The Design Professional has conducted a soil investigation and geotech report for design purposes only. The geotech report does not constitute the contractor's investigation of site conditions and was not included with the contract documents. The geotech report has been requested by bidders and is included with this addenda. The geotech report is deemed as not suitable for contractor's use, contractor is using it at their risk and the report is merely suggestive of the nature of the tested material, not representative of entire site conditions. Acknowledgement of this addenda shows acceptance of all risks associated with any use.

REPORT OF GEOTECHNICAL EXPLORATION
PRAIRIE VIEW ROAD RELOCATION
KANSAS CITY, MISSOURI

Presented to:

WARGER ASSOCIATES
North Kansas City, Missouri

Attn: Mr. Steve Warger

Prepared by:

Seth Youree, P.E.
Tadele M. Akalu

Kruger Technologies, Inc.
Lenexa, Kansas

KTI Project No. 312061G

August 15, 2012

KTI

GEOTECHNICAL ■ ENVIRONMENTAL ■ TESTING ■ INSPECTION
14705 W. 114TH TERRACE ■ LENEXA, KANSAS 66215 ■ VOICE 913-498-1114 ■ FAX 913-498-1116 ■ EMAIL KTIKC@KTIONLINE.COM

August 15, 2012

Mr. Steve Warger
Warger Associates, LLC
1617 Swift Avenue
North Kansas City, Missouri 64116

Re: KTI Project No. 312061G
Prairie View Road Relocation
Kansas City, Missouri

Dear Mr. Warger:

Kruger Technologies, Inc. (KTI) has completed the subsurface exploration and geotechnical report for the above referenced project. The purpose of this report is to describe the surface and subsurface conditions encountered at the site, analyze and evaluate this information, prepare a summary of existing conditions, subsurface material characteristics, and provide geotechnical design recommendations.

We thank you for the opportunity to work with Warger Associates, LLC. If you have any questions, please contact us at 913.498.1114.

Respectfully submitted,
Kruger Technologies, Inc.

Seth Youree, P.E.
Missouri: 2010019609

Tadele M. Akalu
Laboratory Manager

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REPORT OF GEOTECHNICAL EXPLORATION
PRAIRIE VIEW ROAD RELOCATION
KANSAS CITY, MISSOURI

INTRODUCTION

This report presents the findings and subsequent recommendations concerning the geotechnical exploration and engineering analysis for the proposed Prairie View Road Relocation in Kansas City, Missouri. The purpose of this report is to describe the surface and subsurface conditions encountered at the site, analyze and evaluate this information, and prepare a summary of existing conditions, subsurface material characteristics, and provide geotechnical design recommendations.

FIELD EXPLORATION PROCEDURES

Seventeen (17) test borings were completed for the above referenced project on July 9 and 17, 2012. The boring locations were selected and field staked by KTI using a site plan provided by Warger Associates LLC. Ground surface elevations at the boring locations were surveyed and provided to KTI by Warger Associates LLC. The boring locations are shown on an attached Boring Location Diagram.

The test borings were drilled with an ATV mounted CME-55 drill rig. Advancement of the test holes in soil was accomplished using 4-inch O.D. flight augers and in rock by NQ coring. Soil sampling was performed by driving Shelby tube and split-barrel samplers (Standard Penetration Test). Boring B-1 was advanced by hand auger to auger refusal at the bottom of a small creek located on the center line of the proposed 62nd Terrace on the western side of the site. A hand auger was used at B-1 because the area was not ATV accessible.

Site soils were visually and manually classified in general accordance with ASTM D 2488 by the drill crew chief as drilling progressed. All of the soil samples were delivered to the laboratory for verification of the field classifications. Boring logs were created as the test holes

were advanced and supplemented by laboratory test data; the boring logs are attached in Appendix I.

Free water was not observed at the time of the field-work. It should be noted that water level determinations made in relatively impervious (clay) soils might not present a reliable indication of the actual water table. However, water level determinations made in relatively pervious (sand/silt) soils are considered an accurate indication of the water table at the time that those measurements are made. Fluctuations in the water table should be expected with changing seasons and annual differences.

LABORATORY/FIELD TESTS

Laboratory tests were performed on the recovered samples to determine the engineering characteristics and for additional verification of the field classifications in accordance with ASTM D 2487. These tests include, in-situ moisture content, plasticity (Atterberg Limits), moisture-density relationship of soil (Standard Proctor), California Bearing Ratio (CBR) in situ density, unconfined compression and consolidation tests. The laboratory test results are presented in Appendix II.

SITE CONDITIONS

The proposed site is located to the west of I-29, south of 64th Street in Kansas City, Missouri. The site is a grass and tree covered field. A creek approximately 15 feet wide by 3.5 feet deep was present on the south side of the proposed road at the east end of the site.

PROJECT DESCRIPTION

We understand that the project consists of a realignment of Prairie View Road from 64th Street to a newly constructed portion of 62nd Terrace which extends to Chatham Avenue. Retaining walls are proposed along the north side of the new 62nd Terrace for future retail structures. A new detention track is proposed on the south side of the proposed 62nd Terrace.

GEOLOGY/SUBSURFACE CONDITIONS

The subgrade soils are comprised of high plasticity (fat) clays and a low plasticity (lean) clay. The Unified Soil Classification System classifies high plasticity clays as CH and low plasticity as CL. The majority of the subgrade soils are moist and exhibit medium to stiff consistency. Almost every test borings were terminated at auger refusal in limestone bedrock.

According to the road profile plan provided by Warger Associates, it appears that up to four feet of limestone material will need to be excavated to achieve plan elevations roughly between stations 2+00 to 8+50 and 14+50 to 16+50. Upon analysis of the quality of limestone bedrock found on site, it doesn't appear likely that excavation of the limestone with standard earth removal equipment would be practical.

DESIGN CRITERIA AND RECOMMENDATIONS

Laboratory test results of the recovered samples showed the following characteristics that were used as criteria for determining the recommendations for bearing values and design data:

In-Situ Moisture	9.4 to 23.3 %
Liquid Limit	33 to 69
Plasticity Index	9 to 46
In-Situ Density	91.6 to 116.8 pcf
Unconfined Compression	4758to 17542 psf
California Bearing Ratio	4.0 to 4.8 %

Seismic Considerations

Based on the International Building Code (IBC) Section 1615.1.1, the subsurface stratigraphy, and the use of a deep foundation system for retaining walls bearing on limestone and shale bedrock, the general Site Class Definition for the project area is Site Class B. If a shallow foundation system is used for retaining walls then the Site Class Definition for the project area would be Site Class D.

Site Preparation and Engineered Fill

If required, any areas to receive supplemental fill must be stripped of any deleterious materials including vegetation and top soil. Supplemental engineered fill should be placed in uniform horizontal lifts, with loose thicknesses not exceeding eight inches. The thickness may need to be reduced depending on material types, method of compaction and type of equipment used. As a general recommendation of 3.0H: 1.0V for a compacted clay embankment may be used for maximum side slopes and spill fill slopes. The geotechnical engineer should approve any off-site material proposed for use as fill. Engineered fill should be compacted to a minimum of 95 percent of maximum density as determined by ASTM D698 (Standard Proctor). Moisture content of the soil should be kept between 0 and 4 percent above optimum moisture for soils with a Liquid Limit of more than 40 and between -2 and +2 from optimum moisture for soils with a Liquid Limit of 40 or less. Fill should not be placed on soft materials or frozen ground. Any areas of soft soils should be over-excavated and replaced with engineered fill. The compaction of fill should be monitored and tested by a representative of KTI.

The on-site material below the top soil was found suitable for embankment fill. The shale materials are acceptable for the lower parts of the embankment fill provided that the appropriate level of preparation/pulverization is accomplished to render it suitable. To convert the intact shale to an acceptable fill would require soaking and saturation of the shale, after initial exposure, to accelerate the slaking action. The shale should be soaked again prior to disking/pulverization and compaction. Because of their potential to swell, shale materials should not be permitted in the upper 2 feet of embankment and should not have particle size greater than 1” in any dimension. Care should be taken by the contractor when stockpiling material to keep the shale and clay materials separated so as to avoid shale being placed in the top 2 feet of the embankment. Placement of shale materials is suitable in all other embankment areas.

Lateral Earth Pressure

The following K values may be used for the determination of lateral soil resistance for retaining walls and below-grade structures.

Site Cohesive Soils

Estimated ϕ of 20°
K_a = 0.49
K_o = 0.66
K_p = 2.03
Coefficient of sliding friction (design) = 0.30
Wet density of in place soil, average (γ) = 125 pcf

Granular backfill

Estimated ϕ of 35°
K_a = 0.27
K_o = 0.43
K_p = 3.65
Coefficient of sliding friction (design) = 0.40
Wet density of in-place crushed rock, average (γ) = 135 pcf

Fill Settlement

We understand that fills of up to 28 feet will be placed throughout the project. The greatest thickness of fill (28 feet +/-) will be placed in the vicinity of Boring B-5. Placement of this fill will initiate consolidation within the underlying clay soils. Table 1 lists estimated consolidation settlements due to fill placement at selected locations.

Table 1. Estimated Settlements Due To Fill

Boring No.	Elevation	Anticipated Fill Thickness (ft)	Estimated Settlement (in)
B-1	939.72	23	2.6
B-5	923.80	28	3.2

Based on time-rate consolidation tests, it is estimated that at least two to three month of elapsed time will be required to realize 90% of settlement in the vicinity of Borings B-1 and B-5.

Retaining Walls

The subsurface conditions for the proposed retaining wall structures are represented by Borings B-11, B-12, B-15, B-16, B-17, and B-18. To reduce the amount of differential settlement and avoid consolidation issues it is recommended that the retaining wall foundations bear on weathered to slightly weathered shale. The foundation options for support of retaining wall sections include end bearing reinforced concrete, drilled piers bearing on weathered shale bedrock where the shale is deeper, or where the shale is nearer to the surface, extended trench-type footings bearing on weathered or shale bedrock. Based on our borings, shale bedrock ranges from 2 (B-16) to 13 (B-17) feet below grade depending upon boring location.

Drilled Shaft Retaining Wall Foundations Bearing in Weathered Shale Bedrock

The primary recommended retaining wall foundation system is end bearing piers bearing on un-weathered shale bedrock. An allowable contact stress of 10 ksf may be used for piers bearing in weathered shale bedrock and an allowable contact stress of 20 ksf may be used for bearing in un-weathered shale, if encountered. Generally, drilled shafts should be socketed into the shale bedrock at least one foot, or one shaft diameter, whichever is greater. A drilled shaft foundation system supported by un-weathered shale bedrock should result in essentially no settlement of the new structure. Elastic shortening of the shaft would be expected to be less than ¼ inch. No allowances for negative skin friction on drilled shafts were considered in generating capacity recommendations for deep foundations. Though there was no indication of ground water during exploration sloughing and caving of sidewalls may occur and use of temporary casing may be necessary to maintain an open hole and/or control water inflow from unforeseen water bearing zones. Foundation shafts requiring inspection should have a

minimum diameter of 30 inches. All deep foundation installation should be inspected by representatives of KTI.

Lateral resistance of deep foundation element is dependent upon structural design, embedment length, and soil conditions. If authorized, a lateral pile analysis, (LPILE) can be conducted for anticipated lateral load and moment applied to the top of drilled shaft. The pier must remain in contact with the undisturbed materials or engineered fill as long as a lateral load condition exists.

Shallow Retaining Wall Foundations Bearing on Shale Bedrock

Provided all design and inspection recommendations as given in this report are closely followed and good construction practices are exercised, it is recommended that an allowable bearing value of 10 ksf may be used for design purposes to proportion the retaining wall footings bearing on weathered shale bedrock. Long–term structural differential and total settlements for shallow spread footings designed and constructed properly as outlined above should be negligible.

Continuous retaining wall footings should have a minimum width of 12 inches. All exterior footings founded on competent shale should be a minimum of 12 inches below grade.

We recommend that all foundation excavations be evaluated by a representative of the geotechnical engineer immediately prior to placement of foundation concrete.

Excavation Considerations

We believe that most of the project soils are type B as classified in the OSHA Excavation Standard Handbook 29 CFR Parts 1926.650 through 1926.652. This soil type is characterized by cohesive soils above the water table with unconfined compressive strengths greater than 0.5 tons per square foot (tsf) but less than 1.5 tsf, or soils with unconfined compressive strengths greater than 1.5 tsf that are subject to vibration from traffic, railroads, or pile-driving operations.

Temporary excavation slopes for Type B soils can be one horizontal to one vertical with a maximum excavation depth of 20 feet.

Trench excavations in soil exceeding 5 feet in depth will require shoring as outlined in the OSHA Excavation Standard Handbook. Trenches in competent bedrock material can be cut vertically.

Trench Backfill Recommendations

Deleterious materials such as organic matter, topsoil, rock fragments larger than 3 inches in diameter, debris, and any other materials judged to be unsatisfactory by the geotechnical engineer, should not be included in the backfill. Backfill should not be placed on soft materials or frozen ground. Soil backfill overlying the bedding should be placed in uniform horizontal lifts, with loose thicknesses not exceeding eight inches. The thickness must be appropriate for the method of compaction and the type of equipment used. The geotechnical engineer should approve any off-site material proposed for use as fill. Trench backfill under driveways/parking lots should be compacted as outlined in the site preparation and engineered fill section of this report. In common yard areas, the soil backfill should be compacted to a minimum of 90 percent of maximum density (ASTM D 698) using the above moisture parameters. After preparation of the trench bottom, a pipe bed of a minimum of 6" shall be prepared using crushed stone or crushed gravel meeting the following requirements:

Nominal Pipe Size Diameter	AASHTO M43 Size
15" or Less	67, 7, 8 or washed #9
Greater than 15"	57, 6, or 67

Manhole/Inlet Structure Backfill Recommendations

Soil backfill around structures should be placed in uniform horizontal lifts, with loose thicknesses not exceeding eight inches. The thickness must be appropriate for the method of compaction and the type of equipment used. The geotechnical engineer should approve any

off-site material proposed for use as fill. Backfill should be compacted to a minimum of 95 percent of maximum density as defined by Standard Proctor (ASTM D 698) at a moisture content between 0 and 4 percent above optimum moisture (preferred average of plus 2 percent). Another option is to backfill with a Controlled Low Strength Material (CLSM), or flowable fill. The flowable fill should exhibit a minimum unconfined compressive strength of 250 psi after 28 days. Bedding material for manhole/inlet structure should be clean crushed rock conforming to the following gradation:

Sieve Designation	Percent Passing by Weight
1 ½"	100
No. 4	0 – 35
No. 200	0 – 8

PAVEMENT CONSIDERATIONS

Pavement Subgrade Preparation

The subgrade materials on site are comprised of high plasticity and low plasticity clay. Based on the laboratory CBR test, the site soils exhibit 4.0 to 4.8 percent. If a higher bearing capacity is required, we recommend using one of the following over-excavation/replacement approaches listed below.

- Place compacted crushed rock for the upper 12-18" of pavement subgrade. Typical CBR values for this option may range from 15 to 20 percent depending on the type of selected replacement material.
- Place compacted fly ash/lime stabilized site soils for the upper 12-18" of pavement subgrade. Typical CBR values for this option could be up to 10 percent. Generally, 10-15 percent fly ash or 3-5 percent lime must be added to the parent soil to achieve the level of "stabilization" necessary to improve the support characteristics of a high plasticity clay.

Recommended Pavement Sections

The recommended pavement sections are based our experience with pavements subjected to similar traffic conditions in the Kansas City area. Please note that a detailed analysis of the proposed pavement sections was not conducted due to a lack of actual traffic data and other design criteria. Pavement sections include full depth asphaltic concrete, asphaltic concrete over granular base, and Portland cement concrete. Our recommended pavement sections are presented below.

The existing site soils which could be used as pavement subgrade were tested for California Bearing Ratio (CBR). The results of these tests revealed a CBR value of 4.0 and 4.8 percent.

The following minimum pavement sections are in general accordance with APWA standards based on the following assumptions: a subgrade preparation approach is used where a CBR of at least 10.0 is achieved, truck traffic is moderate to high, and the pavement design life is 15 to 20 years.

Option 1:

4 inches Type 3 asphaltic concrete surface course
8 inches Type 1 asphaltic concrete base course
12 inches compacted subgrade (crushed rock or stabilized parent material)

Option 2:

3 inches Type 3 asphaltic concrete surface course
6 inches Type 1 asphaltic concrete base course
9 inches of compacted aggregate base
12 inches compacted subgrade (crushed rock or stabilized parent material)

The asphaltic base course should be compacted to a minimum of 95% of the mixture's Marshall Density, when determined in accordance with ASTM D 6926. The surface course should have a minimum Marshall stability of 1800 pounds and be compacted to a minimum of

97% of the mixture's Marshall density, when determined in accordance with ASTM D 6926. The development of good drainage plan for the pavement subgrade via trench drain or other gravity system and the implementation of a routine pavement maintenance program are important to the performance and longevity of the pavement.

Portland Cement Concrete Pavements

Based on the soil types encountered and previous experience with materials of this type, a design subgrade modulus of 100 pci was used for the design of the PCC pavement sections on unimproved subgrades and 200 pci on fly ash stabilized subgrades.

We recommend that the concrete pavements in areas receiving heavy truck traffic have a minimum thickness of 8 inches. It is also recommended that a 4-inch leveling and drainage course of clean, crushed rock be placed below all PCC pavements and that appropriate sub-drainage or connection to a suitable gravity outfall be provided to remove water from the drainage layer. The aggregate section should be compacted to a minimum of 98 percent of the material's maximum dry density as determined by ASTM D 698 (Standard Proctor). If the PCC pavement section is underlain by a fly ash stabilized subgrade, then the thickness of the PCC section could be reduced to 7 inches. The mixture should be designed to develop a minimum compressive strength of 4000 psi at 28 days with a 4-inch maximum slump and 5 to 7 percent entrained air. Where Portland cement concrete is used, load transfer devices should be installed at all construction joints or post-placement sawed joints.

Construction Considerations

Construction traffic on the pavements has not been considered in the recommended typical sections. If construction scheduling dictates the pavements will be subject to traffic by construction equipment/vehicles, the pavement thickness should be reconsidered to include the effects of the additional traffic loading. Construction traffic should not be allowed on partially

completed pavements as the pavements will not have adequate structural capacity and could be damaged.

