Approved by City of Goodyear

07/01/21

21-2119 - VIP PRODUCTS

GEOTECHNICAL INVESTIGATION REPORT
VIP PRODUCTS
137TH AVENUE AND AUTO CENTER DRIVE
GOODYEAR, ARIZONA

Prepared for:
Sunstate Builders
1050 West Washington Street, Suite 214
Tempe, Arizona 85281

Prepared by:
Alpha Geotechnical & Materials, Inc.
2504 West Southern Avenue
Tempe, Arizona 85282

Alpha Project No. 21-G-12051
March 4, 2021

Alpha
Geotechnical & Materials, Inc.

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Sunstate Builders
1050 West Washington Street, Suite 214
Tempe, Arizona 85281

Attention: Mike Forst

Re: Geotechnical Investigation Report
VIP Products
137th Avenue and Auto Center Drive
Goodyear, Arizona

In accordance with your request and authorization, Alpha Geotechnical & Materials, Inc. (Alpha) has performed a geotechnical investigation for the above referenced site. The purpose of this report is to provide recommendations relative to the geotechnical aspects of the design and construction.

Based on our findings, the site is considered suitable for the proposed construction, provided foundation systems are properly designed, specified site grading recommendations are used, and foundation bearing soils are not exposed to moisture infiltration or moisture content fluctuation. Specific recommendations regarding the geotechnical aspects of project design and construction are presented in the following report. The recommendations contained within this report are dependent on the provisions provided in the Limitations and Recommended Additional Services sections of this report.

We appreciate the opportunity to provide our services for this project. If you have questions regarding this report or if we may be of further assistance, please contact the undersigned.

Sincerely,

ALPHA GEOTECHNICAL & MATERIALS, INC.

Alex Davis, EIT
Geotechnical Staff Professional

Reviewed By:

Garrett Clatanoff, PE
Geotechnical Engineer

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1.0 INTRODUCTION

1.1 General

The purpose of this geotechnical investigation was to evaluate the general surface and subsurface conditions at the referenced site, and to present recommendations related to geotechnical aspects of design and construction of the project for foundations and on-site pavement sections. Results of our investigation are presented within this report. Our scope of services was in general accordance with our proposal 21-G-12051, dated February 8, 2021. This geotechnical report is based on available project information and the site plan provided by the client and our experience with similar construction and soil conditions.

Our study included a site reconnaissance, subsurface exploration, soil sampling, laboratory testing, engineering analyses, and preparation of this report. This report presents recommendations for design of suitable foundation types, site grading and engineered fill placement, moisture protection, and construction considerations. The recommendations contained in this report are subject to the limitations presented herein. Attention is directed to the “Limitations” section of this report.

1.2 Project Description

The project site is located within 4.92 acres of Maricopa County Parcel APN 500-03-456 near the southeast corner of 137th Avenue and Auto Center Drive/Test Drive in Goodyear, Arizona. The proposed construction will consist of a 95,179 square-foot single story warehouse/office building with an attached loading dock and an associated parking lot. The structure will be supported on shallow spread-type footings and/or other conventional shallow foundation system. It is assumed that post-tensioned foundation systems will not be utilized. Alpha has not been provided with structural loads. However, based on our previous experience with similar structures, we estimate the maximum column and wall loads for the structures will be about 100 kips and 10 kips per linear foot, respectively.

2.0 INVESTIGATION

2.1 Subsurface Investigation

The subsurface investigation was performed on February 17, 2021, at six locations across the referenced site. Six soils borings (B-01 through B-06) were advanced beneath the surface to depths between 5 and 20 feet for total drill footage of approximately 90 feet. Locations of the soil borings are shown on **Figure 1**.

Wildcat Dirlling, Inc. (Wildcat) was subcontracted to complete drilling services. Wildcat utilized a truck-mounted CME-45 drill rig to complete the soil borings. An 8-inch outside diameter, hollow-stem auger was used to complete the soil borings.

Soil samples, using standard penetration testing (SPT) or undisturbed ring sampling methods, were obtained at intervals between 2.5 feet and 5 feet. Representative bulk samples of native material were collected from each boring. Completed borings were backfilled with auger cuttings.

Encountered soils were visually inspected, labeled and classified in the field, and logged in general accordance with ASTM D2488. Field direction and borehole logging were performed by Alex Davis, EIT of Alpha. Logs of all borings are presented in **Appendix A**, which also includes a description of drilling and sampling procedures.

2.2 Laboratory Testing

Selected soil samples from the borings were tested in the laboratory for classification purposes and to evaluate their engineering properties. The laboratory tests included:

- Sieve analysis and plasticity index (Atterberg limits) – Soil classification. (ASTM C117/C136) (ASTM D4318);
- Moisture-Density Relationship (Proctor) – Determination of the maximum dry density and optimum moisture content for earthwork factors. (ASTM D698);
- Consolidation – Assessment of compressibility of near-surface soils under embankment fills or structure loads (ASTM D2435);
- One-Dimensional Swell – Assessment of swell potential of near-surface soils under the pavement (ASTM D4546);
- Total soluble sulfates and chlorides – Assessment of the impact of the existing soils on concrete. Used to determine which type of concrete should be used. (Arizona Test Method 733 and 736); and,
- pH and Resistivity – Assessment of the impact of the existing soils on steel. (Arizona Test Method 236).

A brief description of each test preformed on the soil samples and the results are presented in **Appendix B**. Laboratory test results are summarized in **Table B-1** along with individual laboratory sheets are also provided in **Appendix B**.

3.0 SITE CONDITIONS

3.1 Surface Conditions

The site is currently a vacant lot that was previously an agriculture field until approximately 2001 based on historical aerial imagery. The site is a dirt lot with some short weeds growing across the site. Car dealerships are located north and east of Auto Drive/Test Drive and an automobile repair shop is located south of the site. Vacant land is located west of 137th Avenue. The site topography is relatively flat.

3.2 Regional Geology

The southwest region of Arizona is referred to as the Basin and Range Geologic Province. This province consists primarily of a low dry desert environment with a mixture of long faults, fractured rock and wide alluvial basins. The mountain ranges within the province consist of Precambrian plutonic, volcanic and metamorphic rock.

The project is located within the seismic zone referred to as the Salton Periphery Zone which comprises of several seismic source zones (i.e. San Jacinto, South San Andreas, Imperial, Whittier-Elsinore, Perris, Cerro Prieto, Axial Cortez and the Salton Periphery). The seismic zone, as described by Euge and others (1992), are considered discrete seismic sources with limited potential for producing earthquakes.

3.3 Subsurface Conditions

The subsurface soils encountered during the exploration in the upper 20 feet consisted primarily of sandy clay/clay with sand (CL). The tested samples contain between 61 and 71 percent fines (material passing the No. 200 sieve), and up to 1 percent gravel based on laboratory testing. The soils were typically weakly cemented and had low to medium plasticity. The soils were typically characterized as moderately firm to firm in the upper 20 feet. Blow counts ranged between 9 and 57 with a median blow count of 20.

3.4 Groundwater Conditions

Groundwater was not encountered during the investigation. Several well sites are located within the vicinity of the project. Readings collected within the last year from well sites within one mile of site estimate the regional depth to groundwater in the area to be approximately 92 feet below existing grades. This information is available from the ADWR Groundwater Site Inventory database (2021). Seasonal variations could cause fluctuations in the surrounding groundwater depths. In addition, perched water tables may be encountered, especially after flood events.

3.5 Geologic Hazards

3.5.1 Liquefaction Potential

Based on the soil types and soil densities encountered during this investigation along with groundwater not being encountered at the depth explored, the potential for soil liquefaction is considered to be negligible.

