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Consulting Conservator's Report (March 22, 2008)

Memorial Bridge Rehabilitation
Portsmouth-Kittery 13678: US1 over Piscataqua River

Description of the Memorial

General

The main memorial on the Portsmouth-Kittery Bridge (Plaque 1) consists of a rectangular inscription over the roadway at the New Hampshire entrance to the bridge. The inscription, in raised, gilded letters, reads: "Memorial to the sailors and soldiers of New Hampshire who participated in the World War, 1917-1919." The inscription is framed by a simple molding, with an additional molded horizontal element above, supported by two small shields. There are two identical small shields at the bottom edge of the inscription with a larger shield, with bundles of laurel leaves at either side. At either side of the inscription are roundels: one with a military eagle in relief and the other with the shield and motto of the State of New Hampshire. The roundels are ornamented with scrolls at four points and framed with moldings. The roundels sit in clusters of openwork oak and pine branches, decorated on the west with an anchor and on the east with a cannon, that wrap around to the sides at the vertical trusses forming the entrance to the bridge. Beneath the clusters of leaves, a decorative molded band extends across the span between the trusses, supported at either end with brackets decorated with oak clusters. There is a flat trim panel beneath the molded span masking the ironwork beneath. The entire memorial is surmounted at the uppermost truss above the assemblage by an eagle with outspread wings, clutching laurel leaves, arrows and a *fasces*.

Plaques 2 and 3 consist of identical rectangular bronze inscriptions in raised letters, framed with simple moldings, commemorating the construction of the bridge. On the Portsmouth side, the plaque is attached to the east truss and on the Kittery side on the west.

Plaque 4 is an iron plaque on a vertical column at the Portsmouth side of the lift, on the east side of the bridge. The inscription, in raised letters, commemorates the patents associated with the design of the bridge.

Plaque 5 is a bronze inscription in raised letters, commemorating the construction of the approach to the bridge, mounted horizontally in a block of granite in a small traffic island in the roadway on the Portsmouth side of the bridge.

Construction

The main memorial and other plaques were inspected on 11 March 2008; the overhead materials were accessed by man lift, kindly provided by NHDOT through Gene Popien and his team, and the remaining pieces accessed by foot. This cursory inspection did not answer every question pertaining to how the memorial was constructed. Based on that inspection, the following notes are provided on the construction and condition of the memorial.

Plaque 1

The bronze ornament spanning the entrance at the New Hampshire approach to the bridge is an assemblage of at least 47 precisely-fit elements (and probably more), held together and to the structural members of the bridge by mechanical fasteners. The eagle appears to have been cast in a single piece with the *fasces*; the eagle was cast open at the back but is now covered with a bronze plate, fastened by small screws around the perimeter. The eagle was reported to have been removed for repair and re-mounted six or seven years ago (Gene Popien, NHDOT, by verbal communication). The eagle is currently mounted on two or three steel brackets that extend into the box formed by the plate in back at the bottom; these appear to be fixed to the sides of the box with new flathead machine screws at the sides of the box, and with stainless steel hex-head screws visible at the back (square holes in the back plate are presumably from cutting out old fasteners in the remounting). There is also an external strut in steel angle, extending from the back of the eagle to the girder below; the strut is attached to the eagle with a single hex-head stainless screw.

The central inscription is a box-like structure, cast in two sections with a seam down the middle, and enclosed in back with a two plates of bronze or brass, attached with small screws around the perimeter. (NOTE: *Partial removal of the west main inscription back plate was performed in May 2008 by NHDOT (after the conservator's inspection) to examine the method of attachment. This inspection revealed that there are three 4 inch x 4 inch x 3/8 inch vertical angles that lie behind the large back plates and provide support for the overhead inscription plaque.*) It is unclear whether the moldings and sides of the inscription are separate pieces, but it is likely that they were cast as one with the inscription. The molding above the inscription was cast in two pieces, as was the rectangular box in the center above the molding, with flat head machine screws visible on the top of the box along the center seam. The molding is also enclosed in the back with plates held by small screws at the perimeter.

The small shields in front, at the top and bottom, were cast separately, as was the central shield and the clusters of leaves at either side. The shields mask three vertical iron supports running inside the main inscription. These are secured at the top with (nearly) horizontal braces in angled steel. The connections between the horizontal and vertical supports are visible in the space between the upper molding and the inscription in back. The bottom sections of the vertical supports are masked in back by small boxes in bronze sheet, fastened with small screws. The large sections of the inscription are almost certainly attached to the vertical supports, probably with machine screws or bolts, passing through cast-in lugs on the interior of the casting.

