SPEEDIE AND ASSOCIATES
Geotechnical ▪ Environmental ▪ Materials Engineers

www.speedie.net

August 13, 2014

Mr. Ryan Toner, P.E.
Dibble Engineering
7500 N. Dreamy Draw Drive, Suite 200
Phoenix, AZ 85020

RE: Project No. 140751SA
Pinal Airpark Aircraft Parking
Pinal Airpark Road W/o I-10
Pinal County, AZ
Findings and Recommendations

Dear Mr. Toner:

This letter presents the findings of our limited geotechnical investigation for the proposed aircraft parking area to be constructed at the northwest corner of the Pinal Airpark in Pinal County, Arizona.

Project Description

It is understood that there is a desire to construct a new aircraft long term parking area near the northwest corner of the airport. The project will include the construction of a taxi-lane, aircraft storage areas and possibly a tear down/recycle pad. Access to the area will be on the new taxi-lane. It is anticipated that the aircraft will be moved out to this area using aircraft tugs and that the aircraft will not be under their own power. Once in the area the aircraft may be left for extended periods of time with minimal movement. The tear down pad is anticipated to be on the order of 250 feet by 250 feet.

Preliminary information indicates that the primary desire is to use an unpaved all-weather surface, although options for traditional asphalt or concrete pavements may be considered. The taxi-lane and aircraft storage areas will need to be designed to accommodate occasional loading from moderate to heavy aircraft. Based on our discussions, the taxi-lane may see 1 aircraft per day and once moved to the designated parking areas the aircraft may be left for several weeks or more. A detailed analysis on the types and sizes of aircraft that may use the area was unavailable, however it is anticipated that the typical aircraft will consist of larger commercial jets such as the Boeing 747 and Boeing 737. The taxi-lane and parking areas will need to be designed to accommodate these loading conditions.

It is anticipated that this project will be privately funded and the designs and materials will not need to meet the standard FAA specifications. Where applicable to this project, the design process has followed the procedures outlined in FAA AC No. 150/5320-6E. However due to the desire to use an unpaved surface with large aircraft alternate methods and analysis procedures were utilized, including using AASHTO roadway design procedures.

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Field and Laboratory Testing

The project site is located at the northwest corner of the facility near the north end of Runway 12/30. The area primarily consists of undeveloped desert area with a moderate amount of desert vegetation and weeds. It appears that some minor grading/clearing was conducted closer to the runway and the vegetation is generally thicker toward the west end of the project. The airport facilities are located to the east and there are evaporation ponds located to the west. In general the project area is generally flat. The owners have reported that this area occasionally floods or is inundated as a result of the Santa Cruz River flooding during heavy storm events. The Santa Cruz River is located just to the west of this project area.

On May 23, 2014 representatives from Speedie & Associates, Inc. (SA) were on site to conduct the limited field investigation and gather soils for laboratory testing and engineering analysis. The field investigation consisted of conducting a total of six (6) structural borings within the project area. The borings were advanced to a depth of up to 11.5 feet below existing grades utilizing a truck-mounted CME-75 drill rig with 7 ½ inch diameter augers. Samples from the borings were obtained with split-spoon samplers and a California ring sampler (undisturbed samples). The approximate location of each of the borings is shown on the attached Soil Boring Location Plan.

Subsoil within the project limits were somewhat variable. The upper soils on the western half of the site generally consisted of fine grained sandy lean clays to depths of approximately 4 feet below grade. These upper soils were then underlain by sandier soils consisting of clayey sands. The eastern portion of the project consisted primarily of silty clayey sands with isolated lenses of well graded sand and sandy lean clay. The borings were terminated in these deposits at depths of up to 11.5 feet below existing grades. Subordinate amounts of gravel and a varying degree of calcareous cementation were also noted in the profile. The standard penetration resistance test (SPT) values range from 7 to 50+ blows per foot, generally increasing with depth due to the calcareous cementation. Only boring B-6 encountered loose conditions at the bottom depth of the boring, likely a result of the fine sands encountered at that location. No groundwater was encountered during this investigation. Based on visual and tactile observation, the soils were in a 'dry' state at the time of investigation.

Laboratory testing indicates in-situ dry densities of the upper soils on the order of 94 to 105 pcf and water contents on the order of 3 to 9 percent at the time of investigation. Liquid limits range from 19 to 28 percent. Plasticity indices are on the order of 4 to 11 percent. These results generally indicate a moderate shrink/swell potential due to wetting. A C.B.R. test on the finer clayey soils from the western half of the site indicated a C.B.R. value of 11 at 95 percent compaction of a modified proctor. A modified proctor value was selected based on the anticipated aircraft loading of greater than 60,000 lbs and typical FAA standards. These values were used in analysis of the new paved and unpaved aircraft surfaces.

