DEVELOPMENT SERVICES
ENGINEERING DIVISION
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TURLOCK MUNICIPAL AIRPORT
IN MERCED COUNTY, CALIFORNIA
Widen Runway 12/30 and Airfield Electrical Upgrades
FEDERAL PROJECT: AIP 03-06-0265-12-2017

Date: 8/09/2017 **City Project No.: 16-75** **Addendum No.: 1**

Plan holders:

The following changes and notations shall be made to the project plans and specifications or are clarifications to questions that have been presented:

Project Plans:

Install end plug at 4" pipe at Sta. 9+96 with invert of 159.18.

Concrete Vault Dimensions - A.Nominal exterior dimensions are to be 10'-6" X 14'-6" X 10'-6".

1. **Sheet 5:**
   Description of change or reference to attached change.
   I. PHASING NOTES, Item G clarification: Delete reference to "NEW AWOS III". There is no AWOS III work included in the project.
   II. Stockpile area shown on plan sheet 5 is intended for materials suitable for re-use or construction of the specified work, including excess suitable soils, and does not include Items M-105-4.1 Removal of Miscellaneous Improvements or P-151-4.1 Clearing and Grubbing, which are to be legally disposed of off airport property.

2. **Sheet 6:**
   I. Revise outlet pipe on PAVEMENT EDGE DETAIL detail to Schedule 80 PVC. Clarification - Add station label to PIPE UNDERDRAIN CONNECTION DETAIL title on sheet 6 to show "STA 18+86".

3. **Sheet 18:**
   I. Is there a catch basin between runway and taxiway at the end of the 4" edge drain?
      i. There will be no structure required. Add station label at this location to show – STA 16+77/127' RT. 4" INV. = 156.0. Add Construction note to this location to indicate – 10. INSTALL HDPE END CAP (PERFORATED).
4. **Sheet 25:**
   III. Drywell - The installation details depicting a 50-foot estimated total drilling depth as contained in the Dry Well Detail, STA. 40+90/95.6' LT, on plan sheet 25, includes a 15-foot settling Chamber Depth and a 10-foot penetration into permeable soils. The total drilling depth required may be significantly less than estimated 50-foot total depicted on the

detail. This detail, and pay item D-752-5.1 Dry Well, are intended as a standard of performance and materials are not intended to be restrictive.

IV. Refer to specification Item D-705 Pipe Underdrains for Airports for materials and pay item descriptions. General underdrain system is to be 4 inch perforated HDPE pipe installed along north edge of runway from station 9+95 to 39+87, and at infield between runway and taxiway from station 16+77 to 18+77. All outfall pipes are to be schedule 80 PVC and undrain pipe couplers, tees, transition fittings shall be compatible with the type of pipe being connected.

V. 8-inch Tap Installation Detail on sheet 25 may have thermal welded or gasket joints.

5. Sheets 26, 27, 28, and 29:

Description of change or reference to attached change.

VI. Replace sheets 26, 27, 28, and 29 with the attached sheets. Cross section station labels have been added to section locations.

6. Sheet 36:

Description of change or reference to attached change.

VII. Delete depiction of three (3) 2 inch conduits and reference to New AWOS III on sheet E3.5 at station 20+00, north side of runway. There is no AWOS III work included in the project.

7. Sheet 41:

VIII. Revise Conduit Trench Parallel to Runway detail on sheet 41 to show counterpoise conductor at 14 inches below finish grade.

Project Specifications:

8. The Contractor is responsible for control of the work areas within the airport security fence. See Division 6, Item M-005-3.1, and Appendix E CSPP, section 4.7 Contractor Access. Item M-005-3.1, page 167 of the specifications, 1st paragraph, delete "Contractor locks are not permitted on any airport gate." The Contractor will be allowed to interlock the manual rolling gate at the construction access. Payment will be included under bid schedule item 2, M-005-7.1 Airport Safety and Security.

9. The Contractor is responsible for control of all his forces and material suppliers during the work. Pending submittal and approval of the work plan specified in the above referenced M-005-3.1, the Contractor shall make his own estimate of required resources. Escorts can include the Contractor's supervisory personnel, and a Gate Keeper may only be required during material deliveries.

10. There will be no security badges required or issued for this project. Delete 3rd and 4th paragraph on page 167 of the project specifications.

11. The Contractor's work plan will be reviewed with the owner and the Engineer at the pre-construction conference. All construction activity will be reviewed at this meeting and no additional training is required.

12. Haul routes will generally conform to the access depicted on the project plans and Appendix E – CSPP. Closure of runways and taxiways does not preclude rotary wing emergency service aircraft utilizing the aprons.

13. Pg. 171 - Delete reference to Laughlin/Bullhead International Airport and replace with Turlock Municipal Airport.

14. Diuron 4L - Approved equal pre-emergent herbicide can be considered for use.

Pre-Bid Meeting Questions, Clarifications, Supplemental Information:

15. Will a geotechnical report for the project be available?

A. See the attached *Geotechnical Engineering Report for Turlock Municipal Airport,* prepared by Earth Systems Pacific. This report is provided as information only.

16. Will AutoCAD drawings be made available?

A. At the City's discretion, electronic AutoCAD design files can be provided to the successful bidder, upon completion of a construction award.

17. Does the project have state required registration?

A. Yes, see Notice to Contractors, pages 1 and 4 of the bid specifications.

18. Does the project have state or federal aid?

A. Federal funding will be provided under the Airport Improvement Program. See Notice to Contractors, page 2 of the bid specifications. State funding may be provided pending availability.

19. Does the project require a lock in bid prices?

A. Yes. Proposals, including unit bid prices may not be withdrawn for a period of 90 days after the bid opening date. See Notice to Contractors, pages 3 of the bid specifications.

20. When is the starting date for the project?

A. It is anticipated that the project will start in the fall of 2017.

21. Are the 30 days mentioned in the bid document working days or calendar days?

A. The Division 5 Special Provisions, section5.23 Order of the Work, and the associated project phasing plan sheet 5, are distinct and separate from the Division 2 Agreement, Item 6, Time for Performance. The Time for Performance contained in the Division 2 Agreement is set at (123) working days. The Order of Work contained in the Special Provisions and phasing plan is stated as (171) calendar days, to delineate airfield closure durations and anticipated beneficial occupancy. The durations are generally equivalent, assuming 5 working days to 7 calendar days.

22. Electrical specs have part numbers, but no names. Are their specific brands required?

A. A listing of pre-approved airfield lighting equipment is cited and referenced in the Division 4 FAA General Provisions, Section 60 Control of Materials. All certified approved equipment can be found in the references contained on page 106 of the bid specifications. Only pre-approved

airfield lighting equipment, where applicable, may be used in the project with no specific brand(s) required.

23. The scope of work from the bid documents indicates to install a regulator, service panel, and controls. However, these items are not reflected on the schedule of bid items. Please advise.

A. All items are described in the project specifications Method of Measure and Basis of Payment sections of Item L-109 Airport Transformer Vault and Equipment. These are included under bid schedule item 37. L-109-5.1 Airport Transformer Vault and Foundation in Place – per lump sum.

24. Who is to provide construction survey staking?

A. The contractor is to provide construction survey staking per Special Provisions section 5.25 Surveying.

25. When is the new storm drain crossing under the runway permitted to take place?

A. All work within the Runway Safety Area must be completed during runway closures. This work is included in Phase II, during the 60 day runway closure.

26. In item P-101 Surface Preparation, how is the contractor to know what the surface conditions is after milling and quantify the failed areas?

A. The Engineer will inspect the prepared surface with the Contractor and determine if any areas require repair.

27. Is the fog seal required for curing of the lime-treated subgrade? If so, what is the application rate?

A. A fog seal in accordance with Item P-603, will be required for the curing of Item P-155 at the application rate specified in P-155-6.5, Finishing and Curing.

28. Form 15-G and Form 15-H

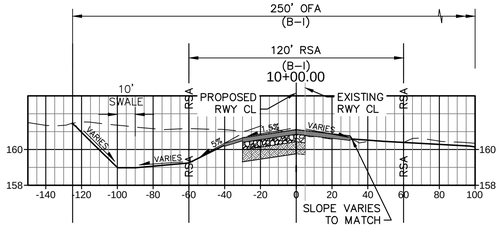
I. Contractor shall follow Caltrans timeline of turning in documentation.

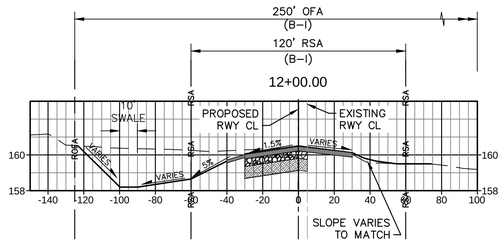
END OF ADDENDUM NO.1

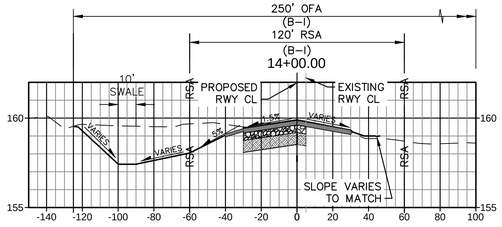
If you have any questions, please call me at (209) 668-6021 or email at RJones@turlock.ca.us.

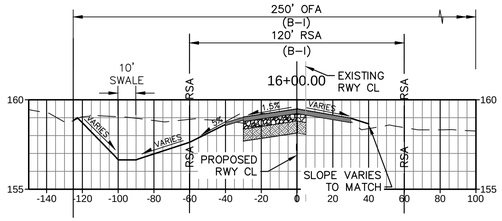
Randall Jones
Assistant Engineer

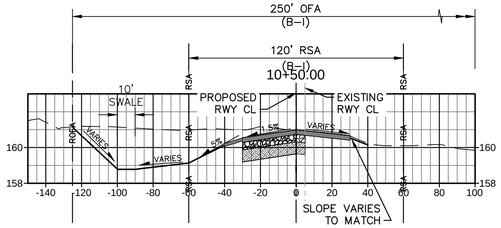
Addendum No. 1 Plan Sheets

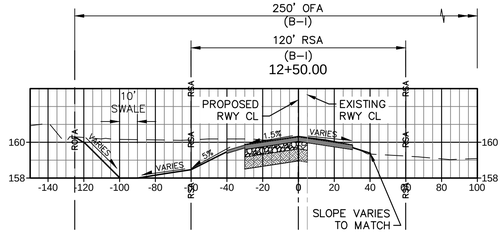


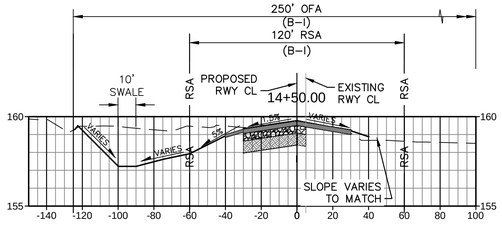


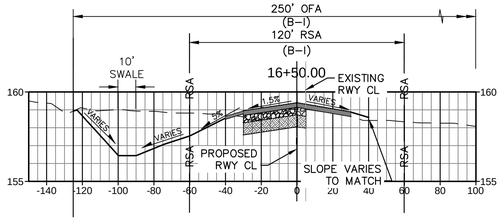


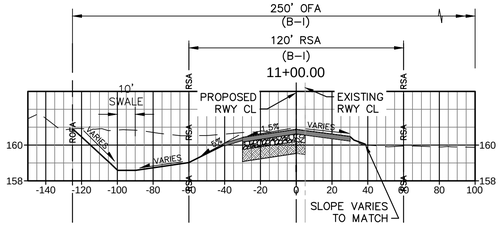


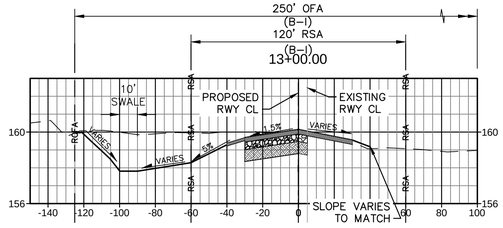


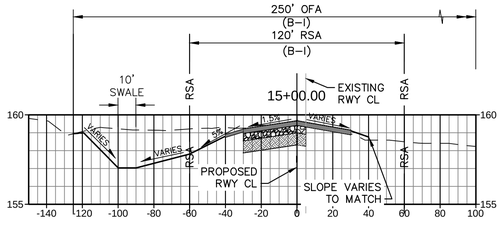


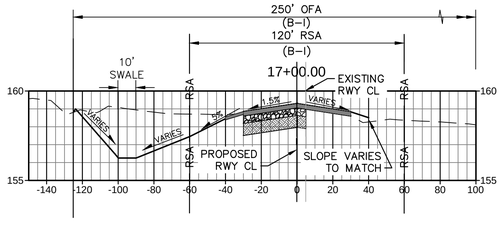


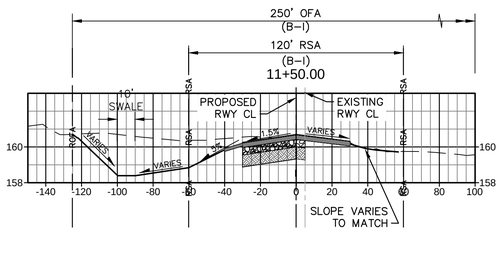


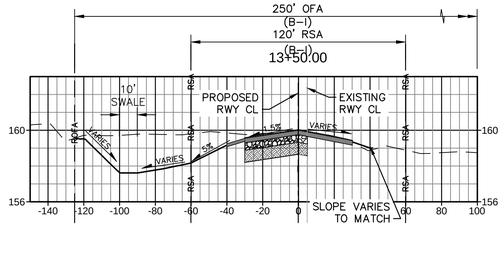


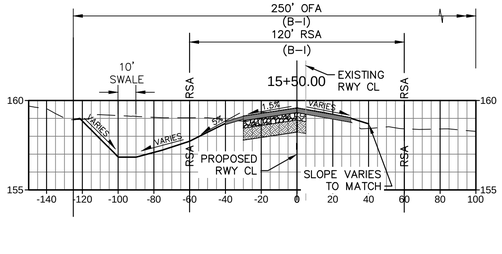


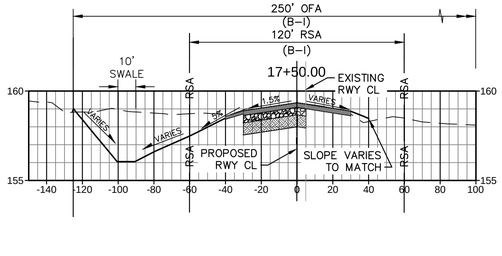












1 ADDENDUM No. 1 – CROSS SECTION STATION LABELS ADDED 8/07/17

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REGISTERED PROFESSIONAL ENGINEER — KEVIN KONG — No: C045886 — CIVIL — STATE OF CALIFORNIA
Expires 12/31/2018

APPROVED BY THE CITY OF TURLOCK

MICHAEL G. PITCOCK, P.E. — DATE
DIRECTOR OF DEVELOPMENT SERVICES
CITY ENGINEER, RCE 52694

CITY OF TURLOCK
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CROSS SECTIONS STA. 10+00 TO 17+50
CAPITAL PROJECT NO. 16-75
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WIDENING RUNWAY 12/30
AND AIRFIELD ELECTRICAL UPGRADES

VERIFY SCALE
BAR IS 1" ON ORIGINAL DRAWING
0 1/4" 3/4" 1" 1/2"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

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REV. BY:	DCS
CH. BY:	MTK
DATE:	JUNE 16, 2017
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SHEET 26 OF 48

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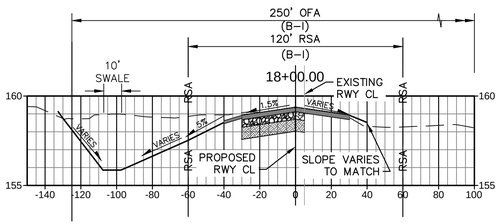

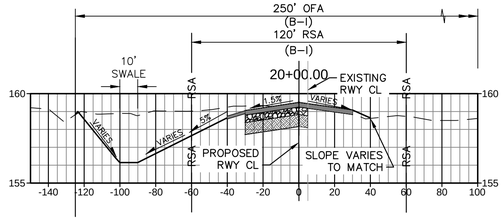

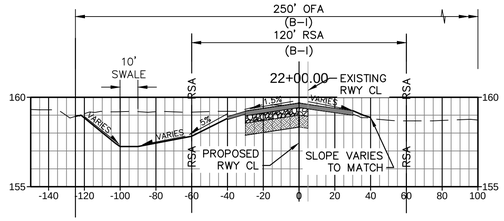

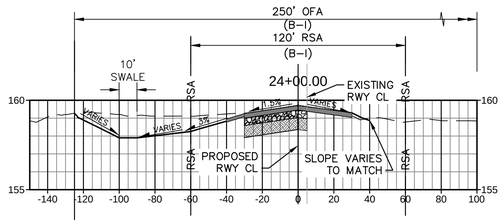

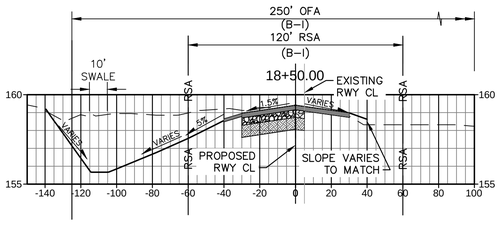

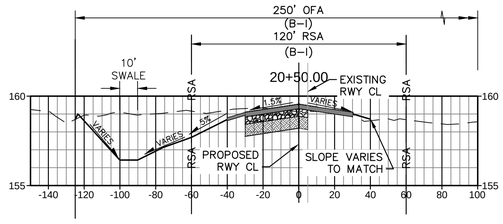

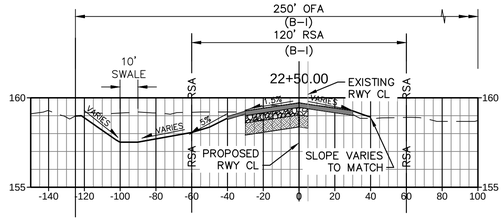

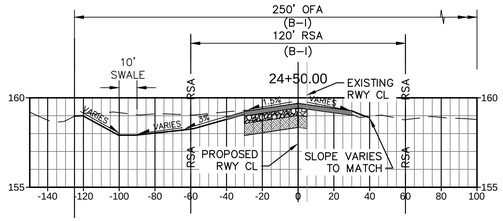

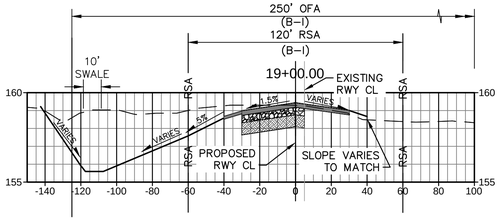

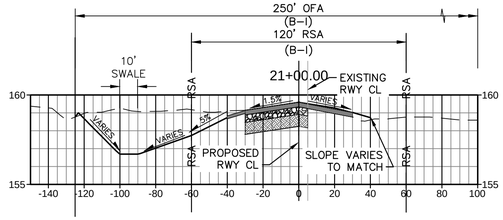

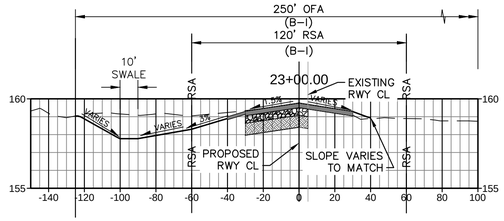

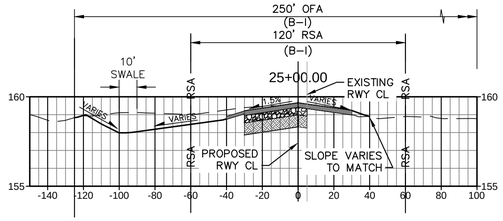

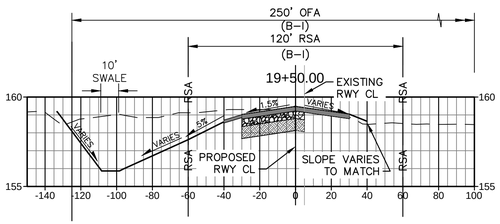

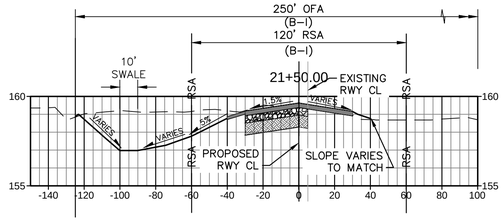

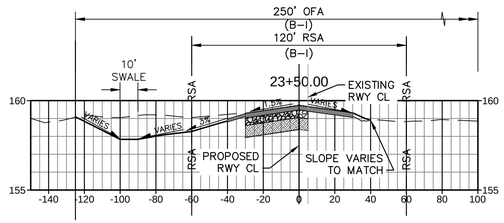

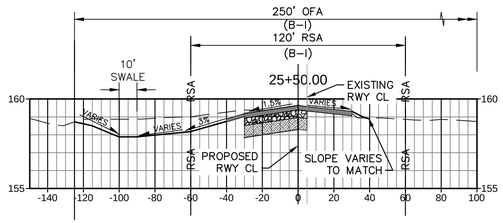

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REGISTERED PROFESSIONAL ENGINEER — GLENN S. KOEPKE — No: C045886 — CIVIL — STATE OF CALIFORNIA
8/16/17
Expires 12/31/2018

