CITY OF HOUSTON

Sylvester Turner
Mayor

HOUSTON AIRPORT SYSTEM

Mario C. Diaz
Director of Aviation

George Bush Intercontinental ~ William P. Hobby ~ Ellington Airport

November 16, 2022

SUBJECT: **Addendum No. 1**

REFERENCE: **Invitation To Bid (ITB) for IAH ARFF 92 AT GEORGE BUSH INTERCONTINETAL AIRPORT; Solicitation No. HHG-ARFF92-2023-007; Project No. 668**.

To: All Prospective Bidders:

This Addendum is being issued for the following reasons:

I. **Extend** the bid due date from **December 1 to December 15, 2022, at 10:30 A.M., (CST).**

II. **Replace** page 24, Document 00410-B3 Bid Form Part B, with the attached updated copy.

III. To Respond to Questions.

1. **Question:** Sheet CS-502 paving section shows 12" compacted subgrade, 6" stabilized base and 10" concrete. Specification Section 31 23 00, 3.04, B8 calls for 6" soil stabilization. Please clarify.

   Response: Project plan sheet CS-502 will be utilized.

2. **Question:** We were unable to locate the geotechnical report in the bid documents.

   Response: Hazardous studies and Geotechnical Report attached and included in this Addendum.

3. **Question:** Section 01210 shows 4 cash allowance items totaling $825,000.00. Section 00410 shows 1 cash allowance item for $10,000.00. Please clarify.

   Response: Please refer to Section 01210. Cash allowance is $35,000 of building permit, $300,000 of permanent electrical service, $15,000 of permanent telephone service and $475,000 of FF&E equipment. Total cash allowance is $825,000.00.

4. **Question:** Section 01450 calls for the Contractor to have QA/QC, however several City of Houston Specifications state that testing is paid for by the Owner. Section 01455 was not definitive. Can you clarify who performs the geotechnical testing?

   Response: Quality Assurance (QA) testing for measurement and acceptance for payment is performed via a third party by HAS. Quality Control (QC) testing is performed by the Contractor.

5. **Question:** Section 01505 refers to construction water. Does HAS have a meter that Contractors can use to obtain free water, or should we plan to obtain a meter and pay for the water?

   Response: Contractor shall provide its own meter and pay for construction water.

6. **Question:** The specified waterline material, Ductile Iron, is currently 8-10 months delivery time. Can HAS suggest a different waterline material that is more readily available?

   Response: HAS confirms the RU8000 series is discontinued. Substitution requests to be provided and submitted at the time of the bid submission as part of the submission packet. Substitutions must meet current HAS Design Criteria Manual requirements.

7. **Question:** We request additional time for questions and a bid date extension for better coverage from Subcontractors**.**

   Response: Please refer to Roman Numeral I at the beginning of this Addendum, the bid date is extended through this addendum.

8. **Question:** Would the owner consider a service to collect, process, and deliver close out documents in an HTML formatted accessible report that interconnects these documents to a system, a drawing, or a room/area in a building?

   Response: No. Closeout documents to be provided per project plans and specification requirements.

9. **Question:** AV Schematic TA-601 detail 1 indicates the Multipurpose Room will have speaker type S2 and to verify the quantity of speakers based on the plans. Reflected Ceiling Plan – Area A TA-131A and Specification Section 274000-1 Part 1.2 indicates that the Multipurpose Rooms audio will be from the display speakers. Please confirm that the Multipurpose Room does not require in-ceiling speakers. If speakers are required, please clarify quantity.

   Response: Multipurpose Room will require (4) ceiling speakers and (1) 70V audio amplifier for sound reinforcement**.**

10. **Question:** AV Schematic TA-601 detail 2 indicates the TV Room will have a credenza in which to place AV equipment inside. However, it is unclear in Specifications 274000-1 Part 1.2 does not describe any furniture to be provided by the AV Contractor. Please confirm the credenza is owner furnished, and if it is not, please provide a manufacture and model number.

    Response: Contractor to coordinate AV equipment space requirements and installation with the furniture vendor and supplied via furniture allowance in the contract.

11. **Question:** AV Schematic TA-601 detail 1 indicates the Multipurpose Rooms display is to be an 85" flat panel display. However, both Floor Plan – Area A TA-111A and Specification Section 274000-1 Part 1.2.A.3 indicates a 75" flat panel display is to be provided. Please clarify the size of the Multipurpose Room flat panel display.

    Response: Provide a 75" flat panel display in the Multipurpose Room.

12. **Question:** AV Schematic TA-601 AV Symbol Legend indicates that all flat panel displays from Samsung's RU8000 series. The RU8000 series has been discontinued and is no longer available. Please confirm that the Samsung BE series displays are an approved alternate for the discontinued 65" and 75" displays, and the QB series for the 85" display.

    Response: HAS confirms the RU8000 series is discontinued. Substitution requests to be provided and submitted at the time of the bid submission as part of the submission packet. Substitutions must meet current HAS Design Criteria Manual requirements.

13. **Question:** Specification Section 274000-1 Part 1.2.A.2 indicates that the cable cubby is provided by the furniture vendor. However, AV Schematic TA-100 AV Responsibility Matrix indicates the AV Contractor is responsible for the cable cubby. Please confirm the AV Contractor is not responsible for installing the cable cubby.

    Response: Contractor to coordinate AV equipment space requirements and installation with the furniture vendor and supplied via furniture allowance in the contract.

14. **Question:** AV Schematic TA-601 AV Symbol Legend indicates that the Barco Clickshare Wireless Presentation device to be provided is part number CSE-200. The manufacture has discontinued that model and has replaced it with the C-10. Please confirm that the C-10 is an approved replacement for the CSE-200.

    Response: HAS confirms the CSE-200 has been replaced with the C-10. Substitution requests to be provided and submitted at the time of the bid submission as part of the submission packet. Substitutions must meet current HAS Design Criteria Manual requirements.

15. **Question**: AV Schematic TA-601 details 1 and 3 illustrates a 70V connection between the amplifier and the speakers. The AV Symbol Legend on AV Schematic TA-601 specifies the XPA U 1002 amplifier which outputs 100 watts at 8 or 4 ohms and does not have a 70V output. Please confirm that the XPA U 1002- 70V is the intended model.

    Response: Confirmed.

16. **Question**: Specification Section 274000-1 Part 1.2.A indicates the AV Contractor is to provide and install a USB web camera above the display in the Conference Room. The AV Schematic does not provide the manufacture or part number for this camera. Please confirm if the Poly Studio R30 webcam is an approved product for this system. If not, please provide manufacture and model number for an acceptable device.

Response: Please provide Bose VB1 conferencing bar or approved equal. Substitution requests to be provided and submitted at the time of the bid submission as part of the submission packet. Substitutions must meet current HAS Design Criteria Manual requirements

17. **Question**: AV Schematic TA-601 AV Symbol Legend specifies the Denon AVR-X2400H to be the AV Receiver. The manufacture has discontinued that model and replaced it with the AVR-X2700H. Please confirm that the AVRX2700H is an approved replacement model for the discontinued AV Receiver.

    Response: HAS confirms the AVR-X2400H has been discontinued. Substitution requests to be provided on and submitted at the time of the bid submission as part of the submission packet. Substitutions must meet current HAS Design Criteria Manual requirements.

18. **Question**: AV Schematic TA-602 indicates that the paging system is to be manufactured by Valcom. Please confirm that an alternative manufacture can be used such as QSC or AtlasIED.

    Response: Substitution requests to be provided and submitted at the time of the bid submission as part of the submission packet. Substitutions must meet current HAS Design Criteria Manual requirements.

19. **Question**: AV Schematic TA-601 detail 4 and Floor Plan – Area A/B TA-111A/B indicates the Captain Rooms display is to be a 55” flat panel display. However, the AV Symbol Legend does not specify a 55” display. Please confirm the display provided should be the same make and model as the rest of the displays for the project.

    Response: Confirmed.

20. **Question**: CS-101 calls for a Type II Curb. What Type II will be used on sheet CS-501?

    Response: City of Houston Standard details show two different construction methods for Type II Curb. Either are acceptable.

21. **Question**: CS-201 for the Proposed Reinforced Concrete Slabs what is the reinforcement required and will it be 10" also? Are we to use the layout provided?

    Response: Per City of Houston Design Standard Details, for 10" reinforced PCC, provide either #4 bars at 12.5" SPA E.W., or #5 bars at 19" E.W. Layout is provided in project plans, including which slabs are to be reinforced.

22. **Question**: CS-201 for the Joint Longitudinal Construction Joint bars will you be using #6X50" Single Tie Bars or Multi-Piece? Are we to use the layout provided?

    Response: Detail on Sheet CS-502 shows either may be used.

23. **Question**: CS-201 for the Joint Longitudinal Contraction Joint bars will you be using #6X50" Single Tie Bars are we to use the layout provided?

    Response: Please refer to the response provided in Question #22.

24. **Question**: Concrete Plinth details on S-311 call out only 3#3 ties for each plinth. However, the plinths are 5'-0" tall. Are we to use detail 5/S-310 w/#3 ties @ 12" spacing with 3 additional ties at top?

    Response: Yes, follow detail 5/S-310 so that in all cases there will be 3 - #3 ties at the top of the plinth, with remainder of ties spaced at maximum of 12" on center.

25. **Question**: Section 5/S310 calls for 8#6 dowels and verts for the plinth. However, detail 6/S311 for typical interior plinth calls for 8#7 verts. Can you clarify? Are we to provide the same size and count dowels out of the footings for the plinths?

    Response: Provide 8 - #7 vertical bars in 24"x24" plinth. Use 8 - #6 dowels out of the footings.

26. **Question**: Arch-A-661A-"Please confirm items listed on furniture schedule on dwg. A-661A, are to be part of the FF&E allowance

    Response: Confirmed.

27. **Question**: Arch-A-661A-"There are items listed on equipment and appliance schedule, where certain items call for no responsible party. Please identify who will be responsible for those items.

    Response: CFCI= Contractor furnished/Contractor. These are to be installed per footnote on schedule that states, "IF NO RESPONSIBLE PARTY IS LISTED, ITEMS TO BE CFCI".

28. **Question**: Arch-A-661A-"Will exercise equipment listed in equipment and appliance schedule be included in FF&E allowance.

    Response: Exercise equipment will be provided by others.

29. **Question**: Contracting-024100-"Please confirm that the owner will be considered the generator of any existing hazardous waste encountered at the site and will sign all manifests.

    Response: Confirmed.

30. **Question**: Arch-A-150A-"General Note 6, references section 075323. This specification is not found, and no fall protection is shown. Please confirm that this note does not apply to this project.

    Response: No fall protection will be required, as all roof equipment is over 10' from roof edge.

31. **Question**: Arch-A-501-"Canopy details appear to show plywood substrate under the roofing and metal panels, but it is not called out. Please identify what is required.

    Response: Canopy details show exterior gyp sheathing under the roofing and metal panels.

32. **Question**: Plumbing-221116-"Will press type fittings be permitted for copper water piping?

    Response: Please refer to the response provided for Question #18.

33. **Question**: Plumbing-P-001-"Blue aluminum air pipe is listed for compressed air piping in the Plumbing Pipe Materials Schedule on P-001. Please provide specifications for this piping including acceptable fittings and joints.

    Response: Clack Steel or Copper is Preferred. Substitution requests to be provided on and submitted at the time of the bid submission as part of the submission packet. Substitutions must meet current HAS Design Criteria Manual requirements.

34. **Question**: Plumbing-221316-"Section 3.09 D. discusses exposed PVC piping, but Section 3.10 Piping Schedule only allows cast iron above ground. Please confirm all soil, waste, and vent piping above ground is to be cast iron.

    Response: All PVC shall be below ground as specified.

35. **Question**: Plumbing-P-001, Spec 221316-"Spec 221316 section 3.10 Piping Schedule lists cast iron as acceptable pipe materials for soil, waste, and vent piping underground. Drawing page P-001 shows underground piping to be PVC. Please confirm whether PVC is allowed or if cast iron is to be used. If cast iron is to be used, please confirm that it must be extra heavy class or if service class is acceptable. If PVC is to be used, please provide specifications.

    Response: Underground piping to be PVC per the drawing page P-001.

36. **Question**: Plumbing-224010-"Section 1.07 lists extra materials required. Please confirm whether providing extra tank repair kits is required while no tank type water closets are listed on the P-501 Fixture Schedule.

    Response: Project design only has toilets with flush valves. No tank kits required.

37. **Question**: Plumbing-P-501-"The Fixture Schedule on P-501 lists Manufacturers and Model Numbers for plumbing fixtures and equipment. Will alternate fixtures be considered? If so, please provide fixture specifications.

    Response: Please refer to the response provided for Question #18.

38. **Question**: Plumbing-Spec 221119, P-501, P-502-"Spec 221119 section 2.10 discusses trap seal primer valves and P- 502 contains details showing trap primer connections on floor drains. The schedule on P-501 does not indicate trap primers are required and they do not appear to be called out on the drawings. Please confirm trap primers are not required.

    Response: Trap primers are required by HAS Design Criteria Manuel in the floor drains in public restrooms. Trap guards are to be provided at all other floor drains as specified in the project plans.

39. **Question**: Plumbing-P-001-"Note 9 indicates that 1" Armaflex pipe (tube) insulation is to be used. This contradicts Spec section 220719. Please clarify.

    Response: Provide Armaflex as specified.

40. **Question**: HVAC-M-001-"Note 9 states that work and service interruptions are to be performed at owners convenience which might include nights and weekends. Please confirm the mechanical scope for this new construction does not require premium time or clarify where this might apply.

    Response: This is a new building so no service interruptions are anticipated. Should one be required, the front-end specifications shall be followed.

41. **Question**: HVAC-M-001, 230593-"M-001 Note 18 denotes that TAB must be performed by a firm independent from the design. Spec 230593 section 1.03 states the TAB must be performed by an impartial firm whose operations are limited only to the TAB. It is unclear whether the TAB firm can be subcontracted to the HVAC firm or if this must be a first-tier subcontractor to the GC. Please clarify

    Response: TAB to be provided per HAS standards and as specified. An independent AABC certified TAB agency is required and will be witnessed by HAS staff.

42. **Question**: HVAC-237420-"Spec 237420 section 2.08 A. states that control equipment and sequence of operations are specified in Division 23 "Instrumentation & Control for HVAC" but this section is not included. Controls are referenced in numerous places throughout the specs. Please provide specifications and requirements for building automation and/or DDC controls for this project.

    Response: The controls for the VRF system will be by the VRF Manufacturer. The non-VRF items will be in the controls package by Allerton (Climatec). A Bacnet interface is required to connect the VRF to the Allerton campus system.

43. **Question**: MEP-CG-007-"Note 2 call out the demolition of the existing ARFF Building, including the removal of all above ground items to the slab. Will this require selective demolition of fire protection, plumbing, mechanical, and/or electrical systems? Will the slab remain or will demolition underground services within the building be required?

    Response: All building and utilities will be demolished to ground and capped. Fiber/Electric lines will be demolished back to branch source and disconnected.

44. **Question**: MEP-CG-007-"Note 2 call out for the removal of the sanitary lift station. Please confirm this shall be removed in its entirety including the pump, controls, wiring, and vault.

    Response: Please refer to the response provided for Question #43.

45. **Question**: Demo-CG-007-"Note 2 says to remove the existing ARFF building to the slab. Please confirm that the slab and foundations remain in place and that there is not site restoration work required in this area.

    Response: All building and utilities will be demolished to ground and capped. Fiber/Electric lines will be demolished back to branch source and disconnected. Site restoration to grass in disturbed areas is required.

46. **Question**: Fire Protection-211300-"Section 3.03 V. references specs "Heat Tracing for Fire-Suppression Piping" and "Fire Suppression Systems Insulation" but these sections do not appear to be included. Please confirm that heat tracing and insulation are not required for Fire Protection.

    Response: Fire protection piping exposed to the outside must be freeze protected as per code. Heat tracing is only to be used if there is no other way to freeze protect the piping. HAS anticipates no exposed fire protection piping.

47. **Question**: Audio Communication System-275113-"Please specify the specific system each section refers to under 2.1 overview. Each line item at the moment refers to an "Error!"

    Response: Cannot find "Error!" the question is referring in the project specifications. Specification 27 51 13 is not included in the bidding project manual.

48. **Question**: Plumbing-P-100-"P-100 includes plumbing items tagged GT-1, SOI-1, and SW-1 but these items are not listed in the Plumbing Schedule. Please provide details and specifications for these items.

    Response: Information included on Sheet P-503

49. **Question**: Plumbing-P-111A, P111B, P-601-"Notes on P-111A and P-111B denote domestic cold water (DCW) connections to fire hose connections. P-601 appears to indicate this is a line separate from the building DCW and is served by a dedicated RPZ. Please confirm this line is separate from the building DCW and clarify whether this line should be identified as non-potable water.

    Response: The items P111A&B refer to the valves in the domestic water line that fills the fire trucks. They are not part of the fire protection system.

50. **Question**: Plumbing-P-111A, P111B-"Notes on P-111A and P-111B denote domestic cold water (DCW) connections to fire hose connections. Please provide details for the hose connections.

    Response: Please refer to the response provided for Question #49.

51. **Question**: Plumbing-P-111A, P111B-"Plan notes indicate compressed air piping to hose reels in several locations, but compressed air hose reels are not listed in the equipment schedule. Please clarify who is responsible for furnishing and installing these hose reels. If hose reels are to be furnished and installed by Division 22, please provide specifications and details for this work.

    Response: The hose reels are to be provided by the contractor.

52. **Question**: Contracting--"Please confirm that the Texas Renovation tax does not apply.

    Response: Confirmed.

53. **Question**: Plumbing-P-501-"Please provide details or specs for the filters listed in the description for AC-1.

    Response: Air Filter to be by manufacturer of dryer.

54. **Question**: Fire Protection-P-010, P-503-"P-010 notes that the Fire Department Connection (FDC) and Post Indicator Valve (PIV) will be located subject to the Fire Marshal. P-503 Detail D1 shows the FDC and PIV mounted in the wall adjacent to the fire entry. Please confirm that the FDC and PIV will be wall mounted as shown and not remotely located.

    Response: The PIV is required to cut off the building. There may be another at the incoming vault, refer to civil drawings.

55. **Question**: Glazing -Spec 08 80 00 -"Specification state the exterior glazing to be STC 50 rated but that cannot be achieved with thickness and specification stated.

    Response: Spec 08 80 00 to be revised to require STC rating of 42 minimum. Glazing to be 1-5/16" insulated hurricane impact glass. Basis of Design Product: Viracon VUE1-50 or approved equal per the material substitution process within the project specifications.

56. **Question**: Environmental-00340-"Section 00340 references lead and asbestos survey reports, but these are not found. Please provide

    Response: Hazardous studies and Geotechnical Report attached and included in this Addendum.

57. **Question**: Contracting-00700 00701-"Section 00700 is the General Conditions and section 00701 is FAA General Provisions. In the event of a conflict, which takes precedence.

    Response: HAS cannot issue an answer based on an assumption. There is no reason for the conditions of the bid package to be in conflict with each other.

58. **Question**: Geotech-00320-"Section 00320 references a Geotech report, but it is not found. Please provide

Response: Hazardous studies and Geotechnical Report attached and included in this Addendum.

59. **Question**: Fire Protection-211300-"Will black steel pipe be accepted for pre-action fire sprinkler piping?

    Response: Please refer to the response provided for Question #18.

60. **Question**: Fire Protection-211300-"Spec section 211300 includes numerous sections for dry system requirements. Please clarify which areas of the building, if any, are to have dry system fire protection.

    Response: None.

61. **Question**: Fire Protection-211300-"Will Schedule 10 pipe for sizes 2-1/2" and larger be accepted?

    Response: All fire suppression piping to be schedule 40 as specified.

62. **Question**: Contracting--"Contractor requests a provision containing a mutual waiver of consequential damages between Owner and Contractor.

    Response: Terms and Conditions remain as stated.

63. **Question**: Contracting--"Contractor requests confirmation that Owner's Liquidated Damages are Owner's sole and exclusive remedy for Contractor caused delay.

    Response: Refer to General Conditions.

64. **Question**: Contracting--"Given the current market conditions, Contractor requests a provision providing Contractor relief from Owner for legitimate and substantiated escalation costs.

    Response: Please refer to the response provided for Question #63.

65. **Question**: Contracting--"Given the current market conditions, Contractor requests time and money relief from Owner due to legitimate and substantiated material shortages.

    Response: Please refer to the response provided for Question #63.

66. **Question**: Contracting-00700-"Contractor requests confirmation that the Agreement and General Conditions control in the event of a conflict between the Agreement, General Conditions, and the FAA General Provisions.

    Response: Please refer to the response provided for Question #57.

67. **Question**: Contracting-00520-"Considering the Scope of Work and Contractor's limited permission by Owner to conduct site investigation, Contractor requests Agreement, Sections 5.1.4 and 5.1.5, and General Conditions, Section 4.3.5.1.2 be stricken.

    Response: Requirements remain as stated.

68. **Question**: Contracting-00700-"Contractor requests that General Conditions, Section 5.2.4, requiring Contractor to release retainage to Subcontractors even if Owner continues to withhold retainage from Contractor, be stricken.

    Response: Requirements remain as stated.

69. **Question**: Contracting-00700-"Contractor requests that General Conditions, 13.2.1 provide for mutual disclaimer of personal liability for both the Owner and Contractor.

    Response: Requirements remain as stated.

70. **Question**: Please confirm vehicles, containers, etc. will be removed before first phase begins.

    Response: Confirmed.

71. **Question**: Geotech and asbestos & lead reports were not found within the project manual. Can an electronic copy for both be provided?

    Response: Please refer to the response provided for Question #58**.**

72. **Question**: Confirm this project is sales tax exempt

    Response: Confirmed.

73. **Question**: Can an architectural finish plan be provided?

    Response: Finish schedule is included on Sheet A-651. All floor finishes transition at centerline of door frame. Extent of accent wall paint shown on Sheets A-111A and A-111B. No finishes floor plan is required.

74. **Question**: Please confirm furniture schedule on sheet A661A is not included in GC scope.

    Response: Furniture schedule is included in FF&E Allowance and to be provided by Contractor unless otherwise noted.

75. **Question**: Please confirm if the gym equipment listed EX-1 through EX-5 under the Equipment & Appliance Schedule is to be by contractor or owner.

Response: Exercise equipment will be provided by others.

76. **Question**: Please provide a manufacturer and model number for the CM-1 Automatic coffee maker, DC-1 Dryer, WM-1 Washer which is listed under Equipment and Appliance Schedule.

    Response: CM-1: Bunn Model #CWTF35-APS*** Product # 23001.0052
    DC-1 Dryer: LG Model #DLEX7900BE
    WM-1 Washer: LG Model #WT7900HBA

    Substitution requests to be provided and submitted at the time of the bid submission as part of the submission packet. Substitutions must meet current HAS Design Criteria Manual requirements.

77. **Question**: Please confirm if the RD-1 watchroom radio 1 and 2 listed under the Equipment and Appliance Schedule is existing and if by contractor or owner?

    Response: RD-1 and RD-2 are CFCI equipment. CFCI= Contractor furnished/Contractor.

78. **Question**: During the Prebid it was stated that there is a DBE requirement of 13%, however, the Supplementary Conditions state a PDBE goal of 13%. Please confirm which is correct.

    Response: DBE goal of 13%.

79. **Question**: Bid Form Part B calls for a cash allowance of $10,000 for the building permit. Section 01210-1 of the project manual calls for a cash allowance of $35,000 for the building permit. Please confirm the correct amount for the building permit allowance.

    Response: Please refer to Section 01210. Cash allowance is $35,000 of building permit, $300,000 of permanent electrical service, $15,000 of permanent telephone service and $475,000 of FF&E equipment. Total cash allowance is $825,000.00.

80. **Question**: Door type elevations show FG and FG2, however, there is only FG and FG3 shown on the door schedule. Please clarify.

    Response: Door type for doors 102.4.9.5 and X102.4.9.5 to be FG2, not FG3.

81. **Question**: The general conditions document says, “no substitutions of products will be considered during the bidding period”. However, under the Products 2.01 section of the 07 42 13.23 metal composite material wall panel spec, it says “substitutions must be identical to basis of design in look, durability, maintenance, and warranty". Please confirm if there will be no substitutions during bidding or if substitutions on ANY product must be identical to basis of design in look, durability, maintenance, and warranty.

    Response: Please refer to the response provided for Question #18.

82. **Question**: Are there any specific advertising requirements besides soliciting to the three plan rooms that were provided?

    Response: No

When issued, Addendum shall automatically become part of the solicitation documents and shall supersede any previous specification(s) and/or provision(s) in conflict with this Addendum. Addenda will be incorporated into the Contract as applicable. It is the responsibility of the bidder(s) to ensure that it has obtained all such Addenda. By submitting a bid on this project, bidder(s) shall be deemed to have received all Addenda and to have incorporated them into their bid.

If further clarification is needed regarding this solicitation, please contact Humberto De La Garza, Sr. Procurement Specialist, via email at humberto.delagarza@houstontx.gov.

DS DE

DocuSigned by:
Cathy Vander Plaats
02232028DE99414...

Cathy Vander Plaats
Aviation Procurement Officer
Houston Airport System

DS AO

cc: Al Oracion
Dallas Evans
Solicitation File

Attachments:

1. Document 00410-B3 – Page 24.
2. Geotechnical Report.
3. Asbestos Survey Report
4. Lead Paint Survey Report.

D. CASH ALLOWANCE TABLE:

Item No.	Spec Ref.	Cash Allowance Short Title	Cash Allowance in figures (1)
[1]		Schedule of cash allowances	$825,000.00
TOTAL CASH ALLOWANCES			$825,000.00

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GEOTECHNICAL INVESTIGATION

HOUSTON AIRPORT SYSTEM
IAH AIRCRAFT RESCUE AND FIREFIGHTING (ARFF)
STATION NO. 92 RELOCATION
2800 N. TERMINAL ROAD
HAS PROJECT NO. 668A
HOUSTON, TEXAS

Prepared for:

Atkins North America, Inc.
Houston, Texas

by

Aviles Engineering Corporation
5790 Windfern
Houston, Texas 77041
713-895-7645

REPORT NO. G150-20

March 2021

AVILES
ENGINEERING CORP.

March 1, 2021

Mr. John Verburg, P.E.
Atkins North America, Inc.
17220 Katy Freeway, Suite 200
Houston, Texas 77094

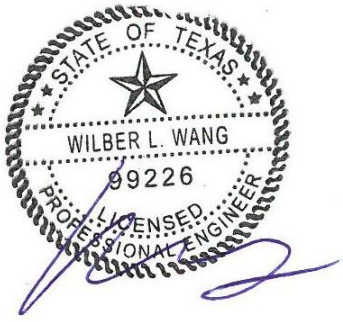
Reference: **Geotechnical Investigation**
Houston Airport System
IAH Aircraft Rescue and Firefighting (ARFF) Station No. 92 Relocation
2800 N. Terminal Road
Houston, Texas
HAS Project No. 668A
AEC Report No. G150-20

Dear Mr. Verburg,

Aviles Engineering Corporation (AEC) is pleased to present this report of the results of our geotechnical investigation for the above referenced project. This investigation was authorized by you on October 21, 2020 via Task Order No. 5 of Subcontract Number 1008201. Project terms and conditions were in accordance with the Master Subcontract Agreement between Atkins North America, Inc. (Atkins) and AEC, dated June 24, 2019. The original scope of services for this project (Borings B-1 through B-7) was performed in accordance with AEC Proposal No. G2020-03-12R, dated September 22, 2020. Additional scope of services for this project (Borings B-8 through B-10) was performed in accordance with AEC Proposal No. G2021-01-08R1, dated January 20, 2021.