3.5.2 Collapsible Soils

Collapsible soils are soils with the potential for a decrease in volume with an increase of external load or moisture. These soils are typically found in areas of alluvial deposits within semi-arid to arid climates. Based on the information collected during our field investigation and

subsequent laboratory testing, we anticipate collapse-susceptible soils will be encountered during construction. The collapse potential for the soil in the upper 5 feet is moderate. However, the potential for damage due to the collapse of the site soils is considered negligible provided that the soil improvement measures are implemented in accordance with the recommendations presented in Section 4.0 of this report.

3.5.3 Land Subsidence and Earth Fissures

The project site is located 2 miles south of documented earth fissures located within the Luke Study Area based on information accessed at the Arizona Geologic Survey (AZGS) website (2021). The project site is in an area with a measured land subsidence of 0 to 1 centimeters over a 10-year period (May 8, 2010 – May 3, 2020) based on information accessed at from the ADWR e-Library (2021).

3.6 Seismic Considerations

The project site is located in south-central Arizona which is an area of low seismic activity. The soil properties in the upper 100 feet of the site are not known in sufficient detail to justify selecting a Site Class C or better. Therefore, the default Site Class D should be used for this site. For structural design based on the 2018 IBC and ASCE7-16 the following seismic parameters should be used:

Table 4.1: Seismic Design Parameters

Site Location: Latitude 33.455260° N, Longitude 112.353037° W	
Parameter	**Value**
Site Class Definition	D
Site Coefficient F_a	1.6
Site Coefficient F_v	2.4
Spectral Acceleration S_{DS}	0.185 g
Spectral Acceleration S_{D1}	0.116 g

4.0 ENGINEERING ANALYSES AND RECOMMENDATIONS

4.1 General Excavation

The near surface soils described in Section 3.3 can be found across the site and can be excavated using conventional excavation equipment. The soils encountered below 20 feet may require heavier equipment to excavate due to potential cementation and very dense materials. However, construction techniques and sequencing should drive the sizing of this equipment.

Prior to excavation, clearing and grubbing of the area may be necessary to remove trees, brush, stockpiles and other vegetation. If excavated materials are intended to be used for engineered fill as described in Section 4.4 special care should be taken to remove as much of the root

system as possible to allow for the maximum amount of material to be used as fill. In addition, it may be necessary to waste material between the surface and approximately one foot below the surface due to vegetation.

4.2 Excavation and Temporary Slopes

Temporary excavation slopes should conform to Occupational Safety and Health Administration and Arizona Division of Occupational Safety and Health regulations. Within this system, the classification of the on-site soils is Type C. It is recommended that unsupported temporary cut slopes in these soils be made no steeper than 1.5H:1V (Horizontal:Vertical) for excavation less than 20 feet.

Spoil piles should be located no closer than 6 feet from the crest of the slopes. Large particles, including large clods, should be kept away from the crest of the slopes. Moisture increases in the soils will weaken them and could cause slope failures. Some localized raveling could occur as the exposed soils dry. The excavations should be protected from storm water runoff or other sources of moisture. Small berms may be necessary to protect the excavations from storm runoff. If the soils are subjected to moisture increases, the stability of the slopes should be reevaluated.

Heavy construction equipment, building materials and vehicular traffic should not be allowed within one-third of the slope height from the top of any excavation. Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning may be required to provide structural stability and to protect personnel working within the excavation. Shoring, bracing, or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Arizona.

Under no circumstances should the information provided in this Section be interpreted to mean that Alpha is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

4.3 Site Grading and Drainage

Areas where improvements will be made should be cleared of all structure remnants, debris, undocumented fill, vegetation, topsoil and other deleterious materials prior to excavation or ground improvements for foundations and slabs or subgrade preparation for pavements per Sections 4.7, 4.8, 4.9, 4.12, and 4.13. Areas where existing utilities are removed, undocumented fill encountered, or other voids caused by removals may be backfilled and compacted in accordance with Sections 4.4 and 4.5. Compaction is necessary to prevent water settling which leads to future ponding.

Positive site drainage should be provided during construction and maintained thereafter. The final ground surface should be sloped away from the perimeter of any structures at a minimum

grade of 5 percent for a minimum distance of 10 feet. Infiltration of water into utility or foundation excavations must be prevented during construction. The drainage design must route all storm and sprinkler water away from the buildings in a positive manner. All water should be diverted away from areas where it could penetrate the ground surface near the buildings and sidewalks. Where lot lines, walls, slopes or other physical barriers prohibit 6 inches of fall within 10 feet, drains or swales should be provided to ensure drainage away from the structure.

Watering of plants should be avoided adjacent to the buildings. Desert-type landscaping is advisable near buildings. Plants, which require more water, should be located and drained away from the building areas.

Roof runoff should be carried away from structures at the ground surface or piped to an underground storm drain system, and in no case should long-term ponding of water be allowed near the structures during or after construction.

Permanent slopes should be no steeper than 3H:1V (Horizontal:Vertical) to promote positive drainage and mitigate erosion. The embankment slope should consist of native cut or compacted fill per Sections 4.4.1 and 4.4.2. To reduce the potential for surface erosion, a berm or "V" ditch may be located at the top of slopes subject to significant overland water flows in order to intercept and redirect surface runoff.

Fill placed on slopes steeper than 5H:1V should be benched into the existing slope. It is recommended that the slope face be compacted per Section 4.5.1.

4.3.1 Earthwork Factors

Based on the laboratory testing and Alpha's experience with similar site conditions, an earthwork factor of 15 percent shrink is recommended when native soils are compacted to 95 percent of the maximum dry density as determined by ASTM D698. Compaction greater than 95 percent of the maximum dry density will increase the total shrink.

4.4 Fill Materials

4.4.1 Engineered Fill

Engineered fill may be required beneath footings or other foundation systems, used to establish grades for slabs-on-grade, used beneath minor structures, backfill voids created during clearing operations, raise site grades, construct pads and as subgrade for pavements. Native soils in the upper 5 feet may be utilized as engineered fill as long as the appropriate compaction and moisture requirements are met based on their expansion characteristics (see Table 4.2 in Section 4.5.1).

Import material may also be used as engineered fill if it meets the requirements presented in Table 4.1.

Table 4.1: Import Material Requirements

Sieve Size	Percent Passing	Required Test
3-inch	100	ASTM C117/136
No. 200	Less than 50	ASTM C117/136
Other Requirements		
Plasticity Index	Less than 15	ASTM D4318
Swell Potential	2 percent or Less	ASTM D4546
Sulfates Content	1,000 ppm or Less	ARIZ 733
Chloride Content	500 ppm or Less	ARIZ 736

Engineered fill should be free of vegetation and other deleterious material and placed in accordance with Section 4.5.1.

4.4.2 Aggregate Base

Aggregate base may be needed beneath slabs, roadways and as bedding material for utilities. The material should meet the requirements of aggregate base material as listed in Maricopa Association of Governments (MAG) *Uniform Standard Specifications and Details for Public Works Constructions* Section 702 (2021).

4.5 Fill Construction

4.5.1 Engineered Fill Placement

Engineered fill material should be utilized as backfill beneath footings, to establish grades for slabs-on-grade, construct pads, and as subgrade for roadways. Engineered fill should meet the requirements of Section 4.4.1. Areas to receive engineered fill should be scarified a minimum of 8 inches, moisture conditioned and compacted to no less than 95 percent of the maximum dry density and within the range of plus 2 percent to minus 2 percent of the optimum moisture content as determined by ASTM D698.

Prior to placement of engineered fill, the material should be moisture conditioned and placed in lifts not to exceed 8 inches thick when compacted with heavy equipment. When using smaller, walk behind compaction equipment, compacted lifts should not exceed 4 inches. Engineered fill should be compacted per Table 4.2.

