The City of Lago Vista

To provide and maintain a healthy, safe, vibrant community, ensuring quality of life.

NOTICE OF A MEETING
AIRPORT ADVISORY BOARD
THURSDAY, April 2, 2015 2:00 PM
CITY COUNCIL CHAMBERS
CITY HALL - 5803 THUNDERBIRD

NOTICE IS HEREBY GIVEN that the Airport Advisory Board of the City of Lago Vista, Texas will hold a special meeting in the Council Chambers, City Municipal Building, 5803 Thunderbird, on the above date and time for discussion and possible action on the following:

STAFF UPDATE

1. Discussion and Questions concerning Airport Improvements.

IT IS HEREBY CERTIFIED that the above Notice was posted on the Bulletin Board located in City Hall in said City at 11:25 AM on the 30th day of March, 2015.

Belinda Kneblick, Assistant City Secretary

THE CITY OF LAGO VISTA IS COMMITTED TO COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT. REASONABLE MODIFICATIONS AND EQUAL ACCESS TO COMMUNICATIONS WILL BE PROVIDED UPON REQUEST.

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MEMO

To: Airport Advisory Board

From: David Harrell, AICP, Director

RE: Staff Update Item #1

The engineering consultant and potentially a member of TXDOT Aviation will be present to answer questions and discuss the future timeframes with the Airport Taxiway-Runway Improvements. Staff is reattaching the Final Engineering Report shown at the March Airport Advisory Board Meeting for reference purposes only, nothing in the report has changed from the last meeting date.

RUSTY ALLEN AIRPORT

LAGO VISTA, TEXAS

2015 Pavement Improvements

TxDOT CSJ No. 1314LAGOV
OE Job No. 847.001AB
OSA Job No. 3944.002

MARCH 2015

FINAL ENGINEERING REPORT

STRAND ASSOCIATES®

STATE OF TEXAS
JASON SCOTT REIMER
118651
LICENSED
PROFESSIONAL ENGINEER

3/11/15

Prepared by:
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203 South Jackson Street
Brenham, Texas 77833
TBPE No. F-8405

TABLE OF CONTENTS

I. PROJECT SCOPE 1
II. EXISTING CONDITIONS/AIRPORT HISTORY 1
III. RECOMMENDATIONS FOR IMPROVEMENTS 2
- A. REHABILITATE AND MARK RUNWAY 16-34 2
- B. REHABILITATE AND MARK TAXIWAYS & APRONS 3
- C. RECONSTRUCT SOUTHWEST HANGAR ACCESS TAXIWAY 4
- D. WIDEN NORTHEAST TAXIWAY RADIUS 7
- E. REPLACE EXISTING WIND CONE WITH NEW LIGHTED WIND CONE 7
- F. RUNWAY/EAST PARALLEL TAXIWAY INTERSECTION PAVEMENT REPAIR 7
- G. WEST PARALLEL TAXIWAY PAVEMENT REPAIR 8
- H. RUNWAY CLOSURE DURING CONSTRUCTION 9
- I. CONSTRUCTION SEQUENCING 9

IV. PROJECT SEQUENCING 10
V. LAND OWNERSHIP 10
VI. OPINION OF PROBABLE COSTS 10

LIST OF FIGURES

FIGURE 1 – EXISTING RW PAVEMENT CONDITIONS 2
FIGURE 2 – CRACK SEAL DETAIL 3
FIGURE 3 – EXISTING TW PAVEMENT CONDITIONS 4
FIGURE 4 – EXISTING APRON PAVEMENT CONDITIONS 4
FIGURE 5 – EXISTING SOUTHWEST HAT PAVEMENT CONDITIONS 5
FIGURE 6 – EXISTING SOUTHWEST HAT PAVEMENT CONDITIONS 5
FIGURE 7 – PROPOSED SOUTHWEST HAT TYPICAL SECTION 6
FIGURE 8 – RW/EAST PARALLEL TW INTERSECTION PAVEMENT REPAIR LOCATION 8
FIGURE 9 – WEST PARALLEL TW PAVEMENT REPAIR LOCATION 8

APPENDICES

APPENDIX A – FAA EMAIL ABOUT RW DESIGNATION CHANGE
APPENDIX B – GEOTECHNICAL REPORT
APPENDIX C – OPINION OF PROBABLE COSTS

EXHIBITS

EXHIBIT 1 – CURRENT AIRPORT LAYOUT DRAWING (ALD)
EXHIBIT 2 – OVERALL PAVEMENT IMPROVEMENTS
EXHIBIT 3 – SOUTHWEST HAT RECONSTRUCTION
EXHIBIT 4 – WIDEN NORTHEAST TW RADIUS & RW/EAST PARALLEL TW INTERSECTION REPAIR
EXHIBIT 5 – WIND CONE
EXHIBIT 6 – WEST PARALLEL TW REPAIR

RUSTY ALLEN AIRPORT

FINAL ENGINEERING REPORT

I. PROJECT SCOPE

Proposed pavement improvements at the Rusty Allen Airport are being funded using 2015 FY State and local funds for construction. Available funds total $540,000 consisting of $486,000 of State funding and $54,000 in local funds. This improvement project is being administered by the Aviation Division of the Texas Department of Transportation (TxDOT).

Major Base Bid work items include:

- Rehabilitate and mark runway 15-33;
- Rehabilitate and mark taxiways;
- Rehabilitate and mark aprons;
- Reconstruct southwest hangar access taxiway;
- Widen northeast taxiway radius; and
- Replace existing wind cone with new internally-lit LED wind cone.

Additive Alternate work items include:

- Concrete pavement in lieu of asphalt pavement;
- Repair runway/east parallel taxiway intersection with concrete; and
- Repair west parallel taxiway with concrete.

Additive Alternate work will be accomplished based upon funding availability.

II. EXISTING CONDITIONS/AIRPORT HISTORY

The airport is owned by the City of Lago Vista and located approximately 2 miles northeast of Lago Vista City Hall. The Airport Reference Point (ARP) is located at coordinates: 30° 29' 54.90" N and 97° 58'10.10" W. The airport elevation is 1230.4 feet.

The current Airport Layout Drawing (ALD) is included as Exhibit 1. Dated April 2010 and prepared by TxDOT Aviation Division, the ALD shows the existing and ultimate Airport Reference Code (ARC) as being B-I. The ALD lists the existing and ultimate pavement strength design for single-wheel gear load (SWL) aircraft as 12,500 lb.

The airport consists of one asphalt runway, RW 15-33, which is 3,808 feet long by 50 feet wide. RW 15-33 is in good condition with minor longitudinal cracking. GPS LNAV instrument approaches exist for RW 15 with 400-foot vertical and 1-mile horizontal visibility minimums. The runway magnetic orientation was recently calculated by the FAA, and it was determined that the runway designation will need to be changed to 16-34 (reference email included as Appendix A). Therefore, the runway designation striping and guide sign panels will be updated to 16-34 as

part of the runway rehabilitation. For the remainder of this report, the runway will be referred to as RW 16-34.

The airport has paved taxiways and apron areas that are in good condition with minor cracking, except for the southwest hangar access taxiway (HAT) which is in poor condition with major pavement failures.

III. RECOMMENDATIONS FOR IMPROVEMENTS

Airport improvements should conform to or exceed FAA criteria for ARC B-I. NPI runway marking standards are applicable and all airport markings should be in accordance with the current edition of FAA Advisory Circular (AC) 150/5340-1. Design standards should be in accordance with the current edition of FAA AC 150/5300-13A.

Standard state-funded contract documents, technical provisions, and item specifications will be used for construction of improvements. No local government or local authority requirements are expected to exceed those of either the FAA or TxDOT.

A. REHABILITATE AND MARK RUNWAY 16-34

Generally the RW 16-34 pavement is in good condition with distresses consisting of mild surface oxidation and minor cracking, as shown in the photo in Figure 1.

FIGURE 1 – EXISTING RW PAVEMENT CONDITIONS

For RW 16-34 rehabilitation, we recommend a pavement crack seal and P-631 coal tar emulsion surface seal. Prior to rehabilitation work, all pavement surfaces shall be thoroughly swept and shall be free of foreign object debris (FOD). Crack sealing shall be performed prior to application of P-631. Most of the cracks on the runway are of the smaller variety (¼-inch and smaller). These cracks will be sealed when applying the coal tar slurry seal. The larger cracks (greater than ¼-inch) will be routed, cleaned, and sealed using an asphalt crack sealer with squeegee applicator, as shown in Figure 2.

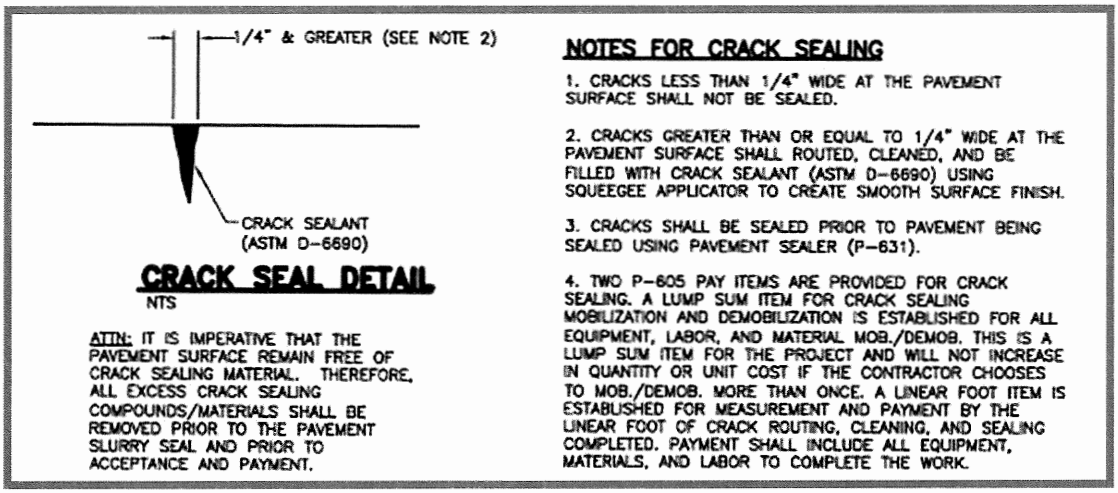

FIGURE 2 – CRACK SEAL DETAIL

Non-precision instrument (NPI) runway markings currently exist on RW 16-34. NPI markings include threshold, designation, and centerline markings as shown on Exhibit 2. Threshold markings will consist of four stripes per runway end. Designation markings are the runway end numerals located at the end of each threshold. Centerline markings will be 18 inches wide and 120 feet long with intervening 80-foot gaps.

All runway markings will include glass beads to provide increased visibility when illuminated by aircraft landing lights. Runway markings will consist of white paint applied in two separate opposing-direction passes, each at a pavement surface application rate of 100 square feet per gallon, for a total of 200 square feet per gallon. Retro-reflective glass beads will be mechanically added during the final pass at a rate of 7 pounds per gallon of paint.

B. REHABILITATE AND MARK TAXIWAYS & APRONS

Generally, taxiway and apron pavement surface conditions are similar to those of the runway, as shown in Figures 3 & 4 below. For the asphalt surfaces, we recommend sealing of cracks and resurfacing these areas with a P-631 seal. An area in front of the fueling area (approximately 150' x 50') shall receive an additional coat of coal tar sealer. This will provide extra protection from fuel and oil spills. Project specifications will require that hangars adjacent to pavement surfaces be covered to preclude coal tar splatter onto hangar walls.

All taxiway and apron markings are yellow in color and paint will be applied in a single pass at a surface application rate of 100 square feet per gallon. Glass beads will be added at an application rate of 7 pounds per gallon of paint.

FIGURE 3 – EXISTING TW PAVEMENT CONDITIONS

FIGURE 4 – EXISTING APRON PAVEMENT CONDITIONS

C. RECONSTRUCT SOUTHWEST HANGAR ACCESS TAXIWAY

The southwest hangar access taxiway (HAT) pavement is in poor condition with distresses consisting of extremely rough surfaces and substantial cracking, as shown in Figures 5 & 6. Due to the extensive damage to the pavement surface, we recommend reconstruction of this HAT. Exhibit 3 shows the limits of the reconstruction and rehabilitation work to the southwest HAT.

