PRELIMINARY DESIGN CONCEPT REPORT

CAMARILLO AIRPORT

Runway 8-26 and Taxiway Improvements

Prepared for
County of Ventura
Department of Airports

COUNTY OF VENTURA
DEPARTMENT OF AIRPORTS

Prepared by
Mead & Hunt

July 2019

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1. EXECUTIVE SUMMARY

The following Preliminary Project Design Concept Report presents the findings of a study that was performed to establish the recommendations for the Runway 8-26 and Taxiway Improvements project. The scope of work for this study consisted of performing a geotechnical analysis, non-destructive testing, topographic survey, and PCN evaluation, and using this data to recommend a pavement improvement method, as well as identify features that are non-compliant with Advisory Circular 150/5300-13A, and perform a preliminary grading design. This evaluation and analysis was prepared in September 2017 and is being finalized based on the 2017 analysis, procedures, and information available and current at that time.

Based on the findings obtained from the geotechnical analysis, non-destructive testing, and PCN evaluation, it was determined that a majority of the runway and connector taxiways are structurally insufficient to support the current fleet mix. The FAA evaluates the adequacy of a pavement structure over a 20-year life. A pavement section is considered insufficient when the number of operations that the pavement can support during the evaluation period is less than the forecast operations in the fleet mix within the same period. Insufficient pavement sections will require major structural rehabilitation or reconstruction in advance of the 20-year timeframe. Estimates of the life expectancy for the insufficient pavement sections were calculated using the FAA pavement design software (FAARFIELD) and are provided as part of the 2017 non-destructive test report by Dynatest (Appendix A, Attachment 3). After the estimated lifetime has elapsed, the pavement sections will start deteriorating at a faster pace compared to structurally sufficient pavement sections. Pavements do not suddenly fail, unless a major overload is applied. In addition to a major rehabilitation or reconstruction project for insufficient pavement areas, the aircraft in the fleet mix can be reduced by maximum allowable weight or number of operations to extend the pavement life. Additionally, the runway and taxiways are comprised of several different pavement sections, some of which include underlying Portland Cement Concrete (PCC) pavement. For these reasons, and other reasons stated in the report, a reconstruction is the recommended pavement improvement method. The reconstruction alternatives include analysis of the runway width, current and potential fleet mixes, addition of paved shoulders, as well as various pavement section options based on subsurface conditions.

The reconstruction alternatives include analysis of the runway width, current and potential fleet mixes, addition of paved shoulders, as well as various pavement section options based on subsurface conditions. These alternatives included: reconstruction with stabilized base (stabilized base is required for aircraft over 100,000 pounds); reconstruction with a 6-inch P-401 surface course; reconstruction with a 4-inch P-401 surface course; and reconstruction for a fleet mix with aircraft over 150,000 pounds (this weight of aircraft affects the runway width). Since the current aircraft in the fleet mix are within 0.40% of 100,000 pounds, the reconstruction with stabilized base is recommended. The total estimated construction cost (with price escalations for 2022 construction as programmed by the Federal Aviation Administration (FAA)) for the Runway 8-26 improvements is $31,310,253.

2. GENERAL SCOPE OF THE PROJECT

2.1 INTRODUCTION

Mead & Hunt, Inc. (Consultant or Mead & Hunt) has prepared this Preliminary Project Design Concept Report for the County of Ventura (County). The purpose of this report is to document the preliminary design investigation efforts used to define the project scope and recommendations for the Runway 8-26 and Taxiway Improvements (Project) at the Camarillo Airport (Airport).

Camarillo Airport is a public use airport owned and operated by the County. It is located three miles west of Camarillo, California, and has one runway (Runway 8-26). Runway 8-26 is 6,013 feet long by 150 feet wide and is oriented east to west. The Runway Design Code (RDC) for Runway 8-26 provides the basis of design for this Project. In accordance with the most recent Airport Layout Plan (ALP), which was conditionally approved in 2011 and revalidated in 2015, the existing RDC is D-II. However, the current traffic includes over 500 operations of aircraft that fall within the D-III RDC, including the Gulfstream G-650. For this reason, this Project will be designed to meet the requirements of D-III runway characteristics.

The Project will be funded by a combination of County funds, a grant from the California Department of Transportation Division of Aeronautics (Caltrans), and a grant from the FAA.

2.2 SCOPE OF WORK

This Project consists of a study to assist with programming the runway and taxiway pavement improvements. The objective of this study is to investigate, evaluate, and provide a recommendation to the County for the preferred pavement improvements. The purpose of the concept report is to document and provide justification for the County's use to communicate the preferred alternative to the FAA for consideration, and to obtain concurrence with the method of improvement, as well as obtain funding eligibility. The pavements which are being evaluated include Runway 8-26, parallel Taxiway F, and Taxiway Connectors A, B, C, D, and E. The engineering services included Heavy Weight Deflectometer (HWD) Testing and Analysis, Geotechnical Investigation, and Topographic Survey. A PCN analysis was also conducted on the airfield pavements. The PCN calculations were performed using the FAA COMFAA program in accordance with Advisory Circular 150/5335-5C. Also included in this report will be a discussion and evaluation of the following:

- FAA Advisory Circular 150/5300-13A analysis of existing and proposed pavement, including surface gradient requirements.
- Construction project phasing analysis, including evaluation of construction duration and operational impacts.
- Pavement design evaluation, including nondestructive pavement testing and analysis, evaluation of pavement improvement alternatives, and life cycle cost analyses.

2.3 HISTORY OF THE EXISTING SYSTEM

Runway 8-26 was constructed in several sections, dating back to 1942. Below is a timeline of the pavement history for Runway 8-26, as well as the taxiways being evaluated in this study:

1942 Original construction of the east section of Runway 8-26. This section was constructed by the State of California Highway Department with 20 inches of subbase, 5 inches of base, and 5 inches of an on-site oil, sand, and gravel mix.

1951 Original construction of the central section of Runway 8-26 and Taxiway D. These sections were both constructed with 6 inches of base and 3 inches of asphalt concrete (AC) pavement. The pavement sections also include 6 inches of subbase under the runway and 11 inches of subbase under Taxiway D.

1955 3-inch AC overlay on the east and central sections of Runway 8-26, and Taxiway D.

1958 Original construction of PCC pavement sections throughout the Airport, including the west section of Runway 8-26 and Taxiways B, E, and F. These areas were constructed with 6 inches of subbase, 6 inches of base, and 11 inches of PCC pavement.

1980 Original construction of Taxiway A. This section was constructed with 16 inches of base and 2.5 inches of AC pavement.

1988 4.5-inch AC overlay on Taxiway A.

1993 Original construction of Taxiway C. This section was constructed with 8 inches of lime-treated subgrade, 6 inches of base, and 4 inches of AC pavement.

1998 2-inch AC overlay on Runway 8-26 and 3-inch overlay on Taxiway D.

2007 Original construction of the Taxiway A Run-up Apron. This section was constructed with 12 inches of lime treated subgrade, 8 inches of Aggregate Base (AB), and 4 inches of AC pavement.

2011 Original construction of the Taxiway B Expanded Fillet. This section was constructed with 15 inches of lime-treated subgrade, 9 inches of AB, and 4 inches of AC pavement.

Additionally, a visual pavement survey was performed on February 11, 2015, as part of the Airport Pavement Management System (APMS) updated in 2016. At the time, the runway and taxiways were found to be in Satisfactory condition (PCI of 70-85). However, this was shortly after a slurry seal had been applied in 2014. Although there have been several overlays and surface treatments on the various pavements, no reconstructions have been performed since original construction. This report further evaluates the structural integrity of the pavements, through non-destructive testing, geotechnical analysis, and PCN evaluation.

2.4 ENVIRONMENTAL CONSIDERATIONS

Upon completion of this study and determination of the proposed improvements, the County will work with an environmental consultant to establish the environmental requirements and parameters.

2.5 FAA ADVISORY CIRCULAR 150/5300-13A ANALYSIS

On September 28, 2012, the FAA released an update to FAA Advisory Circular 150/5300-13, *Airport Design*. This advisory circular contains the FAA standards and recommendations for the geometric layout and engineering design of runways, taxiways, aprons, and other facilities at civil airports. The updated Advisory Circular 150/5300-13A (13A) included significant changes to several airport design standards. The FAA also released Change 1 to the advisory circular on February 26, 2014, which included changes to the Runway Reference Code, as well as additional taxiway fillet information.

Mead & Hunt has analyzed the existing conditions of Runway 8-26 from topographic survey information provided for this Project, as well as available aerial survey data. The table below details the relevant standards applicable to Runway 8-26, and whether the existing conditions conform to each standard. The table also details the proposed conditions that will conform to the 13A requirements.

Standard	13A Section	Scenario	Requirement (D-III)	Location	Existing Condition	Compliant	Proposed Condition
Runway Width	304b	Aircraft < 150,000 lbs	100 ft		150 ft	No	100 ft
		Aircraft > 150,000 lbs	150 ft		N/A	N/A	150 ft
Runway Shoulder Width	304c	Aircraft < 150,000 lbs	20 ft		10 ft ±	No	20 ft
		Aircraft > 150,000 lbs	25 ft		N/A	N/A	25 ft
Runway Shoulder Surface	304c		Paved (Recom.)		AB	Yes	Paved
Runway Blast Pad Width	304d	Aircraft < 150,000 lbs	140 ft		150 ft	No	140 ft
		Aircraft > 150,000 lbs	200 ft		N/A	N/A	200 ft
Runway Blast Pad Length	304d		200 ft		> 200 ft	Yes	200 ft
Runway Longitudinal Grade	313b(1)	Overall	1.5% Max		0.4% Max	Yes	0.4% Max
		First & Last Quarter[1]	0.8% Max		0.4% Max	Yes	0.4% Max
Runway Grade Changes	313b(2)	Overall	1.5% Max		0.13% Max	Yes	0.2% Max
		First & Last Quarter[1]	None Allowed		0.06% Max	No	None
Runway Vertical Curve Length	313b(3)		1000 ft per 1% Grade Change		Unable to determine[2]		Will meet requirement
Runway Vertical Curve Separation	313b(4)		1000 ft x Sum of % Grade Change		Unable to determine[2]		Will meet requirement
Runway Transverse Grades	313b(5)	Configuration	Crown (Center Preferred)		No Crown	No	Yes
		Grades	1% to 1.5%		0.4% to 2.2%	No	1.5%
RSA Longitudinal Grades	313d(1)	Within 200 ft from RWY Threshold[3]	3% Max Downward	RWY 8	0.14% Downward	Yes	0.18%
				RWY 26	0.16% Upward	No	0%
		Beyond 200 ft from RWY Threshold	5% Max / No Surface Penetration	RWY 8	0.2% Max	Yes	1%
				RWY 26	0.45% Max / Penetration[4]	No	1%
Shoulder Transverse Grades	313d(2)	Grades	1.5% to 5%		0.5% to 5%	No	1.5%
		Pavement Drop	1.5 inches				1.5 inches
RSA Transverse Grades	313d(2 & 3)	Overall[5]	1.5% to 3%		0.4% to 2.5%	No	1.5%
		10 ft from Pavement	5%				5%
		Beyond 200 ft from RWY Threshold	5% Max	RWY 8	5% Max	Yes	1.5%
				RWY 26	2% Max	Yes	1.5%
	Figure 3-23	Transverse grades outside of RSA (S-4 note 4)	59' past RSA max grade 10:1		10:1 Max	Yes	10:1 Max

Footnotes

1: The first and last quarter length is 6013 ft / 4 = 1503 ft from each threshold.

2: Due to low frequency of preliminary survey, existing vertical curve cannot be identified by elevation points.

3: This standard applies to longitudinal grades outside the threshold, but less than 200 feet beyond threshold.

4: Due to upward slope beyond the Runway 26 threshold, elevation slightly penetrates the approach surface.

5: This standard applies to transverse grades within the thresholds, and less than 200 feet beyond the thresholds.

The most significant of the 13A standards are described in more detail below:

Runway, Shoulder, and Blast Pad Widths: In accordance with 13A, Table 3-5, Footnote 12, the width of the runway, shoulders, and blast pad are dependent on the weight of aircraft within the fleet mix. Based on the current fleet mix, the heaviest aircraft is a G-650 (99,600 pounds). For aircraft under 150,000 pounds, the standard D-III runway width is 100 feet, with recommended 20-foot paved shoulders. Since the blast pad width extends from shoulder to shoulder, the resulting width is 140 feet (20 shoulder + 100-foot runway + 20-foot shoulder = 140 feet). The existing runway is 150 feet wide, which is non-standard for the current fleet mix.

This report includes an alternative runway design, for a scenario where the fleet mix includes aircraft over 150,000 pounds in the event the fleet mix changes prior to the reconstruction project. In this scenario, the standard D-III runway width is 150 feet, with recommended 25-foot paved shoulders. To account for both scenarios, both a 100-foot and 150-foot runway were analyzed and included as alternatives. Due to the heavier aircraft, the 150-foot runway will require a thicker pavement section, as detailed in Section 5 below.

Due to the frequency of jet operations, it is recommended to groove the runway surface in accordance with Advisory Circular 150/5320-12C for a skid-resistant pavement surface.

Paved Shoulders: Although not required, paved shoulders are recommended for Aircraft Design Group (ADG) III in accordance with 13A, Paragraph 304.c. For this study, paved shoulders will be included in the design and cost estimate.

Runway Crown: Per 13A, the ideal configuration for runway transverse grades is to have a center crown with equal and constant transverse grades on either side. The current configuration does not include a crown. To conform to 13A requirements, the runway will be regraded to have a center crown with equal and constant transverse grades.

3. DESIGN STANDARDS

3.1 APPLICABLE ADVISORY CIRCULARS

The methodologies used in developing designs for this Project are in conformance with applicable FAA standards. The following Advisory Circulars have been reviewed during the preliminary design of the Project and will continue to be referenced through design completion:

Advisory Circular 150/5300-13A	*Airport Design (Change 1)*
Advisory Circular 150/5320-5D	*Airport Drainage Design*
Advisory Circular 150/5320-6F	*Airport Pavement Design and Evaluation*
Advisory Circular 150/5340-30H	*Design and Installation Details for Airport Visual Aids*
Advisory Circular 150/5340-1L	*Standards for Airport Markings*
Advisory Circular 150/5370-2F	*Operational Safety on Airports During Construction*
Advisory Circular 150/5370-10G	*Standards for Specifying Construction of Airports*
Advisory Circular 150/5370-11B	*Use of Nondestructive Testing in the Evaluation of Airport Pavements*

4. CONSIDERATIONS FOR AIRPORT OPERATIONAL SAFETY

4.1 CONSTRUCTION SAFETY AND PHASING ANALYSIS (CSPP)

A CSPP will be developed in accordance with Advisory Circular 150/5370-2F during the detailed design of the proposed improvements. The CSPP will detail the proposed phasing and sequence of work, work area limits and pavement closure(s), haul routes and staging areas, and impacts to operations, based on the selected alternative from this report. The CSPP will also be included in the specification book for the design project.

For this study, a preliminary phasing and construction duration analysis was performed, which will provide the basis for the CSPP. The Airport is a very busy general aviation airport with numerous businesses that rely on the daily use of the Airport. With only a single runway, the construction schedule will be accelerated with multi-shift work to minimize the closure of the airfield pavements. With an existing runway length of 6,013 feet, temporary runway threshold(s) may be considered for reducing the closure of the entire length of the runway, which is the purpose of Phases 1 and 3 below. According to the manufacturer's performance requirements, the Gulfstream 650 series aircraft requires 5,858 feet of take-off distance and the Gulfstream V series aircraft require 5,200 feet of takeoff distance. The construction duration is anticipated to consist of the schedule below with the following assumptions:

- Relocate the threshold end of Runway 8 for a useable runway length of 5,200 feet. This will allow for removal of the AC, portions of underlying PCC, and construction of the new pavement section in the westerly 813 feet of the runway and the blast pad during nightly closures of the Airport between the hours of 9 PM and 6 AM. The Airport could re-open daily with safety area transitions.
- The schedule assumes the construction will be taking place 24 hours a day which increases project costs for and accelerated schedule.
- Based on the current FAA grant cycle and grant offers being made in the August and September months, it would be ideal to schedule the work the following calendar year to begin in May or June to minimize the potential of inclement weather and perform the improvements during months with the most hours of daylight. This will also allow ample time for scheduling and coordination with the on-Airport businesses.

The preliminary construction duration and phasing proposes the following phases:

- Phase 1 – Nighttime runway closure periods between the hours of 9 PM and 6 AM for a period of 25 calendar days. When the runway reopens at 6 AM, there will be 5,200 feet of runway available.
- Phase 2 – Full-time Airport closure for a period of a minimum of 37 calendar days. To allow for some contingencies, 40 calendar days would be beneficial if acceptable to the Airport and Airport users.
- Phase 3 – Nighttime runway closure periods between the hours of 9 PM and 6 AM for a period of 10 calendar days. When the runway reopens at 6 AM, the full length of the runway will be available.

The estimated Construction Duration timeline and sequence of events is included as *Appendix B*.

5. PAVEMENT DESIGN EVALUATION

5.1 AIRCRAFT FLEET MIX

The aircraft fleet mix used for this assessment was obtained through close coordination with the Airport. The fleet mix was developed by researching fleet mixes used for previous projects, applying growth rates and new operations as discussed with the Airport, and analyzing aircraft operation data from the 5010 master record and Traffic Flow Management System Counts (TFMSC). Note that the fleet mix was slightly modified after the non-destructive testing, in order to include most current data. The modifications are negligible and don't significantly affect the pavement design. A copy of the fleet mix used for this Project is included with the PCN evaluation in *Appendix A, Attachment 1.*

5.2 GEOTECHNICAL INVESTIGATION

A geotechnical investigation was performed by Earth Systems Pacific for this Project. The field investigation was performed February 6 through 9, 2017, and the report was completed on August 14, 2017. The purpose of this report was to provide existing pavement section and soil data, which was used to design the pavement section alternatives, perform the PCN evaluation, determine earthwork quantities, and provide data for the non-destructive testing model. A copy of the geotechnical report is included with the PCN evaluation in *Appendix A, Attachment 2.*

The pavement sections observed in the borings were more-or-less consistent with the pavement section history described in Section 2.3, with some variations in thickness as expected. For the most part, each boring represents a different pavement section with a unique history, although some of the borings along Runway 8-26 and Taxiway F represent one uniform section.

Fill material was encountered in most of the borings, consisting of clayey sand, sandy lean clay, and silty sand. Below the pavement sections and fill material, Alluvium was encountered, consisting of sandy lean clay, sandy fat clay, poorly graded sand, silty sand, and sandy silt.

Earth Systems Pacific performed California Bearing Ratio (CBR) tests for each boring, including both in-situ and recompacted conditions. The in-situ CBR values ranged from 1 to 22, and the recompacted CBR values ranged from 2 to 15. For the PCN evaluation, the in-situ CBRs and the non-destructive testing results were both analyzed to determine subgrade strength (see the attached report for further details).

For the pavement design, Earth Systems Pacific recommended pulverizing the existing AC and AB, mixing it with the native subgrade, and performing a lime or cement treatment of the mixture. This would not only strengthen the subgrade but would also incorporate valuable on-site materials as select fill for the runway reshaping. Based on the report, a minimum CBR value of 9 would be expected for the treated material. This is the CBR value that was used for the pavement design evaluation.

5.3 NONDESTRUCTIVE TESTING

In order to better understand the in-place pavement strength and evaluate appropriate pavement improvement alternatives, non-destructive testing was performed on the existing pavement. The testing was performed December 3 through 4, 2016, by Dynatest Consulting, Inc. (Dynatest), using a HWD, and the report was completed in June 2017. The HWD simulated loadings based on an earlier version of the fleet mix described above.

The purpose of non-destructive testing is to measure deflections, which in-turn are used to calculate layer strength moduli, given the known pavement section data provided by the geotechnical report. Dynatest used the ELMOD computer program to perform the calculations. Due to the variety of pavement sections throughout the Airport, the deflection results varied significantly. The average normalized center deflections ranged from 10.92 mils to 136.49 mils

Based on these deflection results, a strength modulus for each layer of each section was calculated using ELMOD. After calculating all the layer strengths, a CBR was determined for each section, which was used in the PCN evaluation.

The Dynatest report also includes a PCN analysis and pavement maintenance recommendations. The PCN evaluation and pavement design alternatives included in this Preliminary Design Concept Report are based on Dynatest's data and recommendations, but further expand upon them to include additional considerations. The pavement design alternatives are described in Section 5.5 below, and a copy of the nondestructive testing report is included with the PCN evaluation in *Appendix A, Attachment 3.*

5.4 PCN EVALUATION

A PCN evaluation was performed as part of this study, in order to determine the existing pavement strength with respect to the current fleet mix. The technical method was used for this analysis, which involves modeling the pavement sections based on data from both the geotechnical and non-destructive testing reports and using the FAA program COMFAA to model loadings by the current fleet mix. The following PCN values were obtained from the analysis:

Airport LOC-ID	Pavement ID	#35 S GW	#36 D GW	#37 DT GW	#38 DDT GW	#39 PCN
CMA	Runway 8-26	46	65			17/F/C/X/T
CMA	AC Connectors	39.5	52.5			15/F/D/X/T
CMA	PCC Taxiways	89	113			34/R/C/W/T
CMA	Taxiway G	55	71			22/F/D/X/T
CMA	Taxiway H	83	126			30/F/A/X/T

The results indicate that Runway 8-26 and the AC connector taxiways (A, C, and D) are insufficient to support the fleet mix within the 20-years evaluation period, based on the pavement section data available. A pavement section that is structurally insufficient will deteriorate quickly and will require major rehabilitation or reconstruction well before the 20-year timeframe. Pavements do not suddenly fail, unless a major overload is applied. This analysis provides justification that a reconstruction is the recommended method for pavement improvement on both Runway 8-26 and the AC connector taxiways. The complete PCN evaluation is included in *Appendix A*.

5.5 PAVEMENT DESIGN ALTERNATIVES

Based on all the available data presented in Sections 5.1 through 5.4, an AC pavement reconstruction is the recommended method of pavement improvement, for several reasons:

- The results of the PCN evaluation indicated a structural inadequacy to support the fleet mix, which would be remedied by improving the subgrade strength and rebuilding the pavement section.
- Runway 8-26 consists of various pavement sections, including some areas with AC overlaying PCC. A reconstruction is recommended to provide a uniform, homogeneous, and consistent pavement section.

- Runway 8-26 grading is changing significantly in order to meet 13A requirements, particularly with the addition of a centered runway crown. The regrading of the site provides an opportunity to rebuild the subgrade and is also the preferred approach as previously communicated by the FAA.

Three alternatives for AC pavement reconstruction were evaluated. For each alternative, a CBR of 9 was used, which is assumed to represent the strength of the subgrade after it is lime-treated (based on the geotechnical report). Per Advisory Circular 150/5320-6F, subgrade stabilization is required for CBR less than 3. The in-situ CBR values determined by Earth Systems Pacific were as low as 1 in many areas; therefore, lime-treatment is recommended and is included in each alternative. The three alternatives are presented below:

Alternative 1 – Reconstruction with Stabilized Base: Per Advisory Circular 150/5320-6F, stabilized base is required when aircraft are over 100,000 pounds. Although no aircraft in the current fleet mix are over 100,000 pounds, the Gulfstream G-650 is very close and is within 0.40% (99,600 pounds). For this reason, a pavement section including a stabilized base layer was modeled in Advisory Circular 150/5320-6F FAARFIELD. The pavement section is as follows:

P-401 HMA Surface	4 inches
P-403 HMA Base	5 inches
P-209 Crushed Aggregate	8 inches
P-155 Lime-Treated Subgrade	12 inches

Alternative 2 – Reconstruction with 6-inch P-401: This alternative removes the stabilized base layer but retains an AC pavement layer that is thicker than the minimum allowed by FAARFIELD. The pavement section is as follows:

P-401 HMA Surface	6 inches
P-209 Crushed Aggregate	14 inches
P-155 Lime-Treated Subgrade	12 inches

Alternative 3 – Reconstruction (incorporating aircraft over 150,000 pounds): As stated in Section 2.5, the required width of the runway is dependent on whether the fleet mix contains aircraft heavier than 150,000 pounds. Currently, all aircraft are under 100,000 pounds, so the other three alternatives are based on a runway width of 100 feet. This alternative takes into consideration the possibility that heavier aircraft may use the Airport in the near future prior to the Project. If this is the case, maintaining the current runway width of 150 feet may be a viable option. The pavement section was designed based on adding a 737-400 to the fleet mix (150,500 pounds), and consists of the following:

P-401 HMA Surface	4 inches
P-403 HMA Base	5 inches
P-209 Crushed Aggregate	10 inches
P-155 Lime-Treated Subgrade	12 inches

Runway Shoulders and Blast Pads: For the paved runway shoulders and blast pads, Advisory Circular 150/5320-6F requires that the FAARFIELD design include 15 passes of the most demanding aircraft, which is the Gulfstream G-650. The resulting pavement section is as follows:

P-403 HMA Surface	4 inches
P-209 Crushed Aggregate	10.5 inches
P-155 Lime-Treated Subgrade	12 inches

Alternative 1 is the recommended option for the reconstruction. It provides the necessary structural capacity for the proposed fleet mix, the increased AC surface thickness will be less prone to cracking as it ages, and minimizes the impact to the construction schedule as the bituminous courses can be constructed more efficiently than AB courses.

The FAARFIELD pavement design reports are included as *Appendix C*.

6. ADDITIONAL PROJECT ELEMENTS

6.1 TAXIWAY CONNECTOR RECONSTRUCTION

Based on the findings in this study, both Runway 8-26 and the connector taxiways are in need of reconstruction. Whenever a pavement is reconstructed, the proposed improvements are required to meet current FAA standards. For the connector taxiways, one significant consideration is the fillet requirement per 13A. Wherever there is a turn in the taxiway (including from taxiway to runway), the fillets must be designed to allow sufficient pavement for the aircraft gear, which follows a specific path that forms the basis for the standard geometry in 13A.

The existing taxiways were constructed well in advance of 13A being issued and do not meet the current fillet geometry requirements. Additionally, taxiway realignments are depicted on the current ALP (last update was pre-13A updates, as well), which could have a bearing on the ultimate configuration of the taxiways. Another consideration is that Taxiway H was constructed in 2011, which included a reconstruction of a large portion of the connector taxiways. All of these factors play a role in determining to what extent the connector taxiways should be reconstructed, the ultimate realignment, and configuration to best fit the Airport.

For this study, due to the changing grade of Runway 8-26, the design and cost estimates include reconstructing the taxiways to the limit required to transition back to existing grade, with the assumption that taxiway geometry remains the same. Upon determination of the proposed runway improvements (including grading design and pavement section), the taxiway reconstruction will need to be explored further, with coordination between Mead & Hunt, the County, the County's planning consultant, and the FAA. The taxiways also vary with the surface type being PCC for a portion of Taxiways B, E, and F. The reconstruction pavement section for the preferred surface type can also be determined during the preliminary design.

7. TOPOGRAPHIC SURVEY

A topographic survey was performed on February 8, 2017 by Stantec Inc., with the resulting data provided on February 13, 2017. The survey consisted of Runway 8-26 elevation cross sections, taken at intervals of approximately 500 feet (13 total cross sections), and extending 200 feet from the runway centerline. The data was utilized to perform a preliminary surface gradient analysis and design, to establish compliance with 13A and provide a basis for preliminary earthwork quantities. A more detailed survey will be performed as part of the design process for the runway and taxiway reconstruction project(s), once a determination is made from this study.

8. SURFACE GRADIENT AND DRAINAGE ANALYSIS

The existing surface was analyzed to determine compliance with 13A surface gradient requirements, as well as establish the drainage characteristics of the site. As detailed in Section 2.5, some of the 13A standards are not currently met by the Runway 8-26 surface, including longitudinal grade changes, crown configuration, and transverse grades for the runway, shoulders, and Runway Safety Area (RSA). All of these standards will be met with the proposed improvements.

Currently the site slopes from east to west, and everything north of the runway pavement drains to the north, where it catches the toe of the access road levee, and enters the Camarillo Hills Drain channel via inlets under the road. The runway itself currently slopes to the south, and everything south of the runway drains into catch basins within the unpaved infields.

To minimize the potential for water intrusion within the pavement section, underdrain systems have been incorporated into the typical section and cost estimates.

Overall the drainage characteristics of the site are anticipated to change as a result of adding a crown to the runway due to 13A surface gradient standards. Additional flow lines outside of the RSA are anticipated due to the increased slopes required for within the safety area. The flow lines would eventually drain back into the existing grade of the site beyond the grading limits of the Project. The flowlines are defined in the cross sections included in *Appendix E.*

Additionally, with the assumption that the runway width will be decreased to 100 feet with 20-foot shoulders, no additional impervious area is anticipated at this time. We understand the County is in the process of performing a drainage study which will be needed to establish whether the Project will require mitigation of the stormwater to meet MS4 requirements. Storm drain piping has been incorporated into the engineer's estimate in the event piping the storm water to the south to the preconstruction condition is required. Also included are infiltration trenches within the proposed flow lines to minimize and offset on-site runoff for the increased safety area slopes and now collecting runoff in defined swales.

9. AIRFIELD LIGHTING AND SIGNAGE

9.1 RELOCATION OF AIRFIELD ELECTRICAL FACILITIES

Due to the proposed increase in elevation of the runway pavement surface, as well as the reduction in runway width, many of the airfield electrical facilities will need to be relocated, including edge lights, guidance signs, Runway End Identifier Lights (REILs), and Precision Approach Path Indicators (PAPIs). Upon determination of the recommendations in this study, further analysis will be performed to establish the new configuration of the lighting system. All new installed electrical equipment will meet the requirements of FAA Advisory Circular 150/5340-30H. Due to the recent installation of the airfield lighting system (lights and signs), REILs, and PAPIs, the cost estimate assumes the existing fixtures (REILs and PAPI equipment) can be salvaged and re-installed with new infrastructure and cabling.

10. PAVEMENT MARKINGS

FAA criteria listed in Advisory Circular 150/5340-1L provides guidance for the marking of airfield pavements. This Project will include new markings to meet the current standards. The Runway 8-26 approach type is non-precision, which dictates what runway marking is required.

Since the current marking configuration is based on a non-precision approach, there will not be any significant changes to the marking scheme. Certain markings will be affected by the reduction in runway width, such as threshold and chevron markings.

All new markings will include a black border, which is required for the runway and holding position markings and recommended for the taxiway centerline markings. In addition, all new markings will be conventional waterborne paint with reflective media.

11. UTILITY LINES IN WORK AREA

The known utilities will be shown on the Project plans. The Contractor must comply with California 811/USA North 811 requirements for underground service alert of northern California. There are utilities crossing the Airport and the Contractor will be required to pothole at locations for existing utility conflicts. In the unlikely event a utility is disrupted, the Contractor is responsible for contacting that utility company and requesting the repair. The Airport will assist with the location of utilities.

12. SPONSOR REQUESTED MODIFICATIONS TO AIRPORT IMPROVEMENT PROGRAM (AIP) STANDARDS

No modifications to AIP standards are anticipated for this Project.

13. DELINEATION OF AIP ELIGIBLE AND INELIGIBLE WORK ITEMS

When the scope of the Project is determined as a result of this study, the design and construction will be funded by FAA AIP grants. All Project elements are anticipated to be AIP eligible.

14. DBE PARTICIPATION

The FAA grant for this Project will exceed $250,000. The County of Ventura updated their DBE program, dated May 2017, which was subsequently approved by the FAA. Language will be included in the bidding documents to encourage DBE participation, but it is not required. The established DBE goal is 6.03%.

15. PROJECT SCHEDULE

15.1 DESIGN AND BIDDING SCHEDULE

The Project Design Schedule is detailed below:

Pre-Project Schedule

It is anticipated the Drainage Study, Environmental Documents, and Taxiway Reconfiguration analysis, if required, will be completed prior to the design proposal beginning. The design proposal and independent fee estimate analysis is anticipated to begin in April of 2020 so that a grant for design can be executed in August of 2020.

Design Schedule

The design is anticipated to begin in September of 2020 and be completed in December of 2021.

Bidding Milestones

The Project is anticipated to be bid in February of 2022 to align with the FAA-programmed ACIP schedule.

15.2 CONSTRUCTION SCHEDULE

This Project will be completed in two distinct elements: Mobilization and Construction. See Section 4 and *Appendix B* for preliminary construction duration estimates for the overall phasing alternatives. A summary of the estimated construction schedule, based on the recommended phasing approach, is included as *Appendix B*.

16. ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COST AND PRELIMINARY PROJECT BUDGET

For this report, preliminary construction costs were developed for the recommended pavement design Alternative No. 1 and then adjusted for the various pavement sections and areas for Alternatives 2 and 3. The estimated costs are listed below:

Alternatives	Project Cost
Alt 1: Reconstruction with Stabilized Base	$31,310,253
Alt 2: Reconstruction with 6-inch P-401 Surface	$30,463,586
Alt 3: Reconstruction (Aircraft over 150,000 lbs)	$36,151,010

A complete breakdown of the estimated construction costs for the recommended Alternative No. 1 is included as *Appendix D*. The costs above reflect construction, design, environmental, County/Airport administration, and construction administration with a 2% annual price index increase to account for FY 2022 construction as programmed by the FAA.

17. RECOMMENDATIONS

Runway 8-26 and the connector taxiways were constructed in several sections dating back to 1942, some of which include AC pavement overlaying PCC. Although several overlays and seal coats have resulted in PCI values ranging from 70 to 85, the PCN evaluation has indicated that a majority of the runway and connector taxiways are structurally insufficient to support the current fleet mix. For these reasons, and other reasons stated in the report, a reconstruction is the recommended pavement improvement method.

Of all the alternatives evaluated in this study, Alternative 1 is recommended, which includes a stabilized base section, and consists of the following layers:

P-401 HMA Surface	4 inches
P-403 HMA Base	5 inches
P-209 Crushed Aggregate	8 inches
P-155 Lime-Treated Subgrade	12 inches

The stabilized base section is recommended to provide support for the critical aircraft in the fleet mix that are within 0.40% of the 100,000 pounds, such as the Gulfstream G-650.

Upon determination of the pavement improvement method, it is recommended that coordination take place between Mead & Hunt, the County, the County's planning consultant, and the FAA, to establish the extent of the connector taxiway reconstruction.

Respectfully submitted by,

MEAD & HUNT, Inc.

Jeffrey Leonard

Jeffrey T. Leonard, PE
Project Manager

REGISTERED PROFESSIONAL ENGINEER
JEFFREY T. LEONARD
NO. 71754
Exp. date 12-31-19
CIVIL
STATE OF CALIFORNIA

7-25-19

APPENDICES

Appendix A – PCN Evaluation

Appendix B – Construction Duration

Appendix C – FAARFIELD Pavement Design Reports

Appendix D – Cost Estimate

Appendix E – Cross Sections

Appendix A

PCN Evaluation

Mead &Hunt
1360 19th Hole Drive
Suite 200
Windsor, California 95492
707-526-5010
meadhunt.com

July 22, 2019

Ms. Erin Powers
County of Ventura
Project Administrator
Department of Airports
555 Airport Way, Suite B
Camarillo, CA 93010

Project: Camarillo Airport – Preliminary Project Design Concept Report for Runway 8-26 and Taxiway Improvements

Subject: Pavement Classification Number (PCN) Analysis

Dear Ms. Powers:

This PCN evaluation and analysis report was prepared in September 2017 and is being finalized based on the 2017 analysis, procedures, and information available and current at that time.

Per your request, Mead & Hunt, Inc. (Mead & Hunt) has performed an assessment of the pavements at Camarillo Airport (Airport), in accordance with the Federal Aviation Administration (FAA) Advisory Circular 150/5335-5C, "Standardized Method of Reporting Airport Pavement Strength - PCN." The Advisory Circular provides guidance for using the standardized method, known as the Aircraft Classification Number-Pavement Classification Number (ACN-PCN) for reporting pavement strength. The FAA recommends that all general aviation (GA) airports that receive Airport Improvement Program (AIP) funds perform a PCN analysis, and subsequently update the FAA Form 5010 and Airport Master Record with PCN and aircraft gross weight data.

The ACN-PCN system is only intended as a method of reporting relative pavement strength so airport operators can evaluate acceptable operations of aircraft. There are two methods that have been established for reporting PCN values: 1) the "using aircraft method," and 2) the "technical evaluation method." The "using aircraft method" is a simple procedure; the ACN values for all aircraft currently permitted to use the pavement facility are evaluated and the largest ACN value is reported as the PCN. The "technical evaluation method" determines pavement strength/rating by considering the current aircraft fleet mix, pavement structural section, and subgrade bearing strength. The "technical evaluation method" is preferred over the "using aircraft method" because of the level of accuracy; thus, the "technical evaluation method" is used in our analysis.

In order to perform the technical evaluation, it is necessary to obtain accurate information in regards to the existing conditions. When available, we used existing record information and local knowledge from the projects that have been designed on the Airport. In addition, Earth Systems Pacific performed a geotechnical investigation of the runway and taxiways. The report outlines the existing pavement sections, aggregate base strength, and subgrade California Bearing Ratio (CBR). The geotechnical report is included as *Attachment 2*. Dynatest Consulting, Inc. also performed heavy weight deflectometer testing on the runway and taxiways. The report includes an evaluation of pavement and subgrade strength using deflection measurements, and is included as *Attachment 3*.

The Dynatest report also includes a PCN analysis and pavement maintenance recommendations. This PCN evaluation was done in addition to Dynatest's PCN analysis in order to check results, apply minor updates to the fleet mix, and consolidate the areas into representative sections.

The assumptions that are made in the evaluation may have a significant impact on the resulting PCN value. The following is a list of the information and assumptions that were used for the analysis:

1. **Aircraft Fleet Mix** (*See Attachment 1*) – The aircraft fleet mix used for this assessment was obtained through close coordination with the Airport. The fleet mix was developed by researching fleet mixes used for previous projects, applying growth rates and new operations as discussed with the Airport, and analyzing aircraft operation data from the 5010 master record and Traffic Flow Management System Counts (TFMSC). Note that the fleet mix was slightly modified after the non-destructive testing, in order to include most current data. The modifications are negligible and don't significantly affect the PCN values. The total fleet mix was modelled on Runway 8-26 and all taxiways, except for Taxiway G. For this analysis it was assumed Taxiway G accommodates approximately half of the total operations.

   According to Advisory Circular 150/5335-5C, Appendix C, Section C.5.3, traffic volume to be modeled should include annual departures for each aircraft that has used or is planned to use the Airport during the pavement life period.

2. **Pass to Traffic Cycle (P/TC)** – In accordance with Advisory Circular 150/5335-5C, Appendix A, Section 2, it is important to determine which aircraft movements need to be counted when considering pavement stress. Typically, aircraft arrive at an airport with a lower amount of fuel than is used to takeoff. As a consequence, the stress loading of the wheels on the runway pavement is less when landing than at takeoff, due to the lower weight of the aircraft, as a result from the fuel used during flight and the lift on the wings. For purposes of this assessment we have assumed that each departure creates one pass in the aircraft loading model.

3. **Pavement Structural Section** – For evaluation purposes the existing pavement section under consideration must be converted to a standard equivalent pavement section. The standard section, which corresponds to the total thickness requirement calculated by the COMFAA program, assumes a defined layer of asphalt surface, a defined layer thickness of aggregate base material with a CBR 80 or higher, and a variable thickness subbase layer with a CBR 20 or higher.

   The existing pavement structural sections were obtained from Earth System's geotechnical report, with the exception of Taxiway G, which was modeled based on available record drawings. The total equivalent pavement sections were established using the FAA Flexible Pavement Layer Equivalency Factor Range Table, Table B-1 of Advisory Circular 150/5335-5C. Since the fleet mix does not include any aircraft with four or more wheels per gear, the FAA recommends a reference section assuming 3 inches of Hot Mix Asphalt (HMA) and 6 inches of crushed aggregate for equivalent thickness calculations.

Determining the subgrade strength involved reviewing both the geotechnical report and the non-destructive testing report, and applying reasonable assumptions to consolidate the data into one recommendation. For instance, the geotechnical report determines subgrade strength using a CBR test. The non-destructive testing report determines subgrade strength by measuring deflections, taking the pavement section into account, and back-calculating a subgrade modulus. Additionally, the subgrade under Taxiway H was lime-treated. The Earth Systems report did not perform a CBR test on the lime-treated material, so the layer was modeled as P-154, with an assumed underlying CBR underneath. For the Dynatest report, since the subgrade strength is back-calculated, it was determined in the same manner as the untreated subgrade.

A PCN model was run for each pavement section and boring using both Earth Systems and Dynatest data. A table showing the results of all the models is included as *Attachment 4*. After analyzing all the results, we recommend using Dynatest's subgrade strength values for the representative pavement sections. Most of Earth Systems' CBR values were very low, but had to be assumed due to moisture content and density values being out of range. The non-destructive testing presents a realistic look at how pavement responds to applied loads. Although there are distresses throughout the runway and taxiways, it is not evident that the current fleet mix is causing significant structural damage; however, surface failures have recently become evident on Taxiway A.

There are several pavement sections within the runway, and different pavement sections for each of the taxiways. In order to consolidate the data, a representative pavement section was chosen for each model:

a. For Runway 8-26, the section between Taxiways B and D represents the largest percentage of the runway, and is also the weakest section. This section was chosen as the representative, using an average of the subgrade strength values.

b. For the asphalt concrete (AC) pavement connector taxiways, Taxiway A was chosen as the representative section, since it is the most used of the AC pavement connectors, being the access for Runway 26 departures. The average of AC taxiway connector subgrade strengths was used in the model.

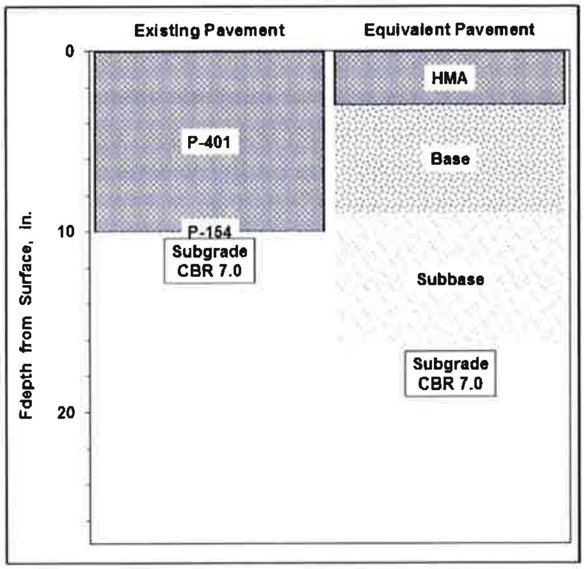
c. All Portland Cement Concrete (PCC) taxiways have the same pavement section, with minor variations in PCC thickness. An average of the subgrade strength values was used for the representative section.

d. Taxiway G was modeled based on record drawings for the construction project.

e. Taxiway H was modeled based on the testing done within the south portions of Taxiways C and D.

The graphics and tables below indicates the pavement section data that was used in this study.

Runway 8-26



Existing Pavement Section

10 inch asphalt surface layer

Subgrade CBR 7

Equivalent Pavement Section

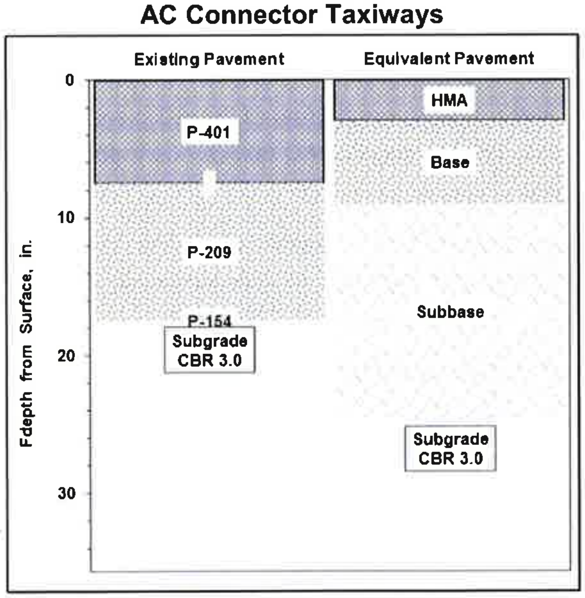
3 inch asphalt surface layer

6 inch aggregate base layer

7.3 inch subbase layer

Subgrade CBR 7

AC Connector Taxiways



Existing Pavement Section

7.5 inch asphalt surface layer

10 inch aggregate base layer

Subgrade CBR 3

Equivalent Pavement Section

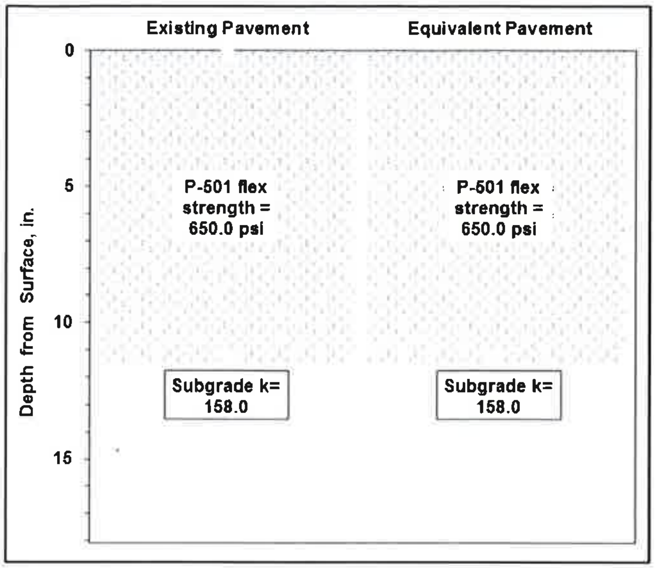
3 inch asphalt surface layer

6 inch aggregate base layer

15.7 inch subbase layer

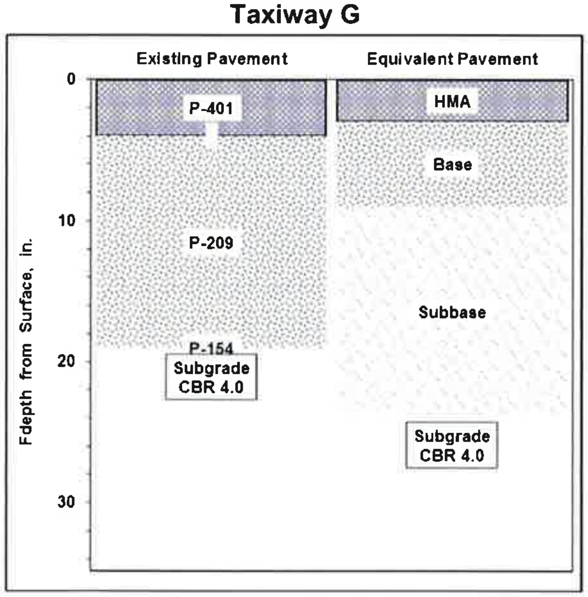
Subgrade CBR 3

PCC Taxiways



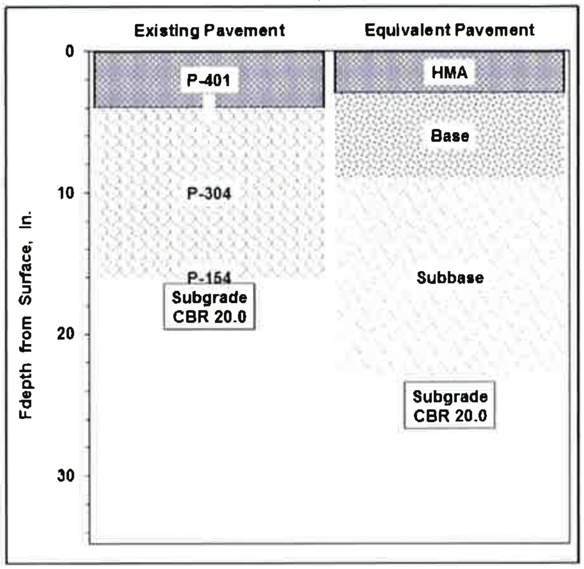
Existing Pavement Section	**Equivalent Pavement Section**
11.5 inch PCC surface layer	11.5 inch PCC surface layer
Subgrade k-value 158	Subgrade k-value 158

Taxiway G



Existing Pavement Section	**Equivalent Pavement Section**
4 inch asphalt surface layer	3 inch asphalt surface layer
15 inch aggregate base layer	6 inch aggregate base layer
Subgrade CBR 4	14.8 inch subbase layer
	Subgrade CBR 4

Taxiway H



Existing Pavement Section

4 inch asphalt surface layer

12 inch cement-treated base layer

Subgrade CBR 20

Equivalent Pavement Section

3 inch asphalt surface layer

6 inch aggregate base layer

14 inch subbase layer

Subgrade CBR 20

PCN Analysis

PCN values were calculated using the methodology established in FAA Advisory Circular 150/5335-5C and COMFAA 3.0 software program. The COMFAA program results are presented in *Attachment 5.*

Advisory Circular 150/5335-5C contains detailed guidance for interpreting PCN values in different scenarios, as illustrated in the various examples within Appendix C. One such scenario that was encountered in this analysis involves the case where the pavement has significant excess structural capacity compared with the requirement due to forecast traffic. This scenario was encountered with Taxiway H. The COMFAA program uses a Cumulative Damage Factor (CDF) to indicate the damage done to the pavement by the associated fleet mix. When the CDF is less than 0.15, which is the case here, the calculated PCN value represents an unrealistic allowable gross aircraft weight. The FAA recommends increasing the number of aircraft coverages until the CDF reaches 0.15. This results in a realistic PCN value and indicates that the pavement can support increased operations without reducing the pavement life.

For Taxiway H, the COMFAA analysis resulted in a CDF that was too low to properly determine a PCN value. For this reason, it is recommended to use the maximum ACN value as the Taxiway H PCN value. At this time, a Gulfstream G-650 is anticipated to be the most critical aircraft in the fleet mix. If heavier aircraft are anticipated to use the Airport in the future, a new PCN evaluation should be done.

Recommendations

The table below is a summary of all the PCN values and allowable gross weights, as reported in the recommended Form 5010:

Airport LOC-ID	Pavement ID	#35 S GW	#36 D GW	#37 DT GW	#38 DDT GW	#39 PCN
CMA	Runway 8-26	46	65			17/F/C/X/T
CMA	AC Connectors	39.5	52.5			15/F/D/X/T
CMA	PCC Taxiways	89	113			34/R/C/W/T
CMA	Taxiway G	55	71			22/F/D/X/T
CMA	Taxiway H	83	126			30/F/A/X/T

In the table, column #35 lists the allowable gross weight for single-gear configuration (in thousands of pounds), column #36 lists the allowable gross weight for dual-wheel configuration, and column #39 lists the recommended PCN value. The letters following the PCN value indicate type of pavement (flexible or rigid), subgrade strength category (A-D), allowable tire pressure (X for 254 psi, W for unlimited (recommended for PCC)), and PCN determination method (technical evaluation or using aircraft). The complete Form 5010 is included as *Attachment 6*.

The table below shows a list of ACN values for some of the aircraft in the fleet mix. The ACN values shown are based on maximum gross weight of the aircraft, and can be reduced if the weight is lowered.

ACN Values				
Aircraft	Subgrade Category			
	Flexible			Rigid
	A	C	D	C
BeechJet 400A	6	6	7	6
Hawker 800	7	8	9	9
Citation X	10	12	12	13
Challenger 600	12	14	16	15
Gulfstream G-IV	22	25	25	27
Gulfstream G-V	26	29	31	32
Global Express 6000	29	33	34	35
Gulfstream G-650	29	33	34	35

Our analysis has shown that Runway 8-26, AC connector taxiways, and Taxiway G have PCN values that are below the ACN values. For the runway and taxiway connectors, this indicates the pavement is insufficient to support the fleet mix. The FAA evaluates the adequacy of a pavement structure over a 20-year life. A pavement section is considered insufficient when the number of operations that the pavement can support during the evaluation period is less than the forecast operations in the fleet mix within the same period. Insufficient pavement sections will require major structural rehabilitation or reconstruction in advance of the 20-year timeframe. Estimates of the life expectancy for the insufficient pavement sections were calculated using the FAA pavement design software (FAARFIELD) and are provided as part of the 2017 non-destructive test report by Dynatest (Attachment 3). After the estimated lifetime has elapsed, the pavement sections will start deteriorating at a faster pace compared to structurally sufficient pavement sections. Pavements do not suddenly fail, unless a major overload is applied. In addition to a major rehabilitation or reconstruction project for insufficient pavement areas, the aircraft in the fleet mix can be reduced by maximum allowable weight or number of operations to extend the pavement life. For Taxiway G, since the PCN analysis is based on record drawings, a geotechnical report may be beneficial in the future to more accurately model the pavement section. Also, the fleet mix could be evaluated more carefully to determine how many operations Taxiway G accommodates, or whether the taxiway should be restricted to certain aircraft. At this time, however, Taxiway G does not exhibit significant distresses.

For the PCC taxiways, although the ACN values for the Gulfstream G-650 are higher than the PCN, the difference is less than 5% of the PCN. According to Advisory Circular 150/5335-5C, Appendix D, occasional traffic cycles by aircraft with an ACN not exceeding 5% above the reported PCN should not significantly affect the life of a rigid pavement.

As discussed earlier, the PCN value for Taxiway H is well over the ACN value, and has been adjusted to reflect the current ACN value. This section is considered adequate and can be further evaluated in the future if more critical aircraft are anticipated to use the Airport.

Pavement reconstructions are recommended for the insufficient areas, so the PCN values can be increased. In addition, we recommend the Airport monitor the existing airfield pavements and operations on a routine basis to check for stress or damage to the pavement caused by aircraft operations.

If you have any questions, please feel free to contact us at 707-526-5010.

Sincerely,

MEAD & HUNT, Inc.

Jeffrey Leonard

Jeffrey Leonard, PE
Project Manager

Attachments: *Attachment 1 – Camarillo Airport Fleet Mix*
Attachment 2 – 2017 Geotechnical Report, by Earth Systems
Attachment 3 – 2017 Non-destructive Testing Report, by Dynatest
Attachment 4 – Pavement Section and PCN Table
Attachment 5 – PCN Calculation Sheets
Attachment 6 – Recommended Form 5010

Appendix B
Construction Duration

Camarillo Airport, Ventura County
Preliminary Project Design Concept Report for Runway 8-26 and Taxiway Improvements

DRAFT - Critical Path Construction Duration, Version 1

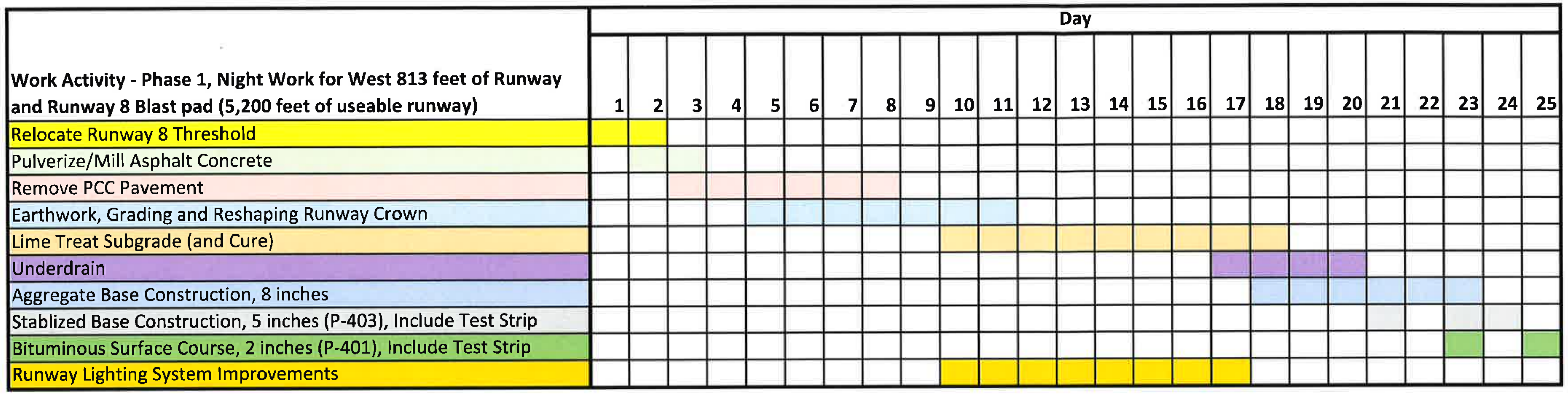
Work Activity - Phase 1, Night Work for West 813 feet of Runway and Runway 8 Blast pad (5,200 feet of useable runway)	Day																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Relocate Runway 8 Threshold	■	■																							
Pulverize/Mill Asphalt Concrete		■	■																						
Remove PCC Pavement			■	■	■	■	■	■																	
Earthwork, Grading and Reshaping Runway Crown					■	■	■	■	■	■	■														
Lime Treat Subgrade (and Cure)										■	■	■	■	■	■	■	■	■							
Underdrain																	■	■	■	■					
Aggregate Base Construction, 8 inches																		■	■	■	■	■	■		
Stablized Base Construction, 5 inches (P-403), Include Test Strip																					■		■	■	
Bituminous Surface Course, 2 inches (P-401), Include Test Strip																							■		■
Runway Lighting System Improvements										■	■	■	■	■	■	■	■								

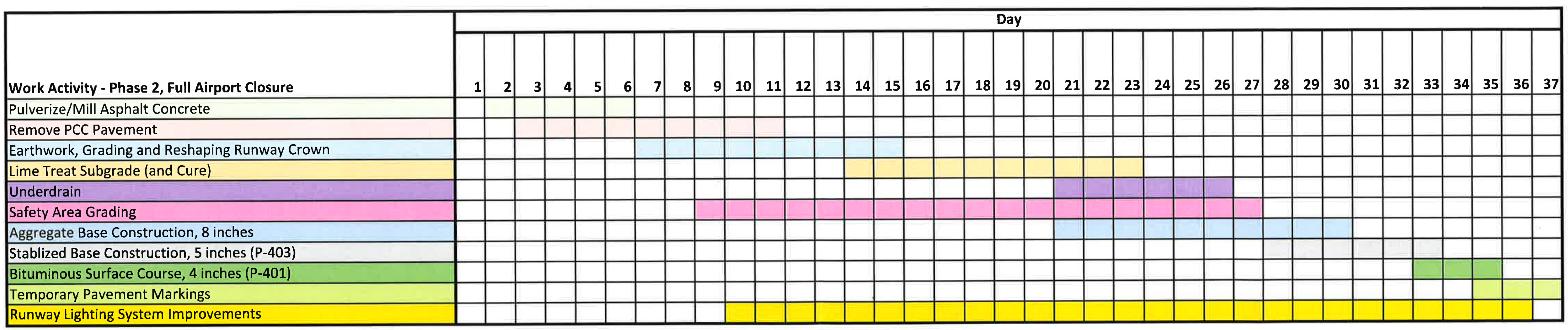
Work Activity - Phase 2, Full Airport Closure	Day																																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Pulverize/Mill Asphalt Concrete		■	■	■	■	■																															
Remove PCC Pavement			■	■	■	■	■	■	■	■	■																										
Earthwork, Grading and Reshaping Runway Crown							■	■	■	■	■	■	■	■	■																						
Lime Treat Subgrade (and Cure)														■	■	■	■	■	■	■	■	■	■														
Underdrain																					■	■	■	■	■	■											
Safety Area Grading									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
Aggregate Base Construction, 8 inches																					■	■	■	■	■	■	■	■	■	■							
Stablized Base Construction, 5 inches (P-403)																												■	■	■	■	■	■				
Bituminous Surface Course, 4 inches (P-401)																																	■	■	■		
Temporary Pavement Markings																																			■	■	■
Runway Lighting System Improvements										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	

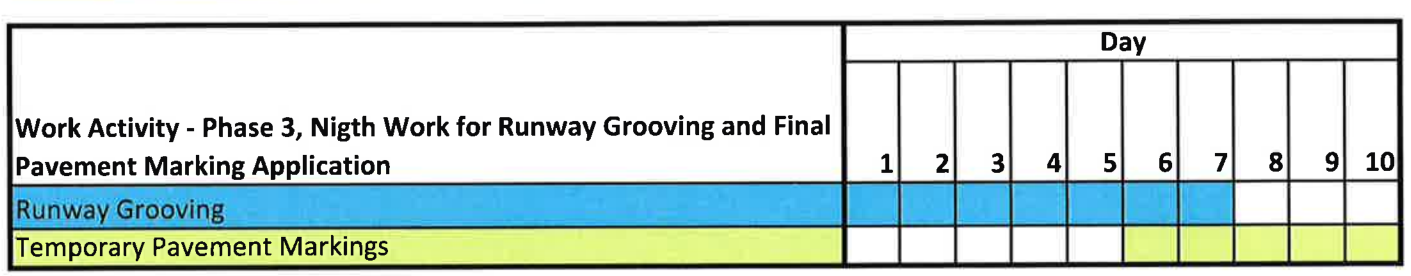
Work Activity - Phase 3, Nigth Work for Runway Grooving and Final Pavement Marking Application	Day									
	1	2	3	4	5	6	7	8	9	10
Runway Grooving	■	■	■	■	■	■	■			
Temporary Pavement Markings						■	■	■	■	■

Camarillo Airport, Ventura County
Preliminary Project Design Concept Report for Runway 8-26 and Taxiway Improvements

DRAFT - Critical Path Construction Duration, Version 1



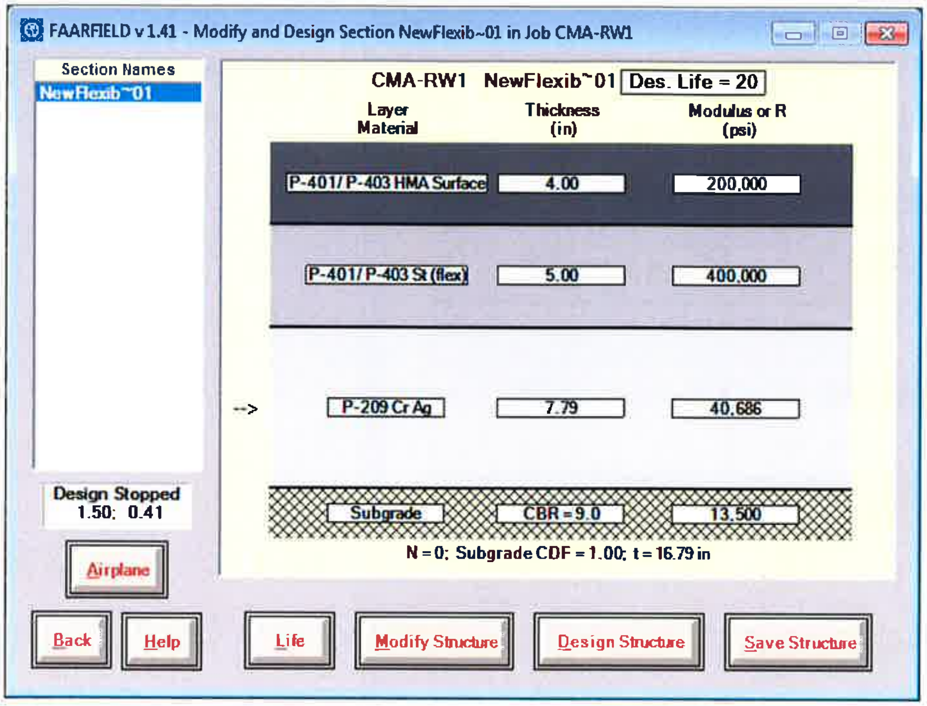




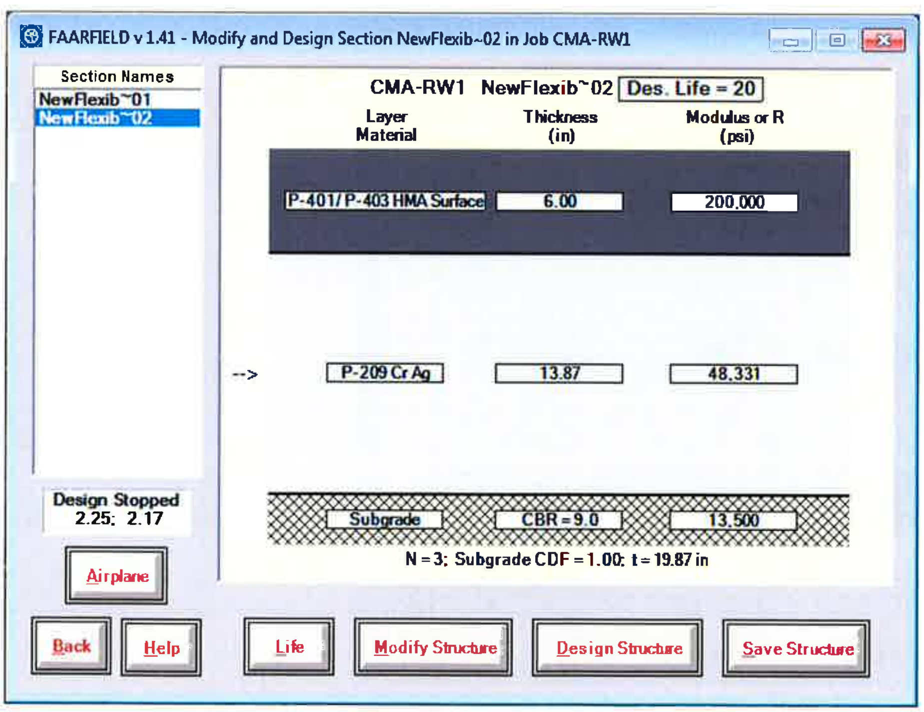
Appendix C

FAARFIELD Pavement Design Reports

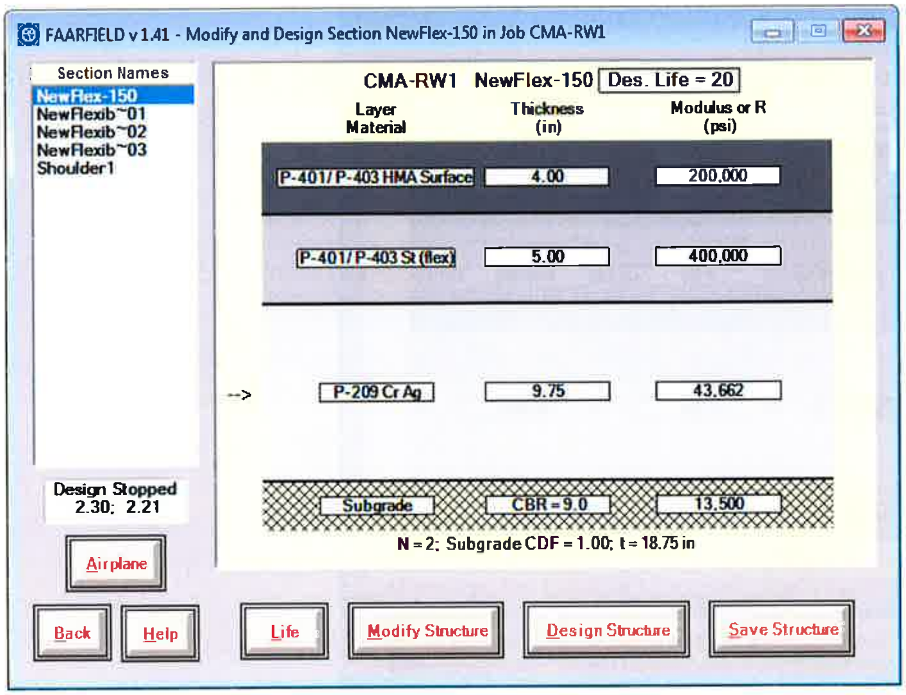
Alternative No. 1 – Runway Reconstruction with Stabilized Base – Recommended



