

November 7, 2005

Mr. Virgil Clark  
UTAZ Development  
3850 E. Baseline Road, #128  
Mesa, Arizona 85206

Geotechnical Report  
Vacant Land Parcel  
SEC 164<sup>th</sup> Street & Riggs Road  
Gilbert, Arizona

Project No. A05-0100G



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Vacant Land Parcel  
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Gilbert, Arizona**

Dear Mr. Clark:

Submitted herewith is the report of the geotechnical investigation for the subject project. In brief, the report includes a plan of borings, boring logs, laboratory test results, and a description of subsurface conditions. Based on the findings, recommendations are set forth for the design and construction of foundations and pavement.

We appreciate this opportunity to be of service to you. If you have any questions regarding this report, please contact us.

Respectfully submitted,  
ACURA ENGINEERING ARIZONA, LLC

  
Prabhakar (Peter) Rupal, P.E.  
President



Enclosure  
Copies submitted: 4

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## **PURPOSE AND SCOPE**

This report presents the results of a geotechnical engineering study conducted on a vacant land parcel at the southeast corner of 164<sup>th</sup> Street and Riggs Road in Gilbert, Arizona. The study was conducted for the purpose of developing foundation recommendations for design and construction.

Our field exploration program consisted of exploratory borings drilled to obtain information on subsurface conditions. The locations of the borings are shown on the Site Plan included in Appendix A. Samples were tested to determine physical and engineering characteristics. Results of the field exploration and laboratory tests were analyzed to develop earthwork and foundation design recommendations for the project, and to determine appropriate bearing pressures for foundations supporting the new structure. Our results and recommendations are presented herein.

This report has been prepared to summarize the data obtained during this study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to construction are included in the report.

## **PROPOSED CONSTRUCTION**

While specific details such as building footprints are not known, development of the approximate 12-acre site is to consist of the construction of office condominiums. The structures are presumably single story with masonry and/or wood frame walls and conventional slab-on-grade. Structural loads are anticipated to be light to moderately heavy. Settlement tolerances are not known at this time. Paved areas will support a moderate volume of typical passenger traffic and occasional heavy truck (such as delivery and refuse) traffic.

If locations or conditions are significantly different from those described, or as depicted in this report, we should be notified so that we may re-evaluate the recommendations provided herein.

## **SITE DESCRIPTION**

At the time of this investigation the site was a vacant, undeveloped parcel of land with typical desert-type vegetation. Several washes cross the site trending in a southeast–northwest direction. Of note was a swale-like feature just south of B-4 that appeared to extend from 164<sup>th</sup> Street eastward for several hundred feet. Gopher and other animal holes frequent the site. The site is bounded on the north by Riggs Road, on the south and east by contiguous vacant desert, and on the west by an orchard. There was no evidence of the presence of former structures on the site. If available, the Phase 1 Environmental Site Assessment may also be reviewed for additional site information.

## **FIELD EXPLORATION**

Five widely spaced exploratory borings were drilled at the locations shown on the Site Plan included in Appendix A to explore the subsurface conditions. Locations of the exploratory borings were established by standard taping and/or pacing techniques. The drill crew advanced the borings through the on-site soils with a CME-75, truck-mounted drill rig using a 7-inch diameter hollow stem auger. Our field technician logged the borings and obtained samples for laboratory analysis. The exploratory borings were backfilled with auger cuttings upon completion of all drilling activities.

Samples of the subsurface materials were obtained with either a 2.0-inch standard split spoon sampler or a 2.42-inch inside diameter, ring-lined barrel sampler in general accordance with ASTM Method D1586, Split-Barrel Sampling. The samplers were driven into the various strata using a 140-pound hammer falling 30 inches. The number of blows required to advance each respective sampler was recorded as the penetration resistance (SPT or N) value. Penetration resistance values provide an indication of the relative density of granular soils or consistency of fine-grained soils. Depths at which the samples were obtained and the penetration resistance values are shown on the attached exploratory boring logs.

## **SUBSURFACE PROFILE AND ENGINEERING PROPERTIES**

### **Subsurface Profile**

The subsurface profile consists mainly of interbedded sandy clays and clayey sands with subordinate amounts of gravel and calcareous cementing. Discontinuous units of silty sand were noted. The borings terminated within this stratigraphic unit at depths of about 11 to 21 feet below grade. Standard penetration resistance (N) values ranged from 25 to 50+ blows per foot. The subsoils sampled are described as being 'damp' based on visual and tactile evaluation at the time of investigation. Groundwater was not encountered in the test borings during the investigation.

The boring logs should be referenced for complete soil descriptions and classifications, interpolated thickness of the strata, and penetration resistance (N) values.

### **Laboratory Test Results**

Samples of soil obtained during the field exploration were observed and visually classified in accordance with ASTM D2487, which is based on the Unified Soil Classification System. Samples were selected for testing to determine the engineering and physical properties in general accordance with ASTM or other generally recognized procedures. Results of all laboratory tests are presented in Appendix B.

To summarize, in-place dry density within the upper 5 feet ranges from 102 to 114 pcf at natural water contents of about 2 to 6 percent at the time of investigation. Liquid limits of the upper soils tested range from 17 to 22 percent. Plasticity indices range from 2 to 9 percent. An undisturbed sample of the upper soils displayed additional compression due to inundation under typical foundation loading conditions. A sample of the silty sand soils, remolded to density and moisture levels typically expected during construction, displayed volume increase of less than 1 percent due to wetting under a 100 psf surcharge load.

## **ENGINEERING ANALYSIS AND RECOMMENDATIONS**

### **Analysis**

Analysis of the field and laboratory data indicates that subsoils at the site are suitable for support of the proposed structure on shallow spread foundations and for slab-on-grade construction subject to remedial earthwork.

The site may be located within an area that has undergone considerable subsidence due to groundwater removal. Total subsidence of several feet has been recorded in the valley. In addition, earth fissuring has affected off-site areas within one or more miles from the site. Recent investigations have indicated that the rate of subsidence is decreasing due to reduced groundwater withdrawal as a result of urbanization and subsequent lowered agricultural demand for groundwater. In general, fissure gullies tend to form over subsurface irregularities such as soil-rock contacts that cause tensional stresses and differential subsidence. While there was no obvious evidence of fissure gullies on this site or reported in the immediate area, an anomaly was observed, namely the east-west trending swale-like feature.

It is recommended that additional study of the site be conducted to verify the presence or lack thereof, of earth fissure activity on the site.

Laboratory testing appears to indicate that the upper soils are susceptible to additional compression due to inundation. The upper soils also appear to be somewhat vesicular. Accordingly, recommendations are made to over-excavate and re-compact the bearing soils to increase density and reduce the potential for collapse. Attention must be paid to provide proper drainage to limit the potential for water infiltration of deeper soils.

