PRELIMINARY PAVEMENT DESIGN
RUNWAY 12-30 REHABILITATION PROJECT
GRANTS PASS AIRPORT
AIP # 3-41-0023-00X

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PRELIMINARY PAVEMENT DESIGN REPORT
JANUARY 2010

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RUNWAY 12-30 REHABILITATION
AIP # 3-41-0023-00X

JANUARY 2010

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Introduction

WHPacific is under contract with the Josephine County Airports (JCA), to rehabilitate Runway 12-30 at the Grants Pass Airport. The purpose of this report is to investigate the existing pavement structure and develop a pavement design that will evaluate the existing runway structure and rehabilitate the runway taking current and future airplane traffic into effect. Geotechnical testing was performed by Foundations Engineering, Inc as a subconsultant to WHPacific.

This report is being compiled to request concurrence of the pavement design from the Federal Aviation Administration (FAA) and JCA. Once this concurrence has occurred, the remaining portions of the contract will then begin.

Existing Conditions

Existing Pavement

The 4001 foot runway was constructed in 1959. According to the April 2009 PCI Report, the runway consists of 5 inches of crushed aggregate base underneath 2 inches of asphalt. The runway also received an application of +/-1/2" Bituminous Surface Treatment (BST) at time of construction. Since that time, the runway has received a rejuvenator, has been cracked sealed numerous times and was fog sealed.

According to the Airport Master Record, the load bearing capacity of the runway is listed as 19,000 pounds in a single wheel gear configuration.

Geotechnical Testing

Geotechnical testing was performed on the runway on the nights of November 9, 2009, by Foundation Engineering, Inc.(FEI). Eight exploratory test pits where dug along the edge of the runway to determine soil compositions, ground water levels, and to acquire samples for laboratory tests, most notably, the California Bearing Ratio (CBR), which is a strength determination of the subgrade. Ten pavement cores were also cut from the runway in regular intervals to determine the overall thickness of the pavement section.

CBR values ranging from 5.5 to 8.5 were recorded for the subgrade soils that were laboratory compacted to 95% relative compaction. However, the results of the field bulk density tests suggest a typical relative compaction of 79% to 95%, with an average of 85% for the subgrade beneath the runway. Test results for CBR values drop dramatically when subgrade compaction is lower than 95%. FEI recommends using a nominal subgrade CBR value of 2 for evaluating the existing runway pavement section for evaluating or designing overlays. FEI also recommends using a CBR value of 5 for

designing new pavements constructed on subgrade compacted to a minimum of 95% relative compaction.

The runway pavement encountered in the core holes typically consisted of 4 to 5 inches of asphaltic concrete over 2.5 to 8 inches of crushed aggregate, which is substantially more asphalt than the PCI reports. The subgrade encountered typically consists of stiff, medium plasticity, silty clay.

The geotechnical report is included in Appendix 1.

Pavement Design Analysis

Aircraft Mix

WHPacific is currently developing the Airport Master Plan Update for Grants Pass Airport. The aircraft fleet mix and traffic was developed using the Draft Airport Master Plan Update, Chapter 2, "Aeronautical Activity Forecast."

The table below is compiled from Table 3O from Chapter 2 of the Airport Master Plan Update, broken down into engine types.

From Table 3O of the AMPU

Aircraft Mix	2009 Annual Operations	2009 Annual Departures	Growth Percentage
Single Engine Piston	28,590	14,295	1.1%
Multi-Engine Piston	375	188	1.1%
Turboprop	450	225	1.1%
Turbojet	210	105	1.1%

In order to complete the pavement design using the above information, a conversion from engine type to aircraft type must occur. The assumptions made were that the Single Engine Piston Aircraft is most represented by a Cessna 172 type aircraft, single wheeled gear (SWG), 3,000 pounds and under. The remaining operations would be considered to be the design aircraft, which is the King Air 200, a dual wheeled gear (DWG) aircraft with a gross weight of 12,590 lbs. In addition, the runway has a pavement load rating of 19,000 lbs. SWG. To maintain that load rating, a nominal 100 departures of that type of aircraft was used in the design, or roughly 2 departures a week, per year. Below is a table which summarizes the aircraft mix used in the analysis.

Aircraft Mix	Weight, lbs.	2009 Annual Operations	2009 Annual Departures	Growth Percentage
Single Wheeled Gear	3,000	28,590	14,295	1.1%
King Air 200	12,590	1,035	518	1.1%
Single Wheeled Gear	19,000	200	100	1.1%

In addition, the airport wanted WHPacific to perform an analyses of the pavement required should the planned development, Paradise Ranch, was constructed. This was done by analyzing the next logical step of pavement load rating of 30,000 lbs. SWG, 100 departures a year. The next step was to add 100 departures a year of 45,000 lbs DWG Aircraft and then the final step was 100 departures of 60,000 lbs of DWG Aircraft, giving a final Aircraft Mix in the table below.

Aircraft Mix	Weight, lbs.	2009 Annual Operations	2009 Annual Departures	Growth Percentage
Single Wheeled Gear	3,000	28,590	14,295	1.1%
King Air 200	12,590	1,035	518	1.1%
Single Wheeled Gear	19,000	200	100	1.1%
Single Wheeled Gear	30,000	200	100	1.1%
Dual Wheeled Gear	45,000	200	100	1.1%
Dual Wheeled Gear	60,000	200	100	1.1%

Lastly, a fifth mix design was considered. This mix would not include any 19,000 lbs SWG aircraft, which essentially reduces the published pavement strength of the runway to 12,500 Single Wheeled Gear. This option will be evaluated due to limited FAA funding for this project. The runway could be constructed in a stage construction over multiple years, as funding is available.

Aircraft Mix	Weight, lbs.	2009 Annual Operations	2009 Annual Departures	Growth Percentage
Single Wheeled Gear	3,000	28,590	14,295	1.1%
King Air 200	12,590	1,035	518	1.1%

Analysis Procedure

The analysis was completed using the FAARFIELD layered elastic model and AC 150/5320-6E "Airport Pavement Design and Evaluation." The first design was to design an overlay using a subgrade CBR of 2. The second was a full depth reconstruction using a subgrade CBR of 5. However, both construction approaches went through the design for the 5 Aircraft Fleet Mixes presented above.

Overlay Design

Since the subgrade is unable to be compacted in the construction of an overlay, the overlay design used a CBR of 2 and the overlay was designed for a 20 year life. The existing pavement structure was averaged to be 4 inches of asphalt over 4 inches of crushed aggregate base.

The results of the overlay required to achieve the various pavement load ratings over a 20 year design life are in the table below.

FAARFIELD RESULTS

Load Rating	Overlay Thickness
19,000 SWG	2.8 in.
30,000 SWG	5.03 in.
45,000 DWG	7.04 in.
60,000 DWG	9.19 in.
12,500 SWG	2 in.

However, for constructability concerns, the asphalt thickness should be adjusted to the nearest 0.25in.

OVERLAY DESIGN RESULTS

Load Rating	Overlay Thickness
19,000 SWG	3.0 in.
30,000 SWG	5.0 in.
45,000 DWG	7.0 in.
60,000 DWG	9.25 in.
12,500 SWG	2.0 in.

The FARFIELD detailed design results are included in Appendix 2.

Full Depth Reconstruction Design

The second design assumed the identical traffic loading as the overlay design, but assumed the entire pavement section would be removed; the subgrade would be excavated and graded to the depth necessary and the subgrade compacted to the optimum compaction to achieve a subgrade CBR of 5. However, the contractor may find the subgrade difficult to compact given the clayey nature of the soil. Compaction may have to be achieved through soil amendments like the addition of cement or lime in order to stabilize the subgrade to resist construction operations.

The FAARFIELD design program sets the thickness for the asphalt surface was 2.5 inches for a SWG aircraft and with an asphalt surface thickness of 4 inches for the DWG aircraft. The program then calculated the necessary crushed aggregate base thickness to achieve a 20 year design life for the traffic anticipated. The results of the full pavement depth reconstruction required are shown in the table below.

FAARFIELD RESULTS

Load Rating	Asphalt Thickness	Aggregate Thickness
19,000 SWG	2.5 in.	8.53 in.
30,000 SWG	2.5 in.	11.19 in.
45,000 DWG	4.0 in.	11.25 in.
60,000 DWG	4.0 in.	14.20 in.
12,500 SWG	2.5 in.	5.38 in.

The FARFIELD detailed design results are included in Appendix 2.

Summary

- Design aircraft is 19,000 pound single wheel gear configuration
- Subgrade design CBR values for overlay construction is 2
- Subgrade design CBR values for full depth reconstruction is 5
- Proposed overlay section to maintain current pavement strength is a 3.0" overlay
- Proposed full depth section is 2.5"asphalt over 8.5" crushed aggregate base.

Recommendations

The subgrade at the airport is anticipated to be difficult to work with given the type of soil and the weather conditions of the area. It is most likely that expensive subgrade enhancement will be necessary to construct the pavement. Additionally, excavation of the existing pavement must occur and whether or not that material can be reused, it is still an additional expense. Finally as being the only runway at the Grants Pass Airport, users and business owners would be greatly impacted as an extended closure of the runway must occur for this construction to occur.

WHPacific is recommending that the overlay option be utilized for this project. The overlay option will be less expensive to construct and while the runway will still have to be closed, the closure will be greatly reduced or be constructed in phases to minimize the closures. Also, an increase in pavement strength can occur incrementally as traffic increases and as funds allow. A drawback to gaining strength through overlays is that as the lifts of asphalt get higher, additional shoulder work must be completed and runway edge lights will have to be raised to meet minimum FAA shoulder grade standards.

WHPacific recommends that the project be split into two different phases with the electrical work as an additive alternate. Current FAA funding limitations may necessitate constructing the 2.0" overlay to facilitate the design aircraft, then have a second phase to restore the published strength rating of the runway. In addition, the electrical work may have to be completed at a later date due to funding. However, given the age of the system and the location of the airport regulator (under a counter in the FBO), WHPacific recommends that the electrical work must be completed soon.

Costs

The total construction cost for the 19,000 lbs SWG rehabilitation 3.0" overlay as described in the Summary of Work with WHP to include electrical items is estimated to be $1,908,467. The project can be split into a paving base bid of $1,422,405 and an electrical additive alternate of $486,062.

The FAA has expressed to the Airport that there will approximately $1.1 million in FAA funding available for the construction portion of this project or $1.474 million total project budget, with Josephine County matching funds, which would not allow even the base bid to be awarded as has been estimated. Actual bids may be less than the estimate.

An option would be to construct the runway overlay in 2 different phases. First year, construct a 2.0" overlay as the base bid, with an electrical additive alternate, which will provide a pavement that will support the design aircraft of the airport, the King Air 200, 12,500 lbs. DWG. The estimated cost of the 2.0" overlay base bid is $1,162,804 and the estimated cost of the electrical additive alternate is $486,063. If both bid schedules were awarded, the estimated total bid would be $1,648,867.

The engineer's estimate for the 2 overlay options are in Appendix 3.

SUMMARY OF COSTS vs. FUNDING

OPTION #1 – 3.0" Overlay with electrical additive alternate

Costs

Admin	$ 10,000.00
Engineering	$ 372,254.83
Estimated Base Bid	$ 1,422,404.68
Estimated Electrical Bid Alternate	$ 486,062.50
Total Costs	**$ 2,290,722.01**

Funding

Available FAA Funds	
FY 2009 & 2010 (95% of project costs)	$ 1,400,000
Josephine County Matching Funds (5%)	$ 73,684
Total Funds	**$ 1,473,684**
FUNDING DEFICIT	**$ 817,038.01**
DEFICIT W/OUT ALTERNATE	**$ 330,975.51**

OPTION #2 – 2.0" Overlay with electrical additive alternate

Costs

Admin	$ 10,000.00
Engineering	$ 372,254.83
Estimated Base Bid	$ 1,162,804.44
Estimated Electrical Bid Alternate	$ 486,062.50
Total Costs	**$ 2,031,121.77**

Funding

Available FAA Funds	
FY 2009 & 2010 (95% of project costs)	$ 1,400,000
Josephine County Matching Funds (5%)	$ 73,684
Total Funds	**$ 1,473,684**
FUNDING DEFICIT	**$ 557,437.77**
DEFICIT W/OUT ALTERNATE	**$ 71,375.27**

APPENDIX 1

Geotechnical Investigation

Grants Pass Airport
Runway 12-30 Rehabilitation

Josephine County, Oregon

Prepared for:

WHPacific
Portland, Oregon

December 18, 2009

Professional Geotechnical Services

Foundation Engineering, Inc.

Foundation Engineering, Inc.
Professional Geotechnical Services

Peter Murphy, P.E.
WHPacific
9755 SW Barnes Road, Suite 300
Portland, Oregon 97225

December 18, 2009

Grants Pass Airport
Runway 12-30 Rehabilitation
Geotechnical Investigation
Josephine County, Oregon

Project 2091086

Dear Mr. Murphy:

We have completed the requested geotechnical investigation for the above-referenced project. Our report includes a description of our work, a discussion of the site conditions, a summary of laboratory testing, and recommendations for subgrade preparation.

It has been a pleasure assisting you with this phase of your project. Please do not hesitate to contact us if you have any questions or if you require further assistance.

Sincerely,

FOUNDATION ENGINEERING, INC.

Jonathan C. Huffman, P.E.
Project Engineer

David L. Running, P.E., G.E.
Senior Engineer

JCH/DLR/cs
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GEOTECHNICAL INVESTIGATION
GRANTS PASS AIRPORT
RUNWAY 12-30 REHABILITATION
JOSEPHINE COUNTY, OREGON

BACKGROUND

Improvements are planned at the Grants Pass Airport, located ±5 miles northwest of Grants Pass in Josephine County (Figure 1A, Appendix A). The proposed improvements will rehabilitate the existing ±4,000-foot long by ±75-foot wide Runway 12-30. Options include either overlaying or reconstructing the runway. The layout of the site is shown on Figure 2A (Appendix A).

WHPacific is the prime engineering consultant for the project and will provide pavement design services. Foundation Engineering, Inc. (FEI) was retained by WHPacific to perform the required subsurface investigation, conduct laboratory testing, and provide recommendations for subgrade preparation if new pavements are constructed. The following sections summarize the work conducted by FEI.

FIELD EXPLORATION

Pavement Coring

Ten pavement cores (C-1 through C-10) were completed on November 11, 2009, using a 5-inch diameter core drill and trailer-mounted drill rig. The locations are shown on Figure 2A. At each location, the asphaltic concrete (AC) cores were removed and the base rock was excavated using a 4-inch diameter, solid-stem auger drill. Shelby tubes were pushed into the subgrade at most core locations to obtain relatively undisturbed samples. Drilling extended ±3 to ±4 feet below the AC surface.