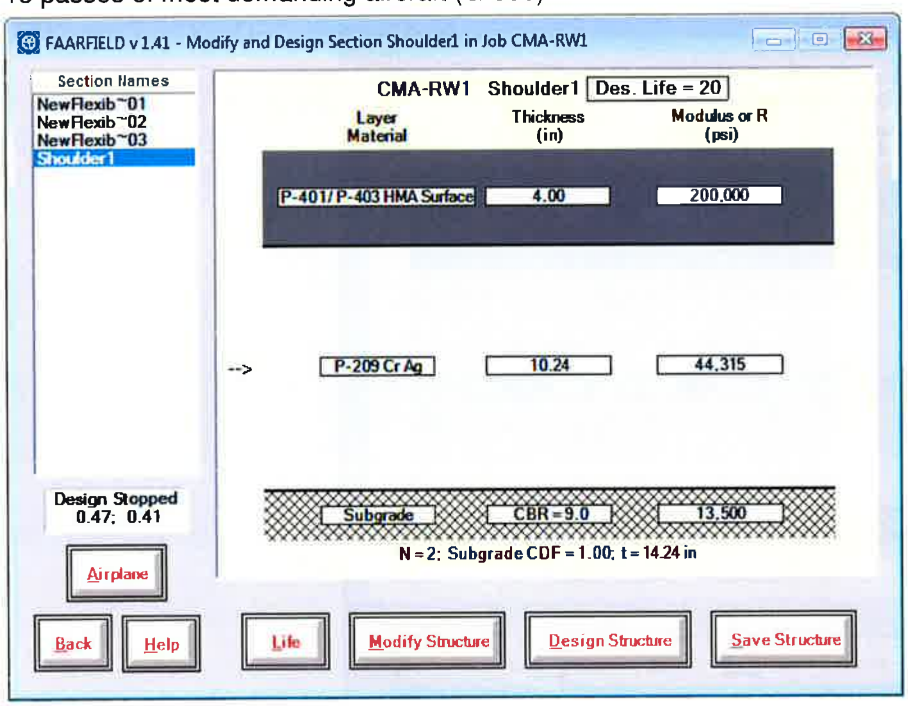
Alternative No. 2 – Runway Reconstruction without Stabilized Base



Alternative No. 3 with 737-400 (over 150,000#, which would require a 150 foot wide runway)



Runway Shoulder and Blast Pa. Recommended for ADG III aircraft per 6.1.3;
15 passes of most demanding aircraft (G-650)



Appendix D

Cost Estimate

Camarillo Airport, Ventura County
Preliminary Project Design Concept Report for Runway 8-26 and Taxiway Improvements

Probable Estimate of Construction Cost - Draft Submittal
Runway 8-26 Improvements, Alternative 1: Reconstruction, Runway Width of 100 feet with Stabilized Base

Construction Cost

Item	Description	Unit	Quantity	Cost	Total
1	Airfield Safety and Traffic Control	LS	1	$250,000.00	$250,000.00
2	Construction Staking and Survey Layout	LS	1	$170,625.00	$170,625.00
3	Access Route Improvements/Repair	T&E	1	$150,000.00	$150,000.00
4	Mobilization	LS	1	$2,982,000.00	$2,982,000.00
5	Remove Portland Cement Concrete Pavement	SY	19,200	$30.00	$576,000.00
6	Miscellaneous Removals and Site Preparation	LS	1	$75,000.00	$75,000.00
7	Pulverize/Mill Asphalt Concrete Pavement and Suitable Base	SY	37,200	$6.50	$241,800.00
8	Sawcut Asphalt Concrete Pavement	LF	2,000	$7.50	$15,000.00
9	Select Fill	CY	22,600	$18.00	$406,800.00
10	Prepare Storm Water Pollution Prevention Plan (SWPPP)	LS	1	$8,500.00	$8,500.00
11	Implement SWPPP / Install Temporary Erosion Control	LS	1	$75,000.00	$75,000.00
12	Unclassified Excavation	CY	50,100	$15.00	$751,500.00
13	Unclassified Excavation, On-site Disposal	CY	36,900	$12.00	$442,800.00
14	Excavation Below Subgrade	CY	3,400	$85.00	$289,000.00
15	Subgrade Preparation and Transition Grading	SY	100,600	$2.00	$201,200.00
16	Lime Treated Subgrade, 12-Inch Depth	SY	100,600	$10.50	$1,056,300.00
17	Crushed Aggregate Base Course, P-209	CY	24,500	$65.00	$1,592,500.00
18	Bituminous Surface Course, P-401	TON	16,500	$125.00	$2,062,500.00
19	Stabilized Base Course, P-403	TON	27,900	$120.00	$3,348,000.00
20	Pavement Markings, Yellow, Initial Application	SF	2,800	$1.50	$4,200.00
21	Pavement Markings, Yellow, with Reflective Media, Final Application	SF	2,800	$2.50	$7,000.00
22	Pavement Markings, White, Initial Application	SF	75,900	$1.50	$113,850.00
23	Pavement Markings, White, with Reflective Media, Final Application	SF	75,900	$2.50	$189,750.00
24	Pavement Markings, Black, Single Application	SF	22,000	$2.00	$44,000.00
25	Runway Grooving	SY	53,500	$4.00	$214,000.00
26	Storm Drainage and Infiltration Trench Improvements	LS	1	$636,250.00	$636,250.00
27	Perforated Underdrain, 6-Inch	LF	15,500	$50.00	$775,000.00
28	Underdrain Cleanout	EA	40	$1,500.00	$60,000.00
29	Remove Airfield Electrical Vault	EA	59	$2,500.00	$147,500.00
30	Remove Base Can and Salvage Existing Airfield Light, Elevated	EA	69	$250.00	$17,250.00
31	Remove Base Can and Salvage Existing Airfield Light, In-Pavement	EA	7	$800.00	$5,600.00
32	Install New Base Can and Salvaged Light Fixture, Elevated	EA	69	$825.00	$56,925.00
33	Install New Base Can and Salvaged Light Fixture, In-Pavement	EA	7	$2,000.00	$14,000.00
34	Conduit, 2-Inch, Schedule 40, Concrete Encased	LF	16,350	$32.00	$523,200.00
35	Counterpoise Wire and Ground Rod	LF	16,350	$6.00	$98,100.00
36	No. 8 AWG, 5 kV, L-824, Type C Cable, Installed in Duct Bank or Conduit	LF	17,985	$2.50	$44,962.50
37	Relocate and Reinstall REILS, Remove Existing Foundations	SET	2	$13,000.00	$26,000.00
38	Relocate and Reinstall PAPI, Remove Existing Foundations	SET	2	$20,000.00	$40,000.00
39	Relocate and Reinstall Distance Remaining Signs	EA	5	$3,000.00	$15,000.00
40	Taxiway Transition Pavement Improvements	SY	16,200	$128.00	$2,073,600.00
				TOTAL	**$19,800,712.50**

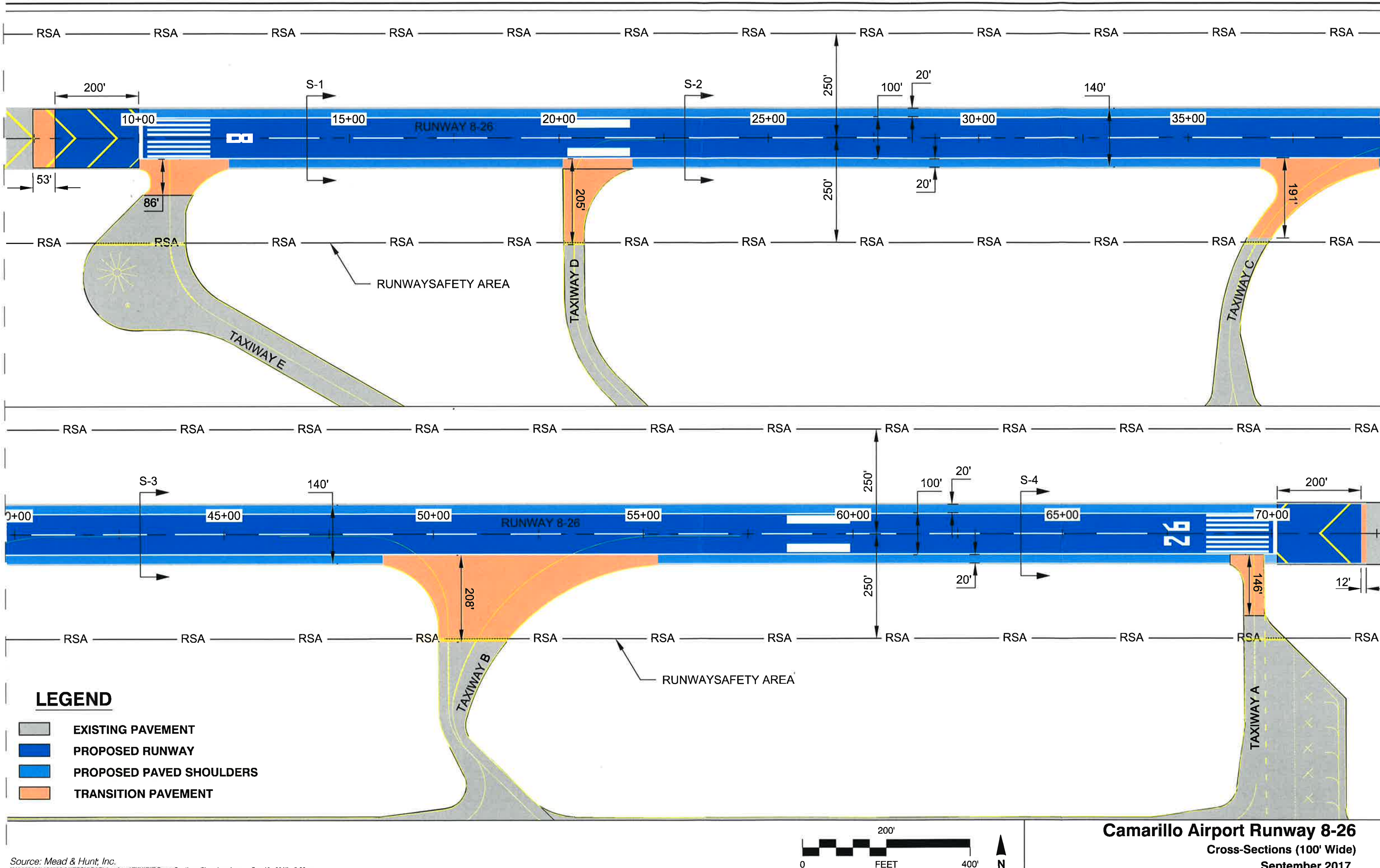
Total Project Cost

COUNTY ADMINISTRATION	$396,100.00
ENVIRONMENTAL DOCUMENTATION	$475,000.00
DESIGN	$2,376,100.00
TOPOGRAPHIC SURVEY	$45,000.00
GEOTECHNICAL INVESTIGATION	$35,000.00
CONSTRUCTION	$19,800,712.50
RESIDENT ENGINEERING	$1,188,100.00
MATERIALS TESTING	$594,100.00
CONSTRUCTION ADMINISTRATION	$1,386,100.00
CONTINGENCY (10%)	$2,629,621.25
TOTAL (2018)	**$28,925,833.75**
Total Adjusted for Price Escalation (2019)	**$29,504,350.43**
Total Adjusted for Price Escalation (2020)	**$30,094,437.43**
Total Adjusted for Price Escalation (2021)	**$30,696,326.18**
Total Adjusted for Price Escalation (2022)	**$31,310,252.71**

Note: Price Escalation assumes 2% per year

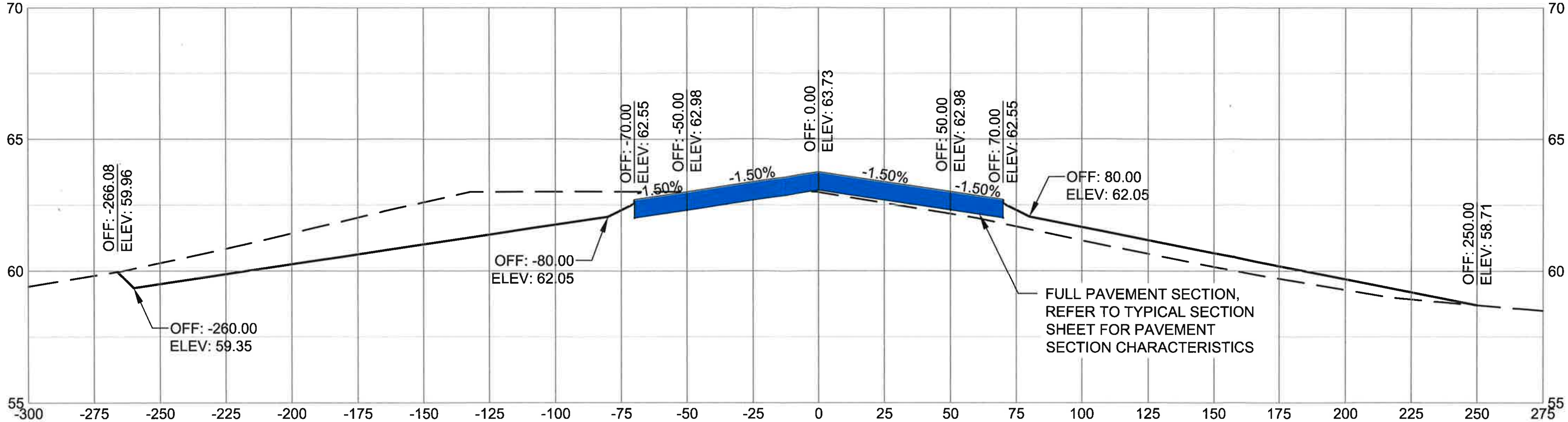
Appendix E

Cross Sections



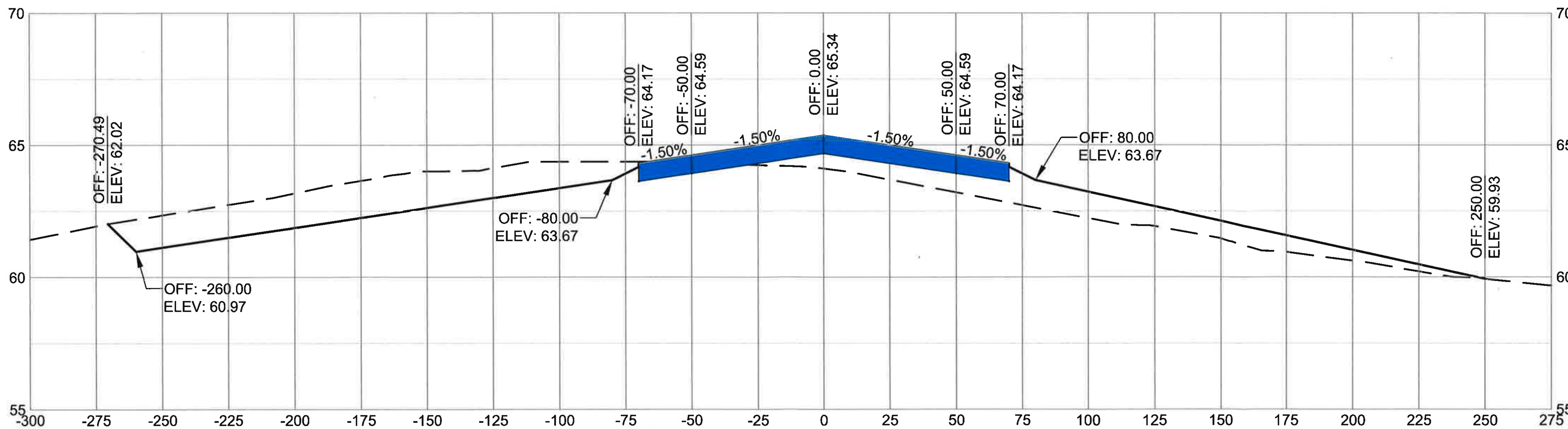
Source: Mead & Hunt, Inc.
X:\3168900\155706.01\TECH\CAD\drawings\EXHIBIT\Cross Sections Plan view.dwg Sep 12, 2017 - 5:23pm

Camarillo Airport Runway 8-26
Cross-Sections (100' Wide)
September 2017



S1 CROSS-SECTION - STA: 14+00

HORIZ SCALE: 1" = 40'; VERT SCALE: 1" = 8'



S2 CROSS-SECTION - STA: 23+00

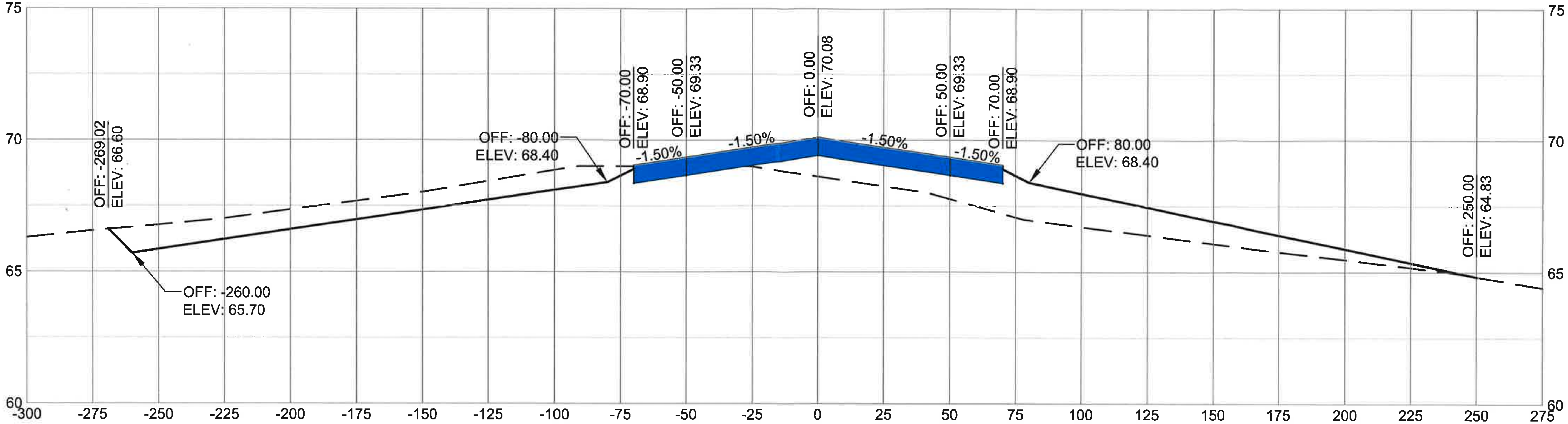
HORIZ SCALE: 1" = 40'; VERT SCALE: 1" = 8'

Source: Mead & Hunt, Inc.
X:\3168900\155706.01\TECH\CAD\drawings\XREF\3168900-155706.01 - CG - 100' Rwy.dwg Sep 12, 2017 - 5:33pm

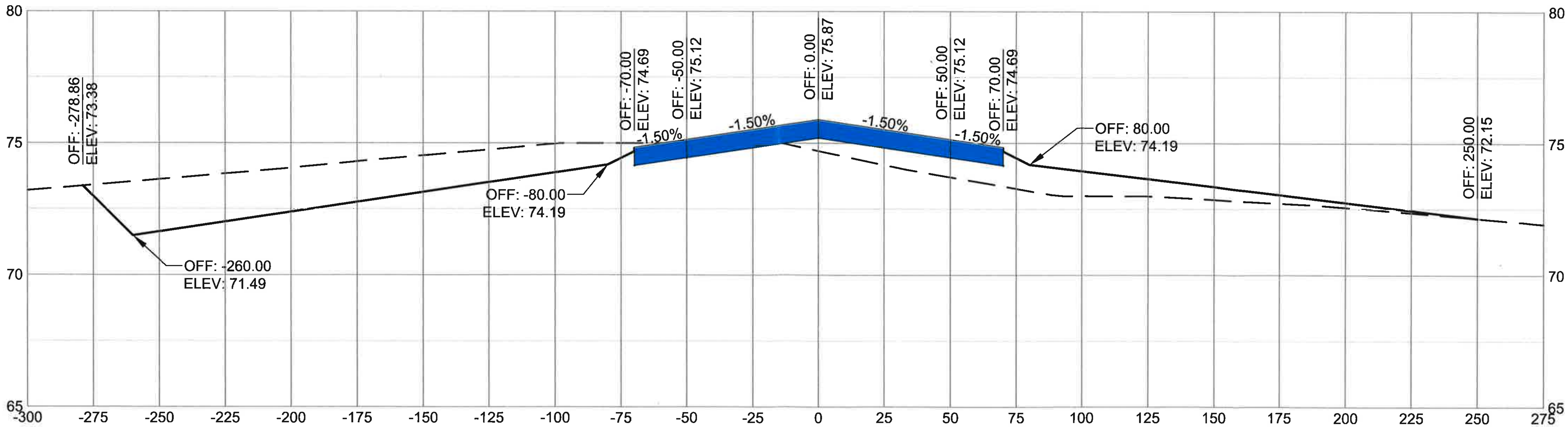
Camarillo Airport Runway 8-26

Cross-Sections (100' Wide)

September 2017



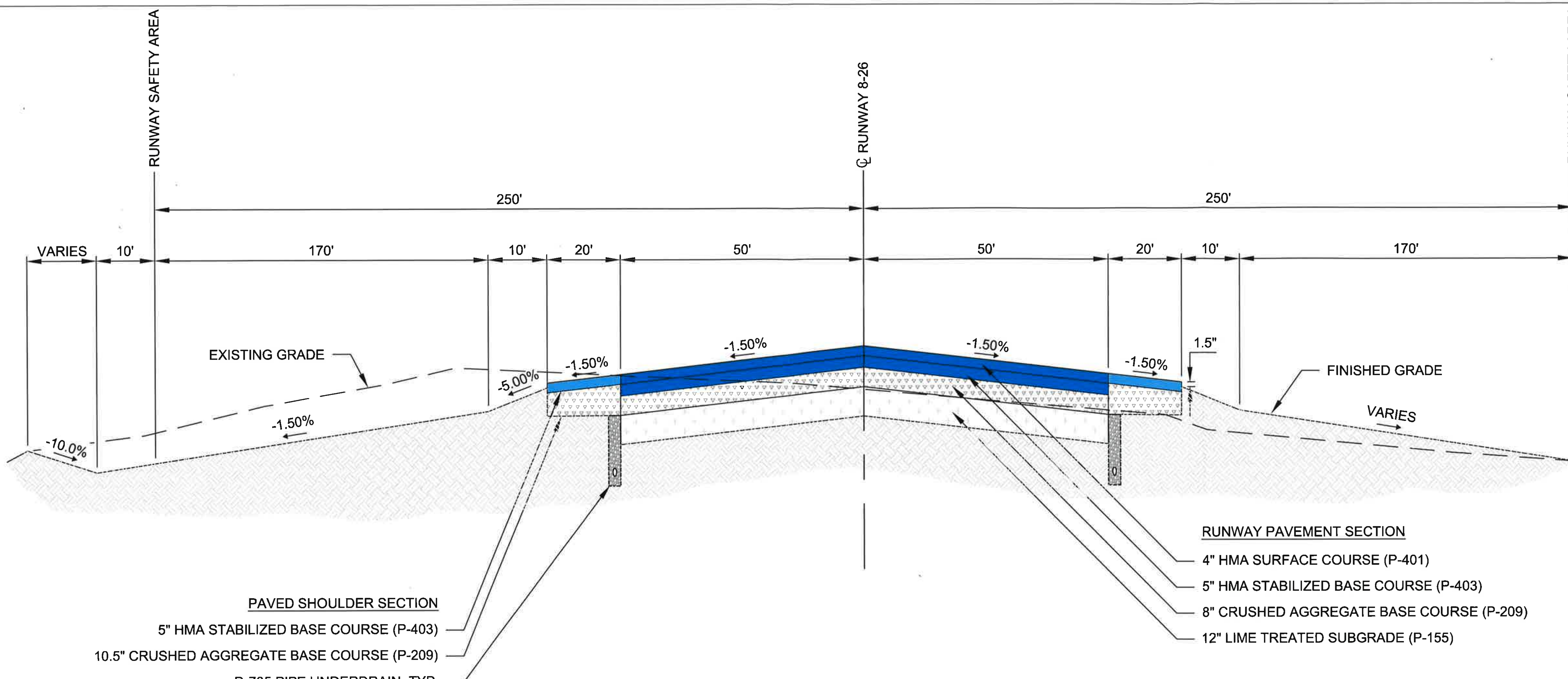
S3 CROSS-SECTION - STA: 43+00
HORIZ SCALE: 1" = 40'; VERT SCALE: 1" = 8'



S4 CROSS-SECTION - STA: 64+00
HORIZ SCALE: 1" = 40'; VERT SCALE: 1" = 8'

Source: Mead & Hunt, Inc.
X:\3168900\155706.01\TECH\CAD\drawings\XREF\3168900-155706.01 - CG - 100' Rwy.dwg Sep 08, 2017 - 6:27pm

Camarillo Airport Runway 8-26
Cross-Sections (100' Wide)
September 2017



5 RUNWAY 8-26 TYPICAL PAVEMENT SECTION

NO SCALE

Camarillo Airport Runway 8-26

Typical Sections

September 2017

Source: Mead & Hunt, Inc.

X:\3168900\155706.01\TECH\CAD\drawings\XREF\3168900-155706.01 - CG - 100' Rwy.dwg Sep 12, 2017 - 5:32pm

PCN Analysis Report - Attachment 1

Camarillo Airport Fleet Mix

Camarillo Airport
Preliminary Project Design Concept Report for Runway 8-26 and Taxiway Improvements

Fleet Mix

Version 3 **Date** 5/15/2017

Fleet Mix Assumptions

Basis of fleet mix from the Taxiway H project and added aircraft from final design of CMA Northeast Hangar Development Fleet Mix and Sun Air (FBO). Also adjusted ops for heavier aircraft based on 2016 TFMSC data.
Estimated the Annual Percentage Growth Rate of 1.8%

Airplane No.	Name	Gross Weight	Annual Departures
1	Single Wheel -8	8,000	86130
2	Single Wheel -12.5	12,500	5000
3	BeechJet-400A	16,300	950
4	Hawker-800	27,520	150
5	Citation-X	36,000	270
6	Challenger 600	48,200	290
7	Gulfstream-GIV	75,000	265
8	Gulfstream-GV	91,000	265
9	Global Express-6000	99,500	185
10	Gulfstream G-650	99,600	730
		Total	**94,235**

PCN Analysis Report - Attachment 2

2017 Geotechnical Report, by Earth Systems

GEOTECHNICAL ENGINEERING REPORT
CAMARILLO AIRPORT
PCN ANALYSIS
CAMARILLO, CALIFORNIA
MEAD & HUNT, INC. PROJECT NO. 3168900-155706.01

August 14, 2017

Prepared for

Mr. Jeff Leonard, PE
Associate Practice Leader
Aviation Services
Mead & Hunt, Inc.

Prepared by

Earth Systems Pacific
4378 Old Santa Fe Road
San Luis Obispo, CA 93401

Earth Systems
Pacific

4378 Old Santa Fe Road
San Luis Obispo, CA 93401
Ph: 805.544.3276
esp@earthsystems.com
www.earthsystems.com

August 14, 2017

FILE NO.: SL-15603-SD

Mr. Jeff Leonard, PE
Associate Practice Leader, Aviation Services
Mead & Hunt, Inc.
1360 19th Hole Drive, Suite 200
Windsor, CA 95492-7717

PROJECT: CAMARILLO AIRPORT
PCN ANALYSIS
CAMARILLO, CALIFORNIA
MEAD & HUNT, INC. PROJECT NO. 3168900-155706.01

SUBJECT: Geotechnical Engineering Report

CONTRACT
REFERENCE: Service Work Order No. 1 by Mead & Hunt, Inc., Referencing Proposal to Provide a Geotechnical Engineering Investigation – Revision 2, Camarillo Airport, PCN Analysis, Camarillo, California, by Earth Systems Pacific, Doc. No. 1505-125.PRP.REV2, revised May 13, 2016

Dear Mr. Leonard:

As per the referenced Service Work Order, this geotechnical engineering report has been prepared for use in the PCN Analysis project for Camarillo Airport in Camarillo, California. Boring logs and a boring location map, results of laboratory testing, and conclusions regarding CBR testing, earthwork shrinkage, and subsurface water and soil moisture contents are provided. Two paper copies and a digital copy of this report are furnished for your use.

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. 03/31/19
GEOTECHNICAL
STATE OF CALIFORNIA

8/14/17

Fred J. Potthast, GE
Principal Engineer

Doc. No.: 1708-090.SER/tb

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

This geotechnical engineering report has been completed for the client's use in the development of Pavement Classification Number (PCN) calculations for Camarillo Airport in Camarillo, California. The areas covered by this report are as follows: Taxiways A through F, and Runway 8-26 from Taxiway A to Taxiway F. The runway and taxiways are in regular use, and the pavement surfaces consist of either asphalt concrete (AC) or Portland cement concrete (PCC).

In general, this report contains logs of the subsurface conditions encountered in our exploratory borings, the results of laboratory tests, and conclusions regarding CBR testing, earthwork shrinkage, and subsurface water and soil moisture contents. It is our understanding that this information will be used by the client to complete PCN calculations for the site. The information may also be used to develop plans for future projects, however no specific projects (i.e., new construction, reconstruction or overlays, or structures) are planned at this time.

2.0 SCOPE OF SERVICES

The scope of work for this 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 Pavement Section Identification Map provided by the client.

The report and recommendations are intended to be in accordance with the client's requested work scope and common geotechnical 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.

It is our intent that this report be used exclusively by the client to form the geotechnical basis of the PCN calculations. The information may also be used to develop plans for future projects, however no specific projects (i.e., new construction, reconstruction or overlays) are planned at this time. Application beyond these intents is strictly at the user's risk. As there may be geotechnical issues yet to be resolved, the geotechnical engineer should be retained to provide consultation as the project progresses, to assist in verifying that pertinent geotechnical issues have been addressed and to aid in conformance with the intent of this report. In the event this report is used to develop project plans, it may also be advantageous to retain the geotechnical engineer to review the grading and drainage plans as they near completion to further aid in conformance of the plans with the intent of this report.

This report does not address issues in the domain of the contractor such as, but not limited to, site safety, 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 in man-made products), lead or mold potential, hydrocarbons, or other chemical properties are beyond the scope of this investigation. Ancillary features beyond the pavement areas covered by this report are also not within our scope and are not addressed.

In the event that there are any changes in the nature of the work scope, 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.

3.0 FIELD INVESTIGATION

On February 6 through February 9, 2017, a total of 18 borings were drilled within the project area. The borings were drilled to a maximum depth of 10.0 feet below the existing surfaces with a Mobile Drill rig, Model B-53, equipped with 6-inch outside diameter hollow stem auger and an automatic hammer for sampling. The boring locations were determined during a site visit with airport staff on January 25, 2017. The approximate locations of the borings are shown on the Exploration Location Map – Figure 1, in Appendix A. A table with the boring locations identified by latitude and longitude, as determined using a Verizon Android Smartphone, is also included in Appendix A. The boring locations were requested by Dynatest, and provided to us by the client. During the field meeting, all requested boring locations were determined by airport staff to be clear of underground utility lines, with the exception of Boring E-1; this location was adjusted slightly, and the coordinates of the adjusted location are included in the table in Appendix A.

As the borings were drilled, samples were obtained with a ring-lined barrel sampler (ASTM D 3550-01/07, with shoe similarto ASTM D 2937-10) at approximate subgrade elevation. Standard penetration tests (ASTM D 1586-11) were also conducted from 5 to 6.5 feet and from 8.5 to 10.0 feet in each boring. Bulk samples were secured from the auger cuttings.

Where the existing pavement surface at a boring location consisted of Portland cement concrete (PCC), a coring subcontractor (Ventura Concrete Cutting) completed 8-inch diameter cores of the PCC before drilling. Where the existing pavement surface at a boring location was asphalt concrete (AC), the Mobile Drill B-53 rig was used to drill through the AC. The pavement sections consisting of PCC or AC over aggregate base (AB) or other supporting layers at each boring location were noted by direct measurement of the material layers in the boring. The soils underlying the pavement sections were initially classified and logged in general accordance with the Unified Soils Classification System (ASTM D 2488-09a). Final classifications of the soils in accordance with the Unified Soils Classification System (ASTM D 2487-11) were made following completion of laboratory testing. 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. Following completion of drilling, the borings were backfilled with cement-treated auger spoils and gravel, and then patched at the surface with quick-setting PCC or cold-mix AC (Instant Road Repair by International Roadway Research), as applicable.

4.0 LABORATORY INVESTIGATION

In situ moisture content and unit dry weight (ASTM D 2937-10, as modified for ring liners) were determined for the ring samples. Nine bulk samples were tested for the following: maximum density and optimum moisture (ASTM D 1557-12, modified), particle size (ASTM D 422-63/07; D 1140-17), plasticity index (ASTM D 4318-10), and CBR (ASTM D 1883-16, for a range of moisture contents, with ASTM D 1557-12 as the reference standard for maximum density). Please refer to Appendix B for the laboratory test results.

5.0 GENERAL SUBSURFACE PROFILE

Variations in the thickness of the existing pavement sections and the underlying soils were observed throughout the borings.

In the runway, Borings R-1 through R-5 encountered pavement sections consisting of 8 to 10 inches of AC overlying 0 to 7 inches of AB. Boring R-6, at the west end of the runway, encountered 2.75 inches of AC over 11.25 inches of PCC; no AB was found in this boring.

In the taxiways, Boring A-1 found 7.5 inches of AC over 10 inches of AB, while Borings B-1 and B-2 found 11.25 to 11.5 inches of PCC with no AB. Boring C-1 encountered 4 inches of AC over 6.5 inches of AB; Boring C-2 found 4 inches of AC over 12 inches of cement treated well graded sand with gravel, over approximately 24 inches of lime treated sandy lean clay, with no AB. Ten inches of AC with no AB were found in Boring D-1. Boring D-2 found 5 inches of AC over 12 inches of cement treated well graded sand with gravel over approximately 36 inches of lime treated silty sand, with no AB. Borings E-1, F-1, F-3 and F-4 found 10.75 to 11.5 inches of PCC at the surface over 0 to 3 inches of AB. Boring F-2 found 12 inches of PCC at the surface over approximately 3 inches of well graded sand with gravel, but no AB.

The pavement sections found in each of the borings are noted on Figure 2 - Existing Pavement Section Thicknesses in Appendix C.

Fill consisting of clayey sand, sandy lean clay and silty sand was found below the pavement sections in Borings R-1 through R-6, B-1, B-2, C-2, D-1, D-2, E-1 and F-1. In Borings C-2 and D-2, the sandy lean clay and silty sand, respectively, were identified as being lime treated. Below the fill in these borings, and below the pavement sections in the remaining borings, was Alluvium, which consisted of sandy lean clay, sandy fat clay, poorly graded sand, silty sand and sandy silt. All soil classifications are per the Unified Soil Classification System – USCS.

In general, the sands were described during drilling as being loose to medium dense, while the silts and clays varied in consistency from very soft to medium stiff.

The soils were also described during drilling as being moist to very moist. Subsurface water was only encountered in Boring D-1, at 9 feet below the pavement surface. However, caliche deposits, a residual mineral in the soil indicating the past presence of subsurface water, were found at various depths in 10 of the 18 borings drilled for this project.

Please refer to the logs in Appendix A for a more complete description of the subsurface conditions found in the borings.

Figure 3 – USCS Soil Types at Subgrade in Appendix C is a summary of the soil types found at or within 1.5 feet of subgrade (i.e., below the pavement sections or any possible subbase) in the borings.

6.0 CONCLUSIONS

CBR Test Results

In our opinion, a primary geotechnical concern at the site is the variability of the CBR values of the soils based on their USCS type and on their moisture contents. The laboratory CBR test results have been summarized on Figures 4 and 5 in Appendix C, and the following paragraphs are a discussion regarding use of the data on the maps. The actual CBR values to be used in either the design of new pavements or the evaluation of existing pavements are the responsibility of the project engineer.

<u>Reconstructed Pavements</u>

In general, the laboratory CBR test results indicate variations in the strengths of the soils tested based on their density and their moisture content. Variations in the CBR values were noted when moisture contents were above or below optimum moisture content for several of the samples. The summary of CBR values provided in the following paragraph is based on the assumption that the subgrade soils will be moisture conditioned to the range extending from 2 percent below optimum moisture content to 2 percent above optimum moisture content.

If the subgrade soils are not maintained within this range, a reduction in the CBR value will occur. Assuming the CBR values provided in this report for pavement section reconstruction will be utilized for design, the project plans should fully indicate the relatively narrow moisture content range as a specification requirement, to allow the contractor to plan his earthwork operations accordingly. Provisions should also be taken (e.g., proper surface drainage and flowlines away from edges of pavement, regular maintenance of the pavement surface to fill any cracks that develop, etc.) to ensure that the moisture contents of the subgrade soils remain within the design range for the design life of the pavement sections.

For fully reconstructed conditions, where the existing pavement sections will be removed and the underlying soils can be moisture conditioned and recompacted, the CBR values of the subgrade soils can be increased in some areas from their *in situ* conditions. However, where the existing conditions are already very well compacted, a *decrease* in the CBR values could occur with moisture conditioning and recompaction to a lesser value than the existing conditions. The most important soil condition achieved with complete reconstruction will be uniformity of subgrade moisture and density. Per FAA AC 150/5320-6D, the degree of relative compaction required at subgrade for any pavement areas where complete reconstruction will be undertaken (and therefore the CBR value that can be used in the reconstruction design) is based on the cohesive/non-cohesive classification of the subgrade soils. With the exception of the silty sands found at or near subgrade in Borings D-2 and E-1, the soils encountered at the site are considered cohesive (plasticity index of 6 or greater). Per FAA AC 150/5320-6D, cohesive soils are required to be compacted at subgrade to a minimum of 95 percent of maximum dry density. The silty sands found in Borings D-2 and E-1 were non-plastic, therefore they are non-cohesive, and per FAA AC 150/5320-6D, are required to be compacted at subgrade to a minimum of 100 percent of maximum dry density.

Figure 4 in Appendix C is a summary of the CBR values expected at the boring locations, based on the results of our laboratory testing and assuming the cohesive soils are compacted to a minimum of 95 percent of maximum dry density within 2 percent of optimum moisture content. For the non-cohesive silty sands found in Borings D-2 and E-1, it was assumed that the soils would be compacted to a minimum of 100 percent of maximum dry density within 2 percent of optimum moisture content. Note that for the lime-treated soils found in Borings C-2 and D-2, no maximum density or CBR results were available for comparison.

To provide better subgrade CBR values and reduce the design section where pavement will be fully reconstructed, lime or cement treatment can be utilized. The existing pavement sections (asphalt concrete - AC and aggregate base - AB) can also be pulverized/milled in place and mixed with the subgrade, to reduce or even eliminate off-haul and disposal from demolition, and to provide a stronger subgrade material than the native soils. Milled pavement section material should be thoroughly mixed with the native soils using disks or other suitable equipment, prior to shaping to provide the design crowned subgrade section. Final mixing of the materials after shaping will be completed during the lime/cement treatment process by pugmills. Lime/cement treatment of the native soils mixed with milled AC/AB material will provide a far superior subgrade material for support of new pavement, when compared to the native soils. For preliminary design purposes, 4 to 6 percent lime or cement treatment should be utilized. A minimum CBR value of 9 would be expected for lime or cement treatment of the native soils mixed with milled AC/AB. Additional laboratory testing would be needed to finalize these values.

Existing Pavements

Figure 5 in Appendix C shows the approximate CBR values of the subgrade soils at each boring location, based on their existing density and moisture contents, and on the results of the laboratory CBR tests. Note that in 10 of the borings, the existing soil moisture contents were beyond the range of the data from the laboratory CBR tests; in those locations, which are marked with an asterisk, the CBR value should be considered as a rough estimate only. As the CBR value of the soils varies with changes in subsurface moisture, it is recommended that edge drains and centerline drains, as discussed in the "Subsurface Water and Soil Moisture Contents" Section, be considered for all new pavements, and as retrofits for existing pavements to enhance their service lives.

Note that for the lime-treated soils found in Borings C-2 and D-2, no maximum density or CBR results were available for comparison.

Earthwork Shrinkage

Soil volume loss, or "shrinkage", during earthwork can be attributed to three categories; soil loss due to stripping or demolition of existing improvements, subsidence of the underlying soils due to compaction, and shrinkage of fill soil as it is placed and compacted. These factors are partly due to the soil characteristics, but largely due to depths of cuts and fills, stripping techniques, type and weight of earthwork equipment, traffic pattern of earthwork equipment, and soil moisture at the time of grading.

Where new pavement is to be constructed, careful stripping of the organics from the site should result in only minor soil loss. In paved areas that are to be reconstructed, removal of distinct AC and AB layers can result is less loss than from removal of heavy vegetation. The amount of soil loss that will occur is largely dependent upon how careful the contractor is in stripping and demolition/removal operations.

Subsidence of the site due to compaction of the soils below a fill area also occurs. Based upon the conditions observed in the borings, subsidence due to compaction is likely to be in the range of 0.1 to 0.2 feet. The main zone of subsidence is typically the upper two to three feet. Deeper subsidence is not expected as earthwork operations for pavement reconstruction are expected to be limited to the upper few feet of the site.

To estimate shrinkage, *in situ* soil density data from ring samples taken in the borings at approximate subgrade elevation were analyzed. Appendix D contains a summary of the existing relative compaction at each depth where a ring sample was secured, as well as calculated shrinkage assuming final relative compaction values ranging from 90 to 100 percent.

As loss, subsidence, and shrinkage are only partly due to the soil characteristics, and are largely influenced by the grading plan, earthwork equipment, earthwork methods, and natural soil moisture, these factors cannot be precisely estimated. If possible, the grading should be planned in such a manner that grades can be adjusted upward or downward to either generate, or receive, fill material as necessary to aid in balancing the earthwork.

Subsurface Water and Soil Moisture Contents

Subsurface water was only encountered in Boring D-1, at 9 feet below the pavement surface. However, caliche deposits, a residual mineral in the soil indicating the past presence of subsurface water, were found at various depths in 10 of the 18 borings drilled for this project. Caliche is an indicator that significant soil moisture contents have been present in the past. If soil moisture contents are well above optimum in pavement areas to be reconstructed, the soils could become unstable under equipment traffic. Unstable conditions hinder compaction efforts and are not acceptable to support fill or pavement section placement. All grading areas should be firm and unyielding following compaction operations and prior to placement of fill, aggregate base or pavement.

Depending on the time of year that construction operations take place, the most effective methods to deal with unstable conditions due to high soil moisture could be scarification and aeration, or the use of geotextile stabilization fabrics. Additional excavation below subgrade may also be needed before the stabilization fabric is used. After all excavations are complete, and prior to placement of the geotextiles, the exposed surfaces are typically back-dragged to a smooth condition to the degree practicable with light earthwork equipment. Geotextile stabilization fabric (Mirafi RS580i or similar material) should then be placed over the subgrade and extended up the sidewalls of the excavation to within 2 inches of the bottom of the AC layer. The fabric should be rolled out along the long dimension of the reconstruction area (not perpendicular to it), and it should be stretched, overlapped and held in place according to the manufacturer's recommendations. Recycled subbase and/or imported aggregate base, per the overall pavement section design, should then be placed over the fabric in thin, moisture-conditioned lifts and compacted. Recycled subbase and/or aggregate base should be placed by end-dumping on the fabric and spreading ahead of equipment; no equipment traffic should be allowed to travel directly over the fabric. The initial lift of subbase/base should be spread and compacted by rubber-tired equipment; subsequent lifts may be compacted using sheepsfoot and/or steel-drum equipment. Compaction equipment should be operated in static mode only until base grade is reached, to reduce the potential for any free water in the underlying soils to be drawn through the fabric and into the subbase or aggregate base.

If it appears that stable conditions will not be created at base grade after the use of geotextiles, a layer of geogrid (Tensar TriAx TX-7 or similar material) should be placed according to the manufacturer's recommendations as additional reinforcement at the approximate mid-depth of the subbase/aggregate base layer. It is recognized that sufficient material may not be in place over the geotextile stabilization fabric at mid-depth of the design subbase/aggregate base layer to fully mobilize its strength characteristics and to determine if geogrid will be needed, therefore it may be advisable to construct a full-scale test strip of the pavement section, with and without geogrid reinforcement. This test strip will give an indication as to whether or not geogrids will be required in any reconstruction areas.

To reduce the potential for accumulated moisture in the subgrade, positive surface drainage away from all paved areas must be provided. Consideration can also be given to the use of edge drains adjacent to the pavement areas and centerline drains within pavement areas. The drains could consist of conventional geotextile-wrapped and gravel-filled trenches with perforated collection pipes, or prefabricated panel-type drainage systems that are placed in narrow trenches. The 3- to 4-inch diameter perforated collection pipes in conventional trenches have the advantage of being able to be fitted with cleanouts for system maintenance; however, this could be outweighed by the relatively low cost of a thin panel drain system, as gravel drains require excavation of wider trenches, trench spoil disposal, and gravel placement. The actual type of system to be utilized, if any, should be determined by the engineer. The drains should be placed, wherever practicable, to dewater the upper 2 to 3 feet of soil below the pavement sections.

The site soils are considered to be 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.

7.0 OBSERVATION AND TESTING

1. The conclusions contained in this report are based on a limited number of borings and rely on continuity of the subsurface conditions encountered.

2. If this report is used as a basis for project plans, the geotechnical engineer should be retained to provide consultation during the design phase, to interpret this report during construction, and to provide construction monitoring in the form of testing and observation.

3. If this report is used as a basis for project plans, at a minimum, the following should be provided by the geotechnical engineer during construction:
    - Professional observation during grading
    - Oversight of special inspection during grading

4. If this report is used as a basis for project plans, special inspection of grading should be provided as per the requirements of the FAA or Section 1705.6 and Table 1705.6 of the CBC; the soils special inspector should be under the direction of the geotechnical engineer. Subject to approval by the building official or other jurisdiction, special inspection requirements should be addressed by the geotechnical engineer during the preconstruction meeting (see below) prior to the start of grading operations.

    At a minimum, the following items should be inspected and/or tested by the special inspector:

    - Stripping and clearing of vegetation and existing pavement where planned for removal

- Excavations to subgrade in any pavement reconstruction areas, and corrective operations (scarification/aeration or placement of geotextile stabilization fabric) in any unstable areas
- Excavations to subgrade in any pavement reconstruction areas and scarification, moisture conditioning, and recompaction in stable areas
- Fill, pulverized AC and imported aggregate base quality, placement, moisture conditioning, and compaction
- Utility trench backfill

5. It will be necessary to develop a program of quality control prior to beginning any construction project. It is the responsibility of the owner, contractor, or project manager to determine any additional inspection items required by the engineer or the governing jurisdiction.

6. Locations and frequency of compaction tests should be as per the recommendation of the geotechnical engineer at the time of construction. The recommended test location and frequency may be subject to modification by the geotechnical engineer, based upon soil and moisture conditions encountered, size and type of equipment used by the contractor, the general trend of the results of compaction tests, or other factors.

7. A preconstruction conference among a representative of the client, the geotechnical engineer, the architect/engineer, the soils special inspector, and contractors is recommended to discuss any planned construction procedures and quality control requirements. The geotechnical engineer should be notified at least 48 hours prior to beginning grading operations.

8. 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, FAA 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.

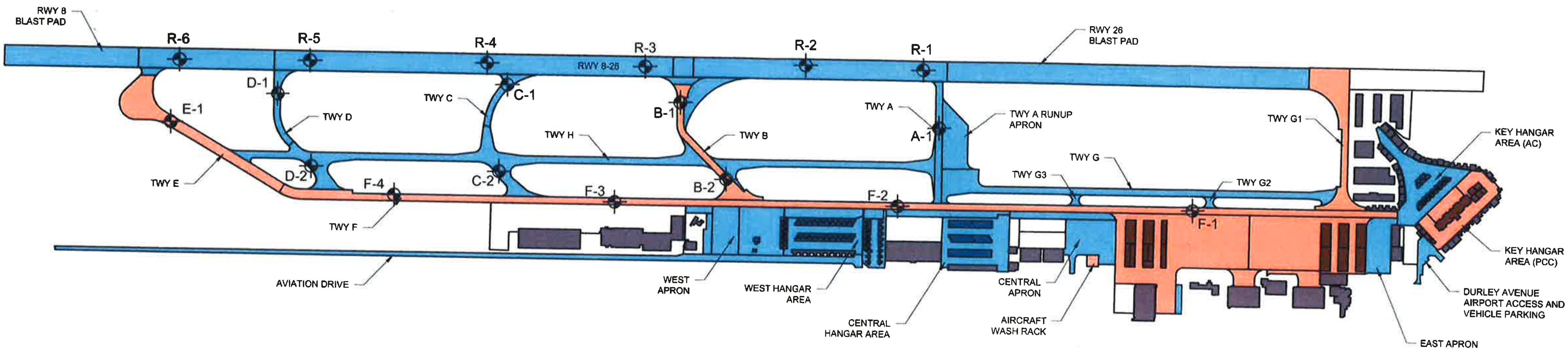
APPENDIX A

Figure 1 – Exploration Location Map

Table of Boring Locations by Latitude and Longitude

Boring Logs

Boring Log Legend



LEGEND

18 ⌖ Boring Location (Approx.)

PCC Pavement

AC Pavement

BASE MAP PROVIDED BY: MEAD & HUNT

NOT TO SCALE

N

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 • Fax (805) 544-1786

EXPLORATION LOCATION MAP

Camarillo Airport - PCN Analysis
Mead & Hunt Project No. 3168900 - 155706.01
Camarillo, California

Date
May 8, 2017

Project No.
SL-15603-SD

Figure 1

TABLE 1 - BORING LOCATIONS BY LATITUDE AND LONGITUDE

CAMARILLO AIRPORT - PCN ANALYSIS

MEAD & HUNT PROJECT NO. 3168900-155706.01

ESP FILE NO. SL-15603-SD
ESP REPORT NO. 1505-061.SER

REF.: Exhibit B - Camarillo Airport: Boring Locations, by Mead & Hunt / Dynatest
All boring locations were determined in the field by latitude and longitude using a Verizon Android Smartphone
All borings were marked with white paint with circle/cross hair, Boring No. and "ESP/USA".

DATE MARKED	BORING NO.	LATITUDE, DEG. N.	LONGITUDE, DEG. W
1/25/2017	R-1	34.21367	119.08524
1/25/2017	R-2	34.2138	119.08821
1/25/2017	R-3	34.21377	119.09231
1/25/2017	R-4	34.21370	119.09559
1/25/2017	R-5	34.21382	119.09950
1/25/2017	R-6	34.21381	119.10296
1/25/2017	A-1	34.21253	119.08459
1/25/2017	B-1	34.21285	119.09101
1/25/2017	B-2	34.21146	119.08977
1/25/2017	C-1	34.21312	119.09545
1/25/2017	C-2	34.21161	119.09547
1/25/2017	D-1	34.21281	119.10092
1/25/2017	D-2	34.21181	119.10013
1/25/2017	E-1	34.21250	119.10359
1/25/2017	F-1	34.21092	119.07842
1/25/2017	F-2	34.21091	119.08595
1/25/2017	F-3	34.21102	119.09289
1/25/2017	F-4	34.21102	119.09844

Earth Systems Pacific

Boring No. R-1

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

JOB NO.: SL-15603-SD
DATE: 02/06/17

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			8.0" AC over 3.5" AB					
1	SC		CLAYEY SAND: light brown, medium dense, moist, trace gravel (Fill)	1.5 - 3.0	Ring Sample	123.7	8.3	13, 18, 18
2				2.0 - 4.0	Grab Sample			
4	CL		SANDY LEAN CLAY: gray brown, very soft, moist (Alluvium)	5.0 - 6.5	SPT			0, 0, 1
8			light brown	8.5 - 10.0	SPT			1, 3, 6
9	SP		POORLY GRADED SAND: light brown, loose, moist					
10			End of Boring @ 10.0' No subsurface water encountered					

Depth scale: 0 1 2 3 4 5 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 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

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

Boring No. R-2

JOB NO.: SL-15603-SD
DATE: 02/07/17

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			10.0" AC over 7.0" AB					
1.5	SC		CLAYEY SAND: light brown, medium dense, moist, trace gravel (Fill)	1.5 - 3.0	Ring Sample	121.5	10.6	8, 15, 13
4	CL		SANDY LEAN CLAY: gray brown, very soft, moist (Alluvium)	5.0 - 6.5	SPT			0, 1, 1
8	SM		SILTY SAND: light brown, loose, moist	8.5 - 10.0	SPT			1, 1, 3
10			End of Boring @ 10.0' 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. R-3

PAGE 1 OF 1
JOB NO.: SL-15603-SD
DATE: 02/07/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		10.0" AC over 0.0" AB					
1	SC	CLAYEY SAND: light brown, medium dense, moist, trace to few gravel (Fill)	1.5 - 3.0	Ring Sample	99.4	12.9	13 14 17
4	CL	SANDY LEAN CLAY: gray brown, soft, moist (Alluvium)	4.0 - 6.0	Grab Sample			
			5.0 - 6.5	SPT			0 2 2
8	ML	SANDY SILT: light brown, medium stiff, moist	8.5 - 10.0	SPT			0 2 4
10		End of Boring @ 10.0' 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. R-4
PAGE 1 OF 1
JOB NO.: SL-15603-SD
DATE: 02/07/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0 - 1			9.5" AC over 0.0" AB					
1 - 3	SC		CLAYEY SAND: light brown, medium dense, moist, trace to few gravel (Fill)	1.5 - 3.0	Ring Sample	115.9	8.2	4 / 10 / 10
3 - 8.5	CL		SANDY LEAN CLAY: dark gray brown, medium stiff, moist (Alluvium)	5.0 - 6.5	SPT			2 / 2 / 4
8.5 - 10			trace caliche, soft	8.5 - 10.0	SPT			0 / 2 / 2
10			End of Boring @ 10.0' 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. R-5
PAGE 1 OF 1
JOB NO.: SL-15603-SD
DATE: 02/07/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			9.5" AC over 0.0" AB					
1.5	SC		CLAYEY SAND: light brown, medium dense, moist, trace to few gravel (Fill)	1.5 - 3.0	Ring Sample	99.3	23.0	3 6 6
2.5	CL		SANDY LEAN CLAY: light brown, stiff, moist					
4	CL		SANDY LEAN CLAY: dark gray brown, medium stiff, moist (Alluvium)	5.0 - 6.5	SPT			1 3 4
8			gray brown, trace caliche	8.5 - 10.0	SPT			1 2 3
10			End of Boring @ 10.0' 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. R-6

PAGE 1 OF 1
JOB NO.: SL-15603-SD
DATE: 02/07/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		2.75" AC over 11.25" PCC; no AB present					
2	SC	CLAYEY SAND: light brown, medium dense, moist, trace gravel (Fill)	2.0 - 3.5	Ring Sample	108.8	21.4	4 5 9
	CL		2.0 - 5.0	Grab Sample			
4.5		SANDY LEAN CLAY: light brown, very soft, moist (Alluvium)	5.0 - 6.5	SPT			2 1 3
5	SC	CLAYEY SAND: dark gray, loose, very moist					
7	CL	SANDY LEAN CLAY: gray brown, medium soft, moist	8.5 - 10.0	SPT			2 2 3
10		End of Boring @ 10.0' 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. A-1

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

JOB NO.: SL-15603-SD
DATE: 02/06/17

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			7.5" AC over 10.0" AB					
2	CL		SANDY LEAN CLAY: brown, medium stiff, moist, some sand (Alluvium)	1.5 - 3.0	Ring Sample	105.6	18.9	2 3 6
				2.0 - 5.0	Grab Sample			
5			decreasing sand content, very soft	5.0 - 6.5	SPT			0 1 1
8	SP		POORLY GRADED SAND: light brown, medium dense, moist	8.5 - 10.0	SPT			4 6 6
10			End of Boring @ 10.0' No subsurface water encountered					

Depth scale: 0 to 26 feet.

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

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

Boring No. B-1

JOB NO.: SL-15603-SD
DATE: 02/08/17

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		11.5" PCC over 0.0" AB					
1	SC	CLAYEY SAND: light brown, medium dense, moist, trace to few gravel (Fill)	1.5 - 3.0	Ring Sample	122.0	16.4	6 8 9
3	CL	SANDY LEAN CLAY: gray brown, soft, moist (Alluvium)	2.5 - 5.0	Grab Sample			
5			5.0 - 6.5	SPT			0 2 2
5.5		brown, caliche deposits					
8.5			8.5 - 10.0	SPT			0 2 8
10	SP	POORLY GRADED SAND: light brown, medium dense, moist					
		End of Boring @ 10.0' 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. B-2

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

JOB NO.: SL-15603-SD
DATE: 02/08/17

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			11.25" PCC over 0.0" AB					
1 - 2	SC		CLAYEY SAND: light brown, medium dense, moist (Fill)	1.5 - 3.0	Ring Sample	106.0	21.4	9 9 12
2 - 5.5	CL		SANDY LEAN CLAY: dark brown / gray mottled, stiff, moist	5.0 - 6.5	SPT			0 2 2
5.5 - 10	CL		SANDY LEAN CLAY: brown, soft, moist, trace caliche (Alluvium)	8.5 - 10.0	SPT			3 6 1
10			End of Boring @ 10.0' 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

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

Boring No. C-1

JOB NO.: SL-15603-SD
DATE: 02/09/17

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		4.0" AC over 6.5" AB					
1 – 7.5	CH	SANDY FAT CLAY: dark gray brown, medium stiff, moist (Alluvium)	1.5 - 3.0	Ring Sample	104.4	19.8	3 5 9
			2.0 - 5.0	Grab Sample			
			5.0 - 6.5	SPT			2 3 4
7.5 – 10	ML	SANDY SILT: brown, soft, moist, caliche deposits	8.5 - 10.0	SPT			0 2 2
10		End of Boring @ 10.0' 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. C-2

JOB NO.: SL-15603-SD
DATE: 02/09/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0 - 1.3			4.0" AC over 12.0" Cement treated Well Graded Sand with Gravel; no AB present					
1.3 - 3.5	CL		SANDY LEAN CLAY: brown, medium dense, moist, lime treated (Fill)	1.5 - 3.0	Ring Sample	96.3	19.8	12 14 12
3.5 - 6	CL		SANDY LEAN CLAY: dark gray, medium stiff, moist	5.0 - 6.5	SPT			2 3 5
6 - 10	CL		SANDY LEAN CLAY: brown, medium stiff, moist, caliche deposit (Alluvium)	8.5 - 10.0	SPT			0 1 2
10			End of Boring @ 10.0' 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

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

Boring No. D-1

PAGE 1 OF 1
JOB NO.: SL-15603-SD
DATE: 02/08/17

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		10.0" AC over 0.0" AB					
1	SC	CLAYEY SAND: light brown, medium dense, moist (Fill)	1.5 - 3.0	Ring Sample	107.9	16.9	3 4 7
2	CL	SANDY LEAN CLAY: light brown, medium stiff, moist, some clay (Fill)	2.0 - 5.0	Grab Sample			
5			5.0 - 6.5	SPT			3 4 5
6	CL	SANDY LEAN CLAY: dark gray, stiff, moist (Alluvium)					
8.5			8.5 - 10.0	SPT	No Return		0 1 2
9		wet, light brown					
10		End of Boring @ 10.0' Subsurface water encountered @ 9.0'					

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. D-2

JOB NO.: SL-15603-SD
DATE: 02/08/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			5.0" AC over 12.0" Cement treated Well Graded Sand with Gravel; no AB present					
1	SM		SILTY SAND: light brown, medium dense, moist, lime treated (Fill)	1.5 - 3.0	Ring Sample	105.3	16.2	21 / 11 / 14
4	CL		SANDY LEAN CLAY: dark gray, medium stiff, moist (Alluvium)	5.0 - 6.5	SPT			1 / 3 / 4
8			light brown, soft, caliche deposit	8.5 - 10.0	SPT			0 / 1 / 2
9			some sand					
10			End of Boring @ 10.0' 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. E-1

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

PAGE 1 OF 1
JOB NO.: SL-15603-SD
DATE: 02/07/17

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			10.75" PCC over 0.0" AB					
1	SM		SILTY SAND: light brown, dense, moist (Fill)	1.5 - 3.0	Ring Sample	119.8	10.3	18 / 28 / 28
2				2.0 - 4.0	Grab Sample			
5	CL		SANDY LEAN CLAY: gray to dark gray, medium stiff, moist (Alluvium)	5.0 - 6.5	SPT			2 / 3 / 4
8			very soft	8.5 - 10.0	SPT			0 / 0 / 2
10			End of Boring @ 10.0' 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. F-1

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

JOB NO.: SL-15603-SD
DATE: 02/08/17

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		11.5" PCC over 3.0" AB					
1	CL	SANDY LEAN CLAY: gray brown, stiff, moist (Fill)	1.5 - 3.0	Ring Sample	110.5	20.5	12 / 6 / 7
4	CL	SANDY LEAN CLAY: brown, soft, moist (Alluvium)	5.0 - 6.5	SPT			0 / 2 / 2
			8.5 - 10.0	SPT			2 / 1 / 1
9		8" lens of Poorly Graded Sand					
10		End of Boring @ 10.0' 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. F-2
PAGE 1 OF 1
JOB NO.: SL-15603-SD
DATE: 02/08/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			12.0" PCC over 3.0" Well Graded Sand with Some Gravel (Possible Subbase?)					
1	CL		SANDY LEAN CLAY: gray brown, stiff, moist (Alluvium)	1.5 - 3.0	Ring Sample	108.7	19.1	8 6 10
2				2.0 - 4.0	Grab Sample			
5	CL		SANDY LEAN CLAY: gray brown, soft, moist, trace caliche	5.0 - 6.5	SPT			0 1 1
9			medium stiff	8.5 - 10.0	SPT			1 3 5
10			End of Boring @ 10.0' 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. F-3
PAGE 1 OF 1
JOB NO.: SL-15603-SD
DATE: 02/08/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			11.5" PCC over 0.0" AB					
1	CL		SANDY LEAN CLAY: light brown, stiff, moist (Alluvium)	1.5 - 3.0	Ring Sample	107.3	19.7	4 7 11
4	CL		SANDY LEAN CLAY: gray brown, soft, moist	5.0 - 6.5	SPT			0 2 2
8			light brown, very soft, trace caliche	8.5 - 10.0	SPT			0 0 1
10			End of Boring @ 10.0' 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. F-4

PAGE 1 OF 1
JOB NO.: SL-15603-SD
DATE: 02/08/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

CAMARILLO AIRPORT - PCN ANALYSIS
Mead & Hunt Project No. 3168900-155706.01
Camarillo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0 – 1			11.5" PCC over 0.0" AB					
1 – 5	CL		SANDY LEAN CLAY: light brown, medium stiff, moist (Alluvium)	1.5 - 3.0	Ring Sample	106.0	20.1	4, 7, 8
5 – 7			soft	5.0 - 6.5	SPT			1, 2, 2
7 – 10	CL		SANDY LEAN CLAY: light brown to brown, very soft, moist, trace caliche	8.5 - 10.0	SPT			0, 1, 1
10			End of Boring @ 10.0' 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	▽

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	MORE THAN HALF OF MATERIAL IS LARGER THAN #200 SIEVE SIZE	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GP	POORLY GRADED GRAVELS, OR 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 OR 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 SMALLER THAN #200 SIEVE SIZE	ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS OR 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 OR 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 (SATURATED)

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 FINE	SAND MEDIUM	SAND COARSE	GRAVEL FINE	GRAVEL COARSE	COBBLES	BOULDERS

TYPICAL BEDROCK 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 BEDROCK WEATHERING

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
FRESH	NO DISCOLORATION, NOT OXIDIZED
SLIGHTLY WEATHERED	DISCOLORATION OR OXIDATION IS LIMITED TO SURFACE OF, OR SHORT DISTANCE FROM, FRACTURES: SOME 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 Legend121714.dwg

APPENDIX B

Laboratory Test Results

Camarillo Airport
PCN Analysis

SL-15603-SD

BULK DENSITY TEST RESULTS

ASTM D 2937-10 (modified for ring liners)

May 9, 2017

BORING NO.	DEPTH feet	MOISTURE CONTENT, %	WET DENSITY, pcf	DRY DENSITY, pcf
R1	2.5 - 3.0	8.3	133.9	123.7
R2	2.5 - 3.0	10.6	134.4	121.5
R3	2.5 - 3.0	12.9	112.2	99.4
R4	2.5 - 3.0	8.2	125.4	115.9
R5	2.5 - 3.0	23.0	122.0	99.3
R6	3.0 - 3.5	21.4	132.0	108.8
A1	2.5 - 3.0	18.9	125.5	105.6
B1	2.5 - 3.0	16.4	141.9	122.0
B2	2.5 - 3.0	21.4	128.6	106.0
C1	2.5 - 3.0	19.8	125.1	104.4
C2	2.5 - 3.0	19.8	115.3	96.3
D1	2.5 - 3.0	16.9	126.2	107.9
D2	2.5 - 3.0	16.2	122.4	105.3
E1	2.5 - 3.0	10.3	132.1	119.8
F1	2.5 - 3.0	20.5	133.2	110.5
F2	2.5 - 3.0	19.1	129.4	108.7
F3	2.5 - 3.0	19.7	128.4	107.3
F4	2.5 - 3.0	20.1	127.4	106.0

Camarillo Airport
PCN Analysis

SL-15603-SD

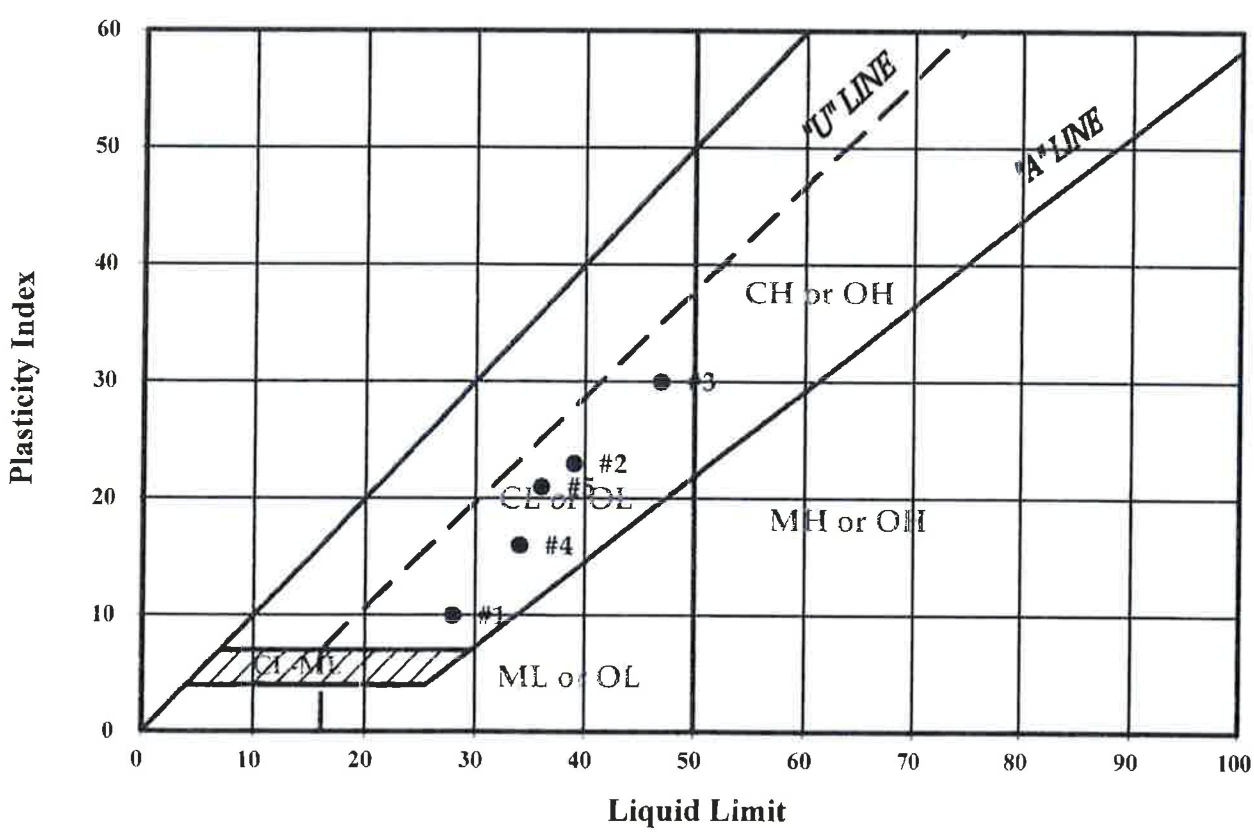
PLASTICITY INDEX

ASTM D 4318-10

May 9, 2017

Test No.:	1	2	3	4	5
Boring No.:	R1	R3	R6	A1	B1
Sample Depth:	2.0 - 4.0'	4.0 - 6.0'	2.0 - 5.0'	2.0 - 5.0'	2.5 - 5.0'
Liquid Limit:	28	39	47	34	36
Plastic Limit:	18	16	17	18	15
Plasticity Index:	10	23	30	16	21