The swell potential of the fine portion of the upper clayey soils is a concern. While the results of laboratory testing indicate a relatively low degree of swell, other projects in the immediate vicinity have exhibited similar soil variability and higher degrees of volume increase due to wetting. The potential is

usually strong enough to cause differential movements of slabs-on-grade such as floors and sidewalks but not enough to cause damage to structures. Accordingly, attention must be paid to provide proper drainage to limit the potential for water infiltrating under slabs. A minimum slope of at least 5 percent for a distance of 10 feet is recommended for unpaved landscaped areas. Typical recommendations to reduce the swell potential include reducing the compaction requirements and requiring higher moisture contents during pad preparation and/or requiring at least one foot of non-expansive material to be placed directly beneath the building slabs and slabs contiguous to the structure such as sidewalks. It may be possible to locate low plastic, low to non-expansive soils on the site for use in this regard.

A less desirable method would be to reduce the compaction requirements and require higher moisture contents during pad preparation. In order for this method to be successful, it will require close control on placement of fills, maintaining the higher moisture and preventing construction traffic from densifying the pad.

For exterior slabs on grade, frequent jointing is recommended to control cracking and reduce tripping hazards should differential movement occur. It is also recommended to pin the landing slab to the building floor/stem wall. This will reduce the potential for the exterior slab lifting and blocking the operation of outswinging doors. Pinning typically consists of 24 inch long No. 4 reinforcing steel dowels placed at 12 inch centers.

Excavation operations are expected to be relatively problem-free. Very dense and/or cemented soils may impede excavation progress. Sloughing may occur in fills (compacted and uncompacted), sandy or loose deposits, requiring the laying back of side slopes. The contractor should make his own independent assessment in regard to excavation methods. All excavations should be constructed in accordance with relevant governmental regulations including but not limited to OSHA. Maintenance of safe trenches is solely the responsibility of the contractor.

Groundwater is not expected to be a factor in the design and construction of foundations and underground utilities to the depths anticipated.

### **Foundation Recommendations**

We determined a foundation depth and bearing pressure for the design of footings that should provide against bearing failure and excessive settlement. We estimate the total settlement for the shallow footings on engineered fill will be less than 1 inch for the conditions presented below. We estimate differential settlement will be about half the total settlement. Additional localized settlements of the same magnitude or more could occur if supporting soils were to experience a significant increase in moisture content. Positive drainage away from structures, and controlled routing of roof runoff, must be provided to prevent ponding adjacent to foundations.

It is recommended that the structure be founded on shallow spread footings bearing a minimum depth of 18 inches below lowest finished exterior grade within 5 feet of the structure, on at least 2 feet of engineered fill. If site preparation is carried out as set forth herein, an allowable bearing pressure of 2,500 psf may be utilized for design purposes.

This bearing pressure refers to the total of all loads, dead and live, and is a net pressure. It may be increased one-third for wind, seismic or other loads of short duration. All footing excavations should be level and cleaned of all loose or disturbed materials. Positive drainage away from the proposed building **must** be maintained at all times.

Retaining walls adjacent stormwater retention basins should be designed based on an allowable bearing pressure of 1,500 psf. The footings should be situated at least 18 inches below lowest finished grade within 5 feet of the footing bearing on dense, native, undisturbed soil. It will be especially important to remove all loose material from the foundation excavation to reduce the potential for settlement.

Although borings were not advanced to 100 feet, Soil Profile Type  $S_c$ , (per Table 16-J, 1997 UBC) or Soil Site Class C (per Table 1615.1.1, 2000 IBC) may be used for design of the structure based on the nature of the subsoils encountered in the borings and geology in the area.

Continuous wall footings and isolated rectangular footings should be designed with minimum widths of 16 and 24 inches, respectively, regardless of the resultant bearing pressure. Lightly loaded interior partitions (less than 800 pounds per linear foot) may be supported on reinforced thickened slab sections (minimum 12 inches of bearing width).

Continuous masonry wall footings and stem walls should be reinforced to distribute stresses arising from small differential movements, and long walls should be provided with control joints to accommodate these movements. Reinforcement and frequent control joints are suggested to allow slight movement and prevent minor floor slab cracking especially in floor areas to be covered with hard tile.

### **Lateral Design Parameters**

The following tabulation presents recommendations for lateral stability analyses:

<sup>1</sup> Foundation Toe Pressures	1.33 x max. allowable
<sup>2</sup> Equivalent Fluid Pressures (Drained Condition): Restrained walls	60 psf/ft

Unrestrained walls	35 psf/ft
Lateral Passive Pressures:	
Continuous walls/footings	350 psf/ft
Spread columns/footings	400 psf/ft
Coefficient of Base Friction:	
Independent of passive resistance	0.45
In conjunction with passive resistance	0.35

<sup>1</sup>Increase in allowable foundation bearing pressure previously tabulated for foundation toe pressures due to eccentric or lateral loading. The entire bearing surface of the footing should remain in compression.

<sup>2</sup>Equivalent fluid pressures for vertical walls and horizontal backfill surfaces (maximum 10 feet in height). Backfill material must be well-graded, free-draining gravel with less than 8 percent passing the No. 200 sieve. Pressures do not include temporary forces imposed during compaction of the backfill, swelling pressures developed by over-compacted clayey backfill, hydrostatic pressures from inundation of backfill, or surcharge loads. Walls should be suitably braced during backfilling to prevent damage and excessive deflection.

Compaction of the backfill soils against embedded footings or walls designed to provide passive resistance should be accomplished to a minimum of 95 percent of the material's maximum dry density (ASTM D-698) to develop this resistance with low strains.

## **SITE PREPARATION AND GRADING**

### **Site Preparation**

The entire area to be occupied by the proposed construction should be stripped of all vegetation, rubble, surficial fill, fill piles, obviously loose surface soils, and any other undesirable materials or conditions not revealed by this investigation. A representative of the geotechnical engineer should examine the subgrade once sub-excavation is complete and prior to backfilling to ensure removal of deleterious materials.

Special attention must be paid to areas where depressions from natural stream channels (washes) appear to trend. In areas where loose channel fills occur, the loose material should be removed, generally to a depth of 1 to 2 feet, be re-placed and compacted.

Subsoils directly beneath shallow foundation elements should be over-excavated to a depth of at least 2 feet below proposed footing bottom elevation, or existing grade, whichever results in the deeper, extending at least 5 feet beyond footing edges and compacted as set forth herein. The entire building pad does not require deep over-excavation provided that footing lines can be accurately located during

earthwork operations and that final grades allow for at least 12 inches of non-expansive material directly beneath the building slab and slabs contiguous to the structure, in addition to the typical 4 inches of aggregate base course.

Prior to the placement of structural fill below footing bottom elevation, the exposed grade should first be scarified to a depth of 8 inches, moisture- conditioned to optimum ( $\pm 2$  percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698. Asphalt pavement areas should be scarified, moisture conditioned and recompacted in a similar manner.

