Rehabilitation of the Willard Hirsch Panel Mold

Summary of the Rehabilitation of the Mold for the Willard Hirsch Bas-Relief Panels Commemorating the History of the South Carolina Army National Guard

by

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Introduction

The rehabilitation of the mold for the Willard Hirsch *bas relief* sculpture was developed as part of a larger mitigation plan established by the South Carolina Army National Guard (SCARNG) and the South Carolina Department of History and Archives (SCDHA) in response to the rehabilitation, closure, and deaccession of armories containing a Willard Hirsch panel. The scope of work included the production of a new platform for the mold, cleaning the surface of the mold, removal of previous repairs, and the design and preparation of mortar repairs to restore the original artistic work and return the mold to a usable condition. SCARNG contracted CIRCA AHP LLC (CIRCA) to provide these services between June 14, 2016 and September 30, 2016.

The production of a new platform included the design and construction of a custom, heavy-duty frame, the transfer of the mold from the existing substructure to the custom platform, and the installation of nailers around the perimeter of the platform to enable the attachment of removable forms. Once located on the custom platform, the mold was cleaned and previous repair materials were removed. All large mortar repairs were entirely removed, paint and other coatings were removed to the level of the original surface, and all loose and friable repairs in the pitted surface of the mold were removed. The final portion of the scope of work involved the design, testing, and application of appropriate mortar repair materials. More detailed specifications and images of the work performed have been included in the following rehabilitation summary.

Willard Hirsch Mold

In the early 1950s, the South Carolina Army National Guard (SCARNG) initiated the design and construction of a series of armory buildings throughout the state. The architect for each of these facilities was Heyward S. Singley, who was a colleague of the noted Charleston sculptor, Willard Hirsch. Although the design for the armory buildings varied, Singley incorporated a unifying design element in the facade of each of the buildings in the form of a *bas-relief* panel. In 1953, he commissioned Hirsch to sculpt a panel commemorating the history of SCARNG (Smith 2014). The original panel was completed in plaster and was used to cast a reusable mold. Since the location of the original panel is unknown, it is possible that the panel has been lost, intentionally destroyed, or simply destroyed in the production of the reusable mold (Moser 2016). The resulting mold, which is the focus of this project, was intended to be used by a cast-stone contractor to produce a panel for installation at each of the armory buildings using the same materials as the other cast-stone elements at each facility. The existing panels were installed at armory buildings constructed in the state between 1953 and 1972 (Smith 2014).

Decorative Motifs

The mold is a reverse or negative impression of the artistic work, which depicts a profile view of armed and uniformed soldiers from each of the conflicts that SCARNG has been involved in since its inception. These include the Indian Wars (1715-63), Revolutionary War (1775-83), War of 1812 (1812-15), Mexican War (1846-47), Civil War (1861-65), Spanish-American War (1898), Mexican Border Campaign (1910-19), World War I (1917-18), and World War II (1941-45) (Smith 2014). These soldiers are located in three rows along the lower portion of the panel. The center and upper portion of the panel contains an eagle with stylized, outstretched wings and a shield with a palmetto tree growing out of a felled tree trunk.

Construction

The mold appears to be constructed using the same technique as the existing panels. The two panels that have provided the most useful comparisons are the Beaufort and Lexington panels, which have been uninstalled due to the demolition of their associated armory buildings and enabled the inspection of side and back surfaces of the panels. The Beaufort panel is on display in front of the replacement Beaufort armory building, and the Lexington panel is currently located adjacent to the mold at the McCrady Training Center in Eastover. Unfortunately, this panel was heavily damaged during the demolition of the armory building, and its exposure to weathering in an exterior storage area prior to its acquisition by SCARNG.

The mold is 4’-0” in height and 7’-0” in width. The central portion is approximately 4” thick and has thickened sections along the entire length of the top and bottom edges of the mold. The thickened sections are 8” wide and 6” thick. The mold appears to have been produced using a similar technique to the panels. Original construction specifications indicated that the panels were to be constructed using the Mo-Sai technique (Moser 2016) established by John J. Earley in the early 20th century, which is named for the appearance of the exposed aggregate in the finished panel that approximates the appearance of a mosaic (Cellini 2008). The specifications called for a relatively thin layer of concrete containing specially selected and graded aggregate that would be intentionally exposed in the finishing process. The specialty concrete would be poured into the mold using a wet casting method, a wire reinforcing grid would be installed in the back of the specialty concrete layer, and then a layer of standard concrete would be poured to fill the remainder of the desired area of the panel (Kenney 2008). This process would have been completed at one time in order to ensure that the two layers of concrete bonded to form a structural sound panel. Observations of all four sides of the mold, as well as the Beaufort and Lexington panels, reveal two distinct layers of concrete and suggest that both the mold and the panels were constructed using the Mo-Sai technique.