APPROVED BY THE CITY OF TURLOCK

MICHAEL G. PITCOCK, P.E. DATE
DIRECTOR OF DEVELOPMENT SERVICES
CITY ENGINEER, RCE 52694

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SHEET 27 OF 48

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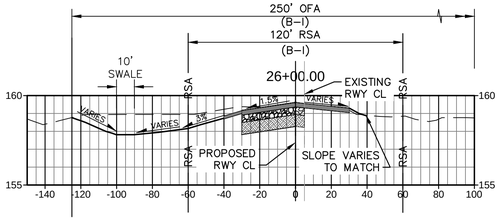

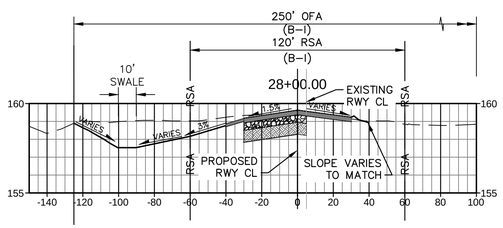

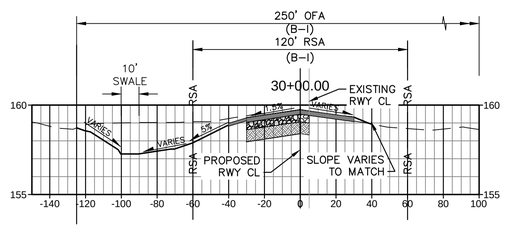

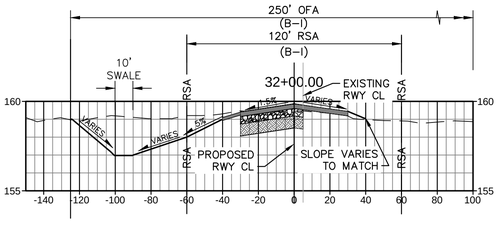

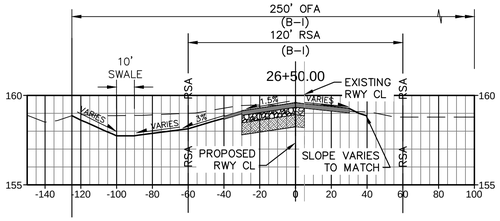

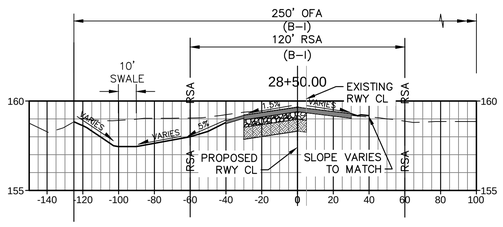

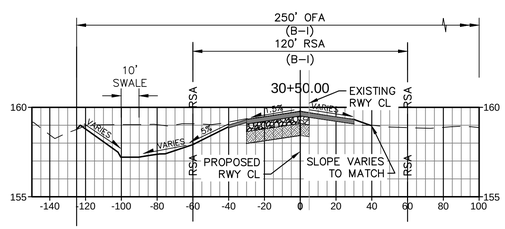

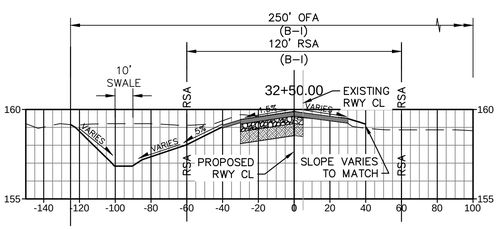

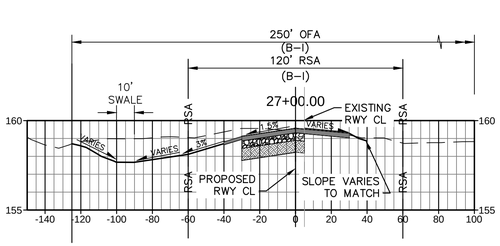

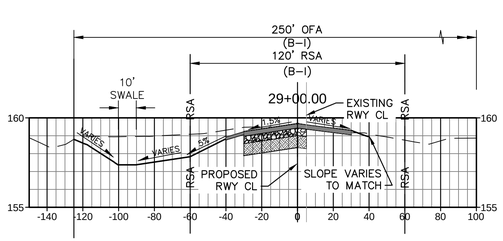

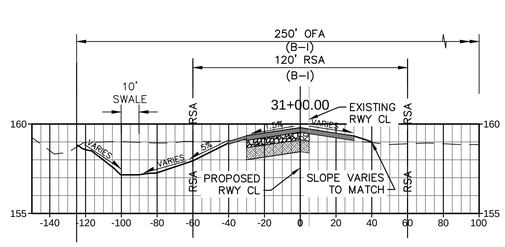

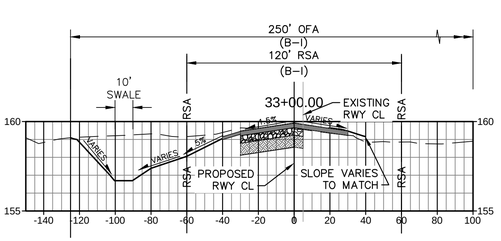

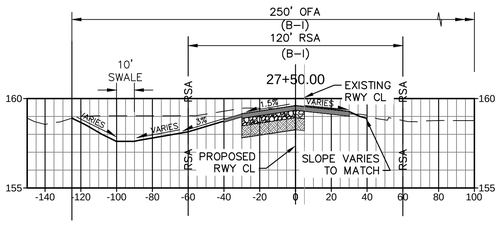

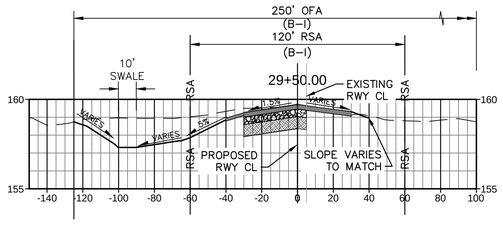

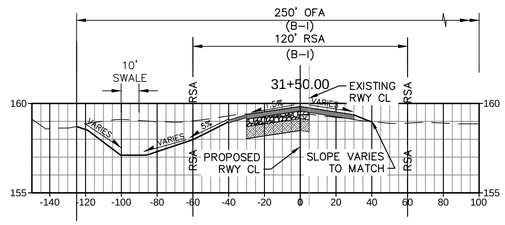

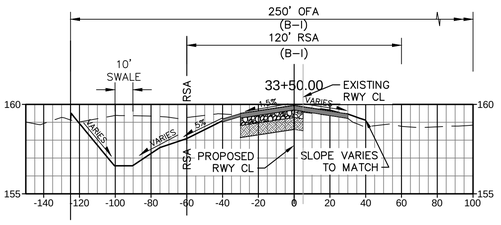

1 ADDENDUM No. 1 – CROSS SECTION STATION LABELS ADDED 8/07/17

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8211 S. 48th Street
Phoenix, AZ 85044-5355
Tel. 602.438.2200
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8/7/2017 9:51:14 AM By: Peterson, Justin (Phoenix)

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REGISTERED PROFESSIONAL ENGINEER
No: C045886
6/6/17
CIVIL
STATE OF CALIFORNIA
Expires 12/31/2018

APPROVED BY THE CITY OF TURLOCK

MICHAEL G. PITCOCK, P.E. DATE
DIRECTOR OF DEVELOPMENT SERVICES
CITY ENGINEER, RCE 52694

CITY OF TURLOCK
DEVELOPMENT SERVICES
ENGINEERING DIVISION
156 S. BROADWAY, STE 150
(209) 668-5520

CROSS SECTIONS STA. 26+00 TO 33+50
CAPITAL PROJECT NO. 16-75
AIP PROJECT NO. 03-06-0265-012-2017
WIDENING RUNWAY 12/30
AND AIRFIELD ELECTRICAL UPGRADES

VERIFY SCALE
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1/4" 3/4" 1"
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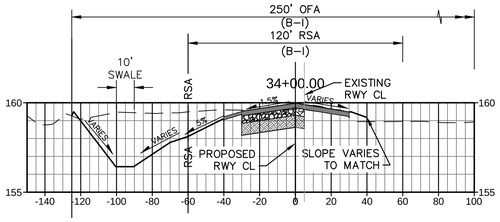

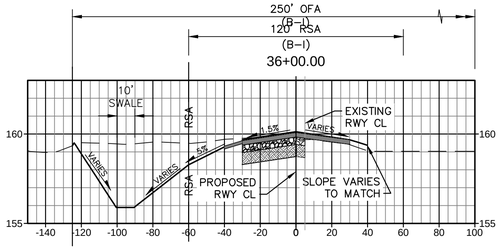

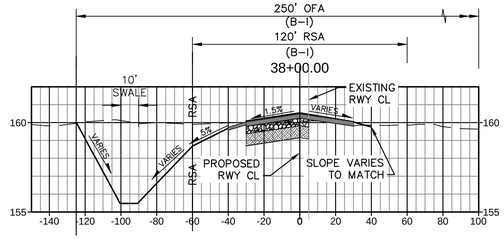

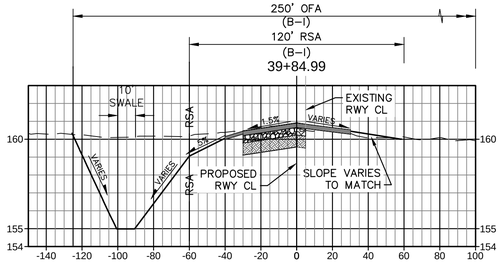

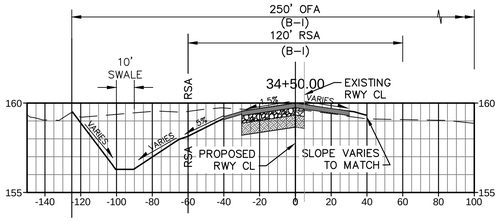

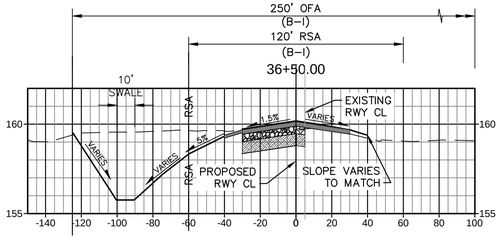

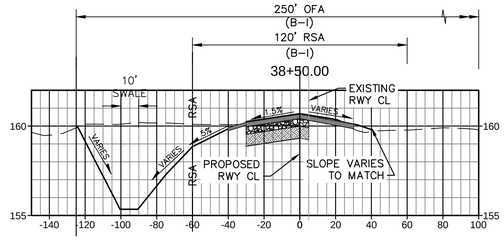

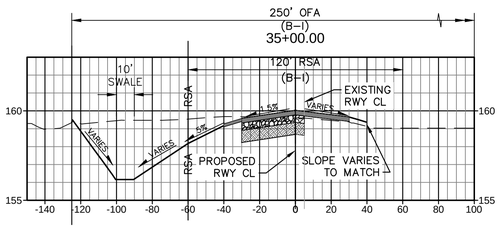

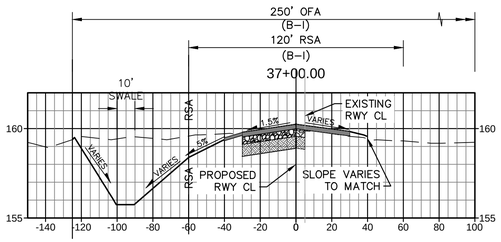

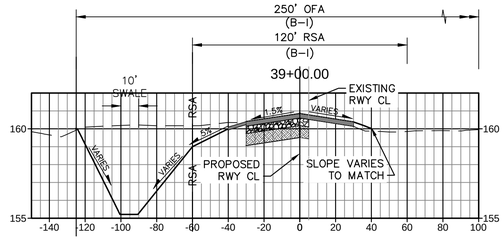

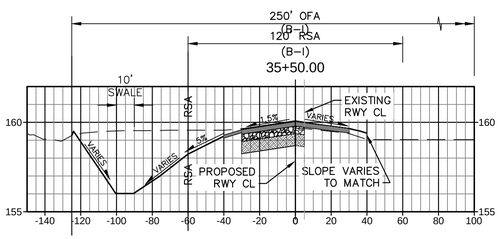

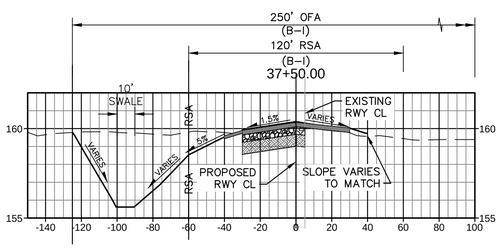

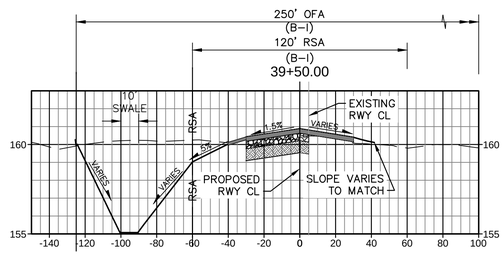

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REGISTERED PROFESSIONAL ENGINEER — WILLIAM R. KOEPKE — No: C045886 — 6/6/17 — CIVIL — STATE OF CALIFORNIA
Expires 12/31/2018

APPROVED BY THE CITY OF TURLOCK

MICHAEL G. PITCOCK, P.E. DATE
DIRECTOR OF DEVELOPMENT SERVICES
CITY ENGINEER, RCE 52694

CITY OF TURLOCK
DEVELOPMENT SERVICES
ENGINEERING DIVISION
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CROSS SECTIONS STA. 34+00 TO 39+92.47
CAPITAL PROJECT NO. 16-75
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SHEET 29 OF 48

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8/7/2017 9:51:46 AM By: Peterson, Justin (Phoenix)

Geotechnical Engineering Report
Turlock Municipal Airport
Runway Widening and RSA Improvements

Prepared by
Earth Systems Pacific

GEOTECHNICAL ENGINEERING REPORT
TURLOCK MUNICIPAL AIRPORT
RUNWAY WIDENING AND RSA IMPROVEMENTS
TURLOCK, CALIFORNIA

December 31, 2009

Prepared for

Mr. Bill Harvey
Stantec Consulting, Inc.

Prepared by

Earth Systems Pacific
400 Park Center Drive, #1
Hollister, CA 95023

Earth Systems Pacific

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Hollister, California 95023

(831) 637-2133 • FAX (831) 637-0510
E-mail: esp@earthsys.com

December 31, 2009

FILE NO.: SH-11116-SA

Mr. Bill Harvey
Stantec Consulting, Inc.
8211 South 48th Street
Phoenix, AZ 85044

PROJECT: TURLOCK MUNICIPAL AIRPORT
RUNWAY WIDENING AND RSA IMPROVEMENTS
TURLOCK, CALIFORNIA

SUBJECT: Geotechnical Engineering Report

REF.: Proposal to Provide a Geotechnical Engineering Investigation, Turlock Municipal Airport, Runway Widening and RSA Improvements, Turlock, California, by Earth Systems Pacific, Doc. No. 0909-539.PRP, dated September 25, 2009

Dear Mr. Harvey:

As per your authorization of the referenced proposal, this geotechnical engineering report has been prepared for use in the development of plans and specifications for the proposed runway widening and RSA improvements at Turlock Municipal Airport in Turlock, California. Results of laboratory testing, conclusions regarding CBR testing, and recommendations for site preparation, grading, foundations and lateral pressures, utility trenches, drainage around improvements, and observation and testing are presented herein. Results of percolation testing in the two proposed dry well locations are also included. One unbound and two bound copies of this report are furnished for your use; an electronic copy has also been transmitted via e-mail.

We appreciate the opportunity to have provided geotechnical services for this project and look forward to working with you again in the future. If there are any questions concerning this report, please do not hesitate to contact the undersigned.

Sincerely,

Earth Systems Pacific

REGISTERED PROFESSIONAL ENGINEER FREDERICK J. POTTHAST No. GE 2369 Exp. 03/31/10 GEOTECHNICAL STATE OF CALIFORNIA

Fred J. Potthast, G.E.

