Project Management Professional Services – Runway 8-26 Reconstruction at Rafael Hernández Airport, Aguadilla, PR

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Abstract *— The Statement of Qualifications (SOQ) for project management services for the Rehabilitation of Runway 8-26 at Rafael Hernández Airport, Aguadilla, Puerto Rico is required to identified experienced firms capable of managing project development. This project consists of construction of Runway 8-26 to the south, converting existing one into taxiway. For the SOQ, a multidisciplinary team of seven professionals with experience on construction management of Portland Cement Concrete pavement runways, airport safety and project controls is identified. Furthermore, four potential risks that could affect project's success and possible solutions are described. First, karstic topography characterized by depressions could be mitigated filling voids with aggregate. The challenge of drainage system located within Runway Safety Area could be lessen relocating the runway. Establishing tailored strategies for airport operations affected could minimize the impact. Finally, obtaining variations to specifications using as guide recent airport projects in the Island could alleviate limited availability of material suppliers.*

Key Terms *— Airports, Project Management, Project Risk, Statement of Qualifications*

INTRODUCTION

The project consists of the design and construction of Runway 8-26 in the Aguadilla airport [1]. The purpose of this is to have a runway with a resistant pavement and in conditions to accommodate existing and future operations at the Aguadilla Airport. This new runway will be located parallel 500 ft south of the current runway. Its dimensions will be 11,000 ft long and 150 ft wide. It will be made up to Portland Cement Concrete Pavement. The current runway will be changed into a taxiway. In addition, the project contemplates temporary pavement repairs, demolition, stakeout lines, signage, marking, storm drainage, and erosion control, among others [1].

This study describes the development process for a Statement of Qualifications (SOQ) for project management professional services for the Rehabilitation of Runway 8-26. The study describes the methodology for the development of the SOQ and the case analysis where the project understanding, team organization, project management approach, and project control techniques are included for this specific project.

LITERATURE REVIEW

Airfield construction projects are complex in nature; thus, this literature review seeks to gather information on construction projects executed in airports within Puerto Rico and the United States, which provide similar scope, site and environmental conditions to the Runway 8-26 at the Rafael Hernandez Airport in Aguadilla, Puerto Rico. With the purpose to identify potential risks and challenges that may affect the runway construction that is located within a karst area the Rehabilitation of Main Runway and Taxiways at Monroe County Airport in Bloomington, Indiana was studied. This airport is also located at a karst area, formed by groundwater. Due to this condition, a hole of approximately six (6) feet wide with a depth of six (6) feet was formed. A geotechnical study was conducted, and the potential solution identified was to fill the eggs type of rock

Figure 1
Location map

designated as “clean 53”, since it can be compacted and in turn allows water to flow through while keeping underground areas safe. [2] The location of the drainage system within the Runway Safety Area (RSA) is a major concern for the project, therefore the project Runway 16C-34C rehabilitation at Seattle-Tacoma International Airport, Washington State was reviewed. This project included the reconstruction of the road and the replacement of the rainwater system located within the RSA. To successfully complete this reconstruction a variety of requirements for pipeline approval within this area were needed to be met. [3] For the PRPA it is essential to minimize the disruptions to the airport operations, hence the project Lambert Taxiway/Runway Rehabilitation at St. Louis Lambert International Airport Missouri was studied. During this project the biggest challenge was carrying out the construction while parts of the pavement were actively operating. To deal with this situation, the construction was divided into stages, that allow the passage of the aircraft on one side of the taxiway, while the other side was under construction. [4]

PROBLEM

The Puerto Rico Port Authority (PRPA) is requesting Project and Construction Management services to manage the design-build joint-venture contract for Runway 8-26 Reconstruction given the complexity of the project and the need to comply with the Federal Aviation Administration (FAA) Airport Improvement Program (AIP) to secure funding. The management firms interested on participating must prepare a Statement of Qualification (SOQ) to prove qualifications and experience on projects of similar scope, complexity, and budget. The SOQ should demonstrate project understanding and special concerns, define the team organization and expertise, define the project and construction management approach, provide project control strategies, and prove the ability to meet schedules. The objective of this project is to develop the SOQ in accordance with all the requirements.

