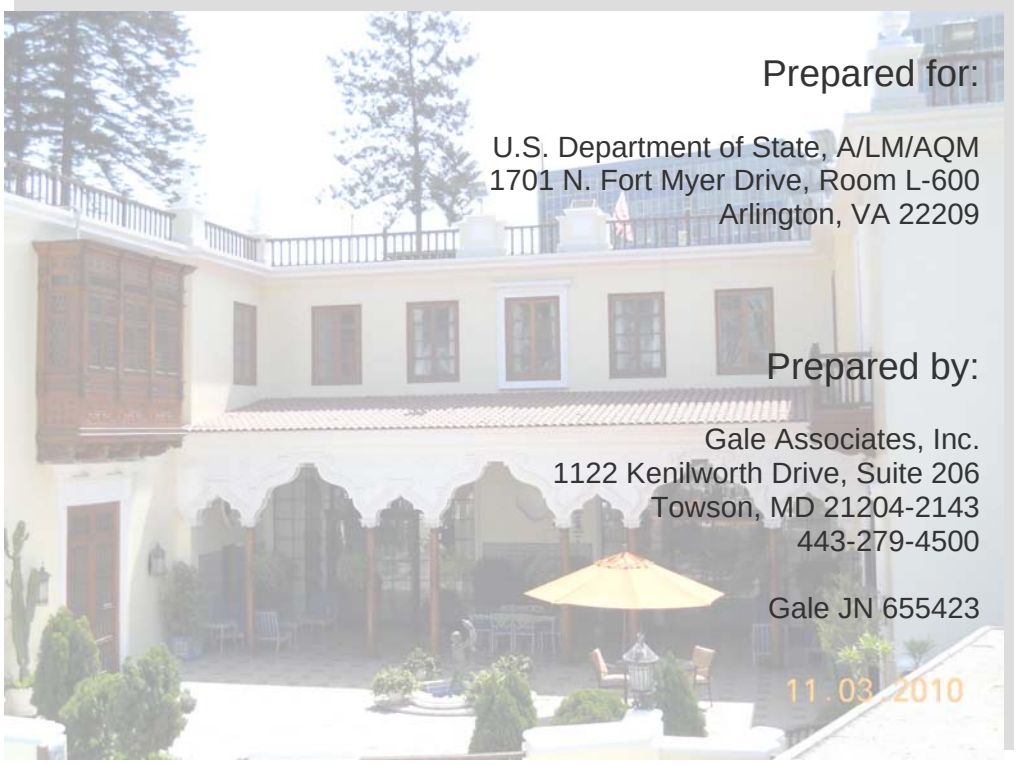
ROOF CONDITION ASSESSMENT

CHIEF OF MISSION RESIDENCE (CMR)

Lima, Peru

Final Submission

September 19, 2012



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** Cost Estimates are provided under a separate cover.

INTRODUCTION

In accordance with our statement of work dated January 12, 2010, Gale Associates, Inc. (GALE) personnel visited the Chief of Missions Residence (CMR) Lima, Peru during the week of November 8, 2010 to perform an onsite roof condition assessment of the facility and to develop construction documents for repair and replacement of the roof systems as required. Our roof assessment of the facility consisted of a visual inspection of the roof systems, to include all roof level related components.

The purpose of the assessment was to evaluate the existing roof systems, document existing construction conditions and determine the most appropriate means to permanently and cost effectively repair or replace the roof systems.

During our assessment, GALE measured and mapped the roof area(s), identifying roof penetrations and roof top equipment, and recorded existing conditions. Additionally, existing roof construction components and details were documented to include selective core sampling to determine the roof system configuration.

The following report will discuss the conditions noted by GALE and possible roof repair and/or replacement recommendations to include engineering cost estimates for the recommended actions. Annotated roof area plans and photographic documentation have been provided to assist in documenting the existing conditions.

BACKGROUND

The CMR was constructed in 1945, commissioned by the FBO, for its intended use. The facility, along with its out buildings, was constructed in a Spanish colonial revival style. The facility consists of a primary residence and what appears to be two attached additions plus an unattached cabana or pool house. The primary building or main residence is a 2-story structure, with ornate cast in place concrete fascia and an ornamental wood railing. The main residence roof area is approximately 938 square meters (10,100 square feet). The total roof area for the facility including the cabana is approximately 1,384 square meters (14,900 square feet). It is unsure if the roof systems on the facility are from original construction. Reportedly the roof system(s) consist of a liquid sealant tile over concealed roofing. Isolated leaks were reported, no specific active or problematic leak locations were identified.