All cut areas and areas above footing bottom elevation that are to receive only floor slab fill should be scarified 8 inches, moisture-conditioned to at least optimum to 2 percent above optimum, and uniformly compacted to 92 to 95 percent of maximum dry density as determined by ASTM D-698.

### **Fill and Backfill**

Native soils are considered suitable for use in general grading fills and as engineered fill but should **not** be used in the top foot of pad fill or as wall backfill without prior approval as a low to non-expansive soil.

The top foot should be completed with an approved low or non-expansive soil. The upper 12 inches of pad fill should consist of approved imported common borrow or select granular soil. If select granular is used, the 4 inches of under slab aggregate base may be included as part of the 12 inches. Otherwise, a full 12 inches of common borrow should be used in addition to the normal 4 inches of aggregate base.

As a less desirable but cost savings measure, the native soils may be used in the top 12 inches of the building pad provided that compaction is limited and the moisture content maintained at a high level as indicated below prior to placing the slabs on grade. The risk for slab movement is increased if the subgrade soils experience a significant moisture increase after the slab is cast. In order for this method to be successful, it will require close control on placement of fills, maintaining the higher moisture and preventing construction traffic from densifying the pad. This option should only be used with the approval of the owner.

Retaining walls should be backfilled with a well-graded granular material with no particles greater than 3 inches in size and not less than 8 percent passing the No. 200 sieve. If retaining walls are anticipated, this office should be consulted for additional details.

If import material is required to achieve the desired finished ground surface elevations, it should consist of non-expansive, imported fill free of organics and deleterious material, meeting all of the following specification requirements:

Maximum particle size	3 inches
Maximum percent passing #200 sieve	50
Maximum plasticity index (PI)	10
Maximum liquid limit (LL)	30
Maximum swell (under 100 psf surcharge)	1.5 percent

Fill should be placed on subgrade that has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve moisture content within 2 percent of optimum moisture (optimum to +2 percent underslab fill). Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to the percent of its maximum dry density per ASTM D-698 set forth as follows:

A.	Building Areas	
1.	Below footing level	95
2.	Below slabs-on-grade, non-expansive soils	95
3.	Below slabs-on-grade, clayey soils,	92-95 (max)
4.	Exterior foundation wall backfill	95
B.	Pavement Subgrade or Fill	95
C.	Utility Trench Backfill	
1.	More than 2.0 feet below finish subgrade	95
2.	Within 2.0 feet of finish subgrade (non-granular)	95
3.	Within 2.0 feet of finish subgrade (granular)	100
D.	Aggregate Base Course	
1.	Below floor slabs	95
2.	Below asphalt paving	100
E.	Landscape Areas	
1.	Miscellaneous fill	90
2.	Utility trench - more than 1.0 foot below finish grade	85
3.	Utility trench - within 1.0 foot of finish grade	90

### Surface Drainage

The ground surface adjacent to the exterior foundations should be sloped to drain away from the foundation in all directions. We recommend a minimum slope of 6 inches in the first 10 feet in landscaped areas, and 3 inches in the first 10 feet in paved areas. Planters requiring heavy watering

should not be placed adjacent to or within 5 feet of the structure. Hardscape adjacent the structure can be useful in promoting runoff and minimizing infiltration of water.

Roof downspouts and drains should discharge well beyond the limits of all foundation backfill. Care should be taken in design and construction to insure that domestic and interior storm drain water is contained to prevent seepage.

In the case of retaining walls adjacent retention basins, it is recommended that the basins sides be sloped so that water does not sit immediately against the wall for long periods of time.

### **UTILITY INSTALLATION**

All trench excavations should be constructed in accordance with relevant governmental regulations including but not limited to OSHA. Maintenance of safe trenches is solely the responsibility of the contractor. Sloughing may occur in fills (uncompacted and compacted), sandy or loose deposits, requiring the laying back of side slopes. The contractor should make his own independent assessment in regard to excavation methods.

Backfill of utility trenches outside of the pipe bedding zone may be carried out with native excavated material provided particles in excess of 3 inches are first removed. This material should be moisture-conditioned, placed in 8-inch lifts and mechanically compacted. Compaction requirements are summarized in the "Fill and Backfill" section of this report.

### **FLOOR SLAB CONSTRUCTION**

To facilitate fine grading operations and aid in concrete curing, a 4-inch thick layer of granular material conforming to the gradation for Aggregate Base (AB) as per M.A.G. Specification Section 702 should be utilized beneath the slab.

To reduce the effects of some differential movement, floor slabs should be separated from all bearing walls and columns with expansion joints, which allow unrestrained vertical movement. The joints should be sealed. Floor slab control joints should be used to reduce damage due to shrinkage cracking. Joints should be spaced in accordance with ACI guidelines. The joints should be sealed. The requirements for slab reinforcement and thickness should be established by the designer based on experience and the intended use of the slabs.

If moisture sensitive flooring and/or adhesive are planned, the use of a vapor barrier or low permeability concrete should be considered. Vapor barriers do increase the potential for slab curling and water entrapment under the slab. Accordingly, if a vapor barrier is used, additional precautions such as low

slump concrete, frequent jointing and proper curing will be required and detailed to reduce curling potential and prevent the entrapment of outside water sources. Placement of moisture sensitive materials should be delayed until concrete floor slabs have dried to a very low moisture condition that is verified by testing.

## **PAVEMENT DESIGN**

The primary purpose of a pavement section is the distribution of concentrated wheel loads to the subgrade in a manner such that the subgrade is not over-stressed. Performance of the pavement section is directly related to the strength of the subgrade soils, and the characteristics of the traffic loading. For purposes of designing a pavement section, subgrade soils are represented by a soil support value for flexible pavements (asphalt concrete) or by a modulus of subgrade reaction value for rigid pavements (Portland cement concrete). Both of these representative values are empirically related to strength.

Pavement design procedures are based upon strength properties of the subgrade soils and pavement materials, along with the design traffic conditions (especially truck traffic). Subgrade strength decreases when the subgrade is wetted, and is further reduced when saturated. Therefore, proper drainage, both surface and subsurface, is essential for adequate pavement performance on such a subgrade.

We analyzed pavement requirements for anticipated uses within the parking lots and driveways. We anticipate that traffic will consist of cars, pickups, and occasional delivery trucks.

### **Recommended Pavement Sections**

If earthwork in paved areas is carried out to finish subgrade elevation as set forth herein, the subgrade will provide adequate support for pavements.

For lot pavement areas to be used primarily for automobile traffic and parking, our experience in the area indicates that a minimum of 2.0 inches of asphalt over 5.0 inches of aggregate base course will provide satisfactory service. Heavy duty areas subject to occasional truck traffic (such as delivery and refuse trucks) should be 3.0 inches of asphalt over 7.0 inches of base. We recommend a rigid section made up of 6.5 inches of concrete (PCCP) on 4 inches of aggregate base for dumpster pads and their approaches.