FIGURE 5 – EXISTING SOUTHWEST HAT PAVEMENT CONDITIONS

FIGURE 6 – EXISTING SOUTHWEST HAT PAVEMENT CONDITIONS

We propose to reconstruct the pavement using existing HAT pavement materials. The proposed pavement structure consists of 4 inches of recycled existing materials (including asphalt, flexible base, and subgrade) and 2 inches of new TxDOT 247 crushed aggregate base, mixed thoroughly together. Cement (3% by weight) will be added to these recycled and mixed materials to produce a cement–stabilized base. This cement-stabilized base will be micro-cracked and topped with 2 inches of TxDOT 340 hot mix asphalt (HMA) having a ½-inch maximum aggregate.

Cement-treatment of the recycled and mixed materials will be in accordance with TxDOT 275. The cement and recycled materials will be thoroughly dry–mixed to a uniform consistency; the moisture content will be adjusted to within three percent of optimum; and the mixture will be compacted to at least 95 percent of maximum dry unit weight as determined by ASTM D698.

Compaction will be completed within 2 hours of the addition of water to a dry mix of materials and cement, or within 2 hours after the addition of cement to a wet mix of materials. After compaction, the contractor will: tight blade the surface and roll the clipped surface with a pneumatic roller to achieve a smooth surface.

The cement-treated subgrade will be moist-cured, plus two percent above optimum moisture, for at least 72 hours after completion of compaction. To minimize reflective cracking, the cement-treated material will be micro-cracked after the 72–hour cure period. A typical rolling operation will include 2 to 3 passes with a 12–ton double drum smooth street wheel roller on vibratory mode.

As part of the reconstruction process, we will design a smooth profile for the HAT. A smooth profile will improve taxiing conditions for pilots and improve drainage along the HAT. The typical section of the proposed HAT is shown in Figure 7.

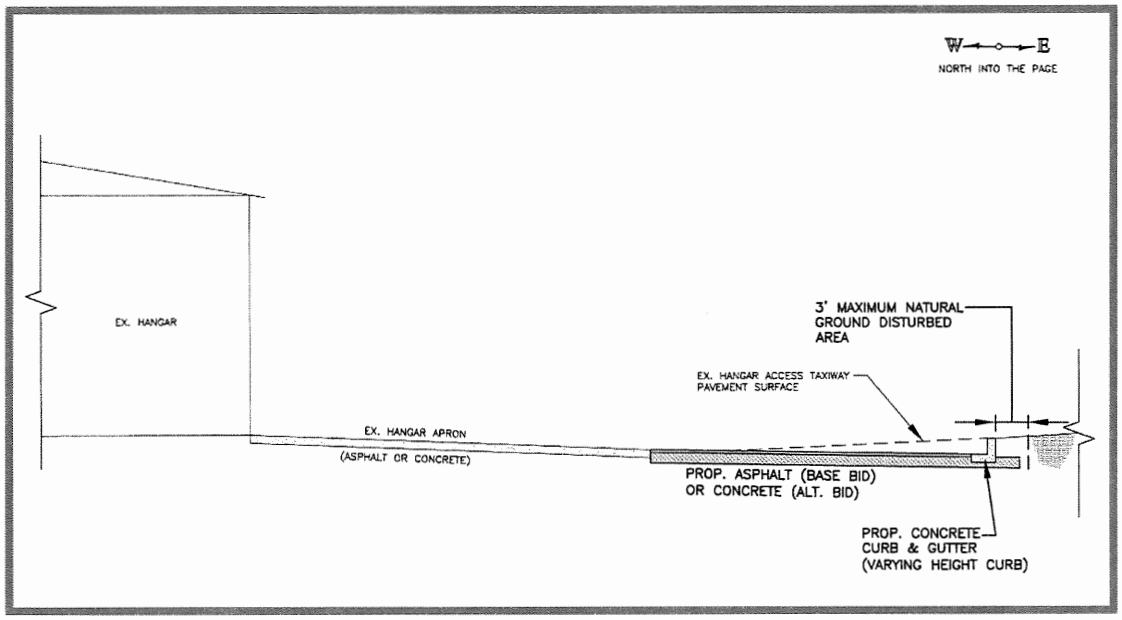

FIGURE 7 – PROPOSED SOUTHWEST HAT TYPICAL SECTION

The section includes a concrete curb and gutter with a varying height curb. This will reduce the amount of natural ground to be disturbed east of the HAT (3-foot maximum), and also improve drainage along the east side of the HAT. The curb and gutter will flow from north to south, discharge into an earthen swale south of the HAT, and flow southwesterly to the roadside ditch along Rawhide Trail.

After completion of the reconstruction work, we recommend a P-631 coal tar emulsion surface seal to provide extra protection to the new asphalt surface. HAT markings will include glass beads to provide increased visibility when illuminated by aircraft landing lights. HAT markings will consist of yellow paint applied in one pass, at a pavement surface application rate of 100 square feet per gallon. Retro-reflective glass beads will be mechanically added to the paint at a rate of 7 pounds per gallon of paint.

As an additive alternate, we will solicit bids for concrete pavement in lieu of asphalt pavement. The proposed concrete pavement section will consist of 6 inches of concrete over 4 inches of recycled and mixed existing materials. For the small quantities involved, as well as the distance and access road grades involved in hauling hot mix, concrete may be found to be less expensive than asphalt. Concrete also has the distinct advantage of requiring less future maintenance.

The geotechnical report that was completed for the project, including borings from the southwest HAT, is included as Appendix B.

D. WIDEN NORTHEAST TAXIWAY RADIUS

Near the runway midfield, where the east parallel taxiway turns west to intersect the runway, the taxiway width through the radius needs to be widened to prevent frequent aircraft traffic from leaving the pavement. We propose to correct this by widening the interior pavement edges by 5 feet, thus increasing the taxiway width through the radius, as shown on Exhibit 4. Widening the interior radius will require relocation of the guide sign farther away from the taxiway, also shown on Exhibit 4.

The widening will be accomplished using concrete due to the small quantity involved. The proposed concrete pavement section will consist of 6 inches of concrete over a minimum of 6 inches of compacted recycled and mixed existing materials. There will be excess materials from the reconstruction of the southwest HAT that can be used as base material under this concrete.

E. REPLACE EXISTING WIND CONE WITH NEW LIGHTED WIND CONE

The State and City desire to relocate and replace the midfield wind cone which provides wind data for RW 16-34 operations. Based on our studies of the airport property and general topography of the Airport, the current wind cone location was determined to be the best location until more land can be acquired to the west of the runway, as shown on Exhibit 5. To minimize installation and operational costs associated with the new wind cone, we recommend an internally–lighted LED wind cone, directly tied to the existing RW MIRL circuit. An LED wind cone consumes only slightly more power than a single SE–type threshold fixture. Being wired to the MIRL circuit, an LED wind cone significantly reduces costs associated with wiring and trenching as compared to traditional wind cones.

Most wind cones are hinged at, or near, their base. This allows for ease of future maintenance. It can be very difficult for a lone person to right such poles after maintenance if the unit is oriented such that the pole tilts away from the predominant wind direction. We will specify the unit be placed so that it tilts into the prevalent wind direction. In this way, the wind will usually work with the operator when righting the pole after maintenance operations are completed.

F. RUNWAY/EAST PARALLEL TAXIWAY INTERSECTION PAVEMENT REPAIR

During our field visits to the Airport, also near the runway midfield, we found that the intersection of the runway and east parallel taxiway has substantial cracking due to runoff flowing across the pavement, as shown in Figure 8. This has caused asphalt failures and increased FOD near the runway.

FIGURE 8 – RW/EAST PARALLEL TW INTERSECTION PAVEMENT REPAIR LOCATION

As an alternate to the project, we propose removing a 4-foot wide section of asphalt the entire length of the runway/taxiway intersection and replacing it with the previously mentioned concrete section.

G. WEST PARALLEL TAXIWAY PAVEMENT REPAIR

Also during our field visits to the Airport, we discovered an area along the west parallel TW, where substantial cracking is taking place due to surface runoff across the pavement, as shown in Figure 9. This has caused asphalt failures and increased FOD on the parallel taxiway.

FIGURE 9 – WEST PARALLEL TW PAVEMENT REPAIR LOCATION

As an alternate to the project, we propose removing a 10-foot wide section of asphalt the entire width of the west parallel TW, and replacing it with a concrete flume, as shown on Exhibit 6. The same concrete section that was previously mentioned will be used to construct these improvements. This will improve drainage and reduce the amount of FOD on the west parallel TW due to pavement failures.

H. RUNWAY CLOSURE DURING CONSTRUCTION

All project improvements will be designed to minimize aircraft operations impacts. However, construction activities within the Runway Obstacle Free Zone (ROFZ) will necessitate, per FAA construction safety requirements, that the runway be closed during all such activities. The ROFZ is defined as the area within 125 feet of the runway centerline or extended runway centerline, for the entire length of the runway plus 200 feet beyond each runway end.

Work items in this project that will require closing the runway during construction include rehabilitation of RW 16-34 and TWs that are within the ROFZ. A construction sequencing schedule is provided in the next section of this report.

I. CONSTRUCTION SEQUENCING

All project improvements will be designed with two primary construction sequence goals: maximization of airport operational safety and minimization of operational impacts. When these two goals conflict, safety will always take priority. Construction sequencing is planned as follows:

Phase I Construction Activities (RW 16-34 Open)

1) Reconstruct southwest HAT outside the RW 16-34 ROFZ.
2) Rehabilitate existing TWs and aprons outside the RW 16-34 ROFZ.

Phase II Construction Activities (RW 16-34 Closed)

1) Close RW 16-34.
2) Rehabilitate RW 16-34.
3) Rehabilitate/reconstruct TWs within the RW 16-34 ROFZ.
4) Open RW without markings for curing of the slurry seal.
5) Close RW and install striping for RW 16-34.
6) Install striping for taxiways within the RW 16-34 ROFZ.
7) Open RW 16-34.

Phase III Construction Activities (RW 16-34 Open)

1) Install striping for all remaining pavement surfaces outside the RW 16-34 ROFZ.

IV. PROJECT SEQUENCING

The following schedule is an approximate timeline for the project, from Final Engineering Report Phase to Complete Construction.

- Submitted Final Engineering Report (FER) – Mid March
- Final design documents submitted to the City and TxDOT – Mid March
- Project advertises for bidding – Mid July
- Bid Opening/Award – Mid August
- Construction Start – Early October
- Completion of Construction Phase – Early February 2016

V. LAND OWNERSHIP

According to the approved ALD, Lago Vista owns all the land at the Airport to accomplish all recommended construction improvements included in this engineering report.

VI. OPINION OF PROBABLE COSTS

Probable cost estimates were developed for the recommendations made in this report including construction costs, construction inspection, and construction testing. These costs are presented in Appendix C.

APPENDIX A

FAA EMAIL ABOUT RW DESIGNATION CHANGE

From: Mastello, Albert A (FAA)
Sent: Tuesday, August 26, 2014 10:45 AM
To: 'awalts99@hotmail.com'; 'dharrell@lago-vista.org'
Cc: 'Keith Snodgrass'; 'Greg Miller'; 'Michelle.Hannah@txdot.gov'; Inkman, Thomas (FAA); Southerland, Christopher L (FAA) (Christopher.L.Southerland@faa.gov); Childress, Catherine (FAA)
Subject: Lago Vista TX-Rusty Allen (RYW), TX Runway 15 Obstruction Data
Importance: High

David/Jim,

Attached is a 5 page PDF showing the obstruction issues affecting Rwy 15.

There are two issues: Obstacles that penetrate the (1) Glideslope Qualification Surface (GQS), and (2) the 20:1 visual surface. A clear GQS is required to permit any type of vertical guidance; a clear 20:1 is required to permit night landing. A GQS penetration MUST be removed or lowered. A 20:1 can be lighted or lowered although we prefer REMOVED.

In the package you will find:
Page 1 - 20:1 visual surface obstructions. Penetrations are identified by a positive number under the 20:1 Pent column. I also underlined them. I noted by use of a "dot" which ones are also GQS issues.
Page 2 – GQS penetrations. These are identified by a positive number under the GQS PEN column. The one listed a "vertical structure" is likely a pole.
Page 3 – TERPS graphic showing all the obstructions. The ones that penetrate the 20:1 are identified by a bolded dot.
Page 4 – TERPS graphic showing GQS penetrations. I have circled them as well as identified which is which and which ones affect both surfaces.
Page 5 – a Google Earth® graphic that shows just the obstructions previously identified as offending.