Plasticity Chart



Camarillo Airport
PCN Analysis

SL-15603-SD

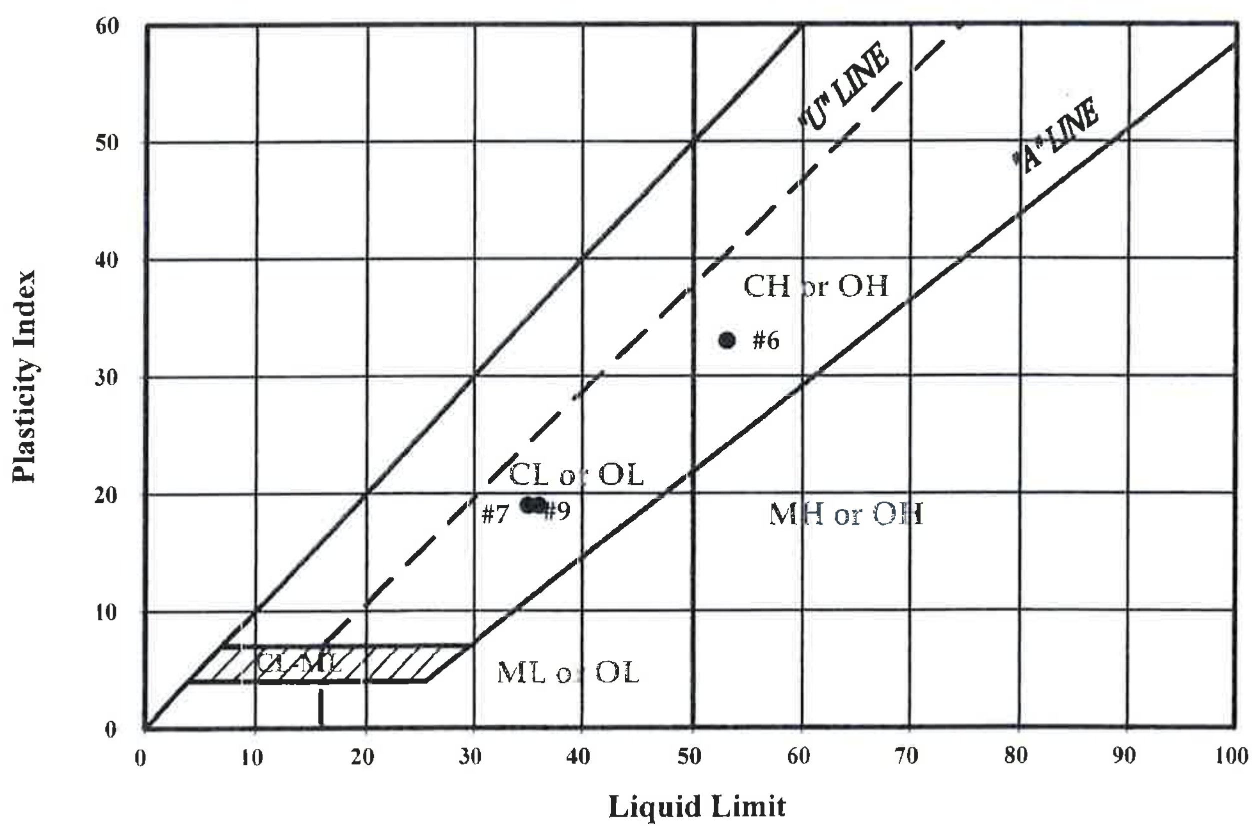
PLASTICITY INDEX

ASTM D 4318-10

May 9, 2017

Test No.:	6	7	8	9	
Boring No.:	C1	D1	E1	F2	
Sample Depth:	2.0 - 5.0'	2.0 - 5.0'	2.0 - 4.0'	2.0 - 4.0'	
Liquid Limit:	53	35	NL	36	
Plastic Limit:	20	16	NP	17	
Plasticity Index:	33	19	NP	19	

Plasticity Chart



Camarillo Airport
PCN Analysis

SL-15603-SD

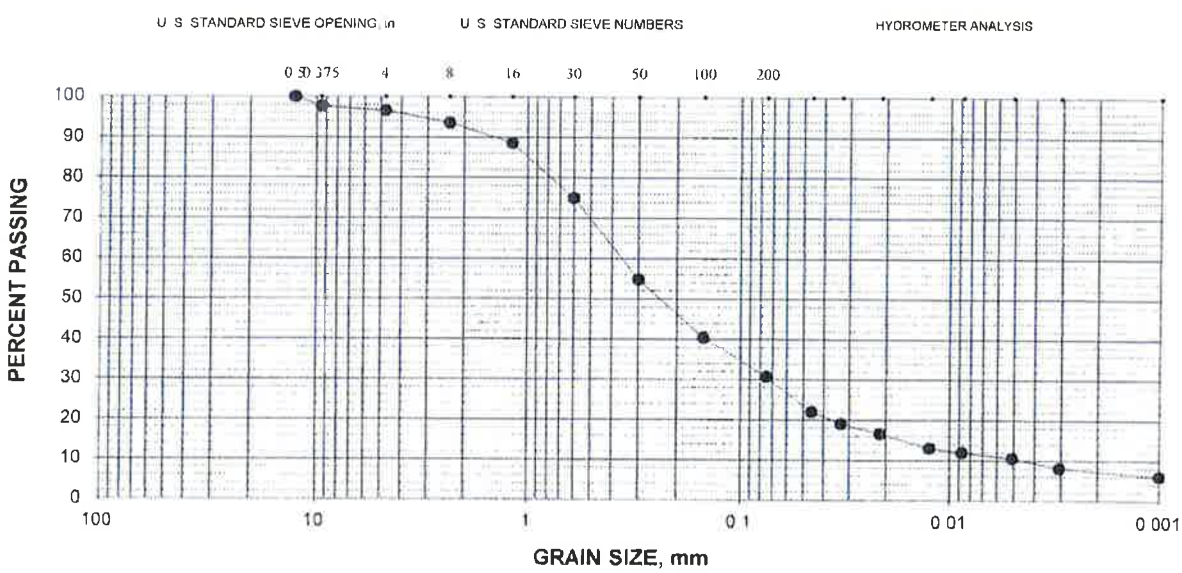
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07

Boring #R1 @ 2.0 - 4.0'
Clayey Sand (SC)
LL = 28; PL = 18; PI = 10

May 9, 2017
Specific Gravity = 2.65 (assumed)
Gravel = 3%; Sand = 66%; Silt = 20%; Clay = 11%

Sieve size	% Retained	% Passing
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	2	98
#4 (4.75-mm)	3	97
#8 (2.36-mm)	6	94
#16 (1.18-mm)	11	89
#30 (600-µm)	25	75
#50 (300-µm)	45	55
#100 (150-µm)	60	40
#200 (75-µm)	69	31
Hydrometer Analysis		
46-µm		22
33-µm		19
21-µm		17
12-µm		13
9-µm		12
5.1-µm		11
3.1-µm		8
Colloids		6



Camarillo Airport
PCN Analysis

SL-15603-SD

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

PROCEDURE USED: C

PREPARATION METHOD: Dry

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.65 (assumed)

May 9, 2017

Boring #R1 @ 2.0 - 4.0'

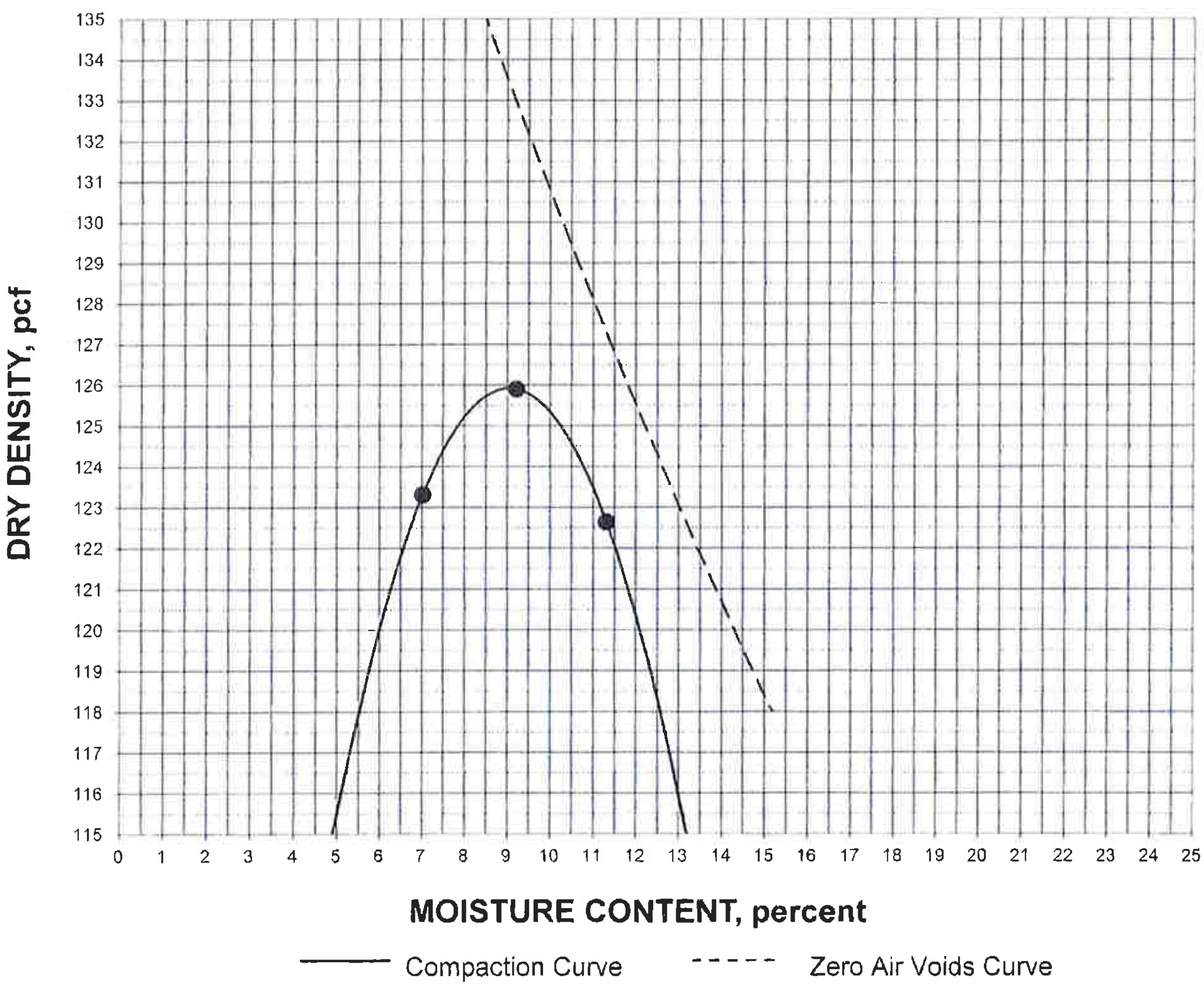
Light Brown Clayey Sand (SC)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 125.9 pcf

OPTIMUM MOISTURE: 9.0%



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #R1 @ 2.0 - 4.0'
Light Brown Clayey Sand (SC)

May 9, 2017

10 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	105.2	111.0	115.2
Moisture content, %, before soak	6.0	9.0	12.0
Moisture content, %, after soak, avg.	21.8	14.9	17.6
Moisture content, %, after soak, top 1"	17.6	18.0	14.0
Expansion, %, 96 hour soak	0.4	0.7	0.0
Bearing Ratio, 0.100" penetration	3.9	6.6	5.4

25 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	111.1	120.4	119.5
Moisture content, %, before soak	6.0	9.0	12.0
Moisture content, %, after soak, avg.	16.7	13.8	-202.5
Moisture content, %, after soak, top 1"	18.0	16.3	13.8
Expansion, %, 96 hour soak	1.1	0.5	0.0
Bearing Ratio, 0.100" penetration	3.1	20.6	4.8

56 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	120.3	126.4	119.9
Moisture content, %, before soak	6.0	9.0	12.0
Moisture content, %, after soak, avg.	14.1	11.9	12.5
Moisture content, %, after soak, top 1"	14.8	11.8	14.2
Expansion, %, 96 hour soak	0.9	0.3	0.0
Bearing Ratio, 0.100" penetration	17.9	29.9	3.4

Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

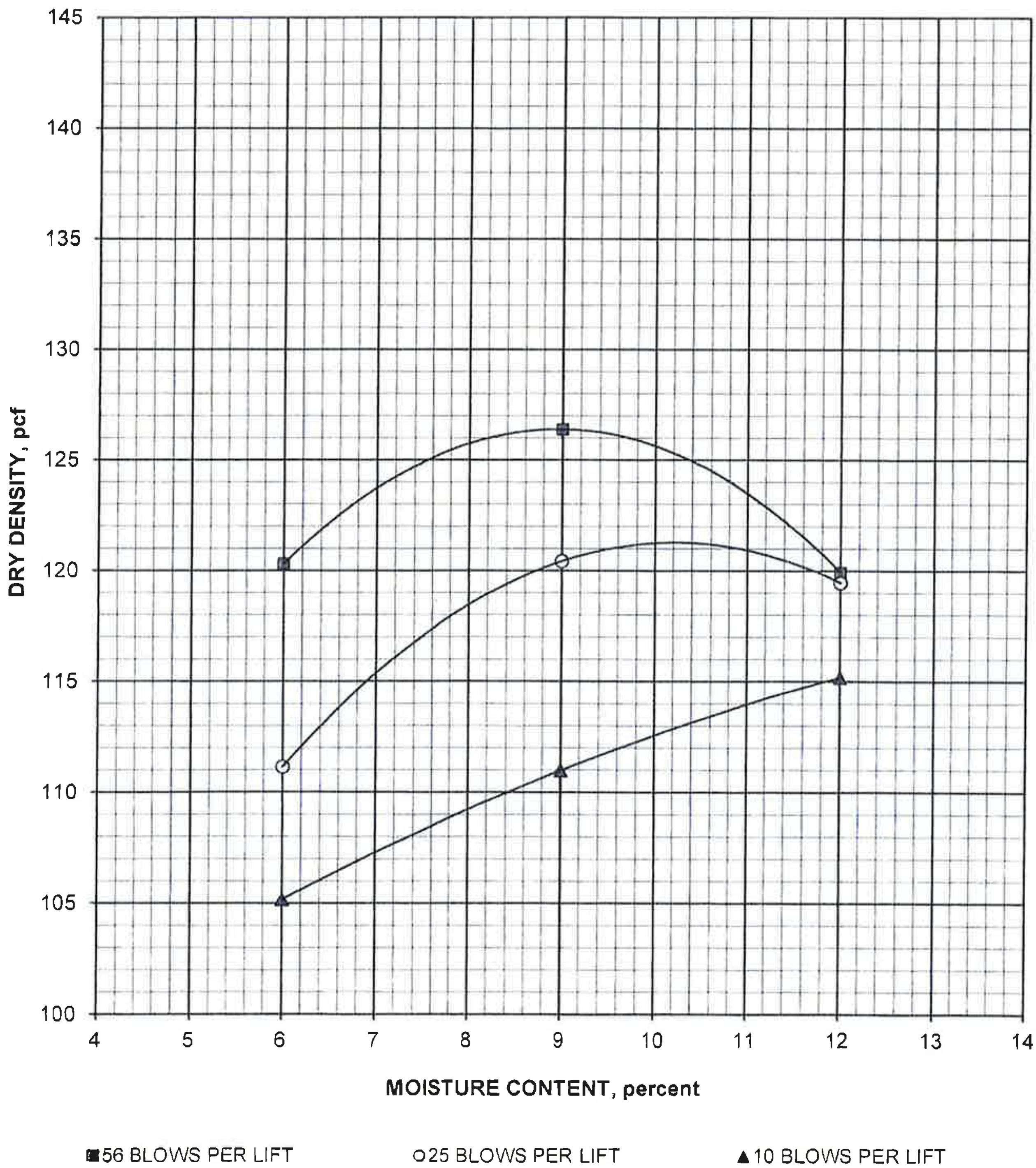
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #R1 @ 2.0 - 4.0'

May 9, 2017

Light Brown Clayey Sand (SC)

DRY DENSITY vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

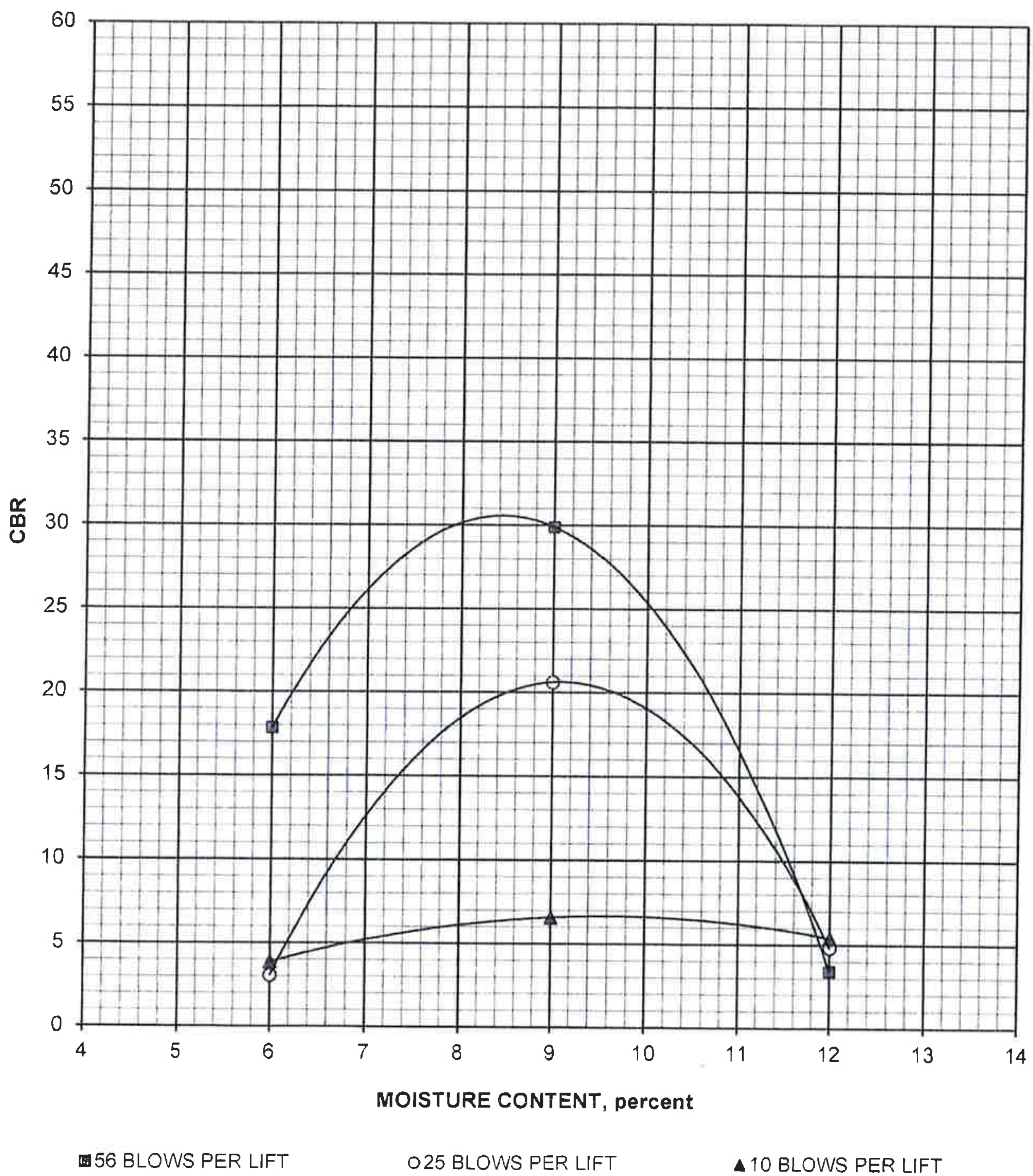
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #R1 @ 2.0 - 4.0'

May 9, 2017

Light Brown Clayey Sand (SC)

CBR vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

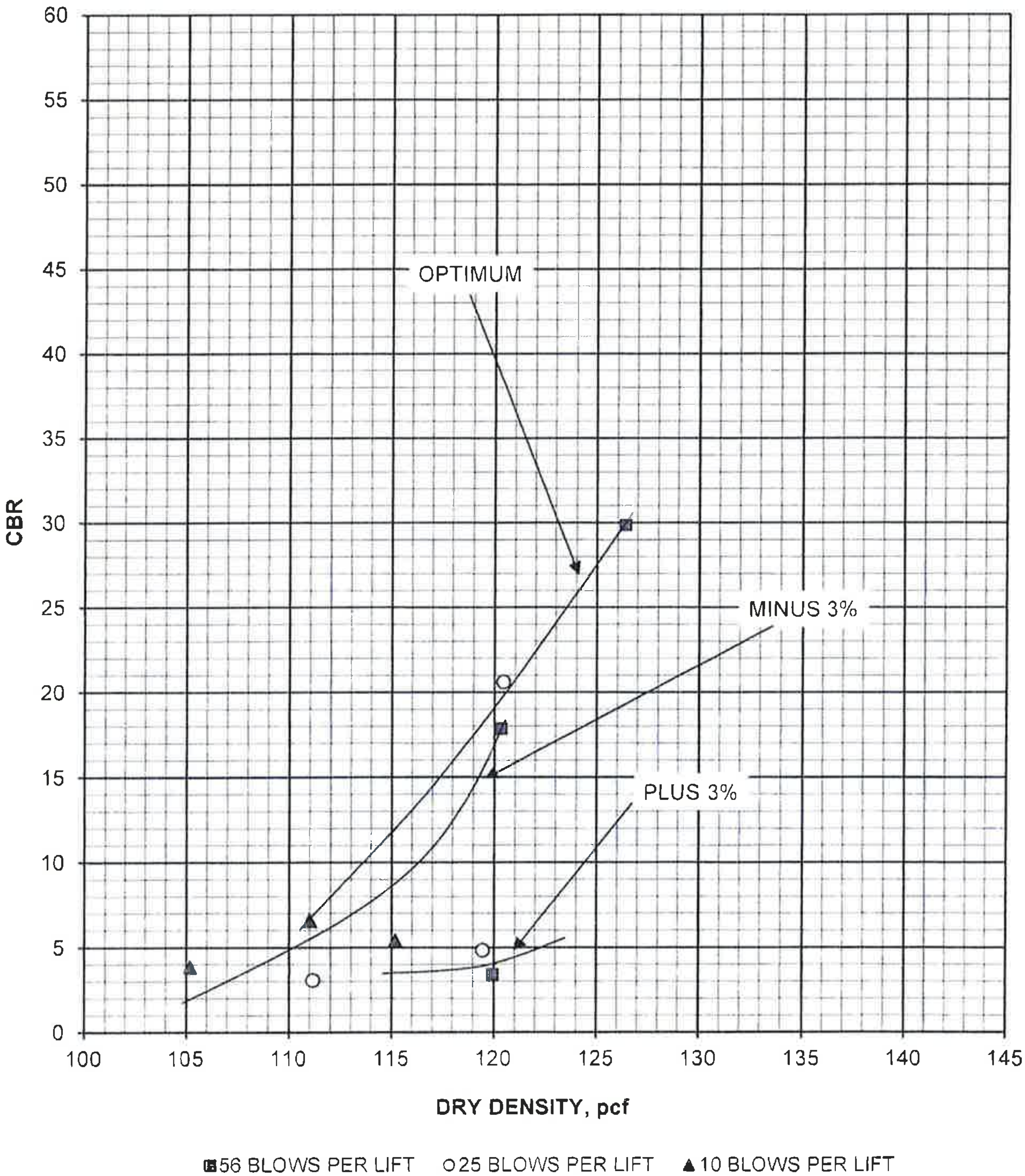
Boring #R1 @ 2.0 - 4.0'

May 9, 2017

Light Brown Clayey Sand (SC)

DRY DENSITY vs. CBR

Arranged According to Moisture Content



Camarillo Airport
PCN Analysis

SL-15603-SD

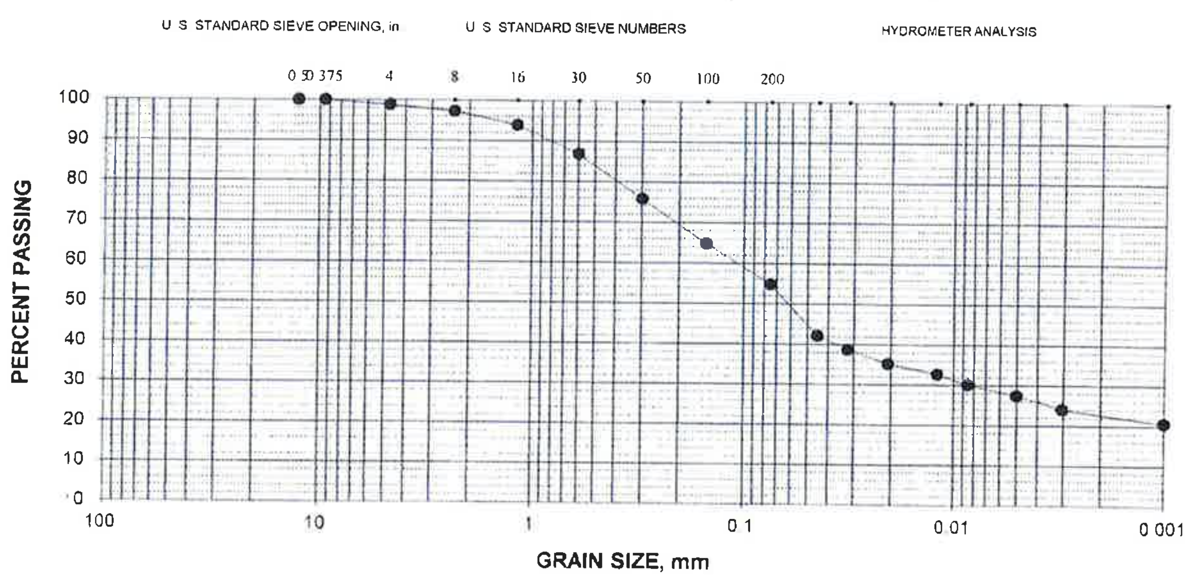
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07

Boring #R3 @ 4.0 - 6.0'
Sandy Lean Clay (CL)
LL = 39; PL = 16; PI = 23

May 9, 2017
Specific Gravity = 2.70 (assumed)
Gravel = 1%; Sand = 44%; Silt = 27%; Clay = 28%

Sieve size	% Retained	% Passing
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	1	99
#8 (2.36-mm)	3	97
#16 (1.18-mm)	6	94
#30 (600-µm)	13	87
#50 (300-µm)	24	76
#100 (150-µm)	35	65
#200 (75-µm)	45	55
Hydrometer Analysis		
45-µm		42
32-µm		39
21-µm		35
12-µm		33
9-µm		30
5.0-µm		28
3.1-µm		24
Colloids		21



Camarillo Airport
PCN Analysis

SL-15603-SD

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

PROCEDURE USED: C

PREPARATION METHOD: Dry

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.70 (assumed)

May 9, 2017

Boring #R3 @ 4.0 - 6.0'

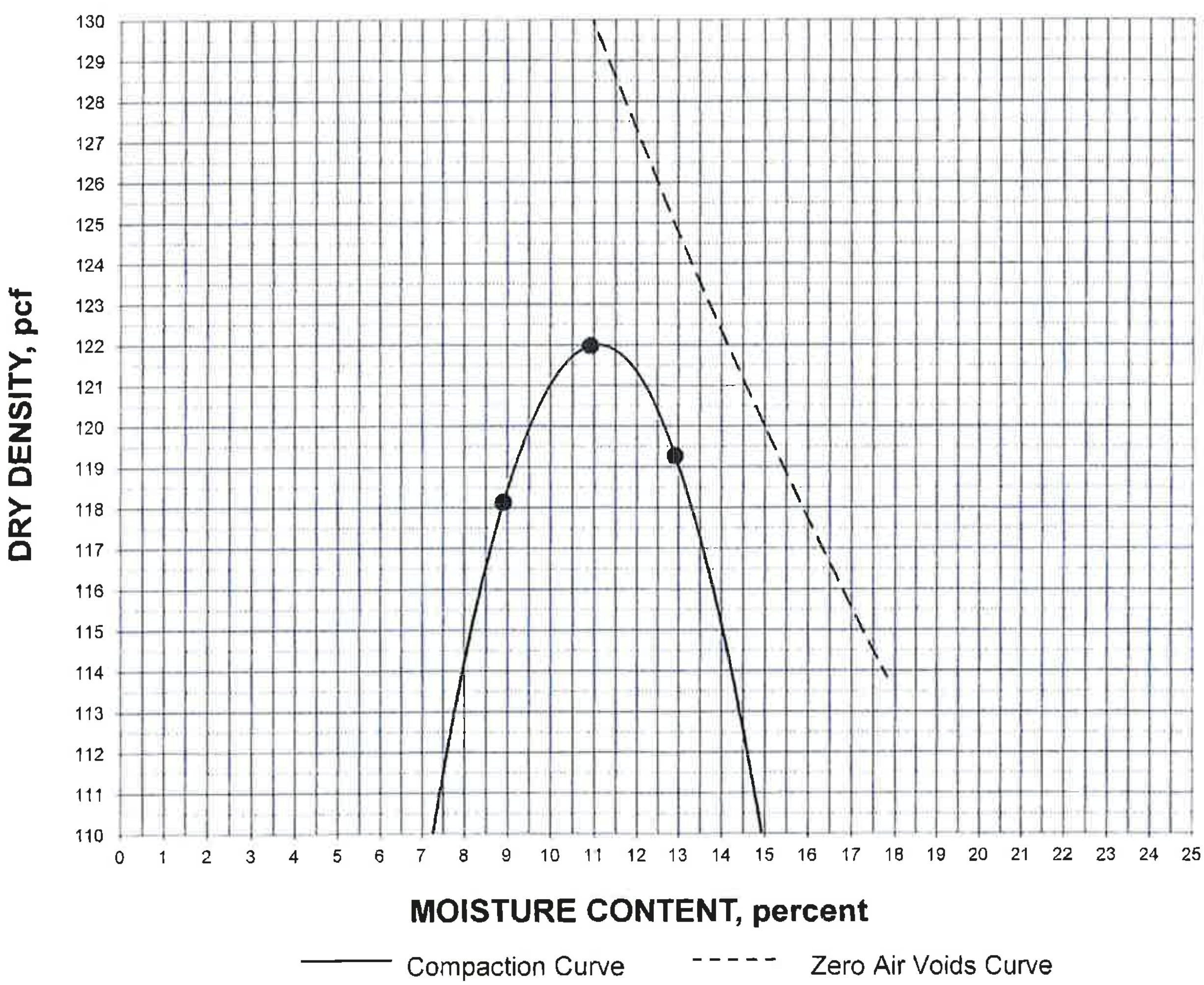
Gray Brown Sandy Lean Clay (CL)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 122.0 pcf

OPTIMUM MOISTURE: 11.1%



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #R3 @ 4.0 - 6.0'
Gray Brown Sandy Lean Clay (CL)

May 9, 2017

10 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	97.8	104.8	102.0
Moisture content, %, before soak	8.1	11.1	14.1
Moisture content, %, after soak, avg.	24.6	21.1	27.4
Moisture content, %, after soak, top 1"	27.8	25.8	21.4
Expansion, %, 96 hour soak	0.9	2.4	6.5
Bearing Ratio, 0.100" penetration	1.4	2.3	3.3

25 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	112.2	117.4	117.1
Moisture content, %, before soak	8.1	11.1	14.1
Moisture content, %, after soak, avg.	20.1	15.6	15.6
Moisture content, %, after soak, top 1"	24.3	19.2	16.7
Expansion, %, 96 hour soak	2.6	1.8	1.5
Bearing Ratio, 0.100" penetration	2.6	5.2	7.3

56 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	116.5	123.3	119.0
Moisture content, %, before soak	8.1	11.1	14.1
Moisture content, %, after soak, avg.	17.6	13.2	15.6
Moisture content, %, after soak, top 1"	23.5	17.6	16.5
Expansion, %, 96 hour soak	2.0	1.5	1.1
Bearing Ratio, 0.100" penetration	3.4	11.9	12.7

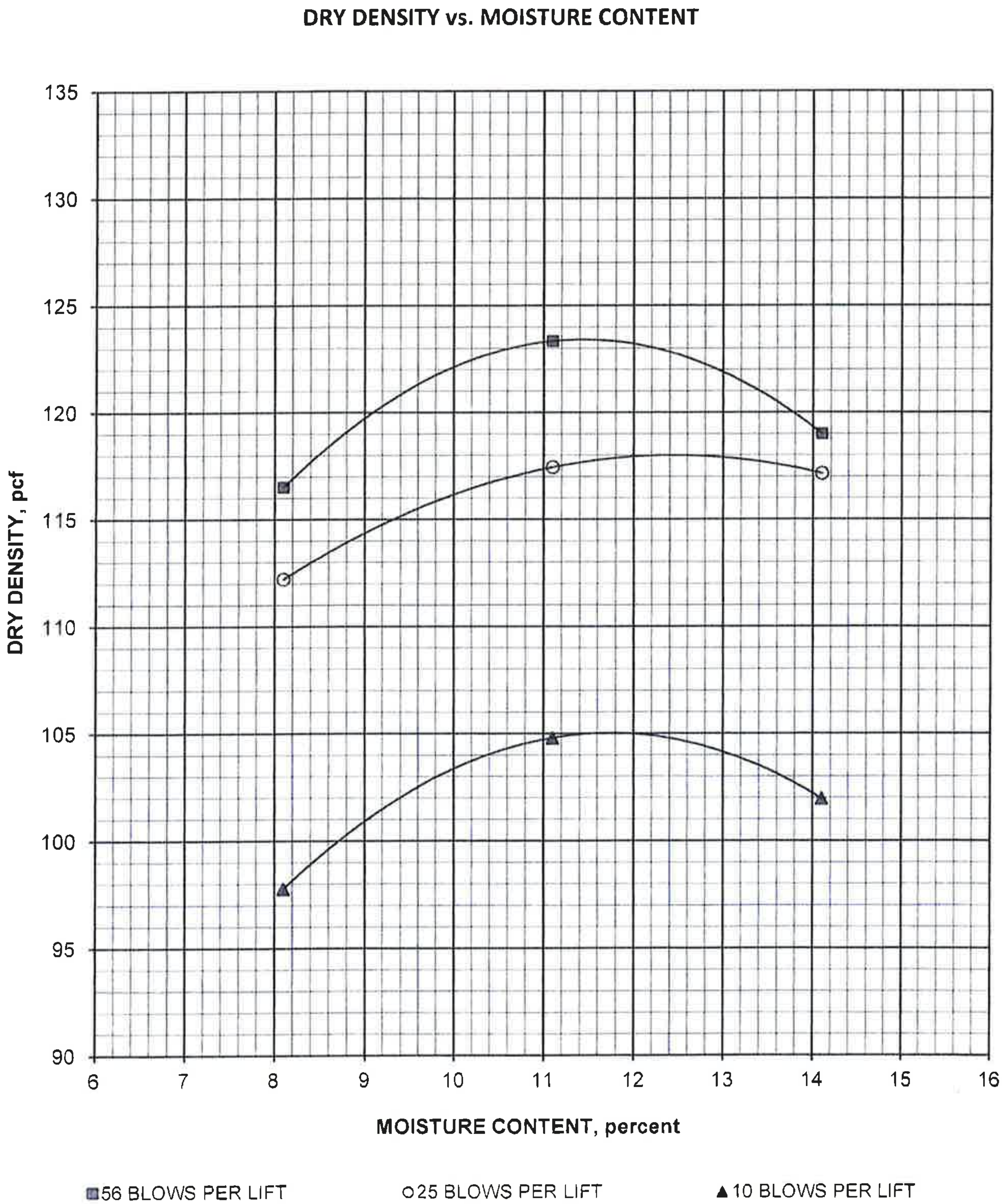
CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #R3 @ 4.0 - 6.0'

May 9, 2017

Gray Brown Sandy Lean Clay (CL)



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

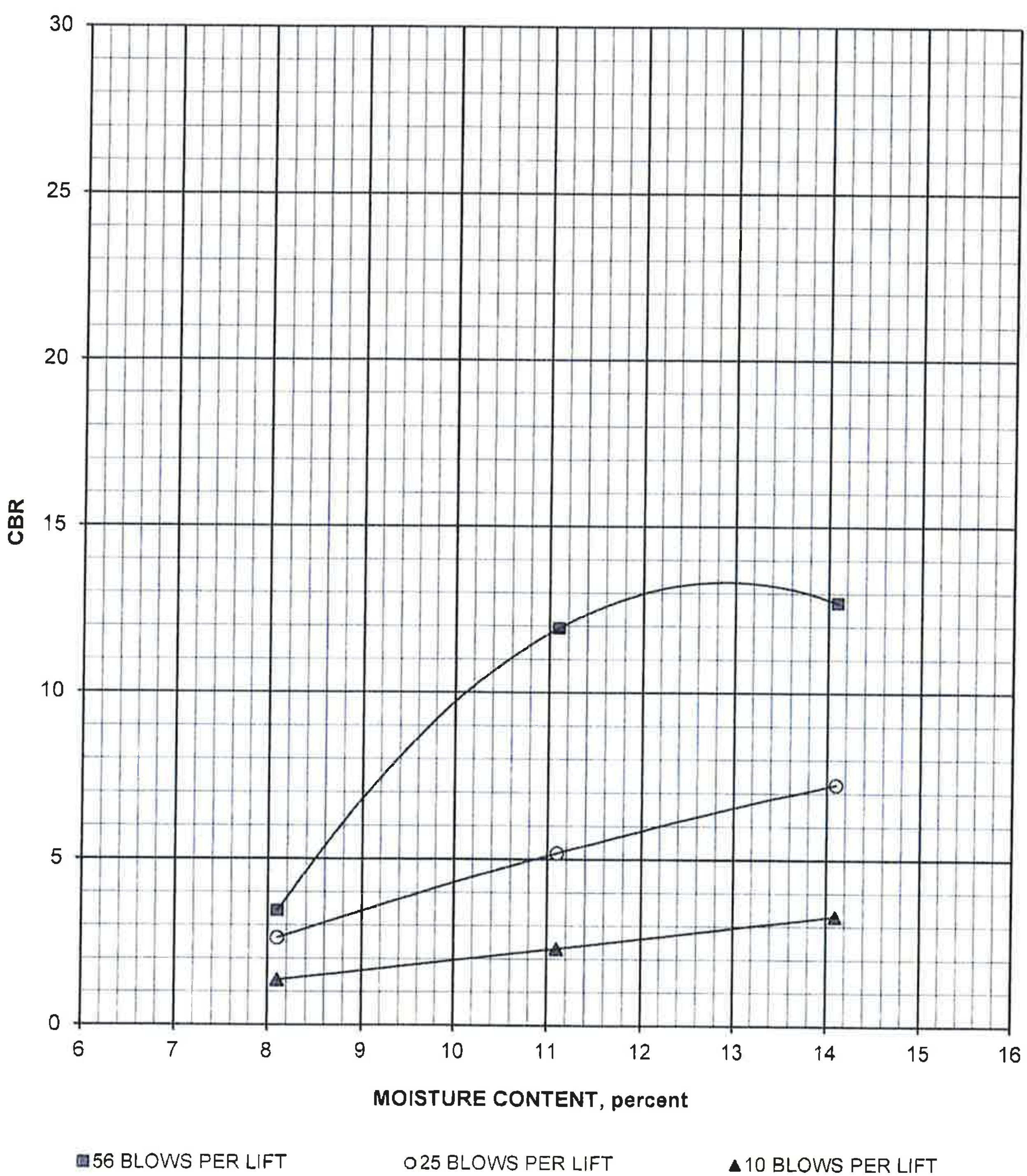
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #R3 @ 4.0 - 6.0'

May 9, 2017

Gray Brown Sandy Lean Clay (CL)

CBR vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

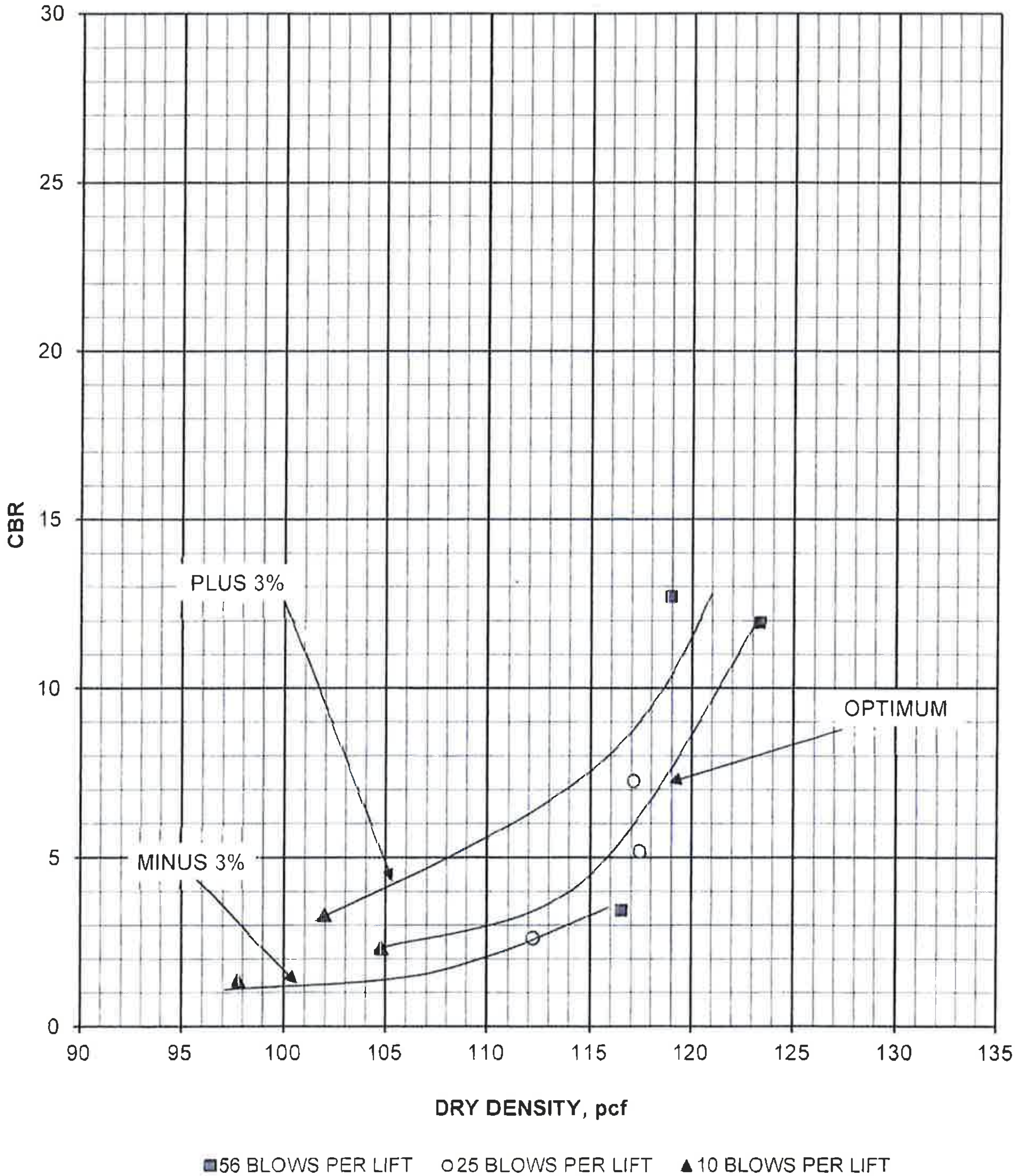
Boring #R3 @ 4.0 - 6.0'

May 9, 2017

Gray Brown Sandy Lean Clay (CL)

DRY DENSITY vs. CBR

Arranged According to Moisture Content



Camarillo Airport
PCN Analysis

SL-15603-SD

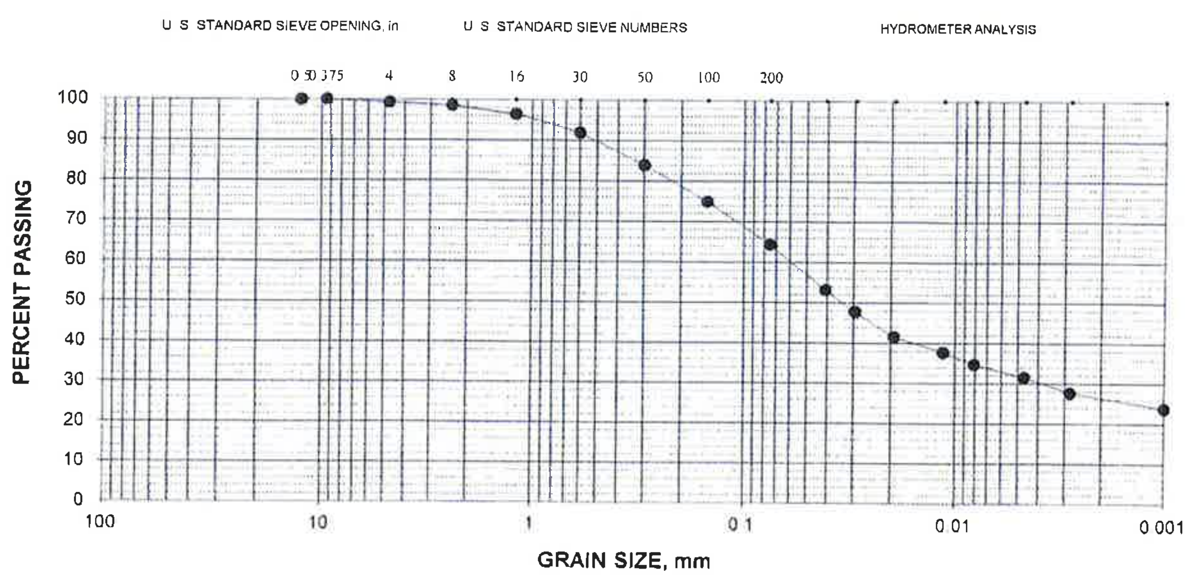
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07

Boring #R6 @ 2.0 - 5.0'
Sandy Lean Clay (CL)
LL = 47; PL = 17; PI = 30

May 9, 2017
Specific Gravity = 2.70 (assumed)
Gravel = 1%; Sand = 35%; Silt = 32%; Clay = 32%

Sieve size	% Retained	% Passing
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	1	99
#8 (2.36-mm)	1	99
#16 (1.18-mm)	4	96
#30 (600-µm)	8	92
#50 (300-µm)	16	84
#100 (150-µm)	25	75
#200 (75-µm)	36	64
Hydrometer Analysis		
41-µm		53
30-µm		48
19-µm		42
11-µm		38
8-µm		35
4.7-µm		32
2.8-µm		28
Colloids		24



Camarillo Airport
PCN Analysis

SL-15603-SD

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

PROCEDURE USED: C

PREPARATION METHOD: Dry

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.70 (assumed)

May 9, 2017

Boring #R6 @ 2.0 - 5.0'

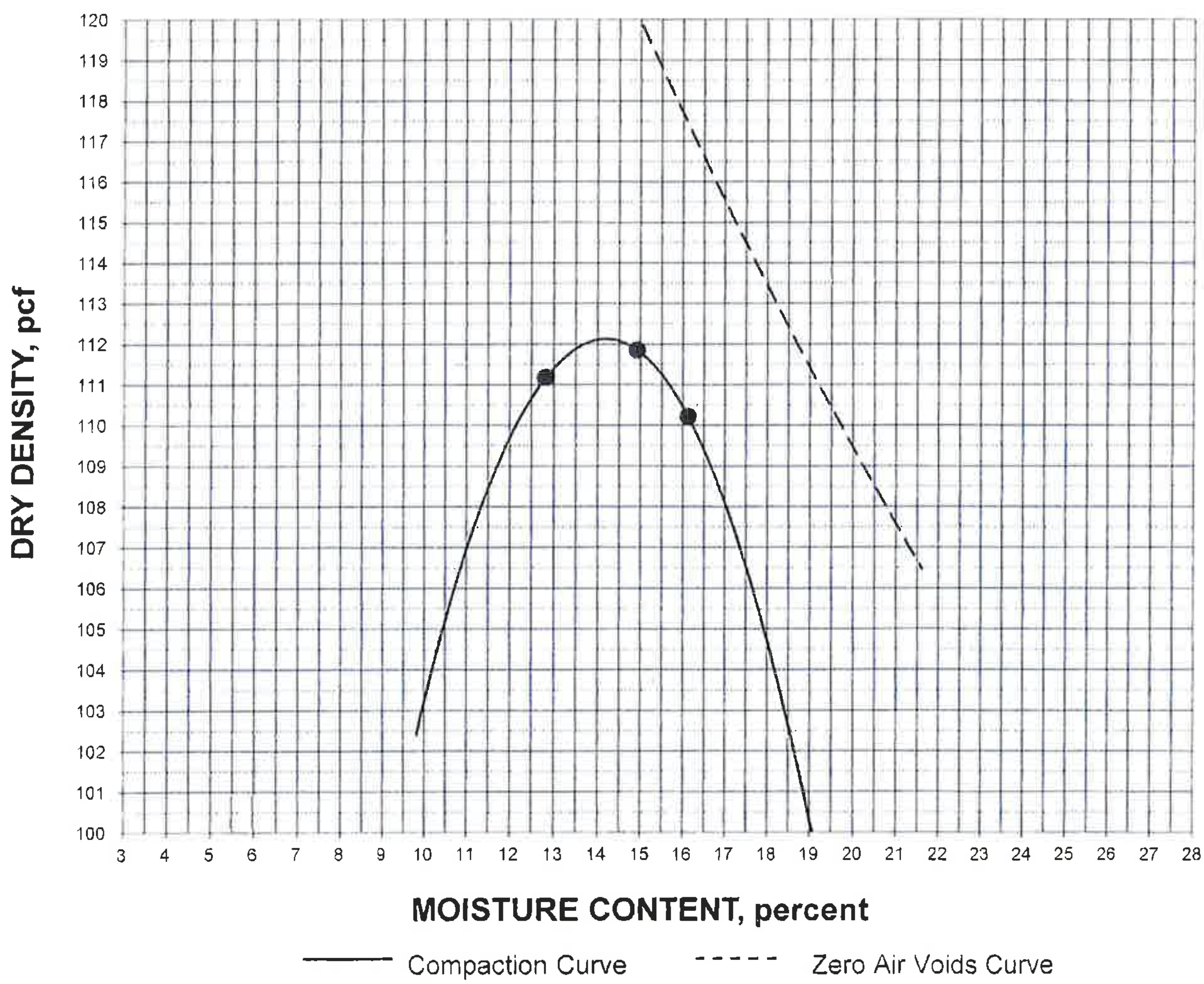
Light Brown Sandy Lean Clay (CL)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 112.1 pcf

OPTIMUM MOISTURE: 14.2%



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #R6 @ 2.0 - 5.0'
Light Brown Sandy Lean Clay (CL)

May 9, 2017

10 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	100.9	104.7	103.4
Moisture content, %, before soak	11.2	14.2	17.2
Moisture content, %, after soak, avg.	25.6	22.6	22.5
Moisture content, %, after soak, top 1"	30.0	28.5	21.7
Expansion, %, 96 hour soak	0.3	0.6	0.7
Bearing Ratio, 0.100" penetration	1.5	1.6	3.2

25 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	108.7	110.8	110.5
Moisture content, %, before soak	11.2	14.2	17.2
Moisture content, %, after soak, avg.	20.0	20.9	18.9
Moisture content, %, after soak, top 1"	27.7	23.5	21.7
Expansion, %, 96 hour soak	2.6	4.4	0.6
Bearing Ratio, 0.100" penetration	1.6	4.4	8.7

56 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	111.6	114.9	112.1
Moisture content, %, before soak	11.2	14.2	17.2
Moisture content, %, after soak, avg.	22.8	18.2	20.8
Moisture content, %, after soak, top 1"	22.6	19.9	18.9
Expansion, %, 96 hour soak	4.2	2.4	0.2
Bearing Ratio, 0.100" penetration	2.7	11.5	9.1

Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

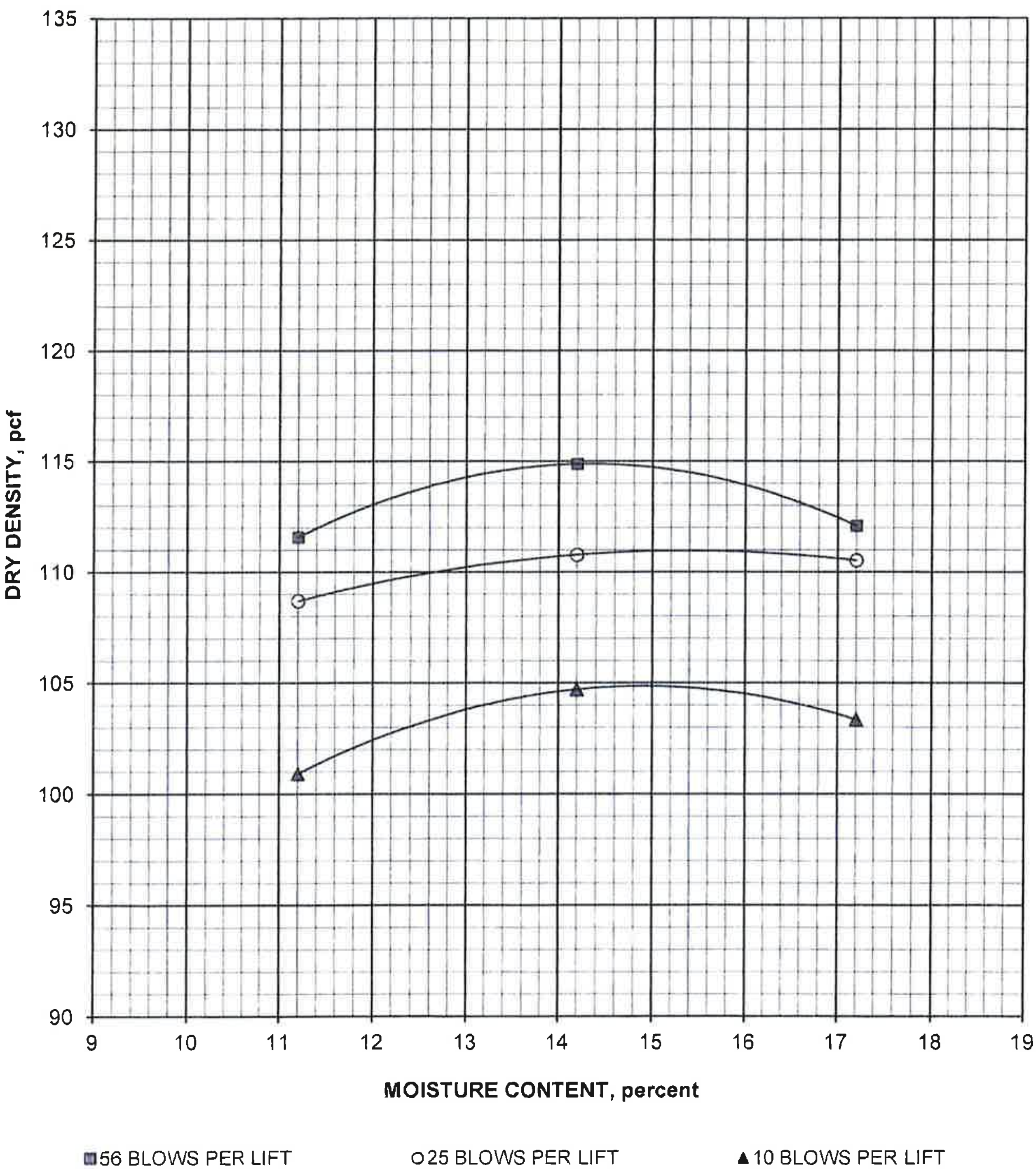
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #R6 @ 2.0 - 5.0'

May 9, 2017

Light Brown Sandy Lean Clay (CL)

DRY DENSITY vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

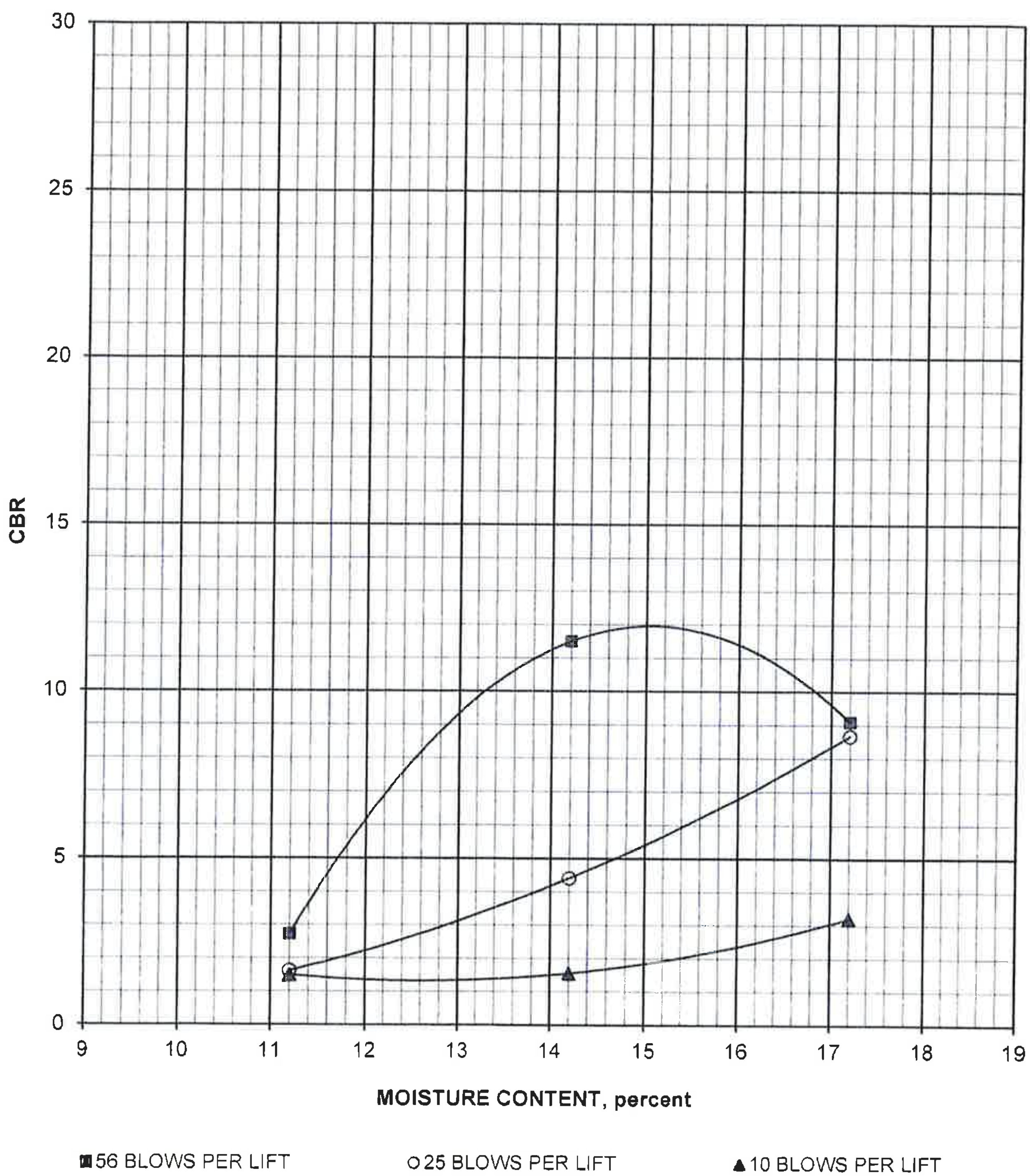
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #R6 @ 2.0 - 5.0'

May 9, 2017

Light Brown Sandy Lean Clay (CL)

CBR vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

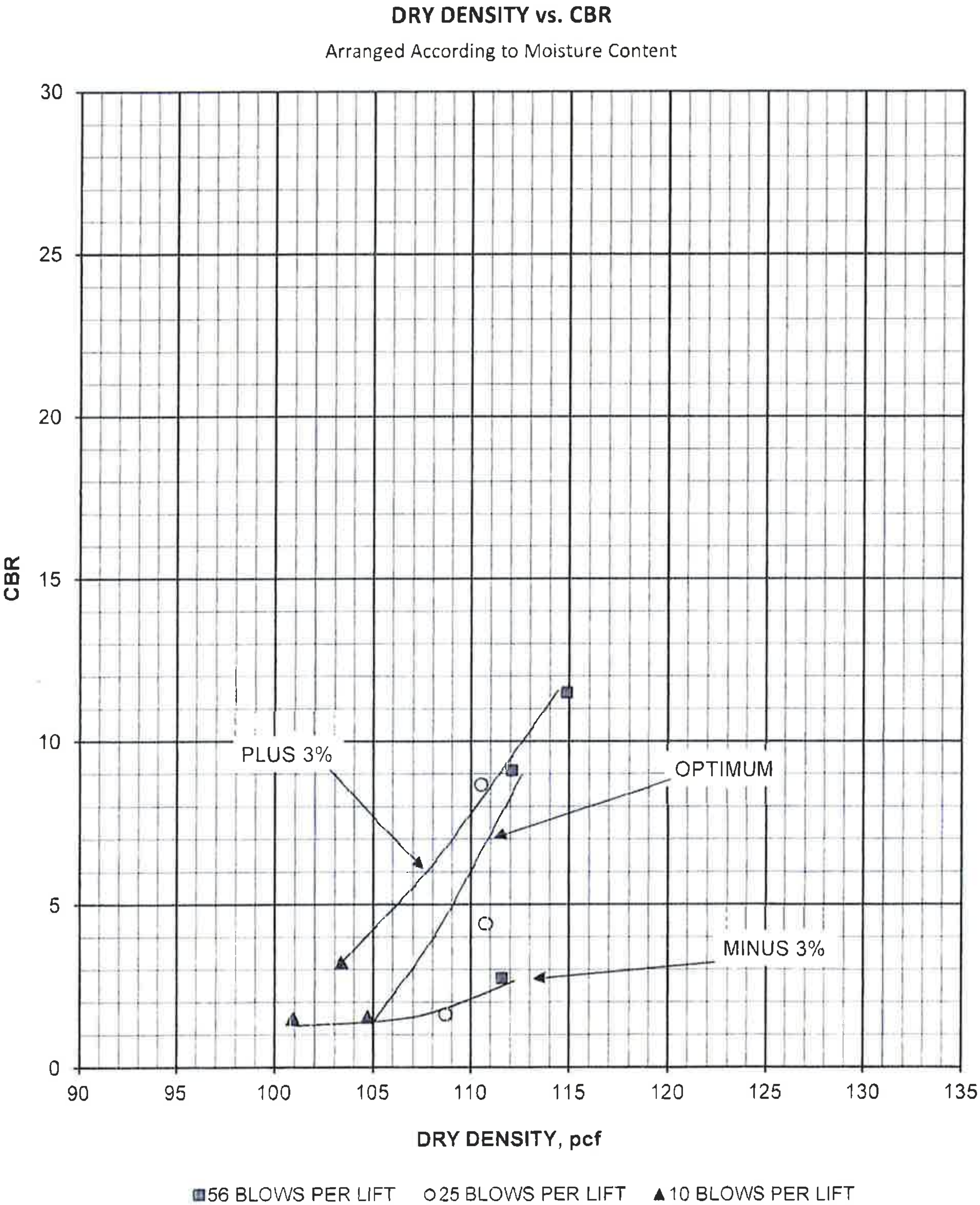
CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #R6 @ 2.0 - 5.0'

May 9, 2017

Light Brown Sandy Lean Clay (CL)



Camarillo Airport
PCN Analysis

SL-15603-SD

PARTICLE SIZE ANALYSIS

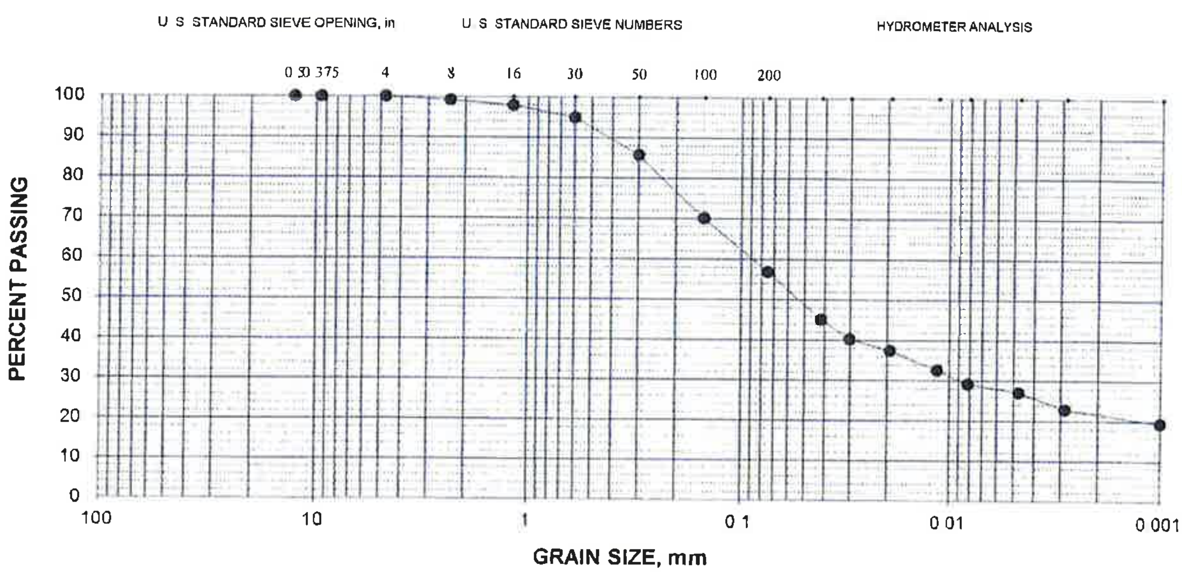
ASTM D 422-63/07

Boring #A1 @ 2.0 - 5.0'
Sandy Lean Clay (CL)
LL = 34; PL = 18; PI = 16

May 9, 2017
Specific Gravity = 2.70 (assumed)
Gravel = 0%; Sand = 43%; Silt = 30%; Clay = 27%

Sieve size	% Retained	% Passing
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	0	100
#8 (2.36-mm)	1	99
#16 (1.18-mm)	2	98
#30 (600-µm)	5	95
#50 (300-µm)	14	86
#100 (150-µm)	30	70
#200 (75-µm)	43	57

Hydrometer Analysis	
42-µm	45
30-µm	40
19-µm	37
11-µm	33
8-µm	29
4.7-µm	27
2.9-µm	23
Colloids	19



Camarillo Airport
PCN Analysis

SL-15603-SD

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

PROCEDURE USED: C
PREPARATION METHOD: Moist
RAMMER TYPE: Mechanical
SPECIFIC GRAVITY: 2.70 (assumed)