The roundels at either side appear to have been cast in one unit consisting of the sides, scrolls, and decoration in front. The open casts are enclosed in the back with round plates, fastened with small screws around the perimeter. It seems likely that there are vertical iron angle supports inside the roundels and that the roundels are fixed to these supports with machine screws through cast-in lugs. At the bottom in back the spaces between the elements below and the roundels are enclosed in truncated pyramidal boxes, held with small screws around the perimeter. There are light-weight brass or bronze bars connecting the outer perimeter of the roundels to the upper portion of the brackets in back; the bars are fastened with hex-head screws, presumably in bronze.

It is unclear whether the oak and pine ornaments at either side of the roundels were cast in one or two pieces, but the sections wrapping around the corners are a single cast along with the cannon and the anchor. It is also unclear how these elements are attached to the bridge or each other at the bottom, as visibility is masked by the covers on the surrounding ornaments; however, where the ornament is connected to the truss in back, the heads of hex-head bolts; are visible at the bottom of the leaves inside.

The long horizontal molding beneath the main inscription was cast in at least three pieces and perhaps more. Like the other elements above, it is enclosed in back with a cover consisting of three rectangular sheets, fastened around the perimeter with small screws. The brackets at either side of the molding were cast in two sections and are presumed to be fastened internally. The brackets are fixed to the trusses on the outside with large hex-head nuts, with the bolts visible on the underside of the truss.

The lower trim on the underside of the span is a complex structure consisting primarily of three rectangular cast bronze plates forming the south face and a series of smaller plates forming the west face. The plates on the east side are joined internally at cast-in flanges with iron bolts and the assembly suspended by "T" shaped hangers from the iron truss above. There are also iron straps running inside the assembly, presumably for attachment of the plates on the west side. Much of this assembly is obscured on the inside by accumulated debris.

A summary of each of these parts is, along with estimated weights of selected elements is provided in the table in **Attachment 1**.

Plaque 2

The inscription was cast in one piece. The plaque is attached to the truss with four hex-head machine screws, bolted in back.

Plaque 3

The inscription was cast in one piece. The plaque is attached to the truss with four hex-head machine screws, bolted in back.

Plaque 4

The inscription was cast in one piece. The plaque is attached to the column with four very large, modern hex-head machine screws.

Plaque 5

The inscription was cast in one piece. The plaque is attached to the stone with four hex-head machine screws.

Conditions

Plaque 1

With a few exceptions, the bronze elements of the Memorial Bridge are in good condition. The bronze exhibits typical green corrosion of bronzes in an outdoor environment, particularly on the uppermost surfaces. The green, primarily copper carbonates and sulfates but along with some chlorides, is a symptom of exposure to acid precipitation in conjunction to the somewhat salty precipitation of a marine environment. On outdoor bronzes where corrosion is severe, the metal is deeply pitted and etched; however, the surface of the bronze on the Memorial Bridge is evenly and light. In fact, much of the surface is well preserved with large areas of original reddish brown patination and gilding on the letters of the inscription still intact. There is also some darkening in well protected areas. These corrosion products are mostly copper sulfides, caused by sulfur in the atmosphere and are also typical of outdoor bronzes in the modern industrial environment.

While the surface of the bronze is in relatively good condition, at many points of contact with the bridge and with internal supports, the steel is severely rusting. This is dramatically illustrated at the point where the center support, at the top and in the back of the main inscription is attached and in the surface of the trusses beneath the brackets in the front. This is likely to be at least partially due to galvanic (bimetallic) corrosion.

The most problematic area in the assembly is the lower trim plates where the "v" shaped configuration in back has allowed deep accumulation of organic debris. Sufficient material has accumulated to support tree growth through the front of the memorial. In addition, moisture in the organic debris is likely responsible for severe corrosion of the steel support bands connecting the bronze elements of this assembly. The back plates, particularly on the east side, are buckled slightly, either from expanding rust, frost jacking, or both. Several of the "T" hangers that support the plates in front are broken and failing and the remaining hangers are clearly over-stressed. There is a gap between the front and back plates and this prompted NHDOT to install the cables around these elements that we see today. (These cables do not currently support the panels and were installed as a safety precaution, as related by Gene Popien). There are many traces of old, iron fasteners and holes in these plates, probably from the attachment of traffic signs and signals in the past.