Periodic maintenance of all of the pavements should be anticipated. This should include sealing of cracks and joints and by maintaining proper surface drainage to avoid ponding water on or near the pavement areas.

Pavement Drainage

If the asphaltic concrete sections are to include a granular base, the granular thickness should be uniform and the pavement subgrade should be graded to provide positive drainage of the granular base section. The granular section should be graded to adjacent storm sewer inlets or drainage ditches and provisions should be made to provide drainage from the granular section into the storm sewer. Drainage of the granular base is particularly important where two different sections of pavements (such as full-depth asphaltic concrete and Portland cement concrete with aggregate base) abut, so that water does not pond beneath the pavements and saturate the subgrade soils.

The performance of pavements will be dependent upon a number of factors, including subgrade conditions at the time of paving, rainwater runoff, and traffic. Rainwater runoff should not be allowed to seep below pavements from adjacent areas. All pavements should be sloped approximately 1/4 inch per foot to provide rapid surface drainage. Proper drainage below the pavement section helps prevent softening of the subgrade and has a significant impact on pavement performance and pavement life. Therefore, we recommend that a granular blanket drain be constructed at all storm sewer inlets within the pavement areas. The blanket drain should consist of clean, crushed stone aggregate extending a minimum of 6 inches below pavement subgrade level. The blanket drains should extend radially a minimum of 8 feet from each of the storm sewer inlets. The grade within the blanket drain should be sloped toward the storm sewer inlet, and weep holes should be drilled through the inlet to provide drainage of the

granular section into the inlet. Placement of geotextile filter fabric across the weep holes could be considered to prevent loss of aggregate through the weep holes. These recommendations are very important for long-term performance of the pavements. Because pavements typically have relatively low factors of safety, it will be very important that the specifications are followed closely during pavement construction.

Based on our experience with similar projects, irrigation systems are commonly installed in the landscaped areas adjacent to portions of the pavement areas. If such an irrigation system is to be installed, we recommend that consideration be given to installing subsurface drainage lines between irrigated areas and the planned pavements. It has been our experience that the quantity of subsurface seepage originating from irrigated areas can be substantial and can adversely affect the performance of the pavement subgrade. Therefore, consideration should be given to constructing edge drain lines along the pavements located adjacent to irrigated areas, to intercept and divert subsurface water flows from beneath the pavements. These lines should be constructed behind the curblines, on the upgradient side of the pavements, and should be sloped to provide positive gravity flow to a suitable outfall.

REMARKS

It is recommended that the geotechnical engineer be retained to review the plans and specifications for the project so that an evaluation and comments can be provided regarding the proper incorporation of information from this geotechnical report into the final construction documents. We further recommend that the geotechnical engineer be retained during construction phases in order to provide observation and testing to aid in determining that design intent has been accomplished.

The findings, recommendations, and suggestions contained in this report are our opinions based on data acquired to date and are assumed to be representative of conditions at

locations between borings. Due to the fact that the area at the borings is very small relative to the overall site, and for other reasons, we make no statement warranting the conditions below our borings or at other locations throughout the site. In addition, we do not warrant that the general strata logged at the borings are necessarily typical of the remaining areas of the site.

Reports shall not be reproduced except in full, without written approval of KTI. Information in this report applies only to the referenced project in its present configuration and location and shall not be used for any other project or location.

BORING LOCATION DIAGRAM

B-16
B-2
B-1 hand auger
B-15
B-11
B-3
B-4
B-18
B-17
B-7B
B-5
B-6
B-8
B-7A
B-12
B-9
B-10

GRAPHIC SCALE
60 0 30 60 120 180
(IN FEET)
1 inch = 60 ft.

NOT CERTIFIED FOR INFORMATION ONLY

SURVEYOR'S CERTIFICATION
I HEREBY CERTIFY THAT THIS DRAWING WAS PREPARED UNDER MY SUPERVISION TO SHOW BORE HOLE LOCATIONS. THIS DOES NOT REPRESENT A BOUNDARY SURVEY. NO PROPERTY CORNERS WERE VERIFIED OR SET.

ROBERT G. YOUNG, PLS-2007000089 DATE

IF THE SURVEYOR'S SEAL IS NOT SHOWN IN COLOR, THEN THE SURVEY IS A COPY THAT SHOULD BE ASSUMED TO CONTAIN UNAUTHORIZED ALTERATIONS. THUS THIS CERTIFICATION CONTAINED ON THIS DOCUMENT SHALL NOT APPLY.

\\Server\p\cl\A-PLATTE COUNTY\P-12019\dwg\P-12019.dwg 6/22/2012 9:29:15 AM CDT

R.L. Buford & Associates, LLC
LAND SURVEYING – DEVELOPMENT CONSULTANTS
P.O. BOX 14089, PARKVILLE, MO. 64152 (816) 741-6152

FOR	SEC.-TWP.-RGE.	COUNTY	JOB NO.
STEVE WARGER	29-51-33	PLATTE	P-12019
	DATE	FIELD BOOK	PAGE
	06/22/2012	LOOSE LEAF	LOOSE LEAF
EXHIBIT (I-29 AND 64TH STREET)			DRAWN BY R.G.Y.

APPENDIX I

Boring Logs

Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING
BORING B-1

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: Hand Augering
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 939.72
FINISH: 7/9/12

LOGGER: TMA
DATE CHECKED:

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
0 / 939			Topsoil				
1.5 / 937.5		CL-ML	Silty lean clay yellowish brown with gravel				
3 / 936		CL	Lean clay with weathered shale, stiff, grayish brown, moist	1, ST	91.6	9	
4.5 / 934.5			Hand auguring discontinued at sample refusal at 3.5 feet				
6 / 933							
7.5 / 931.5							
9 / 930							
10.5							

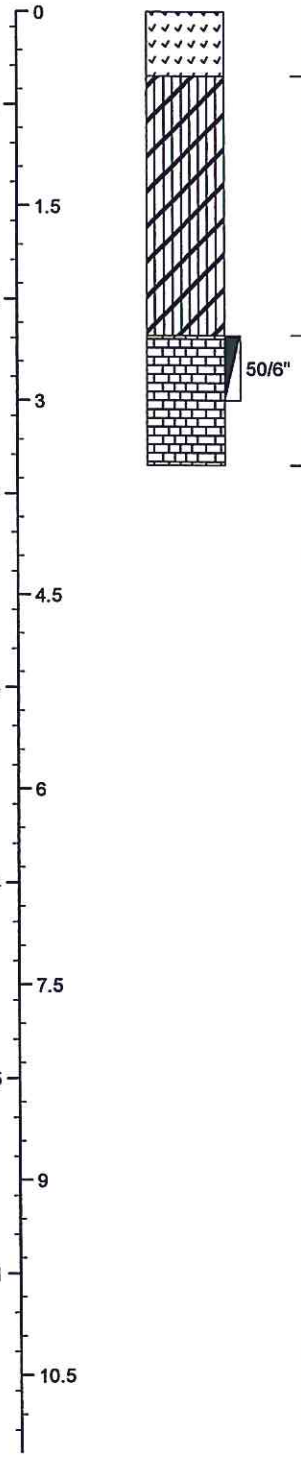
Notes:

Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING
BORING B-2

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 960.72
FINISH: 7/9/12
LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
			Topsoil				
		CL-ML	Silty lean clay with gravel, yellowish brown				
	50/6"	LS	Limestone fragments, hard, gray	1, SS			
			Drilling discontinued at auger refusal at 3.5 feet				

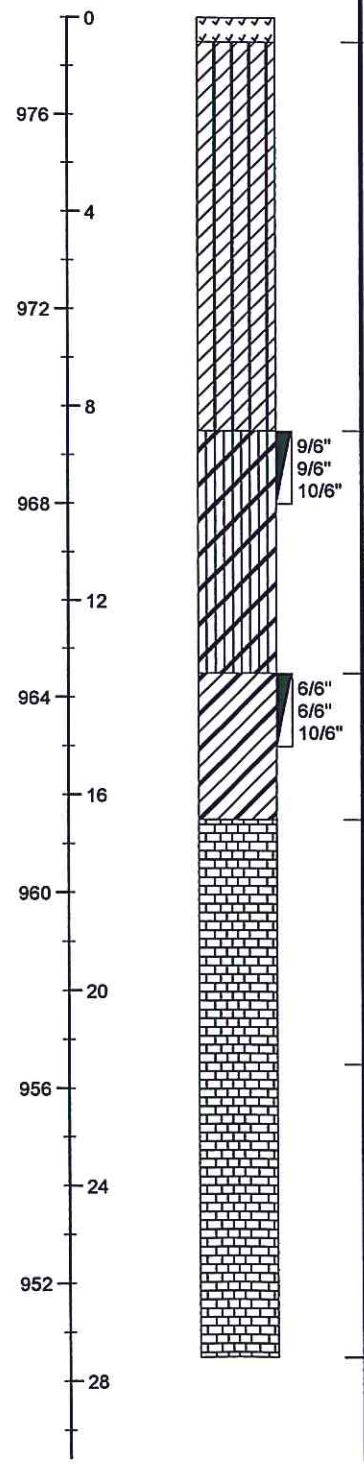
Notes:

Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING
BORING B-3

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers/NQ Core Barrel
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 978.00
FINISH: 7/9/12
LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
		Topsoil				
	CL	Lean clay, light brown, moist				
		become dark brown				
	CL-ML	Silty lean clay, very stiff, light brown, moist	1, SS		15	
	CL-CH	Lean to fat clay, Fe staining, very stiff, brown, moist Auger refusal at 16.5 feet	2, SS			
	LS	Limestone, slightly to moderately weathered, gray Recovery= 100% RQD= 41%				
	LS	Limestone weathered, gray Recovery: 100% RQD= 48%				
		NQ coring discontinued at 27.5 feet				

Notes:

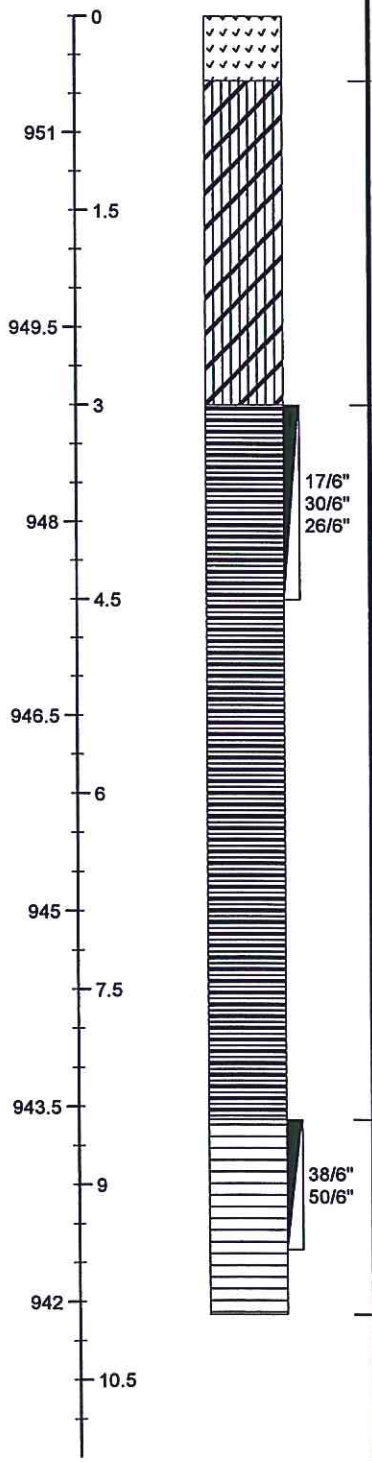
Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING

BORING B-4

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving**

DATE: 8/15/2012
ELEVATION: 951.90
FINISH: 7/9/12
LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
		Topsoil				
	CL-ML	Silty lean clay, light brown				
	W	Weathered shale, hard, gray, dry	1, SS		13	
	Sh	Shale, moderately weathered, hard, dark gray, dry	2, SS			
		Drilling discontinued at auger refusal at 10 feet				

Notes:

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Lenexa, Kansas
913-498-1114

LOG OF TEST BORING
BORING B-5

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 923.80
FINISH: 7/9/12
LOGGER: TMA
DATE CHECKED:

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
0			Topsoil				
922.5 1.5		CL-ML	Silty lean clay, yellowish brown				
921 3			Silty lean clay, very stiff, brown, moist	1, ST	94.6	11	4758
919.5 4.5		CL-ML					
918 6			Limestone fragments, hard, gray	1, SS			
			Drilling discontinued at auger refusal at 6.5 feet				
916.5 7.5							
915 9							
913.5 10.5							

Notes:

Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING
BORING B-6

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 965.05
FINISH: 7/9/12

LOGGER: TMA
DATE CHECKED:

ELEVATION/ DEPTH	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
0 / 964.5		Topsoil				
	GC	Silty lean clay with limestone fragments, yellowish brown, moist				
1.5 / 963	CL	Lean clay with weathered shale, stiff, grayish brown, moist	1, SS			
		Drilling discontinued at auger refusal at 1.5 feet				
3 / 961.5						
4.5 / 960						
6 / 958.5						
7.5 / 957						
9 / 955.5						
10.5 / 954						

Notes:

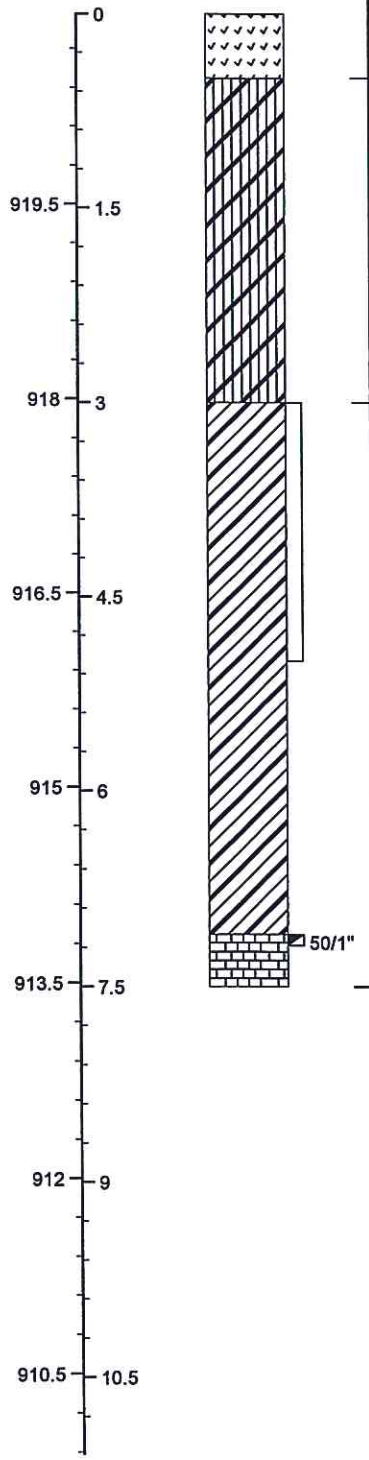
Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING

BORING B-7A

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 920.97
FINISH: 7/9/12
LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
			Topsoil				
		CL-ML	Silty lean clay, yellowish brown				
		CL-CH	Lean clay, Fe staining stiff, reddish brown, moist	1, ST			
	50/1"		Limestone, weathered, gray	1, SS			
			Drilling discontinued at auger refusal at 7.5 feet				

Notes:

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913-498-1114

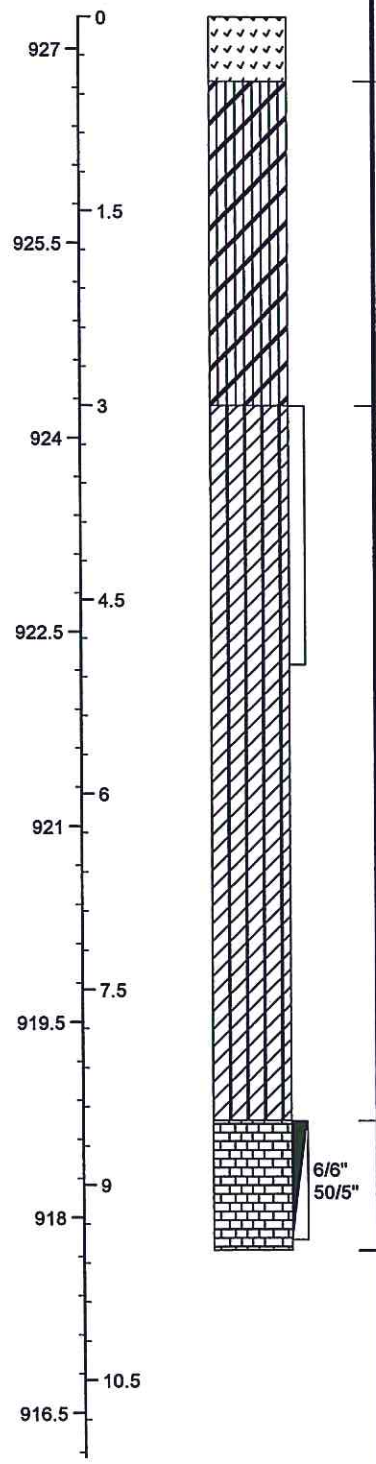
LOG OF TEST BORING

BORING B-7B

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 927.25
FINISH: 7/9/12

LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
		Topsoil				
	CL-ML	Silty lean clay, brown				
	CL	Lean clay, very stiff, brown, moist	1, ST	112.1	16	16455
	LS	Limestone fragments, hard, gray	1, SS			
		Drilling discontinued at auger refusal at 9.5 feet				

Notes:

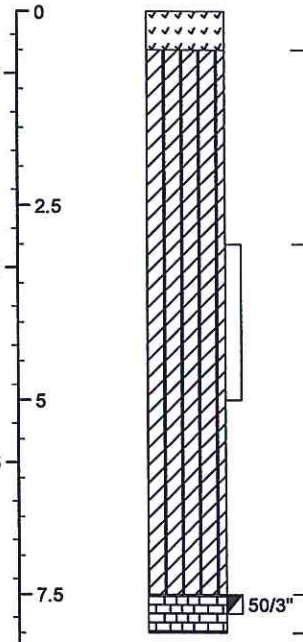
Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING
BORING B-8

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 923.30
FINISH: 7/9/12

LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
			Topsoil				
		CL	Lean clay, brown				
			Lean clay, stiff, brown, moist	1, ST	105.2	20	8708
		CL					
	50/3"	LS	Limestone fragments, hard, gray	1, SS			
			Drilling discontinued at auger refusal at 8 feet				

