Section 5: Site & Building Assessment

Preamble

As part of the **Level I / Level II Study** for the Wyoming State Capitol, members of the **HDR/PDP/Plan1 Design Team** performed a comprehensive visual assessment of the exterior and interior of the Capitol Building and Site. Multiple site visits were made by the Design Team from March, 2013 through October, 2013 to conduct an intensive assessment of the building interior and exterior, including the existing building systems. With the assistance of members of the **State of Wyoming Department of Administration and Information Division of Construction Management** [**AICM**] and the Capitol facilities team, up-close visual access to the building was conducted using 125' and 80' high portable lifts and ladders. In addition, visual assessment of the Dome exterior and interior was performed using industrial rope access techniques. Interior assessments and building surveys were also conducted during this period.

Organization of Findings

Volume I Section 5 : Site & Building Assessment is divided into a series of discussions pertaining to individual building elements or systems, beginning with the Capitol site and then organized starting from the top of the building and proceeding down to ground level [following gravity]. From there, the discussion moves to the building interior and discusses the present architectural, life safety, and building systems issues. The various building elements are presented in the following order:

- **5.1 Site:** This section describes the Historic Evolution of the Capitol Grounds, the physical and visual impact of the Herschler Building and Plaza on the historic Capitol Site, and the existing condition of the Capitol Site itself.
- **5.2 Dome:** This section focuses on the condition of the Dome's exterior and interior. It evaluates the findings of the Vertical Access Report to provide an overview of the patterns of deterioration observed and the condition of recent repair interventions completed since the Dome was last repaired in 2011.
- **5.3 Roofing:** This section discusses the existing condition of the Capitol roof, including the standing seam metal roofs and the low-slope EPDM roof system, as well as the historic skylight locations.
- **5.4 Parapets:** This section discusses the existing deterioration observed at the formed metal entablature, cornice, pedimets and parapet walls.
- **5.5 Exterior Masonry:** This section reviews the existing condition of the exterior masonry envelope, the patterns of deterioration, and the long-term concerns with the observed conditions.
- **5.6 Windows and Doors**

  Sections 5.3 through 5.6 each include:

  1. A description of the field observations of the existing conditions and findings, as well as the deterioration mechanisms observed and any evident relationships between them;
  2. Conclusions based on the field observations, information contained within the Design Team's consultant reports and all relevant historical data in an attempt to best set a course for the restoration of the building envelope.
- **5.7 Building Interior**

  5.7.1 Introduction

  5.7.2 Architectural Description: This section provides a detailed description of the existing interior architectural features.

  5.7.3 Architectural Finishes: This section describes the historic evolution of the building's interior finishes based on archival documentation and description and analysis of the "as-found" conditions.

  5.7.4 Architectural Lighting: This section provides a comprehensive assessment of the existing interior architectural lighting, including descriptions of the existing light fixtures, identification of potentially historic luminaires, and a brief discussion regarding the current interior lighting conditions.

  5.7.5 Life and Fire Safety: This section provides a summary of the detailed evaluation of the Capitol Building's existing life safety and fire protection systems. It includes identification of areas of noncompliance, and whether a prescriptive or performance-based analysis is the most appropriate measure to document the behavior of the building during an event [e.g. a fire]. This section identifies additional life safety measures required to meet the life safety goals of the project.

  5.7.6 Building Systems: This section provides a description and analysis of the existing building systems and their distribution networks. In addition, the existing building systems are reviewed with respect to their age, performance, and their ability to meet the needs of a modern Capitol Building.

Volume I of the **Level I / Level II Study** is intended to provide the client with a synthesis of the detailed information and technical reports found in *Volumes II and III*. This section provides a description of the "as-found" conditions of the building. As part of the analysis of the existing conditions, the Design Team carefully organized archival documentation and compared it against the "as-found" conditions in order to:

A. Understand the evolution of the building and its associated components and systems. This not only charts the various interventions and alterations made during the building's useful life, but it has and will continue to provide direction for both Non-Destructive Evaluation and Destructive Examinations of the existing building fabric. This is a critical tool in fully comprehending the present state of the building, as it assists the design team in correlating observed conditions with specific modifications [e.g. construction campaigns] to the building. For instance, plaster cracking observed in the House Chamber corresponds with selective infill of the original Phase II [1890] east end wall, as part of the Phase III [1917] construction.

B. Provide context to the observed conditions. For example, review of documents related to the exterior masonry repairs program conducted in 1994 provided valuable information regarding the locations of specific conditions, and the repairs and treatments associated with each. By cross-referencing the "as-found" exterior masonry conditions against previous repair campaigns, the Design Team has a more complete timeline and understanding of patterns of distress and the success or failure of previous interventions.

Figure 5.1.1: South Elevation of the Capitol Building [Phase I], ca. 1888.

Figure 5.1.2: Photograph of the West Elevation of the Capitol Building and Site During the Phase II Construction, ca. 1889.

Figure 5.1.3: South Elevation of the Capitol Building [Phase II], ca. 1896. Note the wrought iron fence that lines the Capitol Site and frames the approach to the South Entry Stair.

Figure 5.1.4: Capitol Building [Phase II] From the Southeast, ca. 1902. Note the wrought iron fence that lines the Capitol Site.

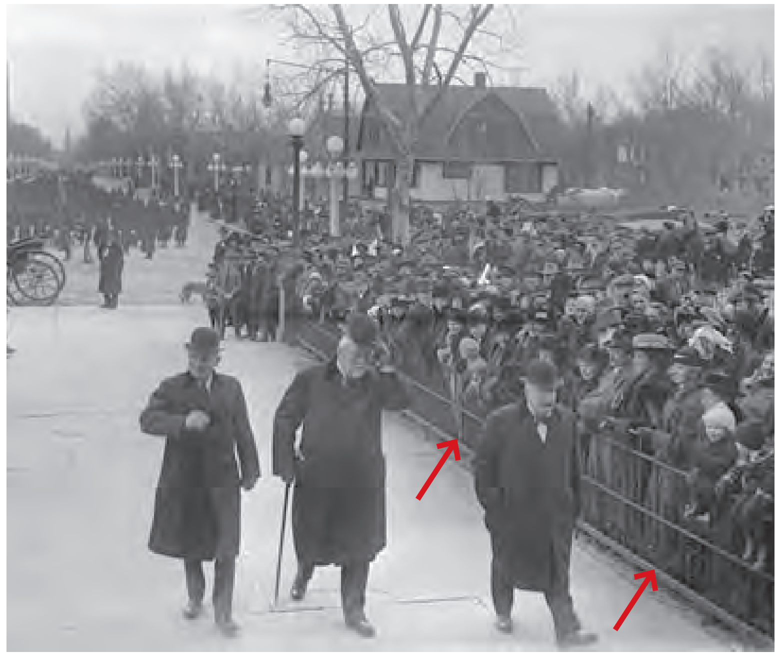

Figure 5.1.5: Governor John B. Kendrick [Left] and Governor Joseph M. Carey [Center] Walking Toward the South Capitol Entrance During Gov. Kendrick's Inauguration in January, 1915.

Figure 5.1.6: Wyoming State Capitol South Elevation, ca. 1915. Note the width of the south plaza and arrangement of the wrought iron fencing.

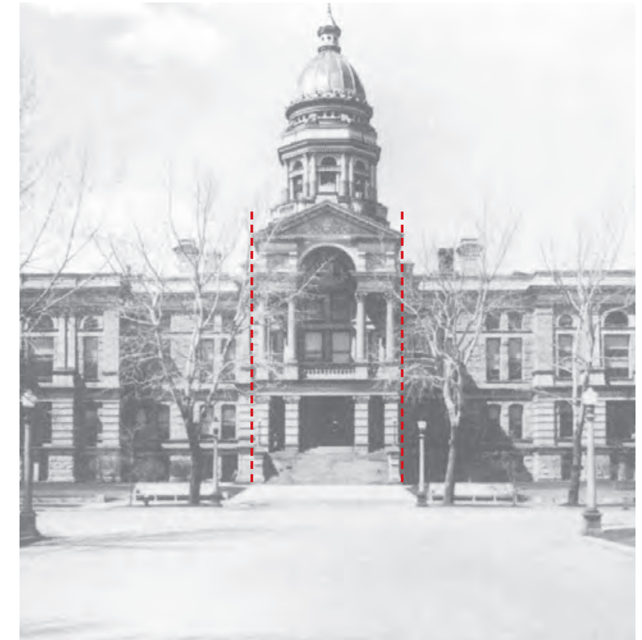

Figure 5.1.7: Wyoming State Capitol South Elevation, ca. 1920. Note the south plaza has been widened to align with the limits of the south portico and the wrought iron fencing has been removed.

Figure 5.1.8: Bird's-Eye Photograph of the Capitol Site Looking Southwest, ca. 1930.

Figure 5.1.9: Aerial Photograph of the Capitol Building South Elevation and East Lawn, ca. 1940. Note the rectilinear reflecting pool, outlined in red.

Introduction

Historically bounded by 25th and 24th Streets to the North and South, and by Central Avenue and Carey Avenue to the East and West, the Wyoming State Capitol Site was expanded an additional block to the North [26th Street] following the completion of the Herschler Building in 1983. In conjunction with the Cheyenne Depot at the southern end of Capitol Avenue, the Capitol Site acts as the northern anchor of downtown Cheyenne. The four acre Capitol Site is presently comprised of three [3] buildings:

1. The Capitol, along the southern edge of the site;
2. The Herschler Building, along the northern edge of the site;
3. An underground "connector" building, completed in 1985, which provides pedestrian access between the two buildings, as well as an underground parking garage and mechanical equipment rooms that serve the Capitol Complex [i.e. the Barrett, Hathaway and Supreme Court Buildings, in addition to the Capitol and Herschler Buildings].

Historic Site Development

Archival photographs and drawings illustrate that the general architectural form of the Capitol Grounds took shape in the [approximately] 20 year period following the completion of the Phase III construction [1917]. [*Figures 5.1.10 and 5.1.8*] Following the completion of the Phase III construction, alterations to the Capitol Grounds were made on a gradual basis, probably as money became available through the Capitol Maintenance Budget. As such, a series of minor additions and modifications were made until a comprehensive landscape design was devised in 1934.

- In the years following the completion of the Phase III construction, the paved walkway leading from 24th Street to the South Entrance was widened to match the width of the entry stairs – similar to today's configuration. It appears that the ornamental light posts, formerly located midway along each side of the walkway, and the wrought iron fence were removed as well. [*Figures 5.1.5, 5.1.6 and 5.1.7*]
- Located at the southeast and southwest corners of the site and to the east and west of the main walkway leading to the South Entry, stone benches appear to have been installed a few years later, following the complete removal of the wrought iron perimeter site fencing that was installed in 1896. [*Figure 5.1.7*]
- In multiple photographs, young coniferous trees can be seen in the southeast and southwest corners of the site, immediately behind the aforementioned stone benches. By all indications they are the same trees found there today.
- A series of comprehensive landscape design schemes were developed in April 1934 in conjunction with work associated with a site-wide irrigation system. [*Figure 5.1.11*] The plans included a proposed network of pedestrian pathways, planting beds and a small parking area. One of the plans closely resembles the scheme shown in a 1938 photograph from the west, depicting a geometric composition of hardscapes and greenscapes. [*Figure 5.1.12*]

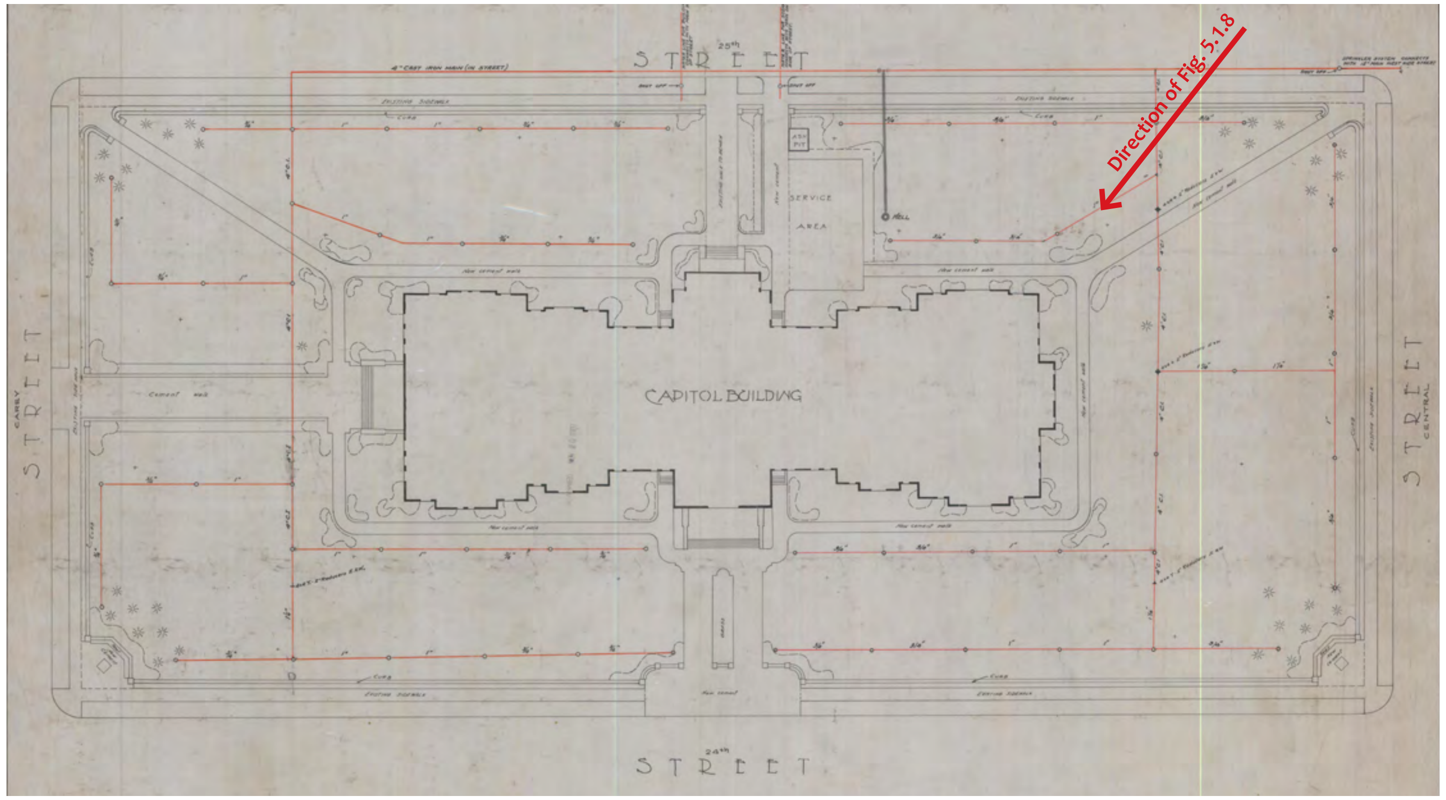

Figure 5.1.10: Existing Capitol Grounds Site Plan, ca. 1934.

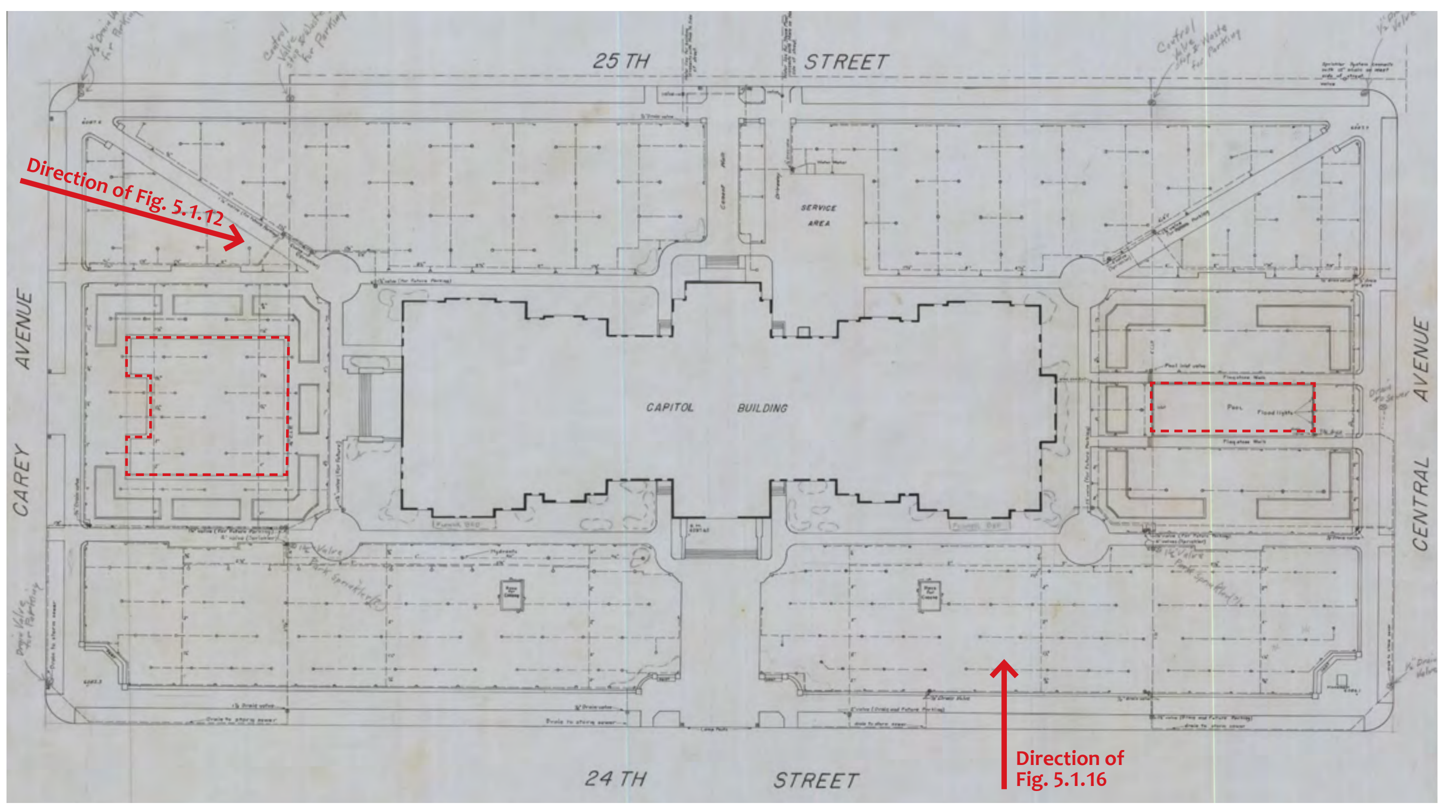

Figure 5.1.11: One of Two Schemes Developed for a Comprehensive Landscape Design for the Capitol Grounds, ca. 1934. Based on photographic evidence, the scheme shown above most closely resembles the as-built condition in the following years.

Figure 5.1.12: Photograph of the Capitol Building West Elevation, ca. 1938. Note the configuration of the planter beds and what appears to be a reflecting pool within (close examination of the photograph suggests that the reflecting pool was not filled with water at the time of the photograph).

Figure 5.1.13: "Service Area" Adjacent to the North Portico, ca. 1945.

Figure 5.1.14: Parking Lot at North Lawn, ca. 1978.

Figure 5.1.15: Photograph of the Herschler Building Construction, ca. 1981. Note the level of disturbance north of the Capitol.

Figure 5.1.16: Aerial Photograph of the Capitol Building South Elevation and East Lawn, ca. 1940. Note the rectilinear reflecting pool similar to the landscape design scheme shown in Figure 5.1.11.

Figure 5.1.17: Photograph of the Herschler Building and Plaza, ca. 2013.

Similar to what is found today, all four elevations of the building were bounded by a series of east-west and north-south walkways. At each corner of the building, the intersection points of the walkways were demarcated by large paved circles. Then, as now, diagonal pathways emanating from these circular nodes branched off to the northwest and northeast corners of the site.

The plans show various schemes for the landscaped areas in front of the East and West Porticoes [*Figure 5.1.11*]. Archival photographs confirm that reflecting pools were installed at both the West and East Lawns. Both lawns were framed with perimeter planting beds, portions of which are still in place today.

a. The West Lawn's reflecting pool comprised the majority of the area inside of the planters and was situated in the center of the lawn, surrounded by a grass terrace between the pool and the planters [*Figure 5.1.12*].

b. The East Lawn's reflecting pool was rectangular, approximately as wide as the East Portico, and flanked by paved walkways to the north and south [*Figure 5.1.16*].

It is unclear as to exactly when the reflecting pools were removed. Photographs from 1978 show the East and West Lawns infilled with grass. It seems likely that the reflecting pools were removed, as part of the substantial alterations made to the Capitol landscape sometime in the 1970s [as discussed below].

- On the site plans, a driveway and corresponding "service area" run adjacent to and east of the north walkway. A photograph from the 1940s confirms that the drive and service area were in fact constructed similar to the 1934 design [*Figure 5.1.13*]. Photographs from 1978 show that the small service area was eventually expanded to become a large paved parking lot that essentially ran the full length of the building along the North Elevation [*Figure 5.1.14*]. Furthermore, an aerial photograph from the 1940's indicates that a similar parking area was constructed from 24th Street along the east side of the Capitol [*Figure 5.1.16*].