The core holes were logged to delineate the thickness of the AC and base rock and to identify the subgrade conditions. Following the completion of the explorations, the holes were backfilled with the excavated base materials (placed and compacted in ±1 to 2-inch lifts) and capped with AC cold patch.

Test Pits

Eight exploratory test pits (TP-1 through TP-8) were dug on November 11, 2009, using a Hitachi EX30 mini-excavator. The test pits were dug adjacent to the runway to supplement the core hole data. The locations are shown on Figure 2A. The test pit explorations extended ±3.5 to 6 feet below the ground surface. The soil profiles were logged and disturbed soil samples were retained for possible laboratory testing.

The profiles exposed in the explorations are summarized on the core hole and test pit logs (Appendix B). The logs were prepared based on a review of the field logs, results of the laboratory testing and an examination of the soil samples in our office.

DISCUSSION OF SITE CONDITIONS

The following sections provide a summary of the surface and subsurface conditions encountered during the exploration. More specific details of the subsurface conditions are provided on the summary logs of the pavement cores and test pits (Appendix B).

Surface Conditions

The airport is surrounded by mountainous terrain. Within the airport property, the ground surface is relatively flat with a gentle slope down to the north. Vegetation within the vicinity of the runway is primarily limited to short grass. Taller grass, and small bushes and scattered trees grow further from the paved areas.

Subsurface Conditions

Core Holes. Coring along Runway 12-30 encountered ±4 to 5 inches of AC. The AC is typically underlain by medium dense, ±1½ to 2-inch minus crushed gravel and/or crushed rock (base rock). The thickness of the base rock varies from ±2.5 to 8 inches. The total thickness of the pavement section ranges from ±7 to 12 inches. Pavement section thicknesses are summarized on Table 1B (Appendix B).

The pavement subgrade typically consists of stiff, medium plasticity, silty clay (residual soil). Trace to some sand to gravel-sized rock fragments were also noted in the residual soil in C-5, C-6, C-8 and C-9. Higher silt content and decreased plasticity was noted in the explorations completed towards the south end of the runway.

Test Pits. Similar subsurface conditions were encountered in the test pits. Digging extended through ±4 to 12 inches of crushed gravel fill. The fill is typically underlain by stiff to very stiff, medium plasticity, silty clay or clayey silt with trace to some sand and gravel-sized rock fragments (residual soil). The residual soil extended to the bottom of the explorations at TP-1, TP-3, TP-4 and TP-5.

Extremely soft to soft (R0 to R2), moderately weathered to decomposed diorite (bedrock) with trace to some clay was encountered below the residual soil in TP-2, TP-6, TP-7 and TP-8 at depths ranging from ±2 to 4 feet. The rock is typically highly fractured to the maximum depth of the explorations. The small excavator used to complete the excavations was able to dig ±1 to 2 feet into the rock surface with moderate difficulty.

Ground Water

The explorations were completed after a series of relatively heavy rains and perched water was typically encountered at shallow depths beneath the gravel fill in the test pits and on the subgrade surface beneath the pavement section. Ground water was not encountered at greater depths in any of the explorations.

LABORATORY TESTING

The laboratory work included natural water content determinations, Atterberg limits testing, and mechanical sieve and hydrometer analyses to classify the soils and estimate their overall engineering properties. The results of the index testing are summarized on Table 1C and Figures 1C through 3C (Appendix C).

Atterberg limits tests were completed on five subgrade samples. The results indicate liquid limits (LL) ranging from 25 to 50 and plasticity indices (PI) ranging from 6 to 25. The resulting FAA/USCS classifications range between CL-ML and CL-CH, with most test samples falling in the CL range. Based on the results from the laboratory testing and site observations, we anticipate that most of the subgrade can be classified as medium plasticity (i.e., fine-grained soils with a PI between 15 and 30).

Sieve and hydrometer gradation curves were completed for samples S-3-1, S-6-1 and S-7-1. The gradation curves indicate a significant amount of sand and gravel-sized rock fragments in all three samples. However, the soil characteristics will be controlled by the fine-grained portion of the samples.

Moisture-density (ASTM D 698) tests were run on bulk samples S-3-1, S-6-1 and S-7-1, and California Bearing Ratio (CBR) tests were run on S-6-1 and S-7-1. The tests were completed to establish the compaction characteristics of the subgrade and develop parameters for pavement design. The test results are summarized on Figures 4C through 8C (Appendix C). Results for sample S-3-1 indicate a maximum dry density of 102.5 pcf at an optimum moisture content of 23.1%. The test results for sample S-6-1 indicate a maximum dry density of 110.7 pcf at an optimum moisture content of 16.2%. A CBR value of 5.2 was recorded for S-6-1 compacted to 95% relative compaction. The test results for sample S-7-1 indicate a maximum dry density of 113.9 pcf at an optimum moisture content of 16.1%. A CBR value of 8.5 was recorded for S-7-1 compacted to 95% relative compaction.

Bulk density tests were run on relatively undisturbed Shelby tube samples from eight of the core holes. The results are summarized in Table 2C (Appendix C). The available moisture-density curves (discussed above) were used to estimate the relative compaction of the samples. A maximum dry density of ±102.5 pcf (results from S-3-1) was used to estimate the relative compaction of samples obtained from core holes C-1 through C-4. A maximum dry density of ±112.3 pcf (average results from S-6-1 and S-7-1) was used to estimate the relative compaction of samples obtained from C-5 through C-7 and C-9. The results suggest the relative compaction of the subgrade beneath the runway ranges from ±79% to 95%.

DISCUSSION OF GEOTECHNICAL CONSIDERATIONS AND DESIGN RECOMMENDATIONS

Both pavement reconstruction and pavement overlay are being considered to rehabilitate Runway 12-30. The following discusses different design considerations and concerns for both options.

Discussion of Subgrade Conditions

The test pit and core hole explorations typically encountered subgrade consisting of medium plasticity, silty clay. A FAA/USCS classification of CL is appropriate for the majority of the subgrade. However, there is minor variability. A FAA/USCS classification of CL-ML is likely appropriate for the subgrade near the south end of the runway.

The 1995 FAA Airport Pavement Design and Evaluation Advisory Circular (AC 150/5320 6D) indicates that soil classified as CL or CL-ML is fair to good as a foundation material when not subject to frost action. The subgrade is expected to be highly moisture-sensitive. Such soils typically require careful moisture control and moisture contents at or slightly below optimum during compaction to prevent pumping.

Subgrade Preparation and Parameters for New Pavement Design

CBR values of 5.2 and 8.5 were recorded for subgrade compacted to 95% relative compaction. The tested samples are relatively similar residual soil. However, the lower CBR value (5.2) was recorded on a sample with trace sand-sized rock fragments, while the higher CBR value (8.5) was recorded on a sample with trace sand to gravel-sized rock fragments. A CBR value of 8.5 is relatively high for the soil types encountered at the airport and test results may have been affected by the gravel content of the sample. Therefore, we recommend using a nominal subgrade CBR value of 5 to design new runway pavements.

The subgrade for the reconstructed pavement section should be compacted to a minimum of 95% relative compaction (based on the maximum dry density of ASTM D 698) prior to placing subbase and base rock. Due to the sensitive nature of the soil, we recommended compacting subgrade at or slightly below optimum moisture to reduce the risks of pumping and decreased subgrade strength. Subgrade preparation should also include covering the compacted soil as soon as practical to limit moisture fluctuation (i.e., wetting or drying of the prepared subgrade).

Parameters for Pavement Overlay

Pavement overlay is another rehabilitation option under consideration. Results of the bulk density tests suggest a relative compaction of 79% to 95% for the subgrade beneath the runway, with an average value of 85% (based on the maximum dry density of ASTM D 698). Test results indicate the CBR value drops significantly for samples compacted to less than 95% relative compaction. Based on the test results, we recommend using a reduced CBR value of 2 for designing the pavement overlays.

Frost Considerations

Subgrade across the site typically corresponds to a FAA/USCS soil classification of CL or CL-ML. The soil typically has a PI greater than 12, indicating a FAA frost group classification of FG-3. However, the subgrade towards the south end of the runway has a higher silt content and PI less than 12, indicating a FAA frost group classification of FG-4.

Complete mitigation of the risk of detrimental frost heave will require overexcavation and replacement of the silty soils below the depth of frost penetration. Limited subgrade frost protection or a reduced subgrade strength are other potential mitigation options.

Construction Timing

Construction timing will be an issue if full-depth reconstruction is selected. Laboratory tests suggest that the natural water content of the subgrade soils beneath and adjacent to the runway pavements varied from ±2% below to ±21% above the optimum moisture content at the time of our exploration. Based on the recent test results and our experience with similar soils, we expect that the subgrade will be sensitive to disturbance when wet. Therefore, we recommend that the earthwork be conducted during the dry summer months (typically July through September), when it should be practical to adjust the moisture content of the soil to near optimum and compact the subgrade. The contractor may still experience pumping problems and have difficulty achieving adequate compaction in the summer if the soils have not adequately dried.

During wet weather, a minimum of ±18 to 24 inches of granular fill and a separation geotextile is typically required to protect fine-grained subgrade from construction traffic. The actual recommended fill thickness would depend on the stiffness and/or density of the subgrade.

Contractors bidding on the project should clearly understand that if the soils are wet there is potential for pumping and rutting of the subgrade under construction equipment. Therefore, contractors should incorporate these geotechnical concerns into their approach to the earthwork and in preparation of their bids.

Fill Materials and Compaction

If a new pavement section is constructed, the base rock should consist of 1 or ¾-inch minus, clean (i.e., less than 5% passing the No. 200 sieve), well-graded, crushed gravel or rock conforming to FAA P-209 requirements. Subbase material should consist of free-draining sand, gravel, rock, asphalt grindings, or mixtures of the above that are free of plastic clay and organic matter which conforms to FAA P-154 requirements.

All fill should be placed in level lifts not exceeding 12 inches and compacted to a minimum of 95% relative compaction. The maximum dry density of ASTM D 698 should be used as the standard for estimating relative compaction. The moisture content of the fill should be adjusted to within ±2% of its optimum value prior to compaction. Efficient compaction of fine-grained soils (where appropriate) will typically require the use of a padfoot or kneading roller to achieve the required compaction. Granular fill (sand, rock or gravel) will compact most efficiently with a smooth drum, vibratory roller. Field density tests should be run frequently to confirm adequate compaction of the base rock, subbase and subgrade. Adequate compaction of fill materials, which are too coarse for density testing, should be evaluated by observation of the compaction method and proof-rolling with a loaded dump truck or other approved heavy construction vehicle.

Base rock beneath the existing runway consists of crushed gravel and crushed rock. We believe the material could be re-used as subbase if new pavements are constructed. AC grindings may also be used provided the grindings meet P-154 gradation requirements.

Site Drainage

We observed a perched water condition at the subgrade surface during rainy weather, indicating the subgrade has relatively poor drainage (and/or low permeability). Potential drainage improvements may include raising and crowning the new pavements to promote surface runoff to both sides of the runway. Additional options include installing drains along the edges of the pavements to collect surface runoff and perched ground water.

DESIGN REVIEW/CONSTRUCTION OBSERVATION/TESTING

We should be provided the opportunity to review all drawings and specifications that pertain to site preparation and fill placement. Site preparation for new pavements (if required) will require field confirmation of the subgrade conditions. Mitigation of pumping subgrade and fill will also require engineering review and judgment. That judgment should be provided by one of our representatives. We recommend that we be retained to provide the necessary construction observations.

VARIATION OF SUBSURFACE CONDITIONS, USE OF THIS REPORT AND WARRANTY

The analysis, conclusions and recommendations contained herein are based on the assumption that the soil profiles encountered in the test pits and core holes are representative of the overall site conditions. The above recommendations assume we will have the opportunity to review final drawings and be present during construction to confirm the assumed subgrade conditions. No changes in the enclosed recommendations should be made without our approval. We will assume no responsibility or liability for any engineering judgment, inspection or testing performed by others.

This report was prepared for the exclusive use of WHPacific and their design consultants for the Grants Pass Airport Runway 12-30 Rehabilitation project in Josephine County, Oregon. Information contained herein should not be used for other sites or for unanticipated construction without our written consent. This report is intended for planning and design purposes. Contractors using this information to estimate construction quantities or costs do so at their own risk. Our services do not include any survey or assessment of potential surface contamination or contamination of the soil or ground water by hazardous or toxic materials. We assume that those services, if needed, have been completed by others.

Our work was done in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

REFERENCES

U.S. Department of Transportation Federal Aviation Administration, Airport Pavement Design and Evaluation Advisory Circular (Draft), AC No. 150/5320-6E.