Table 4.2: Compaction Requirements

Material Type	Design Element or Site Improvements[1]	Required Compaction[2]	Required Moisture Content[2]
Engineered Fill - Consisting of native or import soils with swell potential of 2 percent or less.	Below Slabs	Minimum 95% of the maximum dry density	+2% to -2% of the optimum moisture content
	Below Spread-Type Footings		
	Below Flexible and Rigid Pavements		
	General Site and Embankment Fill[3]		

1 - Depth of soil improvement or lift thicknesses should follow the recommendation in this report for the given design element. General site fill should refer to fill not directly beneath design elements or within the limits of other soil improvements as recommended in this report.
2 - Compaction percentage and moisture content requirements should be based on the maximum dry density and optimum moisture content as determined by ASTM D698.
3 - In areas where fill will exceed 5 feet in height the geotechnical engineer should be consulted to determine adequate foundation preparation and embankment compaction requirements.

4.5.2 Aggregate Base Placement

Aggregate base may be needed beneath slabs, roadways and as bedding material for utilities. Aggregate base should meet the requirements of Section 4.4.2. Areas to receive aggregate base should be free of vegetation. Aggregate base should be placed on compacted engineered fill per Table 4.2 in Section 4.5.1. Aggregate based shall be compacted per MAG Section 310 (2021).

4.6 Pipe Backfill and Bedding

Pipes should be placed on pipe bedding material meeting the requirements of aggregate base as discussed in Sections 4.4.2 and 4.5.2 of this report. Pipe bedding should be placed from the bottom of the trench to the springline.

On-site soils may be utilized as backfill for non-metallic pipes where applicable, provided the soil is free from broken concrete, broken pavement, wood, or other deleterious material and with no piece/clods larger than 2 inches.

Metal pipes should be backfilled with material that meets the manufacture's requirements. In the absence of any manufacture's recommendations, Alpha recommends soils have a pH between

5.0 and 9.0, and a resistivity greater that 2,000 ohm-cm when tested in accordance with Arizona Method 236.

As an alternative to backfill directly above the pipe, Alpha recommends that all utility trenches may be backfilled with ½-sack Controlled Low-Strength Material (CLSM) meeting the requirements of MAG Section 604 (2021). The CLSM should extend from springline to 12 inches above the pipe.

The remainder of the trench should be backfilled with engineered fill material, meeting the requirements of Section 4.4.1, compacted in lifts not to exceed 8 inches when compacted. Each lift should be compacted per Table 4.2 in Section 4.5.1.

4.7 Foundations

Lightly loaded structures may be supported on spread or continuous footings. Geotechnical recommendations for footing foundations, based on anticipated sizes and shapes, are provided in Section 4.7.1.

4.7.1 Isolated Spread or Continuous-Type Footings

Small, isolated spread-type footings should have no single dimensions measuring more than 8 feet, a length to width ratio less than three and be used for supporting columns or other concentrated loads.

Continuous footings should have a length to width ratio greater than three, a width of less than 5 feet and are to be used for supporting walls or other strip type loading. Footings should be designed with the following recommendations:

1. Footings should bear at a minimum depth of 1.5 feet below the lowest adjacent or existing grade, whichever is lower. Footings shall bear on a minimum of 2 feet of engineered fill as outlined in item 4. Footings that require a higher bearing pressure should bear at the embedment depth as outlined in item 5.
2. Soils beneath footings should be excavated to a minimum depth of 2 feet below the bottom of the footing and laterally beyond the footing edges at a ratio of 1H:1V (Horizontal:Vertical).
3. The bottom of the footing excavation should be scarified to a depth of 8 inches and then compacted to a minimum of 95 percent of the maximum dry density and within a range of plus 2 percent to minus 2 percent of the optimum moisture content as determined by ASTM D698 prior to the placement of any additional materials.
4. Backfill material between the bottom of the footing and bottom of the excavation should consist of engineered fill, as described in Sections 4.4.1 and 4.5.1, in order to provide uniform bearing below the structure.

5. Footings should be designed for an allowable bearing pressure which includes dead plus normal live loads. The following bearing pressures may be used based on depth of embedment.

Embedment Depth (feet)	Bearing Pressure (psf)
1.5	2,000
2.5	2,500
3.0	3,000

   The allowable bearing pressure may be increased by one-third when considering transient wind or seismic loading.

6. Spread and continuous-type footings should have minimum widths of 2 feet and 1.5 feet, respectively.
7. The structural engineer should place resultant pressure on the foundation base in the middle third of the footing. The maximum loading for spread and continuous-type footings should not exceed 192 kips and 15 kips per linear foot, respectively.
8. A representative of Alpha should observe the foundation excavations prior to placement of the fill and reinforcing steel.

4.7.2 Settlement

Alpha estimates settlement of footings designed and constructed in accordance with the recommendations provided in Section 4.7.1 will not exceed 3/4 inch. However, a representative of Alpha should observe the foundation excavations and surface preparation prior to placement of any fill material or reinforcing steel. When bearing and uplift values are increased by one-third to consider transient wind or seismic loading, settlement may increase to 1 inch.

4.7.3 Lateral Resistance

Lateral loads may be resisted by soil friction and by the passive resistance of the soils acting on the sides of the footing. A coefficient of friction of 0.38 may be used between the footings and the supporting soils. The passive resistance of the properly-compacted structural fill or undisturbed native soils against spread footings may be calculated assuming an allowable equivalent fluid unit weight of 150 pounds per cubic foot (pcf). A one-third increase in the passive value may be used for wind or seismic loads. The frictional resistance and the passive resistance of the soils may be combined without reduction in determining the total lateral resistance.

4.8 Conventional Reinforced Slabs

Conventional reinforced slabs may be used to support the lightly loaded structures. Conventional reinforced slabs for this report are defined as a reinforced concrete slab that does not have reinforcement tied into the vertical elements (i.e. isolated spread footing or continuous type footing). Based on the site soils the following design parameters should be implemented.

Recommended design parameters:
Maximum Allowable Bearing Pressure, q_a: 1,250 psf (at grade)
Coefficient of Subgrade Reaction, k: 150 pounds per cubic inch

Areas where slabs are to be constructed should be cleared in accordance with Section 4.3. The slabs should bear on a minimum of 4 inches of compacted aggregate base material as measured from the bottom of the slab. Aggregate base material should meet the requirements provided in Section 4.4.2 and be compacted to 100 percent of the maximum dry density within a range of plus 3 percent to minus 3 percent of the optimum moisture content as determined by ASTM D698. Excavation beneath the slab may be necessary to accommodate the 4 inches of aggregate base. The surface on which the aggregate base will be placed should be scarified a minimum of 8 inches, moisture conditioned and compacted to 95 percent of the maximum dry density and within a range of plus 2 percent to minus 2 percent of the optimum moisture content as determined by ASTM D698 prior to the placement of any additional materials. The limits of this subgrade improvement should extend a minimum of 5 feet beyond the edges of the slab.

Structures bearing on prepared subgrade as presented in this Section may experience total settlement of approximately ½ -inch. Differential settlement is expected to be less than ¼-inch between similarly loaded areas. Additional foundation movements could occur if the supporting soils become wetted, please refer to Section 4.3 for drainage requirements.

4.9 Slabs-on-Grade

Non-load bearing, non-reinforced slabs typically used as floor slabs should be designed and constructed using the following recommendations. Areas where slabs-on grade are to be constructed should be cleared in accordance with Section 4.3. The slabs should bear on a minimum of 4 inches of compacted aggregate base material as measured from the bottom of the turndown. Aggregate base material should meet the requirements provided in Section 4.4.2 and be compacted to 100 percent of the maximum dry density within a range of plus 3 percent to minus 3 percent of the optimum moisture content as determined by ASTM D698. Excavation beneath the slab may be necessary to accommodate the 4 inches of aggregate base. The surface on which the aggregate base will be placed should be scarified a minimum of 8 inches, moisture conditioned and compacted to 95 percent of the maximum dry density and within a range of plus 2 percent to minus 2 percent of the optimum moisture content as determined by ASTM D698 prior to the placement of any additional materials. The limits of this subgrade improvement should extend a minimum of 5 feet beyond the edges of the slab.

