Roadway Geotechnical Engineering Report

Sabino Kolb Extension

South of Tanque Verde Road and North of Mullins Landfill

Tucson, Arizona

September 29, 2010

Terracon Project No. 63105043, Revision No. 1

Prepared for:

PSOMAS

Tucson, Arizona

Prepared by:

Terracon Consultants, Inc.

Tucson, Arizona

Expires 03/31/2012

Terracon

September 29, 2010

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Re: Roadway Geotechnical Engineering Report
Sabino Kolb Extension
South of Tanque Verde Road and North of Mullins Landfill
Tucson, Arizona
Terracon Project No. 63105043, Revision No. 1

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. This report is specific to the roadway portion of the project. A separate preliminary report specific to the bridge and landfill portions of the project has also been completed and was dated September 7, 2010. These services were performed in general accordance with our proposal, number D6309008, Revision No. 6, dated March 30, 2010. This geotechnical engineering report presents the results of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of pavements for the proposed project. Pavement section recommendations are provided in our pavement design summary under a separate cover.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Oleg B. Lysyj, P.E.
Principal

Bryan W. Reed, P.E.
Project Manager

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Copies to: Addressee (1 via email, 4 via mail)

Terracon

TABLE OF CONTENTS

EXECUTIVE SUMMARY i
1.0 INTRODUCTION 1
2.0 PROJECT INFORMATION 1
2.1 Project Description 1
3.0 SUBSURFACE CONDITIONS 2
4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION 2
4.1 Geotechnical Considerations 2
4.2 Pavement Subgrade Parameters 3
4.3 Foundations for Minor Structures 3
4.4 Earthwork 3
4.5 Slopes 4
5.0 GENERAL COMMENTS 5

Appendix A – Field Exploration
Site Plan and Boring Location Diagram
Field Exploration Description
Boring Logs
General Notes
Unified Soil Classification System

Appendix B – Laboratory Testing
Laboratory Test Description
Laboratory Test Results
Summary of Laboratory Results

Expires 03/31/2012

ROADWAY GEOTECHNICAL ENGINEERING REPORT
SABINO KOLB EXTENSION
SOUTH OF TANQUE VERDE ROAD AND
NORTH OF MULLINS LANDFILL
TUCSON, ARIZONA

Terracon Project No. 63105043, Revision No. 1

EXECUTIVE SUMMARY

A geotechnical investigation has been performed for the Kolb Road Connection with Sabino Canyon Road in the proposed alignment beginning south of the intersection of Sabino Canyon Road and Tanque Verde Road and extending to the northern limits of the Mullins Landfill in Tucson, Arizona. Terracon performed three soil borings specifically for the roadway portion of this project, designated B-3, B-4 and B-6, to depths of approximately 6 feet below the existing ground surface.

Based on the information obtained from our subsurface exploration the site can be developed for the proposed project. The following geotechnical considerations were identified:

- The roadway subgrade soils generally have good soil support characteristics.

- It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

ROADWAY GEOTECHNICAL ENGINEERING REPORT
SABINO KOLB EXTENSION
SOUTH OF TANQUE VERDE ROAD AND
NORTH OF MULLINS LANDFILL
TUCSON, ARIZONA

Terracon Project No. 63105043, Revision No. 1

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering services performed for the Kolb Road connection with Sabino Canyon Road. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Earthwork
- Pavement Design and Construction

Our geotechnical engineering scope of work for this portion of the project included the advancement of three test borings to depths of approximately 6 feet below existing site grades.

Logs of the borings along with a Site Plan and Boring Locations Diagram (Exhibit A-1), are included in Appendix A of this report. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included in Appendix B of this report. Descriptions of the field exploration and laboratory testing are included in their respective appendices.

2.0 PROJECT INFORMATION

2.1 Project Description

We understand this project will ultimately consist of the construction of an extension of Kolb Road with an alignment running north from Kolb Road, just north of Speedway Boulevard, across the Pantano Wash, and extending further north to connect with the intersection of Tanque Verde Road and Sabino Canyon Road. A new bridge structure will be constructed across the Pantano Wash. Additionally, a portion of the alignment on the north side of the

Pantano Wash will cross the Mullins Landfill. A preliminary geotechnical report specific to the bridge and the landfill portion of the project (a structural roadway supported on deep foundations is being proposed for the portion of the alignment crossing the landfill) was provided in a separate report dated September 7, 2010.

The roadway portion of the project includes the planned new portion of roadway beginning south of the intersection of Tanque Verde Road and Sabino Canyon Road, and ending at the northern boundary of the Mullins Landfill. This portion of the alignment is approximately ½-mile long.

3.0 SUBSURFACE CONDITIONS

Specific conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs included in Appendix A of this report. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum (feet)	Material Encountered	Consistency/Density
Stratum 1 (Borings B-3 & B-4)	6 (max. depth of exploration)	Clayey Sand with varied amounts of gravel	Medium Dense to Very Dense
Stratum 1 (Boring B-6)	6 (max. depth of exploration)	Sandy Silty Clay	Stiff

The clayey sand soils have plasticities in the medium range and the sandy silty clay soils have low plasticity.

Laboratory tests were conducted on selected soil samples and the test results are presented in Appendix B.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

The subgrade soils along the project alignment generally consisted of clayey sand and sandy silty clay. Overall, the site soils are considered to have good subgrade support characteristics.

4.2 Pavement Subgrade Parameters

The recommended resilient modulus for pavement design was determined by analysis of the correlated and laboratory tested R-value results in accordance with the procedures of the ADOT. The resilient modulus analysis included the following correlated and laboratory R-value test results:

Project Section		Correlated R-Values	Laboratory R-Values	Mean R-Value	Design Resilient Modulus (M_r)
Sabino-Kolb Interconnect	Mean	44.2	27.0	32.5	14,143
	Standard Deviation	15.3	10.5		

Based on the information on the previous table and the location of the project the resilient modulus of the on site soils was calculated to be 14,143, using a weighted design R-value of 32.5. ADOT recommends limiting the construction control R-value to 5 below the design R-value. This is to reduce future maintenance and increase pavement reliability in poor subgrade locations.

The roadway subgrade soils generally have good soil support characteristics. Full details of the pavement design for this project including recommended pavement section alternatives are provided in the separate Pavement Design Summary Report.