Doc. No.: 0912.140.SER/MW

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Appendices

1.0 INTRODUCTION AND SITE SETTING

The proposed project at Turlock Municipal Airport will involve the widening of Runway 12-30, and grading and drainage improvements in the Runway Safety Area (RSA). The widened runway section will consist of asphalt concrete (AC) over aggregate base (AB) and native subgrade. An overlay of the existing runway may be performed as part of the widening effort. Cuts and fills a maximum of 2 feet from the existing grades are anticipated for the RSA improvements, which may include storm drainage inlets and piping. No drainage basins are planned, however dry wells are being considered in two locations on the north side of the widened runway, one approximately 900 feet east of the west end and the second approximately 100 feet east of the east end. The project will also include the construction of an underground electrical vault adjacent to the existing T-hangars on the south side of the runway, and a navigation aid (AWOS III) approximately 700 feet north of the runway and 1,000 feet east of the runway's west end. The electrical vault may be as deep as 5 feet below grade, and it will be either pre-fabricated or of cast-in-place concrete construction. It is assumed that a prefabricated equipment shelter supported by a slab-on-grade and/or conventional continuous foundations will be utilized for the AWOS III, and that electrical lines will be routed in underground conduits from it and the electrical vault. No sitework retaining walls are planned to accommodate grade changes.

The proposed runway widening areas are generally flat with little to no vegetation, as they comprise the shoulders of the existing runway. The proposed dry well areas are also flat, with a light to moderate growth of vegetation. Where the AWOS III is planned, the area is generally flat and vacant, but there are numerous scattered piles of fill soil that have been partially leveled; this area also has a light to moderate growth of vegetation. The area planned for the electrical vault adjacent to the T-hangars is flat, has no pavement, and is devoid of vegetation.

The locations and dispositions of utility lines on the site are unknown.

2.0 SCOPE OF SERVICES

The scope of work for the geotechnical engineering report included a general site reconnaissance, subsurface exploration, laboratory testing of soil samples, engineering evaluation of the data collected, and the preparation of this report. The investigation and

subsequent recommendations were based on information and a preliminary plan of the project area showing the improvement locations, as provided by the client.

The report and recommendations are intended to fulfill the requirements of Federal Aviation Administration (FAA) Advisory Circular AC 150/5320-6D for preliminary soil testing for airport facilities as outlined in the client's original requested work scope, the requirements of the 2007 California Building Code (CBC) for structure design, and common soils engineering practice in this area under similar conditions at this time. The tests were performed in general conformance with the standards noted, as modified by common geotechnical practice in this area under similar conditions at this time.

Preliminary geotechnical recommendations for site preparation, grading, foundations and lateral pressures, utility trenches, drainage around improvements, and observation and testing are presented to guide the development of project plans and specifications. Results of percolation testing in the dry well locations are also provided. This firm should be retained to provide consultation as the design progresses to review final project plans; these services are intended to assist in verifying that pertinent geotechnical issues have been addressed, and to aid in conformance with the intent of this report.

It is our intent that this report be used exclusively by the client to form the geotechnical basis of the design of the project described herein, and in the preparation of plans and specifications. Application beyond this intent is strictly at the user's risk.

This report does not address issues in the domain of the contractor such as, but not limited to, site safety, subsidence of the site due to compaction, loss of volume due to stripping of the site, shrinkage of fill soils during compaction, excavatability, shoring, temporary slope angles, construction methods, etc. Analysis of site geology and of the soil for corrosive potential, radioisotopes, asbestos (either naturally occurring or man-made), lead or mold potential, hydrocarbons, or other chemical properties are beyond the scope of this investigation. Ancillary structures such as access roads, fences, flag poles and nonstructural fills are also not within our scope and are not addressed. While development of soil strength data (California Bearing Ratio or CBR) was part of our work scope, determination of pavement sections for the widening of the runway is the responsibility of the client.

In the event that there are any changes in the nature, design, or location of improvements, or if any assumptions used in the preparation of this report prove to be incorrect, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing. The criteria presented in this report are considered preliminary until such time as any peer review or review by any jurisdiction has been completed, conditions are observed by the soils engineer in the field during construction, and the recommendations have been verified as appropriate or modified.

3.0 FIELD INVESTIGATION AND PERCOLATION TESTING

On November 30, 2009, a total of 13 borings were drilled on the site. The borings were drilled to a maximum depth of 16.5 feet below the existing ground surface with a Simco 2400 SK-1 drill rig, equipped with either a 4-inch or 6-inch outside diameter solid stem auger. The boring locations were determined by the client. The approximate locations of the borings are shown on the Boring Location Map in Appendix A.

As the borings were drilled, samples were obtained with a ring-lined barrel sampler (ASTM D 3550-01/07, with shoe similar to ASTM D 2937-04). Standard penetration tests were also conducted at selected intervals in each boring (ASTM D 1586-08a). Bulk samples were secured from the auger cuttings.

The soils encountered in the borings were classified and logged in general accordance with the Unified Soils Classification System (ASTM D 2488-09). Copies of the boring logs and a boring log legend can also be found in Appendix A. In reviewing the boring logs and legend, the reader should recognize that the legend is intended as a guideline only, and there are a number of conditions that may influence the soil characteristics as observed during drilling. These include, but are not limited to, cementation, variations in soil moisture, presence of groundwater, and other factors. Consequently, the logger must exercise judgment in interpreting soil characteristics, possibly resulting in soils descriptions that vary somewhat from the legend.

Percolation testing was performed in Borings 7 and 11 after logging and sampling operations were completed. The borings were cased with a perforated 4-inch diameter PVC casing, and the annular space between the casing and the boring sidewall was backfilled with clean pea gravel.

The borings were filled with water following casing as a presaturation measure. The borings were refilled and percolation testing was completed on December 1, 2009. Following testing, the casings were removed and the borings were backfilled with the on-site soils. The percolation test results are included in Appendix B. Evaluation of the data and determination of percolation potential are the responsibility of the client.

4.0 LABORATORY INVESTIGATION

In situ moisture content and unit dry weight were determined for the ring samples (ASTM D 2937-04, as modified for ring liners). Bulk samples were tested for the following: maximum density and optimum moisture (ASTM D 1557-09, modified and 698-09, modified), particle size (ASTM D 422-63/07), plasticity index (ASTM D 4318-05), California bearing ratio (ASTM D 1883-05, for a range of moisture contents, with ASTM D 698-09 as the reference standard for maximum density), and cohesion and angle of shearing resistance (ASTM D 3080-04, modified for consolidated, undrained conditions). Please refer to Appendix B for the geotechnical laboratory test results.

5.0 GENERAL SOIL PROFILE

The existing pavement sections encountered in Borings 2, 4, 5 and 9 consisted of approximately 2.5 inches of AC, with no underlying aggregate base.

At the surface in Borings 1 and 3, and below the AC layer in Borings 2, 4 and 5, was loose to medium dense silty clayey sand. Below the AC in Borings 2, 4 and 5, this soil layer appeared to have been recompacted and it was identified as fill, although the thickness of recompaction varied from approximately 6 inches in Boring 5 to approximately 18 inches in Boring 2. Below the fill, the underlying soils were identified as alluvium. In Boring 1, the silty clayey sand extended for the full boring depth of 6.5 feet. In Borings 2 through 5, the underlying soils were medium dense to very dense silty sand or clayey sand.

From the surface to the termination depths of Borings 6, 8 and 10, and below the AC layer in Boring 9 was loose to medium dense silty sand. The upper 6 to 18 inches of this material in Borings 6, 8 and 9 appeared to have been recompacted, and was identified as fill; the underlying material was alluvium.

Boring 11 at the proposed location of Drywell No. 1 encountered 18 inches of medium dense clayey sand fill at the surface, followed by loose to medium dense silty sand for 9 feet, and hard sandy silt to the termination depth of 16.5 feet.

At the location of proposed Drywell No. 2, Boring 7 encountered medium dense silty sand for the entire depth explored of 15.5 feet.

Boring 12 at the electrical vault location encountered 1 foot of medium dense silty sand at the surface, followed by 2 feet of hard sandy lean clay and dense silty sand (alluvium) to the boring termination depth of 6.5 feet.

Boring 13 at the proposed AWOS III location found 2.5 feet of dense silty clayey sand at the surface, followed by very dense silty sand. From 8 feet to the termination depth of 10.0 feet, hard sandy silt was found.

Discontinuous zones of caliche cementation, a mineral deposit indicating the past presence of water, were found in several of the borings at various depths.
The soils were described during drilling as being moist to wet. Free subsurface water was not encountered to the maximum depth explored of 16.5 feet below the existing ground surface.

Please refer to the boring logs in Appendix A for a more complete description of the conditions encountered at each boring location.

6.0 CONCLUSIONS

In our opinion, the site is suitable from a geotechnical standpoint for the proposed improvement project, provided that design and construction conforms to the recommendations presented herein. In our opinion, the primary geotechnical concerns are the variable densities and moisture contents of the upper soils, the apparent reduction in CBR value of the upper soils with increases in soil moisture content, and the erosion potential of the site soils.

The soils found at the surface in the borings were logged as being loose to medium dense, with moisture contents ranging from below to well above optimum moisture content. With depth, the

soil generally became increasingly dense; however the moisture contents were still variable. In our opinion, the soils at depth are sufficiently dense in their current condition, and only minor overexcavation, scarification and recompaction of the surface are considered necessary prior to construction of pavement sections, placement of fill or following excavations to grade. Additional overexcavation could be needed in isolated areas in order to achieve the relative compaction percentages specified by FAA AC 150/5320-6D, however this should be determined by the engineer based on the design aircraft and gross weight, and by the soils engineer considering the conditions exposed at the time of construction. Minor overexcavation and recompaction is also recommended for the foundations to support the AWOS III navigation aid. No remedial overexcavation and recompaction is considered necessary for foundations to support the electrical vault.

Based on the laboratory test data, the upper soils encountered below and adjacent to existing runway should be considered as noncohesive per FAA AC 150/5320-6D (plasticity index less than 6). For the silty clayey sand found at the surface or directly below the existing AC in Borings 1 through 5, a CBR value of 6 is recommended for design of new pavement (AC and AB) placed over compacted subgrade, assuming a minimum of 100 percent of maximum dry density is obtained using the ASTM D 698 test method. For the silty sand found at the surface or directly below the existing AC in Borings 6 and 8 through 10, a CBR value of 20 can be utilized for design of new pavement (AC and AB) placed over compacted subgrade, assuming a minimum of 100 percent of maximum dry density is obtained using the ASTM D 698 test method. Determination of pavement sections for the widened runway is the responsibility of the engineer.

If an overlay of the existing AC runway is to be performed as part of the widening project, due to the variable in-situ moistures and densities encountered in the soils below the existing pavement, we recommend a CBR value of no more than 4 be utilized for the area of Borings 1 through 5, and a CBR value of no more than 18 be utilized for the area of Borings 8 through 10.

As the CBR test results on the site soils show variations with changes in moisture content above optimum, compaction of subgrade soils should be achieved with moisture contents as close as possible to optimum moisture content. Soil moisture contents well above optimum will reduce

the CBR values; therefore control of moisture in the subgrade soil is critical to maintaining its load-carrying characteristics.

The site soils are considered to be highly erodible. It is essential that all surface drainage be controlled and directed to appropriate discharge points, and that surface soils, particularly those disturbed during construction, are stabilized by vegetation or other means during and following construction.

The clayey sand soil found in Boring 3 from 4 to 9.5 feet should be considered a cohesive material; it exhibited a plasticity index of 19. This material is not expected to be exposed at subgrade elevation, however if it is, the subgrade compaction standard per FAA AC 150/5320-6D is only 95 percent of maximum dry density using the ASTM D 698 test method. CBR testing of this material, if exposed, should be completed to determine a value to be utilized in pavement design.

The caliche cementation found in the borings was considered to be variable and discontinuous, and not indicative of an overall hardpan layer across the site. This cementation is not expected to affect construction of the proposed project.

7.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

The following preliminary recommendations are for the proposed runway widening, RSA and other improvements, as described in the "Introduction" section of this report. If locations, elevations, etc., change, the recommendations contained herein may require modification.

The runway widening area is defined as the area within and extending to 3 feet beyond the edge of pavement (or any edge of pavement drainage facilities) not including any existing paved areas that are not to be reconstructed. The AWOS III building area is defined as the area within and extending a minimum of 3 feet beyond the perimeter of any foundation or slab-on-grade to support the AWOS III or any associated equipment shelter. The electrical vault area is defined as the excavated area within the footprint of the proposed electrical vault.

The grading area is the entire area to be graded; it includes the runway widening and AWOS III building areas, and any other areas where fill will be placed or improvements will be constructed on grade.

Site Preparation

1. The grading area should be prepared for construction by removing all vegetation, debris, existing improvements, stockpiled fill, and other potentially deleterious material. Recommendations for abandonment of utilities, if any, can be made as necessary.

2. Voids created by removal of materials and utilities and extending below the planned depths of excavation should be called to the attention of the soils engineer. No fill should be placed unless the underlying soil has been observed by the soils engineer.

Grading

1. In the runway widening area, following excavations 1 foot or greater than below existing grade, the exposed surface should be scarified to a minimum depth of 12 inches, moisture conditioned, and recompacted.

2. In the runway widening area, following excavations less than 1 foot below existing grade or prior to placement of fill, the prepared soils should be overexcavated to a minimum depth of 1 foot below existing grade. The resulting surface should be scarified to a minimum depth of 12 inches, moisture conditioned, and recompacted.

3. In the AWOS III building area, the prepared soils should be overexcavated to a minimum depth of 1 foot below existing grade or 1 foot below the bottom of the foundation, whichever is deeper. The resulting surface should be scarified to a minimum depth of 12 inches, moisture conditioned, and recompacted.

4. In the electrical vault area, no remedial overexcavation is considered necessary. However, following excavation to grade for the vault, the expose surface should be compacted to correct any looseness caused by excavation operations.

5. In all other grading areas, prior to placement of fill or following excavations to grade, the prepared or excavated soil surface should be scarified to a minimum depth of 12 inches, moisture conditioned, and recompacted.

6. Based on our understanding of the design aircraft for this site, and assuming non-cohesive soils are exposed in all areas, the relative compaction requirement for subgrade soils should also be 100 percent of maximum dry density per ASTM D 698. All aggregate base in areas to be paved for runway improvements should be compacted to a minimum of 100 percent of maximum dry density per ASTM D 698.

7. In the AWOS III building area and the electrical vault area, the soils should be compacted to a minimum of 90 percent of maximum dry density per ASTM D 1557.

8. The engineer should determine the degree of compaction and the maximum density standard for all other areas of the site.

9. To maintain the subgrade characteristics for the design CBR values, compaction of the soil at subgrade elevation should be performed with soil moistures within 2 percent of optimum moisture content. Soil moisture should be relatively uniform throughout soils to be compacted.

10. If the soils are overly moist so that they become unstable, or if the minimum recommended compaction cannot be readily achieved due to excess soil moisture, additional measures may be necessary. Such measures could include additional overexcavation, installation of geotextiles, aeration of the soil or mixing the with drier materials, or cement or lime treatment. Specific recommendations for stabilization should be provided by the soils engineer based on conditions encountered at the time of construction.

11. Fill material should be placed in level lifts not exceeding 8 inches in loose thickness. On-site soils may be used for fill once they are cleaned of all debris and any rock larger than 3 inches in diameter. On-site soils selected for use as fill should have CBR characteristics similar to or better than the materials used in the design. If desired, due to

its relatively high plasticity and anticipated low CBR value, the engineer may designate that any clayey sand similar to the soil exposed in Boring 3 between 4 and 9.5 feet be placed beyond areas to receive pavement.

12. Imported fill materials (if any) should have similar or better CBR characteristics when compared to the on-site soils. All proposed imported materials should be reviewed by the soils engineer before being transported to the site.

13. To maintain the subgrade characteristics for the design CBR values following construction, edge drains can be utilized in areas to receive pavement improvements. The drains should be constructed along the edges of the pavement, and should be placed to dewater the upper 3 feet (approximately) below finished grade. The actual alignments and depths of the drains may be varied to match available discharge points. The drains can consist of conventional gravel-filled trenches that are a minimum 12-inches wide. The gravel should be completely wrapped with geotextile filter fabric and should contain a minimum 4-inch diameter rigid perforated PVC collection pipe at the bottom. Alternately, the drains may consist of a prefabricated panel drainage system. Although the collection drains could be installed with little or no slope as long as the discharge points are provided on 300 to 400-foot centers, if possible, the drains should have a minimum 0.5 percent slope to the outlet.

14. Subgrade and aggregate base should be firm and unyielding when proofrolled with rubber-tired grading equipment before continuing construction.

15. The recommendations of this section are minimums only, and may be superseded by the requirements of the engineer or the governing jurisdiction.

Foundations and Lateral Pressures

1. Continuous footings and slabs-on-grade may be used to support the AWOS III, any associated equipment shelters, and the electrical vault. All footings and slabs should be supported by firm soil compacted as per the "Grading" section of this report.

2. Continuous footings should be a minimum of 12 inches wide. Minimum overall footing depths should be 12 inches below lowest adjacent grade. Continuous footings should be reinforced, at a minimum, by two No. 4 rebar, one near the top and one near the bottom, or as required by the engineer. Spread footings should be reinforced in accordance with the requirements of the engineer.

3. Slabs-on-grade should have a minimum thickness of 4 full inches and should be reinforced, at a minimum, with No. 3 rebar at 24 inches on-center each way. At a minimum, slabs should be doweled to perimeter footings by No. 3 rebar lapped to the slab rebar at 24-inches on center, or as per the requirements of the engineer.

4. Footings bearing in firm recompacted soil may be designed using maximum allowable bearing capacities of 1,500 psf dead load and 2,000 psf dead plus live loads. Allowable bearing capacities may be increased by one-third when transient loads such as wind or seismicity are included. Using these criteria, total settlement and differential settlement are expected to be less than ½-inch and ¼-inch in 15 feet, respectively.

5. Slabs-on-grade may be designed using a modulus of subgrade reaction (K_{30}) of 200 psi/inch (pci).

6. Foundations may be designed using the following seismic parameters:

Site Classification (2007 CBC Table 1613.5.2)	D
Mapped Spectral Accelerations	
0.2 second period – S_S	0.604g
1.0 second period – S_1	0.247g
Design Response Spectral Acceleration Parameters	
0.2 second period – S_{DS}	0.530g
1.0 second period – S_{D1}	0.313g

7. Lateral loads may be resisted by friction and by passive resistance of the soil acting on foundations. A passive equivalent fluid pressure of 350 pcf, and a friction factor of 0.45 may be utilized, in combination and without reduction, for resistance to lateral loads.

Lateral capacity is based on the assumption that backfill adjacent to foundations is properly compacted.

8. Active and at-rest pressures on the electrical vault or other buried structures may be taken as 35 and 50 pcf, respectively, for native soil or for imported sand or gravel backfill.

9. To accommodate seismic loads on the electrical vault or other buried structures, a uniformly distributed pressure of 17 psf should be used for the active case, or 27 psf should be used for the at-rest case. The pressure due to seismicity may be analyzed like any other uniform load with the resultant of the uniformly distributed pressure acting at one-half the height of the vault or buried structure wall.