You should work with TXDOT on the removal/mitigation as well as the magnetic variation issue below. When the GQS issues are resolved then you can work through TXDOT to request reconsideration of the +V for the LP or request a WAAS LPV approach.

Additionally, the next time we do any work on your instrument procedures the airport magnetic variation will need to be updated as it exceeds 3° between the officially assigned and the current EPOCH year value. This will also runway renumbering from 15-33 to 16-34. The current assign variation is E7/1980. The current EPOCH Yr value is E4.25/2015. The difference is 3.75°.

Any questions, email or call me.

Thank you,

Al

Albert A Mastello
Senior Instrument Flight Procedures Specialist

FAA ATO Central Service Center
Operation Support Group AJV-C24
Flight Procedures Team
(817) 321-7619

Moving forward does not neccessarily constitute progress

APPENDIX B

GEOTECHNICAL REPORT

Rodriguez Engineering Laboratories

Construction Materials Engineering Testing

Geotechnical Investigation For
Rusty Allen Airport
"Hangar Access Taxiway Reconstruction"
TxDOT CSJ No. 1314LAGOV
Lago Vista, Texas

Submitted to:

Jason Reimer, P.E.
O'Malley Strand Engineers, Inc.
203 S. Jackson Street
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February 12, 2015

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Rodriguez Engineering Laboratories, LLC

Geotechnical Investigation For Rusty Allen Airport "Hangar Access Taxiway Reconstruction" TxDOT CSJ No. 1314LAGOV

Lago Vista, Texas

Submitted to:

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Submitted by:

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Austin, Texas 78728

February 12, 2015

STATE OF TEXAS
JOSE MELENDEZ
95430
LICENSED
PROFESSIONAL ENGINEER

Jose Melendez, P.E.

Isaac Molina, E.I.T.

Geotechnical Investigation for Brenham Municipal Airport "TxDOT CSJ No. 13HGBRENM" Brenham, Texas

Table of Contents

I. Introduction	1
II. Purpose of Study	1
III. Subsurface Investigation	1
IV. Laboratory Testing	2
V. Site and Subsurface Conditions	2
VI. Summary of Test Results	3
VII. Conclusions and Recommendations	6
VIII. Design Considerations	6
IX. Site Preparation	7
X. Foundation Construction Guidelines	7
XI. Excavation Considerations	9
XII. Limitations	10
XIII. Appendices	
1. Appendix A	
Bore Log Data	A-1
2. Appendix B	
Potential Vertical Rise Results	B-1
3. Appendix C	
University of Texas, Bureau of Economic Geology Map	C-1
Map of Borehole Locations	C-2

Geotechnical Investigation for
Rusty Allen Airport
"Hangar Access Taxiway Reconstruction"
TxDOT CSJ No. 1314LAGOV
Lago Vista, Texas

INTRODUCTION

Rodriguez Engineering Laboratories was retained by O'Malley Strand Associates, Inc. to perform a geotechnical investigation at Rusty Allen Airport located in Lago Vista, Texas.

PURPOSE OF STUDY

The purpose of this investigation is to determine the engineering properties of the in-situ subsurface soils for proposed reconstruction of the hangar access taxiway at the Rusty Allen Airport. The scope of work for the field geotechnical investigation includes drilling boreholes, excavating test pits, and collecting representative soil and base samples to perform the appropriate laboratory tests. The objective is to submit a summary of the laboratory test results and provide flexible pavement section recommendations for the given aircraft design information. The results of this geotechnical investigation are summarized in this report.

SUBSURFACE INVESTIGATIONS

The subsurface investigation was performed under the supervision of Jose Melendez, P.E. The drilling and field inspection was performed by Tim Sutherland. Two borings were drilled to a depth of five feet below existing grade and two test pits were excavated down to the subgrade material in locations approved by O'Malley Strand Associates, Inc. The boring depths were initiated from existing elevation at the specified locations noted in Appendix C. Appendix A contains information of each borehole along with the laboratory test results for Moisture Content, Atterberg Limits, Sieve Analysis and Unified Soil Classification. The borings were drilled with a Giddings trailer mounted drill rig with a six (6) inch diameter flight auger at the selected locations. The test pits were excavated using a saw and jackhammer.

LABORATORY TESTING

The soil samples obtained during the exploration were sealed at the site and transported to the laboratory. A testing program was conducted on the sealed samples to aid in classification and evaluation of the engineering properties required for analysis. The laboratory tests were performed by experienced laboratory technicians and monitored by the geotechnical engineer. The parameters were determined by the following laboratory tests:

- Potential volumetric shrinkage characteristics of the cohesive soils were determined by the Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D 4318).
- Material gradation for soil classification was determined by the Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) (ASTM D 2487).
- Material moisture content was determined by the Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass (ASTM D 2216).
- Field description of the material was determined by the Practice for Description and Identification of Soils (Visual-Manual Procedure) (ASTM D 2488).

The data can be found in Appendix A.

- The Moisture-Density relationship of the subgrade soils was determined by the standard test method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3(600 kN-m/m^3)) (ASTM D 698).
- An index of strength and deflection characteristics of the natural subgrade soils was determined by performing the Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils (ASTM D 1883).

The data can be found in Appendix B.

- The Soluble Sulfate Content was determined for the purpose of insuring that these would not be any potential adverse sulfate-lime reaction in the event lime stabilization is recommended by Standard Test Method for Sulfate Content in Soils Colorimetric Method (Tex-145-E).

The data can be found on the CBR and table of this report.

SITE AND SUBSURFACE CONDITIONS

Site Conditions

The Rusty Allen Airport is located approximately 2.3 nautical miles northeast of downtown in Lago Vista, Texas. The topography of the area is relatively flat.

The Geologic Atlas of Texas (Austin Sheet) published by the Bureau of Economic Geology at the University of Texas at Austin indicates that the general geology of the area is Cretaceous with Edwards Limestone (Ked) from the Lower Cretaceous Period, which is part of the Fredericksburg Group undivided (Kfr). Edwards Limestone includes limestone, dolomite and chert. The limestone is aphanitic to find grained, massive to thin bedded, hard and brittle. The dolomite is fine to very fine grained, porous, and medium gray to grayish brown in color. Nodules and plates are common in the chert. The amount varies, and is white to light gray in color. The thickness of Edwards Limestone ranges from 60 to 350 feet, and thins northward.

Appendix C includes an area map of the geological survey provided by the University of Texas at Austin Bureau of Economic Geology as well as a site map of the borehole locations.

Subsurface Conditions

Borings to depth were generally advanced with ease until limestone stratum was encountered; the material sampled varied from low to high plasticity clays. The particular subsurface stratigraphy, as determined by the exploration, is shown in detail in the boring logs.

Borings were terminated short of the desired depth due to encountering a hard limestone stratum. Limestone was encountered at Borings No. 1 and 2 at 4.5' and 3.5', respectively.

Groundwater was encountered at boring location B-1 at 4.5 feet on top of rock during drilling operations, possible perched water. However, the short-term field observations generally do not permit an accurate evaluation of the subsurface water levels. Any ground water elevation information provided is representative of conditions existing on the day and for the specific location where the information was taken. The actual groundwater elevation may fluctuate due to time, climatic conditions, and/or construction activities.

SUMMARY OF TEST RESULTS

The following is a summary of test results obtained from the field borings, test pits, and laboratory tests of the representative soil samples.

Subgrade Laboratory CBR Value

The laboratory compacted CBR value, based on a 95% maximum dry density (ASTM D-698) compaction level and a soaking period of 96 hours for the specified subgrade soil is as follows:

CBR No.	Sample Location	Laboratory Compacted – Soaked CBR	Maximum Dry Density (PCF)	Optimum Moisture (%)	Average Percent Swell Measured
1	Hangar Access Taxiway (TP1 & TP2)	6.8	114.6	15.2	0.3

The soil classification for the subgrade material used on the CBR test is as follows:

CBR No.	Soil Classification	Atterberg Limits		Moisture Content (%)	Material Passing (%)			Soluble Sulfate Content	
		LL	PI		#4	#40	#200	mg/Kg	%
1	Grayish Brown, Clayey Sand with Gravel (SC)	26	10	10.7	68.9	50.1	37.5	<100	<0.010

Laboratory Test Results of Existing Base from Test Pits

The following is a summary of the properties of the encountered base material:

Test Pit No.	Location	Existing Base Thickness (in)	Properties of Existing Base			
			Group Symbol	Soil Classification	LL	PI
1	Hangar Access Taxiway	3	SC	Crushed Limestone Base, Gray, Clayey Sand with Gravel	24	8
2	Hangar Access Taxiway	4	GM	Crushed Limestone Base, Reddish Brown, Silty Gravel with Sand	17	2

The actual gradation for the existing base material obtained from test pits are as follows:

Sieve Size	Actual Percent Retained			Percent Retained Requirements		
	Test Pit No. 1	Test Pit No. 2	Average of Test Pit No. 1 & 2	TxDOT Item 247, Grade 1	TxDOT Item 247, Grade 2	FAA Item P-209
2 ½"	0	0	0	——	0	——
2	0	0	0	——	——	0
1 ¾'	0	0	0	0	0 – 10	——
1 ½"	0	0	0	——	——	0 – 5
1	0.5 ③	11.8	6.2	——	——	5 – 30
7/8"	1.0 ①	16.1	8.6 ①	10 – 35	——	——
¾"	2.4 ③	22.0	12.2 ③	——	——	15 – 45
3/8"	17.3 ①	37.3	27.3 ①	30 – 50	——	——
# 4	29.2 ①②③	49.2	39.2 ①②③	45 – 65	40 – 75	40 – 70
# 30	51.8 ③	67.6 ③	59.7 ③	——	——	70 – 88
# 40	54.5 ①②	70.1	62.3 ①	70 – 85	60 – 85	——
# 200	67.1 ③	79.7 ③	73.4 ③	——	——	92 – 100

① Does not meet specifications for Flexible Base, TxDOT Item 247, Grade 1.

② Does not meet specifications for Flexible Base, TxDOT Item 247, Grade 2.

③ Does not meet gradation specifications for Crushed Aggregate Base, FAA Item P-209.

Summary of Soil Parameters

The following is a summary of test results for soil samples from the borings.

Boring No.	Depth (ft)	Soil Classification	Moisture Content (%)	Atterberg Limits		Sieve Analysis Percent Passing		
				LL	PI	#4	#40	# 200
1	0" - 1 ½"	1.5" HMAC Pavement	—	—	—	—	—	—
	1½"-7¾"	6.25" Crushed Limestone BASE. Reddish Brown, Clayey Gravel with Sand (GC)	9.3	26	9	58.7	37.6	27.2
	7¾"- 2.5	Reddish Brown, Clayey Sand (SC)	20.7	26	9	95.0	69.8	47.5
	2.5 - 4.5	Light Brown, Lean Clay with Sand (CL)	30.5	26	9	99.5	82.0	71.0
2	0" - 1 ¼"	1.25" HMAC Pavement	—	—	—	—	—	—
	1¼"-5¼"	4" Crushed Limestone BASE. Brown, Clayey Gravel with Sand (GC)	11.0	28	11	63.6	43.2	32.1
	5¼"- 2.0	Dark Brown, Sandy Fat Clay (CH)	33.2	72	47	93.9	77.4	66.3
	2.0 - 3.5	Dark Brown, Fat Clay with Sand (CH)	33.3	70	48	94.8	82.3	72.7

Cement Treated Base/RAP Strength Results

Existing base material (Combination of Test Pit No. 1 and 2) was separated by size and HMAC material was crushed to obtain Recovered Asphalt Pavement (RAP) with a maximum size of 1-3/4". Resulted material was recombined (70% Base and 30% RAP) and mixed with cement according with Test Method Tex-120-E. Moisture-density relationship using Tex-113-E was performed on the mixed material with 5% cement (based on the dry mass of the Base/RAP material). After obtaining the optimum moisture content for the material with 5% cement, three specimens were molded. The moisture content for the samples that were prepared with 3%, 7%, and 9% cement were adjusted based on experience. After a curing period of seven days, the compressive strength of the compacted specimens was determined by Tex-120-E.