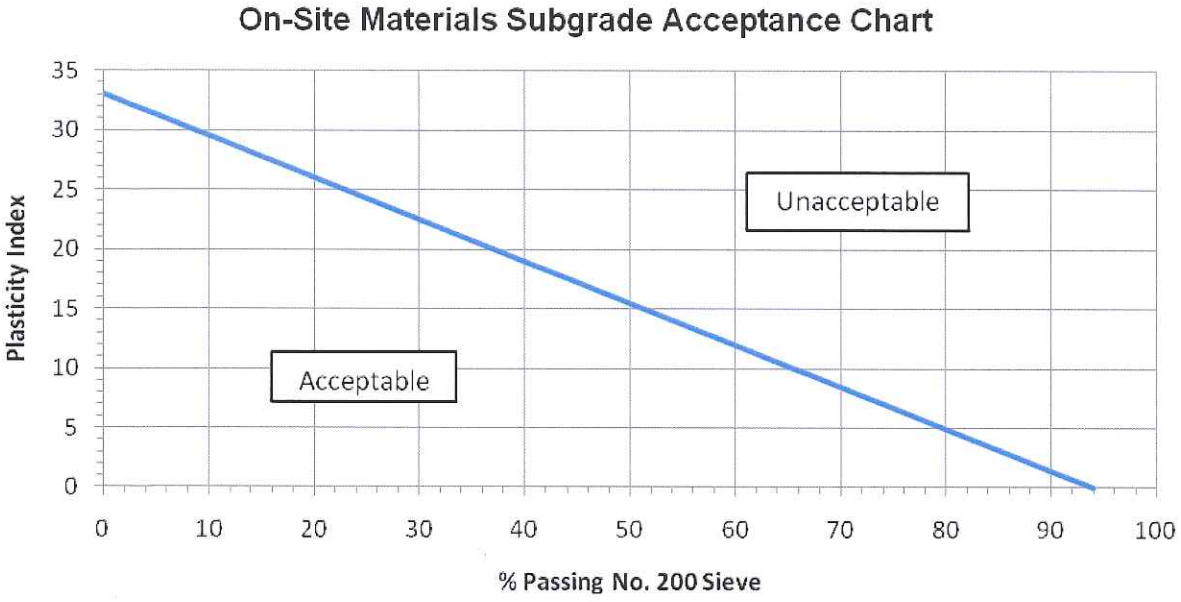
4.3 Foundations for Minor Structures

Preliminary foundation recommendations for the bridge and landfill structures were provided in a separate report. In the event minor structures such as light poles and signage are constructed as part of this project, we recommend these structures be supported on drilled shaft or direct set pole foundations bearing at depths of at least 5 feet below the ground surface. An allowable bearing pressure of 3500 psf may be used for axial loading with a shaft tip depth between 5 and 10 feet. A passive resistance pressure of 350 psf/ft may be used for lateral loading design.

4.4 Earthwork

Earthwork and roadway grading should be performed in accordance with Sections 203 and 205 of the Standard and Specifications. A ground compaction factor of 0.2 feet is estimated for existing subgrade soils. A shrinkage factor of 20% is estimated for on-site soils compacted to 95% of the material's Standard Proctor dry density. This figure does not include any material lost in transit or oversized material or material unsuitable for use, or compaction greater than 95%.

The following on-site subgrade acceptance chart is provided to assist in determining the acceptably of existing on-site soils use as subgrade material within 3-feet of finished pavement subgrade. It is based upon using a construction control R-value of 27.5:



If the existing subgrade soils do not meet these criteria, the unsuitable soils should be removed to a depth of 3 feet below finished pavement subgrade and replaced with suitable fill meeting the criteria outlined below. Close observation will be required during construction to identify areas of unsuitable existing subgrade soils.

All off-site, or imported, fill materials placed for pavement support should meet the following minimum requirements to satisfy the recommended design resilient modulus:

> **The Plasticity Index (PI) and the percent passing the No. 200 sieve when used in the equation below, shall give a value of "X" that does not exceed 80.5 for all imported materials placed within 3-feet of finished pavement subgrade.**
>
> **X = (Minus No. 200 Sieve) + 2.83 (PI)**

4.5 Slopes

For permanent slopes in compacted fill and cut native areas, recommended maximum configurations and erosion control measures are provided in the following table:

Slope (horizontal:vertical)	Recommended Surface Treatment
5:1 to 3:1	Re-vegetate

Slope (horizontal:vertical)	Recommended Surface Treatment
3:1 to 2:1	Rip-rap over filter fabric
2:1 to 1.5:1	Grouted rip-rap or 6-inch thick grout over filter fabric, with integrated tow-down at base of slope having a minimum depth of ¼ the total slope height
Steeper than 1.5:1	Stability analysis required, or structural retaining wall

We expect slopes with this configuration to be resistant to erosion and stable against circular failure. The face of all slopes should be compacted to the minimum specification for fill embankments. Alternately, fill slopes can be over-built and trimmed to compacted material.

5.0 GENERAL COMMENTS

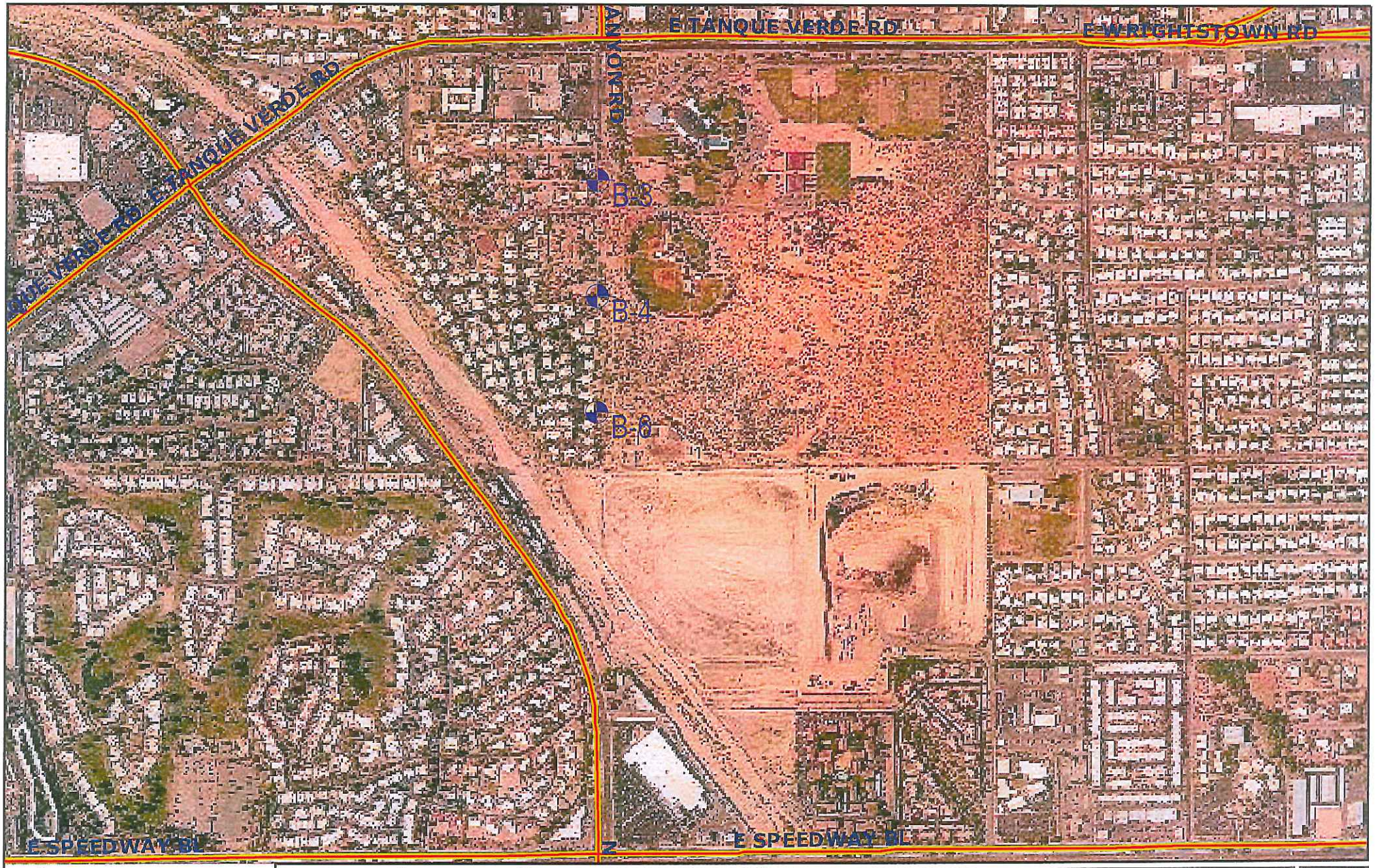
Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION



Project Mngr:	OBL
Drawn By:	RSK
Checked By:	OBL
Approved By:	OBL
Project No.	63105043
Scale:	1:900
File No.	63105043.DWG
Date:	7/13/2010

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SITE PLAN & BORING LOCATIONS DIAGRAM

PSOMAS

SABINO KOLB EXTENSION

S. OF TANQUE VERDE RD AND N. OF MULLINS LANDFILL

TUCSON ARIZONA

EXHIBIT

A-1

Field Exploration Description

Terracon performed three soil borings specifically for the roadway portion of this project, designated B-3, B-4, and B-6.

These borings were drilled at the site on July 21, 2010. The borings were drilled to depths ranging from approximately 6 feet below the ground surface at the approximate locations shown on the attached Site Plan and Boring Locations Diagram, Exhibit A-1. The test borings were advanced with a truck-mounted CME-55 drill rig utilizing 8-inch diameter hollow-stem augers.

The borings were located in the field by using the proposed site plan, an aerial photograph of the site, and measuring from existing property lines. The accuracy of boring locations should only be assumed to the level implied by the method used.

Continuous lithologic logs of each boring were recorded by the field geologist during the drilling operations. At selected intervals, samples of the subsurface materials were taken by driving split-spoon or ring-barrel samplers. Bulk samples of subsurface materials were also obtained.

Penetration resistance measurements were obtained by driving the split-spoon and ring-barrel samplers into the subsurface materials with a 140-pound automatic hammer falling 30 inches. The penetration resistance value is a useful index in estimating the consistency or relative density of materials encountered.

Groundwater conditions were evaluated in each boring at the time of site exploration.

LOG OF BORING NO. B-3

CLIENT **PSOMAS**

SITE **S. of Tanque Verde Rd. & N. of Mullins Landfill Tucson, Arizona**

PROJECT **Sabino Kolb Extension**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLE INTERVAL	SAMPLE TYPE	PENETRATION TEST RESULTS (BLOWS/FT.)	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS LIQUID LIMIT	TESTS PLASTICITY INDEX	TESTS -#200
	CLAYEY SAND WITH GRAVEL; cobbles and occasional boulders, red brown, very dense, slightly damp, medium plasticity.		SC		BS				27	17	29
		2	SC		RS	93/8"					
		4									
	6	6	SC		RS	63					
	BOTTOM OF BORING.										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼
WL	▼	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	7-21-10		
BORING COMPLETED	7-21-10		
RIG	CME-55	FOREMAN	BWR
APPROVED	OBL	JOB #	63105043

BOREHOLE 2008 63105043.GPJ TERR2000.GDT 9/22/10

LOG OF BORING NO. B-4

CLIENT **PSOMAS**

SITE **S. of Tanque Verde Rd. & N. of Mullins Landfill Tucson, Arizona**

PROJECT **Sabino Kolb Extension**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLE INTERVAL	SAMPLE TYPE	PENETRATION TEST RESULTS (BLOWS/FT.)	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS LIQUID LIMIT	TESTS PLASTICITY INDEX	TESTS -#200
	CLAYEY SAND WITH GRAVEL: light brown, medium dense to very dense, slightly damp, low plasticity.	2	SC		BS				22	8	12
			SC		RS	15	3	109			
		4									
	6	6	SC		RS	87/9"					
	BOTTOM OF BORING.										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼
WL	▼	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	7-21-10		
BORING COMPLETED	7-21-10		
RIG	CME-55	FOREMAN	BWR
APPROVED	OBL	JOB #	63105043

BOREHOLE 2008 63105043.GPJ TERR2000.GDT 9/22/10

LOG OF BORING NO. B-6

CLIENT **PSOMAS**

SITE **S. of Tanque Verde Rd. & N. of Mullins Landfill Tucson, Arizona**

PROJECT **Sabino Kolb Extension**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLE INTERVAL	SAMPLE TYPE	PENETRATION TEST RESULTS (BLOWS/FT.)	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS LIQUID LIMIT	TESTS PLASTICITY INDEX	TESTS #200
	SANDY SILTY CLAY; light brown, stiff, slightly damp, low plasticity.		CL-ML		BS				23	6	56
		2	CL-ML		RS	43	6	81			
		4									
		6	CL-ML		RS	23					
	BOTTOM OF BORING.										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL	▽ None WD	▼	
WL	▼	▼	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	7-21-10		
BORING COMPLETED	7-21-10		
RIG	CME-55	FOREMAN	BWR
APPROVED	OBL	JOB #	63105043

BOREHOLE 2008 63105043.GPJ TERR2000.GDT 9/22/10

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-3/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube – 2" O.D., 3" O.D., unless otherwise noted	PA:	Power Auger (Solid Stem)
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value". For 3" O.D. ring samplers (RS) the penetration value is reported as the number of blows required to advance the sampler 12 inches using a 140-pound hammer falling 30 inches, reported as "blows per foot," and is not considered equivalent to the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	BCR:	Before Casing Removal
WCI:	Wet Cave in	WD:	While Drilling	ACR:	After Casing Removal
DCI:	Dry Cave in	AB:	After Boring	N/E:	Not Encountered

