4260	71.00	0.0	0.079	0.62	0	0.7333

GOLDER ASSOCIATES INC., REDMOND, WA

\D DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-17-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	SWL SAND
TEST No.:	SS-2W

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	73.65
AREA (sq ft):	0.1964	WET WT. + TARE (g):	470.57
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	421.86
MOLD + SOIL (g):	17004	MOISTURE CONTENT (%):	14.0
MOLD (g):	8758		
		WET DENSITY (pcf):	123.4
CIFIC GRAVITY:	2.83	DRY DENSITY (pcf):	108.2

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.048	0.00	0	0.6322
30	0.50	54.6	0.058	0.11	278	0.6304
60	1.00	138.9	0.067	0.21	707	0.6288
90	1.50	272.8	0.075	0.30	1389	0.6273
120	2.00	461.6	0.084	0.40	2350	0.6257
150	2.50	699.9	0.092	0.49	3563	0.6243
180	3.00	974.1	0.101	0.59	4959	0.6226
210	3.50	1280.9	0.109	0.68	6521	0.6212
240	4.00	1613.8	0.117	0.77	8216	0.6197
270	4.50	1971.2	0.126	0.87	10036	0.6181
300	5.00	2343.4	0.134	0.96	11931	0.6166
330	5.50	2558.8	0.139	1.01	13028	0.6157
360	6.00	2537.6	0.140	1.02	12920	0.6156
390	6.50	2560.4	0.141	1.03	13036	0.6154
420	7.00	2535.9	0.141	1.03	12911	0.6154
450	7.50	2575.1	0.142	1.04	13111	0.6152
480	8.00	2555.5	0.142	1.04	13011	0.6152
510	8.50	2542.5	0.142	1.04	12945	0.6152
540	9.00	2526.1	0.142	1.04	12861	0.6152
570	9.50	2580.0	0.142	1.04	13135	0.6152

600	10.00	2566.9	0.142	1.04	13069	0.6152
630	10.50	2555.5	0.142	1.04	13011	0.6152
660	11.00	2547.4	0.143	1.06	12969	0.6150
690	11.50	2545.7	0.142	1.04	12961	0.6152
720	12.00	2535.9	0.143	1.06	12911	0.6150
750	12.50	2529.4	0.143	1.06	12878	0.6150
780	13.00	2580.0	0.143	1.06	13135	0.6150
810	13.50	2570.2	0.143	1.06	13086	0.6150
840	14.00	2560.4	0.143	1.06	13036	0.6150
870	14.50	2555.5	0.143	1.06	13011	0.6150
900	15.00	2550.6	0.143	1.06	12986	0.6150
930	15.50	2545.7	0.143	1.06	12961	0.6150
960	16.00	2544.1	0.143	1.06	12953	0.6150
990	16.50	2539.2	0.143	1.06	12928	0.6150
1020	17.00	2535.9	0.143	1.06	12911	0.6150
1050	17.50	2531.0	0.143	1.06	12886	0.6150
1080	18.00	2529.4	0.143	1.06	12878	0.6150
1110	18.50	2584.9	0.144	1.07	13160	0.6148
1140	19.00	2575.1	0.144	1.07	13111	0.6148
1170	19.50	2568.6	0.144	1.07	13077	0.6148
1200	20.00	2571.8	0.144	1.07	13094	0.6148
1230	20.50	2364.6	0.142	1.04	12039	0.6152
1260	21.00	1453.9	0.135	0.97	7402	0.6165
1290	21.50	753.7	0.129	0.90	3837	0.6175
1320	22.00	300.0	0.122	0.82	1527	0.6188
1350	22.50	85.6	0.114	0.73	436	0.6203
1380	23.00	11.8	0.105	0.63	60	0.6219
1410	23.50	3.2	0.093	0.50	16	0.6241
1440	24.00	0.0	0.087	0.43	0	0.6252
1470	24.50	0.0	0.087	0.43	0	0.6252
1500	25.00	0.0	0.087	0.43	0	0.6252
1530	25.50	0.0	0.087	0.43	0	0.6252
1560	26.00	0.0	0.087	0.43	0	0.6252
1590	26.50	0.0	0.087	0.43	0	0.6252
1620	27.00	0.0	0.087	0.43	0	0.6252
1650	27.50	0.0	0.087	0.43	0	0.6252
1680	28.00	0.0	0.087	0.43	0	0.6252
1710	28.50	0.0	0.087	0.43	0	0.6252
1740	29.00	2.6	0.093	0.50	13	0.6241
1770	29.50	28.2	0.104	0.62	144	0.6221
1800	30.00	252.5	0.112	0.71	1286	0.6206
1830	30.50	608.5	0.120	0.80	3098	0.6192
1860	31.00	1085.0	0.127	0.88	5524	0.6179
1890	31.50	1643.2	0.135	0.97	8366	0.6165
1920	32.00	2237.3	0.143	1.06	11391	0.6150
1950	32.50	2527.8	0.147	1.10	12870	0.6143
1980	33.00	2545.7	0.148	1.11	12961	0.6141
2010	33.50	2529.4	0.148	1.11	12878	0.6141
2040	34.00	2575.1	0.149	1.12	13111	0.6139
2070	34.50	2560.4	0.149	1.12	13036	0.6139
2100	35.00	2550.6	0.148	1.11	12986	0.6141
2130	35.50	2545.7	0.149	1.12	12961	0.6139
2160	36.00	2540.8	0.148	1.11	12936	0.6141
2190	36.50	2537.6	0.149	1.12	12920	0.6139