10. No surcharges are taken into consideration in the values indicated in Paragraphs 7, 8 and 9. The bearing pressures in Paragraph 4 are allowable values; no factors of safety, load factors or other factors have been applied to the remaining values. With the exception of the allowable bearing pressure, these values will require application of appropriate factors of safety, load factors, and/or other factors as deemed appropriate by the engineer.

11. The pressures in Paragraphs 8 and 9 are applicable to a retained surface that is horizontal at the vault or other buried structure. Long-term settlement of properly compacted vault or structure backfill should be assumed to be 0.5 percent of the depth of the backfill. Improvements that are constructed adjacent to the vault or other buried structure should be designed to accommodate this potential settlement.

12. The active and at-rest pressures contained in Paragraphs 8 and 9 are for fully drained conditions; therefore, all vault and buried structure walls should be drained with perforated pipe encased in a free-draining gravel blanket. The pipe should be placed perforations downward and should discharge to a sump or in a nonerosive manner away from improvements. The gravel zone encasing the pipe should have a width of approximately 1 foot and should extend upward to 1 foot from the top of the backfill. The upper 1 foot of backfill should consist of native soils to reduce the flow of surface drainage into the wall drain system. If a slab-on-grade abuts the top of the vault, the gravel zone should extend to the slab-on-grade. To reduce infiltration of the backfill soil

into the gravel, a permeable synthetic filter fabric, conforming to Caltrans Section 88-1.03 for Underdrains, should be placed between the two. Manufactured synthetic drains, such as Miradrain and Enkadrain, are acceptable alternatives to the use of gravel, provided they are installed in accordance with the manufacturer's recommendations. If seepage into the vault is allowable, the perforated pipe may be omitted in lieu of weep holes on maximum 4-foot centers placed at the lowest point in the vault walls that will still provide drainage into it. A filter fabric as described above should be placed between the weep holes and the drain gravel.

13. In lieu of a drainage system, vault walls can be designed for an active and at-rest pressures of 75 and 90 pcf, respectively, for saturated native soil or for imported sand or gravel backfill.

14. The soil unit weight may be taken as 115 pcf for compacted, unsaturated backfill. Under saturated conditions, the soil's buoyant unit weight should be taken as 55 pcf.

15. Where moisture transmission through a vault or buried structure wall would be undesirable, the vault or wall should be thoroughly waterproofed in accordance with the requirements of the architect/engineer. Where moisture vapor transmitted from the underlying soil would be undesirable, the vault and equipment shelter slabs should be protected from subsurface moisture vapor. A number of options for vapor protection are provided in the following paragraphs, however, the means of vapor protection, including the type and thickness of the vapor retarder, if specified, are left to the discretion of the engineer.

16. Several recent studies, including those of American Concrete Institute (ACI) Committees 302 and 306, have concluded that it is preferable to eliminate the typical sand layer beneath the slabs, and to place the slab concrete in direct contact with a "Class A" vapor retarder, particularly during wet weather construction. However, placing the concrete directly on the vapor retarder requires special attention to using the proper vapor retarder a very low water-cement ratio in the concrete mix, and special finishing and curing techniques.

17. Probably the next most effective option would be the use of vapor-inhibiting admixtures in the slab concrete mix and/or application of a sealer to the surface of the slab. This would also require special concrete mixes and placement procedures, depending upon the recommendations of the admixture or sealer manufacturer.

18. Another option that may be a reasonable compromise between effectiveness and cost considerations is the use of a subslab vapor retarder protected by a sand layer. If a "Class A" vapor retarder (see discussion below) is specified, the retarder can be placed directly on the prepared subgrade. The retarder should be covered with a minimum 2 inches of *clean* sand. If a less durable vapor retarder is specified (Class B or C), a minimum of 4 inches of clean sand should be provided on top of the prepared subgrade, and the retarder should be placed in the center of the clean sand layer. Clean sand is defined as a well or poorly graded sand (ASTM D 2487-06) of which less than 3 percent passes the No. 200 sieve.

19. Where specified, vapor retarders should conform to ASTM Standard E 1745-97/04. This standard specifies properties for three performance classes, Class A, B and C. The appropriate class should be selected based on the sensitivity of the equipment supported by the slab to moisture intrusion and the potential for damage to the vapor retarder during placement of slab reinforcement and concrete.

20. Regardless of the underslab vapor retarder selected, proper installation of the retarder is critical for optimum performance. The vapor retarder should be installed in accordance with ASTM Standard Practice E 1643-98/05. All seams must be properly lapped, and all seams and utility penetrations properly sealed in accordance with the vapor retarder manufacturer's recommendations.

21. If sand is used between the vapor retarder and the slab, it should be moistened only as necessary to promote concrete curing; saturation of the sand should be avoided, as the excess moisture would be on top of the vapor retarder, potentially resulting in vapor transmission through the slab for months or years.

22. Foundation excavations should be observed by a representative of this firm during excavation and prior to placement of formwork, reinforcing steel or concrete. Soils in foundation excavations should be moistened to within 2 percent of optimum moisture content, and no desiccation cracks should be present prior to concrete placement.

Utility Trenches

1. A select, noncorrosive, granular, easily compacted material should be used as bedding and shading immediately around utilities. The site soil may be used for trench backfill above the select material.

2. The project engineer should designate the relative compaction percentage and the maximum dry density standard for trench backfill within the runway and RSA areas. Trench backfill in unimproved areas where settlement of the backfill would not be detrimental should be compacted to a minimum of 85 percent of maximum dry density per ASTM D 1557. Trench backfill in all other areas should be compacted to a minimum of 90 percent of maximum dry density per ASTM D 1557.

3. Trench backfill should be placed in level lifts not exceeding 6 inches in loose thickness and compacted as noted above. Trench backfill should be moisture conditioned to at least optimum moisture content prior to application of compactive effort.

4. The recommendations of this section are minimums only, and may be superceded by the requirements of the engineer, the governing jurisdiction, utility companies or pipe manufacturers.

Drainage Around Improvements

1. Unpaved ground surfaces should be graded during construction, and finish graded to direct surface runoff away from pavement at a minimum 2 percent grade for a minimum distance of 5 feet. If this is not practicable due to the terrain or other improvements, swales with improved surfaces, area drains, etc. should be provided to divert drainage away from paved areas.

2. The site soils are highly erodible. Stabilization of soils, particularly those disturbed by construction, vegetation, or other means during and following construction, is recommended to reduce erosion damage. Care should be taken to establish and maintain vegetation.

Observation and Testing

1. The recommendations contained in this report are based on a limited number of borings and rely on continuity of the subsurface conditions encountered. Therefore, this firm should be retained to provide consultation during the design phase, to review final plans once they are available, to interpret this report during construction, and to provide construction monitoring in the form of testing and observation.

2. The standard test used to define field density and moisture content should be ASTM D 6938-08a, or other methods acceptable to the soils engineer and jurisdiction.

3. At a minimum, the following items should be reviewed, tested, or observed by this firm:
   - Final plans
   - Stripping and clearing of vegetation
   - Removal of existing fill stockpiles and debris
   - Overexcavation to the recommended depths
   - Scarification, moisture conditioning, and recompaction
   - Utility trench and buried structure backfill
   - Fill quality, placement, moisture conditioning, and compaction
   - Subgrade and aggregate base compaction and proofrolling

4. Unless otherwise superseded by the requirements of the FAA, compaction of soils, and backfill of excavations and trenches, should be considered to fall under Section 1704.7 "Soils" of the CBC. Special inspection of grading/backfill should be provided as per Section 1704.7 and Table 1704.7 of the CBC. The special inspector should be under the direction of the soils engineer.

5. Unless otherwise superseded by the requirements of the FAA, in our opinion, with the approval of the building official, periodic special inspections can be performed in lieu of

continuous inspection to verify use of proper materials, densities and lift thicknesses during placement and compaction of backfill.

6. A program of quality control should be developed prior to beginning grading. The contractor or project manager should determine any additional inspection items required by the engineer or the governing jurisdiction.

7. In accordance with CBC Section 1803.5 the following locations and frequency of test are recommended, unless otherwise superseded by the FAA. At a minimum, the special inspector should verify that:
   - A minimum of two compaction tests are taken in areas to receive slabs-on-grade at pad grade and for every 1.5 feet of fill or recompacted soil.
   - A minimum of one compaction test is taken in each site utility trench for every 1.5 feet above the pipe, for every 300 linear feet of trench, or fraction thereof.
   - At least one compaction test is taken in the pavement areas at subgrade and aggregate base grade for every 10,000 square feet of pavement or fraction thereof.

8. The above recommendations relative to special inspection, and test location and frequency may be subject to modification by the soils engineer, based upon soil, rock or moisture conditions encountered, size and type of equipment used by the contractor, the general trend of the results of compaction tests, or other factors.

9. A preconstruction conference between the owner, this firm, the design engineer, and contractors is recommended to discuss planned construction procedures and quality control requirements.

10. This firm should be notified at least 48 hours prior to beginning construction operations. If Earth Systems Pacific is not retained to provide construction observation and testing services, it shall not be responsible for the interpretation of the information by others or any consequences arising therefrom.

8.0 CLOSURE

Our intent was to perform the investigation in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the locality of this project and under similar conditions. No representation, warranty, or guarantee is either expressed or implied. This report is intended for the exclusive use by the client as discussed in the "Scope of Services" section. Application beyond the stated intent is strictly at the user's risk.

This report is valid for conditions as they exist at this time for the type of project described herein. The conclusions and recommendations contained in this report could be rendered invalid, either in whole or in part, due to changes in building codes, regulations, standards of geotechnical or construction practice, changes in physical conditions, or the broadening of knowledge.

If changes with respect to development type or location become necessary, if items not addressed in this report are incorporated into plans, or if any of the assumptions used in the preparation of this report are not correct, this firm shall be notified for modifications to this report. Any items not specifically addressed in this report should comply with the FAA, the CBC and/or the requirements of the governing jurisdiction.

The preliminary recommendations of this report are based upon the geotechnical conditions encountered at the site and may be augmented by additional requirements of the engineer, or by additional recommendations provided by this firm based on conditions exposed at the time of construction.

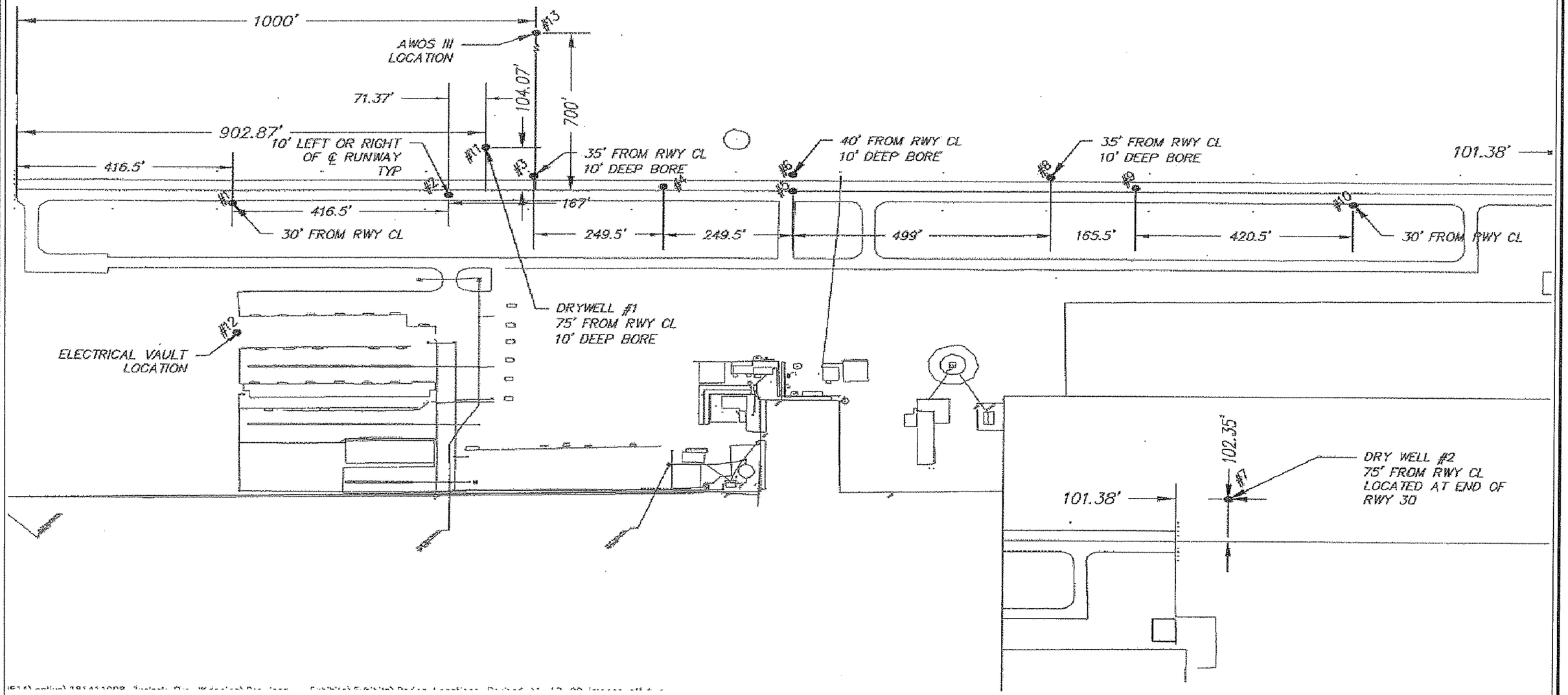
This document, the data, conclusions, and recommendations contained herein are the property of Earth Systems Pacific. This report shall be used in its entirety, with no individual sections reproduced or used out of context. Copies may be made only by Earth Systems Pacific, the client, and the client's authorized agents for use exclusively on the subject project. Any other use is subject to federal copyright laws and the written approval of Earth Systems Pacific.

Thank you for this opportunity to have been of service. If you have any questions, please feel free to contact this office at your convenience.

End of Text.

APPENDIX A

Boring Location Map
Boring Logs
Boring Log Legend



BASE MAP PROVIDED BY STANTEC CONSULTING, INC.

LEGEND

13● Boring Location (Approx.)

N

NOT TO SCALE

BORING LOCATION MAP

TURLOCK MUNICIPAL AIRPORT
RUNWAY WIDENING AND RSA IMPROVEMENTS

Turlock, California

Earth Systems

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E-mail: esc@earthsys.com

December 24, 2009 SB SH-11116-SA

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING AND RSA IMPROVEMENTS–122409Borings

Earth Systems Pacific

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 6" Solid Stem

Boring No. 1
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0	SC-SM		SILTY CLAYEY SAND: dark red brown, loose, moist, fine to medium grained sand (Alluvium)	0.0–3.0	○			
1				0.5–2.0	▩	121.3	12.6	13
2			medium dense					
3			increasing clay content					
4			orange brown, decreasing clay content	4.5–6.0	▩	116.7	13.9	50/6.0"
5			very dense, caliche cemented					
6			End of Boring @ 6.0'					
7			No subsurface water encountered.					
8								
9								
10								
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12								
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16								
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18								
19								
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21								
22								
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24								
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26								

LEGEND: ▩ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ◍ SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 2
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 6" Solid Stem

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0			3.0" Asphalt Concrete					
1	SC-SM		SILTY CLAYEY SAND: dark red to orange brown, loose, moist, fine to coarse grained sand, trace fine gravel (Fill)	1.5–3.0	Ring	110.0	23.2	9
2	SM		SILTY SAND: red to orange brown, medium dense, moist to very moist, fine to medium grained sand, trace clay lenses (Alluvium)					
3								
4				5.0–6.5	Ring	117.5	13.7	50/5.0"
5			very dense, caliche cemented					
6								
7			End of Boring @ 6.5' No subsurface water encountered.					
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22								
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25								
26								

LEGEND: Ring Sample ◯ Grab Sample ▭ Shelby Tube Sample ◉ SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 3
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0	SC–SM		SILTY CLAYEY SAND: dark red brown, loose, moist, fine to medium grained sand (Alluvium)					
2			medium dense	0.0–3.0	○			
4	SC		CLAYEY SAND: yellow brown, medium dense, moist, fine to medium grained sand	3.5–5.0	▬	98.0	36.7	13
7			very dense, caliche cemented					
8				8.0–9.5	▬	98.9	22.1	50/3.0"
10			End of Boring @ 9.5' No subsurface water encountered.					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 4
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0			2.5" Asphalt Concrete					
1	SC–SM		SILTY CLAYEY SAND: dark red brown, medium dense, moist (Fill)	1.5–3.0	Ring	119.0	12.4	50/3.0"
2	SM		SILTY SAND: red to yellow brown, very dense, very moist, fine to medium grained sand, cemented (Alluvium)					
4	SC		CLAYEY SAND: red brown, very dense, moist, fine to medium grained sand	5.0–6.5	Ring	115.3	15.8	50/6.0"
7			End of Boring @ 6.5' No subsurface water encountered.					

LEGEND: Ring Sample ◯ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 5
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

SOIL DESCRIPTION

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0			2.5" Asphalt Concrete					
1	SC-SM		SILTY CLAYEY SAND: dark red brown, medium dense, moist (Fill)	1.5–3.0	Ring	119.2	9.2	15
2	SM		SILTY SAND: red brown, medium dense, very moist, fine to coarse grained sand (Alluvium)					
3								
4				5.0–6.5	Ring	112.5	7.3	17
5								
6								
7			End of Boring @ 6.5' No subsurface water encountered.					
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25								
26								

LEGEND: Ring Sample ◯ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 6
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0	SM		SILTY SAND: yellow brown, medium dense, moist, fine to medium grained sand (Fill)					
1	SM		SILTY SAND: red brown, medium dense, moist, fine to medium grained sand (Alluvium)					
2								
3								
4				3.5–5.0	▬	118.5	9.1	16
5								
6								
7								
8								
9				8.0–9.5	▬	99.8	12.7	50/3.0"
10			very moist to wet, caliche cemented					
11			End of Boring @ 10.5' No subsurface water encountered.					
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ▬ Ring Sample ◯ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 7
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0	SM		SILTY SAND: yellow to red brown, medium dense, moist, medium to coarse grained sand (Alluvium)					
5			discontinuous caliche cemented lenses	5.0–6.5	●			23
10				10.0–11.5	●			50/5.0"
13			increasing clay content					
15				15.0–155.5	●			50/5.5"
16			End of Boring @ 15.5' No subsurface water encountered.					

LEGEND: ▩ Ring Sample ◯ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 8
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0	SM		SILTY SAND: yellow brown, loose, slightly moist (Fill)					
1				1.0–2.5	▬	112.4	6.6	10
2	SM		SILTY SAND: red to yellow brown, medium dense, moist, medium grained sand (Alluvium)					
3								
4								
5								
6								
7								
8								
9				10.0–11.5	▬	122.1	12.2	72
10								
11			dense, very moist					
12			End of Boring @ 11.5' No subsurface water encountered.					
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ▬ Ring Sample ◯ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 9
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0			2.5" Asphalt Concrete					
1	SM		SILTY SAND: yellow brown, medium dense, moist (Fill)	1.0–2.5	Ring	119.5	6.1	29
2	SM		SILTY SAND: red brown, medium dense, moist to very moist, medium to coarse grained sand (Alluvium)					
3								
4			loose	3.5–5.0	Ring	109.8	7.3	12
5			End of Boring @ 5.0' No subsurface water encountered.					
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: Ring Sample ◯ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplificotion of actuol conditions encountered. It opplies ot the locotion ond time of drilling. Subsurface conditions may differ at other locotions ond times.