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0 - 1	Very Soft
500 – 1,000	2 - 4	Soft
1,000 – 2,000	4 - 8	Medium Stiff
2,000 – 4,000	8 - 15	Stiff
4,000 – 8,000	15 - 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 50	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	≥ 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75 to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification	
					Group Symbol	Group Name[B]
Coarse Grained Soils	Gravels	Clean Gravels	Cu ≥ 4 and 1 ≤ Cc ≤ 3[E]		GW	Well-graded gravel[F]
More than 50% retained	More than 50% of coarse fraction retained on No. 4 sieve	Less than 5% fines[C]	Cu < 4 and/or 1 > Cc > 3[E]		GP	Poorly graded gravel[F]
on No. 200 sieve		Gravels with Fines	Fines classify as ML or MH		GM	Silty gravel[F,G,H]
		More than 12% fines[C]	Fines classify as CL or CH		GC	Clayey gravel[F,G,H]
	Sands	Clean Sands	Cu ≥ 6 and 1 ≤ Cc ≤ 3[E]		SW	Well-graded sand[I]
	50% or more of coarse fraction passes No. 4 sieve	Less than 5% fines[D]	Cu < 6 and/or 1 > Cc > 3[E]		SP	Poorly graded sand[I]
		Sands with Fines	Fines classify as ML or MH		SM	Silty sand[G,H,I]
		More than 12% fines[D]	Fines Classify as CL or CH		SC	Clayey sand[G,H,I]
Fine-Grained Soils	Silts and Clays	inorganic	PI > 7 and plots on or above "A" line[J]		CL	Lean clay[K,L,M]
50% or more passes the No. 200 sieve	Liquid limit less than 50		PI < 4 or plots below "A" line[J]		ML	Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays	inorganic	PI plots on or above "A" line		CH	Fat clay[K,L,M]
	Liquid limit 50 or more		PI plots below "A" line		MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

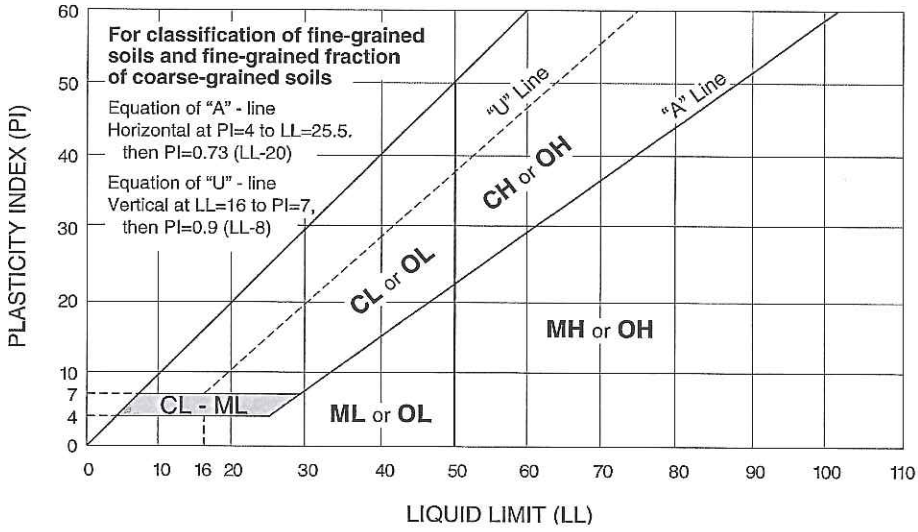
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Terracon

Form 111—6/98

APPENDIX B
LABORATORY TESTING

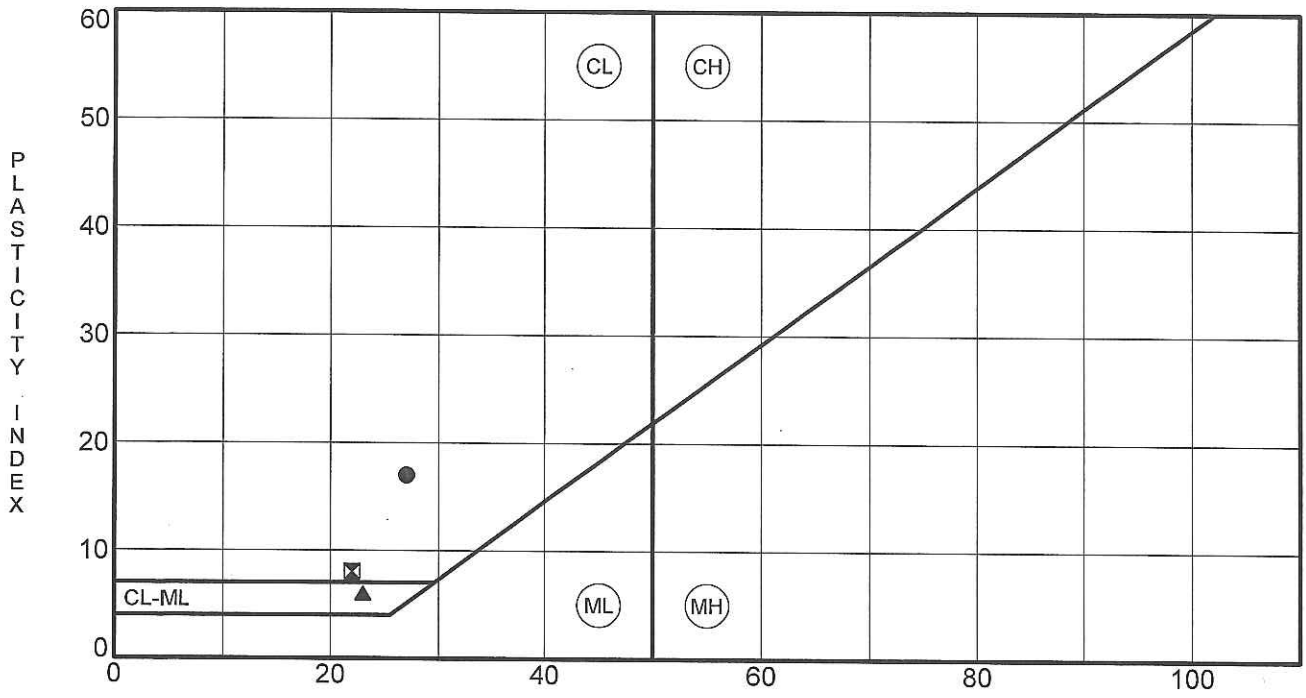
Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) described in Appendix A. At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

Laboratory tests were conducted on selected soil samples and the test results are presented in this appendix. The laboratory test results were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- Standard Proctor
- Sieve Analysis
- Atterberg Limits
- In-situ Water Content
- In-situ Dry Density
- R-value



	Specimen Identification		LL	PL	PI	%-#200	Soil Description
●	B-3	0.0ft	27	10	17	29	CLAYEY SAND with GRAVEL(SC)
⊠	B-4	0.0ft	22	14	8	12	CLAYEY SAND with GRAVEL(SC)
▲	B-6	0.0ft	23	17	6	56	SANDY SILTY CLAY(CL-ML)

