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Pressing Forward: A Technical Study of the Mancos Times-Tribune Building With Recommendations for Conservation

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University of Pennsylvania

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Pressing Forward: A Technical Study of the Mancos Times-Tribune Building With Recommendations for Conservation

Abstract

The Mancos Times-Tribune Building is located at 135 West Grand Avenue in downtown Mancos, a small town of about 1300 in the Four Corners Regions of southwest Colorado. Built in 1911, it has served as the offices for the local newspaper, The Mancos-Times Tribune Building until the early 2000s. The building is unique for only serving a single function and owner throughout its over 100 year history. It is also in a remarkable state of preservation, making it an excellent case for studying the development of late 19th and early 20th century construction technologies. Through, the study of period literature, materials analysis, and review of conservation techniques for each material, a well-informed conservation program was developed to restore the building for future use by a town with a growing interest in preserving its heritage.

Keywords

sheet metal, cornice, ceiling, finishes, rehabilitation

Disciplines

Architectural Technology | Historic Preservation and Conservation

Comments

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PRESSING FORWARD: A TECHNICAL STUDY OF THE MANCOS TIMES-
TRIBUNE BUILDING WITH RECOMMENDATIONS FOR CONSERVATION

Samuel Tucker Loos

A THESIS

in

Historic Preservation

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Partial Fulfillment of the Requirements of the Degree of

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2015

Advisor
Frank G. Matero
Professor of Architecture

Program Chair
Randall Mason
Associate Professor

*For my parents,
who have encouraged and supported me more than anyone throughout my long, consecutive
academic career.*

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Chapter 1 – Introduction

The rise of the small town newspaper during the late 19th century helped define American democratic society, free to think nationally and govern locally. The town newspaper was the lifeline and identity of every community fortunate enough to have an editor and a press and its physical presence was often central to the town and its activities. In recent years, the small town newspaper and its civic presence has been disappearing from rural America. Its survival, if at all, is often through its rebirth as a consolidated enterprise produced digitally as well as remotely, leaving behind the physical presence of its former prominence on many American main streets.¹

In the southwestern corner of Colorado lies the small town of Mancos, gateway to Mesa Verde and home to one of the oldest newspapers in the state, *The Mancos Times*, founded in 1893.² In 1905 the newspaper enlarged to become *The Mancos Times-Tribune* and in 1911 the newspaper moved to its new home on Grand Avenue where it served as office and printing shop until the 1970s when it transferred to digital production in Cortez. The building remained in use by the newspaper's staff until 2011. In its one hundred year history, its function has never changed, making it possibly the oldest continuously operating business in the downtown district of Mancos.

The significance of the building owes in large part to the survival of its original design, contents, and singular use as a newspaper office and print shop for a century. Today the building is vacant but remains completely intact with its glass fronted, ornamental pressed metal façade and its original interiors and contents including a rare Cranston printing press, linotype machines, typesetter's benches, boxes of metal type and image blocks, and a complete archive of original newspapers from 1910-2010. Such situations are rare, especially for commercial spaces.

¹ Frank G. Matero, "Historic Structure Assessment - The Mancos Times-Tribune Building" (2014): 1.

² Fern Ellis, *Come Back to My Valley: An Early History of the Mancos Valley* (Mancos, CO: no listed publisher. 1976), 34.

Although once ubiquitous across the United States, newspaper office and print shops have been disassembled, their presses sold for scrap, and their contents dispersed.

The future of the Mancos Times-Tribune Building lies in the recognition of its historical significance and architectural integrity as well as its continuity as a place for promoting communication through the printed word and image. This was acknowledged and formalized by The Mancos Common Press, Inc. which was founded in 2014 to establish a center dedicated to the printer's art while restoring and reusing the historic building as a new facility for students and graphic artists. As the town continues to promote itself as an arts community and tourist destination, this enterprise will contribute to the development of the arts and education, and promote cultural tourism for the town and region while preserving and revitalizing a key historic building. It would also allow the physical presence of the "local town newspaper" to remain on the town's main thoroughfare while providing a model preservation project on the first locally designated historic structure in Mancos.

Mancos has demonstrated a strong desire for preserving its heritage, indicated from its number of designated sites, its recently restructured Historic Preservation Board and past rehabilitations of historic structures. Since the town has such a desire for preservation, the building itself can showcase "best practices" of technical preservation in accordance with the Secretary of the Interiors Standards for the Treatment of Historic Properties. As the building is the first to be locally designated, the project will serve as a pilot model program for the town, demonstrating 'rehabilitation through preservation', wherein the building itself is rehabilitated for a new use, but through the preservation of its historic fabric. This will reinforce the benefits of sound preservation approaches and methods for the town's many historic properties and especially for its recently created local designation program. It is hoped that the implementation of a well-researched and thorough conservation program informing the reuse of the Mancos Times-Tribune building will ferment renewed interest in the restoration and rehabilitation of the

Mancos' commercial core as well as its surrounding residential neighborhoods. It will be particularly useful for the three other buildings included in the original block, as these presumably were constructed using the same materials and methods as those found in the Mancos Times-Tribune Building.