Earth Systems Pacific

Boring No. 10
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 6" Solid Stem

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

SOIL DESCRIPTION

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0	SM		SILTY SAND: yellow to red brown, medium dense, moist, medium to coarse grained sand (Alluvium)	0.0–3.0	○			
1				1.0–2.5	▨	116.6	5.9	22
2								
3								
4				5.0–5.5	▨	108.1	9.6	50/5.0"
5								
6			End of Boring @ 5.5' No subsurface water encountered.					
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ▨ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 11
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0	SC		CLAYEY SAND: yellow brown, medium dense, very moist (Fill)					
2	SM		SILTY SAND: yellow to red brown, medium dense, moist, fine to coarse grained sand (Alluvium)					
5			loose	5.0–6.5	●			8
6			medium dense, thin, discontinuous caliche cemented lenses					
9	ML		SANDY SILT: gray/orange mottled, hard, moist, fine grained sand, laminated					
10				10.0–11.5	●			49
15				15.0–16.5	●			60
16			End of Boring @ 16.5' No subsurface water encountered.					

LEGEND: ▬ Ring Sample ◯ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 12
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

SOIL DESCRIPTION

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0	SM		SILTY SAND: dark yellow brown, medium dense, moist (Fill)					
1–2	CL		SANDY LEAN CLAY: orange brown, hard, moist, fine grained sand (Alluvium)	1.0–2.5	Ring	110.6	13.2	50/3.0"
3–6	SM		SILTY SAND: light gray to tan, dense, moist, fine grained sand	5.0–6.5	Ring	107.1	11.6	82
7			End of Boring @ 6.5' No subsurface water encountered.					

LEGEND: Ring Sample ◯ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 13
PAGE 1 OF 1
JOB NO.: SH-11116-SA
DATE: 11/30/09

LOGGED BY: B. Faust
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

TURLOCK MUNICIPAL AIRPORT RUNWAY WIDENING & RSA IMPROVEMENTS
E. Greenway Avenue
Turlock, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0	SM–SC		SILTY CLAYEY SAND: dark yellow brown, dense, slightly moist, fine grained sand (Alluvium)	1.0–2.5	Ring	113.2	5.8	47
3	SM		SILTY SAND: orange brown, very dense, moist, fine to medium grained sand	4.5–6.0	Ring	104.7	14.5	50/6.0"
6			thin, discontinuous cemented lenses					
8	ML		SANDY SILT: light gray/orange mottled, hard, moist, fine grained sand	8.5–10.0	SPT			34
10			End of Boring @ 6.5' No subsurface water encountered.					

LEGEND: Ring Sample ◯ Grab Sample ▭ Shelby Tube Sample SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

BORING LOG LEGEND

SAMPLE / SUBSURFACE WATER SYMBOLS	GRAPH. SYMBOL
CALIFORNIA MODIFIED	
STANDARD PENETRATION TEST (SPT)	
SHELBY TUBE	
BULK	
SUBSURFACE WATER DURING DRILLING	
SUBSURFACE WATER AFTER DRILLING	

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS	GROUP SYMBOL	TYPICAL DESCRIPTIONS	GRAPH. SYMBOL
COARSE GRAINED SOILS (MORE THAN HALF OF MATERIAL IS TESTED OR JUDGED TO BE LARGER THAN #200 SIEVE SIZE)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
	GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES	
	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
	SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES	
FINE GRAINED SOILS (HALF OR MORE OF MATERIAL IS TESTED OR JUDGED TO BE SMALLER THAN #200 SIEVE SIZE)	ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY, CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY	
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY, SILTY SOILS, ELASTIC SILTS	
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

OBSERVED MOISTURE CONDITION

DRY	SLIGHTLY MOIST	MOIST	VERY MOIST	WET
LITTLE/NO MOISTURE	JUDGED BELOW OPTIMUM	JUDGED ABOUT OPTIMUM	JUDGED OVER OPTIMUM	SATURATED

TYPICAL CONSISTENCY

COARSE GRAINED SOILS

BLOWS/FOOT SPT	BLOWS/FOOT CA SAMPLER	DESCRIPTIVE TERM
0-10	0-16	LOOSE
11-30	17-50	MEDIUM DENSE
31-50	51-83	DENSE
OVER 50	OVER 83	VERY DENSE

FINE GRAINED SOILS

BLOWS/FOOT SPT	BLOWS/FOOT CA SAMPLER	DESCRIPTIVE TERM
0-2	0-3	VERY SOFT
3-4	4-7	SOFT
5-8	8-13	MEDIUM STIFF
9-15	14-25	STIFF
16-30	26-50	VERY STIFF
OVER 30	OVER 50	HARD

GRAIN SIZES

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENING		
# 200	# 40	# 10	# 4	3/4"	3"	12"

SILT & CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

TYPICAL ROCK HARDNESS

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
EXTREMELY HARD	CORE, FRAGMENT, OR EXPOSURE CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CAN ONLY BE CHIPPED WITH REPEATED HEAVY HAMMER BLOWS
VERY HARD	CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CORE OR FRAGMENT BREAKS WITH REPEATED HEAVY HAMMER BLOWS
HARD	CAN BE SCRATCHED WITH KNIFE OR SHARP PICK WITH DIFFICULTY (HEAVY PRESSURE); HEAVY HAMMER BLOW REQUIRED TO BREAK SPECIMEN
MODERATELY HARD	CAN BE GROOVED 1/16 INCH DEEP BY KNIFE OR SHARP PICK WITH MODERATE OR HEAVY PRESSURE; CORE OR FRAGMENT BREAKS WITH LIGHT HAMMER BLOW OR HEAVY MANUAL PRESSURE
SOFT	CAN BE GROOVED OR GOUGED EASILY BY KNIFE OR SHARP PICK WITH LIGHT PRESSURE, CAN BE SCRATCHED WITH FINGERNAIL; BREAKS WITH LIGHT TO MODERATE MANUAL PRESSURE
VERY SOFT	CAN BE READILY INDENTED, GROOVED OR GOUGED WITH FINGERNAIL, OR CARVED WITH KNIFE; BREAKS WITH LIGHT MANUAL PRESSURE

TYPICAL ROCK WEATHERING

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
FRESH	NO DISCOLORATION, NOT OXIDIZED
SLIGHTLY WEATHERED	DISCOLORATION OR OXIDATION IS LIMITED TO SURFACE OF, OR SHORT DISTANCE FROM; SOME FRACTURES PRESENT; FELDSPAR CRYSTALS ARE DULL
MODERATELY WEATHERED	DISCOLORATION OR OXIDATION EXTENDS FROM FRACTURES, USUALLY THROUGHOUT; Fe-Mg MINERALS ARE "RUSTY"; FELDSPAR CRYSTALS ARE "CLOUDY"
INTENSELY WEATHERED	DISCOLORATION OR OXIDATION THROUGHOUT; FELDSPAR AND Fe-Mg MINERALS ARE ALTERED TO CLAY TO SOME EXTENT OR CHEMICAL ALTERATION PRODUCES IN SITU DISAGGREGATION
DECOMPOSED	DISCOLORATION OR OXIDATION THROUGHOUT, BUT RESISTANT MINERALS SUCH AS QUARTZ MAY BE UNALTERED; FELDSPAR AND Fe-Mg MINERALS ARE COMPLETELY ALTERED TO CLAY

drafting/masters/Boring Log Legend091608.dwg

APPENDIX B

Percolation Test Results

PERCOLATION TEST REPORT

PROJECT: Turlock Municipal Airport

DRILLED BY: B. Faust

TESTED BY: L. Azevedo

TEST LOCATION: Drywell 1, Boring 11

DATE DRILLED: 11/30/09

DATE TESTED: 12/1/09

DIAMETER: 6 inches

DEPTH: 16.5 feet

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	PERCOLATION RATE, MIN./INCH
12:00 PM	---	6.32	---	---
12:05 PM	5	6.60	0.28	1
12:10 PM	5	7.10	0.50	1
12:15 PM	5	8.35	1.25	0.3
12:20 PM	5	8.66	0.31	1
12:25 PM	5	8.87	0.21	2
12:30 PM	5	9.05	0.18	2
12:35 PM	5	9.30	0.25	2
	REFILL		REFILL	
12:45 PM	---	6.48	---	---
12:50 PM	5	6.77	0.29	1
12:55 PM	5	7.06	0.29	1
1:00 PM	5	7.53	0.47	1
1:05 PM	5	7.89	0.36	1
1:10 PM	5	8.05	0.16	3
1:15 PM	5	8.39	0.34	1
1:20 PM	5	8.61	0.22	2

PERCOLATION TEST REPORT

PROJECT: Turlock Municipal Airport

DRILLED BY: B. Faust

TESTED BY: L. Azevedo

TEST LOCATION: Drywell 2, Boring 7

DATE DRILLED: 11/30/09

DATE TESTED: 12/1/09

DIAMETER: 6 inches

DEPTH: 15.5 feet

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	PERCOLATION RATE, MIN./INCH
10:13 AM	---	6.99	---	---
10:18 AM	5	7.26	0.27	2
10:23 AM	5	7.48	0.22	2
10:28 AM	5	7.59	0.11	4
10:33 AM	5	7.65	0.06	7
10:38 AM	5	7.77	0.12	3
10:43 AM	5	7.94	0.17	2
10:48 AM	5	8.10	0.16	3
	REFILL		REFILL	
10:59 AM	---	6.55	---	---
11:04 AM	5	6.85	0.30	1
11:09 AM	5	7.02	0.17	2
11:14 AM	5	7.21	0.19	2
11:19 AM	5	7.34	0.13	3
11:24 AM	5	7.44	0.10	4
11:29 AM	5	7.55	0.11	4
11:34 AM	5	7.68	0.13	3
11:39 AM	5	7.82	0.14	3

APPENDIX C

Geotechnical Laboratory Test Results

Turlock Municipal Airport
Runway Widening and RSA Improvements

SH-11116-SA

BULK DENSITY TEST RESULTS

ASTM D 2937-04 (modified for ring liners)

December 23, 2009

BORING NO.	DEPTH feet	MOISTURE CONTENT, %	WET DENSITY, pcf	DRY DENSITY, pcf
1	1.5 - 2.0	12.6	136.5	121.3
1	5.5 - 6.0	13.9	133.0	116.7
2	2.5 - 3.0	23.2	135.5	110.0
2	6.0 - 6.5	13.7	133.5	117.5
3	4.5 - 5.0	36.7	134.0	98.0
3	9.0 - 9.5	22.1	120.9	98.9
4	2.5 - 3.0	12.4	133.7	119.0
4	6.0 - 6.5	15.8	133.5	115.3
5	2.5 - 3.0	9.2	130.2	119.2
5	5.0 - 5.5	7.3	120.8	112.5
6	4.5 - 5.0	9.1	129.2	118.5
6	10.0 - 10.5	12.7	112.4	99.8
8	2.0 - 2.5	6.6	119.8	112.4
8	11.0 - 11.5	12.2	137.0	122.1
9	2.0 - 2.5	6.1	126.8	119.5
9	4.5 - 5.0	6.5	116.9	109.8
10	2.0 - 2.5	5.9	123.5	116.6
10	5.0 - 5.5	9.6	118.4	108.1
12	2.0 - 2.5	13.2	125.3	110.6
12	6.0 - 6.5	11.6	119.5	107.1
13	2.0 - 2.5	5.8	119.7	113.2
13	5.5 - 6.0	14.5	119.8	104.7

Turlock Municipal Airport
Runway Widening and RSA Improvements

SH-11116-SA

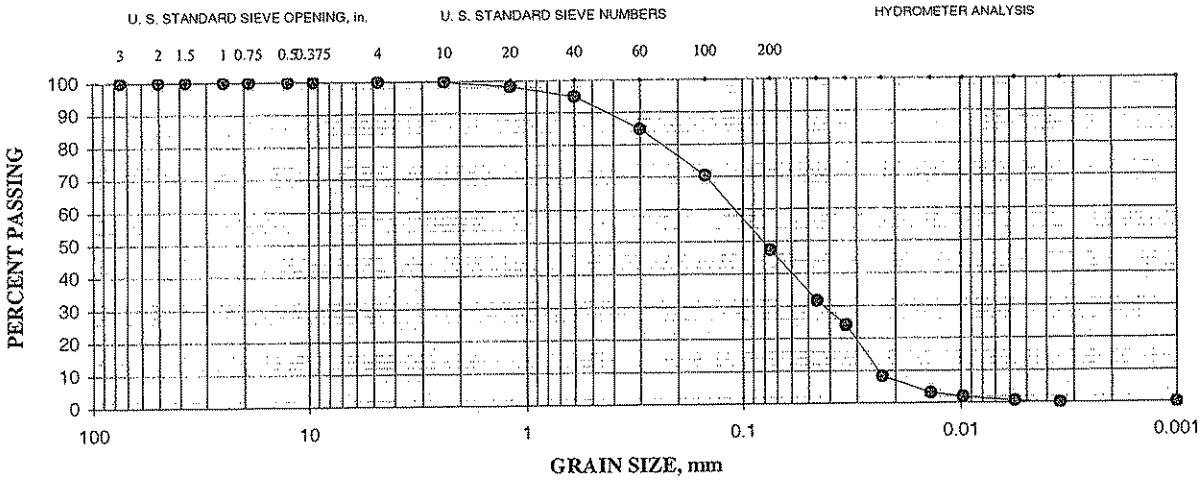
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07

Boring #1 @ 0.0 - 3.0'
Silty, Clayey Sand (SC-SM)
LL = 18; PL = 13; PI = 5

December 23, 2009
Specific Gravity = 2.70 (assumed)
Gravel = 0%; Sand = 53%; Silt = 46%; Clay = 1%

Sieve size	% Retained	% Passing
3" (75.0-mm)	0	100
2" (50.0-mm)	0	100
1-1/2" (37.5-mm)	0	100
1" (25.0-mm)	0	100
3/4" (19.0-mm)	0	100
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	0	100
#8 (2.36-mm)	0	100
#16 (1.18-mm)	2	98
#30 (600-μm)	5	95
#50 (300-μm)	15	85
#100 (150-μm)	30	70
#200 (75-μm)	53	47
Hydrometer Analysis		
45-μm		32
34-μm		24
23-μm		8
14-μm		3
10-μm		2
5.7-μm		1
3.5-μm		0
Colloids		0



Turlock Municipal Airport
Runway Widening and RSA Improvements

SH-11116-SA

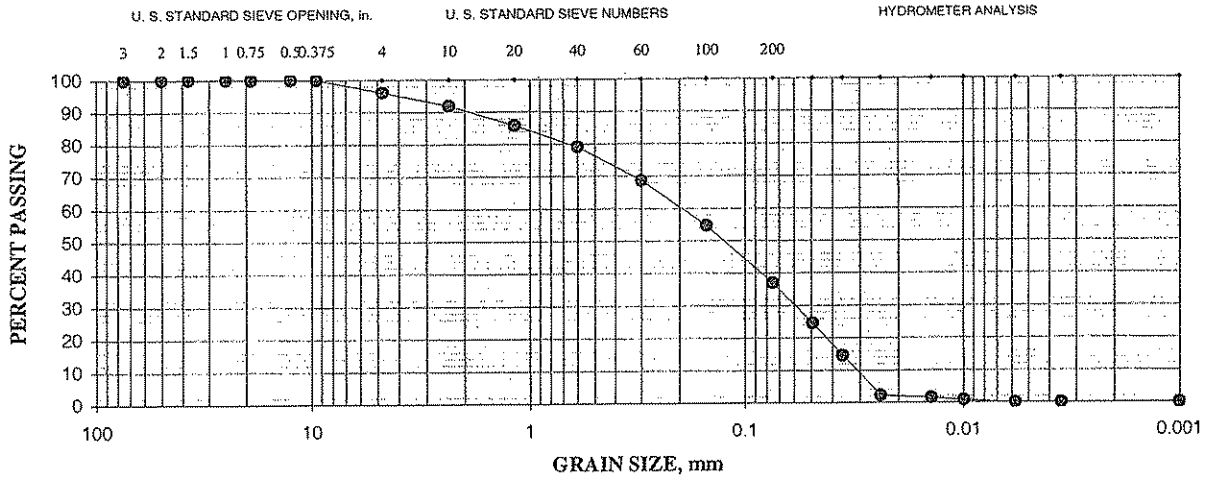
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07

Boring #3 @ 9.0 - 9.5'
Clayey Sand (SC)
LL = 37; PL = 18; PI = 19

December 23, 2009
Specific Gravity = 2.65 (assumed)
Gravel = 4%; Sand = 59%; Silt = 37%; Clay = 0%

Sieve size	% Retained	% Passing
3" (75.0-mm)	0	100
2" (50.0-mm)	0	100
1-1/2" (37.5-mm)	0	100
1" (25.0-mm)	0	100
3/4" (19.0-mm)	0	100
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	4	96
#8 (2.36-mm)	8	92
#16 (1.18-mm)	14	86
#30 (600-μm)	21	79
#50 (300-μm)	31	69
#100 (150-μm)	45	55
#200 (75-μm)	63	37
Hydrometer Analysis		
49-μm		25
36-μm		15
24-μm		2
14-μm		2
10-μm		1
5.7-μm		0
3.5-μm		0
Colloids		0



