EXHIBIT A-2
SCOPE OF SERVICES

HAS PROJECT NUMBER 646A

PROFESSIONAL ENGINEERING DESIGN SERVICES FOR TAXIWAYS RA, RB, SA, AND SB AT IAH

1. INTRODUCTION

1.1. The objective of this Project includes:

1.1.1. Reconstruct an approximate 4000lf section of existing Taxiway RA on the south side of the terminal complex from Taxiway SF to the JFK bridge. This will be a full depth reconstruction of the concrete section including lights, signage, drainage, striping and other components as identified during final design.

1.1.2. Rehabilitation of the identified distressed areas on Taxiway RB between Taxiway SF and the JFK bridge. Rehabilitation could include full panel replacements, partial panel replacements, spall repair, crack repairs, joint sealant or other as needed.

1.1.3. Reconstruction of the full length of Taxiway SA (approx. 10,000lf) from asphalt surface to concrete section and upgrade to current requirements including lights, signage, drainage, striping and other components as identified during final design.

1.1.4. Resurfacing of the full length of asphalt Taxiway SB, approx. 10,000lf

1.2. The anticipated value of construction cost is approximately $70,000,000.00 and the Professional Services budget is approximately $4,000,000.00, a portion of which may be funded with an FAA/AIP Grant. Project documentation and procedures should follow FAA standards and requirements as well as the HAS Design Manual and current standards.

1.3. The scope includes 2 distinct bid packages. Bid Schedule I will include RA, RB and SB and is anticipated to be bid in October 2019. Bid Schedule II will include SA and is anticipated to be bid in October 2020. All construction, incidental to this Project is planned to be accomplished through the award of a single contract for each bid schedule.

1.4. Engineer shall prepare a preliminary engineering study phase (Phase I) to determine to develop alternative solutions, layout, construct-ability, operational phasing and report on the results prior to final design(s). The studies will be documented by a written Preliminary Engineering Report (PER). It will include

results of investigations, the Engineer's assessments, recommended design solution, construction budget estimates corresponding to the various upgrade alternatives as well as schedules, exhibits, and illustrations. During the study phase, the Engineer will be required to hold periodic meetings with the project team to discuss progress, conditions encountered, and other matters bearing on the Project, as well as to obtain clarifications, decisions and coordination/support to further his work in an orderly manner. Upon completion of this phase (30% review submittal), the City will choose the upgrade alternative to be designed by the Engineer.

1.5. During the final design phase, (Phase II) formal review submittals will be required at approximately the 65%, 95% and 100% design progress levels. These submittals will include drawings, specifications and semi-detailed cost estimates corresponding to the level of design development. Final Engineering Report (FER) shall be submitted at the end of design phase, and a revision if necessary after construction is complete. Periodic meetings with the project team are normally held also during this phase and have been found useful in the past.

1.6. During the construction phase the Engineer will furnish "Phase III" services defined in the standard City of Houston A/E Consultant Contract documents. The services envisioned generally include periodic observation of the work, consulting with HAS concerning its quality, execution and changes needed, review of shop drawings, submittals, test reports review, issuing clarifications or change documentation, construction quality coordination, attending weekly progress meetings, participate in the design aspects of construction issues, and prepare final inspection punch-list.

2. SCOPE OF SERVICES

2.1. GENERAL

2.1.1. The work shall consist of geotechnical, subsurface utility engineering, environmental, other professional technical services defined during negotiations, topographic surveys, traffic load and design alternatives analysis, life cycle cost studies and recommendations. The development of cost effective design solutions and construction documents will be based on the decisions taken on the study phase report. Estimates of probable construction cost and schedule, as well as work phasing recommendations to minimize construction interference with airfield operations will also be required both during the study phase and the design phase.

2.1.2. Engineer is responsible to obtain plans review and agency approvals (include FAA 7460, FAA specification deviations/modifications, and others as needed) before the work is advertised for construction bids and to update construction and record documents to "As-Built" condition. Permitting will be with HAS Permitting office.

2.1.3. During Construction Phase Services, Engineer shall materially participate in document reviews and modifications, if needed, on RFIs and Change Order Requests.