AEC appreciates the opportunity to be of service to you. Please call us if you have any questions or comments concerning this report or when we can be of further assistance.

Respectfully submitted,
Aviles Engineering Corporation
(TBPELS Firm Registration No. F-42)



Wilber L. Wang, P.E.
Senior Engineer

3/1/2021

Hanie Joodat, Ph.D., E.I.T.
Staff Engineer

Reports Submitted: 1 Atkins North America, Inc. (electronic)
1 File (electronic)

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AVLES ENGINEERING CORP.

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APPENDICES

AVILES
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GEOTECHNICAL INVESTIGATION

HOUSTON AIRPORT SYSTEM
IAH AIRCRAFT RESCUE AND FIREFIGHTING (ARFF)
STATION NO. 92 RELOCATION
2800 N. TERMINAL ROAD
HAS PROJECT NO. 668A
HOUSTON, TEXAS

1.0 INTRODUCTION

1.1 General

The report submitted herein presents the results of Aviles Engineering Corporation's (AEC) geotechnical investigation for the Houston Airport System's (HAS) proposed Aircraft Rescue and Firefighting (ARFF) Station No. 92 Relocation at George Bush Intercontinental Airport (IATA Code IAH), to be located at 2800 N. Terminal Road in Houston, Texas (Houston/Harris County Key Map No.: 374C). A vicinity map is presented on Plate A-1, in Appendix A.

According to the information provided by Atkins North America, Inc. (Atkins), the proposed improvements include: (i) relocating the ARFF Station No. 92 to an existing underutilized asphalt parking lot located south of Will Clayton Parkway and east of the existing ARFF Station No. 92; and (ii) constructing new driveways and parking spaces for the relocated station. According to the information provided by Atkins, the existing ARFF Station No. 92 located at 4300 Will Clayton Parkway will be converted to a parking lot. Based on the site plan provided by Atkins, dated December 22, 2020, the proposed 21,378 square foot ARFF Station No. 92 building will have a footprint that is approximately 111 feet wide by 308 feet long. New driveways will be constructed at the project site to connect the relocated ARFF Station No. 92 including its main building and the apparatus vehicle stations to the access road.

1.2 Purpose and Scope

The purpose of this geotechnical investigation is to evaluate the subsurface soil and groundwater conditions at the project site and develop geotechnical engineering recommendations for the proposed improvements. The scope of this geotechnical investigation is summarized below:

1. Drilling and sampling ten soil borings ranging from 10 to 40 feet below existing grade.
2. Soil laboratory testing on selected soil samples.

3. Engineering analyses and recommendations for foundation types, bearing depth, allowable bearing capacity, floor slab, and subgrade preparation for the building and apparatus bays.
4. Engineering analyses and recommendations for concrete pavement, including pavement thickness and subgrade preparation.
5. Construction recommendations for the building foundations and pavement.

2.0 SUBSURFACE EXPLORATION

2.1 Soil Borings

Subsurface conditions at the project site were investigated by drilling a total of ten soil borings (Borings B-1 through B-10) at the site, to depths ranging from 10 to 40 feet below existing grade. The locations for Borings B-1 through B-7 were selected and marked in the field by Atkins personnel. The approximate boring locations and boring surface elevations for Borings B-1 through B-7 were provided by Atkins to AEC. Drilling was then performed by AEC personnel at the provided approximate locations. The locations for Borings B-8 through B-10 were later selected and marked in the field by AEC personnel. The total drilling footage is 220 feet. A survey of AEC's boring locations was not performed after completion of drilling. The approximate boring locations are shown on the Boring Location Plan on Plate A-2, in Appendix A.

AEC notes that Borings B-1 through B-7 were drilled in December 2020 before an updated site plan was available. The proposed ARFF Station No. 92 was moved further to the north by others from its original proposed location after the borings were drilled. As a result, Borings B-1 and B-2 are no longer located within the footprint of the proposed ARFF Station No. 92. Based on the current site plan, Boring B-6 was drilled to a depth of 10 feet within the building footprint. Although the soil conditions in Boring B-6 were like those encountered in Borings B-1 and B-2 (i.e., a combination of clay and sandy soils), three additional soil borings (Borings B-8 through B-10 in February 2021) were performed to a depth of 20 feet within the footprint of the current ARFF Station No. 92 location to confirm the design and construction recommendations presented in this report.

2.2 Drilling and Sampling Methods

Prior to drilling, existing pavement at Borings B-1 through B-4 and B-6 was first cut with a core barrel while existing pavement at Borings B-8 through B-10 was augered through. The borings were drilled using a buggy-mounted drilling rig. Borings B-1 through B-4 were advanced initially using dry auger method, and then using wet rotary method once groundwater was encountered. Borings B-5 through B-10 were advanced using

dry auger method alone. Undisturbed samples of cohesive soils were obtained from the borings by pushing 3-inch diameter thin-wall, seamless steel Shelby tube samplers in general accordance with ASTM D 1587. Granular soils were sampled with a 2-inch split-barrel sampler in accordance with ASTM D 1586. Standard Penetration Test resistance (N) values were recorded for the granular soils as "Blows per Foot" and are shown on the boring logs. Strength of the cohesive soils was estimated in the field using a hand penetrometer. The undisturbed samples of cohesive soils were extruded mechanically from the core barrels in the field and wrapped in aluminum foil; all samples were sealed in plastic bags to reduce moisture loss and disturbance. The samples were then placed in core boxes and transported to the AEC laboratory for testing and further study. Groundwater readings were obtained during drilling. After completion of drilling, Borings B-1 through B-9 were backfilled with bentonite chips while Boring B-10 was grouted with cement-bentonite. Existing pavement (where present) was patched with either non-shrink grout or cold-placed asphalt.

Sample Pit: In addition to soil borings, a sample pit was excavated in the vicinity of Boring B-7 to collect subgrade materials for Standard Proctor and California Bearing Ratio (CBR) testing (see Section 3.1 of this report). AEC used a drill rig with a continuous flight auger to collect samples continuously from a depth of 0 to 4 feet below grade. The samples were then bagged and transported to the AEC laboratory for testing. The pit was backfilled with bentonite chips upon completion of field work.

3.0 LABORATORY TESTING PROGRAM

3.1 Geotechnical Tests

Index Properties: Soil laboratory testing was performed by AEC personnel. Samples from the borings were examined and classified in the laboratory by a technician under supervision of a geotechnical engineer. Laboratory tests were performed on selected soil samples to evaluate the engineering properties of the foundation soils in accordance with applicable ASTM Standards. Atterberg limits, moisture contents, percent passing a No. 200 sieve, and dry unit weight tests were performed on selected samples to establish the index properties and confirm field classification of the subsurface soils. Strength properties of cohesive soils were determined by means of torvane (TV), unconfined compression (UC), and unconsolidated-undrained (UU) triaxial tests performed on undisturbed samples. The laboratory test results are presented on the representative boring logs (see Plates A-3 through A-12, in Appendix A). A key to the boring logs, classification of soils for engineering purposes, terms used on boring logs, and reference ASTM Standards for laboratory testing are presented on Plates A-13 through A-16, in Appendix A.

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Organic Matter Content: AEC performed organic matter content tests on selected soil samples in accordance with ASTM D 2974. Organic content test results are summarized on Table 1 and are presented on Plate A-17, in Appendix A.

Table 1. Organic Matter Content Test Results (ASTM D 2974)

Sample ID and Description	Organic Content (%)
B-3, 1'-2', Fill: Sandy Silty Clay (CL-ML)	1.7
B-6, 1'-2', Fill: Sandy Lean Clay (CL)	1.3

Compaction and CBR: Soils (from the ground surface to a depth of 4 feet below grade) recovered from a sample pit excavated in the vicinity of Boring B-7 were mixed and split in general accordance with ASTM C 702. After splitting, Atterberg limits were performed to determine the index properties of the sample. The sample was then molded and compacted in accordance with ASTM D 698 (Standard Proctor). After the sample was compacted, it was soaked for a period of 96 hours and a CBR (ASTM D 1883) test was performed.

Compaction and index property test results are presented on Plate A-18, in Appendix A. A summary of sample pit index properties is presented on Table 2. CBR test results are presented on Plates A-19 and A-20, in Appendix A. A summary of CBR test results is presented on Table 3.

Table 2. Sample Pit Soil Properties

Sample ID and Description	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve (%)	ASTM D 698 Maximum Dry Density (pcf)	ASTM D 698 Optimum Moisture Content (%)
B-7, 0'-4', Sandy Lean Clay (CL)	30	17	-	116.4	12.7

Table 3. California Bearing Ratio Test Results (ASTM D 1883)

Sample ID	Percent Compaction (%), ASTM D 698	Dry Density (pcf)	CBR (%)
B-7, 0'-4', Composite Sample	95	110.6	5.57
	90	104.8	2.76
	85	98.9	2.21

3.2 Chemical Tests

To evaluate the potential of the onsite soils for sulfate and chloride attack on concrete foundations, AEC selected a soil sample for chemical analyses. Chemical testing included pH, resistivity, sulfate content, and chloride content on a sample recovered from Boring B-7 from a depth of 0 to 2 feet. AEC used Texas Department of Transportation (TxDOT) test methods for each test type, Tex-128-E, Tex-129-E, Tex-145-E Part 2, and Tex-620-J, respectively. A summary of the test results is presented on Table 4 below.

Table 4. Chemical Test Results

Sample ID	Resistivity (ohm/cm)	Sulfate (mg/kg)	Chloride (mg/kg)	pH	Aggressive Environment
B-7, 0'-2'	3,424	20	329	8.66	Yes

According to the Federal Highway Administration (FHWA) Design Manual "Design and Construction of Driven Pile Foundations", concrete design should be based on an aggressive subsurface environment whenever the pH value is 4.5 or less. Alternately, if the resistivity is less than 2,000 ohms/cm, the soils should be treated as an aggressive environment. If the soil resistivity is between 2,000 and 5,000 ohms/cm, and the chloride ion content is greater than 100 parts per million (ppm) or the sulfate ion content is greater than 200 ppm, the foundation design should be based on an aggressive subsurface environment. Resistivity values greater than 5,000 ohms/cm can be considered non-aggressive environments.

Based on the test results in Table 4 and the FHWA criteria, the tested soil sample is considered an aggressive environment.

Sulfate ions in soils and groundwater result in an expansive chemical reaction with Portland cement. Expansion of concrete often leads to cracking and spalling which can significantly reduce the available structural capacity of footings. Chloride ions do not attack concrete directly; instead, they cause corrosion of reinforcement steel, which then causes expansion cracking and spalling of the concrete as products of steel corrosion are formed. This loss of bond between steel and concrete can result in a reduction of foundation capacity. Protective measures which can reduce the potential for corrosion attack include increased concrete cover around the reinforcing steel, the use of galvanized or epoxy coated reinforcement, or using Type II Portland cement (with moderate sulfate resistance) for concrete foundation.

Sulfate Content Tests for Pavement Subgrade: The sulfate content test performed on the soil sample recovered

from Boring B-7 from a depth of 0 to 2 feet was also used to determine if the onsite soils have a potential for sulfate attack on lime-stabilized subgrade for pavements. Sulfate test result is presented on Table 5.

Table 5. Sulfate Content Test Result (Tex-145-E)

Sample ID and Description	Sulfate Content (mg/kg)	Treatment Level for Roadway Subgrade (1)
B-7, 0'-2', Fill: Sandy Lean Clay (CL)	20	Level 1/Traditional

Note: (1) Evaluation of sulfate attack on stabilized subgrade for roadways is based on TxDOT criteria.

According to TxDOT's "Guidelines for Treatment of Sulfate-Rich Soils and Bases in Pavement Structures", different levels of treatment are required if roadway subgrade will be stabilized. As defined by TxDOT's document: (i) Level 1 treatment (Traditional Treatment) can be used for roadway subgrades that have a sulfate content of 3,000 ppm or less; (ii) Level 2 treatment (Modified Treatment) can be used for roadway subgrades that have a sulfate content between 3,000 ppm and 8,000 ppm; and (iii) Level 3 treatment (Alternative Treatment) is required when the sulfate content is greater than 8,000 ppm. Based on Table 5, the existing soils at the project site have very low sulfate contents (i.e., significantly less than 3,000 ppm). Based on the result presented in Table 5, Level 1 treatment (Traditional Treatment) can be used for subgrade stabilization.

4.0 SITE CONDITIONS

A summary of existing pavement sections encountered in AEC's borings is presented on Table 6 below.

Table 6. Summary of Existing Pavement Thickness at the Proposed ARFF Station No. 92

Boring No.	Pavement Section
B-1	2.5" asphalt, 4" stabilized sand and gravel base, 9.5" stabilized clay subgrade
B-2	2.5" asphalt, 4.5" stabilized sand and gravel base, 8" stabilized clay subgrade
B-3	2.5" asphalt, 4.25" stabilized sand and gravel base, 9" stabilized clay subgrade
B-4	3" asphalt, 3.5" stabilized sand and gravel base, 7.5" stabilized clay subgrade
B-6	3" asphalt, 4" stabilized sand and gravel base, 9.5" stabilized clay subgrade
B-8	3" asphalt, 3" stabilized clay subgrade
B-9	3" asphalt, 5" stabilized sand subgrade
B-10	3" asphalt, 7" stabilized sand subgrade

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4.1 Subsurface Conditions

Details of the soils encountered during drilling are presented in the boring logs on Plates A-3 through A-12, in Appendix A. Soil strata encountered in the borings are summarized below.

Boring	Depth (ft)	Description of Stratum
B-1	0 - 1.3	Pavement, base, and subgrade: see Table 6 in Section 4.0 of this report.
	1.3 - 2	Fill: Silty Clayey Sand (SC-SM), with sandy lean clay pockets
	2 - 8	Fill: Clayey Sand (SC), with sand pockets and vertical partings
	8 - 10	Clayey Sand (SC), with sandy lean clay and silty sand seams
	10 - 27	Medium dense to very dense, Poorly Graded Sand with Silt (SP-SM)
	27 - 40	Soft to very stiff, Lean Clay (CL)
B-2	0 - 1.3	Pavement, base, and subgrade: see Table 6 in Section 4.0 of this report.
	1.3 - 2	Fill: Sandy Silty Clay (CL-ML), with clayey sand partings and silty sand seams
	2 - 6	Fill: Silty Sand (SM)
	6 - 14	Stiff to very stiff, Sandy Lean Clay (CL), with silty sand pockets and vertical partings
	14 - 27	Medium dense to dense, Poorly Graded Sand with Silt (SP-SM)
	27 - 37	Very stiff, Lean Clay (CL)
	37 - 40	Stiff, Fat Clay (CH), with clayey sand pockets and seams
B-3	0 - 1.3	Pavement, base, and subgrade: see Table 6 in Section 4.0 of this report.
	1.3 - 6	Fill: stiff to hard, Sandy Silty Clay (CL-ML), with silty sand partings
	6 - 10	Hard, Sandy Lean Clay (CL), with clayey sand partings
	10 - 14	Medium dense, Clayey Sand (SC)
	14 - 16	Dense, Poorly Graded Sand with Silt (SP-SM), with clayey sand seams
	16 - 25	Medium dense to dense, Silty Sand (SM), wet
B-4	0 - 1.2	Pavement, base, and subgrade: see Table 6 in Section 4.0 of this report.
	1.2 - 2	Fill: very dense, Silty Sand (SM), with sandy lean clay pockets
	2 - 4	Very dense, Silty Sand (SM), with clayey sand pockets
	4 - 6	Clayey Sand (SC), with sandy lean clay and silty sand pockets
	6 - 10	Firm to very stiff, Sandy Lean Clay (CL), with sand pockets and seams
	10 - 12	Medium dense, Silty Clayey Sand (SC-SM)
	12 - 18	Medium dense, Silty Sand (SM)
	18 - 22	Stiff to very stiff, Sandy Silty Clay (CL-ML), with clayey sand partings
	22 - 25	Medium dense, Silty Sand (SM), with sandy lean clay pockets, wet
B-5	0 - 4	Fill: Silty Clayey Sand (SC-SM), with sandy lean clay pockets and silty sand partings
	4 - 10	Stiff to very stiff, Lean Clay (CL), with ferrous nodules
B-6	0 - 1.4	Pavement, base, and subgrade: see Table 6 in Section 4.0 of this report.
	1.4 - 6	Fill: very stiff to hard, Sandy Lean Clay (CL), with clayey sand partings
	6 - 8	Silty Sand (SM), with fat clay pockets
	8 - 10	Very stiff, Lean Clay (CL), with fat clay and sand pockets

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Boring	Depth (ft)	Description of Stratum
B-7	0 - 2	Fill: very stiff, Sandy Lean Clay (CL), with silty sand partings and gravel
	2 - 10	Stiff to very stiff, Lean Clay (CL)
B-8	0 - 0.5	Pavement and subgrade: see Table 6 in Section 4.0 of this report.
	0.5 - 2	Fill: Silty Sand (SM), with calcareous nodules
	2 - 6	Fill: medium dense, Clayey Sand (SC)
	6 - 14	Clayey Sand (SC)
	14 - 20	Medium dense, Silty Clayey Sand (SC-SM), wet
B-9	0 - 0.7	Pavement and subgrade: see Table 6 in Section 4.0 of this report.
	0.7 - 1	Fill: Silty Sand (SM), with gravel, cement-stabilized
	1 - 4	Fill: hard, Sandy Silty Clay (CL-ML), with sandy lean clay pockets and silty clayey sand partings
	4 - 8	Fill: stiff to hard, Sandy Lean Clay (CL), with silty sand seams
	8 - 10	Stiff to very stiff, Sandy Lean Clay (CL), with fat clay pockets, and sand pockets and seams
	10 - 12	Silty Sand (SM), with sandy lean clay pockets
	12 - 20	Medium dense, Silty Clayey Sand (SC-SM)
B-10	0 - 0.8	Pavement and subgrade: see Table 6 in Section 4.0 of this report.
	0.8 - 4	Fill: very dense, Silty Sand (SM), cement-stabilized
	4 - 6	Fill: stiff, Sandy Lean Clay (CL), with fat clay lenses, and sand seams and pockets
	6 - 12	Stiff to very stiff, Sandy Lean Clay (CL)
	12 - 14	Medium dense, Clayey Sand (SC), with sandy lean clay partings
	14 - 20	Medium dense to dense, Silty Clayey Sand (SC-SM)

Subsurface Soil Properties: The subsurface clayey soils (including fill but excluding clayey sand) encountered in the borings have none to high plasticity (see "Degree of Plasticity of Cohesive Soils" on Plate A-14, in Appendix A), with liquid limits (LL) ranging from 17 to 48, and plasticity indices (PI) ranging from 4 to 30 (according to Plate A-14, a PI of 4 is still considered "none" plasticity). The cohesive soils encountered in the borings are classified as "CL-ML", "CL", and "CH" type soils and granular soils are classified as "SC", "SC-SM", "SM", and "SP-SM" type soils in accordance with ASTM D 2487. "CH" soils undergo significant volume changes due to seasonal changes in soil moisture contents. "CL" soils with lower LL (less than 40) and PI (less than 20) generally do not undergo significant volume changes with changes in moisture content. However, "CL" soils with LL approaching 50 and PI greater than 20 essentially behave as "CH" soils and could undergo significant volume changes.

Groundwater Conditions: Groundwater levels and boring cave-in depths encountered in AEC's borings during drilling are summarized in Table 7.

Table 7. Water Levels in Borings

Boring No.	Date Drilled	Boring Depth (ft)	Boring Groundwater Depth (ft)	Boring Cave-in Depth (ft)
B-1	12/14/2020	40	18 (Drilling) 11.7 (5 Mins.)	11.7 (Drilling)
B-2	12/15/2020	40	18 (Drilling) 12.3 (5 Mins.)	12.3 (Drilling)
B-3	12/14/2020	25	18 (Drilling)	13.4 (Drilling)
B-4	12/14/2020	25	18 (Drilling) 13 (5 Mins.)	13 (Drilling)
B-5	12/15/2020	10	Dry (Drilling)	-
B-6	12/15/2020	10	Dry (Drilling)	-
B-7	12/14/2020	10	Dry (Drilling)	-
B-8	2/2/2021	20	18 (Drilling)	13 (Drilling)
B-9	2/2/2021	20	18 (Drilling)	14.3 (Drilling)
B-10	2/2/2021	20	17 (Drilling) 12.8 (5 Mins.)	12.8 (Drilling)

The information in this report summarizes conditions found on the dates the borings were drilled. However, it should be noted that our groundwater observations are short-term; groundwater depths and subsurface soil moisture contents will vary with environmental variations such as frequency and magnitude of rainfall and the time of year when construction is in progress.

4.2 Hazardous Materials

No signs of visual staining or odors were encountered during field drilling or during processing of the soil samples in the laboratory. However, AEC notes that the presence of potential hazardous material at other locations within the project area cannot be discounted based upon the very small and limited number of samples taken.

4.3 Subsurface Variations

It should be emphasized that: (i) at any given time, groundwater depths can vary from location to location, and (ii) at any given location, groundwater depths can change with time. Groundwater depths will vary with seasonal rainfall and other climatic/environmental events. Subsurface conditions may vary away from and in between the boring locations.

Clay soils in the Greater Houston area typically have secondary features such as slickensides, calcareous and ferrous nodules, and contain sand/silt seams/lenses/layers/pockets. It should be noted that the information in the boring logs is based on 3-inch diameter soil samples which were obtained continuously at intervals of 2 feet from the ground surface to a depth of 10 to 20 feet of the borings, then at intervals of 5 feet thereafter (in Borings B-1 through B-4) to the boring termination depths of 25 to 40 feet below grade. A detailed description of the soil secondary features may not have been obtained due to the small sample size and sampling interval between the samples. Therefore, while a boring log shows some soil secondary features, it should not be assumed that the features are absent where not indicated on the boring logs.

5.0 GEOTECHNICALENGINEERING RECOMMENDATIONS

According to the information provided by Atkins, the proposed improvements include: (i) relocating the ARFF Station No. 92 to an existing underutilized asphalt parking lot located south of Will Clayton Parkway and east of the existing ARFF Station No. 92; and (ii) constructing new driveways and parking spaces for the relocated station. According to the information provided by Atkins, the existing ARFF Station No. 92 located at 4300 Will Clayton Parkway will be converted to a parking lot. Based on the site plan provided by Atkins, dated December 22, 2020, the proposed 21,378 square foot ARFF Station No. 92 building will have a footprint that is approximately 111 feet wide by 308 feet long. New driveways will be constructed at the project site to connect the relocated ARFF Station No. 92 including its main building and the apparatus vehicle stations to the access road. Based on the proposed site grading plan (100% Schematic Design, dated February 4, 2021) provided by Atkins, the proposed ARFF Station No. 92 building will have a finished floor elevation (FFE) of +87.6 feet Mean Sea Level (MSL).

5.1 ARFF Station No. 92 Building

Soil Conditions: Based on Borings B-2, B-6, and B-8 through B-10, the subsurface soil conditions at the proposed building location are variable and the soils encountered are a combination of clay and sandy soils. The top 20 feet of the subsurface soils encountered in Boring B-2 consists of sandy silty clay (CL-ML) and silty sand (SM) fill material from the ground surface to a depth of 6 feet, followed by approximately 8 feet of stiff to very stiff sandy lean clay (CL), underlain by medium dense to dense poorly graded sand with silt (SP-SM) from a depth of 14 to 20 feet. The subsurface soils in Boring B-6 consists of very stiff to hard lean clay (CL) fill material from the ground surface to a depth of 6 feet, followed by approximately 2 feet of silty sand (SM), underlain by very stiff lean clay (CL) from a depth of 8 to 10 feet. The subsurface soils in Boring B-8 consists of medium

dense silty sand (SM) and clayey sand (SC) fill material from the ground surface to a depth of 6 feet, followed by approximately 8 feet of clayey sand (SC), underlain by medium dense silty clayey sand (SC-SM) from a depth of 14 to 20 feet. The subsurface soils in Boring B-9 consists of silty sand (SM) and stiff to hard lean/silty clay (CL/CL-ML) fill material from the ground surface to a depth of 8 feet, followed by approximately 2 feet of stiff to very stiff lean clay (CL), underlain by medium dense silty sand (SM) and silty clayey sand (SC-SM) from a depth of 10 to 20 feet. The subsurface soils in Boring B-10 consists of very dense silty sand (SM) and stiff lean clay (CL) fill material from the ground surface to a depth of 6 feet, followed by approximately 6 feet of stiff to very stiff lean clay (CL), underlain by medium dense to dense clayey sand (SC) and silty clayey sand (SC-SM) from a depth of 12 to 20 feet.

Based on the soil conditions encountered, AEC recommends that the proposed ARFF Station No. 92 building be supported on shallow spread footings, founded at 5 feet below existing grade. **AEC does not recommend that drilled and underreamed footings be used for this project site; drilled-and-underreamed footings would be difficult to construct considering the thick layers of granular soils encountered in Borings B-2 and B-8 through B-10. The granular soils present in these borings may result in sloughing or caving-in of the shaft sidewall and underream excavation. Straight-sided drilled shafts were also evaluated by AEC as a foundation alternative, but it is AEC's opinion that drilled shafts would be very costly to install compared to spread footings.**

5.1.1 Shallow Spread Footings

Based on the existing topographic survey (dated February 4, 2021) provided by Atkins, the approximate surface elevation of Borings B-2, B-6, and B-8 through B-10 (i.e., borings performed within/adjacent to the building footprint) varies from +86.3 and +87.7 feet MSL.

Footing Depth and Allowable Bearing Capacity: Shallow spread footings founded at a depth of at least 5 feet below the existing ground surface (i.e., bearing at an approximate elevation of +81.3 to +82.7 feet MSL) can be designed for a net allowable bearing capacity of 2,000 pounds per square foot (psf) for sustained loads and 3,000 psf for total loads, based on a minimum factor of safety (FS) of 3 for sustained loads and 2 for total loads. Whichever allowable bearing capacity results in a more conservative footing size should be used for design.

Backfill above Footings: Backfill (if any) placed on top of footings should consist of compacted select clay fill. Select clay fill should be in accordance with Section 5.3.1 of this report.

Footing Spacing: AEC recommends that the minimum edge-to-edge clear spacing between spread footings should not be less than one times the width of the larger footing to reduce stress overlap from adjacent footings and potential construction problems.