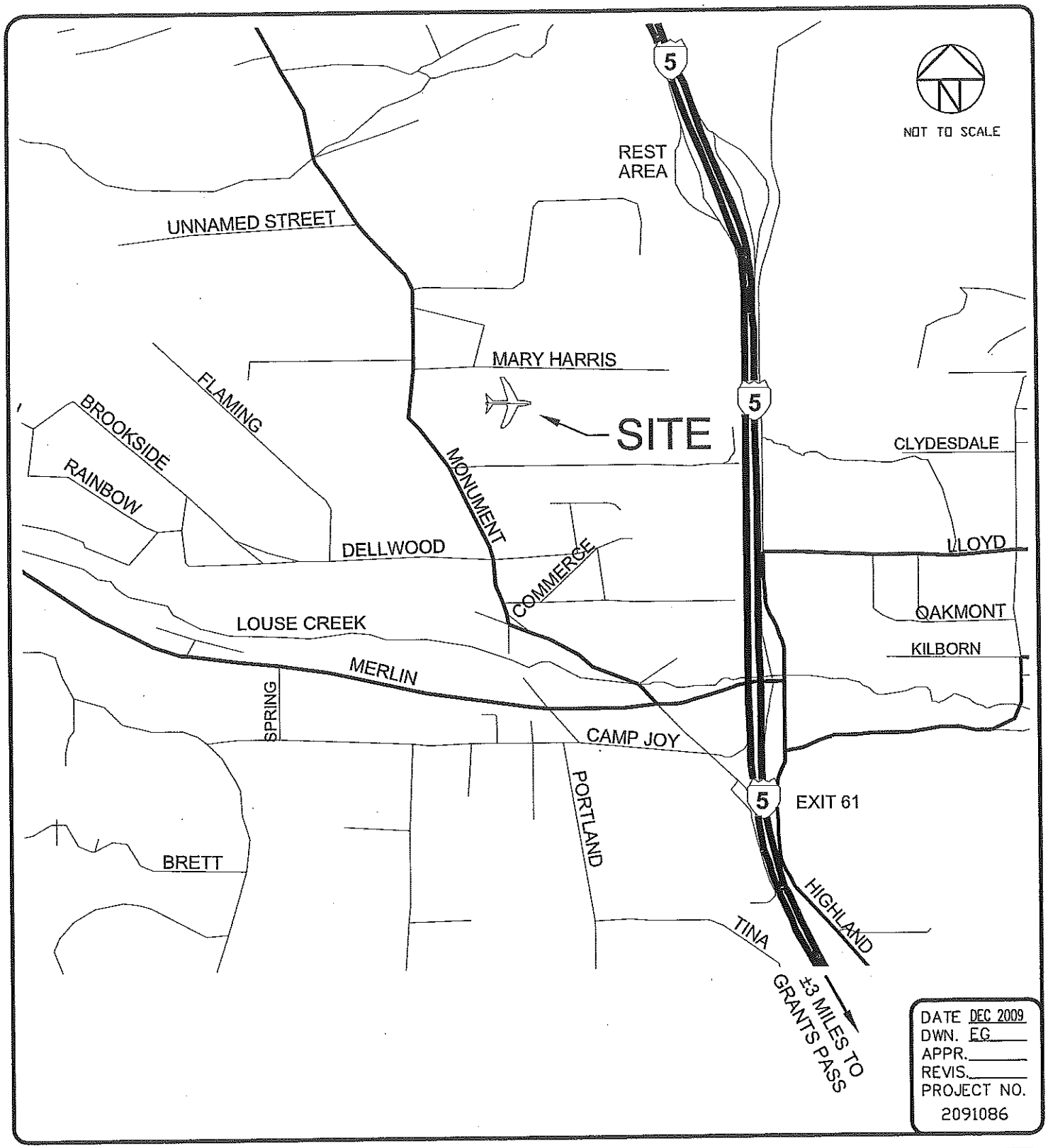
U.S. Department of Transportation Federal Aviation Administration, 2005, Standards for Specifying Construction of Airports Advisory Circular, AC No. 150/5370-10B.

Appendix A

Figures

Professional
Geotechnical
Services

Foundation Engineering, Inc.



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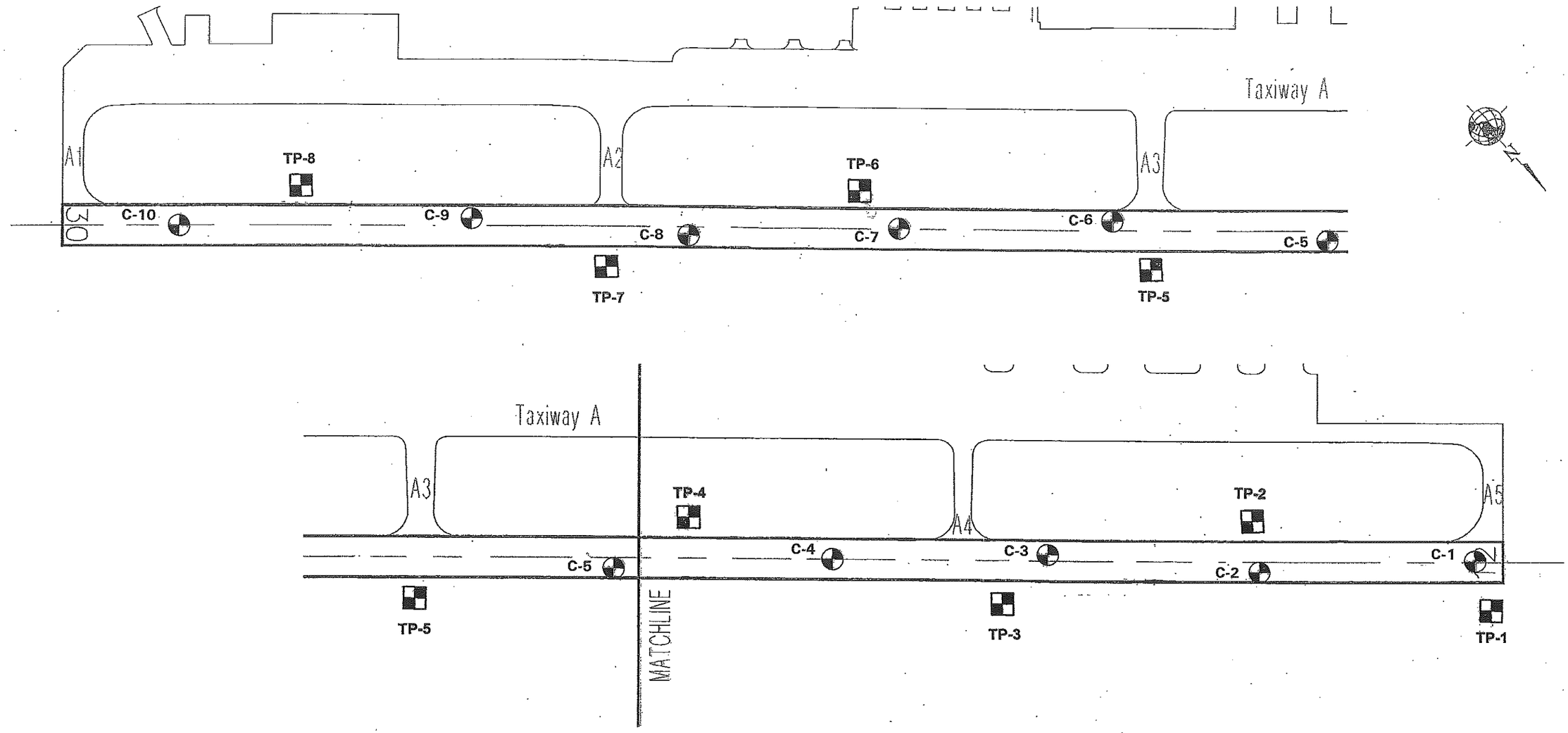
VICINITY MAP
GRANTS PASS AIRPORT
RUNWAY 12-30 REHABILITATION
GRANTS PASS, OREGON

FIGURE NO.
1A



SCALE: 1" = 200'

0 50' 100' 200'

NOTES:
1. EXPLORATION LOCATIONS WERE ESTABLISHED USING A MEASURING WHEEL AND ARE APPROXIMATE.
2. SEE REPORT FOR A DISCUSSION OF SUBSURFACE CONDITIONS.
3. BASE MAP WAS PROVIDED BY WHPACIFIC.

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DATE NOV 2009
DWN. EG
APPR.
REVIS.
PROJECT NO. 2091086

EXPLORATION LOCATIONS
GRANTS PASS AIRPORT
RUNWAY 12-30 REHABILITATION
GRANTS PASS, OREGON

FIGURE NO.
2A

Appendix B

Test Pit and Core Hole Logs

Professional
Geotechnical
Services

Foundation Engineering, Inc.

DISTINCTION BETWEEN FIELD LOGS AND FINAL LOGS

A field log is prepared for each boring or test pit by our field representative. The log contains information concerning sampling depths and the presence of various materials such as gravel, cobbles, and fill, and observations of ground water. It also contains our interpretation of the soil conditions between samples. The final logs presented in this report represent our interpretation of the contents of the field logs and the results of the laboratory examinations and tests. Our recommendations are based on the contents of the final logs and the information contained therein and not on the field logs.

VARIATION IN SOILS BETWEEN TEST PITS AND BORINGS

The final log and related information depict subsurface conditions only at the specific location and on the date indicated. Those using the information contained herein should be aware that soil conditions at other locations or on other dates may differ. Actual foundation or subgrade conditions should be confirmed by us during construction.

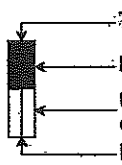
TRANSITION BETWEEN SOIL OR ROCK TYPES

The lines designating the interface between soil, fill or rock on the final logs and on subsurface profiles presented in the report are determined by interpolation and are therefore approximate. The transition between the materials may be abrupt or gradual. Only at boring or test pit locations should profiles be considered as reasonably accurate and then only to the degree implied by the notes thereon.

SAMPLE OR TEST SYMBOLS

SH-3-4

- Sample Number
- Boring or Test Pit Number
- Sample Type



- Top of Sample Attempt
- Recovered Portion
- Unrecovered Portion (large circle indicates no recovery)
- Bottom of Sample Attempt

S – Grab Samples
SS – Standard Penetration Test Sample (split–spoon)
SH – Thin–walled Shelby Tube Sample
C – Core Sample
CS – Continuous Sample

▲ Standard Penetration Test Resistance equals the number of blows a 140 lb. weight falling 30 in. is required to drive a standard split–spoon sampler 1 ft. Practical refusal is equal to 50 or more blows per 6 in. of sampler penetration.

● Water Content (%).

UNIFIED SOIL CLASSIFICATION SYMBOLS

G – Gravel	W – Well Graded
S – Sand	P – Poorly Graded
M – Silt	L – Low Plasticity
C – Clay	H – High Plasticity
Pt – Peat	O – Organic

FIELD SHEAR STRENGTH TEST

Shear strength measurements on test pit side walls, blocks of soil or Shelby tube samples are typically made with Torvane or pocket penetrometer devices.

TYPICAL SOIL/ROCK SYMBOLS

Sand	Silt
Clay	Gravel
Basalt	Siltstone

WATER TABLE

▼ Water Table Location

(1/31/00) Date of Measurement

Piezometer Tip Location (if used)

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SYMBOL KEY

BORING AND TEST PIT LOGS

Explanation of Common Terms Used in Soil Descriptions

Field Identification	Cohesive Soils			Granular Soils	
	SPT	S_u* (tsf)	Term	SPT	Term
Easily penetrated several inches by fist.	0 – 1	< 0.125	Very Soft	0 – 4	Very Loose
Easily penetrated several inches by thumb.	2 – 4	0.125–0.25	Soft	5 – 10	Loose
Can be penetrated several inches by thumb with moderate effort.	5 – 8	0.25 – 0.50	Medium Stiff (Firm)	11 – 30	Medium Dense
Readily indented by thumb but penetrated only with great effort.	9 – 15	0.50 – 1.0	Stiff	31 – 50	Dense
Readily indented by thumbnail.	16 – 30	1.0 – 2.0	Very Stiff	> 50	Very Dense
Indented with difficulty by thumbnail.	31 – 60	> 2.0	Hard		

* Undrained shear strength

Term	Soil Moisture Field Description
Dry	Absence of moisture. Dusty. Dry to the touch.
Damp	Soil has moisture. Cohesive soils are below plastic limit and usually moldable.
Moist	Grains appear darkened, but no visible water. Silt/clay will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grain surfaces. Sand and cohesionless silt exhibit dilatancy. Cohesive silt/clay can be readily remolded. Soil leaves wetness on the hand when squeezed. "Wet" indicates that the soil is wetter than the optimum moisture content and above the plastic limit.

Term	PI	Plasticity Field Test
Nonplastic	0 – 3	Cannot be rolled into a thread.
Low Plasticity	3 – 15	Can be rolled into a thread with some difficulty.
Medium Plasticity	15 – 30	Easily rolled into thread.
High Plasticity	> 30	Easily rolled and rerolled into thread.

Term	Soil Structure Criteria
Stratified	Alternating layers at least 1 inch thick – describe variation.
Laminated	Alternating layers at less than 1 inch thick – describe variation.
Fissured	Contains shears and partings along planes of weakness.
Slickensides	Partings appear glossy or striated.
Blocky	Breaks into lumps – crumbly.
Lensed	Contains pockets of different soils – describe variation.

Term	Soil Cementation Criteria
Weak	Breaks under light finger pressure.
Moderate	Breaks under hard finger pressure.
Strong	Will not break with finger pressure.

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COMMON TERMS
SOIL DESCRIPTIONS

Explanation of Common Terms Used in Rock Descriptions

Field Identification		UCS (psi)	UCS (MPa)	Strength (Hardness)
Indented by thumbnail.	R0	< 100	0.25–1.0	Extremely Weak (Extremely Soft)
Crumbles under firm blows with geological hammer, can be peeled by a pocket knife.	R1	100–1000	1.0–5.0	Very Weak (Very Soft)
Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with geological hammer.	R2	1000–4000	5.0–25	Weak (Soft)
Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single blow of geological hammer.	R3	4000–8000	25–50	Medium Strong (Medium Hard)
Specimen requires more than one blow of geological hammer to fracture it.	R4	8000–16000	50–100	Strong (Hard)
Specimen requires many blows of geological hammer to fracture it.	R5	16000–36000	100–250	Very Strong (Very Hard)
Specimen can only be chipped with geological hammer.	R6	> 36000	> 250	Extremely Strong (Extremely Hard)

Term	Weathering Field Identification
Fresh	Crystals are bright. Discontinuities may show some minor surface staining. No discoloration in rock fabric.
Slightly Weathered	Rock mass is generally fresh. Discontinuities are stained and may contain clay. Some discoloration in rock fabric.
Moderately Weathered	Significant portions of rock show discoloration and weathering effects. Crystals are dull and show visible chemical alteration. Discontinuities are stained and may contain secondary mineral deposits.
Highly Weathered	Rock can be excavated with geologist's pick. All dicontinuities exhibit secondary mineralization. Complete discoloration of rock fabric. Surface of core is friable and usually pitted due to washing out of highly altered minerals by drilling water.
Decomposed	Rock mass is completely decomposed. Original rock "fabric" may be evident. May be reduced to soil with hand pressure.

Spacing (meters)	Spacing (feet)	Spacing Term	Bedding/Foliation
< 0.06	< 2 in.	Very Close	Very Thin
0.06 – 0.30	2 in. – 1 ft.	Close	Thin
0.30 – 0.90	1 ft. – 3 ft.	Moderately Close	Medium
0.90 – 3.0	3 ft. – 10 ft.	Wide	Thick
> 3.0	> 10 ft.	Very Wide	Very Thick (Massive)

Vesicle Term	Volume
Some	3 – 20%
Highly	20 – 50%
Scoria	> 50%

Stratification Term	Description
Lamination	< 1 cm thick beds
Fissile	Preferred break along laminations
Parting	Preferred break direction
Foliation	Metamorphic layering of minerals

RQD %	Designation	RQD %	Designation
0 – 25	Very Poor	75 – 90	Good
25 – 50	Poor	90 – 100	Excellent
50 – 75	Fair		

Rock Quality Designation (RQD) is the percent of a core run with intact lengths greater than 0.1 m excluding breaks caused by drilling.