2.2. WORK ELEMENT

2.2.1. Specifically, the services will consist of all actions needed incidental to the accomplishment of the design for the project consisting of the following major work elements:

2.2.1.1. Rehabilitate, Reconstruct, and Resurface various taxiways as defined in section 1.1 of this document.

2.2.1.2. Replacement and improvement of the existing runway pavement sections where the new taxiway ties in, if needed, without changing the runway's structural integrity.

2.2.1.3. All electrical work shall comply with the latest applicable revision of the NEC – National Electric Code, NFPA -70E, IEEE, the Illuminating Engineering Society of North America - IES, FAA 150 series of airport advisory circulars and the HAS Electrical Standards.

2.2.1.4. All electrical field work shall be coordinated and approved by HAS electrical superintendent.

2.2.1.5. All communication work shall be coordinated and approved by HAS IT Department and appropriate regulatory agencies. All communication work shall follow HAS standards and specifications. This includes but not limited to all communication duct bank, cabling and electronic equipment etc.

2.2.1.6. Submittals shall include the following, at a minimum:

2.2.1.6.1. Preliminary Engineering Report
2.2.1.6.2. 65%, 95%, and 100% bid documents
2.2.1.6.3. Technical specifications;
2.2.1.6.4. Catalog cuts; and
2.2.1.6.5. Construction details

2.2.1.7. Installation / Replacement of taxiways signage and edge lights. LED is recommended to be used for all taxiway edge lights.

2.2.1.8. Installation of light fixtures, cable, spacers, multi-hole adapter rings and transformers where applicable along taxiway.

2.2.1.9. All signs and panels shall comply with the latest FAA requirements.

2.2.1.10. Evaluate lighting circuits for loading capacity, quality of infrastructure, circuitry tie in compatibility, and make recommendations.

2.2.1.11. Review and make recommendation on the in-field drainage analysis for both construction and permanent conditions.

2.2.1.12. Review and make recommendations on constructability of all components given the restrictions of active airside operations. Include identification of sacrificial pavements, if any.

2.2.1.13. All structures within safety area of the taxiways or runways shall be aircraft rated.

2.2.1.14. Design of pavement markings (permanent and detour) per the latest FAA Advisory Circular.

3. TECHNICAL CONSIDERATIONS

3.1. In general, it is the City's desire that all work on this project reflects engineering excellence, economy and use proven, up-to-date technology meeting applicable

codes, engineering standards and be reasonably reflective of the established budget. It is understood the study phase investigations and analysis may develop information and/or solutions that could result in adjustment of the current budget to assure maximum cost-benefit from this Project.

3.1.1. Taxiway

3.1.1.1. Pavement designs alternatives shall be developed to meet the requirements of the latest FAA Advisory Circulars, specifically AC 150/5300-13A (Change-1) and AC 150/5320-6E and prudent engineering judgment of the physical condition of the various pavement areas, contributory cause of deterioration and current technical capabilities. The alternatives shall also respect the structural concept of the pavement in so far as feasible while meeting the needs of future traffic loads.

3.1.1.2. Anticipated airport traffic levels have been projected by an on-going Airport Master Plan update.

3.1.1.3. The Engineer shall draw its own conclusions from the data and perform a minimal amount of additional research study/updating of the information, especially regarding aircraft mix, to assure himself the sufficiency of the premises chosen to meet the needs of the project.

3.1.1.4. The Engineer will be required to perform surveys, testing and pavement evaluations of pavement areas to be upgraded/improved to determine the actual strength and conditions that may affect design decisions. Soil studies and survey will also be required to the extent necessary to support the evaluation and design efforts.

3.1.1.5. The Engineer shall prepare concrete pavement alternatives for the present and future improvements of the pavement for HAS's considerations, and shall make recommendations concerning the optimum solution and timing of any future structural reinforcement that may be needed to accommodate traffic growth. The alternatives will include initial and life

cycle cost projections. Pavement thickness calculations shall comply with the latest FAA Advisory Circular.