2220	37.00	2531.0	0.149	1.12	12886	0.6139
2250	37.50	2526.1	0.149	1.12	12861	0.6139
2280	38.00	2578.4	0.149	1.12	13127	0.6139
2310	38.50	2571.8	0.149	1.12	13094	0.6139
2340	39.00	2568.6	0.149	1.12	13077	0.6139
2370	39.50	2562.1	0.149	1.12	13044	0.6139
2400	40.00	2558.8	0.149	1.12	13028	0.6139
2430	40.50	2555.5	0.149	1.12	13011	0.6139
2460	41.00	2553.9	0.149	1.12	13003	0.6139
2490	41.50	2545.7	0.149	1.12	12961	0.6139
2520	42.00	2547.4	0.149	1.12	12969	0.6139
2550	42.50	2547.4	0.149	1.12	12969	0.6139
2580	43.00	2544.1	0.149	1.12	12953	0.6139
2610	43.50	2542.5	0.149	1.12	12945	0.6139
2640	44.00	2537.6	0.149	1.12	12920	0.6139
2670	44.50	2537.6	0.149	1.12	12920	0.6139
2700	45.00	2535.9	0.149	1.12	12911	0.6139
2730	45.50	2534.3	0.149	1.12	12903	0.6139
2760	46.00	2531.0	0.149	1.12	12886	0.6139
2790	46.50	2532.7	0.149	1.12	12895	0.6139
2820	47.00	2532.7	0.149	1.12	12895	0.6139
2850	47.50	2531.0	0.149	1.12	12886	0.6139
2880	48.00	2522.9	0.151	1.14	12845	0.6136
2910	48.50	2526.1	0.151	1.14	12861	0.6136
2940	49.00	2526.1	0.152	1.16	12861	0.6134
2970	49.50	2527.8	0.152	1.16	12870	0.6134
3000	50.00	2549.0	0.153	1.17	12978	0.6132
3030	50.50	2534.3	0.153	1.17	12903	0.6132
3060	51.00	2531.0	0.153	1.17	12886	0.6132
3090	51.50	2529.4	0.153	1.17	12878	0.6132
3120	52.00	2573.5	0.154	1.18	13102	0.6130
3150	52.50	2571.8	0.154	1.18	13094	0.6130
3180	53.00	2568.6	0.154	1.18	13077	0.6130
3210	53.50	2565.3	0.154	1.18	13061	0.6130
3240	54.00	2565.3	0.154	1.18	13061	0.6130
3270	54.50	2563.7	0.154	1.18	13052	0.6130
3300	55.00	2562.1	0.154	1.18	13044	0.6130
3330	55.50	2560.4	0.154	1.18	13036	0.6130
3360	56.00	2560.4	0.154	1.18	13036	0.6130
3390	56.50	2555.5	0.154	1.18	13011	0.6130
3420	57.00	2557.2	0.154	1.18	13019	0.6130
3450	57.50	2558.8	0.154	1.18	13028	0.6130
3480	58.00	2555.5	0.154	1.18	13011	0.6130
3510	58.50	2555.5	0.154	1.18	13011	0.6130
3540	59.00	2553.9	0.154	1.18	13003	0.6130
3570	59.50	2550.6	0.154	1.18	12986	0.6130
3600	60.00	2553.9	0.154	1.18	13003	0.6130
3630	60.50	2553.9	0.154	1.18	13003	0.6130
3660	61.00	2549.0	0.154	1.18	12978	0.6130
3690	61.50	2550.6	0.154	1.18	12986	0.6130
3720	62.00	2550.6	0.154	1.18	12986	0.6130
3750	62.50	2550.6	0.154	1.18	12986	0.6130
3780	63.00	2549.0	0.154	1.18	12978	0.6130
3810	63.50	2553.9	0.154	1.18	13003	0.6130