The average strength results for the compacted Base/RAP-cement laboratory mixed material, based on compressive strength test are as follows:

Strength Results for 70% BASE & 30% RAP Material				
% Cement	Approximate Molding Moisture (%)	Averaged Unconfined Compressive Strength (psi)	Maximum Dry Density (pcf)	Optimum Moisture (%)
3	9.0	307	——	——
5	9.5	447	122.5	9.5
7	10.0	553	——	——
9	10.5	710	——	——

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based upon the data obtained from the borings and laboratory testing of the soil samples, the project information provided to us by O'Malley Strand Associates, Inc. and experience with similar soils and site conditions.

Pavement Design Parameters

The FAA's Airport Pavement Design and Evaluation (FAA Advisory Circular 150/5320-6E) and the FAARFIELD software has been used as basis for our recommendations along with the CBR Values and the following aircraft information provided by O'Malley Strand Associates, Inc. The annual departures and type of aircrafts notably influence the section thickness. A new pavement analysis should be performed if modifications are made to the design parameters shown below.

Aircraft Type	Gear Type	Gross Weight (lbs)	Annual Departures	% Annual Growth
GA Sngl Whl-12.5	Single	12,500	832	0
GA Sngl Whl-5	Single	5,000	1,200	0

The Foundation Modulus of the Subgrade (K Value) and Resilient Modulus of the Subgrade (E_{SG} Value) were obtained using a CBR Value of 6.8 and the following correlation shown in the FAA Advisory Circular 150/5320-6E.

$K = [(1500 * CBR) / 26]^{0.7788}$

$E_{SG} = 26 * K^{(1.284)}$

- Design CBR value: 6.8
- Design K value: 104.7 pci
- E_{SG} = Resilient Modulus of the Subgrade = 10,200 psi

Pavement Section Recommendations

The HMAC pavement section for the T-Hangar Access Taxiway using the provided aircraft mix should consist of 2" HMAC on 7.27" of Crushed Aggregate Base (Appendix D-1), or 2" HMAC on 4" of Soil Cement Base (Appendix D-2). However, the following options may be utilized:

New Section	Recycled Section
2" FAA Item P-401 HMAC Pavement	2" FAA Item P-401 HMAC Pavement
7.5" FAA Item P-209 Crushed Aggregate Base	6" TxDOT Item 275 Cement Treated Recycled Pavement (3% Cement)
6" FAA Item P-152 Compacted Subgrade or *"If required"* 8"FAA Item P-155 Lime Treated Subgrade	6" FAA Item P-152 Compacted Subgrade or *"if required"* 8"FAA Item P-155 Lime Treated Subgrade

The recommended pavement sections were based on the laboratory and engineering analysis of the soil samples taken. If any subsurface conditions other than those described here are encountered, Rodriguez Engineering Laboratories should be immediately notified so that further investigations and supplemental recommendations can be provided.

The recommended pavement sections do not take the Potential Vertical Rise (PVR) into consideration; if PVR is desired as part of the design parameters, the geotechnical investigation will need to be expanded. Deeper borings and additional testing will be required to determine the PVR value. The above pavement sections are based on percent swell calculations using ASTM D-1883 method.

General Pavement Recommendations

Areas containing unsuitable materials (with vegetable or organic matter) should be removed to avoid differential settlements due to decomposition of these materials. Unsuitable materials shall be disposed to authorized areas or if approved, used for embankment slope to support vegetation.

If embankment is utilized for lower areas, it should comply with the requirements of FAA Item P-152. Embankment material should consist of non-expansive, well-graded soil with sufficient binder material for compaction purposes. Compact the material to a minimum of 95% of Standard Proctor Density ASTM D698 and the moisture content of the material during placement shall be within ±2% of the optimum moisture content. For non-cohesive material, the top 6" of the embankment under pavement should be compacted to 100% maximum density. The material should be placed in successive horizontal layers of 8 inches or less (measured un-compacted) for the entire width of the cross section.

Compaction of side slopes should be parallel to the long direction of the side slopes. Pieces larger than 4 inches will not be allowed on the upper 6 inch course. Embankment should extend at least 5 feet from the pavement edge. Subgrade preparation shall comply with the requirements of FAA Item P-152. Compact non-cohesive material to 100% or cohesive material to 95% of Standard Proctor Density ASTM D698 and the moisture content of the material during placement shall be within ±2% of the optimum moisture content.

Subgrade material having plasticity index exceeding 20 should be stabilized with lime slurry at eight (8) inch minimum-compacted thickness.

Subgrade samples containing clay were analyzed for Sulfate Content, which was found to be less than 0.02 percent by weight of dry soil. This is well below the 0.2 percent indicated by Dallas N. Little* as the level at or above which expansion problems may occur with lime, so this should not be a concern. Although the sulfate content during our investigation was relatively low, the soil should be periodically analyzed for sulfate content during construction. If it is determined that the sulfate content of the soil is higher than what was determined during the geotechnical investigation, REL should be notified in order to re-evaluate the changed conditions.

If lime is used to stabilize the subgrade, it shall comply with the requirements of FAA Item P-155 (slurry-lime). Compact the material to a minimum of 95% of Standard Proctor Density (ASTM D-698) and the moisture content of the mixture at the start of the compaction shall not be below nor more than 2% of the optimum moisture. Lime-treated subgrade should extend at least 5 feet from the pavement edge.

If Crushed aggregate base is used, it shall comply with the requirements of FAA Item P-209. Compact the material to a minimum of 100% of the maximum dry density as determined by the Standard Proctor Density ASTM D-698 and the moisture content of the material during placement shall not be below or 1½ percentage points above the optimum moisture content. Although the use of TxDOT Item 247 Flexible Base material is permitted for aircrafts weighing 30,000 pounds or less, it has a tendency to more readily reflect cracks from the subgrade through the asphalt. Base material should extend at least 2 feet from the pavement edge. Topsoil should be placed over the base extension to protect base from excess water penetration and to prevent erosion.

If Flexible Base is used, it shall comply with the requirement of TxDOT Specification Item 247, Type A, Grade 2 or better. The base material during placing operations shall be moisture conditioned to not be below, nor more than 2% above, the optimum moisture content and compacted to a minimum of 100% of the maximum dry density as determined by Test Method Tex-113-E.

HMAC pavement shall comply with the requirements of FAA specification Item P-401 (Plant Mix Bituminous Pavements) with 3/4" maximum nominal size aggregate and 50-blow compaction. Mix complying with this specification has sufficient asphalt to better resist oxidation and age hardening to which pavements receiving intermittent traffic are susceptible.

If cement treated recycled Base/RAP is used, it should comply with the requirements of TxDOT Specification Item 275 "Cement Treatment Road Mixed". The percentage (based on the dry weight of the Base/RAP) of cement required for the recycled base/RAP samples obtained during our investigation was approximately 3%. The base material during placing operations shall be moisture conditioned to not below, nor more than 2% above, the optimum moisture content and compacted to a minimum of 98% of the maximum dry density as determined by Test Method Tex-120-E.

During construction, care should be taken to assure that the cement is added uniformly to the recycled base/RAP, and that the mixture is properly compacted and cured. The existing pavement should be milled in such manner as to uniformly mix the surface and/or existing base. The HMAC should be milled so that 100% passes the 2" sieve. Care should be taken to minimize base degradation during the recycling of the material.

It will be necessary to closely inspect the installation process to insure that no contamination from the subgrade occurs and to assure that the quality of the final product is achieved. At least 2" of the existing base should be left undisturbed to serve as a buffer so that the recycled base is not adversely affected by contamination with the subgrade. If additional base material is needed to complete the required cement treated base thickness, TxDOT Specification Item 247, Type A, Grade 2 or better shall be used.

Care should be taken to slope the site to prevent water ponding around or on the pavement structure during and after construction. Once completed, the ground surface should slope away from the pavement and have enough topsoil to grow vegetative cover to prevent erosion. It should be known that the extensive use of a vibratory roller, or heavy construction equipment, might wick the groundwater through the soil and into the pavement causing pumping during construction. If this problem arises, use of the vibratory roller, or heavy construction equipment, may need to be limited and the conditions may need to be evaluated.

It was also determined that the topsoil encountered during our investigation can be excavated using conventional earth moving equipment (ripper, trencher, backhoe). However, if bedrock is encountered, rock hammers or possibly blasting may be required. Due to the close proximity of limestone to the surface, the pavement section may need to be altered during construction to accommodate an outcrop of the limestone.

* *Handbook for Stabilization of Pavement Subgrades and Base Courses with Lime, by Dallas N. Little, Kendall / Hunt Publishing Co., 1995. Pp. 51 & 52*

LIMITATIONS

This investigation was performed in accordance with accepted geotechnical engineering practices for the exclusive use of O'Malley Strand Associates, Inc. in the preparation of the pavement designs, construction, drawings, and specifications for the proposed improvements at the Rusty Allen Airport. Verification of subsurface conditions for purposes of determining difficulty of excavation, dewatering, trafficability, etc., is the responsibility of others specializing in those areas. Our geotechnical scope of work for this site did not include an environmental assessment or chemical testing and analysis of the property's air, water, and subsurface soils. This report is not intended for use in determining construction means and methods and may therefore be misleading if used for that purpose. In the event that any changes in the nature, design or locations of the structure are made from those assumed herein, the conditions and recommendations contained in this report shall not be considered valid until the changes are reviewed and the conclusions are verified in writing.

Appendix A:

Bore Log
Data

Rodriguez Engineering Laboratories

Bore Log Data
Boring No. 1

Project: Rusty Allen Airport
Location: Hangar Access Taxiway (30°29'40.9"N, 97°58'6.0"W)
Date Drilled: 1/8/2015

Boring Depth: 5 ft.
Water Level: 4.5 ft.
Drilling Method: A = Auger

Depth (ft)	Soil Symbol	Sample No.	Laboratory Classification: Material Description	Laboratory Classification: Group Symbol	Drilling Method	Moisture Content (%)	Atterberg Limits: LL	Atterberg Limits: PI	Sieve Analysis, Percent Passing: 3"	7/8"	3/4"	3/8"	No.4	No.10	No.40	No.200	Depth (ft)
		NS	1-1/2" HMAC Pavement		A												
0.5		1-1	6-1/4" Crushed Limestone BASE. Reddish Brown, Clayey GRAVEL with Sand	GC	A	9.3	26	9	100.0	100.0	96.3	76.8	58.7	47.6	37.6	27.2	0.5
1.0, 1.5, 2.0, 2.5		1-2	Reddish Brown, Clayey SAND	SC	A	20.7	26	9	100.0	100.0	100.0	98.2	95.0	88.6	69.8	47.5	1.0, 1.5, 2.0, 2.5
3.0, 3.5, 4.0, 4.5		1-3	Light Brown, Lean CLAY with Sand	CL	A	30.5	26	9	100.0	100.0	100.0	100.0	99.5	96.6	82.0	71.0	3.0, 3.5, 4.0, 4.5
4.5		▼	Water encountered on top of Limestone														
5.0		NS	Limestone		A												

Boring terminated at 5 ft. Groundwater was encountered at 4.5 ft.

Rodriguez Engineering Laboratories

Bore Log Data
Boring No. 2

Project: Rusty Allen Airport
Location: Hangar Access Taxiway (30°29'38.0"N, 97°58'5.0"W)
Date Drilled: 1/8/2015

Boring Depth: 4 ft.
Water Level: N / A
Drilling Method: A = Auger

Depth (ft)	Soil Symbol	Sample No.	Laboratory Classification: Material Description	Laboratory Classification: Group Symbol	Drilling Method	Moisture Content (%)	Atterberg Limits: LL	Atterberg Limits: PI	Sieve Analysis, Percent Passing: 3"	7/8"	3/4"	3/8"	No.4	No.10	No.40	No.200	Depth (ft)
		NS	1-1/4" HMAC Pavement		A												
		2-1	4" Crushed Limestone BASE. Brown, Clayey GRAVEL with Sand	GC	A	11.0	28	11	100.0	100.0	100.0	80.6	63.6	54.4	43.2	32.1	
0.5		2-2	Dark Brown, Sandy Fat CLAY	CH	33.2	33.2	72	47	100.0	100.0	100.0	97.0	93.9	88.4	77.4	66.3	0.5
1.0																	1.0
1.5																	1.5
2.0																	2.0
		2-3	Dark Brown, Fat CLAY with Sand	CH	A	33.3	70	48	100.0	100.0	100.0	97.3	94.8	91.1	82.3	72.7	
2.5																	2.5
3.0																	3.0
3.5																	3.5
		NS	Limestone		A												
4.0																	4.0
																	4.5
																	5.0

Boring terminated at 4 ft. due to auger refusal. No groundwater was encountered.