OBSERVATIONS AND DISCUSSIONS

GALE conducted a visual inspection the roof systems throughout the compound to determine the condition of the in-place roof systems. The intent of our observations was to document the existing construction configuration to develop repair and/or

replacement construction documents. The following observations were noted during our assessment. Where appropriate and applicable, observations are followed by a brief discussion. The roof systems and general construction is consistent throughout the main residence and the attached one story additions with the exception of a small steep sloped clay tile shed roof and a roof over the veranda, see attached Roof Area Plan for locations. Subsequently, our observation and discussions will concentrate on the main residence unless otherwise indicated.

The roof system consists of a thin terracotta clay tile (9-inches by 9-inches by 1-1/2-inches) set in a 1-inch to 3-inch lightweight concrete setting bed over a cast in place concrete roof deck. Limited core sampling did not reveal any membrane or other waterproofing material directly on the concrete deck as was originally suspected.

Photo A

The exposed terracotta clay is in generally fair to good condition. Isolated areas where the tile is deteriorated or dimensionally unstable were noted. However these areas represent a small percentage of the overall roof area(s). Sections of clay tile have been removed at numerous locations to accommodate water lines and HVAC piping installed above the roof deck (see Appendix A – Photo 1). In some cases, sheet metal or other covers have been installed to prevent moisture infiltration. In other cases no means of waterproofing have been reinstalled at retrofitted areas (see Appendix A – Photo 2).

The ornamental roof level wood balustrade or wood railing throughout the perimeter is in generally good condition. Random probing of the railing revealed little to no rot.

Ornamental concrete piers throughout the roof perimeter appear in generally good condition. Piers are used to support the railing. Minor deterioration of the concrete piers was noted at rail penetrations (see Appendix A – Photo 11).

The perimeter of the roof has a precast concrete cornice or fascia that is flush with the tile roof system. The cornice appears in generally good condition. No noted defects were observed (see Appendix A – Photo 10).

Roof level conduit services roof level AC units exists throughout the roof area. Conduit is face fastened to the terracotta tile roof.

Glass block skylights exist on the north wing. Glass block is flush with the existing tile roof. Supplemental, translucent, nonpermanent enclosures have been provided to cover these glass block skylights (see Photo B). It should be noted that the glass block skylights are visible from the interior and provide very unique lighting to the interior space.

Photo B

The large wooden roof hatch is heavy and cumbersome. Large separate concrete door stops have been provided to catch the door when it is opened (see Appendix A – Photo 4). Based on our observations the roof access door is not watertight.

A small copper roof exists over the bump out in the master suite. This roof system is generally good condition (see Appendix A – Photo 12).

The terracotta clay tile roofs over the veranda and the shed roof are in generally good condition. It should be noted that these areas are not sensitive to moisture infiltration (see Appendix A – Photos 15 and 16).

The roof systems on the lower one story attached additions are in generally fair to good condition. The level of retrofit penetrations is far less than that on the main building roof (see Appendix A – Photos 13 and 14).

ENGINEERING ANALYSIS

Roof design criteria, as required and referenced by the current building code and general industry standards were reviewed by GALE during the preliminary design state of this roof replacement project. A summary of our replacement roof design analysis as it relates to the design criteria is provided below.

WIND UPLIFT

The latest editions of the International Building Code (IBC), the ASCE-7 Design Standards, and Factory Mutual Requirements were referenced to analyze the wind

uplift forces on this facility. Wind uplift analysis was performed using the latest edition of the ASCE-7. Wind data was not available in the referenced publications. However, research revealed that the record wind speed in Lima, Peru is 82 mph. GALE used 100 mph as a design wind speed to provide another factor of safety.

Calculations using the simplified design method for components and cladding indicates that the uplift pressures for Zones 1, 2, and 3 or the field, edge, and corners, are 18, 30.2, and 45.4, respectively.