NOTE: ***Slabs-on-grade should not be considered raft or mat foundations and should not be expected to bear structural loads.***

4.10 Lateral Earth Pressures for Walls

Rigid, absolutely restrained walls that can tolerate little or no movement should be designed for the at-rest earth pressure represented by an equivalent-fluid unit weight of 60 pcf for level structure backfill. That value is based on a compacted moist unit weight of 120 pcf and an effective (drained) friction angle of 30 degrees for level, free-draining backfill. Walls that can tolerate rotation (movement of the top of the wall) or lateral translation equal to or greater than about 0.002 times the height of the wall (height, H, is defined as measured from bottom of footing to top of level backfill) should be designed for active earth pressure represented by an equivalent-fluid soil unit weight of 40 pcf for level structure backfill. Vertical surcharge loads and/or hydrostatic pressures will increase the recommended equivalent-fluid soil unit weight. The resultant lateral earth loads should be assumed to act at a distance of one-third H above the wall base, where H is as defined above.

If heavy mechanical compaction equipment will be operating within a distance of one-half the retained height (defined as being from the backfill grade at the back of the wall to the wall base), additional earth pressure induced by compaction should be used in wall design. The additional earth pressure should be estimated using the procedure presented by Clough and Duncan (1991). If compaction equipment used adjacent to the walls is to consist of small rollers and tampers, the additional earth pressure should not be used.

The wall backfill should consist of free-draining backfill and backfill drainage provisions, such as weep holes. The result should be such that the effect of hydrostatic pressure on the wall should not require consideration.

4.11 Corrosion Potential

4.11.1 Sulfate and Chloride Content

Selected samples of the near-surface soils encountered at the site were subjected to chemical analysis for the purpose of corrosion assessment. The samples were tested for soluble sulfates, and soluble chlorides. The samples were tested in general accordance with Arizona Test Methods 733, and 736 for soluble sulfates, and soluble chlorides, respectively. The test results are provided in **Appendix B**.

Based on provisions of American Concrete Institute (ACI) 318 Section 4.3, Table 4.3.1, *Requirements for Concrete Exposed to Sulfate-Containing Solutions* a sulfate concentration below 0.10 percent by weight (1,000 ppm) is negligible. Based on the laboratory results, sulfate contents of the site soils tested indicate a negligible degradation potential to concrete which places no restrictions on and cement type.

Based on the available published data regarding chloride ion content in soils a concentration of 500 ppm or greater is considered corrosive and may require additional concrete cover over reinforcement. Based on the laboratory results of the sample collected for this project, chloride contents of the site soils tested indicate that the soil has a negligible potential for degradation of concrete and requires no additional requirements on concrete cover over reinforcement.

4.11.2 pH and Resistivity

One sample of the near-surface soil was tested for corrosion potential testing. The testing performed consisted of pH and resistivity in accordance with Arizona Test Method 236. The laboratory pH value determined was 8.3. The resistivity value determined was 1,159 ohm-centimeters (ohm-cm). Soil where the pH is greater than 9.0 and/or the resistivity is less than 2,000 ohm-cm requires the use of special pipes and/or pipe coatings. Based on these results, there is potential for corrosion of buried steel pipes and other buried steel structures. Special consideration should be given to the design and use of corrosion protected steel piping and structures. It is recommended that the pipe type and/or coating be selected in accordance with manufacturer requirements.

4.12 Pavement Sections

4.12.1 Flexible Pavement

The planned pavements are not located within the City's right-of-way. Alpha has recommended a pavement section for light duty and heavy-duty traffic areas. The light duty should be used in areas where the majority of traffic will be passenger vehicles. Heavy duty should be used in areas where truck traffic is anticipated. The flexible pavement section for these areas are provided in Table 4.3.

Table 4.3: Flexible Pavement Section

Roadway Type	Asphaltic Concrete Thickness	Aggregate Base Thickness
Light Duty	2 inches	6 inches
Heavy Duty	3 inches	6 inches

The pavement section materials should be placed as described hereafter. Subgrade material should meet the engineered fill requirements presented in Section 4.4.1. The subgrade should be scarified to a depth of 8 inches, moisture conditioned and compacted to 95 percent of the maximum dry density and within the range of plus 2 percent to minus 2 percent of the optimum moisture content as determined by ASTM D698.

Aggregate base materials should meet the requirement of Section 4.4.2 and compacted per Section 4.5.2.

Asphaltic concrete material should meet MAG Section 710 (2021) and should be placed in general accordance with MAG Section 321 (2021) or local standards.

4.12.2 Rigid Pavement

In areas where rigid pavement may be necessary, a minimum of 6 inches of Portland cement concrete should be used. Portland cement concrete pavement should be placed over 4 inches of aggregate base and 8 inches of improved subgrade. In areas where heavier traffic will be encountered due to heavy truck activities the concrete section should be increased to a minimum of 7 inches. The rigid pavement sections are provided in Table 4.4.

Table 4.4: Rigid Pavement Sections

Roadway Type	Portland Cement Concrete Pavement Thickness	Aggregate Base Thickness
Light Duty	6 inches	4 inches
Heavy Duty	7 inches	4 inches

The pavement section materials should be placed as described hereafter. Subgrade material should meet the engineered fill requirements presented in Section 4.4.1. The subgrade should be scarified to a depth of 8 inches, moisture conditioned and compacted to 95 percent of the maximum dry density and within the range of plus 2 percent to minus 2 percent of the optimum moisture content as determined by ASTM D698.

Aggregate base materials should meet the requirement of Section 4.4.2 and compacted per Section 4.5.2.

Portland cement concrete material should meet MAG Class AA (4,000 psi), per Section 725 (2021) and should be placed in general accordance with MAG Section 324 (2021).

4.13 Sidewalks

Sidewalk sections should be constructed in accordance with MAG Section 340 (2021) and designed in general accordance with the MAG Standard Detail 230 (2021). The sidewalk should consist of 4-inch thick, MAG Class B concrete (2,500 psi).

5.0 CLOSURE

5.1 Limitations

Our professional services have been performed using that degree and skill ordinarily exercised, under similar circumstances, by reputable Geotechnical Engineers practicing in this or similar localities. No warranty is expressed or implied.

The recommendations contained in this report are based on our field exploration, laboratory test results, and our understanding of the proposed construction. The subsurface data used in the preparation of this report was obtained from the test borings excavated during the field subsurface exploration. It is anticipated that some variations in the soil conditions will exist on-site. The nature and extent of variations may not be evident until construction occurs. If any conditions are encountered at this site that are different from those described in this report, we should be immediately notified so that we may make any necessary revisions to the recommendations contained in this report. In addition, if the scope of the proposed construction changes from that described in this report, our firm should also be notified.

It is the Client's responsibility to see that all parties to the project including the designer, contractor, subcontractor, etc. are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.

This report is for the exclusive purpose of providing Geotechnical Engineering and/or testing information and recommendations. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken. This report has also not addressed the site geology and the possible presence of geologic hazards.

This report may be used only by the Client and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on and off-site), or other factors may change over time, and additional work may be required with the passage of time. Any party, other than the Client, who wishes to use this report, should notify Alpha of such intended use. Based on the intended use of this report, Alpha may require that additional work be performed and that an updated report be issued.

5.2 Recommended Additional Services

This report is a **geotechnical report** completed to characterize the referenced site. This report should be utilized primarily for planning and may not be sufficient for final design. An additional geotechnical report may be required to evaluate additional design elements should loading conditions change or significant earthwork occurs at the site.

The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be performed during the construction. These tests and observations should be performed by the Geotechnical Engineer's representative and should include, but are not necessarily be limited to the following:

- Observe and document that any existing surficial vegetation and other deleterious materials have been removed from the site as required in site preparation section.
- Approve any material used as engineered fill in building areas to document that it meets the requirements outlined above before placement.
- Monitor the scarification operations of the exposed subgrade.
- Monitor scarification operations to document those footings are bearing in soils as recommended above.
- Monitor the backfill procedures.
- Perform field density tests, as needed, to verify compaction compliance. The representative should monitor the progress of compaction and filling operations.
- Keep records of on-site activity and progress.