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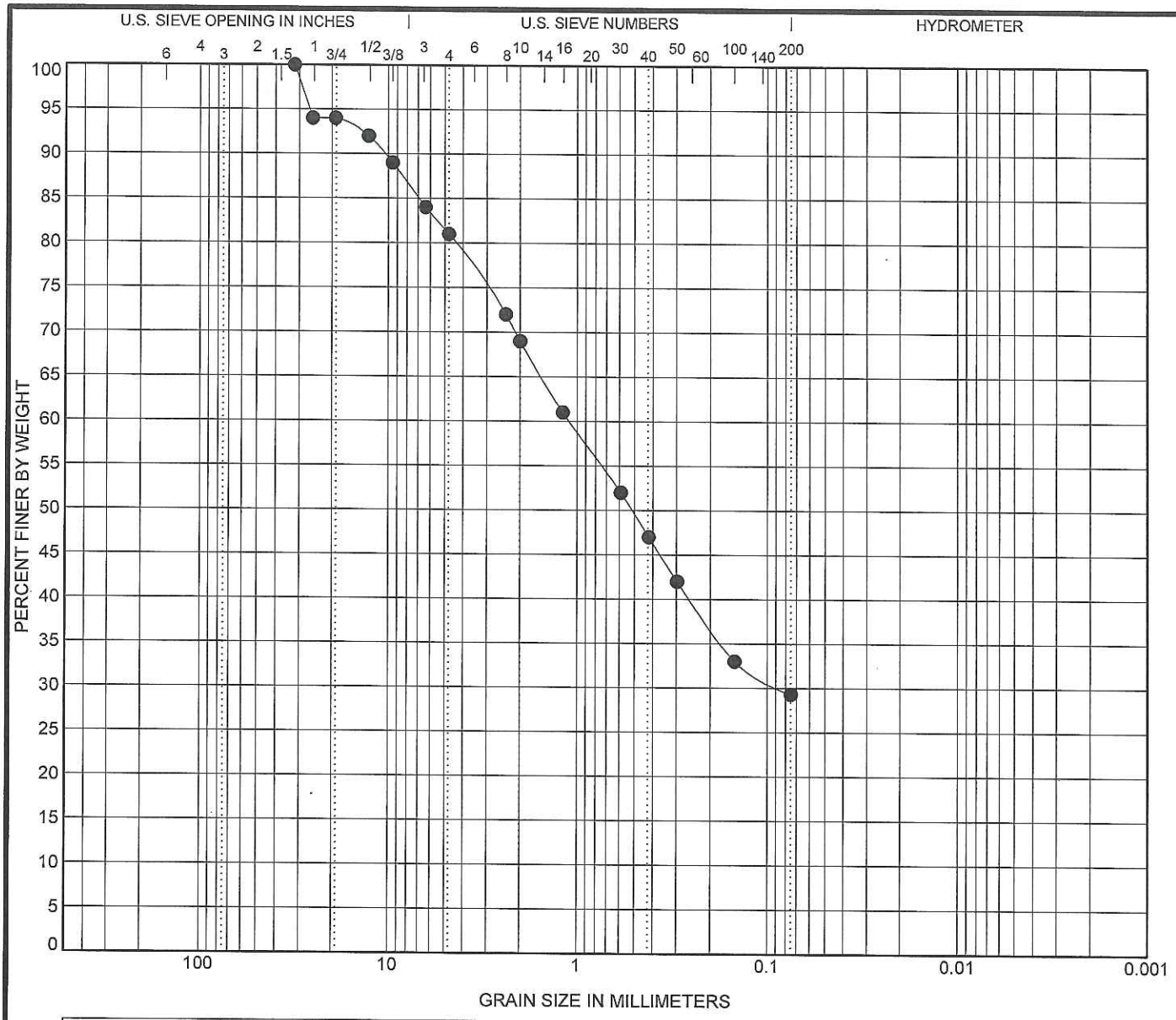
ATTERBERG LIMITS RESULTS

Project: Sabino Kolb Extension
Site: S. of Tanque Verde Rd. & N. of Mullins Landfill Tucson, Arizona
Job #: 63105043
Date: 9-22-10

TC_ATTERBERG_LIMITS_63105043.GPJ TERRACON.GDT 9/22/10



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	B-3	0.0 ft	CLAYEY SAND with GRAVEL(SC)	27	10	17		
⊠		ft						
▲		ft						
★		ft						
⊙		ft						

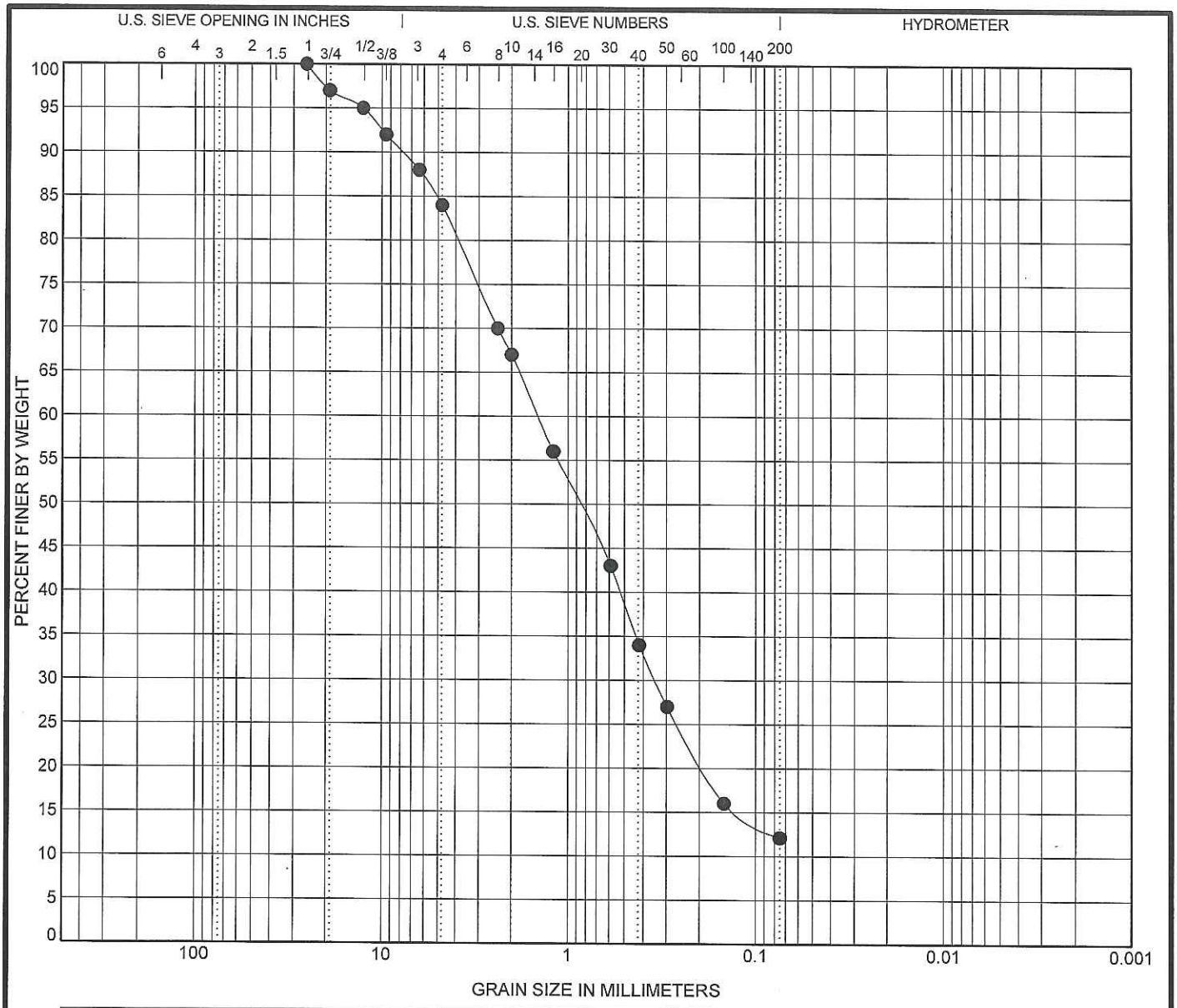
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-3	0.0 ft	31.75	1.101	0.085		19.0	51.7	29.3	
⊠		ft								
▲		ft								
★		ft								
⊙		ft								