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COMMON TERMS
ROCK DESCRIPTIONS

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: short grass, scattered gravel fill.								CRUSHED GRAVEL, (GW) (±5 inches); grey, damp, loose, ±½-inch minus, (fill).
	1-	S-1-1						Silty CLAY, trace sand-sized rock fragments, (CL-CH); red-brown, trace manganese-staining, medium plasticity, damp, stiff, (residual soil).
	2-							
	3-							
	4-							
No seepage or ground water encountered to the limit of excavation.	5-							
	6-							BOTTOM OF TEST PIT

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 10, 2009

Test Pit Log: TP-1

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: short grass, scattered gravel fill.								CRUSHED GRAVEL, (GW) (±3 inches); grey, damp, loose, ±1-inch minus, (fill).
	1-	S-2-1						Silty CLAY, (CL); red-brown, medium plasticity, damp, stiff to very stiff, (residual soil).
	2-							Silty CLAY, some sand to gravel-sized rock fragments, (CL); dark brown, low plasticity, damp, stiff, (residual soil).
	3-	S-2-2						
No seepage or ground water encountered to the limit of excavation.	4-							DIORITE, trace clay; brown to dark grey, moderately weathered to decomposed, extremely soft to soft (R0 to R2), highly fractured.
	5-	S-2-3						BOTTOM OF TEST PIT
	6-							

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 10, 2009

Test Pit Log: TP-2

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: short grass, scattered gravel fill.								CRUSHED GRAVEL, (GW) (±4 inches); grey, damp, loose, ±1-inch minus, (fill).
	1-	S-3-1						Silty CLAY, trace sand-sized rock fragments, (CL); red-brown, trace manganese-staining, medium plasticity, damp, stiff to very stiff, (residual soil).
	2-							
	3-							
	4-							
No seepage or ground water encountered to the limit of excavation.	5-							
	6-							BOTTOM OF TEST PIT

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 10, 2009

Test Pit Log: TP-3

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: short grass, scattered gravel fill.								CRUSHED GRAVEL, trace clay, (GW-GC) (±6 inches); grey, damp, loose, ±1-inch minus gravel, (fill).
Perched water encountered at ±6 inches.	1-	S-4-1						Silty CLAY, (CL); red-brown, iron-stained, trace manganese-staining, medium plasticity, damp, stiff, (residual soil).
	2-							
	3-							Becomes stiff and trace to some rock fragments below ±3 feet.
	4-							
	5-							Becomes hard below ±5 feet.
	6-							BOTTOM OF TEST PIT

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 10, 2009

Test Pit Log: TP-4

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: short grass, scattered gravel fill.								GRAVEL, (GW) (±12 inches); grey, damp, loose, angular to subrounded up to ±3 inches in diameter, (fill).
Perched water encountered at ±12 inches.	1-	S-5-1						Clayey SILT, trace sand-sized rock fragments, (CL); red-brown, low plasticity, moist, stiff, (residual soil).
	2-							
	3-							Clayey SILT, some gravel-sized rock fragments, (CL-ML); light brown, medium plasticity, damp to moist, stiff, (residual soil).
	4-	S-5-2						
	5-							
	6-							BOTTOM OF TEST PIT

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 10, 2009

Test Pit Log: TP-5

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: short grass, scattered gravel fill.								CRUSHED GRAVEL, (GW) (±5 inches); grey, damp, loose, ±1-inch minus, (fill).
Perched water encountered at ±5 inches.	1-	S-6-1						Silty CLAY, trace sand-sized rock fragments, (CL); light brown to red-brown, medium plasticity, damp to moist, stiff, (residual soil).
	2-							Becomes stiff to very stiff and includes increased rock fragments below ±2 feet.
	3-							
	4-	S-6-2						DIORITE, trace to some clay; brown to dark grey, moderately weathered to decomposed, extremely soft to soft (R0 to R2), highly fractured.
	5-							BOTTOM OF TEST PIT
	6-							

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 10, 2009

Test Pit Log: TP-6

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: short grass, scattered gravel fill.								CRUSHED GRAVEL, (GW) (±5 inches); grey, damp, loose, ±1-inch minus, (fill).
		S-7-1						Clayey SILT, (CL-ML); red-brown, low plasticity, damp to moist, medium stiff, (residual soil).
	1-							Silty CLAY, trace to some sand to gravel-sized rock fragments, (CL); light brown, medium plasticity, moist, medium stiff to very stiff, (residual soil).
	2-							DIORITE, trace to some clay; brown to dark grey, moderately weathered to decomposed, extremely soft to soft (R0 to R2).
		S-7-2						
	3-							
No seepage or ground water encountered to the limit of excavation.	4-							BOTTOM OF TEST PIT
	5-							
	6-							

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 10, 2009

Test Pit Log: TP-7

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: short grass, scattered gravel fill. Slow seepage encountered at ±6 inches.								CRUSHED GRAVEL, some clay, (GW-GC) (±6 inches); grey to brown, damp, loose, ±1-inch minus gravel, (fill).
	1-	S-8-1						Silty CLAY, (CL); red-brown, low plasticity, moist, very stiff, (residual soil).
	2-	S-8-2						CLAY, trace to some sand to gravel-sized rock fragments, (CL); light brown, trace iron and manganese-staining, medium plasticity, moist, medium stiff to stiff, (residual soil).
	3-							
	4-							DIORITE, trace to some clay; brown to dark grey, moderately weathered to decomposed, extremely soft to soft (R0 to R2), highly fractured.
		S-8-3						
	5-							
	6-							BOTTOM OF TEST PIT

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 11, 2009

Test Pit Log: TP-8

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Perched water noted on top of the subgrade.								ASPHALTIC CONCRETE (±4 inches).
		C-1-1						CRUSHED ROCK, (GW) (±7 inches); grey, wet, medium dense, ±1½-inch minus, (base rock).
	1-	SHC-1-2						Silty CLAY, (CL-CH); red-brown, medium plasticity, damp to moist, medium stiff to stiff, (residual soil).
	2-							
	3-							BOTTOM OF CORE HOLE
	4-							

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 11, 2009

Core Hole Log: C- 1

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Perched water noted on top of the subgrade.								ASPHALTIC CONCRETE (±4½ inches).
								CRUSHED ROCK, (GW) (±6½ inches); grey, damp to wet, medium dense, ±1½-inch minus, (base rock).
	1-							Silty CLAY, (CL); red-brown, medium plasticity, damp, stiff, (residual soil).
		SHC-2-1						
	2-							
	3-							
								Silty CLAY, trace sand-sized rock fragments, (CL); dark brown, medium plasticity, moist, stiff to very stiff, (residual soil).
		C-2-2						
	4-							BOTTOM OF CORE HOLE

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 11, 2009

Core Hole Log: C- 2

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Perched water noted on top of the subgrade.								ASPHALTIC CONCRETE (±4½ inches).
								CRUSHED ROCK, (GW) (±2½ inches); grey, damp, medium dense, ±2-inch minus, (base rock).
	1-							Silty CLAY, (CL); red-brown, medium plasticity, damp to moist, stiff, (residual soil).
		SHC-3-1						
	2-							Becomes very stiff with trace to some sand to gravel-sized rock fragments below ±18 inches.
	3-							BOTTOM OF CORE HOLE
	4-							

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 11, 2009

Core Hole Log: C- 3

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Perched water noted on top of the subgrade.								ASPHALTIC CONCRETE (±5 inches).
								CRUSHED ROCK, (GW) (±4 inches); grey, damp to wet, medium dense, ±2-inch minus, (base rock).
	1-							Silty CLAY, (CL); red-brown, medium plasticity, damp to moist, stiff, (residual soil).
		SHC-4-1						
	2-							
	3-							BOTTOM OF CORE HOLE
	4-							

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 11, 2009

Core Hole Log: C- 4

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Perched water noted on top of the subgrade.								ASPHALTIC CONCRETE (±5 inches).
								CRUSHED ROCK and GRAVEL, (GW) (±4 inches); grey, damp to wet, dense, subrounded gravel up to ±3 inches in diameter, (base rock).
	1-							Silty CLAY, some sand to gravel-sized rock fragments, (CL); dark grey to brown, low to medium plasticity, damp, stiff, (residual soil).
		SHC-5-1						
	2-							
	3-							BOTTOM OF CORE HOLE
	4-							

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 11, 2009

Core Hole Log: C- 5

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Perched water noted on top of the subgrade.								ASPHALTIC CONCRETE (±5 inches).
								CRUSHED ROCK, (GW) (±3 inches); grey, damp, dense, ±2-inch minus, (base rock).
	1-							Silty CLAY, trace to some sand to gravel-sized rock fragments, (CL); grey to brown, low to medium plasticity, damp, stiff, (residual soil).
		SHC-6-1						
	2-							
	3-							BOTTOM OF CORE HOLE
	4-							

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 11, 2009

Core Hole Log: C- 6

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Perched water noted on top of the subgrade.								ASPHALTIC CONCRETE (±4½ inches).
								CRUSHED ROCK and GRAVEL, (GW) (±5½ inches); grey, damp to wet, medium dense, subrounded gravel up to 4 inches in diameter, (base rock).
	1-							Silty CLAY, (CL); light brown, medium plasticity, moist, stiff to very stiff, (residual soil).
		SHC-7-1						
	2-							
	3-							BOTTOM OF CORE HOLE
	4-							

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 11, 2009

Core Hole Log: C- 7

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Perched water noted on top of the subgrade.								ASPHALTIC CONCRETE (±4 inches).
								GRAVEL, (GW) (±8 inches); grey, damp, medium dense, subangular to subrounded up to 3 inches in diameter, (base rock).
	1-							Silty CLAY, trace sand-sized rock fragments, (CL); grey, medium plasticity, moist, stiff, (residual soil).
		C-8-1						
	2-							
	3-							BOTTOM OF CORE HOLE
	4-							

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 11, 2009

Core Hole Log: C- 8

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Perched water noted on top of the subgrade.								ASPHALTIC CONCRETE (±5 inches).
								CRUSHED ROCK, (GW) (±5 inches); grey, damp, dense, ±2-inch minus, (base rock).
	1-							Silty CLAY, trace sand-sized rock fragments, (CL); brown to grey, medium plasticity, damp, stiff to very stiff, (residual soil).
	2-	SHC-9-1						
	3-							
								BOTTOM OF CORE HOLE
	4-							

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 11, 2009

Core Hole Log: C- 9

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Perched water noted on top of the subgrade.								ASPHALTIC CONCRETE (±4 inches).
								GRAVEL, (GW) (±6 inches); grey, damp, medium dense, subangular, ±2-inch minus, (base rock).
	1-							Silty CLAY, (CL); grey-brown, medium plasticity, moist, stiff, (residual soil).
		C-10-1						
	2-							
	3-							
								BOTTOM OF CORE HOLE
	4-							

Project No.: 2091086

Surface Elevation: N/A

Date of Test Pit: November 11, 2009

Core Hole Log: C-10

Grants Pass Airport Runway 12-30 Rehabilitation

Grants Pass, Oregon

Table 1B. Summary of Pavement Thicknesses

Exploration Location	Asphaltic Concrete Thickness (in.)	Base Rock Thickness (in.)	Total Pavement Section (in.)
C-1	4	7	±11
C-2	4.5	6.5	±11
C-3	4.5	2.5	±7
C-4	5	4	±9
C-5	5	4	±9
C-6	5	3	±8
C-7	4.5	5.5	±10
C-8	4	8	±12
C-9	5	5	±10
C-10	4	6	±10

Note: Base rock typically consists of medium dense, 1½ to 2-inch minus, CRUSHED GRAVEL and/or ROCK. An FAA Class GW is appropriate.

Appendix C

Laboratory Test Results

Professional Geotechnical Services

Foundation Engineering, Inc.

Table 1C. Natural Water Content, Atterberg Limits and Percent Fines

Sample Number	Sample Depth (feet)	Natural Water Content (%)	LL	PL	PI	FAA/USCS Classification
S-1-1	1.0 – 2.0	25.2	50	25	25	CL-CH
S-2-1	1.0 – 2.0	31.6				
S-2-2	3.0 – 4.0	22.8				
S-3-1	1.0 – 2.0	24.0	45	26	19	CL
S-4-1	1.0 – 2.0	40.1				
S-5-1	1.5 – 2.0	18.5				
S-5-2	4.0 – 5.0	24.1				
S-6-1	1.0 – 2.0	14.2	35	20	15	CL
S-7-1	0.5 – 2.0	15.9	25	19	6	CL-ML
S-8-1	1.0 – 1.5	19.0				
S-8-2	2.0 – 2.5	26.8				
SHC-1-2	1.0 – 2.5	31.7				
SHC-2-1	1.5 – 3.5	28.0				
SHC-3-1	1.5 – 1.9	30.0				
SHC-4-1	1.5 – 2.3	34.0				
SHC-5-1	1.5 – 2.5	27.3				
SHC-6-1	1.5 – 2.0	20.8				
SHC-7-1	1.5 – 2.5	24.7	36	22	14	CL
C-8-1	1.2 – 2.0	26.1				
SHC-9-1	2.0 – 3.2	24.7				
C-10-1	1.5 – 2.0	37.3				