3840	64.00	2547.4	0.154	1.18	12969	0.6130
3870	64.50	2547.4	0.154	1.18	12969	0.6130
3900	65.00	2545.7	0.154	1.18	12961	0.6130
3930	65.50	2279.7	0.152	1.16	11607	0.6134
3960	66.00	1388.6	0.145	1.08	7070	0.6146
3990	66.50	727.6	0.139	1.01	3704	0.6157
4020	67.00	291.9	0.133	0.94	1486	0.6168
4050	67.50	88.4	0.124	0.84	450	0.6185
4080	68.00	11.5	0.115	0.74	59	0.6201
4110	68.50	2.2	0.103	0.61	11	0.6223
4140	69.00	0.0	0.095	0.52	0	0.6237

GOLDER ASSOCIATES INC., REDMOND, WA

'AD DEFORMATION TESTING

PROJECT:	MW-COE / TESTING / WA
PROJECT No.:	923-A026
DATE:	11-18-93
TECH:	DPO/KPS
REVIEW:	DPO

SOIL TYPE:	SWL SAND
TEST No.:	SS-3W

HEIGHT (in):	9.002	MOISTURE DETERMINATION	
DIAMETER (in):	6.001	TARE WT. (g):	78.88
AREA (sq ft):	0.1964	WET WT. + TARE (g):	467.12
VOLUME (cu ft):	0.1473	DRY WT. + TARE (g):	420.08
MOLD + SOIL (g):	17331	MOISTURE CONTENT (%):	13.8
MOLD (g):	8758		
		WET DENSITY (pcf):	128.3
:CIFIC GRAVITY:	2.83	DRY DENSITY (pcf):	112.7

ELAPSED TIME (sec)	ELAPSED TIME (min)	LOAD (lb)	LVDT DISPL. (in)	STRAIN (%)	STRESS (psf)	VOID RATIO
0	0.00	0.0	0.068	0.00	0	0.5672
30	0.50	28.2	0.077	0.10	144	0.5656
60	1.00	96.4	0.086	0.20	491	0.5641
90	1.50	182.5	0.095	0.30	929	0.5625
120	2.00	299.5	0.104	0.40	1525	0.5609
150	2.50	443.7	0.113	0.50	2259	0.5594
180	3.00	608.5	0.121	0.59	3098	0.5580
210	3.50	796.2	0.130	0.69	4054	0.5564
240	4.00	1003.4	0.138	0.78	5109	0.5550
270	4.50	1228.7	0.147	0.88	6256	0.5534
300	5.00	1476.7	0.155	0.97	7518	0.5520
330	5.50	1733.0	0.164	1.07	8823	0.5505
360	6.00	2013.7	0.172	1.16	10252	0.5491
390	6.50	2296.0	0.181	1.26	11690	0.5475
420	7.00	2534.3	0.188	1.33	12903	0.5463
450	7.50	2544.1	0.190	1.36	12953	0.5460
480	8.00	2547.4	0.191	1.37	12969	0.5458
510	8.50	2584.9	0.192	1.38	13160	0.5456
540	9.00	2542.5	0.192	1.38	12945	0.5456
570	9.50	2534.3	0.189	1.34	12903	0.5461

