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Project Team

Owner’s Representative
University of Iowa Facilities Management
Design & Construction

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General Information

Building Name
Common Name: Old Capitol
Third Capitol of the Territory of Iowa & First Capitol of the State of Iowa

Owner
The Board of Regents for the State of Iowa

Location
Located at the center of the Pentacrest on the University of Iowa
Bounded by Washington, Madison, Jefferson and Clinton Streets

Description
Building Cornerstone July 4, 1840

Code Review
2015 International Building Code as adopted by Iowa Administrative Rule 661-201 and 661-301
2015 International Fire Code as adopted by Iowa Administrative Rule 661-201
2015 International Residential Code as adopted by Iowa Administrative Rule 661-301
2012 International Energy Conservation Code as adopted by Iowa Administrative Rule 661-303
2015 International Existing Building Code as adopted by Iowa Administrative Rule 661-301 and 661-350
2010 Americans with Disabilities Act as adopted by Iowa Administrative Rule 661-302

Nomination
Old Capitol
Listed on the National Register of Historic Places on May 31, 1972
National registration Information System Number: 72000475
National Historic Landmark

Period of Significance
Old Capitol’s historic features include architectural elements dating to its original construction (circa 1840) and to the occupation of the building by the University of Iowa, especially the alterations completed by the University between 1921 and 1924. Both periods contribute to the building’s significance.
Executive Summary

Built between 1840 and 1842, the Old Capitol is the University of Iowa's logo and remains one of the most recognizable images and landmarks in the state of Iowa. Together, Old Capitol Museum and the Museum of Natural History (next door in Macbride Hall) form the University of Iowa Pentacrest Museums. Old Capitol Museum has been in operation since 1976, when the building reopened after a major renovation. It is the only National Historic Landmark in Iowa City. Throughout its long history, the building has served as a seat of the territorial and state governments, a university building serving numerous schools and colleges, administrative offices, and finally a museum.

In the 181 years since the cornerstone was laid, the building has undergone multiple additions and renovations, as well as survived a major fire in 2001. It was protected from complete loss when the Old Capitol tower, cupola and dome caught fire on November 20, 2001 because a fire separation barrier was installed during a structural rehabilitation project in the 1920s. While the interior spaces had damage from the water above used to extinguish the fire, this National Historic Landmark remained standing.

The dome is constructed of wood ribs with a wood deck that is covered by lead coated copper, primer, size (the product used to adhere the gold leaf to the primer), and gold leaf. Gold leaf sheets are very thin; it takes 250,000 sheets of leaf to equal one inch of thickness. The existing gold leaf on the dome was installed post fire in February 2003 in a hanger at the Iowa City airport. The 12,000-pound dome was transported back the building, lifted by a crane, and placed back on the building.

The goal of this study was to document the extent and cause of the gilding failure, evaluate options for repair or restorations, and make recommendations for restoration of the gold dome. The University of Iowa provided valuable assistance to locate existing documents for review while also providing review comments and discussions to complete this study. Field investigations for sampling of the observations, discussions with Pentacrest Museum and FM staff, and review of documents related to gilding installation were the basis of researching the gilding failure.

Summary of Findings

The failure of the gilding appeared to be on the surface of the existing lead coated copper. Observations show a smooth lead where the gold leaf was no longer in place. The gold leaf, size, and primer have peeled at the lead coated copper surface. Test locations taken at the storm damage or bird damage.

Options discussed with the University of Iowa Stakeholders

In discussions with University representatives, two complete restoration options were considered. A third option to apply spot repairs only to areas of current failure was discussed but not considered as part of the study. After reviewing the conditions on site, it was determined that spot repairs would not resolve the underlying causes of failure. The resulting appearance of the dome would also be inconsistent between areas of original gilding and repaired gilding.

Option 1: Re-gilding the dome by removal of the current leaf

Removing the existing gold leaf and lead coating down to existing copper would provide a completely new gilded dome. This would be completed using both scaffolding and industrial rope access. This is a similar method to that used to re-gild the Iowa State Capitol in Des Moines in 1999. After removal of the current gold leaf, the sheet metal would receive a primer and two topcoats tinted to yellow base then the size and new gold leaf would be installed.

The existing copper material should last over 150 years. Gilding should be scheduled for replacement every 30 to 35 years depending on the storm damage or bird damage.

Option 2: Replacement of sheet metal with pre-finished gold color.

This option would remove the existing metal roof of the dome and replace with a pre-finished gold colored sheet metal. The existing copper is not historical material as this is replacement after the fire in 2001. The life span of a pre-finished sheet metal product is less than the 30 to 35 year lifespan of the gilding.