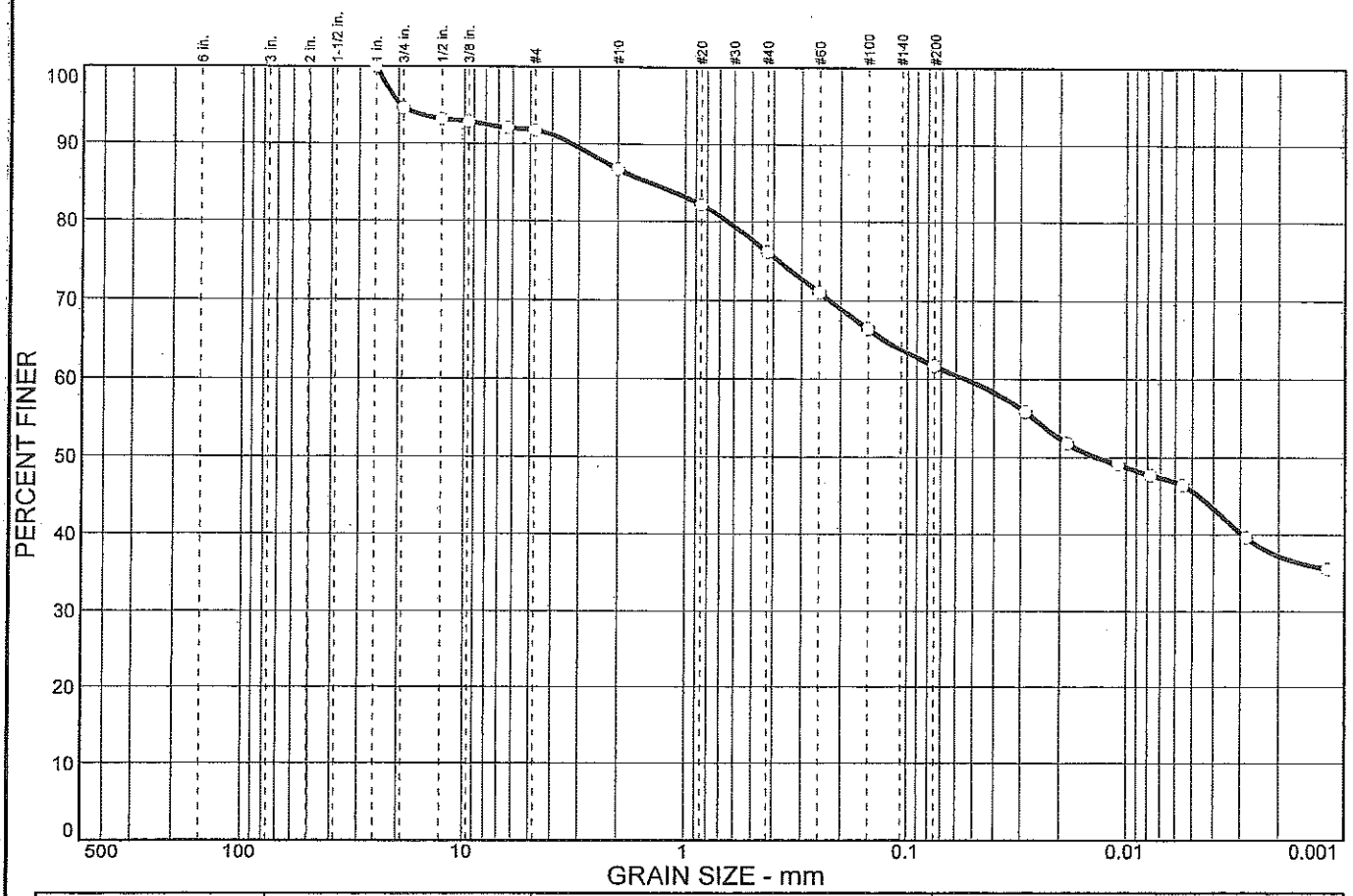
Table 2C. Bulk Densities

Sample Number	Sample Depth (feet)	Soil Description	Water Content (%)	Moist Bulk Density (pcf)	Dry Density (pcf)	Relative Compaction (%)
SHC-1-2	1.0 – 2.5	Red-brown, silty CLAY	31.7	111.2	84.5	82.4
SHC-2-1	1.5 – 3.5	Red-brown, silty CLAY	28.0	120.5	94.1	91.8
SHC-3-1	1.5 – 1.9	Red-brown, silty CLAY	30.0	105.3	81.0	79.0
SHC-4-1	1.5 – 2.3	Red-brown, silty CLAY	34.0	110.8	82.7	80.7
SHC-5-1	1.5 – 2.5	Dark grey to brown, silty CLAY, some sand to gravel-sized rock fragments	27.3	124.5	97.8	87.1
SHC-6-1	1.5 – 2.0	Grey to brown, silty CLAY, some sand to gravel-sized rock fragments	20.8	129.2	106.9	95.2
SHC-7-1	1.5 – 2.5	Light brown, silty CLAY	24.7	111.5	89.4	79.6
SHC-9-1	2.0 – 3.1	Grey, silty CLAY, trace sand -sized rock fragments	24.7	120.7	96.8	86.2

Notes: 1. Relative compaction for samples obtained from C-1 through C-4 assumes a maximum dry density of 102.5 pcf, which is based on the moisture-density test (ASTM D698) completed on sample S-3-1.

2. Relative compaction for from C-5 through C-9 assumes a maximum dry density of 112.3 pcf, which is based on the average from moisture-density tests (ASTM D698) completed on samples S-6-1 and S-7-1.

Grain Size Analysis ASTM C-136/C-117



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	5.4	2.8	5.0	10.7	14.4	16.0	45.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 in.	100.0		
3/4 in.	94.6		
1/2 in.	93.2		
3/8 in.	92.9		
1/4 in.	92.1		
#4	91.8		
#10	86.8		
#20	82.2		
#40	76.1		
#60	71.0		
#100	66.4		
#200	61.7		

* (no specification provided)

Material Description

Red-brown, silty CLAY, trace sand-sized rock fragments

Atterberg Limits

PL= 26 LL= 45 PI= 19

Coefficients

D_{85}= 1.42 D_{60}= 0.0540 D_{50}= 0.0135
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(10)

Remarks

Sample No.: S-3-1 **Source of Sample:** 4390 **Date:**
Location: **Elev./Depth:** 1.0-2.0'

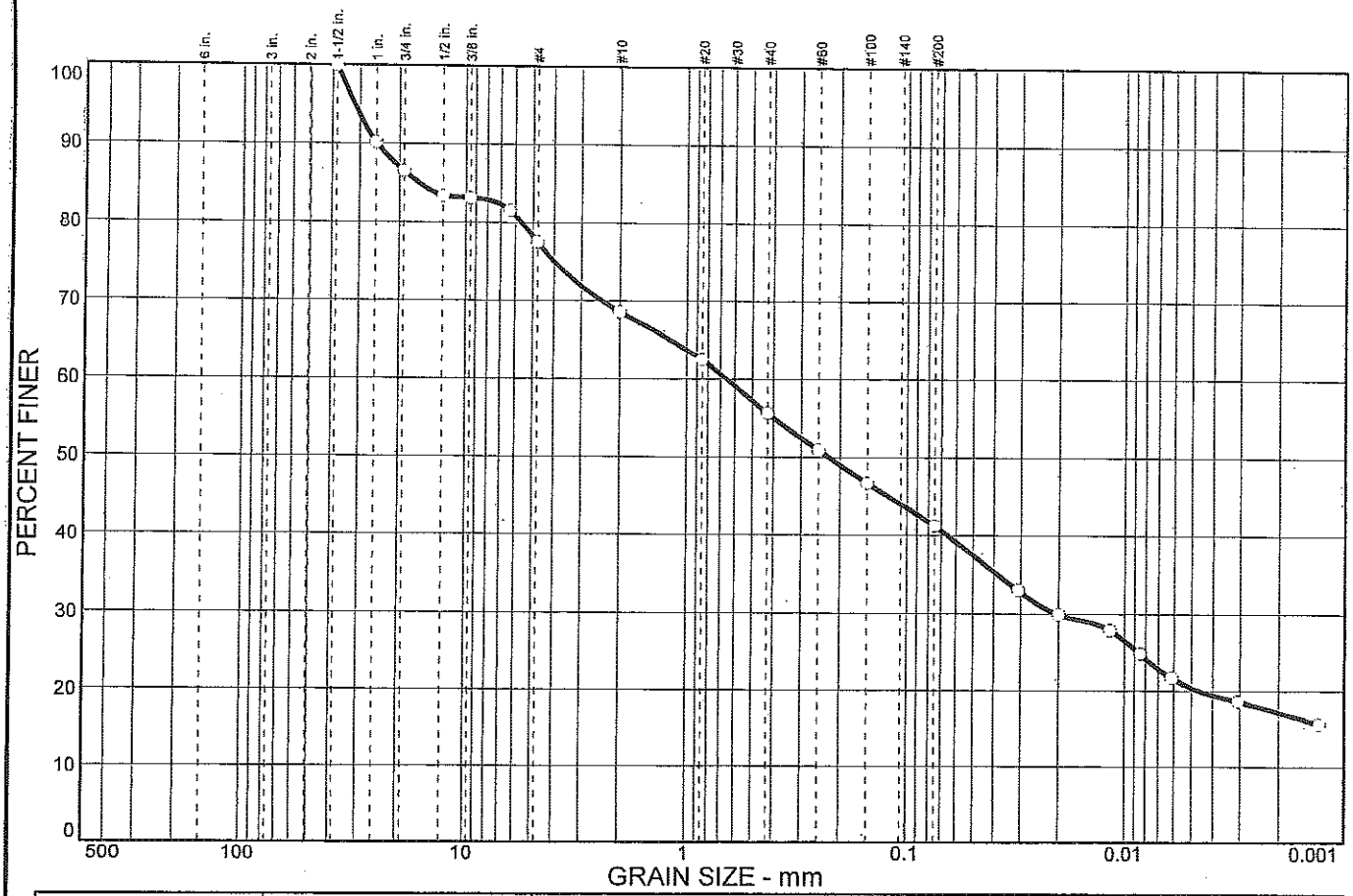
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Foundation Engineering Inc.; Project #2091086
Project: Grants Pass Airport - Runway 12-30

Project No: 2096009-561 **Figure** 1C

Grain Size Analysis ASTM C-136/C-117



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	13.4	9.1	8.9	13.0	14.4	20.8	20.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1 in.	90.2		
3/4 in.	86.6		
1/2 in.	83.4		
3/8 in.	83.1		
1/4 in.	81.6		
#4	77.5		
#10	68.6		
#20	62.5		
#40	55.6		
#60	50.9		
#100	46.7		
#200	41.2		

* (no specification provided)

Material Description

Light brown to red-brown, silty CLAY, trace sand-sized rock fragments

Atterberg Limits

PL= 20 LL= 35 PI= 15

Coefficients

D_{85}= 16.1 D_{60}= 0.654 D_{50}= 0.225
D_{30}= 0.0204 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO= A-6(2)

Remarks

Sample No.: S-6-1 **Source of Sample:** 4390 **Date:**
Location: **Elev./Depth:** 1.0-2.0'

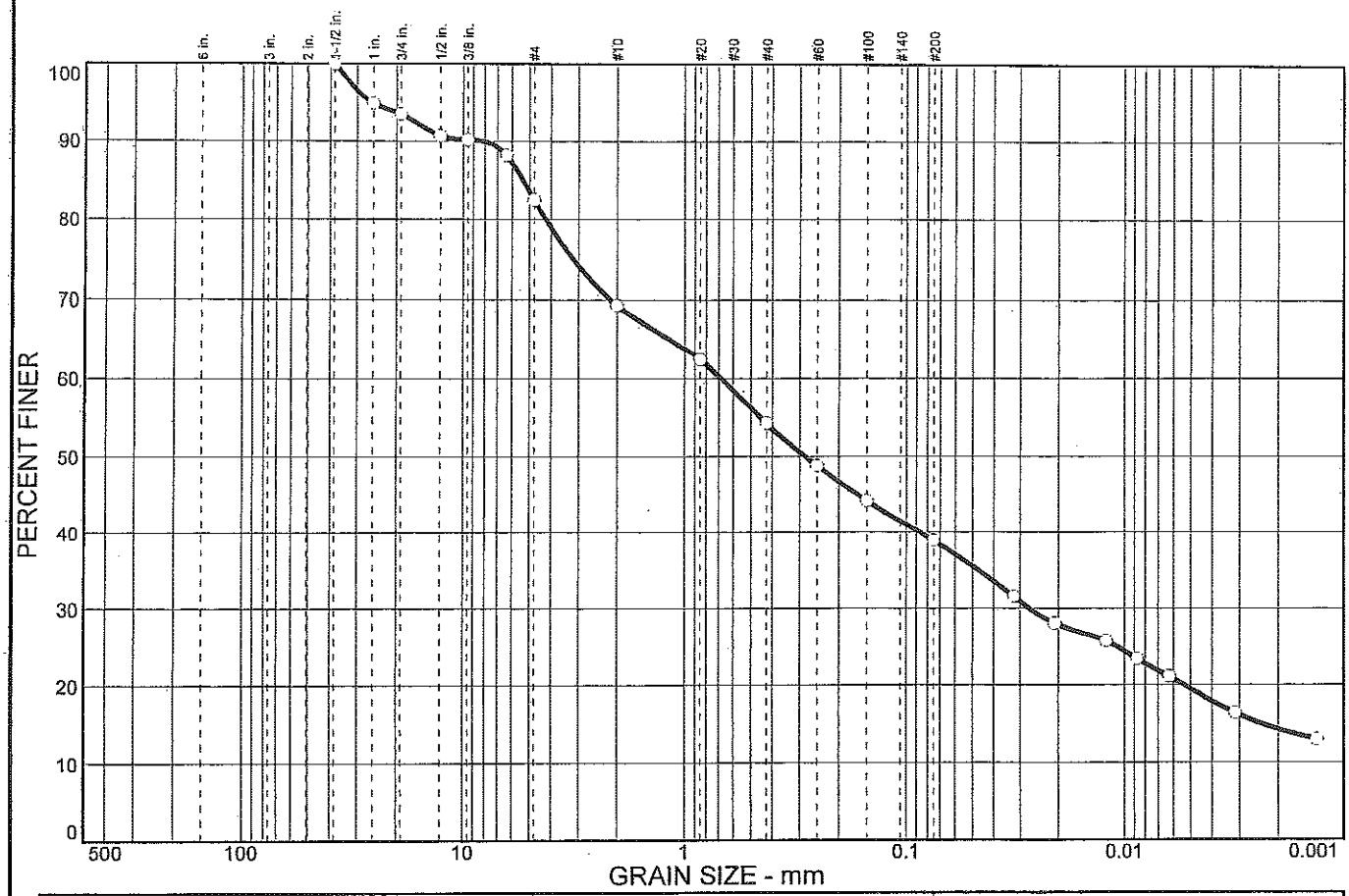
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Foundation Engineering Inc.; Project #2091086
Project: Grants Pass Airport - Runway 12-30

Project No: 2096009-561 **Figure** 2C

Grain Size Analysis ASTM C-136/C-117



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	6.5	11.0	13.2	15.0	15.4	19.4	19.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
01.5 in.	100.0		
1 in.	94.9		
3/4 in.	93.5		
1/2 in.	90.7		
3/8 in.	90.2		
1/4 in.	88.2		
#4	82.5		
#10	69.3		
#20	62.4		
#40	54.3		
#60	48.8		
#100	44.1		
#200	38.9		

* (no specification provided)

Material Description

Light brown to red-brown, silty CLAY,
trace to some sand to gravel-sized rock fragments

Atterberg Limits

PL= 19 LL= 25 PI= 6

Coefficients

D_{85}= 5.33 D_{60}= 0.681 D_{50}= 0.283
D_{30}= 0.0271 D_{15}= 0.0024 D_{10}=
C_u= C_c=

Classification

USCS= AASHTO= A-4(0)

