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SITE OBSERVATION REPORT #1

Rpt.Date October 19, 2019

Project No: 19-174

Date August 14, 2019, 3pm
&Time Cloudy, 65F
on site: &
August 21, 2019, 3:30pm
Part cloudy,

Attendees:

Bob Gallagher, Lighthouse
Keeper.
Scituate Historical Society:
David Ball, Pres.,
Steve Litchfield,
Bob Chessia

Anne Gilbert, Rivermoor
Engineering

By: Anne M Gilbert, PE, SECB

Site: Scituate Lighthouse, 100 Lighthouse Rd, Scituate, MA, 02066

Scope : At the request of the Light House Keeper and Historical Society of Scituate to review the structure of the lantern portion at the top of the Scituate Lighthouse for their structural concerns and to aid in determining a suitable method of repairs of the lantern which shows evidence of deterioration of some of the cast iron support members and wood roof framing members. This report is based on the referenced information and two site visits on 8/14/19 and 8/21/19.

Reference information: published articles related to former structural work or retrofits to the existing Scituate Lighthouse: Historic American Buildings Survey drawing sheet no.1, created in 1935; for written documents, see the reference list. There are no known drawings or records of the original lighthouse construction available.

General Comment: This report is limited to the portion of the structure identified in the scope of work above. Observations are based on exposed to view surfaces during the site visits. The effects of uncovered or concealed conditions are not addressed in this report. Rivermoor Engineering has completed the site review at the above referenced site and presents the following:

The Existing Scituate Lighthouse Lantern Structure Description and Observations:
See references and the site visit photos attached.

Scituate lighthouse was built between 1810-1811. It is approximately 52 feet high, with a granite stone base width of 17'-6", and top lantern interior diameter is approximately 7 ft with 11'-6"+/- outer diameter at the exterior utility catwalk perimeter. The lighthouse has had several refittings, repairs and overall renovations over the past 200 years with known structural revisions made in 1827, 1841, 1930, and 1991. Although the Patriot

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Ledger article¹¹ from 1991 doesn't contain structural information on the renovations made, it is apparent from the article's photograph that the wood roof framing and trimming were removed and reconstructed. The original primary structure, columns and plates are not visible in the photo, but were observed in the field to be wrought iron and likely from the 1841 construction.

The existing lantern structure consists of a wrought iron frame. Refer to Rivermoor sketches EX-1 and EX-2 attached. The wrought iron columns are built with vertical plate (½"thick x4.5") with presumably two short 3/8" bent plates-one each side. The column plates are connected with ½" bent plate elements with bolts to a continuous horizontal iron top ring plate (½"thick x4") that connects all 12 columns, generating a dodecagonal-shape layout. The iron ring supports the timber headers (5"x5.5") above it, by the same vertical thru bolt that connects the column to the ring plate. The timber beams support the wood roof rafters and wood plank roofing sheathing. Rafters consist of two stacked 2x lumber, with the top members cut in an arch shape that form the roof dome. Wood trim encloses the wrought iron plate columns, windows, wall and sills. Copper cladding covers the exterior of the lantern, covering wood roof plank sheathing, wood trim of the columns, sills, walls, and catwalk floor.

The existing lantern structure is supported on the existing perimeter brick bearing wall which is supported on a contiguous granite stone wall below that continues down to its base foundation. The interior floor of the lantern is a concrete slab that may have been installed in 1991. It supports the wood trim and wood walls/windows. It is likely that the original wrought iron columns are still supported and presumably buried in the existing brick bearing walls below as described in the article² dated 1841. This floor slab is above a plastered masonry dome which is supported on the exterior brick walls. The dome construction is discussed in the article² from 1841 as being built with brick². There is a ½" horizontal gap between the bottom of the concrete floor slab and the top of the dome. It's possible that the original soap stone floor still exists above the dome and slab may have been installed to span to the outer walls and as it shrunk during curing, it may have caused this gap. However, the soap stone pavers are not visually evident. Review of this condition will be needed after the existing lantern structure is removed.

Existing Conditions of the Lantern Structural Members:

See the site visit photos attached for reference and additional information.

Overall, there is significant deterioration of the structural members, ie wrought iron columns, wood roof framing members, and copper cladding of the lantern structure. These were addressed in the field and by email, which Rivermoor recommended immediate shoring and bracing of the existing structural framing of the lantern framing.

Wrought iron columns (photos 4 & 5): severe rusting and deterioration is evident for approximately 58% of all columns. The lower portion of these column bases have crumbled.

Wrought iron continuous ring plate (photos 6 & 7): severe rusting is visible on top of the ring plate for approximately 30% of its overall length; however the depth of rusting and deterioration is unknown. The plate does not appear to be crumbling.

Roof wood plank sheathing (photos 2, 6, 8, 9 & 11): localized portions of the wood planking is deteriorated/molded at the perimeter ends of the roof dome, however the extent of deterioration is not visible.