With the construction of the Herschler Building to the north of the Capitol in 1981, the historic Capitol Site was no more. 25th Street, formerly the north boundary of the site, was transformed into the entry and exit points for the new underground parking garage. Based on photographic documentation, it appears that construction of the Herschler Building and the corresponding disruption to the Capitol Site resulted in a comprehensive redesign of the existing Capitol landscape. A series of paved drives were constructed to the north of the Capitol, maintaining vehicular access to the North Entrance of the Building. In addition, a new structure housing a series of cooling towers was constructed at the northeast corner of the site concurrent with the construction of Herschler.

The disruption to the northern section of the Capitol site required modifications to the plantings at the East and West lawns, which were simplified from their 1934 designs to incorporate fewer planting beds. At the same time, photographs suggest that shrubbery ca. 1930, which were formerly located at the base of the building perimeter and along a number of pedestrian walkways throughout the site, was removed just prior to 1978. A pair of small cannons that were situated on the southeast and southwest lawns since the 1930s were removed and trees were planted in their place.

Figure 5.1.18: South Elevation, ca. 2013.

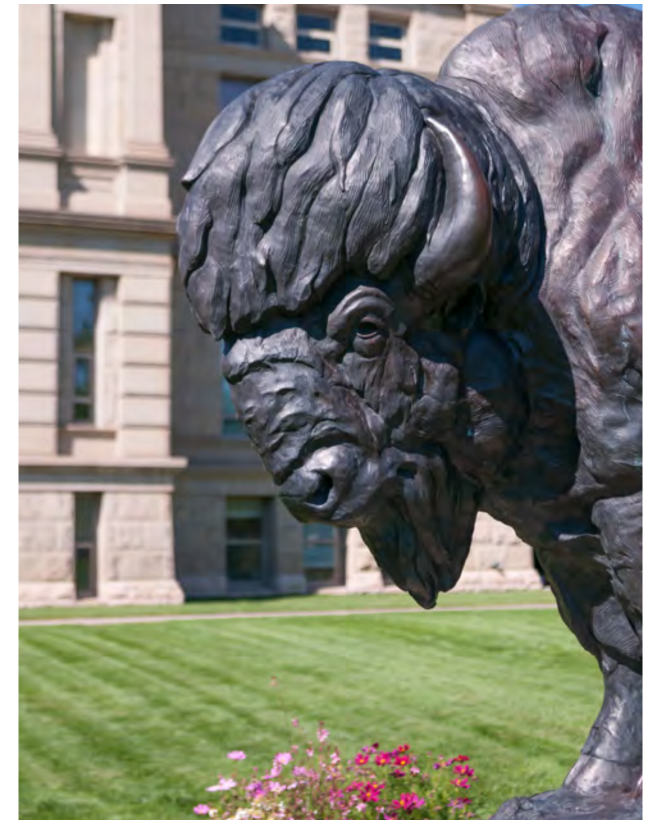

Figure 5.1.19: Bronze Bison Statue, East Lawn.

Figure 5.1.20: "The Spirit of Wyoming" Statue, West Lawn.

Figure 5.1.21: North Elevation, ca. 2013.

Figure 5.1.22: Statue of Chief Washakie of the Shoshone Tribe, West Side of the South Plaza.

Figure 5.1.23: Statue of Esther Hobart Morris, East Side of the South Plaza.

Existing Conditions

The existing grounds north of the Capitol are primarily paved. Paved access drives extend east-west from the North Portico to Central and Carey Avenues. A small parking lot containing approximately seven [7] spots is situated just north of the east drive. A one-story granite-clad structure housing a series of cooling towers marks the northeast corner of the site, beside a series of green and beige electrical transformers. Stone-clad wing walls, constructed as part of the 1983-85 Herschler Plaza project, create a canyon-like space to the east and west of the North Portico and eliminate any visual connection to the Herschler Building from the Capitol Basement.

Construction of the Herschler Building, and the Plaza soon after, effectively eliminated the historic character of the Capitol Site; the formal delineation of the Capitol north lawn along 25th Street vanished, integrated into the paved terraces and underground access ramps. The original Herschler Plaza design created a series of paved tiers, interspersed with recessed planters and lightwells serving the underground space below. The plaza was renovated in 2009 in order to rectify a series of accessibility, structural and moisture infiltration issues related to the original design. The new design resulted in the loss of the original exterior stone steps within the North Portico in order to provide an accessible exterior pathway from the Capitol to the plaza. The artificial grade change imposed by Herschler Plaza altered the historic perception of the Capitol from the north, while eliminating the historic entry and exit experience of the Capitol via the North Portico.

Concrete pathways surround the building, connecting the various entrances to one another and the street. Large, paved circles denote the intersection of the primary east-west and north-south pathways at the southern corners of the building. The existing Capitol Building is surrounded by green space to the West, South and East. Sunken gardens to the East and West of the building are demarcated by statues symbolizing the State's history.

- "The Spirit of Wyoming", the iconic bronze statue of the Bucking Horse and Rider, sits in the center of the West Lawn, accessed by a concrete pathway along the east-west building axis [*Figure 5.1.20*]. The West Lawn is framed by a quartet of flower beds at each corner.
- A bronze statue of a bison sits atop a stone plinth in the center of the East Lawn [*Figure 5.1.19*]. Flower beds radiate outward from the statue in the four cardinal directions.

The South Lawn is planted with evenly spaced elm trees and centered along the east-west axis. Additional elm trees line the curb strip between the sidewalk and the street, and small clusters of blue spruce trees demarcate the four corners of the site. A small bronze statue of a calf kicking up its hind legs was installed in 2005 on the Southwest Lawn, commemorating former Governor Cliff Hansen and the Wyoming cattle industry. On the Southwest Lawn, a large piece of stone with bronze lettering and the State Seal marks the formal façade of Capitol.

The recently renovated paved stone plaza in front of the South Portico is characterized by a polished granite seal of the State of Wyoming. Directly north of the seal is a pair of bronze statues, which are replicas of originals housed in the National Statuary Hall in Washington, D.C.

- The statue of Esther Hobart Morris, situated at the east side of the plaza, honors the Wyoming woman who played an instrumental role in the Women's Suffrage Movement in the late nineteenth century [*Figure 5.1.23*]. Because of the efforts of people like Morris, Wyoming became the first jurisdiction in the world to grant women the right to vote [December 10, 1869].
- At the west side of the plaza sits a bronze replica of Chief Washakie of the Shoshone Tribe [*Figure 5.1.22*]. A fierce warrior and adept diplomat, Chief Washakie was instrumental in granting access to Shoshone land in Wyoming to the Union Pacific Railroad during construction of the Transcontinental Railroad.

Conclusions

Incremental alterations or improvements were made to the Capitol grounds prior to the development of a comprehensive landscape design in 1934. Though major changes have been made to the landscape over the last 35 years, many of the key architectural elements from the 1934 scheme continue to exist today.

From the network of pedestrian pathways connecting various Capitol building entrances with the surrounding neighborhood, to the arrangement of planting beds and reflecting pools, the fully-realized landscape was a beautiful composition of built and natural features befitting a prominent building such as the Capitol [*Figure 5.1.24*].

Further study of the Capitol site will be required as part of the Design Phase, including:

1. Determination of a Period of Interpretation.

   As discussed in *Volume I Section 4 : Historic Analysis*, the Capitol building was substantially complete by 1918 with the construction of the interior finishes. Bases on current knowledge and evidence, a comprehensive exterior landscape plan was not developed until 1934. Therefore, the Design Team recommends that the Period of Interpretation of the rehabilitated and restored Capitol Site, including the Capitol Building interior and exterior, would extend between 1917 and 1934. This will be further researched and verified during the Design Phase of the project.

2. Review of Site "Intrusions."

   The level of disturbance related to the construction of the Herschler Plaza and the Underground Connector Building have had a significant impact on the interpretation of the Capitol Site. Furthermore, the construction of on-grade cooling towers and multiple paved access drives has "intruded" on the northern half of the Capitol Site. These "intrusions" should be addressed as part of the Capitol Site design [*Figure 5.1.25*].

3. Monuments.

   The important monuments that populate the Capitol landscape need to be carefully considered as part of any landscape design.

4. Materials.

   Careful consideration must be given to the materials [e.g. paving] introduced as part of the landscape design. These materials need to sensitive to the historic character of the building and site, as well as safe for pedestrian travel.

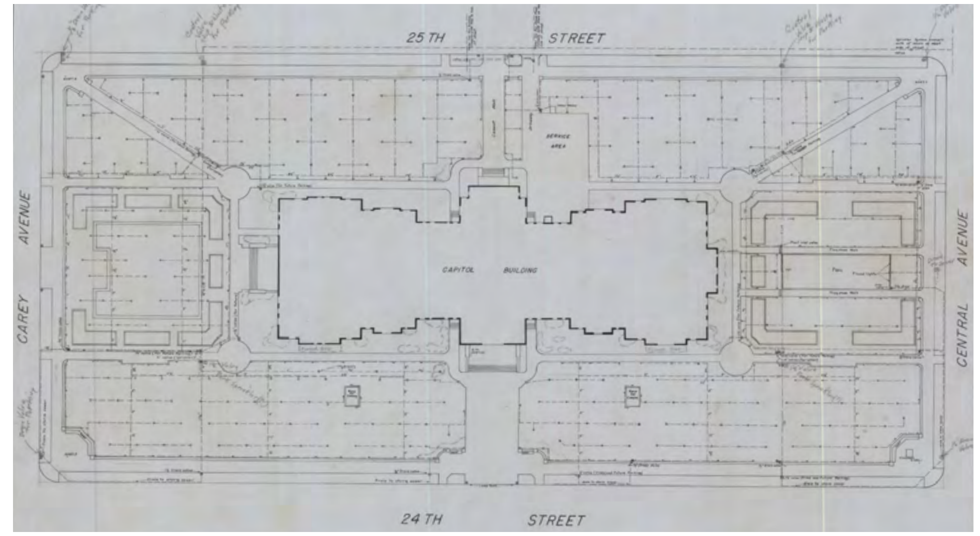

Figure 5.1.24: One of Two Schemes Developed for a Comprehensive Landscape Design for the Capitol Grounds, ca. 1934. Based on photographic evidence, the scheme shown above most closely resembles the as-built condition in the following years.

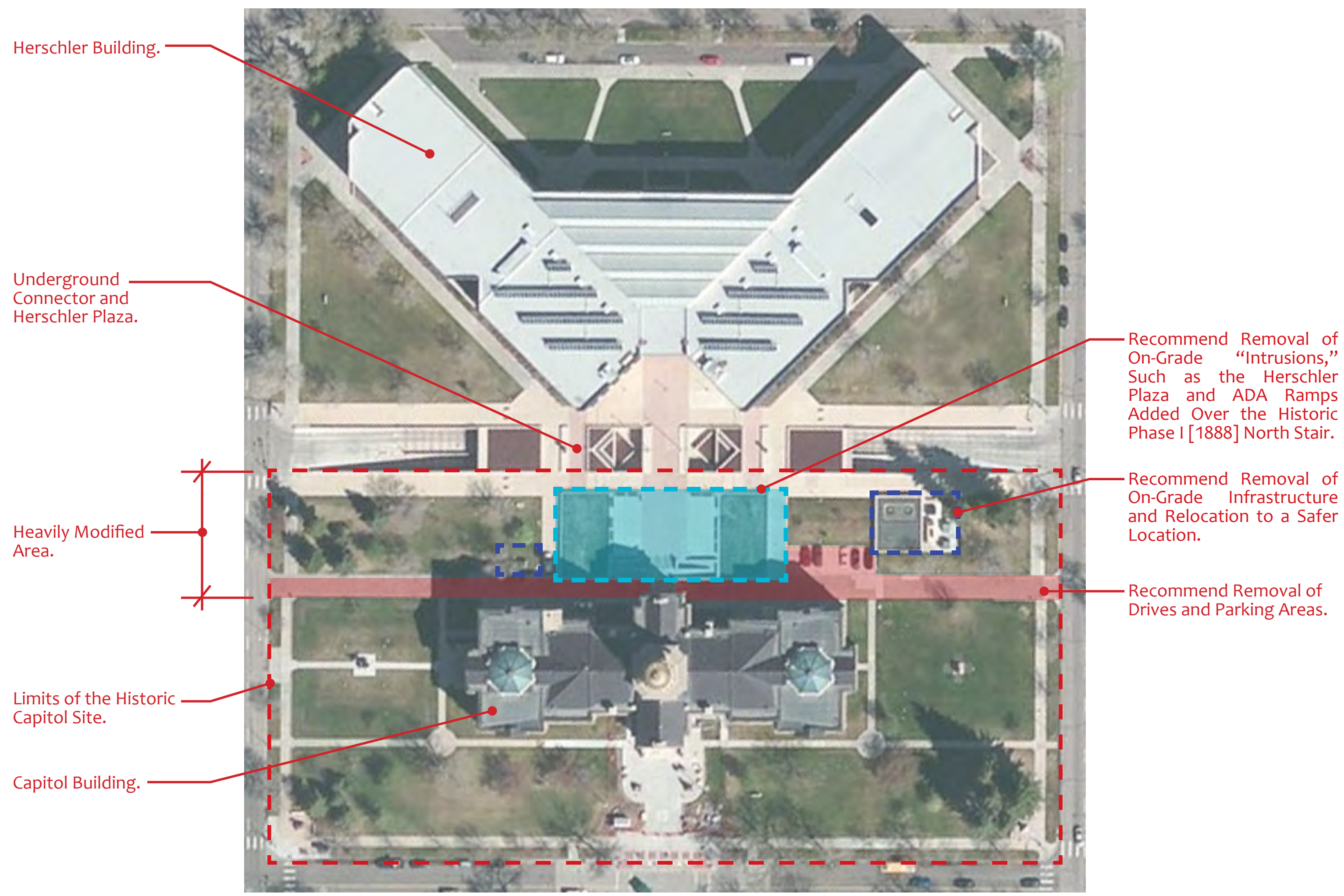

Figure 5.1.25: Aerial Photograph of the Capitol Grounds, Illustrating the Relationship Between the Capitol Building, the Herschler Building and the Underground Connector.

Figure 5.2.1: Wyoming State Capitol Dome Exterior.

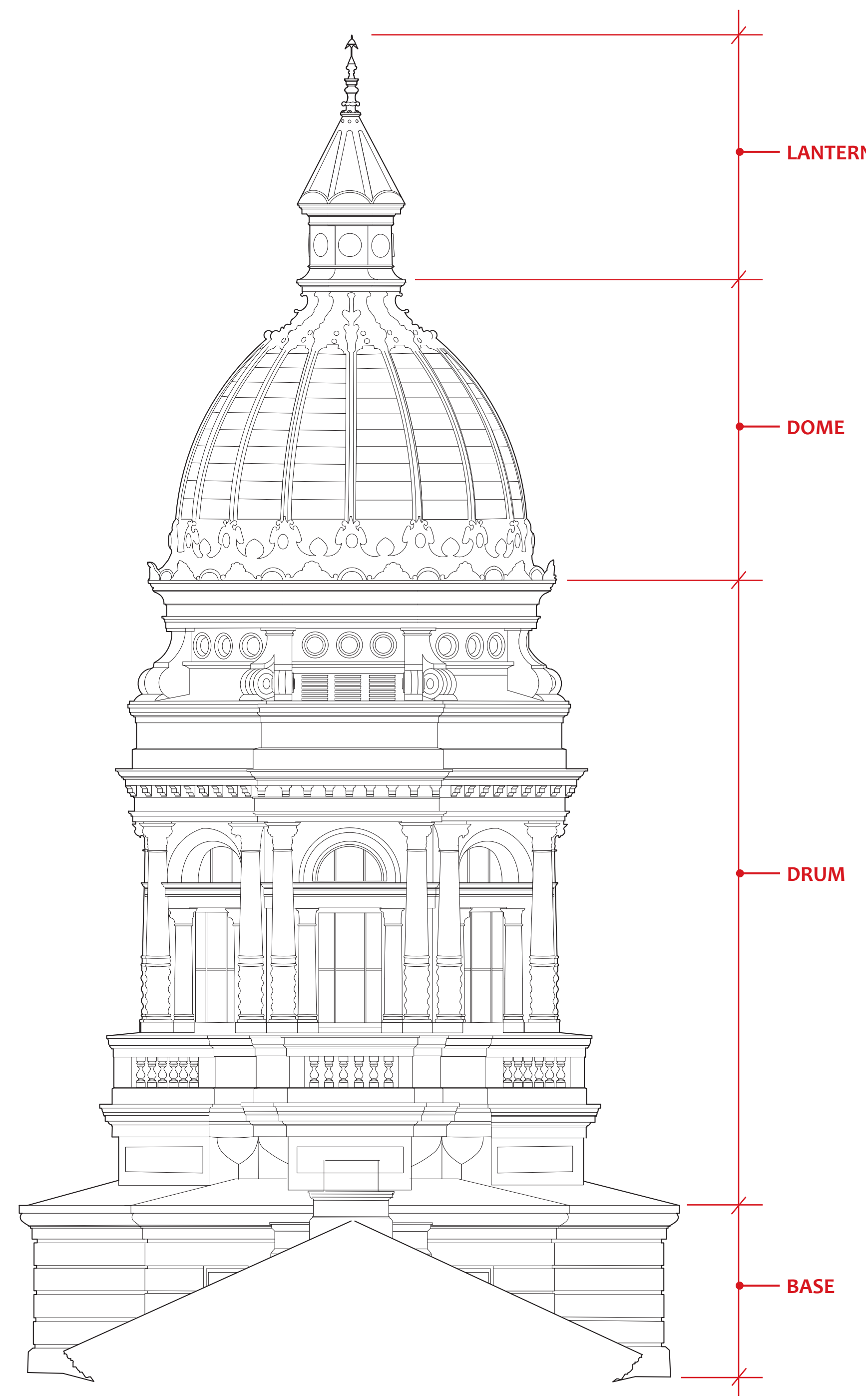

Figure 5.2.2: Nomenclature for the Wyoming State Capitol Dome Exterior.

5.2 Dome

Introduction

As part of the comprehensive envelope assessment, Vertical Access [VA] visually surveyed the existing conditions at the Wyoming State Capitol Dome interior and exterior using industrial rope access techniques in May 2013. Members from Preservation Design Partnership, LLC [PDP] and Robert Silman Associates [RSA], visually observed the existing conditions of the Dome from adjacent roof surfaces, and reviewed documentation related to the original Dome design and subsequent repair projects. GB Geotechnics [GBG] performed a thermal review of the existing interior and exterior condition of the Dome, as part of their non-destructive examination of the building envelope via a 125' high reach equipment and ladder access.

As part of the Level I / Level II Services, the Design Team performed a comprehensive evaluation of the Dome in order to:

- Review and document the existing conditions of all surfaces and components
- Establish a set of recommendations for repairs to the Dome interior and envelope

VA's report can be found in its entirety in *Volume II - Appendix N.*

VA's scope of work included:

- The investigation and documentation of existing conditions at the exterior of the drum, Dome, and lantern
- The investigation and documentation of existing conditions at the interior of the Dome
- Measurement of sheet metal thickness at representative locations
- Paint adhesion testing at the gilded panels and the painted formed metal
- Selective removal of paint coatings at representative locations on the exterior of the Dome for analysis
- Live-feed video to review and discuss conditions with the project team

Methodology

Vertical Access utilized industrial rope access techniques to gain hands-on access for the investigation of the interior and exterior surfaces of the Capitol Dome. Technicians were suspended on one rope termed the "work positioning line" with a redundant "fall protection line" used as backup. Hands-off descent control and fall protection devices were integrated into site-specific rigging systems, along with industry-specific climbing and suspension harnesses. VA technicians are third-party certified for industrial rope access work by SPRAT, the Society of Professional Rope Access Technicians. [*Figures 5.2.3 and 5.2.4*]

During the hands-on investigation of the drum, Dome and lantern, the location, severity and quantity of the following deteriorative conditions were recorded on elevation drawings:

- Punctures
- Tears
- Dents
- Failed seams

- Corrosion
- Paint coating failure
- Missing and loose elements

VA also performed an up-close review of the interior of the Dome and lantern. Photographs were taken of representative and notable conditions of deterioration, with the photographs hyperlinked to the annotated drawings. VA also performed one live-feed video "drop" on the southeast side of the Dome. The conditions at this side of the Dome were documented using "high-definition video" with audio commentary. PDP participated in the live-feed video, which allowed for discussion of conditions during the recording of the video.

To assist with the assessment of the condition of the existing paint coatings and to gain a better understanding of the chronology of the coatings at the exterior of the Dome, VA performed paint adhesion tests and paint sampling at representative areas.

OBSERVATIONS

The Capitol Dome consists of a galvanized sheet metal lantern and drum, and sheet copper cupola and Dome. The 54-foot high drum has eight [8] identical facets, with large openings at the colonnade level and smaller round windows at the drum attic. Above the drum attic, the Dome has sixteen [16] facets, each with ten [10] rows of gilded copper panels. The lantern that caps the Dome has eight [8] facets and a sloped roof consisting of the gilded copper panels topped by a finial.

The base of the drum, which meets the existing metal standing seam roof below, is clad in cast iron panels. Above the cast iron, the cladding of the drum and ornament are galvanized sheet metal, including the blind balustrades of the colonnade base and eight [8] engaged columns of the drum colonnade. The Dome itself is clad in gilded copper panels, as is the roof of the lantern. The ribs of the Dome and lantern roof, as well as most of the cladding of these areas of the Dome, are painted galvanized sheet metal. The sheet metal is hot dipped galvanized and, for the most part, is in good condition and appears to be original, based on the dates of the graffiti observed at the interior.