Mancos Times-Tribune Building Description

The Mancos Times-Tribune Building is located at 135 West Grand Avenue, a main thoroughfare of the town and is a one and a half story, one part commercial block structure with a rectangular plan, flat roofline and subdued features. The building comprises about 760 ft² and is set at the edge of its lot, oriented orthogonally with its adjacent street, abutting it. The lot continues south, terminating at the Mancos River.

Concrete sidewalls provide the building's structure with a rear wall of horizontal wooden plank under corrugated sheet iron and a classic western commercial vernacular façade which maximizes the full height of the building. The façade is one and one half stories in height with its lower portion comprised of a recessed entrance, centered between two large glazed wooden polygonal windows over a plain concrete base (Figure 1.1). Its upper portion is capped with a pressed ornamental metal cornice with festooned decoration, below which lies a frieze and broad ribbed architrave. The rear wall has symmetrical fenestration with a central doorway, currently removed, flanked by double-hung, two-over-two sash windows. The roof is flat with a slight pitch to the south to shed water and flanked by duo-stepped parapet sidewalls.



Figure 1.1 Façade of the Mancos Times-Tribune Building (Author 2014).

The simple interior has an open rectangular plan with exposed concrete floor, plastered walls and pressed metal ceiling of a uniform pattern without a molding or other decorative features (Figure 1.2). A border of wallpaper, directly below the ceiling, is evident in areas of deteriorating paint and a plain baseboard runs along the three plastered walls. The ceiling was originally plastered (Figure 1.6) put later replaced possibly due to a fire from the heating stove as suggested by charred roof rafters above. The interior of the façade windows contain flat seats or display areas finished with original narrow bead board wainscot paneling.



Figure 1.2 Interior view looking towards the rear wall (Author 2014).

Short History of the town of Mancos and the Mancos-Times Tribune

The small town of Mancos is located in Montezuma County of southwest Colorado in the Four Corners Region. It lies at the mouth of Weber Canyon in the Mancos Valley. The region's earliest inhabitants were the Pueblo peoples, known for their cliff dwellings, whose presence in the area can be traced back to 600 A.D. After their migration out of the region around the turn of the 14th century, the Ute and Navajo tribes became the dominant inhabitants. The region then became part of New Spain and later, Mexico. After becoming territory of the United States, cattle ranchers and miners were the first Anglo-Americans to establish permanent settlements in the Mancos Valley in the 1870s with Mormon pioneers from southern Utah settling in Weber Canyon soon after in 1881.³ Currently, the town has a population of just over thirteen hundred.⁴

³ Ellis, *Come Back to My Valley*, 19.

⁴ "Community Facts – Mancos town, Colorado," *American Fact Finder – U.S. Census Bureau*, census.gov, factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

The history of Mancos begins, like that of many other western towns, with a search for gold. Captain John Moss led an excursion of seven other men seeking mining prospects in the La Plata Mountains. In July 1874, the party traveled through the Mancos Valley. Their trek would end at the La Plata River about fifteen miles west of the valley, but all seven men later returned to the valley the next year to settle. Dick Giles is credited with building the first permanent structure by a white settler in the valley, a log cabin, during the winter of 1875-76.⁵ Cattle ranchers would begin to settle in the area the next year.⁶ The area then began to establish a more permanent footing as women and children arrived, and a post office was erected along with other institutional buildings such as a school in 1878⁷ and churches of various denominations.

The town itself was laid out in 1881 and initially consisted of a school house, three settler's cabins, and a store established by George Bauer.⁸ It was officially incorporated by the state in December 1894 with George Bauer serving as its first mayor.⁹

The Mancos Times was established in 1893 as the town's first newspaper with C.M. Danford as editor.¹⁰ In its inaugural edition on April 28 of that year, the paper stated their mission candidly: "We have no political friends to reward or enemies to punish-in fact, no axe to grind. We hope to be of service to Mancos and her people, and bring her wonderfully rich resources to the notice of the world."¹¹ This early date of publication makes it one of the oldest newspapers in Colorado. Danford was replaced as editor after three months' time by W.H. Kelly, a more seasoned newspaperman, who headed the paper until March of 1904.¹² *The Mancos Times* was

⁵ Ellis, *Come Back to My Valley*, 1-3.

⁶ *Ibid*, 4-5.

⁷ *Ibid*, 9.

⁸ *Ibid*, 13.

⁹ *Ibid*, 43.

¹⁰ *Ibid*, 34.