This assumes that all subgrades are prepared in accordance with the recommendations contained in the "Site Preparation" and "Fill and Backfill" sections of this report, and paving operations carried out in

a proper manner. If pavement subgrade preparation is not carried out immediately prior to paving, the entire area should be proof-rolled at that time with a heavy pneumatic-tired roller to identify locally unstable areas for repair.

### **Asphalt Pavement**

Pavement materials should be in accordance with the requirements of the Maricopa Association of Governments Standard Specifications for Asphalt Concrete (Section 710, MAG Type C-¾ inch or 19 mm). While a ¾ inch (19.0mm) mix may have a somewhat rougher texture, it offers more stability and resistance to scuffing, particularly in truck turning areas. Pavement installation should be carried out under applicable portions of M.A.G. Section 321 and municipality standards. The asphalt supplier should be informed of the pavement use and required to provide a mix that will provide stability and be aesthetically acceptable. Some of the newer M.A.G. mixes are very coarse and could cause placing and finish problems. A mix design should be submitted for review to determine if it will be acceptable for the intended use.

### **Portland Cement Concrete Pavement**

Pavement materials should be in accordance with the requirements of the Maricopa Association of Governments Standard Specifications for Portland Cement Concrete (Section 725, MAG Class AA). Placement requirements for rigid paving should be in general conformance with the Arizona Department of Transportation Standard Specifications for Portland Cement Concrete Pavement (Section 401).

### **Base Course**

Base course materials for use beneath interior floor slabs and pavements should be well-graded sand and gravel materials meeting the Maricopa Association of Governments Specifications for Aggregate Base Materials (Section 702, MAG AB).

## **CONTINUING SERVICE**

Two additional elements of geotechnical engineering service are important to the successful completion of this project.

*Consultation with design professionals during the design phases.* This is important to ensure that the intentions of our recommendations are properly incorporated in the design, and that any changes in the design concept properly consider geotechnical aspects.

*Observation and monitoring during construction.* A geotechnical engineer or technician from our firm should observe the excavation, earthwork, and foundation phases of the work to determine that subsurface conditions are compatible with those used in the analysis and design. During site grading, placement of structural fill should be observed and tested to confirm that the proper density has been achieved.

## **BUILDING MAINTENANCE**

It is extremely critical that proper maintenance be performed over the life of the structure. It is very important that positive site drainage be maintained to ensure overall performance of the foundation and floor systems as presented herein. The owner must be provided with a copy of this report.

Maintaining positive site drainage will require periodic maintenance to ensure roof gutters and roof downspouts are properly maintained and properly discharged away from the foundation in all directions. All landscaping or surface re-grading must take into consideration the positive drainage recommendations presented herein. Changing the surface drainage could have a negative impact on surface flow and create a source of water and the development of perched water conditions.

## **LIMITATIONS**

This study has been conducted in accordance with generally accepted geotechnical engineering practices in this area for use by the client for design purposes. The conclusions and recommendations submitted in this report are based upon the design data submitted to Acura Engineering, data obtained from the exploratory borings drilled at the location indicated on the Site Plan included in Appendix A, and the proposed construction discussed in this report. No other warranty, expressed or implied, is made as to the professional advice set forth.

Acura's scope of work does not include the investigation, detection, or design related to the presence of any biological pollutants. The term 'biological pollutants' includes, but is not limited to mold, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms. The scope of this investigation and report does not include regional considerations such as seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, nor any considerations of hazardous releases or toxic contamination of any type.

The nature and extent of subsurface variations across the site may not become evident until construction. During construction, if fill, soil, rock or water conditions appear to be different from those described herein, this office should be advised at once so that we may re-evaluate the recommendations made.

This report has been prepared for the exclusive use by our client for design purposes. We are not responsible for technical interpretations by others of our exploratory information that has not been described or documented in this report. This report should not be used by the contractor as the sole tool for bidding quantities or establishing construction/excavation methods. The contractor should make his own independent assessment in these regards. As the project evolves, we should provide continued consultation and field services during construction to review and monitor the implementation of our recommendations, and to verify that the recommendations have been appropriately interpreted. Significant design changes may require additional analysis or modifications of the recommendations presented herein. We recommend on-site observation of excavations and foundation bearing strata and testing of structural fill by a representative of the geotechnical engineer.

**Appendix A**  
**Field Results**



5235 South 39<sup>th</sup> Street  
Phoenix, Arizona

Project No.: A05-0100G

Name & Location:  
Vacant Land Parcel  
SEC164<sup>th</sup> Street & Riggs Road  
Gilbert, AZ













○ Approximate Boring  
Location

Source: Maricopa County, AZ  
Assessors Web Site







# LEGEND AND NOTES


## SOIL TYPE

	GW, Well-Graded Gravel		SW, Well-Graded Sand		ML, Silt
	GP, Poorly-Graded Gravel		SP, Poorly-Graded Sand		CL, Lean Clay
	GM, Silty Gravel		SM, Silty Sand		CH, Fat Clay
	GC, Clayey Gravel		SC, Clayey Sand		Fill, Unclassified

## SAMPLER TYPES

	Split-Spoon		Modified Dames and Moore
	Auger		Shelby Tube

## GROUNDWATER

	Groundwater Level
---	-------------------

## SOIL GRAIN SIZE U.S. STANDARD SIEVE

	6"	3"	3/4"	4	10	40	200		
BOULDERS	COBBLES		GRAVEL		SAND			SILT	CLAY
			COURSE	FINE	COURSE	MEDIUM	FINE		
	152	76.2	19.1	4.76	2.00	0.420	0.074		0.002
SOIL GRAIN SIZE IN MILLIMETERS									

## STRENGTH OF COHESIVE SOILS

CONSISTENCY	NUMBER OF BLOWS PER FT., N	UNDRAINED SHEAR STRENGTH Kips Per Sq. Ft.
Very Soft	0 - 2	Less Than 0.25
Soft	3 - 4	0.25 to 0.50
Firm	5 - 8	0.50 to 1.00
Stiff	9 - 15	1.00 to 2.00
Very Stiff	16 - 30	2.00 to 4.00
Hard	Over 30	Greater Than 4.00

## DENSITY OF NON-COHESIVE SOILS

NUMBER OF BLOWS PER FT., N	RELATIVE DENSITY
0 - 4	Very Loose
4 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
Over 50	Very Dense

## Criteria for Describing Moisture Condition

Description	Criteria
Damp	Dusty, dry to the touch
Moist	Damp but no visible of water
Wet	Visible free water, usually soil is below water table