Consequently, the replacement roof systems for this facility will be designed to meet FM 1-90 criteria.

All components of the replacement system will be designed to meet or exceed these standards.

Thermal Analysis (Roof)

The International Building Code (IBC), which refers to the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Standard 90.1, was referenced as a basis to analyze the Thermal Requirements for the facility. The current IBC requires a minimum R-Value of 38 for insulation within the attic spaced and an R-Value of 20 for insulation entirely above the roof deck in Lima, Peru. Give the flat profile of the roof and the lack of venting noted on the building exterior, it is unlikely that the interstitial space between the interior fixed ceiling and the roof deck has any significant insulation. It should be noted that GALE was unable to access the area to confirm the presence of insulation. If it is the intent of OBO to upgrade the thermal performance of the roof GALE recommends that the insulation be provided above roof level. This would minimize disruption to the buildings interior and also allow the roof level conduit and ducting to be insulated.

Drainage Analysis

Research of local rainfall data (see Appendix B) revealed that Lima will receive a maximum of approximately 1.5mm (.06-inches) of rain during the month of August.

Currently the roof slope on the CMR is minimal but directs water to the building's perimeter. Currently no roof drains or perimeter gutters exist. Given the historical nature of the facility, GALE does not anticipate adding roof drains or exterior gutters. Consequently, no drainage calculations were performed.

Asbestos Analysis

No suspect materials were observed that would be part of the roof replacement project.

STRUCTURAL REVIEW

Department of State has directed GALE to remove the existing slurry and terracotta tile roofing throughout the CMR roof areas and provide new lightweight cementitious fill. Providing slope within the material will require additional dead load to be applied to the existing concrete roof deck. Without as-built drawings or design data for the existing roof slab, GALE cannot verify the capacity of the existing deck.

Using a minimum thickness that matches the existing fill and providing approximately 1/8-inch per foot slope, calculations indicate that the new fill will increase the existing dead load on the existing roof deck by approximately 16%. This exceeds the Code allowable increase of 5%.

It is likely that the existing concrete deck can support the additional load but this cannot be verified without the existing design data or as-built drawings.

If the slope of the new fill is reduced to 1/16-inch per foot, the increase in dead load would be acceptable based on a fill density of 40 pcf. Actual fill density to be confirmed during the design process.

CONCLUSIONS

GALE presents the following conclusions regarding the assessment of the in-place roof systems on the CMR. Our conclusions are based on our exterior and interior observations and our limited core sampling.

The roof systems on the facility are in generally fair condition. No significant leaks were reported during our assessment. However, GALE did not observe a waterproofing membrane as was originally reported. This lack of formal waterproofing membrane coupled with the poor detailing surrounding the numerous retrofitted penetrations to accommodate water piping and miscellaneous conduit installed above the existing concrete roof deck indicated a need for significant repairs to ensure the roof system is watertight.

It appears as if the Department of State has made and attempt to insulate some of the retrofitted piping installed above deck level (see Appendix A – Photo 7).

This should be considered when recommending feasible repair solutions.

A new roof system can be provided in one of two ways: total removal and replacement of the existing roof system(s) or installing a retrofit roof system over the existing materials. When considering the most appropriate roof replacement system, considerations should be given to installing additional insulation above roof level. This will assist in insulating the roof level piping and provide additional thermal

insulation to the facility. However, Department of State has indicated that the new roof systems shall not be provided with additional thermal insulation.

Removal of the existing lightweight fill and terracotta paver system will create significant noise and debris as well as complicate coordination issues. Installation of new lightweight fill will be required to match the perimeter concrete cornice and provide slope to drain. This, however, will allow a traditional modified bitumen or similar roof system to be installed over the new fill. Installation of a new modified bitumen or liquid applied roof system could be installed directly atop the existing after incidental repairs are made.

It should be noted that regardless of the roof system, the existing railing system will provide flashing issues. The railings could be raised to accommodate new roofing materials. Raising the existing railings would provide an opportunity to position them at an elevated height that would meet current OSHA standards; however the ends of the railings would require significant modifications to allow attachment at the current locations on the piers. Alternatively, the piers could also be raised. However, each case would dramatically alter the overall roof line from the current configuration.

RECOMMENDATIONS

The following recommendations are provided for your consideration to address roof related issues noted during this assessment.