In general, Mo-Sai panels were typically 20 to 100 square feet in surface area and only 2” thick. These large, thin panels were achieved through the use of a 4” x 4” x 3/8” diameter galvanized iron reinforcing grid and 7,500 psi concrete in both the specialty and standard concrete layers of the panel (Kenney 2008). The Hirsch mold and panels are 28 square feet in surface area and two to three times thicker than standard Mo-Sai panels. This could indicate a variation in the standard Mo-Sai specification or simply that the thickness was adjusted to facilitate the installation of the panels into the standard brick wall used in each of the armory buildings. Further testing, including analysis of the concrete and x-rays of the mold and panels, would confirm whether or not the Hirsch panel and molds conformed to the standard Mo-Sai technique as specified in the construction specifications for the panels.

Repairs and Alterations

There are no known records indicating the date or dates that previous repairs were made to the mold. This must be assessed through an analysis of the mold repairs and the design of each of the existing panels. In the absence of the original plaster panel, the original design can only be gleaned from an analysis of the earliest panels in the series. The portions of the mold with the most extensive damage and previous repairs were located along the bottom edge of the mold and the lower portions of each side of the mold. Damage along the bottom edge slightly altered the triggers and trigger guards of the rifles carried by the Spanish-American War and World War I soldiers. More significant damage occurred on the lower right corner and side of the mold (lower left corner and side of the panels) on the arm of the War of 1812 soldier and the end of the Spanish-American War solider's rifle.

Inman, 1961 (original rifle):

Chesterfield, 1962 (first repair):

Walterboro, 1969 (second repair):

The Spanish-American War soldier's rifle is the most significant repair on the mold, because it differs significantly from the original design and appears to have required two distinct periods of repair. In its original configuration, the components of the rifle muzzle were rectilinear and had a narrow band perpendicular to the barrel of the gun. After the first repair, the rifle was shortened, the barrel tapered slightly toward the muzzle end of the rifle, and the perpendicular band nearly doubled in thickness. Based on an analysis of this particular feature in the existing panels, it appears that the initial damage and repair occurred circa 1961 to 1962. All of the panels installed prior to 1962 have the original rifle design with the exception of the North Charleston panel, which is dated circa 1953. Due to the similarity of the design of this detail to a later configuration, further research should be conducted to determine whether this anomaly is due to an incorrect date for this facility, the replacement of this panel circa 1962 to 1965, or the repair of this element *in situ* circa 1962 to 1965, in the form of the mold at that point in time.

Inman, 1961 (original rifle):

Chesterfield, 1962 (first repair):

Walterboro, 1969 (second repair):

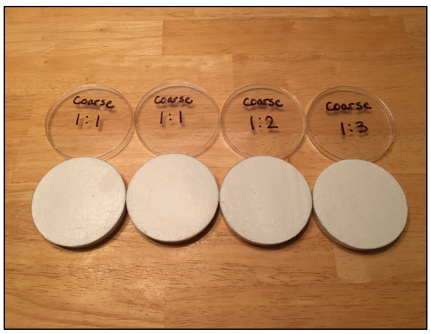
In contrast, all of the panels dated between 1962 and 1965 have the shortened rifle, slightly tapered barrel, and thickened perpendicular band with the exception of the Myrtle Beach panel, which dates to 1963. Given the design of this rifle, this panel was most likely cast at the same time as the earlier panels. It may have been stored for installation at a later date or the construction of this armory may have been extended or delayed, giving the facility a later completion date.

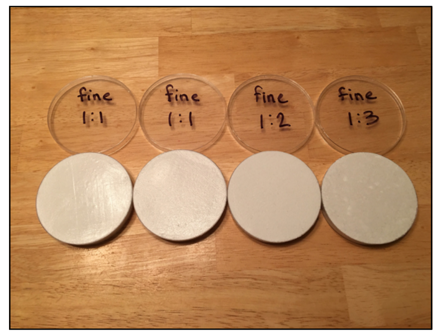
The second repair to the Spanish-American War soldier's rifle occurred circa 1965 to 1969. At this time, the barrel of the rifle was altered to have a much more significantly tapered end. The length of the rifle and the thickened band seem to be unchanged from the first repair. This condition exists on all panels dated between 1969 and 1972. Further research should be conducted to determine the condition of the Spanish American War soldier's rifle in the Lancaster panel, which is dated to 1968. If the rifle is only slightly tapered, the second repair probably occurred circa 1968 to 1969. If the rifle has a significantly tapered barrel, the second repair most likely occurred circa 1965 to 1968.