Sheet lead was used for the high relief ornament applied to the cornices at the drum attic, the base of the Dome and the top of the Dome. Since the copper Dome was first gilded in 1900, it has been re-gilded several times, most recently in 2009, when the existing copper panels were removed by Sheet Metal Products, Inc. [SMP] and new copper panels were gilded by Glenn Otto & Son and installed by SMP. Similar installation of new gilded copper panels at the Dome was reportedly carried out in 1980 and 1986, both performed by SMP and Glenn Otto & Son Painting.

Exterior Conditions

Overall, the galvanized sheet metal and gilded sheet copper of the Wyoming State Capitol Dome are in good condition, with the paint coatings showing signs of failure but with the gilding in excellent condition. There are dents in the gilded copper panels likely caused by hail impact, but no apparent punctures or tears at the copper. This is not unexpected since the panels were replaced in 2009. On the other hand, dents, punctures and tears were noted in much of the sheet lead ornament at the top and base of the Dome,

Figure 5.2.3: Vertical Access Design Team Member During Their Exterior Dome Survey.

Figure 5.2.4: Preparation of Industrial Rope Access Prior to the Commencement of Survey of the Capitol Dome Exterior.

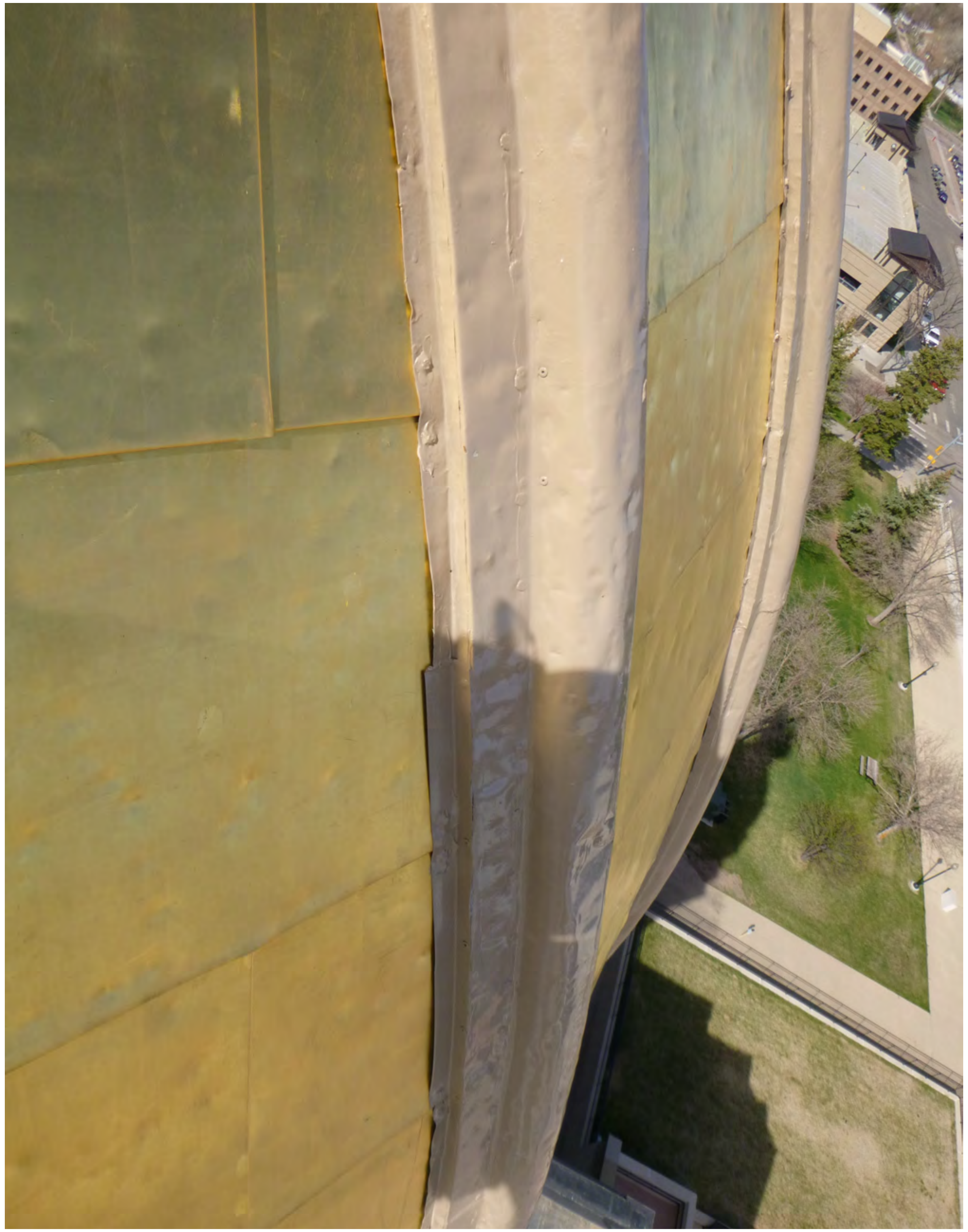

Figure 5.2.5: Failed Seams at the Dome Ribs.

Figure 5.2.6: Coating Failure and Spot Corrosion at the Lantern.

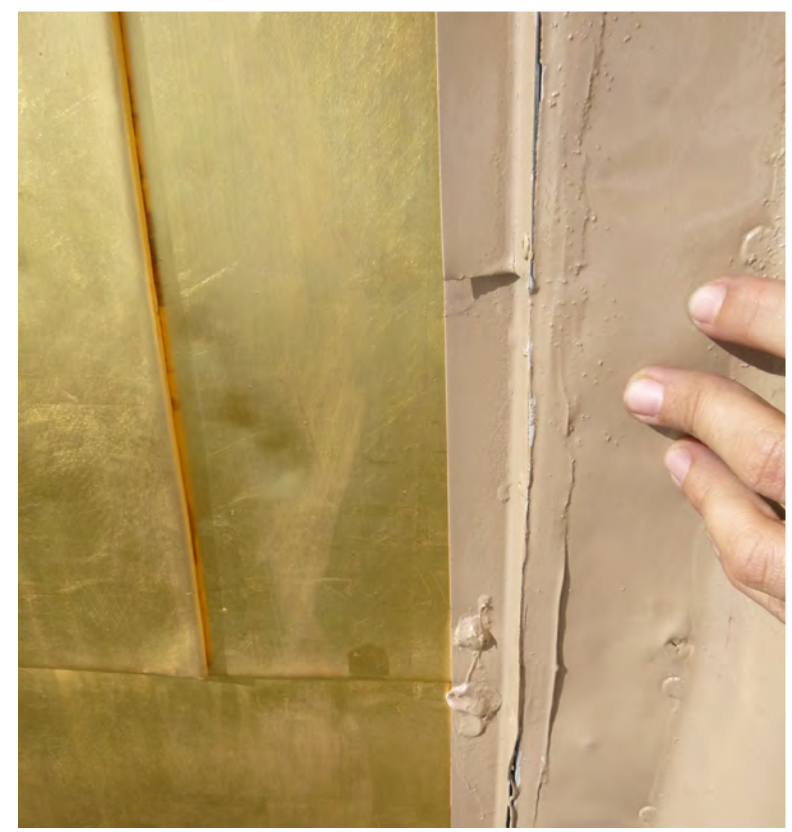

Figure 5.2.7: Failed Seams at the Dome Ribs.

likely due to hail impact. There are some open seams and loose fasteners at the sheet metal cladding.

Below is a summary of the conditions identified during VA's investigation of the exterior of the Wyoming State Capitol Dome:

Lantern and Finial

Coatings

- The lantern at the top of the Dome is in fair condition. Similar to the drum and Dome, the galvanized sheet metal of the lantern exhibits paint failure. [*Figure 5.2.6*] The gilded copper panels of the lantern roof installed in 2009 are in good condition, with dents from hail damage, but no apparent tears or punctures. [*Figure 5.2.5*]
- The galvanized sheet metal finial at the top of the lantern is in good condition. The paint coatings at the finial exhibit discrete areas of loss. Where the paint coatings are missing, traces of gilding as the earliest coatings on the sheet metal are visible.

Dome

Damaged Metal

- The copper panels are dented from hail impact, reportedly from a severe hailstorm that took place in 2011. According to Glenn Otto & Son Painting, spot repairs and re-gilding were performed in 2011, soon after the hailstorm. The denting is most severe at the upper half of the Dome. No perforations or tears were noted in the copper panels and the seams between the panels appeared sound. Above the top row of the new copper panels are older copper panels, one panel per facet. These copper panels are currently painted, though field observation and historic research suggests these panels were originally gilded, which is consistent with Domes of this style and construction period.
- The rib covers between the gilded facets of the Dome are galvanized sheet metal. The sheet metal is in good condition, with some denting and open seams noted. [*Figures 5.2.5 and 5.2.7*] Some sections of the rib covers appear to be replacement pieces, and likely date to the 2009 Dome Restoration project performed by Sheet Metal Products, Inc. [SMP] and Glenn Otto & Son Painting. The previous paint coatings at the ribs appear to have been completely removed prior to the last painting campaign.
- The lead ornament is in poor condition, with dents, tears and punctures noted at many locations. The tears and punctures occur on all sides of the Dome, but are most numerous on the east side. Some of the perforations have been filled with clear silicone sealant, automotive metal patching compounds or other materials. Based on discussions with Jay Otto of Glenn Otto & Son Painting, many of these repairs date to the 2010 and 2011 repair projects. While these emergency repairs temporarily addressed damage incurred during severe weather events, they are non-historic and have altered the historic form, assembly, and performance of the Dome envelope.
- The cornice at the base of the Dome has a band of projecting foliated ornament. Many of the individual leaves of the ornament are missing. Some pieces of ornament have tears and are loose.

Coatings

- The base of the Dome and the top of the Dome have galvanized sheet metal cladding with applied sheet metal ornament. The galvanized sheet metal is in fair condition, with some open seams, failed paint coatings and minor surface corrosion. There is more loss of paint coatings on the east side than at the other areas of the Dome.
- The most recent paint coatings at the Dome date to 2009, when the new gilded copper panels were installed. The coating is darker and glossier than the current paint coating at the drum.

Drum

Coatings

- Overall, the cast iron base of the drum is in good condition. Minor paint coating failure and light surface corrosion were noted on all sides of the drum at the lower portion of the cast iron base, near the intersection with the metal standing seam roof below. Paint adhesion tests revealed that the paint coatings at the cast iron have poor adhesion to the substrate.
- The deck coatings at the wash surfaces of the drum above the base, at the colonnade and at the attic are in poor condition. Most of the wash surfaces slope away from the walls of the drum; the wash surfaces at the balustrade level and the drum attic do not adequately slope away from the drum, allowing water to pond on the deck coatings at these levels.
- The paint coatings at the galvanized sheet metal cladding of the drum are in poor condition, with widespread paint loss and peeling. [*Figure 5.2.8*] In some locations, especially at the cornice elements of the drum, the more recent paint coatings are separating from underlying coatings, increasing the probability of exposure of the underlying galvanized sheet metal. In other areas, the paint loss is so severe that the galvanized sheet metal substrate below is exposed to the elements. In addition to being visually detracting, prolonged exposure of the galvanized sheet metal could lead to deterioration and corrosion of the base metal. The paintings and coatings at the Dome not only complete the visual aesthetic of the Capitol, but they form a protective layer over the various metal surfaces of the Dome's exterior envelope.

Surface Corrosion

- At some locations where paint loss was observed, minor surface corrosion of the galvanized sheet metal was also noted. [*Figure 5.2.10*] Surface corrosion was noted at the console scrolls of the consoles at the drum attic. [*Figure 5.2.9*]

Damaged Metal

- Dents in the sheet metal of the drum were noted at the bases of the engaged columns and the balusters. No tears or perforations were noted at these elements or other areas of the galvanized sheet metal cladding at the drum level.

Windows

- The inoperable semi-circular windows at the colonnade and the inoperable round windows at the drum attic have wood frames and sash. These windows are in fair condition, with minor weathering of the wood and failed paint coatings. [*Figure 5.2.11*]

Figure 5.2.8: Adhesion Test Indicating in Coating Failure. The existing coating is not currently properly adhering to the metal substrate.

Figure 5.2.9: Coating Failure at the Console.

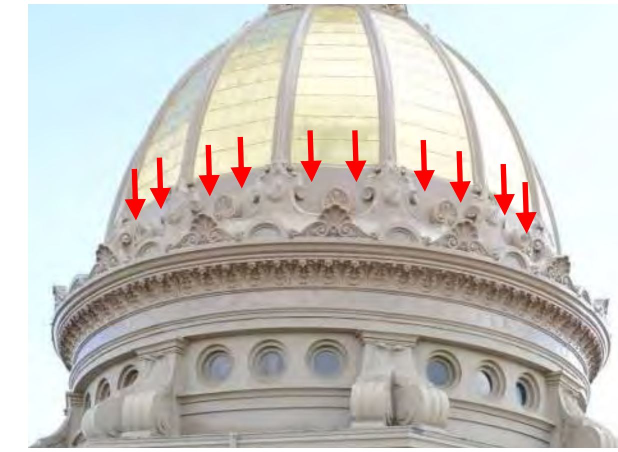

Figure 5.2.12: Diagram Illustrating the Observed Open Seam Locations at the Ornamental Metal Along the Base of the Dome Exterior.

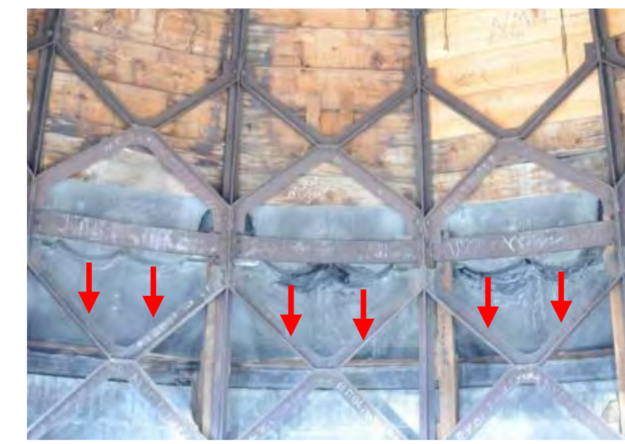

Figure 5.2.13: Diagram Illustrating the Corresponding Interior Locations of the Observed Open Seam Locations at the Ornamental Metal Along the Base of the Dome Exterior.

Figure 5.2.10: Spot Corrosion at the Drum.

Figure 5.2.11: Coating Failure Adjacent to Window Frame and Sill.

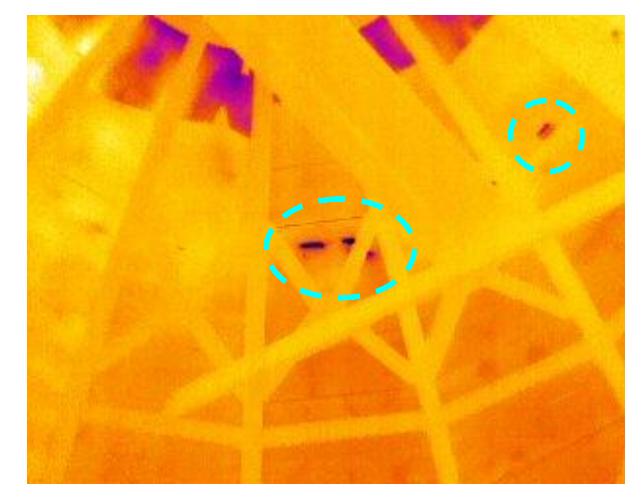

Figure 5.2.14: Thermal Image of the Interior Locations of the Observed Open Seam Locations at the Dome Exterior. The warmer [purple] locations indicate areas of heavy moisture, while the cooler [yellow] areas indicate areas of little or no moisture.

Figure 5.2.15: Widespread Moisture Damage at the Inner Face of the Dome Wood Decking.

Figure 5.2.16: Moisture Damage at a Failed Connection Between the Metal Dome Structure and a Wood Outrigger.

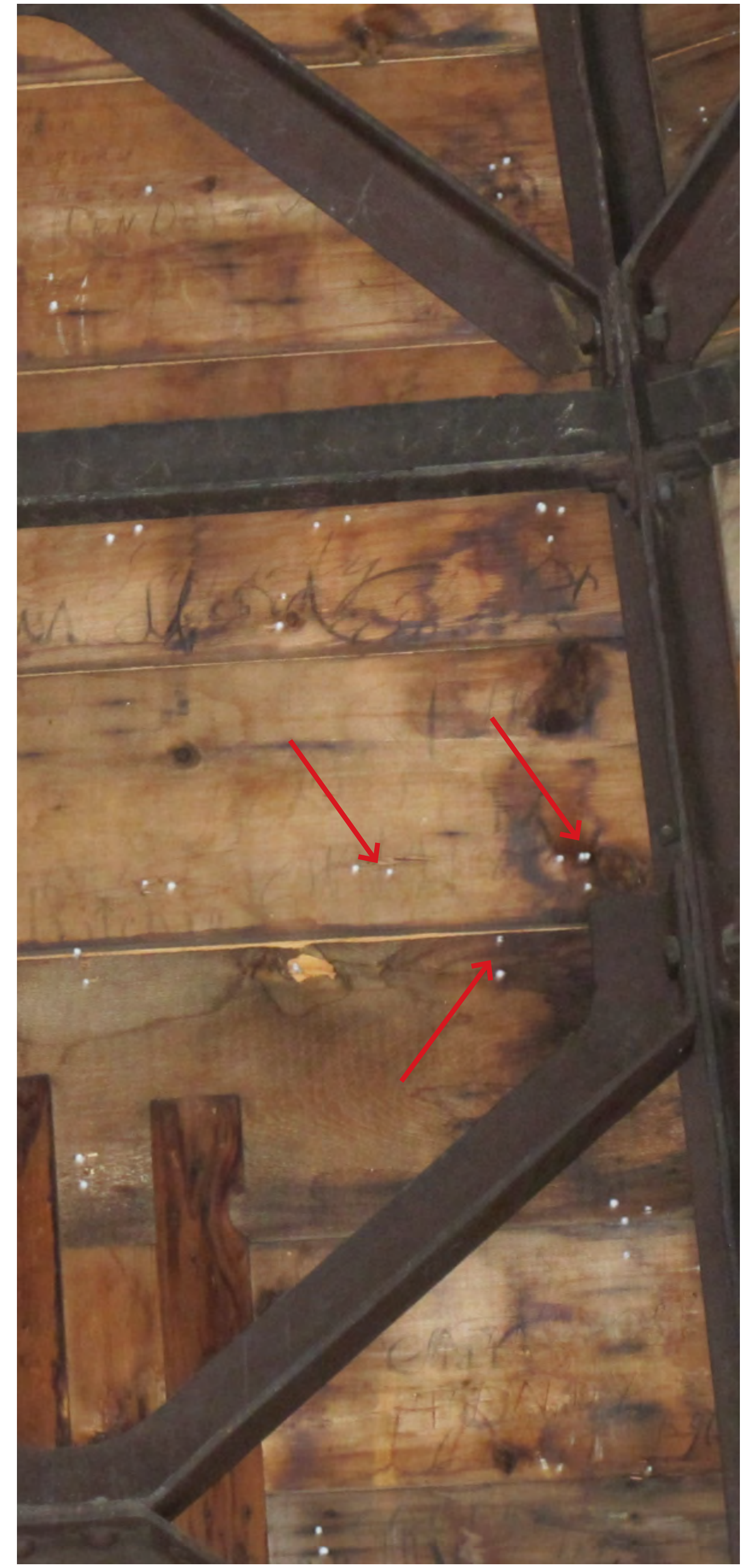

Figure 5.2.17: Visible Frost on Nail Heads and Adjacent Moisture Damage at the Wood Decking Along the Dome Interior.

Interior Conditions

Inside the Dome, the steel frame and wood roof decking below the gilded sheet copper panels are visible. Overall, the steel frame appears to be in good condition, with no deformation of members or obvious corrosion. [*Figures 5.2.18 and 5.2.20*] There is a gap at the horizontal seam between steel sections that make up the X-bracing of the frame at one level, but there are no signs of stress associated with the gap. Water staining was noted at the wood decking, but overall the decking materials appear to be sound. [*Figure 5.2.15*] Decay was noted at some of the wood blocking behind the lunettes.

Thermal imaging of the Dome interior confirmed multiple areas of active moisture infiltration. Four points of moisture infiltration through the upper portion of the Dome were identified. Thermal responses were found to worsen during rainfall, and a large amount of leakage could be seen visually at an intermediate Dome platform. In some instances, water had collected over the wooden floors at the platform. The source of the moisture infiltration appears to correspond with the galvanized sheet metal ornament at the base of the Dome. [*Figures 5.2.12 - 5.2.14*] This is consistent with Vertical Access' observations during their exterior visual assessment, as multiple open seams were noted in this area. [The *Capitol Dome Conditions Survey Report* can be found in *Volume III*]

Below is a summary of the conditions identified during VA's investigation of the interior of the Wyoming State Capitol Dome:

Moisture Damage

- The wood decking at the interior of the Dome exhibits water staining, but is otherwise in good condition. A split was noted in one of the decking boards on the north side of the Dome. Most of the wood decking appears to be original; replacement boards are visually defined by the lack of water staining and dated by graffiti attributing them to previous re-roofing campaigns. During a brief thunderstorm that occurred during the interior Dome assessment, water was observed running down the inside of the Dome, in line with a rib at the northwest side. Water was also noted coming in the Dome at the north side, above the round window of the drum attic.
- During a separate visual assessment of the Dome interior in April 2013, members of the Design Team observed frost on various metal surfaces along the Dome interior, including the inward face of the galvanized sheet metal and at nail heads secured to the wood roof decking. [*Figures 5.2.17 and 5.2.19*] As the Dome's metal envelope was warmed by sunlight, the frost began to melt and the condensation dripped down the face of the wood roof decking and onto the intermediate wood and concrete Dome platforms below.
- Decay was noted at wood blocking at the interior of the lantern at the level of the lantern cornice. The rot is most widespread on the south side of the lantern interior.