OPTION 1: REMOVAL

- Remove the existing terracotta clay tile roof and underlying fill down to the structural concrete roof deck. Remove piping on roof that is determined to be abandoned by the COR.
- Prime the concrete deck and install a torch applied modified bitumen membrane (vapor barrier).
- Provide new tapered lightweight fill to match the existing perimeter conditions with a slope of 1/16-inch per foot.
- Provide 2-ply torch applied modified bitumen roof system.
- Coat modified bitumen membrane with 2 coats of bright white elastomeric coating.
- GALE anticipates leaving the existing railings in place without augmentation.

- GALE anticipates leaving the steep sloped terracotta tile roofs on the veranda and the shed roof in place.
- The metal roof on the bump out in the master suite shall be removed and replaced with a new, locked and soldered, copper roof.

OPTION 2: RECOVER

- Provide a fluid applied or torch applied SBS membrane roof system over the existing roof system.
- GALE anticipated leaving the steep slope terracotta tile roofs on the veranda and the sheet roof in place.
- The metal roof on the bump out in the master suite shall be removed and replaced with a new, locked, and soldered, sheet metal roof. Liquid applied roofing can be substituted on the bump out.

TAB 1: APPENDIX A – PHOTOGRAPHIC DOCUMENTATION

PHOTOGRAPHIC DOCUMENTATION

Photo 1: Overall view of main roof area (Area A).

Photo 2: Overall view of main roof area (Area A).

PHOTOGRAPHIC DOCUMENTATION

Photo 3: Overall view of main roof area (Area A).

Photo 4: Roof access door. Note large concrete stops and deteriorated terra cotta tiles.

PHOTOGRAPHIC DOCUMENTATION

Photo 5: Piping shut off valves embedded in roofing.

Photo 6: Elevator penthouse.

PHOTOGRAPHIC DOCUMENTATION

Photo 7: Piping connections with temporary sheet metal enclosures. Note CWF enclosure over piping route.

Photo 8: Relatively informal termination at piping shut off valves.

PHOTOGRAPHIC DOCUMENTATION

Photo 9: Electrical junction box mounted to pier.

Photo 10: Roof level transition at electrical junction box. Note typical profile of cornice.

PHOTOGRAPHIC DOCUMENTATION

Photo 11: Close up of railing at pier.

Photo 12: Bump out with metal roof at master suite.

PHOTOGRAPHIC DOCUMENTATION

Photo 13: Overall view of Cabana and Roof Area B.

Photo 14: Overall View of Roof Areas C and D.

PHOTOGRAPHIC DOCUMENTATION

Photo 15: Veranda roof. Roof is in generally good condition.

Photo 16: Shed roof. Roof is in generally fair to good condition.

TAB 2: APPENDIX B – CLIMATE DATA

LIMA, PERU

Average Monthly Weather Patterns

	January	February	March	April	May	June	July	August	September	October	November	December
High Temperature (**F**)	79	80	79	76	72	68	66	66	66	69	72	76
Low Temperature (**F**)	67	68	67	64	62	60	59	59	59	60	62	65
Precipitation (**in**)	0.03	0.02	0.02	0.00	0.01	0.03	0.04	0.06	0.03	0.01	0.00	0.01

Source(s): Weather Underground

Source(s): Google Maps

Travel: No tourist visa required. A valid passport is required to enter and depart Peru. Tourists must also provide evidence of return or onward travel. Visit the Embassy of Peru Website for the most current visa information. Peru does not require any immunizations for entry, although it recommends vaccination against Yellow Fever.

Business visa required. Business travelers are issued three-month visas, which must be renewed quarterly at the Oficina de Migraciones. Passport must have a remaining validity of at least the length of the trip. Visa **form** must be filled out. Letter from your company indicating the motive and the time of your stay. One passport picture, copy of the flight ticket, money order payable to Consulado General del Peru for US $ 30.00. If this procedure is done by mail, you must send a FedEx pre-paid envelope with your name and complete address to return the documents.

Source(s): US Department of State and Peruvian Embassy

TAB 3: APPENDIX C – SPECIFICATIONS

TAB 4: APPENDIX D – ROOF REPLACEMENT DRAWINGS (REDUCED)