Finally, the Sumter Guards panel in North Charleston was the only undated panel at the time of this analysis. Based on the configuration of the Spanish-American War soldier's rifle, it appears that this panel was cast circa 1962 to 1965. Further adjustment of this date is possible following the completion of the recommended research into the configuration of the rifle in the Lancaster panel. If the Spanish-American War soldier's rifle is only slightly tapered, the possible date for the Sumter Guards panel would be expanded to circa 1962 to 1968.

Design Mix and Prepare Mock-ups

The design of an appropriate repair material and the production of mock-ups for testing and approval were a key component of this scope of work and involved consultation with both SCDHA and SCARNG staff. CIRCA initiated the process by consulting with SCDHA to design the mortar mix, prepared mock-ups for testing, and utilized three distinct repair mortars to reconstruct large patches of missing material, fill pitting across the entire surface of the mold, and fill hairline fractures.



Consult with South Carolina Department of History and Archives

The process began on July 19, 2016, when CIRCA consulted with Mr. John Sylvest at the SCDHA regarding the rehabilitation of the mold. Since the mold and the resulting panels are significant due primarily to their association with the artist, the intent of this project as defined by Dr. Jason Moser and SCARNG was to repair the surface of the mold and return it to a usable condition. This would facilitate the production of additional panels in the future for both display and interpretative purposes. Based on these factors, CIRCA proposed that the repair materials should be distinct in performance and appearance from the original materials. As such, SCDHA, SCARNG, and CIRCA concluded that it would be appropriate to move forward with a high-calcium lime putty, which is significantly lower in compressive strength than the estimated 7,500 psi Portland cement concrete used to manufacture Mo-Sai precast concrete panels and molds, which were specified in the construction documents for the panels and cast stone trim for these mid-twentieth century armory buildings. This material would also be relatively easy to reverse if it becomes necessary to return the panel to its pre-rehabilitation condition in the future. In addition, the repair material is visually discernible from the original mold material, which has a Munsell color description of 2.5Y 8/1 to 2.5Y 8/2 when clean and dry. The distinction between the original and repair materials also provides a public outreach opportunity to interpret both the artist's work and the mitigation process itself.

Prepare Mock-ups

CIRCA used a high-calcium lime putty that had been aged for 48 months, which is a quality suitable for fresco restoration and art conservation. In addition, the aggregate selected for use in the repair mortars is crushed marble. Being a calcium carbonate based material, it is chemically similar to the high-calcium lime putty and would also be soluble in a weak acid. This would enable both the binder and aggregate components of the repair mortar to be removed from the pitted surface of the mold, if necessary. This combination seemed to best meet the goals of reversibility and clear delineation between the repairs and the original materials. In order to assess the performance of these materials together, CIRCA produced six mock-ups. Three of the mock-ups utilized the aggregate as supplied by the manufacturer with particle sizes up to 1.25 mm. For the remaining three mock-ups, CIRCA sieved the aggregate using a standard No. 30 sieve to include only particles less than 0.6 mm. The coarse and fine aggregate types were both used to produced mock-ups in a 1:1, 1:2, and 1:3 ratio of binder to aggregate. All of the mock-ups were aged 28 days and assessed for shrinkage and other performance related issues prior to commencing work. The 1:2 and 1:3 mock-ups experienced less than 1% shrinkage, but the 1:3 ratio repair mortar was "dry" and less workable. As a result, a 1:2 ratio was selected for the mortar repairs. A neat mix, or a 1:0 ratio of binder to aggregate, was used to inject into the hairline cracks on the surface of the mold and in a light lime wash used to consolidate the surface of the mortar repairs and fill minute pitting on the surface.

Construct Platform and Removable Forms

The production of a new platform required the design and construction of a custom, heavy-duty frame, the transfer of the mold from the existing substructure to the custom platform, and the installation of nailers around the perimeter of the platform to enable the attachment of removable forms.