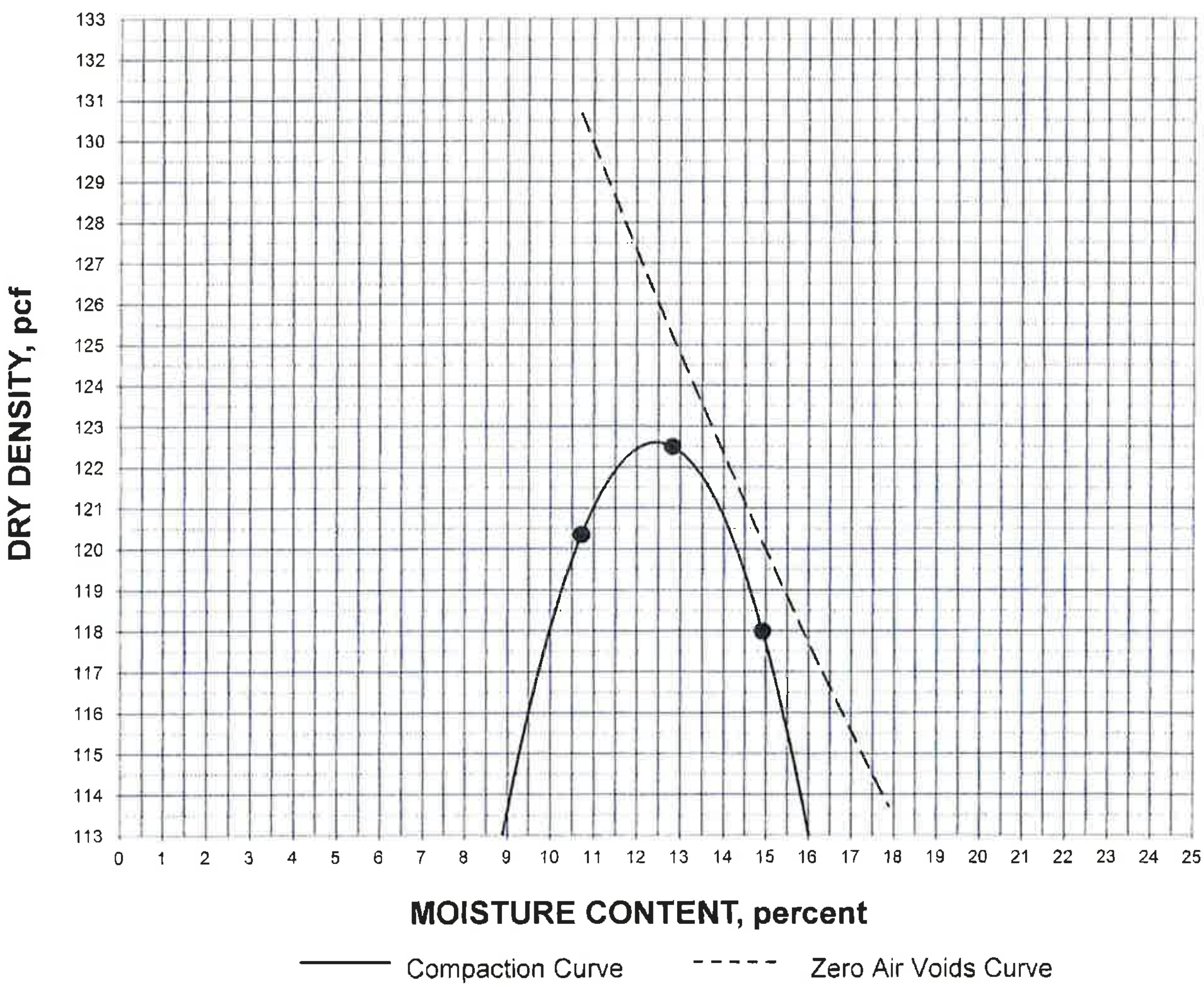
May 9, 2017
Boring #A1 @ 2.0 - 5.0'
Brown Sandy Lean Clay (CL)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 122.6 pcf

OPTIMUM MOISTURE: 12.4%



CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #A1 @ 2.0 - 5.0'
Brown Sandy Lean Clay (CL)

May 9, 2017

10 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	103.0	108.8	112.3
Moisture content, %, before soak	9.4	12.4	15.4
Moisture content, %, after soak, avg.	22.5	20.6	17.9
Moisture content, %, after soak, top 1"	23.7	22.7	19.2
Expansion, %, 96 hour soak	1.9	2.4	0.2
Bearing Ratio, 0.100" penetration	1.8	5.1	4.0

25 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	111.4	119.3	116.2
Moisture content, %, before soak	9.4	12.4	15.4
Moisture content, %, after soak, avg.	21.7	14.6	16.7
Moisture content, %, after soak, top 1"	20.5	18.6	17.1
Expansion, %, 96 hour soak	5.6	2.5	0.6
Bearing Ratio, 0.100" penetration	2.9	11.4	8.2

56 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	119.3	123.1	119.2
Moisture content, %, before soak	9.4	12.4	15.4
Moisture content, %, after soak, avg.	16.5	13.6	14.0
Moisture content, %, after soak, top 1"	20.5	15.6	16.2
Expansion, %, 96 hour soak	6.1	1.2	0.3
Bearing Ratio, 0.100" penetration	6.0	16.0	9.8

Camarillo Airport
PCN Analysis

SL-15603-SD

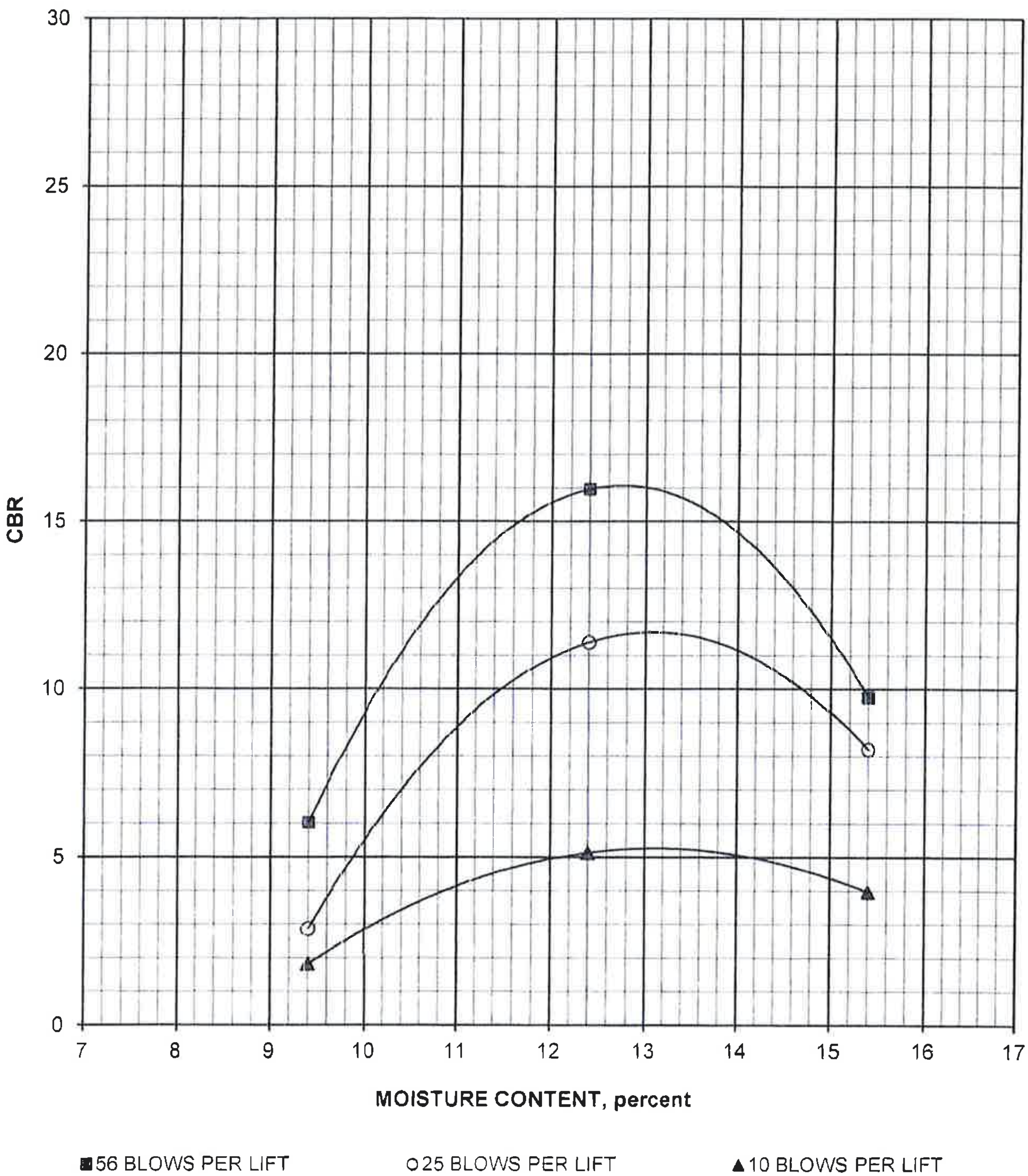
CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #A1 @ 2.0 - 5.0'
Brown Sandy Lean Clay (CL)

May 9, 2017

CBR vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

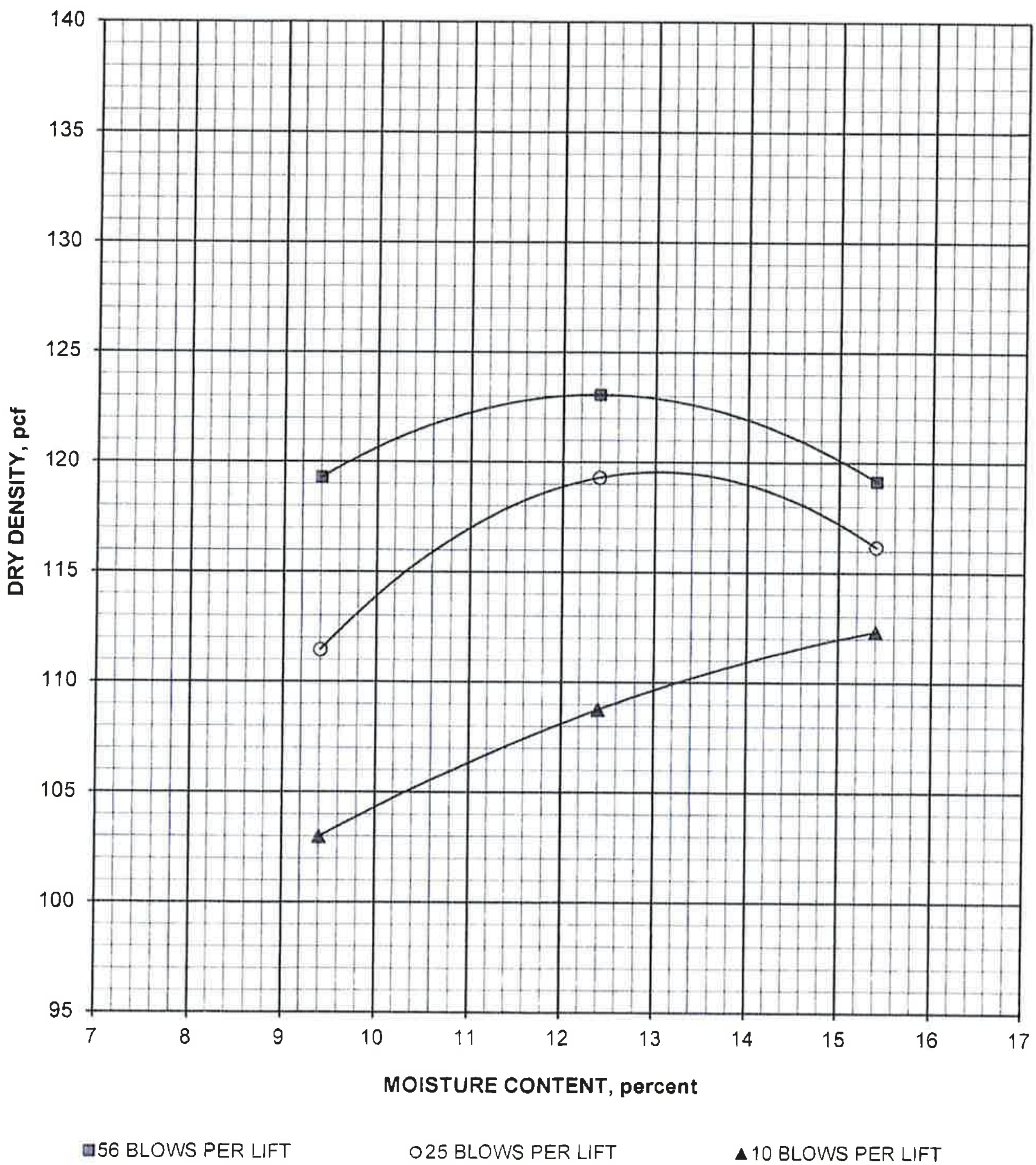
CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #A1 @ 2.0 - 5.0'
Brown Sandy Lean Clay (CL)

May 9, 2017

DRY DENSITY vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

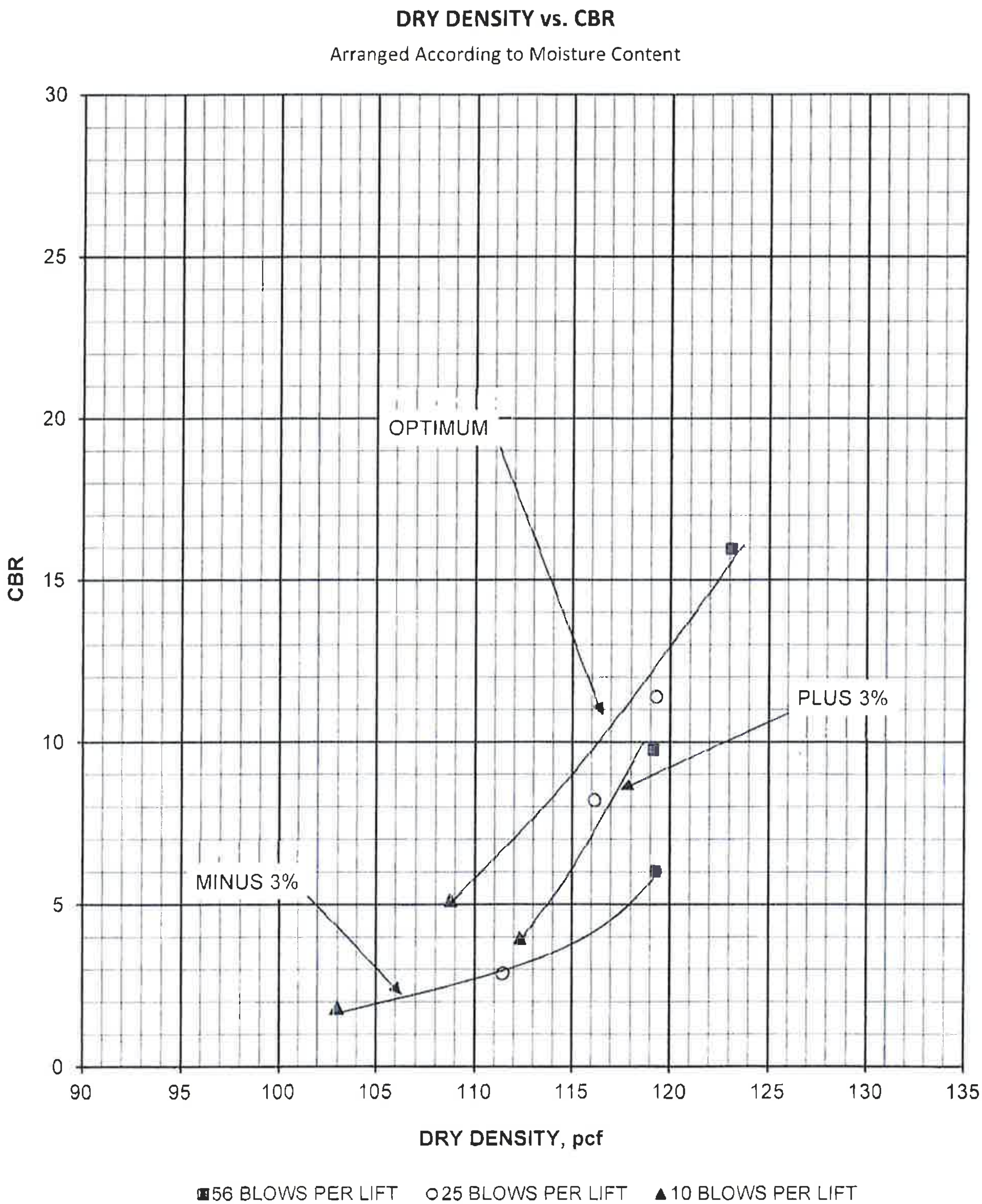
CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #A1 @ 2.0 - 5.0'

May 9, 2017

Brown Sandy Lean Clay (CL)



Camarillo Airport
PCN Analysis

SL-15603-SD

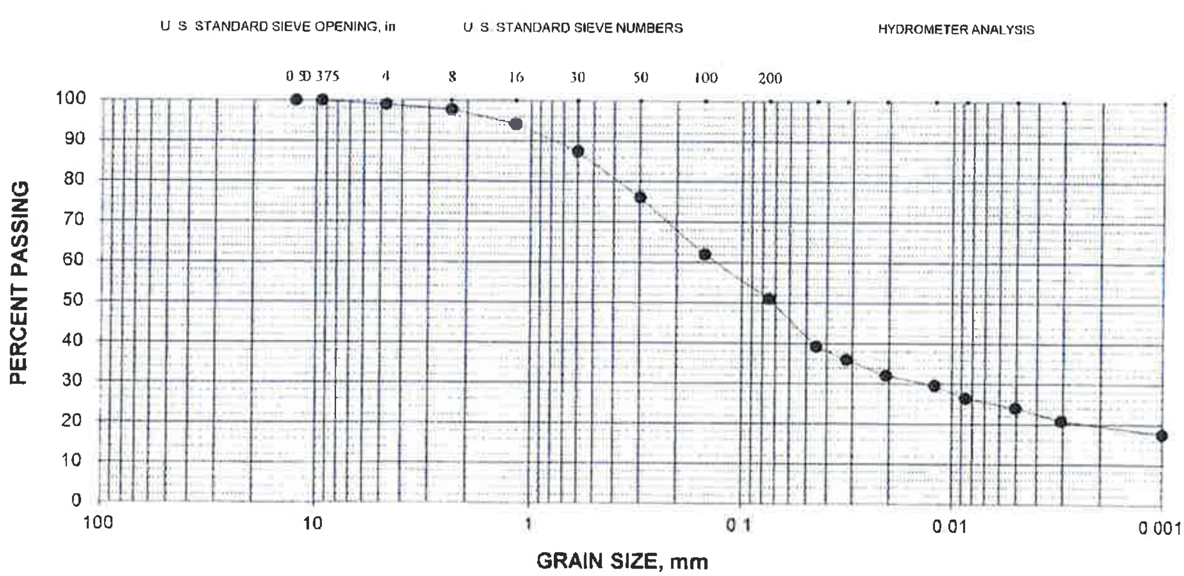
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07

Boring #B1 @ 2.5 - 5.0'
Sandy Lean Clay (CL)
LL = 36; PL = 15; PI = 21

May 9, 2017
Specific Gravity = 2.70 (assumed)
Gravel = 1%; Sand = 48%; Silt = 27%; Clay = 24%

Sieve size	% Retained	% Passing
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	1	99
#8 (2.36-mm)	2	98
#16 (1.18-mm)	6	94
#30 (600-µm)	12	88
#50 (300-µm)	24	76
#100 (150-µm)	38	62
#200 (75-µm)	49	51
Hydrometer Analysis		
45-µm		39
32-µm		36
21-µm		32
12-µm		30
9-µm		26
5.0-µm		24
3.1-µm		21
Colloids		18



Camarillo Airport
PCN Analysis

SL-15603-SD

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

PROCEDURE USED: C

PREPARATION METHOD: Dry

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.70 (assumed)

May 9, 2017

Boring #B1 @ 2.5 - 5.0'

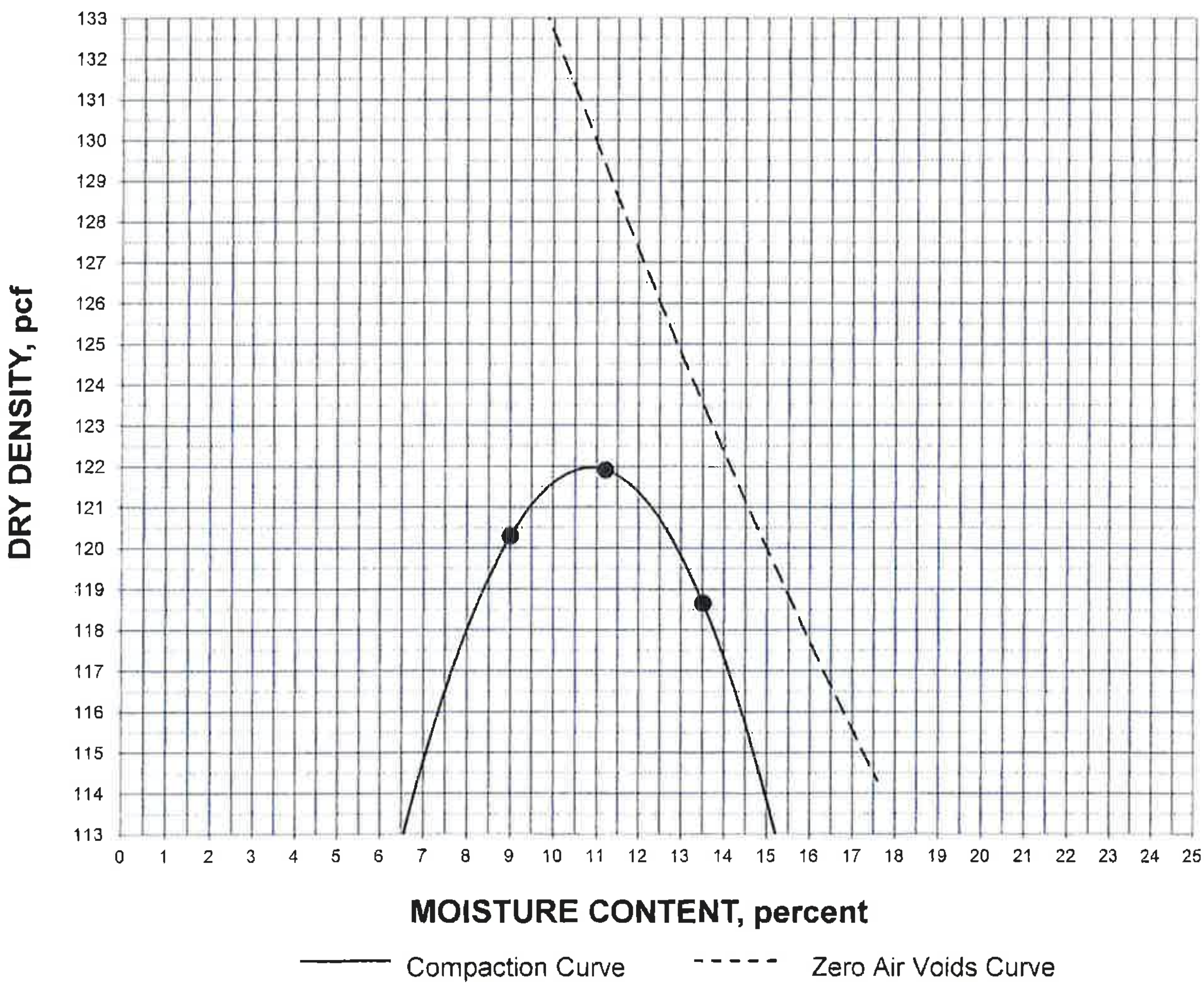
Gray Brown Sandy Lean Clay (CL)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 122.0 pcf

OPTIMUM MOISTURE: 10.9%



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #B1 @ 2.5 - 5.0'
Gray Brown Sandy Lean Clay (CL)

May 9, 2017

10 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	99.3	103.6	111.6
Moisture content, %, before soak	7.9	10.9	13.9
Moisture content, %, after soak, avg.	24.6	22.1	17.2
Moisture content, %, after soak, top 1"	26.6	25.4	17.8
Expansion, %, 96 hour soak	4.6	3.0	2.4
Bearing Ratio, 0.100" penetration	1.6	1.7	3.2

25 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	107.2	114.4	116.9
Moisture content, %, before soak	7.9	10.9	13.9
Moisture content, %, after soak, avg.	20.1	18.3	15.3
Moisture content, %, after soak, top 1"	25.5	22.8	18.2
Expansion, %, 96 hour soak	2.9	1.0	0.2
Bearing Ratio, 0.100" penetration	2.2	3.5	4.5

56 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	113.0	123.8	119.1
Moisture content, %, before soak	7.9	10.9	13.9
Moisture content, %, after soak, avg.	20.0	15.2	15.0
Moisture content, %, after soak, top 1"	24.8	18.2	21.8
Expansion, %, 96 hour soak	2.8	1.5	0.2
Bearing Ratio, 0.100" penetration	2.4	10.9	9.4

Camarillo Airport
PCN Analysis

SL-15603-SD

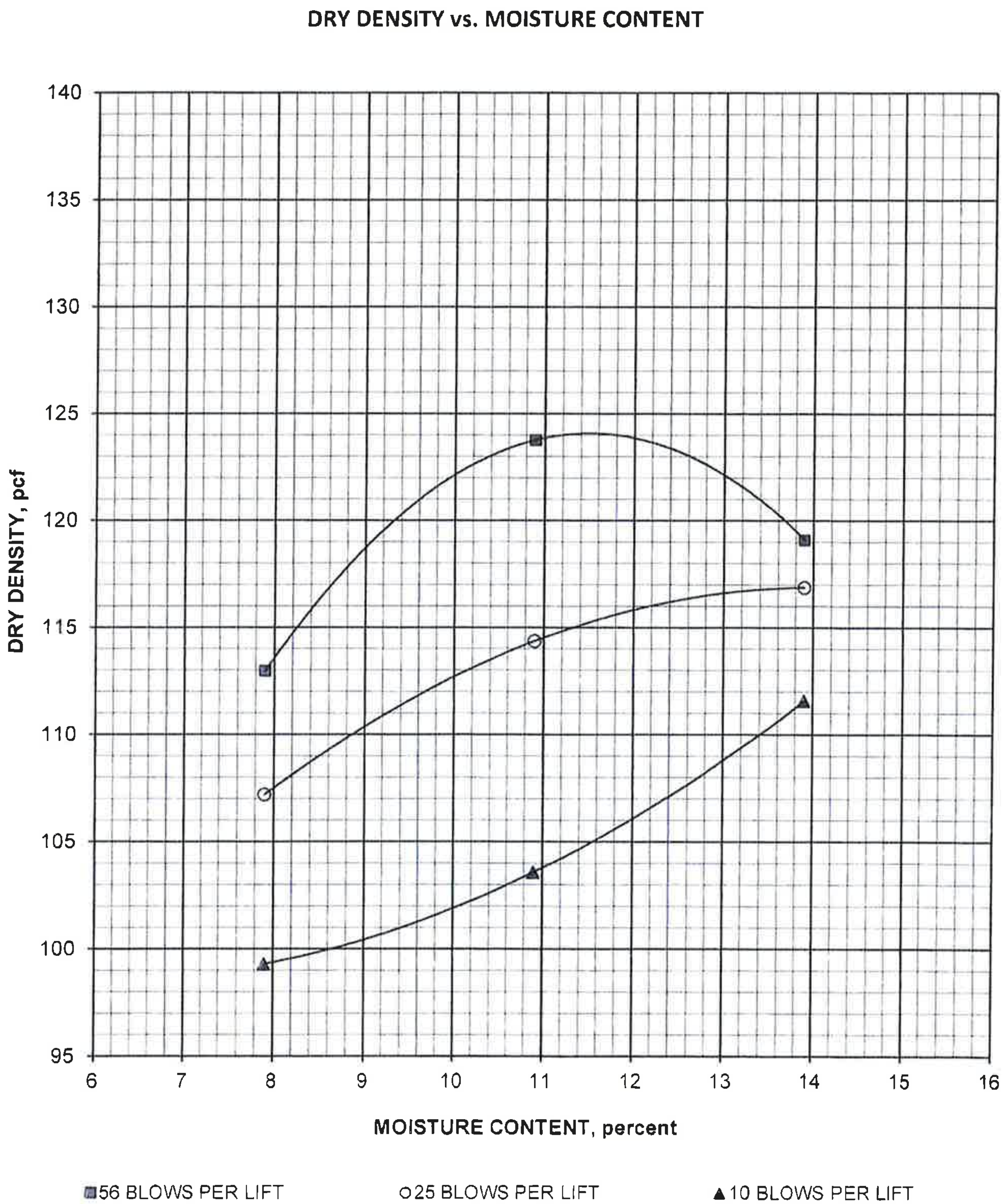
CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #B1 @ 2.5 - 5.0'

May 9, 2017

Gray Brown Sandy Lean Clay (CL)



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

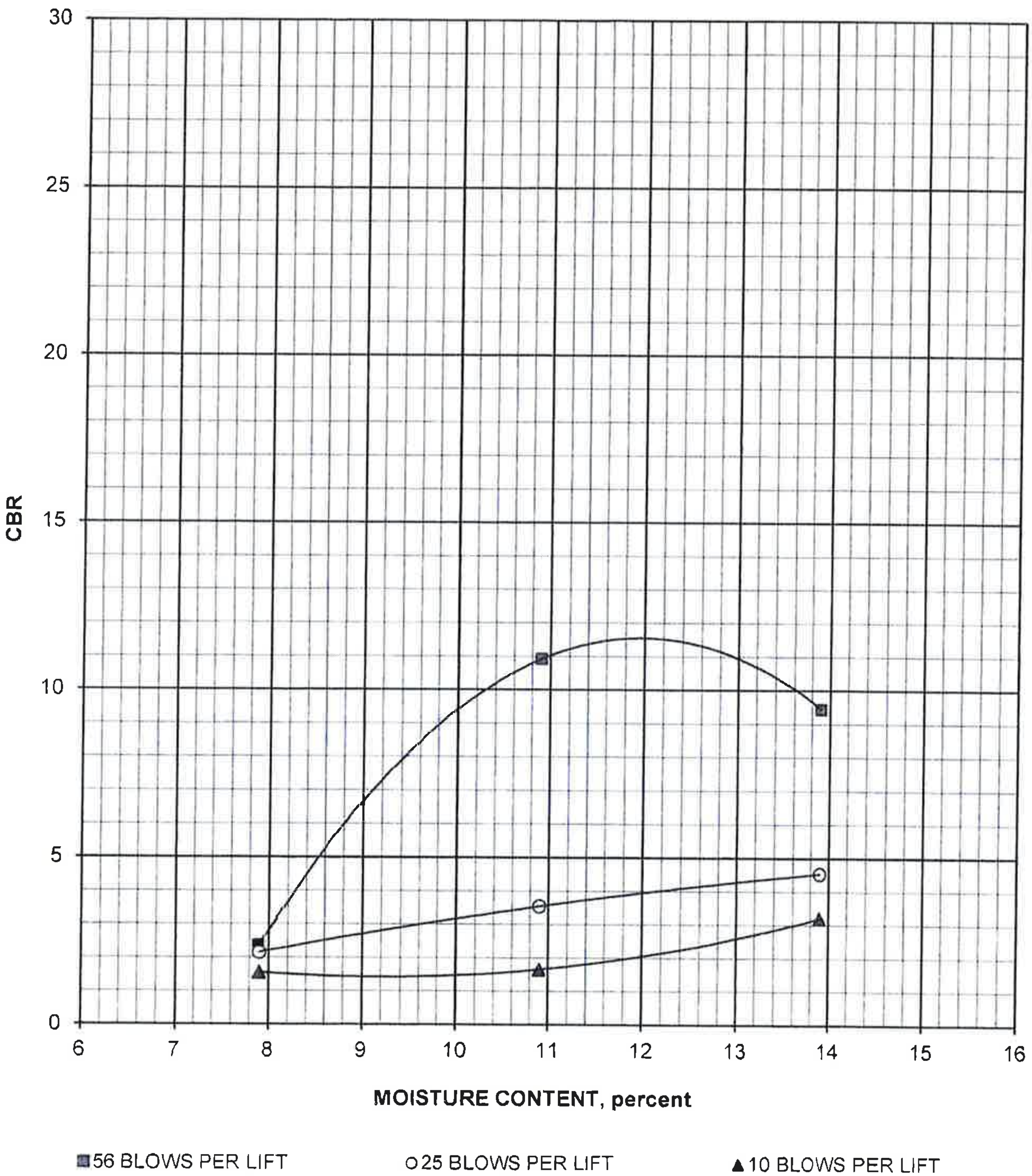
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #B1 @ 2.5 - 5.0'

May 9, 2017

Gray Brown Sandy Lean Clay (CL)

CBR vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

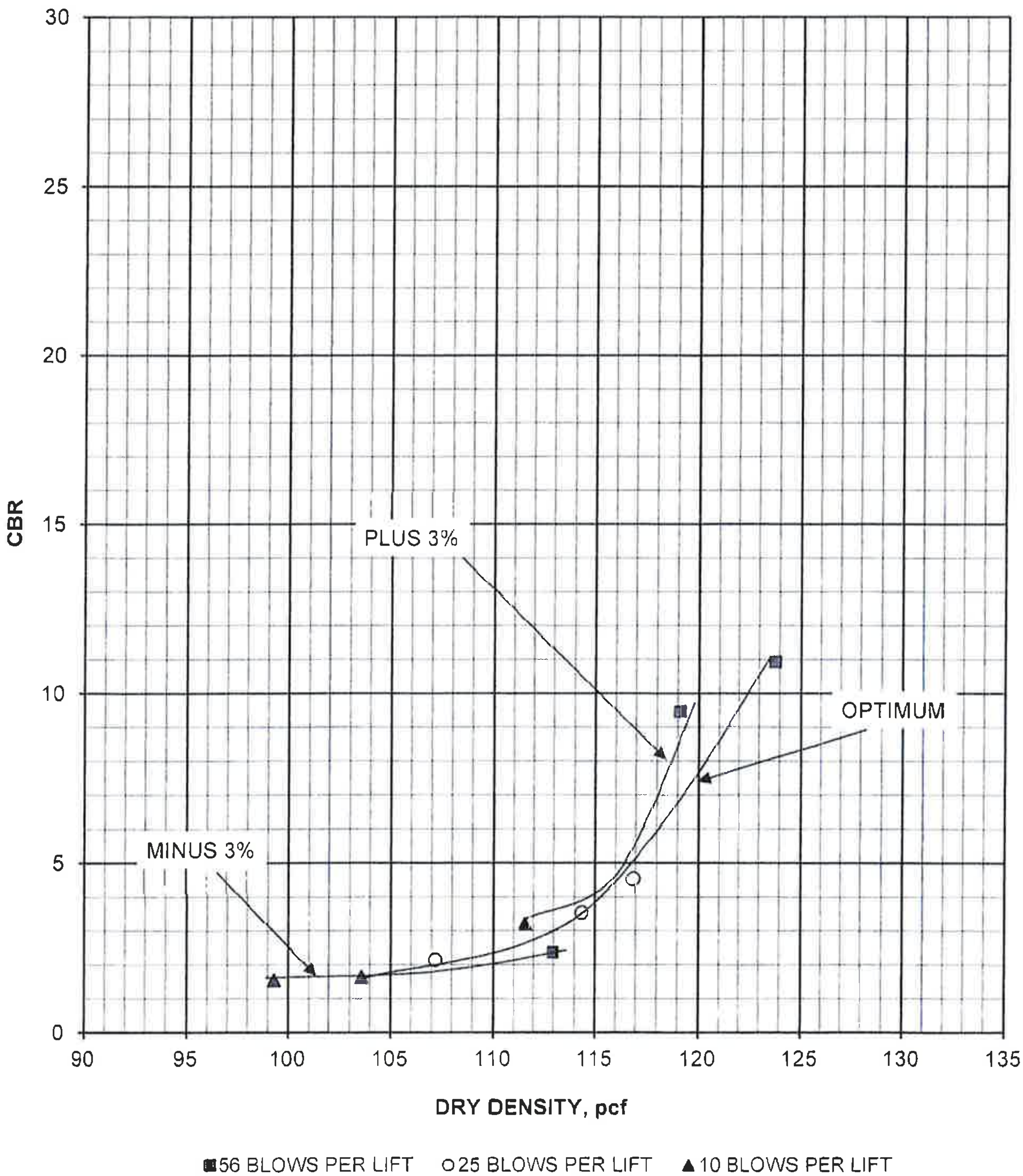
Boring #B1 @ 2.5 - 5.0'

May 9, 2017

Gray Brown Sandy Lean Clay (CL)

DRY DENSITY vs. CBR

Arranged According to Moisture Content



Camarillo Airport
PCN Analysis

SL-15603-SD

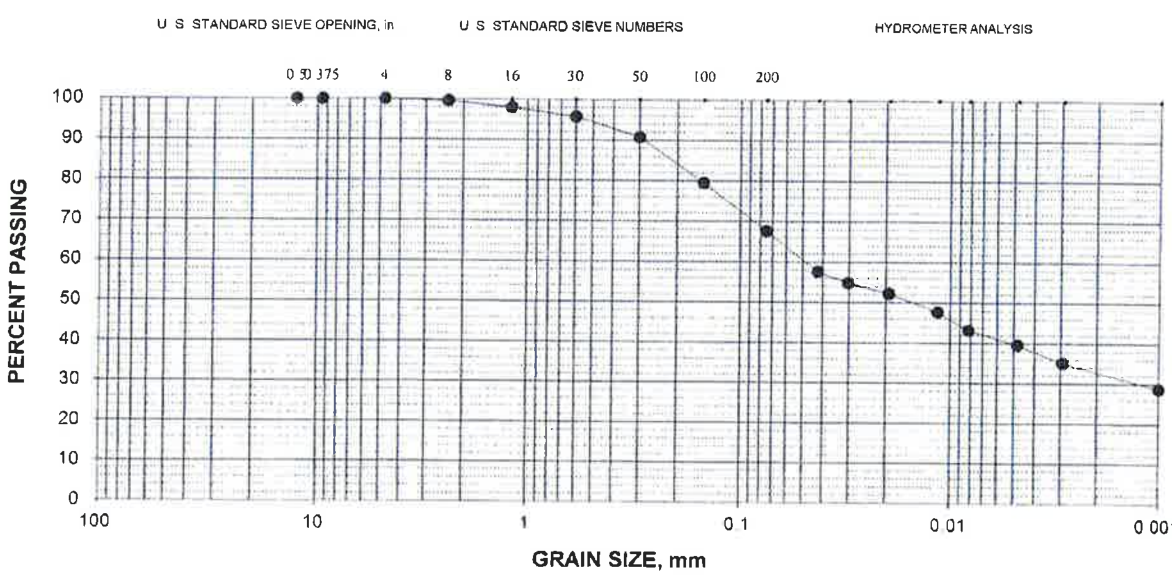
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07

Boring #C1 @ 2.0 - 5.0'
Sandy Fat Clay (CH)
LL = 53; PL = 20; PI = 33

May 9, 2017
Specific Gravity = 2.70 (assumed)
Gravel = 0%; Sand = 32%; Silt = 28%; Clay = 40%

Sieve size	% Retained	% Passing
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)	4	96
#50 (300-µm)	9	91
#100 (150-µm)	20	80
#200 (75-µm)	32	68
Hydrometer Analysis		
42-µm		58
30-µm		55
19-µm		52
11-µm		48
8-µm		43
4.8-µm		40
2.9-µm		35
Colloids		29



Camarillo Airport
PCN Analysis

SL-15603-SD

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

PROCEDURE USED: C

PREPARATION METHOD: Dry

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.70 (assumed)

May 9, 2017

Boring #C1 @ 2.0 - 5.0'

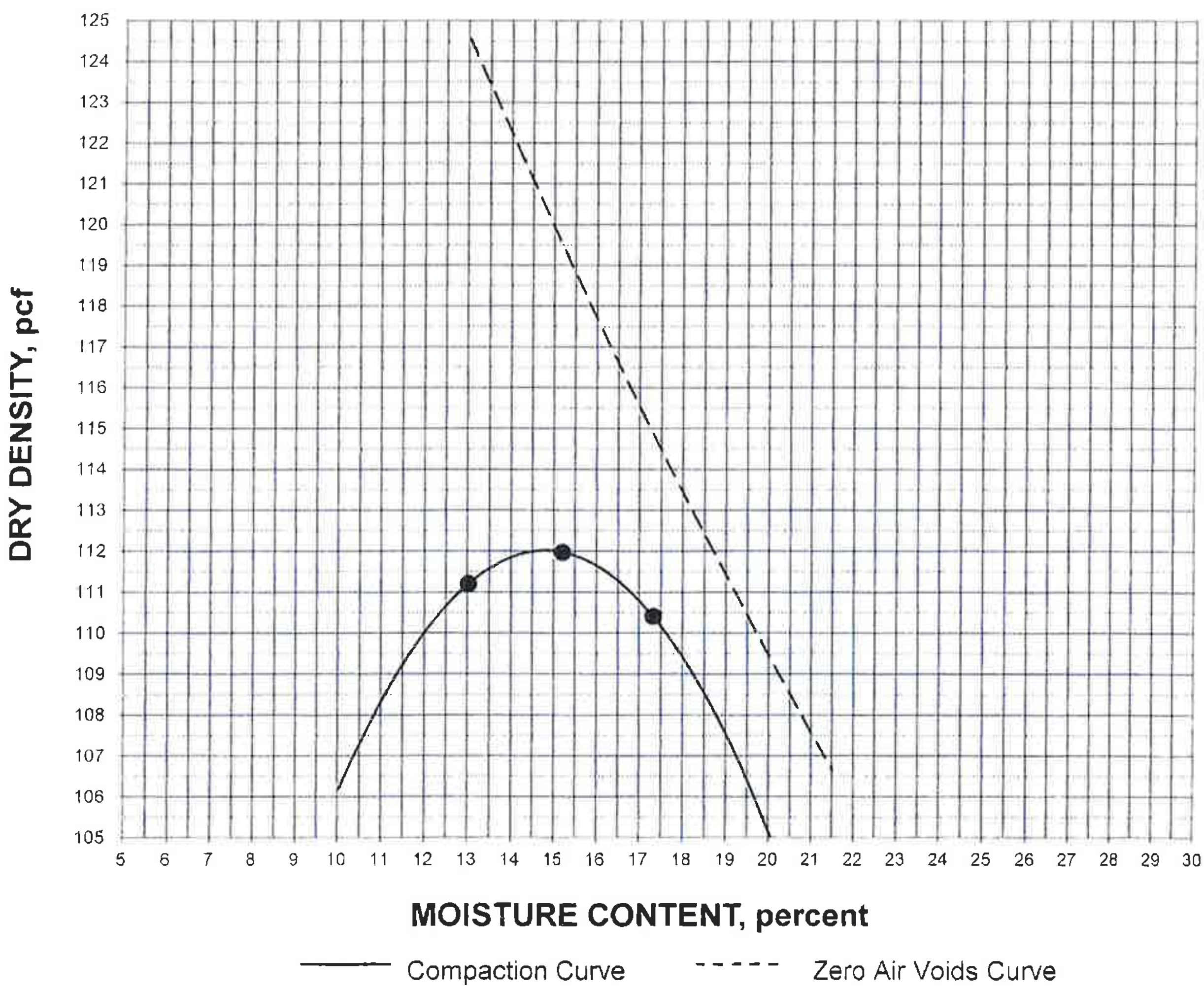
Dark Gray Brown Sandy Fat Clay (CH)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 112.0 pcf

OPTIMUM MOISTURE: 14.8%



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #C1 @ 2.0 - 5.0'
Dark Gray Brown Sandy Fat Clay (CH)

May 9, 2017

10 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	89.1	90.1	93.9
Moisture content, %, before soak	11.8	14.8	17.8
Moisture content, %, after soak, avg.	32.4	32.0	32.3
Moisture content, %, after soak, top 1"	33.1	38.9	30.0
Expansion, %, 96 hour soak	2.5	2.1	0.4
Bearing Ratio, 0.100" penetration	1.4	1.7	2.7

25 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	100.4	104.1	108.2
Moisture content, %, before soak	11.8	14.8	17.8
Moisture content, %, after soak, avg.	28.0	25.7	20.7
Moisture content, %, after soak, top 1"	30.9	29.3	24.6
Expansion, %, 96 hour soak	2.2	1.3	0.1
Bearing Ratio, 0.100" penetration	2.0	3.2	6.3

56 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	106.1	115.0	112.2
Moisture content, %, before soak	11.8	14.8	17.8
Moisture content, %, after soak, avg.	21.0	17.9	19.5
Moisture content, %, after soak, top 1"	32.3	22.7	20.7
Expansion, %, 96 hour soak	1.9	1.4	0.7
Bearing Ratio, 0.100" penetration	2.2	10.7	10.0

Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

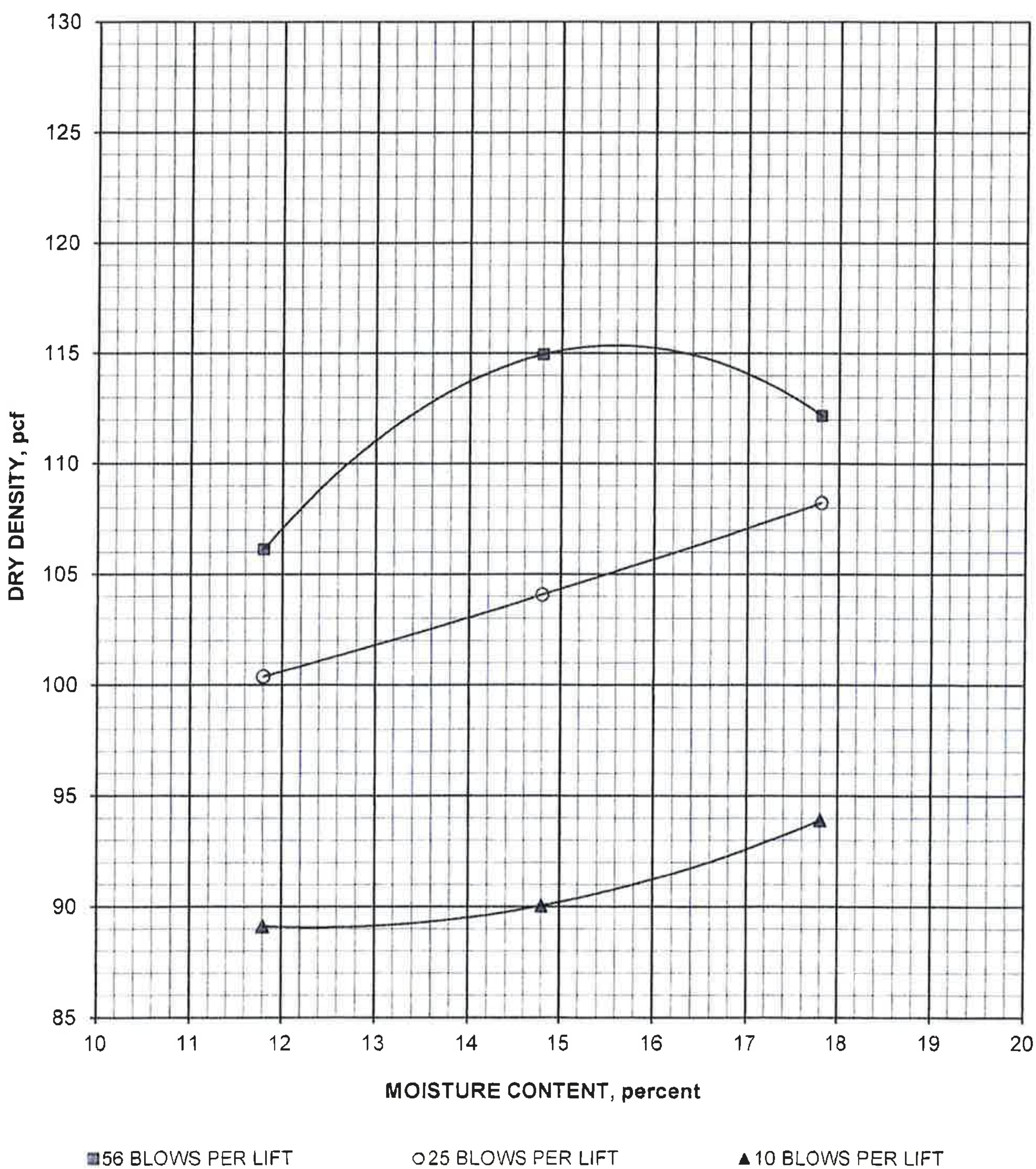
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #C1 @ 2.0 - 5.0'

May 9, 2017

Dark Gray Brown Sandy Fat Clay (CH)

DRY DENSITY vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

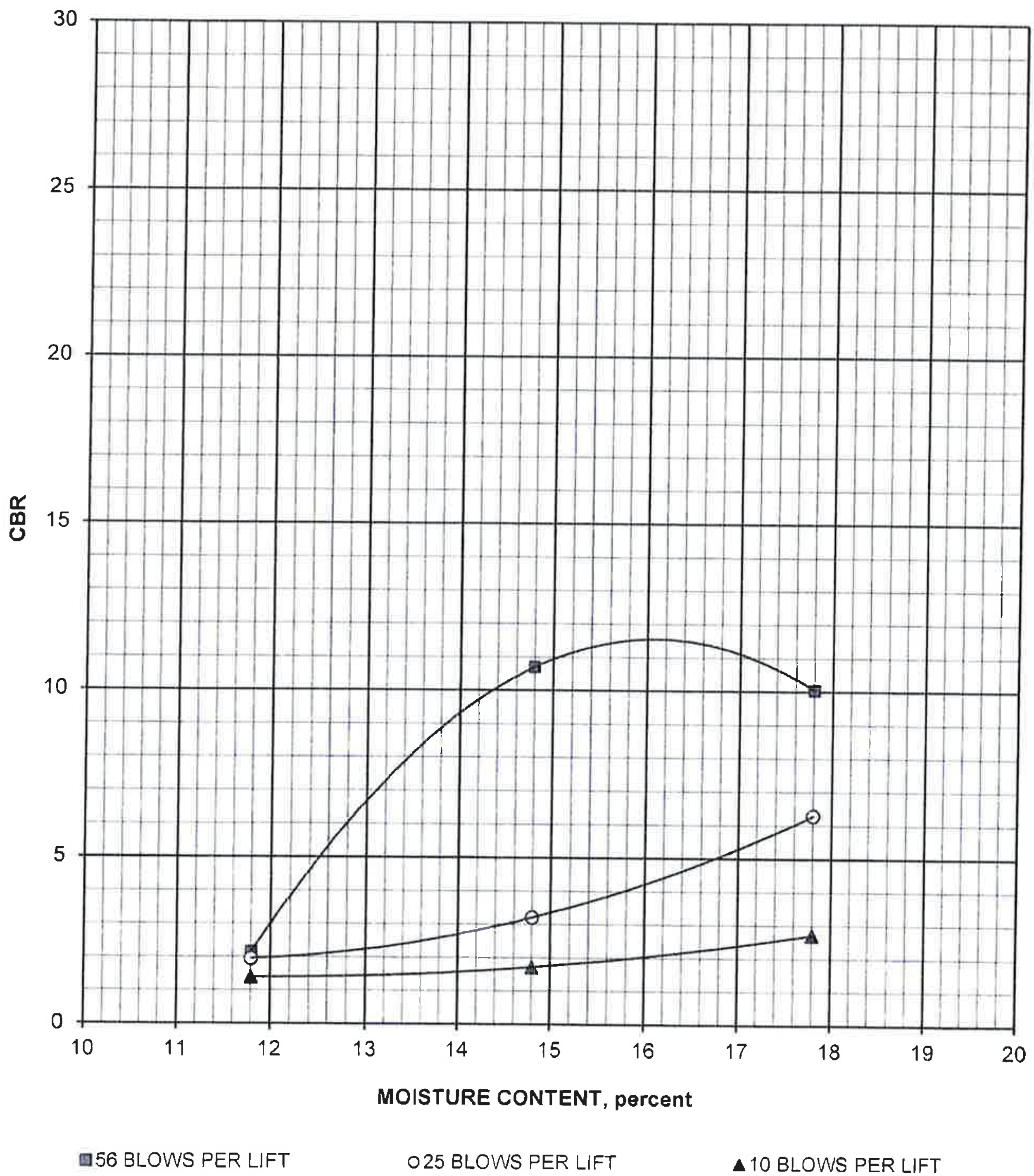
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #C1 @ 2.0 - 5.0'

May 9, 2017

Dark Gray Brown Sandy Fat Clay (CH)

CBR vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

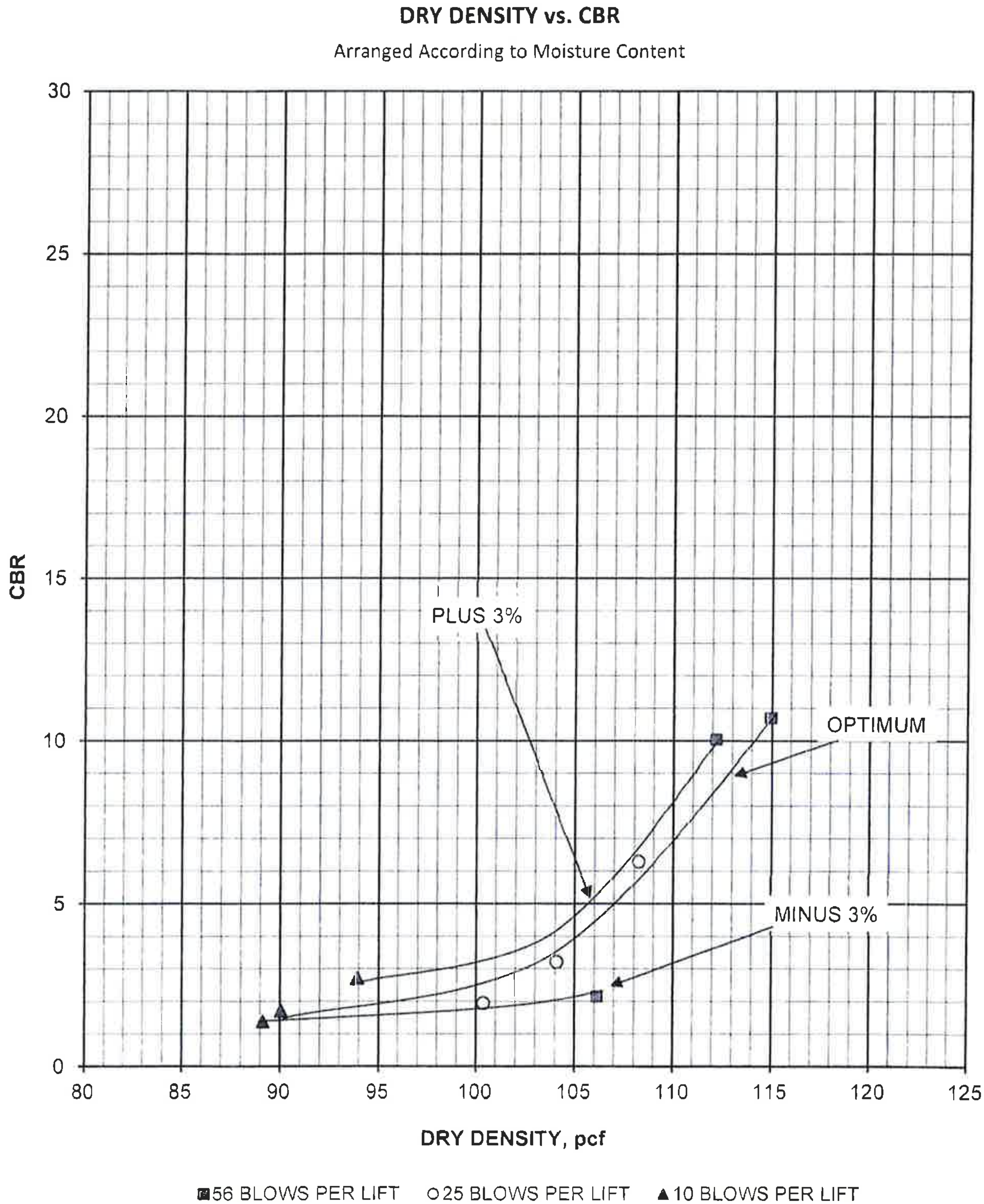
CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #C1 @ 2.0 - 5.0'

May 9, 2017

Dark Gray Brown Sandy Fat Clay (CH)



Camarillo Airport
PCN Analysis

SL-15603-SD

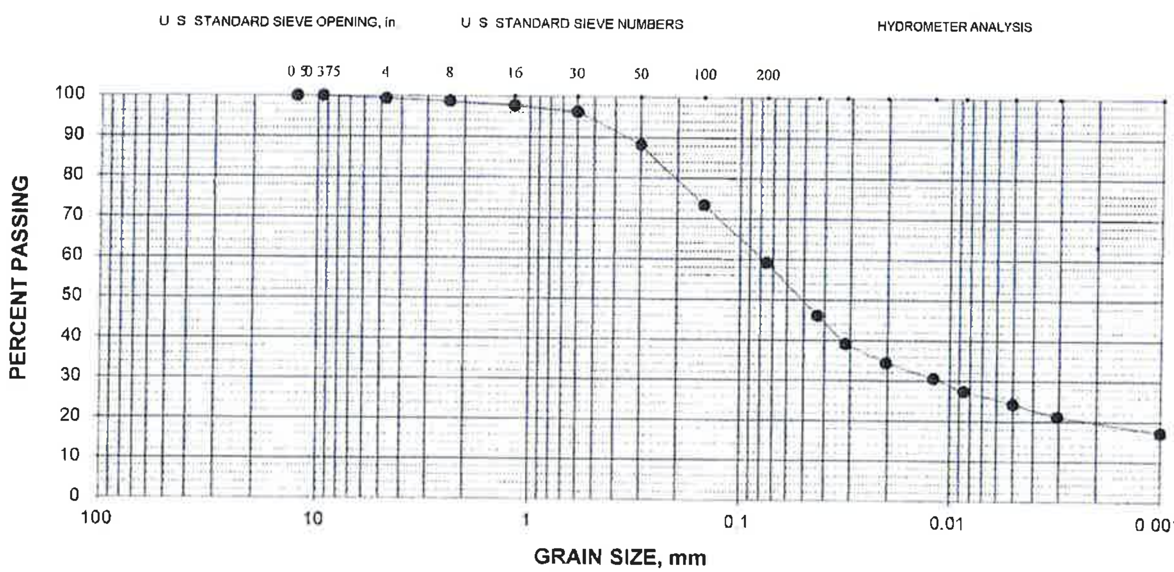
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07

Boring #D1 @ 2.0 - 5.0'
Sandy Lean Clay (CL)
LL = 35; PL = 16; PI = 19

May 9, 2017
Specific Gravity = 2.70 (assumed)
Gravel = 1%; Sand = 40%; Silt = 35%; Clay = 24%

Sieve size	% Retained	% Passing
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	1	99
#8 (2.36-mm)	1	99
#16 (1.18-mm)	2	98
#30 (600-µm)	4	96
#50 (300-µm)	12	88
#100 (150-µm)	27	73
#200 (75-µm)	41	59
Hydrometer Analysis		
43-µm		46
32-µm		39
20-µm		34
12-µm		30
9-µm		27
5.0-µm		24
3.1-µm		21
Colloids		17



Camarillo Airport
PCN Analysis

SL-15603-SD

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

PROCEDURE USED: C

PREPARATION METHOD: Dry

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.70 (assumed)

May 9, 2017

Boring #D1 @ 2.0 - 5.0'

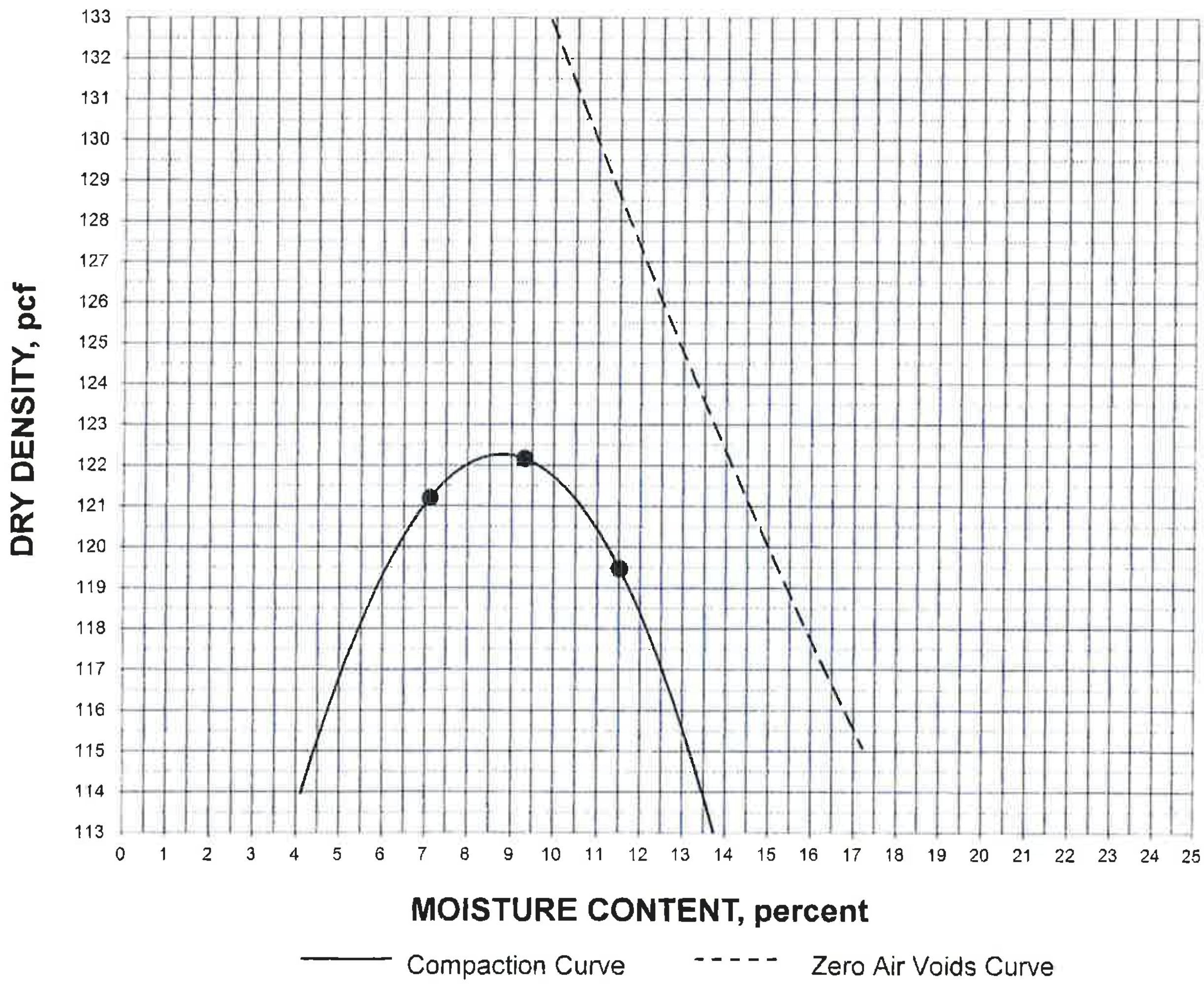
Light Brown Sandy Lean Clay (CL)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 122.3 pcf

OPTIMUM MOISTURE: 8.8%



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #D1 @ 2.0 - 5.0'
Light Brown Sandy Lean Clay (CL)

May 9, 2017

10 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	99.8	105.5	109.1
Moisture content, %, before soak	5.8	8.8	11.8
Moisture content, %, after soak, avg.	23.7	21.1	18.3
Moisture content, %, after soak, top 1"	24.2	24.0	21.7
Expansion, %, 96 hour soak	2.0	1.5	1.3
Bearing Ratio, 0.100" penetration	1.8	2.5	3.6

25 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	108.8	113.6	116.0
Moisture content, %, before soak	5.8	8.8	11.8
Moisture content, %, after soak, avg.	14.1	19.9	17.3
Moisture content, %, after soak, top 1"	21.7	22.6	19.1
Expansion, %, 96 hour soak	1.5	0.9	1.8
Bearing Ratio, 0.100" penetration	2.6	5.4	8.5

56 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	116.5	123.0	120.7
Moisture content, %, before soak	5.8	8.8	11.8
Moisture content, %, after soak, avg.	18.2	14.3	17.5
Moisture content, %, after soak, top 1"	24.0	19.0	17.6
Expansion, %, 96 hour soak	4.4	1.3	1.8
Bearing Ratio, 0.100" penetration	3.3	14.9	12.0

Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

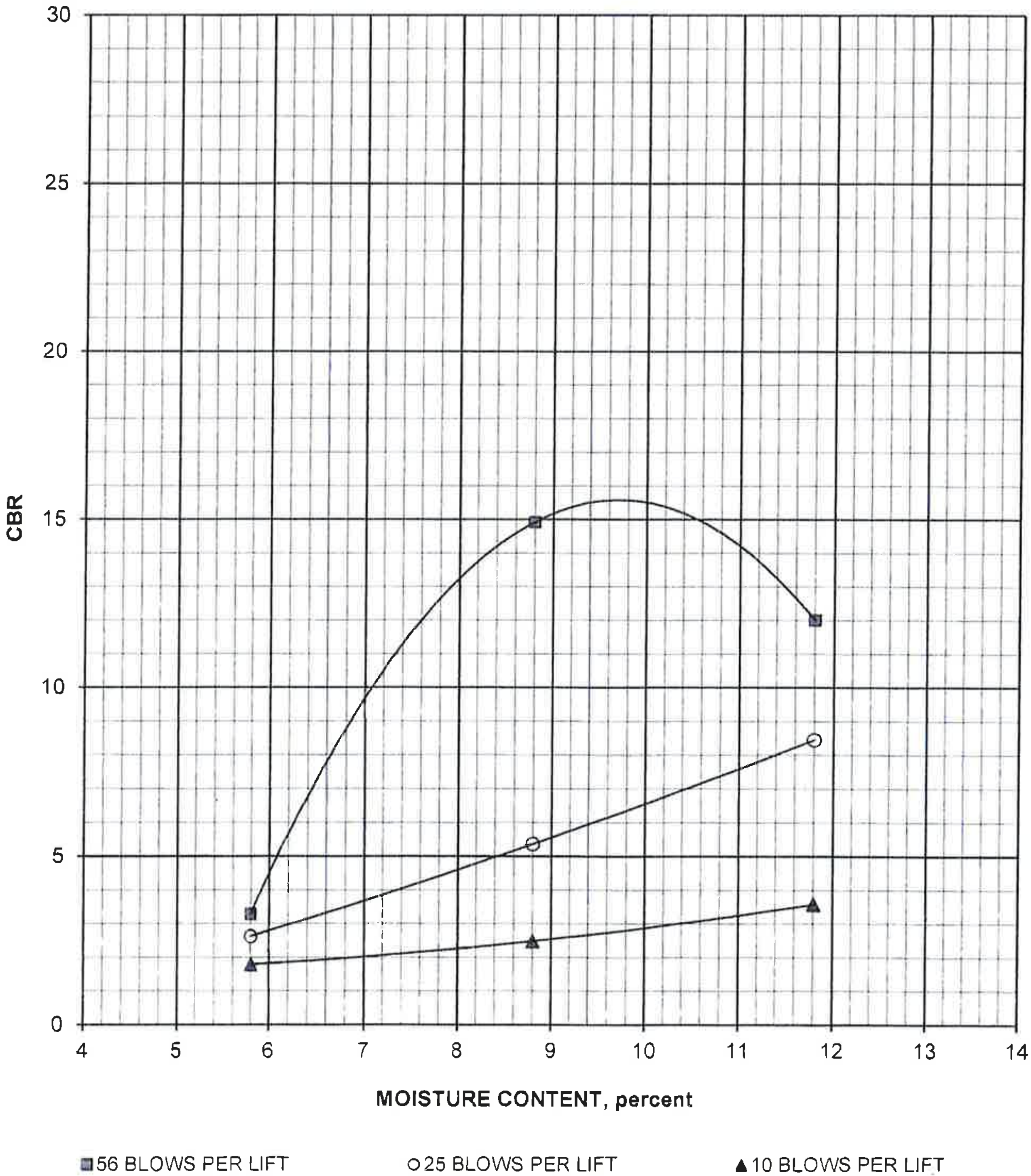
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #D1 @ 2.0 - 5.0'

May 9, 2017

Light Brown Sandy Lean Clay (CL)