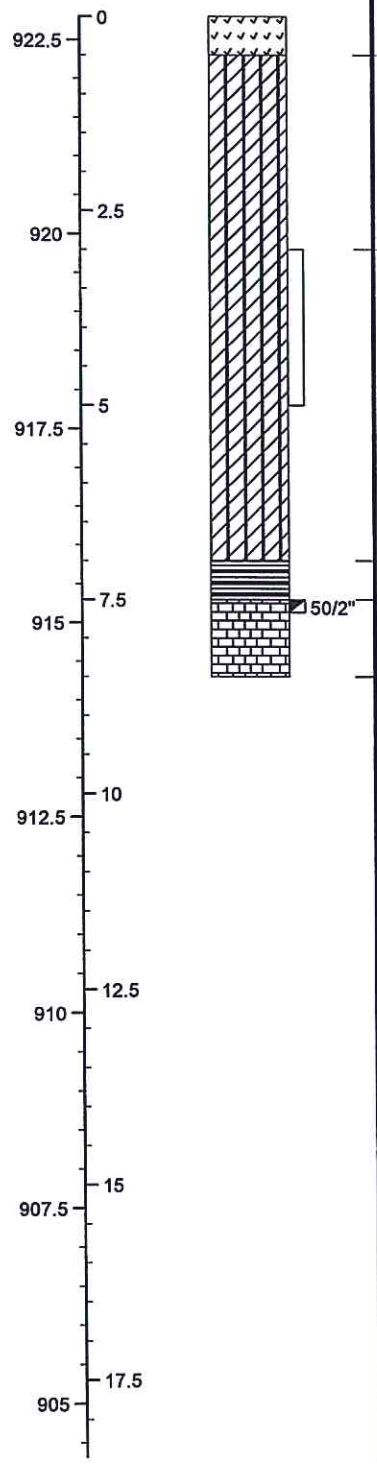
Notes:

Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING
BORING B-9

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 922.80
FINISH: 7/9/12
LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
			Topsoil				
		CL	Lean clay, reddish brown, moist				
		CL	Lean clay, stiff, grayish brown, moist	1, ST	106.4	20	7779
		W	weathered shale, gray				
		LS	Limestone fragments, hard, gray	1, SS			
			Drilling discontinued at auger refusal at 8.5 feet				

Notes:

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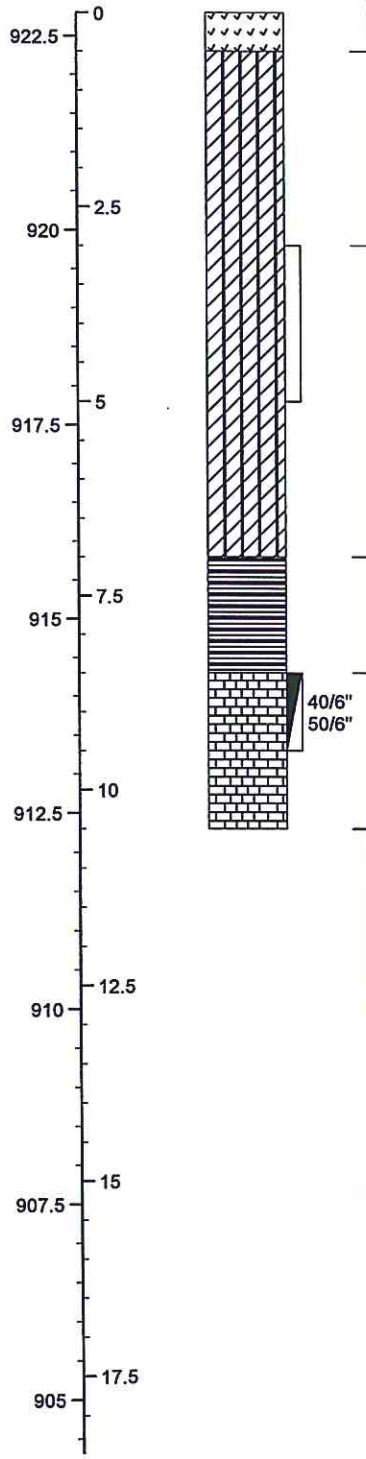
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING
BORING B-10

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 922.80
FINISH: 7/9/12

LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
			Topsoil				
		CL	Lean clay, brown, moist				
		CL	Lean clay, Fe staining, stiff, reddish brown, moist	1, ST	108.8	19	10194
		W	weathered shale, gray				
		LS	Limestone fragments & weathered shale, hard, light gray	1, SS			
			Drilling discontinued at auger refusal at10.5 feet				

Notes:

Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

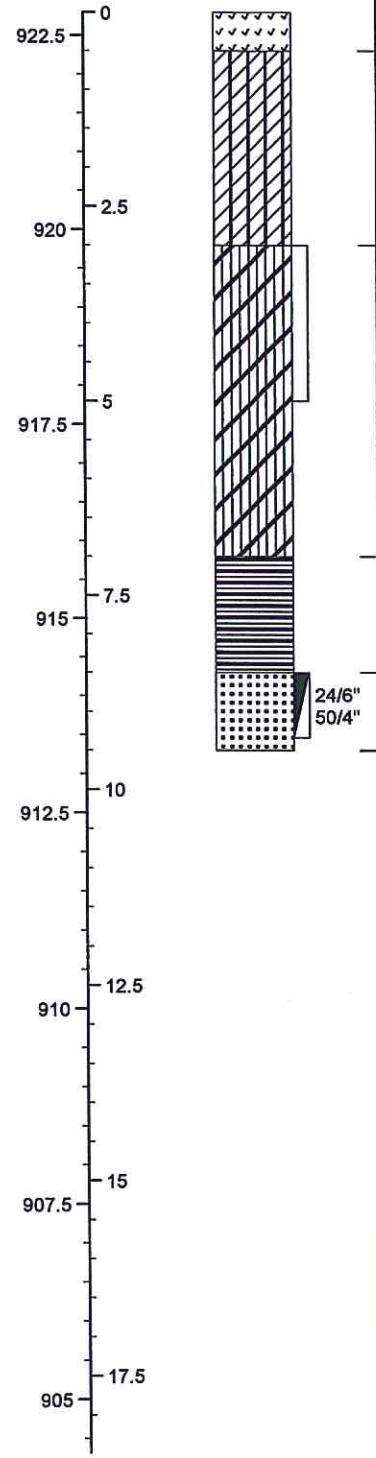
LOG OF TEST BORING

BORING B-11

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 922.80
FINISH: 7/9/12

LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
			Topsoil				
		CL	Lean clay, brown, moist				
		CL-ML	Silty lean, stiff, brown, moist	1, ST	111.3	18	16806
		W	weathered shale, gray				
		SN	Sandstone, hard, brown	1, SS			
			Drilling discontinued at auger refusal at 9.5 feet				

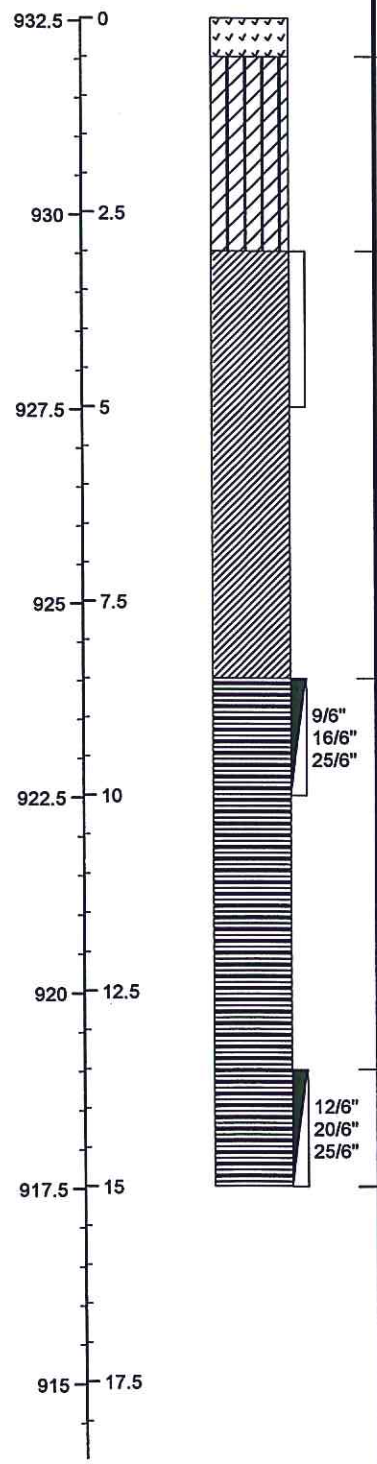
Notes:

Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING
BORING B-12

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 932.54
FINISH: 7/9/12
LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
932.5 / 0		Topsoil				
	CL	Lean clay, grayish brown, moist				
930 / 2.5						
	CH	Fat clay, stiff, reddish brown, moist	1, ST	101.6	23	7345
927.5 / 5						
925 / 7.5						
	W	Weathered shale, hard, grayish brown, dry	1, SS			
922.5 / 10						
920 / 12.5						
	W	Weathered shale, hard, light gray, moist	2, SS			
917.5 / 15		Drilling discontinued at auger refusal at 15.0 feet				
915 / 17.5						

Notes:

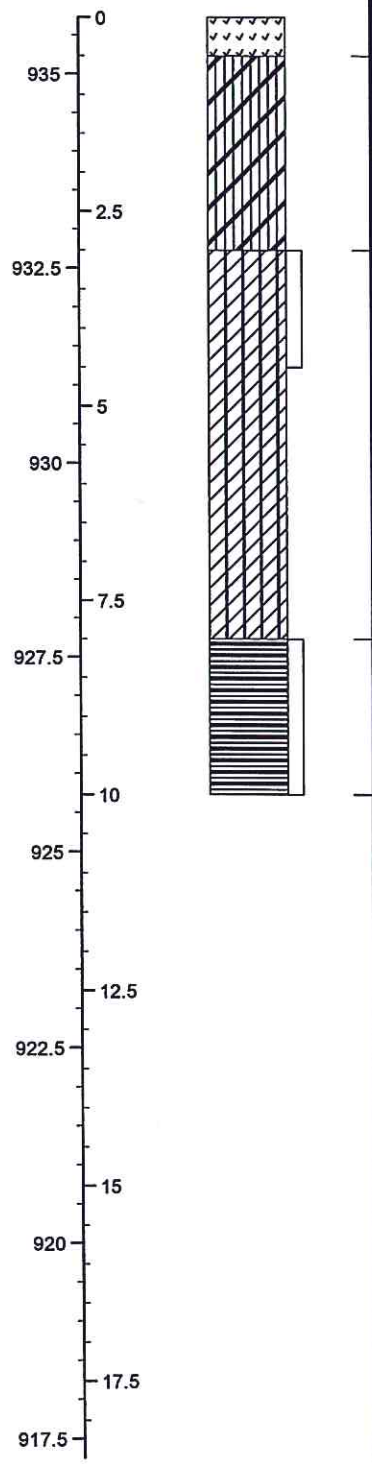
KTI
Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING
BORING B-15

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 935.73
FINISH: 7/9/12

LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
			Topsoil				
		CL-ML	Silty clay with gravel, brown, moist				
		CL	Lean clay, very stiff, dark brown, moist	1, ST	101.8	16	
		W	Shale, weathered, very stiff, dark brown, dry	2, ST	108.5	19	4670
			Drilling discontinued at 10.0 feet				

Notes:

Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING

BORING B-16

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 963.38
FINISH: 7/9/12

LOGGER: TMA
DATE CHECKED:

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
0 / 962.5			Topsoil				
		CL-ML	Silty lean clay with gravel, light brown				
2.5 / 960	50/6"	LS	Limestone fragments, hard, gray	1, SS			
			Drilling discontinued at auger refusal at 3.0 feet				
5 / 957.5							
7.5 / 955							
10 / 952.5							
12.5 / 950							
15 / 947.5							
17.5 / 945							

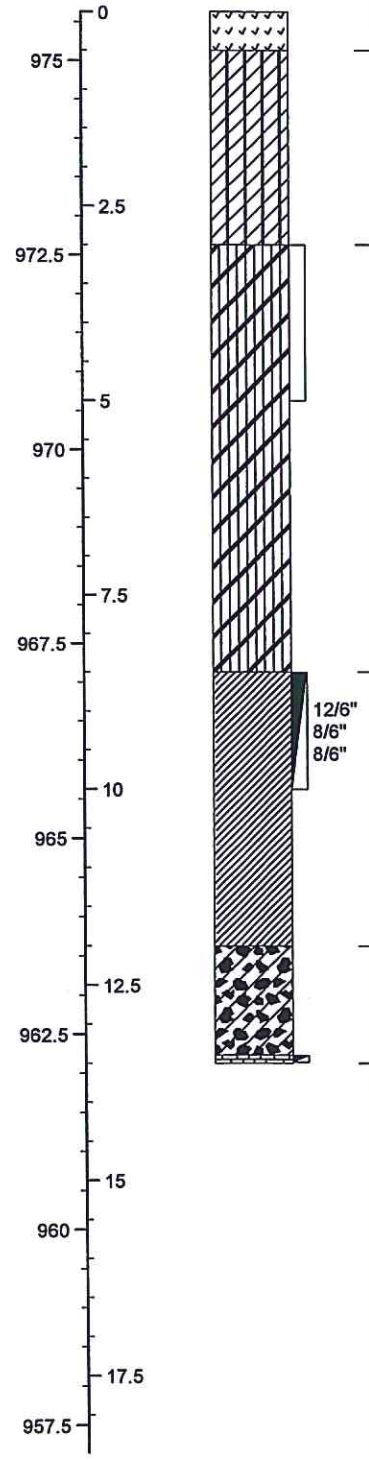
Notes:

Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING
BORING B-17

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 975.63
FINISH: 7/9/12
LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
			Topsoil				
		CL	Clay, grayish brown, moist				
		CL-ML	Silty lean clay, very stiff, light brown, moist	1, ST	116.8	13	17542
		CH	Fat clay, very stiff, Fe staining, reddish brown, moist	1, SS			
		GC	With gravel				
			Limestone, weathered, gray	1, SS			
			Drilling discontinued at 13.5 feet				

Notes:

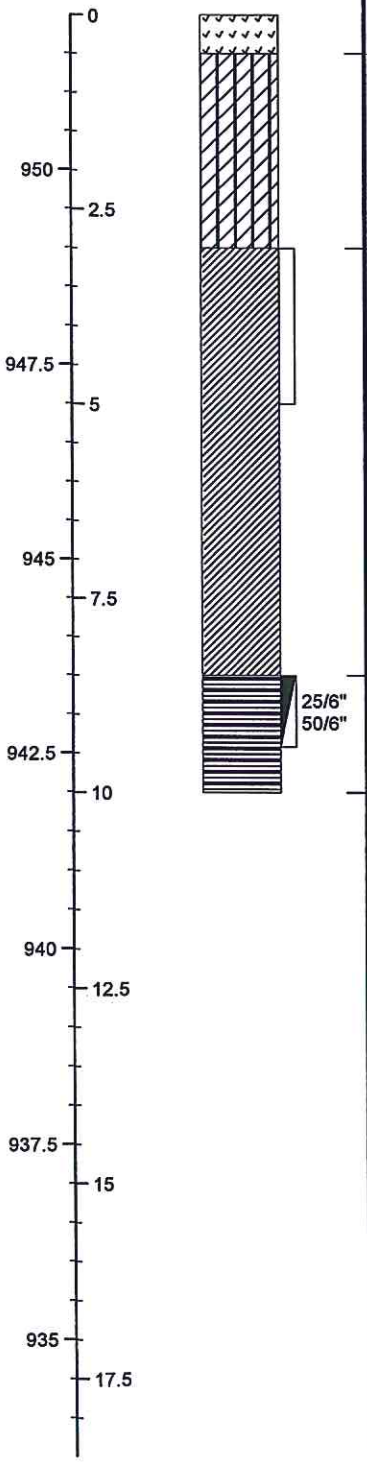
Kruger Technologies, Inc.
Lenexa, Kansas
913-498-1114

LOG OF TEST BORING
BORING B-18

PROJECT: Prairie View Road Location
CLIENT: Warger Associates
PROJECT NO.: 312061G **START:** 7/9/12
BORING LOCATION: See Boring Location Plan
METHOD OF DRILLING: 4" Continuous Flight Augers
DEPTH TO - water None **caving** None

DATE: 8/15/2012
ELEVATION: 951.99
FINISH: 7/9/12

LOGGER: TMA
DATE CHECKED:



ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Sample # & Type	Density pcf	Moist-ure, %	Qu, psf
			Topsoil				
		CL	Lean clay, reddish brown, moist				
		CH	Fat clay, very stiff, grayish brown, moist	1, ST	107.0	19	17346
			become yellowish brown				
		W	Weathered shale, grayish brown, hard, gray	1, SS			
			Drilling discontinued at sample refusal at 10.0 feet				

Notes:

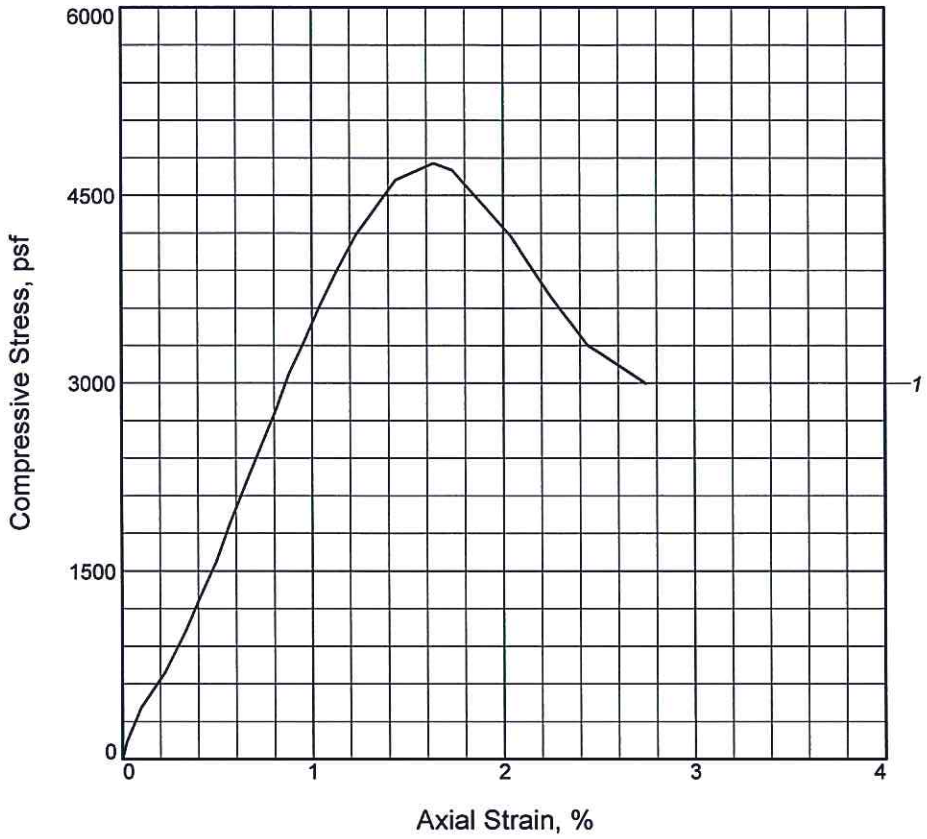
APPENDIX II

Laboratory Results

SUMMARY OF LABORATORY RESULTS

Boring	Depth (Ft)	Sample No./Type	Natural Moisture %	Natural Dry Density (pcf)	Unconfined Compressive Strength (psf)	C.B.R %	Swell %	Atterberg Limits		Soil Type
								Liquid Limit %	Plasticity Index %	
1	1.0-3.0	1, ST	9.4	91.6						
3	8.5-10.0	1, SS	15.1							
4	3.0-5.0	1, SS	13.2							
5	3.0-5.0	1, ST	10.7	94.6	4758			33	9	CL
7B	3.0-5.0	1, ST	16.3	112.1	16455			44	24	CL
8	3.0-5.0	1,ST	19.5	105.2	8708			47	27	CL
9	3.0-5.0	1, ST	20.4	106.4	7779			48	28	CL
10	3.0-5.0	2, ST	18.7	108.8	10194			47	21	CL
11	3.0-5.0	3, ST	18.4	111.3	16806			52	31	CH
12	3.0-5.0	1, ST	23.3	101.6	7345					
15	3.0-5.0	4, ST	16.4	101.8						
17	3.0-5.0	2, ST	13.3	116.8	17542					
18	3.0-50	1, ST	19.3	107.0	17346			69	46	CH
BS-1	1.0-2.0	BULK				4.0	0.27	35	23	CL
BS-2	1.0-2.0	BULK				4.8	0.39	41	25	CL

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	4758			
Undrained shear strength, psf	2379			
Failure strain, %	1.6			
Strain rate, in./min.	0.05			
Water content, %	10.7			
Wet density, pcf	104.7			
Dry density, pcf	94.6			
Saturation, %	36.7			
Void ratio	0.7951			
Specimen diameter, in.	2.86			
Specimen height, in.	5.64			
Height/diameter ratio	1.97			

Description: Lean to fat clay, very stiff, brown, moist

LL = 33	**PL** = 24	**PI** = 9	**GS**= 2.72	**Type:** ST

Project No.: 312061G
Date Sampled: 7/9/12
Remarks:

Figure _____

Client: Warger Associates

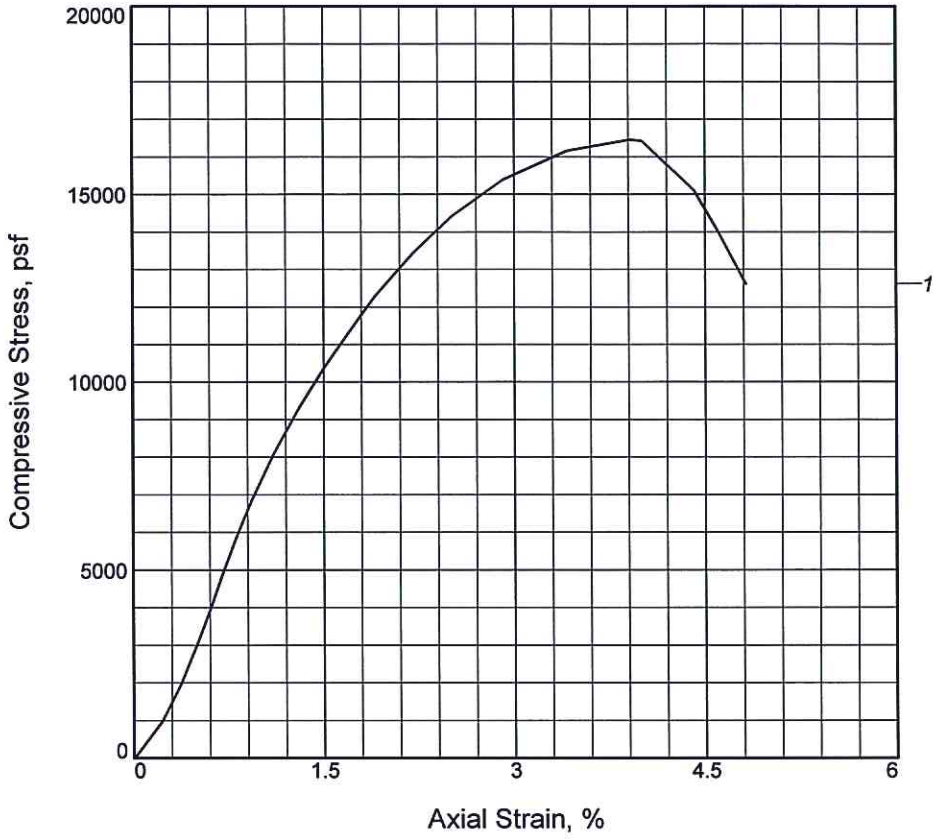
Project: Prairie View Road Location

Source of Sample: B-5 **Depth:** 3
Sample Number: 1

UNCONFINED COMPRESSION TEST
KRUGER TECHNOLOGIES, INC.
LENEXA, KS

Tested By: TMA **Checked By:** SY

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	16455			
Undrained shear strength, psf	8228			
Failure strain, %	3.9			
Strain rate, in./min.	0.05			
Water content, %	16.3			
Wet density, pcf	130.4			
Dry density, pcf	112.1			
Saturation, %	86.3			
Void ratio	0.5147			
Specimen diameter, in.	2.89			
Specimen height, in.	5.57			
Height/diameter ratio	1.93			

Description: Lean clay, very stiff, brown, moist

LL = 44	**PL** = 20	**PI** = 24	**GS**= 2.72	**Type:** ST

Project No.: 312061G
Date Sampled: 7/9/12
Remarks:

Figure _____

Client: Warger Associates

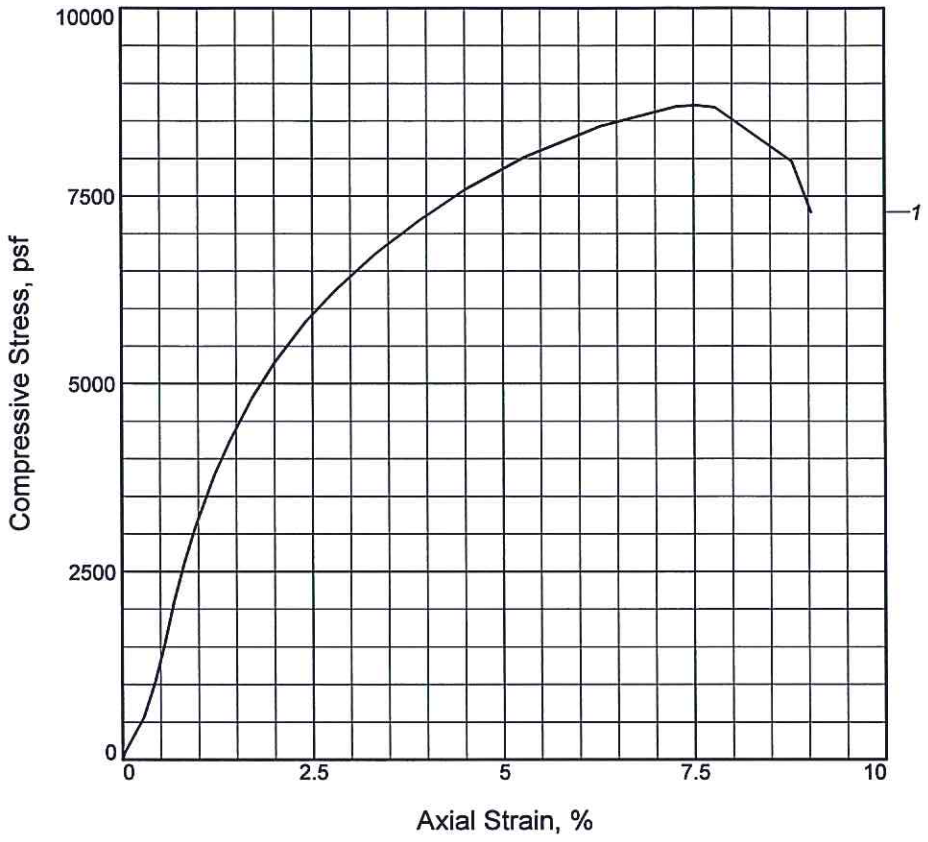
Project: Prairie View Road Location

Source of Sample: B-7B **Depth:** 3
Sample Number: 1

UNCONFINED COMPRESSION TEST
KRUGER TECHNOLOGIES, INC.
LENEXA, KS

Tested By: TMA **Checked By:** SY

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	8708			
Undrained shear strength, psf	4354			
Failure strain, %	7.5			
Strain rate, in./min.	0.05			
Water content, %	19.5			
Wet density, pcf	125.8			
Dry density, pcf	105.2			
Saturation, %	86.5			
Void ratio	0.6135			
Specimen diameter, in.	2.86			
Specimen height, in.	5.60			
Height/diameter ratio	1.96			

Description: Fat clay, stiff, brown, moist

LL = 47	**PL** = 20	**PI** = 27	**GS**= 2.72	**Type:** ST

Project No.: 312061G
Date Sampled: 7/9/12
Remarks:

Figure _____

Client: Warger Associates

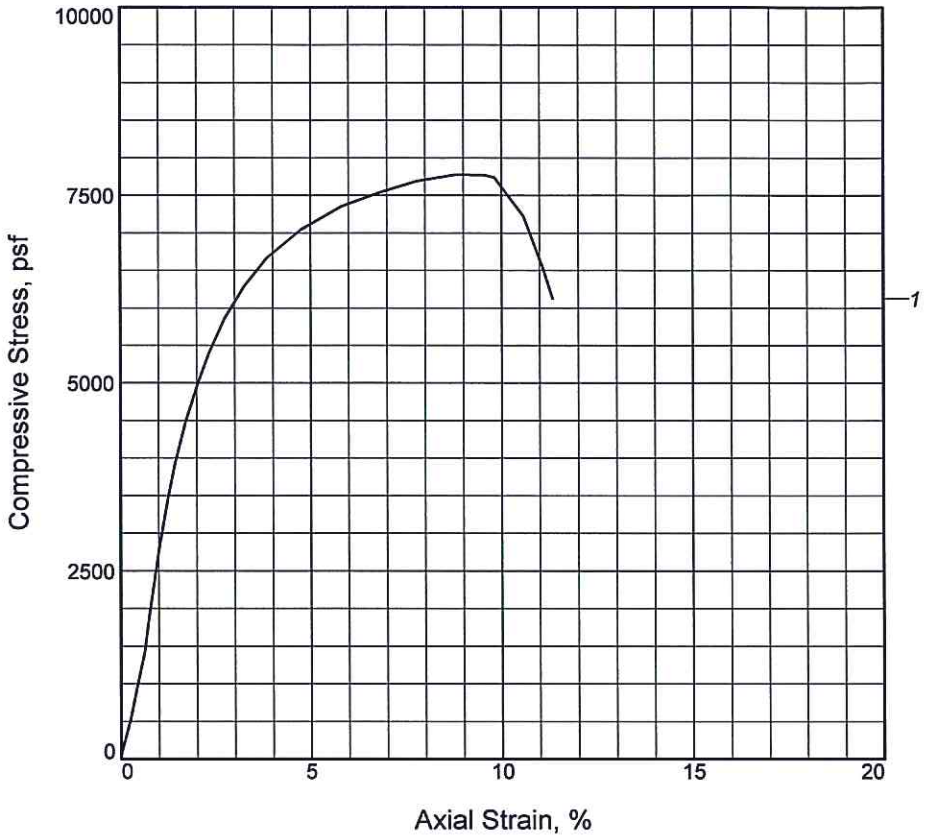
Project: Prairie View Road Location

Source of Sample: B-8 **Depth:** 3
Sample Number: 1

UNCONFINED COMPRESSION TEST
KRUGER TECHNOLOGIES, INC.
LENEXA, KS

Tested By: TMA **Checked By:** SY

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	7779			
Undrained shear strength, psf	3890			
Failure strain, %	8.8			
Strain rate, in./min.	0.05			
Water content, %	20.4			
Wet density, pcf	128.2			
Dry density, pcf	106.4			
Saturation, %	93.3			
Void ratio	0.5952			
Specimen diameter, in.	2.87			
Specimen height, in.	5.64			
Height/diameter ratio	1.97			

Description: Fat clay, stiff, grayish brown, moist

LL = 48	**PL** = 20	**PI** = 28	**GS**= 2.72	**Type:** ST

Project No.: 312061G
Date Sampled: 7/9/12
Remarks:

Figure _____

Client: Warger Associates

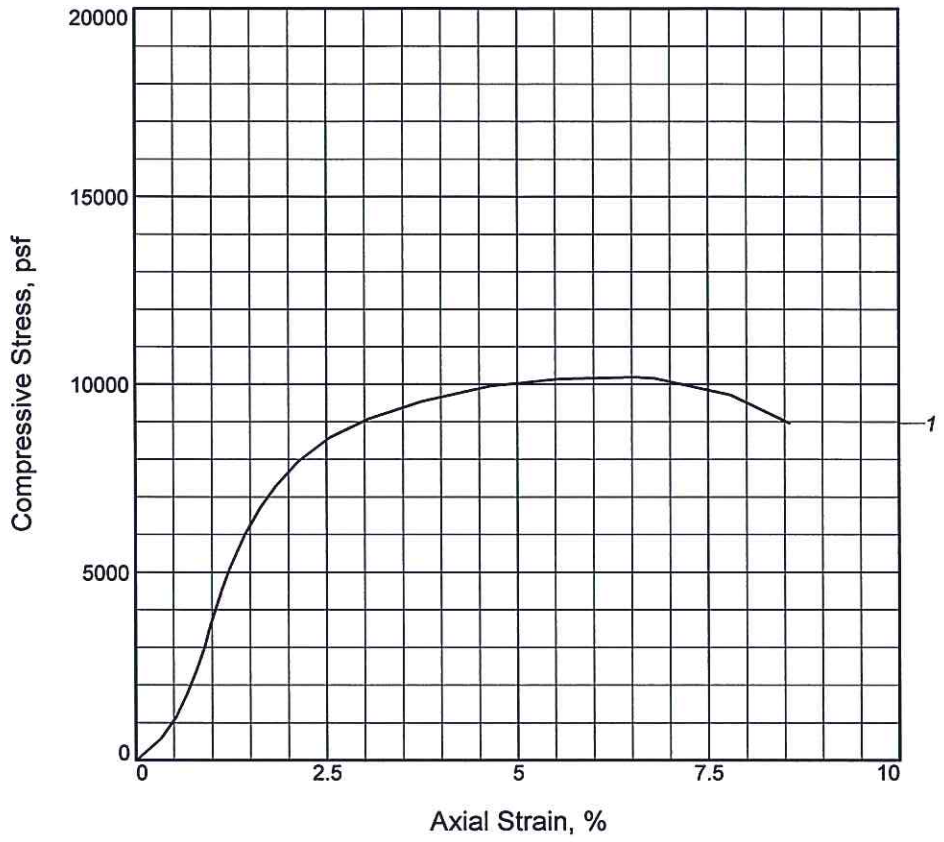
Project: Prairie View Road Location

Source of Sample: B-9 **Depth:** 3
Sample Number: 1

UNCONFINED COMPRESSION TEST
KRUGER TECHNOLOGIES, INC.
LENEXA, KS

Tested By: TMA **Checked By:** SY

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	10194			
Undrained shear strength, psf	5097			
Failure strain, %	6.6			
Strain rate, in./min.	0.05			
Water content, %	18.7			
Wet density, pcf	129.2			
Dry density, pcf	108.8			
Saturation, %	90.8			
Void ratio	0.5601			
Specimen diameter, in.	2.73			
Specimen height, in.	5.66			
Height/diameter ratio	2.07			

Description: Lean to fat clay, Fe stainng, stiff, reddish brown, moist

LL = 47	**PL** = 21	**PI** = 26	**GS**= 2.72	**Type:** ST

Project No.: 312061G
Date Sampled: 7/9/12
Remarks:

Figure _____

Client: Warger Associates

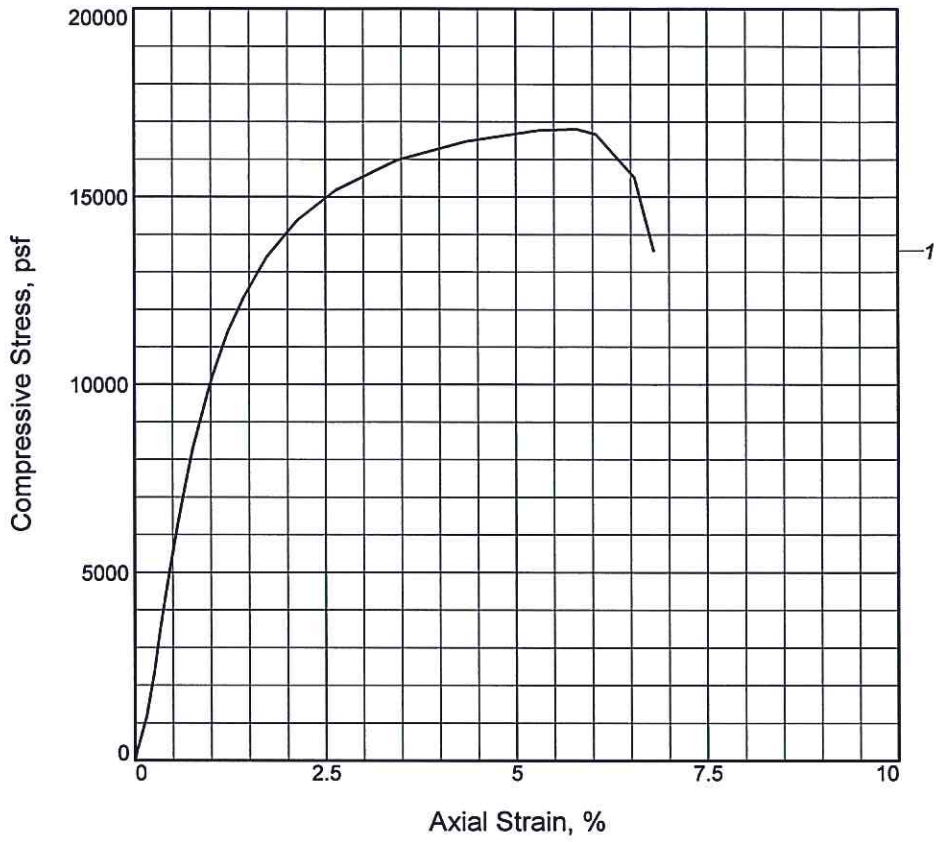
Project: Prairie View Road Location

Source of Sample: B-10 **Depth:** 3
Sample Number: 1

UNCONFINED COMPRESSION TEST
KRUGER TECHNOLOGIES, INC.
LENEXA, KS

Tested By: TMA **Checked By:** SY

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	16806			
Undrained shear strength, psf	8403			
Failure strain, %	5.8			
Strain rate, in./min.	0.05			
Water content, %	18.4			
Wet density, pcf	131.7			
Dry density, pcf	111.3			
Saturation, %	95.0			
Void ratio	0.5260			
Specimen diameter, in.	2.84			
Specimen height, in.	5.66			
Height/diameter ratio	1.99			

Description: Silty lean, stiff, brown, moist

LL =	PL =	PI =	GS= 2.72	Type: ST

Project No.: 312061G
Date Sampled: 7/9/12
Remarks:

Figure _____

Client: Warger Associates

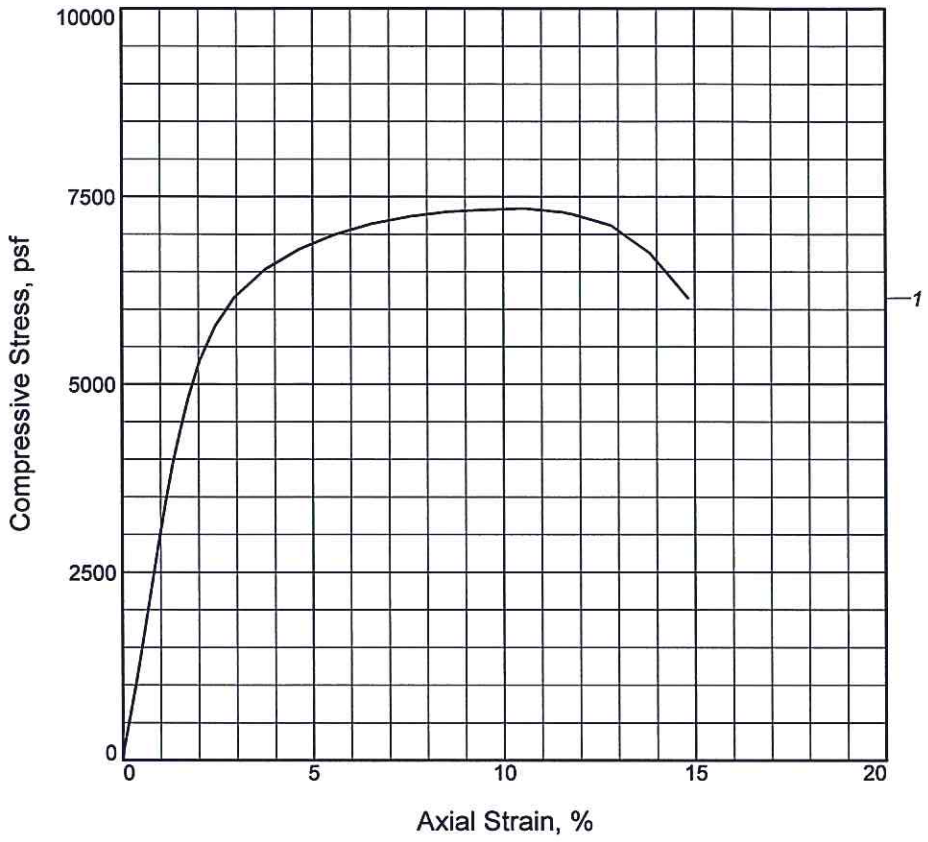
Project: Prairie View Road Location

Source of Sample: B-11 **Depth:** 3
Sample Number: 1

UNCONFINED COMPRESSION TEST
KRUGER TECHNOLOGIES, INC.
LENEXA, KS

Tested By: TMA **Checked By:** SY

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	7345			
Undrained shear strength, psf	3673			
Failure strain, %	10.6			
Strain rate, in./min.	0.05			
Water content, %	23.3			
Wet density, pcf	125.3			
Dry density, pcf	101.6			
Saturation, %	94.4			
Void ratio	0.6707			
Specimen diameter, in.	2.83			
Specimen height, in.	5.67			
Height/diameter ratio	2.00			

Description: Fat clay, stiff, reddish brown, moist

LL = 52	**PL =** 21	**PI =** 31	**GS=** 2.72	**Type:** ST

Project No.: 312061G
Date Sampled: 7/9/12
Remarks:

Figure _____

Client: Warger Associates

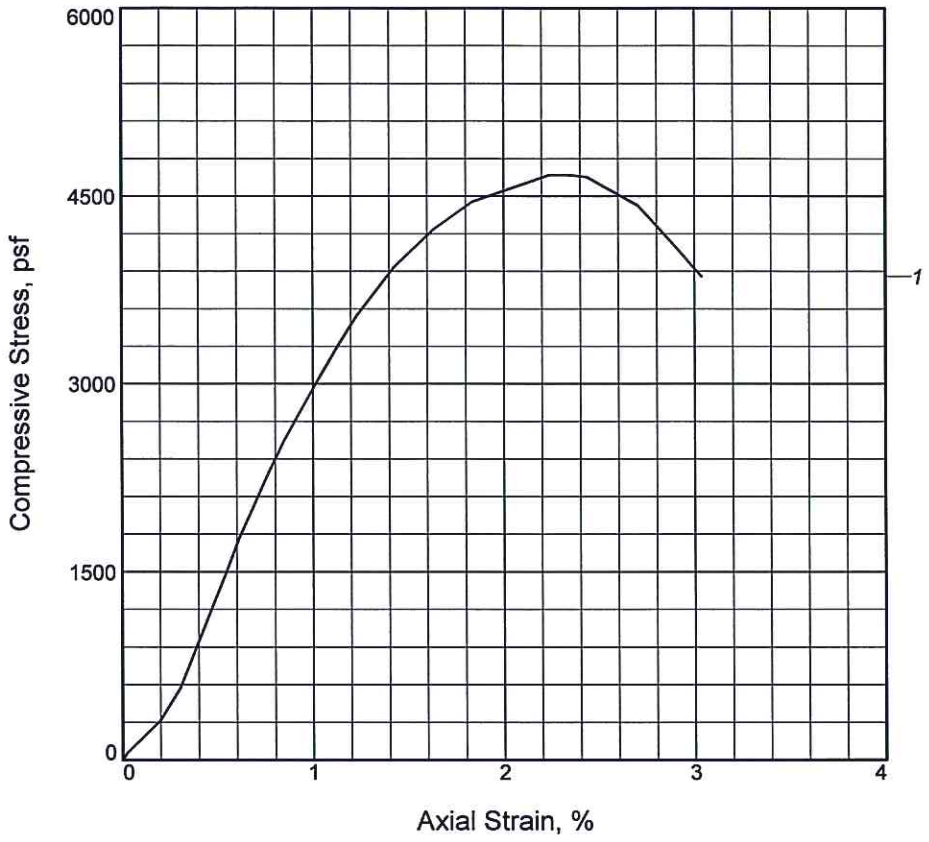
Project: Prairie View Road Location

Source of Sample: B-12 **Depth:** 3
Sample Number: 1

UNCONFINED COMPRESSION TEST
KRUGER TECHNOLOGIES, INC.
LENEXA, KS

Tested By: TMA **Checked By:** SY

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	4670			
Undrained shear strength, psf	2335			
Failure strain, %	2.3			
Strain rate, in./min.	0.05			
Water content, %	19.2			
Wet density, pcf	129.4			
Dry density, pcf	108.5			
Saturation, %	92.6			
Void ratio	0.5648			
Specimen diameter, in.	2.84			
Specimen height, in.	5.62			
Height/diameter ratio	1.98			

Description: Shale, weathered, very stiff, dark brown, dry

LL =	PL =	PI =	GS= 2.72	Type: ST

Project No.: 312061G
Date Sampled: 7/9/12
Remarks:

Figure _____

Client: Warger Associates

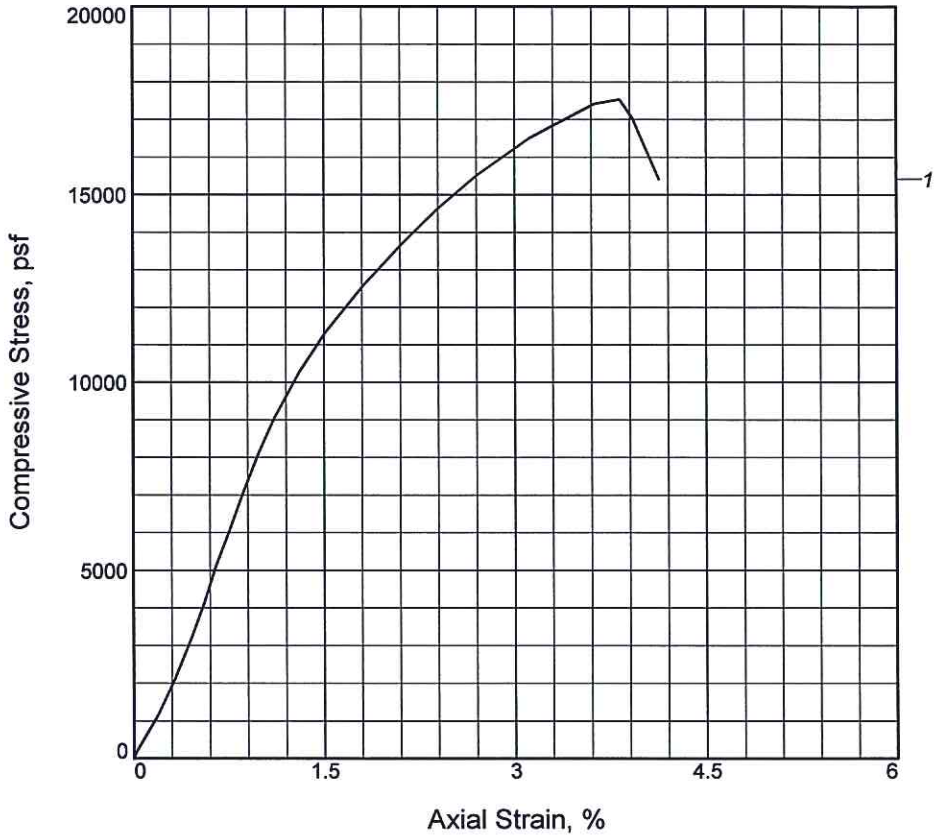
Project: Prairie View Road Location

Source of Sample: B-15 **Depth:** 8.
Sample Number: 2

UNCONFINED COMPRESSION TEST
KRUGER TECHNOLOGIES, INC.
LENEXA, KS

Tested By: TMA **Checked By:** SY

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	17542			
Undrained shear strength, psf	8771			
Failure strain, %	3.8			
Strain rate, in./min.	0.05			
Water content, %	13.3			
Wet density, pcf	132.3			
Dry density, pcf	116.8			
Saturation, %	79.5			
Void ratio	0.4538			
Specimen diameter, in.	2.81			
Specimen height, in.	5.07			
Height/diameter ratio	1.80			

Description: Silty lean clay, very stiff, light brown, moist

LL =	**PL =**	**PI =**	**GS=** 2.72	**Type:** ST

Project No.: 312061G
Date Sampled: 7/9/12
Remarks:

Figure _____

Client: Warger Associates

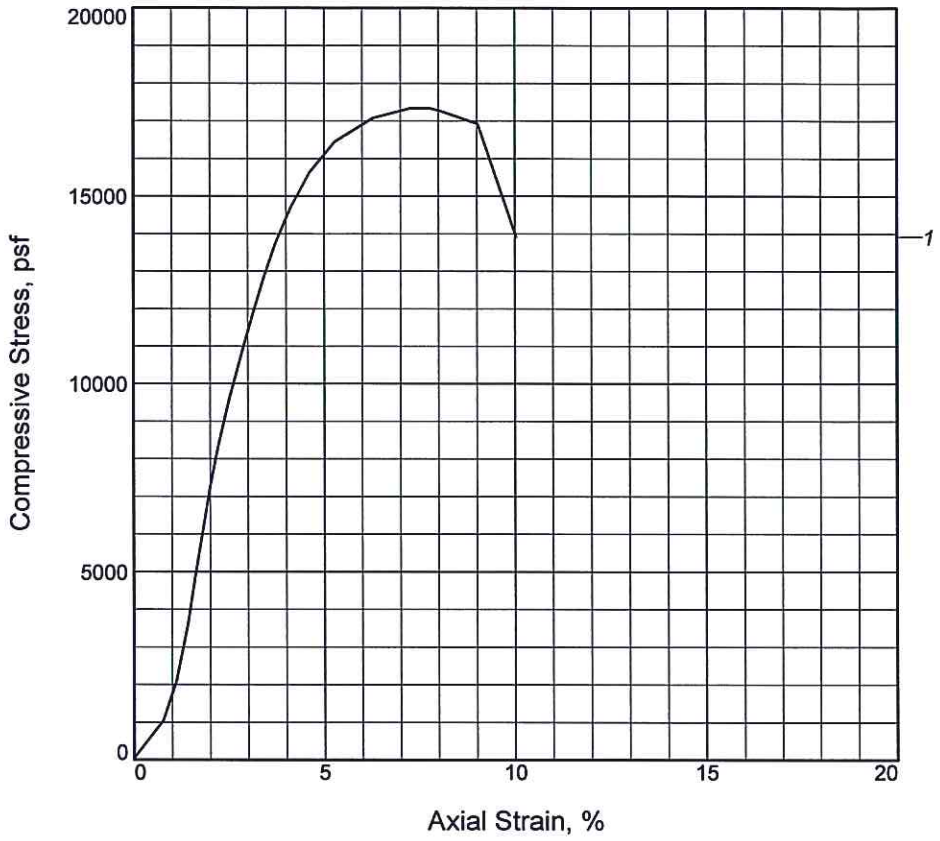
Project: Prairie View Road Location

Source of Sample: B-17 **Depth:** 3
Sample Number: 1

UNCONFINED COMPRESSION TEST
KRUGER TECHNOLOGIES, INC.
LENEXA, KS

Tested By: TMA **Checked By:** SY

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	17346			
Undrained shear strength, psf	8673			
Failure strain, %	7.3			
Strain rate, in./min.	0.05			
Water content, %	19.3			
Wet density, pcf	127.6			
Dry density, pcf	107.0			
Saturation, %	89.4			
Void ratio	0.5869			
Specimen diameter, in.	2.88			
Specimen height, in.	5.68			
Height/diameter ratio	1.97			

Description: Lean to fat clay, very stiff, grayish brown, moist

LL = 69	**PL** = 23	**PI** = 46	**GS**= 2.72	**Type:** ST

Project No.: 312061G
Date Sampled: 7/9/12
Remarks:

Figure _____

Client: Warger Associates

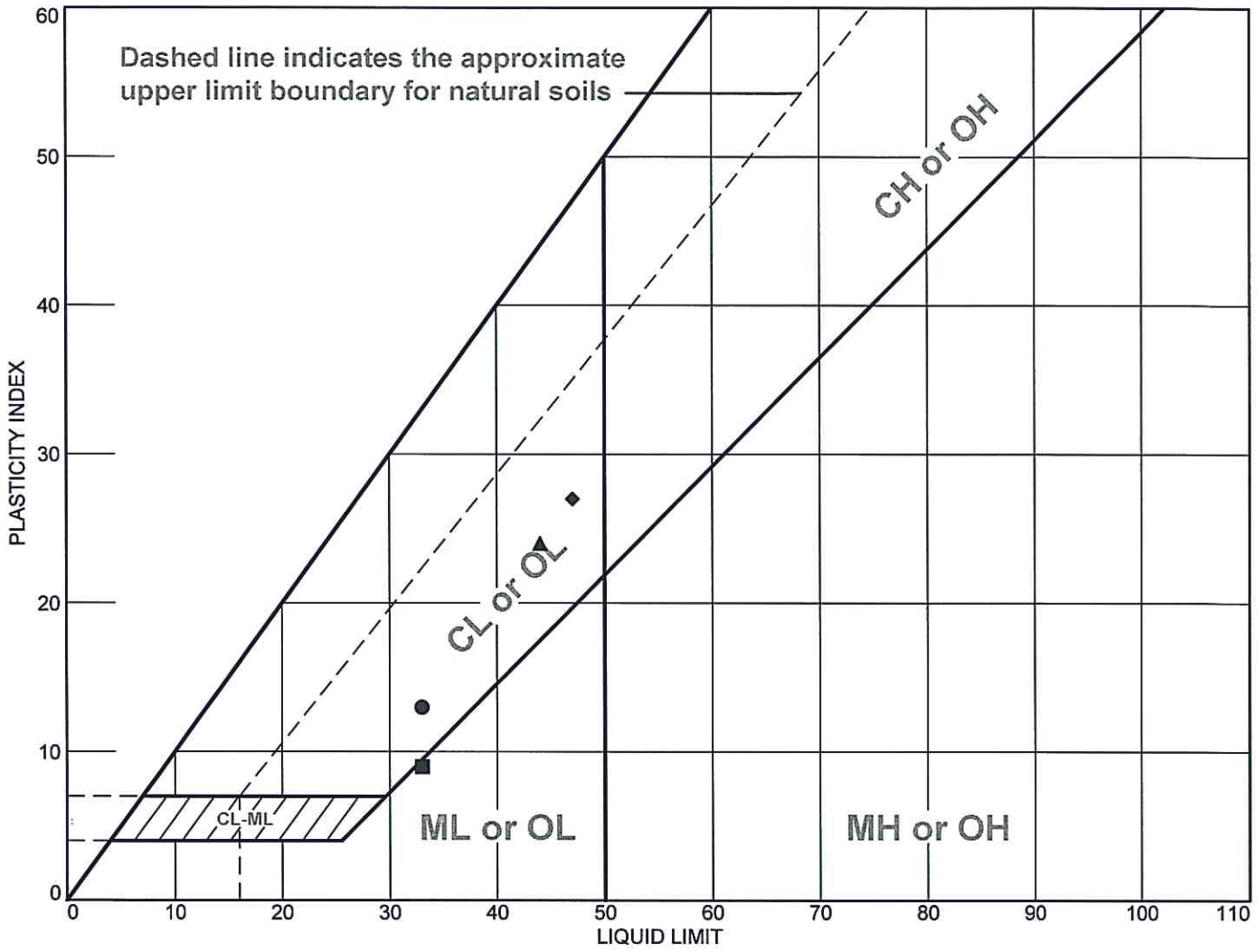
Project: Prairie View Road Location

Source of Sample: B-18 **Depth:** 3
Sample Number: 1

UNCONFINED COMPRESSION TEST
KRUGER TECHNOLOGIES, INC.
LENEXA, KS

Tested By: TMA **Checked By:** SY

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D 4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	lean clay with weathered shale, stiff, grayish brown, moist	33	20	13			CL
■	Lean to fat clay, very stiff, brown, moist	33	24	9			CL-ML
▲	Lean clay, very stiff, brown, moist	44	20	24			CL
◆	Fat clay, stiff, brown, moist	47	20	27			CL