Dome STRUCTURE

Lantern and Finial

Inside the lantern, the frame consists of angles supporting the outer walls with 3/4" diameter tension rods running diagonally from the outer walls to two [2] connection hubs at the center of the lantern. Another tension rod, two inches in diameter, runs vertically to connect these hubs. One of the diagonal tension rods on the southeast side of the lantern is loose, with the nut at the connection hub not fully threaded.

Dome and Drum

Overall, the steel frame visible at the interior of the Dome is in good condition. There does not appear to be deformation or corrosion of the framing members. At one level of the X-bracing, there is a gap in the horizontal seam between members. The gap is as large as two [2] inches, but is typically between one and one-and-a-half inches wide at most of the seams. On the west side of the Dome, there is one seam that is fully closed. At most of the horizontal seams between members that make up the X-bracing, rivets are used; but at the level with the aforementioned gap, hex-head and some square-head carriage bolts are used at the horizontal seam.

- Some of the bolts are missing.
- The majority of the bolts that do exist are loose and do not appear to have ever been tight.

There is no visible evidence of cracking or other signs of stress indicating that the gap is due to movement in the structural frame. It is likely that each of these are as-built conditions.

In addition, deterioration and/or damage was observed at multiple wood outriggers. While the deterioration of the outriggers can be attributed to the previously described moisture issues at the interior, the damage is likely a structural issue that may be related to the tension and shear load paths of the Dome structure. [*Figure 5.2.16*]

Figure 5.2.18: Typical Dome Structure Trussing Connection.

Figure 5.2.19: Visible Frost on the Inward Face of the Metal Drum and Moisture Damage at the Adjacent Wood Framing.

Figure 5.2.20: Dome Interior Structure.

Summary of Observed Conditions

The Design Team's visual observations of the Capitol Dome indicate that there were several notable types and patterns of deterioration observed at the interior and exterior, including:

- Coating failure over large portions of the exterior.
- Dents, tears and punctures to virtually all metal surfaces across the Dome envelope, including the gilded copper panels, the galvanized sheet metal, and the sheet lead ornament.
- Poor condition of the metal ornament. Temporary repairs installed in 2010 and 2011 included clear silicone sealant and automotive metal patching compounds. While these emergency repairs temporarily addressed damage incurred during severe weather events, they are non-historic and have altered the historic form, assembly, and performance of the Dome envelope.
- Spot corrosion at cast iron and galvanized sheet metal elements, particularly at the applied decorative elements, including the consoles as well as the lowest section of the drum.
- Limited water infiltration in isolated locations, possibly related to open seams.
- Moisture damage at the interior of the Dome, specifically at the wood roof decking, exposed wood structural members [e.g. outriggers], and wood flooring.
- Unsecured or non-existent connections at interior structural members.

Conclusions

There are two important factors that need to be considered as part of any repair and restoration efforts at the Capitol Dome:

1. The Dome is over 125 years old
2. The local climate and weather conditions - high winds, intense thunderstorms and high risk of hail damage, potential for low temperatures, and low humidity - have historically had, and will continue to have, an impact on the Dome.

Based on the Design Team's assessment of the Capitol Dome, the following items need to be further evaluated as part of the Design Phase:

A. A detailed analysis of the Dome needs to be performed.

B. A three-dimensional computer model of the Dome will allow the Design Team to analyze the structural behavior of the Dome with relation to:

   1. Wind
   2. Impact of missing / nonexisting structural elements
   3. Impacts on the rest of the Capitol Building structure

C. The observed interior and exterior conditions will be further evaluated in order to develop a comprehensive treatment plan. In general:

   1. Sources of moisture infiltration will be addressed.
   2. Dents and perforations of the Dome skin will be located and incorporated as part of the recommended treatments.
   3. All exterior "skin" surfaces are to be stripped to bare metal, and all rust is to be removed. All metal surfaces are to be sound and deemed acceptable to the coatings manufacturer prior to any surface preparation. All metal surfaces are to be properly prepared to receive new coatings. A rust-inhibitive primer is to be applied to the bare metal, and new high performance coatings [e.g. TNEMEC] are to be applied to all metal surfaces according to the manufacturer's requirements and approved by a technical representative. The high performance coatings system will supply the metal with a durable outer layer that will protect the metal from the exterior elements for at least 25 years, minimizing exposure to moisture and subsequent corrosion.

D. The interior temperature and relative humidity of the Dome and Attic need to be monitored over time for at least twelve months. The detailed data produced by the monitoring program will assist the Design Team in developing treatment and design recommendations for each space.

Figure 5.3.1: View of Standing Seam Metal Roof at Ridgecap.

Figure 5.3.2: Detail View of EPDM Roofing. There are holes and cracking, which can allow water to infiltrate the roofing assembly.

Figure 5.3.3: View of EPDM Roofing. Note the Numerous Patches. The maintenence staff states that they patch the roof on an annual basis. The flashing at the base of the skylight is sealed with sealant, a short-term solution.

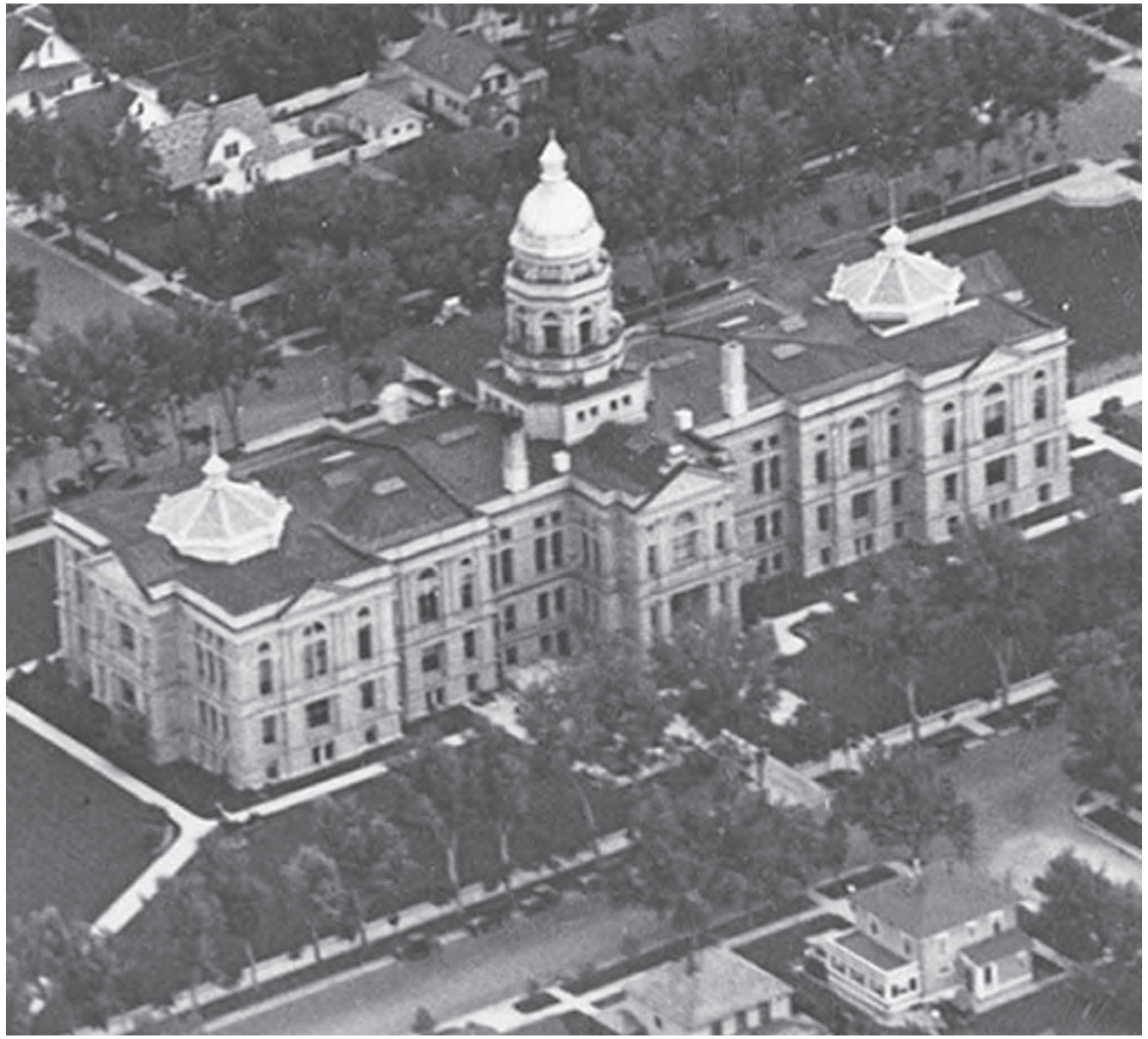

Figure 5.3.4: Wyoming State Capitol Buiding, Aerial View of Roof and North Elevation, looking Southwest, ca. 1930.

Overview

According to the original specifications, the sloped roofing system at the Wyoming State Capitol consisted of painted standing seam tin, while the "flat roofs, including the gutter liners," were clad with soldered flat seam tin. [*Figure 5.3.1*] Today, the sloped portions of the roof are clad with standing seam copper and the flat sections of the roof are covered with rubber or EPDM (ethylene propylene diene monomer (M-class) rubber). [*Figure 5.3.3*]

Condition Assessment: Changes Over Time

In 1999, the roofing systems were replaced as part of the *Roof Replacement, Exterior Renovations and Repairs Project* led by the Architecture/Engineering firm, HDH from Salem, Virginia and contractor, Waddle & Daub. At that time the entire roof system was taken down to the structural deck, and a new 20 oz. standing seam copper roof was installed at all sloped sections of the roof. [*Figures 5.3.2, 5.3.3 and 5.3.7*] In addition, many of the original skylight openings were covered with the standing seam metal roof. The EPDM roofing was also installed in 1999.

The pyramidal roofs above the large skylights were replaced in 2008 with standing seam copper and appear to be in good condition.

The existing EPDM roof has numerous patches, and the maintenance staff states that they patch the roof on an annual basis. [*Figures 5.3.4, 5.3.5 and 5.3.6*] The EPDM roof is nearing the end of its useful life and will require replacement in the near-term.

Roofing Summary

There are several key issues related to the roof:

1. Several areas of failure
2. The existing EPDM roof has reached and exceeded its useful service life
3. There have been modifications and/or installation of skylights and monitors during recent roofing campaigns that are:
   a. Not sensitive to the historic character of the building [in some locations, historic skylights have been completely roofed over]
   b. Not performing properly and exhibit signs of moisture infiltration, specifically the Chamber skylights installed in 2008
4. As part of the rehabilitation and restoration of the Capitol interior, the sensitive and thoughtful installation of new building systems will result in multiple penetrations through the roof for:
   a. Smoke evacuation
   b. HVAC outside air intake and exhaust
   c. Bathroom ventilation stacks

With each of the above taken into account, the area affected by the required removals and installations indicates that it would be more effective to replace the roof in its entirety.

- As a result, ideal locations for roof penetrations can be integrated with the existing architecture of the roof. For example, the inward sides of the parapets can be designed to include these penetrations, simplifying typically complex flashing conditions.
- A 30 - 50 year roof system would be installed, which would include:
  a. Metal standing seam roof
  b. Cold fluid-applied membrane roof at low-slope areas

  These systems will ensure a durable comprehensive roof system with a long-term warranty.

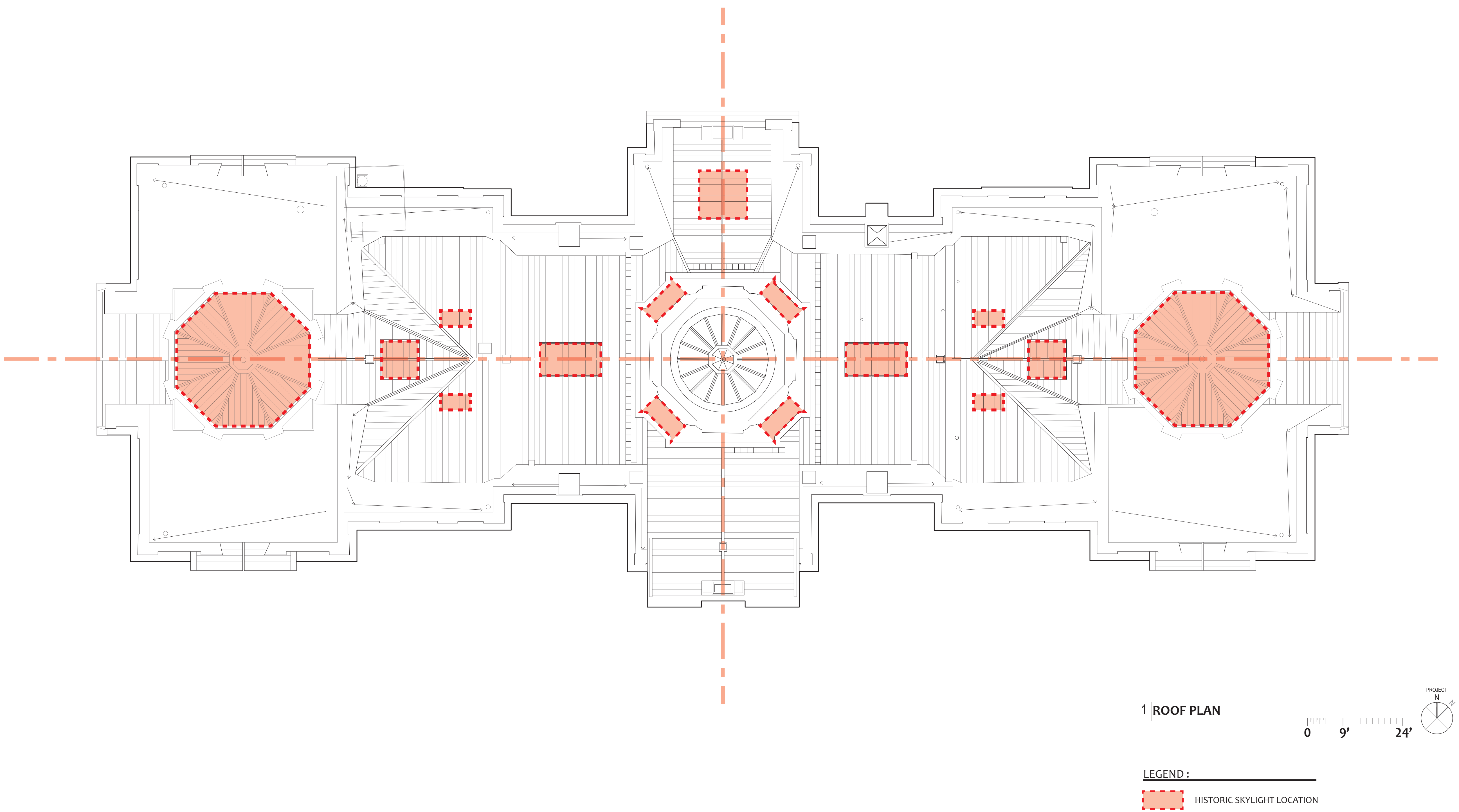

Figure 5.3.6: Diagram Showing Historic Skylight Locations.

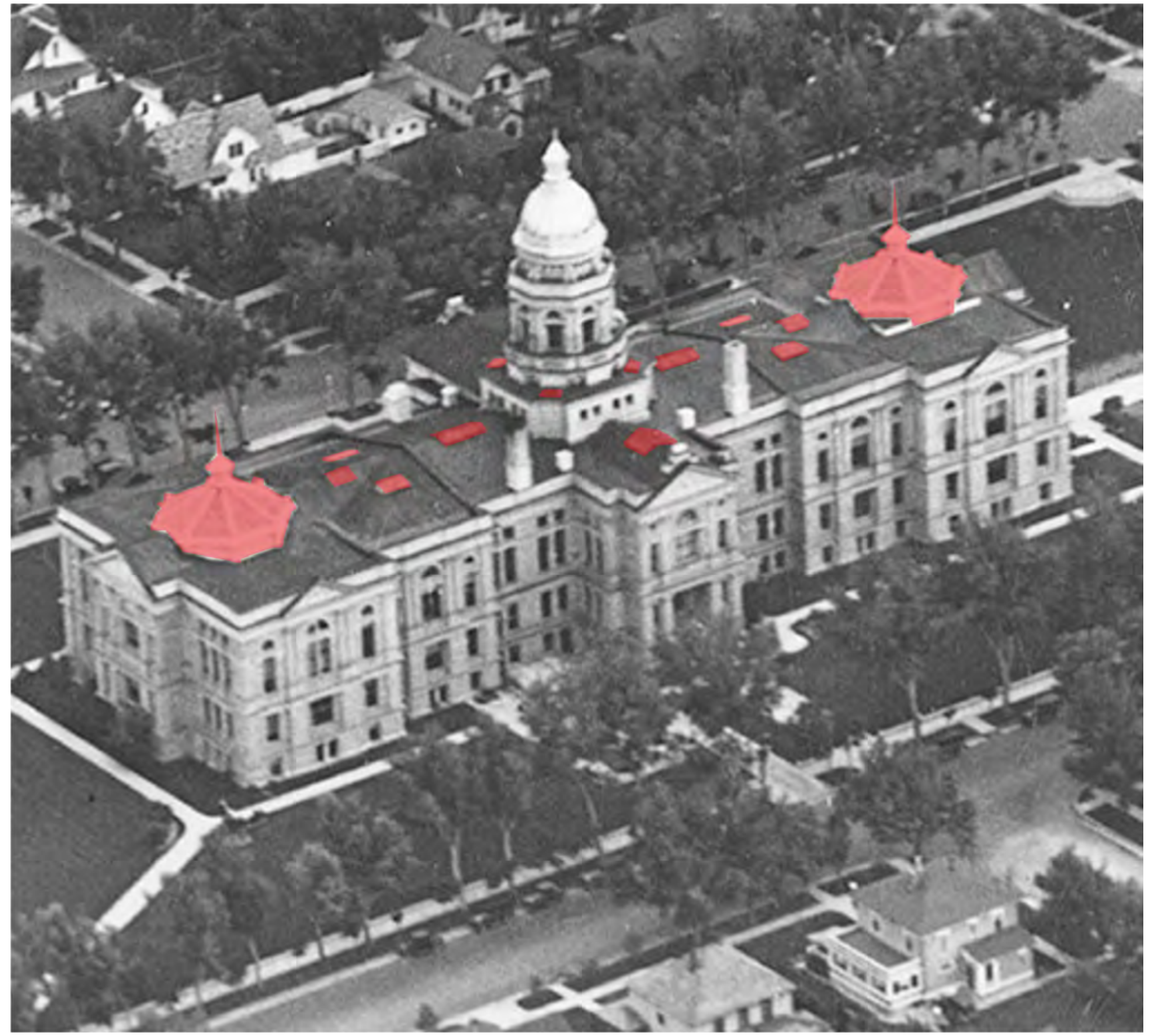

Figure 5.3.7: Wyoming State Capitol Building, View of the North Elevation and Roof showing original Skylight locations in red. View looking Southwest, ca. 1930.

Skylight Summary

As indicated in the historic bird's-eye photograph to the left [*Figure 5.3.9*], the completed Phase III [1917] Capitol had considerably more skylights than exist today.

1. Original Skylights.
   a. Based on research, the completed Capitol had **15** skylights [*Figure 5.3.8*].
      i. Chamber monitors [1 House; 1 Senate]
      ii. Rotunda skylights [4 total]. These skylights, located at the corners of the Dome drum, provided daylight to the Rotunda laylight.
      iii. Supreme Court skylight. Located north of the Dome, within the Phase I [1888] construction, this skylight served the former Supreme Court space below.
      iv. Monumental Stair skylights. These skylights were located directly above the monumental staircases and provided daylight to the corridors below.
      v. Chamber Lobby skylights. Originally comprised of only a single skylight centered on the roof and designed to serve the Phase II [1890] House and Senate Chambers, the roof was modified as part of the Phase III [1917] construction to include two [2] additional skylights designed to serve the Third Floor Chamber Lobbies and adjacent spaces.
2. Historic Appearance.
   a. Archival research, including photographs and original construction drawings, has provided information on the original designs of the historic skylights. These documents will assist the Design Team in generating the recommended designs for each of the skylights.
   b. The original framed roof openings can be clearly seen in the interior of the Attic.
3. Skylight "curse".
   a. **The commonly held belief is that all skylights leak. This is simply not true.**
   b. The truth is that improperly designed and detailed skylights will leak, as will skylights that are not properly maintained.
4. Value of the skylights.
   a. It is important to recognize how important each of the historic skylights are to the interpretation and experience of the Capitol interior. Reminders of these once-magnificient design features are still visible throughout the building and should be recaptured as part of the design.

For further discussion regarding the proposed scope of work for the roof and skylights, see *Volume I Section 07 : Proposed Scope of Work*.