Remarks

Sample No.: S-7-1 **Source of Sample:** 4390 **Date:**
Location: **Elev./Depth:** 0.5-2.0'

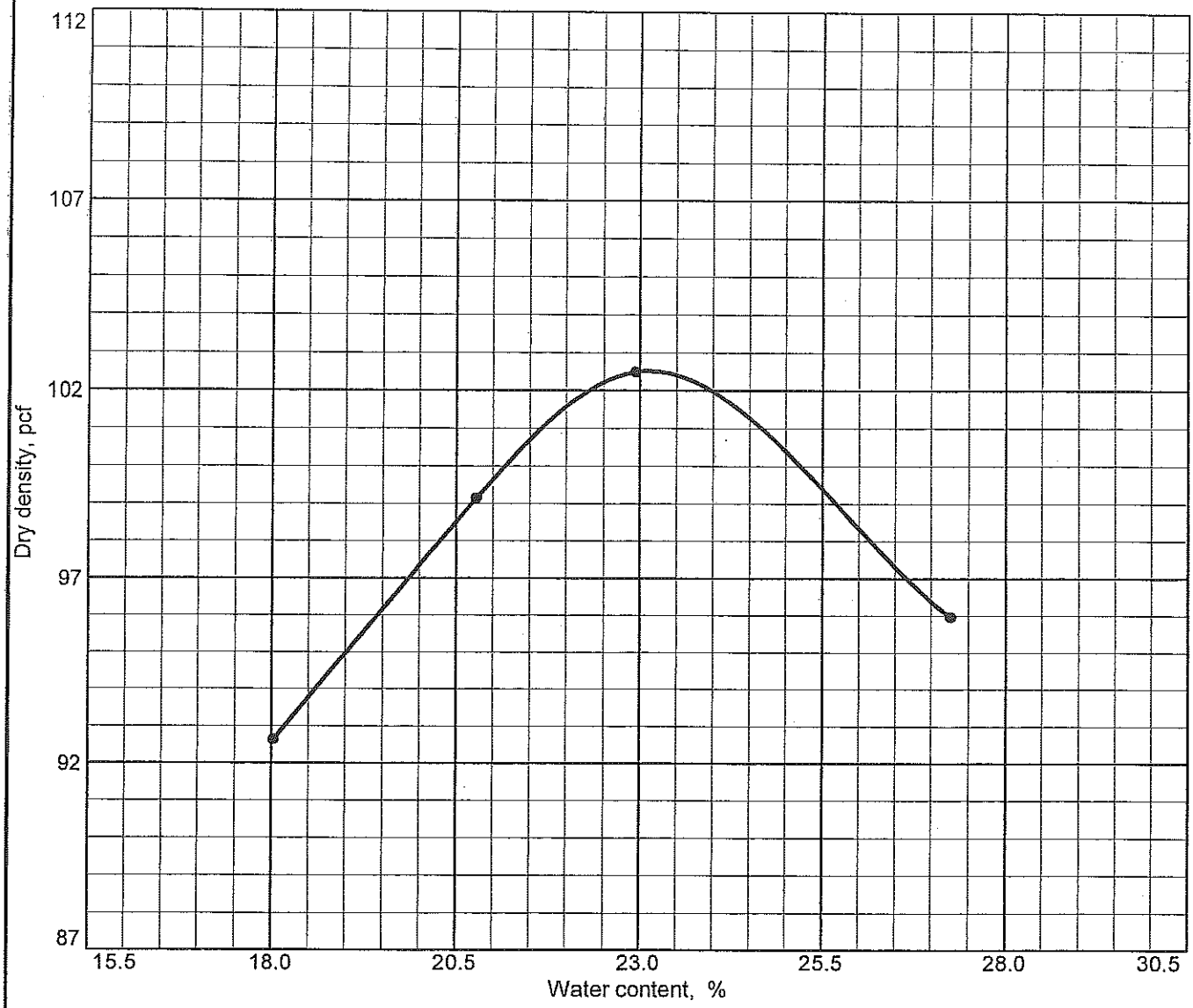
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Foundation Engineering Inc.; Project #2091086
Project: Grants Pass Airport - Runway 12-30

Project No: 2096009-561 **Figure** 3C

MOISTURE - DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-00a Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
1.0-2.0'	CL		24.0		45	19		

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 102.5 pcf Optimum moisture = 23.1 %	Red-brown, silty CLAY, trace sand-sized rock fragments

Project No. 2096009-561 **Client:** Foundation Engineering Inc.; Project #2091086
Project: Grants Pass Airport - Runway 12-30

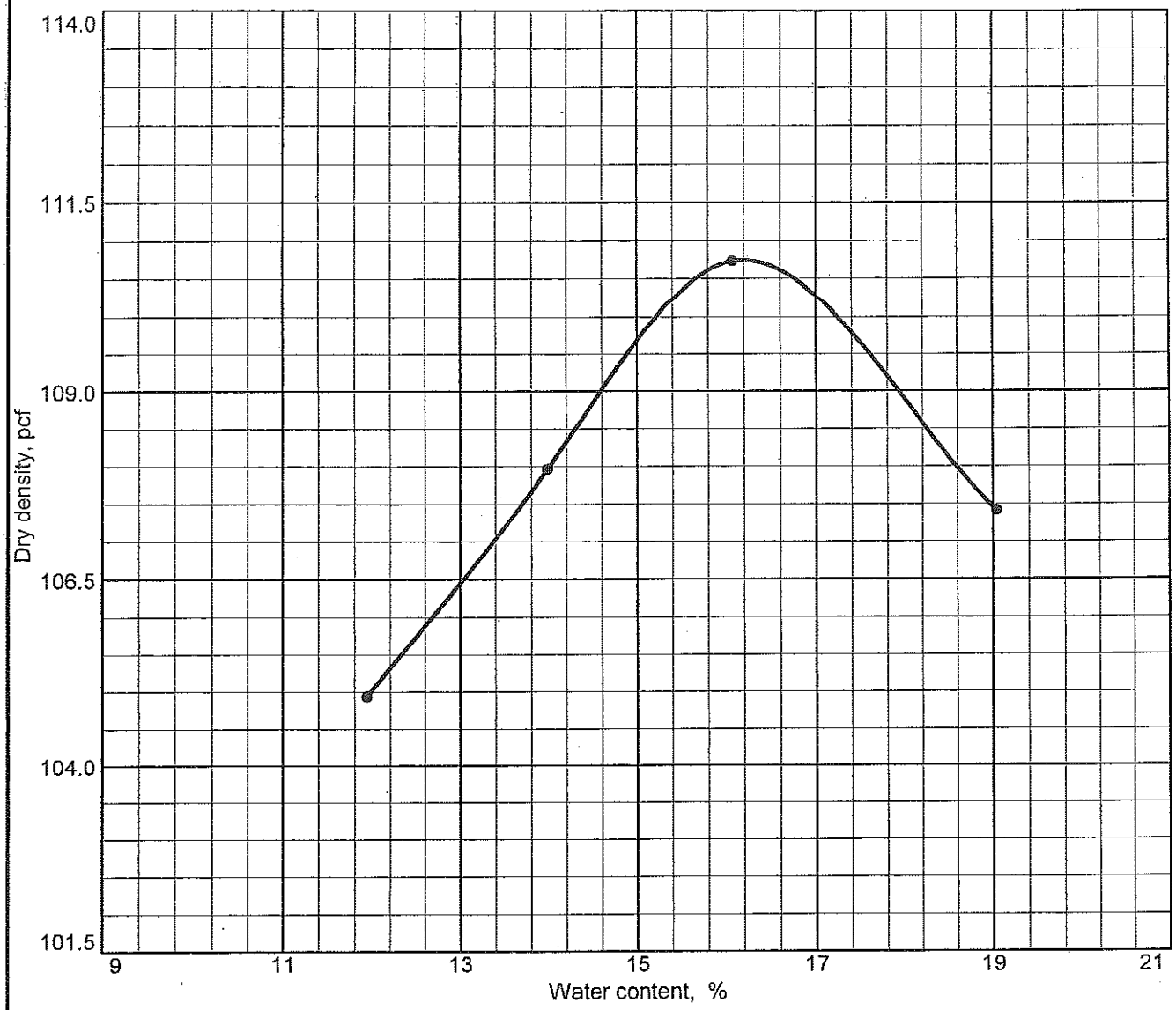
● **Source:** 4390 **Sample No.:** S-3-1 **Elev./Depth:** 1.0-2.0'

Remarks:

MOISTURE - DENSITY RELATIONSHIP TEST
FEI Testing & Inspection, Inc.
Corvallis, OR

Figure 4C

MOISTURE - DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-00a Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
1.0-2.0'	CL		14.2		35	15		

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 110.7 pcf Optimum moisture = 16.2 %	Light brown to red-brown, silty CLAY, trace sand-sized rock fragments

Project No. 2096009-561 **Client:** Foundation Engineering Inc.; Project #2091086
Project: Grants Pass Airport - Runway 12-30

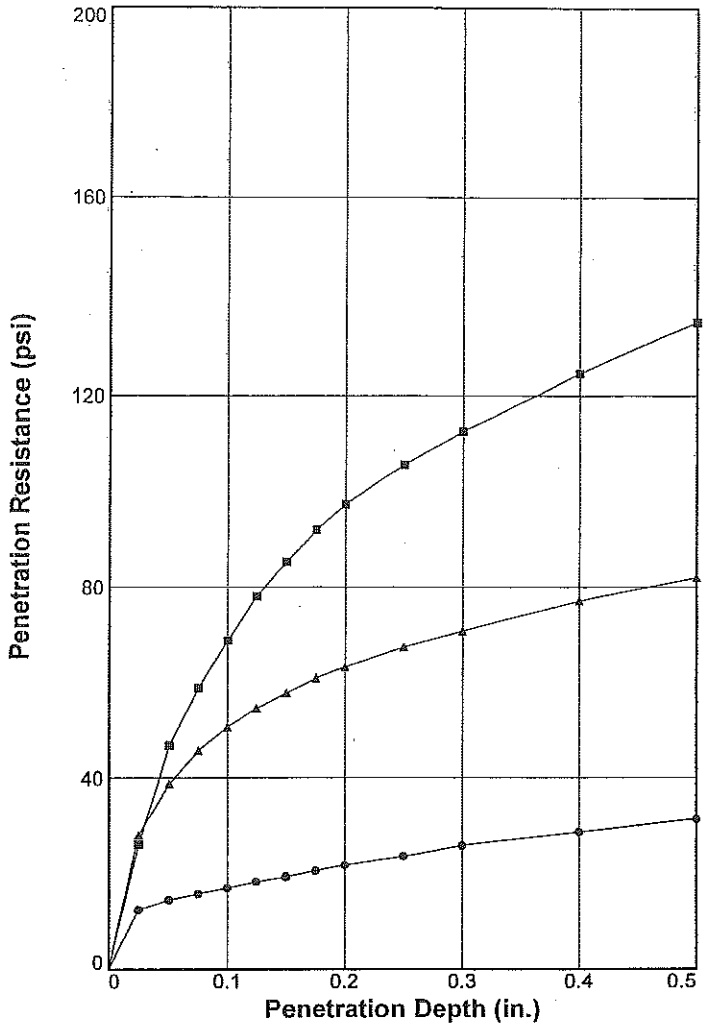
● **Source:** 4390 **Sample No.:** S-6-1 **Elev./Depth:** 1.0-2.0'

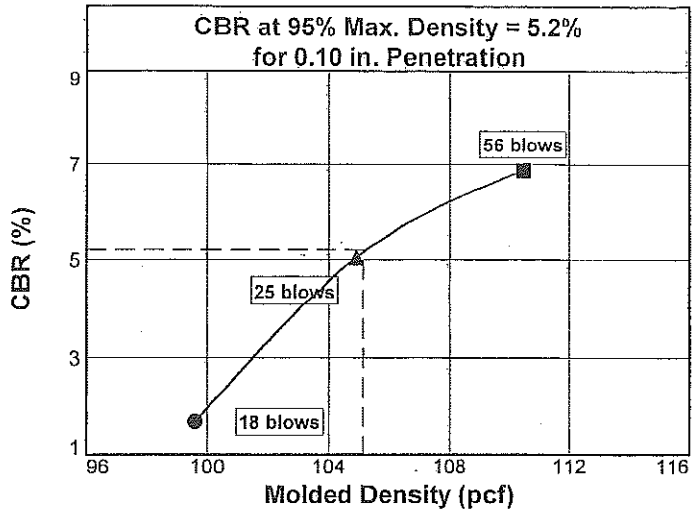
Remarks:

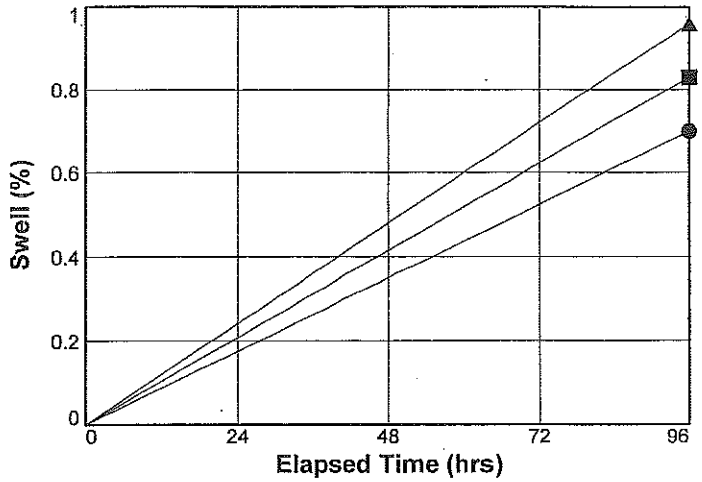
MOISTURE - DENSITY RELATIONSHIP TEST
FEI Testing & Inspection, Inc.
Corvallis, OR

Figure 5C

BEARING RATIO TEST REPORT
ASTM D 1883-05







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ●	99.6	90	16.2	98.9	89.3	23.7	1.7	1.4	0.000	32.5	0.7
2 ▲	104.9	94.8	16.6	103.9	93.9	21.7	5.0	4.2	0.000	32.5	1
3 ■	110.4	99.7	16.5	109.5	99	20.2	6.9	6.5	0.000	32.5	0.8

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Light brown to red-brown, silty CLAY, trace sand-sized rock fragments	CL	110.7	16.2	35	15

Project No: 2096009-561

Project: Grants Pass Airport - Runway 12-30

Source of Sample: 4390 **Depth:** 1.0-2.0'