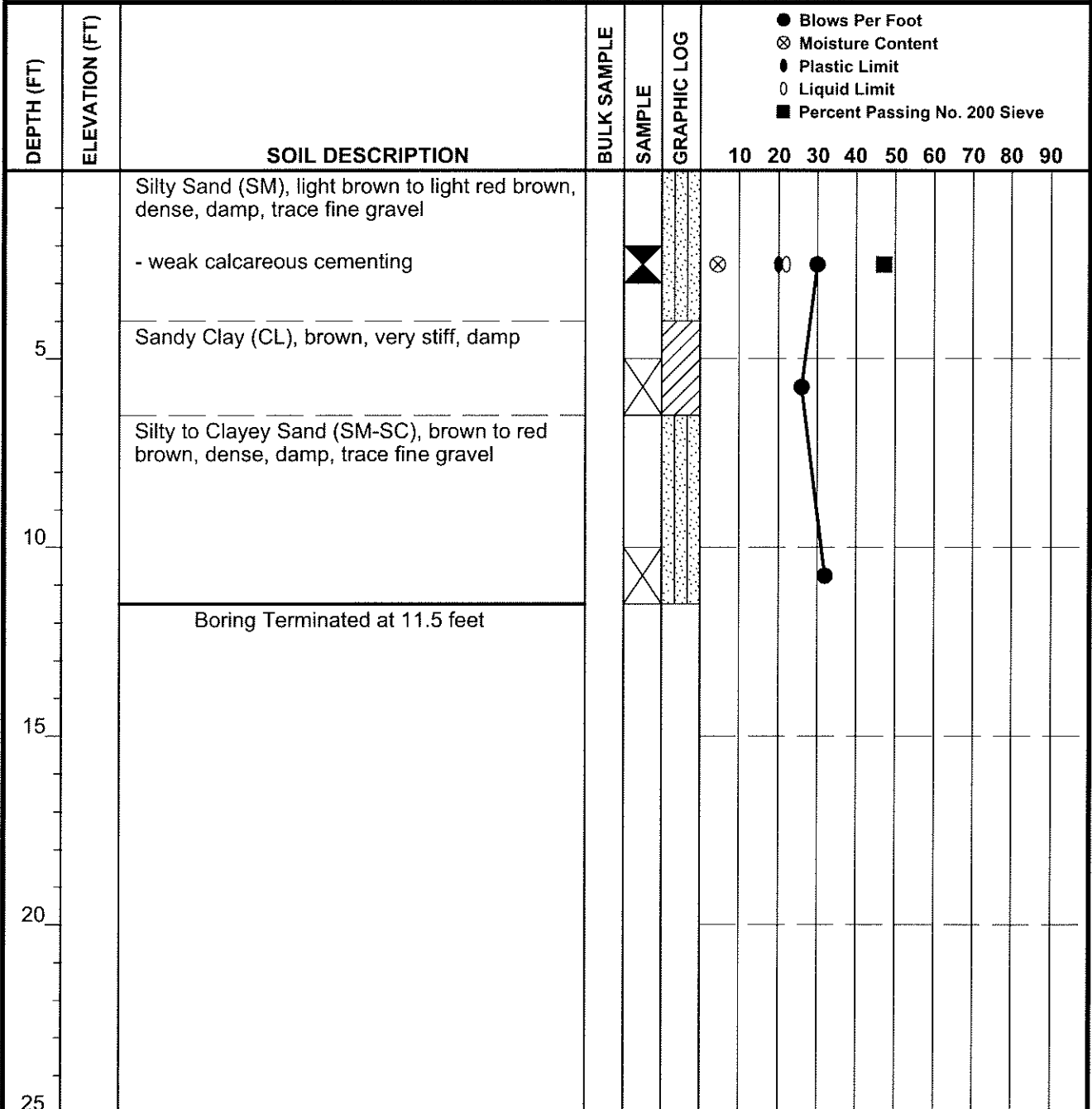
## ASTM D 2488 Note 16 Criteria for Describing Percentages of Gravel, Sand and Fines

Description	Criteria
Trace	Particles are present but estimated to be less than 5 %
Few	5 to 10 %
Little	15 to 25 %
Some	30 to 45 %
Mostly	50 to 100 %

# Exploratory Boring Log

Boring No. B-1  
Sheet 1 of 1

Logged By: J. Householder	Project No.: A05-0100G
Driller: FC LP	Project Name: Vacant Land Parcel
Auger/Core Type: Hollow Stem Auger	
Approximate Elevation (ft): Not Available	Location: SEC 164th St & Riggs Rd Gilbert, AZ
Total Boring Depth (ft): 11.5	
Special Requirements: None	Date Started: 9/23/2005 Date Completed: 9/23/2005
	Depth to Groundwater (ft): No Water



Lithology lines represent approximate boundaries between soil and rock layers; in-situ, the transition may be gradual. The Exploratory Boring Log should not be used separately from the interpretations and recommendations presented in the report.

# Exploratory Boring Log

Boring No. B-2  
Sheet 1 of 1

Logged By: J. Householder	Project No.: A05-0100G
Driller: FC LP	Project Name: Vacant Land Parcel
Auger/Core Type: Hollow Stem Auger	
Approximate Elevation (ft): Not Available	Location: SEC 164th St & Riggs Rd Gilbert, AZ
Total Boring Depth (ft): 11.5	
Special Requirements: None	Date Started: 9/23/2005 Date Completed: 9/23/2005
	Depth to Groundwater (ft): No Water