3.1.1.6. Pavement markings shall meet the latest FAA advisory circular requirements at the time of construction. Generally, they shall include centerline striping & lead in and hold lines. Waterborne traffic paint on asphalt and concrete surfaces; and two coats of paint should be applied to all markings. Engineer shall make recommendation on where, if at all, thermoplastics can be applied consistent with the FAA recommendations. Paint markings as a minimum shall meet the requirements of federal specifications TT-P1952D.

3.1.1.7. Sustainability is becoming increasingly important in preserving the longevity of the Taxiway pavement structures. The design team should address how sustainability is provided for in both the key components of the pavement design and construction as well as elements of the program of monitoring to be carried out by HAS MUST assess the need for pavement maintenance. Key components of the design would include pavement support, joints, and drainage components; aspect of construction would include crack control and quality of curing. The design team should outline the key aspects of the maintenance monitoring program (to include equipment and frequency of testing) that should be undertaken to preserve the condition of the pavement structure at a high enough level to avoid the need for full-depth patch repair or joint under–sealing over the design life of the pavement structure.

3.1.1.8. Prepare construction phasing plan including staging/haul routes, with consideration to operational needs, peak travel periods, blackout dates, scheduled runway closures and construction methods to maximize safety and efficiency.

3.1.1.9. Prepare comparison analysis for each proposed alternative design.

3.1.2. <u>Airfield Drainage</u>

3.1.2.1. Design re-grading as necessary to prevent storm water intrusion into electrical and communications duct systems through MH.

3.1.2.2. Re-grading along pavement edges and to improve area drainage may be necessary. Should re-grading affect manholes, markers, signage and drainage facilities, those shall be adjusted as appropriate to the new grades or new grading designed in a manner to minimize such adjustments.

3.1.2.3. All re-graded areas shall be top soiled and grassed. Solid sodding will be used along pavement edges, drainage channels and around storm inlets. A combination of strip sodding, hydro seeding and mulching shall be used in open areas.

3.1.2.4. Design temporary drainage facilities for use during construction phases as needed.

4. MISCELLANEOUS REQUIREMENTS/SPECIAL CONSIDERATIONS

4.1. The Engineer will endeavor to stay within the established budget and provide recommendations at various stages of progress of expected probable costs so that appropriate decisions/adjustments may be made by HAS. Statements of estimated construction cost (line item, unit cost, and quantities) will be submitted after the engineering study phase and with the 30%, 65% and 95% design progress submittals.

4.2. The Runways must continue in operation while this project is constructed. Cross taxiways shall be closed one at a time if re-construction is necessary. Other cross taxiways shall be kept in operation always. Selected firm shall prepare a phased construction schedule concept and operations plan as part of the preliminary (30%) design submittal for HAS approval, and incorporate the finalized phased construction schedule into the construction documents. Schedule and phasing of work elements shall be designed to minimize construction impact on airfield operations.

4.3. The Engineer will be required to produce/transcribe the design drawings onto a compact disk (CD) AUTOCAD (latest version) computer data disk and provide it as a "Deliverable" to HAS/Infrastructure in addition to the traditional "hard copy" plans and specifications.

4.4. Since the Project will participate in FAA/AIP funding, the Engineer should use the appropriate forms and formats in contract and design documentation for review and approval. Generally, this will require utilization of FAA specification formats, breakout of "eligible/non-eligible" line item costs; the preparation of the FAA mandated design report as well as compliance with the related procedures and coordination.

4.5. It is noted that some FAA cabling is in the project area. The Engineer will be required to coordinate with the FAA, IAH Sector office, to ascertain and show the general location and to make corresponding measures to assure that integrity is protected by appropriate details and notes on the construction documents.

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ESTIMATED PROJECT SCHEDULE
(Cumulative in Calendar Days per phase)

A. **Phase I - Preliminary Design**	90 calendar days after Notice-to-Proceed
B. Phase II – Final Design	
65% Design	90 calendar days after approved Phase I
95% Design	150 calendar days after approved Phase I
100% (Bid Set) Design	210 calendar days after approved Phase I
Bidding/Award Services	Anticipated 40 days after completion of 100% Design
Phase III – Construction Administration	Equal to total construction phasing plus 30 days