Analysis

Analysis of the field and laboratory data indicates that the subgrade soils will provide marginal support for the new taxi-lane and storage areas. While it would be preferable to use a traditional asphalt concrete surface, we understand that the area will have limited traffic passes and that all aircraft will be towed out to the storage areas, therefore an unpaved surface may be feasible. Options are provided for both an unpaved surface and traditional asphalt concrete surface. For the unpaved surface option several alternative approaches are available for consideration.

Using an unpaved surface will require a slightly thicker section of granular material and it will be critical to provide proper grading and drainage to reduce the amount maintenance that may be required. All unpaved surfaces will require more frequent routine maintenance than traditional pavement construction.

Adequate drainage will be critical for long-term performance of the unpaved surface. Special attention must be paid to proper crowning (crossfall) and/or longitudinal slope to prevent ponding on the surface. Typically a minimum cross slope of 5 percent is recommended for unpaved areas. If ponding is allowed on any unpaved surface, early breakdown of the surface and increased maintenance will be required.

Based on our discussions with the owner there are also concerns with potential flooding from the Santa Cruz River to the west. Due to this potential it is recommended that the proposed storage areas and taxi-lanes be built up to minimize the chances of flooding and long term water ponding which will reduce the integrity of the surface.

Due to the aircraft loading conditions (greater than 60,000 pounds), any site preparation below areas subjected to aircraft loading, should be compacted to the specified percent compaction of the maximum dry density determined by ASTM D-1557 (Modified proctor) test method.

Groundwater is not expected to be a factor in the design or construction of the proposed improvements and any underground utilities. Excavation operations should be relatively straightforward although variable cemented soils may impede progress and possibly require the use of heavier equipment for deeper excavations.

Site Preparation

The entire area to be occupied by the proposed new construction should be stripped of all vegetation, debris, rubble and obviously loose surface soils. Any remaining structures or old pavements within the project limits should be removed in their entirety along with soil disturbed by this activity. We assume that the project will not encroach on or include the evaporation ponds at this time. Any existing asphaltic concrete may be cold-milled in-place to a gradation similar to that of an ABC and it, along with any existing aggregate base, stockpiled for possible reuse as part of the unpaved storage area or taxi-lane structure.

Sufficient additional soil should be removed to allow placement of the new pavement/access section. All resulting excavations should be widened as necessary to allow access for compaction equipment. The exposed area should be proof-rolled with a heavy rubber tire vehicle (loaded water truck or dump truck). If unstable soil conditions are present, it may be necessary to deepen the over-excavation to remove all deleterious material and soft soil. A representative of the geotechnical engineer should examine the subgrade once sub-excavation is complete and prior to backfilling to ensure removal of deleterious or loose materials. Fill placement and quality should be as defined in the "Fill and Backfill" section of this letter.

Prior to placing the new structural fill in areas subject to aircraft traffic, the exposed subgrade should be compacted to 95 percent of maximum dry density as determined by ASTM D-1557 to a depth of 12 inches. (Note: FAA Standards call for Modified proctor reference for aircraft over 60,000 lbs.). The depth of compaction is increased over the standard 8 inches to ensure a stable base for the unpaved surface.

Fill and Backfill

Native soils are considered suitable for use in general grading fills and general engineered pad fill provided particles greater than 3 inches in size are first removed.

If imported common fill for use in site grading is required (raising site grades), it should be examined by a Soils Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious material. In general, the fill should have 100 percent passing the 3-inch sieve and no more than 60 percent passing the 200 sieve. For the fine fraction (passing the 40 sieve), the liquid limit and plasticity index should not exceed 30 percent and 10 percent, respectively. It should exhibit less than 1.5 percent swell potential when compacted to 95 percent of maximum dry density (ASTM D-1557) at a moisture content of 2 percent below optimum, confined under a 100 psf surcharge, and inundated.

Fill should be placed on subgrade which has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve optimum moisture content, ±2 percent. Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to the percent of maximum dry density per **ASTM D-1557** set forth as follows:

A.	Non Airfield Pavement Subgrade or Fill	92
B.	Airfield Pavement Subgrade or Fill	95
C.	Non Airfield Utility Trench Backfill	92
D.	Aggregate Base Course/Unpaved Surface	100
E.	Tear-down/Recycle pad	100
F.	Landscape Areas	90

For the unpaved surface option, the unpaved surface should consist of a granular material, such as an aggregate base course, asphalt millings or cement treated base (CTB). This base course material should be A.B.C. per M.A.G. Section 702 Specifications or FAA Specification P-209. Since this is a 'private' project, materials may meet local governing agency (M.A.G.) specifications rather than FAA material requirements.