Turlock Municipal Airport
Runway Widening and RSA Improvements

SH-11116-SA

PARTICLE SIZE ANALYSIS

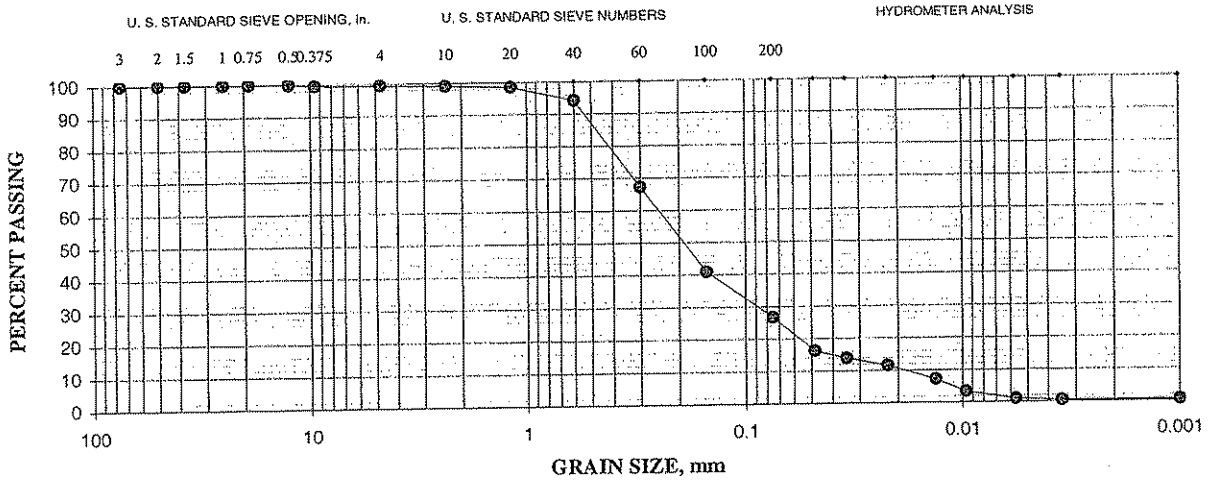
ASTM D 422-63/07

December 23, 2009

Boring #10 @ 0.0 - 3.0'
Silty Sand (SM)
Non-Plastic

Specific Gravity = 2.70 (assumed)
Gravel = 1%; Sand = 72%; Silt = 26%; Clay = 1%

Sieve size	% Retained	% Passing
3" (75.0-mm)	0	100
2" (50.0-mm)	0	100
1-1/2" (37.5-mm)	0	100
1" (25.0-mm)	0	100
3/4" (19.0-mm)	0	100
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	1	99
#4 (4.75-mm)	1	99
#8 (2.36-mm)	1	99
#16 (1.18-mm)	1	99
#30 (600-μm)	6	94
#50 (300-μm)	33	67
#100 (150-μm)	59	41
#200 (75-μm)	73	27
Hydrometer Analysis		
48-μm		16
34-μm		14
22-μm		12
13-μm		7
10-μm		3
5.6-μm		1
3.5-μm		0
Colloids		0



Turlock Municipal Airport
Runway Widening and RSA Improvements

SH-11116-SA

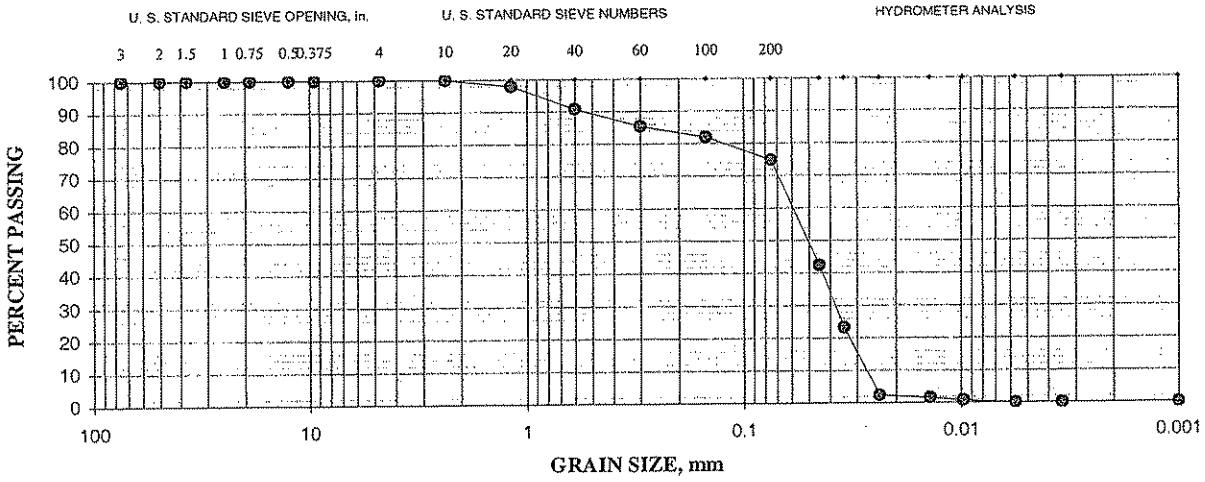
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07

Boring #11 @ 10.5 - 11.0'
Sandy Silt (ML)
LL = 29; PL = 25; PI = 4

December 23, 2009
Specific Gravity = 2.70 (assumed)
Gravel = 0%; Sand = 25%; Silt = 75%; Clay = 0%

Sieve size	% Retained	% Passing
3" (75.0-mm)	0	100
2" (50.0-mm)	0	100
1-1/2" (37.5-mm)	0	100
1" (25.0-mm)	0	100
3/4" (19.0-mm)	0	100
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	0	100
#8 (2.36-mm)	0	100
#16 (1.18-mm)	2	98
#30 (600-μm)	9	91
#50 (300-μm)	15	85
#100 (150-μm)	18	82
#200 (75-μm)	25	75
Hydrometer Analysis		
45-μm		42
34-μm		23
24-μm		2
14-μm		2
10-μm		1
5.7-μm		0
3.5-μm		0
Colloids		0



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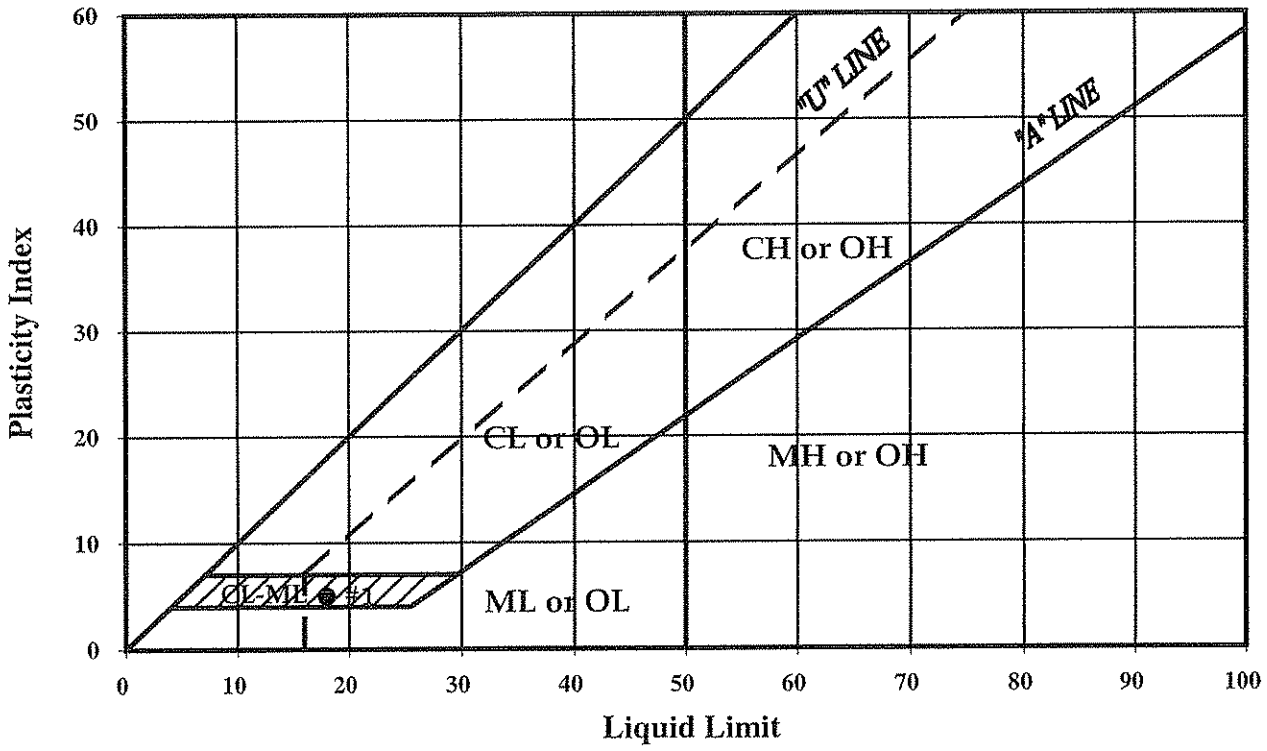
PLASTICITY INDEX

ASTM D 4318-05

December 23, 2009

Test No.:	1	2	3	4	5
Boring No.:	1	3	10	11	
Sample Depth:	0.0 - 3.0'	9.0 - 9.5'	0.0 - 3.0'	10.0 - 11.5'	
Liquid Limit:	18	37	NL	29	
Plastic Limit:	13	18	NP	25	
Plasticity Index:	5	19	NL/NP	4	

Plasticity Chart



Turlock Municipal Airport
Runway Widening and RSA Improvements

SH-11116-SA

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-09 (Modified)

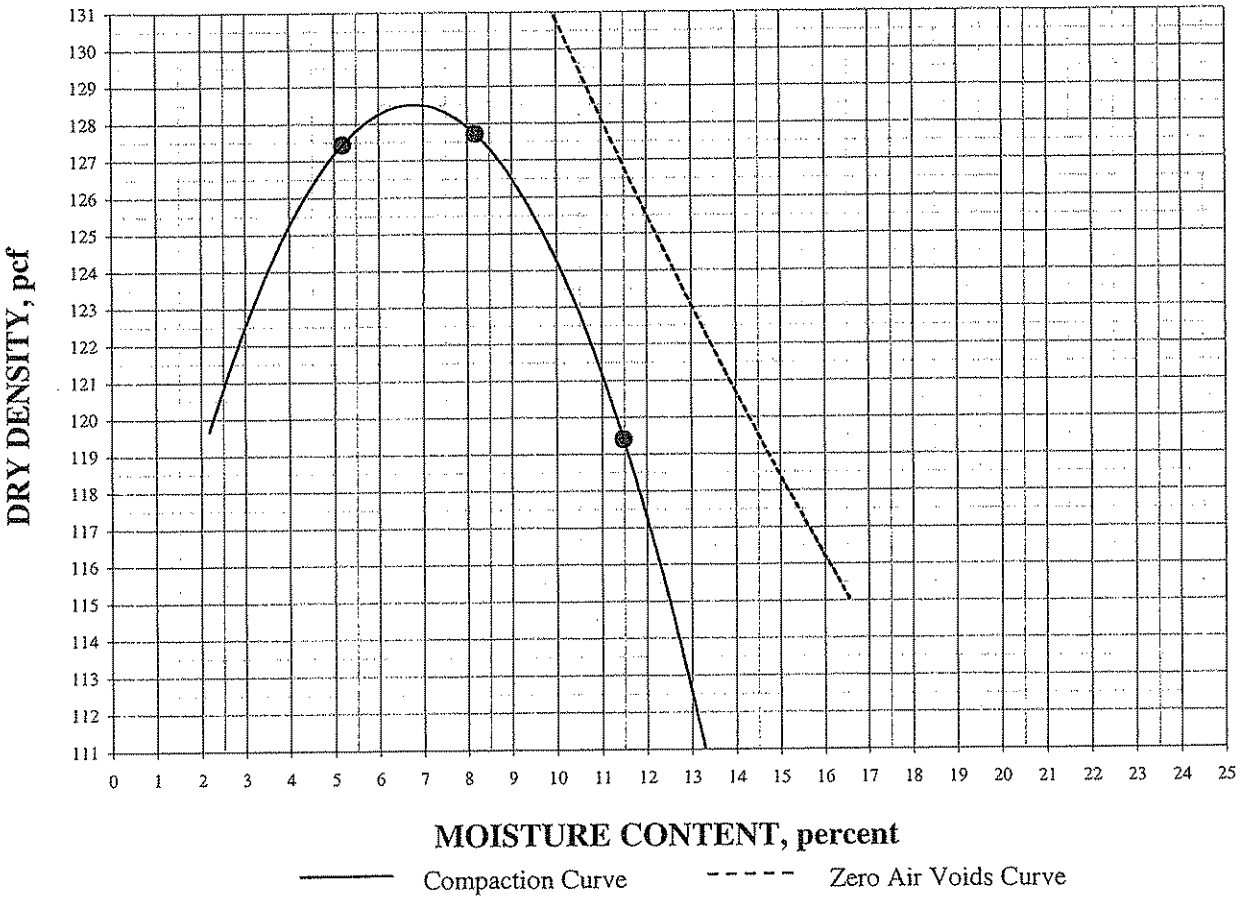
PROCEDURE USED: A
PREPARATION METHOD: Moist
RAMMER TYPE: Mechanical
SPECIFIC GRAVITY: 2.65 (assumed)

December 23, 2009
Boring #1 @ 0.0 - 3.0'
Dark Red Brown Silty, Clayey Sand (SC-SM)

SIEVE DATA:

Sieve Size	% Retained
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 128.5 pcf
OPTIMUM MOISTURE: 6.8%



Turlock Municipal Airport
Runway Widening and RSA Improvements

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DIRECT SHEAR

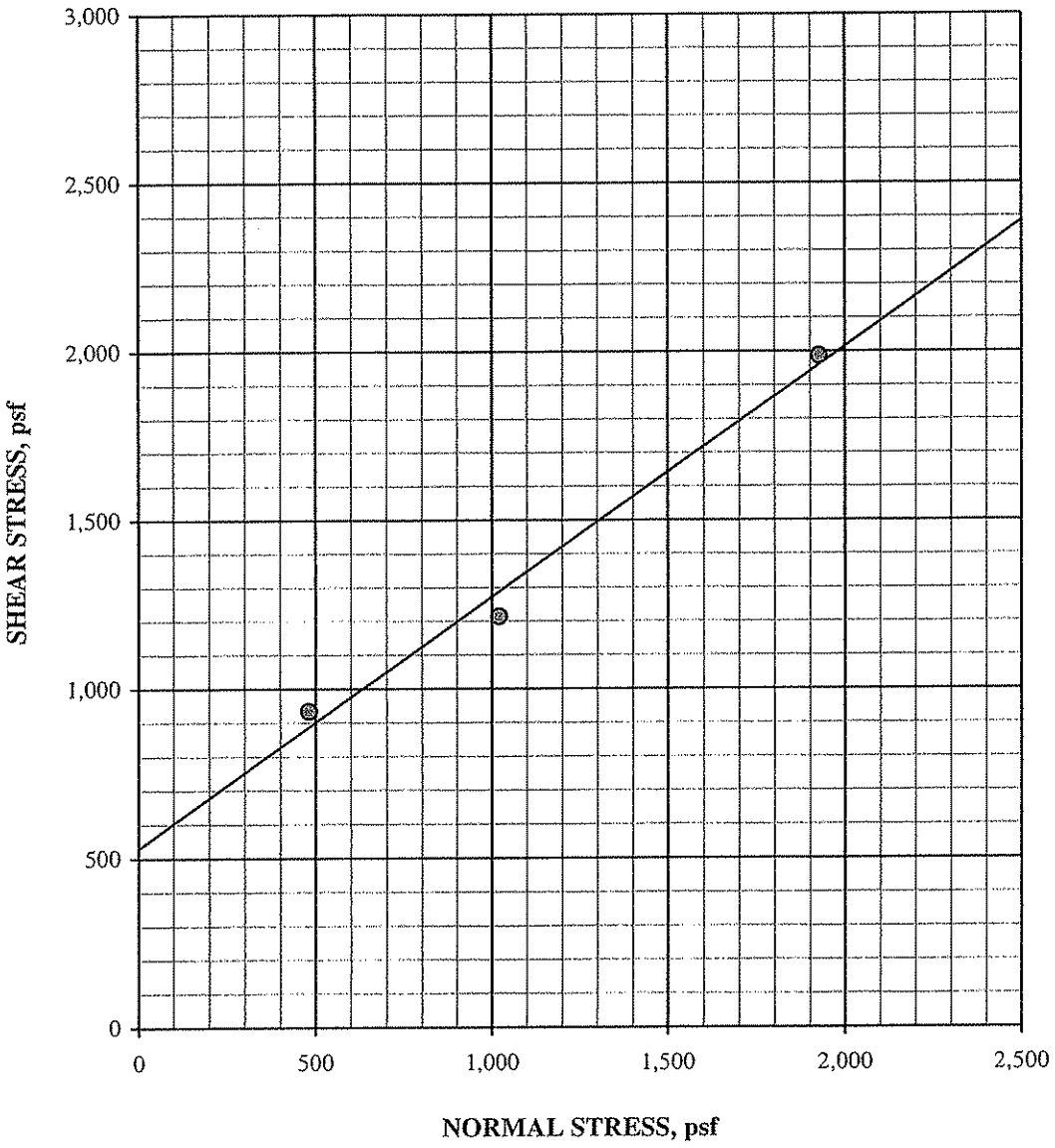
ASTM D 3080-04 (modified for consolidated, undrained conditions)

December 23, 2009

Boring #12 @ 6.0 - 6.5'
Silty Sand (SM)
Ring sample, saturated

INITIAL DRY DENSITY: 104.6 pcf
INITIAL MOISTURE CONTENT: 11.6 %
PEAK SHEAR ANGLE (Ø): 37°
COHESION (C): 530 psf

SHEAR vs. NORMAL STRESS



Turlock Municipal Airport
Runway Widening and RSA Improvements

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DIRECT SHEAR continued

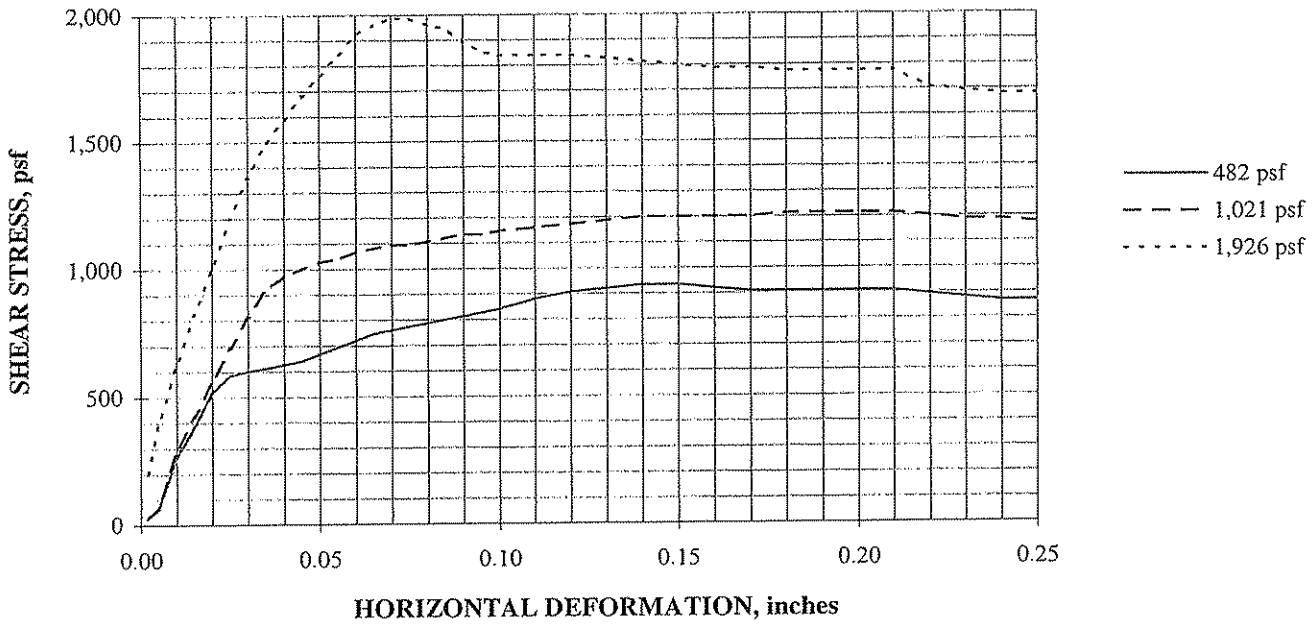
ASTM D 3080-04 (modified for consolidated, undrained conditions)