Terracon

GRAIN SIZE DISTRIBUTION

Project: Sabino Kolb Extension
Site: S. of Tanque Verde Rd. & N. of Mullins Landfill Tucson, Arizona
Job #: 63105043
Date: 9-22-10

TC GRAIN SIZE 63105043.GPJ TERRACON.GDT 9/22/10



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	B-4	0.0 ft	CLAYEY SAND with GRAVEL(SC)	22	14	8	1.6	27.7
⊠		ft						
▲		ft						
★		ft						
⊙		ft						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-4	0.0 ft	25.4	1.437	0.345		16.0	71.9	12.1	
⊠		ft								
▲		ft								
★		ft								
⊙		ft								

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GRAIN SIZE DISTRIBUTION

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Site: S. of Tanque Verde Rd. & N. of Mullins Landfill Tucson, Arizona
Job #: 63105043
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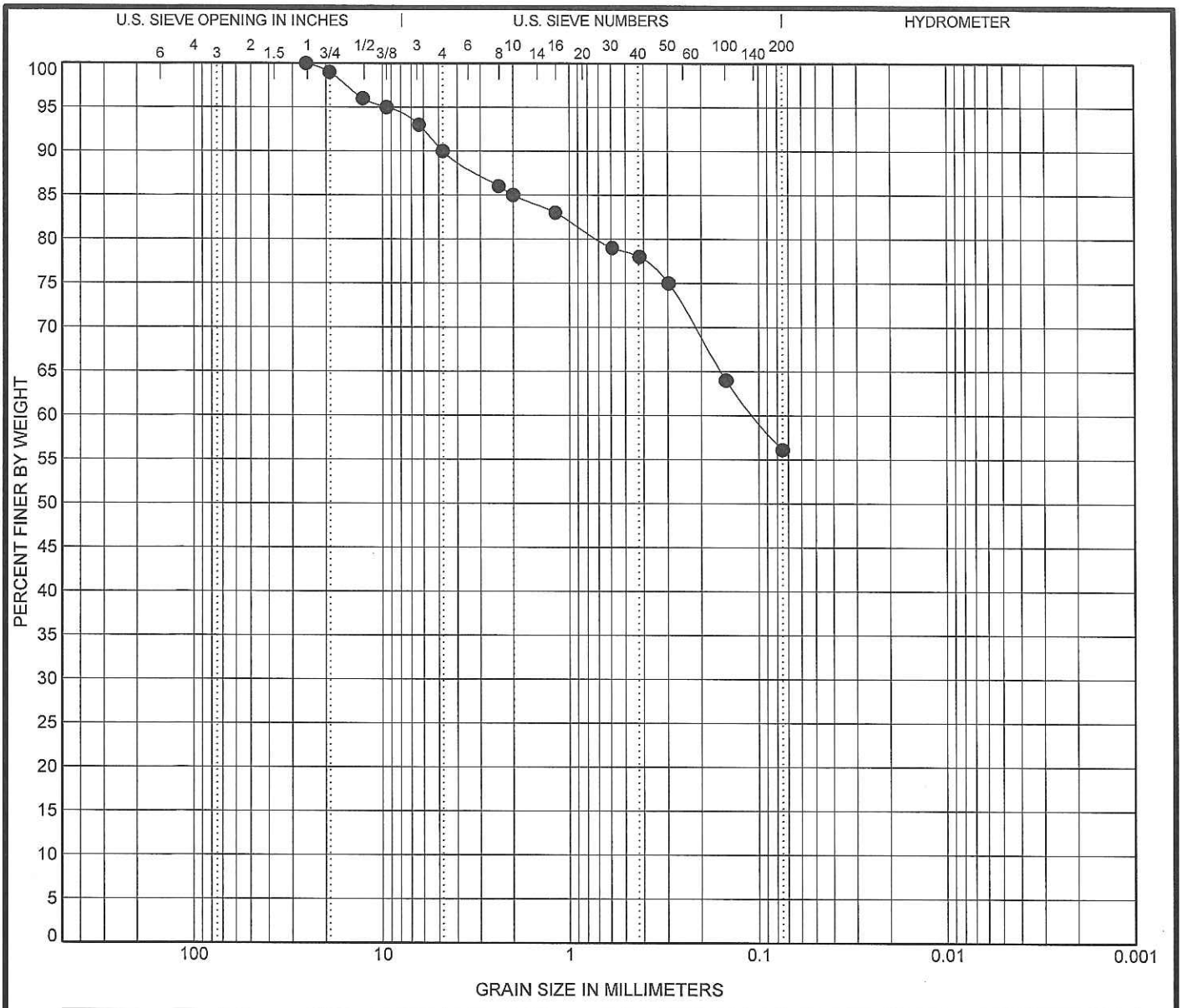
TC_GRAIN SIZE 63105043.GPJ TERRACON.GDT 9/22/10



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	B-6	0.0 ft	SANDY SILTY CLAY(CL-ML)	23	17	6		
⊠		ft						
▲		ft						
★		ft						
⊙		ft						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6	0.0 ft	25.4	0.105			10.0	33.9	56.1	
⊠		ft								
▲		ft								
★		ft								
⊙		ft								

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GRAIN SIZE DISTRIBUTION

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Site: S. of Tanque Verde Rd. & N. of Mullins Landfill Tucson, Arizona
Job #: 63105043
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TC GRAIN SIZE 63105043.GPJ TERRACON.GDT 9/22/10

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4685 South Ash Avenue, Suite H-4
Tempe, Arizona 85282
(480) 897-8200 FAX(480) 897-1133