Observation of footing excavations should be performed prior to placement of reinforcing and concrete to confirm that satisfactory bearing materials are present. Construction testing, including field and laboratory evaluation of fill and backfill materials, concrete and steel should be performed to determine whether applicable project requirements have been met.

6.0 REFERENCES

Arizona Department of Water Resources (ADWR), 2021. Arizona Land Subsidence Maps accessed at https://new.azwater.gov/hydrology/e-library in February.

ADWR, 2021. Arizona Groundwater Site Inventory (GWSI) accessed at http://gisweb3.azwater.gov/gwsi in February.

Arizona Geological Survey (AZGS), 2021. Arizona Geohazards Viewer accessed at http://data.azgs.az.gov/hazard-viewer in February.

American Concrete Institute (ACI), 2014. *Building Code Requirements for Structural Concrete* (ACI 318-14) *and Commentary*. Reported by ACI Committee 318.

ATC, 2021. Hazards by Location Viewer accessed at https://hazards.atcouncil.org/#/ in February.

Clough, GW, and JM Duncan, 1991. Earth Pressures. In Foundation Engineering Handbook, 2nd edition, edited by Hsai-Yang Fang, pp. 223-235. New York: Van Nostrand Reinhold.

Euge, KM, BA Schell and IP Lam. 1992. *Development of Seismic Acceleration Contour Maps for Arizona, Final Report. Report No. FHWA-AZ92-344.* Prepared for the Arizona Department of Transportation, Phoenix, Arizona. September.

International Building Code (IBC), 2015. 2015 International Building Code. Reported by International Code Council, Inc.

Maricopa Association of Governments (MAG), 2021. 2021 Revision to the 2020 Edition. Uniform Standard Specifications and Details for Public Works Constructions. February.

FIGURES

VIP Products
137th Avenue and Auto Center Drive
Goodyear, Arizona

Figure 1 – Site Map

5' Boring
20' Boring

www.Maricopa.gov

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APPENDIX A
Field Investigation

FIELD INVESTIGATION

SOIL TEST BORINGS

The subsurface conditions at the site were explored February 17, 2021 by advancing 6 soil test borings using a CME-45 truck-mounted drill rig. The locations of soil test borings advanced for this investigation are shown in Figure 1 of the report.

Our engineer maintained a log of the excavations; visually classified soils encountered according to the Unified Soil Classification System (USCS) (see USCS Table) and obtained samples of the subsurface materials.

SAMPLING PROCEDURES

Bulk samples were taken from the test borings at selected intervals. Soil samples were packaged and sealed in the field to reduce moisture loss and disturbance, and returned to our laboratory for further testing. After the soil test borings were completed, they were backfilled with the excavated soils.

Dynamically driven tube samples are obtained at selected intervals in the borings. Two-inch outside diameter, 1 3/8-inch inside diameter samples are used to obtain the standard penetration resistance in accordance with ASTM D1586. “Undisturbed” samples are obtained with 3-inch outside diameter samples lined with 2.42-inch inside diameter brass rings in accordance with ASTM D3550. The driving energy is generally recorded as the number of blows of a 140-pound, 30-inch free gall drop above ground hammer required to advance the samples in 6-inch increments. The values are expressed in blows per 6 inches on the boring logs.

LIST OF ATTACHMENTS

The following exhibits are attached and complete this appendix.

Unified Soil Classification System
Logs of Soil Test Borings

UNIFIED SOIL CLASSIFICATION SYSTEM					CONSISTENCY OR RELATIVE DENSITY		
Major Divisions			Group Symbols	Typical Names	CRITERIA		
Coarse-Grained Soils (More than 50% retained on No. 200 sieve)	Gravels (50% or more of coarse fraction retained on No. 4 sieve)	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	**Standard Penetration Test** Density of Granular Soils		
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines	Penetration Resistance N (blows/ft)	Relative Density	
		Gravels With Fines	GM	Silty gravels, gravel-sand-silt mixtures			
			GC	Clayey gravels, gravel-sand-clay mixtures	0-4	Very Loose	
	Sands (More than 50% of coarse fraction passes No. 4 sieve)	Clean Sands	SW	Well-graded sands and sand-gravel mixtures, little or no fines	5-10	Loose	
			SP	Poorly graded sands and sand-gravel mixtures, little or no fines	11-30	Medium Dense	
		Sands With Fines	SM	Silty sands, sand-gravel-silt mixtures	31-50	Dense	
			SC	Clayey sands, sand-gravel-clay mixtures	>50	Very Dense	
Fine-Grained Soils (50% or more passes No. 200 sieve)	Silts and Clays (Liquid Limit 50% or less)		ML	inorganic silts, very fine sands, silty or clayey fine sands, clayey silts with slight plasticity	**Standard Penetration Test** Consistency of Cohesive Soils		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, silty clays, sandy clays lean clays	Penetration Resistance N (blows/ft)	Consistency	Unconfined Compressive Strength (Tons/ft2)
			OL	Organic silts and organic silty clays of low plasticity	0-4	Very Soft	<0.25
	Silts and Clays (Liquid Limit greater than 50%)		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	5-8	Soft	0.25-0.50
			CH	Inorganic clays of high plasticity, fat clays	9-15	Moderately Firm	0.50-1.00
			OH	Organic clays and organic silts of medium to high plasticity	16-30	Firm	1.00-2.00
Highly Organic Soils			PT	Peat, humus, and swamp soils with high organic content	31-50	Very Firm	2.00-4.00
					>50	Hard	>4.0

		3"		3/4"	#4	#10	#40	#200 U.S. Standard Sieve
Unified Soil Classification	Cobbles	Gravel			Sand			Silt or Clay
		coarse		fine	coarse	medium	fine	

MOISTURE CONDITIONS

Slightly Moist	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water; usually is below water table

MATERIAL QUANTITY

rare	<2%
occasional	<5%
trace	10%
some	20%
considerable	30%

OTHER SYMBOLS

U	Undisturbed Sample
S	SPT Sample
A	Auger Sample
D	Disturbed Bulk Sample

BASIC LOG FORMAT:
USCS Soil Type, Other Soil Types Present (Modifiers, Gradation, Angularity), Gradation/Angularity of Main Soil Type Modifier, Fradation/Angularity of Main Soil Type, Structure, Cementation, Plasticity, Color, Moisture, Firmness/Density, Dry Strength, Odor, Additional Descriptions

UNIFIED SOIL CLASSIFICATION SYSTEM

Alpha Engineering | Testing | Solutions

Alpha Project Number:	21-G-12051	**Log of Boring No.**	B-01
Project Name:	VIP Products	**Rig Type:**	CME 45
Project Location:	Goodyear, Arizona	**Boring Type:**	Hollow Stem Auger
Date(s) Complete:	2/17/2021	**Boring Location:**	See Figure 1 - Site Map

Depth (Feet)	Sample	Sample Type	Blow Count (6 inch Interval)			Dry Density (PCF)	Moisture (%)	Unified Soil Classification	Remarks	Field and Drilling Notes:
0										**Visual Classification**
	X	S	5	6	8			CL	slightly moist	**SANDY CLAY**
										rare fine grained, subangular to subrounded gravel, considerable fine grained sand, medium plasticity, brown
									moderately firm to firm	
	X	S	6	10	12					
5	X	S	14	14	16					
										Stopped auger at 4'6"
										Sampled to 6'
										Backfilled with drill cuttings
10										
15										
20										

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

Sample Type Key: S = Split Spoon
A = Auger Cuttings U = Relatively Undisturbed Ring D = Disturbed Bulk

Alpha Geotechnical & Materials, Inc.
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Tempe, Arizona 85282