December 23, 2009

Boring #12 @ 6.0 - 6.5'
Silty Sand (SM)
Ring sample, saturated

SPECIFIC GRAVITY: 2.65 (assumed)

SAMPLE NO.:	1	2	3	AVERAGE
INITIAL				
WATER CONTENT, %	11.6	11.6	11.6	11.6
DRY DENSITY, pcf	106.1	106.0	101.7	104.6
SATURATION, %	55.1	54.9	49.2	53.1
VOID RATIO	0.558	0.560	0.625	0.581
DIAMETER, inches	2.420	2.350	2.420	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	20.2	23.0	22.4	
DRY DENSITY, pcf	107.7	103.1	103.8	
SATURATION, %	100.0	100.0	100.0	
VOID RATIO	0.535	0.605	0.593	
HEIGHT, inches	0.99	0.97	0.98	



Turlock Municipal Airport
Runway Widening and RSA Improvements

SH-11116-SA

MOISTURE-DENSITY COMPACTION TEST

ASTM D 698-07 (Modified)

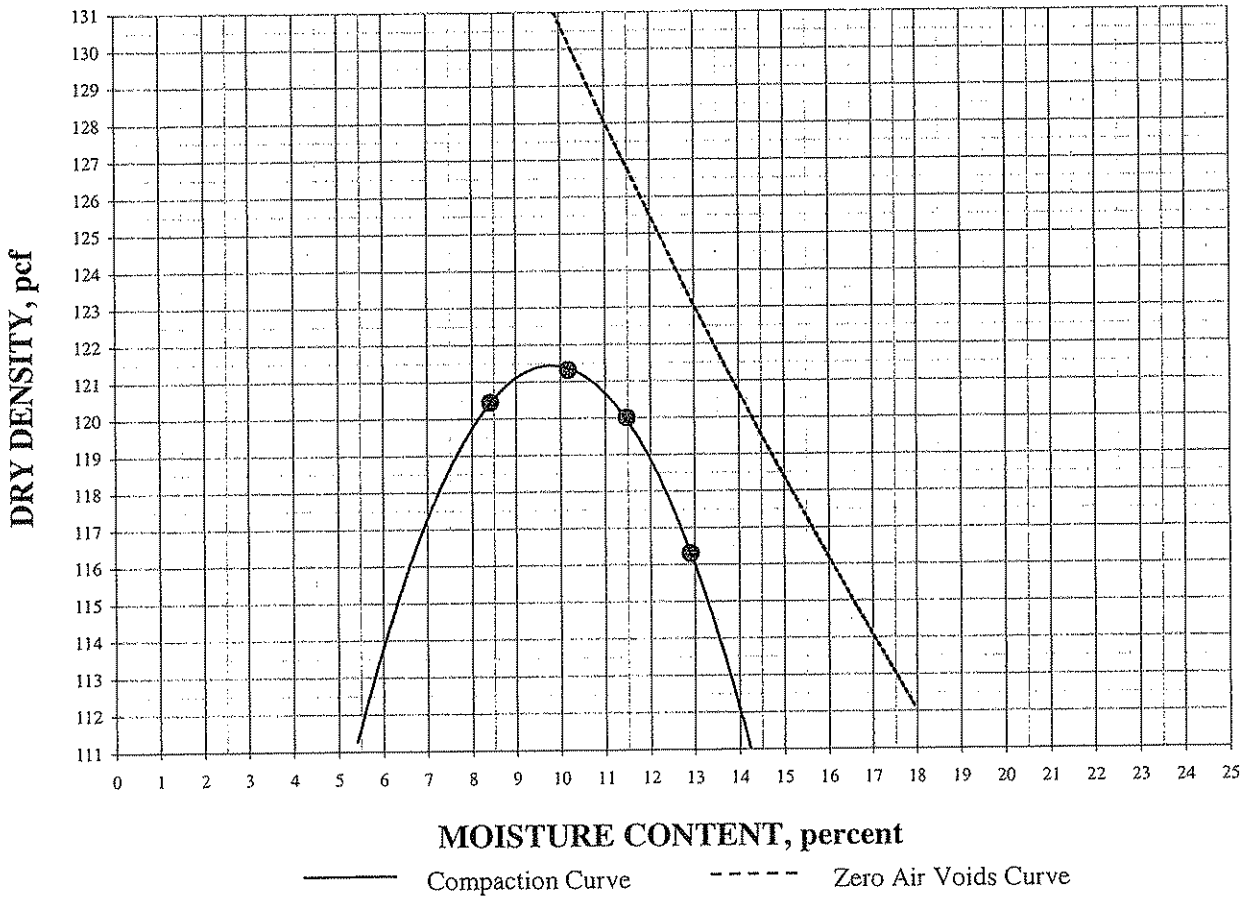
PROCEDURE USED: A
PREPARATION METHOD: Moist
RAMMER TYPE: Mechanical
SPECIFIC GRAVITY: 2.65 (assumed)

December 23, 2009
Boring #1 @ 0.0 - 3.0'
Dark Red Brown Silty, Clayey Sand (SC-SM)

SIEVE DATA:

Sieve Size	% Retained
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 121.4 pcf
OPTIMUM MOISTURE: 9.8%



Turlock Municipal Airport
Runway Widening and RSA Improvements

SH-11116-SA

CALIFORNIA BEARING RATIO

ASTM D 1883-07 (For a Range of Moisture Contents)

Boring #1 @ 0.0 - 3.0'
Dark Red Brown Silty, Clayey Sand (SC-SM)

December 23, 2009
Reference Max: ASTM D698-07

10 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	101.1	108.0	116.1
Moisture content, %, before soak	6.8	9.8	12.8
Moisture content, %, after soak, avg.	15.1	16.8	13.3
Moisture content, %, after soak, top 1"	23.5	17.4	14.9
Expansion, %, 96 hour soak	0.0	0.0	0.0
Bearing Ratio, 0.100" penetration	0.3	1.7	2.2

25 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	110.9	113.5	115.5
Moisture content, %, before soak	6.8	9.8	12.8
Moisture content, %, after soak, avg.	15.6	14.8	13.3
Moisture content, %, after soak, top 1"	15.9	15.2	13.7
Expansion, %, 96 hour soak	0.3	1.1	0.6
Bearing Ratio, 0.100" penetration	2.0	4.0	2.3

56 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	115.9	120.8	116.3
Moisture content, %, before soak	6.8	9.8	12.8
Moisture content, %, after soak, avg.	14.2	14.8	12.9
Moisture content, %, after soak, top 1"	14.9	15.2	15.0
Expansion, %, 96 hour soak	1.9	1.7	2.0
Bearing Ratio, 0.100" penetration	4.1	7.9	1.1

Turlock Municipal Airport
Runway Widening and RSA Improvements

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CALIFORNIA BEARING RATIO

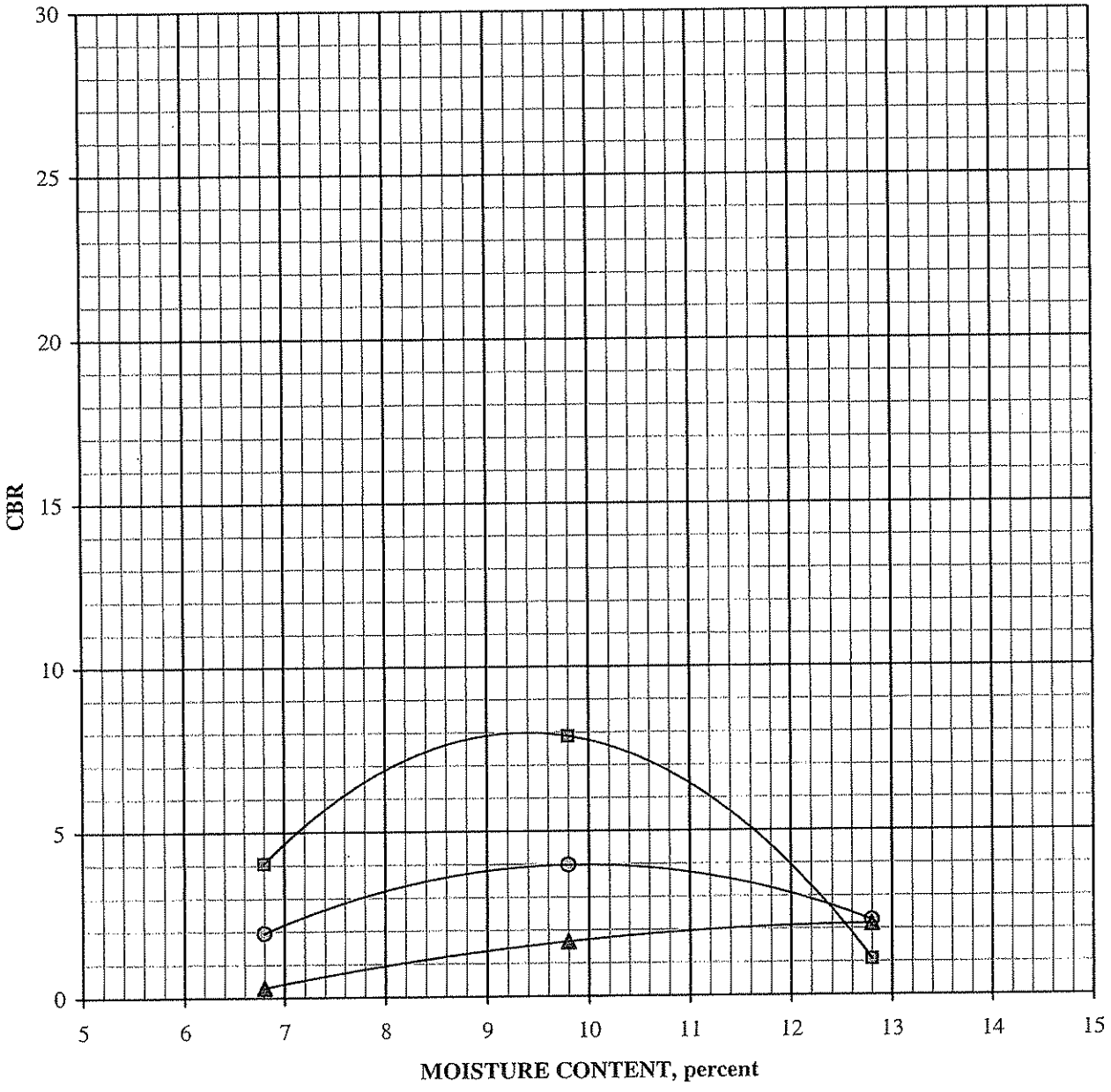
ASTM D 1883-07 (For a Range of Moisture Contents)

Boring #1 @ 0.0 - 3.0'

December 23, 2009

Dark Red Brown Silty, Clayey Sand (SC-SM)

CBR vs. MOISTURE CONTENT



Turlock Municipal Airport
Runway Widening and RSA Improvements

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CALIFORNIA BEARING RATIO

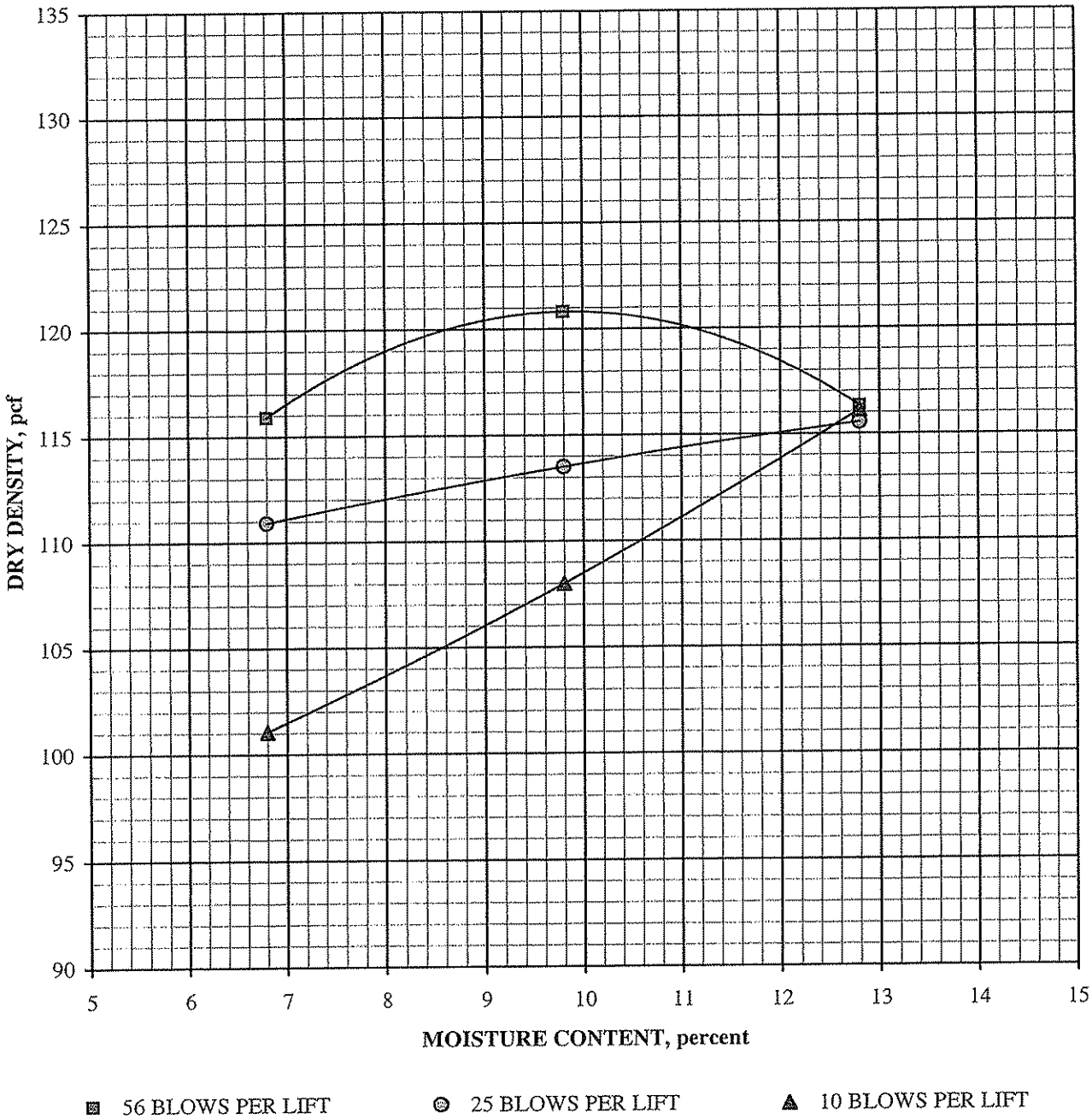
ASTM D 1883-07 (For a Range of Moisture Contents)

December 23, 2009

Boring #1 @ 0.0 - 3.0'

Dark Red Brown Silty, Clayey Sand (SC-SM)

DRY DENSITY vs. MOISTURE CONTENT



Turlock Municipal Airport
Runway Widening and RSA Improvements

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CALIFORNIA BEARING RATIO

ASTM D 1883-07 (For a Range of Moisture Contents)

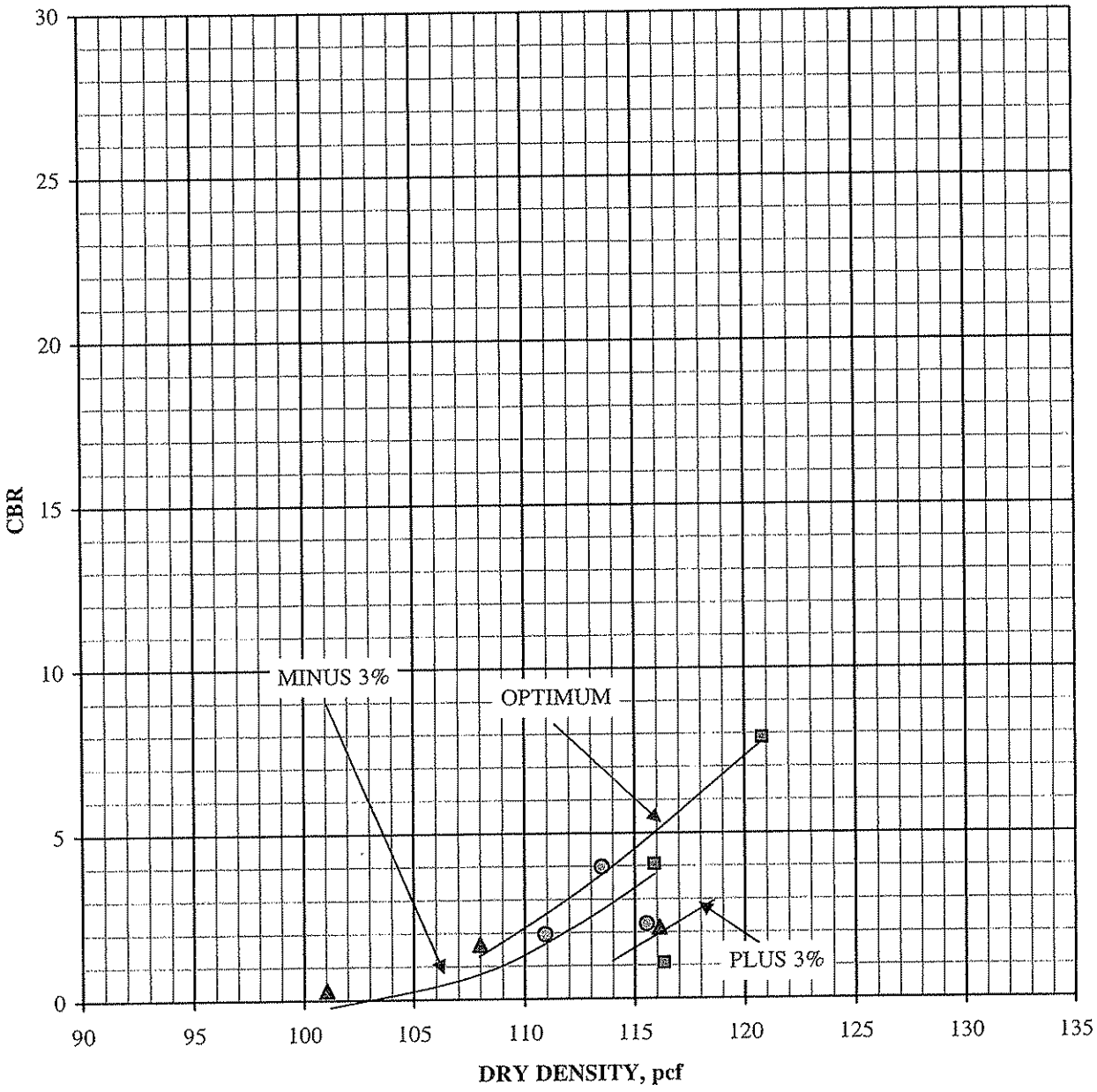
December 23, 2009

Boring #1 @ 0.0 - 3.0'