Pavement – Unpaved Surface

It is understood that the primary approach for this project will be to provide an unpaved gravel surface to use for aircraft parking. The aircraft will be towed to the location and may be left for several weeks to months. Given the intended use a comprehensive traffic analysis was unavailable for this project. Based on past uses at this airport it is anticipated that the subject site will use moderate sized to large sized commercial type aircraft. The aircraft may consist of moderate sized aircraft, such as the Boeing 737, which will likely be more frequent to the large size Boeing 747. Operations are anticipated to be low with 1 to 2 passes a day possible for the taxi-lane portion of the project. Maximum takeoff weights of these aircraft ranges from 100,000 lbs up to approximately 700,000 lbs. These general parameters were used in estimating the required section for the unpaved and paved surfaces. If the loading conditions change or these estimates are not accurate, additional evaluation may be necessary.

These pavement sections were calculated using the general procedures outlined in FAA Advisory Circular AC 150/5320-6E and the FAA computer program FAARFIELD. The designs are based on the assumption that the controlling subgrade will consist of the compacted native soils materials meeting the requirements presented herein. A C.B.R. value of 11 was used in the determination of new structural sections. Since this may be a 'private' project, materials may meet local governing agency (M.A.G.) specifications rather than FAA material requirements. Options are provided for using just a standard aggregate base material as well as using a cement treated base, which reduces the required section.

These new sections are being constructed on loose to medium dense clayey sand and sandy clay, shallow groundwater is not an issue, drainage is good (therefore subbase is not soaked), the climate is dry and there is no frost. The following table presents the recommended sections to support the anticipated traffic. The designer/owner should choose the appropriate sections to meet the intended use.

Unpaved Storage Pavement and Taxi-Lane Sections

Pavement Location	Total Pavement Thickness	Unpaved Section		
		CTB P-304[2]	ABC P-209[3]	Compacted Subgrade P-152
Aircraft Parking Areas	16.0"	-	16.0"	12.0"
	14.0"	6.0"	8.0"	12.0"

Notes:
1. Section minimums according to FAARFIELD
2. A cement treated base following either FAA Specification P-304 or M.A.G. Section 312.
3. Aggregate base course using FAA Specification P-209 or M.A.G. Section 702. Asphalt millings may be used provided the meet the general requirements of M.A.G. aggregate base course.
4. All unpaved surfaces will require routine maintenance. Proper drainage is critical to the long term performance.
5. It is recommended that regardless of the option selected a surface seal be applied to help reduce moisture infiltration, erosion, and dust build up. The surface seal could consist of an asphalt prime coat or another topical treatment.

Pavement – Asphalt Concrete Surface

Given the intended use of the area and the low traffic volumes anticipated an unpaved surface may be feasible but may require additional maintenance. As an alternative to an unpaved surface a more traditional asphalt concrete section is provided for consideration. The following asphalt concrete sections may be used for the anticipated low volume traffic on this project.

Asphalt Concrete Pavement Sections

Pavement Location	Total Pavement Thickness	Asphalt Section		
		AC P-401[2]	ABC P-209[3]	Compacted Subgrade P-152
Aircraft Parking Areas	15.0"	3.0"	12.0"	12.0"
	14.0"	4.0"	10.0"	12.0"

Notes:
1. Section minimums according to FAARFIELD
2. Asphalt concrete surface using FAA Specification P-401 or M.A.G. Section 710.
3. Aggregate base course using FAA Specification P-209 or M.A.G. Section 702. Asphalt millings may be used provided the meet the general requirements of M.A.G. aggregate base course.

Asphalt concrete subject to direct plane traffic should consist of FAA Specification P-401 (or modified M.A.G. 710). Pavement base course material should be A.B.C. per M.A.G. Section 702 Specifications. It is recommended that a ½ inch or ¾ inch mix designation be used for the pavement. While a ¾ inch mix may have a somewhat rougher texture, it offers more stability and resistance to scuffing, particularly in turning areas. PG 70-10 is the recommended bituminous material grade. 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 be 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.

Concrete Slabs on Grade

The project may consist of a demolition pad which will allow for the deconstruction and crushing of aircraft. As a result it may be desired to have a working slab for this operation. For this section we would recommend a minimum of 8 inches of concrete pavement on at least 8 inches of aggregate base.

Aircraft Plain, jointed Portland Cement Concrete Pavement should be designed to meet the FAA Standard Specifications P-501. It must have a minimum 28-day flexural strength 650-psi (compressive strength of approximately 5,000-psi), (90-day design strength of 715-psi). Type II low alkali cement is acceptable. A minimum cement content of 564 pounds per cubic yard and a maximum water/cement ratio of 0.45 are recommended. Type F flyash may be used as a partial replacement for some of the cement, typically up to 15 percent. Locally, public agencies have been considering increasing the direct (1:1) replacement of up to 25 percent of the cement. This provides additional protection against alkali silica reaction (ASR) should the supplier have an aggregate issue.