Rodriguez Engineering Laboratories

Test Pit Log Data
Test Pit No. 1

Project: Rusty Allen Airport
Location: Hangar Access Taxiway (30°29'39.9"N, 97°58'5.7"W)
Date Drilled: 1/8/2015

Test Pit Depth: 9 in.
Water Level: N / A
Drilling Method: E=Excavation

Depth (ft)	Soil Symbol	Sample No.	Laboratory Classification: Material Description	Laboratory Classification: Group Symbol	Drilling Method	Moisture Content (%)	Atterberg Limits: LL	Atterberg Limits: PI	Sieve Analysis, Percent Passing: 3"	7/8"	3/4"	3/8"	No.4	No.10	No.40	No.200	Depth (ft)
		NS	1.3" HMAC Pavement		E												
		TP1-1	3" Crushed Limestone BASE. Gray, Clayey SAND with Gravel	SC	E		24	8	10.0	99.0	97.6	82.7	70.8	60.2	45.5	32.9	
0.5		TP1-2	Grayish Brown, Clayey SAND with Gravel	SC	E												0.5
1.0																	1.0

Boring terminated at 9 in. No groundwater was encountered.

Rodriguez Engineering Laboratories

Test Pit Log Data
Test Pit No. 2

Project: Rusty Allen Airport
Location: Hangar Access Taxiway (30°29'36.4"N, 97°58'4.2"W)
Date Drilled: 1/8/2015

Test Pit Depth: 11 in.
Water Level: N / A
Drilling Method: E=Excavation

Depth (ft)	Soil Symbol	Sample No.	Laboratory Classification: Material Description	Laboratory Classification: Group Symbol	Drilling Method	Moisture Content (%)	Atterberg Limits: LL	Atterberg Limits: PI	Sieve Analysis, Percent Passing: 3"	7/8"	3/4"	3/8"	No.4	No.10	No.40	No.200	Depth (ft)
		NS	2.0 HMAC Pavement		E												
0.5		TP2-1	4" Crushed Limestone BASE. Reddish Brown, Silty GRAVEL with Sand	GM	E		17	2	100.0	83.9	78.0	62.7	50.8	41.1	29.9	20.3	0.5
1.0		TP2-2	Grayish Brown, Clayey SAND with Gravel	SC	E												1.0

Boring terminated at 11 in. No groundwater was encountered.

LEGEND OF TERMINOLOGY

GRAVELS More than half of Coarse fraction is LARGER than No. 4 Sieve	**Clean Gravels** Little or no Fines	**GW**	Well-Graded, gravel-sand mixtures, mixtures, little or no fines
		GP	Poorly-Graded gravels, gravel-sand mixtures, little or no fines
	Gravels with Fines Appreciable Amount of fines	**GM**	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay Mixtures
SANDS More than half of Coarse fraction is SMALLER than No. 4 Sieve	**Clean Sands** Little or no Fines	**SW**	Well-Graded sands, gravely sands, little or no fines
		SP	Poorly-Graded sands, gravely sands little or no fines
	Sands with Fines Appreciable Amount of fines	**SM**	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
SILTS and CLAYS Liquid Limit LESS than 50		**ML**	Inorganic silts & very fine sands, rock flour, silty or clayey fine sands or clayey silts w/slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravely clays, sandy clays
		OL	Organic silts & organic silty clays of low plasticity
SILTS and CLAYS Liquid Limit GREATER than 50		**MH**	Inorganic silts, micoceous or diatomaceous fine sand or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
Highly ORGANIC Soils		**PI**	Peat & other highly organic soils

Legend of Symbols

	HMAC
	Base
	Lean Clay with Sand
	Fat Clay with Sand
	Clayey Sand Clayey Sand with Gravel
	Limestone

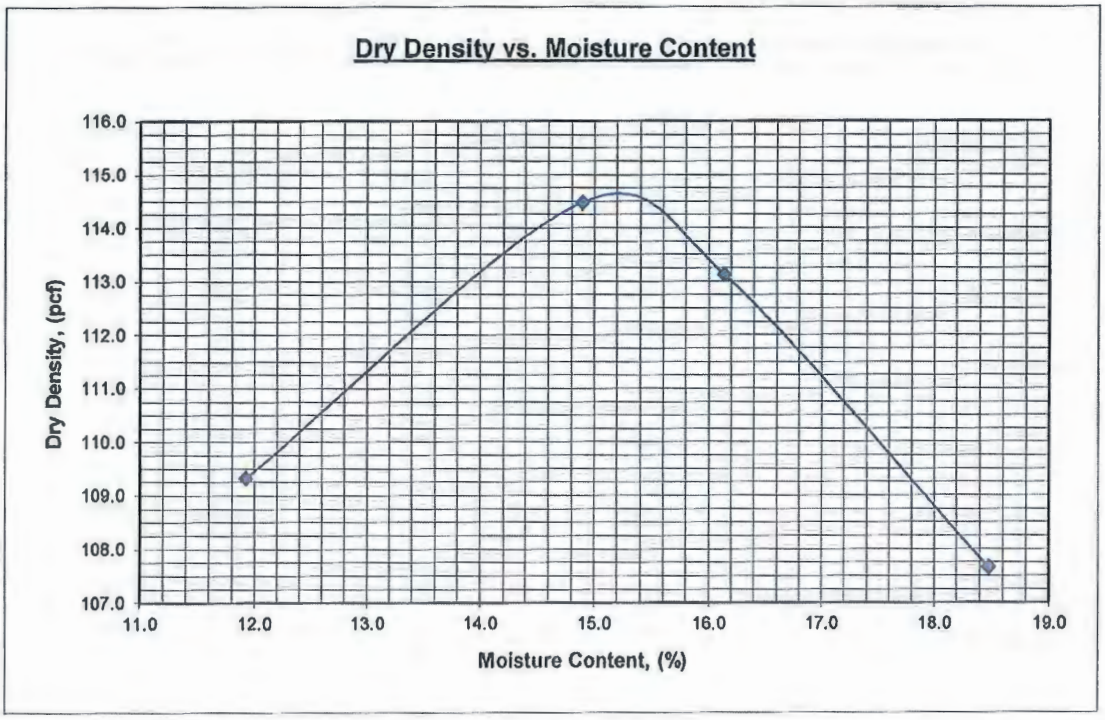
Appendix B:

Proctor and CBR Data

RUSTY ALLEN AIRPORT
LAGO VISTA , TEXAS
Proctor Chart for CBR Sample

Laboratory No:	RE15-0024	**Compactive Effort:**	ASTM D698-C
Material Type:	Subgrade	**Maximum Density (pcf):**	**114.6**
Sample Location:	TP1 and TP2	**Optimum Moisture (%):**	**15.2**

Specimen No.	1	2	3	4	5
% Water Added	2.0	4.0	6.0	8.0	--
Net Wt. Of Specimen & Mold (g)	6810.8	7122.4	7117.4	6987.3	--
Tare Wt. Of Mold (g)	2648.0	2648.0	2648.0	2648.0	--
Wet Wt. Of Specimen (lb)	9.177	9.864	9.853	9.566	--
Volume of Specimen (ft^3)	0.0750	0.0750	0.0750	0.0750	--
Wet Density of Specimen (pcf)	122.4	131.5	131.4	127.6	--
Guesstimated Dry Density (pcf)	120.0	126.5	123.9	118.1	--
Wet Wt. Of Specimen & Pan (g)	5434.4	5708.3	5748.2	5610.8	--
Dry Wt. Of Specimen & Pan (g)	4990.8	5129.4	5127.4	4935.0	--
Tare Wt. Of Pan (g)	1271.1	1242.4	1279.9	1277.5	--
Wt. Of Water (g)	443.6	578.9	620.8	675.8	--
Dry Wt. Of Material (g)	3719.7	3887.0	3847.5	3657.5	--
Total % Moisture of Specimen	**11.9**	**14.9**	**16.1**	**18.5**	--
Dry Density of Specimen (pcf)	**109.3**	**114.5**	**113.1**	**107.7**	--



RUSTY ALLEN AIRPORT
LAGO VISTA , TEXAS
Proctor Chart for CBR Sample

Laboratory No:	RE15-0024	**Compactive Effort:**	ASTM D698-C
Material Type:	Subgrade	**Maximum Density (pcf):**	**114.6**
Sample Location:	TP1 and TP2	**Optimum Moisture (%):**	**15.2**

Specimen No.	**1**	**2**	**3**
No. of Blows	**10 Blows**	**25 Blows**	**56 Blows**
Net Wt. Of Spec.& Mold (g)	7774.6	8113.2	8390.2
Tare Wt. Of Mold (g)	4225.8	4178.4	4209.2
Wet Wt. Of Specimen (lb)	7.824	8.675	9.217
Volume of Specimen (ft^3)	0.0750	0.0750	0.0750
Wet Density of Spec.(pcf)	104.3	115.7	122.9
Wet Wt. of Spec.& Pan (g)	1025.1	1025.1	1025.1
Dry Wt. Of Spec. & Pan (g)	970.7	970.7	970.7
Tare Wt. Of Pan (g)	500.3	500.3	500.3
Wt. Of Water (g)	54.4	54.4	54.4
Dry Wt. Of Material (g)	470.4	470.4	470.4
Total % Moisture of Spec.	**11.6**	**11.6**	**11.6**
Target % Moisture of Spec.	**15.2**	**15.2**	**15.2**
Dry Density of Spec. (pcf)	**93.5**	**103.7**	**110.2**
Initial Measurement (Div.)	10	47	32
Final Measurement (Div.)	15	64	47
Percentage of Swelling	**0.1**	**0.4**	**0.3**

10 blows/lift

Penetration (in)	Load (lb)	Stress (psi)
0.025	7.2	2.4
0.050	8.8	2.9
0.075	11.2	3.7
0.100	11.8	3.9
0.125	14.2	4.7
0.150	16.5	5.5
0.175	17.8	5.9
0.200	19.3	6.4
0.300	26.0	8.7
0.400	31.5	10.5
0.500	37.4	12.5

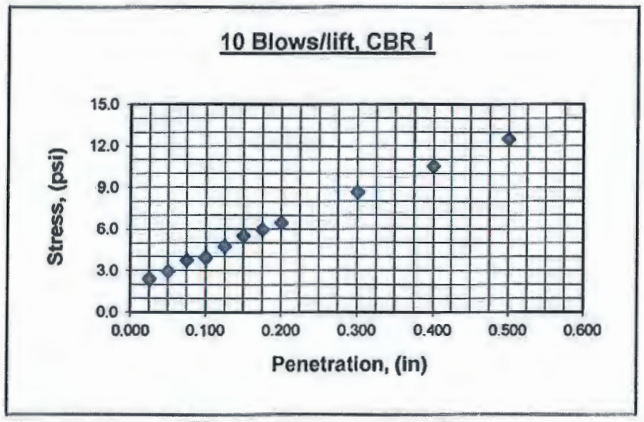
25 blows/lift

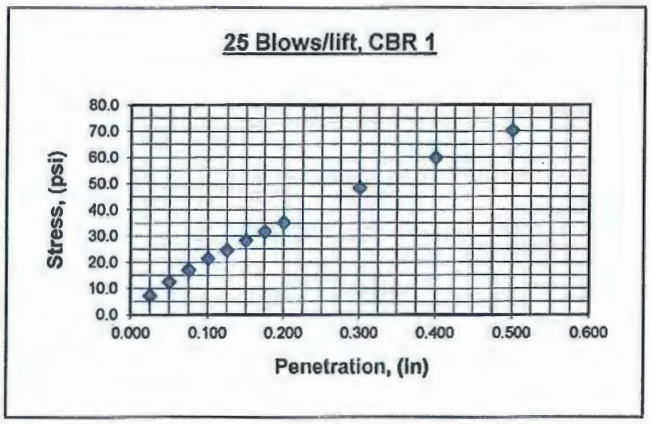
Penetration (in)	Load (lb)	Stress (psi)
0.025	21.6	7.2
0.050	37.1	12.4
0.075	51.0	17.0
0.100	64.0	21.3
0.125	73.7	24.6
0.150	85.1	28.4
0.175	94.8	31.6
0.200	105.0	35.0
0.300	145.1	48.4
0.400	179.6	59.9
0.500	211.0	70.3