GROUNDWATER

DEPTH	TIME	DATE
N/A	N/A	N/A

Alpha Project Number:	21-G-12051	**Log of Boring No.**	B-02
Project Name:	VIP Products	**Rig Type:**	CME 45
Project Location:	Goodyear, Arizona	**Boring Type:**	Hollow Stem Auger
Date(s) Complete:	2/17/2021	**Boring Location:**	See Figure 1 - Site Map

Depth (Feet)	Sample	Sample Type	Blow Count (6 inch Interval)			Dry Density (PCF)	Moisture (%)	Unified Soil Classification	Remarks	Field and Drilling Notes:
0										**Visual Classification**
		S	4	6	7			CL	slightly moist	**SANDY CLAY**
										considerable fine grained sand, low plasticity, brown
									moderately firm to firm	
		S	6	9	8					
5		S	8	9	11					
10										**Stopped auger at 4'6"**
										Sampled to 6'
										Backfilled with drill cuttings
15										
20										

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

Sample Type Key: S = Split Spoon
A = Auger Cuttings U = Relatively Undisturbed Ring D = Disturbed Bulk

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Tempe, Arizona 85282

GROUNDWATER

DEPTH	TIME	DATE
N/A	N/A	N/A

Alpha Project Number:	21-G-12051	**Log of Boring No.**	B-03
Project Name:	VIP Products	**Rig Type:**	CME 45
Project Location:	Goodyear, Arizona	**Boring Type:**	Hollow Stem Auger
Date(s) Complete:	2/17/2021	**Boring Location:**	See Figure 1 - Site Map

Depth (Feet)	Sample	Sample Type	Blow Count (6 inch Interval)			Dry Density (PCF)	Moisture (%)	Unified Soil Classification	Remarks
0									
		S	4	6	7			CL	slighlty moist
									moderately firm to firm
		S	7	11	18				
5		S	12	12	15				
10		S	11	12	16				
15		S	6	13	15				
20		S	5	7	11				

Field and Drilling Notes:

Visual Classification

CLAY WITH SAND
considerable fine grained sand, medium plasticity, brown

note: increase in fines content below 18'

Stopped auger at 19'6"
Sampled to 21'
Backfilled with drill cuttings

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

Sample Type Key: S = Split Spoon
A = Auger Cuttings U = Relatively Undisturbed Ring D = Disturbed Bulk

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GROUNDWATER		
DEPTH	TIME	DATE
N/A	N/A	N/A

Alpha Project Number:	21-G-12051	**Log of Boring No.**	B-04
Project Name:	VIP Products	**Rig Type:**	CME 45
Project Location:	Goodyear, Arizona	**Boring Type:**	Hollow Stem Auger
Date(s) Complete:	2/17/2021	**Boring Location:**	See Figure 1 - Site Map

Depth (Feet)	Sample	Sample Type	Blow Count (6 inch Interval)			Dry Density (PCF)	Moisture (%)	Unified Soil Classification	Remarks
0									
		S	3	4	8			CL	slighlty moist
									moderately firm to hard
		U		20					
5		S	9	15	26				
10		S	13	15	15				
15		S	24	28	29				
20		S	15	20	23				

Field and Drilling Notes:

Visual Classification

SANDY CLAY
rare fine grained, subangular to subrounded gravel, considerable fine grained sand, low plasticity, brown

note: weakly cemented below 5'

Stopped auger at 19'6"
Sampled to 21'
Backfilled with drill cuttings

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

Sample Type Key: S = Split Spoon
A = Auger Cuttings U = Relatively Undisturbed Ring D = Disturbed Bulk

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GROUNDWATER		
DEPTH	TIME	DATE
N/A	N/A	N/A

Alpha Project Number:	21-G-12051	**Log of Boring No.**	B-05
Project Name:	VIP Products	**Rig Type:**	CME 45
Project Location:	Goodyear, Arizona	**Boring Type:**	Hollow Stem Auger
Date(s) Complete:	2/17/2021	**Boring Location:**	See Figure 1 - Site Map

Depth (Feet)	Sample	Sample Type	Blow Count (6 inch Interval)			Dry Density (PCF)	Moisture (%)	Unified Soil Classification	Remarks
0									
		S	5	6	9			CL	slighlty moist
									moderately firm to firm
		S	8	13	15				
5		S	6	7	11				
10		S	5	6	10				
15		S	6	7	12				
20		S	7	7	10				

Field and Drilling Notes:

Visual Classification

SANDY CLAY
considerable fine grained sand, low plasticity, brown

note: increase in fines content below 15'

Stopped auger at 19'6"
Sampled to 21'
Backfilled with drill cuttings

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

Sample Type Key: S = Split Spoon
A = Auger Cuttings U = Relatively Undisturbed Ring D = Disturbed Bulk

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GROUNDWATER		
DEPTH	TIME	DATE
N/A	N/A	N/A

Alpha Project Number:	21-G-12051	**Log of Boring No.**	B-06
Project Name:	VIP Products	**Rig Type:**	CME 45
Project Location:	Goodyear, Arizona	**Boring Type:**	Hollow Stem Auger
Date(s) Complete:	2/17/2021	**Boring Location:**	See Figure 1 - Site Map

Depth (Feet)	Sample	Sample Type	Blow Count (6 inch Interval)			Dry Density (PCF)	Moisture (%)	Unified Soil Classification	Remarks	Field and Drilling Notes:
0										**Visual Classification**
		S	3	4	6			CL	slighlty moist moderately firm to firm	**SANDY CLAY** rare fine grained, subangular to subrounded gravel, considerable fine grained sand, low to medium plasticity, brown
		S	4	5	4					
5		S	6	7	8					
10		S	14	13	12					
15		S	12	11	15					note: increase in fines content below 15'
									slightly moist firm	**CLAYEY SAND** rare fine grained, subangular to subrounded gravel, predominantly fine to medium grained, subangular to subrounded sand, low plasticity, brown
										Stopped auger at 19'6" **Sampled to 21'** **Backfilled with drill cuttings**
20		S	5	8	8			SC		

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

Sample Type Key: S = Split Spoon
A = Auger Cuttings U = Relatively Undisturbed Ring D = Disturbed Bulk

Alpha Geotechnical & Materials, Inc.
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Tempe, Arizona 85282

GROUNDWATER		
DEPTH	TIME	DATE
N/A	N/A	N/A

APPENDIX B
Laboratory Test Results

Table B-1 - Summary of Laboratory Test Results

Boring Number	Depth (ft[1])		USCS/Group Symbol[2] (ASTM D2487)	Percent Fines (minus No. 200) (ASTM C136/C117)	Percent Sand (Retained Between the No. 4 and No. 200	Percent Gravel (Retained Above No. 4 Sieve)	Liquid Limit (ASTM D4318)	Plasticity Index (ASTM D4318)	Swell Potential (%[4]) (ASTM D4546)	Consolidation (%) (ASTM D2435)	Maximum Dry Density (pcf[3]) (ASTM D698A)	Optimum Moisture Content (%[4]) (ASTM D698A)	Soluble Sulfates (ppm[5]) ARIZ 733	Chlorides (ppm[5]) (ARIZ 736)	Resistivity (Ohm-cm[6]) (ARIZ 236)	pH (ARIZ 236)
	Begin	End														
B-02	0.0	4.5	CL	66	34	0	28	13								
B-03	0.0	4.5	CL	71	29	0	30	14								
B-04	0.0	4.5	CL	61	38	1	27	12	2.3		119.4	12.3	6	88	1,159	8.3
B-04	2.5	3.5								7.8						
B-05	0.0	4.5	CL	70	30	0	29	12								
Average				**67**	**33**	**0**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
Standard Deviation				**5**	**4**	**1**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
Minimum				**61**	**29**	**0**	**27**	**12**	**2.3**	**7.8**	**119.4**	**12.3**	**6**	**88**	**1,159**	**8.3**
Maximum				**71**	**38**	**1**	**30**	**14**	**2.3**	**7.8**	**119.4**	**12.3**	**6**	**88**	**1,159**	**8.3**
Count				**4**	**4**	**4**	**4**	**4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

Notes:

[1] ft = feet

[2] USCS group symbol as determined by laboratory testing (ASTM D2487).