METHODOLOGY

To be able to develop a Statement of Qualifications (SOQ) the first step is to study the Request for Qualifications (RFQ) issued by the PRPA to determine project requirements and special needs. Additional documents like the Geotechnical Study, the Environmental Assessment and Finding of No Significant Impact (FONSI) are studied to acquire knowledge of the project environment. If the management firm consider that

it is qualified to participate, then, a Request for Clarification (RFC) including all questions, comments, and concerns that the firm has after reviewing the available documentation for the project should be submitted via email to the owner with attention to the General Manager. This RFC has a specific timeframe to be submitted, if not met, the owner is not bound to answer late submissions. Within ten (10) days calendar PRPA will provide the answers to the RFC made by all the participant firms and a meeting is held to discuss their answers. The development of the SOQ starts with the extensive research of similar projects with the following characteristics: rehabilitation of the airport runway, construction within karstic zones, drainage systems within the Runway Safety Area, and maintenance of airport operations while it is being built. That were identified while studying the project documentation. This research will serve to foresee or determine potential risks and challenges the reconstruction of Runway 8-26 will face. To determine the team organization, it's qualifications and expertise require for this project the following FAA Standards are studied:

- AC 150/5100-14E: Architectural, Engineering, and Planning Consultant Services for Airport Grant Projects [5]
- AC 70/7460-1M: Obstruction Marking and Lighting [6]
- AC 150/5370-2G: Operational Safety on Airports During Construction [7]
- AC 150/5370-12B: Quality Management for Federally Funded Airport Construction Projects [8]
- AC 150/5340-1M: Standards for Airport Markings [9]
- 1000 – Construction Phase: Development Projects. [10]
- AC 150/5300-13B: Airport Design [11]
- AC 150/5320-6G: Airport Pavement Design and Evaluation [12]
- AC 150/5370-10H: Standard Specifications for Construction of Airports [13]
- AC 150/5320-5D: Airport Drainage Design [14]
- AC 150/5370-13A: Off-Peak Construction of Airport Pavement Using Hot-Mix Asphalt [15]

A project and construction management approach is developed based on the requirements set forth in these standards and the specific characteristics of the project. This approach describes the collaboration and communications, the safety, and the quality control project management strategies. Cost and schedule control management systems are also developed to ensure the efficient delivery of the project on time and within budget. Figure 2 presents a flow chart of the process for developing the SOQ.

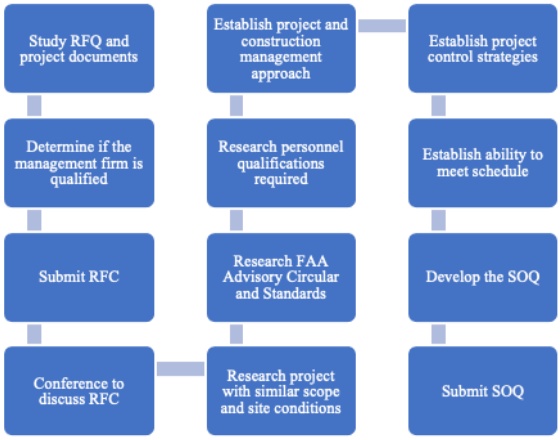

Figure 1
Process flow chart

SOQ CASE ANALYSIS

A Statement of Qualifications (SOQ) is developed to establish the ability of the management firm to fulfill the functions as agent of the owner while managing the design-build contract for the Runway 8-26 reconstruction. The SOQ is focused on the firm's understanding of the project, the unique abilities, and accomplishments of the team members that qualify them to successfully manage the project. In addition, it describes the firm's experience on similar projects, their project and construction management approach, their project controls strategies, and their ability to meet schedules. The SOQ consists of seven (7) sections detailed below.

Projects of Similar Scope and Complexity

In the investigative process on projects carried out in Puerto Rico and the United States that were similar or had situations like the Aguadilla project, three projects were found. The first, Monroe County Airport in Bloomington, Indiana. [2] His main problem was the appearance of a hole approximately 6 feet wide with a depth of 6 feet, a situation seen in previous years in the project. The airport is located within a karst zone, formed by groundwater. Therefore, a soil study was carried out to detect the size and the areas to be repaired. The solution, fill the eggs with a type of rock designated “clean 53”, as it can be compacted and in turn allows water to flow through and keeps underground areas safe. Sixty to seventy percent of material was excavated, down to bedrock, about 430,000 cubic feet were estimated. Once excavated, 4- to 5-foot layers of stone were placed, followed by a thin layer of fifty-three (53) Stone.

The second project used as a reference [3] is the Rebuilding the center runway and upgrade the storm water drainage system at 16C-34C Runway located at Seattle-Tacoma International Airport, Washington State. The project includes the reconstruction of the road that has exceeded its useful life by about 20 years (built in 1969) and the replacement of the rainwater system. The drainage system is located within the security areas of the runway, so they had a variety of requirements that needed to be met for pipeline approval within this area. Runway 16C/34C is one of the 3 oldest at the northwest's largest airport and is 9,426ft long. The airport is serving more than 42 million passengers. As a solution, in locating the drainage system, the contractor ensured that there is no stagnation within the runway safety area, zero pipeline failures, quick installation, meets all grant eligibility requirements of the FAA and that the pipeline is structurally sound for use within the safety area runway.