A minimal section of aggregate base course is included in the section to provide for fine grading and uniform support of the pavement. Attention must be paid to using low slump concrete and proper curing to reduce curling. No structural reinforcement is necessary. Joint design and spacing should be in accordance with FAA recommendations. Panels should be divided in as nearly square patterns as possible with width to length ratios not exceeding 1.25. Joint spacing should not exceed 20-feet. Joint sealant meeting FAA requirements is recommended. Dowel bars are recommended at all joints in accordance with FAA guidelines. Tie bars are recommended in the last two sets of joints adjacent to unsupported edges to reduce the potential for the joint opening. Dowel bars will also be required where the new pavement ties into the existing concrete pavement.

Our analysis of data and the recommendations presented herein are based on a visual assessment, a limited investigation and the assumption that soil conditions do not vary significantly from those found on the observed locations.

We recommend that a representative of the Soils Engineer observe and test the earthwork and inspect the grading portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

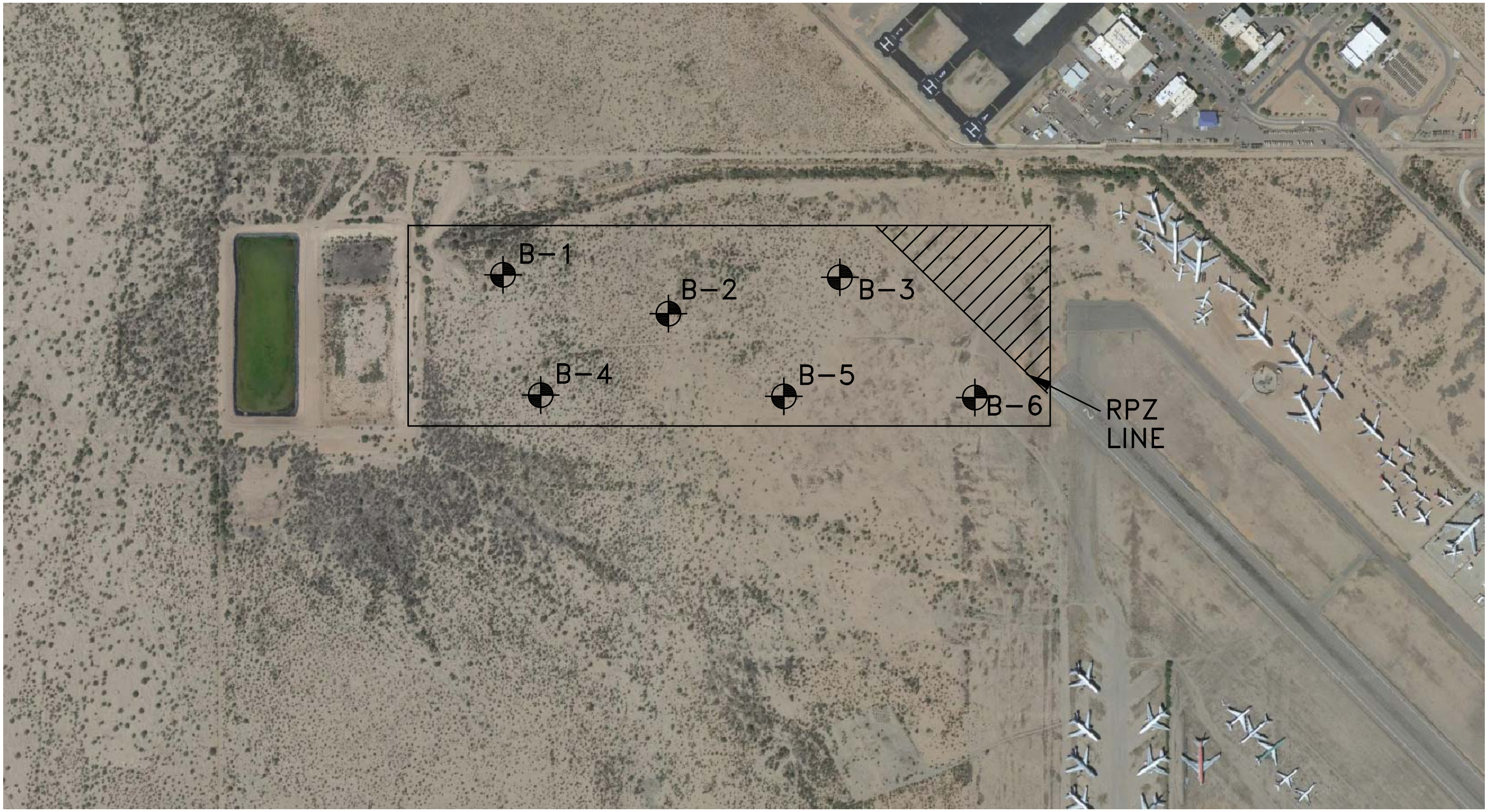
If there are any questions, or if we can be of further service, please call.