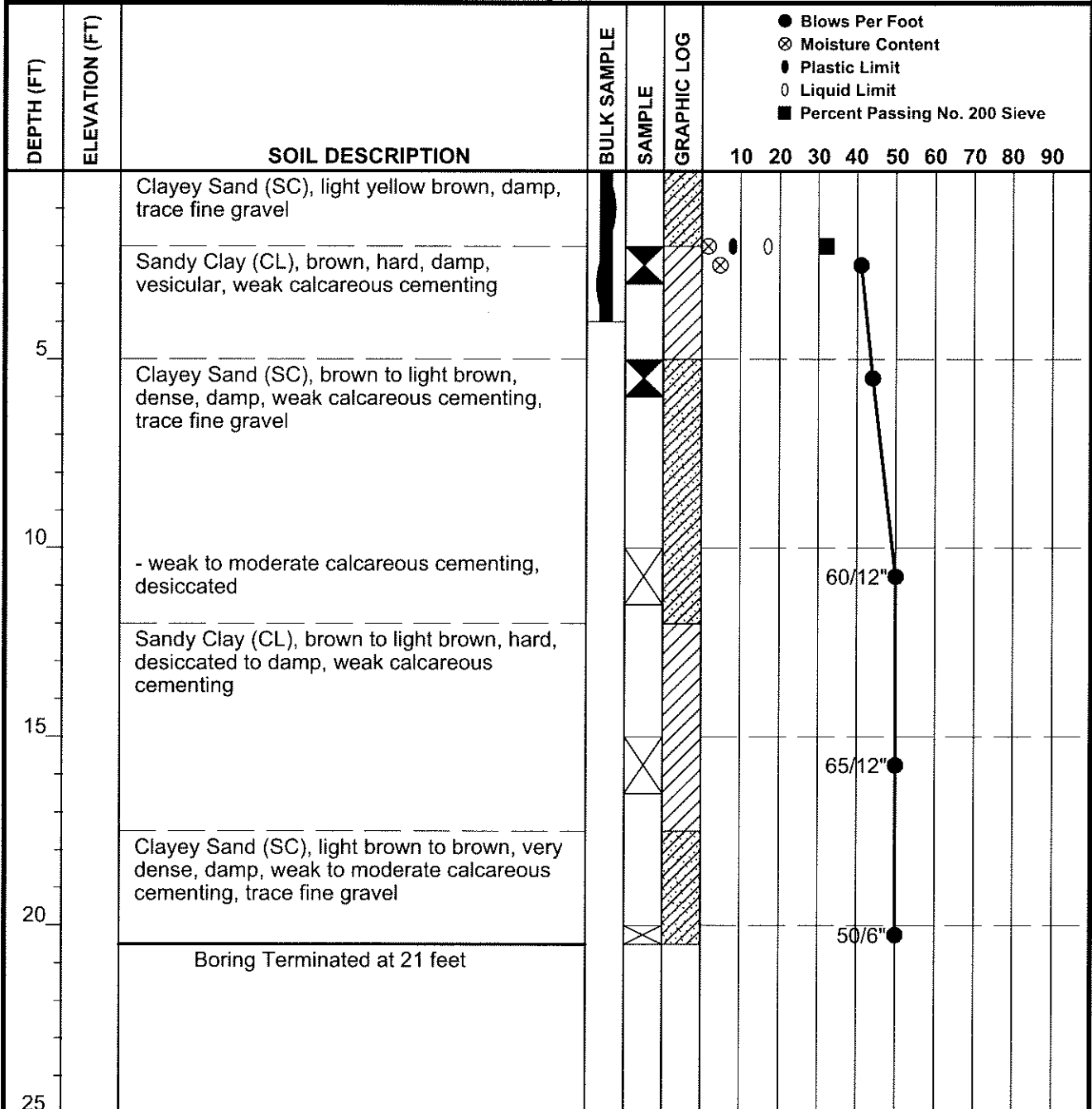
DEPTH (FT)	ELEVATION (FT)	SOIL DESCRIPTION	BULK SAMPLE	SAMPLE GRAPHIC LOG	<ul style="list-style-type: none"> <li>● Blows Per Foot</li> <li>⊗ Moisture Content</li> <li>● Plastic Limit</li> <li>○ Liquid Limit</li> <li>■ Percent Passing No. 200 Sieve</li> </ul>															
					10	20	30	40	50	60	70	80	90							
		Clayey Sand (SC), light brown to light red brown, damp, trace fine gravel																		
5		Sandy Clay (CL), brown to mottled brown and white, very stiff to hard, damp, weak calcareous cementing, trace fine gravel	▲	⊗					●											
			⊗	●					54/12"											
10		Clayey Sand (SC), light brown to brown, very dense, damp, moderate to strong calcareous cementing, trace to few fine to coarse gravel	⊗	●					68/12"											
		Boring Terminated at 11.5 feet																		
15																				
20																				
25																				

Lithology lines represent approximate boundaries between soil and rock layers; in-situ, the transition may be gradual. The Exploratory Boring Log should not be used separately from the interpretations and recommendations presented in the report.

# Exploratory Boring Log

Boring No. B-3  
Sheet 1 of 1

Logged By: J. Householder	Project No.: A05-0100G
Driller: FC LP	Project Name: Vacant Land Parcel
Auger/Core Type: Hollow Stem Auger	
Approximate Elevation (ft): Not Available	Location: SEC 164th St & Riggs Rd Gilbert, AZ
Total Boring Depth (ft): 21.5	
Special Requirements: None	Date Started: 9/23/2005 Date Completed: 9/23/2005
	Depth to Groundwater (ft): No Water



Lithology lines represent approximate boundaries between soil and rock layers; in-situ, the transition may be gradual.  
 The Exploratory Boring Log should not be used separately from the interpretations and recommendations presented in the report.  
 Acura Engineering - 5235 S. 39th Street - Phoenix, Arizona 85040 - 602.458.7484 - Fax 602.458.9246

# Exploratory Boring Log

Boring No. B-4  
Sheet 1 of 1

Logged By: J. Householder	Project No.: A05-0100G
Driller: FC LP	Project Name: Vacant Land Parcel
Auger/Core Type: Hollow Stem Auger	
Approximate Elevation (ft): Not Available	Location: SEC 164th St & Riggs Rd Gilbert, AZ
Total Boring Depth (ft): 11.5	
Special Requirements: None	Date Started: 9/23/2005 Date Completed: 9/23/2005
	Depth to Groundwater (ft): No Water