Footing Settlements: Based on the soil conditions encountered, we estimate that spread footings, designed, and constructed as recommended in this report, will experience total settlements on the order of 1 inch.

5.1.2 Floor Slab

Based on the proposed site grading plan (100% Schematic Design, dated February 4, 2021) provided by Atkins, the FFE of the proposed ARFF Station No. 92 building will be +87.6 feet MSL. Based on the existing topographic survey (dated February 4, 2021) provided by Atkins, the approximate surface elevation of Borings B-2, B-6, and B-8 through B-10 (i.e., borings performed within/adjacent to the building footprint) varies from +86.3 and +87.7 feet MSL.

Estimated Soil Movements: Expansive clays exhibit a potential to shrink and swell with changes in their moisture contents. The changes in the soil moisture content are usually caused by variations in the seasonal amount of rainfall and evaporation rates or other localized factors like the moisture withdrawal by nearby trees. The seasonal moisture active zone generally extends to about 10 feet below ground in the Greater Houston area, and will be deeper if trees with deep root zones exist adjacent to the structure.

Potential Vertical Rise (PVR) is an estimate of the potential of an expansive soil (if any) to swell from its current state. For the top 10 feet of the existing soils encountered in Borings B-2, B-6, and B-8 through B-10, the total PVR within the proposed ARFF Station No. 92 building footprint is estimated to be approximately 0.1 to 0.3 inches. PVR was computed using the TxDOT test method Tex-124-E.

Additional movements can occur in areas if water is allowed to pond during or after construction on soils with high plasticity, or if highly plastic soils are allowed to dry out prior to fill or concrete placement. High plasticity clay may also experience shrinkage during periods of dry weather as moisture evaporation occurs at the ground surface and the groundwater table drops. The actual PVR of the site will be highly dependent upon the actual PI and moisture regime of the clayey soils at the time of construction. Therefore, uniformity and preservation of the moisture contents of the near surface clays during construction and during the life of the structure is critical to reducing potential shrink-swell movement of the floor slab.

Floor Slab: In general, the tolerable differential vertical movement for a common building slab is about 1 inch. Since the estimated PVR for the proposed building is less than 1 inch (i.e., approximately 0.1 to 0.3 inches), a subgrade supported floor slab may be used for the proposed ARFF Station No. 92 building.

Subgrade Preparation: Subgrade preparation should extend a minimum of 5 feet beyond the floor slab perimeter. Existing asphalt pavement, base, and subgrade material should be removed and wasted. Once demolition of existing pavement, base, and subgrade material is completed, a minimum of 6 inches of surface soils, existing vegetation, trees, roots, and other deleterious materials shall be removed and wasted. The excavation depth should be increased when inspection indicates the presence of organics or otherwise deleterious materials to greater depths.

After surface stripping, AEC recommends that an additional 18 inches (total depth of 24 inches, including the 6 inches of surface stripping; i.e., excavate down to an approximate elevation of +84.3 to +85.7 feet MSL) of existing exposed soils be over-excavated and removed. The exposed subgrade should be proof-rolled in accordance with Item 216 of the 2014 TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges to identify and remove any weak, compressible, or other unsuitable materials; such materials should be replaced with compacted select fill. After proof rolling is performed, compacted select clay fill should then be used to achieve the design FFE (+87.6 feet MSL) of the building. Select clay fill should be in accordance with Section 5.3.1 of this report.

Even though the estimated PVR is less than 1 inch; the Owner should be aware that some risk of floor slab movement is still present if this floor slab option is selected. If conditions which exacerbate moisture variations such as the presence of trees, poor drainage, excessive drying/wetting of subsurface soils, or leaking underground utilities are located nearby, the floor slab total vertical movements and net differential vertical movements could be higher than estimated.

Grade Beams: AEC recommends that foundation grade beams be founded at least 30 inches below the lowest final grade. We recommend that tensile reinforcement be placed in both top and bottom of the beams. The footings and beams should be tied together.

Floor slabs are typically structurally tied to the grade beams, although this will be at the building designer's discretion. Alternatively, isolating the floor slabs from grade beams with a flexible impervious compound will be beneficial to reduce the potential for slab cracking due to differential soil movement; however, its use will not

mitigate the total and differential PVR movements and the floor slabs are expected to move corresponding to the subgrade soils.

Moisture Barrier: AEC recommends that a horizontal moisture barrier (minimum 10-mil thick) be placed below the concrete slab to move edge effects away from the slab and mitigate seasonal fluctuations of water content directly below the structure.

5.1.3 Apparatus Bays

The apparatus bays can be isolated from the building superstructure, and instead of using footings to support them, AEC recommends that the apparatus bays be supported on a heavy-duty concrete pavement (like a mat foundation).

Allowable Bearing Capacity: A heavy-duty pavement for the apparatus bays should be designed for an allowable bearing capacity of 1,400 psf for sustained loads and an allowable bearing capacity of 2,100 psf for total loads, based on a minimum FS of 3 for sustained loads and 2 for total loads. Whichever allowable bearing capacity results in a more conservative heavy-duty pavement thickness should be used for design.

Modulus of Subgrade Reaction: The modulus of subgrade reaction (k) is frequently used in the structural analysis of mat foundations and pavements. Based on the soil conditions encountered, we recommend using k = 125 pci for the heavy-duty concrete pavement.

Subgrade Preparation: Subgrade preparation should extend a minimum of 2 feet beyond the apparatus bay pavement slab perimeter. Existing asphalt pavement, base, and subgrade material should be removed and wasted. Once demolition of existing pavement, base, and subgrade material is completed, a minimum of 6 inches of surface soils, existing vegetation, trees, roots, and other deleterious materials shall be removed and wasted. The excavation depth should be increased when inspection indicates the presence of organics or otherwise deleterious materials to greater depths.

After surface stripping, an additional 18 inches (total depth of 24 inches, including the 6 inches of surface stripping; i.e., excavate down to an approximate elevation of +84.3 to +85.7 feet MSL) of existing soils at the ground surface should be removed. The exposed subgrade should be proof-rolled in accordance with Item 216 of the 2014 TxDOT Standard Specifications to identify and remove any weak, compressible, or other unsuitable

materials; such materials should be replaced with compacted select fill. After proof rolling is performed, compacted select clay fill should then be used to achieve the design FFE (+87.6 feet MSL) of the apparatus bays. Select clay fill should be in accordance with Section 5.3.1 of this report.

5.2 Pavement

According to the information provided by Atkins, onsite concrete pavement will consist of driveways and parking spaces for the relocated ARFF Station No. 92. Based on the proposed site grading plan (100% Schematic Design, dated February 4, 2021) provided by Atkins, the pavement will be constructed at or near existing grade. Traffic volume and vehicle loads were not available at the time this report was prepared; however, AEC assumes that the site traffic will primarily consist of emergency vehicles including firefighting apparatus, ambulances, and other rescue vehicles. AEC should be notified if traffic volume and vehicle load information becomes available, so that the pavement recommendations can be revised, if necessary.

According to the Program Definition Manual (PDM, dated August 30, 2018) prepared by HNTB Corporation (HNTB), a 7 inch thick jointed concrete pavement over an 8 inch thick stabilized subgrade was estimated for the proposed pavement sections at the site. Based on the suggestion from the PDM, AEC considered a 7 inch thick concrete pavement for driveway pavement design. The pavement recommendations provided herein assume that the proposed driveways and parking spaces will be constructed using jointed reinforced concrete pavement (JRCP).

Construction Specifications: AEC assumes that the latest edition of the City of Houston Standard Construction Specifications (COHSCS) will be used for this project. AEC should be notified if different construction specifications, such as Federal Aviation Administration (FAA) Airport Construction Standards, should be used instead, so that our recommendations can be updated if necessary.

The pavement design recommendations developed below are in accordance with the "AASHTO Guide for Design of Pavement Structures," 1998 edition.

5.2.1 Rigid Pavement

Rigid pavement design is based on the anticipated design number of 18-kip Equivalent Single Axle Loads (ESALs) the pavement is subjected to during its design life. The parameters that were used in computing the

rigid pavement section are as follows:

Overall Standard Deviation (S_0)	0.35
Initial Serviceability (P_0)	4.5
Terminal Serviceability (P_t)	2.0
Reliability Level (R)	85%
Overall Drainage Coefficient (C_d)	1.2 (curb and gutter)
Load Transfer Coefficient (J)	3.2
Loss of Support Category (LS)	1.0
Roadbed Soil Resilient Modulus (M_R)	8,355 psi (based on CBR test)
Elastic Modulus (E_{sb}) of Stabilized Soils	30,000 psi
Composite Effective Modulus of Subgrade Reaction (k)	147 pci
Concrete Compressive Strength (f'_c)	4,000 psi (at 28 days)
Mean Concrete Modulus of Rupture (S'_c)	600 psi (at 28 days)
Concrete Elastic Modulus (E_c)	3.6 x 10^6 psi

AEC should be notified if different parameters are required for concrete pavement design. In accordance with Section 02751 of latest edition of the COHSCS, **AEC assumes that 4,000 psi (at 28 days) compressive strength concrete will be used for concrete pavement construction. AEC should be notified if a different concrete compressive strength (such as 3,000 or 3,500 psi at 28 days) will be specified in the construction documents**, so that our recommendations can be revised, as necessary.

As noted in Section 5.2 of this report, AEC considered a 7 inch thick concrete pavement for onsite driveways, based on the suggestion of the PDM. AEC should be notified if an alternative pavement section should be considered, instead. The recommended rigid pavement sections are presented on Table 8.

Table 8. Recommended Concrete Pavement Section

Pavement Layer	Parking/Light Duty	Driveways
Portland Cement Concrete (in)	6	7
Lime-Fly Ash Stabilized Subgrade (in)	8	8
Estimated 18-kip ESAL Load Capacity	1,065,281 (See Plate B-1, in Appendix B)	2,511,532 (See Plate B-2, in Appendix B)

AEC used the DarWIN version 3.0 computer program to perform rigid pavement design; pavement design results are presented in Plates B-1 and B-2, in Appendix B. According to the DarWIN program, the parking area/light duty and driveway pavement sections will have an estimated load capacity of 1,065,281 and 2,511,532 repetitions of 18-kip ESALs, respectively. The design engineer should verify whether the proposed pavement sections will provide enough ESALs for the anticipated amount of site traffic. AEC should be notified if

different standards or constants are required for pavement design at the site, so that our recommendations can be updated accordingly.

Concrete Pavement: Portland Cement Concrete (PCC) pavement should be constructed in accordance with Section 02751 of the latest edition of the COHSCS. **According to Item 2.03.B of Section 02751 of the latest edition of the COHSCS, concrete mix design should produce a concrete that has a flexural strength of 500 psi at 7 days and 600 psi at 28 days and minimum compressive strength of 3,000 psi at 7 days and 4,000 psi at 28 days.** AEC should be notified if a different concrete mix design will be used, so that our recommendations can be revised, as necessary.

5.2.2 Reinforcing Steel

Reinforcing steel should be in accordance with Section 02751 of the latest edition of the COHSCS. Reinforcing steel is required to control pavement cracks, deflections across pavement joints, and resist warping stresses in rigid pavements. The cross-sectional area of steel (A_s) required per foot of slab width can be calculated as follows (for both longitudinal and transverse steel).

$$A_s = FLW/(2f_s) \qquad \text{.....Equation (1)}$$

where:
- A_s = Required cross-sectional area of reinforcing steel per foot width of pavement, in^2
- F = Coefficient of resistance between slab and subgrade, F = 1.8 for stabilized soil
- L = Distance between free transverse joints or between free longitudinal edges, ft.
- W = Weight of pavement slab per foot of width, lbs/ft
- f_s = Allowable working stress in steel, 0.75 x (yield strength), psi
  i.e., f_s = 45,000 psi for Grade 60 steel.

5.2.3 Pavement Subgrade Preparation

AEC encountered silty clayey sand (SC-SM) fill material at the ground surface in the vicinity of Borings B-1 and B-5, sandy silty clay (CL-ML) fill material at the ground surface in the vicinity of Borings B-2 and B-3, silty sand (SM) fill material at the ground surface in the vicinity of Borings B-4 and B-8 through B-10, and lean clay (CL) fill material at the ground surface in the vicinity of Borings B-6 and B-7. The PI of the material varied from 4 to 8 for the CL-ML and CL soils and from 1 to 7 for the SM and SC-SM soils. Based on the soil types and PI results, AEC recommends that the pavement subgrade be stabilized with a combination of at least 3 percent lime and 7 percent fly ash (by dry soil weight).

Roadway grading and fill should be performed in general accordance with Section 02315 of the latest edition of the COHSCS. Existing pavement, base, and subgrade material should be demolished in accordance with Section 02221 of the latest edition of the COHSCS. Subgrade preparation should extend a minimum of 2 feet beyond the paved area perimeters. After demolition of existing pavement, base, and subgrade material, the top 6 inches of existing soil and any deleterious materials at the ground surface should be removed and wasted. The excavation depth should be increased when inspection indicates the presence of organics and deleterious materials to greater depths. The exposed soils should be proof-rolled in accordance with Item 216 of the 2014 TxDOT Standard Specifications to identify and remove ant weak, compressible, or other unsuitable materials; such materials should be replaced with compacted select clay fill. Select clay fill should be in accordance with Section 5.3.1 of this report.

After proof rolling, scarify the exposed subgrade to a depth of 8 inches and stabilize with a combination of at least 3 percent hydrated lime and 7 percent fly ash (by dry soil weight). Lime-fly ash stabilization shall be performed in accordance with Section 02337 of the latest edition of the COHSCS. After application of lime and fly ash, the stabilized subgrade should be compacted to at least 95 percent of their ASTM D 698 (Standard Proctor) dry density at a moisture content ranging from optimum to 3 percent above optimum.

5.3 Fill Requirements

5.3.1 Select Clay Fill

'Select' Clay Fill: It is AEC's experience that 'select' fill material imported from sand and clay pits in the Greater Houston area is generally non-homogenous (i.e., composed of a mixture of sands, silts, and clays, instead of a homogenous sandy clay material) and of poor quality, and either contains too much sand or has large clay clods with high expansive potential. Use of this non-homogenous soil can result in poor long-term performance of structures and pavements placed on top of the fill.

Precautions: Prior to construction, the Contractor should determine if they can obtain qualified select clay fill meeting the below select fill criteria. The closest sand and clay pit to the project site may not be able to deliver fill material that meets the requirements below. The Contractor should also be aware that testing of select clay fill (see below) typically takes a minimum of 1.5 days to complete and they should accommodate testing in their fill placement in their project schedule. In addition, imported fill that is delivered to the project site may vary from day to day; material delivered to the site may pass one day but fail the next.

Select Clay Fill Requirements: Select clay fill (whether imported from offsite or excavated onsite) should consist of ***uniform***, non-active inorganic lean clays with a PI between 10 and 20 percent, and more than 50 percent passing a No. 200 sieve. Any clay soil intended for use as select fill (whether imported from offsite or excavated onsite) shall not have clay clods with PI greater than 20, clay clods greater than 2 inches in diameter, or contain sands/silts with PI less than 10. Sand and clay mixtures/blends are unacceptable for use as select fill. Sand/silt with clay clods is unacceptable for use as select fill. Mixing sand into clay or mixing clay into sand/silt is also unacceptable for use as select fill. **The testing lab shall *reject* any imported material delivered to the project site that does not meet the PI, sieve, and clay clod requirements above, without exceptions.**

Lifts and Compaction: All material intended for use as select clay fill should be tested prior to use to confirm that it meets select fill criteria. The fill should be placed in loose lifts not exceeding 8 inches in thickness. Backfill within 3 feet of walls or columns should be placed in loose lifts no more than 4-inches thick and compacted using hand tampers, or small self-propelled compactors.

Select clay fill should be compacted to a minimum of 95 percent of the ASTM D 698 (Standard Proctor) maximum dry unit weight at a moisture content ranging between optimum and 3 percent above optimum.

Testing: **If select clay fill will be used, at least one Atterberg Limits and one percent passing a No. 200 sieve test shall be performed for each 10,000 square feet (sf) of placed fill, per lift (with a minimum of one set of tests per lift), to determine whether it meets select clay fill requirements.** Prior to placement of pavement or concrete, the moisture contents of the top 2 lifts of compacted select clay fill shall be re-tested (if there is an extended period between fill placement and concrete placement) to determine if the in-place moisture content of the lifts have been maintained at the required moisture requirements.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Site Preparation and Grading

To mitigate site problems that may develop following prolonged periods of rainfall, it is essential to have adequate drainage to maintain a relatively dry and firm surface prior to starting any work at the site. Adequate drainage should be maintained throughout the construction period. Methods for controlling surface runoff and ponding include proper site grading, berm construction around exposed areas, and installation of sump pits with pumps.

Pumping Soils: Based on AEC's borings, silty sand (SM), silty clayey sand (SC-SM), and silty clay (CL-ML) were present at the ground surface in the vicinity of Borings B-1 through B-5 and B-8 through B-10. **These soils are prone to pumping when they are saturated after rainfall. Pumping soils are not able to support construction equipment.** If rainfall occurs and pumping soils are encountered at the ground surface, methods to mitigate the effect of the pumping soils include: (i) providing positive drainage around the pumping soils area, including cutting drainage swales as necessary; (ii) excavate and replace the pumping soils with competent, compacted clay fill that is free from debris or other deleterious materials; (iii) adding lime or fly ash to the pumping soils in order to dry out the soil, as well as increase soil strength; (iv) using woven geotextiles (such as a Mirafi RS series, or equivalent) to reinforce and separate weak/wet underlying soil layers; or (v) a combination of the above methods.

In addition to the recommended subgrade preparation, measures should be taken to reduce the potential for moisture changes in the subsurface soils under the proposed structure, which will in turn mitigate the potential for shrink and swell movements to occur. Measures recommended for consideration include:

- Maintain uniform compaction and moisture content for fill/subgrade soils during construction.
- Do not allow water to pond or allow the soils to dry out prior to constructing floor slabs.
- Locate landscaping away from floor slabs; trees should be located no closer than their mature canopy radius to the structure; even so, the tree roots influence zone can extend beyond their mature canopy radius.
- Design roof drains to discharge into paved areas or into a subsurface drainage system.
- Design final grading to provide site drainage away from the structure.

6.2 Construction Monitoring

Site preparation (including clearing and proof-rolling), earthwork operations, foundation and pavement construction, and subgrade preparation, as well as excavation should be monitored by qualified geotechnical professionals to check for compliance with project documents and changed conditions, if encountered. AEC should be allowed to review the design and construction plans and specifications prior to release to check that the geotechnical recommendations and design criteria presented herein are properly interpreted.

6.3 Monitoring of Existing Structures

Existing structures, underground utilities, and pavements in the vicinity of the project site should be closely monitored prior to, during, and for a period after excavation. Several factors (including soil type and

stratification, construction methods, weather conditions, other construction in the vicinity, construction personnel experience and supervision) may impact ground movement in the vicinity of the project site. We therefore recommend that the Contractor be required to survey and adequately document the condition of existing structures in the vicinity of the project site.

7.0 LIMITATIONS

The information contained in this report summarizes conditions found on the dates the borings were drilled. The attached boring logs are true representations of the soils encountered at the specific boring locations on the dates of drilling. Reasonable variations from the subsurface information presented in this report should be anticipated. AEC should be notified immediately when conditions encountered during construction are significantly different from those presented in this report.

The investigation was performed using the standard level of care and diligence normally practiced by recognized geotechnical engineering firms in this area, presently performing similar services under similar circumstances. This report is intended to be used in its entirety. The report has been prepared exclusively for the project and location described in this report. If pertinent project details change or otherwise differ from those described herein, AEC should be notified immediately and retained to evaluate the effect of the changes on the recommendations presented in this report and revise the recommendations if necessary. The scope of services does not include a fault investigation. The recommendations presented in this report should not be used for other structures located at this site or similar structures located at other sites, without additional evaluation and/or investigation.

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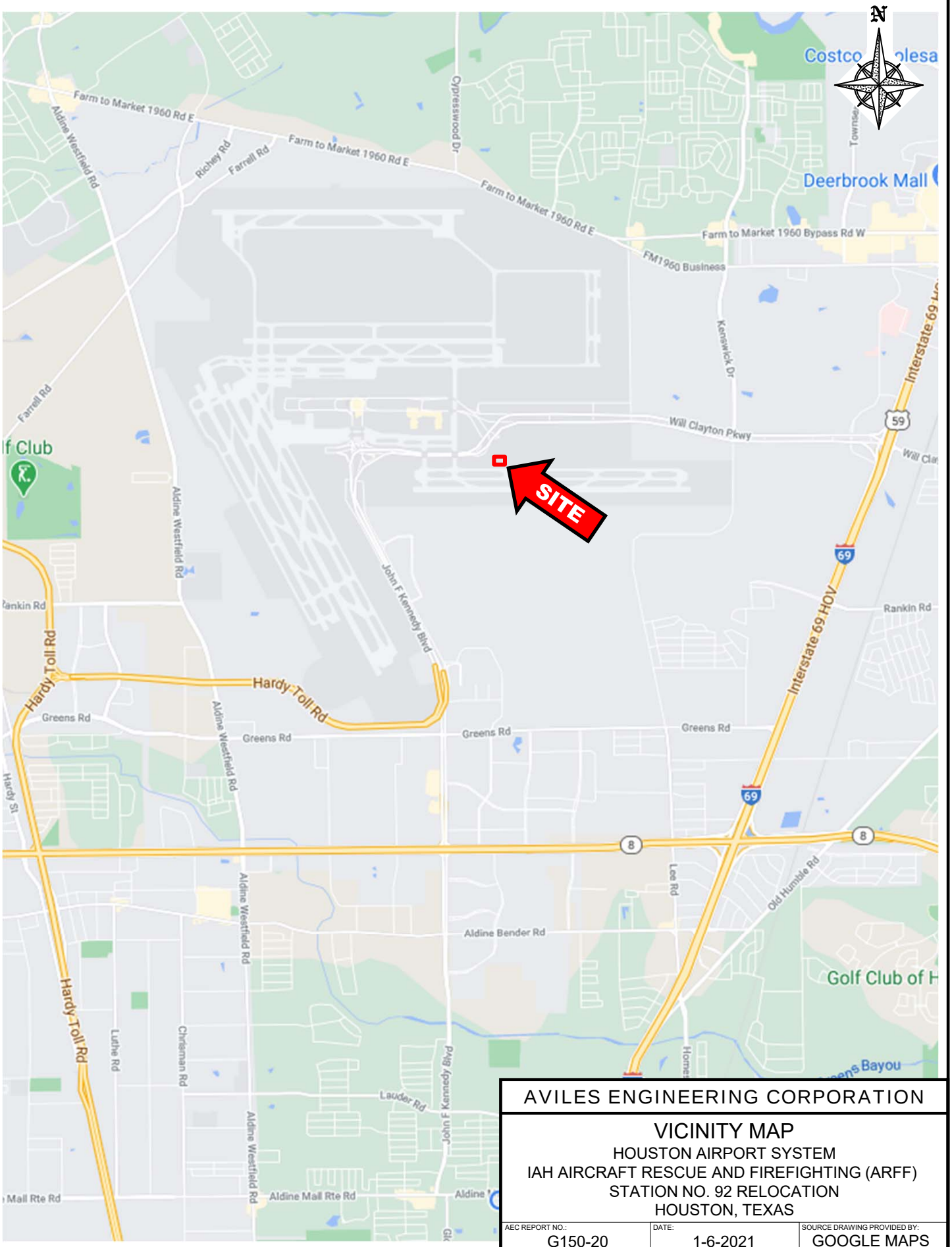
APPENDIX A

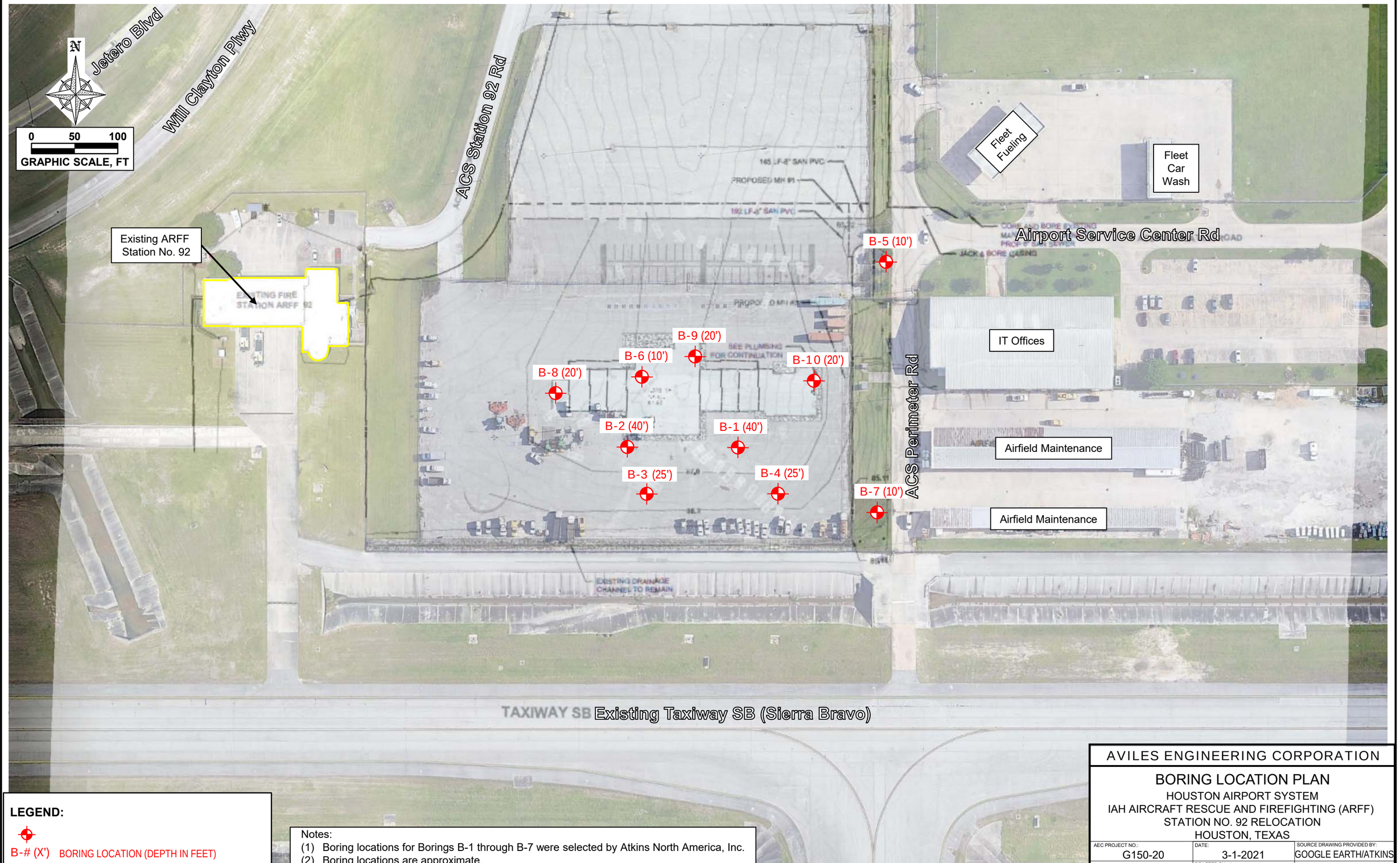


AVILES ENGINEERING CORPORATION

VICINITY MAP

HOUSTON AIRPORT SYSTEM
IAH AIRCRAFT RESCUE AND FIREFIGHTING (ARFF)
STATION NO. 92 RELOCATION
HOUSTON, TEXAS

AEC REPORT NO.:	DATE:	SOURCE DRAWING PROVIDED BY:
G150-20	1-6-2021	GOOGLE MAPS
APPROX. SCALE:	DRAFTED BY:	PLATE NO.:
N.T.S.	HJ	PLATE A-1



LEGEND:

B-# (X') BORING LOCATION (DEPTH IN FEET)

Notes:
(1) Boring locations for Borings B-1 through B-7 were selected by Atkins North America, Inc.
(2) Boring locations are approximate.
(3) Site plan is 'best fit' to aerial.