Respectfully submitted,
SPEEDIE & ASSOCIATES, INC.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
43813
TODD B.
HANKE
Date Signed 8/13/14
ARIZONA, U.S.A.
Expires 03/31/15

Todd B. Hanke, P.E.

Attachments:



– APPROXIMATE SOIL BORING LOCATIONS

SOIL BORING LOCATION PLAN

DR: TBH	CHK:	REV:	DATE: 6/25/14	PROJECT NO. 140751SA

PINAL AIRPARK AIRCRAFT PARKING
PINAL AIR PARK ROAD WEST OF I-10
PINAL COUNTY, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS
3331 E. WOOD ST. PHOENIX, ARIZONA 85040 (602) 997-6391

Rig Type:	**CME-75**
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**Not Determined**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0–25–50)
0	Very Stiff Orange-Brown SANDY LEAN CLAY (CL-Dry)					
		BS-1	2.0	NT	NT	
		S-2	3.5	NT	NT	
4.0	Very Dense Light Orange-Brown CLAYEY SAND (SC-Dry) Very Fine to Fine-Grained, Cemented, Contains Cemented Nodules					
		RS-3	6.0	NT	NT	64/12"
11.5	End of Boring	S-4	11.5	NT	NT	54/12"

Boring Date:	**5-23-14**
Field Engineer/Technician:	**K. Karaba**
Driller:	
Contractor:	**Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-1**

Pinal Air Park Aircraft Parking

Pinal Air Park

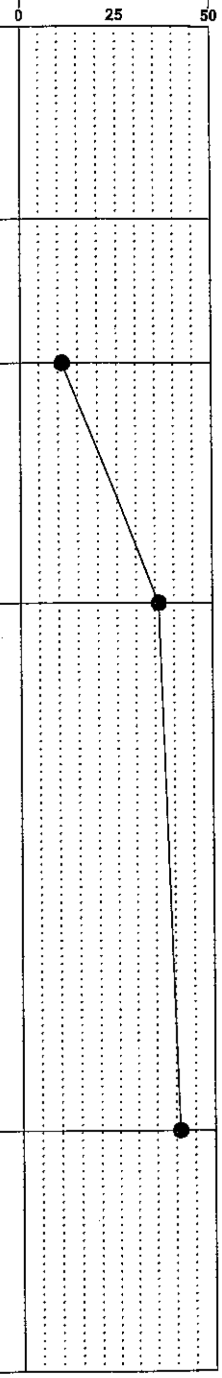
Marana, Arizona

Project No.: **140751SA**

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **Not Determined**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0	Medium Dense Orange-Brown SILTY, CLAYEY SAND (SC/SM-Dry) Fine to Coarse-Grained				
		BS-1	2.0	NT	NT
		S-2	3.5	NT	NT
5	Slightly cemented below 5 feet				
		RS-3	6.0	3.3	105.0
9.0	Dense Brown WELL GRADED SANDY GRAVEL (GW-Dry) Fine to Coarse-Grained				
10					
11.5	End of Boring	S-4	11.5	NT	NT

Penetration Resistance Blows per Foot



Boring Date: **5-23-14**
Field Engineer/Technician: **K. Karaba**
Driller:
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-2**

Pinal Air Park Aircraft Parking

Pinal Air Park

Marana, Arizona

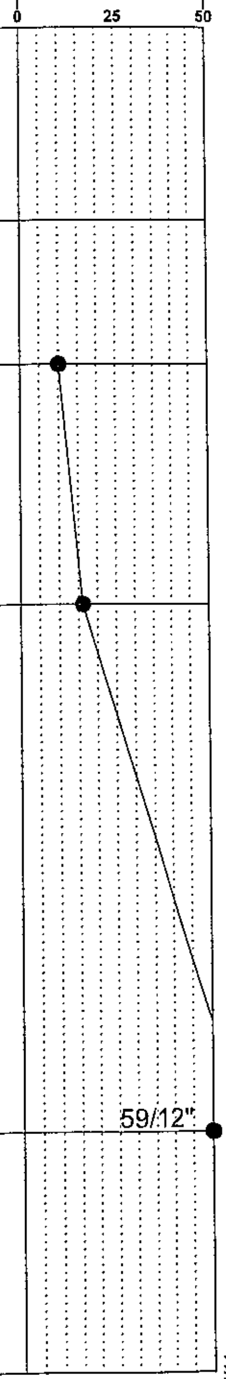
Project No.: **140751SA**

_SPEEDIE 140751SA.GPJ GENGEO.GDT 6/25/14

Rig Type:	**CME-75**
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**Not Determined**