[3] pcf = pounds per cubic foot

[4] % = percent

[5] ppm = parts per million

[6] ohm-cm = ohm-centimeters

APPENDIX B
LABORATORY TESTING

LABORATORY TESTS

Laboratory tests were performed on selected samples to aid in soil classification and to evaluate physical properties of the soils, which may affect the Geotechnical aspects of project design and construction. A description of the laboratory testing program is presented below.

Sieve Analysis

Sieve analyses were performed to evaluate the gradation characteristics of the material and to aid in soil classification. Tests were performed in general accordance with ASTM Test Method C136 and D2487.

Atterberg Limits

Atterberg Limits tests were performed to aid in soil classification and to evaluate the plasticity characteristics of the material. Additionally, test results were correlated to published data to evaluate the shrink/swell potential of near-surface site soils. Tests were performed in general accordance with ASTM Test Method D4318.

One-Dimensional Consolidation

A one-dimensional consolidation test was performed on a ring samples to evaluate consolidation potential of the site soil. Test procedure was in general accordance with ASTM Test Method D 2435.

Moisture-Density Relationship

The test results are used to determine the maximum dry density from the peak point of the compaction curve and its corresponding moisture content, also known as the optimum moisture. Additionally, test results are used to determine earthwork factors. Tests were performed in general accordance with ASTM Test Method D698.

Swell

Swell tests were performed on remolded bulk soil samples to evaluate the swell potential of the subgrade soils. Test procedures were in general accordance with ASTM Test Method D4546.

Sulfate Content

Sulfate content tests were performed to evaluate the corrosion potential of the on-site soils. Tests were performed in general accordance with ARIZ 733.

Chloride Content

Chloride content tests were performed to evaluate the corrosion potential of the on-site soils. Tests were performed in general accordance with ARIZ 736.

pH and Resistivity

pH and resistivity tests were performed on the bulk soil sample to evaluate the site soil corrosion potential. Test procedure was in general accordance with Arizona Test Method 236.

Alpha Geotechnical & Materials, Inc.

Project:	VIP Products	**Project Number:**	21-G-12051
Location:	137th Avenue and Test Drive	**Sample Number:**	44023
Material:	Native Soil	**Sample Date:**	02/17/21
Sample Source:	B-02 @ 0' - 4.5'	**Sampled by:**	AX
Proposed Use:	Pads		

Sieve Analysis of Fine and Coarse Aggregates (ASTM C136/C117)
Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D4318) (Dry Prep)

Mechanical Analysis

Sieve Size	% Passing
6 in / 152mm	100
4 in / 100mm	100
3 in / 75mm	100
2 in / 50mm	100
1 1/2 in / 37.5mm	100
1 1/4 in / 32 mm	100
1 in / 25 mm	100
3/4 in / 19 mm	100
1/2 in / 12.5 mm	100
3/8 in / 9.5 mm	100
1/4 in / 6.4 mm	100
#4, 4.75mm	100
#8, 2.36mm	99
#10, 2.00mm	99
#16, 1.18mm	98
#30, 0.60mm	95
#40, .425mm	93
#50, .300mm	89
#100, .150mm	78
#200, .075mm	66

Atterberg Limits

LL:	28
PL:	15
PI:	13
USCS:	CL
AASHTO:	A-6(6)

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Tempe, Arizona 85282

Alpha Geotechnical & Materials, Inc.

Project:	VIP Products	**Project Number:**	21-G-12051
Location:	137th Avenue and Test Drive	**Sample Number:**	44024
Material:	Native Soil	**Sample Date:**	02/17/21
Sample Source:	B-03 @ 0' - 4.5'	**Sampled by:**	AX
Proposed Use:	Pads		

Sieve Analysis of Fine and Coarse Aggregates (ASTM C136/C117)
Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D4318) (Dry Prep)

Mechanical Analysis

Sieve Size	% Passing
6 in / 152mm	100
4 in / 100mm	100
3 in / 75mm	100
2 in / 50mm	100
1 1/2 in / 37.5mm	100
1 1/4 in / 32 mm	100
1 in / 25 mm	100
3/4 in / 19 mm	100
1/2 in / 12.5 mm	100
3/8 in / 9.5 mm	100
1/4 in / 6.4 mm	100
#4, 4.75mm	100
#8, 2.36mm	100
#10, 2.00mm	99
#16, 1.18mm	99
#30, 0.60mm	97
#40, .425mm	95
#50, .300mm	91
#100, .150mm	82
#200, .075mm	71

Atterberg Limits

LL:	30
PL:	16
PI:	14
USCS:	CL
AASHTO:	A-6(8)

Reviewed by: JV

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Tempe, Arizona 85282

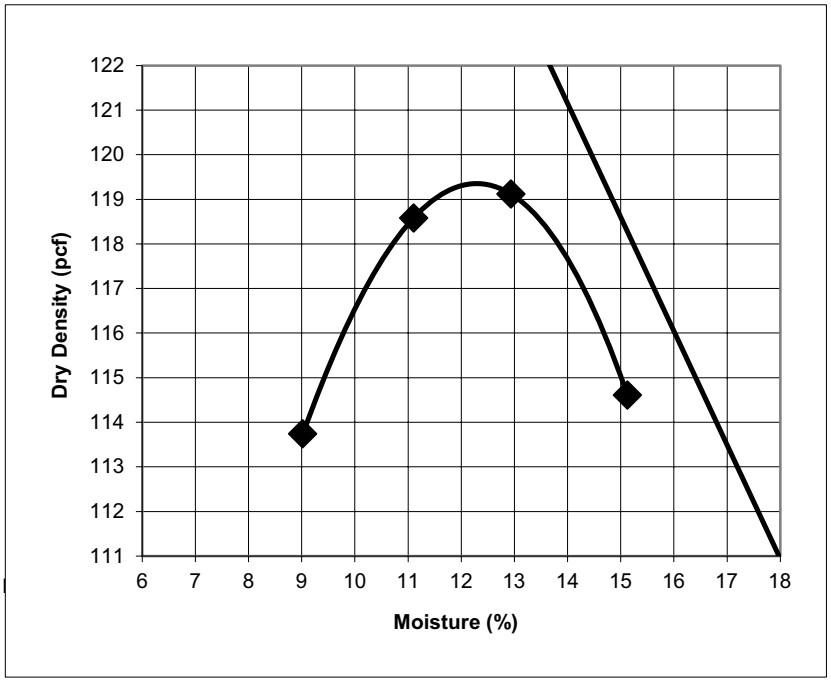
Alpha Geotechnical & Materials, Inc.

Project:	VIP Products	**Project Number:**	21-G-12051
Location:	137th Avenue and Test Drive	**Sample Number:**	44025
Material:	Native Soil	**Sample Date:**	02/17/21
Sample Source:	B-04 @ 0' - 4.5'	**Sampled by:**	AX
Proposed Use:	Pads		

Laboratory Compaction Characteristics of Soils Using
Standard Efforts (12,400ft-lb-ft/cu.ft) (ASTMD698A)
Sieve Analysis of Fine and Coarse Aggregates (ASTM C136/C117)
Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D4318) (Dry Prep)

ONE DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS, 144 PSF SURCHARGE (ASTM D-4546)

	English (pcf)	Metric (kg/cu.m)
Maximum Dry Density:	119.4	1912
Optimum Moisture (%):	12.3	12.3



Sieve Size	Percent Passing
6 in / 152mm	100
4 in / 100mm	100
3 in / 75mm	100
2 in / 50mm	100
1 1/2 in / 37.5mm	100
1 1/4 in / 32 mm	100
1 in / 25 mm	100
3/4 in / 19 mm	100
1/2 in / 12.5 mm	100
3/8 in / 9.5 mm	100
1/4 in / 6.4 mm	100
#4, 4.75mm	99
#8, 2.36mm	99
#10, 2.00mm	99
#16, 1.18mm	98
#30, 0.60mm	94
#40, .425mm	91
#50, .300mm	86
#100, .150mm	74
#200, .075mm	61

LL:	27
PI:	12
% Swell:	2.3
USCS:	CL
AASHTO:	A-6(4)

Notes:

- The Zero Air Void Curve Represents a Specific Gravity of 2.65 assumed for the -#4 Material.
- This is a Summarized Report of the Referenced Procedures and Does Not Include All Reporting Requirements. Additional Data Can be Provided at Clients Request.