The fasteners used to reinstall the eagle appear to be stainless steel and are in good condition. Many of the small screws holding the cover plates to the back of the inscription, roundels, and other features appear to have been replaced with stainless steel. There are a few missing screws. Other exposed bronze fasteners, such as the screws in horizontal surface of the box at the top of the inscription and the screws visible at the top of the ornaments at either side of the shield at the bottom of the inscription, are slightly corroded but appear to be in good condition.

Plaque 2

The plaque is slightly corroded overall, with typical light green corrosion products. The plaque is in otherwise good condition.

Plaque 3

The plaque is slightly corroded overall, with typical light green corrosion products. The plaque is in otherwise good condition.

Plaque 4

The plaque is covered with many layers of paint. The paint is cracked and there is slight rusting around the perimeter. The bolts holding the plaque in place appear to be of non-corrosive metal and are in good condition.

Plaque 5

The plaque is somewhat more corroded that the other bronzes, probably due to its horizontal orientation. The surface is slightly pitted. The screws holding the plaque in place are out of plane and may not be securing the plaque. Although drainage channels have been cut in the stone at the sides of the plaque, grass and soil stand higher than the perimeter of the stone making the channels ineffectual.

Digital images prepared during inspection are submitted with this report and are included in the CD ROM (**Attachment 4)**.

Description of the Project

General

It is understood that de-installation of the bronze elements from the bridge is necessary to facilitate repair, replacement of some steel, and repainting. De-installation of these elements will require close cooperation between several teams of specialists, including: a sculpture conservator, an art-handling and transportation firm, riggers and crane operators, with occasional input from a

structural engineer. During de-installation, the art-handling firm will be responsible for detaching the elements, safely lowering them from the bridge (working with a rigger and crane operator), and packing the pieces appropriately for transport. The conservation team will be responsible for documenting the de-installation, labeling the elements, collecting the fasteners and interfacing with the art handling team on appropriate handling and packing.

Treatment of the bronze elements will be undertaken by the conservation team and will occur off-site. Treatment will include cleaning, repair, repatination and application of protective coatings. Prior to re-installation, the input of a structural engineer will likely be needed to determine the extent and design of new supports, fasteners and attachments. Fabrication of the new supports will be undertaken by the general contractor.

As with de-installation, re-installation will be a complex operation, requiring close cooperation between team members, with the art-handling team working closely with the riggers, crane operator, and conservator.

Specifications

Draft specifications for the work on Plaques 1-5 are submitted with this report.

Budget

A budget sketch for de-installation, treatment and re-installation is submitted in **Attachment 2**. The $328,500 figure is considerably higher than the $30,000 estimate presented elsewhere, but considering the complexity of the project, it is not unrealistic. This estimate is something of a "worst case" scenario, where de-installation and re-installation go slowly and require a great deal of trouble shooting. The previously presented figure of $5,000 for Plaques 2-4 is realistic; this sketch includes all plaques in the de-installation and re-installation.

This sketch does not include the cost of the crane and operator as it seems likely that suitable equipment will be available as part of other work. Likewise, it may be that an on-hand rigging crew could be used for this part of the project. This sketch does not include the cost of transport/trucking, nor does it include a figure for rental of space or security after removal and during conservation treatment. This budget does not include the cost of participation by a structural engineer.

This project will almost certainly require staging under the span to provide a safe working platform during extraction of fasteners and lowering of many of the elements. Therefore, the de-installation and re-installation will need to be done after road closing and before re-opening. This program fits with both Construction Schedule Options. Conservation treatment should take from six to eight weeks and would likewise fit into either of these Options.

Qualifications of Team Members

Following are some recommendations for qualifying of the conservation and art handling teams:

Conservator:

- The successful bidder will include as head of the team a Professional Associate of the American Institute for Conservation of Artistic and Historic Works.
- The successful bidder will have at least ten years of experience in working with large scale outdoor bronzes.
- The successful bidder will have demonstrable experience in handling and relocating large-scale works of art.

- The successful bidding firm will be a well-established firm and will have been in business for at least five years.

The field of bidders for the conservation work could be further limited by requiring that the team include a Fellow of the American Institute for Conservation. A short list of potential local bidders is provided in **Attachment 3**. The list may be expanded through the American Institute for Conservation's referral service (http://aic.stanford.edu/public/select.html#two).

Art Handling Firms:

- The successful bidder will have at least ten years of demonstrable experience in handling and transporting large scale, complex works of art.
- The successful bidder will be a well-established firm and will have been in business for at least five years.
- The successful bidder will have demonstrable ability to work with rigging crews and crane operators.

Respectfully sumitted,

22 March 2008