The third Project [4] is located at St. Louis Lambert International Airport (STL) and consists of the Reconstruction of Taxiway Kilo. The biggest challenge of the project was carrying out the construction while parts of the pavement were active. For this project it was essential that Taxiway Kilo could remain active for the different cargo airlines, including Amazon, FedEx and UPS. To deal with this situation, they used the project in stages, and in this way, the passage of the aircraft on one side of the taxiway was achieved, while the other side was completely rebuilt. For safety, aircraft tugs were used to ensure the safe passage of aircraft as they passed through the construction zone. Continuous barricades lining the work zone, along with temporary markings, edge lighting and pedestrians, helped keep the tugs on a safe course. Another challenge for the project was its completion in November, so that it would not impact the Christmas season. This project was required to be built in four phases, sequentially, with work hours limited to 8 hours during the day with no weekend work allowed, which affected concrete injection volumes. Thanks to successful coordination and communication, the project opened 18 days ahead of schedule. It is important to emphasize that has received the American Concrete Paving Association Excellence in Concrete Paving Award for taxiway and runway rehabilitation work at St. Louis Airport.

Project Understanding and Special Concerns

Based on the Environmental Assessment and the preliminary Soil Study, it was possible to identify possible situations within the project that could complicate the progress of the work. The analysis of the current conditions and the development of the work, part of the professionals who area part of the team that alternatives can be found to develop a viable project, within the budget and within the stipulated time. Therefore, out work team has identified the possible situations that may affect the progress of the project. Next, they are identified:

Risk 1: Soil

Based on the soil study provided for the qualification process, the area to be impacted has subsurface exploration. Originally, 15 SPT Borings

were contemplated, but due to their location, the boring no. 10 to boring no. 15 were not carried out, these are located within the Active Zone of runway 8-26 and on Taxiway M and Taxiway C, therefore, they only carried out 9 borings, this being the first anticipated problem, due to the lack of information. In addition, it is known through this soil study that the soil where the new runway will be built, located 500 feet south of the existing one, has a soil with prominent topography, characterized by having tropical depressions with occasional sinkholes, these being the characteristics of a karst topography. Construction in karstic topography is characterized by being difficult, expensive, and dangerous. This environment presents more challenges and risks compared to others. Within the geophysical investigation, twenty-one (21) areas with possible sinkholes were pre-selected. Part of those pre-selected areas are located within the proposed runway.

The construction of the new runway is located within a karstic area, which constitutes the greatest challenge in its development. Starting from a karstic environment, and together with the evaluation of a geotechnical engineer, a reconnaissance of the place and a preliminary evaluation of the site can be carried out, this evaluation may include an exploration of the traditional subsurface, taking into consideration, carrying out the pertinent steps to power will access the Active Zone of the airport. In this way, it will be possible to identify the existing conditions of the place, and facilitating the information for an adequate track design, avoiding building in risk areas. In these cases, the following tests may be considered [2]:

- Ground-penetrating radar (non-destructive testing)
- Falling weight deflectometer

In karstic areas, different alternatives must be considered for their stabilization. Starting from what the conservation laws of the karst regions indicate, such as: Organic Law of the DRNA. Law of extraction of the earth's crust. Law for the conservation, development, and use of water resources in Puerto Rico and the Law for the protection and conservation of caves, caverns, and sinkholes in Puerto Rico. Therefore, possible solutions for this situation may be [16]:

- Filling voids with aggregate or concrete
- Replacement of the runway base with fill material, based on the soil study.
- Base stabilization with geogrid
- Involve a geotechnical engineer, a structural engineer (track weight) and a civil engineer (drainage system): The geotechnical engineer on site can provide his evaluation and constant inspection of the activities carried out within the karst zone of the project, in this way the impact of karst areas and the performance of the track as it is built can be reduced.

Risk 2: Drainage System

The location of the pipe for the collection of rainwater is proposed within a Runway Safety Area (RSA), either the new runway or the existing one, since from center to center there is only a 500ft distance. This affects the development of the project because it does not comply with FAA standards, which indicate the following: “The RSA is a defined surface surrounding the runway, typically 500-feet wide and extending 1,000-feet beyond each runway end.” [17]

- Alternative to installing SaniTite HP pipe: This pipe is considered for its efficient installation, light, cost-effective and durable.