600	10.00	2560.4	0.190	1.36	13036	0.5460
630	10.50	2545.7	0.190	1.36	12961	0.5460
660	11.00	2532.7	0.190	1.36	12895	0.5460
690	11.50	2573.5	0.190	1.36	13102	0.5460
720	12.00	2557.2	0.191	1.37	13019	0.5458
750	12.50	2544.1	0.190	1.36	12953	0.5460
780	13.00	2535.9	0.190	1.36	12911	0.5460
810	13.50	2527.8	0.190	1.36	12870	0.5460
840	14.00	2562.1	0.191	1.37	13044	0.5458
870	14.50	2549.0	0.191	1.37	12978	0.5458
900	15.00	2542.5	0.191	1.37	12945	0.5458
930	15.50	2535.9	0.191	1.37	12911	0.5458
960	16.00	2529.4	0.191	1.37	12878	0.5458
990	16.50	2527.8	0.191	1.37	12870	0.5458
1020	17.00	2584.9	0.192	1.38	13160	0.5456
1050	17.50	2570.2	0.192	1.38	13086	0.5456
1080	18.00	2553.9	0.192	1.38	13003	0.5456
1110	18.50	2555.5	0.192	1.38	13011	0.5456
1140	19.00	2552.3	0.192	1.38	12994	0.5456
1170	19.50	2544.1	0.192	1.38	12953	0.5456
1200	20.00	2539.2	0.192	1.38	12928	0.5456
1230	20.50	2535.9	0.192	1.38	12911	0.5456
1260	21.00	2531.0	0.192	1.38	12886	0.5456
1290	21.50	2527.8	0.192	1.38	12870	0.5456
1320	22.00	2532.7	0.192	1.38	12895	0.5456
1350	22.50	1661.2	0.185	1.30	8458	0.5468
1380	23.00	916.9	0.179	1.23	4668	0.5479
1410	23.50	399.6	0.172	1.16	2034	0.5491
1440	24.00	134.9	0.164	1.07	687	0.5505
1470	24.50	32.4	0.155	0.97	165	0.5520
1500	25.00	0.6	0.144	0.84	3	0.5540
1530	25.50	0.0	0.137	0.77	0	0.5552
1560	26.00	0.0	0.137	0.77	0	0.5552
1590	26.50	0.0	0.137	0.77	0	0.5552
1620	27.00	0.0	0.137	0.77	0	0.5552
1650	27.50	0.0	0.137	0.77	0	0.5552
1680	28.00	0.0	0.137	0.77	0	0.5552
1710	28.50	0.0	0.137	0.77	0	0.5552
1740	29.00	0.0	0.137	0.77	0	0.5552
1770	29.50	0.0	0.137	0.77	0	0.5552
1800	30.00	0.0	0.137	0.77	0	0.5552
1830	30.50	0.0	0.139	0.79	0	0.5548
1860	31.00	28.2	0.149	0.90	144	0.5531
1890	31.50	205.7	0.158	1.00	1047	0.5515
1920	32.00	508.9	0.166	1.09	2591	0.5501
1950	32.50	928.4	0.174	1.18	4727	0.5487
1980	33.00	1440.8	0.182	1.27	7335	0.5473
2010	33.50	1964.7	0.189	1.34	10003	0.5461
2040	34.00	2452.7	0.197	1.43	12487	0.5447
2070	34.50	2540.8	0.200	1.47	12936	0.5442
2100	35.00	2573.5	0.201	1.48	13102	0.5440
2130	35.50	2549.0	0.201	1.48	12978	0.5440
2160	36.00	2534.3	0.201	1.48	12903	0.5440
2190	36.50	2581.6	0.201	1.48	13144	0.5440