AVILES ENGINEERING CORPORATION

BORING LOCATION PLAN

HOUSTON AIRPORT SYSTEM
IAH AIRCRAFT RESCUE AND FIREFIGHTING (ARFF)
STATION NO. 92 RELOCATION
HOUSTON, TEXAS

AEC PROJECT NO.:	DATE:	SOURCE DRAWING PROVIDED BY:
G150-20	3-1-2021	GOOGLE EARTH/ATKINS
APPROX. SCALE:	DRAFTED BY:	PLATE NO.:
1" = 100'	HJ	PLATE A-2

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: ARFF Station No. 92 Relocation BORING B-1

DATE 12/14/2020 TYPE 4" Dry Auger/Wet Rotary LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
			Approximate Surface Elevation (feet): 87.0							
0			Pavement: 2.5" asphalt							
			Base: 4" stabilized sand and gravel							
			Subgrade: 9.5" stabilized clay		16		49	21	15	6
			Fill: gray Silty Clayey Sand (SC-SM), with sandy lean clay pockets		13					
4			Fill: grayish brown Clayey Sand (SC), with sand pockets and vertical partings -with fat clay pockets 2'-4' -brown and gray 4'-6'		11					
			-gray, with fat clay pockets 6'-8'		16	111.9	49	35	14	21
8			Gray and tan Clayey Sand (SC), with sandy lean clay and silty sand seams		13	119.3				
			Medium dense to very dense, light gray Poorly Graded Sand with Silt (SP-SM)	31	16					
12			-boring cave-in at 11.7' during drilling -with clayey sand pockets and seams 12'-18', wet at 12'	29	22		9	NP	NP	NP
				22	21					
16			-with fat clay pockets 16'-18'	49	21					
				20	21		12	NP	NP	NP
20										
24				83/ 11.5"	22					
28			Soft to very stiff, light gray and tan Lean Clay (CL)		20	109.8				

SHEAR STRENGTH, TSF

△ Confined Compression
● Unconfined Compression
○ Pocket Penetrometer
□ Torvane

0.5 1 1.5 2

BORING DRILLED TO **18** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **18** FEET WHILE DRILLING ▽

WATER LEVEL AT **11.7** FEET AFTER **5 MINS** ▼

DRILLED BY **VAN AND SONS** DRAFTED BY **HJ** LOGGED BY **JS**

PROJECT NO. G150-20

PLATE A-3

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: ARFF Station No. 92 Relocation BORING B-1

DATE 12/14/2020 TYPE 4" Dry Auger/Wet Rotary LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF (△ Confined Compression, ● Unconfined Compression, ○ Pocket Penetrometer, □ Torvane; 0.5 1 1.5 2)	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
			Lean Clay (CL) (cont.)								
32			-reddish tan and light gray, with silty sand and silty clay seams 33'-35'		24				48	18	30
36			-reddish tan, with fat clay seams 38'-40'		31	101.6	△ ○				
40			Termination Depth = 40 feet								
44											
48											
52											
56											

BORING DRILLED TO **18** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **18** FEET WHILE DRILLING ▽

WATER LEVEL AT **11.7** FEET AFTER **5 MINS** ▼

DRILLED BY **VAN AND SONS** DRAFTED BY **HJ** LOGGED BY **JS**

PROJECT NO. G150-20

PLATE A-3

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: ARFF Station No. 92 Relocation BORING B-2

DATE 12/15/2020 TYPE 4" Dry Auger/Wet Rotary LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF (△ Confined Compression, ● Unconfined Compression, ○ Pocket Penetrometer, □ Torvane; 0.5 1 1.5 2)	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
			Approximate Surface Elevation (feet): 87.4								
0			Pavement: 2.5" asphalt								
			Base: 4.5" stabilized sand and gravel								
			Subgrade: 8" stabilized clay		13			56	23	16	7
			Fill: grayish brown Sandy Silty Clay (CL-ML), with clayey sand partings and silty sand seams		16						
4			Fill: gray Silty Sand (SM) -with sandy lean clay pockets 2'-4' -grayish brown, with lean clay pockets 4'-6'		13						
			Stiff to very stiff, gray and tan Sandy Lean Clay (CL), with silty sand pockets and vertical partings		14			59	29	13	16
8					14						
					15	115.1					
12			-boring cave-in at 12.3' during drilling		14			55	30	13	17
			Medium dense to dense, gray and tan Poorly Graded Sand with Silt (SP-SM)	31	20						
16			-with clayey sand pockets 16'-18', wet at 16'	30	25						
			-light tannish gray 18'-20'	44	23			9	NP	NP	NP
20											
24			-light gray 23'-25'	39	23						
			Very stiff, light gray and tan Lean Clay (CL)								
28					18	114.0					

BORING DRILLED TO **18** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **18** FEET WHILE DRILLING

WATER LEVEL AT **12.3** FEET AFTER **5 MINS**

DRILLED BY **VAN AND SONS** DRAFTED BY **HJ** LOGGED BY **JS**

PROJECT NO. G150-20

PLATE A-4

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: ARFF Station No. 92 Relocation BORING B-2

DATE 12/15/2020 TYPE 4" Dry Auger/Wet Rotary LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF (△ Confined Compression, ● Unconfined Compression, ○ Pocket Penetrometer, □ Torvane; 0.5 1 1.5 2)	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
32			Lean Clay (CL) (cont.)								
			-tan and reddish tan, with ferrous nodules 33'-35'		21				46	17	29
36											
			Stiff, light gray and red Fat Clay (CH), with clayey sand pockets and seams								
					31	97.5	△ ○				
40			Termination Depth = 40 feet								
44											
48											
52											
56											

BORING DRILLED TO **18** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **18** FEET WHILE DRILLING ▽

WATER LEVEL AT **12.3** FEET AFTER **5 MINS** ▼

DRILLED BY **VAN AND SONS** DRAFTED BY **HJ** LOGGED BY **JS**

PROJECT NO. G150-20

PLATE A-4

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: ARFF Station No. 92 Relocation BORING B-3

DATE 12/14/2020 TYPE 4" Dry Auger/Wet Rotary LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0			Approximate Surface Elevation (feet): 86.9							
			Pavement: 2.5" asphalt							
			Base: 4.25" stabilized sand and gravel							
			Subgrade: 9" stabilized clay		12					
			Fill: stiff to hard, grayish brown Sandy Silty Clay (CL-ML), with silty sand partings	34	13		59	17	13	4
4			-with lean clay pockets 1.3'-4'							
			-gray 2'-6'							
			-with clayey sand pockets 4'-6'		12	119.0				
			Hard, gray Sandy Lean Clay (CL), with clayey sand partings		14					
8			-with silty sand seams 6'-8'				50	28	13	15
			-gray and tan, with sand pockets and seams 8'-10'		14					
			Medium dense, gray Clayey Sand (SC)		19	108.3				
12			-with silty sand partings, and silty clayey sand and fat clay pockets 10'-12'							
			-with lean clay pockets 12'-14'	18	19					
			-boring cave-in at 13.4' during drilling							
			Dense, gray and tan Poorly Graded Sand with Silt (SP-SM), with clayey sand seams	32	20		9	NP	NP	NP
16			Medium dense to dense, light gray Silty Sand (SM), wet							
			▽	21	25					
				28	24					
20										
24			-with silty clayey sand seams and lean clay pockets 23'-25'	31	22		25	19	17	2
			Termination Depth = 25 feet							
28										

SHEAR STRENGTH, TSF

△ Confined Compression
● Unconfined Compression
○ Pocket Penetrometer
□ Torvane

0.5 1 1.5 2

BORING DRILLED TO **18** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **18** FEET WHILE DRILLING ▽

WATER LEVEL AT **N/A** FEET AFTER **N/A** ▼

DRILLED BY **VAN AND SONS** DRAFTED BY **HJ** LOGGED BY **JS**

PROJECT NO. G150-20

PLATE A-5

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: ARFF Station No. 92 Relocation BORING B-4

DATE 12/14/2020 TYPE 4" Dry Auger/Wet Rotary LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
			Approximate Surface Elevation (feet): 86.0							
0			Pavement: 3" asphalt							
			Base: 3.5" stabilized sand and gravel							
			Subgrade: 7.5" stabilized clay	73	14		42	17	16	1
			Fill: very dense, brownish gray Silty Sand (SM), with sandy lean clay pockets	55	15					
4			Very dense, dark gray Silty Sand (SM), with clayey sand pockets							
			Gray and tan Clayey Sand (SC), with sandy lean clay and silty sand pockets		14	115.0				
			Firm to very stiff, gray and tan Sandy Lean Clay (CL), with sand pockets and seams		17		51	30	15	15
8			-with fat clay pockets and ferrous nodules 8'-10'		14	116.8				
			Medium dense, gray and tan Silty Clayey Sand (SC-SM)	27	17					
12			Medium dense, gray and tan Silty Sand (SM)							
			-boring cave-in at 13' during drilling	28	19		20	20	19	1
			-light gray and tan 14'-16'	28	20					
16			-light gray 16'-18', wet at 16'	18	22					
			Stiff to very stiff, light gray Sandy Silty Clay (CL-ML), with clayey sand partings	21	22		56	25	19	6
20										
			Medium dense, light gray Silty Sand (SM), with sandy lean clay pockets, wet							
24				24	24					
			Termination Depth = 25 feet							
28										

SHEAR STRENGTH, TSF

△ Confined Compression
● Unconfined Compression
○ Pocket Penetrometer
□ Torvane

0.5 1 1.5 2

BORING DRILLED TO **18** FEET WITHOUT DRILLING FLUID
WATER ENCOUNTERED AT **18** FEET WHILE DRILLING ▽
WATER LEVEL AT **13** FEET AFTER **5 MINS** ▼
DRILLED BY **VAN AND SONS** DRAFTED BY **HJ** LOGGED BY **JS**

PROJECT NO. G150-20

PLATE A-6

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: ARFF Station No. 92 Relocation BORING B-5

DATE 12/15/2020 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF (△ Confined Compression, ● Unconfined Compression, ○ Pocket Penetrometer, □ Torvane; 0.5 1 1.5 2)	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0			Approximate Surface Elevation (feet): 85.4								
			Fill: gray Silty Clayey Sand (SC-SM), with sandy lean clay pockets and silty sand partings -with roots 0'-2'		15			46	23	16	7
					13	114.9					
4			Stiff to very stiff, gray and tan Lean Clay (CL), with ferrous nodules -with fat clay pockets 4'-6' and sandy lean clay partings 4'-8' -gray and reddish tan, with silty sand seams 6'-8'		21						
					18						
8			-with clayey sand partings and decomposed roots 8'-10'		17						
			Termination Depth = 10 feet								
12											
16											
20											
24											
28											

BORING DRILLED TO **10** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **N/A** FEET WHILE DRILLING ▽

WATER LEVEL AT **N/A** FEET AFTER **COMPLETE** ▼

DRILLED BY **VAN AND SONS** DRAFTED BY **HJ** LOGGED BY **JS**

PROJECT NO. G150-20

PLATE A-7

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: ARFF Station No. 92 Relocation BORING B-6

DATE 12/15/2020 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0			Approximate Surface Elevation (feet): 87.5							
			Pavement: 3" asphalt							
			Base: 4" stabilized sand and gravel							
			Subgrade: 9.5" stabilized clay		16		59	22	14	8
			Fill: very stiff to hard, gray Sandy Lean Clay (CL), with clayey sand partings		13					
4			-brownish gray, with sand seams 2'-4'							
			-dark gray and tan, with gravel 6'-8'		14	121.8				
			Gray and tan Silty Sand (SM), with fat clay pockets		14					
8			Very stiff, gray Lean Clay (CL), with fat clay and sand pockets		16					
			Termination Depth = 10 feet							
12										
16										
20										
24										
28										

SHEAR STRENGTH, TSF

△ Confined Compression
● Unconfined Compression
○ Pocket Penetrometer
□ Torvane

0.5 1 1.5 2

BORING DRILLED TO **10** FEET WITHOUT DRILLING FLUID
WATER ENCOUNTERED AT **N/A** FEET WHILE DRILLING ▽
WATER LEVEL AT **N/A** FEET AFTER **COMPLETE** ▽
DRILLED BY **VAN AND SONS** DRAFTED BY **HJ** LOGGED BY **JS**

PROJECT NO. G150-20

PLATE A-8

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: ARFF Station No. 92 Relocation BORING B-7

DATE 12/14/2020 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0			Approximate Surface Elevation (feet): 84.6				△ Confined Compression ● Unconfined Compression ○ Pocket Penetrometer □ Torvane 0.5 1 1.5 2				
			Fill: very stiff, gray Sandy Lean Clay (CL), with silty sand partings and gravel		12			51	22	14	8
			Stiff to very stiff, gray and tan Lean Clay (CL) -with sand seams 2'-4' and sandy lean clay partings and pockets 2'-8' -with organics 4'-6' and ferrous stains 4'-8'		22	100.1					
4					19						
			-gray and reddish tan 6'-8', with clayey sand partings 6'-10'		16						
8					17						
			Termination Depth = 10 feet								
12											
16											
20											
24											
28											

BORING DRILLED TO **10** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **N/A** FEET WHILE DRILLING ▽

WATER LEVEL AT **N/A** FEET AFTER **COMPLETE** ▼

DRILLED BY **VAN AND SONS** DRAFTED BY **HJ** LOGGED BY **JS**

PROJECT NO. G150-20

PLATE A-9

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: ARFF Station No. 92 Relocation BORING B-8

DATE 2/2/2021 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF (△ Confined Compression, ● Unconfined Compression, ○ Pocket Penetrometer, □ Torvane; 0.5 1 1.5 2)	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0			Approximate Surface Elevation (feet): 86.9								
			Pavement: 3" asphalt								
			Subgrade: 3" stabilized clay								
			Fill: brown and gray Silty Sand (SM), with calcareous nodules		14						
			-with gravel 0.5'-1'								
			-gray, cement stabilized 1'-2'	29	13			49	23	14	9
4			Fill: medium dense, brown and gray Clayey Sand (SC)								
			-with sandy silty clay partings 2'-4'		12	120.5	●				
			-with silty clayey sand partings and organics 4'-6'								
			Gray and green Clayey Sand (SC)		17						
8			-with sandy lean clay pockets and partings 6'-12'					47	31	16	15
					16						
			-gray and tan 10'-14'								
					18	110.2	△				
12											
			-with sandy lean clay seams 13'-14'		20						
			-boring cave-in at 13' during drilling								
			Medium dense, gray Silty Clayey Sand (SC-SM), wet	12	23						
16			-light gray 16'-18', with sandy lean clay pockets 16'-20'					27			
				19	24						
			-light gray and light tan 18'-20'								
				12	25						
20			Termination Depth = 20 feet								
24											
28											

BORING DRILLED TO **20** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **18** FEET WHILE DRILLING ▽

WATER LEVEL AT **N/A** FEET AFTER **N/A** ▼

DRILLED BY **VAN AND SONS** DRAFTED BY **HJ** LOGGED BY **AZ**

PROJECT NO. G150-20

PLATE A-10

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: ARFF Station No. 92 Relocation BORING B-9

DATE 2/2/2021 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0			Approximate Surface Elevation (feet): 87.7							
			Pavement: 3" asphalt							
			Subgrade: 5" stabilized sand							
			Fill: gray and light brown Silty Sand (SM), with gravel, cement-stabilized		11		60			
			Fill: hard, brown Sandy Silty Clay (CL-ML), with sandy lean clay pockets and silty clayey sand partings	47	12					
4			Fill: stiff to hard, brown and gray Sandy Lean Clay (CL), with silty sand seams -with organics 4'-6' -gray and tan, with sand pockets 6'-8'	28	13		58	25	16	9
					15	111.7				
8			Stiff to very stiff, gray and light gray Sandy Lean Clay (CL), with fat clay pockets, and sand pockets and seams		14		55	33	13	20
			Gray and light tan Silty Sand (SM), with sandy lean clay pockets		15					
12			Medium dense, gray and light tan Silty Clayey Sand (SC-SM) -with lean clay pockets 12'-16'	21	17					
			-boring cave-in at 14.3' during drilling -light gray 14'-16'	23	18		28			
16			gray 16'-20', wet at 16'	30	23					
				26	25					
20			Termination Depth = 20 feet							
24										
28										

SHEAR STRENGTH, TSF

△ Confined Compression
● Unconfined Compression
○ Pocket Penetrometer
□ Torvane

0.5 1 1.5 2

BORING DRILLED TO **20** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **18** FEET WHILE DRILLING ▽

WATER LEVEL AT **N/A** FEET AFTER **N/A** ▼

DRILLED BY **VAN AND SONS** DRAFTED BY **HJ** LOGGED BY **AZ**

PROJECT NO. G150-20

PLATE A-11

AVLES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT: ARFF Station No. 92 Relocation BORING B-10

DATE 2/2/2021 TYPE 4" Dry Auger LOCATION See Boring Location Plan

DEPTH IN FEET	SYMBOL	SAMPLE INTERVAL	DESCRIPTION	S.P.T. BLOWS / FT.	MOISTURE CONTENT, %	DRY DENSITY, PCF	SHEAR STRENGTH, TSF (△ Confined Compression, ● Unconfined Compression, ○ Pocket Penetrometer, □ Torvane; 0.5 1 1.5 2)	-200 MESH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0			Approximate Surface Elevation (feet): 86.3								
			Pavement: 3" asphalt								
			Subgrade: 7" stabilized sand								
			Fill: very dense, brown Silty Sand (SM), cement-stabilized		15			26			
			-with gravel 0.8'-2'	50/ 5.5"	11						
4			Fill: stiff, gray Sandy Lean Clay (CL), with fat clay lenses, and sand seams and pockets	12	18			54	32	14	18
			Stiff to very stiff, gray and light gray Sandy Lean Clay (CL)		12			56	30	15	15
8			-with sand seams, pockets, and partings 6'-10'								
			-tan and light tan 8'-10'		14	118.6					
			-gray, with clayey sand pockets 10'-12'	20	17						
12			Medium dense, light gray Clayey Sand (SC), with sandy lean clay partings					22			
			-boring cave-in at 12.8' during drilling	22	18						
			Medium dense to dense, gray and tan Silty Clayey Sand (SC-SM)								
			-with sandy lean clay seams 14'-18'	31	19						
16			gray 16'-20', wet at 16'	18	23						
				15	23						
20			Termination Depth = 20 feet								
24											
28											

BORING DRILLED TO **20** FEET WITHOUT DRILLING FLUID

WATER ENCOUNTERED AT **17** FEET WHILE DRILLING ▽

WATER LEVEL AT **12.8** FEET AFTER **5 MINS** ▼

DRILLED BY **VAN AND SONS** DRAFTED BY **HJ** LOGGED BY **AZ**

PROJECT NO. G150-20

PLATE A-12

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Paving
	Fill
	Clayey sand
	Poorly graded sand with silt
	Low plasticity clay
	High plasticity clay
	Silty sand
	Silty clayey sand
	Silty low plasticity clay
Misc. Symbols	
⏚	Water table depth during drilling
⏚	Subsequent water table depth
○	Pocket Penetrometer
●	Unconfined Compression
△	Confined Compression
□	Torvane

Symbol	Description
Soil Samplers	
	Rock core
	Auger
	Undisturbed thin wall Shelby tube
	Standard penetration test

AYLES ENGINEERING CORP.

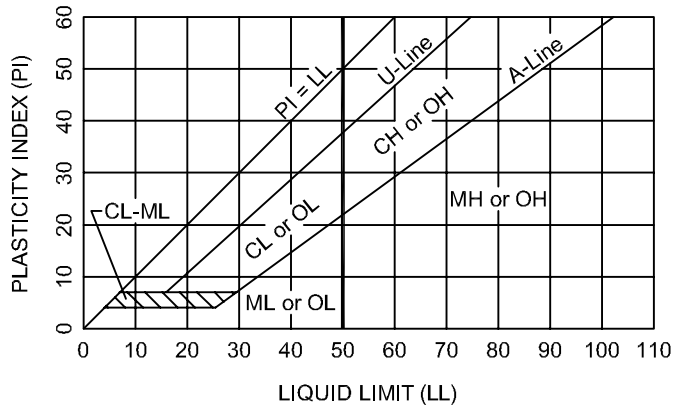
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM Designation D-2487

MAJOR DIVISIONS				GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (Less than 50% of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)		GW	Well-graded gravel, well-graded gravel with sand
				GP	Poorly-graded gravel, poorly-graded gravel with sand
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart	GM	Silty gravel, silty gravel with sand
			Limits plot above "A" line & hatched zone on plasticity chart	GC	Clayey gravel, clayey gravel with sand
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)		SW	Well-graded sand, well-graded sand with gravel
				SP	Poorly-graded sand, poorly-graded sand with gravel
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart	SM	Silty sand, silty sand with gravel
			Limits plot above "A" line & hatched zone on plasticity chart	SC	Clayey sand, clayey sand with gravel
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)		SILTS AND CLAYS (Liquid Limit Less Than 50%)		ML	Silt, silt with sand, silt with gravel, sandy silt, gravelly silt
				CL	Lean clay, lean clay with sand, lean clay with gravel, sandy lean clay, gravelly lean clay
				OL	Organic clay, organic clay with sand, sandy organic clay, organic silt, sandy organic silt
		SILTS AND CLAYS (Liquid Limit 50% or More)		MH	Elastic silt, elastic silt with sand, sandy elastic silt, gravelly elastic silt
				CH	Fat clay, fat clay with sand, fat clay with gravel, sandy fat clay, gravelly fat clay
				OH	Organic clay, organic clay with sand, sandy organic clay, organic silt, sandy organic silt

NOTE: Coarse soils between 5% and 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone of the plasticity chart are to have dual symbols.

PLASTICITY CHART



Equation of A-Line: Horizontal at PI=4 to LL=25.5, then PI=0.73(LL-20)

Equation of U-Line: Vertical at LL=16 to PI=7, then PI=0.9(LL-8)

DEGREE OF PLASTICITY OF COHESIVE SOILS

Degree of Plasticity	Plasticity Index
None	0 - 4
Slight	5 - 10
Medium	11 - 20
High	21 - 40
Very High	>40

SOIL SYMBOLS

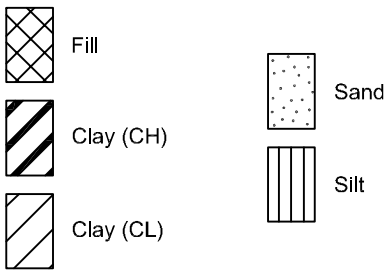


PLATE A-14

AYLES ENGINEERING CORP.

TERMS USED ON BORING LOGS

SOIL GRAIN SIZE

U.S. STANDARD SIEVE

6"	3"	3/4"	#4	#10	#40	#200	
BOULDERS	COBBLES	GRAVEL		SAND			SILT / CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	
152	76.2	19.1	4.76	2.00	0.420	0.074	0.002

SOIL GRAIN SIZE IN MILLIMETERS

STRENGTH OF COHESIVE SOILS

Consistency	Undrained Shear Strength, Kips per Sq. ft.	SPT Blowcount
Very Soft	less than 0.25	< 2 bpf
Soft	0.25 to 0.50	2-4 bpf
Firm	0.50 to 1.00	4-8 bpf
Stiff	1.00 to 2.00	8-16 bpf
Very Stiff	2.00 to 4.00	16-32 bpf
Hard	greater than 4.00	>32 bpf

RELATIVE DENSITY OF COHESIONLESS SOILS FROM STANDARD PENETRATION TEST

Very Loose	<4 bpf
Loose	5-10 bpf
Medium Dense	11-30 bpf
Dense	31-50 bpf
Very Dense	>50 bpf

SPLIT-BARREL SAMPLER DRIVING RECORD

Blows per Foot	Description
25	25 blows driving sampler 12 inches, after initial 6 inches of seating.
50/7"	50 blows driving sampler 7 inches, after initial 6 inches of seating.
Ref/3"	50 blows driving sampler 3 inches, during initial 6-inches seating interval.

NOTE: To avoid change to sampling tools, driving is limited to 50 blows during or after seating interval.

DRY STRENGTH ASTM D2488

None	Dry specimen crumbles into powder with mere pressure of handling
Low	Dry specimen crumbles into powder with some finger pressure
Medium	Dry specimen breaks into pieces or crumbles with considerable pressure
High	Dry specimen cannot be broken with finger pressure, it can be broken between thumb and hard surface
Very High	Dry specimen cannot be broken between thumb and hard surface

MOISTURE CONDITION ASTM D2488

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the easiness of breaking along these planes.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt; usually more or less vertical.
Friable	Crumbly, can be easily crushed with light pressure.
Blocky	Clays that have a block-like or polyhedral structure.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil types.
Interlayered	Soil sample composed of alternating layers of different soil types.
Intermixed	Soil sample composed of pockets of different soil types and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of calcium material.

AVILES
ENGINEERING CORP.