CBR vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

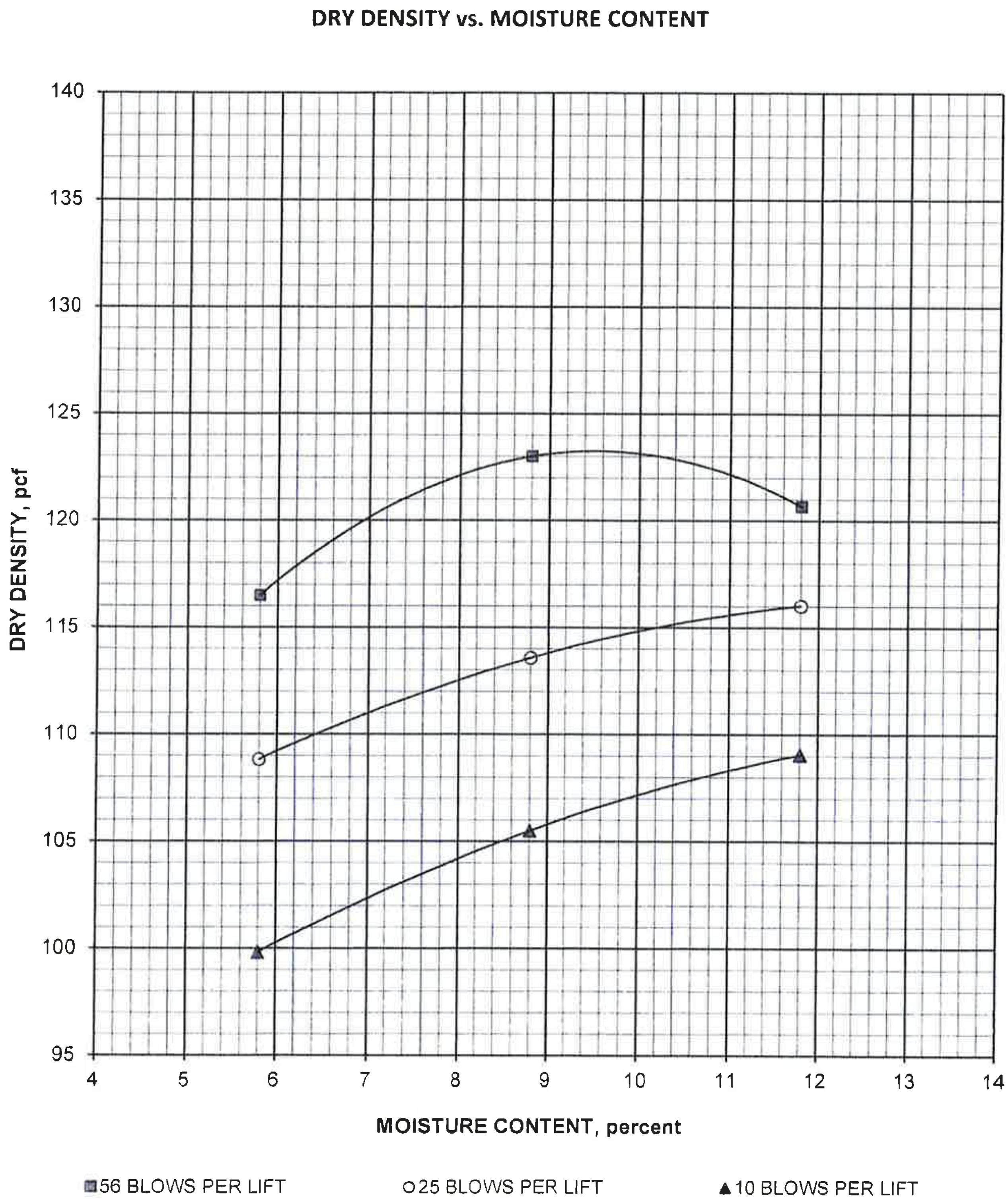
CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #D1 @ 2.0 - 5.0'

May 9, 2017

Light Brown Sandy Lean Clay (CL)



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

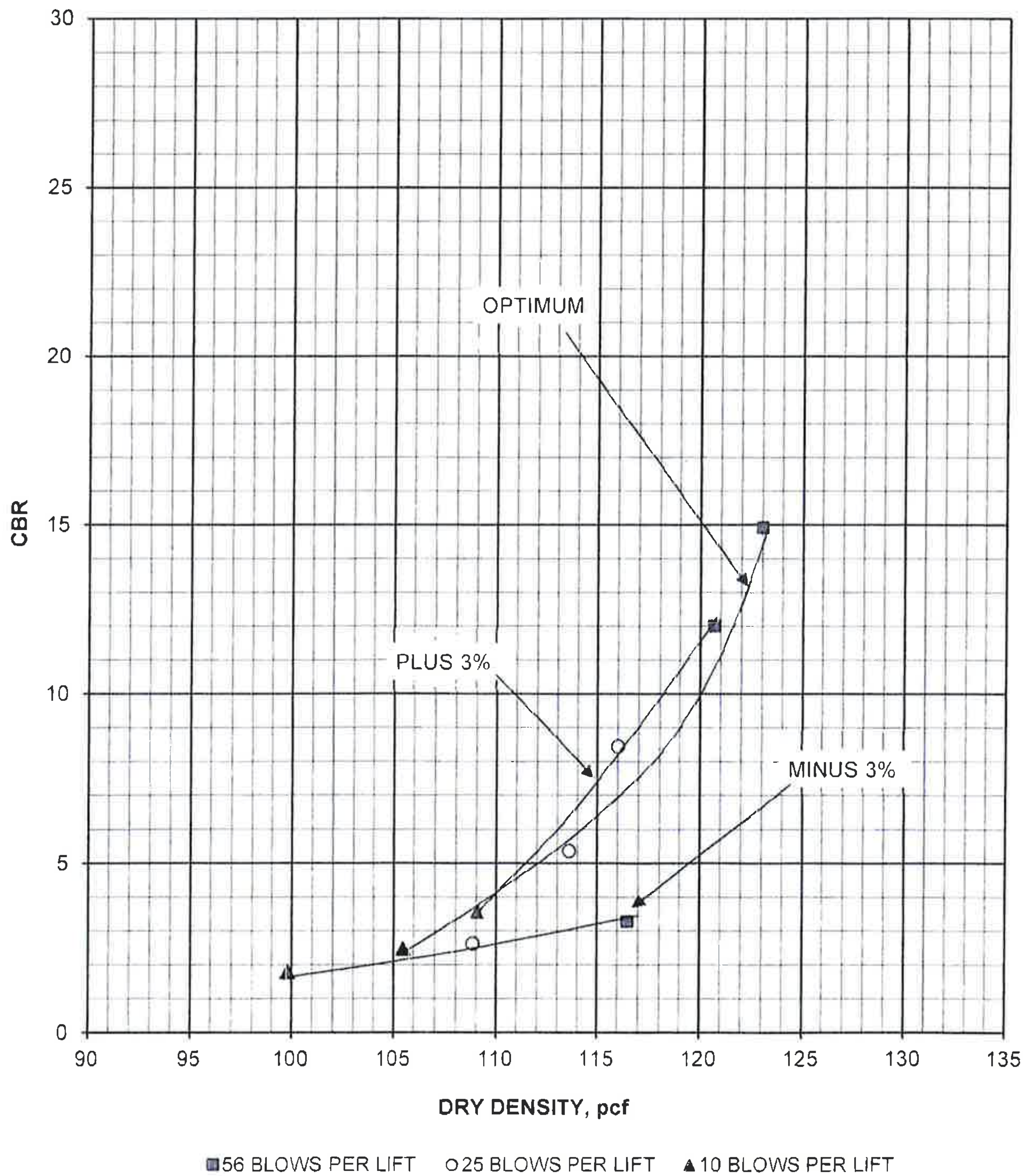
Boring #D1 @ 2.0 - 5.0'

May 9, 2017

Light Brown Sandy Lean Clay (CL)

DRY DENSITY vs. CBR

Arranged According to Moisture Content



Camarillo Airport
PCN Analysis

SL-15603-SD

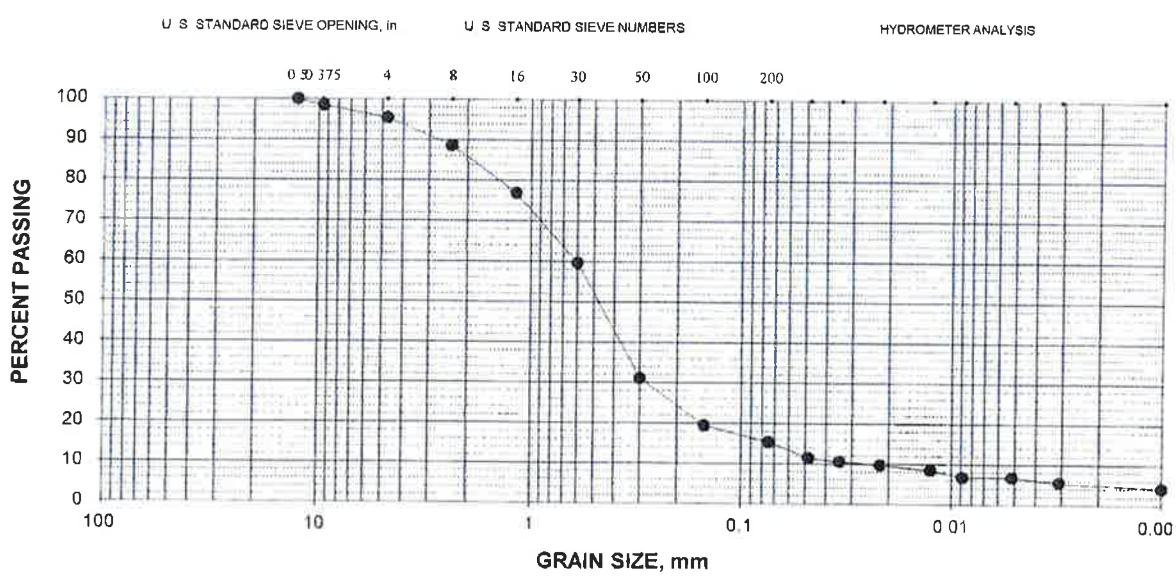
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07

Boring #E1 @ 2.0 - 4.0'
Silty Sand (SM)

May 9, 2017
Specific Gravity = 2.65 (assumed)
Gravel = 5%; Sand = 80%; Silt = 8%; Clay = 7%

Sieve size	% Retained	% Passing
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	2	98
#4 (4.75-mm)	5	95
#8 (2.36-mm)	11	89
#16 (1.18-mm)	23	77
#30 (600-µm)	40	60
#50 (300-µm)	69	31
#100 (150-µm)	81	19
#200 (75-µm)	85	15
Hydrometer Analysis		
48-µm		11
34-µm		11
22-µm		10
13-µm		8
9-µm		7
5.2-µm		7
3.1-µm		5
Colloids		4



Camarillo Airport
PCN Analysis

SL-15603-SD

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

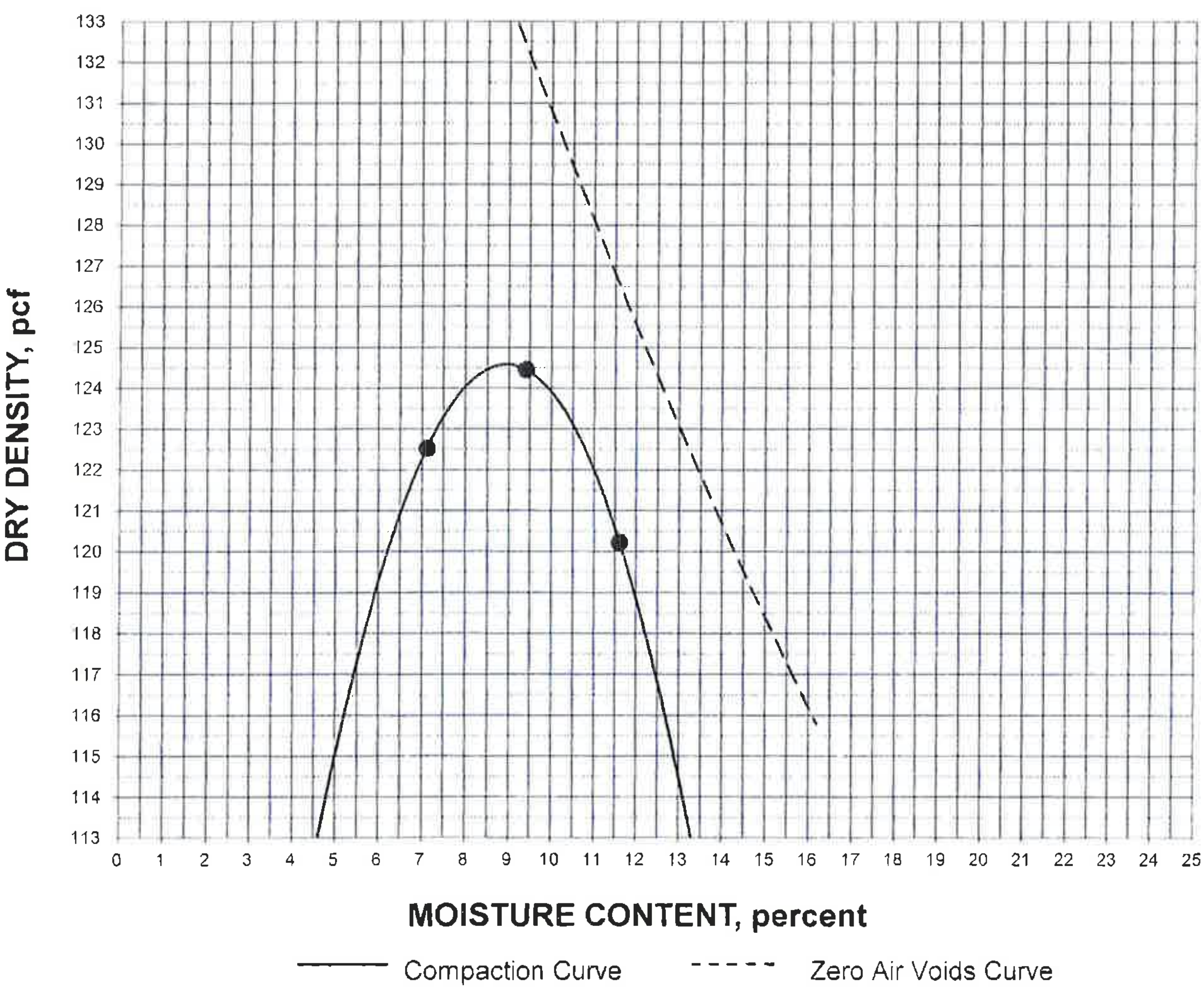
PROCEDURE USED: C
PREPARATION METHOD: Moist
RAMMER TYPE: Mechanical
SPECIFIC GRAVITY: 2.65 (assumed)

May 9, 2017
Boring #E1 @ 2.0 - 4.0'
Light Brown Silty Sand (SM)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 124.6 pcf
OPTIMUM MOISTURE: 8.9%



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #E1 @ 2.0 - 4.0'
Light Brown Silty Sand (SM)

May 9, 2017

10 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	108.2	109.7	114.7
Moisture content, %, before soak	5.9	8.9	11.9
Moisture content, %, after soak, avg.	17.1	15.5	13.5
Moisture content, %, after soak, top 1"	15.2	13.2	12.5
Expansion, %, 96 hour soak	0.0	0.0	0.0
Bearing Ratio, 0.100" penetration	3.5	5.5	8.5

25 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	113.9	118.1	118.6
Moisture content, %, before soak	5.9	8.9	11.9
Moisture content, %, after soak, avg.	13.5	13.0	11.9
Moisture content, %, after soak, top 1"	12.8	10.5	11.0
Expansion, %, 96 hour soak	0.0	0.0	0.0
Bearing Ratio, 0.100" penetration	8.5	11.3	10.5

56 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	120.3	126.5	121.7
Moisture content, %, before soak	5.9	8.9	11.9
Moisture content, %, after soak, avg.	11.1	7.3	12.6
Moisture content, %, after soak, top 1"	10.8	8.7	10.8
Expansion, %, 96 hour soak	0.0	0.0	0.0
Bearing Ratio, 0.100" penetration	11.8	15.4	14.1

Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

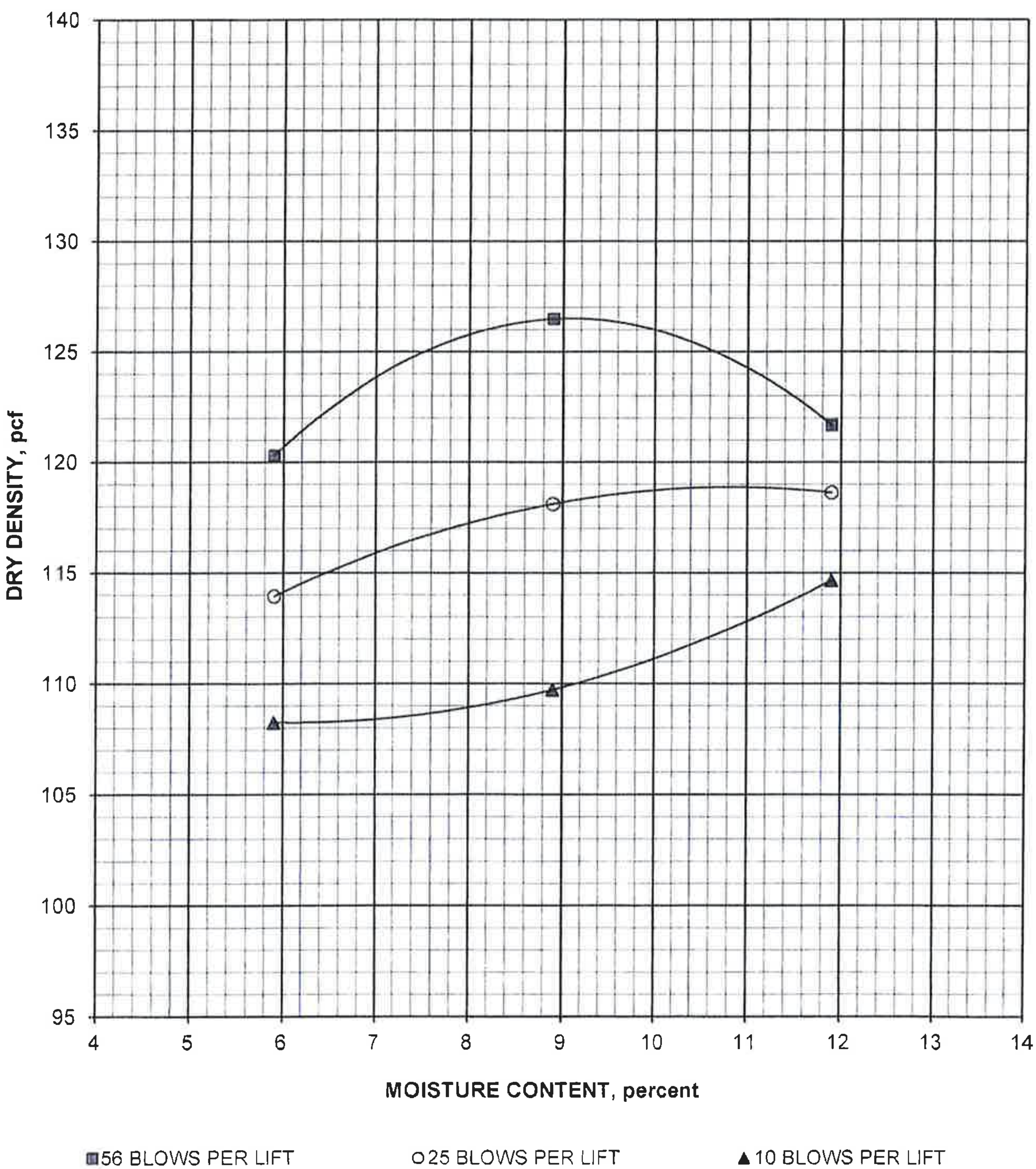
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #E1 @ 2.0 - 4.0'

May 9, 2017

Light Brown Silty Sand (SM)

DRY DENSITY vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

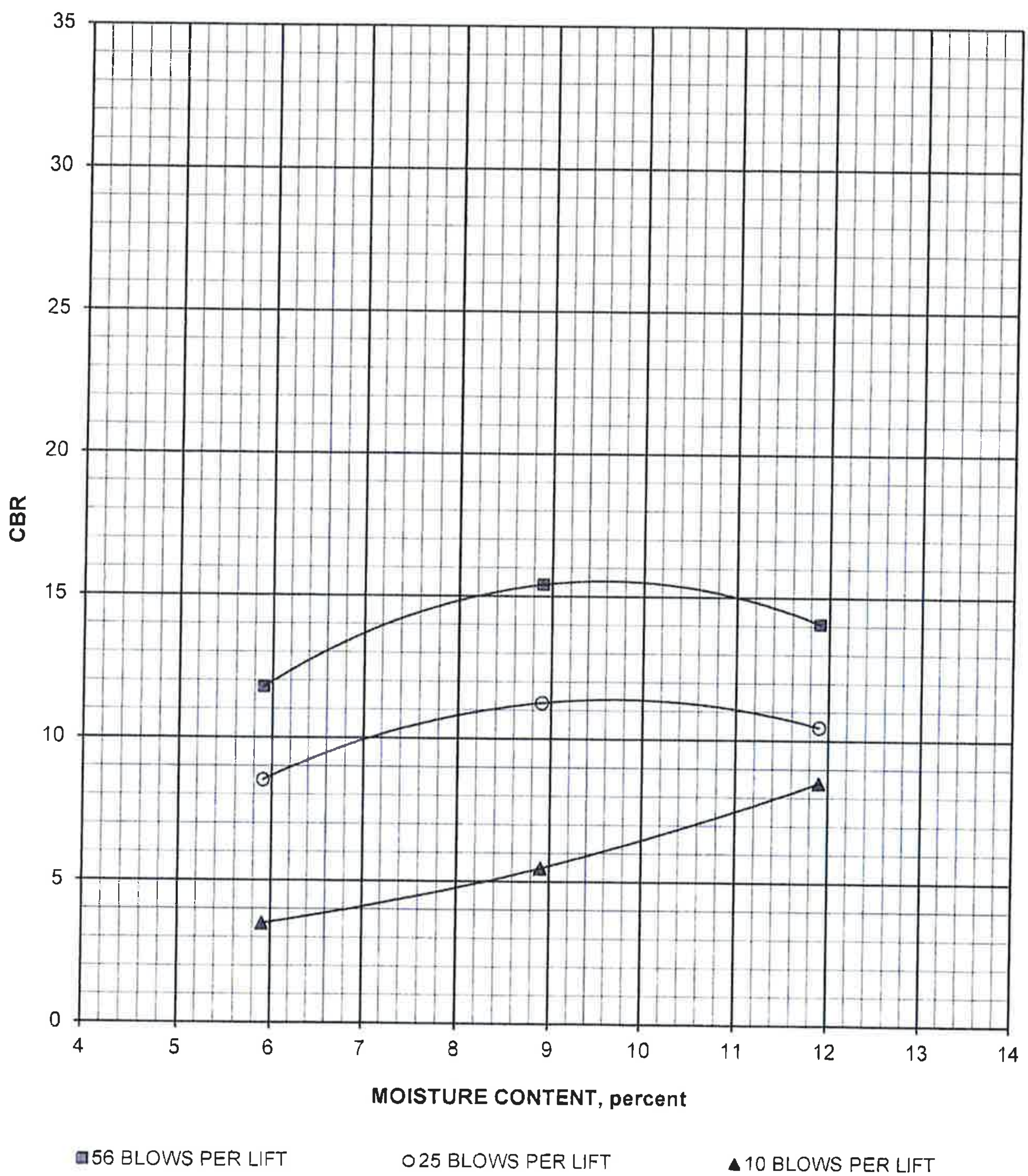
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #E1 @ 2.0 - 4.0'

May 9, 2017

Light Brown Silty Sand (SM)

CBR vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

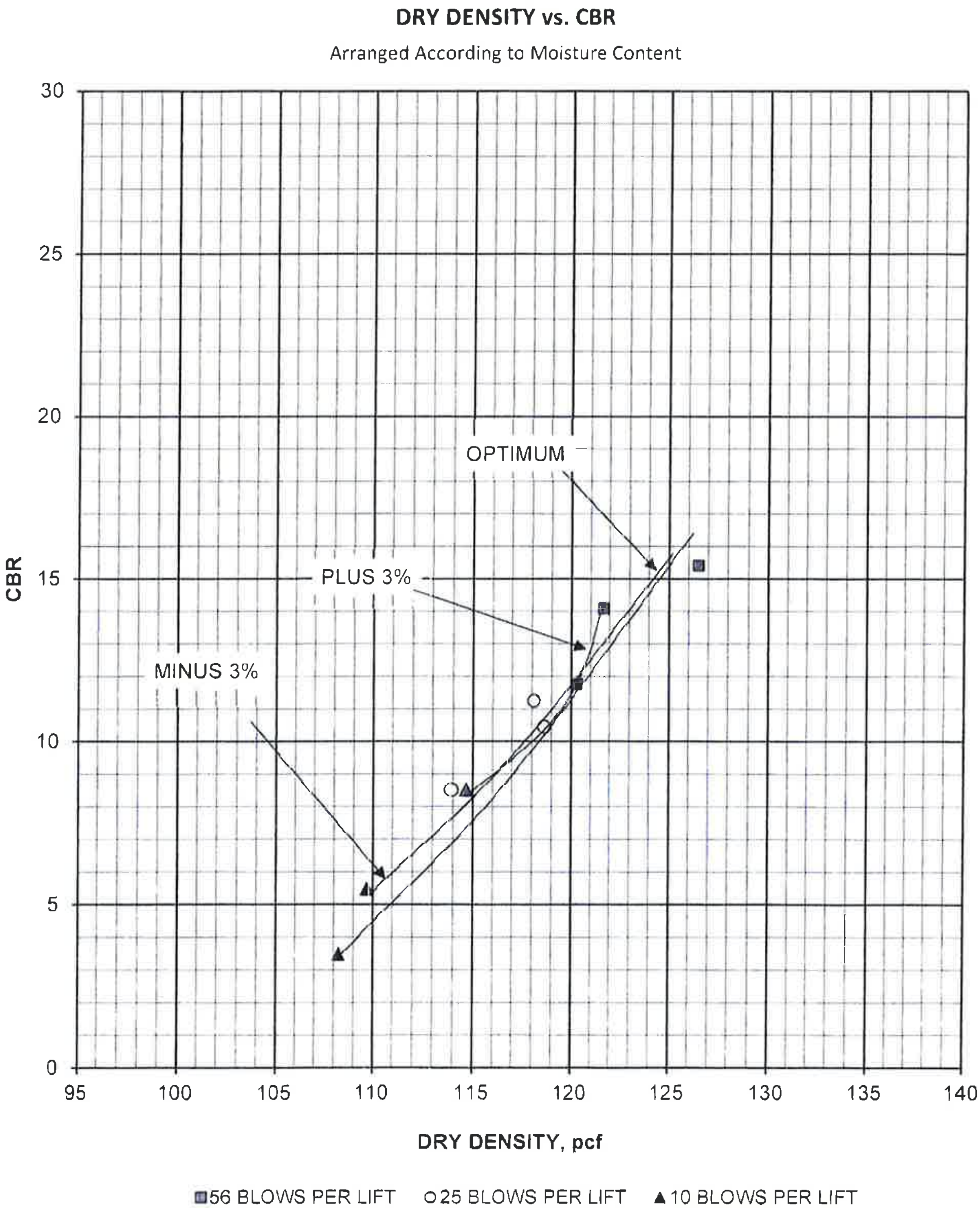
CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #E1 @ 2.0 - 4.0'

May 9, 2017

Light Brown Silty Sand (SM)



Camarillo Airport
PCN Analysis

SL-15603-SD

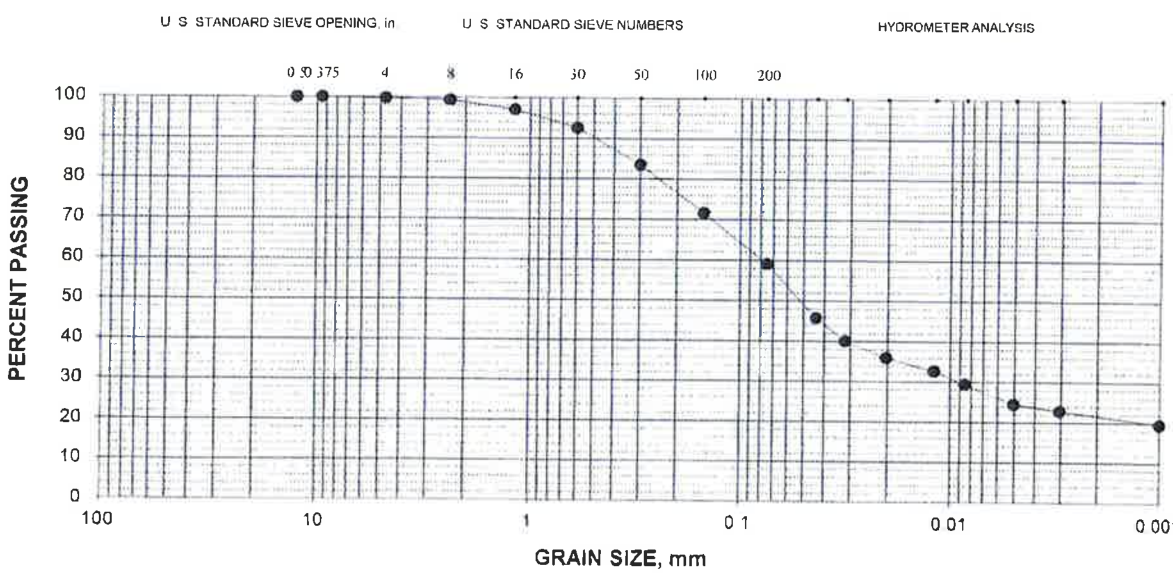
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07

Boring #F2 @ 2.0 - 4.0'
Sandy Lean Clay (CL)
LL = 36; PL = 17; PI = 19

May 9, 2017
Specific Gravity = 2.70 (assumed)
Gravel = 0%; Sand = 41%; Silt = 34%; Clay = 25%

Sieve size	% Retained	% Passing
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	0	100
#8 (2.36-mm)	1	99
#16 (1.18-mm)	3	97
#30 (600-µm)	7	93
#50 (300-µm)	16	84
#100 (150-µm)	28	72
#200 (75-µm)	41	59
Hydrometer Analysis		
44-µm		46
32-µm		40
20-µm		36
12-µm		33
9-µm		29
5.0-µm		25
3.1-µm		23
Colloids		20



Camarillo Airport
PCN Analysis

SL-15603-SD

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

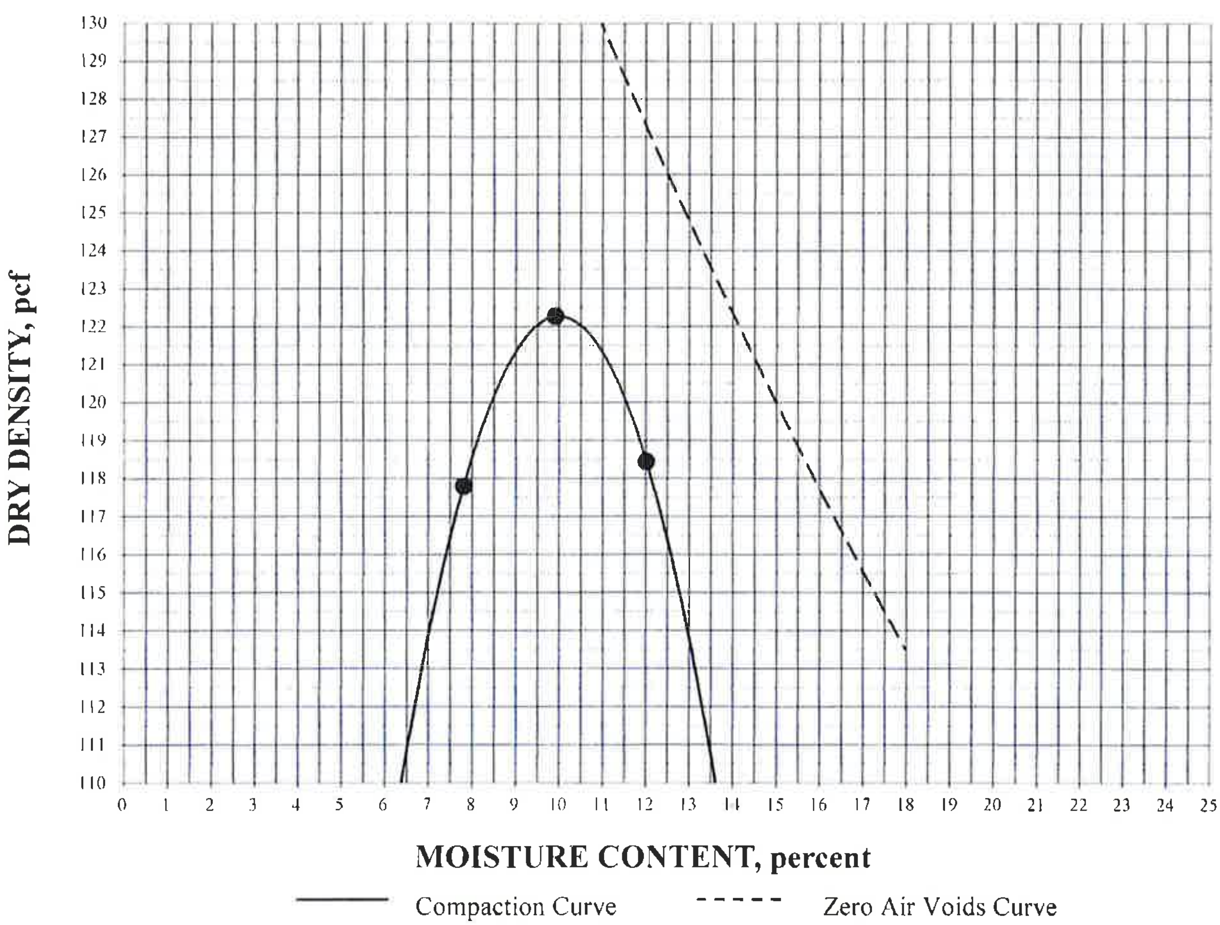
PROCEDURE USED: C
PREPARATION METHOD: Moist
RAMMER TYPE: Mechanical
SPECIFIC GRAVITY: 2.70 (assumed)

May 9, 2017
Boring #F2 @ 2.0 - 4.0'
Gray Brown Sandy Lean Clay (CL)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 122.3 pcf
OPTIMUM MOISTURE: 10.0%



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #F2 @ 2.0 - 4.0'
Gray Brown Sandy Lean Clay (CL)

May 9, 2017

10 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	104.9	108.2	105.9
Moisture content, %, before soak	7.0	10.0	13.0
Moisture content, %, after soak, avg.	22.1	19.4	18.8
Moisture content, %, after soak, top 1"	21.9	23.5	24.8
Expansion, %, 96 hour soak	1.0	4.6	0.5
Bearing Ratio, 0.100" penetration	2.2	3.8	2.0

25 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	108.3	120.7	118.0
Moisture content, %, before soak	7.0	10.0	13.0
Moisture content, %, after soak, avg.	19.4	15.2	16.0
Moisture content, %, after soak, top 1"	21.4	19.8	17.9
Expansion, %, 96 hour soak	3.3	2.6	0.0
Bearing Ratio, 0.100" penetration	3.0	8.8	8.0

56 BLOWS PER LIFT

	-3 Percent	Optimum Moisture	+ 3 percent
Dry density, pcf, before soak	116.5	123.8	122.0
Moisture content, %, before soak	7.0	10.0	13.0
Moisture content, %, after soak, avg.	17.3	11.9	13.9
Moisture content, %, after soak, top 1"	20.2	18.0	16.1
Expansion, %, 96 hour soak	6.6	4.2	0.0
Bearing Ratio, 0.100" penetration	6.1	17.5	15.2

Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

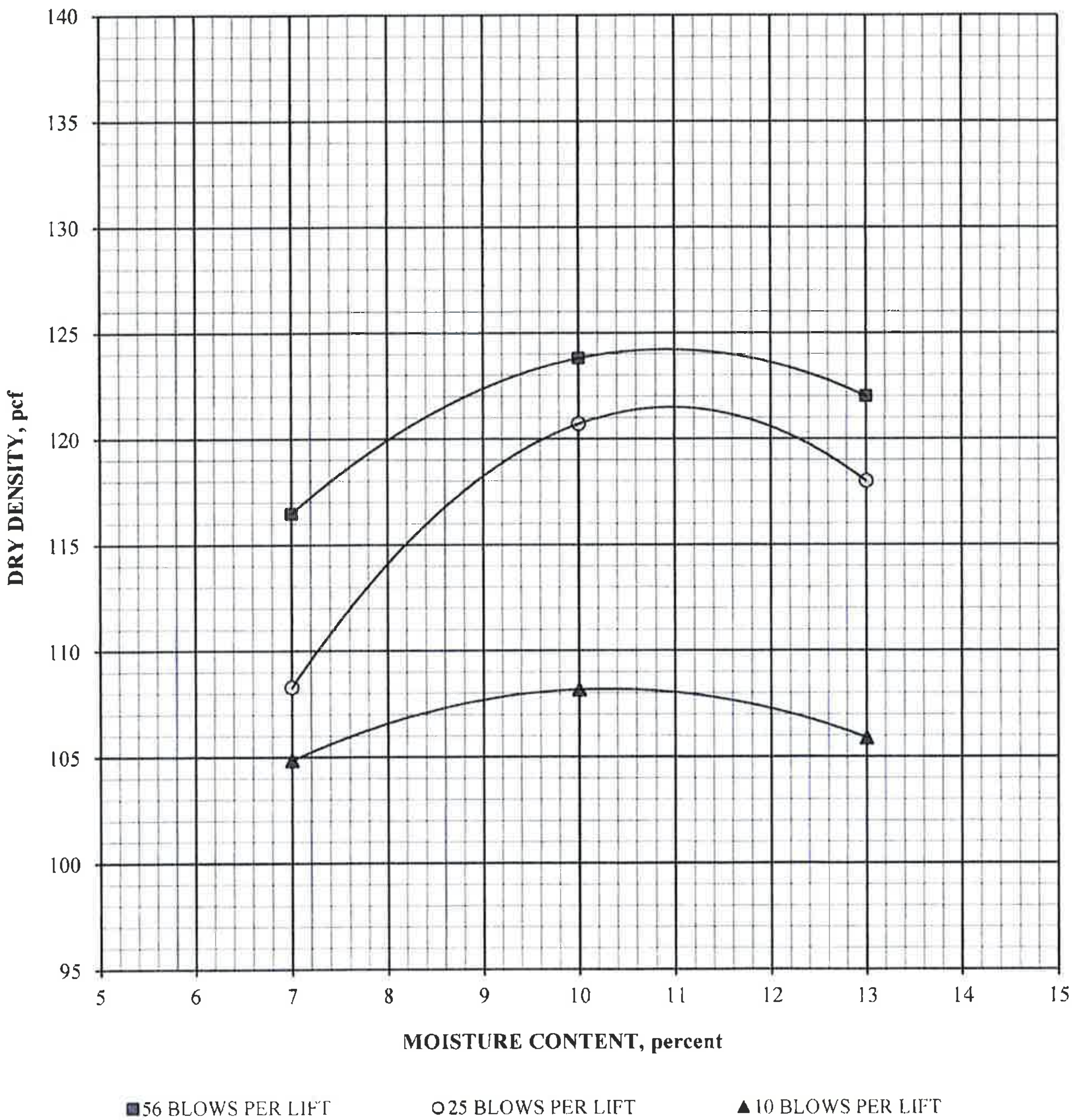
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #F2 @ 2.0 - 4.0'

May 9, 2017

Gray Brown Sandy Lean Clay (CL)

DRY DENSITY vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

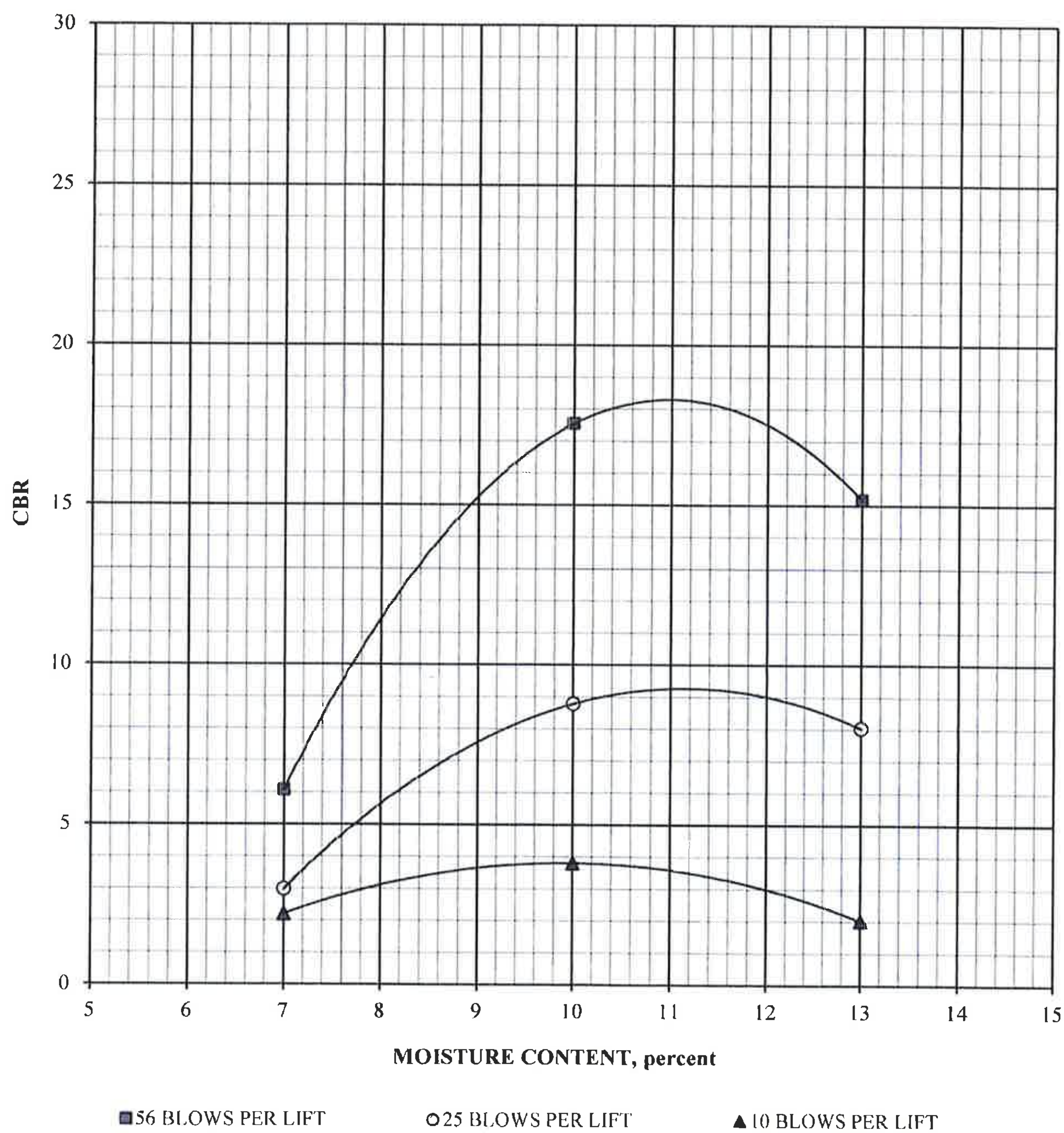
CALIFORNIA BEARING RATIO

ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #F2 @ 2.0 - 4.0'
Gray Brown Sandy Lean Clay (CL)

May 9, 2017

CBR vs. MOISTURE CONTENT



Camarillo Airport
PCN Analysis

SL-15603-SD

CALIFORNIA BEARING RATIO

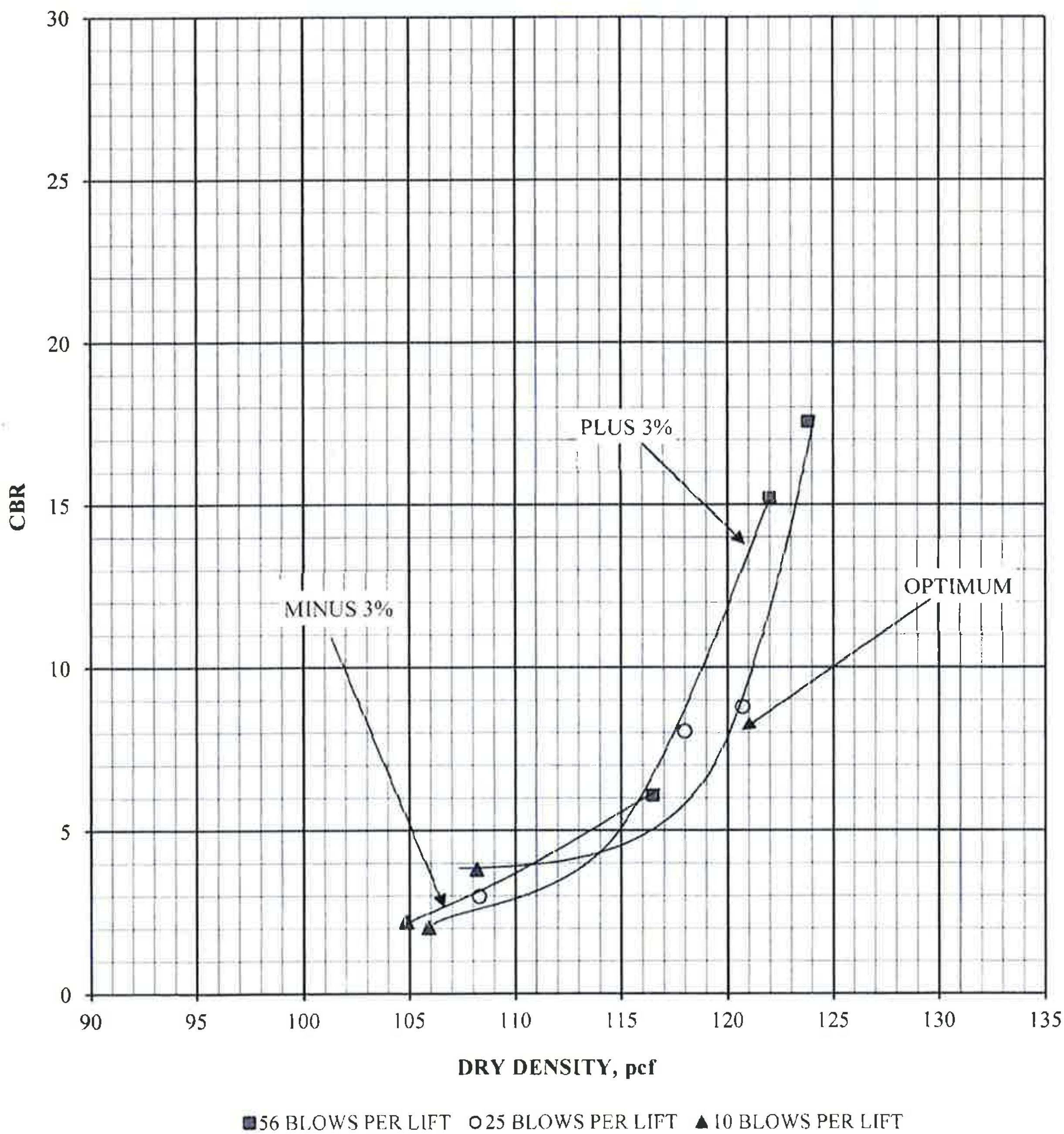
ASTM D 1883-16 (For a Range of Moisture Contents)

Boring #F2 @ 2.0 - 4.0'
Gray Brown Sandy Lean Clay (CL)

May 9, 2017

DRY DENSITY vs. CBR

Arranged According to Moisture Content



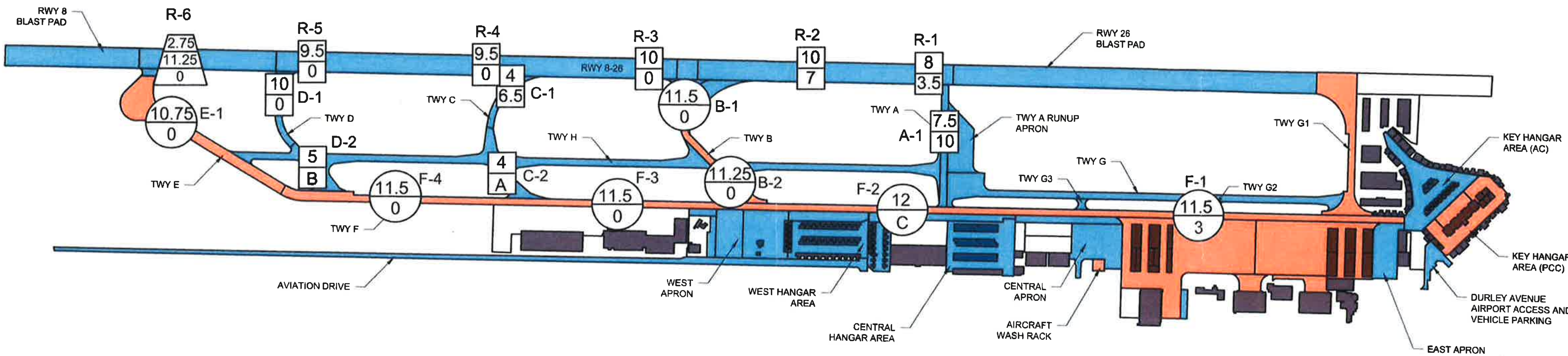
APPENDIX C

Figure 2 - Existing Pavement Section Thicknesses

Figure 3 – USCS Soil Types at Subgrade

Figure 4 - CBR Values for Recompacted Soil

Figure 5 – Approximate CBR Values Based on Existing Soil Density and Moisture Content at Subgrade



LEGEND

## / ## / ##	Asphalt Concrete (AC) - inches Portland Cement Concrete (PCC) - inches Aggregate Base (AB) - inches
## / ##	Asphalt Concrete (AC) - inches Aggregate Base (AB) - inches
## / ## (circle)	Portland Cement Concrete (PCC) - inches Aggregate Base (AB) - inches
(orange)	PCC Pavement
(blue)	AC Pavement

NOTES

A - 12.0" Cement treated well graded sand with gravel over 24.0" lime treated sandy lean clay below 4.0" AC surface layer; no AB present

B - 12.0" Cement treated well graded sand with gravel over 36.0" lime treated silty sand below 5.0" AC surface layer; no AB present

C - 3.0" Well graded sand with some gravel (possible subbase?) below 12.0" PCC surface layer, no AB present

N

NOT TO SCALE

BASE MAP PROVIDED BY: MEAD & HUNT

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 • Fax (805) 544-1786

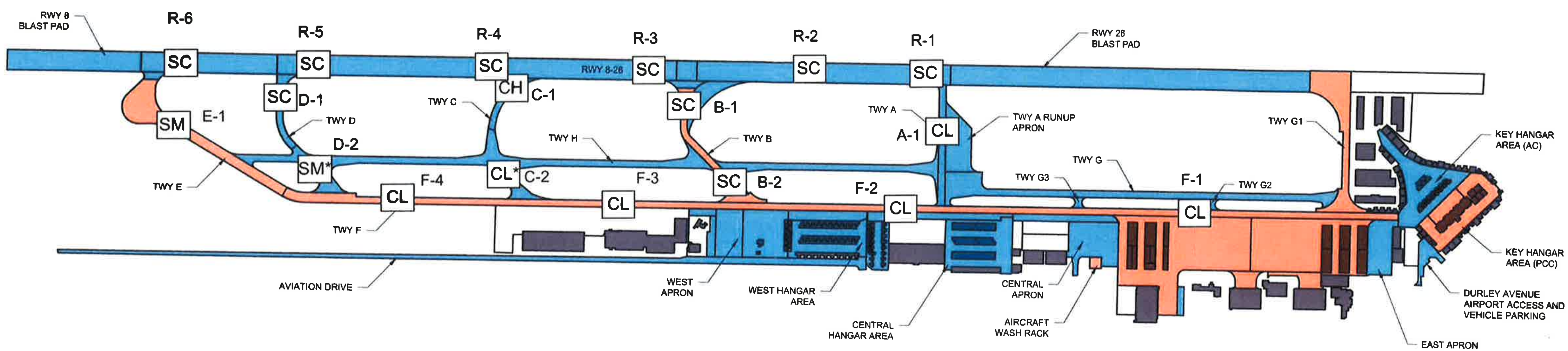
EXISTING PAVEMENT SECTION THICKNESS

Camarillo Airport - PCN Analysis
Mead & Hunt Project No. 3168900 - 155706.01
Camarillo, California

Date
May 8, 2017

Project No.
SL-15603-SD

Figure 2



LEGEND

##	USCS soil type found at or within 1.5 feet of subgrade, i.e., below the pavement section or any possible subbase
##*	Asterisk indicates subgrade soil identified as lime treated
	PCC Pavement
	AC Pavement

N

NOT TO SCALE

BASE MAP PROVIDED BY: MEAD & HUNT

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 • Fax (805) 544-1786

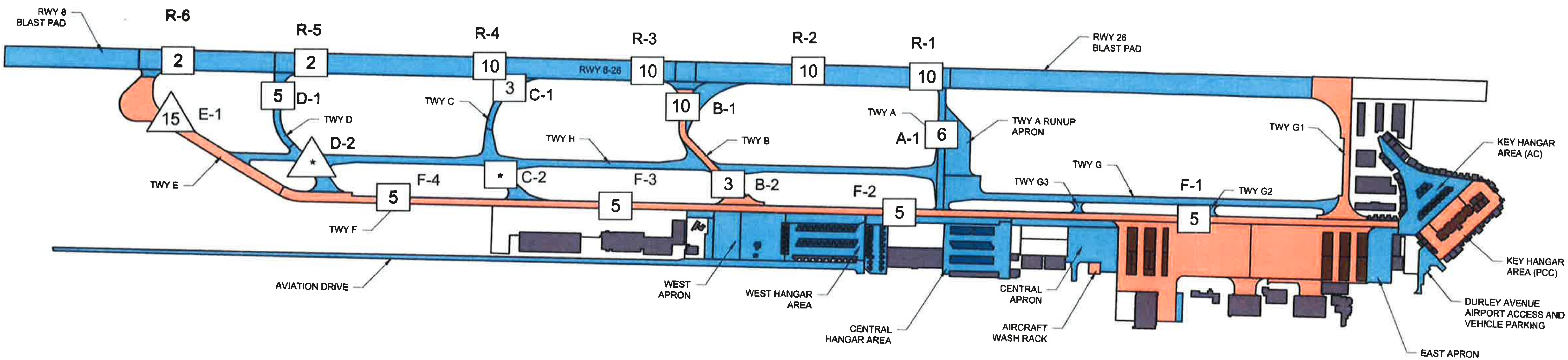
USCS SOIL TYPES AT SUBGRADE

Camarillo Airport - PCN Analysis
Mead & Hunt Project No. 3168900 - 155706.01
Camarillo, California

Date
May 8, 2017

Project No.
SL-15603-SD

Figure 3



LEGEND

## (square)	Recommended CBR value for reconstructed areas with subgrade compacted to a minimum of 95% relative compaction and soil moisture content in range of optimum +/- 2 percent (cohesive soil)
## (triangle)	Recommended CBR value for reconstructed areas with subgrade compacted to a minimum of 100% relative compaction and soil moisture content in range of optimum +/- 2 percent; applies to D2 and E1 only (non-cohesive soil)
*	Asterisk indicates lime treated subgrade soil; no maximum density or CBR test for comparison
	PCC Pavement
	AC Pavement

BASE MAP PROVIDED BY: MEAD & HUNT

NOT TO SCALE

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 • Fax (805) 544-1786

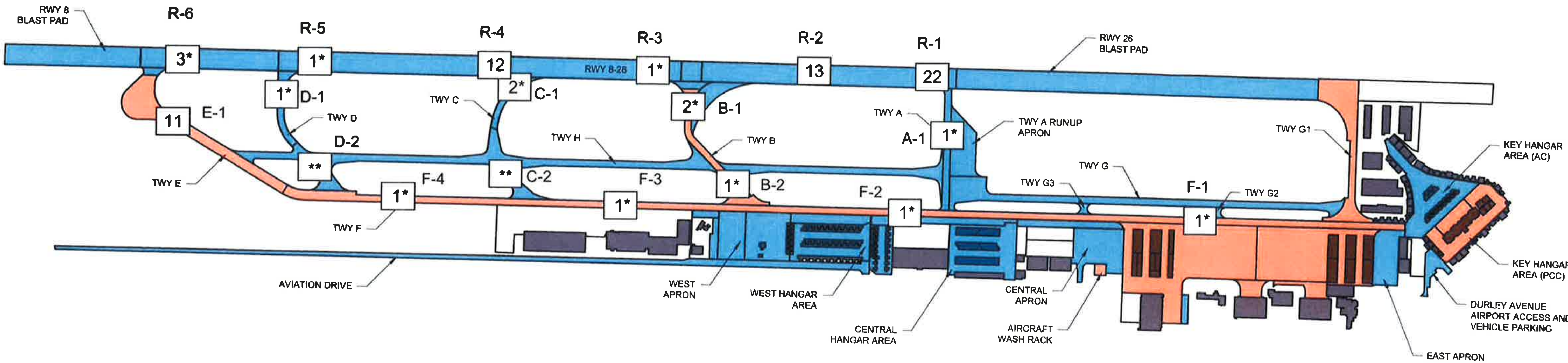
CBR VALUES FOR RECOMPACTED SOIL

Camarillo Airport - PCN Analysis
Mead & Hunt Project No. 3168900 - 155706.01
Camarillo, California

Date
May 8, 2017

Project No.
SL-15603-SD

Figure 4



LEGEND

#	Approximate CBR base on existing soil density and moisture content at subgrade
#*	Asterisk indicates existing soil moisture content and/or density at subgrade out of data range - CBR value estimated only (Minimum CBR Value = 1)
**	Subgrade soil lime treated, no maximum density or CBR test for comparison
	PCC Pavement
	AC Pavement

N

NOT TO SCALE

BASE MAP PROVIDED BY: MEAD & HUNT

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 • Fax (805) 544-1786

APPROXIMATE CBR VALUES BASED ON EXISTING SOIL DENSITY AND MOISTURE CONTENT AT SUBGRADE
Camarillo Airport - PCN Analysis
Mead & Hunt Project No. 3168900 - 155706.01
Camarillo, California

Date
May 8, 2017

Project No.
SL-15603-SD

Figure 5

APPENDIX D

Estimates of Earthwork Shrinkage

Estimates of Earthwork Shrinkage Using In-Place Density Values from Borings and Assumed Final Relative Compaction Values. All Calculations Based on Uniform Density, Moisture Content and Compaction Effort Negative Values Indicate Expansion (Bulking).

Boring No	Depth	Material Description	USCS Classificatio	Maximum Density, pcf	Optimum Moisture, %
R1	2.0 - 4.0 ft.	Light Brown Clayey Sand	SC	125.9	9.0
R3	4.0 - 6.0 ft.	Gray Brown Sandy Lean Clay	CL	122.0	11.1
R6	2.0 - 5.0 ft	Light Brown Sandy Lean Clay	CL	112.1	14.2
A1	2.0 - 5.0 ft.	Brown Sandy Lean Clay	CL	122.6	12.4
B1	2.5 - 5.0 ft.	Gray Brown Sandy Lean Clay	CL	122.0	10.9
C1	2.0 - 5.0 ft.	Dark Gray Brown Sandy Fat Clay	CH	112.0	14.8
D1	2.0 - 5.0 ft.	Light Brown Sandy Lean Clay	CL	122.3	8.8
E1	2.0 - 4.0 ft.	Light Brown Silty Sand	SM	124.6	8.9
F1	2.0 - 4.0 ft.	Gray Brown Sandy Lean Clay	CL	122.3	10.0

Boring	Depth, Ft. Below Ext. Grade	Moisture in Place, %	Dry Density in Place, pcf	Maximum Dens., pcf	Existing Rel.Comp. %	Shrinkage, % at 90 % Rel. Comp.	Shrinkage, % at 91 % Rel. Comp.	Shrinkage, % at 92 % Rel. Comp.	Shrinkage, % at 93 % Rel. Comp.	Shrinkage, % at 94 % Rel. Comp.	Shrinkage, % at 95 % Rel. Comp.
R1	2.5 - 3.0	8.3	123.7	125.9	98	-8.4	-7.4	-6.4	-5.3	-4.3	-3.3
R2	2.5 - 3.0	10.6	121.5	125.9	97	-6.7	-5.7	-4.7	-3.6	-2.6	-1.6
R3	2.5 - 3.0	12.9	99.4	125.9	79	14.0	15.3	16.5	17.8	19.1	20.3
R4	2.5 - 3.0	8.2	115.9	125.9	92	-2.2	-1.1	-0.1	1.0	2.1	3.2
R5	2.5 - 3.0	23.0	99.3	112.1	89	1.6	2.7	3.9	5.0	6.1	7.2
R6	3.0 - 3.5	21.4	108.8	112.1	97	-7.3	-6.2	-5.2	-4.2	-3.1	-2.1
A1	2.5 - 3.0	18.9	105.6	122.6	86	4.5	5.6	6.8	8.0	9.1	10.3
B1	2.5 - 3.0	16.4	122.0	125.9	97	-7.1	-6.1	-5.1	-4.0	-3.0	-2.0
B2	2.5 - 3.0	21.4	106.0	122.0	87	3.6	4.7	5.9	7.0	8.2	9.3
C1	2.5 - 3.0	19.8	104.4	112.0	93	-3.4	-2.4	-1.3	-0.2	0.8	1.9
D1	2.5 - 3.0	16.9	107.9	122.3	88	2.0	3.1	4.3	5.4	6.5	7.7
E1	2.5 - 3.0	10.3	119.8	124.6	96	-6.4	-5.4	-4.3	-3.3	-2.2	-1.2
F1	2.5 - 3.0	20.5	110.5	122.3	90	-0.4	0.7	1.8	2.9	4.0	5.1
F2	2.5 - 3.0	19.1	108.7	122.3	89	1.3	2.4	3.5	4.6	5.8	6.9
F3	2.5 - 3.0	19.7	107.3	122.3	88	2.6	3.7	4.9	6.0	7.1	8.3
F4	2.5 - 3.0	20.1	106.0	122.3	87	3.8	5.0	6.1	7.3	8.5	9.6
Average Shrinkage, percent, all locations :						**-0.5**	**0.6**	**1.7**	**2.8**	**3.9**	**5.0**
						At 90 % Rel. Comp.	**At 91 % Rel. Comp.**	**At 92 % Rel. Comp.**	**At 93 % Rel. Comp.**	**At 94 % Rel. Comp.**	**At 95 % Rel. Comp.**

* - Subgrade soil in Borings C-2 and D-2 lime treated, no maximum density for comparison.

PCN ANALYSIS

MEAD & HUNT PROJECT NO. 3168900-155706.01

Estimates of Earthwork Shrinkage Using In-Place Density Values from Borings and Assumed Final Relative Compaction Values. All Calculations Based on Uniform Density, Moisture Content and Compaction Effort Negative Values Indicate Expansion (Bulking).

Boring No	Depth	Material Description	USCS Classificatioi	Maximum Density, pcf	Optimum Moisture, %
R1	2.0 - 4.0 ft.	Light Brown Well-Graded Sand	SW	125.9	9
R3	4.0 - 6.0 ft.	Gray Brown Sandy Lean Clay	CL	122.0	11.1
R6	2.0 - 5.0 ft	Light Brown Sandy Lean Clay	CL	112.1	14.2
A1	2.5 - 5.0 ft.	Brown Clayey Sand	SC	122.6	12.4
B1	2.5 - 5.0 ft.	Gray Brown Sandy Lean Clay	CL	122.0	10.9
C1	2.0 - 5.0 ft.	Dark Gray Brown Sandy Lean Clay	CL	112.0	14.8
D1	2.5 - 5.0 ft.	Light Brown Sandy Silt	ML	122.3	8.8
E1	2.0 - 4.0 ft.	Light Brown Sandy Silt	ML	124.6	8.9
F1	2.0 - 4.0 ft.	Gray Brown Sandy Lean Clay	CL	122.3	10.0

Boring	Depth, Ft. Below Ext. Grade	Moisture in Place, %	Dry Density in Place, pcf	Maximum Dens., pcf	Existing Rel.Comp. %	Shrinkage, % at 96 % Rel. Comp.	Shrinkage, % at 97 % Rel. Comp.	Shrinkage, % at 98 % Rel. Comp.	Shrinkage, % at 99 % Rel. Comp.	Shrinkage, % at 100 % Rel. Comp.
R1	2.5 - 3.0	8.3	123.7	125.9	98	-2.3	-1.3	-0.3	0.8	1.8
R2	2.5 - 3.0	10.6	121.5	125.9	97	-0.5	0.5	1.5	2.6	3.6
R3	2.5 - 3.0	12.9	99.4	125.9	79	21.6	22.9	24.1	25.4	26.7
R4	2.5 - 3.0	8.2	115.9	125.9	92	4.3	5.4	6.5	7.5	8.6
R5	2.5 - 3.0	23.0	99.3	112.1	89	8.4	9.5	10.6	11.8	12.9
R6	3.0 - 3.5	21.4	108.8	112.1	97	-1.1	-0.1	1.0	2.0	3.0
A1	2.5 - 3.0	18.9	105.6	122.6	86	11.5	12.6	13.8	14.9	16.1
B1	2.5 - 3.0	16.4	122.0	125.9	97	-0.9	0.1	1.1	2.2	3.2
B2	2.5 - 3.0	21.4	106.0	122.0	87	10.5	11.6	12.8	13.9	15.1
C1	2.5 - 3.0	19.8	104.4	112.0	93	3.0	4.1	5.1	6.2	7.3
D1	2.5 - 3.0	16.9	107.9	122.3	88	8.8	9.9	11.1	12.2	13.3
E1	2.5 - 3.0	10.3	119.8	124.6	96	-0.2	0.9	1.9	3.0	4.0
F1	2.5 - 3.0	20.5	110.5	122.3	90	6.3	7.4	8.5	9.6	10.7
F2	2.5 - 3.0	19.1	108.7	122.3	89	8.0	9.1	10.3	11.4	12.5
F3	2.5 - 3.0	19.7	107.3	122.3	88	9.4	10.6	11.7	12.8	14.0
F4	2.5 - 3.0	20.1	106.0	122.3	87	10.8	11.9	13.1	14.2	15.4
Average Shrinkage, percent, all locations :						**6.1**	**7.2**	**8.3**	**9.4**	**10.5**
						At 96 % Rel. Comp.	**At 97 % Rel. Comp.**	**At 98 % Rel. Comp.**	**At 99 % Rel. Comp.**	**At 100 % Rel. Comp.**

* - Subgrade soil in Borings C-2 and D-2 lime treated, no maximum density for comparison.

PCN Analysis Report - Attachment 3

2017 Non-destructive Testing Report, by Dynatest

Dynatest®
DYNATEST CONSULTING, INC.

165 South Chestnut Street
Ventura, California 93001 USA
Tel +1 805 648-2230
Fax +1 805 648-2231

Email: usa@dynatest.com
Webpage: www.dynatest.com

Pavement Engineering Specialists
and Equipment

Mead and Hunt, Inc.

June 2017

Load/Deflection Analysis of Dynatest Heavy Weight Deflectometer Test Results and ACN/PCN Evaluation for:

County of Ventura
Camarillo Airport

in
Camarillo, California

Dynatest®

Table of Contents

List of Appendices

1: Executive Summary

The following information, relative to the tested features at County of Ventura Camarillo Airport (CMA), is summarized from SECTIONS 2 through 7 of this report and is for the benefit of those simply interested in a general overview of the analyses without the input data, discussion and other details associated with and leading to these recommendations. It is imperative that reviewers familiarize themselves with the detailed information included in the following report prior to making any specific decisions based on these recommendations.

The objectives of this project are to determine the structural capacity, voids underneath the slabs, slab load transfer efficiency (LTE), Pavement Classification Number (PCN) and pavement rehabilitation recommendations on several features at CMA Airport for a design period of twenty years subject to the proposed aircraft traffic mix. The structural analyses are based on mechanistic design principles and Heavy Weight Deflectometer (HWD) measurements, and pavement thicknesses information provided by Mead & Hunt, Inc. The pavement structural evaluation was conducted using Federal Aviation Administration (FAA) computer software: COMFAA and FAARFIELD.

Table 1 shows the PCN codes calculated using COMFAA for the existing pavement structures. The PCN values are associated with the traffic used in the evaluation, and an increase in traffic during the evaluation period will reduce the PCN. In addition, Table 1 shows the ACN/PCN ratio for each feature. Typically a ratio greater than 1.1 is considered to be problematic for the proposed aircraft mix.