Visual Classification

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0	Loose Orange-Brown SILTY, CLAYEY SAND (SC/SM-Dry) Fine to Coarse-Grained					
		BS-1	2.0	NT	NT	
		S-2	3.5	NT	NT	
5	Medium Dense, slightly cemented at 5 feet					
		RS-3	6.0	3.8	103.8	
8.5	Medium Dense Light Orange-Brown WELL GRADED SAND (SW-Dry) Fine to Coarse-Grained					
11.0	Hard Brown SANDY CLAY (CL-Dry) Moderately Cemented					
11.5	End of Boring	S-4	11.5	NT	NT	59/12"



Boring Date:	**5-23-14**
Field Engineer/Technician:	**K. Karaba**
Driller:	
Contractor:	**Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-3**

Pinal Air Park Aircraft Parking

Pinal Air Park

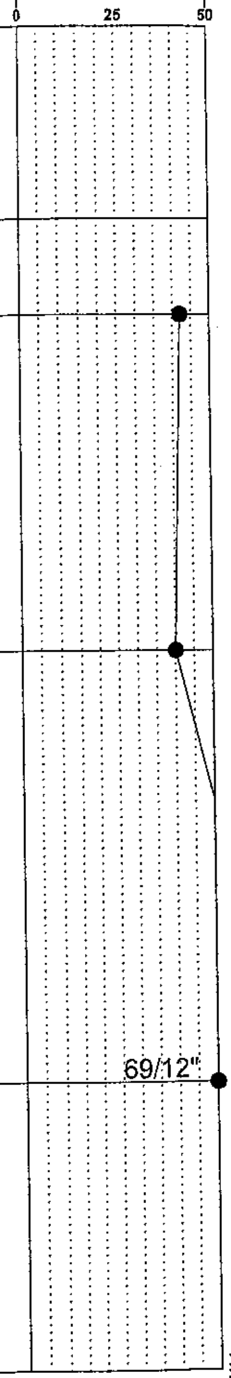
Marana, Arizona

Project No.: **140751SA**

_SPEEDIE 140751SA.GPJ GENGEO.GDT 6/25/14

Rig Type:	**CME-75**
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**Not Determined**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0	Hard Orange-Brown SANDY CLAY (CL-Dry) Well Cemented					
		BS-1	2.0	NT	NT	
		RS-2	3.0	NT	NT	
4.0	Dense Orange-Brown CLAYEY SAND (SC-Dry) Very Fine to Fine-Grained, Cemented					
5						
		S-3	6.5	NT	NT	
10.0	Hard Brown SANDY CLAY (CL-Dry) Well-Cemented					
11.0	End of Boring	S-4	11.0	NT	NT	69/12"



Boring Date:	**5-23-14**
Field Engineer/Technician:	**K. Karaba**
Driller:	
Contractor:	**Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-4**

Pinal Air Park Aircraft Parking

Pinal Air Park

Marana, Arizona

Project No.: **140751SA**

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **Not Determined**

Visual Classification

Depth (feet)	Visual Classification
0 – 8.5	Medium Dense Orange-Brown SILTY, CLAYEY SAND (SC/SM-Dry) Fine to Coarse-Grained
5	Light Orange-Brown, with Gravel at 5 feet
8.5 – 10.9	Hard Light Orange-Brown SANDY CLAY (CL-Dry) Well Cemented
10.9	End of Boring

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
BS-1	2.0	NT	NT	
RS-2	3.0	NT	NT	
S-3	6.5	NT	NT	
S-4	10.9	NT	NT	84/9"

Boring Date: **5-23-14**
Field Engineer/Technician: **K. Karaba**
Driller:
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-5**