ASTM & TXDOT DESIGNATION FOR SOIL LABORATORY TESTS

SOIL TEST	ASTM TEST DESIGNATION	TXDOT TEST DESIGNATION
Unified Soil Classification System	D 2487	Tex-142-E
Moisture Content	D 2216	Tex-103-E
Specific Gravity	D 854	Tex-108-E
Sieve Analysis	D 6913	Tex-110-E (Part 1)
Hydrometer Analysis	D 7928	Tex-110-E (Part 2)
Minus No. 200 Sieve	D 1140	Tex-111-E
Liquid Limit	D 4318	Tex-104-E
Plastic Limit	D 4318	Tex-105-E
Standard Proctor Compaction	D 698	Tex-114-E
Modified Proctor Compaction	D 1557	Tex-113-E
California Bearing Ratio	D 1883	-
Swell	D 4546	-
Consolidation	D 2435	-
Unconfined Compression	D 2166	-
Unconsolidated-Undrained Triaxial	D 2850	Tex-118-E
Consolidated-Undrained Triaxial	D 4767	Tex-131-E
Permeability (constant head)	D 5084	-
Pinhole	D 4647	-
Crumb	D 6572	-
Double Hydrometer	D 4221	-
pH of Soil	D 4972	Tex-128-E
Soil Suction	D 5298	-
Soil Sulfate	C 1580	Tex-145-E
Organics	D 2974	Tex-148-E

AVILES ENGINEERING CORPORATION

Consulting Engineers - Geotechnical, Construction Materials Testing, Environmental

ORGANIC MATTER IN SOILS

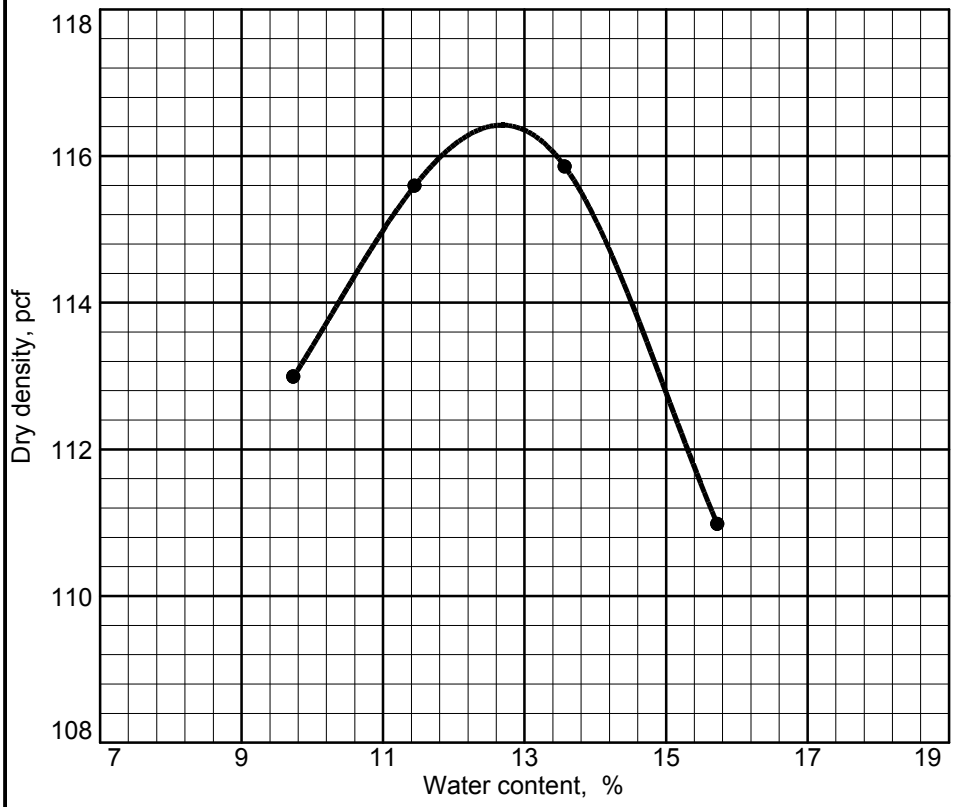
ASTM D 2974-07, Test Method C

Project : ARFF Station No. 92 Relocation
Location of Project: Houston, Texas

Job No.: G150-20
Date of Testing:

Boring	**B-3**	**B-6**
Depth (ft)	1.3 to 2	1.4 to 2
Soil Description	Fill: Sandy Silty Clay (CL-ML)	Fill: Sandy Lean Clay (CL)
Organic Matter Content	**1.7%**	**1.3%**
Furnace Temperature, ^{o}C	440	440

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 698-07 Procedure A Standard

Hammer Wt.: 5.5 lb.
Hammer Drop: 12 in.
Number of Layers: three
Blows per Layer: 25
Mold Size: .03333 cu.ft.

Test Performed on Material Passing No.4 **Sieve**

Soil Data

NM 18 **Sp.G.**
LL 30 **PI** 17
%>No.4 **%<#200**
USCS CL **AASHTO**

TESTING DATA

	1	2	3	4	5	6
WM + WS	3868.1	3941.2	3982.8	3935.3		
WM	1993.6	1993.6	1993.6	1993.6		
WW + T #1	1269.20	1161.20	1300.80	1166.90		
WD + T #1	1171.80	1059.40	1166.10	1032.10		
TARE #1	171.20	170.00	173.30	174.90		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	9.7	11.4	13.6	15.7		
DRY DENSITY	113.0	115.6	115.9	111.0		

TEST RESULTS

Maximum dry density = 116.4 pcf

Optimum moisture = 12.7 %

Material Description

Sandy Lean Clay (CL)

Project No. G150-20 **Client:** Atkins
Project: ARFF 92 Relocation

● **Source:** Proctor/CBR **Sample No.:** 1

Remarks:
Collected from 0'-4' near Boring B-7

COMPACTION TEST REPORT

Aviles Engineering Corp.

G150-20 IAH Aircraft Rescue and Firefighting (ARFF) Station No. 92 Relocation
California Bearing Ratio (ASTM D-1883)

Boring/Pit B-7 Sample - Standard Proctor (ASTM D-698)
Maximum Dry Density = 116.4 pcf and Optimum Moisture = 12.7%

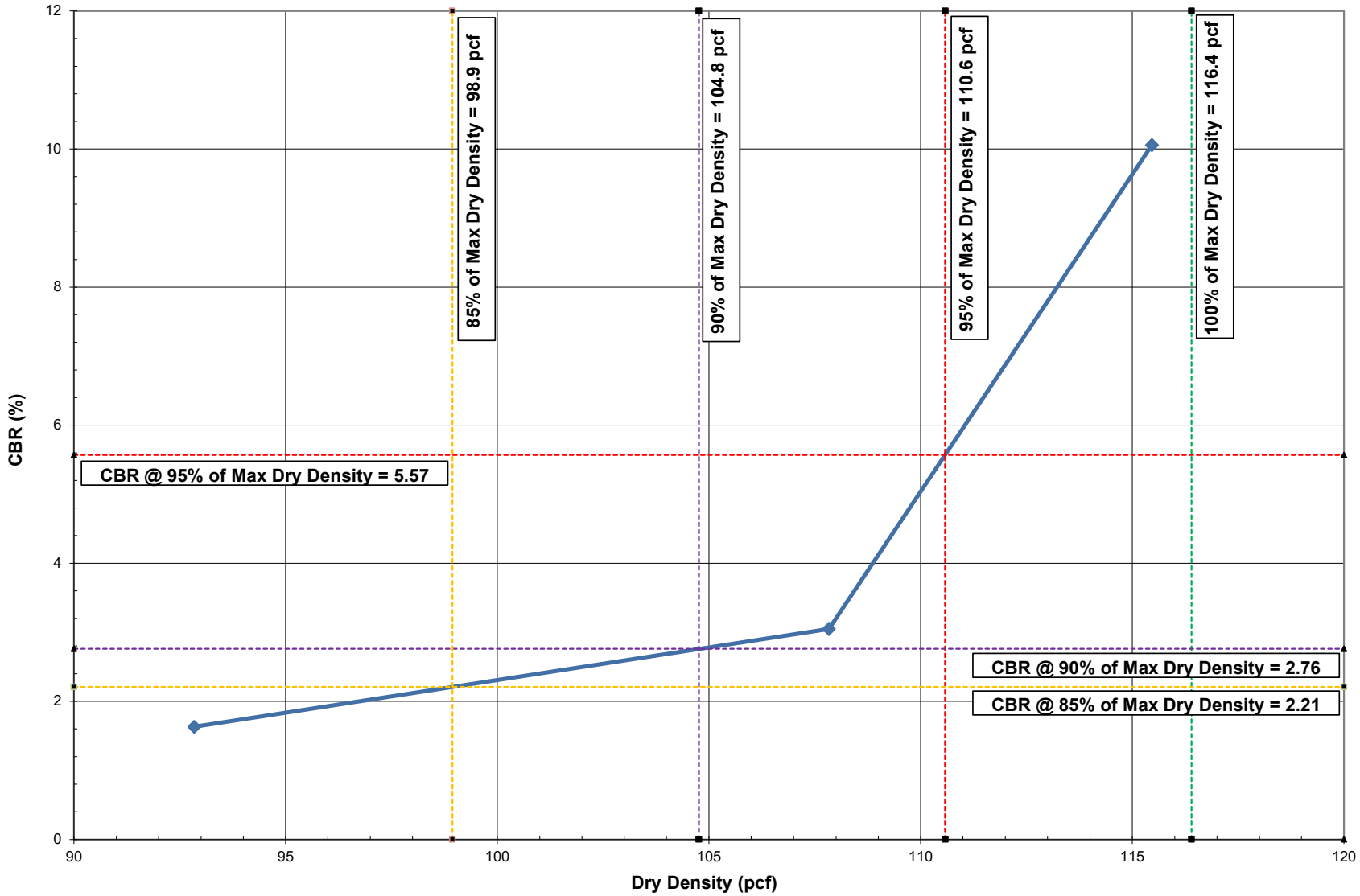


PLATE A-19

G150-20 IAH Aircraft Rescue and Firefighting (ARFF) Station No. 92 Relocation
California Bearing Ratio (ASTM D-1883)

Boring/Pit B-7 Sample - Standard Proctor (ASTM D-698)
Maximum Dry Density = 116.4 pcf and Optimum Moisture = 12.7%

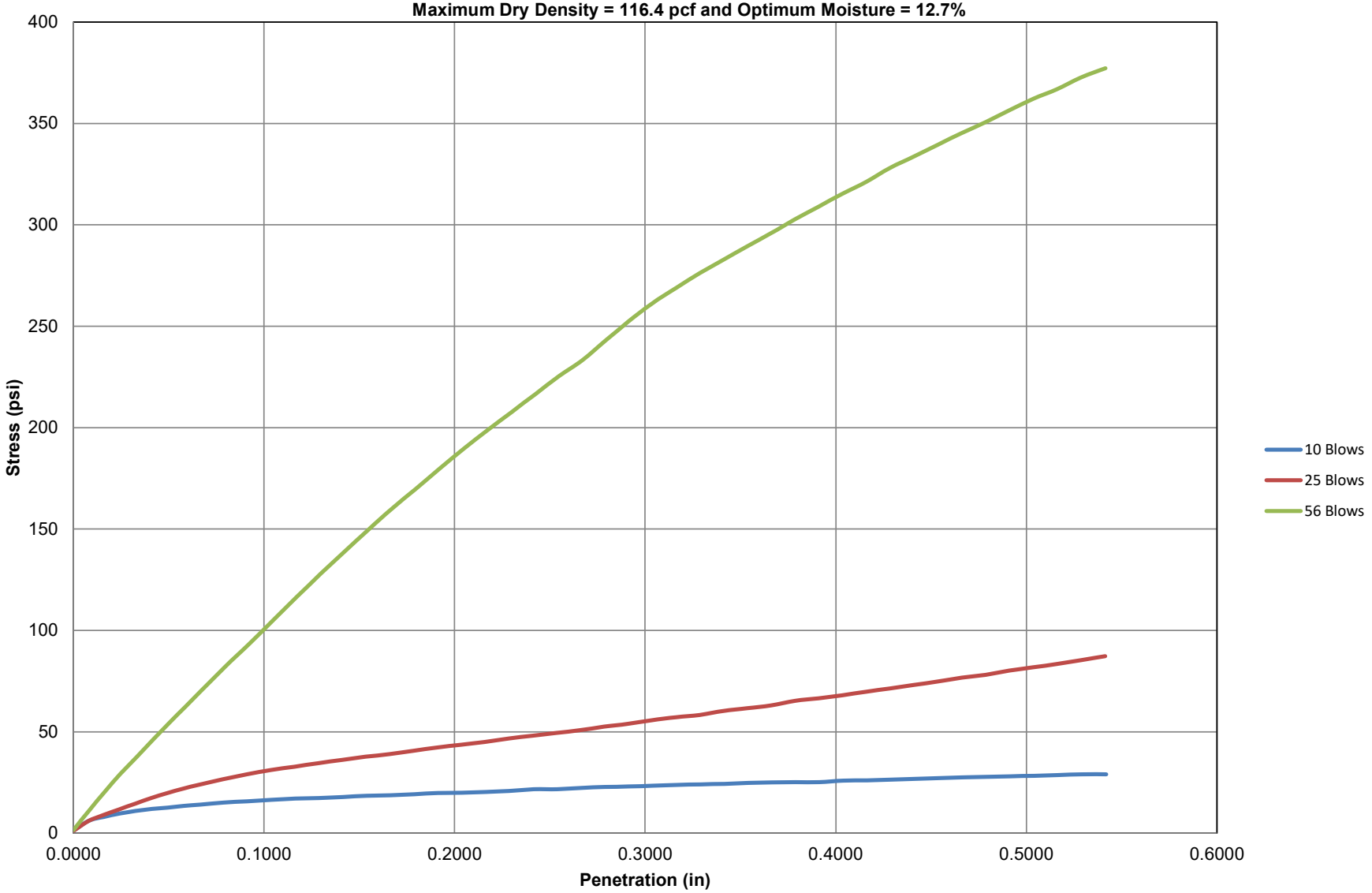


PLATE A-20

AVLES
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APPENDIX B

Plates B-1 and B-2 DarWIN v3.0 Results for Concrete Pavement Design

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare Computer Software Product

AVILES

Rigid Structural Design Module

ARFF Station No. 92 Parking Area
(ESAL capacity based on provided thickness)

Rigid Structural Design

Pavement Type	JRCP
Slab Thickness for Performance Period Traffic	6 in
Initial Serviceability	4.5
Terminal Serviceability	2
28-day Mean PCC Modulus of Rupture	600 psi
28-day Mean Elastic Modulus of Slab	3,600,000 psi
Mean Effective k-value	147 psi/in
Reliability Level	85 %
Overall Standard Deviation	0.35
Load Transfer Coefficient, J	3.2
Overall Drainage Coefficient, Cd	1.2
18-kip ESALs Over Initial Performance Period	1,065,281

Effective Modulus of Subgrade Reaction

Period	Description	Roadbed Soil Resilient Modulus (psi)	Base Elastic Modulus (psi)
1	1	8,355	30,000

Base Type	-
Base Thickness	8 in
Depth to Bedrock	100 ft
Projected Slab Thickness	6 in
Loss of Support Category	1
Effective Modulus of Subgrade Reaction	147 psi/in

PLATE B-1

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product
AVILES

Rigid Structural Design Module

ARFF Station No. 92 Driveways
(ESAL capacity based on provided thickness)

Rigid Structural Design

Pavement Type	JRCP
Slab Thickness for Performance Period Traffic	7 in
Initial Serviceability	4.5
Terminal Serviceability	2
28-day Mean PCC Modulus of Rupture	600 psi
28-day Mean Elastic Modulus of Slab	3,600,000 psi
Mean Effective k-value	147 psi/in
Reliability Level	85 %
Overall Standard Deviation	0.35
Load Transfer Coefficient, J	3.2
Overall Drainage Coefficient, Cd	1.2
18-kip ESALs Over Initial Performance Period	2,511,532

Effective Modulus of Subgrade Reaction

Period	Description	Roadbed Soil Resilient Modulus (psi)	Base Elastic Modulus (psi)
1	1	8,355	30,000

Base Type	-
Base Thickness	8 in
Depth to Bedrock	100 ft
Projected Slab Thickness	7 in
Loss of Support Category	1
Effective Modulus of Subgrade Reaction	147 psi/in

PLATE B-2

efi global

2000 South Dairy Ashford, Suite 600
Houston, Texas 77077
Tel: 832-518-5145

ASBESTOS SURVEY

EFI Global File No.: 029.01935

GEORGE BUSH INTERNATIONAL AIRPORT
IAH – FIRE STATION NO. 92
4300 WILL CLAYTON PARKWAY
HOUSTON, TEXAS

April 22, 2020

Prepared For:

City of Houston

Attn: Mr. Gabriel Mussio
900 Bagby, Floor 2
Houston, Texas 77002

efi global
2000 South Dairy Ashford, Suite 600
Houston, Texas 77077

Project No. 029.01935
April 22, 2020

Mr. Gabriel Mussio
City of Houston
900 Bagby, Floor 2
Houston, Texas 77002

via email: Gabriel.mussio@houstontx.com

Subject: **Asbestos Survey**
IAH – Fire Station No. 92
4300 Will Clayton Parkway
Houston, Texas

Dear Mr. Mussio:

This report presents the results of our Asbestos Survey conducted at the IAH, Fire Station No. 92 located at 4300 Will Clayton Parkway in Houston, Texas. EFI Global, Inc. (EFI) performed this work in general accordance with Service Proposal No. 98410-20-0051 Rev.394 dated January 15, 2020, which was authorized by Mr. Gabriel Mussio, of City of Houston via issuance of Purchase Order No. PRO-4200009216. It is our understanding that potential renovations may be scheduled for the subject property.

FIELD SURVEY

Mr. Brian King [Texas Department of State Health Services (DSHS) License #60-3689], of EFI, conducted the field survey on April 13, 2020. This survey was performed in order to determine the presence of Asbestos-Containing Building Materials (ACBM) prior to commencement of renovations of the stairwell areas. The samples were generally collected in sufficient numbers to comply with U.S. Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and DSHS protocols. These protocols require a specified number of samples be obtained, at least three (3), and analyzed based on homogeneous areas of individual building materials. A homogeneous area defined as an area of surfacing material, thermal system insulation, or miscellaneous material that is uniform in color and texture, apparently applied at similar times, and appearing identical in every other respect. The field survey included the identification and sampling of suspect ACBM, which included:

- Gypsum Wallboard and Joint Compound,
- Yellow Cove Base Mastic,
- Yellow Carpet Mastic,
- 2'x2' Ceiling Tile,
- White Duct Mastic,
- 12"x12" Brown Floor Tile with Yellow Mastic,
- Beige Brick Expansion Joint Caulking,
- Grey Sidewalk Expansion Joint Caulking,
- Dark Brown Window Expansion Joint Caulking,

- Transite Pipe Sleeve @ Generator Exhaust,
- Plaster Soffit, and
- Domestic Water Pipe Insulation with mastic.

Sampling: Since no "as built" drawings were available at the time of our survey to identify suspect materials, we proceeded with our observations and sample collection. The Client provided a floor plan, and the approximate location of each material sample documented on the drawing, which is included as an appendix to this report. A total of thirty-six (36) bulk samples were collected in the survey area. The samples were collected in a manner that reduces the potential for fiber release and exposure by using wet sampling methods and personal protective equipment, as necessary. Samples were deposited in secure containers for transport to our subcontract asbestos laboratory, J3 Resources, Inc. in Houston, Texas. Appropriate chain-of-custody protocols were initiated at the site for all samples.

Laboratory Analysis

The bulk samples were transported to J3 Resources' laboratory in Houston, Texas for analysis. This laboratory is a participant in the Department of Commerce, National Institute of Standards and Technology National Voluntary Laboratory Accreditation Program (NVLAP) and licensed by the DSHS (License No. 30-0273). The current Certificate of Accreditation of Asbestos Fiber Analysis for bulk samples is effective until March 31, 2020, and J3 Resources is licensed by DSHS through April 15, 2020. The material samples obtained during this survey and listed in Appendix A will be retained at the laboratory, without charge, for a period of sixty (60) days from the date of this report. Samples obtained during this survey and retained at the laboratory more than sixty (60) days will be disposed if we have not received your specific written instructions for the disposition of these samples.

Analytical Procedure. All material samples were analyzed using Polarized Light Microscopy (PLM) coupled with dispersion staining as detailed in the EPA's "Method for the Determination of Asbestos in Bulk Building Materials" (EPA/600/R-93/116). Percentages for the samples were determined by visual area estimation.

Analytical Results. The laboratory results of the sample analyses are included in Appendix A along with the Chain of Custody indicating the location of the samples collected. Based on the laboratory analyses, the following information was obtained:

- **The transite pipe sleeve collected from the emergency generator room at exterior wall was found to contain 15% Chrysotile asbestos and 3% Crocidolite asbestos (approximately 1 linear feet).**

CONCLUSIONS AND RECOMMENDATIONS

The EPA - NESHAP regulations require that all RACM be removed from a facility being demolished or renovated prior to any activity that would disturb the material. RACM is defined as (a) friable ACM, (b) Category I non-friable ACM that has become friable, (c) Category I non-friable ACM that will be or has been subject to sanding, grinding, or abating, or (d) Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material during the course of the demolition or renovation operations.

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State of Texas, the DSHS is the state's NESHAP enforcement agency for the EPA. The DSHS has also written their own regulations which mirror and at times exceed the NESHAP regulations with regard to notification requirements, definitions of RACM and categories, the need for engineering controls and wet removal techniques and the proper disposal of ACM.

The transite pipe sleeve is classified as a Category II Non-Friable ACM.

Please note that the DSHS regulations require a 10-working day notification and a Texas licensed abatement contractor to remove and dispose of asbestos-containing materials should they be impacted by proposed renovations. Based on these findings, EFI recommends that the identified asbestos-containing transite pipe sleeve be maintained under an Operations and Maintenance Program. All building staff and maintenance personnel should be notified as to the existence and locations of the ACM. This notification should inform personnel not to disturb the identified materials and include procedures to follow when this material is disturbed.

Materials Presumed To Be Asbestos-Containing. No destructive methods were utilized to locate materials in inaccessible locations (i.e. behind walls, beneath fixed objects, below grade, inside chases, etc.) or outside the immediate survey area. Consequently, any additional suspect materials, which may be uncovered by future renovation or demolition activities, and which were not sampled as a part of this asbestos survey should be considered asbestos-containing until sampling and analysis determines otherwise.

QUALIFICATIONS

This report has been prepared to assist City of Houston in determining whether or not asbestos components are present at the IAH, Fire Station No. 92 located at 4300 Will Clayton Parkway in Houston, Texas. This report only describes the conditions present at the time of our survey, and the results presented here are limited, based upon the information available at the time of our survey. This report is prepared for the sole benefit of City of Houston and its affiliates and may not be relied upon by any other person or entity without the written authorization of EFI Global.

CLOSING

We appreciate the opportunity to assist you with this project. If you have any questions or require any additional information, please do not hesitate to contact us at (832) 518-5145.

Sincerely,
EFI Global, Inc.

Cuong Nguyen
Project Manager

Rick A. Anderson, P.E., CIEC.
Senior District Manager

Appendices:
Appendix A – Laboratory Report
Appendix B – Bulk Sample Location Sketch
Appendix C – Licenses and Certificates

(Projects2019\City of Houston\IAH Fire Station No. 92\029.01935 – Fire Station No. 92 ACM svy rpt)

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APPENDIX A
LABORATORY REPORT

J3 Resources, Inc.
6110 W. 34th Street, Houston, Texas 77092
Phone: (713) 290-0221 - Fax: (713) 290-0248
J3Resources.com

Bulk Asbestos Fiber Analysis by Polarized Light Microscopy (PLM)

Appx E Sub E 40 CFR 763 / EPA 600/R-93/116

Alex Nguyen
EFI Global, Inc.
2000 Dairy Ashford, Ste 600
Houston TX 77077

J3 Order #: JH20118985
Project #: 029.01935
Date Received: 13-Apr-2020
Date Analyzed: 15-Apr-2020
Date Reported: 16-Apr-2020

HAS Bush Int. - Fire Station

Sample ID #	Sample Description	Asbestos Constituents	Non-Asbestos Constituents	
1-1	LAYER 1 Texture, White, Homogeneous	None Detected	Non-Fibrous Material	100%
	LAYER 2 Wallboard, Brown/ White, Homogeneous	None Detected	Cellulose Fiber Fibrous Glass Non-Fibrous Material	10% <1 90%
1-2	LAYER 1 Texture, White, Homogeneous	None Detected	Non-Fibrous Material	100%
	LAYER 2 Wallboard, Brown/ White, Homogeneous	None Detected	Cellulose Fiber Fibrous Glass Non-Fibrous Material	10% <1 90%
1-3	LAYER 1 Texture, White, Homogeneous	None Detected	Non-Fibrous Material	100%
	LAYER 2 Wallboard, Brown/ White, Homogeneous	None Detected	Cellulose Fiber Fibrous Glass Non-Fibrous Material	10% <1 90%
1-4	LAYER 1 Paint Texture, White, Homogeneous	None Detected	Non-Fibrous Material	100%
	LAYER 2 Wallboard, Brown/ White, Homogeneous	None Detected	Cellulose Fiber Fibrous Glass Non-Fibrous Material	10% <1 90%
2-1	Cove Base Mastic, Beige, Homogeneous	None Detected	Non-Fibrous Material	100%
2-2	Cove Base Mastic, Beige, Homogeneous	None Detected	Non-Fibrous Material	100%

Jose Sequera Analyst

Scott Ward, Ph.D. Lab Director

NVLAP Lab Code: 200525-0 **TDSHS License: 30-0273**

J3 Resources, Inc.
6110 W. 34th Street, Houston, Texas 77092
Phone: (713) 290-0221 - Fax: (713) 290-0248
J3Resources.com

Bulk Asbestos Fiber Analysis by Polarized Light Microscopy (PLM)

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Alex Nguyen
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Date Received: 13-Apr-2020
Date Analyzed: 15-Apr-2020
Date Reported: 16-Apr-2020

HAS Bush Int. - Fire Station

Sample ID #	Sample Description	Asbestos Constituents	Non-Asbestos Constituents	
2-3	Cove Base Mastic, Beige, Homogeneous	None Detected	Non-Fibrous Material	100%
3-1	Carpet Mastic, Yellow, Homogeneous	None Detected	Non-Fibrous Material	100%
3-2	Carpet Mastic, Yellow, Homogeneous	None Detected	Non-Fibrous Material	100%
3-3	Carpet Mastic, Yellow, Homogeneous	None Detected	Non-Fibrous Material	100%
4-1	Ceiling Tile, White/ Beige, Homogeneous	None Detected	Cellulose Fiber Mineral Wool Non-Fibrous Material	70% 10% 20%
4-2	Ceiling Tile, White/ Beige, Homogeneous	None Detected	Cellulose Fiber Mineral Wool Non-Fibrous Material	70% 10% 20%
4-3	Ceiling Tile, White/ Beige, Homogeneous	None Detected	Cellulose Fiber Mineral Wool Non-Fibrous Material	70% 10% 20%
4-4	Ceiling Tile, White/ Beige, Homogeneous	None Detected	Cellulose Fiber Mineral Wool Non-Fibrous Material	70% 10% 20%

Jose Sequera Analyst

Scott Ward, Ph.D. Lab Director

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Project #: 029.01935
Date Received: 13-Apr-2020
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Date Reported: 16-Apr-2020