Dark Red Brown Silty, Clayey Sand (SC-SM)

DRY DENSITY vs. CBR

Arranged According to Moisture Content



Turlock Municipal Airport
Runway Widening and RSA Improvements

SH-11116-SA

MOISTURE-DENSITY COMPACTION TEST

ASTM D 698-07 (Modified)

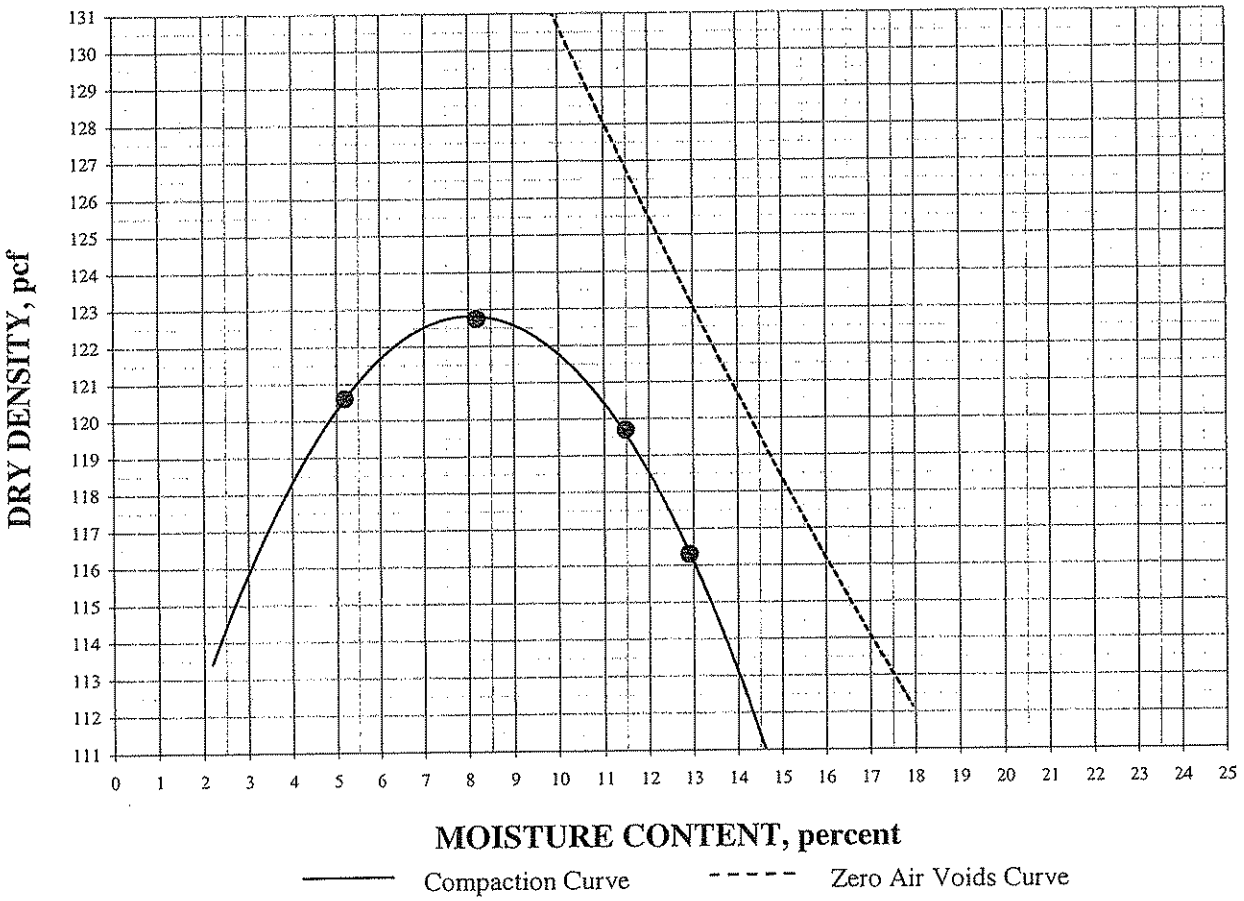
PROCEDURE USED: A
PREPARATION METHOD: Moist
RAMMER TYPE: Mechanical
SPECIFIC GRAVITY: 2.65 (assumed)

December 23, 2009
Boring #10 @ 0.0 - 3.0'
Yellow Brown Silty Sand (SM)

SIEVE DATA:

Sieve Size	% Retained
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 122.8 pcf
OPTIMUM MOISTURE: 8.0%



Turlock Municipal Airport
Runway Widening and RSA Improvements

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CALIFORNIA BEARING RATIO

ASTM D 1883-07 (For a Range of Moisture Contents)

Boring #10 @ 0.0 - 3.0'
Yellow Brown Silty Sand (SM)

December 23, 2009
Reference Max: ASTM D698-07

10 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	108.9	109.1	114.3
Moisture content, %, before soak	5.0	8.0	11.0
Moisture content, %, after soak, avg.	11.7	11.6	15.6
Moisture content, %, after soak, top 1"	14.8	13.3	9.7
Expansion, %, 96 hour soak	0.0	0.0	0.0
Bearing Ratio, 0.100" penetration	2.1	4.1	3.7

25 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	113.7	114.4	117.8
Moisture content, %, before soak	5.0	8.0	11.0
Moisture content, %, after soak, avg.	11.9	14.0	14.3
Moisture content, %, after soak, top 1"	12.3	12.1	10.0
Expansion, %, 96 hour soak	0.0	0.0	0.0
Bearing Ratio, 0.100" penetration	7.0	11.8	8.1

56 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	119.5	121.7	120.3
Moisture content, %, before soak	5.0	8.0	11.0
Moisture content, %, after soak, avg.	12.1	10.2	10.5
Moisture content, %, after soak, top 1"	10.0	10.7	9.9
Expansion, %, 96 hour soak	0.0	0.0	0.0
Bearing Ratio, 0.100" penetration	19.1	23.2	10.8

Turlock Municipal Airport
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CALIFORNIA BEARING RATIO

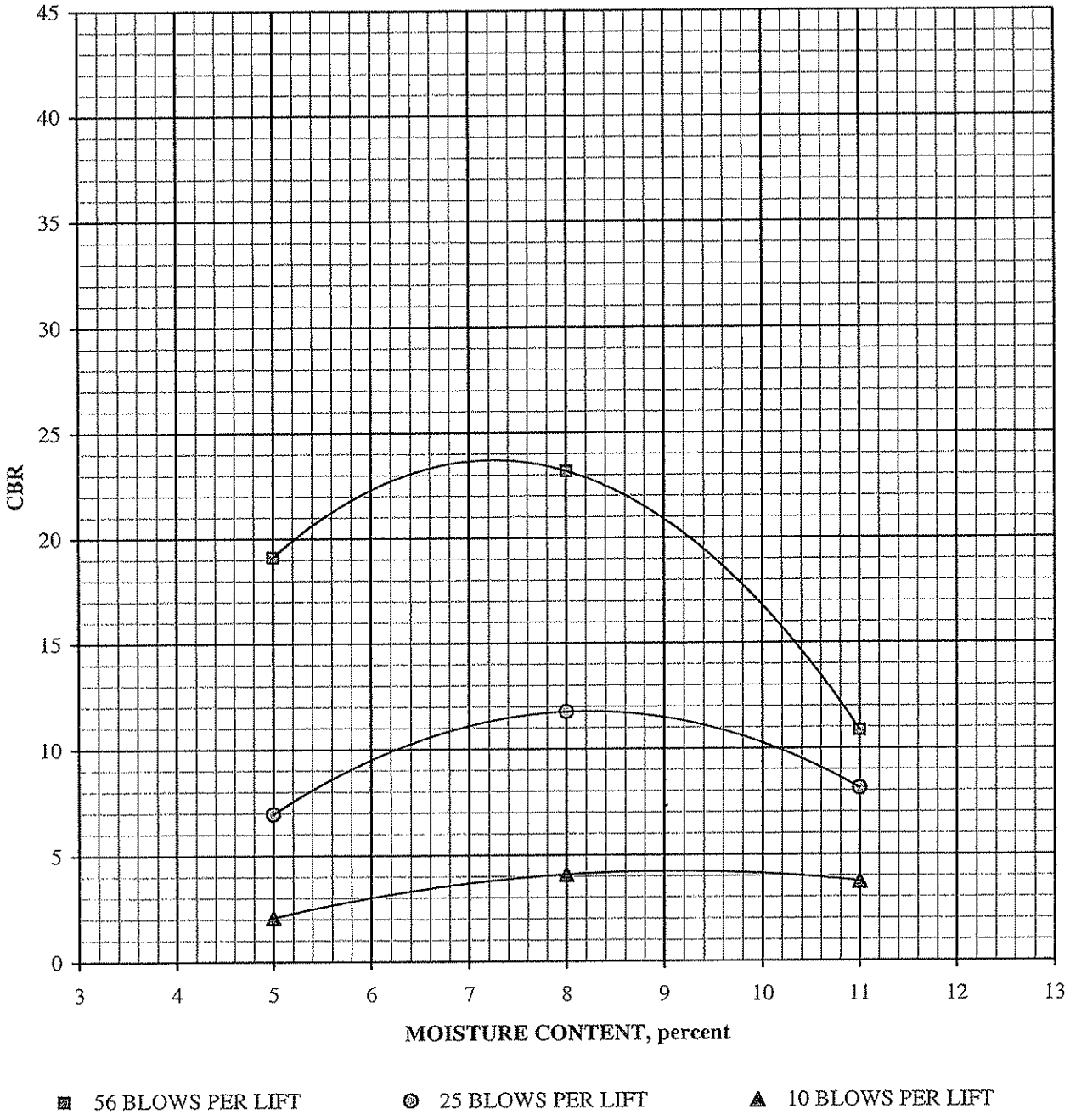
ASTM D 1883-07 (For a Range of Moisture Contents)

Boring #10 @ 0.0 - 3.0'

December 23, 2009

Yellow Brown Silty Sand (SM)

CBR vs. MOISTURE CONTENT



Turlock Municipal Airport
Runway Widening and RSA Improvements

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CALIFORNIA BEARING RATIO

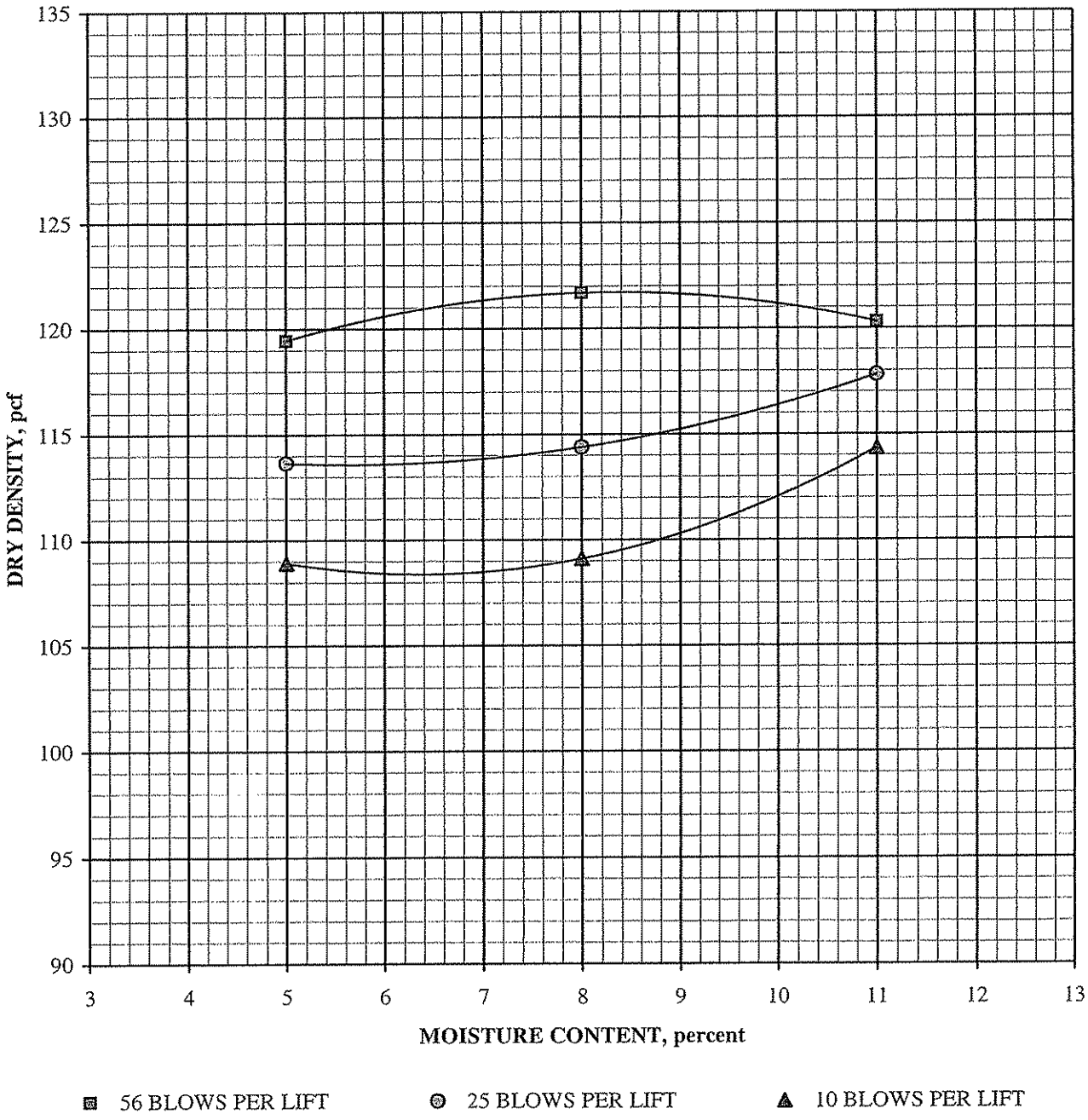
ASTM D 1883-07 (For a Range of Moisture Contents)

Boring #10 @ 0.0 - 3.0'

December 23, 2009

Yellow Brown Silty Sand (SM)

DRY DENSITY vs. MOISTURE CONTENT



Turlock Municipal Airport
Runway Widening and RSA Improvements

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CALIFORNIA BEARING RATIO

ASTM D 1883-07 (For a Range of Moisture Contents)

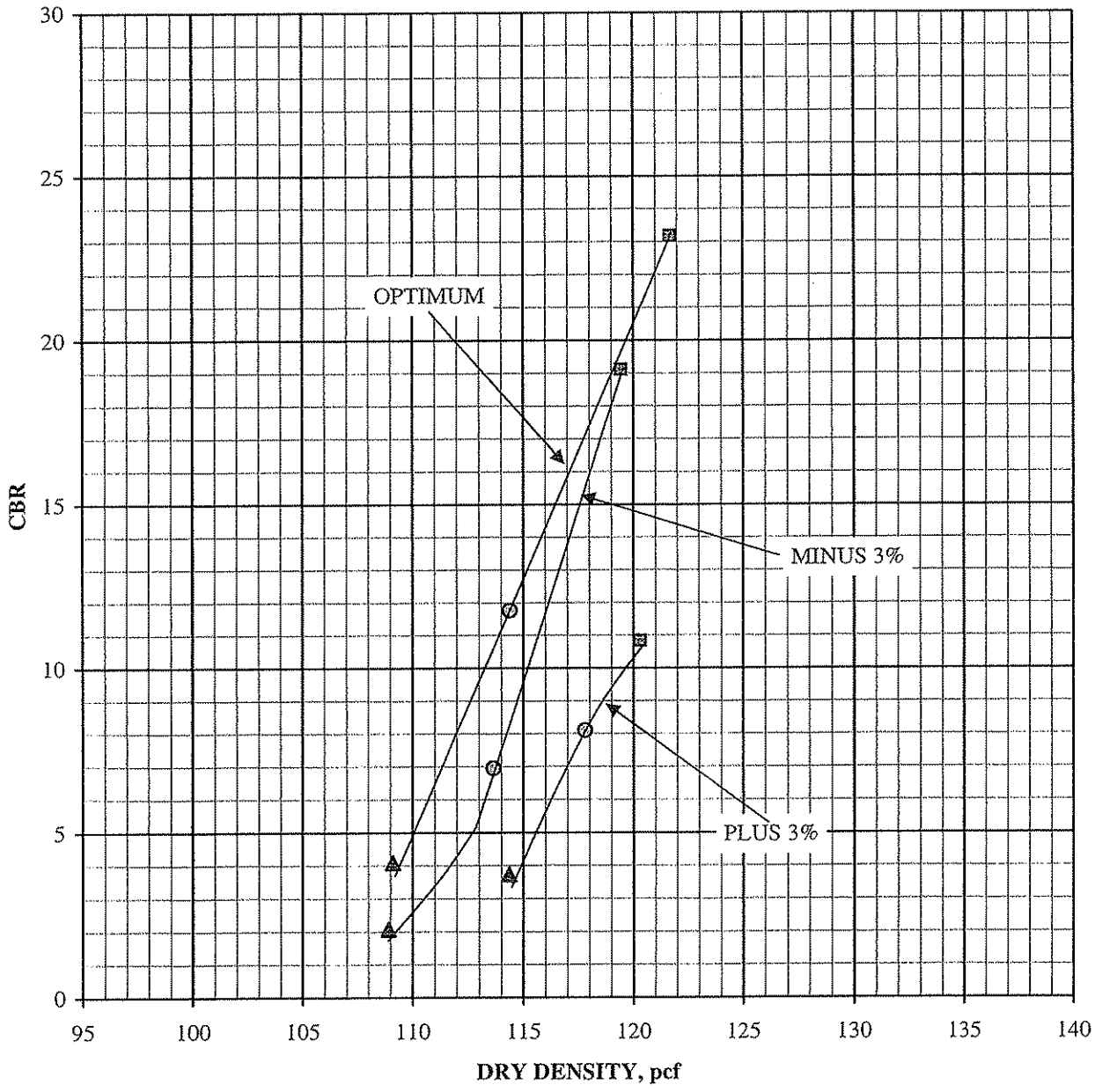
Boring #10 @ 0.0 - 3.0'

December 23, 2009

Yellow Brown Silty Sand (SM)

DRY DENSITY vs. CBR

Arranged According to Moisture Content



■ 56 BLOWS PER LIFT ◎ 25 BLOWS PER LIFT ▲ 10 BLOWS PER LIFT