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Tempe, Arizona 85282

Alpha Geotechnical & Materials, Inc.

Project:	VIP Products	**Project Number:**	21-G-12051
Location:	137th Avenue and Test Drive	**Sample Number:**	44026
Material:	Native Soil	**Sample Date:**	02/17/21
Sample Source:	B-05 @ 0' - 4.5'	**Sampled by:**	AX
Proposed Use:	Pads		

Sieve Analysis of Fine and Coarse Aggregates (ASTM C136/C117)
Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D4318) (Dry Prep)

Mechanical Analysis

Sieve Size	% Passing
6 in / 152mm	100
4 in / 100mm	100
3 in / 75mm	100
2 in / 50mm	100
1 1/2 in / 37.5mm	100
1 1/4 in / 32 mm	100
1 in / 25 mm	100
3/4 in / 19 mm	100
1/2 in / 12.5 mm	100
3/8 in / 9.5 mm	100
1/4 in / 6.4 mm	100
#4, 4.75mm	100
#8, 2.36mm	99
#10, 2.00mm	99
#16, 1.18mm	99
#30, 0.60mm	97
#40, .425mm	95
#50, .300mm	92
#100, .150mm	83
#200, .075mm	70

Atterberg Limits

LL:	29
PL:	17
PI:	12
USCS:	CL
AASHTO:	A-6(6)

Reviewed by: JV

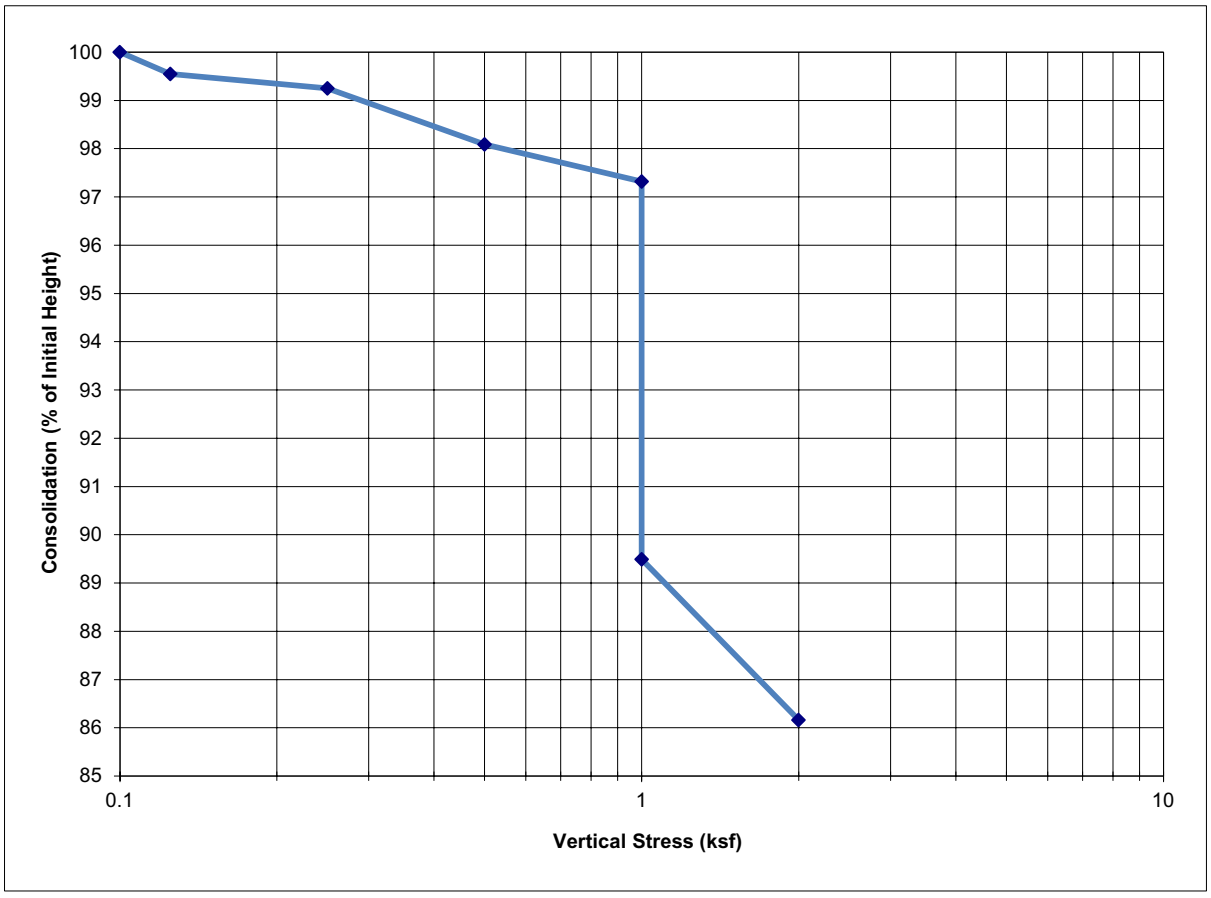
Alpha Geotechnical and Materials, Inc.
2504 West Southern Avenue
Tempe, Arizona 85282

Alpha Geotechnical & Materials, Inc.

Project:	VIP Products	**Project Number:**	21-G-12051
Project Location:	137th Avenue and Test Drive		
Client:	Sun State Builders	**Sample Number:**	44027
Material:	Native	**Date Sampled:**	02/17/21
Sample Source:	Boring B-04 @ 2.5'-3.5'		
Sample Prep:	Insitu		

One-Dimensional Consolidation Properties of Soils (ASTM D2435)

Initial Volume (cu.in)	4.60	Final Volume (cu.in)	3.97
Initial Moisture Content	6.7%	Final Moisture Content	25.5%
Initial Dry Density(pcf)	84.3	FInal Dry Density(pcf)	97.8
Initial Degree of Saturation	18%	FInal Degree of Saturation	98%
Initial Void Ratio	1.0	Final Void Ratio	0.7
Estimated Specific Gravity	2.65	Saturated at	1 ksf



Reviewed by: JV

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Alpha Geotechnical & Materials, Inc.

Project:	VIP Products	**Project Number:**	21-G-12051
Location:	137th Avenue and Test Drive	**Sample Number:**	44025
Material:	Native Soil	**Sample Date:**	2/17/2021
Sample Source:	B-04 @ 0' - 4.5'	**Sampled by:**	AX
Proposed Use:	Pads		

pH & Resistivity (AZ 236)

Resistivity (Ohm-cm)	pH
1159	8.28

Reviewed by: JV

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Tempe, Arizona 85282

MOTZZ LABORATORY, INC.

Laboratory Analysis Report

Alpha Geotechnical and Materials
Juan Valenciano
2504 W. Southern Ave
Tempe, AZ 85282

Project: 21-G-12051
Date Received: 2/24/2021
Date Reported: 2/26/2021
PO Number: 21G12051

Lab Number: 935716-1 **44025** **B-04 (0-4.5')**

Test Parameter	Method	Result	Units	Levels
Sulfate	ARIZ 733b	6	ppm	
Chloride	ARIZ 736b	88	ppm	