HAS Bush Int. - Fire Station

Sample ID #	Sample Description	Asbestos Constituents	Non-Asbestos Constituents	
5-1	LAYER 1 Mastic, Off White, Homogeneous	None Detected	Wollastonite Non-Fibrous Material	5% 95%
	LAYER 2 Paper / Foil Wrap, Beige/ Silver, Homogeneous	None Detected	Cellulose Fiber Fibrous Glass Non-Fibrous Material	45% 10% 45%
	LAYER 3 Insulation, Yellow, Homogeneous	None Detected	Mineral Wool Non-Fibrous Material	95% 5%
5-2	LAYER 1 Mastic, Off White, Homogeneous	None Detected	Wollastonite Non-Fibrous Material	5% 95%
	LAYER 2 Paper / Foil Wrap, Beige/ Silver, Homogeneous	None Detected	Cellulose Fiber Fibrous Glass Non-Fibrous Material	45% 10% 45%
	LAYER 3 Insulation, Yellow, Homogeneous	None Detected	Mineral Wool Non-Fibrous Material	95% 5%
5-3	LAYER 1 Mastic, Off White, Homogeneous	None Detected	Wollastonite Non-Fibrous Material	5% 95%
	LAYER 2 Paper / Foil Wrap, Beige/ Silver, Homogeneous	None Detected	Cellulose Fiber Fibrous Glass Non-Fibrous Material	45% 10% 45%
	LAYER 3 Insulation, Yellow, Homogeneous	None Detected	Mineral Wool Non-Fibrous Material	95% 5%

Jose Sequera Analyst

Scott Ward, Ph.D. Lab Director

NVLAP Lab Code: 200525-0 **TDSHS License: 30-0273**

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Date Received: 13-Apr-2020
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Date Reported: 16-Apr-2020

HAS Bush Int. - Fire Station

Sample ID #	Sample Description	Asbestos Constituents	Non-Asbestos Constituents	
6-1	LAYER 1 Floor Tile, Gray, Homogeneous	None Detected	Non-Fibrous Material	100%
	LAYER 2 Mastic, Yellow, Homogeneous	None Detected	Non-Fibrous Material	100%
6-2	LAYER 1 Floor Tile, Gray, Homogeneous	None Detected	Non-Fibrous Material	100%
	LAYER 2 Mastic, Yellow, Homogeneous	None Detected	Non-Fibrous Material	100%
6-3	LAYER 1 Floor Tile, Gray, Homogeneous	None Detected	Non-Fibrous Material	100%
	LAYER 2 Mastic, Yellow, Homogeneous	None Detected	Non-Fibrous Material	100%
7-1	Caulk, Tan, Homogeneous	None Detected	Non-Fibrous Material	100%
7-2	Caulk, Tan, Homogeneous	None Detected	Non-Fibrous Material	100%
7-3	Caulk, Tan, Homogeneous	None Detected	Non-Fibrous Material	100%
8-1	Caulk, Gray, Homogeneous	None Detected	Wollastonite Non-Fibrous Material	5% 95%
8-2	Caulk, Gray, Homogeneous	None Detected	Wollastonite Non-Fibrous Material	5% 95%
8-3	Caulk, Gray, Homogeneous	None Detected	Wollastonite Non-Fibrous Material	5% 95%

Jose Sequera Analyst

Scott Ward, Ph.D. Lab Director

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Alex Nguyen
EFI Global, Inc.
2000 Dairy Ashford, Ste 600
Houston TX 77077

J3 Order #: JH20118985
Project #: 029.01935
Date Received: 13-Apr-2020
Date Analyzed: 15-Apr-2020
Date Reported: 16-Apr-2020

HAS Bush Int. - Fire Station

Sample ID #	Sample Description	Asbestos Constituents		Non-Asbestos Constituents	
9-1	Caulk, Dk. Gray, Homogeneous	None Detected		Non-Fibrous Material	100%
9-2	Caulk, Dk. Gray, Homogeneous	None Detected		Non-Fibrous Material	100%
9-3	Caulk, Dk. Gray, Homogeneous	None Detected		Non-Fibrous Material	100%
10-1	Transite, Gray, Homogeneous	Chrysotile Crocidolite	15% 3%	Non-Fibrous Material	82%
11-1	Plaster, Off White, Homogeneous	None Detected		Non-Fibrous Material	100%
11-2	LAYER 1 Plaster, Off White, Homogeneous	None Detected		Non-Fibrous Material	100%
	LAYER 2 Plaster, Gray, Homogeneous	None Detected		Non-Fibrous Material	100%
11-3	LAYER 1 Plaster, Off White, Homogeneous	None Detected		Non-Fibrous Material	100%
	LAYER 2 Plaster, Gray, Homogeneous	None Detected		Non-Fibrous Material	100%
12-1	LAYER 1 Painted Wrap, Off White/ Beige, Homogeneous	None Detected		Cellulose Fiber Non-Fibrous Material	85% 15%
	LAYER 2 Paper / Foil Wrap, Beige/ Silver, Homogeneous	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	45% 10% 45%
	LAYER 3 Insulation, Yellow, Homogeneous	None Detected		Mineral Wool Non-Fibrous Material	95% 5%

Jose Sequera Analyst

Scott Ward, Ph.D. Lab Director

NVLAP Lab Code: 200525-0 **TDSHS License: 30-0273**

J3 Resources, Inc.
6110 W. 34th Street, Houston, Texas 77092
Phone: (713) 290-0221 - Fax: (713) 290-0248
J3Resources.com

Bulk Asbestos Fiber Analysis by Polarized Light Microscopy (PLM)

Appx E Sub E 40 CFR 763 / EPA 600/R-93/116

Alex Nguyen
EFI Global, Inc.
2000 Dairy Ashford, Ste 600
Houston TX 77077

J3 Order #: JH20118985
Project #: 029.01935
Date Received: 13-Apr-2020
Date Analyzed: 15-Apr-2020
Date Reported: 16-Apr-2020

HAS Bush Int. - Fire Station

Sample ID #	Sample Description	Asbestos Constituents	Non-Asbestos Constituents	
12-2	LAYER 1 Painted Wrap, Off White/ Beige, Homogeneous	None Detected	Cellulose Fiber Non-Fibrous Material	85% 15%
	LAYER 2 Paper / Foil Wrap, Beige/ Silver, Homogeneous	None Detected	Cellulose Fiber Fibrous Glass Non-Fibrous Material	45% 10% 45%
	LAYER 3 Insulation, Yellow, Homogeneous	None Detected	Mineral Wool Non-Fibrous Material	95% 5%
12-3	LAYER 1 Painted Wrap, Off White/ Beige, Homogeneous	None Detected	Cellulose Fiber Non-Fibrous Material	85% 15%
	LAYER 2 Paper / Foil Wrap, Beige/ Silver, Homogeneous	None Detected	Cellulose Fiber Fibrous Glass Non-Fibrous Material	45% 10% 45%
	LAYER 3 Insulation, Yellow, Homogeneous	None Detected	Mineral Wool Non-Fibrous Material	95% 5%

Jose Sequera Analyst

Scott Ward, Ph.D. Lab Director

NVLAP Lab Code: 200525-0 **TDSHS License: 30-0273**

Revision #v5/SM
Revision Date: 8/22/2019

IH CHAIN OF CUSTODY

eurofins | J3 Resources

☐ Open Lab Fee

J3 Order # / Laboratory Only: 118985

Submitter Name:	Brian King	**Bill to:**	EFI
Company:	EFI	**Address:**	
Address:			
		City/State:	**Zip:**
City/State:	**Zip:**	**PO #:**	

Project Information

Project Name: HAS Bush Int - Fire Station	Project Manager: Alex Nguyen
Project #: 029.01935	Telephone – Office/Cell
Reports - Email Address:	
Invoice - Email Address:	Notification By: Email: ☐ Verbal: ☐
Special Instructions:	

Turnaround Times – Please Select One

Emergency* ☐	1 Day ☐	2 Day ☐	3 Day ☑	5 Day ☐

ASBESTOS

PLM - Bulk	PCM - Air	TEM - Air	TEM - Bulk	TEM - Water	TEM - Dust	TEM/PLM Soil/Vermiculite/Ore
EPA 600/R-93/116 ○ Visual Estimation (<1%) ○ 400 Point Count 0.25% ○ 1,000 Point Count 0.1% ○ Gravimetric Reduction ○ Matrix Reduction (+/-) ○ NIOSH 9002 ○ OSHA ID-191	○ NIOSH 7400 ○ ASTM D7201 ○ ISO 8672 ○ OSHA ID-160	○ AHERA ○ NIOSH 7402 ○ ASTM D6281 ○ ISO 10312 ○ ISO 13794	○ Gravimetric Reduction (<1%) ○ Matrix Reduction (+/-) ○ Qualitative (+/-) ○ Drop Mount ○ Filtration	○ EPA 100.2 Drinking Water ○ >10 µm fibers ○ ≥0.5 µm fibers ○ EPA 100.2 Effluent / WW Received on Ice: ○ Yes ○ No Temp: _____	○ ASTM D5755 Microvac ○ ASTM D6480 Wipe ○ 600/J-93/167 Carpet - EPA ○ Bulk Dust Qualitative	○ ASTM 7521-TEM (+/-) ○ ASTM 7521-TEM (<1%) ○ CARB 435-Modified ○ Soil – PLM Only (+/-) ○ Vermiculite - TEM (+/-) ○ Vermiculite-Cincinnati ○ Erionite ID

METALS

Flame AA	Graphite Furnace AA - LEAD	ICP
○ Lead in Paint – SW846 7420/3050B ○ Lead in Air – NIOSH 7082 ○ Lead in Wipes – SW846 7420/3050B ○ Lead in Soil – SW846 7420/3050B ○ TCLP – SW846-1311/6010B	○ Drinking Water – EPA 200.9 ○ Wastewater – SW846-7421 ○ Soil/Sludge – SW846-7421 ○ Air – NIOSH 7105	○ Elements in Air – NIOSH 7300 ○ Wipe/Soil – SW846-6010B ○ Effluent – SW846-6010B ○ Welding Fume – NIOSH 7300M

SILICA/PARTICULATES

X-Ray Diffraction / Gravimetric
○ Respirable Crystalline Silica NIOSH 7500 / OSHA 142 ○ NIOSH 0500 – Total Particulates ○ NIOSH 0600 – Respirable Particulates

Total Number of Samples Submitted: 36 **Positive Stop:** ☑ YES ☐ NO

Signatures

Relinquished By:		**Date:** 4-13-20	**Time:**
Received By:		**Date:** 4/13/2020	**Time:** 11:53AM
Relinquished By:		**Date:**	**Time:**
Received By:		**Date:**	**Time:**

** Emergency TAT requires prior lab notification. All samples analyzed outside normal business hours are charged at Emergency rate.*
***TAT's are in Business Days rather than Hours (i.e.1 Day TAT = End of Next Business Day)*

Revision #v6/SM
Revision Date: 8/22/2019

Project Name/Number 02G.01935

SAMPLE IDENTIFICATION

SAMPLE NUMBER	SAMPLE LOCATION / MATERIAL	VOLUME/CONDITION
1-1	GWB w/ paint	
-2	"	
-3	"	
2-1	Cove Base Mastic	
-2	"	
-3	"	
1-4	GWB w/ Paint - SDM	

Comments/Special Instructions:

ENVIRONMENTAL MICROBIOLOGY CHAIN OF CUSTODY

Project Name/Number 029-01935 Page _____ of _____

SAMPLE IDENTIFICATION

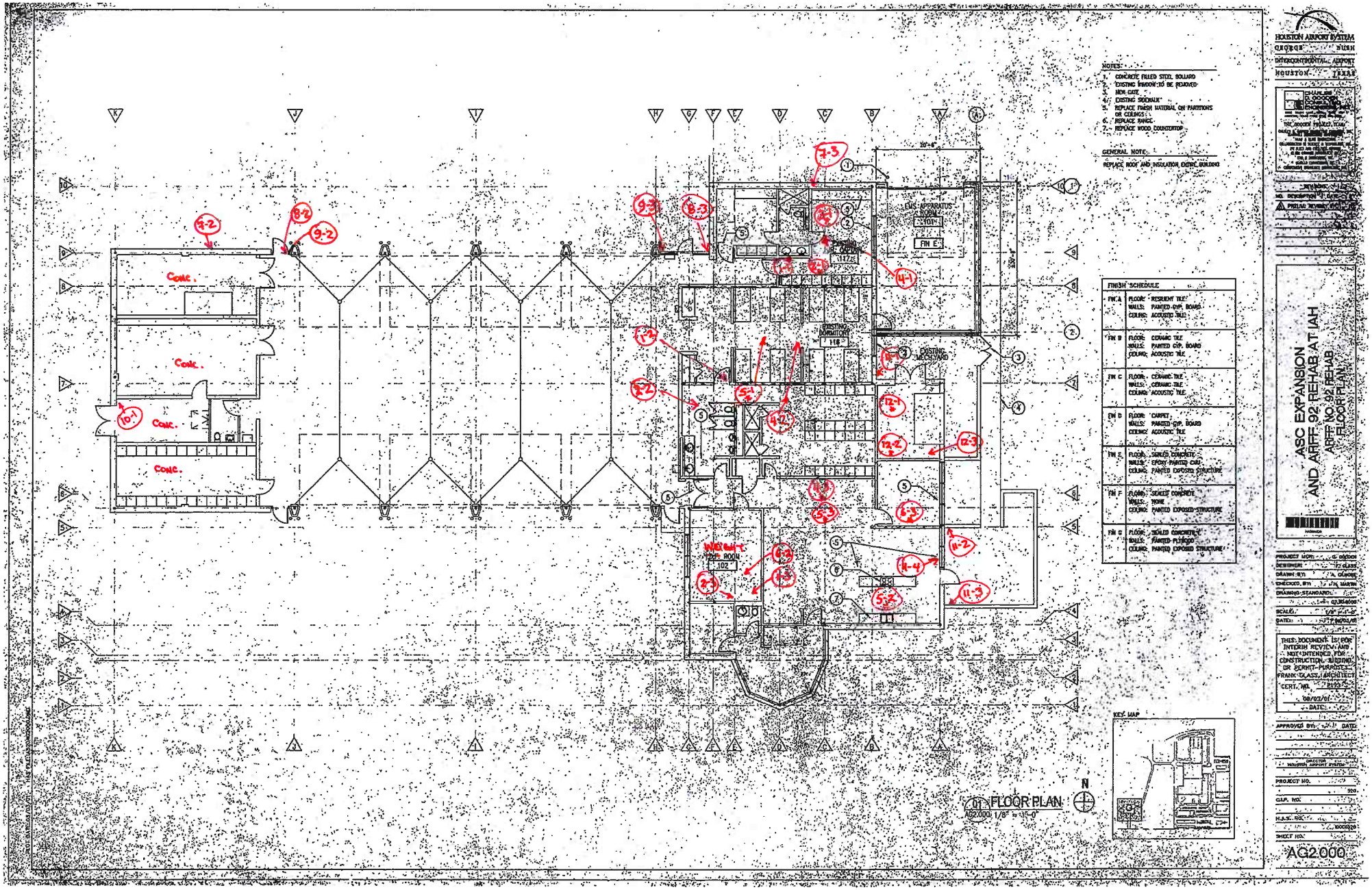
SAMPLE NUMBER	SAMPLE LOCATION / MATERIAL	VOLUME
3-1	Yellow Carpet mastic	
-2	↓	
-3	↓	
4-1	2'x2' CT	
-2	↓	
-3	↓	
5-1	WH. Duct mastic	
-2		
-3		
6-1	12"x12" BRN Felt w/ yel. mastic	
-2	↓	
-3	↓	
7-1	Beige Rubber Expansion Joint Caulking	
-2		
-3		
8-1	Grey Sidewalk Expansion Joint Caulking	
-2		
-3		
9-1	Dk. BRN Window Expansion Joint Caulking	
-2		
-3		
10-1	Terrazzo Floor Slate @ Entrance Stairs	
11-1	Plaster Soffit	
-2	↓	
-3	↓	
12-1	Domestic Hot TSI w/ mastic	
-2	↓	
-3	↓	

Comments/Special Instructions:

Eurofins J3 Resources, Inc. • 6110 West 34th Street • Houston, Texas 77092 • tel: 713-290-0221 • fax: 713-290-0248
Eurofins J3 Resources, Inc. • 3113 Red Bluff Road • Pasadena, Texas 77503 • tel: 713-290-0223 • fax: 713-290-0248

efi global

APPENDIX B
BULK SAMPLE LOCATION SKETCH



efi global

APPENDIX C
LICENSES AND CERTIFICATES

Texas Department of State Health Services

EFI GLOBAL INC

is certified to perform as an

Asbestos Consultant Agency

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1954 and Title 12, Texas Administrative Code, Chapter 295 relating to Texas Asbestos Health Protection, as long as this license is not suspended or revoked.

License Number: 100409

Expiration Date: 04/26/2022

John Hellerstedt, M.D.,
Commissioner of Health

Control Number: 97284

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK

Texas Department of State Health Services

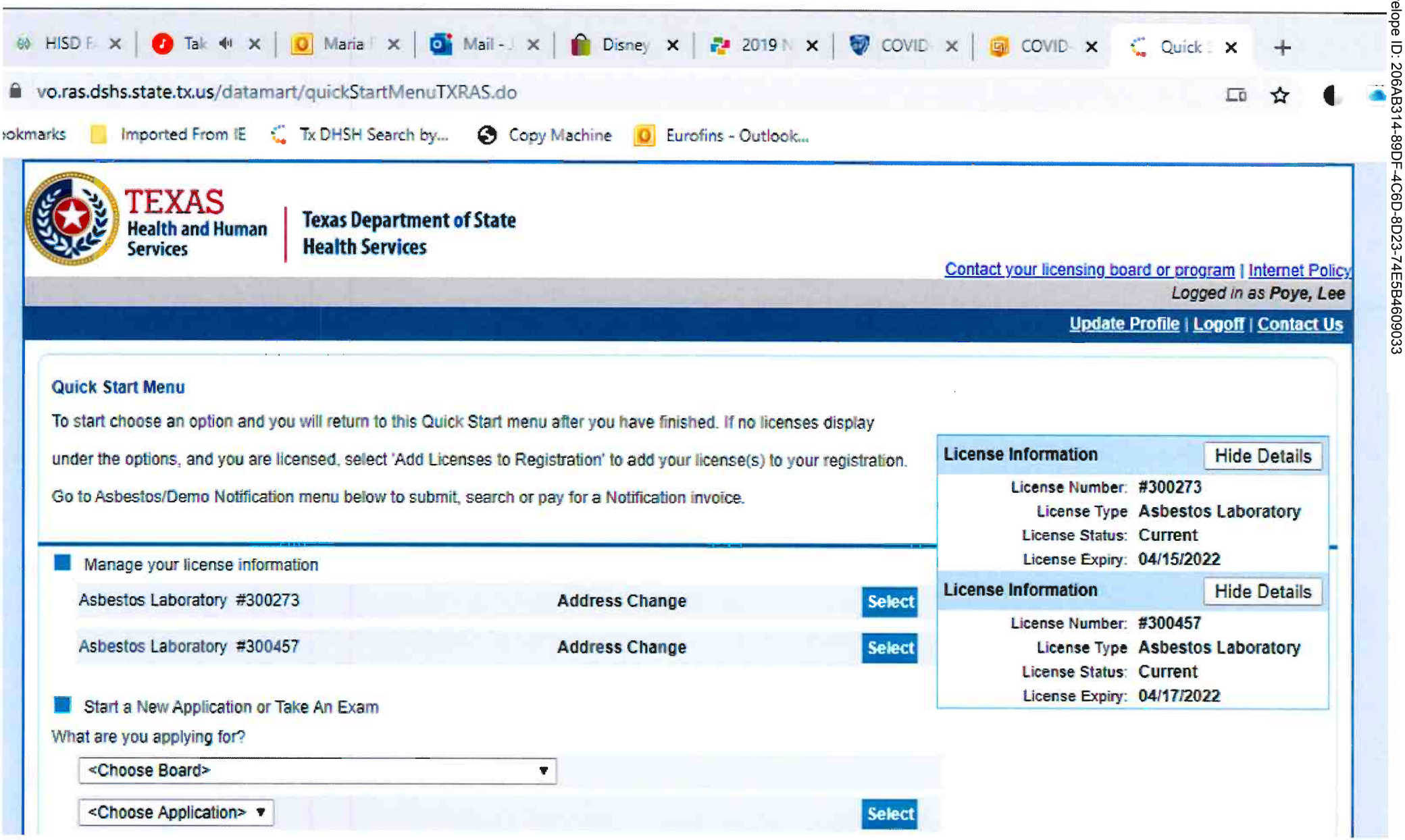
Asbestos Individual Consultant

RICK ALLEN ANDERSON
License No. 105042
Control No. 97636
Expiration Date: 28-Dec-2021

Texas Department of State Health Services

Asbestos Inspector

BRIAN A KING
License No. 603689
Control No. 98981
Expiration Date: 6/14/2020



TEXAS DEPARTMENT OF STATE HEALTH SERVICES

J3 RESOURCES INC

is certified to perform as a

Asbestos Laboratory
PCM, PLM, TEM

in the State of Texas within the purview of Texas Occupations Code, chapter 1954, so long as this license is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

John Hellerstedt, M.D.
Commissioner of Health

License Number: 300273

Control Number: 96276

Expiration Date: 4/15/2020

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

TEXAS DEPARTMENT OF STATE HEALTH SERVICES

J3 RESOURCES INC
J3 RESOURCES, INC.

is certified to perform as a

Asbestos Laboratory
PLM

in the State of Texas within the purview of Texas Occupations Code, chapter 1954, so long as this license is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

John Hellerstedt, M.D.
Commissioner of Health

License Number: 300457

Control Number: 96275

Expiration Date: 4/17/2020

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

THOMAS A. BAZAN, *CONSULTANT*

APPRAISAL
BROKERAGE
CONSULTING
DUE DILIGENCE
ENVIRONMENTAL

April 22, 2020

Mr. Cuong "Alex" Nguyen
Project Manager
EFI Global, Inc.
2000 Dairy Ashford, Suite 600
Houston, Texas 77077

RE: LEAD PAINT SURVEY REPORT

Date of Survey:	April 13, 2020
Certified Risk Assessor:	Thomas A. Bazan, CEI (TDH No. 2070001)
Property Name:	HFD ARFF 92
Property Description:	Specialized Aircraft Rescue Units
Property Location:	3804 Will Clayton Pkwy, Houston, TX 77032
Owner:	City of Houston, Texas
Project No.:	029.01935

Dear Mr. Nguyen:

The purpose of this letter is to transmit a report of the XRF assays taken during a lead paint survey, along with the corresponding site plan/building sketch which indicates the specific location of where the random XRF readings were taken on the interior surfaces of the specified occupied areas of the structure referenced above.

The lead paint survey was performed on April 13, 2020, by Thomas A. Bazan, CEI (TDSHS No. 2070001). The purpose of the survey was to detect lead-contaminated paint "that is deteriorating or present in the interior's accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects if disturbed." The survey was performed using the X-Ray Fluorescence (XRF) sampling technique involving random assays of the interior and exterior of the original architectural components of the existing structures.

I believe that the XRF sample readings taken are representative of the various paint histories of the existing architectural components of the areas to be renovated. No bulk paint chip samples were deemed necessary, although t-clp testing may be required for the identified debris generated by any renovation or demolition activities. The metal debris can be sold as salvage for recycling.

POST OFFICE BOX 40506 **OFFICE: (713) 466-4477**
HOUSTON, TEXAS 77240 ***TOM@BAZAN.NET*** **FAX: (713) 466-7750**

Mr. Cuong "Alex" Nguyen
April 22, 2020
HFD ARFF 92, 3804 Will Clayton Pkwy, Houston, TX

The lead paint survey report indicates that the applicable federal, state, and city promulgated rules define lead concentrations in paint that are ≥5,000 ppm, 0.5% by weight, or 1.0 mg/cm^2 as category C-1 (health hazard, abatement should be a top priority). O.S.H.A. rules 24 CFR 1910.1025 and 24 CFR 1926.62 are much more restrictive for workers being exposed to lead-contaminated dust generated by an activity; thus any nominal concentration of lead-contaminated paint films have been recorded as category C-2, and that lead-safe, low dust generating techniques should be used when disturbing those painted architectural components.

The scope of the assignment is limited to testing the accessible paint films of the original painted architectural components, as well as the subsequent additions and renovations of the structure, which are scheduled to be renovated, refurbished, remediated, or demolished. Due to the scope of the assignment, I can not warrant that all surfaces containing lead paint hazards have been identified. It is possible that there are surfaces containing lead-contaminated paint that were not found because they were either not visible or accessible to the inspector, or for other reasons, were not sampled.

The ARFF 92 was built in 1987 to handle new additions at Intercontinental Airport and is located at Will Clayton and JFK Blvd. Positioned to protect the new southernmost runways. The structure is steel framed with CMU walls and brick veneer.

The table below describes how the instrument assays are classified.

Table 1 – Hazard Categories

Hazard Category		Response Action
C-1:	Lead Present	Health Hazard, as defined by applicable federal, state and city regulation. Abatement should be a top priority. (≥5,000 ppm or 0.5% by weight or 1.0 mg/cm^2)
C-2:	Lead Present	No action necessary when lead levels are found below applicable Federal and State Regulation action levels. OSHA Regulations may apply to workers during demolition or renovations. (>600 ppm or 0.06% but <5,000 ppm or 0.5% by weight or 1.0 mg/cm^2)
A:	Allowable Lead Level	(≤ 90 ppm or 0.009% by weight) as defined by the U.S. Consumer Product Safety Improvement Act of 2008 (CPSIA) (Public Law 110-314)
A-1:	Lead Abated	Once identified; lead containing materials (LCM) have been abated.

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The lead paint survey does not include lead contaminated dust or lead contaminated soil as described in the definition of lead based paint hazard in Title X, CFR Vol. 61 No. 169 Subpart L 745.233 or the Texas Environmental Lead Reduction Rules 295.202.

The inspector's first step was a visual examination (ASTM E2255 / E2255M - 18a) of the property to be tested. The survey included a limited XRF sampling of potential lead based paint areas located at the property (ASTM E2120 - 10[2016]).

Prior to surveying the areas, the inspector performed the XRF manufacturer's recommended warm up and quality control procedures successfully. Then the inspector took calibration check readings on a NIST Standard Reference Material test pad of a known concentration of lead that was provided by the instrument manufacturer. The calibration checks were within the prescribed instrument range, indicating that the XRF instrument was in calibration and that XRF testing could begin. The instrument was checked for calibration prior to being turned off after the morning testing and after completion of that day's testing.

The architectural components inspected were recorded on a Heuresis Pb200i, s/n 1013, instrument as to room equivalent, room description, substrate, component, color, condition, and location. Side A was the side first encountered as the room was entered, and Sides B, C, and D were lettered in a clockwise direction. The Heuresis Pb200i recorded the lead content in mg/cm of each reading (assay) and the result as either Positive (POS), Negative (NEG), or Incomplete (Null). Incomplete readings occur when the instrument is un-intentionally moved prior to completion of a reading.

SUMMARY OF RESULTS

There were one hundred forty (140) assays (readings) taken for this assignment, including the calibration assays. Of the one hundred thirty-two (132) architectural components tested, for OSHA purposes, one (1) of the XRF assays was classified as C-1. There were eighty-five (85) assays which were detected with low levels of lead which are classified as C-2, and are noted.