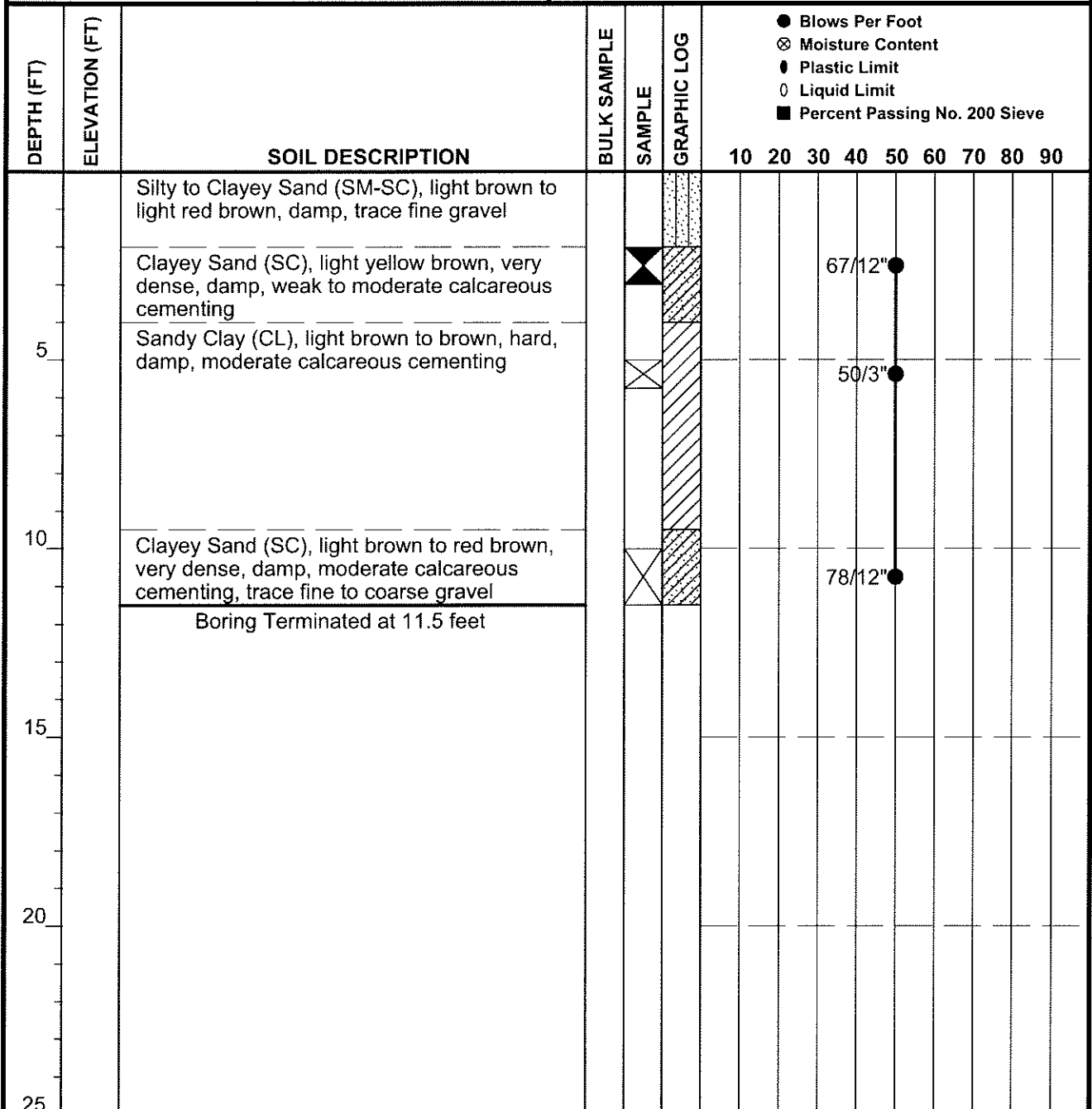
DEPTH (FT)	ELEVATION (FT)	SOIL DESCRIPTION	BULK SAMPLE	GRAPHIC LOG	Blows Per Foot															
					10	20	30	40	50	60	70	80	90							
		Silty to Clayey Sand (SM-SC), light red brown to light brown, damp, trace fine gravel																		
		Sandy Clay (CL), mottled brown and white, hard, damp, weak calcareous cementing	⊗	⊗																
5																				
		- Interbedded Clayey Sand (SC), trace fine gravel	⊗	⊗																
10																				
		Boring Terminated at 11.5 feet																		
15																				
20																				
25																				

Lithology lines represent approximate boundaries between soil and rock layers; in-situ, the transition may be gradual. The Exploratory Boring Log should not be used separately from the interpretations and recommendations presented in the report.

# Exploratory Boring Log

Boring No. B-5  
Sheet 1 of 1

Logged By: J. Householder	Project No.: A05-0100G
Driller: FC LP	Project Name: Vacant Land Parcel
Auger/Core Type: Hollow Stem Auger	Location: SEC 164th St & Riggs Rd Gilbert, AZ
Approximate Elevation (ft): Not Available	
Total Boring Depth (ft): 11.5	Date Started: 9/23/2005 Date Completed: 9/23/2005
Special Requirements: None	Depth to Groundwater (ft): No Water



**Appendix B**  
**Laboratory Test Results**

# REPORT ON SIEVE ANALYSIS AND PLASTICITY INDEX

Vacant Land Parcel  
 SEC 164<sup>th</sup> Sreet & Riggs Road  
 Gilbert, Arizona  
 Acura Project No. A05-0100G

**SAMPLE:**

**Source:** As Noted Below  
**Type:** As Noted  
**Material:** On-site Soils  
**Sampled By:** JH

### Test Results

Sample	Natural Moisture (%)	In-Place Dry Density (pcf)	Atterberg Limits		Sieve Size - Accumulative % Passing							
			LL	PI	#200	#40	#10	#4	3/8"	1.0"	2.0"	CLASS*
B-1 @ 2-3'	4.5	105.1	22	2	47	86	99	100	--	--	--	SM
B-2 @ 3-4'	2.3	113.5	--	--	--	--	--	--	--	--	--	CL
B-3 @ 0-4'	1.7	--	17	9	32	67	94	100	--	--	--	SC
B-3 @ 2-3'	4.7	101.9	--	--	--	--	--	--	--	--	--	CL
B-4 @ 2-3'	5.8	103.1	--	--	50	85	99	100	--	--	--	CL

\* - Unified Soil Classification System (USCS)

NP – non-plastic

NOTE: Sieve analysis results do not include particle sizes greater than 3" in diameter. Refer to boring logs for notes on presence of cobble and boulder-sized particles.