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Roof arched wood rafters (photos 2, 6, 8, 9, 10, 11, 12): lower portions of the roof rafters over the timber beams contain water stains, and evidence of dry rot was apparent in some rafters.

Timber header beams (photos 2, 6, 8, 9, & 11):

The existing timber beams that are supported on top of the rusted sections of the ring plate have water stains, fungus and likely have interior dry rot where beams are in contact with the rust.

Masonry dome construction (photos 16 & 17):

The existing brick masonry dome is below the lantern floor slab and needs to be reviewed prior or during initial demolition/construction to determine the effect the horizontal gap that is between the dome and the floor slab above and review the condition of the dome. The dome appears to have had previous repairs.

Floor slab (photos 15, 16, 18):

The existing lantern floor slab appears level and solid. There are also narrow cracks in the floor slab that project out from the corners of the scuttle opening, which may be just shrinkage cracks. However the horizontal crack below the slab needs to be reviewed in the field prior/during demolition in relation to the see masonry dome – see masonry dome info above).

Coppercladding (photos 20 to 29):

The existing copper cladding, including repairs and patching of the copper, are in deteriorated condition throughout the catwalk, columns, sills, base of windows and walls. The copper cladding on the roof is not visible; however there had been leaks such that water infiltration has caused damage to the wood framing as noted above.

The catwalk requires additional review after the copper is removed, the contractor shall notify the engineer.

Guardrails (photos 27, 28, & 29):

The existing guardrails are wrought iron and are pitted and rusted throughout. It is unknown how much solid iron exists under the paint.

Windows (photo 2, 3, 15, 18, 19, 20, & 21):

Existing windows do not meet current code and are in poor condition due to deteriorated support framing and water infiltration.

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Discussions/Recommendations:

As discussed in the field and correspondence, the existing lantern structure is significantly deteriorated, and requires immediate shoring and bracing to stabilize it.

As discussed in the field and in correspondence, a new lantern structural framing system is required.

Demolition and salvaging the members was discussed for reconstructing the lantern with same configuration and layout and using existing members as templates, the new lantern shall be rebuilt with the same dimensions and same or similar materials (wood and copper cladding, except with stainless steel or hot-dipped galvanized steel).

Due to the deterioration of the existing wrought iron frame and its embedment into the existing concrete slab and presumed embedment down into the existing brick walls adjacent to the brick dome, the existing column plates need to be removed carefully so as not to damage the remaining structure, ie the existing brick walls, corbel and brick dome structure. After the structure's removal, the rust in the openings/holes where wrought iron members or bolts were embedded, needs to be completely removed and inspected, prior sealing them with epoxy in order to avoid further rusting and expansion (so as to avoid future damage to the remaining brick/concrete structure and the brick dome).

Copper cladding is deteriorated particularly at the catwalk, window sills, columns, and base of walls. It was discussed that the copper cladding will be evaluated by a professional/contractor with experience in copper cladding, and copper will be removed and salvaged for/by the owner. New copper cladding will be designed and constructed by an experienced contractor in the use of copper cladding installation of similar projects and conditions.

Attachments:

- 1) Photographs of lantern structure from Rivermoor Engineering site visits on 8/14/2019 and 8/21/2019.
- 2) Rivermoor Engineering sketches of existing structural framing SK-EX-1. And SK-EX-2 based on site observations of exposed to view framing, site measurements, and observations.

References: from Scituate Lighthouse Keeper Robert Gallagher:

- 1) Copy of "Scituate Lighthouse Contract", two pages, June 6, 1827
- 2) Copy of "Contract with Winslow Lewis to Repair and refit Thatcher's Island – Scituate Lighthouses, in Feb 8, 1841
- 3) Drawing Survey of Lighthouse-Scituate Harbor, Plymouth County- Mass, Historic American Buildings Survey no. 2-22, Index code no. MASS, 12-Scituate, sheet no. 1 of 5 (no other sheets available), by US Department of the Interior, Office of National Parks, Buildings, and Reservations, Branch of Plans and Design, dated 1935.
- 4) The Patriot Ledger, article "Retrun to Glory", by Joe Lippincott, July 3, 1991, pg. 8.
- 5) The Associated Press, article "Historic Light House Resumes Operation", unknown date and author
- 6) Scituate Historical Society website, <http://scituatehistoricalsociety.org/light>
- 7) Scituate Lighthouse poster boards on Scituate Lighthouse property, 100 Lighthouse Rd, Scituate, MA

Other references:

- 8) <http://www.newenglandlighthouses.net/scituate-light-history.html>
- 9) <https://uslhs.org/resources/lighthouse-directories-organizations/national-archives>
- 10) The Patriot Ledger, newspaper article "Town's historic lighthouse will cast a beam once again", by Carol Gerwin, July 1, 1991, pg. 8.