Historical Review

The State Historic Preservation Office (SHPO) will need to be part of the design review process for this project. The SHPO review process, can be a simple discussion to keep SHPO informed of future projects. Based on the expected requirements of the Secretary of the Interior’s Standards for the Treatment of Historic Properties, we believe that Option 1 is also the most historically sensitive option.

Recommendation

After consideration of these options, our recommendation is: Option 1: Re-gilding the dome. This is the option that aligns with the budget and schedule for the project. Option 2 exceeds the project budget for sheet metal replacement and current supply chain issues may make it infeasible to procure material within the project schedule.
University of Iowa — Old Capitol Dome Survey

September 9, 2021

East
Upper Dome

South
Upper Dome

East
Lower Dome

South
Lower Dome
Exterior Observations

Gliding samples were collected and numbered and taken using basic painter’s tape (samples were not taken by use of ASTM D3359 cross hatch tape method). Our goal was to observe the location where the leaf to sheet metal separation occurred.

The diagram below shows the locations where samples were taken. All samples, 1 to 5A, at the transition from gold to lead show the existing exposed lead coated copper smooth in appearance with areas having a white corrosion on the surface of the lead. The top surface of the dome has the most peeling loss-area, but the peeling is not limited to this area alone. Most samples had the separation of the gold leaf, size and clear primer at the lead coated copper. Two samples had solder on the back of the sample where primer held on to the soldered joint material. The typical end of life cycle for a gilded dome would be the wearing the gold leaf off the surface, not the separation failure between the base metal to the primer. Typical gilding failure would result in a surface where the gold leaf has worn through, leaving the primer visible in areas of high wear. This would be a surface with areas that still have gilding and areas of loss showing primer. Based on these observations, the separation for this dome is occurring above the lead coated copper to the clear primer. This type of failure exposes the lead to the air, causing this surface to oxidize followed by expansion leading to more loss of gilding. Based on these observations, in order to achieve a uniform, satisfactory gilded finish, it is necessary to, at a minimum, remove the existing gilding system down to the base metal.

The numbers above represent the location of the samples taken, for example number 1 location on the plan is Sample 1. Descriptions and photos are to the right of the partial floor taken on site.

SAMPLE 1
Dome surface separation of the gold leaf, size and clear primer at the lead coated copper

SAMPLE 2
Dome surface separation of the gold leaf, size and clear primer at the lead coated copper.
Sample Photos

**SAMPLE 3**
At the vertical flashing separation of the gold leaf, size and clear primer at the lead coated copper.

**SAMPLE 4**
Dome surface separation of the gold leaf, size and clear primer at the lead coated copper.

**SAMPLE 5**
Soldered joint for the dome surface separation of the gold leaf, size and clear primer at the solder on the lead coated copper. Solder material came off with the gold leaf, size, and clear primer.

**SAMPLE 5A**
Next joint over from Sample 5 - soldered joint for the dome surface separation of the gold leaf, size and clear primer at the solder on the lead coated copper. Solder material came off with the gold leaf, size, and clear primer.
Option 1: Re-gilding the dome by removal of the current leaf.

The existing removal of the gold, preparation of the existing sheet metal surface, new primer, new tinted topcoats, size and new gold would be conducted using industrial rope from the center dome access. Protection of the access ropes and protection of the installed gold leaf will need to be managed for the successful installation. This is the same method was used when the Iowa State Capitol in Des Moines was regilded in 1999. After removal of the current gold leaf, the sheet metal would receive a primer and two topcoats tinted to yellow base then the size and new gold leaf would be installed.

The existing copper material should last more than 150 years. Gilding should be scheduled for replacement about every 30 to 35 years depending on storm damage or bird damage.

Our assessment included a review of the dome structure for locations and scheme to connect industrial rope access rigging, for contractor access to the exterior dome. The heavy timber column structure that supports the top level below the spring point of the dome will allow a tie-off connection back to the structure. Edge protection for the ropes out of the sheet metal dome and floor level will be required. Care is needed to protect the dome surface during the existing gilding removal, primer removal process, new primers and new gilding. Before installing the primer and top coats a design team review will be needed to determine condition of the soldered joints and if any repairs are required.

The gap between the heavy timber columns and the skin will allow connections back to the structure of the building. The point of connection will need a point load of 5,000 lbs per employee attached (22.2kN) [OSHA 1926.502] to secure the ropes. It is likely that two columns would be used to connect the ropes used by individuals on the dome back to the floor level under the dome.

Access for construction materials would be through the top of the dome or on the exterior of the building using scaffolding. Demolished gilding and blasting materials would be transported outside of the building via the scaffolding.