¹¹ C.M. Danford, "Our Salute," *The Mancos Times*, April 28, 1893, Colorado Historic Newspapers Collection, coloradohistoricnewspapers.org, 1.

¹² Ellis, 37.

originally housed in a one-room wooden building constructed for the paper (Figure 1.3). The building was located on the site of its latter, more permanent home.¹³ This building was moved in the 1930s near a footbridge crossing the Mancos River, just west of the Mancos Times-Tribune Building, where it remains today (Figures 1.4).



Figure 1.3 Interior of the original print shop of *The Mancos Times* and *The Mancos Times-Tribune* before 1911 (Ellis 1976, 77).¹⁴

¹³ "New Business Block," *The Mancos Times-Tribune*, Jun 23, 1911, Colorado Historic Newspapers Collection. coloradohistoricnewspapers.org, 1.

¹⁴ Photo dated July 1911 showing Ira Freeman, editor and publisher, and Mattie Holston, typesetter. Only known photograph of the original building's interior.



Figure 1.4 Original building which housed the office and print shop of the *Mancos Times* and later *Mancos Times-Tribune* (Author 2014).¹⁵

A rival newspaper, *The Mancos Tribune*, was established in 1902. George Blakely served as its founding editor, being replaced sometime after by Mel Springer. Two brothers, Ira S. and E. J. Freeman, purchased *The Mancos Times* in 1904 and in 1905 also purchased *The Mancos Tribune*. That same year the two papers were combine into a single publication, *The Mancos Times-Tribune*, which had its inaugural printing on Friday, December 15, 1905 (Figure 1.5).¹⁶ The paper was published weekly on Fridays, was four pages in length and charged an initial annual subscription of two dollars, later reduced to a dollar fifty.¹⁷

¹⁵ Shows the current state of the building. Stabilization efforts have been rightfully aimed at maintaining a cohesive envelope and include covering openings with plywood, replacing the roof with asphalt shingles and placing the structure on a concrete pad.

¹⁶ Ellis, 72.

"Times-Tribune," *The Mancos Times*, Dec 8, 1905, Colorado Historic Newspapers Collection, coloradohistoricnewspapers.org, 1.

Dean & Son, "To the Public," *The Mancos Times-Tribune*, Dec 15, 1905, Colorado Historic Newspapers Collection, coloradohistoricnewspapers.org, 1.

¹⁷ "Advertisement," *The Mancos Times-Tribune*, Dec 22, 1905, Colorado Historic Newspapers Collection, coloradohistoricnewspapers.org, 2.



Figure 1.5 Masthead from the paper's first edition (*The Mancos Times-Tribune*, Dec 15, 1905, 1).

An eloquent editorial was included on the front page of the new paper's first printing which served to lay out the paper's platform, the values it intended to uphold and the aims and purposes it sought to fulfill while also being undoubtedly well-crafted to increase its own circulation. It begins by emphasizing the importance of the local newspaper and its reliance on the surrounding community, and in so doing, also provides a statement of purpose:

Believing as we do that the local press is or ought to be the most important factor in the development of a community and in directing its progress we enter upon this broader field of work with a feeling of no little responsibility for the magnitude of the undertaking. In order for the local press to perform its functions fully, it needs, it must have the unbiased and undivided support of the people in working out the chief ends, and aims of its existence. In order what we may accomplish the greatest good to the greatest number, in order that we may be effectual in promoting the general welfare of this people we ask your great, good will and support. In return for this we pledge ourselves to be honest in our belief, earnest in our efforts, and constant in our purpose to furnish all local news obtainable, such general news as is of interest to this section of country, and that our weight of influence, thought little it may be, will ever be on the side of right and justice as we see it.¹⁸

It then vowed that the paper: "shall be devoted first to the interest of rural homes as the first and most important safeguard against all social and political dangers, and secondly to the preservation, utilization and development of all our natural resources."¹⁹ The notice then ends with a stirring, populist appeal to rally the citizens of Mancos and Montezuma County:

To these ends, let us lay aside all differences, whatsoever, and unite all classes of men to all occupations, unite capital and labor, unite the weak and the strong, the poor and the rich, the employer and the employee in one grand and harmonious

¹⁸ Dean & Son, "To the Public," 1.