Design and Construct Heavy-Duty Metal Platform

The platform used 6” by 3/16” square steel tubing to form a rectangular welded frame to adequately support the estimated 1,200 lbs. weight of the mold. The square tubing was designed to be offset from the edge of the mold by 2” on each side, allowing for the installation of wood nailers and removable forms. 4” x 8” x 3/16” rectangular tubes were installed through the frame to form “fork pockets” that allow the mold to be moved with standard and oversized forklifts. The square and rectangular tubes were used in the design because these shapes make the frame torsionally rigid. CIRCA intended for the mold to be resistant to twisting or bending even if an uneven load was place on the platform. If one corner of the frame is lifted, the platform will remain rigid and will not allow the mold to bend or twist. This design protects both the original and repair materials from damage due to improper handling.

Move the Mold

In order to move the mold, CIRCA used blocking to slowly lift the mold off of the temporary wood pallets and allow the placement of steel beams under the mold. These beams extended beyond the length of the mold and provided lifting points to suspend the mold without coming in contact with the mold itself. CIRCA then used a hydraulic hoist to lift the steel beams with the mold resting on top and reposition the mold on the new platform. When in an elevated position, CIRCA measured the location of existing pockets on the underside of the mold and drilled and tapped corresponding holes in the top surface of the platform. They installed a shear bolt in each hole that extends 3/4” into the existing pockets on the underside of the mold. CIRCA then mixed structural grout, which was packed into the pockets on the underside of the mold, and lowered the mold onto the platform, so that the grout would seal around each of the shear bolts. This was done to position the mold on the platform and prevent lateral movement of the mold without permanently altering the mold. Please note that this will only prevent lateral movement when in a horizontal position. This design does not provide an attachment suitable for standing the mold vertically. **The mold cannot safely be tilted more than 45 degrees.** CIRCA also placed 1/8” by 2” diameter pucks of structural grout every 10-12” between the mold and the platform to ensure that the mold is uniformly supported.

Install Wood Nailers to Support Removable Forms

1 1/2” x 5 1/2” wood nailers were installed and shimmed to be flush with the outside edge of the mold and allow for the attachment of removable form boards in the future. The nailers on the length of the platform were attached using nine #12 x 2-3/4” self-tapping screws. The nailers on the width of the platform were fastened to the adjacent nailers.

Clean Mold and Remove Previous Repairs

Once securely located on the heavy-duty platform, CIRCA cleaned the mold and removed previous repairs. Several tools and methods were used to complete these tasks. It is important to note that no power tools were used to chisel, abrade, or grind the surface of the mold. Although it increased the amount of time spent on site, it was the safest and least invasive method to prepare the surface for the subsequent mortar repairs.



Clean Mold

The mold was brushed and vacuumed to remove dust, loose particles and debris. The brush was a soft, angled paint brush and was effective at removing surface debris; however, the brush was unable to remove dust and debris from the pitting that covered the surface of the mold prior to rehabilitation. For this task, a cordless, handheld vacuum was used to carefully clean the surface of the mold. CIRCA paid close attention while performing this task to ensure that the hose did not make contact with the mold and potentially scratch or otherwise mark the surface.

Remove Mortar Repairs

CIRCA used a variety of masonry chisels to remove the previous mortar repairs, including 1/4”, 3/8”, and 1/2” hand chisels; a 1/8” swept cape chisel with a striking cap; a rubber mallet, a finish nail hammer, and a round hand hammer. The best tool varied depending on the size, location, and previous repair material. While all of the previous mortar repairs were a consistent, white material with no discernible aggregate, some of the repairs were underlain by an application of an amber-colored adhesive. While this description could suggest that these repairs were broken and reattached, this does not appear to be the case. In fact, some of the shallowest repairs were treated in this manner, and it is highly unlikely that the relatively thin repair material would have broken free in a single piece. The pattern of use actually suggests that the adhesive was intended to create a stronger bond to the original materials. If this is the case, it was not successful. Previous mortar repairs attached using this method were fairly easy to remove, often breaking free in one piece. Previous mortar repairs completed without an adhesive were generally firmly attached, even when highly fractured due to shrinkage.

Paint and Coatings

A limited set of tools were used to remove paint and other surface coatings, including 1/4”, 3/8”, and 1/2” hand chisels, as well as a set of metal picks. These tools were generally used with a finish nail hammer or a round hand hammer. The hand chisels were used to remove the coating to the level of the original surface of the mold. The metal picks were used to remove paint and other coatings from pitting on the surface of the mold.