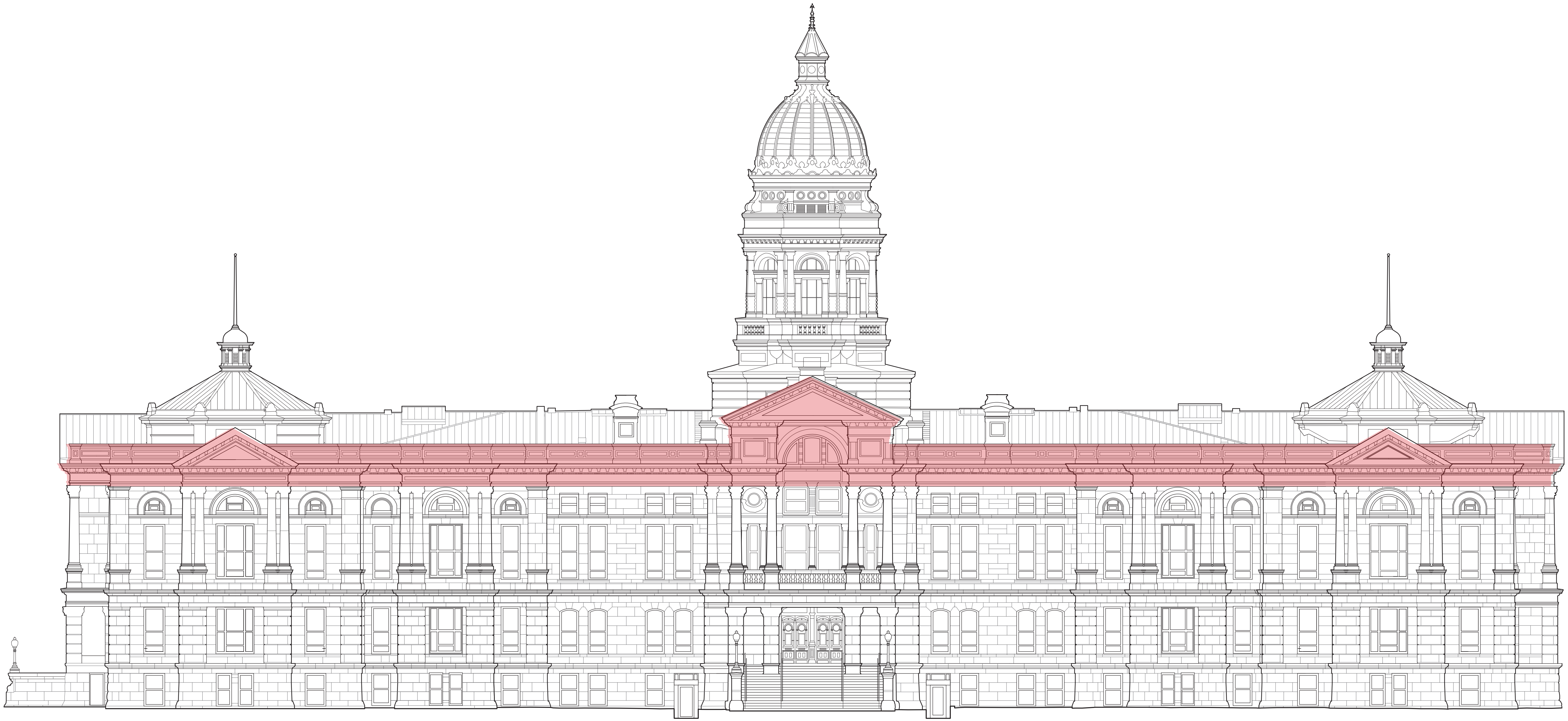

Figure 5.4.1: South Elevation Drawing. The cornices are indicated in red.

5.4 Parapets

Figure 5.4.2: Historic Photograph Showing Galvanized Metal Entablature, Pediments and Parapet Walls, ca. 1902.

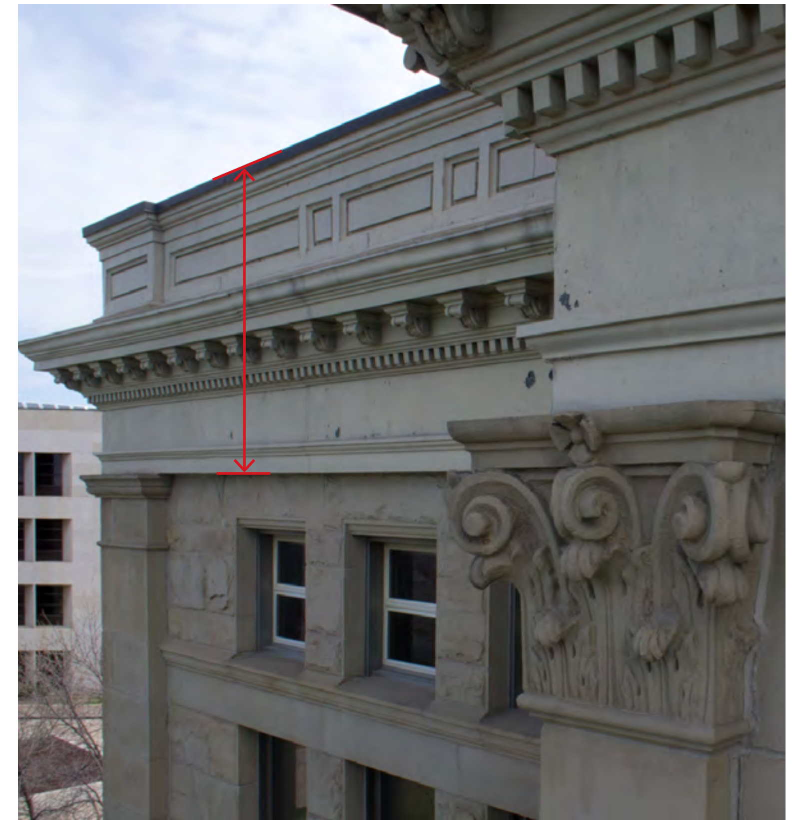

Figure 5.4.3: West SIde of North Portico Looking South. The building elements above the third story pilasters are galvanized metal.

Figure 5.4.4: Galvanized Metal Entablature, Cornice, and Parapet Walls at the North Elevation.

Figure 5.4.5: Many of the Joints Have Been Sealed with Sealant, which Is Visually Obtrusive and Only Functions as a Short-Term Repair.

Introduction

The upper entablature, cornice, pediments and parapet walls above the stone pilaster capitals consist of galvanized metal. [*Figures 5.4.1 through 5.4.4*] The original specifications state that the metal was to be the best quality No. 26 galvanized iron, with the exception of the metal at the cornice, which was to be 24 gauge metal. The specifications state that the cornices, pediments and gutters would be supported by wrought iron lookouts fastened to the roof framing. In addition, there would be 1-1/2" thick wood lookouts at 2'-6" o.c. The original specifications also stated that all galvanized metal was to be primed with yellow ochre paint followed by two coats of the best white lead oil paint. In addition, the last coat was to receive a coat of "Monroe sand." Similar to many buildings of the late 19th century, the metal was originally sand painted to resemble the color and texture of the sandstone masonry below.

The cornices and pediments are adorned with modillions and dentils. [*Figure 5.4.3*] The pediments on the North and South Elevations are decorated with floral patterns, while circular motifs adorn the pediments on the East and West Elevations. The parapet walls are delineated with raised panels. [*Figure 5.4.4*]

Condition Assessment

The galvanized metal appears to be in fair to good condition with limited corrosion evident. [*Figure 5.4.7*] Remedial work was performed at the galvanized metal enclosures in 1999 as part of the Roof Replacement, Exterior Renovations and Repairs. When the galvanized metal was repaired in 1999, it was repaired in place. Some of the conditions observed at the galvanized metal include the following:

- Bent or deformed metal profiles
- Cracks in the metal [*Figures 5.4.11 and 5.4.12*]
- Poorly executed joints and joints that have been sealed with sealant; [*Figures 5.4.5 and 5.4.13*]
- Poorly executed repairs [*Figures 5.4.11 and 5.4.13*]
- Missing ornament from the pediments [*Figure 5.4.10*]
- Peeling paint exposing the bare metal underneath. [*Figures 5.4.6 and 5.4.7*]

It appears that a cold-fluid applied membrane has been applied to the cornice. At some locations the membrane does not appear to be fully adhered to the cornice, particularly at the edges. Standing water was also noted at the cornice following rain events. [*Figures 5.4.8, 5.4.9, and 5.4.14*].

Figure 5.4.6: Typical Peeling Paint at the Galvanized Metal.

Figure 5.4.7: At Some Locations Corrosion Was Visible at Areas Where Paint Has Peeled.

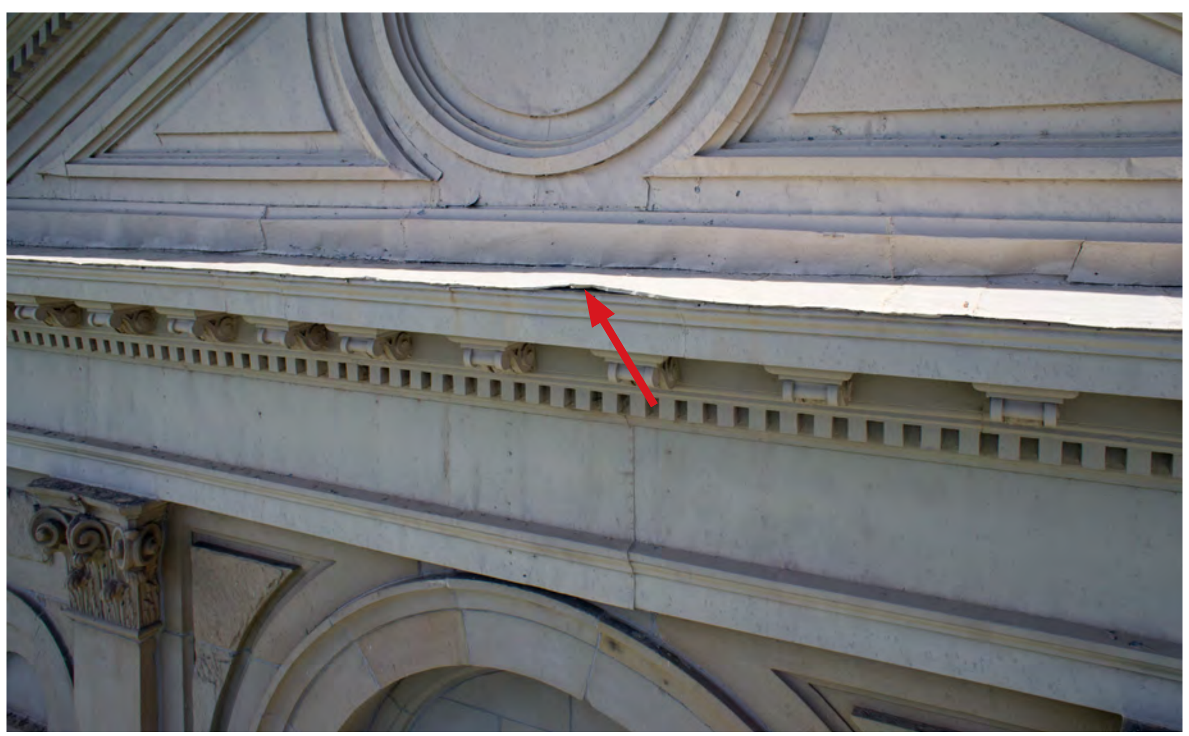

Figure 5.4.8: Delamination of the Cold-Fluid Applied Material at the Cornice at Pediment at East Elevation.

Figure 5.4.9: Detail of Areas Where the Cold-Fluid Applied Membrane Is Not Fully Altered to the Cornice.

Figure 5.4.10: Typical Ornament at the Pediments. At some locations the ornament has broken or is missing.

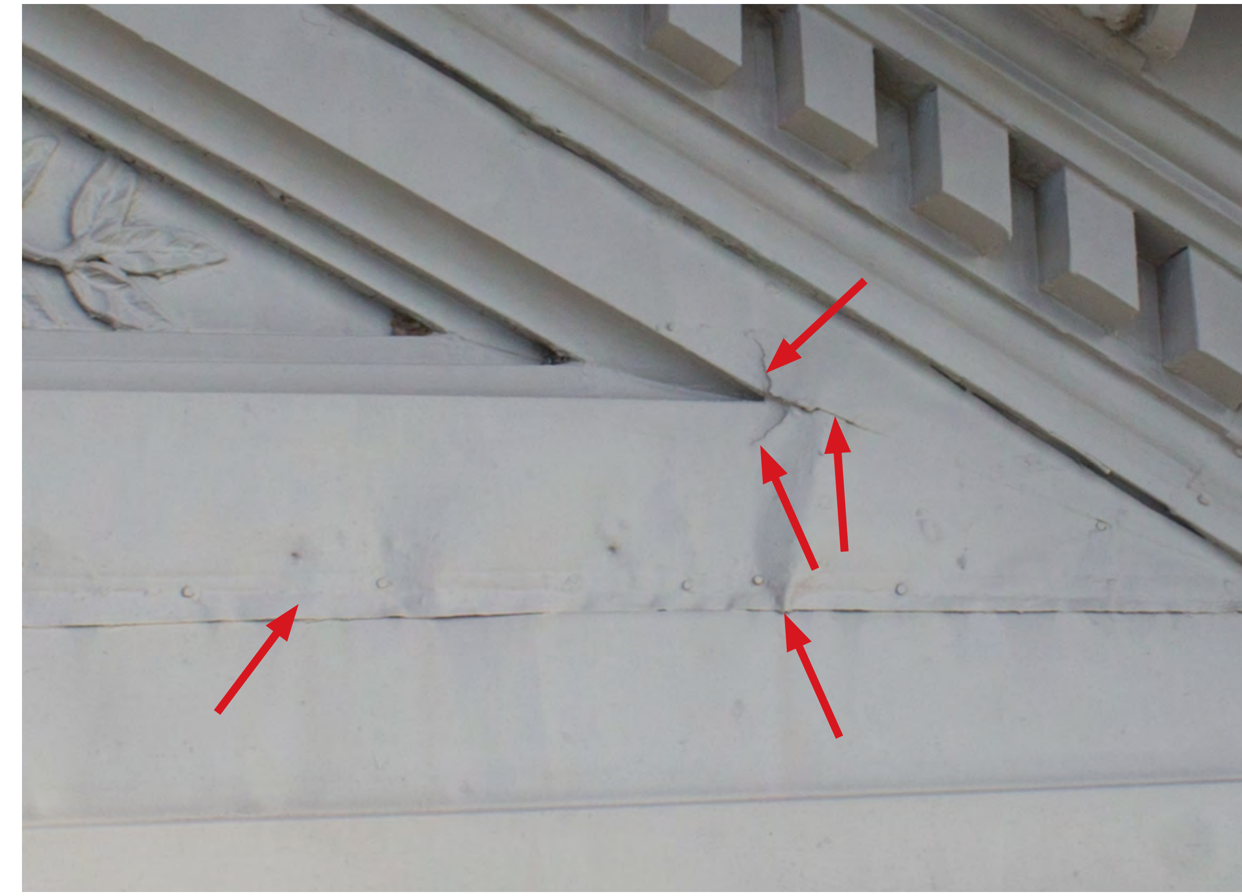

Figure 5.4.11: Detail at North Elevation Corner of Pediment Showing Cracks and Poorly Implemented Repairs Where the Metal Bulges.

Figure 5.4.12: Open Cracks in the Metal, Typical at Some Locations, Allowing Water to Infiltrate the Assembly.

Figure 5.4.13: Detail at Corner of Pediment Showing Poorly Implemented Repairs.

Figure 5.4.14: Detail Showing Loss of the Weatherproofing Membrane at the Cornice. Note the standing water at the cornice.

Conclusions

As discussed in Section 04: Historic Analysis, the expansion of the Capitol Building in 1917 resulted in some major alterations to the east and west wings of the Phase II [1890] structure. One of those alterations involved the removal of the southeast and southwest pediments and the columns that supported them. In order to restore the continuity of the metal parapet, the Phase II metalwork was likely re-configured to run the full length of the Phase II wings. As part of the Design Phase, these locations will be important areas for the Design Team to perform destructive examinations [probes] to verify the condition of the masonry behind the metal parapet and whether localized or comprehensive repairs will be required.

Various repairs will be required at the cornices. Standing seam metal and EPDM membrane roofing types transition into the metal parapet, which then terminate at the stone masonry below.

As part of the Design Phase, the observed conditions will be further evaluated and a comprehensive treatment plan will be developed. In general:

- Remove all metal panels for the full length of the decorative parapet to repair and repoint the masonry back-up wall. Masonry back-up material may require repairs.
- All surfaces are to be stripped to bare metal, and all rust is to be removed.
- All metal surfaces are to be sound and deemed acceptable to the coatings manufacturer prior to any surface preparation. All metal surfaces are to be properly prepared to receive new coatings. A rust-inhibitive primer is to be applied to the bare metal, and new high performance coatings are to be applied to all metal surfaces according to the manufacturer's requirements and approved by a technical representative.
- Following all repairs and refinishing of the metal, the panels are to be reinstalled and proper flashing installed to ensure a weather-tight system.
- In addition, the Design Team will further evaluate the existing drainage conditions of the roof and determine whether modifications need to be made to incorporate overflow scuppers or other drainage features.

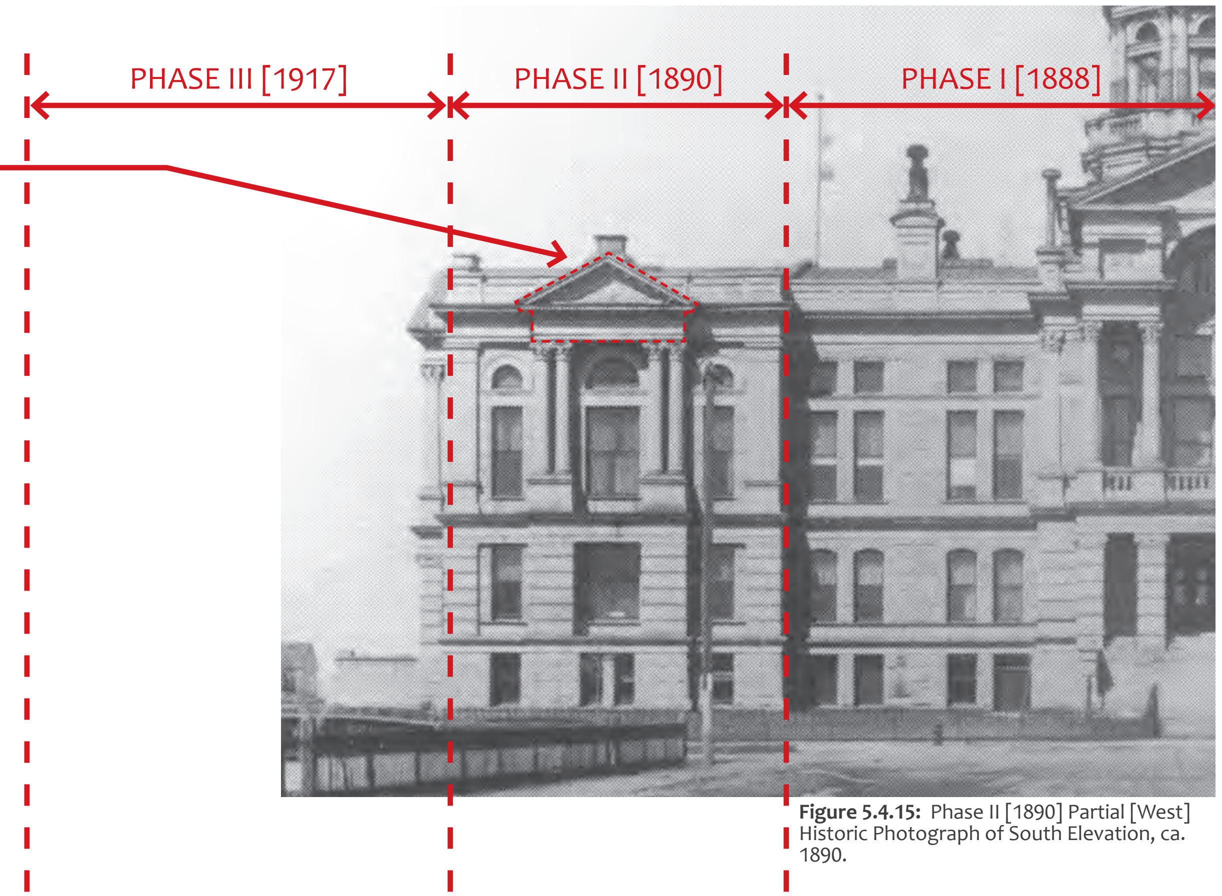

Figure 5.4.15: Phase II [1890] Partial [West] Historic Photograph of South Elevation, ca. 1890.