2220	37.00	2568.6	0.201	1.48	13077	0.5440
2250	37.50	2552.3	0.201	1.48	12994	0.5440
2280	38.00	2545.7	0.201	1.48	12961	0.5440
2310	38.50	2535.9	0.202	1.49	12911	0.5439
2340	39.00	2535.9	0.201	1.48	12911	0.5440
2370	39.50	2527.8	0.202	1.49	12870	0.5439
2400	40.00	2526.1	0.202	1.49	12861	0.5439
2430	40.50	2571.8	0.202	1.49	13094	0.5439
2460	41.00	2565.3	0.202	1.49	13061	0.5439
2490	41.50	2558.8	0.202	1.49	13028	0.5439
2520	42.00	2553.9	0.202	1.49	13003	0.5439
2550	42.50	2549.0	0.202	1.49	12978	0.5439
2580	43.00	2545.7	0.202	1.49	12961	0.5439
2610	43.50	2542.5	0.202	1.49	12945	0.5439
2640	44.00	2537.6	0.202	1.49	12920	0.5439
2670	44.50	2540.8	0.202	1.49	12936	0.5439
2700	45.00	2534.3	0.202	1.49	12903	0.5439
2730	45.50	2565.3	0.203	1.50	13061	0.5437
2760	46.00	2562.1	0.202	1.49	13044	0.5439
2790	46.50	2558.8	0.203	1.50	13028	0.5437
2820	47.00	2552.3	0.202	1.49	12994	0.5439
2850	47.50	2549.0	0.202	1.49	12978	0.5439
2880	48.00	2549.0	0.203	1.50	12978	0.5437
2910	48.50	2547.4	0.203	1.50	12969	0.5437
2940	49.00	2544.1	0.203	1.50	12953	0.5437
2970	49.50	2563.7	0.203	1.50	13052	0.5437
3000	50.00	2562.1	0.204	1.51	13044	0.5435
3030	50.50	2596.3	0.205	1.52	13218	0.5433
3060	51.00	2534.3	0.205	1.52	12903	0.5433
3090	51.50	2553.9	0.205	1.52	13003	0.5433
3120	52.00	2570.2	0.205	1.52	13086	0.5433
3150	52.50	2555.5	0.205	1.52	13011	0.5433
3180	53.00	2550.6	0.205	1.52	12986	0.5433
3210	53.50	2547.4	0.205	1.52	12969	0.5433
3240	54.00	2545.7	0.205	1.52	12961	0.5433
3270	54.50	2542.5	0.205	1.52	12945	0.5433
3300	55.00	2547.4	0.205	1.52	12969	0.5433
3330	55.50	2539.2	0.205	1.52	12928	0.5433
3360	56.00	2539.2	0.205	1.52	12928	0.5433
3390	56.50	2534.3	0.205	1.52	12903	0.5433
3420	57.00	2535.9	0.205	1.52	12911	0.5433
3450	57.50	2532.7	0.205	1.52	12895	0.5433
3480	58.00	2529.4	0.205	1.52	12878	0.5433
3510	58.50	2529.4	0.205	1.52	12878	0.5433
3540	59.00	2529.4	0.205	1.52	12878	0.5433
3570	59.50	2526.1	0.205	1.52	12861	0.5433
3600	60.00	2527.8	0.205	1.52	12870	0.5433
3630	60.50	2573.5	0.206	1.53	13102	0.5432
3660	61.00	2573.5	0.206	1.53	13102	0.5432
3690	61.50	2570.2	0.206	1.53	13086	0.5432
3720	62.00	2566.9	0.206	1.53	13069	0.5432
3750	62.50	2568.6	0.206	1.53	13077	0.5432
3780	63.00	2566.9	0.206	1.53	13069	0.5432
3810	63.50	2563.7	0.206	1.53	13052	0.5432