Project No. 312061G **Client:** Warger Associates

Project: Prairie View Road Location

● **Source of Sample:** B-1 **Depth:** 2 **Sample Number:** 1

■ **Source of Sample:** B-5 **Depth:** 3 **Sample Number:** 1

▲ **Source of Sample:** B-7B **Depth:** 3 **Sample Number:** 1

◆ **Source of Sample:** B-8 **Depth:** 3 **Sample Number:** 1

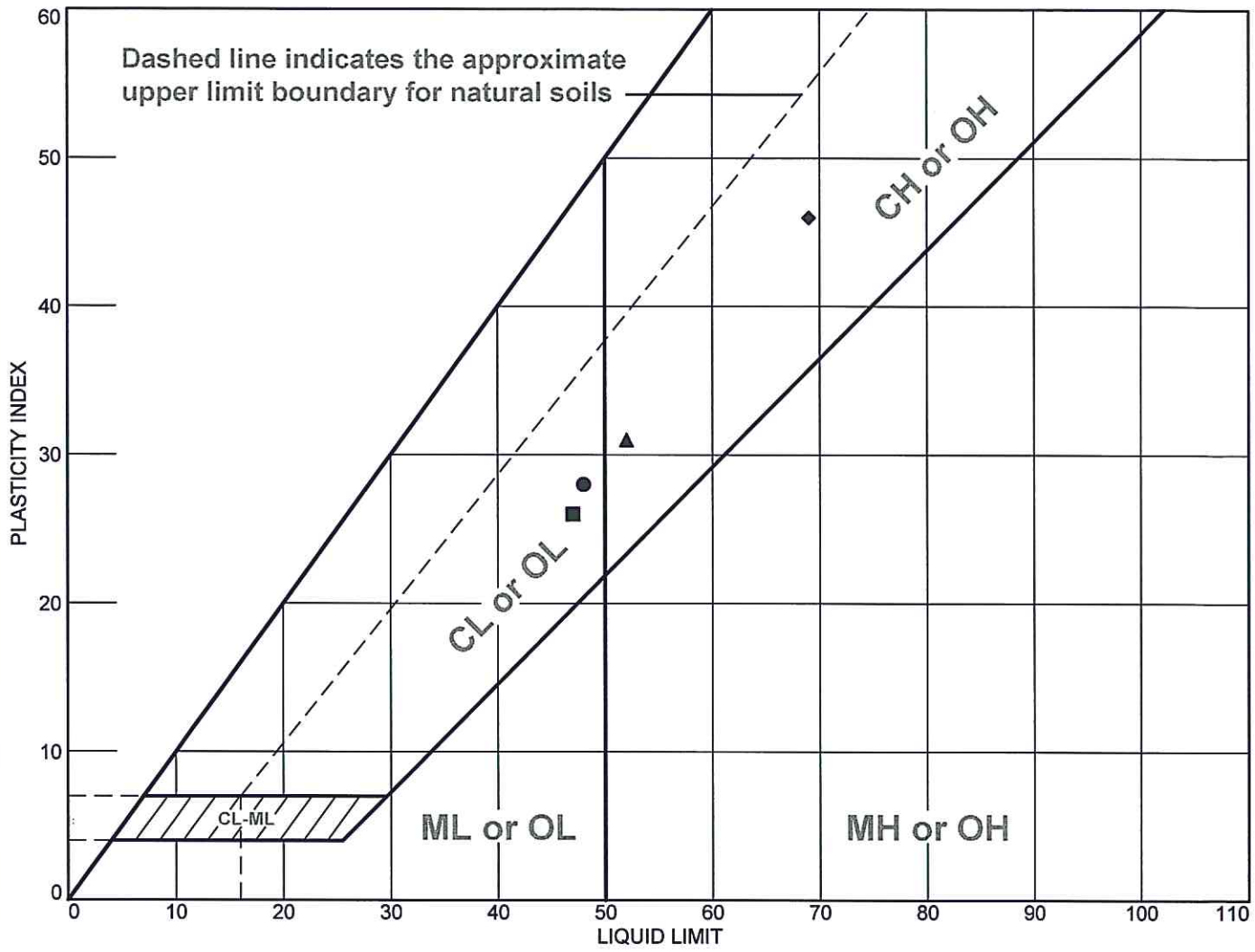
KRUGER TECHNOLOGIES, INC.

LENEXA, KS

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D 4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Fat clay, stiff, grayish brown, moist	48	20	28			CL
■	Lean to fat clay, Fe staining, stiff, reddish brown, moist	47	21	26			CL
▲	Fat clay, stiff, reddish brown, moist	52	21	31			CH
◆	Lean to fat clay, very stiff, grayish brown, moist	69	23	46			CH

Project No. 312061G **Client:** Warger Associates

Project: Prairie View Road Location

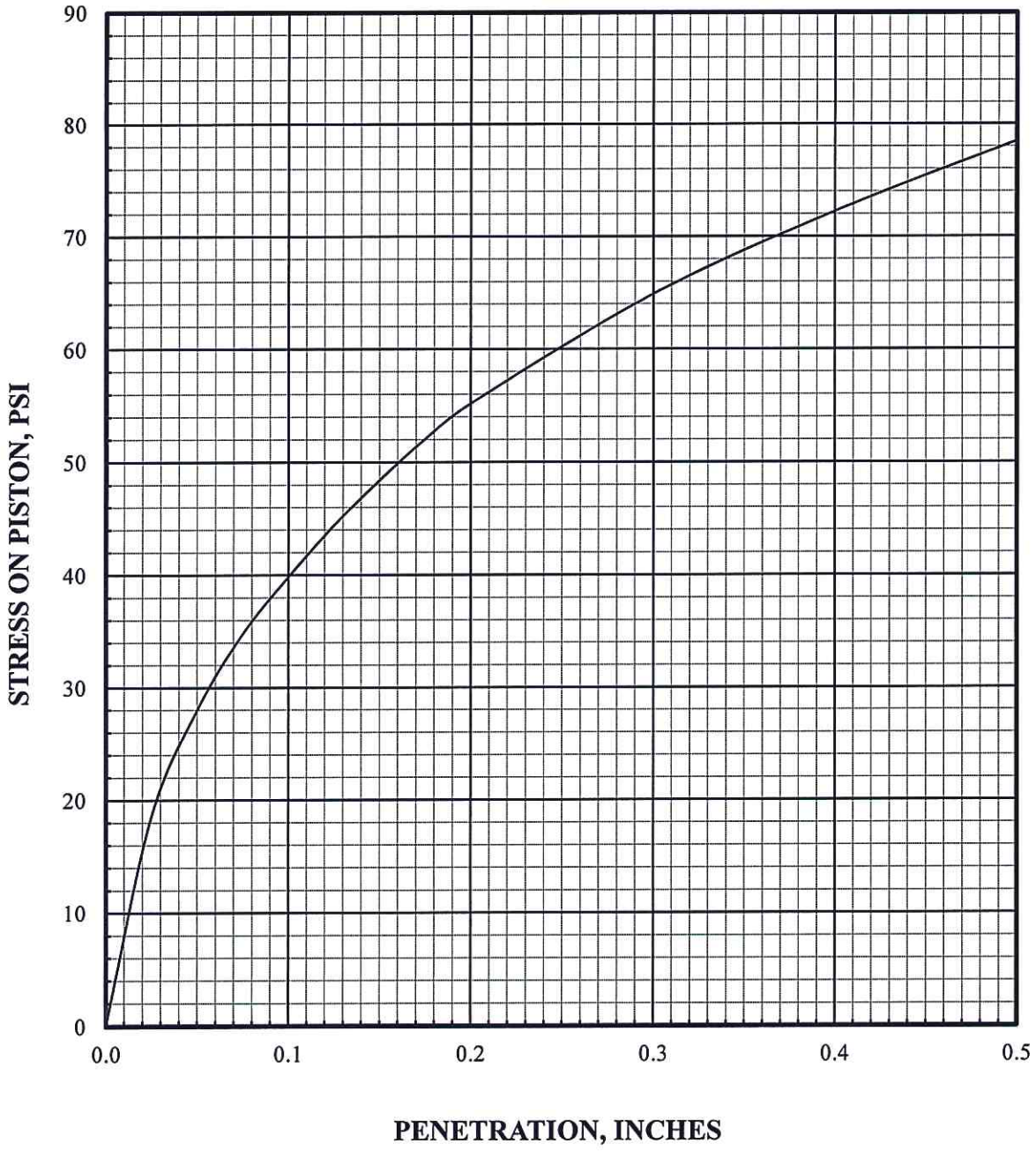
● **Source of Sample:** B-9 **Depth:** 3 **Sample Number:** 1
■ **Source of Sample:** B-10 **Depth:** 3 **Sample Number:** 1
▲ **Source of Sample:** B-12 **Depth:** 3 **Sample Number:** 1
◆ **Source of Sample:** B-18 **Depth:** 3 **Sample Number:** 1

KRUGER TECHNOLOGIES, INC.

LENEXA, KS

Remarks:

Figure



PROJECT NAME

Prairie View Road Relocation

SAMPLE INFORMATION

Max. Dry Density 106.1 pcf
Optimum Moisture Content 18.0 %
by Standard Proctor (ASTM D 698 Method B)
Atterberg Limits (ASTM D-4318)

LL	PL	PI
35	12	23

SAMPLE PREPARATION

Moisture Content

Before Compaction 20.1 %
After Compaction 20.1 %
After Soaking, Top 1-inch 26.0 %
After Soaking, Average 23.9 %

Dry Density

Dry Density = 100.3 pcf = 95 % of Max. Dry Density

Swell after soaking 0.27 %
Surcharge Weight 15 lbs

CALCULATED CBR

4.0 % at 0.1 inches
3.6 % at 0.2 inches

DESCRIPTION

Lean Clay, light brown

SAMPLE LOCATION

Boring - B-2

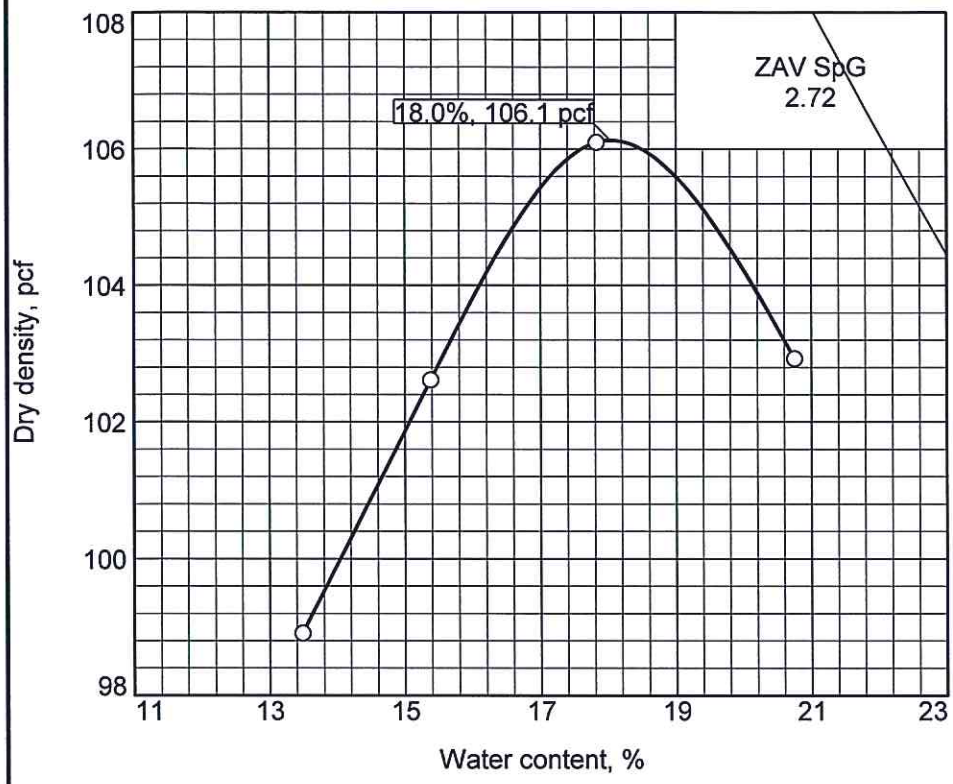
KTI

CALIFORNIA BEARING RATIO
ASTM D1883

Job No.	312061G	Test Date	8/5/12
Sampled By	KTI	Tested By	TAD
Sample Date	7/9/2012	Calc. By	TAD
Proctor No.	1	Ch'd By	SY

MOISTURE DENSITY RELATIONSHIP REPORT

Curve No.



Test Specification:
ASTM D 698-07 Method B Standard

Preparation Method	Wet
Hammer Wt.	5.5 lb.
Hammer Drop	12 in.
Number of Layers	three
Blows per Layer	25
Mold Size	0.03333 cu. ft.

Test Performed on Material Passing 3/8 in. **Sieve**

NM _____ **LL** 35 **PI** 23
Sp.G. (ASTM D 854) _____
%>3/8 in. _____ **%<No.200** _____
USCS CL **AASHTO** _____
Date Sampled 7/9/12
Date Tested 7/12/12
Tested By BS

TESTING DATA

	1	2	3	4	5	6
WM + WS	3775.0	3875.0	3864.0	3682.0		
WM	1985.0	1985.0	1985.0	1985.0		
WW + T #1	275.4	353.8	310.2	339.7		
WD + T #1	240.5	302.4	259.4	301.3		
TARE #1	13.6	14.1	14.6	16.5		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	15.4	17.8	20.8	13.5		
DRY DENSITY	102.6	106.1	102.9	98.9		

TEST RESULTS

Maximum dry density = 106.1 pcf

Optimum moisture = 18.0 %

Material Description

Lean clay, light brown

Remarks:

Project No. 312061G **Client:** Warger Associates
Project: Prairie View Road Location

○ **Source of Sample:** Bulk 1

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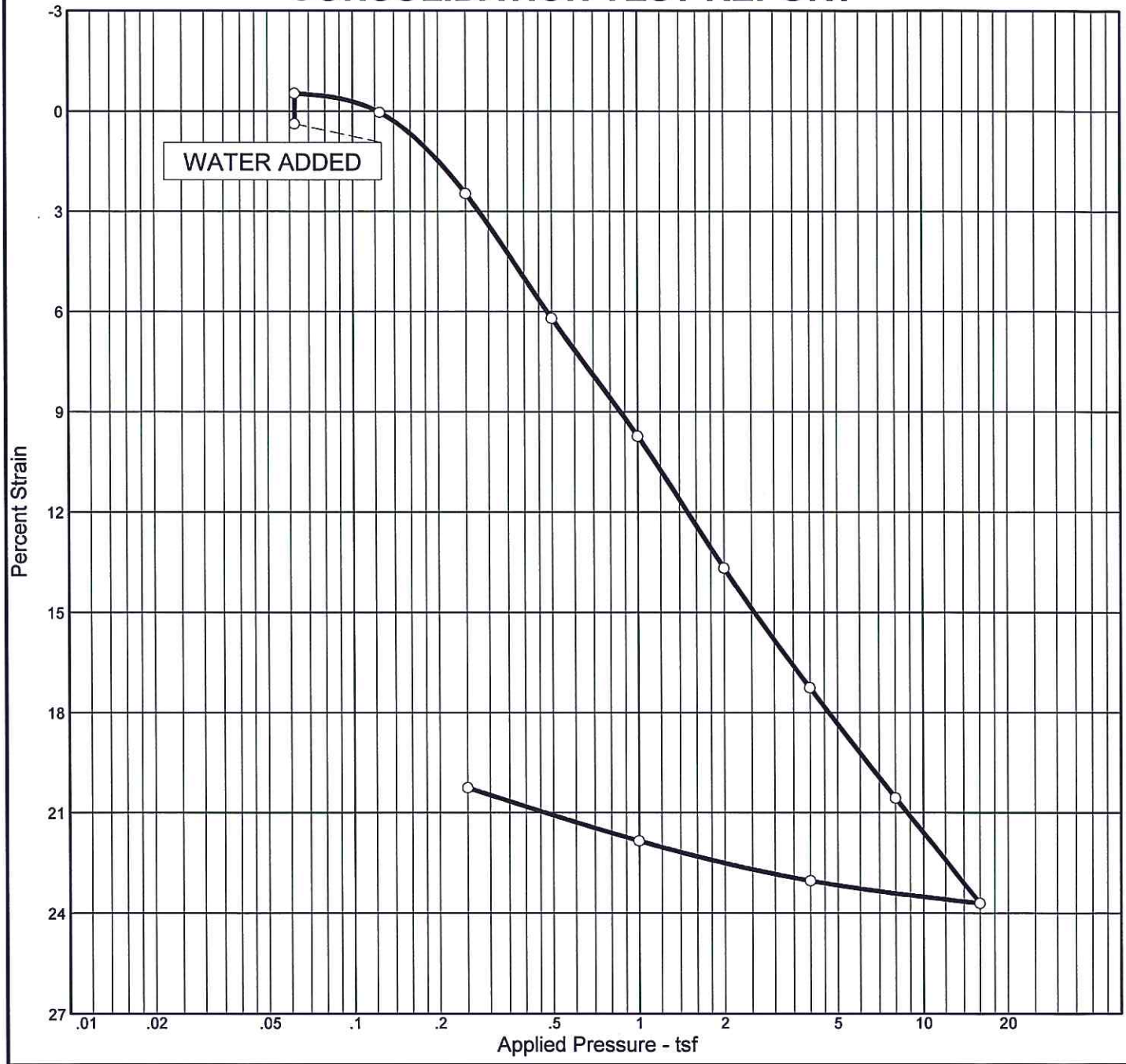
Checked by: TMA
Title: Laboratory Mnager

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_s	Swell Press. (tsf)	Swell %	e_o
Sat.	Moist.											
29.8 %	9.4 %	91.6	33	13	2.72		0.08	0.19	0.04	0.14	0.9	0.853

MATERIAL DESCRIPTION	USCS	AASHTO
Lean clay with weathered shale, stiff, grayish brown, moist	CL	

Project No. 312061G **Client:** Warger Associates

Project: Prairie View Road Location

Source: B-1 **Sample No.:** 1 **Elev./Depth:** 2

KRUGER TECHNOLOGIES, INC.