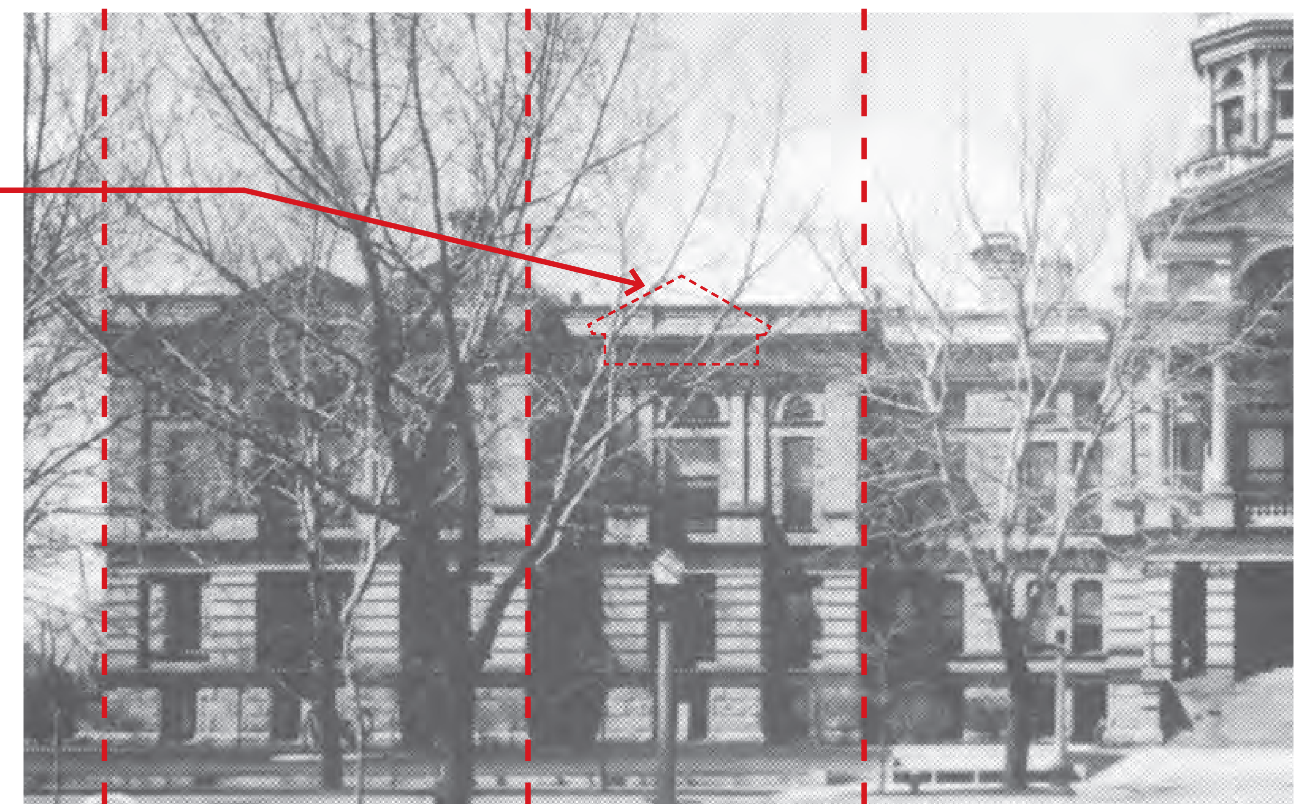

Figure 5.4.16: Phase III [1917] Partial [West] Historic Photograph of South Elevation, ca. 1917.

Figure 5.5.1: South Elevation, View Looking North. The red rectangle identifies the area of masonry distress and deterioration at the cornice above the south entrance and the protective netting installed as a result.

Figure 5.5.2: Close-up of the Protective Netting Installed at the Areas of Distress at the Cornice Above the South Entrance as a Result of the Design Team's Discovery.

Figure 5.5.3: Severely Delaminated Eroded Stone Adjacent to Open Joints at the Cornice Stones Above the South Entrance.

Figure 5.5.4: The First Two Courses of Sandstone, Below the Dashed Line are Buff/Pink Sandstone from Fort Collins, Colorado. The remaining sandstone is quarried from Rawlins, Wyoming. Note the efflorescence at the jamb caused by the upward migration of groundwater through the stone.

5.5.1 Introduction

The Wyoming State Capitol is a masonry Renaissance Revival Building – a style characterized by symmetrical organization, classical orders and round arches. It is three-and-a-half stories high including the basement. There are entrance porticos at the center of the north, south and west elevations. The central section of the building was constructed in 1887 of sandstone on a rubble masonry foundation. Two types of local sandstone were used to clad the building:

- The first two courses of stone at the base of the building are an iron-containing buff/pink sandstone from Fort Collins, Colorado
- The remaining masonry walls are a gray sandstone quarried in Rawlins, Wyoming. [*Figure 5.5.4*]

The east and west wings of the building, completed in 1917, were constructed of the same sandstone materials on concrete foundations.

Masonry Survey Project Team

During the week of May 13-17, 2013, Lisa Soderberg and Pierson Booher of PDP conducted a close-range visual survey of the exterior masonry at the Wyoming State Capitol using an 80-foot portable lift. The structural engineers, Nancy Hudson and Ed Meade of RSA conducted a survey of the exterior masonry on April 8-10, 2013 from the ground using binoculars. The Design Team mapped the types and locations of masonry distress evident with the goal of providing an overview of the condition of the masonry and identifying the general extent and types of deterioration present in the masonry envelope.

Review of Existing Documentation

As part of the masonry survey, the PDP Team also reviewed the available documentation pertinent to the design and condition of the exterior masonry. The following documents were particularly useful in the evaluation:

- Original specifications and drawings of the Capitol
- Previous studies and assessments of the building envelope including, "The Evaluation of the Foundation and Exterior Masonry of the Wyoming State Capitol Building," prepared by Banner Associates, Inc. of Laramie, WY, December 1993

The original specifications identified the source of the existing sandstone, while the original drawings show the intended relationship of the stone and brick or field stone back-up to the steel structure. The specifications describe in detail how the sandstone walls should be finished and emphasize that the joints should not exceed 3/8 of an inch. They require that the exterior masonry walls extend from grade to the top of the pilaster capitals. "The plinth course at the basement level shall be vertically tooled, while the wall between the plinth course and watertable shall be bold split-rock face with two-inch tooled margins…The piers at the first floor level are to have two-inch square sunk joints with two-inch tooled margins…" It directed that all ornament was to be "renaissance," and was to be done by a professional carver and not by a stone cutter. The specifications also state that "iron anchors and angle cramps must be used in the alternate thin courses."[1]

Although the anchor configuration could not be verified, the original specifications and drawings provide an important first step in understanding the probable existing configuration of the building components and materials.

The initial goal of the 1993 masonry investigation was to determine the cause of moisture intrusion into the exterior walls at several basement level offices. The scope of work for the investigation was enlarged to include a binocular survey of conditions at all exterior stonework. In addition, laboratory testing was conducted on representative samples of masonry materials to identify the basic characteristics of each type of sandstone. The report also provided recommendations for waterproofing the foundations as well as cleaning, consolidating and repairing the exterior stonework. It appears that some of the recommendations were implemented as shown in the Storm Drainage Repair and Masonry Preservation Drawings produced by Banner Associates, Inc. in May 1994.

5.5.2 General Observations

The building envelope at the Wyoming State Capitol exhibits deteriorative conditions that are consistent with the building's age and construction materials. The masonry is generally in fair to good condition, although there are localized areas of significantly more advanced deterioration.

The majority of the deterioration appears to result from:

- Inherent characteristics of the sandstone masonry
- Water infiltration
- Weathering
- Inappropriate treatments and interventions

The Wyoming State Capitol exhibits various forms of masonry deterioration resulting from the infiltration of water into the building envelope. At some locations, the deterioration is severe and exacerbated by the fact that the building is constructed of sandstone, a material that is particularly susceptible to the adverse effects of water infiltration.

5.5.3 Field Observations

Below is a description of the types of deterioration and masonry distress observed in the field followed by a more detailed description of the deterioration mechanisms causing the distress.

Mortar Loss: Open and Deteriorated Joints

Mortar loss is generally the first element of aging masonry wall systems to deteriorate, and areas where the mortar is missing are gateways for further moisture penetration into the wall assembly. Therefore, any survey of masonry conditions starts with the documentation of the extent and pattern of mortar loss and deterioration.

It is evident that there have been several repointing campaigns over the years. The majority of the joints in the flat wall surfaces appear sound, although some of the mortar colors do not match. However, at all projecting elements there is significant mortar loss and cracked, deteriorated mortar

Figure 5.5.5: Eroded and Spalled Stone Conditions Adjacent to Open and Deteriorated Joints.

Figure 5.5.6: Large Spall Adjacent to a Deteriorated Joint at the Projecting Cornices.

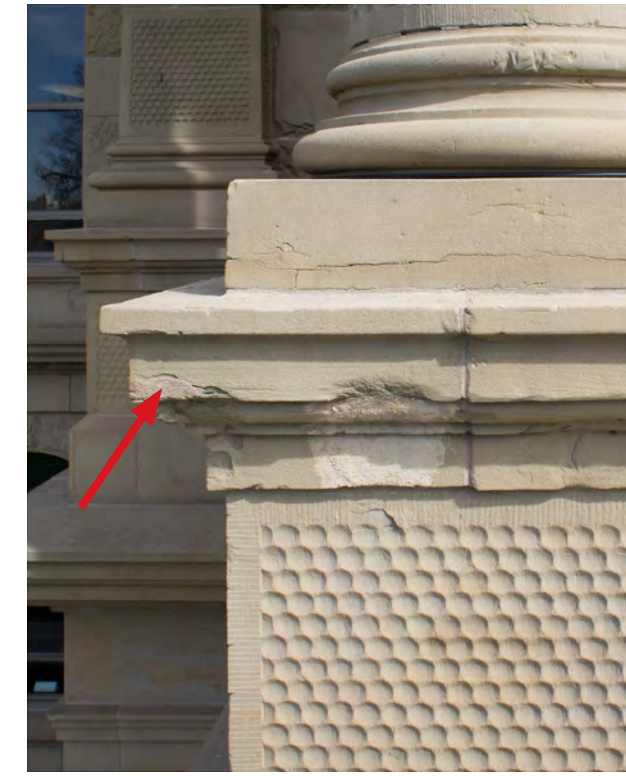

Figure 5.5.7: Deterioration and Failed Patch Repairs at the Column Bases.

Figure 5.5.8: Delaminated, Eroded, Cracked and Spalled Stone Adjacent to Open Joint above South Entrance.

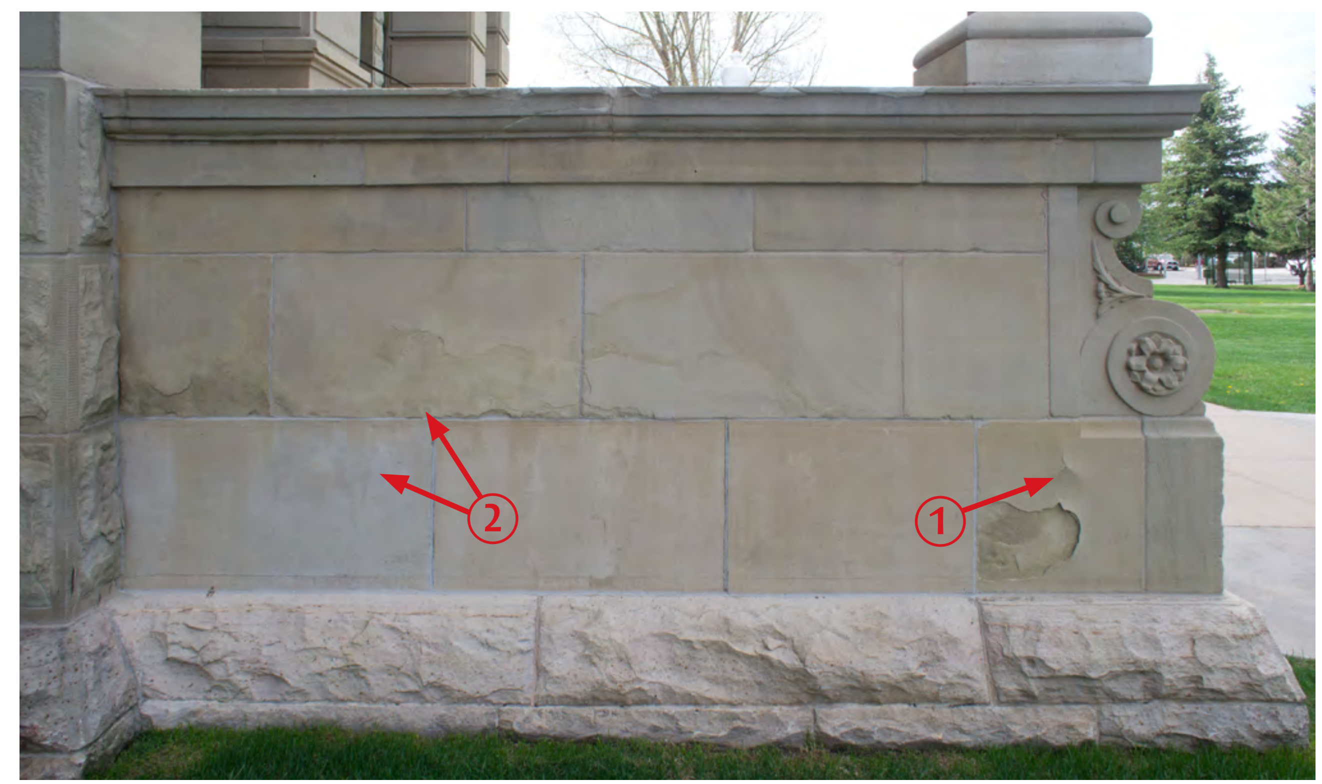

Figure 5.5.9: North Cheek Wall at the West Entrance. 1. Arrow #1 points to blistering sandstone, which eventually results in more extensive surface peeling or delamination as seen below the arrow head. 2. Arrow #2 points to areas of efflorescence caused by the upward migration of groundwater through the stone.

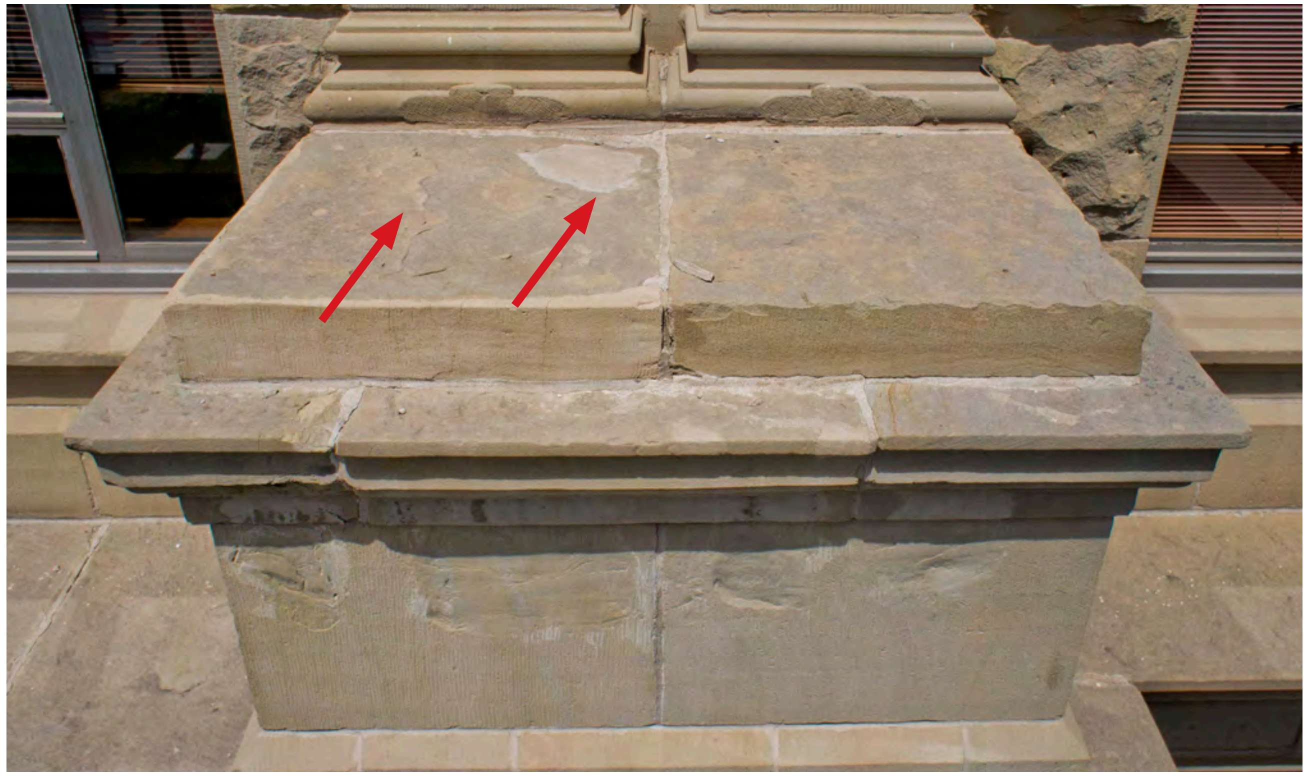

Figure 5.5.10: Delaminated, Eroded Stone at Exposed Horizontal Surfaces at the South Elevation. This exposed sandstone element served as a plinth for two columns constructed as part of the 1890 additions. In 1917 the columns were moved to the new additions at the east and west wings.

Figure 5.5.11: Typical Delamination at Top of Cornice.

Figure 5.5.12: Typical Delamination at Top Surface at Cornice above First Floor Level.

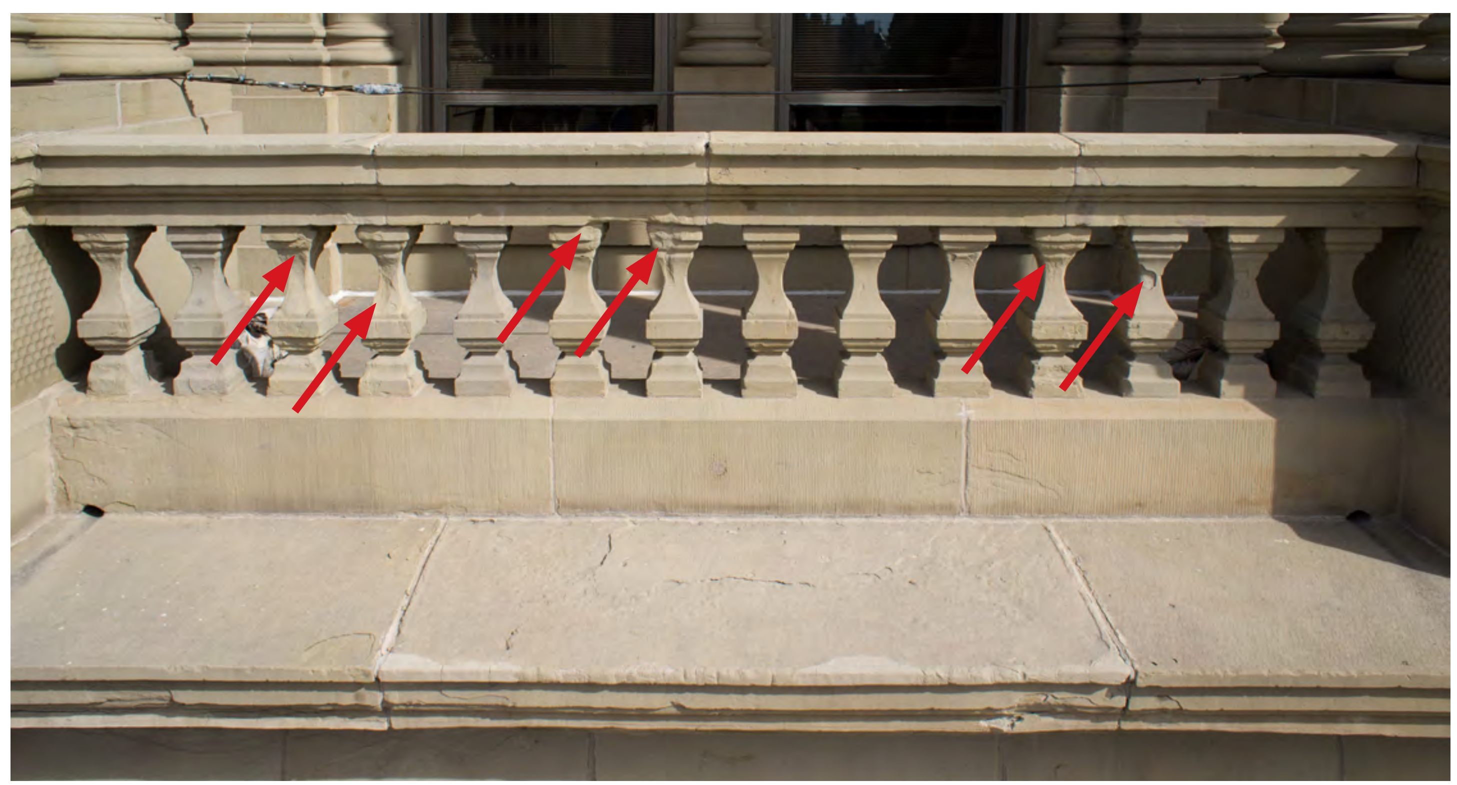

Figure 5.5.13: Delaminated and Eroded Balusters above the South Entrance. Note that the most severe deterioration is at the balusters directly below joints.

joints, particularly at the cornices above the basement and first floor levels. [*Figures 5.5.3, 5.5.5, 5.5.6, and 5.5.8*]

The Design Team noted several joints, which were not properly raked out, where a thin layer of new mortar was installed on top of unsound mortar. These joints have failed. It was also noted that caulk was installed at some of the joints, which has generally failed. A wide range of mortar colors was also observed at the joints.

Cracks, Spalls and Voids

Cracks, voids and losses are systematically documented because they indicate areas where stress has built up in the masonry and exceeded its capacity to resist those stresses. The sources of those stresses are not always apparent from an individual crack; but mapping the locations and patterns of cracks helps in the analysis of the underlying causes, which can range from localized defects in the stone itself, to flaws in the masonry installation, to differential settlement of building elements.