3840	64.00	2563.7	0.206	1.53	13052	0.5432
3870	64.50	2575.1	0.206	1.53	13111	0.5432
3900	65.00	2560.4	0.206	1.53	13036	0.5432
3930	65.50	2560.4	0.206	1.53	13036	0.5432
3960	66.00	2560.4	0.206	1.53	13036	0.5432
3990	66.50	2560.4	0.206	1.53	13036	0.5432
4020	67.00	2560.4	0.206	1.53	13036	0.5432
4050	67.50	2451.1	0.205	1.52	12479	0.5433
4080	68.00	1525.7	0.198	1.44	7768	0.5446
4110	68.50	817.4	0.192	1.38	4162	0.5456
4140	69.00	347.4	0.185	1.30	1769	0.5468
4170	69.50	109.4	0.176	1.20	557	0.5484
4200	70.00	21.4	0.167	1.10	109	0.5500
4230	70.50	1.3	0.156	0.98	7	0.5519
4260	71.00	0.0	0.153	0.94	0	0.5524
4290	71.50	0.0	0.153	0.94	0	0.5524
4320	72.00	3.7	0.158	1.00	19	0.5515
4350	72.50	97.3	0.168	1.11	495	0.5498
4380	73.00	327.1	0.176	1.20	1665	0.5484
4410	73.50	706.4	0.184	1.29	3596	0.5470
4440	74.00	1210.7	0.191	1.37	6164	0.5458
4470	74.50	1781.9	0.199	1.46	9072	0.5444
4500	75.00	2364.6	0.206	1.53	12039	0.5432
4530	75.50	2575.1	0.210	1.58	13111	0.5425
4560	76.00	2553.9	0.211	1.59	13003	0.5423
4590	76.50	2116.5	0.207	1.54	10776	0.5430
4620	77.00	1264.6	0.200	1.47	6438	0.5442
4650	77.50	628.1	0.194	1.40	3198	0.5453
4680	78.00	242.9	0.187	1.32	1237	0.5465
4710	78.50	71.7	0.178	1.22	365	0.5480
4740	79.00	8.3	0.168	1.11	42	0.5498
4770	79.50	0.0	0.157	0.99	0	0.5517
4800	80.00	0.0	0.156	0.98	0	0.5519
4830	80.50	0.0	0.156	0.98	0	0.5519
4860	81.00	1.5	0.162	1.04	8	0.5508
4890	81.50	84.3	0.172	1.16	429	0.5491
4920	82.00	297.3	0.180	1.24	1514	0.5477
4950	82.50	670.5	0.188	1.33	3414	0.5463
4980	83.00	1166.7	0.195	1.41	5940	0.5451
5010	83.50	1742.8	0.203	1.50	8873	0.5437
5040	84.00	2348.3	0.211	1.59	11956	0.5423
5070	84.50	2550.6	0.214	1.62	12986	0.5418
5100	85.00	2529.4	0.214	1.62	12878	0.5418
5130	85.50	2252.0	0.212	1.60	11466	0.5421
5160	86.00	1364.1	0.205	1.52	6945	0.5433
5190	86.50	695.0	0.199	1.46	3538	0.5444
5220	87.00	277.2	0.191	1.37	1411	0.5458
5250	87.50	86.6	0.183	1.28	441	0.5472
5280	88.00	13.1	0.173	1.17	67	0.5489
5310	88.50	0.8	0.162	1.04	4	0.5508
5340	89.00	0.0	0.160	1.02	0	0.5512
5370	89.50	0.0	0.160	1.02	0	0.5512
5400	90.00	1.1	0.164	1.07	6	0.5505
5430	90.50	66.5	0.175	1.19	339	0.5486

5460	91.00	258.3	0.183	1.28	1315	0.5472
5490	91.50	611.8	0.191	1.37	3115	0.5458
5520	92.00	1098.1	0.198	1.44	5591	0.5446
5550	92.50	1682.4	0.206	1.53	8566	0.5432
5580	93.00	2305.8	0.213	1.61	11739	0.5420
5610	93.50	2547.4	0.217	1.66	12969	0.5413
5640	94.00	2526.1	0.217	1.66	12861	0.5413
5670	94.50	2462.5	0.217	1.66	12537	0.5413
5700	95.00	1530.6	0.210	1.58	7793	0.5425
5730	95.50	810.9	0.203	1.50	4129	0.5437
5760	96.00	339.2	0.196	1.42	1727	0.5449
5790	96.50	109.7	0.188	1.33	559	0.5463
5820	97.00	20.1	0.179	1.23	102	0.5479
5850	97.50	1.6	0.168	1.11	8	0.5498
5880	98.00	0.0	0.163	1.06	0	0.5507
5910	98.50	0.0	0.163	1.06	0	0.5507
5940	99.00	1.1	0.169	1.12	6	0.5496
5970	99.50	75.5	0.179	1.23	384	0.5479
6000	100.00	285.3	0.187	1.32	1453	0.5465
6030	100.50	655.8	0.195	1.41	3339	0.5451
6060	101.00	1155.2	0.202	1.49	5881	0.5439
6090	101.50	1755.8	0.210	1.58	8939	0.5425
6120	102.00	2384.2	0.217	1.66	12139	0.5413
6150	102.50	2555.5	0.220	1.69	13011	0.5407
6180	103.00	2537.6	0.220	1.69	12920	0.5407
6210	103.50	2039.8	0.217	1.66	10385	0.5413
6240	104.00	1197.7	0.210	1.58	6098	0.5425
6270	104.50	577.5	0.203	1.50	2940	0.5437
6300	105.00	213.5	0.196	1.42	1087	0.5449
6330	105.50	60.3	0.187	1.32	307	0.5465
6360	106.00	4.0	0.177	1.21	20	0.5482
6390	106.50	0.0	0.166	1.09	0	0.5501
6420	107.00	0.0	0.166	1.09	0	0.5501
6450	107.50	0.0	0.166	1.09	0	0.5501
6480	108.00	10.1	0.176	1.20	51	0.5484
6510	108.50	133.9	0.185	1.30	682	0.5468
6540	109.00	404.5	0.193	1.39	2059	0.5454
6570	109.50	837.0	0.201	1.48	4261	0.5440
6600	110.00	1382.1	0.208	1.56	7037	0.5428
6630	110.50	2012.1	0.216	1.64	10244	0.5414
6660	111.00	2596.3	0.223	1.72	13218	0.5402
6690	111.50	2558.8	0.223	1.72	13028	0.5402
6720	112.00	2542.5	0.223	1.72	12945	0.5402
6750	112.50	1625.3	0.216	1.64	8275	0.5414
6780	113.00	882.7	0.210	1.58	4494	0.5425
6810	113.50	376.7	0.203	1.50	1918	0.5437
6840	114.00	124.9	0.194	1.40	636	0.5453
6870	114.50	27.0	0.185	1.30	137	0.5468
6900	115.00	0.8	0.175	1.19	4	0.5486
6930	115.50	0.0	0.165	1.08	0	0.5503