Table 1 – Existing PCN Codes

Feature	Station (ft.)	PCN Code	ACN Code	ACN/PCN
Runway 8/26	0+00 to 8+60	23/F/B /X/T	31/F/B	1.3
	8+60 to 18+00	39/F/C /X/T	33/F/C	0.8
	18+00 to 30+00	19/F/C /X/T	33/F/C	1.7
	30+00 to 50+00	8/F/D /X/T	34/F/D	4.3
	50+00 to End	37/R/C /W/T	35/R/C	0.9
Taxiway A	0+00 to End	7/F/D /X/T	34/F/D	4.9
Taxiway B	0+00 to End	32/R/C /W/T	35/R/C	1.1
Taxiway C	0+00 to 5+00	1/F/D /X/T	33/F/D	33.0
	5+00 to End	377/F/A /X/T	29/F/A	0.1
Taxiway D	0+00 to 6+50	10/F/C /X/T	33/F/C	3.3
	6+50 to End	105/F/A /X/T	29/F/A	0.3
Taxiway E	0+00 to End	30/R/B/W/T	34/R/B	1.1
Taxiway F	0+00 to 28+00	56/R/C/W/T	35/R/C	0.6
	28+00 to 55+00	55/R/C/W/T	35/R/C	0.6
	55+00 to End	31/R/C/W/T	35/R/C	1.1

The mechanistic analyses using FAARFIELD indicate that the 20-year design life corresponding to the proposed aircraft mix will not be met for the following airport features: Runway 8/26, Taxiway A, C, D and E. Therefore, rehabilitation/reconstruction design is needed for the aforementioned airport features to ensure that the design life will be met. Table 2 shows the recommended structural rehabilitation for the evaluated features. Gulfstream G-650 has the Maximum Take-off Weight (MTOW) using CMA. This aircraft has a MTOW of 99,600-lb. It is important to state that FAA AC 150/5320-6F Sections 3.13.3.2 and 3.14.3.1 requires that a stabilized subbase, such as Cement Treated Base (CTB), is present under both new flexible and rigid pavements serving airplanes weighing 100,000 lb. or more. A crushed aggregate base that can be proven to exhibit a remolded soaked CBR of 100 or greater may be substituted for a stabilized base course, as per FAA AC 150/5320-6F Sections 3.6. In addition, per FAA AC 150/5320-6F Section 3.13.4 a subbase is required as part of the flexible pavement structure on subgrades with a CBR value less than 20. This requirement was accounted for in the reconstruction alternatives.

Table 2 – Recommended Structural Remediation & Maintenance for Proposed Aircraft Mix

Feature	Test Line	Station (ft.) [1]	Recommended Structural Remediation for the Proposed Aircraft Mix for a 20-Year Design Period	
			Alternative 1:	Alternative 2: Reconstruction
Runway 8/26	10 & 30-ft Left, 10 & 30-ft Right	0+00 to 8+60	3.5" HMA Overlay	7" HMA over 6" AB over 5.5" SB or 5" HMA over 5" CTB over 6" AB over 4" SB
		8+60 to 18+00	2" HMA Overlay	7" HMA over 6" AB over 10.5" SB or 5" HMA over 5" CTB over 6" AB over 4" SB
		18+00 to 30+00	2" HMA Overlay	6" HMA over 6" AB over 10" SB or 5" HMA over 5" CTB over 6" AB over 4" SB
		30+00 to 50+00	5" HMA Overlay	8" HMA over 6" AB over 16.5" SB or 5" HMA over 6" CTB over 6" AB over 7" SB
		50+00 to End	Preventive Maintenance	----
Taxiway A	10-ft Left, 10-ft Right	0+00 to End	12" HMA Overlay	14" HMA over 6" AB over 19.5" SB or 7" HMA over 8" CTB over 6" AB over 12" SB
Taxiway B	10-ft Left, 10-ft Right	0+00 to End	Preventive Maintenance	----
Taxiway C	10-ft Left, 10-ft Right	0+00 to 5+00	16.5" HMA Overlay	14" HMA over 6" AB over 22" SB or 7" HMA over 9" CTB over 6" AB over 10" SB
		5+00 to End	Preventive Maintenance	----
Taxiway D	10-ft Left, 10-ft Right	0+00 to 6+50	3.5" HMA Overlay	7" HMA over 6" AB over 16" SB or 5" HMA over 6" CTB over 6" AB over 4" SB
		6+50 to End	Preventive Maintenance	----
Taxiway E	10-ft Left, 10-ft Right	0+00 to End	2" HMA Overlay	----
Taxiway F	10-ft Left, 10-ft Right	0+00 to 28+00	Preventive Maintenance	----
		28+00 to 55+00	Preventive Maintenance	----
		55+00 to End	Preventive Maintenance	----

1) Refer to Appendix B for a schematic showing Station 0+00.
2) HMA: Hot Mix Asphalt P401/403, PCC = Portland Cement Concrete P501, CTB = Cement-Treated Base P304, AB = Aggregate Base P209, SB = Subbase P154.

Since the aircrafts using CMA do not show a MTOW greater or equal than 100,000-lb, the requirements stated in FAA AC 150/5320-6F Sections 3.13.3.2 and 3.14.3.1 are not applicable. Nonetheless, two different reconstruction alternatives are presented in Table 2. The first option accounts for existing traffic conditions and the second option uses a more conservative approach of assuming that an aircraft type having a MTOW greater than 100,000-lb will be in service on CMA during the analysis period, in which case a stabilized layer is recommended.

Several joints were tested for LTE, and possible voids and support problems. Overall, there was very good load transfer efficiency on most of the tested slabs. However, the analyses show possible voids and support problems on several of the evaluated slabs. Poor LTE and voids lead to corner breaks and a significant reduction in pavement structural capacity. Due to the discrete nature of deflection testing, actual location and extent of undersealing requirements need to be determined visually.

2. Introduction

From December 3 to 4th, 2016 nondestructive load-deflection tests were performed on Runway 8/26, Taxiways A, B, C, D, E and F at CMA Airport in Camarillo, CA. The purpose of these tests and the associated analyses is to determine the backcalculated layer moduli for each of the pavement layers of the evaluated airport features and to determine the Load Transfer Efficiency (LTE), PCN and pavement rehabilitation alternatives for a 20-year design period.

3. The Dynatest FWD/HWD Test System

The Dynatest Model 8082 Heavy Weight Deflectometer (HWD) Test System was used to generate the requisite non-destructive testing (NDT) load-deflection data analyzed in this report. Basically, the Dynatest HWD generates a transient, impulse-type load of 20-30 msec duration, at any desired (peak) load level between 6,000 and 72,000-lbs, thereby approximating the effect of a 30-50 mph moving wheel load. For this project, target load levels of 15,000, 25,000, and 35,000-lb were applied. A brief description of the Dynatest FWD/HWD Test System is shown in **Appendix A**.

4. The ELMOD Computer Program

The HWD-generated load-deflection data were analyzed using "analytical-empirical" methodology through a specially developed software package designed to do the task in the best and most efficacious manner available. The system is "analytical" in the sense that actual, in-situ material properties and wheel load responses are derived through a reverse, layered analysis technique, as described below. It is still "empirical", however, in the sense that the relationships between the load-related response of these mechanistic or analytical properties and future pavement performance are based upon past experience (observed performance) and associated research. The software package employed was the Dynatest ELMOD computer program.

ELMOD is an acronym for Evaluation of Layer Moduli and Overlay Design, and the program is used to backcalculate the mechanistic material properties of an axial-symmetric, semi-infinite pavement system (i.e. the elastic moduli or "E"-values of each structural layer in the pavement).

Based on these derived E-values for each individual HWD test point, the design life and needed overlay to bring the pavement up to its design life standard are calculated. The program is able to assign various user controlled seasonal adjustments to the derived E-values (e.g., a lower rainy season subgrade modulus and a varying AC modulus as a function of seasonal temperature), and then calculate the expected remaining service life of the pavement section, and an overlay design if the expected lifetime is inadequate, based on certain "transfer functions" which are also user controlled. These transfer functions are primarily based on laboratory measured performance tests that were subsequently correlated to field observed performance obtained from various pavements.

When the fundamental structural pavement properties (i.e., E-values) have been determined, the critical stresses and strains in the structure are calculated.

As indicated, the prediction of pavement performance (roughness or cracking) from the calculated pavement response (critical stresses and strains) is empirical. The empirical relationships between the derived mechanistic material properties and performance are, however, user controlled, i.e., they are variable inputs to ELMOD. The program, therefore, may be used for any specific local environmental conditions if these relationships are known.

It should be noted that, in general, most of the measured magnitudes of deflection are due to the response of the subgrade. It is therefore very important that the subgrade modulus is accurately determined. A small error in the subgrade modulus will lead to large errors in the overlying layers, including the asphalt or Portland cement concrete modulus. For this reason, it is necessary to consider any non-linearity of the subgrade, which can be done quite easily with the analytical-empirical method using the highly accurate deflection data obtained from the Dynatest FWD or HWD Test System.

Due to the large influence of the subgrade on the measured deflections, it is important that the deflections are measured at a load level similar to that resulting from heavy aircraft wheels, and that the deflections, especially those measured at large distances from the loading center (≥ ~3 ft), are measured very accurately. With the Dynatest FWD or HWD Test System, deflections are measured to a guaranteed absolute dynamic (under the FWD loading conditions) accuracy of 2% ± 2 microns (0.08 mils) and a typical absolute accuracy of 1% ± 1 micron (0.04 mils).

Many other features of the ELMOD program are also significant and important in relation to the process of using FWD or HWD generated data to obtain bearing capacity assessments and rehabilitation designs. Some of the specific applications used for the pavement analyzed in this report are also addressed in the following section, "Analysis Approach".

5. Analysis Approach

5.1. HWD Test Lines

The stationing for this project was carried out in units of feet. Station 0+00 for all the features is shown in **Appendix B**. Testing was performed at 10 and 30-ft left and right of the Runway's centerline and at 10-ft left and right of each Taxiway's centerlines. In addition, HWD test interval was set at approximately 100 and 200-ft intervals for the Runway 8/26 and at 100-ft for all taxiways. HWD test points were staggered between test paths to provide increased coverage over the features.

5.2. Pavement Layer Thicknesses

Earth Systems Pacific on behalf of Mead & Hunt, Inc. performed a total of approximately 19 borings on all evaluated features. The following average layer thicknesses were used in the analyses based on the borings and the information from the deflection testing. It is important to mention that a significant degree of variability was found in the layer thicknesses and types on Runway 8/26. In addition, due to the aforementioned variability the runway was subdivided in five sections based on HWD measured deflections, pavement surface condition, and layer thicknesses and types. Table 3 shows the pavement layer information used in the analyses.

Table 3 – Layer Thicknesses used in the Analyses

Feature	Bore ID	Station (ft.) 1)	AC (in)	PCC (in)	AB (in)
Runway 8-26	R-1	250	8.0	----	3.5
	R-2	1,150	10.0	----	7.0
	R-3	2,400	10.0	----	----
	R-4	3,400	9.5	----	----
	R-5	4,560	9.5	----	----
	R-6	5,650	2.8	11.3	----
Taxiway A	A-1	350	7.5	----	10.0
Taxiway B	B-1	250	----	11.5	----
	B-2	900	----	11.3	----
Taxiway C	C-1	250	4.0	----	7
	C-2*	800	4.0	----	12**
Taxiway D	D-1	300	10.0	----	----
	D-2*	750	5.0	----	12**
Taxiway E	E-1	550	----	10.8	----
	E-2	1,150	----	----	----
Taxiway F	F-1	1,200	----	11.5	3.0
	F-2	3,500	----	12.0	3.0
	F-3	5,650	----	11.5	----
	F-4	7,300	----	11.5	----

1) Refer to Appendix B for a schematic showing Station 0+00.
2) AC = Asphalt Concrete, PCC = Portland Cement Concrete, and AB = Aggregate Base.
* Denotes Lime Treated Subgrade
** Denotes Cement Treated Base

5.3. Design Aircraft Mix

The proposed aircraft mix for the pavement evaluation was provided by Mead & Hunt, Inc. According to Mead & Hunt, Inc. the provided design traffic is based on the fleet mix from the Taxiway H project and added aircraft from the preliminary design of CMA Northeast Hangar Development Fleet Mix and Sun Air (FBO). In addition an estimated annual growth rate of 1.8% was applied to the aircraft operations.

According information provided, a total of 93,995 annual aircraft departures were counted in 2016, as shown in Table 4. These departures were assumed to correspond to all airport features including Runway 8/26, Taxiways A, B, C, D, E and F. One hundred percent of total operations were assigned to each of the airport features.

Table 4 – CMA Annual Aircraft Departures

Aircraft	Maximum Takeoff Weight (lbs)	2016 Annual Departures	2036 Annual Departures
Single Wheel 10,000 lb.	10,000	86,130	123,058
Single Wheel 12,500 lb.	12,500	5,000	7,144
BeechJet 400A	16,300	950	1,357
Hawker-800	27,520	150	214
Citation-X	36,000	195	279
Gulfstream-GIV	80,000	505	722
Gulfstream-GV	91,000	150	214
Global Express-6000	99,500	185	264
Gulfstream G-650	99,600	730	1,043
Total Aircraft Departures		**93,995**	**134,295**

Airport pavement design using FAA Advisory Circular 150/5320-6E considers only departures and ignores the arrival traffic when determining the number of airplane passes. This is because in most cases airplanes arrive at an airport at a significantly lower weight than at takeoff due to fuel consumption. During touchdown impact, remaining lift on the wings further alleviates the dynamic vertical force that is actually transmitted to the pavement through the landing gears. The FAA has defined that a departure is typically accounted for as two aircraft operations. In other words, annual departures are calculated as aircraft operations divided by two to disregard aircraft landing.

In order, to determine pavement damage due to aircraft loading, the Maximum Take-off Weight (MTOW), landing gear configuration and tire pressure of each aircraft were utilized to determine the airport feature's PCN and remaining life.
Table **5** shows the 2036 forecasted aircraft mix that is proposed to be used to conduct the pavement evaluation for CMA Airport features.

Table 5 - Design Aircraft Mix Gear Configuration for CMA Airport

Aircraft	Maximum Takeoff Weight (lbs)	% Gross on One Main Gear	Gear Load (lbs)	Gear Type 1)	Wheel Spacing (in)	Axle Spacing (in)	Tire Pressure (psi)	Tread (in)
Single Wheel 10,000 lb.	10,000	100	10,000	S	----	---	50	150
Single Wheel 12,500 lb.	12,500	47.5	5,938	S	----	---	50	150
BeechJet 400A	16,300	47.5	7,743	S	----	---	90	112
Hawker-800	27,520	47.5	13,072	D	12.85	---	135	112
Citation-X	36,000	47.5	17,100	D	12	----	189	128
Gulfstream-GIV	80,000	47.5	38,000	D	15.75	----	185	172
Gulfstream-GV	91,000	47.5	43,225	D	15.75	----	185	164
Global Express-6000	99,500	47.5	47,263	D	18.5	----	188	172
Gulfstream G-650	99,600	47.5	47,310	D	23	----	188	225

1) S = Single, and D = Dual

6. Discussion of Results

6.1. General

Complete ELMOD analyses were performed using measured HWD test loads and deflections for all of the data. A summary of the relevant results is presented in this section.

Deflection testing was staggered between the lines to increase the coverage on the Runway and Taxiways. Joint load transfer efficiency (LTE) testing was also performed for every other tested slab. Testing was conducted during nighttime when the temperature differential was at its minimum value and also when the joint openings were in the most critical condition. LTE results are presented later in this report. Test loads were determined based on the Mead & Hunt, Inc. provided design aircraft mix. Figure 1 shows the airport features tested. In addition, HWD testing was conducted between 10 pm and 6 am, and the air temperature ranged from 39 to 52°F, while the surface temperature ranged from 44 to 53°F.

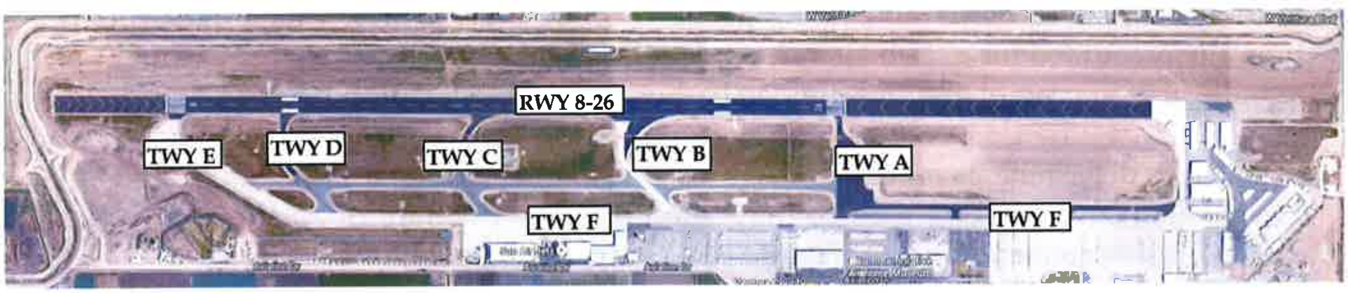


Figure 1 – CMA Airport Features Tested

Table 6 shows the statistics for all normalized center deflections that were tested on CMA Airport. Figure 2 below shows the load-normalized center deflections for each of the lines evaluated on Runway 8/26. Similar plots for the remaining features are presented in **Appendix C**. Further inspection of Runway 8/26 shows a significant variation of the deflection among tested lines and within test lines and a significantly lower deflections near the 8 end (west) of the Runway. This area corresponds to a rigid pavement having an AC overlay over PCC slabs.

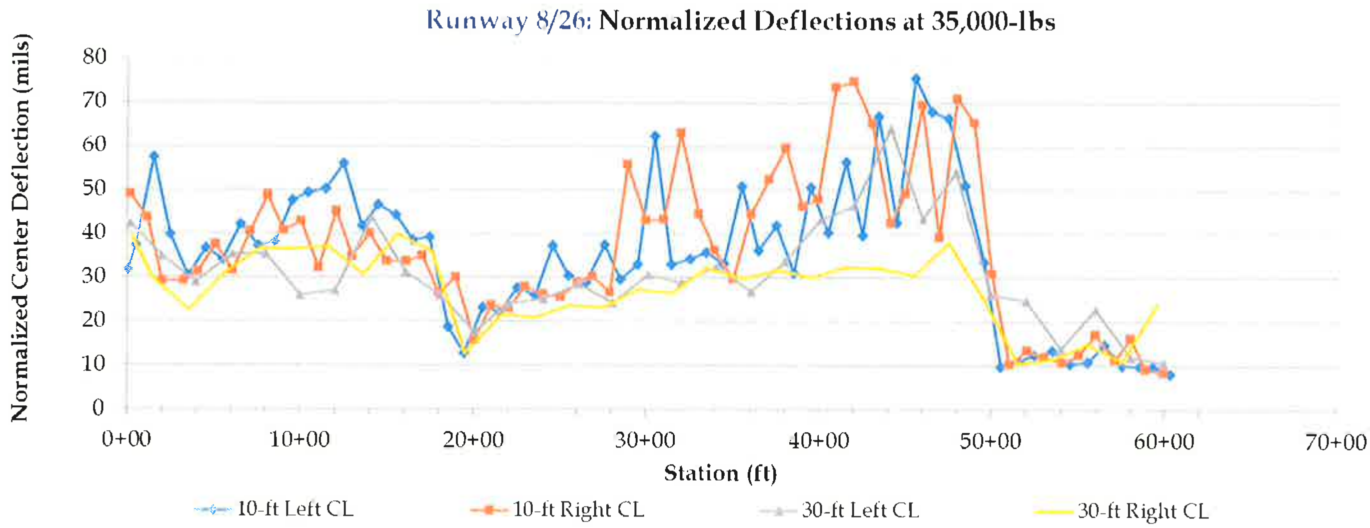


Figure 2 – Normalized Center Deflections for Runway 8/26

From the statistical analysis shown in Table 6, it is clear that some of the features at CMA show abnormally higher normalized center deflections. This becomes evident specifically for Taxiway A and Taxiway C from station 0+00 to 5+00. As a rule of thumb the higher the normalized center deflections the weaker the pavement structure and thus the higher the probability that the pavement would be structurally inadequate.

Table 6 – HWD Load Normalized Center Deflection Statistics

Feature	Station (ft.) 1)	Normalized Center Deflections (mils) 2)		
		Average	Standard Deviation	84th Percentile
Runway 8/26	0+00 to 8+60	36.65	7.25	43.90
	8+60 to 18+00	39.28	7.26	46.55
	18+00 to 30+00	26.21	7.51	33.72
	30+00 to 50+00	45.11	14.55	59.66
	50+00 to End	13.39	5.26	18.65
Taxiway A	0+00 to End	116.34	30.59	146.93
Taxiway B	0+00 to End	20.77	10.23	30.99
Taxiway C	0+00 to 5+00	136.49	30.69	167.18
	5+00 to End	10.92	3.30	14.22
Taxiway D	0+00 to 6+50	35.62	22.75	58.38
	6+50 to End	13.85	6.67	20.52
Taxiway E	0+00 to End	18.04	8.73	26.77
Taxiway F	0+00 to 28+00	20.80	8.93	29.73
	28+00 to 55+00	22.89	10.81	33.70
	55+00 to End	24.90	12.70	37.60

1) Refer to Appendix B for a schematic showing Station 0+00.
2) Center deflections were normalized at 35,000-lb. for all features.

6.2. Layer Moduli

All layer moduli were backcalculated for each deflection basin using ELMOD, and are summarized in Table 7 and are shown graphically in Figure 3 through 9. From the results it is clear that Taxiway A shows the lowest surface layer moduli for all evaluated features. In addition, Taxiway A and Taxiway C from station 0+00 to 5+00 show the lowest subgrade layer moduli indicating a support bearing capacity potential problem.

Each airport feature was subdivided in uniform sections based on visual condition of the surface, pavement thicknesses information and deflection data. In order to simplify the analysis and for construction practicality the subsections were grouped into the smallest possible number of sections.

The modulus of subgrade reaction, k, was obtained through the backcalculation process. The resulting 84^{th} percentile k values for each pavement section were utilized to determine the subgrade ACN/PCN code for the rigid pavements, while the modulus of elasticity was used for the flexible pavements. The results are also shown in Table 7.

Table 7 – Backcalculated Layer Moduli

Feature	Test Line	Station (ft.) [1]	Layer Moduli (ksi) [2]				CBR/ *k* (*pci*)	CBR/ k Category
			Type [3]	Average	Standard Deviation Factor	84th Percentile		
Runway 8/26	10, & 30-ft Left, 10 & 30-ft Right	0+00 to 8+60	Layer 1: AC	451	1.704	265	9.4	B
			Layer 2: AB	42	1.242	34		
			Layer 3: SG	19	1.330	14.1		
		8+60 to 18+00	Layer 1: AC	236	1.632	145	6.7	C
			Layer 2: AB	38	1.260	30		
			Layer 3: SG	14	1.381	10.0		
		18+00 to 30+00	Layer 1: AC	579	1.628	356	7.9	C
			Layer 2: SG	17	1.421	11.8		
		30+00 to 50+00	Layer 1: AC	320	1.819	176	4.0	D
			Layer 2: SG	9	1.429	6.0		
		50+00 to End	Layer 1: AC	400	1.607	249	*142.3*	C
			Layer 2: PCC	3,080	2.066	1,491		
			Layer 3: SG	28	1.349	20.4		
Taxiway A	10-ft Left & Right	0+00 to End	Layer 1: AC	54	2.046	27	1.6	D
			Layer 2: AB	11	1.866	6		
			Layer 3: SG	5	1.899	2.4		
Taxiway B	10-ft Left & Right	0+00 to End	Layer 1: PCC	3,978	1.219	3,264	*165.5*	C
			Layer 2: SG	13	1.900	6.8		
Taxiway C	10-ft Left & Right	0+00 to 5+00	Layer 1: AC	315	2.035	155	1.4	D
			Layer 2: AB	23	1.609	15		
			Layer 3: SG	3	1.663	2.1		
	10-ft Left & Right	5+00 to End	Layer 1: AC	1,165	2.753	423	24.1	A
			Layer 2: CTB	1,461	1.393	1,049		
			Layer 3: SG*	45	1.233	36.2		
Taxiway D	10-ft Left & Right	0+00 to 6+50	Layer 1: AC	392	2.120	185	4.7	C
			Layer 2: SG	10	1.370	7.0		
		6+50 to End	Layer 1: AC	473	2.219	213	16.6	A
			Layer 2: CTB	1,027	1.384	742		
			Layer 3: SG*	40	1.608	25.0		
Taxiway E	10-ft Left & Right	0+00 to End	Layer 1: PCC	3,689	1.344	2,744	*272.2*	B
			Layer 2: SG	17	1.937	8.8		
Taxiway F	10-ft Left & Right	0+00 to 28+00	Layer 1: PCC	4,940	1.426	3,465	*158.8*	C
			Layer 2: AB	38	1.359	28		
			Layer 3: SG	28	1.621	17.4		
		28+00 to 55+00	Layer 1: PCC	3,986	1.252	3,184	*96.0*	C
			Layer 2: AB	37	1.407	26		
			Layer 3: SG	12	1.870	6.6		
		55+00 to End	Layer 1: PCC	3,024	1.311	2,307	*123.3*	C
			Layer 2: SG	11	1.897	5.7		

1) Refer to Appendix B for a schematic showing Station 0+00.
2) Based on a log-normal distribution.
3) AC = Asphalt Concrete, PCC= Portland Cement Concrete, AB = Aggregate Base, CTB = Cement Treated Base, SG = Support, and SG* =Lime Treated Subgrade

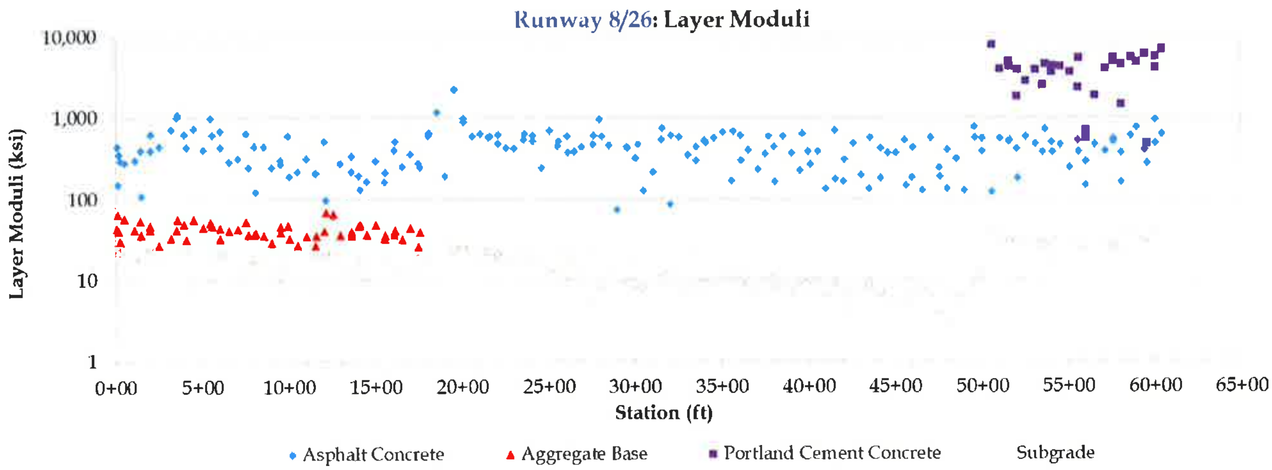


Figure 3 – Runway 8/26 Layer Moduli

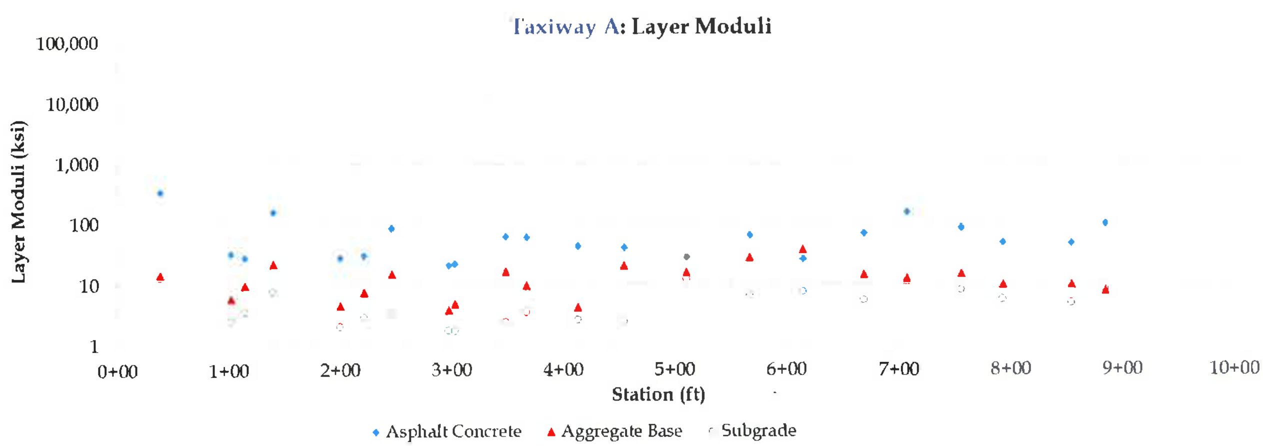


Figure 4 – Taxiway A Layer Moduli

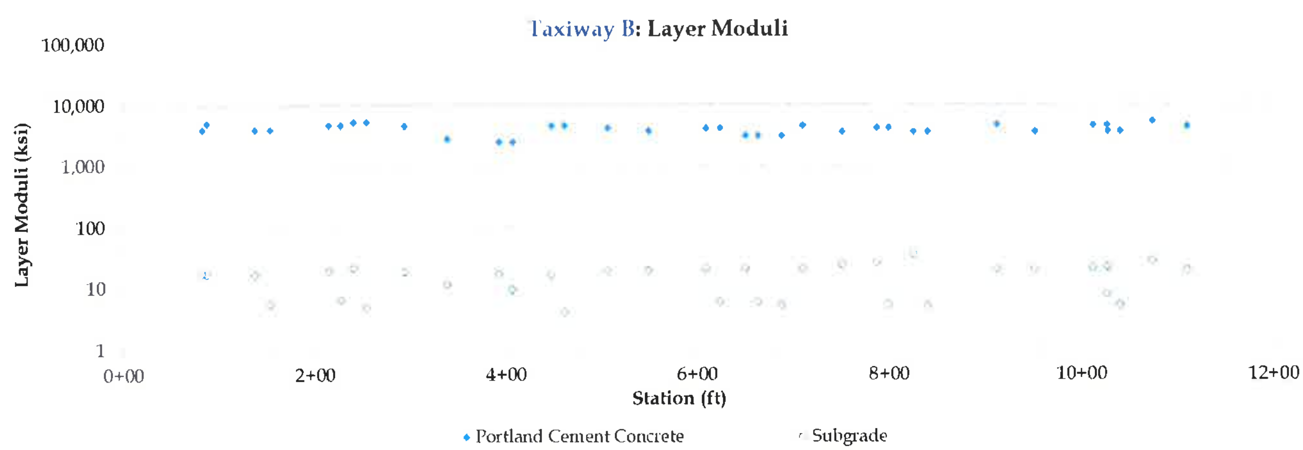


Figure 5 – Taxiway B Layer Moduli

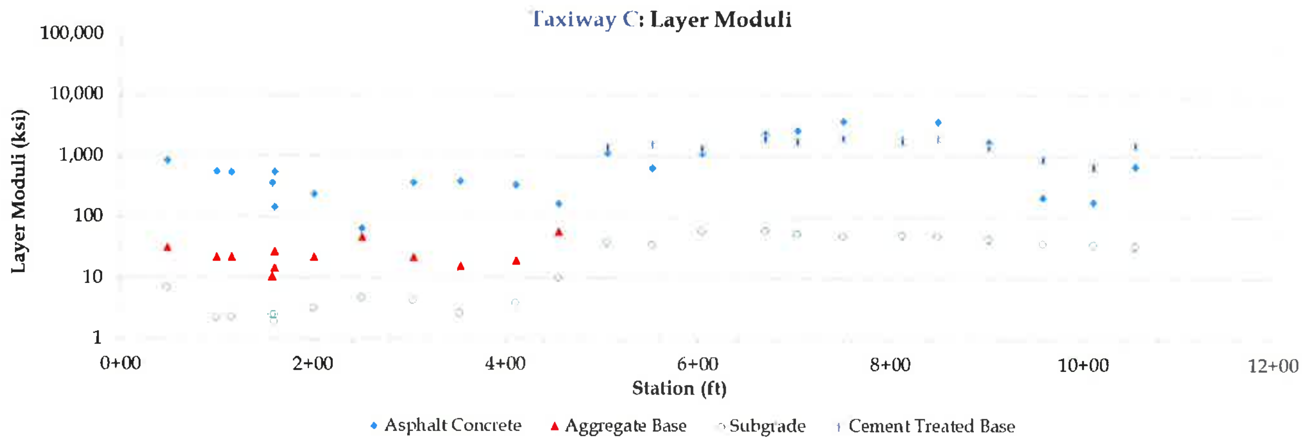


Figure 6 – Taxiway C Layer Moduli

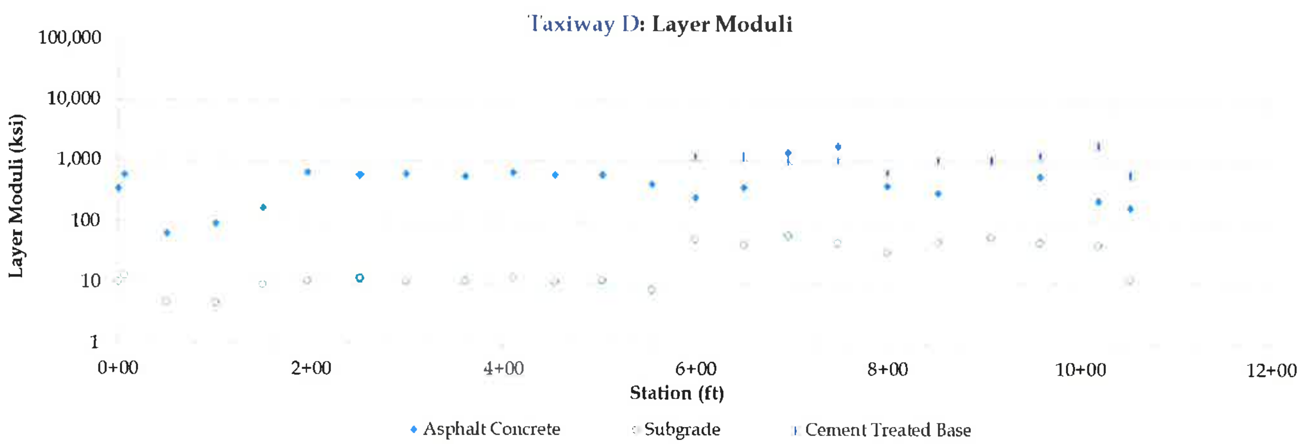


Figure 7 – Taxiway D Layer Moduli

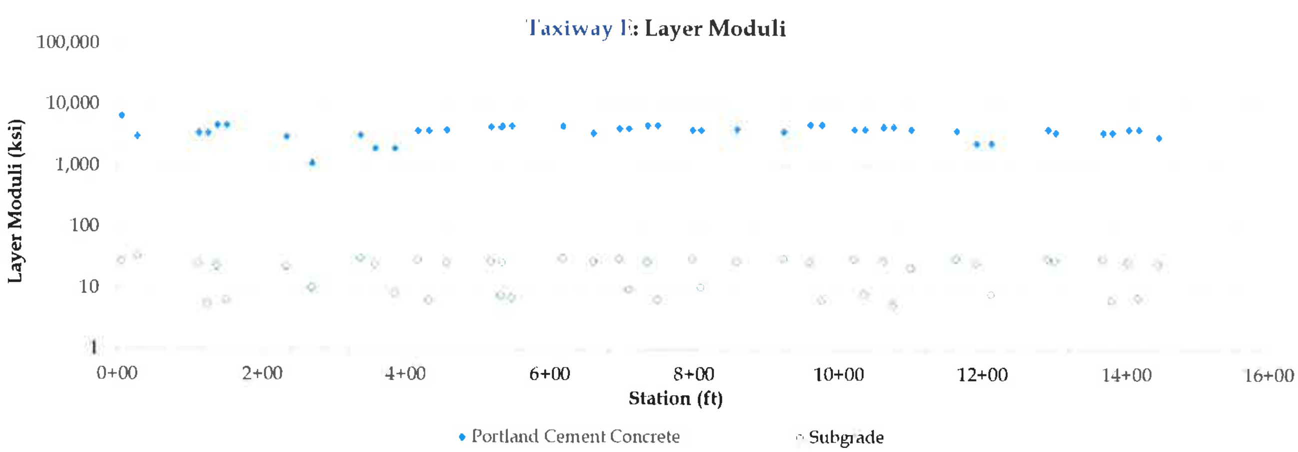


Figure 8 – Taxiway E Layer Moduli

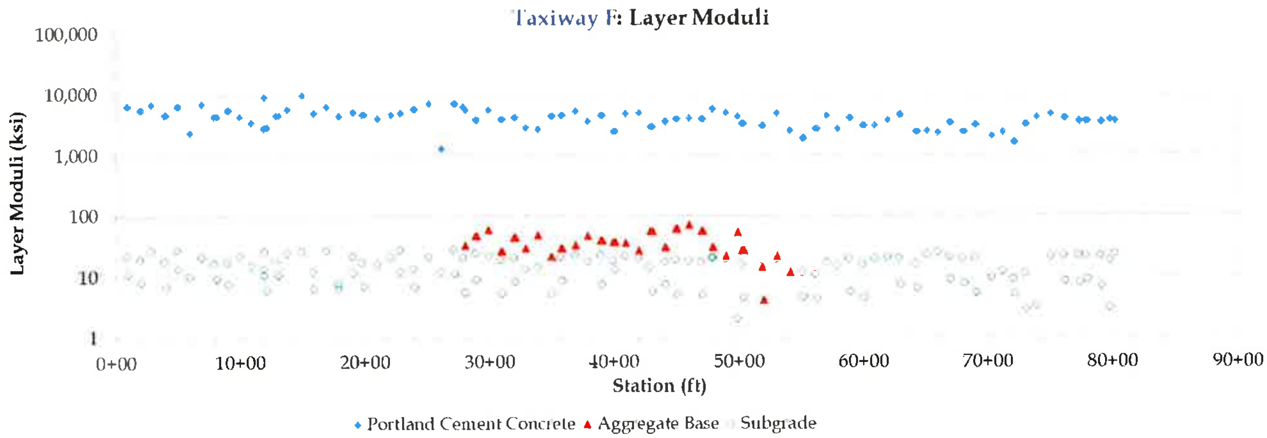


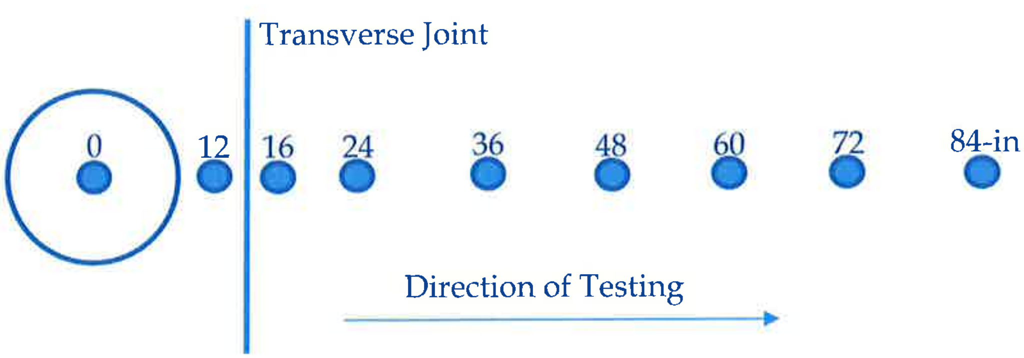
Figure 9 – Taxiway F Layer Moduli

6.3. Load Transfer Efficiency, Voids & Support Problems

The load transfer efficiency (LTE) is reported for each tested PCC joint using the Westergaard's equation. The load transfer efficiency (LTE) was calculated using the Westergaard equation which makes use of the deflections from the two geophones positioned at each side of the joint, and a bending factor from the mid-slab test using the deflections from the same geophones.

$$\%\ \text{LTE} = \frac{2 \times D_{J2}}{D_{J1} + D_{J2}} \times \frac{D_{M1}}{D_{M2}} \times 100$$

D refers to deflection, J and M to joint and mid-slab and 1 and 2 to first and second geophone chosen for the joint calculation. The geophones at 12 and 16-in were used in this case for the transverse joints load transfer efficiency evaluation.



FAA AC 150/5370-11B considers joints with LTE of 70% or greater as acceptable, 50 to 70% as fair, and less than 50% as poor. Low LTE may lead to excessive stress concentrations, voids underneath the slab and ultimately corner breaks. Examining the joints with poor LTE should be inspected and monitored in the field. It should be noted that joint evaluation analysis results are highly dependent on the time of day at which NDT was performed due to temperature effects (i.e. curling and warping of the slab).

Table 8 and Figures 10 through 12 show the LTE results for the evaluated test lines for each evaluated airport feature. Overall, LTE is in in fair to poor condition for all evaluated test lines.

Table 8 – Joint Load Transfer Efficiency

Feature	Test Line	Station (ft.) [1]	Joint Load Transfer Efficiency		
			Average	Standard Deviation Factor	84th Percentile
Taxiway B	10-ft Left, 10-ft Right	0+00 to End	56%	1.38	41%
Taxiway E	10-ft Left, 10-ft Right	0+00 to End	38%	1.35	28%
Taxiway F	10 & 30-ft Left, 10 & 30-ft Right	0+00 to 28+00	71%	1.13	63%
		28+00 to 55+00	60%	1.31	46%
		55+00 to End	56%	1.45	39%

1) Refer to Appendix B for a schematic showing Station 0+00.

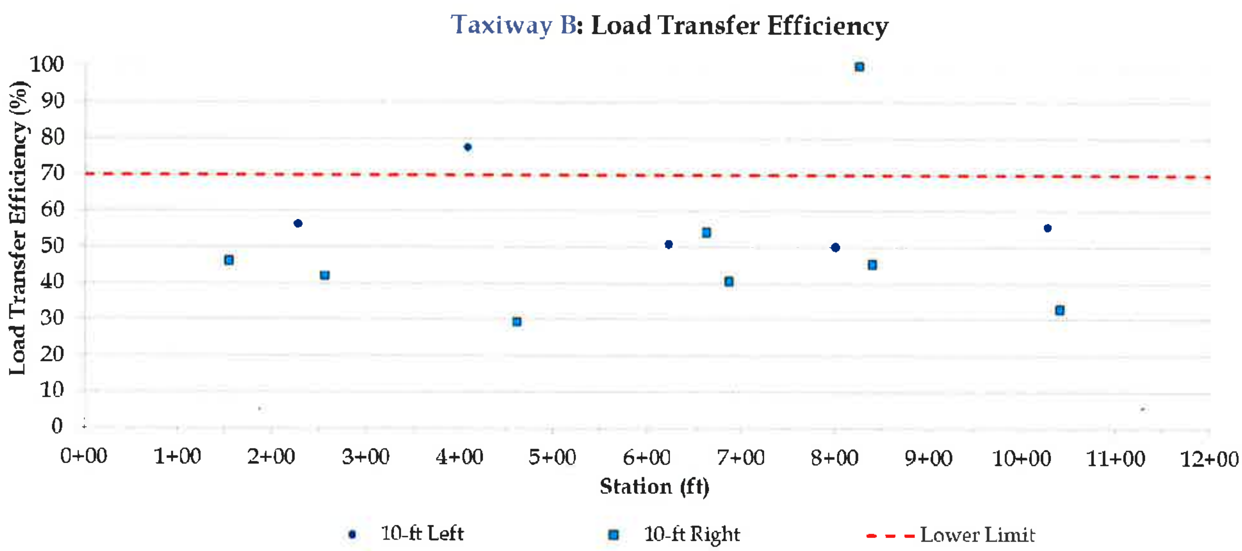


Figure 10 – Load Transfer Efficiency for Taxiway B

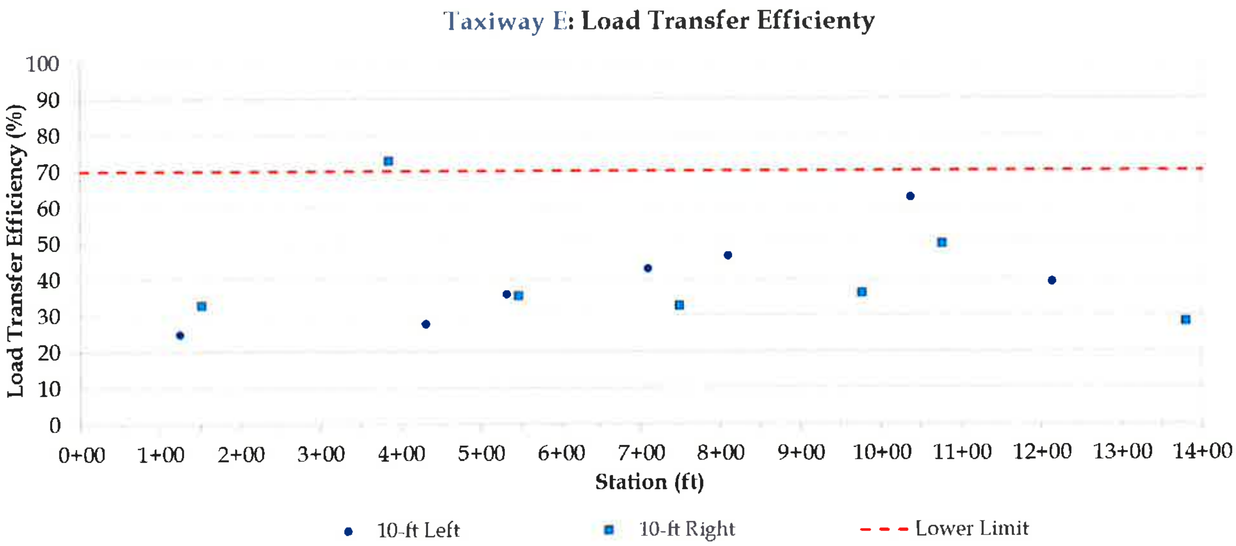


Figure 11 – Load Transfer Efficiency for Taxiway E

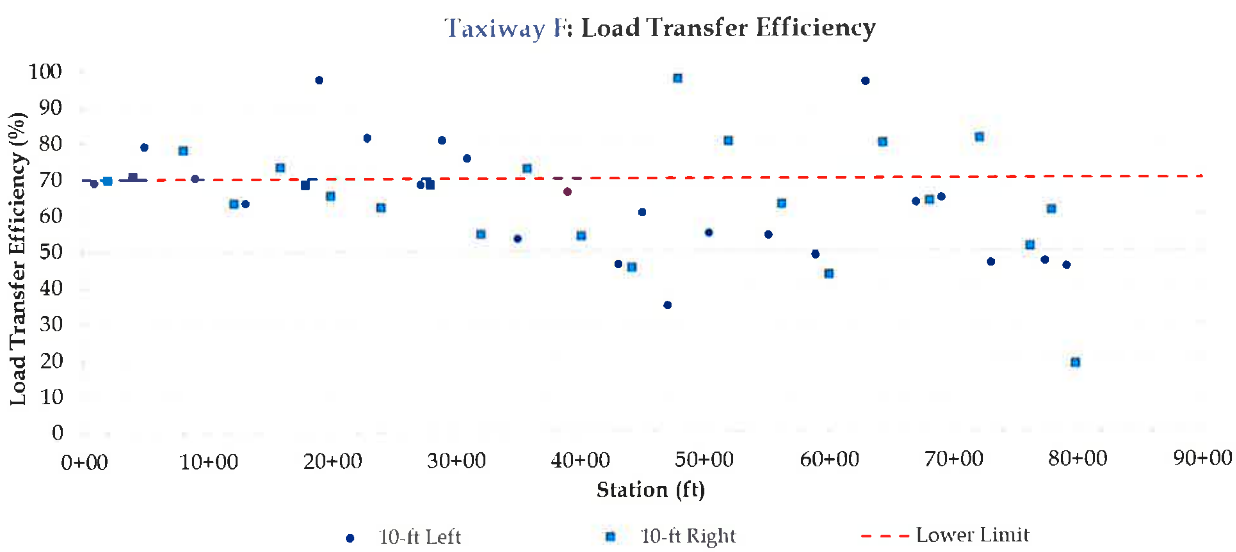


Figure 12 – Load Transfer Efficiency for Taxiway F

Voids underneath the PCC slabs and support problem were assessed using a method described in the 1993 AASHTO Guide for Design of Pavement Structures on which the deflections at the corner/edge are measured at various load levels to establish the load vs. deflection response. According to FAA Circular AC 150/5370-11B, in general, a load-deflection intercept greater than 3 mils indicates the presence of a void. Figure 133 through 15 show the resulting load-deflection intercept for all evaluated airport features. From the results it is clear that potential voids are present underneath the tested slabs. An undersealing campaign is recommended to avoid further pavement deterioration and to improve the overall LTE of all rigid pavements at CMA.

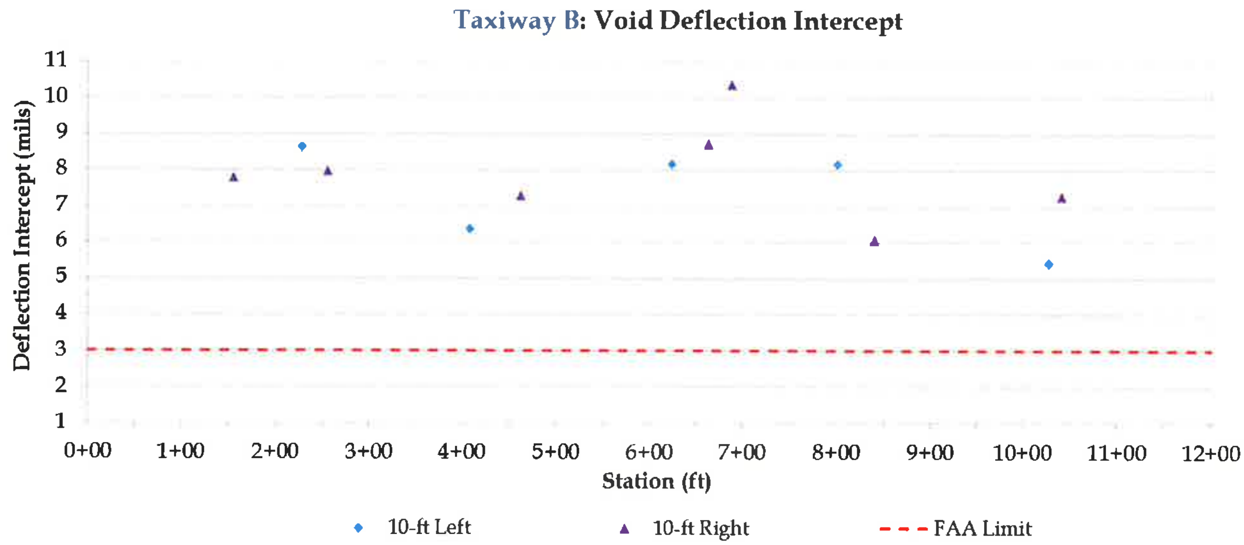


Figure 13 – Load-Deflection Intercept for Taxiway B

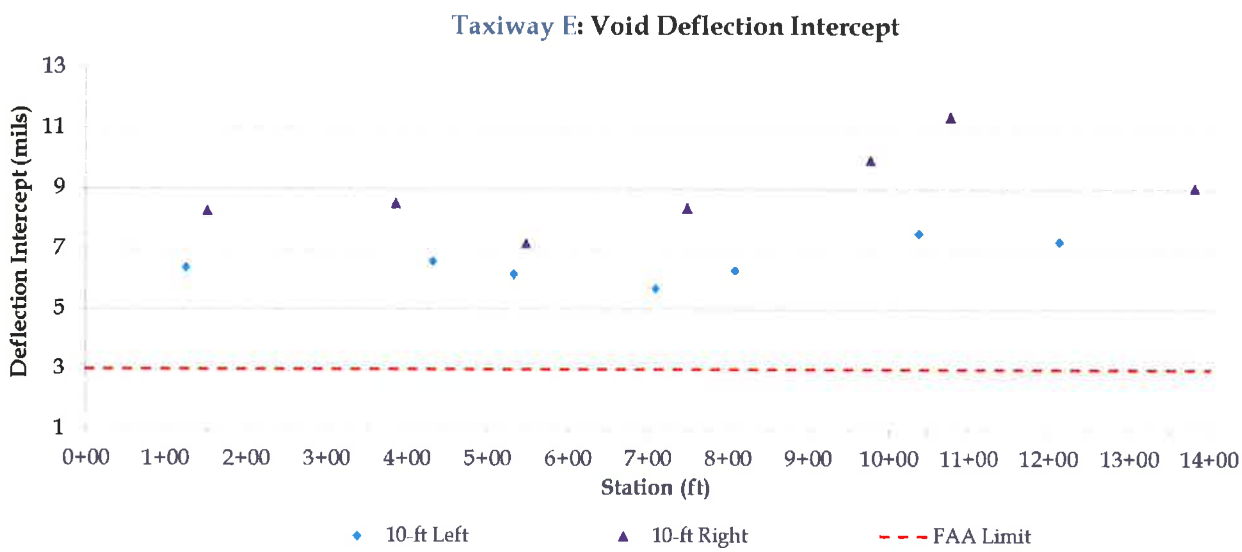


Figure 14 – Load-Deflection Intercept for Taxiway E

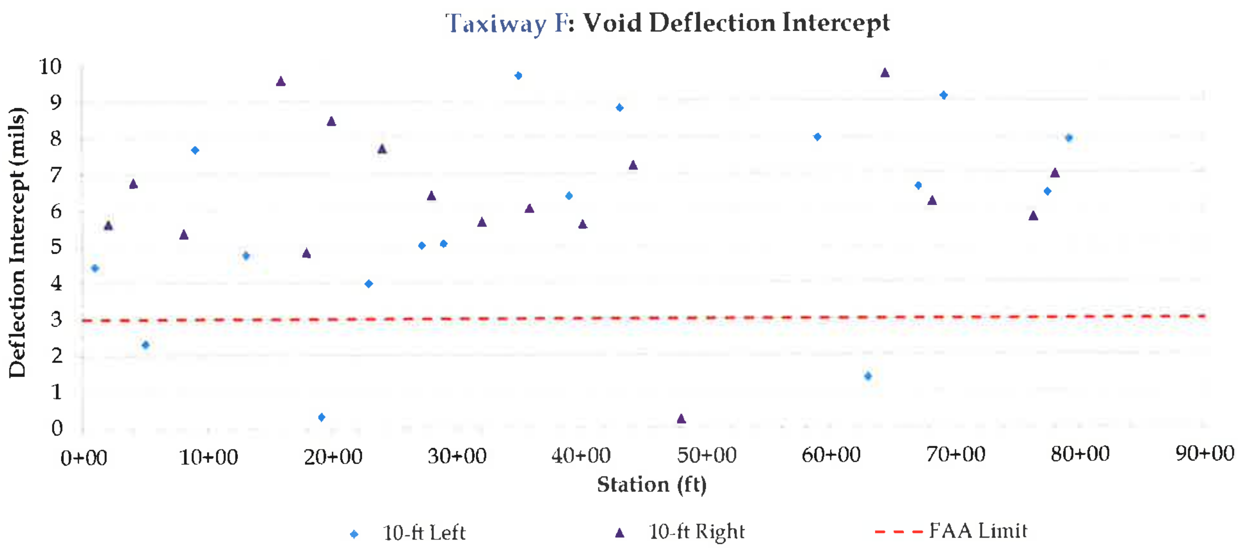


Figure 15 – Load-Deflection Intercept for Taxiway F

6.4. Structural Evaluation

The features were evaluated using the FAA Rigid and Flexible Iterative Elastic Layer Design (FAARFIELD) program (Version 1.41). FAARFIELD implements both layered elastic-based and three-dimensional finite element-based design procedures for new and overlay designs of flexible and rigid pavements, respectively. For rigid pavement design, FAARFIELD uses the maximum horizontal stress at the bottom edge of the PCC slab as the predictor of pavement structural life. The maximum horizontal stress for design is determined using an edge loading condition. FAARFIELD provides the required thickness of the rigid pavement slab needed to support a given airplane traffic mix.

The failure models used in FAARFIELD for both rigid and flexible pavements are based on full-scale tests conducted from the 1940s until the present. FAARFIELD is based on the cumulative damage factor (CDF) concept, in which the contribution of each airplane in a given traffic mix to total damage is separately analyzed. The design process considers one mode of failure for rigid pavement, which is cracking of the concrete slab. The cracking of the surface layer is controlled by limiting the horizontal stress at bottom of PCC slab. Failure of subbase and subgrade layers is not considered for rigid pavements. In the case of flexible pavements, FAARFIELD accounts for fatigue cracking and permanent deformation in the unbound layers. FAARFIELD follows an iterative procedure to determine the surface/overlay layer thickness until the CDF reaches a value of 1.0. Once a CDF of 1.0 is achieved, the section satisfies the design conditions.

It is important to mention that FAARFIELD assumes both flexible and rigid pavements are at least a three-layer system (surface over base/subbase over subgrade). Some of the features at CMA Airport are a two-layer system (surface over subgrade). In order to overcome this limitation, a user-define layer was introduced to be able to model the pavement structure in accordance to FAA requirements. The user-defined layer was modeled having a 6-inch thickness and with the properties of the existing subgrade. In addition, since no laboratory-determined mechanical properties of the PCC slabs were obtained, an average modulus of rupture of 700 psi was selected to conduct the remaining life and the reconstruction design for the rigid pavements.

Complete evaluation details using FAARFIELD are shown in **Appendix D**. The aircraft mix and annual operations shown in
Table **5** were used to conduct the pavement structural evaluation. The mechanistic analyses using FAARFIELD indicate that the 20-year design life corresponding to the proposed aircraft mix will not be met for the following airport features: Runway 8/26, Taxiway A, C, D and E. Therefore, rehabilitation/reconstruction design is needed to ensure that the design life will be met. In addition, preventive maintenance is recommended for some of the airport features.

Table 9 shows the recommended structural rehabilitation for the evaluated features. Gulfstream G-650 has the Maximum Take-off Weight (MTOW) using CMA. This aircraft has a MTOW of 99,600-lb. It is important to state that FAA AC 150/5320-6F Sections 3.13.3.2 and 3.14.3.1 requires that a stabilized subbase, such as CTB, is present under both new flexible and rigid pavements serving airplanes weighing 100,000 lb. or more. A crushed aggregate base that can be proven to exhibit a remolded soaked CBR of 100 or greater may be substituted for a stabilized base course, as per FAA AC 150/5320-6F Sections 3.6. In addition, per FAA AC 150/5320-6F Section 3.13.4 a subbase is required as part of the flexible pavement structure on subgrades with a CBR value less than 20. In addition, all recommended reconstruction alternatives meet the requirements set on Table 3-3 of the FAA AC 150/5320-6F Section 3.12.12.

As shown in Table 4, aircrafts using CMA do not have a MTOW greater or equal than 100,000-lb. Therefore, the requirements stated in FAA AC 150/5320-6F Sections 3.13.3.2 and 3.14.3.1 are not applicable. Nonetheless, two different reconstruction alternatives are presented in Table 9. The first option accounts for existing traffic conditions and the second option uses a more conservative approach of assuming that an aircraft type having a MTOW greater than 100,000-lb will be in service on CMA during the analysis period, in which case a stabilized layer is recommended.

Table 9 – Recommended Structural Remediation for Proposed Aircraft Mix

Feature	Test Line	Station (ft.) 1)	Recommended Structural Remediation for the Proposed Aircraft Mix for a 20-Year Design Period	
			Alternative 1:	Alternative 2: Reconstruction
Runway 8/26	10 & 30-ft Left, 10 & 30-ft Right	0+00 to 8+60	3.5" HMA Overlay	7" HMA over 6" AB over 5.5" SB or 5" HMA over 5" CTB over 6" AB over 4" SB
		8+60 to 18+00	2" HMA Overlay	7" HMA over 6" AB over 10.5" SB or 5" HMA over 5" CTB over 6" AB over 4" SB
		18+00 to 30+00	2" HMA Overlay	6" HMA over 6" AB over 10" SB or 5" HMA over 5" CTB over 6" AB over 4" SB
		30+00 to 50+00	5" HMA Overlay	8" HMA over 6" AB over 16.5" SB or 5" HMA over 6" CTB over 6" AB over 7" SB
		50+00 to End	Preventive Maintenance	----
Taxiway A	10-ft Left, 10-ft Right	0+00 to End	12" HMA Overlay	14" HMA over 6" AB over 19.5" SB or 7" HMA over 8" CTB over 6" AB over 12" SB
Taxiway B	10-ft Left, 10-ft Right	0+00 to End	Preventive Maintenance	----
Taxiway C	10-ft Left, 10-ft Right	0+00 to 5+00	16.5" HMA Overlay	14" HMA over 6" AB over 22" SB or 7" HMA over 9" CTB over 6" AB over 10" SB
		5+00 to End	Preventive Maintenance	----
Taxiway D	10-ft Left, 10-ft Right	0+00 to 6+50	3.5" HMA Overlay	7" HMA over 6" AB over 16" SB or 5" HMA over 6" CTB over 6" AB over 4" SB
		6+50 to End	Preventive Maintenance	----
Taxiway E	10-ft Left, 10-ft Right	0+00 to End	2" HMA Overlay	----
Taxiway F	10-ft Left, 10-ft Right	0+00 to 28+00	Preventive Maintenance	----
		28+00 to 55+00	Preventive Maintenance	----
		55+00 to End	Preventive Maintenance	----

1) Refer to Appendix B for a schematic showing Station 0+00.
2) HMA: Hot Mix Asphalt P401/403, PCC = Portland Cement Concrete P501, CTB = Cement-Treated Base P304, AB = Aggregate Base P209, SB = Subbase P154.

Preventive maintenance consists in applying a surface treatment that reduce deterioration rate, extend pavement life and/or prevent pavement distress propagation. In the case of rigid pavements, a void undersealing campaign is recommended to ensure adequate slab support and to prevent corner breaks and to improve LTE. A subsequent study with the HWD can be performed to evaluate the extend of slabs needed undersealing and also to determine the effectiveness of the treatment.

A limited distress survey was conducted on all tested lines through digital photographs that were automatically collected at 25-ft intervals. These pictures show that the pavements are in relatively good condition with the exception of Taxiway A that shows fatigue cracking and longitudinal and transverse cracking. In addition, Taxiway E and F show some concrete slabs having transverse and longitudinal cracks. A description of the limited distress survey is presented in **Appendix E**.

7. Aircraft Classification Number-Pavement Classification Number (ACN-PCN)

7.1. Background

In 1977, the International Civil Aviation Organization (ICAO) established a Study Group to develop a single international method of reporting pavement strengths. The study group developed, and ICAO adopted, the Aircraft Classification Number - Pavement Classification Number (ACN-PCN) method. Using this method, it is possible to express the effect of an individual aircraft on different pavements with a single unique number that varies according to aircraft weight and configuration (e.g. tire pressure, gear geometry, etc.), pavement type, and subgrade strength. This number is the ACN. Conversely, the load-carrying capacity of a pavement can be expressed by a single unique number, without specifying a particular aircraft or detailed information about the pavement structure. This number is the PCN.

According to this worldwide standard, aircraft can safely operate on a pavement if its ACN is less than or equal to the pavement load bearing capacity or PCN. An aircraft having an ACN equal to or less than the PCN can operate without weight restrictions on a pavement.

It should be noted that the ICAO documentation makes it clear that the ACN/PCN method is not a design/evaluation method and that the PCN is simply the ACN of the most damaging aircraft that can use the pavement on a regular basis (regular being defined by the operator). In addition, an ACN over PCN ratio greater than 1.1 is typically considered to be problematic.

7.2. ACN

The ACN is defined by ICAO, using a "mathematically derived single wheel load to define the landing gear/pavement interaction. This is done by equating the thickness given by the mathematical model for an aircraft gear given the thickness, for a single wheel at a standard tire pressure of 1.25 MPa". Boussinesq's equations are used for flexible pavements and Westergaard's solution for a plate on a Winkler foundation for rigid pavements.

The ACN is two times the derived single wheel load in 1,000 kg. The ACN is calculated by the aircraft manufacturer for 4 subgrade categories for flexible pavements: A: $CBR \geq 13$, B: $8 < CBR < 13$, C: $4 < CBR \leq 8$ and D: $CBR \leq 4$; and also 4 subgrade categories for rigid pavements: A: $k \geq 442$ pci, B: $221 < k < 442$, C: $92 < k \leq 221$ and D: $k \leq 92$. The ACN is specific to a particular aircraft and does not depend on the number of operations or on the pavement structure (apart from the subgrade category). Table 10 shows the ACN corresponding to the design aircraft mix. From the results it is clear that the highest ACN for all subgrade categories is the Gulfstream G-650 aircraft.

Table 10 – ACN for the Design Aircraft Mix

Aircraft	MTOW 1)	Flexible Pavement ACN 2)			
		A	B	C	D
Single Wheel 10,000 lb.	10,000	3.8	5.1	6.7	7.9
Single Wheel 12,500 lb.	12,500	2.3	3	4	4.7
BeechJet 400A	16,300	4.7	5.5	6	6.3
Hawker-800	27,520	6.5	7	8	8.8
Citation-X	36,000	9.9	10.8	11.5	12
Gulfstream-GIV	80,000	24.2	25.5	26.5	27.2
Gulfstream-GV	91,000	25.8	27.9	29.4	30.6
Global Express-6000	99,500	29.1	31.1	32.6	33.7
Gulfstream G-650	99,600	29.2	31.2	32.6	33.7
Aircraft	**MTOW 1)**	**Rigid Pavement ACN 2)**			
		A	**B**	**C**	**D**
Single Wheel 10,000 lb.	10,000	5.4	5.8	6.1	6.3
Single Wheel 12,500 lb.	12,500	3.3	3.5	3.7	3.7
BeechJet 400A	16,300	5.3	5.4	5.5	5.5
Hawker-800	27,520	7.7	8.1	8.5	8.8
Citation-X	36,000	11.9	12.3	12.6	12.8
Gulfstream-GIV	80,000	27.6	28.4	29	29.6
Gulfstream-GV	91,000	30	31	31.9	32.6
Global Express-6000	99,500	33.4	34.5	35.4	36.1
Gulfstream G-650	99,600	33.5	34.5	35.4	36.2

1) Maximum take-off weight (MTOW).
2) A, B, C and D are the subgrade code designations.
3) Maximum ACNs for each subgrade category are shown in red font.

7.3. PCN Evaluation

The PCN was evaluated using the technical method of the FAA AC No. 150/5335-5B "Standardized Method of Reporting Airport Pavement Strength – PCN" (COMFAA). The layer moduli of the subgrade (for flexible pavements) and the modulus of subgrade reaction (for rigid pavements) was backcalculated using ELMOD. The resulting 84th percentile layer moduli or modulus of subgrade reaction were used as part of the COMFAA calculations to determine the airport feature subgrade category. The remaining COMFAA input was calculated using the FAA support Excel file "COMFAA-30-SUPPORT-AC5335-5C.xlsm". Table 11 summarizes the COMFAA ACN/PCN codes for every feature.

Table 11 – ACN/PCN Codes for CMA Airport

Feature	Station (ft.)	PCN Code	ACN Code	ACN/PCN
Runway 8/26	0+00 to 8+60	23/F/B /X/T	31/F/B	1.3
	8+60 to 18+00	39/F/C /X/T	33/F/C	0.8
	18+00 to 30+00	19/F/C /X/T	33/F/C	1.7
	30+00 to 50+00	8/F/D /X/T	34/F/D	4.3
	50+00 to End	37/R/C /W/T	35/R/C	0.9
Taxiway A	0+00 to End	7/F/D /X/T	34/F/D	4.9
Taxiway B	0+00 to End	32/R/C /W/T	35/R/C	1.1
Taxiway C	0+00 to 5+00	1/F/D /X/T	33/F/D	33.0
	5+00 to End	377/F/A /X/T	29/F/A	0.1
Taxiway D	0+00 to 6+50	10/F/C /X/T	33/F/C	3.3
	6+50 to End	105/F/A /X/T	29/F/A	0.3
Taxiway E	0+00 to End	30/R/B/W/T	34/R/B	1.1
Taxiway F	0+00 to 28+00	56/R/C/W/T	35/R/C	0.6
	28+00 to 55+00	55/R/C/W/T	35/R/C	0.6
	55+00 to End	31/R/C/W/T	35/R/C	1.1

From the results, it is clear that the ACN/PCN for the evaluated aircrafts is greater than 1.1 for Runway 8/26 from station 0+00 to 8+60, and from station 18+00 to 50+00, for Taxiway A, Taxiway C from station 0+00 to 5+00, and for Taxiway D from station 0+00 to 6+50. The results are in agreement with the pavement structural evaluation using FAARFIELD. The PCN values are associated with the traffic used in the evaluation, and an increase in traffic during the evaluation period will reduce the PCN.