Sample Number: S-6-1

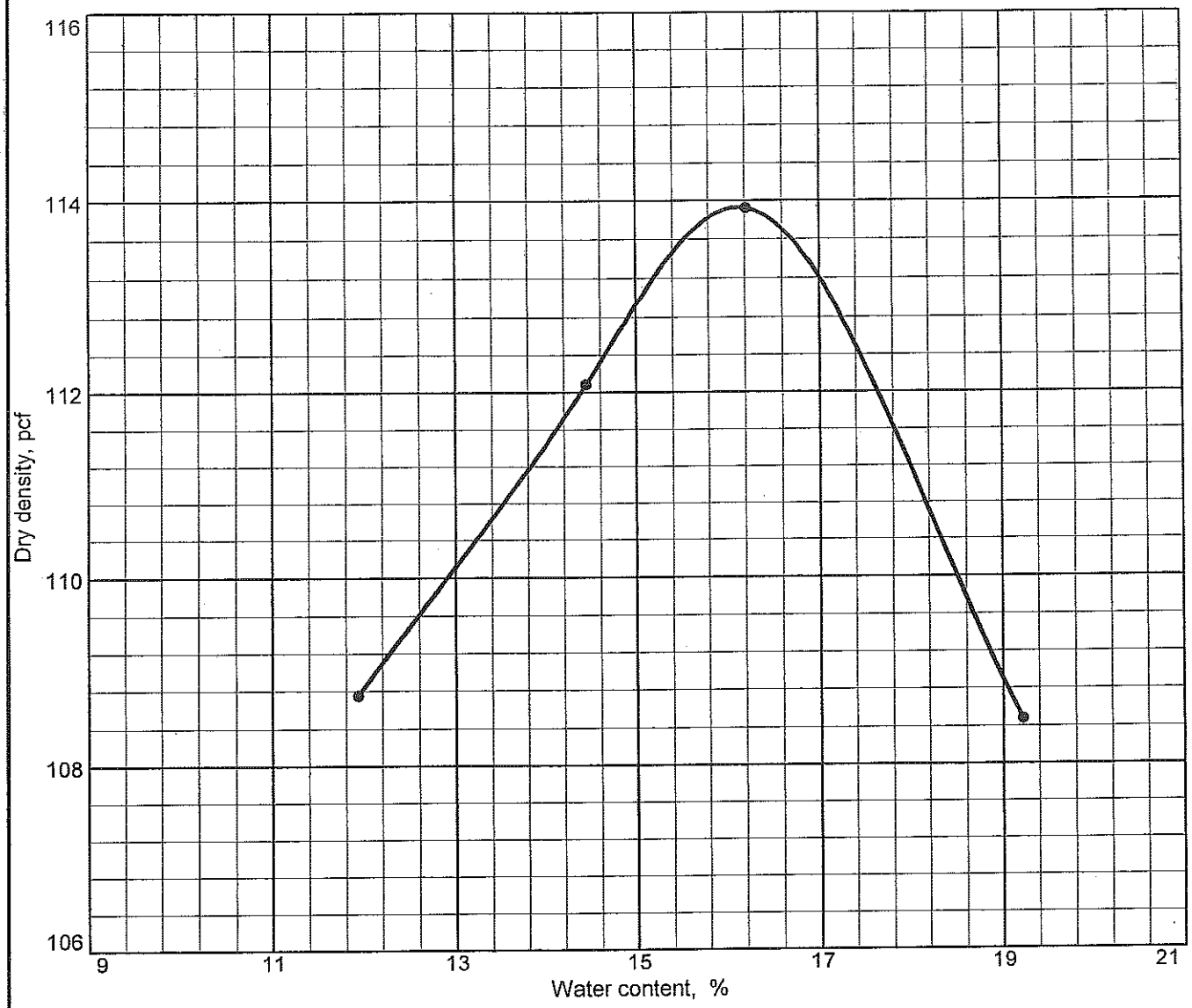
Date:

Test Description/Remarks:

BEARING RATIO TEST REPORT
FEI Testing & Inspection, Inc.
Corvallis, OR

Figure 6C

MOISTURE - DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-00a Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
0.5-2.0'	CL-ML		15.9		25	6		

TEST RESULTS

Maximum dry density = 113.9 pcf

Optimum moisture = 16.1 %

MATERIAL DESCRIPTION

Light brown to red-brown, silty CLAY, trace to some sand to gravel-sized rock fragments

Project No. 2096009-561 **Client:** Foundation Engineering Inc.; Project #2091086

Project: Grants Pass Airport - Runway 12-30

● **Source:** 4390 **Sample No.:** S-7-1 **Elev./Depth:** 0.5-2.0'

Remarks:

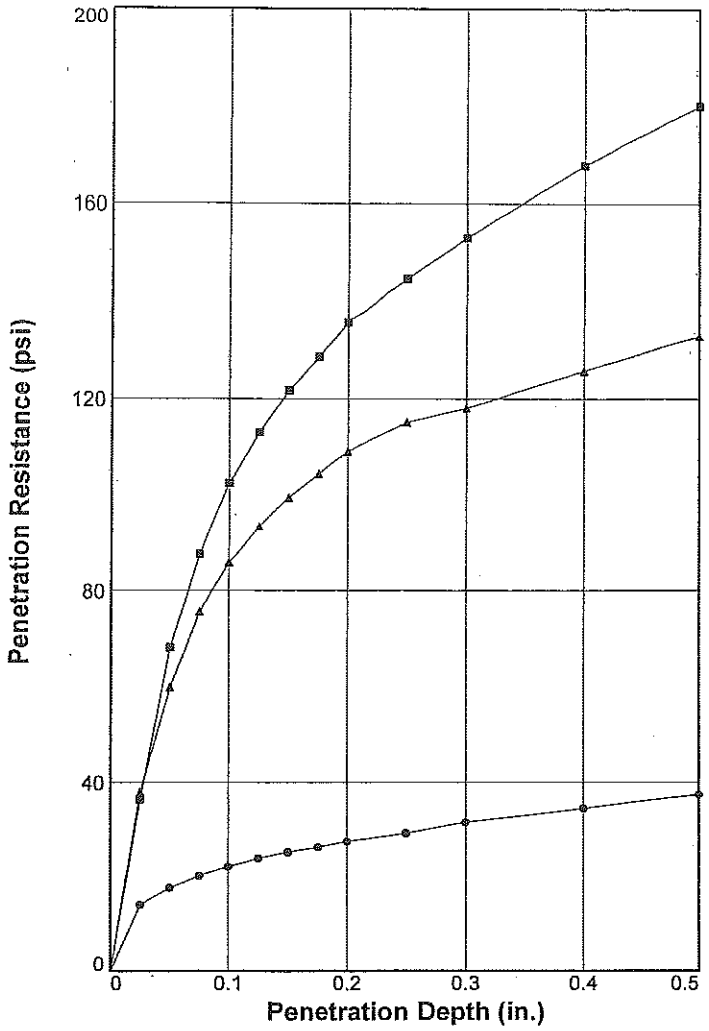
MOISTURE - DENSITY RELATIONSHIP TEST

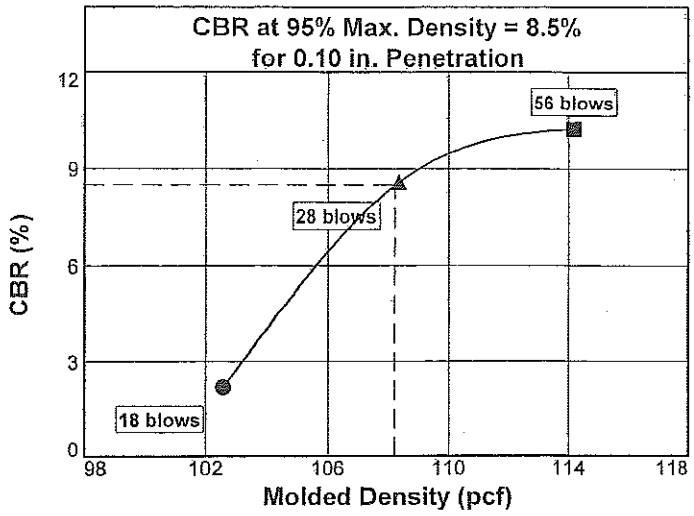
FEI Testing & Inspection, Inc.

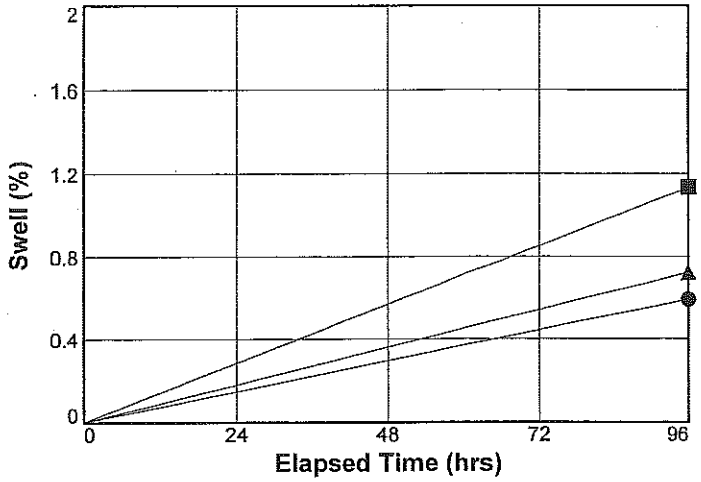
Corvallis, OR

Figure 7C

BEARING RATIO TEST REPORT
ASTM D 1883-05







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	102.6	90.1	16.3	102.0	89.5	22.1	2.2	1.8	0.000	32.5	0.6
2 △	108.3	95.1	16.1	107.6	94.4	19.0	8.6	7.3	0.000	32.5	0.7
3 □	114.2	100.3	15.9	112.9	99.1	18.2	10.2	9.0	0.000	32.5	1.1

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Light brown to red-brown, silty CLAY, trace to some sand to gravel-sized rock fragments	CL-ML	113.9	16.1	25	6

Project No: 2096009-561

Project: Grants Pass Airport - Runway 12-30

Source of Sample: 4390 **Depth:** 0.5-2.0'

Sample Number: S-7-1

Date:

Test Description/Remarks:

BEARING RATIO TEST REPORT
FEI Testing & Inspection, Inc.
Corvallis, OR

Figure 8C

APPENDIX 2

OVERLAY DESIGN

FAARFIELD - Airport Pavement Design (V 1.300, 1/22/09)

Section OL-12500 in Job 34299.
Working directory is C:\Program Files\FAA\FAARFIELD\

The structure is AC Overlay on Flexible.
Design Life = 20 years.
A design has not been completed for this section.

Pavement Structure Information by Layer, Top First

No.	Type	Thickness in	Modulus psi	Poisson's Ratio	Strength R,psi
1	P-401/ P-403 HMA Overlay	2.00	200,000	0.35	0
2	P-401/ P-403 HMA Surface	4.00	200,000	0.35	0
3	P-209 Cr Ag	4.00	8,812	0.35	0
4	Subgrade	0.00	3,000	0.35	0

Total thickness to the top of the subgrade = 10.00 in

Airplane Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	Sngl Whl-3	3,000	14,295	1.10
2	SuperKingAir-B200	12,590	518	1.10

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Sngl Whl-3	0.00	0.00	5.54
2	SuperKingAir-B200	0.37	0.37	2.98

FAARFIELD - Airport Pavement Design (V 1.300, 1/22/09)

Section OL-19000 in Job 34299.
Working directory is C:\Program Files\FAA\FAARFIELD\

The structure is AC Overlay on Flexible. Asphalt CDF was not computed.
Design Life = 20 years.
A design for this section was completed on 01/19/10 at 14:25:59.

Pavement Structure Information by Layer, Top First

No.	Type	Thickness in	Modulus psi	Poisson's Ratio	Strength R,psi
1	P-401/ P-403 HMA Overlay	2.82	200,000	0.35	0
2	P-401/ P-403 HMA Surface	4.00	200,000	0.35	0
3	P-209 Cr Ag	4.00	8,812	0.35	0
4	Subgrade	0.00	3,000	0.35	0

Total thickness to the top of the subgrade = 10.82 in

Airplane Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	Sngl Whl-3	3,000	14,295	1.10
2	SuperKingAir-B200	12,590	518	1.10
3	Sngl Whl-20	19,000	100	1.10

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Sngl Whl-3	0.00	0.00	5.24
2	SuperKingAir-B200	0.00	0.03	2.90
3	Sngl Whl-20	1.00	1.00	3.73

FAARFIELD - Airport Pavement Design (V 1.300, 1/22/09)

Section OL-30swg in Job 34299.
Working directory is C:\Program Files\FAA\FAARFIELD\

The structure is AC Overlay on Flexible.
Design Life = 20 years.
A design has not been completed for this section.

Pavement Structure Information by Layer, Top First

No.	Type	Thickness in	Modulus psi	Poisson's Ratio	Strength R,psi
1	P-401/ P-403 HMA Overlay	5.03	200,000	0.35	0
2	P-401/ P-403 HMA Surface	4.00	200,000	0.35	0
3	P-209 Cr Ag	4.00	8,812	0.35	0
4	Subgrade	0.00	3,000	0.35	0

Total thickness to the top of the subgrade = 13.03 in

Airplane Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	Sngl Whl-3	3,000	14,295	1.10
2	SuperKingAir-B200	12,590	518	1.10
3	Sngl Whl-30	30,000	100	1.10
4	Sngl Whl-20	19,000	100	1.10

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Sngl Whl-3	0.00	0.00	4.57
2	SuperKingAir-B200	0.00	0.00	2.70
3	Sngl Whl-30	0.98	0.98	3.10
4	Sngl Whl-20	0.02	0.02	3.39

FAARFIELD - Airport Pavement Design (V 1.300, 1/22/09)

Section OL-45dwg in Job 34299.
Working directory is C:\Program Files\FAA\FAARFIELD\

The structure is AC Overlay on Flexible.
Design Life = 20 years.
A design has not been completed for this section.

Pavement Structure Information by Layer, Top First

No.	Type	Thickness in	Modulus psi	Poisson's Ratio	Strength R,psi
1	P-401/ P-403 HMA Overlay	7.04	200,000	0.35	0
2	P-401/ P-403 HMA Surface	4.00	200,000	0.35	0
3	P-209 Cr Ag	4.00	8,812	0.35	0
4	Subgrade	0.00	3,000	0.35	0

Total thickness to the top of the subgrade = 15.04 in

Airplane Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	Sngl Whl-3	3,000	14,295	1.10
2	SuperKingAir-B200	12,590	518	1.10
3	Sngl Whl-30	30,000	100	1.10
4	Dual Whl-45	45,000	100	1.10
5	Sngl Whl-20	19,000	100	1.10

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Sngl Whl-3	0.00	0.00	4.09
2	SuperKingAir-B200	0.00	0.00	2.54
3	Sngl Whl-30	0.00	0.08	2.88
4	Dual Whl-45	1.00	1.00	2.19
5	Sngl Whl-20	0.00	0.00	3.13

FAARFIELD - Airport Pavement Design (V 1.300, 1/22/09)

Section OL-60dwg in Job 34299.
Working directory is C:\Program Files\FAA\FAARFIELD\

The structure is AC Overlay on Flexible.
Design Life = 20 years.
A design has not been completed for this section.