56 blows/lift

Penetration (in)	Load (lb)	Stress (psi)
0.025	59.6	19.9
0.050	105.2	35.1
0.075	171.2	57.1
0.100	220.7	73.6
0.125	263.0	87.7
0.150	301.7	100.6
0.175	332.6	110.9
0.200	351.6	117.2
0.300	421.7	140.6
0.400	482.2	160.7
0.500	552.4	184.1

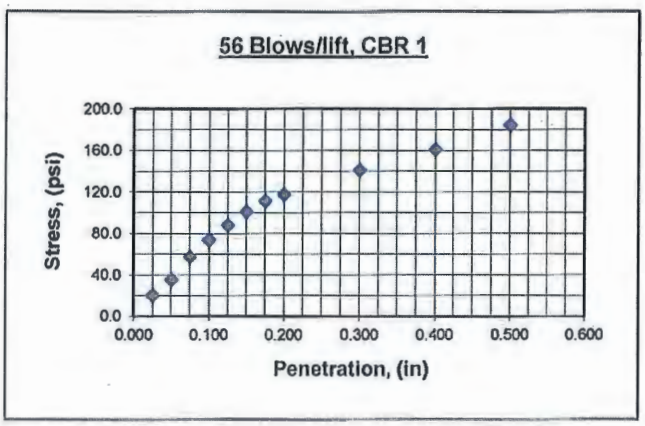
RUSTY ALLEN AIRPORT
LAGO VISTA , TEXAS
Proctor Chart for CBR Sample

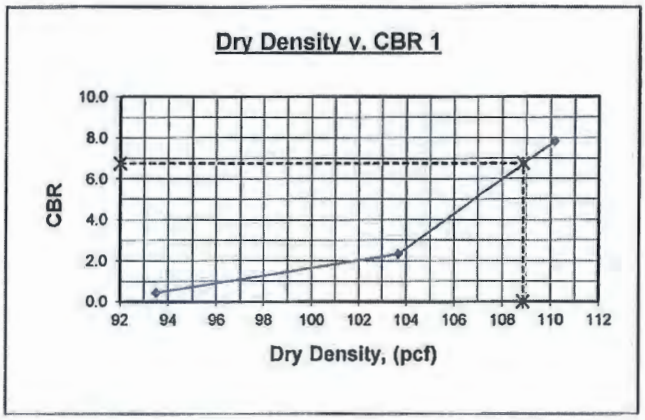




Dry Density @ 10 Blows/lift (pcf) = 93.5
$CBR_{0.100}$ = (3.9 /1000) x 100 = 0.39
$CBR_{0.200}$ = (6.4 /1500) x 100 = 0.43
Use CBR = 0.43

Dry Density @ 25 Blows/lift (pcf) = 103.7
$CBR_{0.100}$ = (21.3 /1000) x 100 = 2.13
$CBR_{0.200}$ = (35.0 /1500) x 100 = 2.33
Use CBR = 2.33





Dry Density @ 56 Blows/lift (pcf) = 110.2
$CBR_{0.100}$ = (73.6 /1000) x 100 = 7.36
$CBR_{0.200}$ = (117.2 /1500) x 100 = 7.81
Use CBR = 7.81

Design CBR @ 95 % Max. Dry Density = 6.8

Design CBR @ 100 % Max. Dry Density = 7.8

Appendix C:

University of Texas, Bureau of Economic Geology Map
and
Map of Borehole Locations

Rusty Allen Airport

Lago Vista, Texas

The University of Texas at Austin, Bureau of Economic Geology,
Geological Atlas of Texas, Austin Sheet, 1974

NOTE: Boring locations are approximate.

Boring No.	Latitude	Longitude
1	30°29'40.9"N	97°58'6.0"W
2	30°29'38.0"N	97°58'5.0"W
3	30°29'39.9"N	97°58'5.7"W
4	30°29'36.4"N	97°58'4.2"W

Rodriguez Engineering Laboratories	
Rusty Allen Airport **Lago Vista, Texas** **O'Malley Strand Associates, Inc.**	
Boring Locations **B-1, B-2, TP1 & TP2**	
Date: 1/8/2015	**Scale: N/A**
PLATE C-2	

Appendix D:

HMAC
Pavement Sections

Rusty Allen Airport
Lago Vista, Texas

Flexible Pavement Section No. 1: 12,500 SWL

FAARFIELD - Airport Pavement Design (V 1.305, 9/28/10 64-bit)

Section ACAggrega~01 in Job RustyAllenAP.
Working directory is C:\Program Files (x86)\FAA\FAARFIELD\

The structure is New Flexible. Asphalt CDF was not computed.
Design Life = 20 years.
A design for this section was completed on 02/09/15 at 11:14:13.

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	2.00	200,000	0.35	0
2	P-209 Cr Ag	7.27	28,668	0.35	0
3	Subgrade	0.00	10,200	0.35	0

Total thickness to the top of the subgrade = 9.27 in

Airplane Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	Sngl Whl-12.5	12,500	832	0.00
2	Sngl Whl-5	5,000	1,200	0.00

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Sngl Whl-12.5	1.00	1.00	4.68
2	Sngl Whl-5	0.00	0.00	5.39

Rusty Allen Airport
Lago Vista, Texas

Flexible Pavement Section No. 2: 12,500 SWL

FAARFIELD - Airport Pavement Design (V 1.305, 9/28/10 64-bit)

Section ACAggrega~02 in Job RustyAllenAP.
Working directory is C:\Program Files (x86)\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	2.00	200,000	0.35	0
2	P-301 SCB	4.00	250,000	0.20	0
3	Subgrade	0.00	10,200	0.35	0

Total thickness to the top of the subgrade = 6.00 in

Airplane Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	Sngl Whl-12.5	12,500	832	0.00
2	Sngl Whl-5	5,000	1,200	0.00

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Sngl Whl-12.5	0.06	0.06	5.79
2	Sngl Whl-5	0.00	0.00	6.94

APPENDIX C

OPINION OF PROBABLE COSTS

Rusty Allen Airport
TxDOT Project No. 1314LAGOV
Opinion of Probable Costs

Pay Item	FAA Item	Description	Units	Quantity	Unit Price	Total Price
		BASE BID: Rehabilitate runway 16-34, taxiways, and aprons with P-631; reconstruct southwest hangar access taxiway; widen taxiway radius; and install new internally-lit LED wind cone.				
1	SS-G-140	Mobilization	LS	1	$40,000.00	$40,000
2	SPECIAL	Install runway closure markers	LS	1	$5,000.00	$5,000
3	TxDOT 506	Construction exit (install)	SY	78	$75.00	$5,850
4	TxDOT 506	Construction exit (remove)	SY	78	$75.00	$5,850
5	TxDOT 506	Temporary sediment-control fence	LF	838	$8.00	$6,704
6	SS-G-700	Pulverize, remove, and stockpile existing asphalt surface and base material (5-inch average depth)	SY	1,293	$10.00	$12,930
7	SS-G-700	Remove and dispose of existing runway hold position guide sign foundation	LS	1	$1,000.00	$1,000
8	SS-G-700	Remove and salvage existing 12-foot wind cone	LS	1	$1,500.00	$1,500
9	P-152	Unclassified excavation	CY	431	$15.00	$6,465
10	P-152	Embankment	CY	388	$25.00	$9,700
11	P-152	Compacted subgrade	SY	1,732	$4.00	$6,928
12	TxDOT 247	Crushed aggregate base (Ty A, Gr 2)(2-inch)	SY	1,516	$7.00	$10,612
13	TxDOT 275	Cement-treat existing pulverized materials (6-inch)	SY	1,516	$25.00	$37,900
14	TxDOT 275	Cement (3% by weight)	TON	13	$400.00	$5,200
15	P-602	Sterilant (soil sterilant @ 15 lbs/acre)	LB	6	$175.00	$1,050
16	P-602	Prime coat (MC-30 @ 0.2 gal/sy)	GAL	304	$20.00	$6,080
17	TxDOT 340	2-inch HMA surface course (compacted)	TON	152	$200.00	$30,400
18	TxDOT 432	Riprap (common stone riprap, grouted)	CY	6	$500.00	$3,000
19	P-605	Mobilization/Demobilization for concrete joint sealing	LS	1	$3,000.00	$3,000
20	P-605	Mobilization/Demobilization for asphalt crack sealing	LS	1	$3,000.00	$3,000
21	P-605	Route, clean, and seal concrete pavement joints using silicone joint sealant	LF	2,500	$2.25	$5,625
22	P-605	Route, clean, and seal asphalt pavement cracks using ASTM D6690 crack sealant	LF	14,355	$2.00	$28,710
23	P-610	Reinforced concrete pavement (6-inch thick)(taxiway radius)	CY	15	$600.00	$9,000
24	P-610	Reinforced concrete curb and gutter (12-inch)	LF	587	$35.00	$20,545
25	P-620	Permanent runway painting (white)	SF	23,900	$1.75	$41,825
26	P-620	Permanent taxiway painting (yellow)	SF	7,522	$1.75	$13,164
27	P-631	Refined coal tar emulsion slurry seal	SY	55,200	$1.85	$102,120
28	SS-L-102	L-867 can (size B)(in concrete) for junction box	EA	4	$1,000.00	$4,000
29	L-107	L-807 12-foot internally-lit LED wind cone with L-810 LED obstruction light	LS	1	$5,500.00	$5,500
30	L-108	Cable, conduit, and/or counterpoise trenching, all widths	LF	143	$40.00	$5,720
31	L-108	No. 6 bare copper counterpoise, in trench, including ground rods and connections for lightning protection	LF	143	$7.50	$1,073
32	L-108	No. 8 type C, 5 kV cable, in conduit, for equipment power	LF	286	$7.50	$2,145
33	L-110	2-inch underground PVC conduit (type I)	LF	143	$25.00	$3,575
34	L-117A-SW	Relocate existing runway hold position guide sign with new foundation	EA	1	$5,000.00	$5,000
35	L-117A-SW	Remove existing RW 15-33 guide sign panel and install new RW 16-34 guide sign panel (Type L-858R, size 1, 2 modules)	EA	4	$1,500.00	$6,000
36	L-117A-SW	Remove existing RW 33 guide sign panel and install new RW 34 guide sign panel (Type L-858R, size 1, 1 module)	EA	2	$1,000.00	$2,000
37	L-118	Taxiway retroreflectors (type 1, style II)(bi-directional)(green)	EA	156	$23.00	$3,588
38	L-118	Taxiway retroreflectors (type 1, style II)(uni-directional)(red)	EA	8	$23.00	$184
39	T-901	Permanent hydromulch seeding with cellulose/plaster fiber mulch	SY	2,049	$4.00	$8,196
40	T-901	Watering for permanent seeded and mulched areas	MG	92	$50.00	$4,600
					Base Bid Construction Subtotal	$474,738
					10% Construction Contingency	$47,474
					BASE BID CONSTRUCTION TOTAL	**$522,212**
		ADDITIVE ALTERNATE BID NO. 1: Construct concrete pavement in lieu of asphalt pavement for southwest hangar access taxiway.				
Deduction		Deduct the total price of Base Bid items 6, 12, 13, and 17.				-$91,842
SA1.1	SS-G-700	Pulverize, remove, and stockpile existing asphalt surface and base material (4-inch average depth)	SY	1,293	$9.00	$11,637
SA1.2	P-152	Unclassified excavation	CY	-190	$15.00	-$2,850
SA1.3	P-152	Embankment	CY	-171	$25.00	-$4,275
SA1.4	TxDOT 275	Cement-treat existing pulverized materials (4-inch)	SY	1,516	$25.00	$37,900
SA1.5	TxDOT 275	Cement (3% by weight)	TON	-5	$400.00	-$2,000
SA1.6	P-610	Reinforced concrete pavement (6-inch thick)	CY	229	$400.00	$91,600
SA1.7	P-620	Permanent taxiway painting (black)	SF	930	$1.50	$1,395
SA1.8	P-631	Refined coal tar emulsion slurry seal	SY	-1,374	$1.85	-$2,542
					Additive Alternate Bid No. 1 Construction Subtotal	$39,023
					10% Construction Contingency	$3,903
					ADDITIVE ALTERNATE BID NO. 1 CONSTRUCTION TOTAL	**$42,926**
		ADDITIVE ALTERNATE BID NO. 2: Construct concrete runway/taxiway intersection repair and west parallel taxiway repair.				
SA2.1	P-152	Unclassified excavation	CY	11	$15.00	$165
SA2.2	SS-G-700	Remove and dispose of existing asphalt and base material (6-inch average depth)	SY	62	$6.00	$372
SA2.3	TxDOT 275	Place and compact excess cement-treated existing pulverized materials (6-inch thick)	SY	62	$30.00	$1,860
SA2.4	P-610	Reinforced concrete pavement repair for runway/taxiway intersection repair (6-inch thick)	CY	6	$750.00	$4,500
SA2.5	P-610	Reinforced concrete pavement repair for west parallel taxiway repair (6-inch thick)	CY	5	$750.00	$3,750
					Additive Alternate Bid No. 2 Construction Subtotal	$10,647
					10% Construction Contingency	$1,065
					ADDITIVE ALTERNATE BID NO. 2 CONSTRUCTION TOTAL	**$11,712**