8. General Remarks

The above analyses were based on structural responses and were controlled by the HWD measured deflections, design aircraft traffic data used in the analyses, and pavement layer thickness information. Pavement layer thickness and traffic information were provided by Mead & Hunt, Inc. personnel.

The structural analyses and associated results provided in this report should be used in conjunction with the results of the pavement surface condition and evaluation performed. Due to the discrete nature of deflection testing, actual location and extent of repair requirements need to be determined visually prior to any rehabilitation, where applicable.

9. Disclaimer

All preceding analyses were based on the HWD test results obtained in the field, as well as other input and analysis assumptions as outlined herein. Dynatest has made every attempt to base their procedures on sound methodology. However, circumstances beyond the control of Dynatest could result in alterations to the above results, which may be completely justifiable. The type of analysis performed on the deflection data is highly sensitive to layer thicknesses and variations from the values provided could have a significant effect on the results presented in this preliminary report.

Report prepared by: Alvaro Ulloa-Calderon, PhD, PE
Senior Engineer

Report reviewed by: Philip Donovan, PhD, PE
Senior Engineer

Appendix A – Dynatest FWD/HWD Test System

Dynatest FWD/HWD Test Systems

Dynatest, the original commercial developer of the Falling Weight Deflectometer (FWD) technology, is the world's largest supplier of FWD equipment. This highly accurate, well supported, reliable and continuously refined Dynatest product line is a proven load/deflection measurement solution for engineers worldwide.

The Dynatest FWD technology additionally provides a measurement foundation for the proprietary Dynatest "analytical-empirical" pavement engineering methodology, a system of advanced automated pavement measurement, analysis and management engineering services and products available only through Dynatest.

Why a Falling Weight Deflectometer (FWD)?

The **Dynatest Model 8000 FWD** makes it possible to treat pavement structures in the same manner as other civil engineering structures by using mechanistically based design methods.

Selecting the type of rehabilitation to be implemented on a given pavement is of considerable economic significance. To reach that decision without an adequate knowledge of the structural condition of the pavement may have very costly consequences.

The use of a Dynatest FWD enables the engineer to determine a deflection basin caused by a controlled load with accuracy and resolution superior to other existing test methods. The FWD produces a dynamic impulse load that simulates a moving wheel load, rather than a static, semi-static or vibratory load. These developments allow the use of mechanistic approaches to analyse FWD data.

FALLING WEIGHT DEFLECTOMETER

Heavy Weight Deflectometer (HWD)

Dynatest was also the first to introduce a heavier loading FWD, the Dynatest Model 8081 HWD. With an expanded loading range, simulating heavy aircraft such as the Boeing 747 (one wheel), the HWD can properly introduce anticipated load/deflection measurements on even heavy pavements such as airfields and very thick highway pavements. The wider loading range also provides the consultant with a load/deflection instrument appropriate for both roads and airfields as required.

HEAVY WEIGHT DEFLECTOMETER

Dynatest FWD/HWD Test Systems

FWD Data Reduction

FWD/HWD generated data, combined with layer thickness, can be confidently used to obtain the "in-situ" resilient E-moduli of a pavement structure. This information can in turn be used in a structural analysis to determine the bearing capacity, estimate expected life, and calculate an overlay requirement, if applicable (over a desired design life).

Software Products for Structural Analysis and Design

For routine analysis purposes, **Dynatest** has developed a software system, ELMOD 6, for both flexible and rigid pavements.

This software application allows extremely rapid data reduction and analysis of FWD/HWD measurements, calculating the layer E-moduli for a typical drop sequence in one second or less. Seasonally adjusted E-moduli, residual life, and required overlay (if applicable) are also calculated within seconds.

For analysis of airfield pavements, **Dynatest** offers the PCN module, which calculates PCN-values in accordance with the ACN/PCN method, as described in the ICAO design manuals.

FWDWin for Windows™

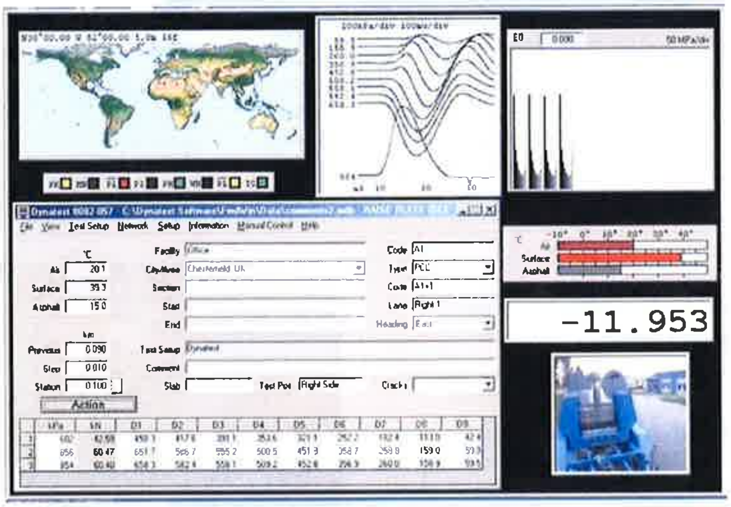
Support for multiple languages

Data Files:

- Data is stored in Access(tm) (.mdb) databases for ease of processing

The program can simultaneously generate various formats:

- .fwd, *.f20, *.f25, *.PDDX Pavement Deflection Data eXchange (PDDX by AASHTO), *.XML eXtensible Markup Language (XML by W3C)
- 15 Active Sensor Capability (hardware required)
- Surface modulus plots can be graphed real time along road sections under test
- Real Time Backcalculation
- Network Database



Advantages

- A non-destructive test device
- One man operational
- Accurate and fast (up to 60 test points/hr)
- Wide loading range
  FWD (7-120 kN) or (1,500-27,000 lbf)
  HWD (30-320 kN) or (6,500-71,800 lbf)
- Designed for multi-purpose pavement applications, ranging from unpaved roads to airfields
- Excellent repeatability
- Ideal for mechanistic/analytical design approaches

Requirements

Windows® XP

Appendix B – Airport Feature Stationing

Figure B-1. Runway 17-35. Station 0+00 at North End

Figure B-2. Taxiway A, B, C, D and E Station 0+00 located at Runway 8/26

Figure B-3. Taxiway F Station 0+00 located at East End of the Airport

Appendix C – Normalized Center Deflections

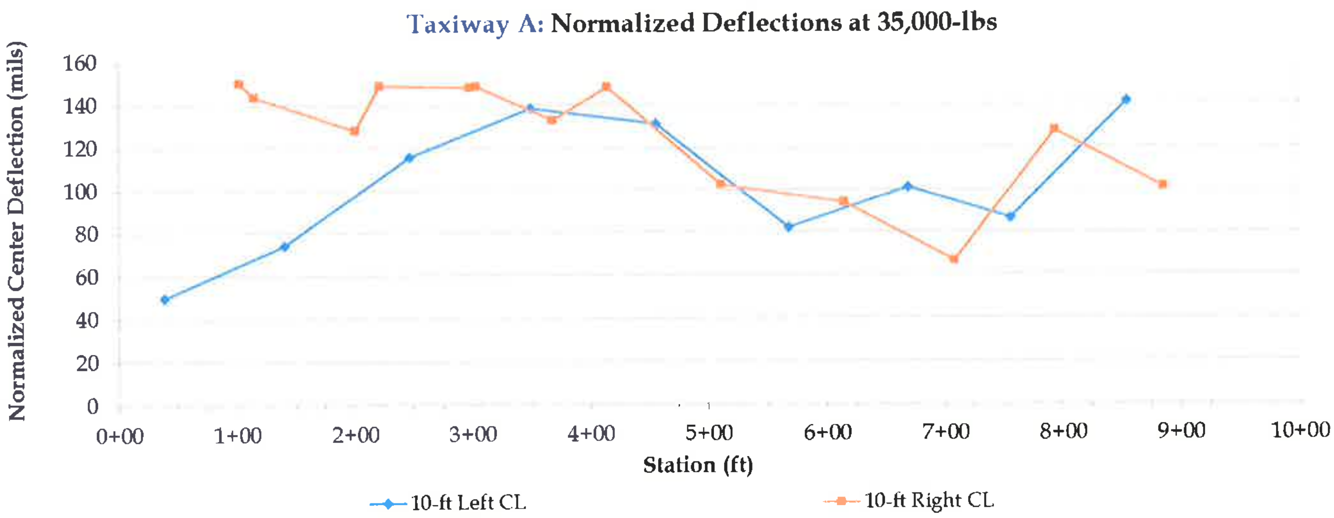


Figure C-1. Normalized Center Deflections for Taxiway A

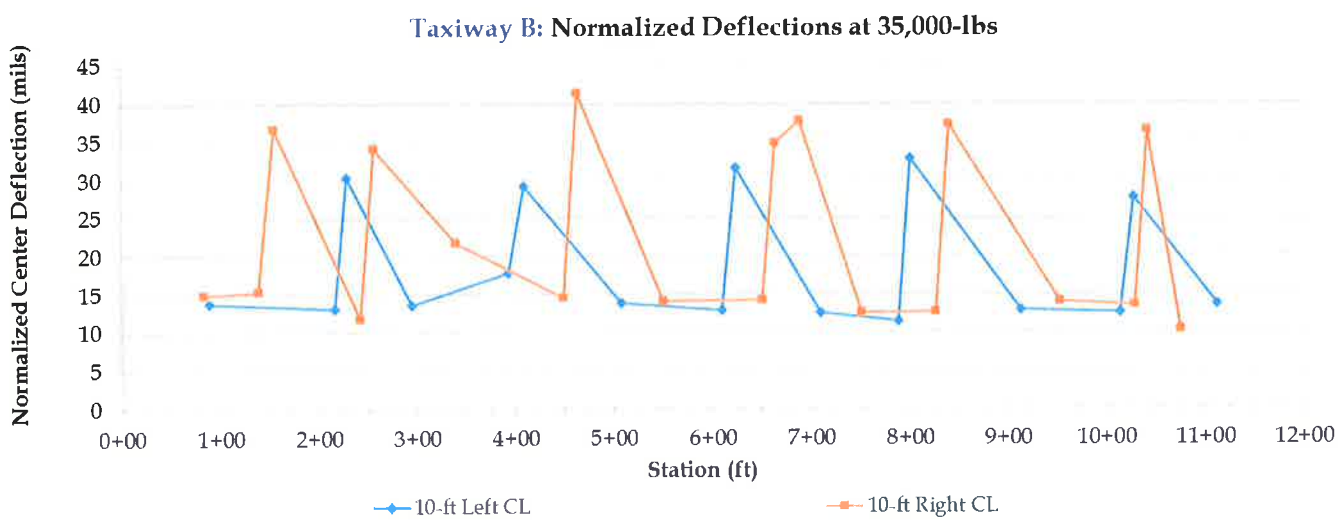


Figure C-2. Normalized Center Deflections for Taxiway B

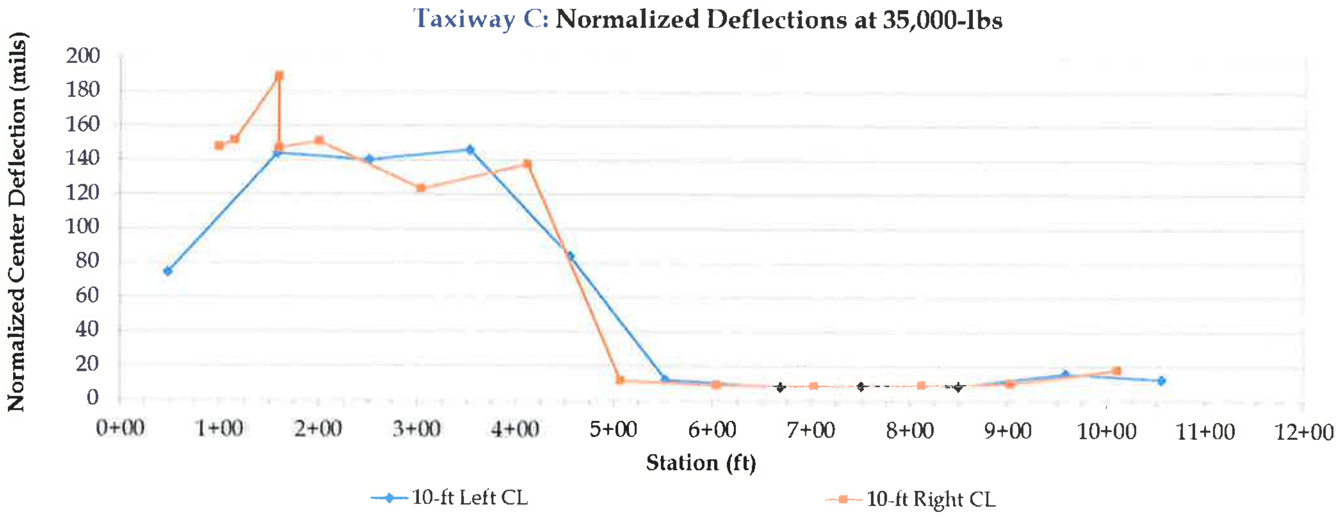


Figure C-3. Normalized Center Deflections for Taxiway C

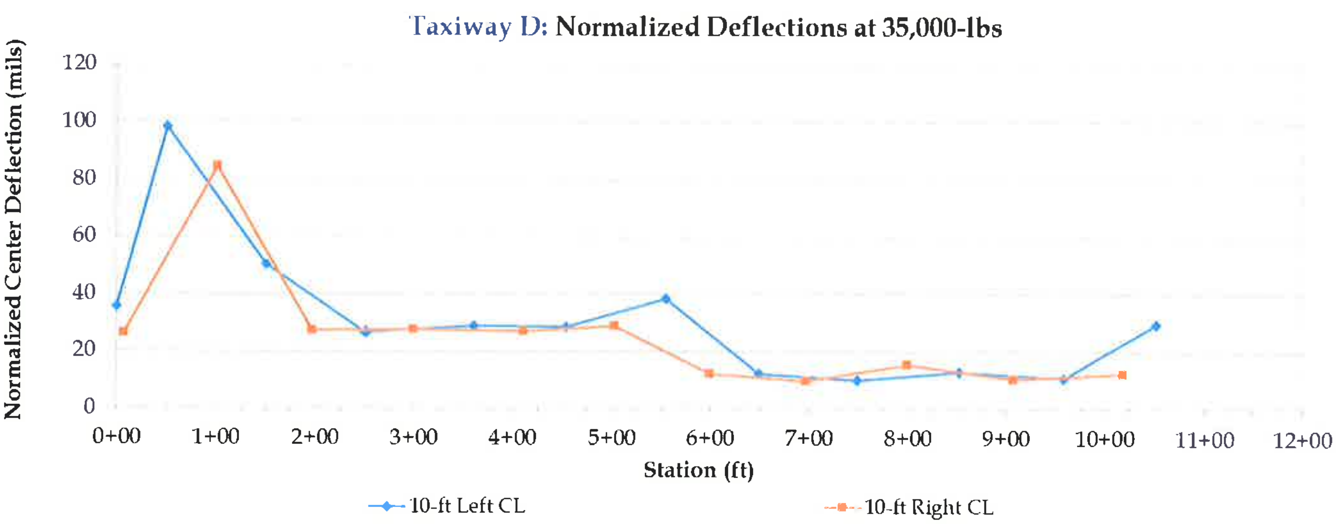


Figure C-4. Normalized Center Deflections for Taxiway D

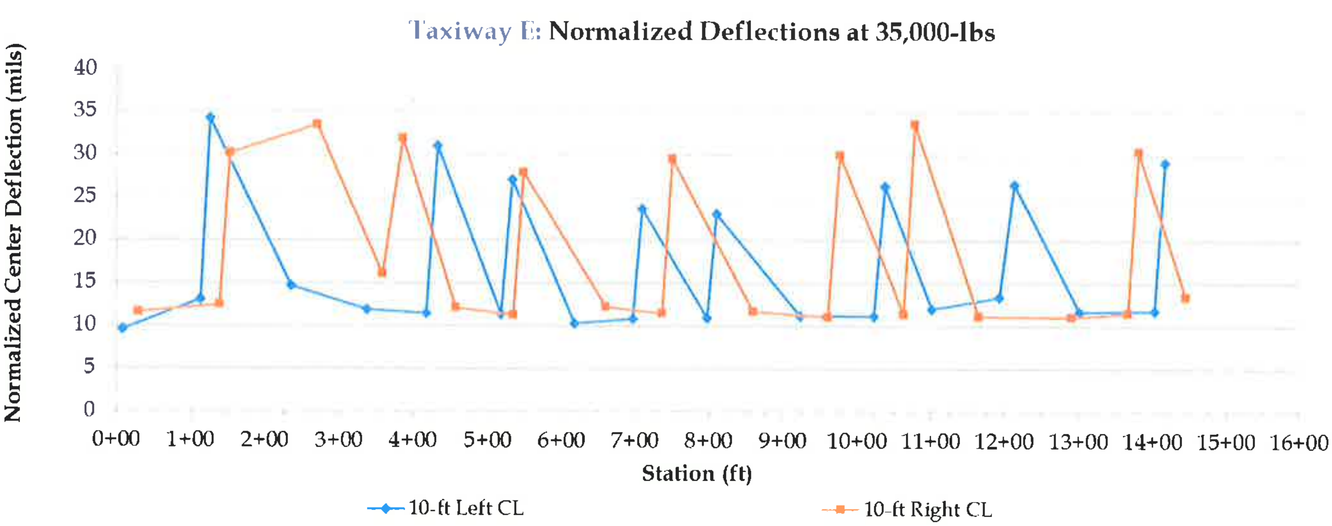


Figure C-5. Normalized Center Deflections for Taxiway E

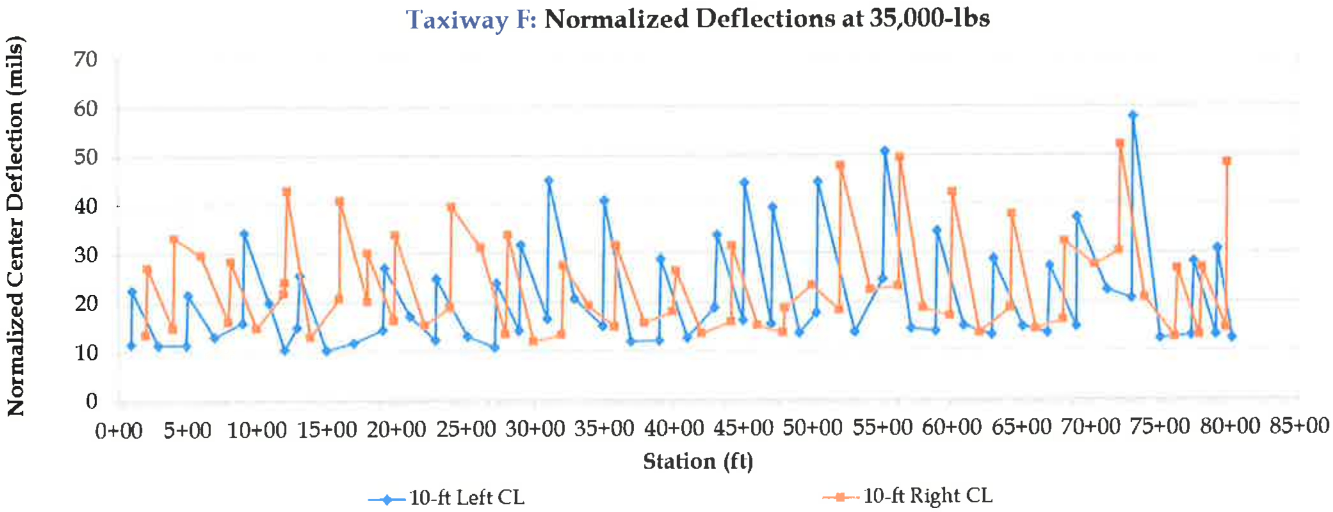


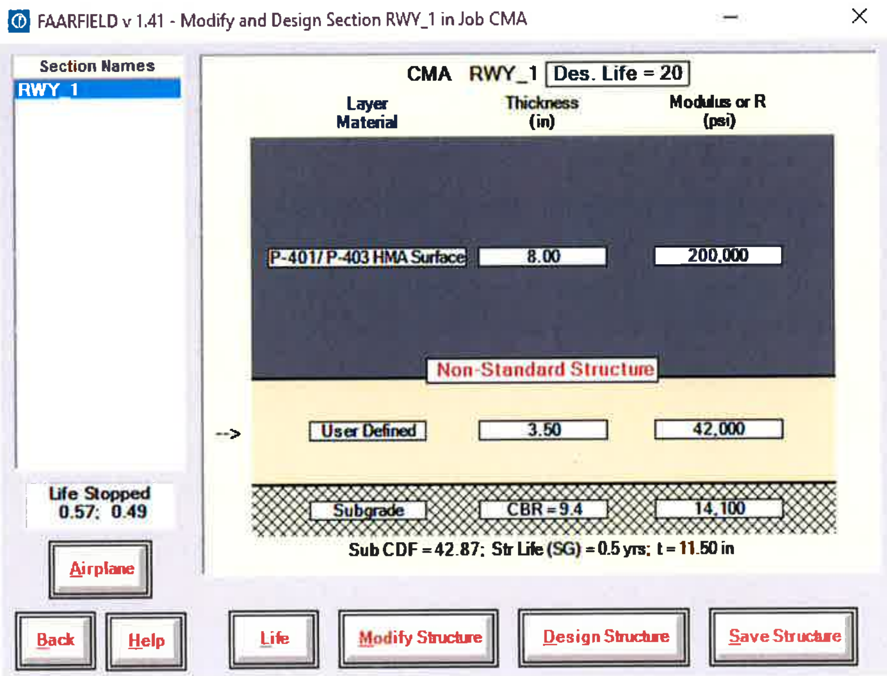
Figure C-6. Normalized Center Deflections for Taxiway F

Appendix D – FAARFIELD Structural Evaluation Outputs

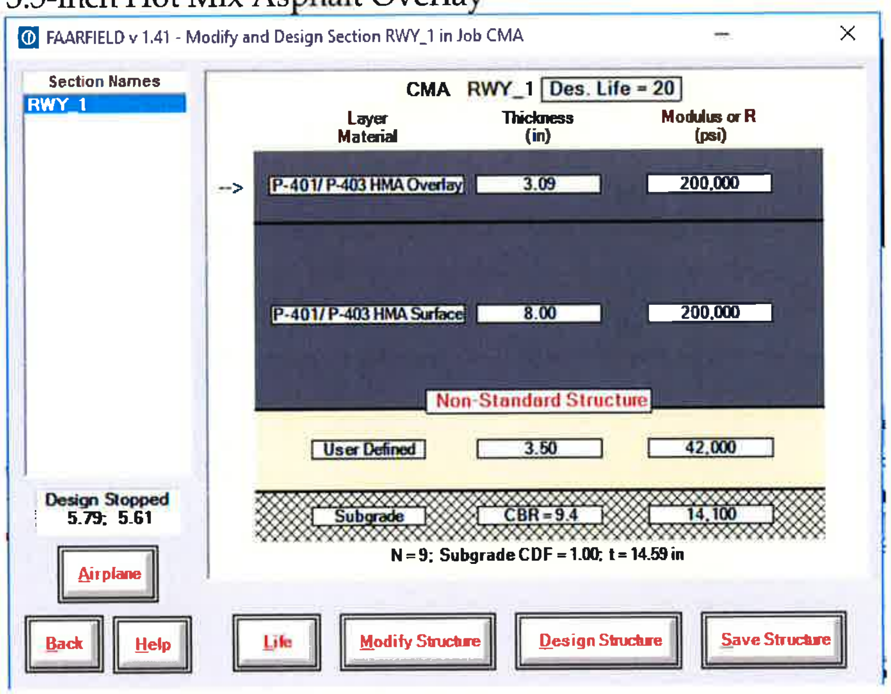
FAARFIELD Evaluation

1) Runway 8/26 Section 1: From 0+00 to 8+60

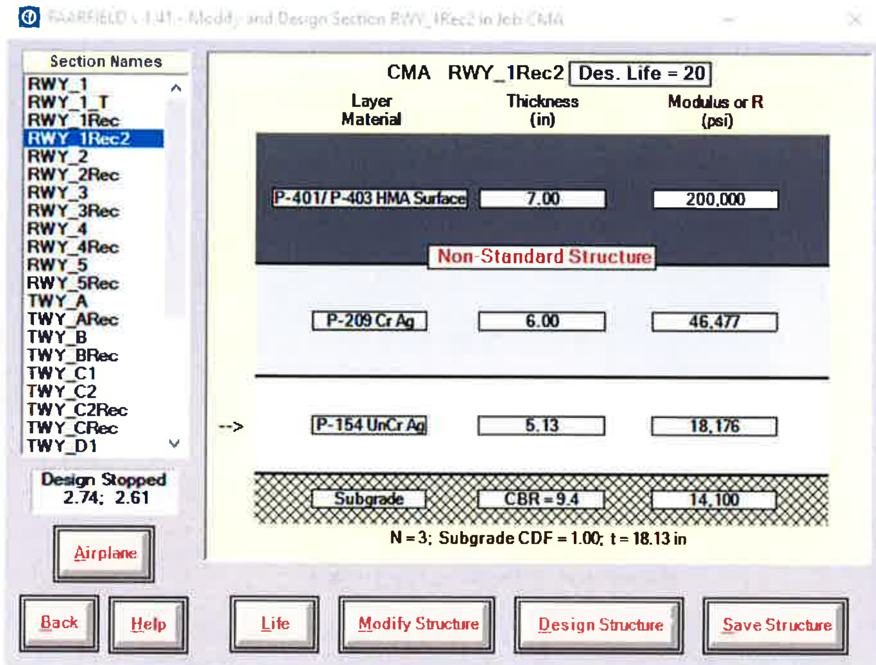
Life = 0.5 years => Structurally Inadequate



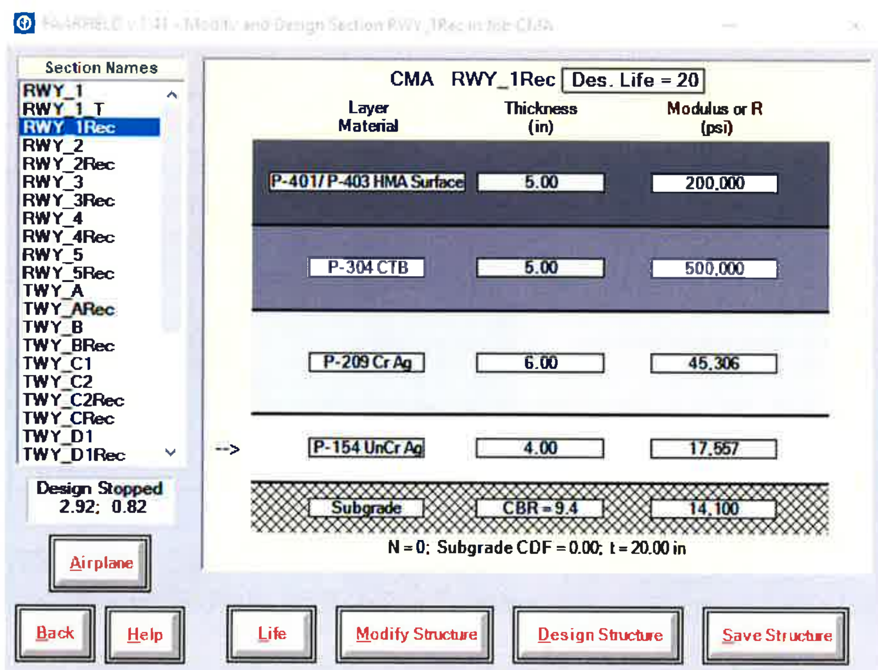
Rehabilitation = 3.5-inch Hot Mix Asphalt Overlay



Reconstruction: Option 1 = 7-inch Hot Mix Asphalt over 6-inch Aggregate Base over 5.5″ Subbase

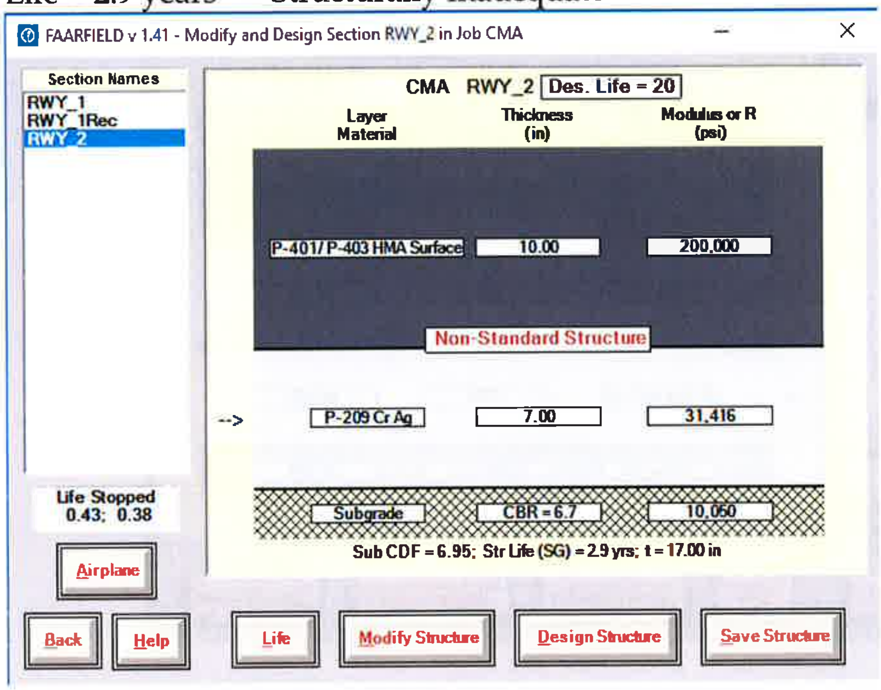


Reconstruction: Option 2 = 5-inch Hot Mix Asphalt over 5-inch Cement Treated Base over 6″ Aggregate Base over 4″ Subbase

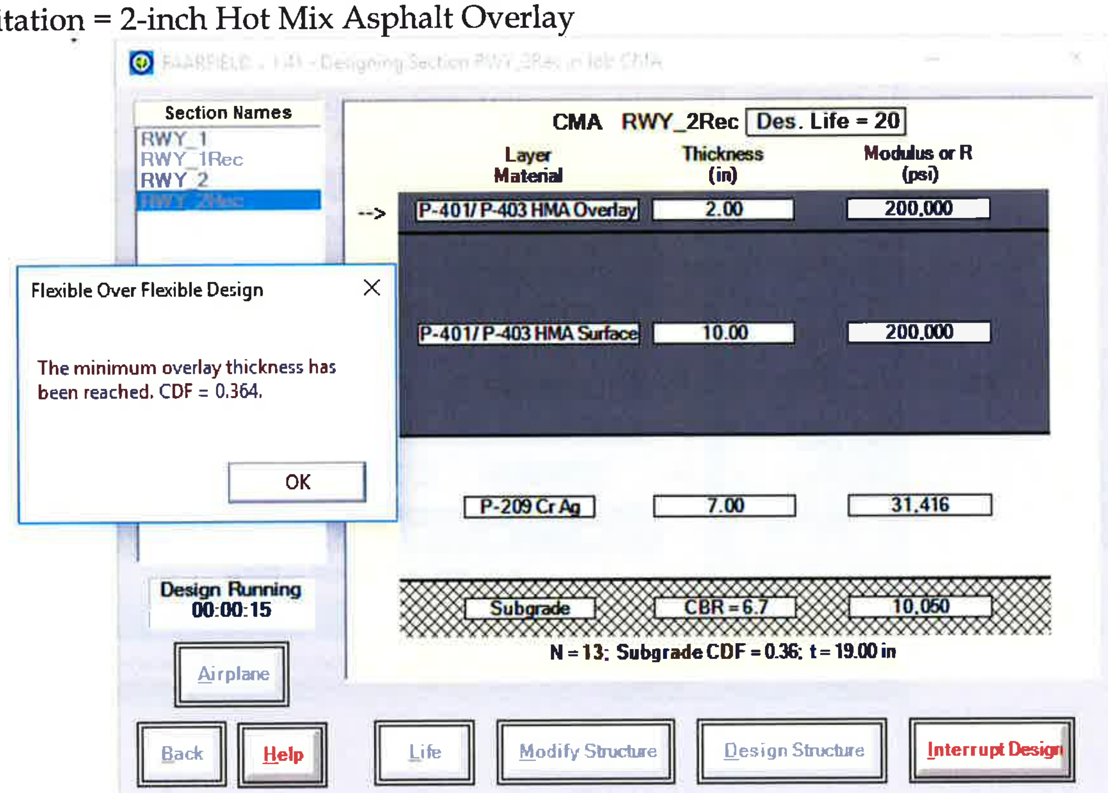


2) Runway 8/26 Section 2: From 8+60 to 18+00

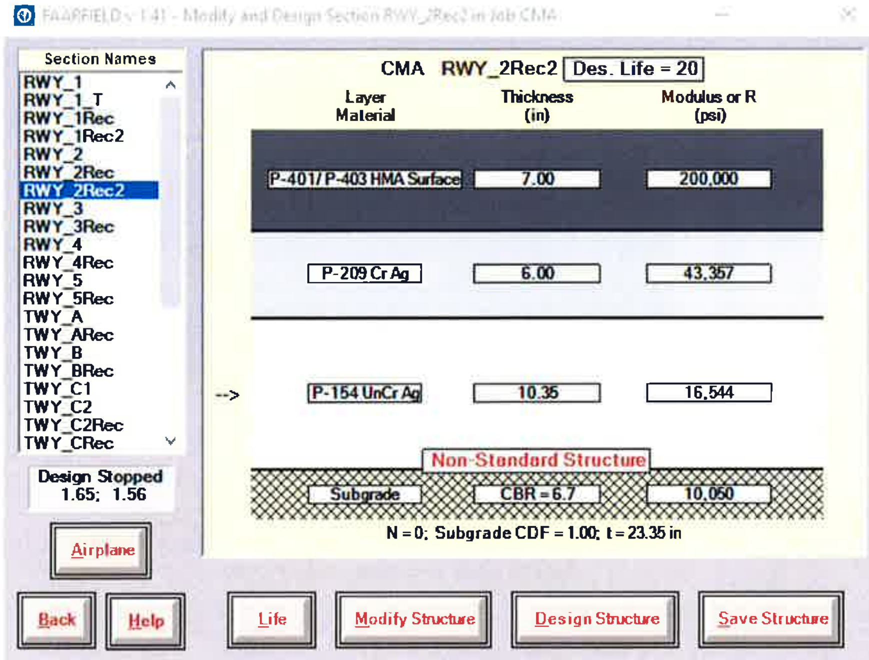
Life = 2.9 years => Structurally Inadequate



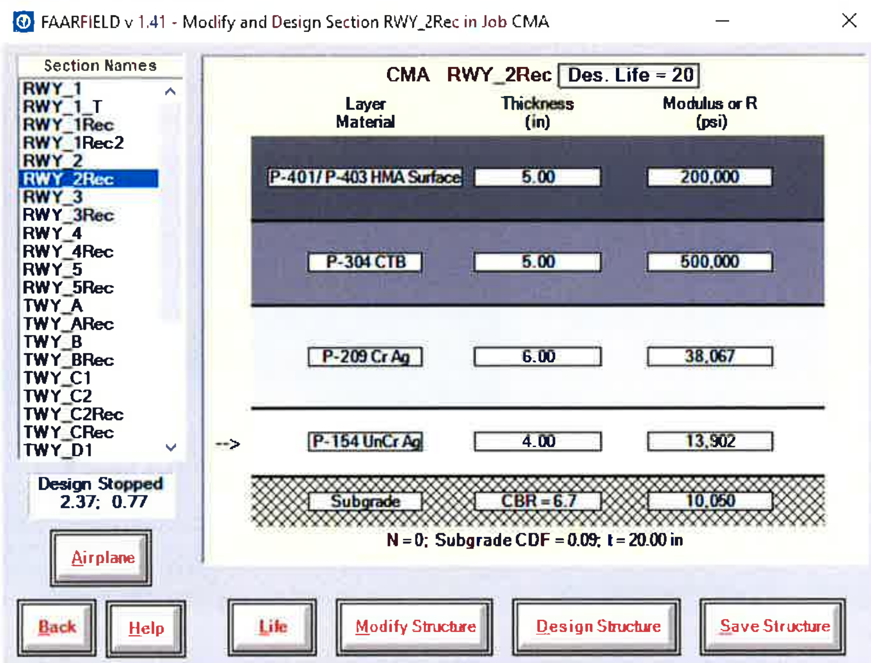
Rehabilitation = 2-inch Hot Mix Asphalt Overlay



Reconstruction: Option 1 = 7-inch Hot Mix Asphalt over 6-inch Aggregate Base over 10.5" Subbase

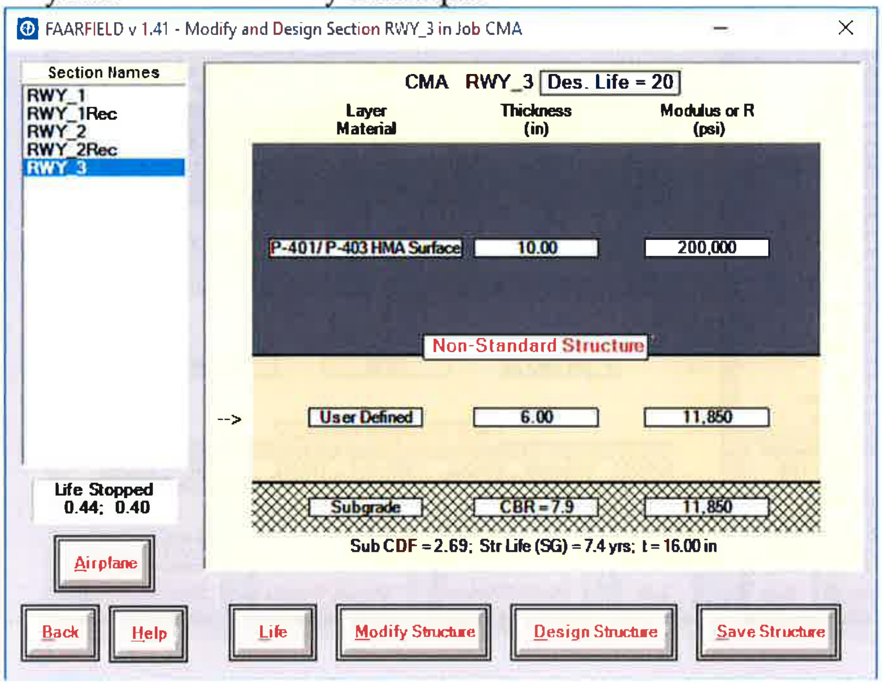


Reconstruction: Option 2 = 5-inch Hot Mix Asphalt over 5-inch Cement Treated Base over 6" Aggregate Base over 4" Subbase

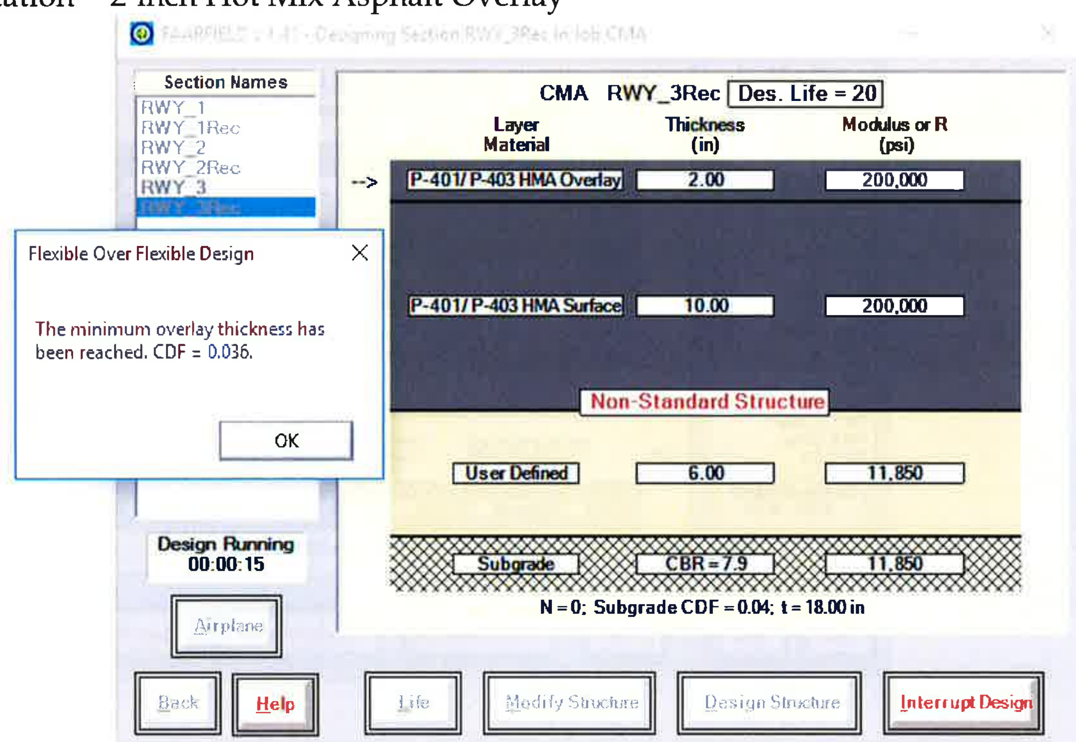


3) Runway 8/26 Section 3: From 18+00 to 30+00

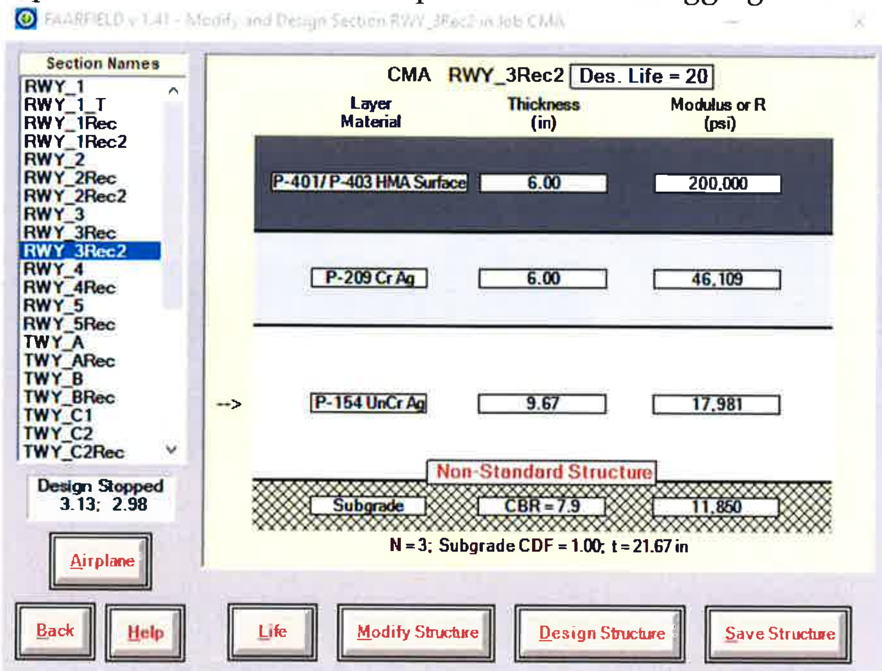
Life = 7.4 years => Structurally Inadequate



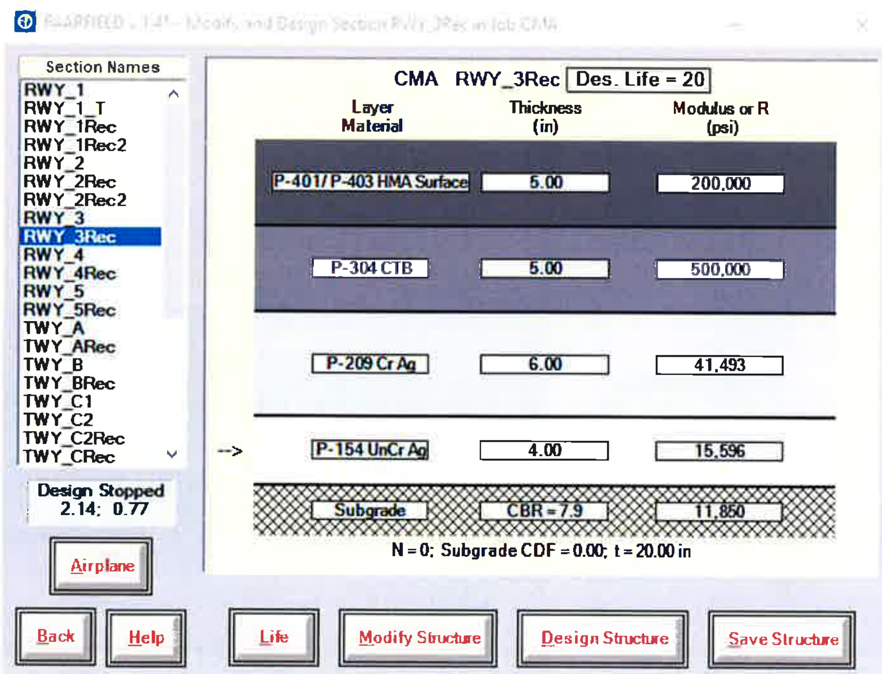
Rehabilitation = 2-inch Hot Mix Asphalt Overlay



Reconstruction: Option 1 = 6-inch Hot Mix Asphalt over 6-inch Aggregate Base over 10" Subbase

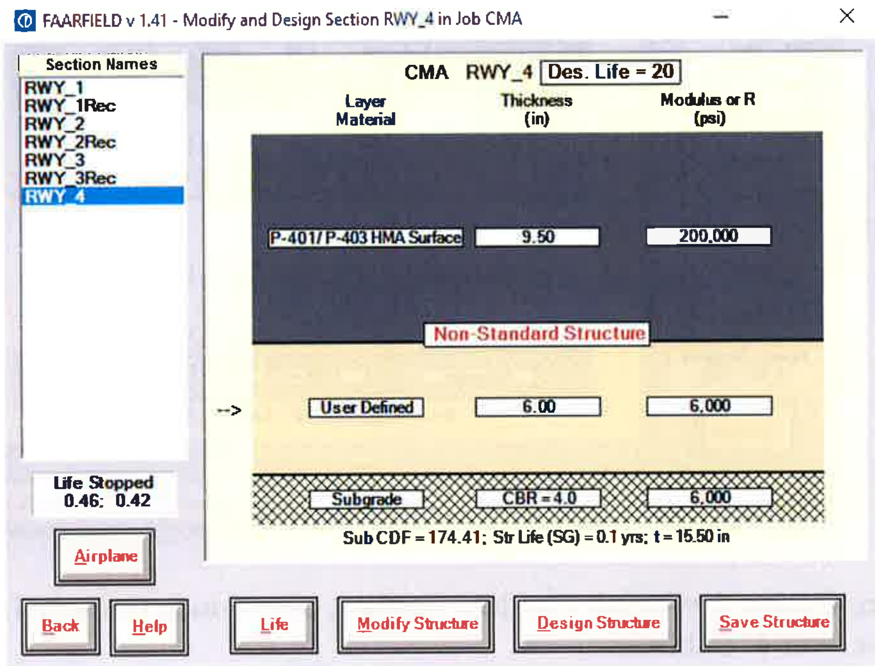


Reconstruction: Option 2 = 5-inch Hot Mix Asphalt over 5-inch Cement Treated Base over 6" Aggregate Base over 4" Subbase

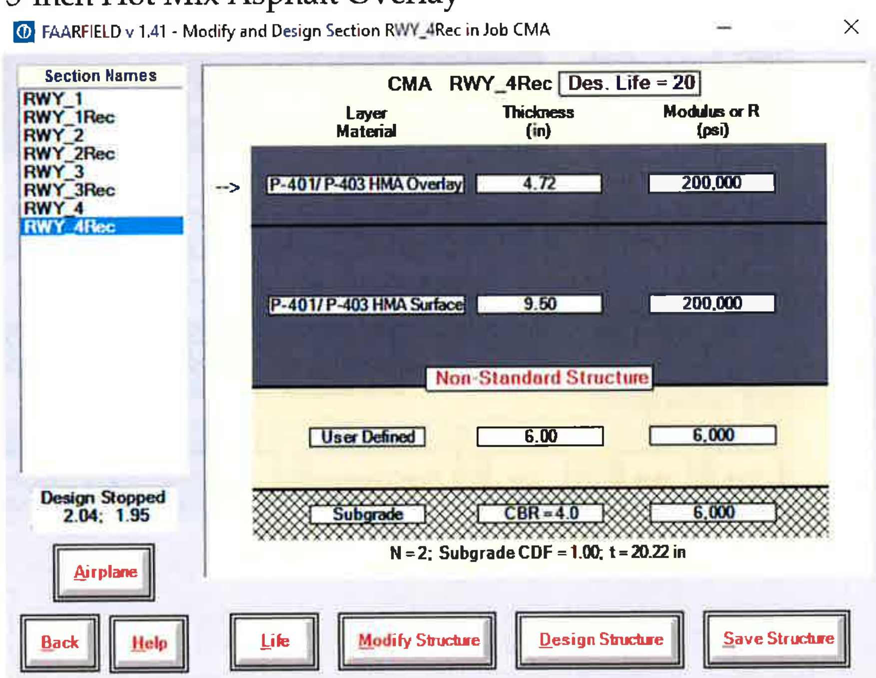


4) Runway 8/26 Section 4: From 30+00 to 50+00

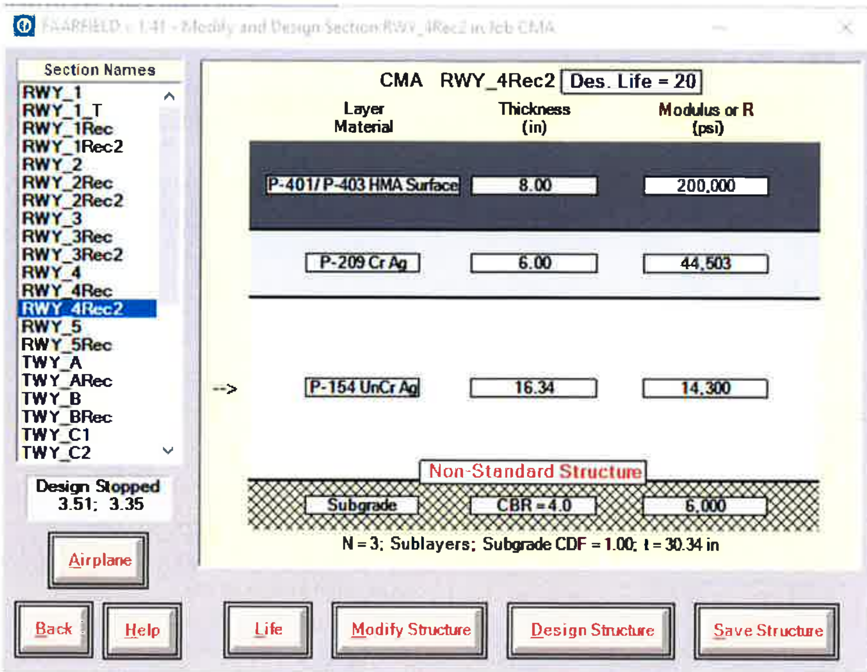
Life = 0.1 years => Structurally Inadequate



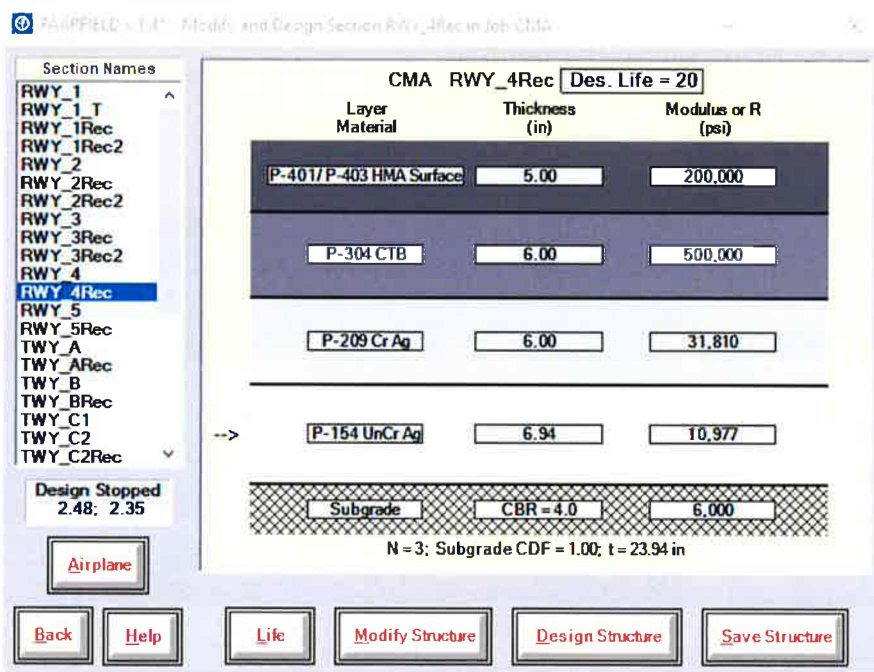
Rehabilitation = 5-inch Hot Mix Asphalt Overlay



Reconstruction: Option 1 = 8-inch Hot Mix Asphalt over 6-inch Aggregate Base over 16.5″ Subbase

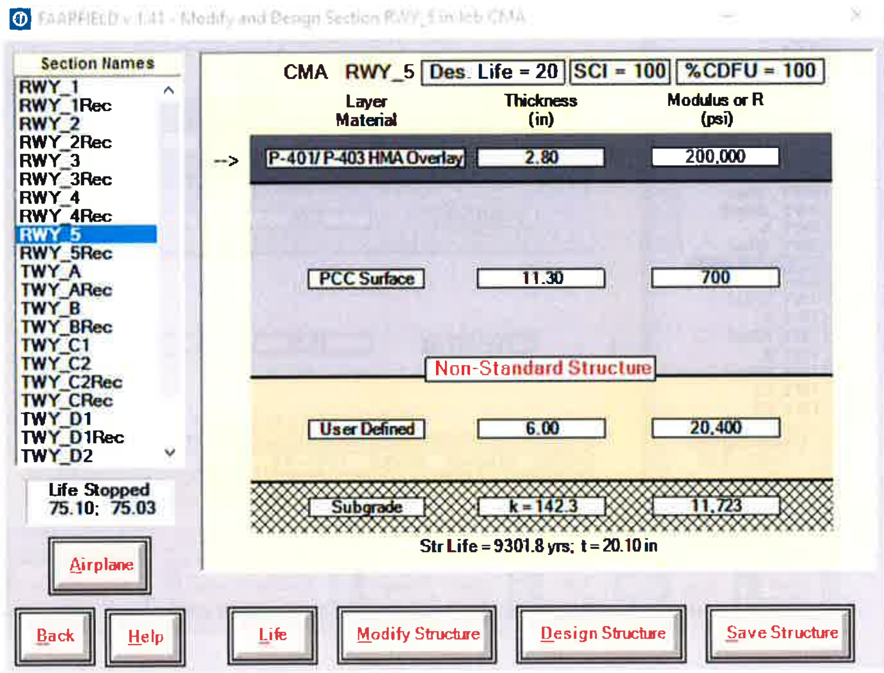


Reconstruction: Option 2 = 5-inch Hot Mix Asphalt over 6-inch Cement Treated Base over 6″ Aggregate Base over 7″ Subbase



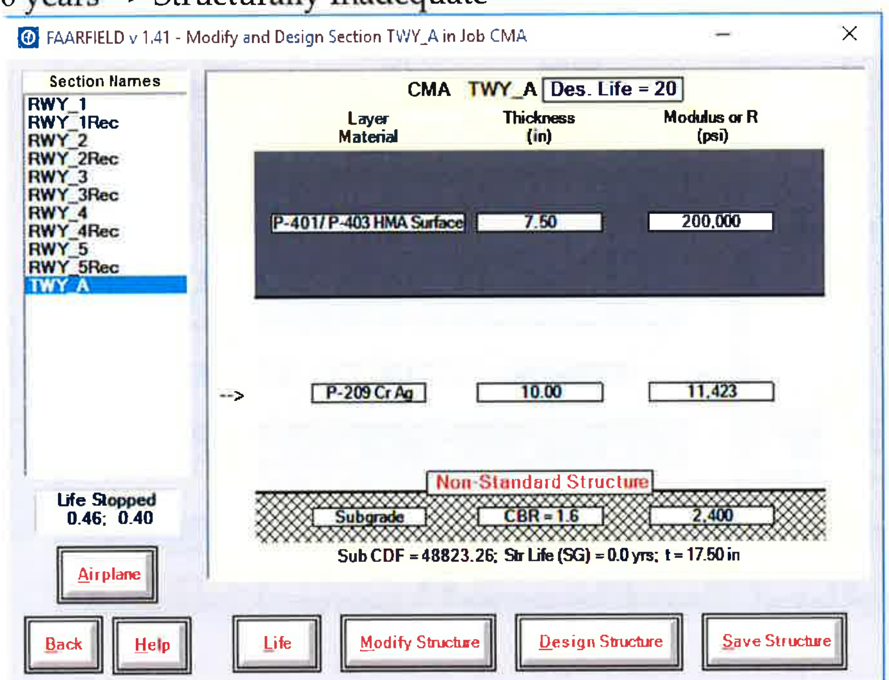
5) Runway 8/26 Section 4: From 50+00 to End

Life > 20 years

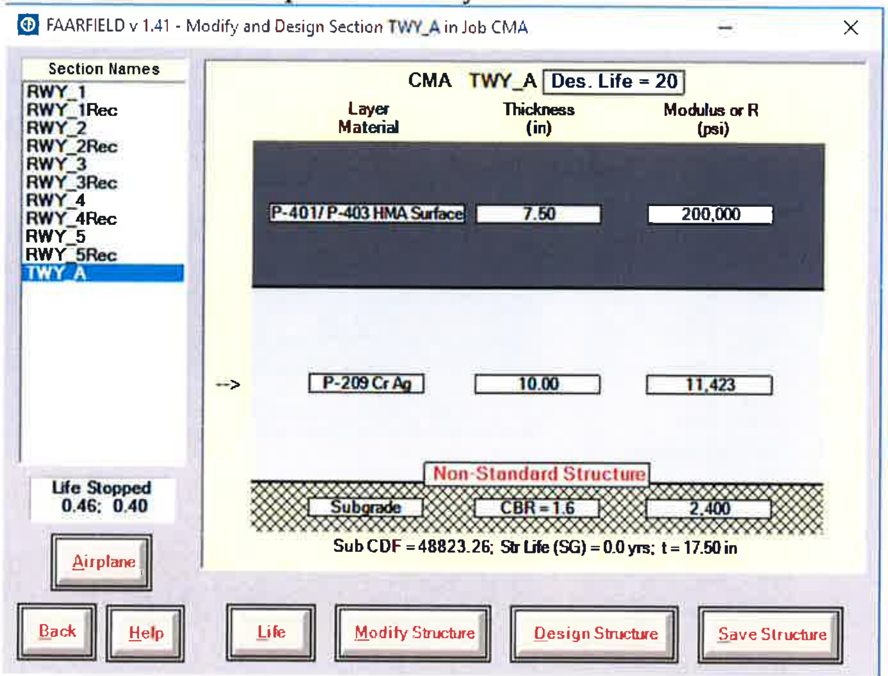


6) Taxiway A Section 1: From 0+00 to End

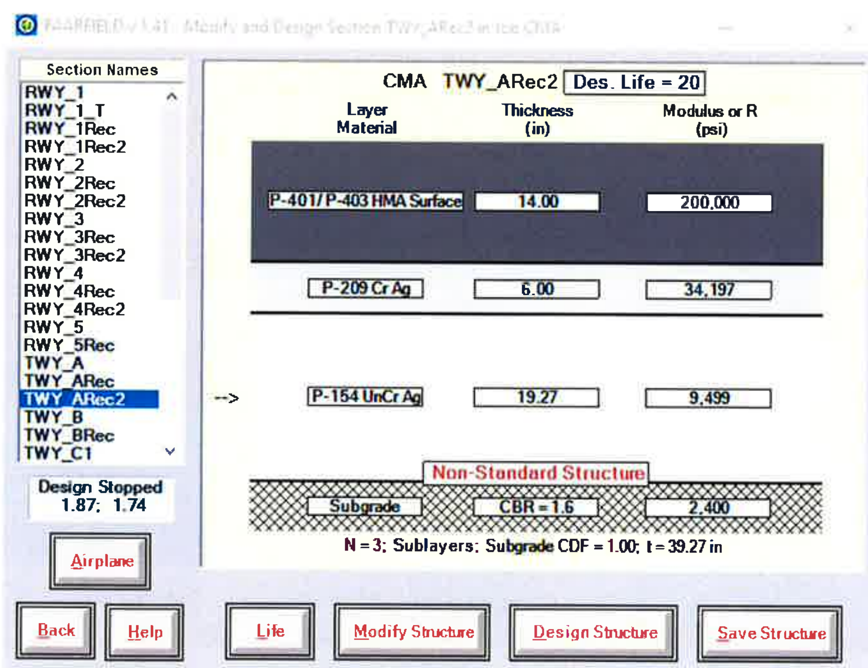
Life = 0 years => Structurally Inadequate



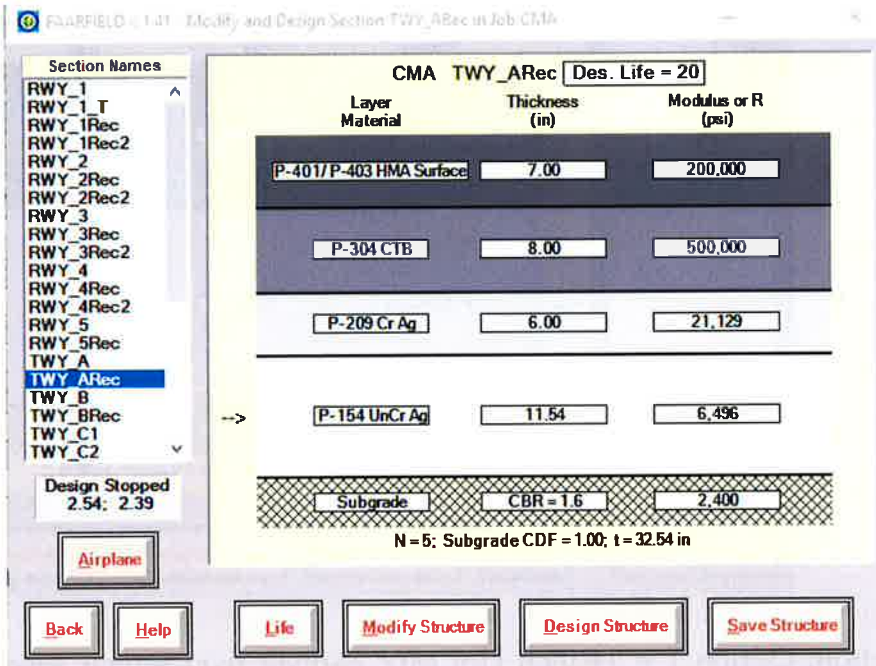
Rehabilitation = 12-inch Hot Mix Asphalt Overlay



Reconstruction: Option 1 = 14-inch Hot Mix Asphalt over 6-inch Aggregate Base over 19.5″ Subbase

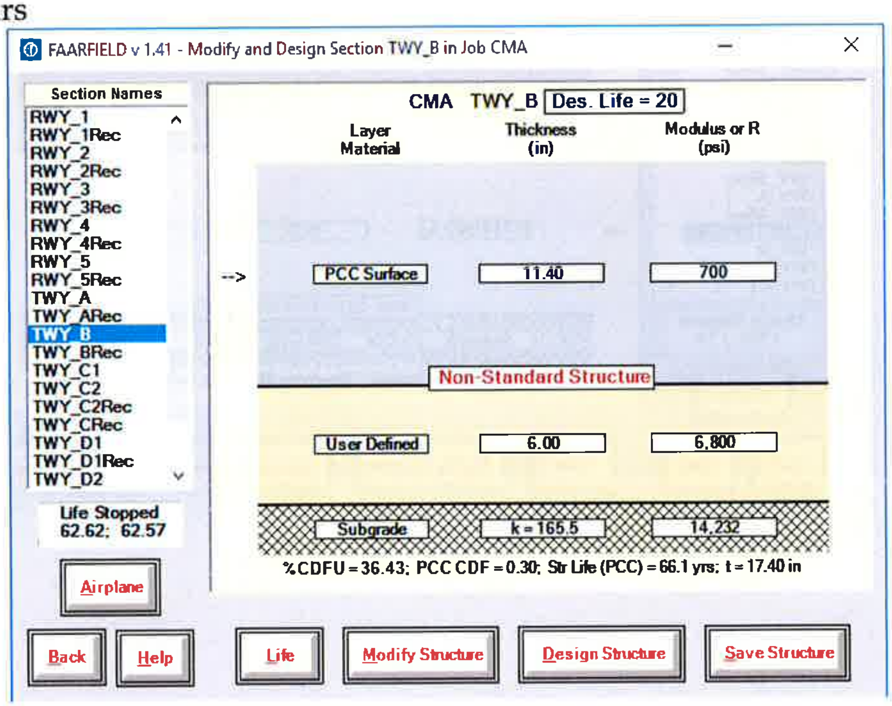


Reconstruction: Option 2 = 7-inch Hot Mix Asphalt over 8-inch Cement Treated Base over 6" Aggregate Base over 12" Subbase