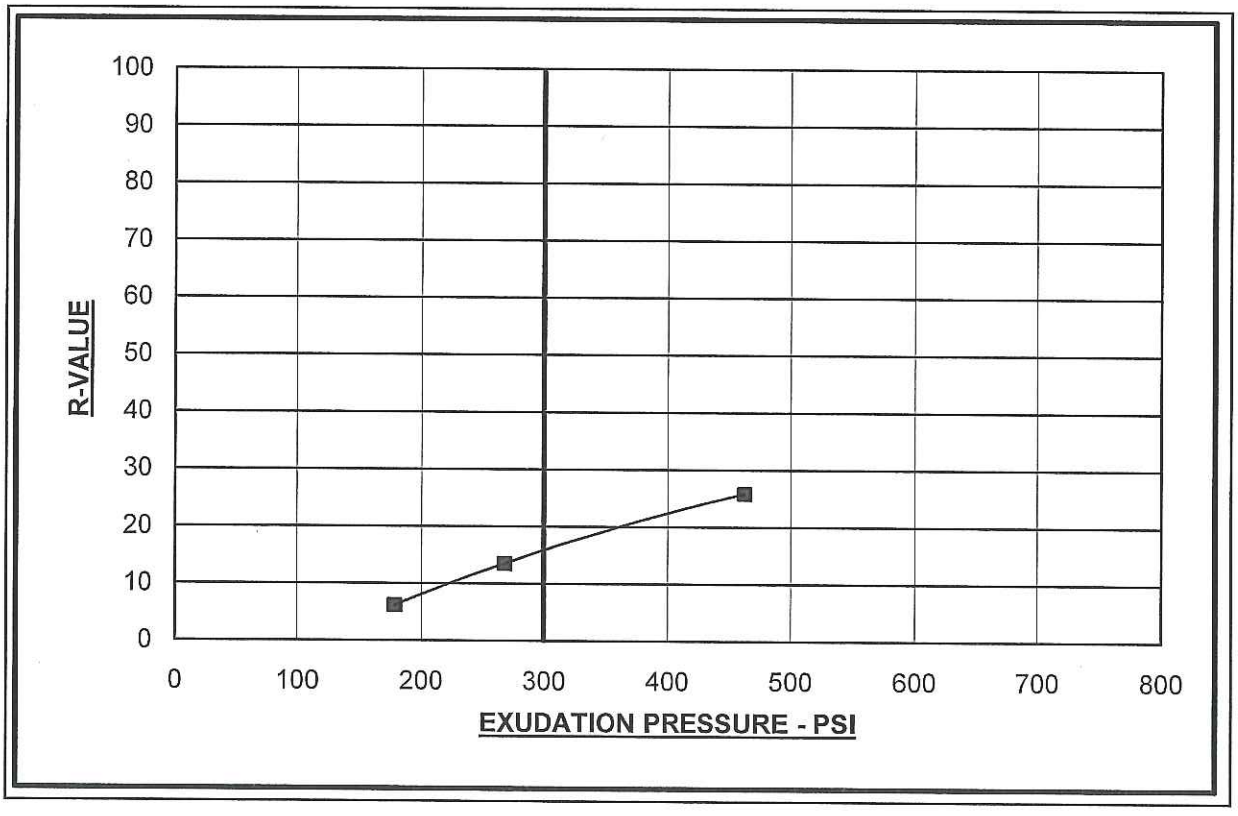
RESISTANCE R-VALUE & EXPANSION PRESSURE OF COMPACTED SOIL ASTM D2844

CLIENT:	0	**DATE OF TEST:**	03-Aug-10
PROJECT:	SABINA/KOLB		
LOCATION:	B-3 0-1		
TERRACON NO.	63105043	**CLASSIFICATION:**	NOT PERFORMED

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
COMPACTION PRESSURE (PSI)	70	130	200
DENSITY (PCF)	122.6	125.1	127.6
MOISTURE CONTENT (%)	12.7	11.8	10.2
EXPANSION PRESSURE (PSI)	-0.16	-0.12	0.03
HORIZONTAL PRESSURE @ 160 PSI	142	129	109
SAMPLE HEIGHT (INCHES)	2.45	2.50	2.50
EXUDATION PRESSURE (PSI)	178.2	267.7	463.0
CORRECTED R-VALUE	6.2	13.5	25.8
UNCORRECTED R-VALUE	6.2	13.5	25.8

R-VALUE @ 300 PSI EXUDATION PRESSURE = 16



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Tempe, Arizona 85282
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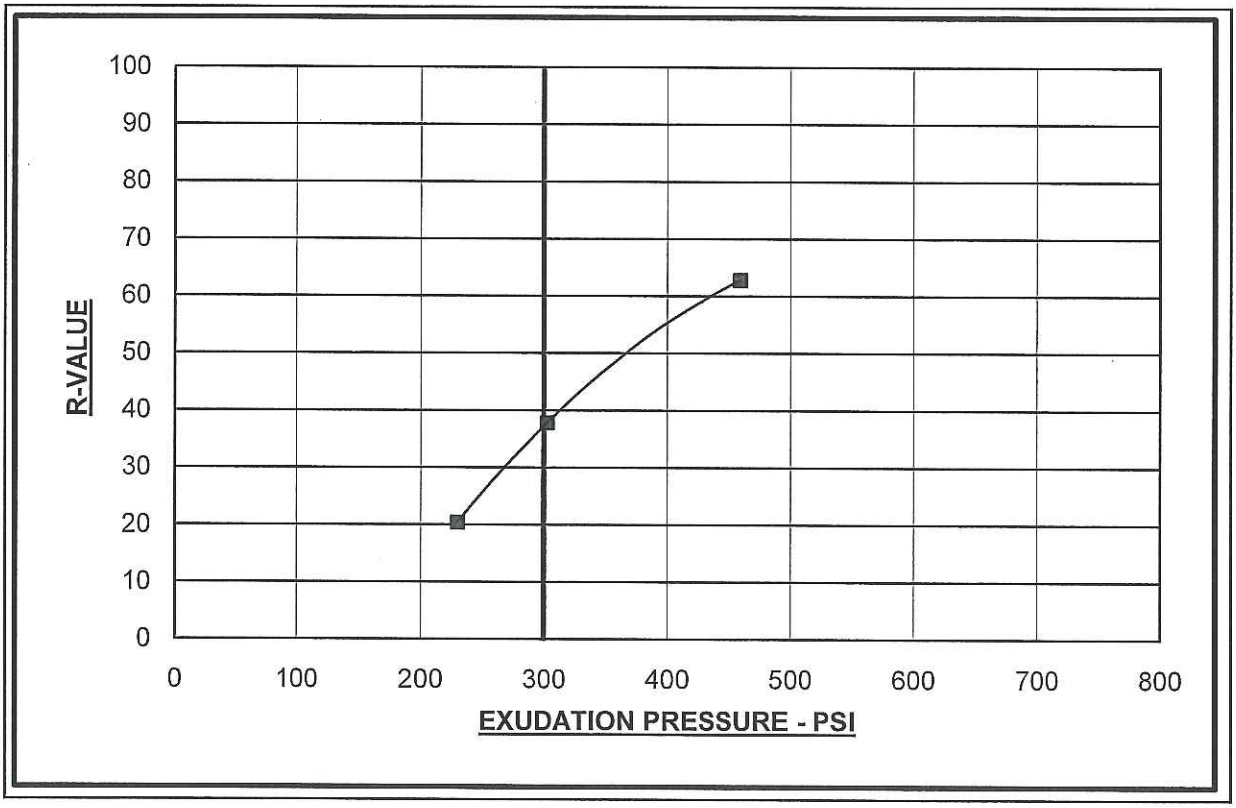
RESISTANCE R-VALUE & EXPANSION PRESSURE OF COMPACTED SOIL ASTM D2844