SAMPLE Gravel

Pycnometer number	L0213				
Temperature at weighings (°C)	20.5 ~~68.9°F~~				
Weight flask + soil + water (W_b)	714.21				
Weight flask + water (W_a)	656.65				
(W_a - W_b)	-57.56				
Evaporating dish number	11				
Weight dish + dry soil	192.85				
Weight dish	104.73				
Weight dry soil (W_o)	88.12				
Temperature factor (K)	0.9999				

$$G_S/\text{control temperature} = \frac{W_o}{W_o + (W_a - W_b)}$$

$$G_S/20°C = \frac{W_o}{W_o + (W_a - W_b)} \cdot K = 2.88$$

Comments: Only -#4 portion tested

Figure

SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project MW-COE / Testing / WA
Project No. 93-A026 Date 11-17-93 Tested By DPO Approved By JPO

Golder Associates

SAMPLE SWL Sand

Pycnometer number	L0213				
Temperature at weighings (°C)	21.3 70.3°F				
Weight flask + soil + water (W_b)	704.53				
Weight flask + water (W_a)	656.56				
(W_a - W_b)	-47.97				
Evaporating dish number	5				
Weight dish + dry soil	180.36				
Weight dish	106.24				
Weight dry soil (W_o)	74.12				
Temperature factor (K)	0.9998				

$$G_S/\text{control temperature} = \frac{W_o}{W_o + (W_a - W_b)}$$

$$G_S/20°C = \frac{W_o}{W_o + (W_a - W_b)} \cdot K = \underline{\underline{2.83}}$$

Comments:

Figure

SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project NW-COE / Testing / WA
Project No. 923-A026 Date 11-17-93 Tested By DDC Approved By DDC

Golder Associates

SAMPLE NDOLF Sand

Pycnometer number	L0213				
Temperature at weighings (°C)	20.8/69.4F				
Weight flask + soil + water (W_b)	708.22				
Weight flask + water (W_a)	656.61				
(W_a - W_b)	-51.61				
Evaporating dish number	4				
Weight dish + dry soil	187.96				
Weight dish	106.74				
Weight dry soil (W_o)	81.22				
Temperature factor (K)	0.9998				

$$G_S/\text{control temperature} = \frac{W_o}{W_o + (W_a - W_b)}$$

$$G_S/20°C = \frac{W_o}{W_o + (W_a - W_b)} \cdot K = \underline{2.74}$$

Comments:

Figure

SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project MW-COE / Testing / WA
Project No. 923-A0216 Date 11-17-93 Tested By DPC Approved By DAO

Golder Associates