Pinal Air Park Aircraft Parking

Pinal Air Park

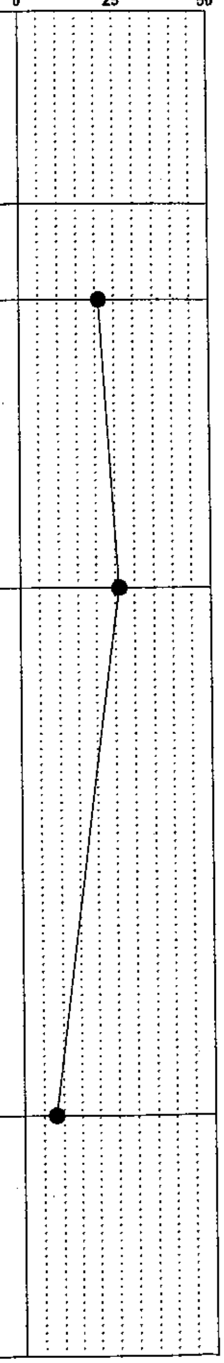
Marana, Arizona

Project No.: **140751SA**

Rig Type:	CME-75
Boring Type:	**Hollow Stem Auger**
Surface Elevation:	**Not Determined**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0 – 7.0	Medium Dense Orange-Brown <u>SILTY, CLAYEY SAND</u> (SC/SM-Dry) Fine to Coarse-Grained	BS-1	2.0	NT	NT
		RS-2	3.0	9.5	94.1
		RS-3	6.0	NT	NT
7.0 – 11.5	Loose Light Orange-Brown <u>WELL GRADED SAND</u> (SW-Dry) Fine to Coarse-Grained	S-4	11.5	NT	NT
11.5	End of Boring				

Penetration Resistance Blows per Foot (0, 25, 50)



Boring Date: **5-23-14**

Field Engineer/Technician: **K. Karaba**

Driller:

Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-6**

Pinal Air Park Aircraft Parking

Pinal Air Park

Marana, Arizona

Project No.: **140751SA**

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Pounds Per Cubic Foot)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
						#200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	3" SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
B-1	BS-1	BULK	0.0 - 2.0	NT	NT	51	79	95	98	100	28	17	11	CL	SANDY LEAN CLAY
B-2	RS-3	RING	5.0 - 6.0	3.3	105.0	NT	NT	NT	NT	NT	NT	NT	NT		
B-3	RS-3	RING	5.0 - 6.0	3.8	103.8	NT	NT	NT	NT	NT	NT	NT	NT		
B-5	BS-1	BULK	0.0 - 2.0	NT	NT	34	66	91	97	100	19	15	4	SC-SM	SILTY, CLAYEY SAND
B-6	RS-2	RING	2.0 - 3.0	9.5	94.1	NT	NT	NT	NT	NT	NT	NT	NT		

Sieve analysis results do not include material greater than 3". Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested

Sheet 1 of 1

Pinal Air Park Aircraft Parking
Pinal Air Park
Marana, Arizona
Project No. 140751SA

SPEEDIE AND ASSOCIATES

MOISTURE-DENSITY RELATIONS

PROJECT: Pinal Air Park Aircraft Parking
PROJECT NO.: 140751SA

LOCATION: Pinal Air Park
DATE: 5/23/14

BORING NO.: B-1 SAMPLE NO.: BS-1 SAMPLE DEPTH: 0 to 2
LABORATORY NO.:

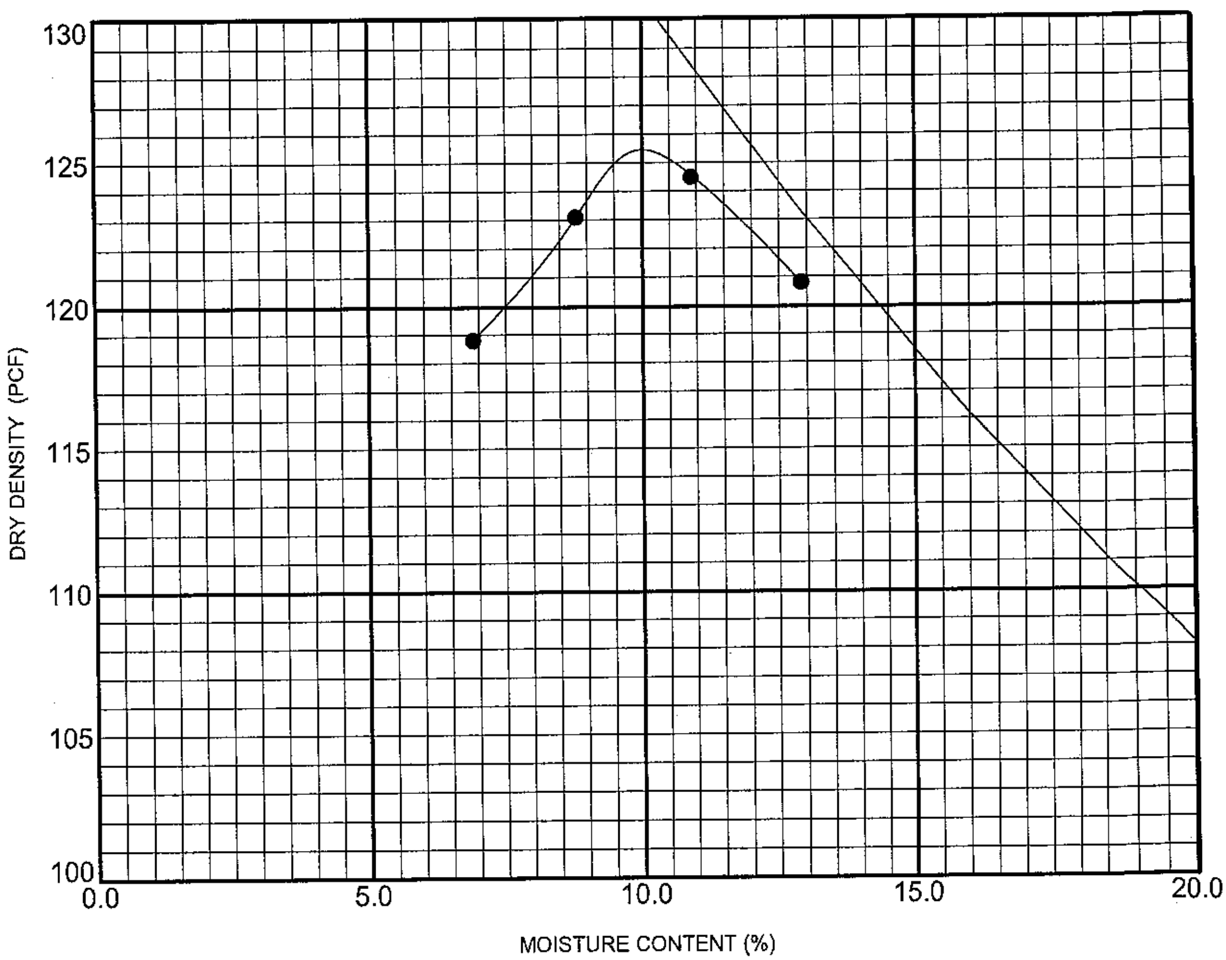
METHOD OF COMPACTION: 1557C

LIQUID LIMIT: 28 PLASTIC LIMIT: 17 PLASTICITY INDEX: 11

CLASSIFICATION: CL ASTM SOIL DESCRIPTION: SANDY LEAN CLAY

ASTM D1557 Method C

MAXIMUM DRY DENSITY: **125.4 PCF**
OPTIMUM MOISTURE CONTENT: **10.0%**



SPEEDIE AND ASSOCIATES

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Geotechnical ▪ Environmental ▪ Materials Engineers
3331 EAST WOOD STREET • PHOENIX, ARIZONA 85040

C.B.R. (ASTM D 1883)

CLIENT: **Dibble Engineering**
Ryan Toner
7500 N. Dreamy Draw Drive, Suite 200
Phoenix, AZ 85020-4660

PROJECT NO: **140751SA**
LAB NO: **NR340**
DATE: **6/9/2014**

PROJECT: **Pinal Airpark Aircraft Parking**
LOCATION: **Pinal Air Park Road W/o I-10**
SAMPLE ID: **B-1 BS-1 @ 0'**

PENETRATION (inches)	10 BLOWS		30 BLOWS		65 BLOWS	
	Load (lbs.)	STRESS (psi)	Load (lbs.)	STRESS (psi)	Load (lbs.)	STRESS (psi)
0.000	0	0.0	0	0.0	0	0.0
0.025	10	3.5	19	6.4	2	0.8
0.050	26	8.6	47	15.6	32	10.7
0.075	44	14.7	80	26.7	102	33.9
0.100	54	18.0	98	32.7	210	70.1
0.125	82	27.2	149	49.5	324	107.9
0.150	110	36.7	200	66.8	411	137.0
0.175	150	50.0	272	90.8	567	189.1
0.200	182	60.8	332	110.5	699	232.9
0.300	262	87.3	476	158.8	1053	351.1
0.400	284	94.7	517	172.2	1156	385.2
0.500	302	100.7	549	183.2	1211	403.7

	DD - BT	DD - AT	% MOIST. BT	% MOIST. AT	TOP 1" % MOIST.	AVE % MOIST - AS	% SWELL	CORR. C.B.R.
10 BL.	108.7	108.6	10.6	16.5	21.6	19.1	2.3	4.1
30 BL.	117.8	116.1	10.3	14.5	20.4	17.5	3.3	10.0
65 BL.	125.2	123.9	10.3	11.3	16.4	13.8	2.0	20.0

MAXIMUM DRY DENSITY (ASTM D 1557 "C") = 125.4 pcf
OPTIMUM MOISTURE CONTENT = 10.0 %

CORRECTED FINAL C.B.R. @ 95 % COMPACTION = 11

Reviewed by: ______________________