Construction Engineering and Closeout	$35,280
Resident Project Representative	$25,000
Construction Materials Testing	$25,000
Construction Surveying	$5,910
PROJECT FEE TOTAL	**$91,190**

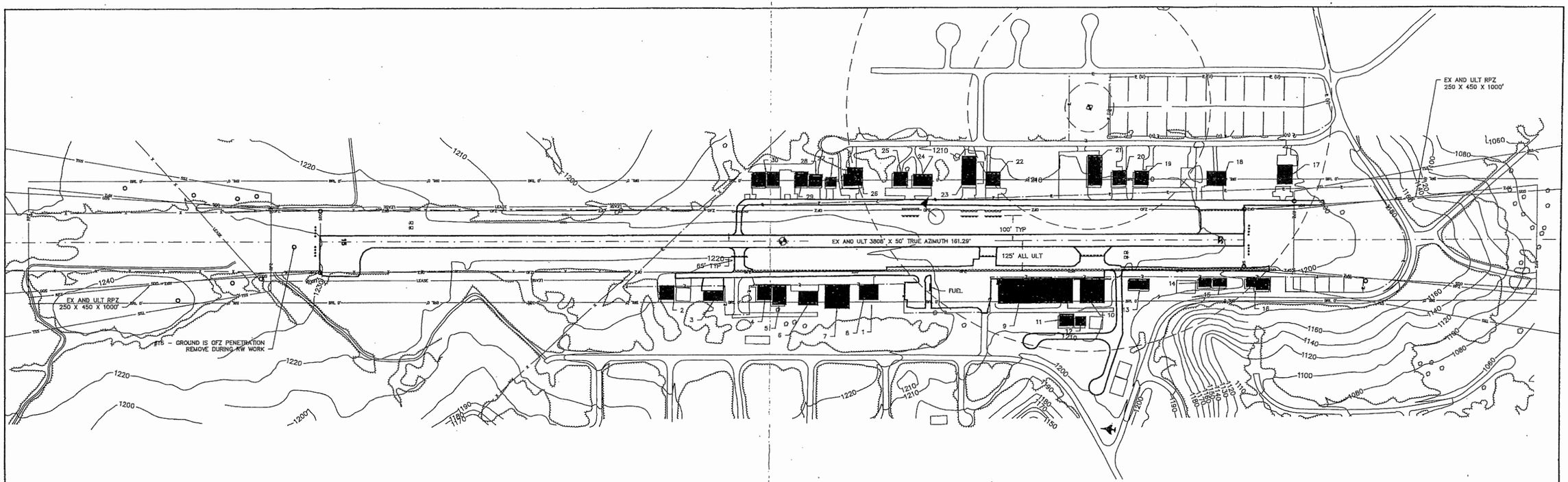
PROJECT TOTAL	**$613,402**
PROJECT TOTAL (W/ ADDITIVE ALTERNATE BID NO. 1)	**$656,328**
TOTAL AVAILABLE PROJECT BUDGET	***$540,000***

STATE OF TEXAS
JASON SCOTT REIMER
118651
LICENSED
PROFESSIONAL ENGINEER

Jason Reimer
3/11/15

EXHIBIT 1

CURRENT AIRPORT LAYOUT DRAWING (ALD)



MAGNETIC
DECLINATION 4°51' E
CHANGING 0°7'
W/YEAR

RUNWAY END COORDINATES AND ELEVATIONS			
RUNWAY END	LATITUDE	LONGITUDE	ELEVATION
EXISTING END OF RWY 15	30°30'12.76" N	97°58'17.04" W	1230.9'
EXISTING END OF RWY 33	30°29'37.07" N	97°58'03.08" W	1209.7'

ALD LEGEND		
FEATURE	EXISTING	ULTIMATE
RUNWAY/TAXIWAY OUTLINE		
RUNWAY/TAXIWAY TO BE REMOVED		
BUILDINGS/FACILITIES		
AIRPORT PROPERTY LINE		
AIRPORT PROPERTY LINE w/FENCE		
FENCE LINE		
BUILDING RESTRICTION LINE (BRL)		
AIRPORT REFERENCE POINT		
WIND CONE & SEGMENTED CIRCLE		
THRESHOLD LIGHTS		
RW END IDENTIFIER LIGHTS (REILS)		
C&G BEACON		
VGSI		
HOLD POSITION AND SIGN		
AWOS		
SURVEY MARKERS		
GROUND CONTOURS		
SIGNIFICANT OBJECT LOCATION		
TREES/BRUSH		
NONDIRECTIONAL BEACON (NDB)		

RUNWAY DATA TABLE				
	RW 15–33			
	EXISTING		ULTIMATE	
RUNWAY ARC	B–I		B–I	
DESIGN AIRCRAFT & ARC	?		?	
BALANCED FIELD LENGTH	?		?	
RUNWAY LENGTH & WIDTH (ft.)	3808' X 50'		3808' X 50'	
PAVEMENT DESIGN STRENGTH (lbs.)	12,500 SW		12,500 SW	
RUNWAY LIGHTING	MIRL		MIRL	
PERCENT EFFECTIVE GRADIENT	0.56%		0.56%	
PERCENT WIND COVERAGE	97.60%		97.60%	
MAXIMUM ELEVATION ABOVE MSL	1230.9'		1230.9'	
RW SURFACE TYPE	ASPH		ASPH	
RSA – LENGTH BEYOND RW END	240'		240'	
RSA – WIDTH	120'		120'	
OFA – LENGTH BEYOND RW END	240'		240'	
OFA WIDTH	400'		400'	
OFZ – LENGTH BEYOND RW END	200'		200'	
OFZ WIDTH	250'		250'	
RUNWAY END	15	33	15	33
APPROACH TYPE	GPS	VISUAL	GPS	VISUAL
APPROACH VISIBILITY MINIMA	1 MILE	VISUAL	1 MILE	VISUAL
THRESHOLD SITING SURFACE & SLOPE	#6 20:1	#6 20:1	#5 20:1	#5 20:1
RUNWAY MARKING	NPI	NPI	NPI	NPI
RUNWAY VISUAL AIDS	PAPI	PAPI	PAPI	PAPI
TOUCHDOWN ZONE ELEVATION	1230.9'	1222.9'	1230.9'	1222.9'
FAR PART 77 APPROACH CATEGORY	A(NP)	A(V)	A(NP)	A(V)
FAR PART 77 APPROACH SURFACE SLOPE	20:1	20:1	20:1	20:1
TAKE–OFF RUN AVAILABLE (TORA)	3808'	3808'	3808'	3808'
TAKE–OFF DISTANCE AVAILABLE (TODA)	3808'	3808'	3808'	3808'
ACCELERATE STOP DISTANCE AVAIL. (ASDA)	3808'	3808'	3808'	3808'
LANDING DISTANCE AVAILABLE (LDA)	3808'	3808'	3808'	3808'

COMMENTS

THERE IS NO SURVEY DATA FOR THE AIRPORT.

50' RUNWAY WIDTH DOES NOT MEET CURRENT FAA STANDARDS FOR DEVELOPMENT OF NEW INSTRUMENT APPROACH PROCEDURES. THE CURRENT STANDARD IS FOR 60' MINIMUM RUNWAY WIDTH FOR CATEGORY A AND B ONLY AIRCRAFT.

THE GLIDESLOPE QUALIFICATION SURFACE AND THRESHOLD SITING SURFACES EACH HAVE PENETRATIONS THAT WILL PRECLUDE DEVELOPMENT OF NEW INSTRUMENT APPROACH PROCEDURES.

BUILDING TABLE			
BUILDING	DESCRIPTION		TOP
NUMBER	EXISTING	ULTIMATE	ELEVATION
1	ROTATING BEACON	–	1273'
2	HANGAR	–	1241'
3	HANGAR	–	1238'
4	HANGAR	–	1444'
5	HANGAR	–	1244'
6	HANGAR	–	1245' EST
7	HANGAR	–	1251'
8	HANGAR	–	1246'
9	MULTIPLE HANGARS	–	1228'
10	HANGAR	–	1241'
11	HANGAR	–	1240'
12	HANGAR	–	1240'
13	HANGARS	–	1225'
14	HANGAR	–	1215'
15	HANGAR	–	1215'
16	HANGARS	–	1215'
17	HANGAR	–	1220'
18	HANGAR	–	1234'
19	HANGAR	–	1235'
20	HANGAR	–	1235' EST
21	HANGAR	–	1235'
22	HANGAR	–	1240'
23	HANGAR	–	1234
24	HANGAR	–	1237'
25	HANGAR	–	1236'
26	HANGAR	–	1250' EST
27	HANGAR	–	1242'
28	HANGAR	–	1250' EST
29	HANGAR	–	1250' EST
30	HANGARS	–	1250' EST

COMMENTS

ALL HANGARS ARE LOCATED OFF AIRPORT PROPERTY AND ARE PRIVATELY OWNED WITH THROUGH THE FENCE OPERATIONS.

ESTIMATED HEIGHTS FOR NEWER HANGARS – NOT SURVEYED.

ALL HANGARS EXCEPT #11 AND 12 ARE WITHIN THE PART 77 PRIMARY SURFACE, AND IF NOT PREVIOUSLY STUDIED UNDER FAA 7460 SHOULD BE STUDIED FOR POSSIBLE MITIGATIONS.

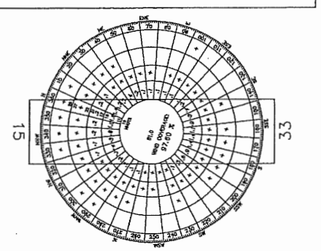
AIRPORT DATA TABLE		
	EXISTING	ULTIMATE
AIRPORT ELEVATION (MSL)	1230.9'	1230.9'
AIRPORT NAVIGATION AIDS	GPS	GPS
MEAN MAX TEMP (Hottest Month °F)	95°	95°
AIRPORT REFERENCE CODE (ARC)	B–I	B–I
TAXIWAY MARKING	STD W/℄ REF	STD W/℄ REF
TAXIWAY LIGHTING	NONE	NONE
AIRPORT REFERENCE POINT COORDINATES	30°29'54.9" N 97°58'10.1" W	30°29'54.9" N 97°58'10.1" W

NOTES

DATUM COORDINATE SYSTEMS – HORIZONTAL DATUM NAD_1983_StatePlane_Texas_Central_FIPS_4203_Feet, VERTICAL DATUM NAVD88.

A SURVEY WAS NOT PERFORMED WITH THIS ALP – THE BEST EXISTING DATA WAS USED, BUT MAY NOT INCLUDE ALL RELEVANT ELEVATIONS AND OBSTRUCTIONS.

TAXIWAYS ON WEST SIDE OF RUNWAY DO NOT MEET CURRENT FAA STANDARDS FOR SEPARATION FROM THE RUNWAY CENTERLINE.