FINDINGS

There was one (1) reading with a significant concentration, classified as C-1, of lead-contaminated paint detected in the paint films covering one vent louver architectural component tested on the mechanical room exterior which was described in the scope of work. Lower levels of lead in either the paint films or substrate, classified as C-2, was detected on metal and concrete interior components covered with various types of paint films.

Assay No	Room	Description	Substrate	Component	Color	Paint Condition	XRF Sampling Location	Pb (mg/cm2)
128/125	Exterior	Mechanical Room	Metal	Grate	Brown	Poor	North	6.6

Lead paint, classified as C-1, was detected on one exterior component, typically covered with a lead primer.

RECOMMENDATIONS

Please be advised that the following rules should be reviewed concerning demolition.

- 24 CFR 1910.1025 USOSHA General Industrial Lead Standards.
- 24 CFR 1926.62 USOSHA Lead In Construction Standards

Please refer to the Sequential Assay report which follows. Depending on the demolition techniques, personal protection equipment may be required along with certain engineering controls so as to limit dust migration.

Any activity that will abrade the surfaces of the identified lower level lead-contaminated component(s) should entail low dust generating techniques. Prior to the disposal of debris, t-clp testing may be required for the identified debris generated as a result of any renovation or demolition activities.

Any metal can be sold as salvage scrap, and merely document that the material may have lead-contaminated paint on the bill of sale to the scrap dealer, so as to indemnify the waste generator.

Mr. Cuong "Alex" Nguyen
April 22, 2020
HFD ARFF 92, 3804 Will Clayton Pkwy, Houston, TX

Additional notes, sketches, and photographic exhibits are in file and available for reference.

Your attention is directed to the **Certification and Statement of Limiting Conditions** that are attached to this final report, which is an integral part of this report.

If you have any questions, please feel free to call for further discussion or clarification.

Respectfully Submitted,

Thomas A. Bazan, CEI
Texas DSHS Certified Risk Assessor No. 2070001

Attachment

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APPENDIX

Environmental Assessment Association

CERTIFICATION AND STATEMENT OF LIMITING CONDITIONS

Certification: The Environmental Inspector certifies to the Buyer, Seller and/or lender in a transaction as named in the inspection report "Principal Parties"; and the Inspector and the Principal Parties agree that:

1. The Environmental Inspector has no present or contemplated future (a) partnership with Principal Parties nor (b) an interest in the property inspected which could adversely affect the Inspector's ability to perform an objective inspection; and neither the employment of the inspector to conduct the inspection, nor the compensation for it, is contingent on the results of the inspection.
2. The Environmental Inspector has no personal interest in or bias with respect to the subject matter of the inspection report or any parties who may be part of a financial transaction involving the property. The conclusions and recommendations of the report are not based in whole or in part upon the race, color, creed, sex or national origin of any of the Principle Parties.
3. The Environmental Inspector has personally inspected the property, both inside and out and has made visual inspection of adjacent properties, to the extent possible by readily available access. The inspection does not include the removal of any soil, water or air samples, the moving of furniture or fixtures, or any type of inspection that would require extraordinary effort to access.
4. All contingent and limiting conditions are contained herein (imposed by the terms of the inspection assignment or by the undersigned affecting the conclusions and recommendations contained in the report).
5. This Environmental Inspection report has been made in conformity with and is subject to the requirements of the Code of Professional Ethics of the Environmental Assessment Association.
6. All opinions, conclusions and recommendations concerning the inspected property that are set forth in the inspection report were prepared by the Environmental Inspector whose signature appears on the report.

Contingent and Limiting Conditions: The certification of the Environmental Inspector appearing in the environmental inspection report is subject to the following conditions and to such other specific and limiting conditions as are set forth by the Inspector in the report.

1. The Inspector assumes no responsibility for matters of a legal nature affecting the property inspected or the title thereto. The property is inspected assuming responsible ownership.
2. Any sketch appearing in or attached to the inspection report, or any statement of dimensions, capacities, quantities or distances, are approximate and are included to assist the reader in visualizing the property. The inspector has made no survey of the property.
3. The Inspector is not required to give testimony or appear in court because of having made the inspection with reference to the property in question, unless arrangements have been previously made therefor.
4. This report is not intended to have any direct effect on the value of the property inspected but simply to provide a visual Environmental Assessment solely for the benefit of the Principal Parties.
5. The Inspector assumes that there are no hidden, unapparent, or latent conditions or defects in or of the property, subsoil, or structures, other

than those noted on the inspection report or any addendum to the report which the Inspector has included. The Inspector assumes no responsibility for such conditions, or for the inspection, engineering or repair which might be required to discover or correct such factors.

6. Information, estimates and opinions furnished to the Inspector, and contained in the report, were obtained from sources considered reliable and believed to be true and correct. However, the Inspector has made no independent investigation as to such matters and undertakes no responsibility for the accuracy of such items.

7. The Inspection and Inspection Report are made by the Inspector solely for the benefit and personal use of the Principal Parties. Disclosure of the contents of the Inspection Report is governed by the Bylaws and Regulations of the Environmental Assessment Association. No disclosure may be made of the Inspection Report without the prior written consent of the Inspector and the Inspector undertakes no responsibility for harm or damages to any party other than the Principle Parties.

8. Neither the Inspection Report, any part thereof, nor any copy of the same (including conclusions or recommendations, the identity of the Inspector, professional designation, reference to any professional organization, or the firm with which the Inspector is connected), shall be used for any purposes by anyone but the Principle Parties. The report shall not be conveyed by anyone to the public through advertising, public relations, news, sales, or other media, without the prior written consent and approval of the Inspector.

Inspectors Name: Thomas A. Bazan

Accepted by: _____

Date: April 13, 2020

Mr. Cuong "Alex" Nguyen
April 22, 2020
HFD ARFF 92, 3804 Will Clayton Pkwy, Houston, TX

APPENDIX

Mr. Cuong "Alex" Nguyen
April 22, 2020
HFD ARFF 92, 3804 Will Clayton Pkwy, Houston, TX

APPENDIX "A"
FLOOR PLAN/SKETCHES

NOTES:
1. CONCRETE FILLED STEEL BOLLARD
2. EXISTING WINDOW TO BE REMOVED
3. NEW GATE
4. EXISTING SIDEWALK
5. REPLACE FINISH MATERIAL ON PARTITIONS OR CEILINGS
6. REPLACE BANDE
7. REPLACE WOOD COUNTERTOP

GENERAL NOTE

REPLACE ROOF AND INSULATION ENTIRE BUILDING

EXISTING MR. CAPTAIN

EXISTING DORMITORY

EXISTING MECHYARD

I.D.F ROOM

FINISH SCHEDULE	
FIN A	FLOOR: RESILIENT TILE WALLS: PAINTED GYP. BOARD CEILING: ACOUSTIC TILE
FIN B	FLOOR: CERAMIC TILE WALLS: PAINTED GYP. BOARD CEILING: ACOUSTIC TILE
FIN C	FLOOR: CERAMIC TILE WALLS: CERAMIC TILE CEILING: ACOUSTIC TILE
FIN D	FLOOR: CARPET WALLS: PAINTED GYP. BOARD CEILING: ACOUSTIC TILE
FIN E	FLOOR: SEALED CONCRETE WALLS: EPOXY PAINTED CMU CEILING: PAINTED EXPOSED STRUCTURE
FIN F	FLOOR: SEALED CONCRETE WALLS: NONE CEILING: PAINTED EXPOSED STRUCTURE
FIN G	FLOOR: SEALED CONCRETE WALLS: PAINTED PLYWOOD CEILING: PAINTED EXPOSED STRUCTURE

01 FLOOR PLAN
AG2.000 1/8" = 1'-0"

N

KEY MAP

Lead Paint Survey - April 13, 2020

T. Bazan, R/A # 2070001

HOUSTON AIRPORT SYSTEM
GEORGE BUSH
INTERCONTINENTAL AIRPORT
HOUSTON TEXAS

THE GOODEN PROJECT TEAM

REVISIONS:
NO. DESCRIPTION DATE BY
1 PRELIM. REVIEW 8/01

ASC EXPANSION AND ARFF 92 REHAB AT IAH
ARFF NO. 92 REHAB
FLOOR PLAN

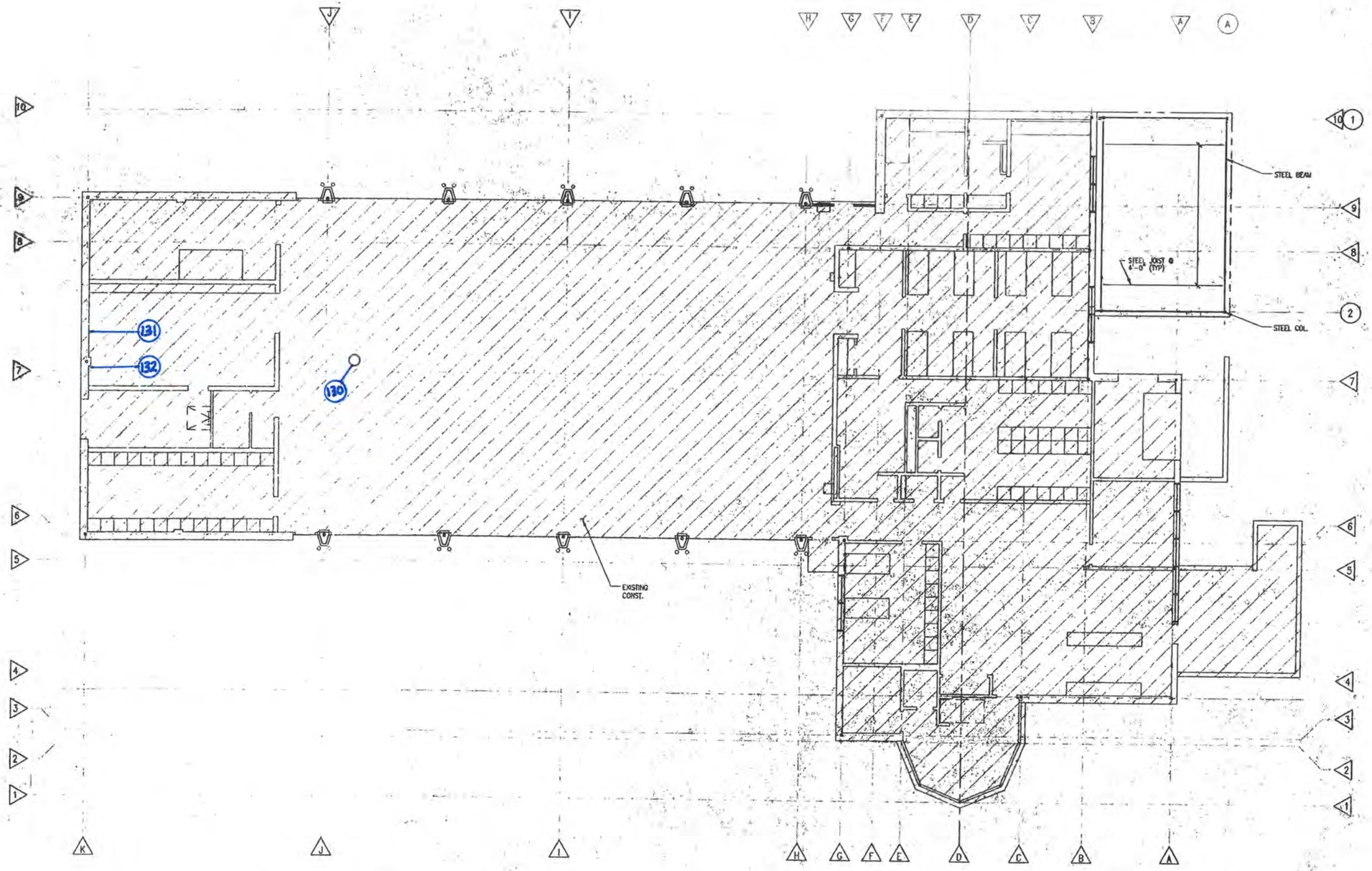
PROJECT MGR: G. GOODEN
DESIGNER: F. GLASS
DRAWN BY: A. GAMORE
CHECKED BY: N. MARTIN
DRAWING STANDARD: 07.201.8000
SCALE: 1/8" = 1'-0"
DATE: 08/03/01

THIS DOCUMENT IS FOR INTERIM REVIEW AND NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES.
FRANK GLASS, ARCHITECT
CERT. NO. 21923
08/03/01
DATE

APPROVED BY: DATE:
DIRECTOR HOUSTON AIRPORT SYSTEM

PROJECT NO. 920
C.I.P. NO.
H.A.S. NO. 10003320
SHEET NO. AG2.000

PLOT DATE:08/03/01 XRS FILE:1A920AG2000.DWG



Lead Paint Survey - April 13, 2020

T. Bazan, R/A # 2070001

01 GS2.001 ROOF FRAMING PLAN 1/8" = 1'-0"

N

HOUSTON AIRPORT SYSTEM
GEORGE BUSH INTERCONTINENTAL AIRPORT
HOUSTON TEXAS

CHARLES D. GOODEN CONSULTING ENGINEERS, INC.
2000 SOUTH LOOP WEST, SUITE 260
HOUSTON, TEXAS 77054 (713) 666-5662

THE GOODEN PROJECT TEAM:
CHARLES D. GOODEN CONSULTING ENGINEERS, INC.
MARSHALL ENGINEERING CORPORATION
HAAS & HAAS ENGINEERING
COLLABORATION IN SCIENCE & TECHNOLOGY, INC.
PB FLEET AND FACILITIES DIVISION
CLARK CONDON ASSOCIATES, INC.
EVIO & ASSOCIATES, INC.
MARILLO ENGINEERING, INC.

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	PRELIM. REVIEW 8/01		AC

ASC EXPANSION AND ARFF 92 REHAB AT IAH

ARFF NO. 92 REHAB ROOF FRAMING PLAN

PROJECT MGR: C. GOODEN
DESIGNER: A. CHAICHANAM
DRAWN BY: M. BALDWIN
CHECKED BY: A. CHAICHANAM
DRAWING STANDARD:

SCALE: 1/8"=1'-0"
DATE: 8/3/01

REVIEW SET ONLY
DOCUMENT INCOMPLETE; NOT RELEASED FOR:
a. PERMIT
b. BIDDING
c. CONSTRUCTION
ENGINEER: ALEX CHAICHANAM
CERT. NO.: 58548
DATE: 8/3/01

APPROVED BY: DATE:

DIRECTOR
HOUSTON AIRPORT SYSTEM

PROJECT NO. 520
C.I.P. NO.
H.A.S. NO. 10000520
SHEET NO. GS2.001

PLOT DATE: 8/3/01 HAS FILE: IC520S2_ROOFING

Mr. Cuong "Alex" Nguyen
April 22, 2020
HFD ARFF 92, 3804 Will Clayton Pkwy, Houston, TX

APPENDIX "B"
LEAD PAINT SURVEY

Job No: 029.01935
Heuresis Pb200i s/n 1013
Date: April 13, 2020

XRF SEQUENTIAL READINGS FOR A LEAD PAINT SURVEY

ARFF 92, 3804 Will Clayton Pkwy
Houston, TX
T. Bazan (TDSHS R/A #2070001)

Assay No	Room	Description	Substrate	Component	Color	Paint Condition	XRF Sampling Location	Pb (mg/cm2)	XRF Mode	LBP Hazard Classification
4 / 1	1	Hallway	Metal	Left Door Frame	Bronze	Intact	Wall "A" West	0.1	Auto	**C-2**
5 / 2	1	Hallway	Drywall	Wall	Ivory	Intact	Wall "A" West	0.2	Auto	**C-2**
6 / 3	1	Hallway	CMU	Wall	Ivory	Intact	Wall "D" South	-0.2	Auto	**C-2**
7 / 4	1	Hallway - Air Vent	Metal	Vent Register	Ivory	Intact	Ceiling West	0.1	Auto	**C-2**
8 / 5	1	Hallway Structural	Metal	Web Joist	Red	Intact	Ceiling West	**0.0**	Auto	**A**
9 / 6	1	Hallway Structural	Metal	Horizontal I-Beam	Red	Intact	Ceiling West	0.1	Auto	**C-2**
10 / 7	2	Bedroom/Office	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" South	**0.0**	Auto	**A**
11 / 8	2	Window	Metal	Frame	Charcoal	Intact	Wall "B" West	0.1	Auto	**C-2**
12 / 9	2	Bedroom/Office	Drywall	Wall	Ivory	Intact	Wall "B" West	-0.1	Auto	**C-2**
13 / 10	2	Murphy Bed	Wood	Wall	Beige	Fair	Wall "C" North	0.4	Auto	**C-2**
14 / 11	2	Cabinet	Wood	Wall	White	Intact	Wall "C" North	-0.1	Auto	**C-2**
15 / 12	2	Furr Down	Drywall	Wall	Ivory	Intact	Wall "C" North	-0.1	Auto	**C-2**
16 / 13	3	Jr. Captain Bedroom	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" West	0.1	Auto	**C-2**
17 / 14	3	Window	Metal	Frame	Charcoal	Intact	Wall "C" East	0.2	Auto	**C-2**
18 / 15	3	Jr. Captain Bedroom	Drywall	Wall	Ivory	Fair	Wall "C" East	**0.0**	Auto	**A**
19 / 16	3	Cabinets	Wood	Wall	White	Intact	Wall "B" North	**0.0**	Auto	**A**
20 / 17	4	Bathroom	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	**0.0**	Auto	**A**
21 / 18	4	Bathroom	Drywall	Ceiling	Ivory	Fair	Ceiling Center	**0.0**	Auto	**A**
22 / 19	4	Bathroom Vanity	Wood	Facing	Beige	Intact	Wall "B" South	0.4	Auto	**C-2**
23 / 20	4	Bathroom	Ceramic Tile	Wainscot	Beige	Intact	Wall "A" East	0.1	Auto	**C-2**
24 / 21	5	Bathroom	Ceramic Tile	Floor	Gray	Intact	Floor South	0.1	Auto	**C-2**
25 / 22	5	Dormatory	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" South	0.3	Auto	**C-2**
26 / 23	5	Window	Metal	Frame	Charcoal	Intact	Wall "C" North	0.1	Auto	**C-2**
27 / 24	5	Dormatory	Drywall	Wall	Ivory	Intact	Wall "C" North	-0.1	Auto	**C-2**
28 / 25	5	Partition	Drywall	Wall	Ivory	Intact	North Side	**0.0**	Auto	**A**
29 / 26	5	Partition	Wood	Trim	Brown	Intact	North Side	**0.0**	Auto	**A**
30 / 27	5	Air Vent	Metal	Register	Ivory	Intact	Ceiling South	0.1	Auto	**C-2**
31 / 28	5	Dormatory Closet	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" North	0.1	Auto	**C-2**
32 / 29	5	Dormatory Closet	Drywall	Wall	Ivory	Fair	Wall "C" South	0.1	Auto	**C-2**
33 / 30	5	Dormatory - Work Area	Wood	Table Top	Brown	Intact	Wall "A" South	-0.1	Auto	**C-2**

A = Allowable Lead level (below 90 ppm or 0.009% by weight).

C-1 = Lead Present; Health Hazard. (5,000 ppm or 0.5% by weight, or 1.0 mg/cm2)

C-2 = Lead present; no action necessary. (>90 ppm and <5,000 ppm or 0.009% by weight)

Job No: 029.01935
Heuresis Pb200i s/n 1013
Date: April 13, 2020

XRF SEQUENTIAL READINGS FOR A LEAD PAINT SURVEY

ARFF 92, 3804 Will Clayton Pkwy
Houston, TX
T. Bazan (TDSHS R/A #2070001)

Assay No	Room	Description	Substrate	Component	Color	Paint Condition	XRF Sampling Location	Pb (mg/cm2)	XRF Mode	LBP Hazard Classification
34 / 31	6	Locker Room	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" West	0.0	Auto	A
35 / 32	6	Ceiling Panel	Metal	Panel	Gray	Intact	Ceiling South	-0.1	Auto	C-2
36 / 33	6	Locker Room	Drywall	Ceiling	Ivory	Intact	Ceiling South	-0.1	Auto	C-2
37 / 34	6	Locker Room	Drywall	Wall	Ivory	Intact	Wall "C" East	0.1	Auto	C-2
38 / 35	6	Locker Room	Ceramic Tile	Wainscot	Beige	Intact	Wall "C" East	0.1	Auto	C-2
39 / 36	6	Locker Room	Ceramic Tile	Floor	Gray	Intact	Floor South	0.2	Auto	C-2
40 / 37	7	Main Restroom	Ceramic Tile	Floor	Gray	Intact	Floor West	0.1	Auto	C-2
41 / 38	7	Main Restroom	Ceramic Tile	Wainscot	Beige	Intact	Wall "D" West	0.1	Auto	C-2
42 / 39	7	Main Restroom	Drywall	Wall	Ivory	Intact	Wall "A" North	0.0	Auto	A
43 / 40	7	Main Restroom	Drywall	Ceiling	Ivory	Intact	Ceiling West	0.0	Auto	A
44 / 41	7	Main Restroom Air Vent	Metal	Register	Ivory	Intact	Ceiling East	0.1	Auto	C-2
45 / 42	7	Stall	Wood	Wall	Beige	Intact	South	0.2	Auto	C-2
46 / 43	7	Main Restroom Vanity	Wood	Facing	Beige	Intact	Wall "D" West	0.2	Auto	C-2
47 / 44	7	Doorway to Entry Hall	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" North	0.0	Auto	A
48 / 45	8	Locker Rm Dressing Area	Wood	Locker Door	Beige	Intact	Wall "B" West	0.0	Auto	A
49 / 46	8	Locker Rm Dressing Area	Drywall	Ceiling	Ivory	Intact	Ceiling South	-0.1	Auto	C-2
50 / 47	8	North Shower	Drywall	Ceiling	Ivory	Intact	Ceiling Center	0.0	Auto	A
51 / 48	8	North Shower	Ceramic Tile	Wainscot	Beige	Intact	Wall "C" South	0.0	Auto	A
52 / 49	8	North Shower	Ceramic Tile	Floor	Gray	Intact	Floor Center	0.0	Auto	A
53 / 50	9	Day Room	Metal	Left Door Jamb	Black	Fair	Wall "A" West	0.1	Auto	C-2
54 / 51	9	Day Room	Drywall	Wall	Ivory	Intact	Wall "B" North	0.1	Auto	C-2
55 / 52	9	Day Room	Fired Tile	Floor	Brown	Intact	Floor West	0.2	Auto	C-2
56 / 53	9	Day Room - Air Vent	Metal	Register	Ivory	Intact	Ceiling Center	0.2	Auto	C-2
57 / 54	9	Day Room - Dining Area	Metal	Left Door Jamb	Black	Fair	Wall "C" East	-0.1	Auto	C-2
58 / 55	9	Window	Metal	Frame	Black	Fair	Wall "C" East	0.0	Auto	A
59 / 56	9	Day Room - Dining Area	Drywall	Wall	Ivory	Fair	Wall "C" East	0.0	Auto	A
60 / 57	9	Cabinet	Wood	Side	Beige	Fair	Wall "C" East	-0.1	Auto	C-2
61 / 58	9	Day Room - Kitchen Area	Drywall	Wall	Ivory	Fair	Wall "D" South	0.0	Auto	A
62 / 59	9	Cupboards	Wood	Facing	Beige	Intact	Wall "D" South	0.0	Auto	A
63 / 60	9	Island Center	Wood	Trim	Brown	Fair	South Side	-0.1	Auto	C-2

A = Allowable Lead level (below 90 ppm or 0.009% by weight).

C-1 = Lead Present; Health Hazard. (5,000 ppm or 0.5% by weight, or 1.0 mg/cm2)

C-2 = Lead present; no action necessary. (>90 ppm and <5,000 ppm or 0.009% by weight)

Job No: 029.01935
Heuresis Pb200i s/n 1013
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XRF SEQUENTIAL READINGS FOR A LEAD PAINT SURVEY

ARFF 92, 3804 Will Clayton Pkwy
Houston, TX
T. Bazan (TDSHS R/A #2070001)

Assay No	Room	Description	Substrate	Component	Color	Paint Condition	XRF Sampling Location	Pb (mg/cm2)	XRF Mode	LBP Hazard Classification
64 / 61	9	Janitor Closet	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" South	-0.1	Auto	**C-2**
65 / 62	9	Janitor Closet	Drywall	Ceiling	White	Intact	Ceiling Center	0.1	Auto	**C-2**
66 / 63	9	Janitor Closet	Ceramic Tile	Wainscot	Beige	Intact	Wall "C" North	0.2	Auto	**C-2**
67 / 64	10	Computer Room	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" West	**0.0**	Auto	**A**
68 / 65	10	Window	Metal	Frame	Charcoal	Intact	Wall "C" East	0.1	Auto	**C-2**
69 / 66	10	Computer Room	Drywall	Wall	Ivory	Fair	Wall "C" East	**0.0**	Auto	**A**
70 / 67	10	Computer Room - Table	Wood	Facing	Brown	Intact	Wall "B" North	**0.0**	Auto	**A**
71 / 68	10	Computer Room Air Vent	Metal	Register	Ivory	Intact	Ceiling NEC	0.2	Auto	**C-2**
72 / 69	11	Watch Office	Metal	Register	Ivory	Intact	Ceiling SEC	-0.1	Auto	**C-2**
73 / 70	11	Watch Office	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" North	**0.0**	Auto	**A**
74 / 71	11	Window	Metal	Frame	Charcoal	Fair	Wall "C" South	**0.0**	Auto	**A**
75 / 72	11	Watch Office	Drywall	Wall	Ivory	Fair	Wall "C" South	**0.0**	Auto	**A**
76 / 73	11	Watch Office - Desk	Wood	Facing	Brown	Intact	Wall "C" South	**0.0**	Auto	**A**
77 / 74	11	Watch Office Murphy Bed	Metal	Frame	Brown	Fair	Wall "D" West	**0.0**	Auto	**A**
78 / 75	12	Watch Office - Toilet	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" South	**0.0**	Auto	**A**
79 / 76	12	Air Vent	Metal	Register	Ivory	Intact	Ceiling Center	-0.1	Auto	**C-2**
80 / 77	12	Watch Office - Toilet	Drywall	Wall	Ivory	Intact	Wall "A" South	**0.0**	Auto	**A**
81 / 78	12	Vanity	Wood	Facing	Beige	Intact	Wall "C" North	0.3	Auto	**C-2**
82 / 79	12	Watch Office - Toilet	Ceramic Tile	Floor	Gray	Intact	Floor Center	0.2	Auto	**C-2**
83 / 80	12	Communications Rm	Metal	Left Door Jamb	Charcoal	Fair	Wall "D" West	**0.0**	Auto	**A**
84 / 81	13	Weight Room	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" North	**0.0**	Auto	**A**
85 / 82	13	Window	Metal	Frame	Charcoal	Intact	Wall "D" West	0.1	Auto	**C-2**
86 / 83	13	Weight Room - Air Vent	Metal	Register	Ivory	Intact	Ceiling Center	**0.0**	Auto	**A**
87 / 84	13	Weight Room	Drywall	Wall	Ivory	Fair	Wall "A" North	**0.0**	Auto	**A**
88 / 85	13	Weight Room - Lockers	Wood	Door	Beige	Intact	Wall "B" East	**0.0**	Auto	**A**
89 / 86	14	High Bay	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" North	**0.0**	Auto	**A**
90 / 87	14	High Bay - Lower Wall	CMU	Wall	Ivory	Intact	Wall "B" East	-0.2	Auto	**C-2**
91 / 88	14	High Bay - Upper Wall	CMU	Wall	Ivory	Poor	Wall "B" East	-0.3	Auto	**C-2**
92 / 89	14	High Bay	Metal	Frame	Black	Intact	Wall "A" North	**0.0**	Auto	**A**
93 / 90	14	High Bay	Metal	Panel	Black	Intact	Wall "A" North	**0.0**	Auto	**A**

A = Allowable Lead level (below 90 ppm or 0.009% by weight).