LENEXA, KS

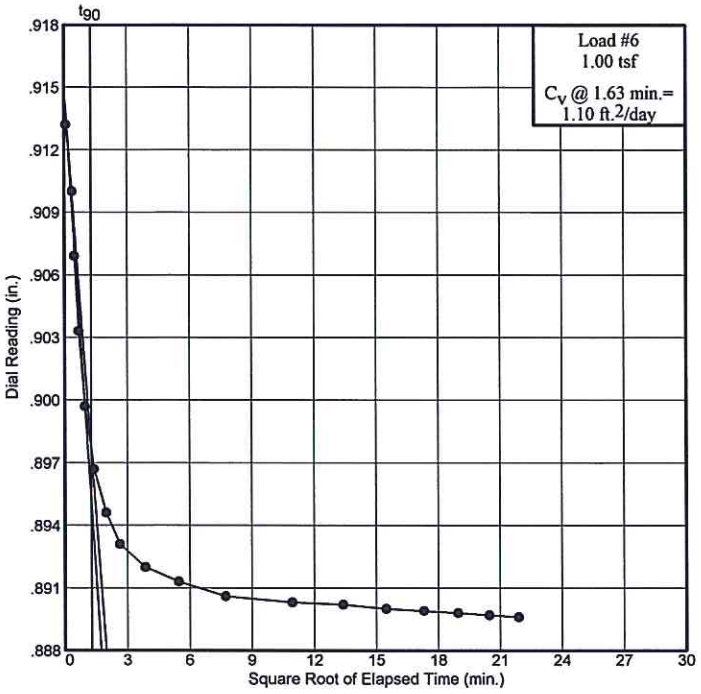
Remarks:

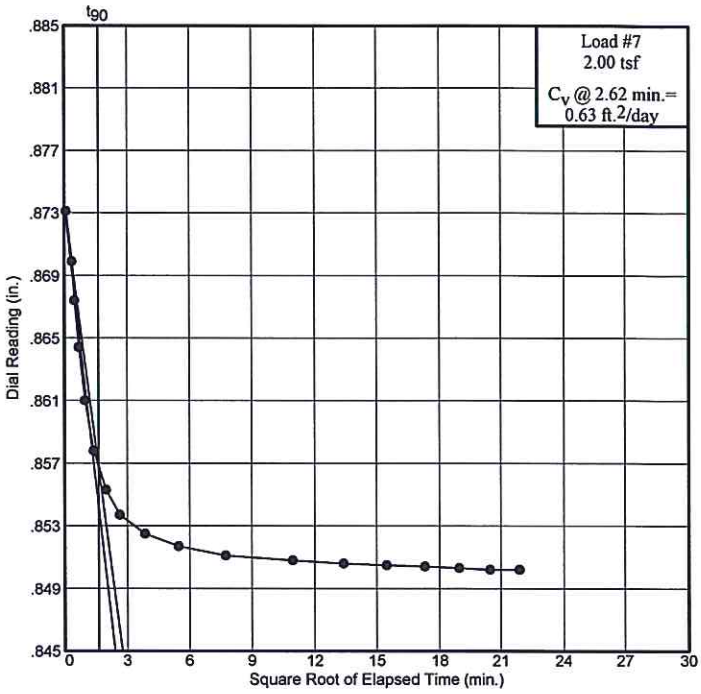
Figure

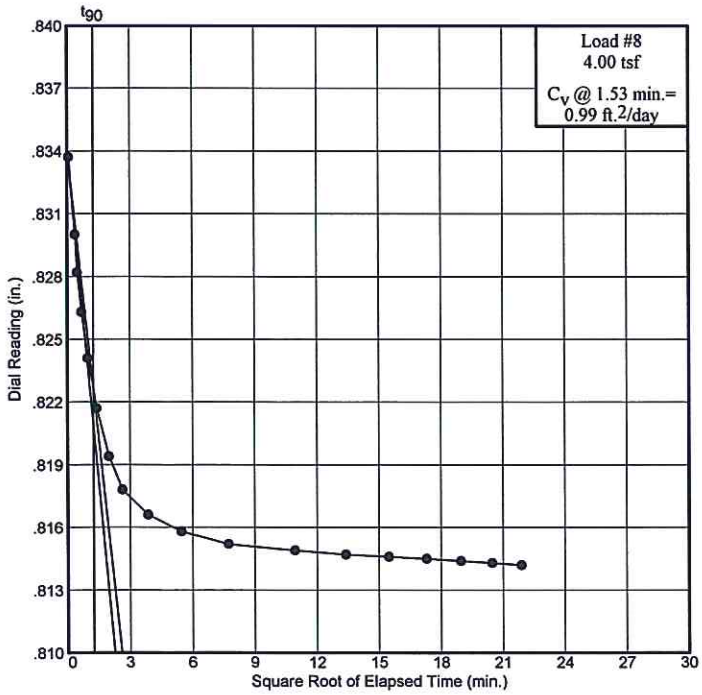
Dial Reading vs. Time

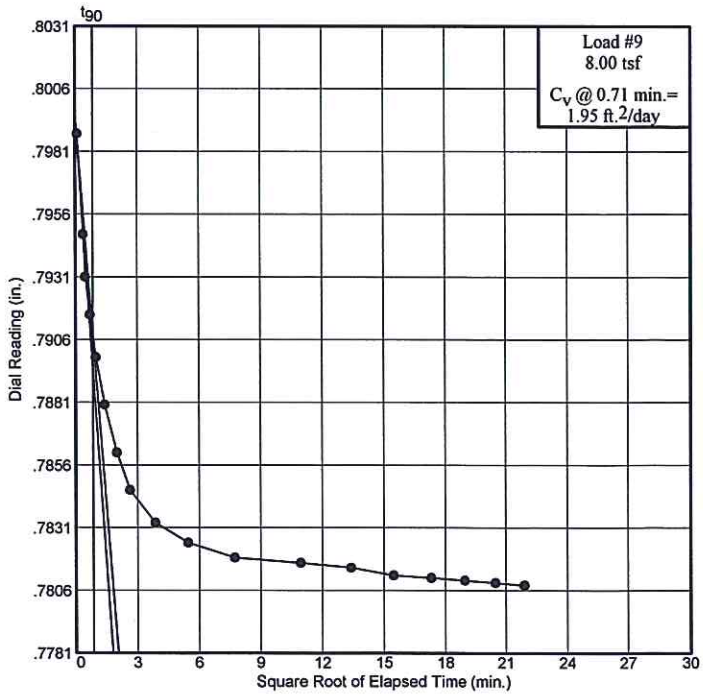
Project No.: 312061G
Project: Prairie View Road Location

Source: B-1 Sample No.: 1 Elev./Depth: 2









KRUGER TECHNOLOGIES, INC.

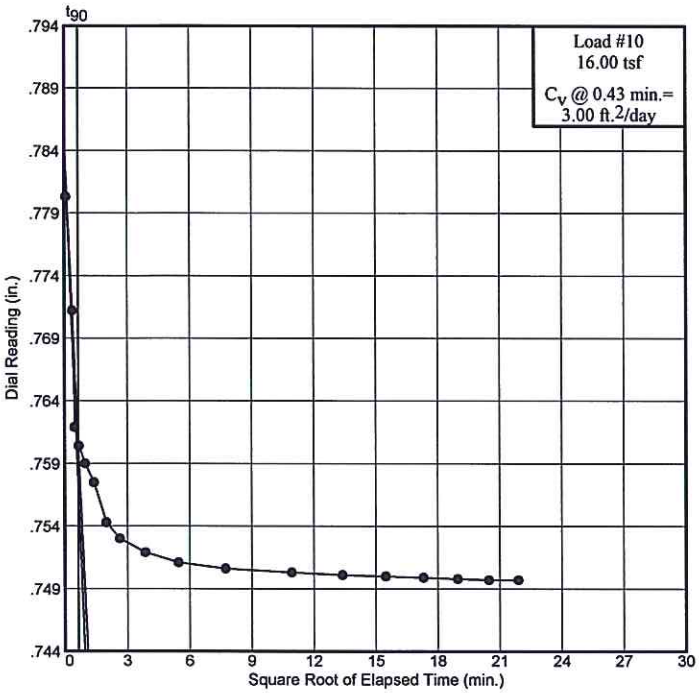
LENEXA, KS

Figure

Dial Reading vs. Time

Project No.: 312061G
Project: Prairie View Road Location

Source: B-1 Sample No.: 1 Elev./Depth: 2



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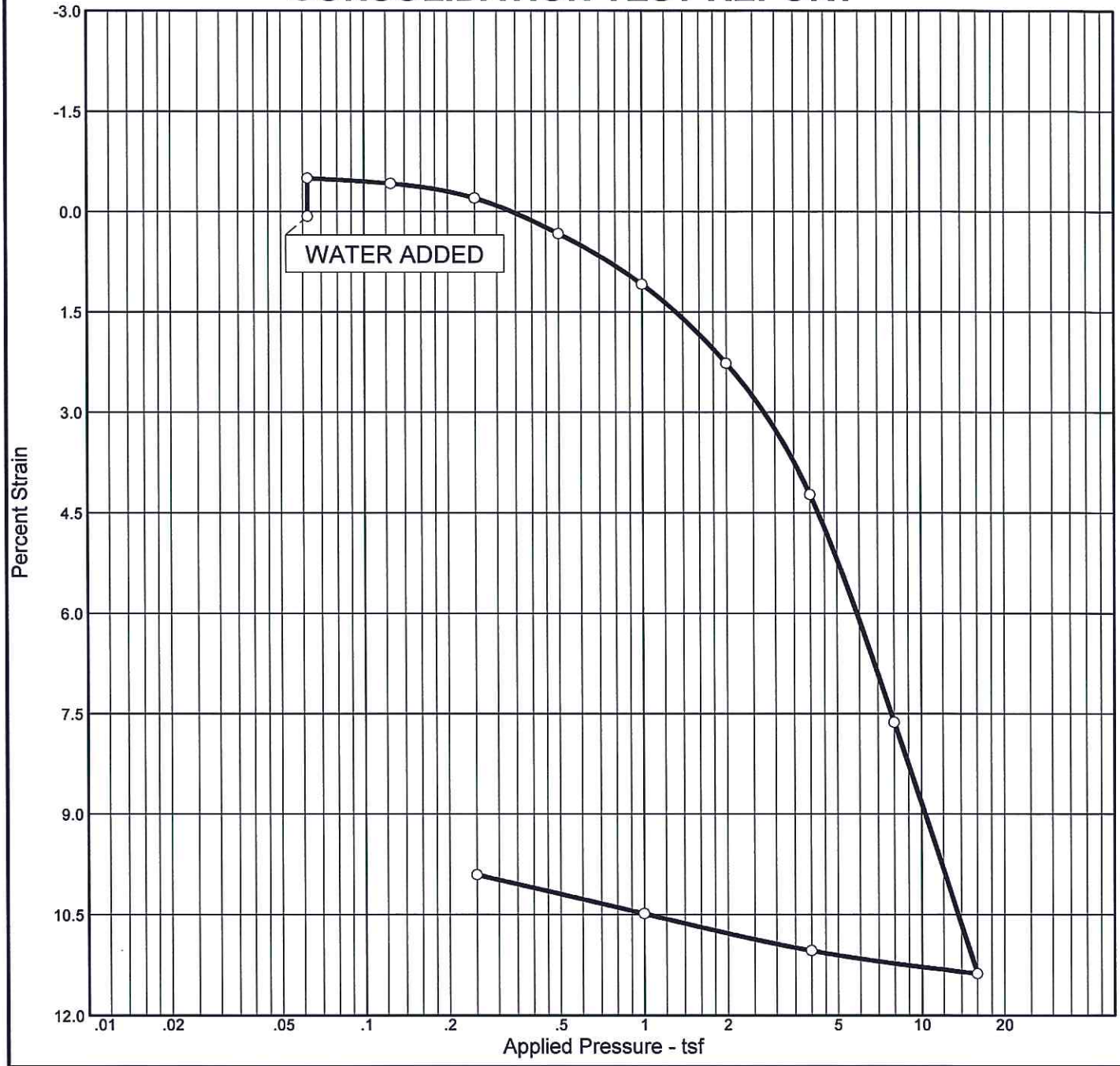
LENEXA, KS

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_s	Swell Press. (tsf)	Swell %	e_o
Sat.	Moist.											
31.6 %	9.9 %	91.6	33	9	2.72		4.25	0.23	0.02	0.37	0.6	0.855

MATERIAL DESCRIPTION	USCS	AASHTO
Silty lean clay, very stiff, brown, moist	CL-ML	

Project No. 312061G **Client:** Warger Associates

Project: Prairie View Road Location

Source: B-5 **Sample No.:** 1 **Elev./Depth:** 3

KRUGER TECHNOLOGIES, INC.

LENEXA, KS

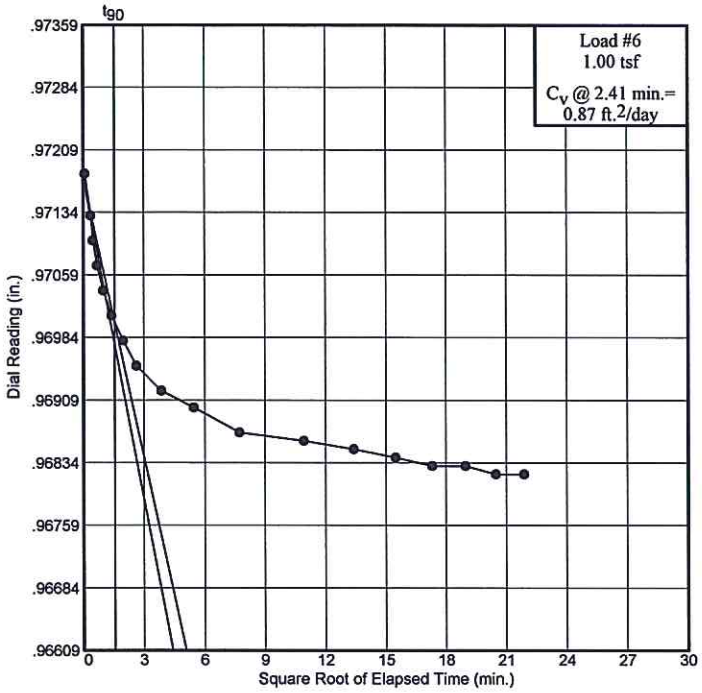
Remarks:

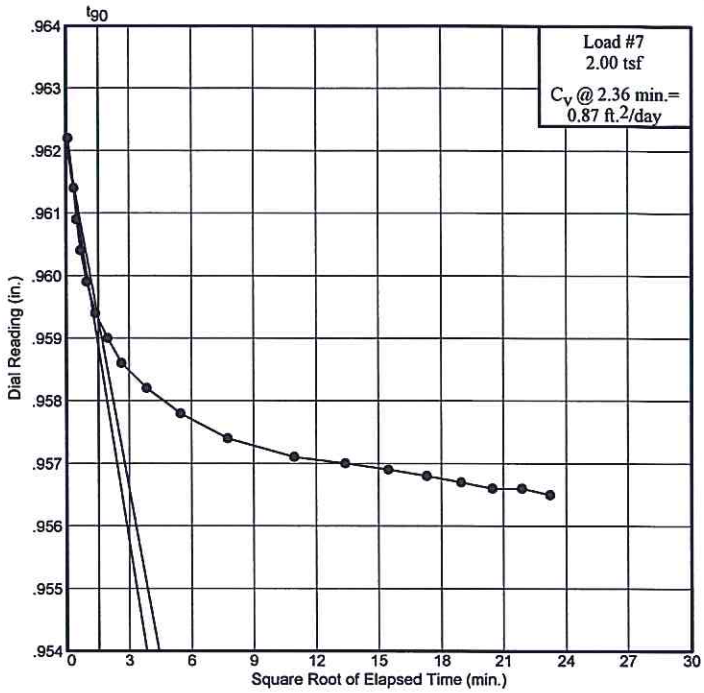
Figure

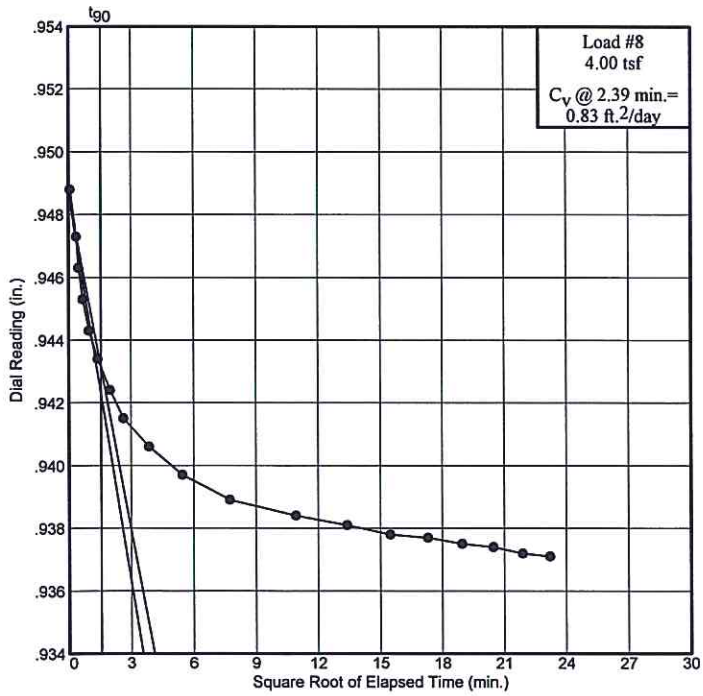
Dial Reading vs. Time

Project No.: 312061G
Project: Prairie View Road Location

Source: B-5 Sample No.: 1 Elev./Depth: 3







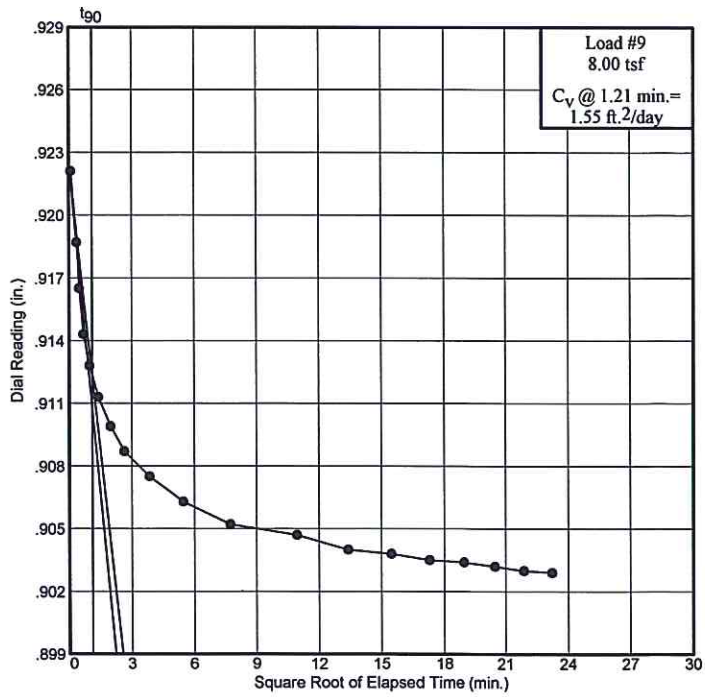


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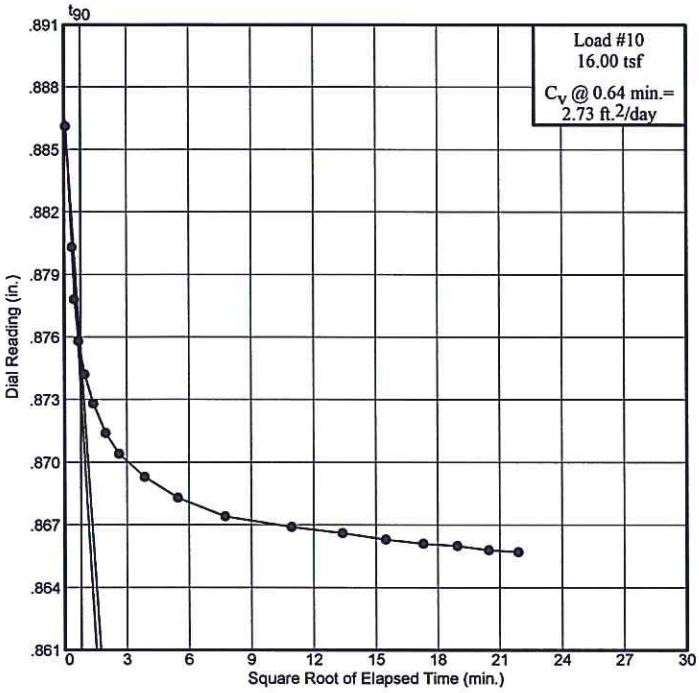
Figure

Dial Reading vs. Time

Project No.: 312061G
Project: Prairie View Road Location

Source: B-5 Sample No.: 1 Elev./Depth: 3



KRUGER TECHNOLOGIES, INC.
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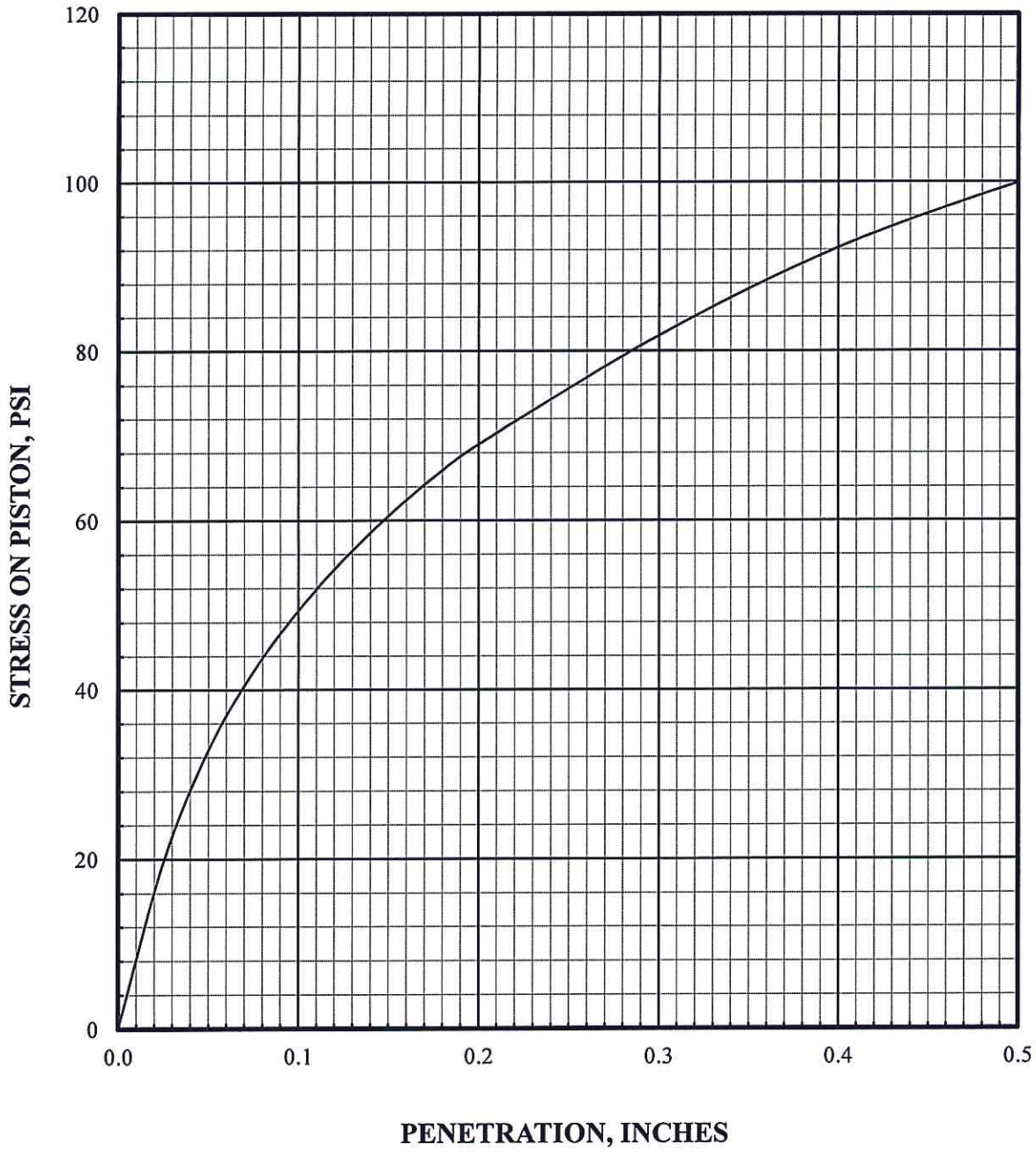
Figure



PROJECT NAME

Prairie View Road Relocatiom

SAMPLE INFORMATION

Max. Dry Density	106.1 pcf
Optimum Moisture Content	16.0 %

by Standard Proctor (ASTM D 698 Method A)

Atterberg Limits (ASTM D-4318)

LL	PL	PI
41	16	25

SAMPLE PREPARATION

Moisture Content

Before Compaction	18.5 %
After Compaction	18.5 %
After Soaking, Top 1-inch	25.0 %
After Soaking, Average	21.0 %

Dry Density

Dry Density = 100.4 pcf = 95 % of Max. Dry Density

Swell after soaking	0.39 %
Surcharge Weight	15 lbs

CALCULATED CBR

4.8 % at 0.1 inches
4.3 % at 0.2 inches

DESCRIPTION

Lean Clay, brown

SAMPLE LOCATION

Boring B-3

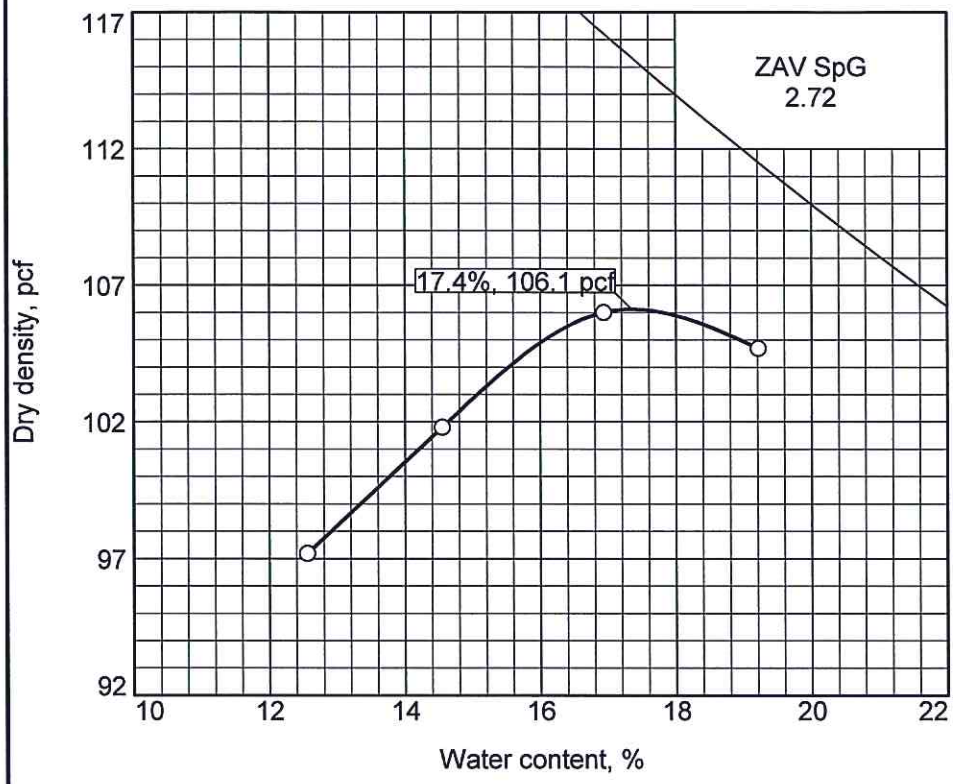
KTI

CALIFORNIA BEARING RATIO
ASTM D1883

Job No.	312061G	Test Date	8/6/12
Sampled By	KTI	Tested By	TAD
Sample Date	9/7/2012	Calc. By	TAD
Proctor No.	1	Ch'd By	SY

MOISTURE DENSITY RELATIONSHIP REPORT

Curve No.



Test Specification:
ASTM D 698-07 Method B Standard

Preparation Method	Wet
Hammer Wt.	5.5 lb.
Hammer Drop	12 in.
Number of Layers	three
Blows per Layer	25
Mold Size	0.03333 cu. ft.

Test Performed on Material Passing 3/8 in. **Sieve**

NM _____ **LL** 41 **PI** 25
Sp.G. (ASTM D 854) _____
%>3/8 in. _____ **%<No.200** _____
USCS CL **AASHTO** _____
Date Sampled 7/9/12
Date Tested 7/12/12
Tested By BS

TESTING DATA

	1	2	3	4	5	6
WM + WS	3748.0	3859.0	3872.0	3639.0		
WM	1985.0	1985.0	1985.0	1985.0		
WW + T #1	327.6	313.7	369.5	338.3		
WD + T #1	288.1	270.3	312.6	302.2		
TARE #1	16.6	14.0	16.4	14.7		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	14.5	16.9	19.2	12.6		
DRY DENSITY	101.8	106.0	104.7	97.2		

TEST RESULTS

Maximum dry density = 106.1 pcf

Optimum moisture = 17.4 %

Material Description

Lean clay, brown

Remarks:

Project No. 312061G **Client:** Warger Associates
Project: Prairie View Road Location

o **Source of Sample:** Bulk 2

Checked by: TMA
Title: Laboratory Mnager

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LENEXA, KS

Figure

GLOSSARY OF GEOTECHNICAL TERMS

ALGAL LIMESTONE	A limestone containing the remains of calcium secreting algae.
ARGILLACEOUS	Rocks composed of or having a notable portion of fine silt and/or clay in their composition.
ATTERBERG LIMITS	Water contents, in percentage of dry weight of soil, that correspond to the boundaries between the states of consistency, i.e. the boundary between the liquid and plastic states (liquid limit) and the boundary between the plastic and solid states (plastic limit).
BEDROCK-IN-PLACE	Continuous rock mass which essentially has not moved from its original depositional position.
BIVALVES	A marine mollusk such as a clam or oyster
CALCAREOUS	Containing calcium carbonate determined by effervescence when tested with dilute hydrochloric acid.
CLAST	Fragments of rock physically weathered from a larger mass, which is subsequently incorporated into a sedimentary rock
FISSILE BEDDING	Term applied to bedding which consists of laminae less than 2 millimeters in thickness.
FORMATION	A distinctive body of rock that serves as a convenient unit for study and mapping.
FOSSIL DETRITUS	The accumulation of broken, fragmented fossil debris.
FOSSILIFEROUS	Containing organic remains.
GROUP	A lithostratigraphic unit consisting of two or more formations.
JOINT	A fracture in a rock along which no appreciable displacement has occurred.
LAMINAE	Layers in a sediment in which the stratification planes are one centimeter or less apart
LENSES	Structures in a body of rock which is thick in the middle and thins toward the edges
LIMESTONE	A sedimentary rock composed mostly of calcium carbonate ($CaCO_3$).

LOESS	A homogenous, nonstratified, unindurated deposit consisting predominantly of silt, with subordinate amounts of very fine sand and/or clay.
MICA	A mineral group, consisting of phyllosilicates, with sheetlike structures.
MEMBER	A specially developed part of a varied formation is called a member, if it has considerable geographic extent.
NODULE	A small, irregular, knobby, or rounded rock that is generally harder than the surrounding rock.
PERMEABILITY	The capacity of a material to transmit a fluid.
RECOVERY	The percentage of bedrock core recovered from a core run length.
RELIEF	The difference in elevation between the high and low points of a land surface.
RESIDUAL SOIL	Soil formed in place by the disintegration and decomposition of rocks and the consequent weathering of the mineral materials.
ROCK QUALITY DESIGNATION (RQD)	Refers to percentage of core sample recovered in unbroken lengths of 4 inches or more.
SERIES	A time-stratigraphic unit ranked next below a system.
SHALE	A fine-grained plastic sedimentary rock formed by consolidation of clay and mud.
SILICEOUS	Containing silica (as silicon dioxide)
SILTSTONE	Sedimentary rock composed mostly of silt sized particles, usually cemented by calcite, silica, or iron oxide.
STRATIGRAPHY	Branch of geology that treats the formation, compositions, sequence, and correlation of the stratified rocks as parts of the earth's crust.
SYSTEM	Designates rocks formed during a fundamental chronological unit, a period.
UNCONFORMITY	A surface of erosion or nondeposition, usually the former, which separates younger strata from older rocks.
WEATHERING	The physical and chemical disintegration and decomposition of rocks and minerals.

General Notes

Laboratory Test Symbols

Symbol	Definition
LL	Liquid Limit (ASTM D4318)
PL	Plastic Limit (ASTM D4318)
PI	Plasticity Index (LL minus PL)
Qu	Unconfined Compressive Strength, Pounds per Square Foot (psf)
Qp	Pocket Penetrometer Reading, Tons per Square Foot (TSF)
RQD	Rock Quality Designation % (Sum of rock core pieces >4 inches/length of core run)

Common Soil Classification Symbols

Clay	
Symbol	**Soil Type**
CL	Low plasticity clay
CL-ML	Low plasticity clay and silt
CL/CH	Medium plasticity clay
CH	High plasticity clay

Silt	
Symbol	**Soil Type**
ML	Low plasticity silt
MH	High plasticity silt

Sand	
Symbol	**Soil Type**
SW	Well graded sand
SP	Poorly graded sand
SM	Silty sand
SC	Clayey sand

Gravel	
Symbol	**Soil Type**
GW	Well graded gravel
GP	Poorly graded gravel
GM	Silty gravel
GC	Clayey gravel

Descriptive Terminology

Cohesionless Soils

Relative Density Term	"N" Value
Very Loose	0 - 4
Loose	5 - 9
Medium Dense	10 - 29
Dense	30 – 49
Very Dense	50 or more

Cohesive Soils

Consistency Term	"N" Value
Very soft	0 – 2
Soft	3 – 4
Medium	5 – 8
Stiff	9 – 15
Very Stiff	16 - 30
Hard	> 30

Relative Proportions and Sizes

Term	Range
Trace	< 5%
A Little	5 – 15%
Some	15 – 30%
With	30 – 50%

Material	Size
Boulder	> 12"
Cobble	3" – 12"
Gravel	4.75 - 76.2 mm
Sand	0.075 – 4.75 mm
Silt and Clay	< 0.075 mm