WIND DATA:
AUSTIN, 1997 TO 2006

OBSTACLE FREE ZONE PENETRATIONS		
SIG OBJ NO.	OBJECT DESCRIPTION	REMEDIATION
8	GROUND	REGRADE DURING NEXT RW RECONSTRUCTION
–	HOLD POSITIONS	RELOCATE HOLD POSITIONS OUTSIDE OFZ ASAP
–	–	–

TEXAS DEPARTMENT OF TRANSPORTATION
AVIATION DIVISION

ALP APPROVED ACCORDING TO FAA AC 150/5300-13 CH 14 PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING AND FAA NRA STUDY PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION ON AIRPORT PROPERTY.

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DAVID PLATON, DIRECTOR, AVIATION DIVISION — 3/18/12 DATE

AIRPORT SPONSOR

CURRENT AND FUTURE DEVELOPMENT DEPICTED ON THIS ALP IS APPROVED AND SUPPORTED BY AIRPORT SPONSOR

SPONSOR ACKNOWLEDGES APPROVAL OF ALP BY TXDOT DOES NOT CONSTITUTE A COMMITMENT TO FUNDING.

SIGNATURE — 12 MAR 2012 DATE

ASSIST. CITY MANAGER
TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

PREPARED BY:

TXDOT AVIATION DIV.
125 E 11TH ST
AUSTIN, TX 78701

K. SNODGRASS — APR 2010
DESIGNED BY — DATE

M. CAFFALL — APR 2010
CHECKED BY — DATE

AIRPORT LAYOUT DRAWING
RUSTY ALLEN AIRPORT
LAGO VISTA, TEXAS (RYW)

Texas Department of Transportation Aviation Division

SHEET 1 OF 3

EXHIBIT 2

OVERALL PAVEMENT IMPROVEMENTS

LEGEND

- PROP. PAVEMENT REHABILITATION WITH P-631
- PROP. HANGAR ACCESS TAXIWAY RECONSTRUCTION

O'Malley Strand Associates, Inc.
TBPE No. F-8405
203 S. Jackson
Brenham, Texas 77833
(979) 836-7937
Fax (979) 836-7936

STRAND ASSOCIATES®

RUSTY ALLEN AIRPORT
PAVEMENT IMPROVEMENTS

NO.	REVISION	BY	DATE

Drawing Name: P:\0847\847.001ab\Exhibits\Paving Improvements.dwg

VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALE.

Field Book: N/A
Date: 03/14
Project Number: 847.001 AB
Design By: JSR
Drawn By: BAG

Sheet Title: EXHIBIT 2

Sheet Number: 1 ....0f.... 1

EXHIBIT 3

SOUTHWEST HAT RECONSTRUCTION

O'Malley Strand Associates, Inc.
TBPE No. F-8405
203 S. Jackson
Brenham, Texas 77833
(979) 836-7937
Fax (979) 836-7936

STRAND ASSOCIATES®

RUSTY ALLEN AIRPORT
PAVEMENT IMPROVEMENTS

NO.	REVISION	BY	DATE

Drawing Name: P:\0084\847.001ab\Exhibits\Exhibit 3.dwg

VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALE.

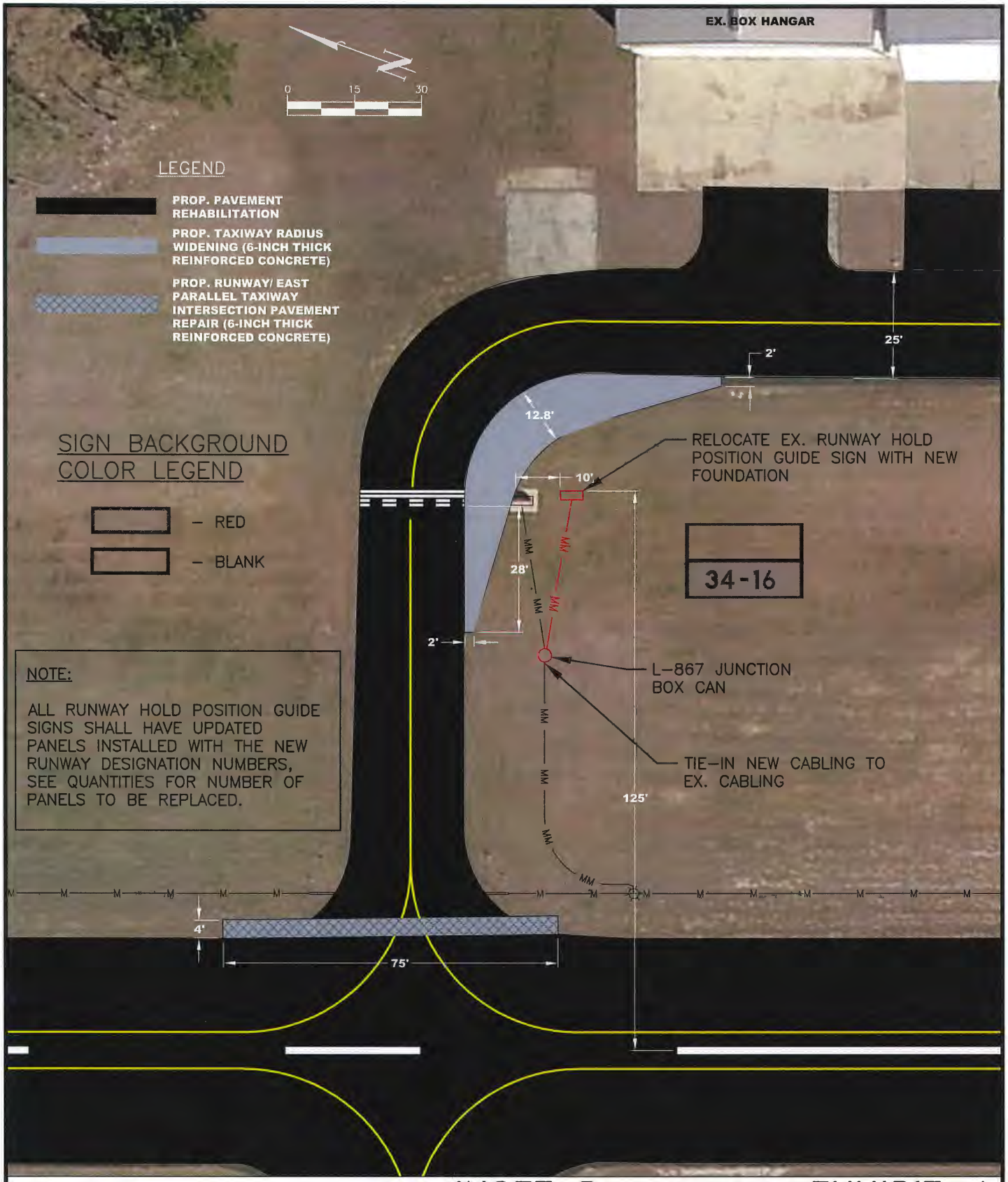
Field Book: N/A
Date: 03/14
Project Number: 847.001 AB
Design By: JSR
Drawn By: BAG

Sheet Title: EXHIBIT 3

Sheet Number: 1 ....Of.... 1

EXHIBIT 4

WIDEN NORTHEAST TW RADIUS & RW/EAST PARALLEL TW INTERSECTION REPAIR



INSET B

EXHIBIT 4

SA STRAND ASSOCIATES®

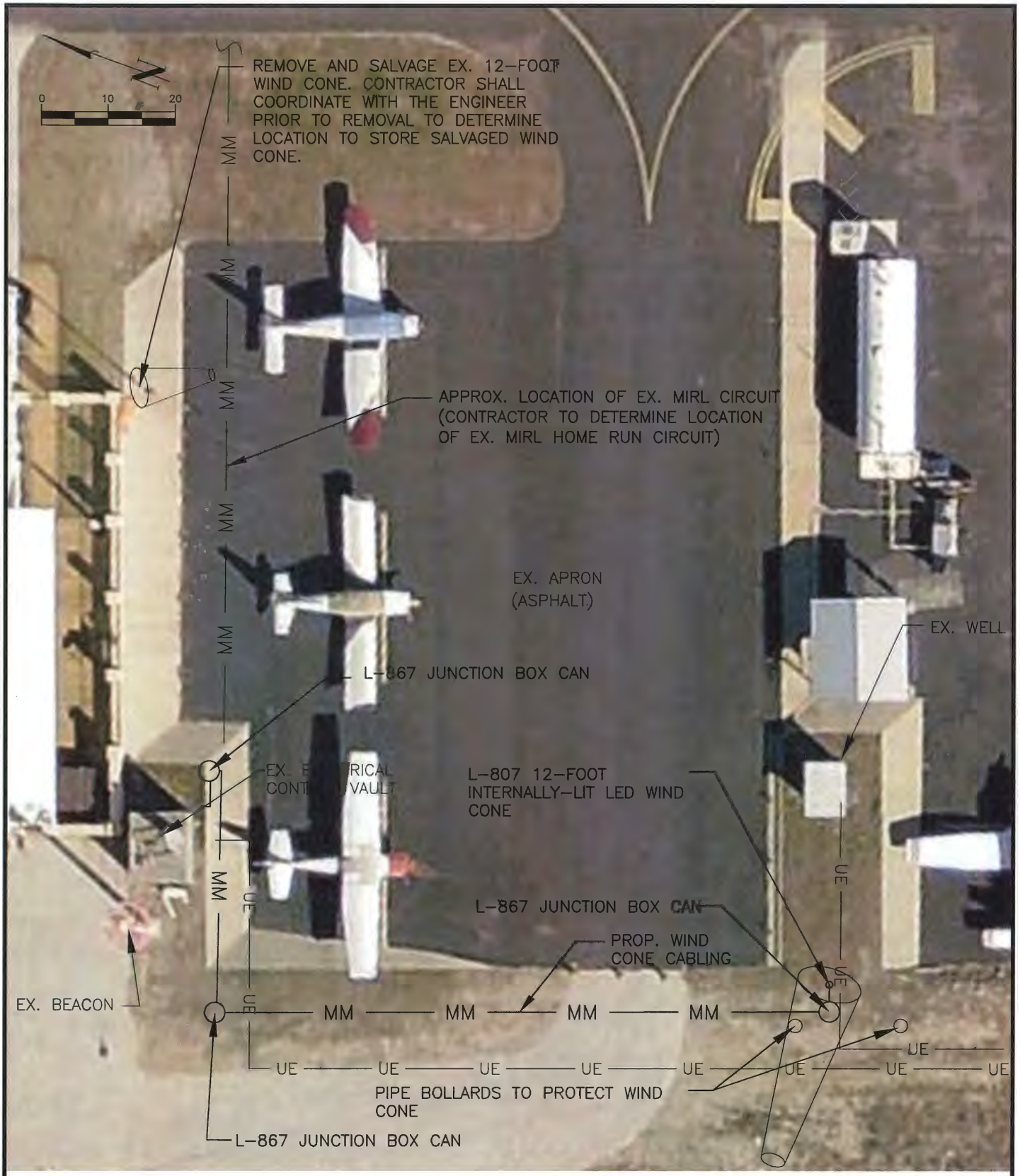
O'Malley Strand Associates, Inc.
TBPE No. F-8405
203 S. Jackson
Brenham, Texas 77833
(979) 836-7937
Fax (979) 836-7936

RUSTY ALLEN AIRPORT PAVEMENT IMPROVEMENTS

Scale: SEE BAR SCALE	
Project Number: 847.001 AB	
Drawn By: BAG	Date: 03/14
Revised:	
Sheet Number: 1 ....Of.... 1	

EXHIBIT 5

WIND CONE



INSET C

EXHIBIT 5

SA STRAND ASSOCIATES®

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203 S. Jackson
Brenham, Texas 77833
(979) 836-7937
Fax (979) 836-7936

RUSTY ALLEN AIRPORT
PAVEMENT IMPROVEMENTS

Scale: SEE BAR SCALE	
Project Number: 847.001 AB	
Drawn By: BAG	Date: 03/14
Revised:	
Sheet Number: 1 ....Of.... 1	

EXHIBIT 6

WEST PARALLEL TW REPAIR

INSET D

EXHIBIT 6

STRAND ASSOCIATES®

O'Malley Strand Associates, Inc.
TBPE No. F-8405
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Brenham, Texas 77833
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RUSTY ALLEN AIRPORT
PAVEMENT IMPROVEMENTS

Scale: SEE BAR SCALE	
Project Number: 847.001 AB	
Drawn By: BAG	Date: 03/14
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Sheet Number: 1 ....Of.... 1	