C-1 = Lead Present; Health Hazard. (5,000 ppm or 0.5% by weight, or 1.0 mg/cm2)

C-2 = Lead present; no action necessary. (>90 ppm and <5,000 ppm or 0.009% by weight)

Job No: 029.01935
Heuresis Pb200i s/n 1013
Date: April 13, 2020

XRF SEQUENTIAL READINGS FOR A LEAD PAINT SURVEY

ARFF 92, 3804 Will Clayton Pkwy
Houston, TX
T. Bazan (TDSHS R/A #2070001)

Assay No	Room	Description	Substrate	Component	Color	Paint Condition	XRF Sampling Location	Pb (mg/cm2)	XRF Mode	LBP Hazard Classification
94 / 91	14	High Bay Floor	Brick	Brick Floor	Red	Intact	Floor North	0.1	Auto	**C-2**
95 / 92	14	Piping	Metal	Vertical Pipe	Ivory	Fair	Wall "B" East	0.1	Auto	**C-2**
96 / 93	14	High Bay Floor Striping	Concrete	Stripe	White	Fair	Floor South	0.1	Auto	**C-2**
97 / 94	Exterior	High Bay - #1 Bay Door	Metal	Bollard	Red	Fair	South Side	0.5	Auto	**C-2**
98 / 95	14	High Bay Fire Hose Dryer	Metal	Side	Blue	Poor	South Side	**0.0**	Auto	**A**
99 / 96	Exterior	High Bay - Bay #4	Metal	Bollard	Red	Poor	North Side	0.4	Auto	**C-2**
100/97	14	High Bay - Utility Area	Ceramic Tile	Wainscot	Ivory	Intact	Wall "C" South	-0.1	Auto	**C-2**
101/98	15	Turnout Gear	Metal	Left Door Jamb	Charcoal	Poor	Wall "A" East	0.4	Auto	**C-2**
102/99	15	Turnout Gear	CMU	Wall	Beige	Fair	Wall "A" East	-0.1	Auto	**C-2**
103/100	16	Maintenance Room	Metal	Left Door Jamb	Gray	Poor	Wall "A" East	-0.2	Auto	**C-2**
104/101	16	Maintenance Room	CMU	Wall	Beige	Intact	Wall "A" East	-0.1	Auto	**C-2**
105/102	17	Electrical Room	CMU	Wall	Ivory	Intact	Wall "A" North	-0.1	Auto	**C-2**
106/103	17	Electrical Room	Metal	Left Door Jamb	Gray	Fair	Wall "A" North	0.4	Auto	**C-2**
107/104	17	Electrical Rm Double Doors	Metal	Left Door Jamb	Gray	Fair	Wall "D" West	0.1	Auto	**C-2**
108/105	17	Piping	Metal	2" Vertical Pipe	Ivory	Fair	Wall "A" North	0.1	Auto	**C-2**
109/106	17	Electrical Room Generator	Metal	Frame	Green	Fair	Wall "A" North	0.1	Auto	**C-2**
110/107	17	Power Panel	Metal	Cover	Gray	Fair	Wall "C" South	**0.0**	Auto	**A**
111/108	17	Compressor	Metal	Side	Silver	Fair	SEC	0.1	Auto	**C-2**
112/109	17	Ladder to Roof	Metal	Side	Ivory	Fair	Wall "B" East	0.1	Auto	**C-2**
113/110	17	Electrical Room	Metal	Conduit	Ivory	Fair	Wall "C" South	0.2	Auto	**C-2**
114/111	18	High Bay - Toilet	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	0.4	Auto	**C-2**
115/112	18	High Bay - Toilet Vanity	Wood	Facing	Gray	Fair	Wall "B" South	**0.0**	Auto	**A**
116/113	18	High Bay - Toilet	Ceramic Tile	Wainscot	Ivory	Intact	Wall "C" W	**0.0**	Auto	**A**
117/114	18	High Bay - Toilet	Ceramic Tile	Floor	Gray	Intact	Floor Center	0.1	Auto	**C-2**
118/115	19	Foam Storage	Metal	Left Door Jamb	Gray	Poor	Wall "A" East	0.4	Auto	**C-2**
119/116	19	Foam Storage	CMU	Wall	Beige	Intact	Wall "D" North	-0.1	Auto	**C-2**
120/117	19	Vertical Piping	Metal	Pipe	Ivory	Poor	Wall "D" North	0.2	Auto	**C-2**
121/118	Exterior	Bench by Entry	Concrete	Seat	Brown	Fair	East	0.2	Auto	**C-2**
122/119	14	High Bay - Structural	Metal	Joist	Ivory	Poor	Ceiling North	0.1	Auto	**C-2**
123/120	14	High Bay - Structural	Metal	Pan	Ivory	Poor	Ceiling North	0.1	Auto	**C-2**

A = Allowable Lead level (below 90 ppm or 0.009% by weight).

C-1 = Lead Present; Health Hazard. (5,000 ppm or 0.5% by weight, or 1.0 mg/cm2)

C-2 = Lead present; no action necessary. (>90 ppm and <5,000 ppm or 0.009% by weight)

Job No: 029.01935
Heuresis Pb200i s/n 1013
Date: April 13, 2020

XRF SEQUENTIAL READINGS FOR A LEAD PAINT SURVEY

ARFF 92, 3804 Will Clayton Pkwy
Houston, TX
T. Bazan (TDSHS R/A #2070001)

Assay No	Room	Description	Substrate	Component	Color	Paint Condition	XRF Sampling Location	Pb (mg/cm2)	XRF Mode	LBP Hazard Classification
124/121	Exterior	Parking Lot Light Stand	Metal	Post	Gray	Poor	North	0.1	Auto	**C-2**
125/122	Exterior	NW Covered Area	Metal	Post	Black	Fair	North	0.2	Auto	**C-2**
126/123	Exterior	Parking Lot	Concrete	Stripe	Yellow	Fair	Floor North	0.4	Auto	**C-2**
127/124	Exterior	Mechanical Room	Metal	Left Door Jamb	Brown	Fair	North	**0.0**	Auto	**A**
128/125	Exterior	Mechanical Room	Metal	Grate	Brown	Poor	North	**6.6**	Auto	**C-1**
129/126	Exterior	Overhang	Concrete	Overhang	White	Intact	East	**0.0**	Auto	**A**
130/127	Exterior	HVAC Unit	Metal	Side	Green	Fair	North	-0.1	Auto	**C-2**
131/128	17	Electrical Rm Structural	Metal	Web Joist	Ivory	Fair	Ceiling East	**0.0**	Auto	**A**
132/129	17	Electrical Rm Structural	Metal	Ceiling Pan	Ivory	Fair	Ceiling East	**0.0**	Auto	**A**
133/130	Roof	Vent Stack	Metal	Stack	White	Intact	Roof West	0.2	Auto	**C-2**
134/131	Roof	Facade	Asphalt	Wall	White	Intact	West Wall	-0.1	Auto	**C-2**
135/132	Roof	Facade	Metal	Flashing Cap	Beige	Intact	West Wall	0.1	Auto	**C-2**
		INSTRUMENT CALIBRATION								
1		Calibration	Wood	Test Film	Red	Intact	NIST SRM	0.9	Auto	
2		Calibration	Wood	Test Film	Red	Intact	NIST SRM	0.9	Auto	
3		Calibration	Wood	Test Film	Red	Intact	NIST SRM	0.9	Auto	
136		Calibration	Wood	Test Film	Red	Intact	NIST SRM	0.7	Auto	Not Flat-Retest
137		Calibration	Wood	Test Film	Red	Intact	NIST SRM	0.7	Auto	Not Flat-Retest
138		Calibration	Wood	Test Film	Red	Intact	NIST SRM	0.9	Auto	
139		Calibration	Wood	Test Film	Red	Intact	NIST SRM	1.0	Auto	
140		Calibration	Wood	Test Film	Red	Intact	NIST SRM	1.0	Auto	
-END-	--------	----END OF UNIT----	----------	----END----	----------	--END--	----------	--END--	----------	----END----

A = Allowable Lead level (below 90 ppm or 0.009% by weight).

C-1 = Lead Present; Health Hazard. (5,000 ppm or 0.5% by weight, or 1.0 mg/cm2)

C-2 = Lead present; no action necessary. (>90 ppm and <5,000 ppm or 0.009% by weight)

Mr. Cuong "Alex" Nguyen
April 22, 2020
HFD ARFF 92, 3804 Will Clayton Pkwy, Houston, TX

APPENDIX "C"
QUALIFICATIONS/CERTIFICATIONS

Texas Department of State Health Services

BE IT KNOWN THAT

THOMAS A BAZAN

is certified to perform as a

Lead Risk Assessor

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1955 and Title 25, Texas Administrative Code, Chapter 295 relating to Texas Environmental Lead Reduction, as long as this license is not suspended or revoked.

Certification Number: 2070001 ***Expiration Date: 08/05/2021***

John Hellerstedt, M.D.,
Commissioner of Health

Control Number: 7647 ***(Void After Expiration Date)***

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK

Texas Department of State Health Services

BE IT KNOWN THAT

THOMAS A BAZAN

is certified to perform as a

Lead Abatement Supervisor

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1955 and Title 25, Texas Administrative Code, Chapter 295 relating to Texas Environmental Lead Reduction, as long as this license is not suspended or revoked.

Certification Number: 2080131

Expiration Date: 12/07/2021

John Hellerstedt, M.D.,
Commissioner of Health

Control Number: 6646

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK

CONGRATULATIONS

Thomas Bazan

has successfully completed the U.S. Department

of Housing and Urban Development,

Office of Healthy Homes and Lead Hazard Control's

VISUAL ASSESSMENT COURSE

pursuant to 24 Code of Federal Regulations Part 35

Jonnette G. Hawkins
Director, Program Management and Assurance Division
Office of Healthy Homes and Lead Hazard Control

U.S. Department of Housing and Urban Development

Environmental Assessment Association

EAA

hereby certifies that

Thomas Andrew Bazan

has been qualified for membership in the

Environmental Assessment Association

and has been accredited by its Board of Directors and declared to be a

CEI

Certified Environmental Inspector

and is hereby granted this certificate
under the conditions prescribed in its by-laws.

THOMAS A. BAZAN
Environmental • Assessment
#7210
• Association •
Certified Environmental Inspector

signed and sealed this 23rd day of October, 1998

Joseph M. Lazzo

Certificate of Training

Thomas Bazan

Has completed the Heuresis Corporation training materials presented on the topic of Instrument Operator Training, Pb200i, with regards to the materials licensed by the Commonwealth of Massachusetts and the Nuclear Regulatory

Instrument Operator Training
Heuresis Corporation, Pb200i

I confirm that the above named individual has received the training listed on this certificate.

Raymond Lindee — 01/18/2016

Name — Date

Regional Representative for Heuresis

Title

I certify that I have received the stated training and understand the content presented. I understand that I can follow up this training with questions from Heuresis Corporation.

_____ — 01/18/2016

Name — Date

Certificate of Training

Thomas Bazan

Has completed the Viken Detection Corporation training materials presented on the topic of Instrument Operator Training, Pb200i, with regards to the materials licensed by the Commonwealth of Massachusetts and the Nuclear Regulatory Commission.

Instrument Operator Training
Viken Detection Corporation, Pb200i

I confirm that the above named individual has received the training listed on this certificate.

Deblyn Palella — April 1st 2020

Name — Date

XRF Sales, Rentals, Training and Consulting

Title

I certify that I have received the stated training and understand the content presented. I understand that I can follow up this training with questions from Viken Detection Corporation.

_____ — April 1, 2020

Name — Date

Mr. Cuong "Alex" Nguyen
April 22, 2020
HFD ARFF 92, 3804 Will Clayton Pkwy, Houston, TX

APPENDIX "D"
USEPA PCS FOR HEURESIS Pb200i XRF

Send all kits and requests to:

SUNTRAC Services, Inc.
1818 East Main Street
League City, TX 77573
(281) 338-2133

ATTN: SIT-KIT

CAUTION: Conduct a survey on the outside of each package placed in the U.S. Mails. Any reading over 0.5 mR/hr at contact with the envelope or package shall not be mailed.

LEAK TEST INVENTORY/REPORT FORM

Company Name: Thomas A. Bazan (14539)

Address: 14722 Wind Cave Lane City: Houston State: TX Zip Code: 77040

Isotope: Co 57 Activity: 5 mCi

Source Serial No: R6-358

Device Serial No: 1013

Manufacturer: Heuresis Model No.: Pb200i

Smear Taken By: T.A. Bazan Leak Test Date: 12/06/19

--- --- --- --- --- --- --- --- --- --- **DO NOT WRITE BELOW THIS LINE** --- --- --- --- --- --- --- --- --- ---

This is to certify that the above described smear/swab has been assayed at our facilities for indication of source leakage.

Our findings show the leakage to be:

ALPHA	BETA-GAMMA
-----	<.0001

µCi (Wet)

Certified By: Elizabeth Ethridge Date: 12/10/19

SUNTRAC Services, Inc. Representative
(Texas Radioactive License No. L03062)

869219

VSSA

Valley Safety Services Associates, Inc.

330 Old Enfield Road, Belchertown, MA 01007

http://www.vssa-inc.com

(413)323-9571

Leak Test Data/Certificate

Complete the data requested on the top part of this form and return it with your leak test to the address in the above heading. Following our analysis of your leak test specimen we will return this form to you for your record of the test and results.

Source/Device Description

Device: Source **Model:** Pb200i **Serial #:** 1013 **Manufacturer:** Heuresis Corp.

Radioisotope Co-57 **Activity (mCi)** 5 mCi

Source model: A3901-2 **Source # :** R6-358 **Manufacturer:** Eckert &Ziegler

The leak testing of this source/device was performed as indicated in manufacturer recommendations or LT-952 kit instructions using kit # 874597

By: Brian Couture Date: 6/14/19

Company: Heuresis Corporation Telephone: 617-467-5526

Address: 330 Nevada St. Fax: 617-467-5024

Newton, MA 02460

Do Not Write Below This Line

Leak Test Analysis Result

Analysis of the above test on 17 June 19 yielded the following;

☒ Statistical analysis of the radioactive count data of this leak test specimen indicated any activity present is less than 0.005 μCi. The source may be used as authorized.

☐ Statistical analysis of the radioactive count data of this leak test specimen indicated there is greater than 0.005 microcuries of activity present. This source should be considered leaking. Consult your device operations manual; place this unit in storage and make the required notification to your regulatory agency.

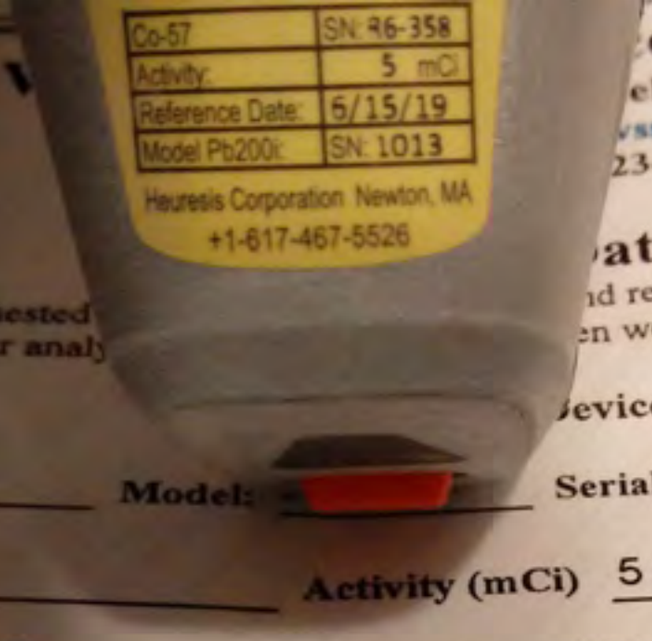
YOUR NEXT REQUIRED LEAK TEST FOR THIS DEVICE/SOURCE IS DUE ON OR BEFORE

17 June 20

The requirement for the Heuresis Pb200i is for leak testing not to exceed 12 months. Your state may have a 6 month requirement. Please ensure to check for the requirements of your state.

THIS CERTIFICATE IS AN ESSENTIAL RECORD AND SHOULD BE MAINTAINED FOR INSPECTION BY THE REGULATORY AGENCY.

CERTIFICATE #: 874597 **BY:** S. Tozier **DATE :** 17 June 19



es Associates, Inc.
elchertown, MA 01007
yssa-inc.com
23-9571

ata/Certificate

nd return it with your leak test to the address in the above
en we will return this form to you for your record of the test and

Complete the data requested
heading. Following our analy
results.

evice Description

Device: Source **Model:** [redacted] **Serial #:** 1013 **Manufacturer:** Heuresis Corp.

Radioisotope Co-57 **Activity (mCi)** 5 mCi

Source model: A3901-2 **Source # :** R6-358 **Manufacturer:** Eckert &Ziegler

The leak testing of this source/device was performed as indicated in manufacturer recommendations or LT-952 kit instructions using kit # 874597

By: Brian Couture **Date:** 6/14/19

Company: Heuresis Corporation **Telephone:** 617-467-5526

Address: 330 Nevada St. **Fax:** 617-467-5024

Newton, MA 02460

Do Not Write Below This Line

Performance Characteristic Sheet

EFFECTIVE DATE: **December 1, 2015**

MANUFACTURER AND MODEL:

Make: ***Heuresis***
Models: ***Model Pb200i***
Source: ***^{57}Co, 5 mCi (nominal – new source)***

FIELD OPERATION GUIDANCE

OPERATING PARAMETERS:

Action Level mode

XRF CALIBRATION CHECK LIMITS:

0.8 to 1.2 mg/cm^2 (inclusive)

SUBSTRATE CORRECTION:

Not applicable

INCONCLUSIVE RANGE OR THRESHOLD:

ACTION LEVEL MODE READING DESCRIPTION	SUBSTRATE	THRESHOLD (mg/cm^2)
Results not corrected for substrate bias on any substrate	Brick Concrete Drywall Metal Plaster Wood	1.0 1.0 1.0 1.0 1.0 1.0

BACKGROUND INFORMATION

EVALUATION DATA SOURCE AND DATE:

This sheet is supplemental information to be used in conjunction with Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown on this sheet are calculated using test results on building components in the HUD archive. Testing was conducted on 146 test samples in November 2015, with two separate instruments running software version 2.1-2 in Action Level test mode. The actual source strength of each instrument on the day of testing was approximately 2.0 mCi; source ages were approximately one year.

OPERATING PARAMETERS

Performance parameters shown in this sheet are applicable only when properly operating the instrument using the manufacturer's instructions and procedures described in Chapter 7 of the HUD Guidelines.

XRF CALIBRATION CHECK:

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm^2 in the NIST Standard Reference Material (SRM) used (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 film).

If the average (rounded to 1 decimal place) of three readings is outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instrument into control before XRF testing proceeds.

SUBSTRATE CORRECTION VALUE COMPUTATION:

Chapter 7 of the HUD Guidelines provides guidance on correcting XRF results for substrate bias. Supplemental guidance for using the paint film nearest 1.0 mg/cm^2 for substrate correction is provided:

XRF results are corrected for substrate bias by subtracting from each XRF result a correction value determined separately in each house for single-family housing or in each development for multifamily housing, for each substrate. The correction value is an average of XRF readings taken over the NIST SRM paint film nearest to 1.0 mg/cm^2 at test locations that have been scraped bare of their paint covering. Compute the correction values as follows:

> Using the same XRF instrument, take three readings on a bare substrate area covered with the NIST SRM paint film nearest 1 mg/cm^2. Repeat this procedure by taking three more readings on a second bare substrate area of the same substrate covered with the NIST SRM.
>
> Compute the correction value for each substrate type where XRF readings indicate substrate correction is needed by computing the average of all six readings as shown below.
>
> <u>For each substrate type</u> (the 1.02 mg/cm^2 NIST SRM is shown in this example; use the actual lead loading of the NIST SRM used for substrate correction):
>
> Correction value = (1st + 2nd + 3rd + 4th + 5th + 6th *Reading*)/6 - 1.02 mg/cm^2
>
> Repeat this procedure for each substrate requiring substrate correction in the house or housing development.

EVALUATING THE QUALITY OF XRF TESTING:

Randomly select ten testing combinations for retesting from each house or from two randomly selected units in multifamily housing.

Conduct XRF re-testing at the ten testing combinations selected for retesting.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below.

Compute the Retest Tolerance Limit by the following steps:

Determine XRF results for the original and retest XRF readings. Do not correct the original or retest results for substrate bias. In single-family and multi-family housing, a result is defined as a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.

Calculate the average of the original XRF result and the retest XRF result for each testing combination.

Square the average for each testing combination.

Add the ten squared averages together. Call this quantity C.

Multiply the number C by 0.0072. Call this quantity D.

Add the number 0.032 to D. Call this quantity E.

Take the square root of E. Call this quantity F.

Multiply F by 1.645. The result is the Retest Tolerance Limit.

Compute the average of all ten original XRF readings.

Compute the average of all ten re-test XRF readings.

Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

TESTING TIMES:

In the Action Level paint test mode, the instrument takes the longest time to complete readings close to the Federal standard of 1.0 mg/cm^2. The table below shows the mean and standard deviation of actual reading times by reading level for paint samples during the November 2015 archive testing. The tested instruments reported readings to one decimal place. No significant differences in reading times by substrate were observed. These times apply only to instruments with the same source strength as those tested (2.0 mCi). Instruments with stronger sources will have shorter reading times and those with weaker sources, longer reading times, than those in the table.

Mean and Standard Deviation of Reading Times in Action Level Mode by Reading Level		
Reading (mg/cm^2)	**Mean Reading Time (seconds)**	**Standard Deviation (seconds)**
< 0.7	3.48	0.47
0.7	7.29	1.92
0.8	13.95	1.78
0.9 – 1.2	15.25	0.66
1.3 – 1.4	6.08	2.50
≥ 1.5	3.32	0.05

CLASSIFICATION OF RESULTS:

XRF results are classified as **positive** if they are **greater than or equal** to the stated threshold for the instrument (1.0 mg/cm^2), and *negative* if they are *less than* the threshold.

DOCUMENTATION:

A report titled *Methodology for XRF Performance Characteristic Sheets* (EPA 747-R-95-008) provides an explanation of the statistical methodology used to construct the data in the sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. The report may be downloaded at http://www2.epa.gov/lead/methodology-xrf-performance-characteristic-sheets-epa-747-r-95-008-september-1997.

This XRF Performance Characteristic Sheet (PCS) was developed by QuanTech, Inc., under a contract with the XRF manufacturer.

A Nonparametric Method for Estimating the 5th and 95th Percentile Curves of Variable-Time XRF Readings Based on Monotone Regression

Prepared for the
HUD Office of Healthy Homes and Lead Hazard Control
by
QuanTech, Inc.

October 24, 2000

For some newer XRF instruments, readings are typically taken in a “variable-time” mode where the reading time depends on the lead level in the paint. As detailed in Appendix B of *Methodology for XRF Performance Characteristic Sheets* (EPA 747-R-95-008, September 1997), it is not appropriate to apply the parametric XRF measurement model to such readings.

Since the underlying distribution is unknown and suspected to be nonnormal, a nonparametric method, based on monotone regression, was developed to obtain estimates of the 5^{th} and 95^{th} percentile XRF readings, as functions of the true lead level. This method applies the assumption that the percentiles are increasing functions of the lead level. Monotone regression is the solution to a quadratic programming problem, and is obtained with the "pool adjacent violators" (PAV) algorithm. The solution takes the form of a step function, formed by percentiles of the data over subgroups in a way that the percentiles do not decrease. Although a monotone regression cannot be "smooth" in appearance, it will approximate the true response if the sample is large, and if the true response is itself a nondecreasing function. A full treatment of monotone regression can be found in *Statistical Inference Under Order Restrictions* (Barlow, Bartholomew, Bremner, and Brunk, Wiley 1972). The nonparametric 5th and 95th percentile curves are applied to determine the threshold/inconclusive range for the PCS for an instrument with variable-time readings. Because the method is nonparametric, there is typically insufficient data to develop thresholds/inconclusive ranges separately by substrate.

TDH
TEXAS DEPARTMENT OF HEALTH

Lead Measurement Standards

Texas Department of Health, Environmental Lead Branch **May 2002**

Lead-Based Paint

1.0 mg/cm^2 - X-ray Fluorescence **(XRF)**

0.5% by weight or 5,000 ppm (µg/g) - **(NLLAP Accredited Laboratory)**

Dust-Lead Hazard Levels (Accredited Laboratory)

≥ 40 µg/ft^2 - floors (carpeted & uncarpeted)

≥ 250 µg/ft^2 - interior window sills

Soil-Lead Hazard Levels (Accredited Laboratory)

≥ 400 ppm - play areas of bare soil & high contact areas for children

≥ 1,200 ppm - averaged in bare soil in rest of yard or non-play areas

Lead Dust Clearance Levels (Accredited Laboratory)

< 40 µg/ft^2 - floors (carpeted & uncarpeted)

< 250 µg/ft^2 - interior window sills

< 400 µg/ft^2 - window troughs (wells)

Water

15 ppb (µg/L), or 0.015 mg/L

Hazardous Waste

5 ppm - Toxicity Characteristic Leaching Procedure (TCLP)

Airborne Lead Particulate

30 µg/m^3 - OSHA action level (8 hour- Time Weighted Average)

50 µg/m^3 - OSHA Permissible Exposure Limit (8 hour-TWA)

Elevated Blood Lead Level

10 µg/dL - for children per Centers for Disease Control (CDC)

20 µg/dL- Environmental Intervention level for children (or 15-19 µg/dL in two consecutive samples taken several months apart - per CDC)

25 µg/dL- for adults per United States Public Health Service (USPHS) and CDC

ppb = µg/dL
ppm = mg/Kg = µg/g
ppm = mg/L
1 ppm = 1,000 ppb
1% by weight = 10,000 ppm

mg/cm^2 – milligrams per square centimeter
mg/L – milligrams per liter
mg/m^2 – milligrams per square meter
ppm – parts per million
ppb – parts per billion
% by weight – percent by weight
µg/dL – micrograms per deciliter
µg/ft^2 – micrograms per square foot
µg/g – micrograms per gram
µg/L – micrograms per liter
µg/m^3 – micrograms per cubic meter