Pavement Structure Information by Layer, Top First

No.	Type	Thickness in	Modulus psi	Poisson's Ratio	Strength R,psi
1	P-401/ P-403 HMA Overlay	9.19	200,000	0.35	0
2	P-401/ P-403 HMA Surface	4.00	200,000	0.35	0
3	P-209 Cr Ag	4.00	8,812	0.35	0
4	Subgrade	0.00	3,000	0.35	0

Total thickness to the top of the subgrade = 17.19 in

Airplane Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	Sngl Whl-3	3,000	14,295	1.10
2	SuperKingAir-B200	12,590	518	1.10
3	Sngl Whl-30	30,000	100	1.10
4	Dual Whl-45	45,000	100	1.10
5	Dual Whl-60	60,000	100	1.10
6	Sngl Whl-20	19,000	100	1.10

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Sngl Whl-3	0.00	0.00	3.69
2	SuperKingAir-B200	0.00	0.00	2.39
3	Sngl Whl-30	0.00	0.00	2.69
4	Dual Whl-45	0.12	0.12	2.08
5	Dual Whl-60	0.88	0.88	1.97
6	Sngl Whl-20	0.00	0.00	2.90

RECONSTRUCT DESIGN

FAARFIELD - Airport Pavement Design (V 1.300, 1/22/09)

Section NewAC19000 in Job 34299.
Working directory is C:\Program Files\FAA\FAARFIELD\

The structure is New Flexible. Asphalt CDF was not computed.
Design Life = 20 years.
A design for this section was completed on 01/19/10 at 14:29:56.

Pavement Structure Information by Layer, Top First

No.	Type	Thickness in	Modulus psi	Poisson's Ratio	Strength R,psi
1	P-401/ P-403 HMA Surface	2.50	200,000	0.35	0
2	P-209 Cr Ag	8.53	24,132	0.35	0
3	Subgrade	0.00	7,500	0.35	0

Total thickness to the top of the subgrade = 11.03 in

Airplane Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	Sngl Whl-3	3,000	14,295	1.10
2	SuperKingAir-B200	12,590	518	1.10
3	Sngl Whl-20	19,000	100	1.10

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Sngl Whl-3	0.00	0.00	5.17
2	SuperKingAir-B200	0.00	0.01	2.88
3	Sngl Whl-20	1.00	1.00	3.69

FAARFIELD - Airport Pavement Design (V 1.300, 1/22/09)

Section NewAC30swg in Job 34299.
Working directory is C:\Program Files\FAA\FAARFIELD\

The structure is New Flexible. Asphalt CDF was not computed.
Design Life = 20 years.
A design for this section was completed on 01/19/10 at 14:30:45.

Pavement Structure Information by Layer, Top First

No.	Type	Thickness in	Modulus psi	Poisson's Ratio	Strength R,psi
1	P-401/ P-403 HMA Surface	2.50	200,000	0.35	0
2	P-209 Cr Ag	11.19	32,172	0.35	0
3	Subgrade	0.00	7,500	0.35	0

Total thickness to the top of the subgrade = 13.69 in

Airplane Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	Sngl Whl-3	3,000	14,295	1.10
2	SuperKingAir-B200	12,590	413	1.10
3	Sngl Whl-30	30,000	100	1.10
4	Sngl Whl-20	19,000	100	1.10

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Sngl Whl-3	0.00	0.00	4.40
2	SuperKingAir-B200	0.00	0.00	2.64
3	Sngl Whl-30	0.97	0.97	3.02
4	Sngl Whl-20	0.03	0.03	3.30

FAARFIELD - Airport Pavement Design (V 1.300, 1/22/09)

Section NewAC45dwg in Job 34299.
Working directory is C:\Program Files\FAA\FAARFIELD\

The structure is New Flexible. Asphalt CDF was not computed.
Design Life = 20 years.
A design for this section was completed on 01/19/10 at 14:31:28.

Pavement Structure Information by Layer, Top First

No.	Type	Thickness in	Modulus psi	Poisson's Ratio	Strength R,psi
1	P-401/ P-403 HMA Surface	4.00	200,000	0.35	0
2	P-209 Cr Ag	11.25	32,247	0.35	0
3	Subgrade	0.00	7,500	0.35	0

Total thickness to the top of the subgrade = 15.25 in

Airplane Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	Sngl Whl-3	3,000	14,295	1.10
2	SuperKingAir-B200	12,590	518	1.10
3	Sngl Whl-30	30,000	100	1.10
4	Dual Whl-45	45,000	100	1.10
5	Sngl Whl-20	19,000	100	1.10

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Sngl Whl-3	0.00	0.00	4.05
2	SuperKingAir-B200	0.00	0.00	2.52
3	Sngl Whl-30	0.01	0.14	2.86
4	Dual Whl-45	1.00	1.00	2.18
5	Sngl Whl-20	0.00	0.00	3.10

FAARFIELD - Airport Pavement Design (V 1.300, 1/22/09)

Section NewAC60dwg in Job 34299.
Working directory is C:\Program Files\FAA\FAARFIELD\

The structure is New Flexible.
Design Life = 20 years.
A design has not been completed for this section.

Pavement Structure Information by Layer, Top First

No.	Type	Thickness in	Modulus psi	Poisson's Ratio	Strength R,psi
1	P-401/ P-403 HMA Surface	4.00	200,000	0.35	0
2	P-209 Cr Ag	14.20	35,969	0.35	0
3	Subgrade	0.00	7,500	0.35	0

Total thickness to the top of the subgrade = 18.20 in

Airplane Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	Sngl Whl-3	3,000	14,295	1.10
2	SuperKingAir-B200	12,590	518	1.10
3	Sngl Whl-30	30,000	100	1.10
4	Dual Whl-45	45,000	100	1.10
5	Dual Whl-60	60,000	100	1.10
6	Sngl Whl-20	19,000	100	1.10

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Sngl Whl-3	0.00	0.00	3.53
2	SuperKingAir-B200	0.00	0.00	2.33
3	Sngl Whl-30	0.00	0.00	2.61
4	Dual Whl-45	0.14	0.14	2.04
5	Dual Whl-60	0.86	0.86	1.93
6	Sngl Whl-20	0.00	0.00	2.80

FAARFIELD - Airport Pavement Design (V 1.300, 1/22/09)

Section NewAC12500 in Job 34299.
Working directory is C:\Program Files\FAA\FAARFIELD\

The structure is New Flexible. Asphalt CDF was not computed.
Design Life = 20 years.
A design for this section was completed on 01/19/10 at 09:50:51.

Pavement Structure Information by Layer, Top First

No.	Type	Thickness in	Modulus psi	Poisson's Ratio	Strength R,psi
1	P-401/ P-403 HMA Surface	2.50	200,000	0.35	0
2	P-209 Cr Ag	5.38	20,554	0.35	0
3	Subgrade	0.00	7,500	0.35	0

Total thickness to the top of the subgrade = 7.88 in

Airplane Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	Sngl Whl-3	3,000	14,295	1.10
2	SuperKingAir-B200	12,590	518	1.10

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Sngl Whl-3	0.00	0.00	6.52
2	SuperKingAir-B200	1.00	1.00	3.23

APPENDIX 3

Grants Pass Airport - Runway 12-30 Rehabilitation
Preliminary Engineering Quantity/Cost Opinion - 2.0" 12.5k SWG

By: PJM
Date: 1/28/2009
Proj. No.: 34299

Item No.	Item Description	Est. Total Qty.	Units	Price	Estimated Cost	Revised Estimate Est. Qty.	Revised Estimate Estimated Cost
0001	Mobilization/Demobilization	1	LS	$ 119,917.60	$ 119,917.60	1	$ 84,567.60
0002	Temporary Flagging, Signing and Marking	1	LS	$ 15,000.00	$ 15,000.00	1	$ 15,000.00
0003	Construction Staking	1	LS	$ 46,122.15	$ 46,122.15	1	$ 46,122.15
0004	Cold Planing (0-3 inches)	35410	SY	$ 1.00	$ 35,410.00	35410	$ 35,410.00
0005	Erosion Control	1	LS	$ 3,000.00	$ 3,000.00	1	$ 3,000.00
0006	Bituminous Leveling Course	1031	TON	$ 85.00	$ 87,656.25	1031	$ 87,656.25
0007	Bituminous Surface Course	4746	TON	$ 85.00	$ 403,417.97	4746	$ 403,417.97
0008	Pavement Marking - White	17020	SF	$ 1.00	$ 17,020.00	17020	$ 17,020.00
0009	Pavement Marking - Yellow	1000	SF	$ 1.00	$ 1,000.00	1000	$ 1,000.00
00010	Construct Edge Drain	8000	LF	$ 16.00	$ 128,000.00	8000	$ 128,000.00
00011	Seeding	9	ACRE	$ 2,500.00	$ 22,382.92	9	$ 22,382.92
00012	Shoulder Restoration	5778	CY	$ 15.00	$ 86,666.67	5778	$ 86,666.67
E-1	#8 AWG USE, Copper 5KV Cable, Unshielded	10500	LF	$ 4.50	$ 47,250.00	0	$ -
E-2	#6 AWG, Bare Copper Ground	10500	LF	$ 4.50	$ 47,250.00	0	$ -
E-3	PAPI INSTALLATION	1	EA	$ 30,000.00	$ 30,000.00	0	$ -
E-4	(1) 2-Inch Sch. 40 Direct Burial PVC Conduit	9500	LF	$ 12.00	$ 114,000.00	0	$ -
E-5	Runway Edge Light	38	EA	$ 900.00	$ 34,200.00	0	$ -
E-6	Runway Threshold Light -	12	EA	$ 900.00	$ 10,800.00	0	$ -
E-7	Electrical Regulator	1	EA	$ 20,000.00	$ 20,000.00	0	$ -
E-8	Miscellaneous Electrical Vault Work	1	LS	$ 50,000.00	$ 50,000.00	0	$ -
							$ 845,675.96
	Bid Schedule Sub-Total				**$ 1,319,093.55**		**$ 930,243.55**
	Preliminary Estimate Contingency @ 25%				$ 329,773.39		$ 232,560.89
	Base Bid Schedule Total				**$ 1,648,866.94**		**$ 1,162,804.44**

File: P:\Josephine County\034299\Design\Cost Estimates\[032685-COST-const estimate_1-28-10-pjm-2.5inches.xls]Summary

Electrical Additive Alternate	$ 353,500.00
Additive Mobilization	$ 35,350.00
Additive Estimate Contingency	$ 97,212.50
Additive Alternate Total	**$ 486,062.50**

Grants Pass Airport - Runway 12-30 Rehabilitation
Preliminary Engineering Quantity/Cost Opinion - 3.0" 19K SWG

By: PJM (Checked by RMK on 5/14/09)
Date: 1/28/2010
Proj. No.: 34299

Item No.	Item Description	Est. Total Qty.	Units	Price	Estimated Cost	Revised Estimate Est. Qty.	Revised Estimate Estimated Cost
0001	Mobilization/Demobilization	1	LS	$ 138,797.61	$ 138,797.61	1	$ 94,058.72
0002	Temporary Flagging, Signing and Marking	1	LS	$ 15,000.00	$ 15,000.00	1	$ 15,000.00
0003	Construction Staking	1	LS	$ 53,383.70	$ 53,383.70	1	$ 53,383.70
0004	Surface Grind w/ minor Cold Planing (0-0.5 inches)	35410	SY	$ 1.00	$ 35,410.00	35410	$ 35,410.00
0005	Erosion Control	1	LS	$ 3,000.00	$ 3,000.00	1	$ 3,000.00
0006	Bituminous Leveling Course	1031	TON	$ 85.00	$ 87,656.25	1031	$ 87,656.25
0007	Bituminous Surface Course	6797	TON	$ 85.00	$ 577,734.38	6797	$ 577,734.38
0008	Pavement Marking - White	17020	SF	$ 1.00	$ 17,020.00	17020	$ 17,020.00
0009	Pavement Marking - Yellow	1000	SF	$ 1.00	$ 1,000.00	1000	$ 1,000.00
00010	Construct Edge Drain	8000	LF	$ 16.00	$ 128,000.00	8000	$ 128,000.00
00011	Seeding	9	ACRE	$ 2,500.00	$ 22,382.92	9	$ 22,382.92
00012	Shoulder Restoration	7222	CY	$ 13.00	$ 93,888.89	7222	$ 93,888.89
E-1	#8 AWG USE, Copper 5KV Cable, Unshielded	10500	LF	$ 4.50	$ 47,250.00	0	$ -
E-2	#6 AWG, Bare Copper Ground	10500	LF	$ 4.50	$ 47,250.00	0	$ -
E-3	PAPI INSTALLATION	1	EA	$ 30,000.00	$ 30,000.00	0	$ -
E-4	(1) 2-Inch Sch. 40 Direct Burial PVC Conduit	9500	LF	$ 12.00	$ 114,000.00	0	$ -
E-5	Runway Edge Light	38	EA	$ 900.00	$ 34,200.00	0	$ -
E-6	Runway Threshold Light -	12	EA	$ 900.00	$ 10,800.00	0	$ -
E-7	Electrical Regulator	1	EA	$ 20,000.00	$ 20,000.00	0	$ -
E-8	Miscellaneous Electrical Vault Work	1	LS	$ 50,000.00	$ 50,000.00	0	$ -
							$ 940,587.24
	Bid Schedule Sub-Total				**$ 1,526,773.74**		**$ 1,034,645.97**
	Preliminary Estimate Contingency @ 25%				$ 381,693.44		$ 258,661.49
	Base Bid Schedule Total				**$ 1,908,467.18**		**$ 1,293,307.46**

Electrical Additive Alternate	$ 353,500.00
Additive Mobilization	$ 35,350.00
Additive Estimate Contingency	$ 97,212.50
Additive Alternate Total	**$ 486,062.50**

File: P:\Josephine County\034299\Design\Cost Estimates\[032685-COST-const estimate_1-28-10-pjm-3.5inches.xls]Summary