The most significant cracking was observed on the East Elevation where there are vertical cracks through both mortar joints and stone units. At one location there was a displaced cornice unit adjacent to a wide, open joint. [*Figures 5.5.17 and 5.5.19*] Several of the cracks extend from window openings into the jamb. [*Figure 5.5.29*] There were also wide vertical mortar joints on this elevation; some joints are as wide as 1-1/2". In addition, there was extensive cracking evident in the interior finishes of the East Wing. Reportedly, some of these cracks have re-opened since the walls were recently repainted.

Cracks were also observed on the interior vestibule walls at the North Portico with corresponding open joints on the exterior. In addition, cracks in the foundation walls at the north entry were observed in the 1993 masonry survey.

Cracked stone units were also noted at a few locations at the stone lintels directly above windows. [*Figures 5.5.30 and 5.5.32*] At the bottom of several lintels, there are steel rods, decorative plate washers and nuts visible, which appear to be original. [*Figure 5.5.33*] There are also steel rods, square plate washers and nuts which appear to be repairs visible at the bottom of many other lintels. [*Figure 5.5.30*] Often, the rods and plate washers are installed at joints. However, in a few locations the square or rectangular washer has been installed at the crack in the stone lintel. [*Figure 5.5.30*]

Blistering, Delamination and Erosion

Blistering, delamination and erosion were documented as they are indicators of breakdown of the stone itself, as opposed to damage to other components of the wall assembly such as the mortar. Typically, blistering and delamination occur in concert with the erosion of the stone.

Blistering is the swelling of the outer masonry layers, accompanied by the rupturing of the thin uniform "skin." It can occur across or parallel to the bedding plane. Typically, blistering is associated with ground moisture and de-icing salts, and eventually results in more extensive surface peeling or delamination. There is evidence of blistering at the Capitol Building. A clear example occurs at the cheek walls at the west entrance. [*Figure 5.5.9*] The deterioration at this location is associated with ground moisture and de-icing salts.

Delamination is the sloughing off of relatively thin layers of stone from the face of the larger stone unit. Similar to blistering, it is most common in sedimentary stones, such as sandstone, and generally occurs along weak or weakened planes of the stone matrix. Mapping of the locations of both the existing and incipient delaminations revealed that while the damage is evident throughout, there is a much higher concentration of delaminated stone on the exposed projecting horizontal surfaces, particularly at the cornices above the basement and first floor levels. [*Figures 5.5.11 and 5.5.12*] The most severe deterioration at the cornice was observed above the south entrance, where there was delamination and long, horizontal cracks in the sandstone. [*Figures 5.5.1, 5.5.3, 5.5.8, 5.5.27, 5.5.26, and 5.5.36*] The quarter-round decorative stone element [ovolo] below the cornice stones exhibits severe delamination or exfoliation. The curved surface cuts across the bedding planes, allowing water to enter the stone more readily, thus placing the surface at greater risk of erosion when exposed to the continuous flow water. [*Figure 5.5.27*] During the survey, it was observed that fragments of exfoliated stone at the ovolo are in danger of breaking off. As recommended by the Design Team, the State retained a contractor to install netting around the deteriorated units to prevent fragments of stone from falling and damaging property or injuring persons. The Design Team recommended that the netting remain in place until the long-term masonry repairs of the cornice units are completed as part of the restoration of the exterior building envelope. [*Figure 5.5.1*]

Delamination also occurs at the flat surfaces that once supported the columns at the South Elevation of the Phase II 1890 additions. These columns were moved to the end bays when the Phase III wings were completed in 1917, leaving the top surfaces exposed to the weather. [*Figure 5.5.10*] Delamination is also evident at the balusters at the south entrance. [*Figure 5.5.13*]

Erosion is a more generalized breakdown of the stone, where its binders fail and the stone is reduced to its constituent elements, which then fall away or erode, under the influence of wind and water movement. Most of the stone erosion appears to be deterioration that occurs as a consequence of the delamination. Once the surface of the stone has been lost, the body of the stone behind the delamination appears to be particularly friable and vulnerable to further stone loss, which then appears to progress rapidly. Erosion occurs at the same locations where there is blistering and delaminated stone. It is evident at the exposed horizontal surfaces of the cornices above the basement and first floor levels. [*Figure 5.5.3*] It is also evident at the basement level window jambs, which have been patched with cementitious patch material. Severe erosion has occurred at the stairs and column base at the west entrance, where de-icing salts are used regularly. [*Figure 5.5.15*]

Efflorescence

Efflorescence is the formation of soluble salts at the surface, and just below the surface, of the masonry. It is caused by the dissolution, transportation, and deposition of salts in the masonry as water migrates through it and evaporates. The salts are varied and generally exist in the walls as part of the wall constituents, that is, in the stone or the mortar. [*Figures 5.5.14, 5.5.27, and 5.5.28*] In many cases, the salts are related to the de-icing salts used during the winter months by building personnel to keep the stairs clear. [*Figures 5.5.9 and 5.5.15*]

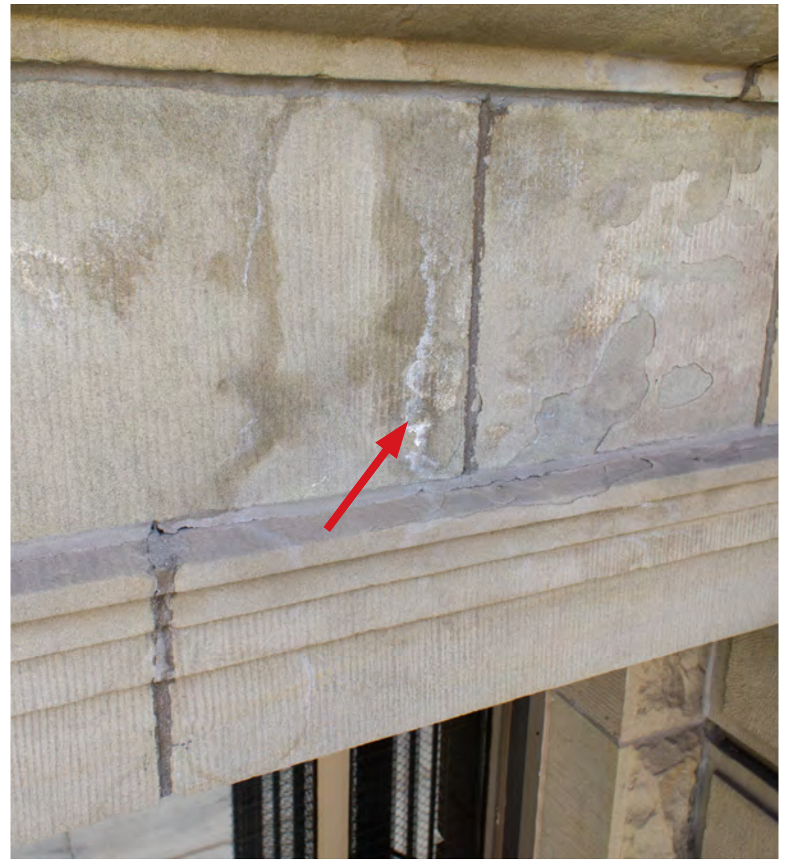

Figure 5.5.14: Efflorescence and Delamination at Some Locations in the Entablature Below the Cornice.

Figure 5.5.15: View of Severe Erosion at West Entrance Due to the Use of De-Icing Salts.

Figure 5.5.16: Typical Staining Where Stone Has Been Treated During Previous Repair Campaigns.

Figure 5.5.17: Cracked Stone Units and Open Joints at the East Elevation. There is a cracked stone unit above a joint that had opened up and was repointed. This is directly above a displaced cornice unit suggesting there may have been some movement at this location.

Figure 5.5.18: East Elevation Cracked Stone and Mortar Joint at the Cornice above a Cracked Stone Unit That Has Been Repaired.

Figure 5.5.19: Displaced Stone Unit at the East Elevation Adjacent to a Wide, Open Joint.

Figure 5.5.21: Fire Stair installed at the North Elevation in 1958.

Figure 5.5.20: Masonry Cut and Damaged to Accommodate the Fire Stair Handrails at the North Elevation.

Figure 5.5.22: Damage and Staining to Stone Caused by Installation of Steel Structure at Glass Enclosures at the North Elevation.

Figure 5.5.23: Spalled Stone Adjacent to Glass Enclosure at the North Elevation.

Efflorescence is a primary, or "first tier", indicator of masonry deterioration as it is a byproduct of water entry and is composed of constituents of the masonry that have been dissolved. Mapping the efflorescence shows where significant amounts of water are evaporating from the building, which is usually near where it entered the wall assembly. There is also a strong correlation between the location of efflorescence and the incipient deterioration of stone, because formation of the salts exerts significant mechanical stress on the stone causing it to gradually break apart.

Efflorescence was observed at the cheek walls and stairs of the west entrance and at the base of the building at the south elevation. [*Figures 5.5.9 and 5.5.37*] It was also noted at isolated locations along the cornice above the first floor level, but most notably above the south entrance.

Soiling

The sandstone is moderately to lightly soiled with isolated areas of dark soiling. The darkest soiling occurs at the cornice projections. Some of the darkened appearance and discoloration at the cornices may be attributed to the consolidation and water repellent treatments that have been applied to the cornices in the past.

Despite evidence of bird control devices, there are localized areas of heavy accumulations of guano, particularly at the column capitals and in the sheltered porticos on the south, west and north elevations.

Inappropriate Treatments and Interventions

There have been several repair campaigns at the Capitol in an effort to extend the life of the building. During the survey, the Design Team noted a few inappropriate repairs to and treatments of the building. Some of these repairs include the following:

- ***Crack Repairs:*** At a few locations, it appears that the stone and cracks were treated with a water repellent or epoxy that has discolored the stone. [*Figure 5.5.16*]
- ***Cornice Treatments:*** At a few locations, drip marks were observed at the cornice suggesting that the cornice was treated with some sort of water repellent or consolidant as indicated on the 1994 masonry drawings. [*Figure 5.5.28*]
- ***Patch Repairs:*** Several composite patch repairs that do not match the color of the stone were noted, particularly at the cornice stone units. In addition many of the patches have cracked and failed. [*Figures 5.5.7, 5.5.24, 5.5.25, and 5.5.26*]
- ***De-icing Salts:*** The application of de-icing salts has caused damage to the stone. The most pronounced deterioration has occurred at the west entrance [*Figures 5.5.9 and 5.5.15]* and at the base of the building, particularly at the south elevation.
- ***Fire Stairs and Glass Enclosures at North Entry:*** The existing fire stairs were installed along the North Elevation in 1958 and the glass enclosures were installed at the north entries in 2002. The masonry was damaged when all of these structures were installed. When the stairs were installed, the stone was cut to accommodate the railings. [*Figure 5.5.20*] When the glass enclosures were installed, the stone cornice above the basement level was cut to receive the roof structure. [*Figure 5.5.22*]

There is also spalled stone adjacent to the steel frame where it abuts the masonry. [*Figures 5.5.20, 5.5.21, 5.5.22, and 5.5.23*]

5.5.4 Conclusions: Long-Term Concerns

It appears that the majority of the deterioration mechanisms identified in the masonry survey can be attributed to one of the following factors or combination of factors:

- ***Normal service-life deterioration:*** Deterioration that gradually occurs to the stone units over the life of the building (ie. mortar joints);
- ***Characteristics inherent in the sandstone masonry:*** The sandstone is highly porous and particularly vulnerable to the adverse effects of water infiltration.
- ***Original building design/detailing issues:*** Scuppers at the sandstone porticos provide an avenue for water to flow continuously across the sandstone surfaces.

Most of the severe masonry damage at the Capitol occurs at locations where there has been continual water infiltration into the sandstone wall assembly or where water is trapped within the wall itself.

Mortar Loss: Open and Deteriorated at Joints

At many locations, the condition of the sandstone is poor, and there is evidence of significant material deterioration at the sandstone units that are directly adjacent to open, deteriorated joints. [*Figures 5.5.3, 5.5.6 and 5.5.27*]

The first line of defense in extending the life of the sandstone masonry is to repoint the joints, particularly at the projecting cornices. All sealant should be removed from the joints and mortar should be installed. Typically, caulk or sealant should not be installed in masonry joints because it does not provide a long-term repair. [The life span of a sealant joint is approximately 5-7 years.]

To ensure a long-lasting durable joint, the joints should be raked out properly to remove all unsound mortar. [Typically, joints are raked out to a depth that is 2-1/2 times the width of the joint or a minimum of ¾".] The repointing mortar should replicate the color and texture of the original mortar and should be softer [measured in compressive strength] and have greater vapor permeability than the masonry units.

Because the skyward facing joints at the cornice projections are particularly vulnerable to weathering and deterioration, lead joint covers should be installed to protect these joints.

Cracks, Spalls and Voids

Several spalls and voids were noted adjacent to open joints, particularly at the cornices. This type of deterioration is also related to the material deterioration of the sandstone when it is in contact with continuous water infiltration. [*Figures 5.5.6 and 5.5.8*]

Cracking at the East Elevation, east end of the North Elevation, and the North Portico

The cracking and distress observed at the East Elevation may be related to the excavation of the steam tunnel in the 1970s, which was constructed very close to the foundation at the east end of the North Elevation. [*Figures 5.5.17, 5.5.18, 5.5.19, and 5.5.29*] The tunnel connects the Capitol to the Barrett, Hathaway and Supreme Court Buildings. The bottom of the tunnel is located below the bottom of the footings of the Capitol.

The cracking observed at the North Portico may be related to the construction of the tunnel to the Herschler Building in 1979.

It is not known if the cracks at the East Elevation, at the east end of the North Elevation and at the North Portico are static [no longer moving] or dynamic [continuing to move]. If the distress is related to the tunnel excavations, it can be assumed that the cracking is static and all that is necessary is to fill the cracks with mortar to prevent water intrusion into the masonry wall. However, because there are corresponding cracks on the interior that continue to move and require repainting, the cracks may be dynamic, particularly at the East Wing. In order to understand the cause of the cracking, the Design Team recommends the following:

- Full documentation of the location and configuration of interior and exterior cracks should be conducted to evaluate and correlate the configuration of the crack patterns.
- The cracks should be monitored with electronic vibrating wire gauges. To understand the seasonal impacts on the cracks, data should be collected for a minimum of 18 months.
- A geotechnical engineer should be retained to review the conditions and determine that there are no concerns regarding the soils that could cause ongoing movement [as a residual effect of the foundations being undermined by the tunnel excavations].
- Any new construction undertaken near the cracked and distressed elevations should be completed under a protection plan that monitors the cracks throughout the duration of the work. It may be prudent to repair, reinforce or brace the cracks during construction to prevent any further damage to the masonry.

Cracked Lintels and Jambs

Original shop drawings show that at least some of the stone lintels are hung from steel girders at the porticos. [*Figures 5.5.31 and 5.5.33*] It is assumed that there is a similar condition at some window openings. The cracks observed at the lintels are of some concern because the distress may be related to the oxidation of metal within the walls. Typically, ferrous metal functions in the masonry walls as anchorage and support. The problem with ferrous metals is that, when they rust, they expand, and in expanding, they exert large enough stresses on the masonry to cause it to crack or be displaced. Rust staining was noted on the ends of the threaded rods with the decorative plate washers and nuts, which appear to be original to the building. The corrosion could be related to the corrosion of the end of the rod only or it may

Figure 5.5.24: Cracked Patch Repair at the Corner of the Cornice on the North Elevation.

Figure 5.5.25: Cracked Patch Repair at the Cornice Below a Window at the South Elevation.

Figure 5.5.26: Cracked and Failed Patch Repair at the Cornice at the South Entrance. Some of the patches are in danger of breaking apart and falling.

Figure 5.5.27: Severe Distress and Deterioration at the Cornice Units Above the South Entrance. The distress includes delamination, erosion, cracking and efflorescence.

Figure 5.5.28: Sandstone Deterioration adjacent to Open Joints. There is delamination of the ovola [curved surface] directly below the joint as well as efflorescence staining.

Figure 5.5.29: Typical Pattern of Cracking at the East Elevation. At this location, the cracks have been repaired inappropriately with an epoxy material that stains the masonry.

indicate the more widespread corrosion of the steel structure above. The cracks observed at the jambs on the East Elevation may also be related to distress associated with the corrosion and rustjacking of the supporting steel. [*Figure 5.5.29*]

In the next phase of work, the Design Team will obtain all of the shop drawings available in the State Archives to verify the construction details at the stone lintels. It may also be necessary to conduct limited destructive probes at a few locations to determine the condition of the concealed steel and to identify the appropriate repair solutions. The final repair solution may entail the disassembly of the masonry lintel to remove the corrosion from the steel lintel and hangers. The steel would be reinforced as necessary and coated with a high performance coating, and the masonry lintel would be reinstalled.

Blistering, Delamination and Erosion

The delamination and exfoliation observed at the sandstone masonry is widespread and is related to characteristics inherent in the stone itself. The depth of loss ranges from 1/16", the depth of the outer stone layer, to in excess of three inches.

When Banner Associates conducted their survey in 1993, they retained the services of the Masonry Stabilization Services Corporation [MSSC] to test the sandstone and identify its rate of water absorption as well as its weathering characteristics. The testing confirmed that quartz is the primary mineral component of the Rawlins sandstone. The sandstone also includes plagioclase feldspar, kaolinite and sericite. Petrographic examination of the stone suggests that the sandstone has been weakened by weathering and the kaolinization of feldspar minerals. Water absorption of the Rawlins sandstone was measured at approximately 4% after 24 hours with 75% to 94% of the total absorbed in the first ten minutes of the test.[2] The 4% absorption rate is slightly above the 3% standard for quartzitic sandstone in ASTM C616-08 [Standard Specification for Quartz-Based Dimension Stone]. With a water soluble content greater than 1%, MSSC stated that the sandstone is particularly vulnerable to water-related deterioration.

The 1993 testing data confirmed that the Fort Collins sandstone at the base of the building is a more durable stone than the Rawlins sandstone with a lower water absorption rate. Over a 24 hour period, the water absorption of the Fort Collins sandstone was measured at 2.62%. The rate of absorption after 10 minutes was only 1.62%.[3]

Sandstone is highly porous, which leads to poor freeze thaw durability. Unlike some sandstone, the Rawlins sandstone contains clay, which makes it even more vulnerable to water damage resulting from freeze/thaw and wet/dry cycling. Water trapped within the body of the stone undergoes cycles of freezing and thawing and wet/dry cycling, swelling and washing out the natural clay binders in the sandstone. The trapped water also transports soluble salts from the mortars into the stone. Typical of porous sandstones, freeze/thaw cracks develop below the stone surface. As a result, the subsurface stone weakens and deteriorates. The outer surface then delaminates, exposing the deteriorated, disaggregated and friable subsurface to the weather.

Once the outer surface of the stone delaminates, the deterioration of the stone body accelerates. The process is not self-limiting; we cannot, at this time determine when, and at what rate, new damage will occur.

As one would expect, the most severe delamination and erosion of the sandstone occurs at locations where there is continual water infiltration into the wall assembly or water continually flowing across the stone surfaces, including:

- ***Open or failed joints at the cornices***
- ***Clogged or malfunctioning gutters and leaders:*** There is significant damage at the sandstone units where there are or have been malfunctioning internal rainwater leaders within the masonry walls. There is severe delamination and erosion at a column base on the east side of the North Portico where one of the original internal leaders is located. [*See Figure 5.5.35*] There was also significant damage on the west side of the South Portico at five stone units adjacent to the pilaster and window opening where another original internal leader is located. [*See Figure 5.5.34*]
- ***Scupper Locations:*** The primary cause of the severe deterioration at the South Portico is the presence of scuppers, which drain water from the portico balcony directly onto the cornice stones. Two pairs of scuppers cut through the bottom rail of the balustrade, each flanking the base of the center columns, allowing water to wash over the sandstone cornice stones during rain events. The deterioration of the sandstone units is most severe directly below the scuppers. [*See Figures 5.5.13 and 5.5.36*]
- ***Rising Damp:*** This occurs at locations at the base of the building, where there is rising damp or the upward migration of groundwater. [*See Figure 5.5.37*]

In the mid-1990s, consolidant treatments were applied to the eroded and delaminated stone surfaces, particularly at the cornices. The purpose of consolidant is to rebuild the binding matrices of the stone, while allowing the stone to breathe and prevent the water from being trapped in the stone. Consolidants are applied to the stone in a manner similar to water repellent. However, consolidant consists of monomers that are suspended in a medium [either water or alcohol] that penetrates deeply into the stone. It polymerizes within the stone as the medium evaporates, strengthening the stone by replacing the natural binding material. The evaporation of the medium ensures that the stone surface remains "breathable".

The disadvantages of consolidant treatments are that the consolidant must be reapplied every 10-15 years. There also have been several studies that state that the use of some consolidants will cause the stone to weather unevenly, that is, consolidated stone will weather differently than untreated stone.[4]

During the next phase of work, the Design Team will investigate the feasibility and effectiveness of consolidation treatments on improving the durability of the delaminated and eroded sandstone.

Figure 5.5.30: Previous Repair with Square Plates, Rods, and Bolts [at Cracked Stone Lintels].