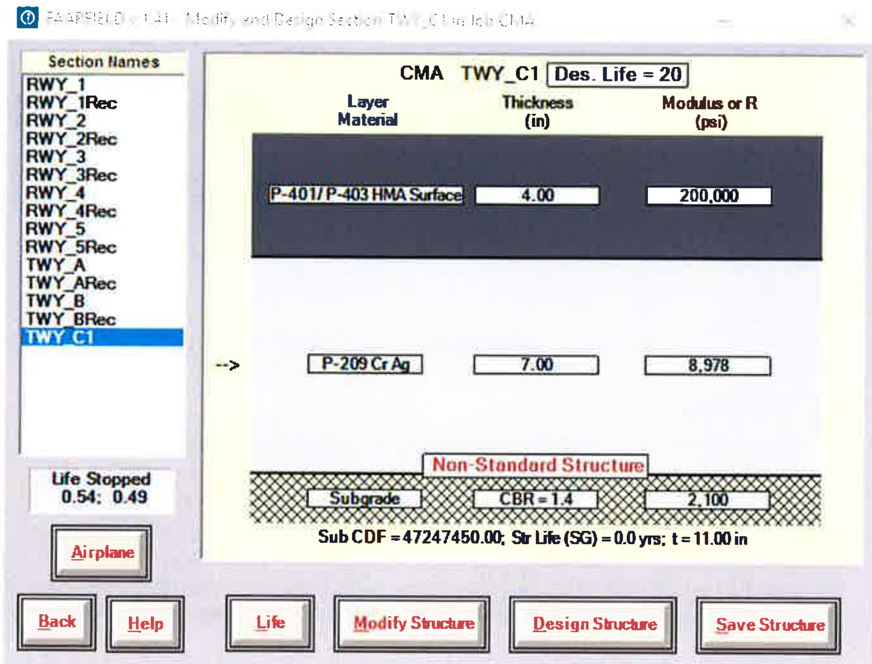
7) Taxiway B: From 0+00 to End

Life > 20 years

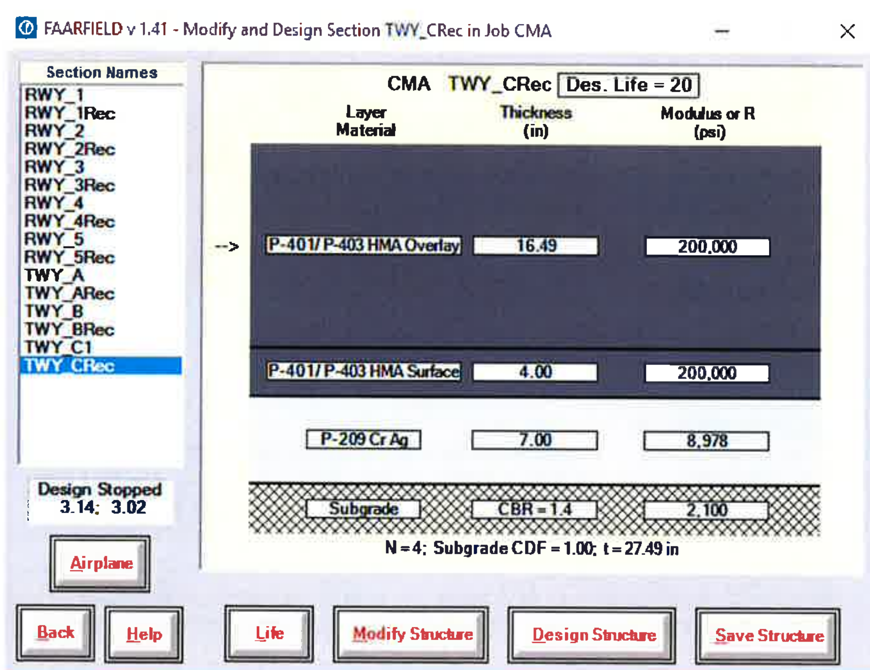


8) Taxiway C: From 0+00 to 5+00

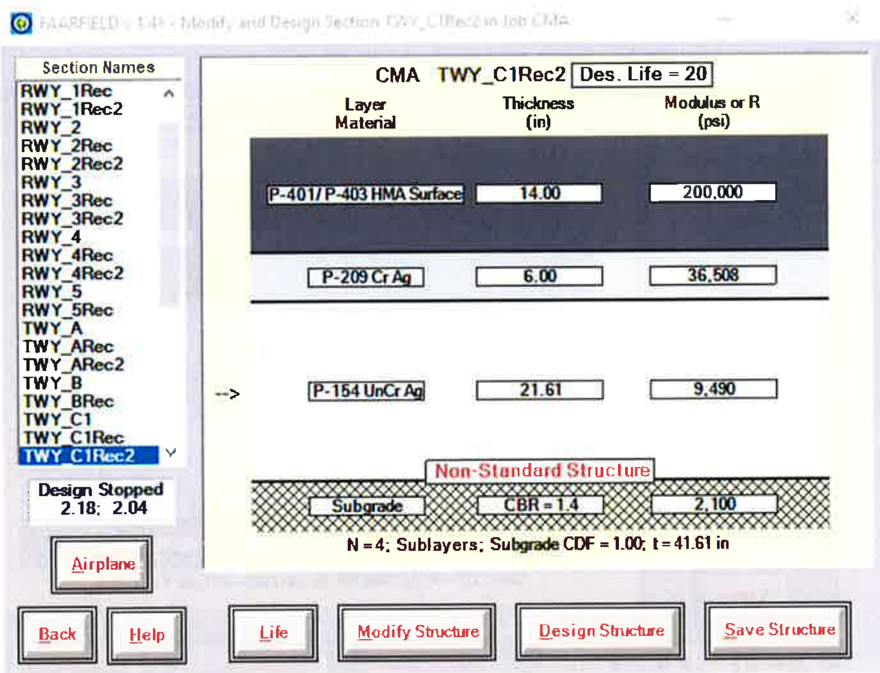
Life = 0 years => Structurally Inadequate



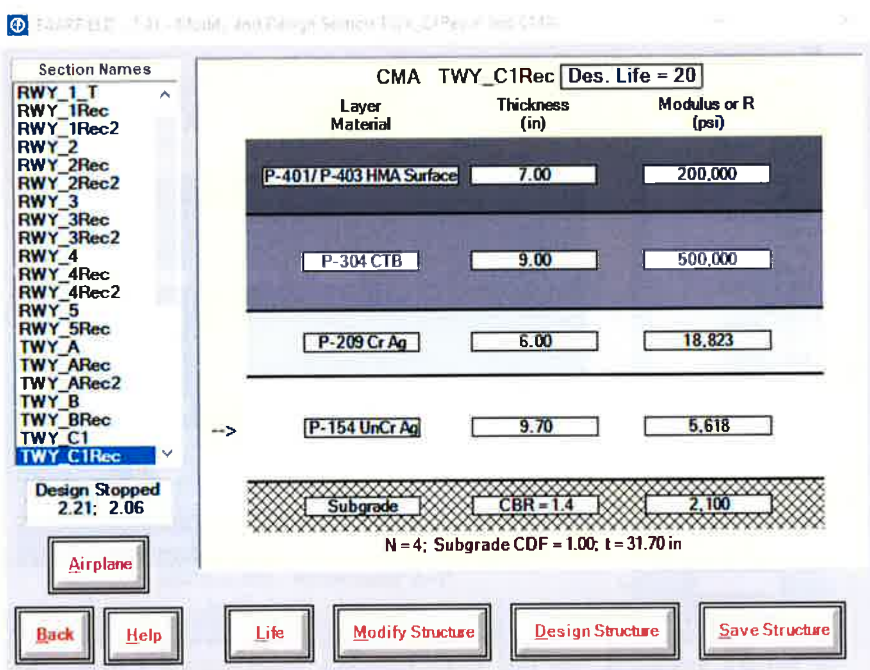
Rehabilitation = 16.5-inch Hot Mix Asphalt Overlay



Reconstruction: Option 1 = 14-inch Hot Mix Asphalt over 6-inch Aggregate Base over 22″ Subbase

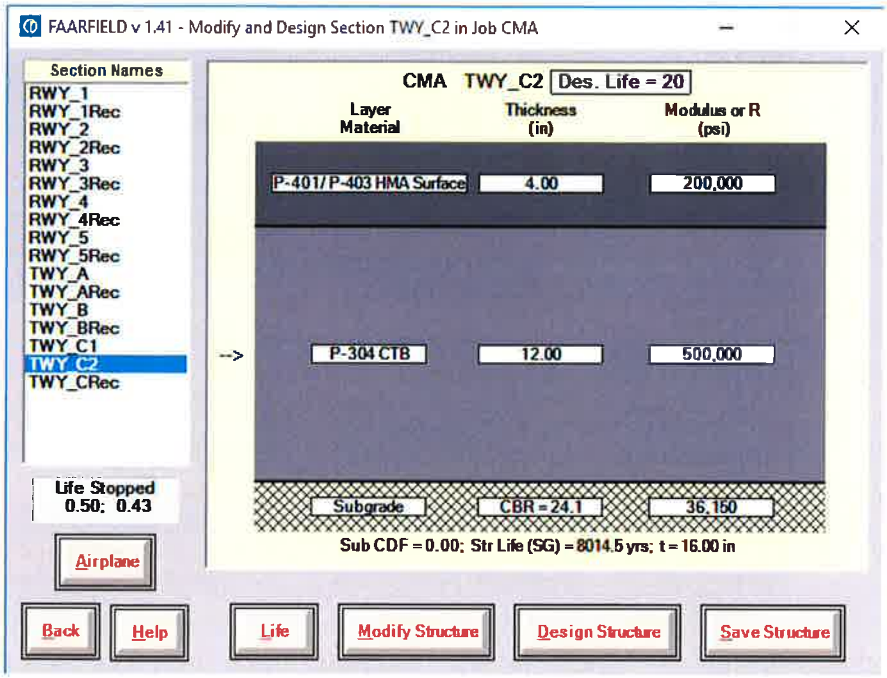


Reconstruction: Option 2 = 5-inch Hot Mix Asphalt over 5-inch Cement Treated Base over 6″ Aggregate Base over 4″ Subbase



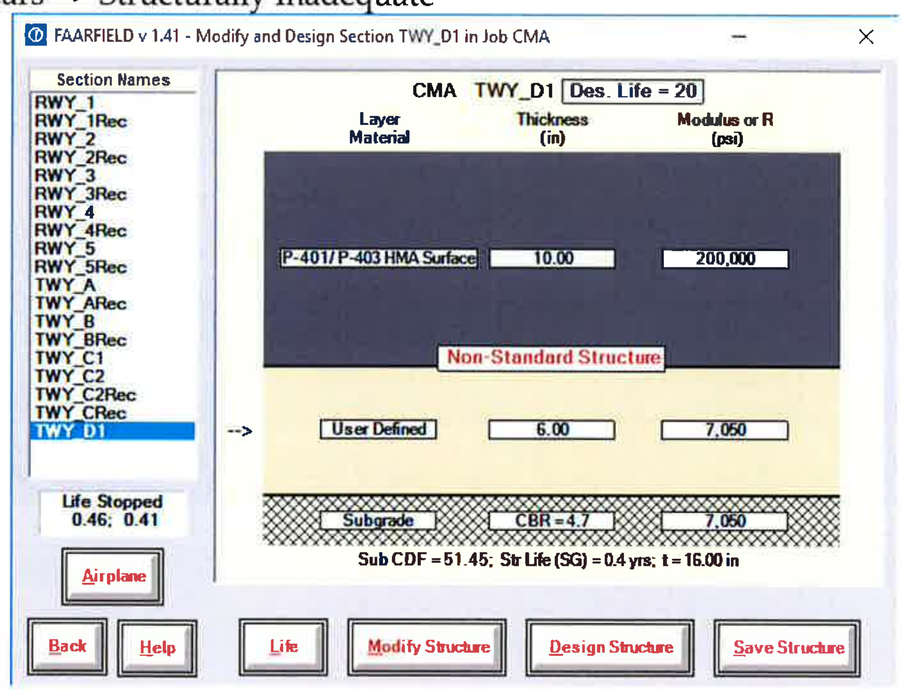
9) Taxiway C: From 5+00 to End

Life > 20 years

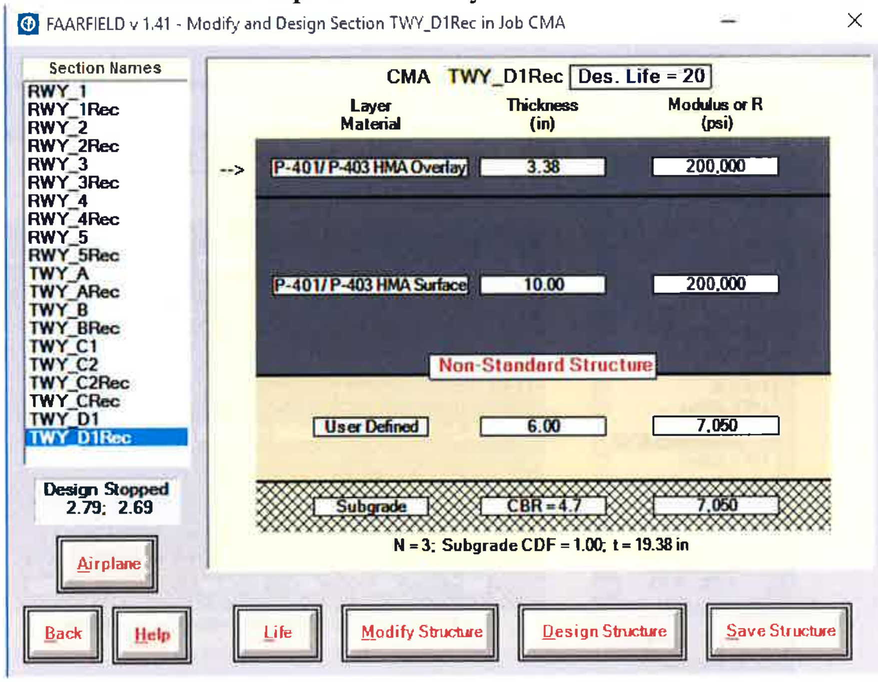


10) Taxiway D: From 0+00 to 6+50

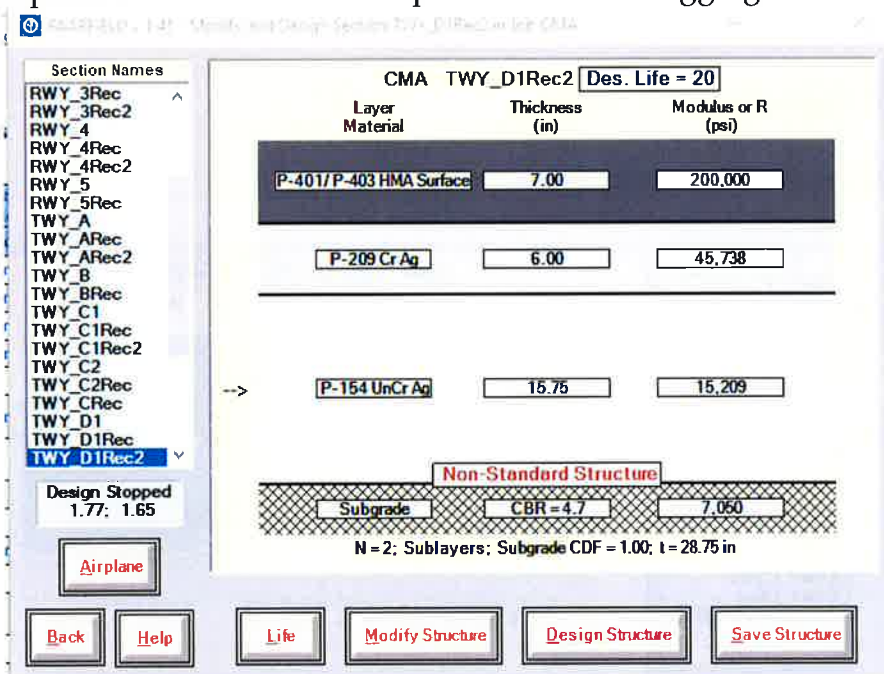
Life = 0.4 years => Structurally Inadequate



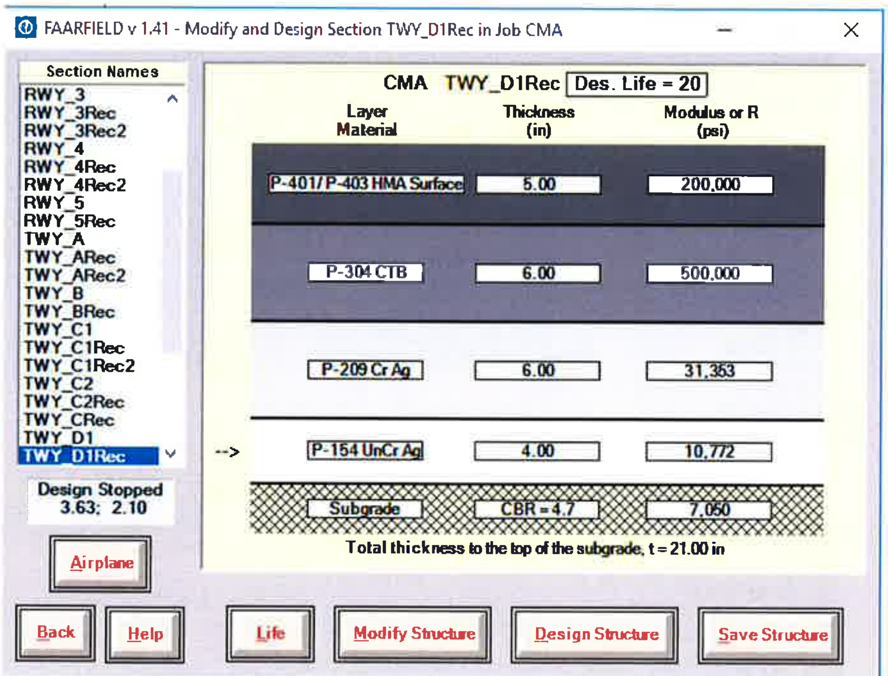
Rehabilitation = 3.5-inch Hot Mix Asphalt Overlay



Reconstruction: Option 1 = 7-inch Hot Mix Asphalt over 6-inch Aggregate Base over 16" Subbase

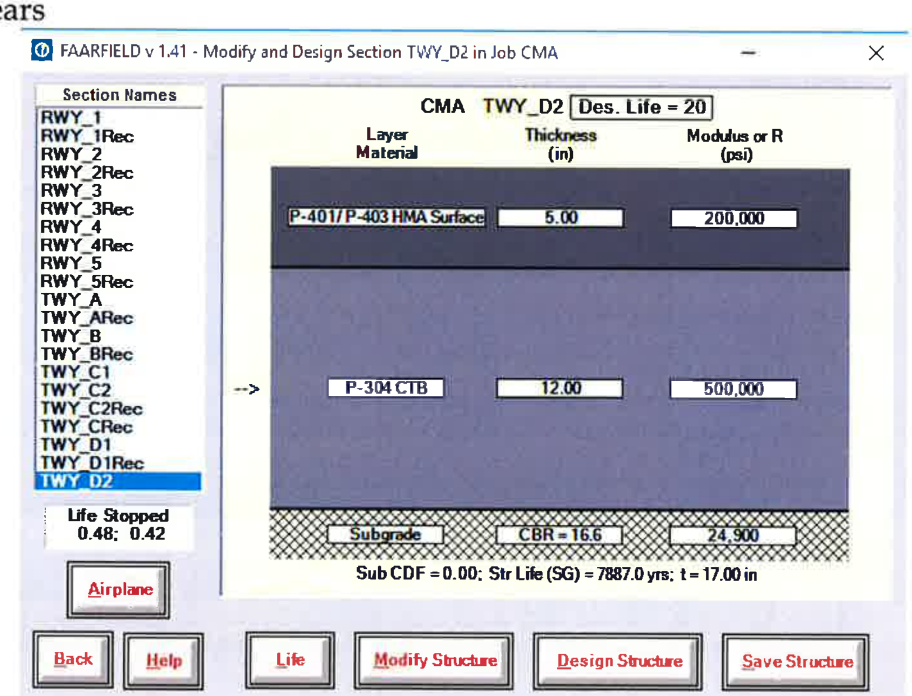


Reconstruction: Option 2 = 5-inch Hot Mix Asphalt over 6-inch Cement Treated Base over 6" Aggregate Base over 4" Subbase



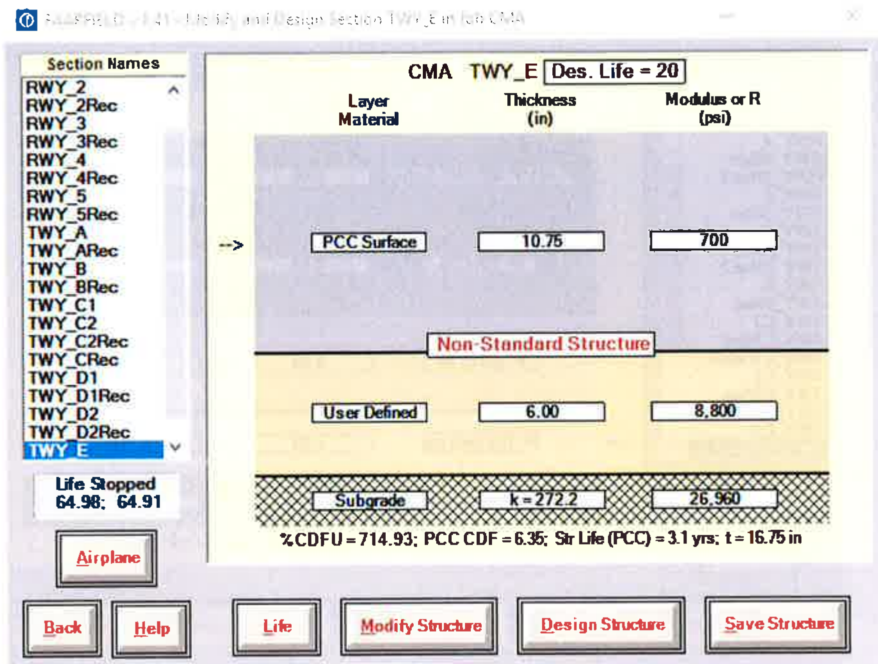
11) Taxiway D: From 6+50 to End

Life > 20 years

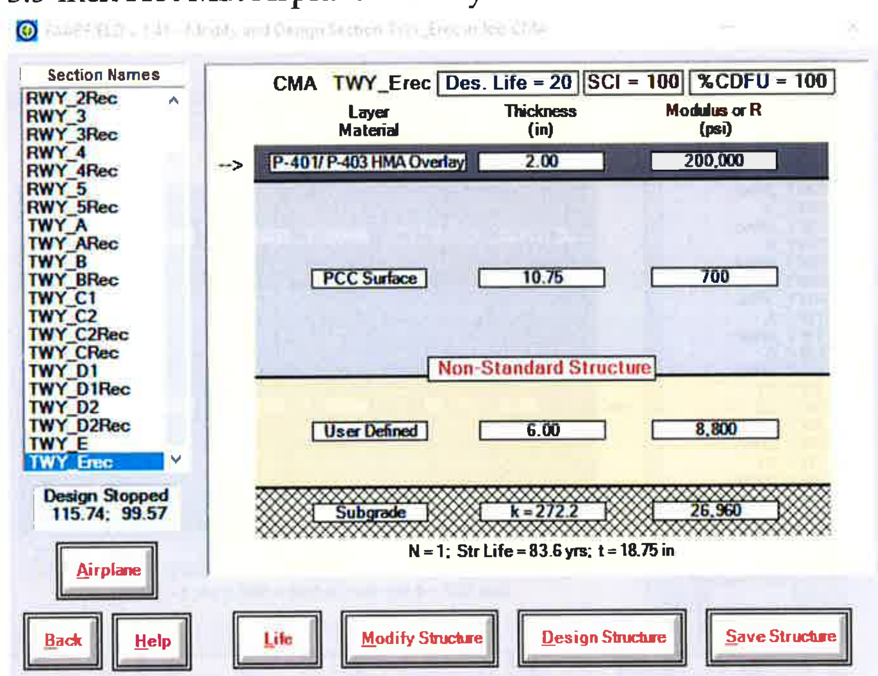


12) Taxiway E: From 0+00 to End

Life = 3.1 years => Structurally Inadequate

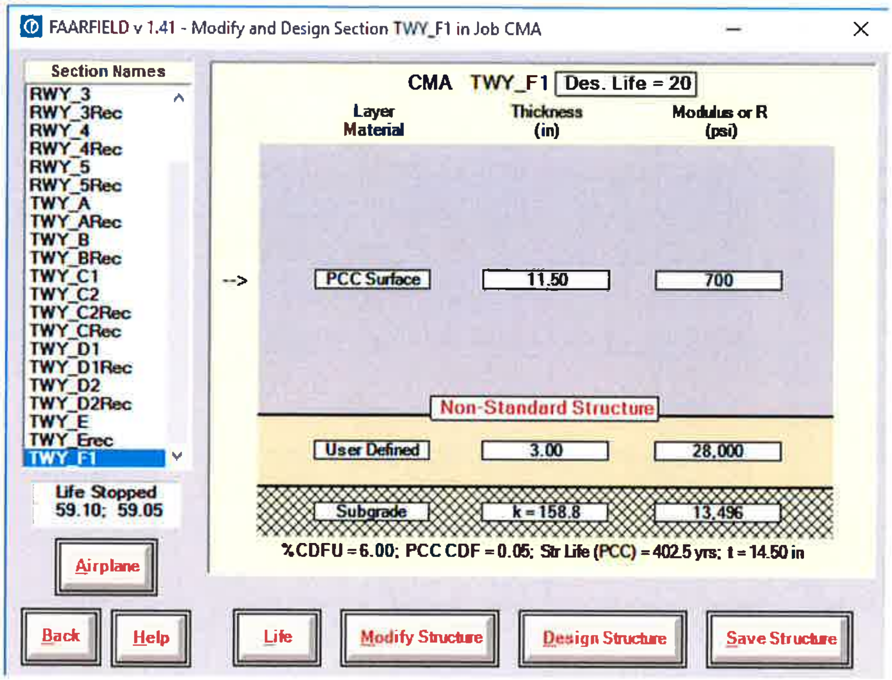


Rehabilitation = 3.5-inch Hot Mix Asphalt Overlay



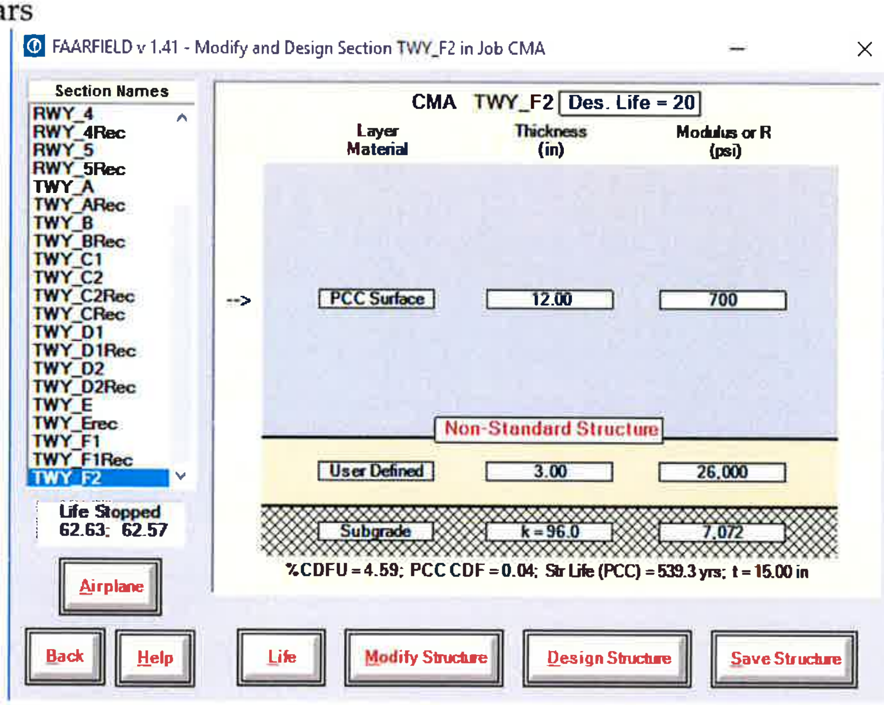
13) Taxiway F: From 0+00 to 28+00

Life > 20 years



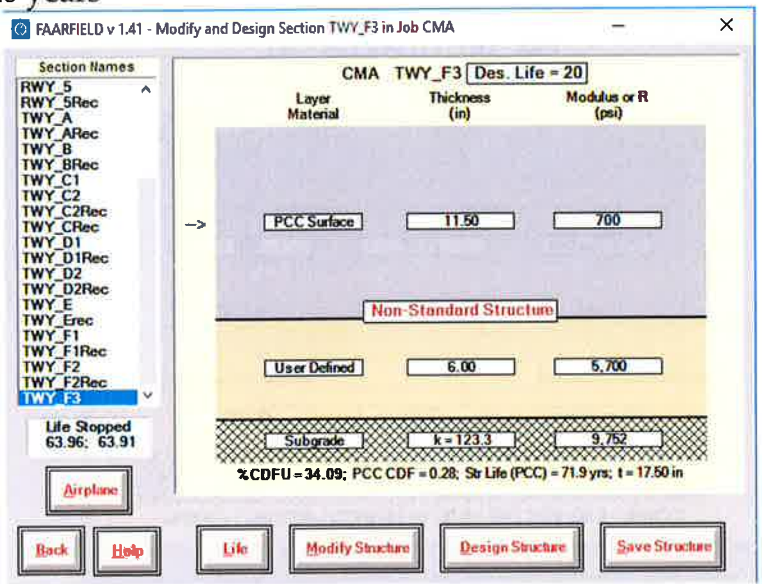
14) Taxiway F: From 28+00 to 55+00

Life > 20 years



15) Taxiway F: From 55+00 to end

Life > 20 years



Appendix E – Limited Pavement Condition Survey

1. **Runway 8/26:**

Overall the Runway 8/26 looks in good condition with no sign of fatigue cracking, permanent deformation or high severity longitudinal and transverse cracking. A surface seal application might be masking any pavement distress.

Figure E-1. Runway 8/26 - Section 1 from Station 0+00 to 8+60

Figure E-2. Runway 8/26 - Section 2 from Station 8+60 to 18+00

Figure E-3. Runway 8/26 - Section 3 from Station 18+00 to30+00

Figure E-4. Runway 8/26 - Section 4 from Station 30+00 to 50+00

Figure E-5. Runway 8/26 - Section 5 from Station 50+00 to End

2. **Taxiway A:**

Taxiway A looks in fair condition with some areas showing high severity alligator cracking and medium to high severity longitudinal and transverse cracking. A surface seal application might be masking additional distresses.

Figure E-6. Taxiway A - Station 0+00 to End

3. **Taxiway B:**

Taxiway B looks in fair to good condition with no signs of shatters slabs or corner brakes. Some slab panels exhibits sealed longitudinal cracks.

Figure E-7. Taxiway B – From Station 0+00 to End

4. **Taxiway C:**

Taxiway C looks in good condition with no signs of alligator cracks. There appears to be some medium severity longitudinal cracks on Section 1 from station 0+00 to 5+00. On the other hand, Section 2 from station 5+00 to end is in good condition, however significant signs of oxidation and weathering can be visible due to its gray color.

Figure E-8. Taxiway C - From Station 0+00 to 5+00

Figure E-9. Taxiway C - From Station 5+00 to End

5. Taxiway D:

Taxiway D appears to be in good condition with no signs of alligator cracks or permanent deformation. A surface seal was applied on Section 1 from station 0+00 to 6+50, which could be masking the presence of pavement distresses. On the other hand, Section 2 from station 6+50 to end is in good condition, however significant signs of oxidation and weathering can be visible due to its gray color.

Figure E-10. Taxiway D – From Station 0+00 to 6+50

Figure E-11. Taxiway D – From Station 6+50 to End

6. **Taxiway E:**

Taxiway E appears to be in fair condition with some sealed longitudinal cracks and no signs of corner breaks.

Figure E-12. Taxiway E – From Station 0+00 to End

7. Taxiway F:

Taxiway F appears to be in fair to good condition with some extend of cracked slabs showing sealed longitudinal cracks. No presence of corner breaks was observed.

Figure E-13. Taxiway F– From Station 0+00 to 28+00

Figure E-14. Taxiway F– From Station 28+00 to 55+00

Figure E-15. Taxiway F– From Station 55+00 to End

PCN Analysis Report - Attachment 4

Pavement Section and PCN Table

Pavement Section and PCN Table

Runway 8-26 (Earth Systems CBR)								COMFAA	COMFAA			Subg	
Section	Boring	AC	PCC	AB	LTSG	CBR	k-value	Thickness	k-value	PCN	ACN	Class	CDF
East	R-1	8	0	3.5		22		16.7		70.5	29.2	A	0
East	R-2	10	0	7		13		26.1		107.7	29.2	A	0
Taxiway B		2	11	0									
Central	R-3	10	0	0		1		16.3		1.5	33.7	D	9234
Central	R-4	9.5	0	0		12		15.2		28	31.2	B	1.9753
Central	R-5	9.5	0	0		1		15.2		1.3	33.7	D	12339
West	R-6	2.75	11.25	0		3	67.5	12.4	67.5	34.2	36.2	D	2.1774

Runway 8-26 (Dynatest CBR)								COMFAA	COMFAA			Subg	
Section	Boring	AC	PCC	AB		CBR	k-value	Thickness	k-value	PCN	ACN	Class	CDF
East	R-1	8	0	3.5		9.4		16.7		24	31.2	B	4.6707
East	R-2	10	0	7		6.7		26.1		40.8	32.6	C	0.1514
Taxiway B		2	11	0									
Central	R-3	10	0	0		7.9		16.3		19.7	32.6	C	16.59
Central	R-4	9.5	0	0		4		15.2		8.2	33.7	D	305.8
Central	R-5	9.5	0	0		4		15.2		8.2	33.7	D	305.8
West	R-6	2.75	11.25	0		7.8	142.3	12.4	142.3	38.4	35.4	C	0.5833
Representative		10	0	0		7.0		16.3		16.9	32.6	C	30.11

Taxiways (Earth Systems CBR)								COMFAA	COMFAA			Subg	
Section	Boring	AC	PCC	AB		CBR	k-value	Thickness	k-value	PCN	ACN	Class	CDF
Taxiway A	A-1	7.5	0	10		1		24.7		3.7	33.7	D	1284
Taxiway B	B-1	0	11.5	0		2	49.2	11.5	49.2	27.6	36.2	D	40.82
Taxiway B	B-2	0	11.25	0		1	28.7	11.25	28.7	23.8	36.2	D	282
Taxiway C	C-1	4	0	6.5		2		11.9		1.8	33.7	D	6645
Taxiway D	D-1	10	0	0		1		16.3		1.5	33.7	D	9234
Taxiway E	E-1	0	10.75	0		11	185.7	10.75	185.7	30.1	35.4	C	10.5
Taxiway F	F-1	0	11.5	3		1	28.7	11.5	38	26.4	36.2	D	80.7
Taxiway F	F-2	0	12	0		1	28.7	12	28.7	27.4	36.2	D	46.4
Taxiway F	F-3	0	11.5	0		1	28.7	11.5	28.7	25	36.2	D	154.5
Taxiway F	F-4	0	11.5	0		1	28.7	11.5	28.7	25	36.2	D	154.5
Taxiway H	C-2	4	0	12 CTB	24	N/A		47		16.6	33.7	D	40.44
Taxiway H	D-2	5	0	12 CTB	36	N/A		61.2		29.3	33.7	D	2.662

Taxiways (Dynatest CBR)								COMFAA	COMFAA			Subg	
Section	Boring	AC	PCC	AB		CBR	k-value	Thickness	k-value	PCN	ACN	Class	CDF
Taxiway A	A-1	7.5	0	10		1.6		24.7		7	33.7	D	389.4
Taxiway B	B-1	0	11.5	0		9.49	165.5	11.5	165.5	33.8	35.4	C	1.95
Taxiway B	B-2	0	11.25	0		9.49	165.5	11.25	165.5	32.4	35.4	C	3.78
Taxiway C	C-1	4	0	6.5		1.4		11.9		1.1	33.7	D	20408
Taxiway D	D-1	10	0	0		4.7		16.3		10	32.6	C	138
Taxiway E	E-1	0	10.75	0		17.97	272.2	10.75	272.2	31.7	34.5	B	3.224
Taxiway F	F-1	0	11.5	3		9	158.8	11.5	190	34.7	35.4	C	1.269
Taxiway F	F-2	0	12	0		4.715	96.0	12	96	33.3	35.4	C	2.426
Taxiway F	F-3	0	11.5	0		6.5	123.3	11.5	123.3	31.8	35.4	C	4.71
Taxiway F	F-4	0	11.5	0		6.5	123.3	11.5	123.3	31.8	35.4	C	4.71
Taxiway H	C-2	4	0	12 CTB		24.1		23		144.6	29.2	A	0
Taxiway H	D-2	5	0	12 CTB		16.6		25.2		136.8	29.2	A	0
AC Connectors		7.5	0	10		3		24.7		15.1	33.7	D	57.5
PCC Taxiways		0	11.5	0			158.0	11.5	158	33.5	35.4	C	2.255

Taxiways (Record Drawings)								COMFAA	COMFAA			Subg	
Section	Boring	AC	PCC	AB	LTSG	CBR	k-value	Thickness	k-value	PCN	ACN	Class	CDF
Taxiway G		4	0	15		4		23.8		21.5	33.7	D	11.06
Taxiway H		4	0	9	15	4		30.4		31.7	33.7	D	1.586

PCN Analysis Report - Attachment 5

PCN Calculation Sheets

RWY 8-26 (Representative)

This file name = PCN Results Flexible 7-21-2017 12;42;25.txt
Library file name = X:\3168900\155706.01\TECH\dsgn\PCN Analysis\COMFAA\Fleet Mix Files\Overall Fleet Mix.Ext
Units = English

Evaluation pavement type is flexible and design procedure is CBR.
Alpha Values are those approved by the ICAO in 2007.

CBR = 7.00 (Subgrade Category is C(6))
Evaluation pavement thickness = 16.30 in
Pass to Traffic Cycle (PtoTC) Ratio = 1.00
Maximum number of wheels per gear = 2
Maximum number of gears per aircraft = 2

No aircraft have 4 or more wheels per gear. The FAA recommends a reference section assuming 3 inches of HMA and 6 inches of crushed aggregate for equivalent thickness calculations.

Results Table 1. Input Traffic Data

No.	Aircraft Name	Gross Weight	Percent Gross Wt	Tire Press	Annual Deps	20-yr Coverages	6D Thick
1	Single Wheel 8	8,000	100.00	50.0	86,130	253,335	11.23
2	Single Wheel 12.5	12,500	95.00	50.0	5,000	12,688	8.19
3	BeechJet-400A	16,300	95.00	105.0	950	1,903	9.33
4	Hawker-800	27,520	95.00	135.0	150	476	8.75
5	Citation-X	36,000	95.00	189.0	270	831	11.45
6	Challenger-CL-604	48,200	95.00	145.0	290	1,154	12.86
7	Gulfstream-G-IV	75,000	95.00	185.0	265	1,172	17.49
8	Gulfstream-G-V	91,000	95.00	188.0	265	1,264	19.18
9	Global Express 6000	99,500	95.00	188.0	185	923	19.62
10	Gulfstream G-650	99,600	95.00	188.0	730	3,642	22.14

Results Table 2. PCN Values

No.	Aircraft Name	Critical Aircraft Total Equiv. Covs.	Thickness for Total Equiv. Covs.	Maximum Allowable Gross Weight	ACN Thick at Max. Allowable Gross Weight	CDF	PCN on C(6)
1	Single Wheel 8	>5,000,000	16.81	7,522	10.26	0.0000	5.1
2	Single Wheel 12.5	>5,000,000	16.13	12,770	9.22	0.0000	4.1
3	BeechJet-400A	>5,000,000	17.35	14,389	10.86	0.0000	5.7
4	Hawker-800	>5,000,000	17.11	25,297	12.20	0.0000	7.2
5	Citation-X	>5,000,000	18.18	29,643	13.79	0.0047	9.2
6	Challenger-CL-604	681,470	19.05	37,353	14.55	0.0510	10.2
7	Gulfstream-G-IV	17,478	21.35	47,153	17.33	2.0200	14.5
8	Gulfstream-G-V	8,751	22.35	54,038	18.20	4.3507	16.0
9	Global Express 6000	5,824	22.90	56,624	18.72	4.7707	16.9
10	Gulfstream G-650	5,798	22.90	56,654	18.73	18.9176	16.9
					Total CDF =	30.1147	

Results Table 3. Flexible ACN at Indicated Gross Weight and Strength

No.	Aircraft Name	Gross Weight	% GW on Main Gear	Tire Pressure	ACN Thick	ACN on C(6)
1	Single Wheel 8	8,000	100.00	50.0	10.58	5.4
2	Single Wheel 12.5	12,500	95.00	50.0	9.12	4.0
3	BeechJet-400A	16,300	95.00	105.0	11.56	6.4
4	Hawker-800	27,520	95.00	135.0	12.86	8.0
5	Citation-X	36,000	95.00	189.0	15.44	11.5
6	Challenger-CL-604	48,200	95.00	145.0	17.09	14.1
7	Gulfstream-G-IV	75,000	95.00	185.0	22.60	24.6
8	Gulfstream-G-V	91,000	95.00	188.0	24.71	29.4
9	Global Express 6000	99,500	95.00	188.0	25.98	32.6
10	Gulfstream G-650	99,600	95.00	188.0	26.00	32.6

Results Table 4. Summary Output for Copy and Paste Into the Support Spread Sheet

Num,Plane,GWin,ACNin,ADout,6Dt,COV20yr,COVtoF,CDFt,GWcdf,PCNcdf,EVALt,SUBcode,KorCBR,PtoTC,FlexOrRig

RWY 8-26 (Representative)

```
1,Single Wheel 8,8000.000,5.4,86130,11.23,2.53335E+005,2.93154E+012,16.81,7521.553,5.1,16.3,C,7.00,1.00,F
2,Single Wheel 12.5,12500.000,4.0,5000,8.19,1.26884E+004,1.01423E+304,16.13,12769.536,4.1,16.3,C,7.00,1.00,F
3,BeechJet-400A,16300.000,6.4,950,9.33,1.90277E+003,5.59351E+008,17.35,14389.384,5.7,16.3,C,7.00,1.00,F
4,Hawker-800,27520.000,8.0,150,8.75,4.75821E+002,1.14381E+008,17.11,25296.758,7.2,16.3,C,7.00,1.00,F
5,Citation-X,36000.000,11.5,270,11.45,8.31072E+002,1.75440E+005,18.18,29643.048,9.2,16.3,C,7.00,1.00,F
6,Challenger-CL-604,48200.000,14.1,290,12.86,1.15386E+003,2.26292E+004,19.05,37352.913,10.2,16.3,C,7.00,1.00,F
7,Gulfstream-G-IV,75000.000,24.6,265,17.49,1.17238E+003,5.80384E+002,21.35,47153.354,14.5,16.3,C,7.00,1.00,F
8,Gulfstream-G-V,91000.000,29.4,265,19.18,1.26424E+003,2.90587E+002,22.35,54037.859,16.0,16.3,C,7.00,1.00,F
9,Global Express 6000,99500.000,32.6,185,19.62,9.22564E+002,1.93381E+002,22.90,56624.081,16.9,16.3,C,7.00,1.00,F
10,Gulfstream G-650,99600.000,32.6,730,22.14,3.64220E+003,1.92530E+002,22.90,56653.726,16.9,16.3,C,7.00,1.00,F
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TWY A (Representative)

This file name = PCN Results Flexible 7-31-2017 14;52;30.txt
Library file name = X:\3168900\155706.01\TECH\dsgn\PCN Analysis\COMFAA\Fleet Mix Files\Overall Fleet Mix.Ext
Units = English

Evaluation pavement type is flexible and design procedure is CBR.
Alpha Values are those approved by the ICAO in 2007.

CBR = 3.00 (Subgrade Category is D(3))
Evaluation pavement thickness = 24.70 in
Pass to Traffic Cycle (PtoTC) Ratio = 1.00
Maximum number of wheels per gear = 2
Maximum number of gears per aircraft = 2

No aircraft have 4 or more wheels per gear. The FAA recommends a reference section assuming 3 inches of HMA and 6 inches of crushed aggregate for equivalent thickness calculations.

Results Table 1. Input Traffic Data

No.	Aircraft Name	Gross Weight	Percent Gross Wt	Tire Press	Annual Deps	20-yr Coverages	6D Thick
1	Single Wheel 8	8,000	100.00	50.0	86,130	253,335	19.95
2	Single Wheel 12.5	12,500	95.00	50.0	5,000	12,688	14.52
3	BeechJet-400A	16,300	95.00	105.0	950	1,903	15.01
4	Hawker-800	27,520	95.00	135.0	150	476	15.13
5	Citation-X	36,000	95.00	189.0	270	831	18.93
6	Challenger-CL-604	48,200	95.00	145.0	290	1,154	21.98
7	Gulfstream-G-IV	75,000	95.00	185.0	265	1,172	28.47
8	Gulfstream-G-V	91,000	95.00	188.0	265	1,264	31.42
9	Global Express 6000	99,500	95.00	188.0	185	923	32.06
10	Gulfstream G-650	99,600	95.00	188.0	730	3,642	35.84

Results Table 2. PCN Values

No.	Aircraft Name	Critical Aircraft Total Equiv. Covs.	Thickness for Total Equiv. Covs.	Maximum Allowable Gross Weight	ACN Thick at Max. Allowable Gross Weight	CDF	PCN on D(3)
1	Single Wheel 8	>5,000,000	26.80	6,797	15.30	0.0017	5.4
2	Single Wheel 12.5	>5,000,000	25.66	11,582	13.76	0.0000	4.4
3	BeechJet-400A	>5,000,000	27.04	13,605	15.64	0.0000	5.6
4	Hawker-800	>5,000,000	26.77	23,666	17.95	0.0001	7.4
5	Citation-X	2,454,604	28.50	27,428	19.74	0.0195	9.0
6	Challenger-CL-604	279,163	30.35	33,139	20.95	0.2377	10.1
7	Gulfstream-G-IV	16,742	34.20	40,871	23.96	4.0267	13.2
8	Gulfstream-G-V	8,314	36.06	45,560	24.99	8.7435	14.4
9	Global Express 6000	5,919	37.02	47,430	25.57	8.9620	15.1
10	Gulfstream G-650	5,898	37.03	47,451	25.57	35.5117	15.1
					Total CDF =	57.5029	

Results Table 3. Flexible ACN at Indicated Gross Weight and Strength

No.	Aircraft Name	Gross Weight	% GW on Main Gear	Tire Pressure	ACN Thick	ACN on D(3)
1	Single Wheel 8	8,000	100.00	50.0	16.60	6.3
2	Single Wheel 12.5	12,500	95.00	50.0	14.30	4.7
3	BeechJet-400A	16,300	95.00	105.0	17.11	6.7
4	Hawker-800	27,520	95.00	135.0	19.53	8.8
5	Citation-X	36,000	95.00	189.0	22.86	12.0
6	Challenger-CL-604	48,200	95.00	145.0	25.90	15.5
7	Gulfstream-G-IV	75,000	95.00	185.0	33.22	25.4
8	Gulfstream-G-V	91,000	95.00	188.0	36.47	30.6
9	Global Express 6000	99,500	95.00	188.0	38.23	33.7
10	Gulfstream G-650	99,600	95.00	188.0	38.25	33.7

Results Table 4. Summary Output for Copy and Paste Into the Support Spread Sheet

Num,Plane,GWin,ACNin,ADout,6Dt,COV20yr,COVtoF,CDFt,GWcdf,PCNcdf,EVALt,SUBcode,KorCBR,PtoTC,FlexOrRig

TWY A (Representative)

1,Single Wheel 8,8000.000,6.3,86130,19.95,2.53335E+005,1.51561E+008,26.80,6796.670,5.4,24.7,D,3.00,1.00,F
2,Single Wheel 12.5,12500.000,4.7,5000,14.52,1.26884E+004,1.23817E+012,25.66,11581.542,4.4,24.7,D,3.00,1.00,F
3,BeechJet-400A,16300.000,6.7,950,15.01,1.90277E+003,4.54170E+007,27.04,13605.359,5.6,24.7,D,3.00,1.00,F
4,Hawker-800,27520.000,8.8,150,15.13,4.75821E+002,3.39030E+006,26.77,23666.293,7.4,24.7,D,3.00,1.00,F
5,Citation-X,36000.000,12.0,270,18.93,8.31072E+002,4.26866E+004,28.50,27427.636,9.0,24.7,D,3.00,1.00,F
6,Challenger-CL-604,48200.000,15.5,290,21.98,1.15386E+003,4.85477E+003,30.35,33138.576,10.1,24.7,D,3.00,1.00,F
7,Gulfstream-G-IV,75000.000,25.4,265,28.47,1.17238E+003,2.91153E+002,34.20,40870.805,13.2,24.7,D,3.00,1.00,F
8,Gulfstream-G-V,91000.000,30.6,265,31.42,1.26424E+003,1.44592E+002,36.06,45559.688,14.4,24.7,D,3.00,1.00,F
9,Global Express 6000,99500.000,33.7,185,32.06,9.22564E+002,1.02942E+002,37.02,47429.989,15.1,24.7,D,3.00,1.00,F
10,Gulfstream G-650,99600.000,33.7,730,35.84,3.64220E+003,1.02563E+002,37.03,47451.273,15.1,24.7,D,3.00,1.00,F

PCC Taxiways (Representative)

This file name = PCN Results Rigid 7-31-2017 14;53;55.txt
Library file name = X:\3168900\155706.01\TECH\dsgn\PCN Analysis\COMFAA\Fleet Mix Files\Overall Fleet Mix.Ext
Units = English

Evaluation pavement type is rigid
Equivalent coverages computed with the AC 150/5320-6C/D edge stress design method.
Maximum gross weight computed with the AC 150/5320-6C/D edge stress design method.

k Value = 158.0 lbs/in^3 (Subgrade Category is C(147))
flexural strength = 650.0 psi
Evaluation pavement thickness = 11.50 in
Pass to Traffic Cycle (PtoTC) Ratio = 1.00

Maximum number of wheels per gear = 2
Maximum number of gears per aircraft = 2

Results Table 1. Input Traffic Data

No.	Aircraft Name	Gross Weight	Percent Gross Wt	Tire Press	Annual Deps	20-yr Coverages	6D Thick
1	Single Wheel 8	8,000	100.00	50.0	86,130	253,335	5.65
2	Single Wheel 12.5	12,500	95.00	50.0	5,000	12,688	4.17
3	BeechJet-400A	16,300	95.00	105.0	950	1,903	4.97
4	Hawker-800	27,520	95.00	135.0	150	476	5.61
5	Citation-X	36,000	95.00	189.0	270	831	6.93
6	Challenger-CL-604	48,200	95.00	145.0	290	1,154	7.53
7	Gulfstream-G-IV	75,000	95.00	185.0	265	1,172	9.92
8	Gulfstream-G-V	91,000	95.00	188.0	265	1,264	10.76
9	Global Express 6000	99,500	95.00	188.0	185	923	11.17
10	Gulfstream G-650	99,600	95.00	188.0	730	3,642	11.68

Results Table 2. PCN Values

No.	Aircraft Name	Critical Aircraft Total Equiv. Covs.	Thickness for Total Equiv. Covs.	Maximum Allowable Gross Weight	ACN Thick at Max. Allowable Gross Weight	CDF	PCN on C(147)
1	Single Wheel 8	>5,000,000	11.75	7,619	4.31	0.0000	4.7
2	Single Wheel 12.5	>5,000,000	11.72	11,985	3.77	0.0000	3.6
3	BeechJet-400A	>5,000,000	11.78	15,455	4.75	0.0000	5.8
4	Hawker-800	>5,000,000	11.83	26,032	5.52	0.0000	8.0
5	Citation-X	>5,000,000	11.90	33,657	6.61	0.0000	11.7
6	Challenger-CL-604	>5,000,000	11.93	44,822	7.13	0.0003	13.7
7	Gulfstream-G-IV	54,974	12.07	68,316	9.30	0.0481	24.2
8	Gulfstream-G-V	15,901	12.12	82,482	10.04	0.1793	28.5
9	Global Express 6000	5,146	11.81	94,682	10.83	0.4043	33.4
10	Gulfstream G-650	5,060	11.80	94,883	10.84	1.6230	33.5
					Total CDF =	2.2550	

Results Table 3. Rigid ACN at Indicated Gross Weight and Strength

No.	Aircraft Name	Gross Weight	% GW on Main Gear	Tire Pressure	ACN Thick	ACN on C(147)
1	Single Wheel 8	8,000	100.00	50.0	4.41	4.9
2	Single Wheel 12.5	12,500	95.00	50.0	3.85	3.7
3	BeechJet-400A	16,300	95.00	105.0	4.86	6.1
4	Hawker-800	27,520	95.00	135.0	5.69	8.5
5	Citation-X	36,000	95.00	189.0	6.85	12.6
6	Challenger-CL-604	48,200	95.00	145.0	7.41	14.9
7	Gulfstream-G-IV	75,000	95.00	185.0	9.79	26.9
8	Gulfstream-G-V	91,000	95.00	188.0	10.60	31.9
9	Global Express 6000	99,500	95.00	188.0	11.12	35.4
10	Gulfstream G-650	99,600	95.00	188.0	11.13	35.4

Results Table 4. Summary Output for Copy and Paste Into the Support Spread Sheet

Num,Plane,GWin,ACNin,ADout,6Dt,COV20yr,COVtoF,CDFt,GWcdf,PCNcdf,EVALt,SUBcode,KorCBR,PtoTC,FlexOrRig

PCC Taxiways (Representative)

1,Single Wheel 8,8000.000,4.9,86130,5.65,2.53335E+005,6.27863E+013,11.75,7619.463,4.7,11.5,C,158.00,1.00,R
2,Single Wheel 12.5,12500.000,3.7,5000,4.17,1.26884E+004,1.24057E+016,11.72,11985.313,3.6,11.5,C,158.00,1.00,R
3,BeechJet-400A,16300.000,6.1,950,4.97,1.90277E+003,4.69460E+011,11.78,15454.509,5.8,11.5,C,158.00,1.00,R
4,Hawker-800,27520.000,8.5,150,5.61,4.75821E+002,3.09522E+009,11.83,26032.268,8.0,11.5,C,158.00,1.00,R
5,Citation-X,36000.000,12.6,270,6.93,8.31072E+002,2.18664E+007,11.90,33656.978,11.7,11.5,C,158.00,1.00,R
6,Challenger-CL-604,48200.000,14.9,290,7.53,1.15386E+003,4.30797E+006,11.93,44821.865,13.7,11.5,C,158.00,1.00,R
7,Gulfstream-G-IV,75000.000,26.9,265,9.92,1.17238E+003,2.43789E+004,12.07,68316.056,24.2,11.5,C,158.00,1.00,R
8,Gulfstream-G-V,91000.000,31.9,265,10.76,1.26424E+003,7.05144E+003,12.12,82482.402,28.5,11.5,C,158.00,1.00,R
9,Global Express 6000,99500.000,35.4,185,11.17,9.22564E+002,2.28210E+003,11.81,94682.400,33.4,11.5,C,158.00,1.00,R
10,Gulfstream G-650,99600.000,35.4,730,11.68,3.64220E+003,2.24405E+003,11.80,94883.457,33.5,11.5,C,158.00,1.00,R

TWY G_Record Dwgs (Half Mix)

This file name = PCN Results Flexible 7-31-2017 14;50;22.txt
Library file name = X:\3168900\155706.01\TECH\dsgn\PCN Analysis\COMFAA\Fleet Mix Files\Overall Fleet Mix.Ext
Units = English

Evaluation pavement type is flexible and design procedure is CBR.
Alpha Values are those approved by the ICAO in 2007.

CBR = 4.00 (Subgrade Category is D(3))
Evaluation pavement thickness = 23.80 in
Pass to Traffic Cycle (PtoTC) Ratio = 0.50 (non-standard)
Maximum number of wheels per gear = 2
Maximum number of gears per aircraft = 2

No aircraft have 4 or more wheels per gear. The FAA recommends a reference section assuming 3 inches of HMA and 6 inches of crushed aggregate for equivalent thickness calculations.

Results Table 1. Input Traffic Data

No.	Aircraft Name	Gross Weight	Percent Gross Wt	Tire Press	Annual Deps	20-yr Coverages	6D Thick
1	Single Wheel 8	8,000	100.00	50.0	86,130	126,667	16.32
2	Single Wheel 12.5	12,500	95.00	50.0	5,000	6,344	11.71
3	BeechJet-400A	16,300	95.00	105.0	950	951	12.00
4	Hawker-800	27,520	95.00	135.0	150	238	11.61
5	Citation-X	36,000	95.00	189.0	270	416	14.94
6	Challenger-CL-604	48,200	95.00	145.0	290	577	17.22
7	Gulfstream-G-IV	75,000	95.00	185.0	265	586	22.71
8	Gulfstream-G-V	91,000	95.00	188.0	265	632	25.03
9	Global Express 6000	99,500	95.00	188.0	185	461	25.45
10	Gulfstream G-650	99,600	95.00	188.0	730	1,821	28.99

Results Table 2. PCN Values

No.	Aircraft Name	Critical Aircraft Total Equiv. Covs.	Thickness for Total Equiv. Covs.	Maximum Allowable Gross Weight	ACN Thick at Max. Allowable Gross Weight	CDF	PCN on D(3)
1	Single Wheel 8	>5,000,000	24.46	7,572	16.15	0.0000	6.0
2	Single Wheel 12.5	>5,000,000	23.86	12,433	14.26	0.0000	4.7
3	BeechJet-400A	>5,000,000	24.63	15,220	16.54	0.0000	6.3
4	Hawker-800	>5,000,000	24.32	26,435	19.10	0.0000	8.4
5	Citation-X	>5,000,000	25.30	32,071	21.49	0.0004	10.6
6	Challenger-CL-604	471,526	26.29	40,311	23.44	0.0135	12.7
7	Gulfstream-G-IV	10,459	28.48	53,913	27.87	0.6201	17.9
8	Gulfstream-G-V	4,393	29.52	61,904	29.64	1.5919	20.2
9	Global Express 6000	2,868	30.05	65,493	30.56	1.7796	21.5
10	Gulfstream G-650	2,855	30.05	65,535	30.57	7.0583	21.5
					Total CDF =	11.0638	

Results Table 3. Flexible ACN at Indicated Gross Weight and Strength

No.	Aircraft Name	Gross Weight	% GW on Main Gear	Tire Pressure	ACN Thick	ACN on D(3)
1	Single Wheel 8	8,000	100.00	50.0	16.60	6.3
2	Single Wheel 12.5	12,500	95.00	50.0	14.30	4.7
3	BeechJet-400A	16,300	95.00	105.0	17.11	6.7
4	Hawker-800	27,520	95.00	135.0	19.53	8.8
5	Citation-X	36,000	95.00	189.0	22.86	12.0
6	Challenger-CL-604	48,200	95.00	145.0	25.90	15.5
7	Gulfstream-G-IV	75,000	95.00	185.0	33.22	25.4
8	Gulfstream-G-V	91,000	95.00	188.0	36.47	30.6
9	Global Express 6000	99,500	95.00	188.0	38.23	33.7
10	Gulfstream G-650	99,600	95.00	188.0	38.25	33.7

Results Table 4. Summary Output for Copy and Paste Into the Support Spread Sheet

Num,Plane,GWin,ACNin,ADout,6Dt,COV20yr,COVtoF,CDFt,GWcdf,PCNcdf,EVALt,SUBcode,KorCBR,PtoTC,FlexOrRig

TWY G_Record Dwgs (Half Mix)

```
1,Single Wheel 8,8000.000,6.3,43065,16.32,1.26667E+005,2.40911E+011,24.46,7571.825,6.0,23.8,D,4.00,0.50,F
2,Single Wheel 12.5,12500.000,4.7,2500,11.71,6.34418E+003,1.05947E+025,23.86,12432.806,4.7,23.8,D,4.00,0.50,F
3,BeechJet-400A,16300.000,6.7,475,12.00,9.51385E+002,1.66770E+010,24.63,15220.285,6.3,23.8,D,4.00,0.50,F
4,Hawker-800,27520.000,8.8,75,11.61,2.37911E+002,5.11420E+009,24.32,26434.873,8.4,23.8,D,4.00,0.50,F
5,Citation-X,36000.000,12.0,135,14.94,4.15536E+002,1.01561E+006,25.30,32071.267,10.6,23.8,D,4.00,0.50,F
6,Challenger-CL-604,48200.000,15.5,145,17.22,5.76929E+002,4.26188E+004,26.29,40311.430,12.7,23.8,D,4.00,0.50,F
7,Gulfstream-G-IV,75000.000,25.4,133,22.71,5.86191E+002,9.45378E+002,28.48,53913.015,17.9,23.8,D,4.00,0.50,F
8,Gulfstream-G-V,91000.000,30.6,133,25.03,6.32122E+002,3.97098E+002,29.52,61903.589,20.2,23.8,D,4.00,0.50,F
9,Global Express 6000,99500.000,33.7,93,25.45,4.61282E+002,2.59201E+002,30.05,65493.322,21.5,23.8,D,4.00,0.50,F
10,Gulfstream G-650,99600.000,33.7,365,28.99,1.82110E+003,2.58007E+002,30.05,65534.858,21.5,23.8,D,4.00,0.50,F
```

TWY H (D-2)_Dynatest

This file name = PCN Results Flexible 7-31-2017 12;56;12.txt
Library file name = X:\3168900\155706.01\TECH\dsgn\PCN Analysis\COMFAA\Fleet Mix Files\Overall Fleet Mix.Ext
Units = English

Evaluation pavement type is flexible and design procedure is CBR.
Alpha Values are those approved by the ICAO in 2007.

CBR = 16.60 (Subgrade Category is A(15))
Evaluation pavement thickness = 25.20 in
Pass to Traffic Cycle (PtoTC) Ratio = 1.00
Maximum number of wheels per gear = 2
Maximum number of gears per aircraft = 2

No aircraft have 4 or more wheels per gear. The FAA recommends a reference section assuming 3 inches of HMA and 6 inches of crushed aggregate for equivalent thickness calculations.

Results Table 1. Input Traffic Data

No.	Aircraft Name	Gross Weight	Percent Gross Wt	Tire Press	Annual Deps	20-yr Coverages	6D Thick
1	Single Wheel 8	8,000	100.00	50.0	86,130	253,335	4.97
2	Single Wheel 12.5	12,500	95.00	50.0	5,000	12,688	3.62
3	BeechJet-400A	16,300	95.00	105.0	950	1,903	5.24
4	Hawker-800	27,520	95.00	135.0	150	476	4.85
5	Citation-X	36,000	95.00	189.0	270	831	6.40
6	Challenger-CL-604	48,200	95.00	145.0	290	1,154	7.15
7	Gulfstream-G-IV	75,000	95.00	185.0	265	1,172	9.80
8	Gulfstream-G-V	91,000	95.00	188.0	265	1,264	10.71
9	Global Express 6000	99,500	95.00	188.0	185	923	10.97
10	Gulfstream G-650	99,600	95.00	188.0	730	3,642	12.44

Results Table 2. PCN Values

No.	Aircraft Name	Critical Aircraft Total Equiv. Covs.	Thickness for Total Equiv. Covs.	Maximum Allowable Gross Weight	ACN Thick at Max. Allowable Gross Weight	CDF	PCN on A(15)
1	Single Wheel 8	>5,000,000	8.27	74,224	14.20	0.0000	28.2
2	Single Wheel 12.5	>5,000,000	7.13	156,261	14.20	0.0000	28.2
3	BeechJet-400A	>5,000,000	11.95	72,532	13.24	0.0000	24.5
4	Hawker-800	>5,000,000	10.54	122,043	17.12	0.0000	41.1
5	Citation-X	>5,000,000	13.10	116,365	17.18	0.0000	41.4
6	Challenger-CL-604	1,154	7.15	381,497	31.24	0.0000	136.8
7	Gulfstream-G-IV	>5,000,000	19.30	120,943	16.93	0.0000	40.2
8	Gulfstream-G-V	>5,000,000	21.05	124,725	16.65	0.0000	38.8
9	Global Express 6000	>5,000,000	22.17	124,725	16.65	0.0000	38.8
10	Gulfstream G-650	>5,000,000	22.18	124,725	16.65	0.0000	38.8
					Total CDF =	0.0000	

When computing the numbers of coverages to failure, the coverages for none of the aircraft converged at a pavement thickness greater than 99 percent of the evaluation thickness. This means that the life of the pavement is unlimited and the pavement is very strong in relation to the aircraft loading. The relative aircraft load evaluations are also unreliable. Consider reviewing the procedures used to determine the evaluation thickness and the strength of the support. The thicknesses for unlimited operations of each of the aircraft are as follows.

Results Table 2a. Thicknesses for Unlimited Operations

Single Wheel 8	8.27
Single Wheel 12.5	7.13
BeechJet-400A	11.95
Hawker-800	10.54
Citation-X	13.10
Challenger-CL-604	14.17
Gulfstream-G-IV	19.30
Gulfstream-G-V	21.05
Global Express 6000	22.17

Gulfstream G-650 22.18

Results Table 3. Flexible ACN at Indicated Gross Weight and Strength

No.	Aircraft Name	Gross Weight	% GW on Main Gear	Tire Pressure	ACN Thick	ACN on A(15)
1	Single Wheel 8	8,000	100.00	50.0	4.66	3.0
2	Single Wheel 12.5	12,500	95.00	50.0	4.02	2.3
3	BeechJet-400A	16,300	95.00	105.0	6.28	5.5
4	Hawker-800	27,520	95.00	135.0	6.82	6.5
5	Citation-X	36,000	95.00	189.0	8.40	9.9
6	Challenger-CL-604	48,200	95.00	145.0	9.10	11.6
7	Gulfstream-G-IV	75,000	95.00	185.0	12.58	22.2
8	Gulfstream-G-V	91,000	95.00	188.0	13.58	25.8
9	Global Express 6000	99,500	95.00	188.0	14.41	29.1
10	Gulfstream G-650	99,600	95.00	188.0	14.42	29.2

Results Table 4. Summary Output for Copy and Paste Into the Support Spread Sheet

```
Num,Plane,GWin,ACNin,ADout,6Dt,COV20yr,COVtoF,CDFt,GWcdf,PCNcdf,EVALt,SUBcode,KorCBR,PtoTC,FlexOrRig
1,Single Wheel 8,8000.000,3.0,86130,4.97,2.53335E+005,1.01423E+304,8.27,74223.794,28.2,25.2,A,16.60,1.00,F
2,Single Wheel 12.5,12500.000,2.3,5000,3.62,1.26884E+004,1.01423E+304,7.13,156260.506,28.2,25.2,A,16.60,1.00,F
3,BeechJet-400A,16300.000,5.5,950,5.24,1.90277E+003,5.31256E+269,11.95,72532.295,24.5,25.2,A,16.60,1.00,F
4,Hawker-800,27520.000,6.5,150,4.85,4.75821E+002,1.01423E+304,10.54,122043.241,41.1,25.2,A,16.60,1.00,F
5,Citation-X,36000.000,9.9,270,6.40,8.31072E+002,4.72568E+195,13.10,116364.874,41.4,25.2,A,16.60,1.00,F
6,Challenger-CL-604,48200.000,11.6,290,7.15,1.15386E+003,6.83919E+127,7.15,381496.585,136.8,25.2,A,16.60,1.00,F
7,Gulfstream-G-IV,75000.000,22.2,265,9.80,1.17238E+003,1.01423E+304,19.30,120943.004,40.2,25.2,A,16.60,1.00,F
8,Gulfstream-G-V,91000.000,25.8,265,10.71,1.26424E+003,8.63096E+201,21.05,124724.933,38.8,25.2,A,16.60,1.00,F
9,Global Express 6000,99500.000,29.1,185,10.97,9.22564E+002,1.01423E+304,22.17,124724.614,38.8,25.2,A,16.60,1.00,F
10,Gulfstream G-650,99600.000,29.2,730,12.44,3.64220E+003,1.01423E+304,22.18,124724.614,38.8,25.2,A,16.60,1.00,F
```

PCN Analysis Report - Attachment 6

Recommended Form 5010

- (●) A Flexible Category (CBR 15)
- ( ) B Flexible Category (CBR 10)
- ( ) C Flexible Category (CBR 6)
- ( ) D Flexible Category (CBR 3)

- ( ) A Rigid Category (k 552 pci)
- ( ) B Rigid Category (k 295 pci)
- ( ) C Rigid Category (k 147 pci)
- ( ) D Rigid Category (k 74 pci)

TIRE PRESSURE

- ( ) W Unlimited
- (●) X 218 psi
- ( ) Y 145 psi
- ( ) Z 73 psi

METHOD USED

- ( ) Using Aircraft
- (●) Technical

Project info

Camarillo Airport - PCN Analysis

AIRCRAFT GEAR TYPE IN TRAFFIC MIX

- [x] S (single wheel gear)
- [x] D (dual wheel gear)
- [ ] 2D (dual tandem wheel gear)
- [ ] 3D (triple tandem wheel gear) e.g B-777
- [ ] DDT or W/B (tandem gear under wing AND tandem gear under body) e.g. B-747, A-340-600, A-380

Airport LOC-ID CMA

Pavement ID Taxiway H

Enter PCN 30

Form 5010 Data Element	Gross Weight and PCN
#35 S gear	83
#36 D gear	126
#37 DT gear	
#38 DDT gear	
#39 PCN	30/F/A/X/T

IF 3D or W/B Gear Checked, #38 = PCN
Please Add Data Element #38 Remark

3D	
2D/2D2	
2D/3D2W	
2D/3D2B	

} **Report Minimum Gross Weight**

Airport LOC-ID	Pavement ID	#35 S GW	#36 D GW	#37 DT GW	#38 DDT GW	#39 PCN
CMA	Runway 8-26	46	65			17/F/C/X/T
CMA	AC Connectors	39.5	52.5			15/F/D/X/T
CMA	PCC Taxiways	89	113			34/R/C/W/T
CMA	Taxiway G	55	71			22/F/D/X/T
CMA	Taxiway H	83	126			30/F/A/X/T