According to the FAA Runway Safety Area Program [18] the process to work in that area is as follows: In cases where the Runway Safety Area cannot be improved to meet FAA standards, documentation is required that addresses alternatives that were considered and which is the most feasible. The first alternative to consider in all cases, according to the FAA, is graded area surrounding the runway. In situations where this is not feasible, other alternatives are considered, which must be submitted with supporting documentation. In those cases, you can consider:

- Relocation, shifting, or realignment of the runway.
- Reduction in runway length where the existing runway length exceeds that which is required for the existing or projected design aircraft
- A combination of runway relocation, shifting, grading, realignment, or reduction and Declared distances.

Risk 3: Maintenance of Airports Operations

The coordination for the development of the project between the Design-Construction team, inspection, and Port Authority, is fundamental. The main objective of the project is to be able to maintain runway 8- 26 in function while it is being built. The maintenance of airport operations is identified as a risk due to the logistics, security and time involved during construction. This situation involves various branches of work and countless personnel. In addition, there is the possibility of not being able to operate with the runway construction. For this reason, mitigation strategies are proposed below [7]:

Minimize operational impact through pre-meetings with the FAA ATO will support operational simulations. Identification of areas and operations affected by the constructions helps to determine potential problems (Closing, or partial closings of Runways, Taxiways and Aprons, and Displaced Thresholds) Construction areas, storage areas, and access routes near runways, taxiways, and aprons. Establish of specific procedure is necessary to maintain the efficiency of airports operations such as: temporary change to runway, temporary change to air traffic control procedures, etc. Continuous communication with all parties

Risk 4: Construction Materials

The limitations of suppliers and construction materials in Puerto Rico may make it difficult to meet project design and specifications. Therefore, it can delay the project schedule and hinder the progress of the work.

- Use as a guide, recent airport projects in Puerto Rico, so that we can obtain the variations to the specifications (if any) of the materials.
- Implement a protocol to ensure uniformity of available materials

Team Organization

The multidisciplinary team organized for the project is comprised of seven (7) professionals with vast experience on aviation developments. A professional licensed engineer and project manager professional (PMP) certified with over twenty (20) years in the construction management field will lead the design, construction and close out of the project as a Senior Project/Construction Manager. A Safety Manager, who is a licensed professional engineer and Construction Health and Safety Technician, will be dedicated to supervising the overall operational safety to ensure proper implementation of the Construction Safety Phasing Planning [7] to minimize disruptions to airport operations. A licensed professional engineer, and certified project manager professional (PMP) will be occupying the Project Control Manager position. To guarantee successful completion of the project this engineer will be monitoring and controlling construction schedule and cost estimate development and will timely mitigate risks factors that could prevent the smoothly progress of the project. A licensed professional engineer with vast local, national, and international experience on airport site and utilities works will be working as the Project Engineer for Site Works and Utilities. The experienced engineer will perform methodological review and make suggestions to the relocation plans, and diagrams of airport's stormwater utilities and energy services. A Document Control Manager who poses a master's in business administration will facilitate the on-time project completion providing broad experience in document control procedures for complex projects and monitoring official documentation compliance with standards requirements. Two important positions are to be subcontracted from KWAME Building Group: Quality Assurance Manager and

Project Engineer for Portland Cement Concrete (PCC) Pavement, marking and navigational aids (NAVAIDS). The integration of KWAME Building Group professional engineers with deep knowledge on aviation infrastructure will elevate the team's performance reviewing and monitoring the design, construction and quality assurance of Portland Cement Concrete runway, navigational aids, and airfield lighting control systems. The organizational chart for the team is presented in Figure 1figure 3. It includes the names and certifications of the professionals occupying each position on this project.

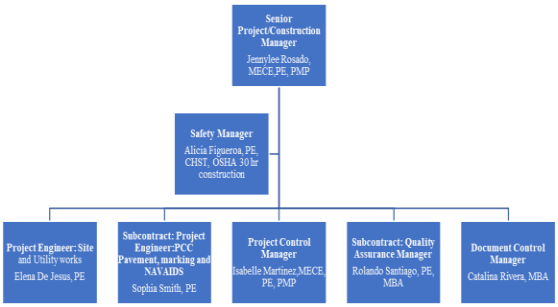

Figure 2
Team organizational chart

Project and Construction Management Approach

Every aviation project is unique and has its own remarkable challenges, hence the team will provide tailored project management strategies and tangible solutions that adhere to airport specific requirements. They will be foreseeing potential risks and difficulties to guarantee minimal impact on airport daily operations while efficiently delivering the project on time and within budget. The following elements are to be considered and implemented on the SOQ.