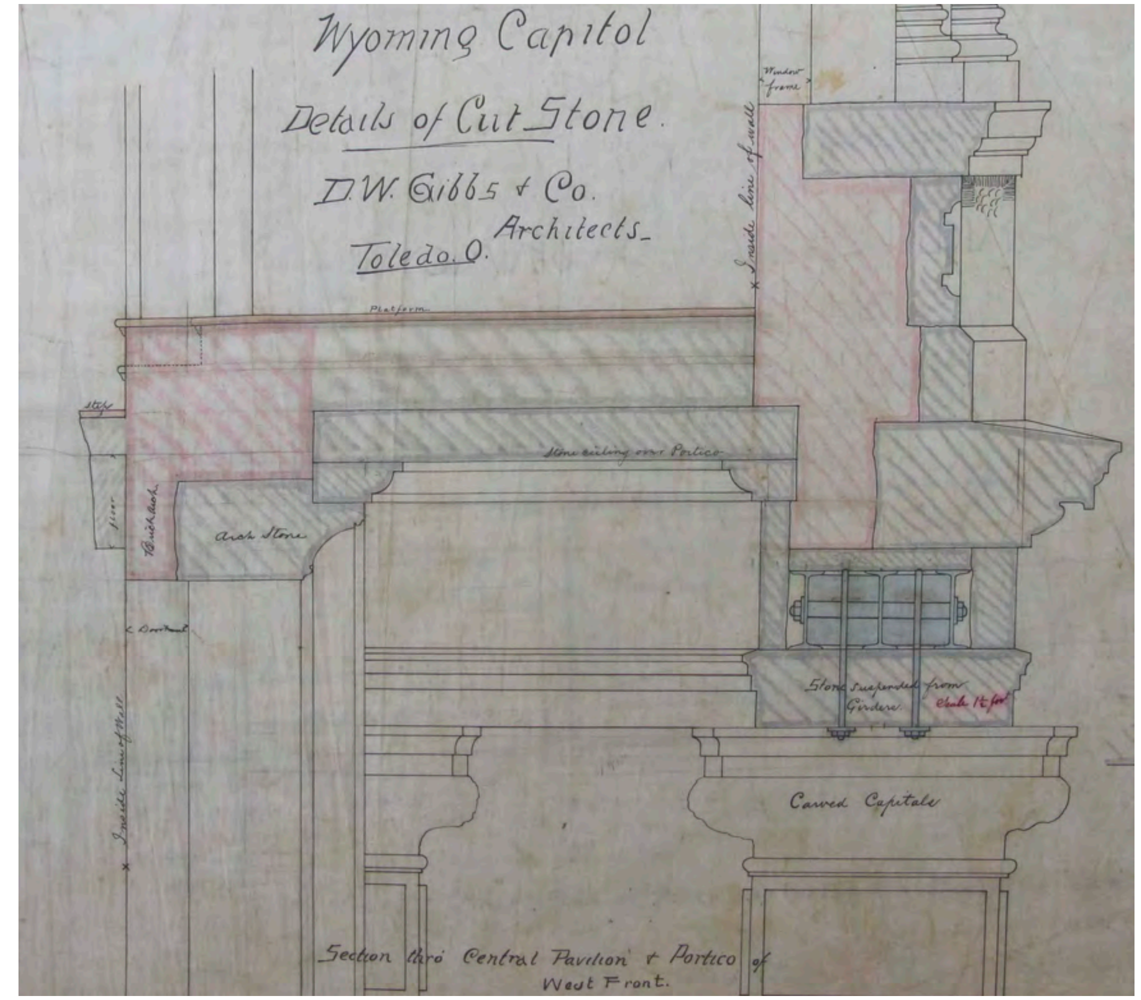

Figure 5.5.31: Original Shop Drawing Showing the Stone Hung from Steel Structure.

Figure 5.5.32: Cracked Lintel at South Elevation.

Figure 5.5.33: Decorative Washers, Bolts, and Rods, Part of the Original Design at Some of the Stone Lintels.

Figure 5.5.34: Delaminated Stone at South Portico Where There Is an Internal Leader.

Figure 5.5.35: Delaminated, Eroded Stone at the North Portico Caused by Malfunctioning Rain Leaders.

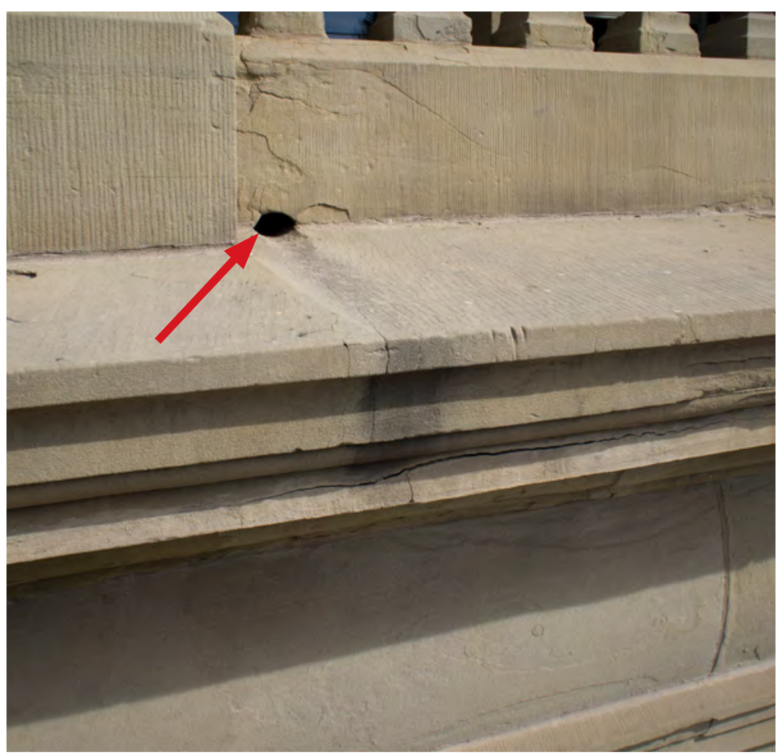

Figure 5.5.36: View of the Scupper at Cornice above South Elevation. Note the Stone Deterioration Adjacent to the Scupper.

Figure 5.5.37: Rising Damp and Efflorescence at the Base of the South Elevation.

In addition, careful consideration will be given to protecting the top surface of the cornice above the first floor windows with metal flashing. The protective cover should be designed in such a way that it is a reversible intervention and is visually unobtrusive.

Rainwater management at the south portico will be examined and redesigned to minimize the quantity of water flowing over the sandstone cornice units.

Efflorescence

The erosion of the sandstone at the window jambs at the basement level appears to result from the upward migration of groundwater. During the testing program conducted in 1993, salts were found in the sandstone scrapings from the window jambs, which explains the deterioration and widespread patch repairs at this location. Groundwater, as it migrates upward through the interior of the stone, transports dissolved salts. As evaporation occurs at the surface of the stone, some of the dissolved salts crystalize within the pores. Then, when the interior is wetted again, the salts are re-dissolved.

The cyclical hydration and recrystallization of soluble salts in the stone exert stress in the stone and ultimately cause the stone to break apart and crumble. Since the primary mechanism of efflorescence is the transportation of soluble salts via water migration, the first step in eliminating efflorescence is to eliminate the source, or sources, of water. Then, because soluble salts are hydroscopic, if there is a heavy reservoir of salts in the walls, they must be removed.

Failed Patches

The majority of the large the cementitious patches at the sills and cornices have failed. There are cracks at many of the patches. Visually, the color and texture of the patch material does not match the color and texture of the stone, and in some cases is visually obtrusive. Patch repairs are not as durable as replacement with new stone units or stone dutchman. At the cornices, in particular, we recommend the installation of stone dutchman at voids greater than 2" square in area. [*See Figures 5.5.24, 5.5.25, and 5.5.26*]

Summary

The conditions observed at the exterior masonry reflect a series of issues, including:

- In some locations, the masonry is over 125 years old.
- Though repairs have been performed to the exterior masonry envelope in the past - the most recent of which occurred in 1994 - the repairs were poorly executed or have failed.
- Aside from evidence of minor repointing at locations accessible from grade, there is no evidence of cyclical maintenance performed at the masonry.

The deterioration of the stone at the Capitol is progressing and, at some locations, accelerating. The observed conditions include:

- Open and Deteriorated Mortar Joints
- Cracks, Spalls and Voids
- Blistering, Delamination and Erosion
- Efflorescence
- Soiling

The majority of these conditions result from:

- Inherent characteristics of the sandstone masonry
- Water infiltration
- Weathering
- Inappropriate treatments and failed interventions
- Lack of a regular maintenance and repair program

As part of the Design Phase, the Team will develop a comprehensive repair program for the exterior masonry envelope, aimed at:

- Repairing deteriorated masonry
- Repairing areas "mutilated" by previous interventions
- Preservation of locations prone to deterioration [i.e. skyward facing surfaces, such as the projecting cornices]

Endnotes

1. D.W. Gibbs & Co., Architects, *"Specifications for the Erection and Completion of a Capitol Building for Wyoming Territory,"* Toledo, 1886, 7.

2. Banner Associates, Inc., *Evaluation of the Foundation and Exterior Masonry of the Wyoming State Capitol Building*, Laboratory Reports prepared for State of Wyoming, Department of Administration and Information, Facilities Management Division, December 1993, 11.

3. Ibid, 11.

4. James R. Clifton, Center for Building Technology, National Engineering Laboratory, National Bureau of Standards, *Stone Consolidationg Materials: A Status Report*, sponsored by the National Park Service, Washington, D.C. http://www.cool.conservation-us.org/byautho/clifton/stone4.html, November 23, 2008.

Figure 5.5.38: The Projecting Cornice Above the South Portico Entry Stair, Where Severe Deterioration of the Stone Was Observed.

Figure 5.6.1 South Elevation Wyoming State Capitol Windows, ca. 1910.

Figure 5.6.2 Detail of Original Windows at South Portico, ca.1888.

Figure 5.6.3 West Elevation of the Capitol, Looking Northeast, ca. 1979. The photograph was taken as part of the HABS documentation. Note that the original third floor windows have been replaced, while the remaining windows are original.

Figure 5.6.4 Detail of Replacement Window at the Third Floor. It appears that the original wood frames have been capped in metal.

5.6.1 Windows

Introduction

The large window openings at the Wyoming State Capitol are significant character-defining elements that articulate the hierarchical and symmetrical tripartite rhythm and organization of the facades. Arched openings adorn the upper floors of the central porticos, the 1917 wing additions on the south and north facades, the upper or third floor level of the central portico on the west façade and the pedimented central bay on the east facade. At the third floor level, the Phase I wings that flank the north and south porticos and the areas flanking the central bays at the east and west elevations bear small, almost square window openings. Typically, large rectangular openings illuminate the second floor level. There are both rectangular and segmented arch windows at the first floor level and small rectangular openings around the perimeter of the building at the basement level. [*Figure 5.6.1*]

Original Windows

The majority of the original windows were wood one-over-one double-hung windows.

The specifications for the original windows indicate that the third story windows [the arched and square window openings] should have head pockets with a sufficient depth to allow a sash to be raised two feet. It also stated that the sash is to consist of a check rail that is 2-1/4 inches deep. "The frames are to be molded, and parting stops cut in the center to allow the sash to be taken out at the bottom." The specifications direct the Contractor to prime the outside of the frames and sash, and apply two coats of dark olive or bronze green to the sash. The frames were to be stone colored and sanded.[1]

The historic photographs from 1902 and 1930 confirm that the windows consisted of a molded frame, which was stone colored with a dark sash. [*Figure 5.6.6*] During this period, sand painted finishes were used. Typically, sand was applied to the paint when it was still tacky. The final appearance of the sanded paint finish was, most likely, very close to the color and texture of the sandstone. A 1902 photograph shows a molded frame that blends into the color of the sandstone surround. Historic photographs also show that almost all of the original windows consisted of large expanses of glass without muntins. [*Figure 5.6.2*]

Window Modifications

Archival research suggests that the window modifications were performed in a series of phases over approximately twenty [20] years, with the earliest phase beginning in 1960. The photographic documentation completed by the Historic American Building Survey [HABS] in 1979 indicates that, by this time, at least some of the third floor wood sashes had been removed and replaced with metal sashes. However, in the 1979 documentation, all other windows at the basement, first and second floor levels appear to be the original wood windows. [*Figure 5.6.3*]

Sometime after 1979, all remaining wood windows, except some at the dome, were removed and metal windows were installed. It appears that at the third floor level, the original arched wood window frames were retained capped in metal. [*Figures 5.6.4, 5.6.5 and 5.6.7*] It may be that other original frames remain in place and were only capped with metal. Further investigation is required to determine the extent of original window fabric remaining on the building.

Other Window Modifications

The second floor window openings on the East Elevation were infilled with stone sometime during the late 20th century when the monumental interior spaces in the East Wing were renovated.

Assessment of Existing Windows

The historic photographs indicate that the metal windows are probably a minimum of 25-30 years old and are at the end of their useful life. At several locations, the joints are wide and filled with sealant that has failed. At other locations, it appears that the metal windows did not fit tightly into their openings. Water spray tests performed by GB Geotechnics at Room H8 [third floor] indicate that water did infiltrate through the top of the window through an opening that was integral to the design of the metal replacement windows. [Refer to the Comprehensive NDE Program of Building Envelope in the Appendix.]

Conclusions

The original wood windows are character-defining components of the Capitol Building.

- Historic photographs indicate that the original windows consisted of a molded frame, which was sand painted to mimic the appearance of the adjacent stone, with a dark painted sash.
- Beginning in the 1960s, the Design Team's research suggests the original window sashes were progressively replaced with metal windows, while the wood frames were covered with metal cap flashing.
  a. Visual observation of the exterior windows indicate that the metal windows are well beyond their useful service life and need to be replaced.
- During the Design Phase, a detailed assessment of the exterior and interior window conditions will be conducted to:
  a. Confirm the presence of original wood frames and/or sashes by means of destructive examinations [probes]
  b. Perform selective finishes analyses of any existing window fabric uncovered as part of the destructive examinations.
  c. Determine how much, if any of the historic window fabric, can be salvaged, repaired and restored
  d. Document the historic window composition and detailing for use within the design documents.

Often with wood windows, cracked paint and other deterioration are seen as signs of failure, resulting in the wholesale replacement of components or systems. In reality, wood windows, when regularly maintained, perform better than their metal counterparts. In a climate such as Cheyenne, where the humidity is consistently low, many of the issues inherent with wood are not present. In addition to being historically accurate, with proper maintenance, well designed wood windows have the ability to out-perform metal windows.

End notes

1. D.W. Gibbs & Co., Architects, *"Specifications for the Erection and Completion of a Capitol Building for Wyoming Territory,"* Toledo, 1886, 7.

Figure 5.6.5 Detail of North Elevation Looking South. Note Replacement Windows.

Figure 5.6.6 Detail of Original Wood Windows, ca.1902. The sand colored frame is highlighted at right. The dark painted sash is indicated with the red arrows.

Figure 5.6.7 Replacement Windows at North Elevation, Looking South.

Figure 5.6.8 Main Entry doors at South Elevation.

Figure 5.6.9 Entry at West Elevation, ca. 1979.

5.6.2 EXTERIOR DOORS

The original exterior door openings are the monumental doors at the central porticos on the south, north and west facades. The arrangement and ornamentation of both the window and door openings at the South Portico reflects its prominent function as the primary and ceremonial entrance to the building. The door at the South Portico consists of two pairs of raised paneled wood doors with a segmental arch transom above the door. Each pair of doors flanks a wood fluted column, which extends upward to divide the transom window. A large rectangular raised panel is at the center of the door with a raised circular panel and an arched pediment above. The large central panel is flanked by two small columns. There are also two small rectangular raised panels at the bottom of the door. It is unclear whether the large rectangular and circular raised panels are original. They appear to be a different color than the door itself. [*Figure 5.6.8*] In addition, in historic photographs of the South Portico, there appears to be glass at the large central rectangular panel and the circular panel above.

The entrance doors at the West Portico are almost identical to the doors at the South Portico with the exception that there is glass at the central rectangular and circular panels. [*Figure 5.6.9*] The North Portico doors are detailed in a manner similar to the West Portico doors. However, there is only one pair of doors at the north entrance.

CONCLUSION

All of the main entrance doors appear to be original, to be in good condition and should be restored.

Service Doors

Several window openings have been modified to accommodate doors, particularly at the fire stairs on the North Elevation. There is a service door at the center of the East Elevation. Basement doors flank the stairs at the South Portico and are located within the "storefront enclosures" on the North Elevation.

CONCLUSION

As the design phase moves forward, the Design Team evaluate the need for and location of service doors to develop an arrangement that is appropriate to the appearance of the building and satisfies programmatic requirements.

Figure 5.7.1.1: Rotunda Looking East from the Third Floor Level.

5.7.1 Building Interior

Introduction

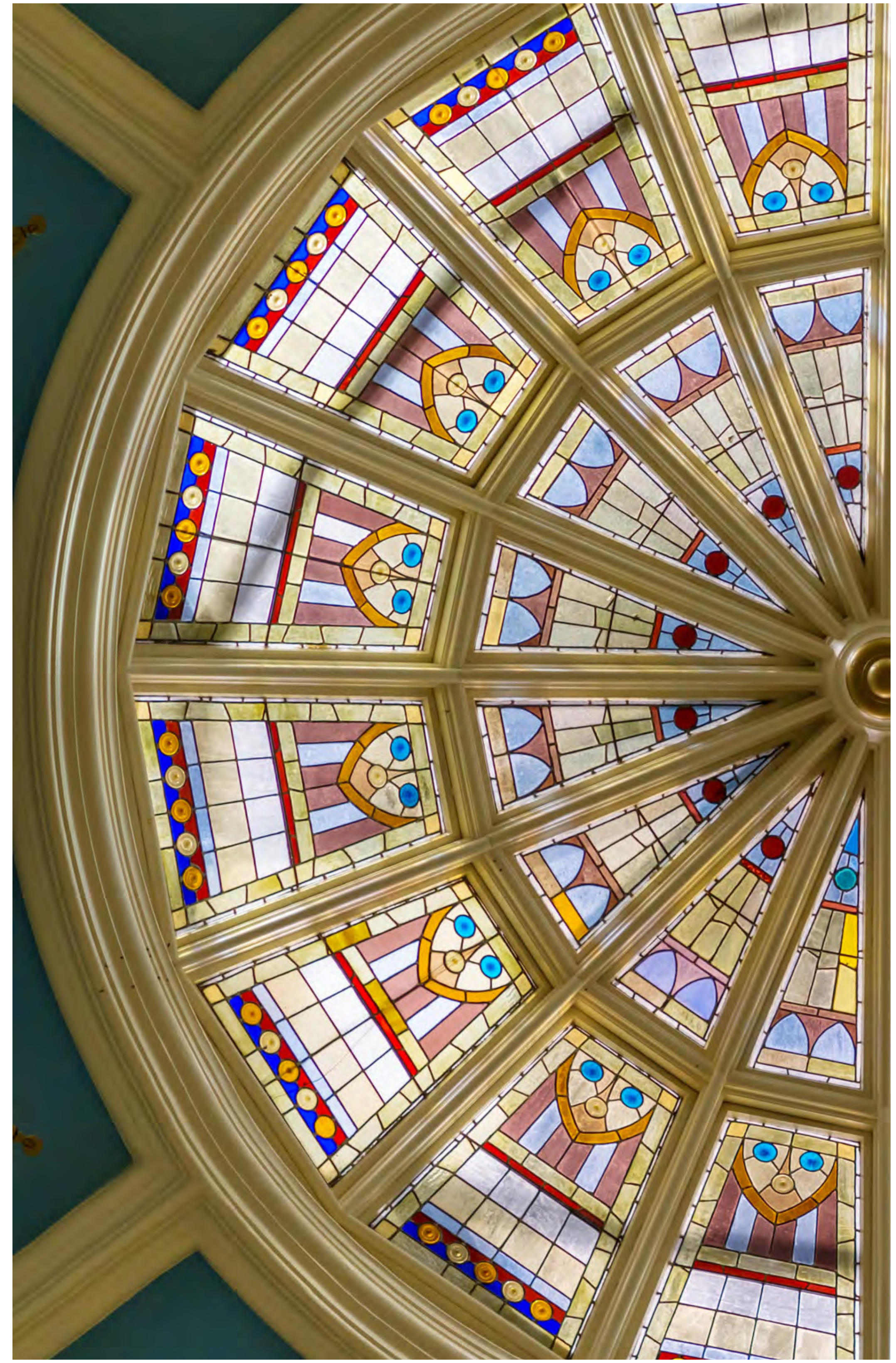

Figure 5.7.2.1: Underside of the Rotunda Laylight.

As part of the Level I / Level II Study for the Wyoming State Capitol, members of the project Design Team performed a comprehensive visual assessment of the building interior, including documentation of:

- Existing architectural conditions, including finishes, and signs of distress and/or damage
- Existing building systems, including vertical and horizontal distribution pathways and equipment condition and locations
- Existing architectural lighting, including natural and electric sources
- Existing condition of life-safety code items, including egress paths, fixture counts and guardrail heights

Members of the Design Team performed walk-throughs of the building interior with the assistance of members of the **Wyoming Department of Administration and Information** [A+I] and the Capitol facilities team during April and May 2013. The interior was documented using high-resolution photography in April and September 2013. In addition, the Design Team conducted interviews with a number of people with intimate knowledge of the Capitol's history. These included historians and former building staff members, painters and glaziers, and architects involved in past renovation projects. When combined with the parallel archival research being performed, the Design Team was able to develop an understanding of the evolution of the building interior, from 1888 to present.