Earlier test samples (July 2012: Conrad Schmitt Studios - Old Iowa State Capitol Dome Gilding Tests) completed by Conrad Schmitt Studios from New Berlin, Wisconsin of gilding and primer were seen on the south side of the hatch. More research is needed with the diagram on-site and product list to determine the relationship to the dome and test samples. Based on the recommendation to regild the dome, additional discussions will be had with Conrad Schmitt Studios during design to assess the test samples and develop gilding specifications.

Weather, both wind and temperature, is a consideration for installing the primer, topcoats, size and gilding for the dome as this is an exterior construction project. Products will need to be monitored for installation temperatures above 45° and below 95° Fahrenheit. Cure times are variable with temperature and can vary with each manufacturer’s products. Data loggers will need to be used on site during the construction period to record these temperatures. Daily field reports will be compared to determine time for installed products. This project is intended to be constructed over the summer of 2022. Weather in the spring in Iowa will be a factor for safe working conditions and installation of products. Under ideal weather conditions, the gilding installation should last a few weeks, however the schedule will allow for weather-related delays.

The lead under the existing gold leaf will be removed as part of the gilding removal process. Scaffolding may be required for removal of the gold leaf due to the need to use equipment which will not fit through the scuttle and to assist in transporting the removed gilding materials from the site. Any scaffolding installation will be scheduled to occur after Spring 2022 commencement.
Option 2: Replacement of sheet metal with pre-finished gold color.

This option would remove the existing metal roof of the dome and replace with a pre-finished gold colored sheet metal. The replacement of sheet metal on the dome and the sheet metal at the top of the cupola transition would be completed by use of scaffolding supported on the main roof of the building. Industrial rope access could still be used in connection with the scaffolding, but only for access to the top surfaces of the dome. The amount of work on the dome requires a scaffolding platform for the existing sheet metal removal and installation of the new sheet metal. Access for construction materials would be through scaffolding stairs or construction crane to unload the construction materials. The loss of the existing copper sheet metal for a painted product is not a substantial approach as new pre-finished sheet metal would be required for the next life cycle replacement. The existing copper sheet has at least 120 years remaining lifespan. The Iowa State Capitol copper sheet metal is over 135 years old now and will continue covering the dome for at least another 150 years. This is due to the large ribs on the dome and the ability of the sheet metal to expand and contract.

A potential issue created by replacing the dome sheet metal with a pre-finished product is the physical connection between the new aluminum and existing copper that will cause galvanic corrosion between these two metals. Copper is more noble than the aluminum but the water flowing off the metal should be considered between the dome to the lead coated copper roof of the building. In order to solve the dissimilar metal requirement additional sheet metal lower than the dome for the tower would need replacement, so that no direct contact is taking place between the two dissimilar metals.

If the metal substrate were to be replaced, multiple options could be considered for the replacement material. Below are three options that were explored and the primary concern associated with each option:

- **Anodized aluminum**: the finish will vary in color from panel to panel during the aging process and the finish will wear not consistent for each panel. If repairs are needed to anodized aluminum, it will be difficult to do an exact color match.
- **Pre-finished steel or aluminum**: may have life span of 40 to 70 years but the finish on the metal will show signs of wear in less than half of this time. Non copper sheet metal will need sealant rather than soldered joints to keep out the water. Sealant joint replacement is typically needed at 10 year intervals and will not allow the expansion of the paint over the sealant.
- **High performance paint applied to new copper sheet metal**: will not have the same shine as gold leaf while the 20-year lifespan is still less than the gold leaf.

Material lead times would be a serious concern if the option to replace the metal were pursued. With the goal to restore the dome during the summer of 2022, current material lead times may in fact be prohibitive. The supply chain for the new sheet metal has been very slow to construction sites. We estimate eight months in the schedule, but the manufacturer has not been able to guarantee the actual shipping date of the product. Manufacturers have told the construction industry that they are behind due to worker shortages and problems in shipping due to lack of trucks. The best advice would be not to use or require long lead time products if possible.
Below is a proposed timeline aligning with durations outlined in the RFP. We anticipate project kick-off after our final report in October, followed by a documentation period of 5 months. OPN anticipates construction to commence April 2022 and conclude in the spring or summer. This schedule may be adjusted in concert with the full team.
### Statement of Probable Costs - Preliminary

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<th>Item</th>
<th>Quantity</th>
<th>Cost Per</th>
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<th>Option 2</th>
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Conclusion

Based on the review comments and discussions with University representatives, option one re-gilding of the Old Capitol dome was selected to move into the next phase of documentation. The goal of this project is to have the contractor under contract in February 2022, start construction in the spring 2022 after the weather allows access to the dome for completion within summer 2022.