CLIENT:	0	**DATE OF TEST:**	03-Aug-10
PROJECT:	SABINA/KOLB		
LOCATION:	B-4 0-5		
TERRACON NO.	63105043	**CLASSIFICATION:**	NOT PERFORMED

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
COMPACTION PRESSURE (PSI)	180	250	300
DENSITY (PCF)	129.6	131.6	133.1
MOISTURE CONTENT (%)	9.0	8.1	7.8
EXPANSION PRESSURE (PSI)	-0.28	-0.16	-0.09
HORIZONTAL PRESSURE @ 160 PSI	116	82	43
SAMPLE HEIGHT (INCHES)	2.55	2.50	2.50
EXUDATION PRESSURE (PSI)	229.9	302.7	459.4
CORRECTED R-VALUE	20.4	37.8	62.8
UNCORRECTED R-VALUE	20.4	37.8	62.8

R-VALUE @ 300 PSI EXUDATION PRESSURE = 37



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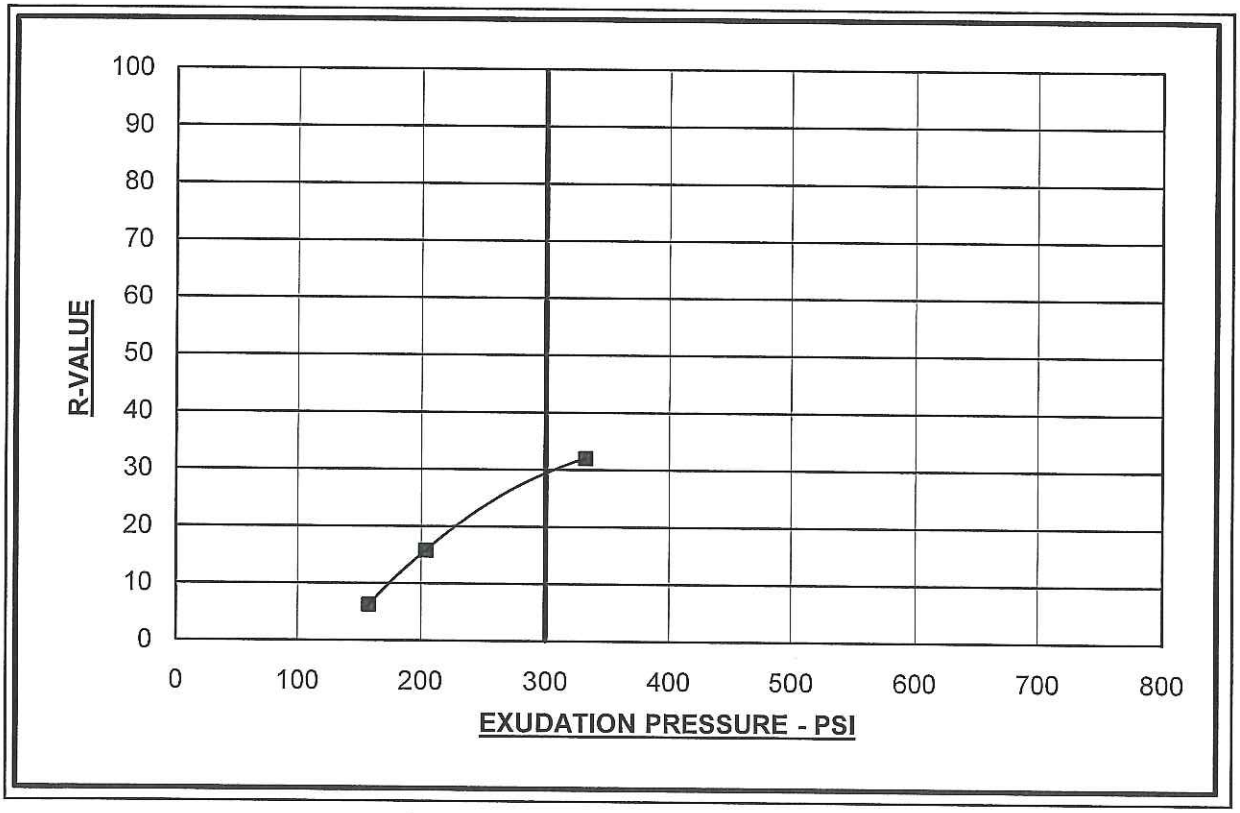
RESISTANCE R-VALUE & EXPANSION PRESSURE OF COMPACTED SOIL ASTM D2844

CLIENT:	0	**DATE OF TEST:**	04-Aug-10
PROJECT:	SABINA/KOLB		
LOCATION:	B-6 0-5		
TERRACON NO.	63105043	**CLASSIFICATION:**	NOT PERFORMED

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
COMPACTION PRESSURE (PSI)	100	210	270
DENSITY (PCF)	111.0	114.2	116.0
MOISTURE CONTENT (%)	15.2	14.0	12.8
EXPANSION PRESSURE (PSI)	-0.22	0.03	0.37
HORIZONTAL PRESSURE @ 160 PSI	140	112	81
SAMPLE HEIGHT (INCHES)	2.80	2.50	2.50
EXUDATION PRESSURE (PSI)	157.9	203.7	332.1
CORRECTED R-VALUE	6.3	15.8	32.0
UNCORRECTED R-VALUE	5.6	15.8	32.0

R-VALUE @ 300 PSI EXUDATION PRESSURE = 28



Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Moisture-Density Relationship			Organic Content	Specific Gravity	Porosity	R-Value	Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Max Dry Density (pcf)	Optimum Water Content (%)	Method					
						LL	PL	PI								
B-3	0	SC			29	27	10	17	124.0	9.5	D272				16	
B-4	0	SC			12	22	14	8	134.0	8.5	D272				37	
B-6	0	CL-ML			56	23	17	6	119.5	12.5	D272				28	

REMARKS

1. Dry Density determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.

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SUMMARY OF LABORATORY RESULTS

Project: Sabino Kolb Extension
Site: S. of Tanque Verde Rd. & N. of Mullins Landfill Tucson, Arizona
Job #: 63105043
Date: 9-22-10