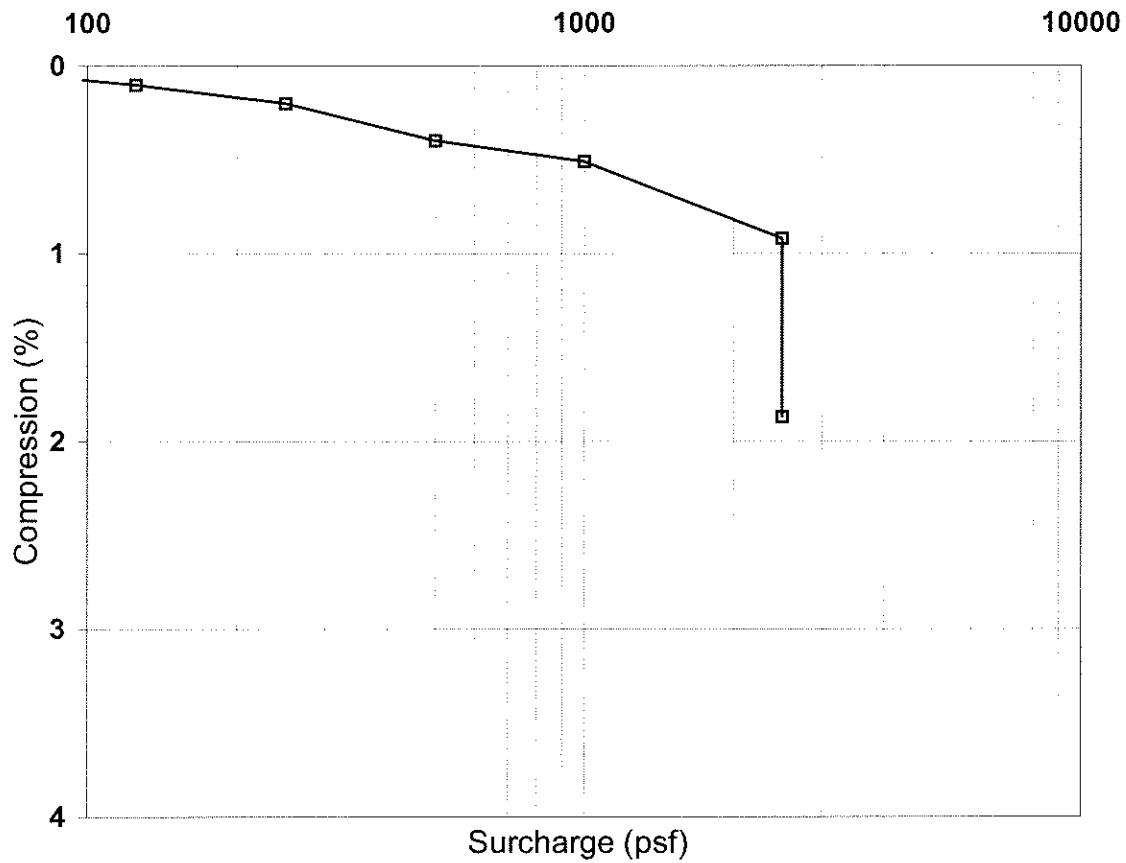
# RESULTS OF CONSOLIDATION TEST

## SAMPLE:

**Project:** Vacant Land Parcel  
**Project No.:** A05-0100G  
**Source:** B-1 @ 2-3'  
**Type:** Driven Ring; 105.1 pcf Dry Density; 4.5% Field Moisture  
**Material:** Silty Sand (SM)  
**Sampled By:** JH

**TESTED:** ASTM D2435 : Sample soaked at approximately 2,500 psf.

## RESULTS:



# REPORT ON REMOLDED EXPANSION TEST

Vacant Land Parcel  
SEC of 164<sup>th</sup> Street & Riggs Road  
Gilbert, Arizona  
Acura Project No. A05-0100G

## SAMPLE:

**Source:** B-3@ 0-4'  
**Type:** Bulk Grab Sample from Auger Cuttings  
**Material:** Clayey Sand (SC)  
**Sampled by:** JH

**TESTED:** Percent expansion upon soaking of a remolded sample compacted to approximately 95 percent of the maximum ASTM D698 density, at about 2% less than optimum moisture content, with a 100 psf surcharge.

## Test Results

Sample I.D.	Dry Density (pcf)	Initial Moisture Content	Surcharge Pressure (psf)	Expansion % Upon Soaking
B-3 @ 0-4'	117.1	6.2	100	0.1

A moisture-density relations test (ASTM D698, Method A) was conducted on the minus #4 portion of the above sample to qualify the results of the expansion test. The results were determined to be:

**B-3 (0.0'-4.0') – 123.3 pcf @ 8.2% moisture**

**MAXIMUM DENSITY - OPTIMUM MOISTURE**  
(ASTM D698, METHOD A)

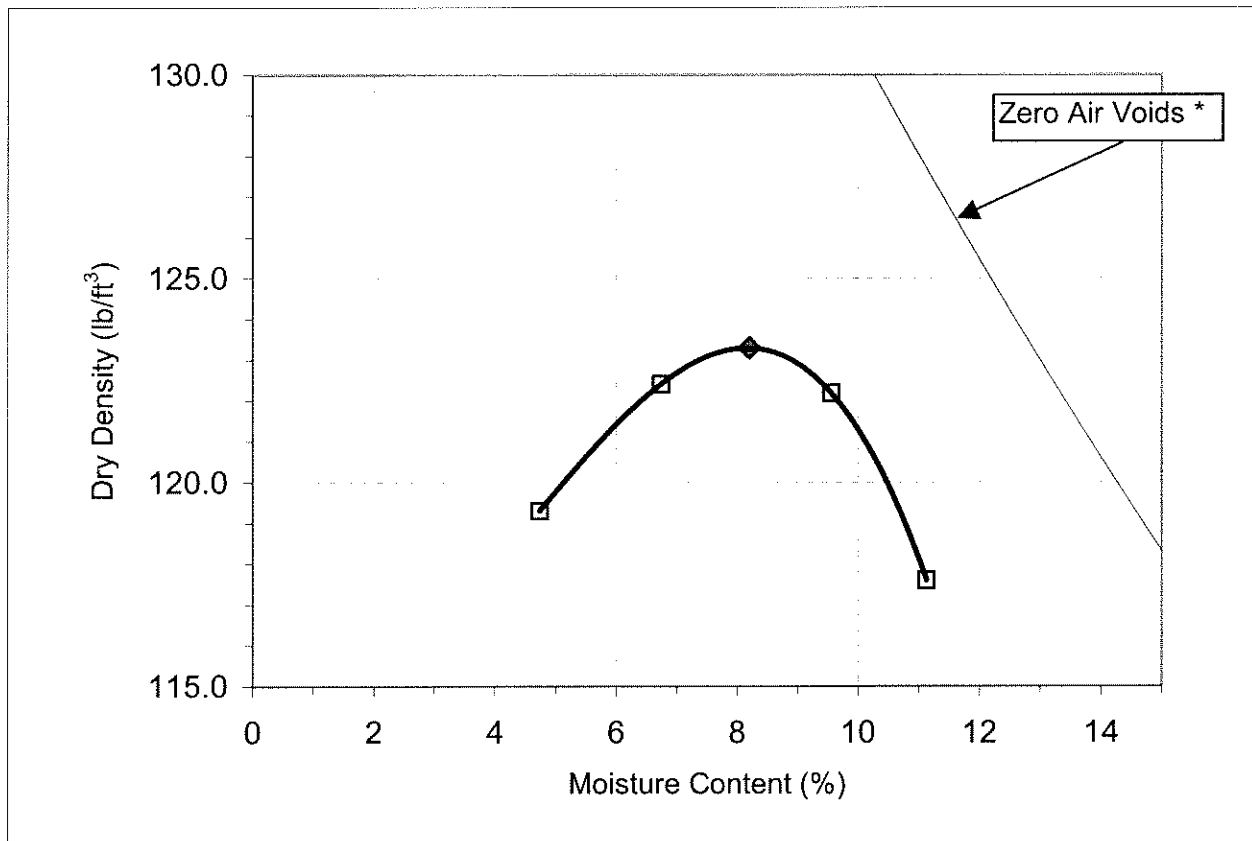
**SAMPLE:**

**Project:** Vacant Land Parcel  
**Source:** B-3 @ 0-4 feet  
**Type:** Bulk Sample  
**Material:** Clayey Sand (SC)  
**Sampled By:** JH 09-23-05

**RESULTS:**

**Maximum Dry Density (pcf) =** 123.3

**Optimum Moisture Content (%) =** 8.2



\* Assumed Gs = 2.65

Project No. A05-0100G