Collaboration and Communication

Early involvement of all stakeholders and the integrated project team to promote a collaborative environment and align the project objectives and quality expectations with the expectations of all the parties involved will be achieved by facilitating a predesign and preconstruction conferences at the beginning of the project. Project manager experts will develop a communication management plan to satisfy the specific project needs.

Safety

To ensure that methodical planification, scheduling and coordination take place the team will thoroughly review and approve the Construction Safety and Phasing Plan (CSPP), the Safety Plan Compliance Document, among others to ensure compliance with FAA AC 150/5370-2G [7].

Quality Control

Establish procedures to effectively monitor performance of prime contractor throughout all the phases of the project. During the pre-construction phase the Quality Assurance (QA) Manager is responsible of review the joint-venture Quality Management Plan to make recommendations. Will evaluate the materials suppliers' qualifications to ensure their ability to fulfill materials specifications as per FAA AC 150/5370-10 [13], including site visits to manufacturing plant. Will ensure the minimum testing frequency for quality assurance and quality control are established on project specifications. Review the Construction Management Program for paving to determine compliance with the FAA AC 150/5370-10 Section 100 [13]. During the construction phase an inspection plan and a quality control checklist will be generated to monitor the construction process to ensure it follows the codes, standards, and specifications. The Form 5370-1 [19], Construction Progress and Inspection Report will be maintained. During the close out phase will conduct the final inspection to check compliance with project scope, plans, standards, specifications, etc. Will prepare an accurate final report summarizing the quantity and quality of completed construction and certify compliance with the AIP requirements.

Project Controls: Cost Control

A cost management system to guarantee compliance with general requirements to properly secure the AIP funding will be implemented. The

Project Control Manager will review schedule of value to ensure no front-end loading is being applied, and to grant the approval. Payment will be based on monthly progress; the joint venture shall submit the Application and Certificate for Payment indicating the status of the contract sum to date. Project Control Manager will follow up to encourage the one-time submission of the request and will review to avoid unapproved changes to be added. Will review change orders and facilitate negotiation for the lowest reasonable price. Will be working hand in hand with the Project/Construction Manager, Quality Assurance Manager and the Project Engineers to ensure no defective work, the contractor is responsibly paying the subcontractors and suppliers, work was performed in accordance with plans and specifications, among others. All payment requests will only be certified for work properly completed. The Project Control Manager will ensure the joint venture received corresponding remuneration on time by monitoring prompt payment by the owner.

Project Controls: Schedule Control

Establish a plan for constant monitoring and updating of the project schedule to positively impact the performance and delivery of the prime contractor. Project Control Manager is responsible of foresee potential delays and make assertive suggestions to keep the construction on track by performing detailed revisions of runway reconstruction critical path schedules to identify and analyze all factors affecting time in addition to requiring weekly updates of 2-week-look-ahead report to make comparisons with past submissions. Ensure that project scope is accurately recorded in the drawings and specifications to reduce change orders. Fostering good communications and a collaborative environment to allow for early problem solving avoiding undesired effects on project schedule.

Ability to Meet Schedules

As part of construction management, the ability to meet schedules is based on several factors that help keep the project going, including review of plans, specifications, and project documents. Create and coordinate the project schedule, create contingency plans, communicate, and collaborate with all staff, and ultimately monitor and document the project process. An example of this was the accelerated design for the reconstruction of runway 8R-26L. This project minimized impacts on airport operations by completing the project in sixty (60) days and with underrun a of $6 million. [20]

CONCLUSION

In conclusion, the team of professionals selected as part of the project management company that is carrying out the Statement of Qualification, meets the professional and experience requirements to carry out the development of the project. These engineers identified the risks and challenges of the project, among them were: Complications due to the construction of the runway in a karstic zone, soil study with limited information, drainage system within the Runway Safety Area (RSA), maintenance of operations of the airport during construction and construction materials. For each of these challenges, design or build alternatives were presented that will reduce the impact of the project, so that it can be taken into consideration during the start of the work. Each of these challenges were from the perspective of construction management, so that the interests of the owner of the work, who is the Puerto Rico Ports Authority, can be safeguarded.

RECOMMENDATIONS

The construction projects that are carried out have differences in design or construction or logistics. For future projects where a Statement of Qualifications is worked on, it is recommended to collect as much information about the project objectives, and design and construction plans. In addition, it is recommended to have as part of the team specialized professionals within the engineering branch that develops the project, in

order to be able to identify possible risks and solutions to the project, so that the complications of the project in future stages can be minimized. For example, request more detailed geotechnical studies to be able to determine additional soil stabilization techniques. Also, to integrate professionals in the materials science and knowledgeable of products availability in the local market to identified all potential suppliers.

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