Surface Pitting

The pitting on the surface was previously repaired using the same consistent, white material used to complete the larger mortar repairs. Metal picks were the only tools used to treat failing repairs of this type. They were used to test the bond between the repair and the pitted surface. When a loose or friable repair was identified, the material was broken into smaller pieces, using only hand pressure and vacuumed out of the pitted surface using a cordless, handheld vacuum. If the repair was intact and firmly adhered to the adjacent material, it was left in place. The process of removing intact repairs of this size and type risked compromising adjacent original materials.

Repair Mold

Based on the performance and appearance of the mock-ups, repair mortars were selected for use in large mortar repairs, the filling of surface pitting and fractures, and as a lime wash used to smooth the texture of certain repair mortars to achieve the desired appearance. All materials were mixed fresh every few hours and stored in an airtight container to prevent early carbonation.

Mortar Repairs

Based on the performance and appearance of the mock-ups, a 1:2 ratio of binder to coarse marble aggregate was used for the mortar repairs. The repair mortar was pressed onto the surface of the mold using a white plastic putty knife to prevent any discoloration or scratching of the surface of the mold. It was hand molded on curved surfaces and shaped with a white plastic putty knife on flat surfaces. The texture of these repairs were intended to be slightly coarser than the original materials, which helps differentiate mortar repairs on the surface of the mold from adjacent original materials. This is particularly important on smaller repairs, including the reconstruction of facial features and the well-defined edge of uniforms and weaponry.

Surface Pitting

Based on the performance and appearance of the mock-ups, a 1:2 ratio of binder to fine marble aggregate was used to fill pitting on the surface of the mold. The repair mortar was pressed onto the surface of the mold using a white plastic putty knife to prevent any discoloration or scratching of the surface of the mold. A flexible plastic scraper was then used to remove excess repair mortar. The surface was then brushed and finished to fill minute pitting and expose as much of the original aggregate material as possible. This method ensured that the profile of the original mold and design were maintained to the greatest extent possible.

Fractures

A neat mix, or a 1:0 ratio of binder to aggregate, was used to inject into the hairline cracks on the surface of the mold. It was also used to prepare a light lime wash that was applied with an artist’s brush to consolidate the surface of the mortar repairs and fill minute pitting on the surface too small to accommodate the 1:2 binder to fine aggregate repair mortar used to fill larger surface pitting.

Recommendations

CIRCA would recommend fully investigating the options available for the reproduction of the mold and the casting of additional panels. This project has achieved the objective of restoring the original design of the artwork and returning the mold to a usable condition. While the use of the original mold to cast a reproduction panel is now possible, the restored surface provides other possibilities as well. Advancements in 3D laser scanning may offer a cost-effective option to document the restored surface of the mold and facilitate the reproduction of a new mold and panel, which would fully preserve the original mold.

In order to use the original mold to cast a new panel, the mold would need to be transported to a cast stone manufacturing facility. The manufacturer would also need to apply an oil-based mold release to the surface of the mold prior to use. This would darken the surface and possibly obscure the repairs, which are currently differentiated by their lighter color and slightly coarser texture. Each of these issues present a philosophical dilemma by risking the condition of the original materials and potentially obscuring the distinction between the original and repair materials.

Advancements in 3D laser scanning and printing could provide a more philosophically sound and cost-effective method to reproduce the original design. The current project has restored the design of the artwork by reconstructing the missing portions of the mold and filling the surface pitting that previously prevented the completion of a usable 3D laser scan. If SCARNG is able to produce a viable 3D scan of the mold, a replacement mold and reproduction panel could be commissioned without transporting the original mold or applying any products to the surface that may have an adverse effect on the appearance or condition of the original materials. In this scenario, SCARNG would be able to cast a new panel, obtain a reusable wood mold, and maintain the highest preservation standards for this significant resource.

Using either method, the current project has successfully restored the original design of the artwork and rehabilitated the mold making it possible to produce a reproduction panel. CIRCA would recommend fully investigating the financial and philosophical costs associated with each of these approaches before proceeding with the next phase of this project.

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Appendix

This section includes three images of the mold for the Willard Hirsch panels showing the mold prior to rehabilitation, following cleaning and the removal of previous repairs, and upon completion of the current scope of work.

A1: Composite Image of the Mold Prior to Rehabilitation

A2: Image of the Mold Following Cleaning and the Removal of Previous Repairs

A3: Image of the Mold Upon Completion of the Current Scope of Work