¹⁹ *Ibid*, 1.

effort, and let all this power be strongly put forth to make more, better, and happier homes.²⁰

On December 30, 1911 the paper moved to a larger and more prestigious building along Grand Avenue where it would remain in use by employees of the paper until the early twenty-first century.²¹ The structure was built as a “cement business block” by Miller and (Leon) Ashback and measured fifty-eight feet in length and thirty-three in width.²² The paper defended its expense of a new office and print shop in an almost obstinate manner, writing:

The weekly newspaper, plant and all, is a worth enterprise, a respectable business, the most essential of all to the progress, public spirit and development of the community, commercial, financially and socially... There is not a man in the community that works harder than the printer or puts in longer hours... For this reason we believe that the country newspaper should have a respectable and comfortable home...²³

The western twenty-five foot portion of the building was constructed with the knowledge that the paper would move into it upon completion. The same equipment from their original location was moved into their new home but with the expectation that in the future they would “be able to put in modern machinery.”²⁴ This ‘modern machinery’ would take the form of a Cranston newspaper press the following November.²⁵ The press, manufactured in Norwich, Connecticut, was one of the finest available at the time and would have distinguished the paper from others in the region. An interior photograph of the new office and print shop shows Ira Freeman, who became the sole editor in 1909,²⁶ and typesetter Mattie Holston with various

²⁰ Dean & Son, 1.

²¹ “Times-Tribune Occupies New Home,” *The Mancos Times-Tribune*, Jan 5, 1912, Colorado Historic Newspapers Collection, coloradohistoricnewspapers.org, 1.

²² “New Business Block,” *The Mancos Times-Tribune*, 1.

²³ “The Labor and Laborer is Worthy,” *The Mancos Times-Tribune*, Sep 15, 1911, Colorado Historic Newspapers Collection, coloradohistoricnewspapers.org, 1.

²⁴ “Times-Tribune Occupies New Home,” *The Mancos Times-Tribune*, 1.

²⁵ “Untitled,” *The Mancos Times-Tribune*, November 29, 1912, Colorado Historic Newspapers Collection, coloradohistoricnewspapers.org, 1.

²⁶ Ellis, 72.

furnishings, many of which survive today, and the Cranston Press behemoth (Figures 1.2, 1.6 and 1.7).

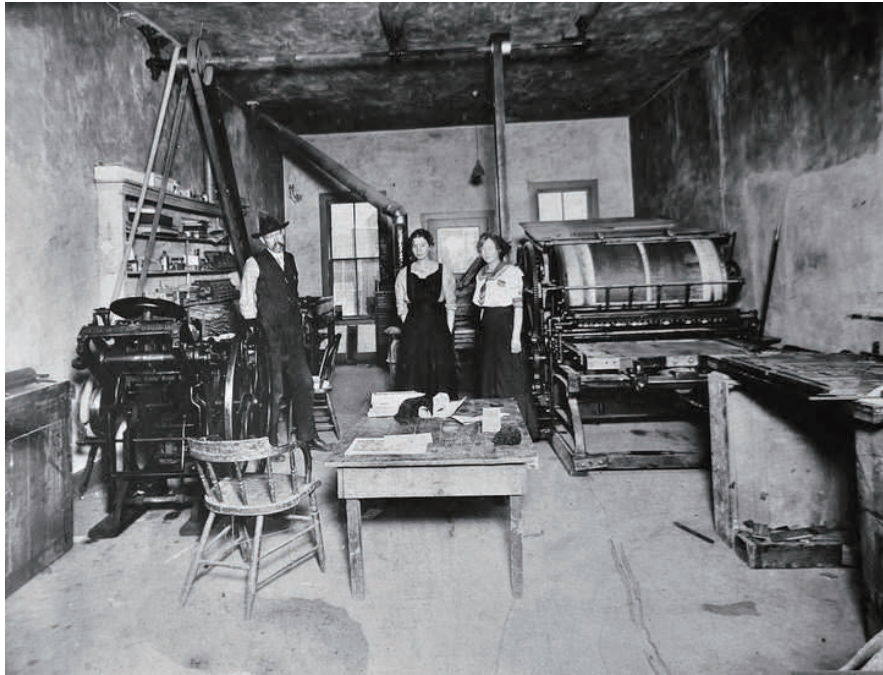


Figure 1.6 Interior of the Mancos Times-Tribune Building, circa 1912 (Matero n.d.).²⁷

Fires destroyed numerous buildings in the commercial district of Mancos around the turn of the twentieth century, including 1898, 1900, 1901, 1902 and 1907.²⁸ These local fires, along with the great fires of San Francisco and Chicago, likely prompted the use of ‘fireproof’ materials of concrete and plaster in this new commercial block. Concrete would allow the building to be fireproof without having to resort to more expensive materials, such as stone, while also flaunting an innovative technology which the equally fireproof, but common and dated brick could also provide. The fireproof nature of the building was highlighted by the paper itself along with the increased work space.²⁹

²⁷ This is the only known photograph contemporaneous to the building’s construction.

²⁸ Ellis, 69-71.

²⁹ “New Business Block,” *The Mancos Times*, 1.

The Cranston press served the paper for many decades and was its main instrument for printing the newspaper and jobbing. At some date, the original belt driven system that operated the presses was removed and an electric motor was installed on the press. In 1971, it ran for the last time, as Cortez Newspapers, which came to own the *Mancos Times-Tribune*, converted to offsite electronic printing in Cortez for publishing its papers. The Cortez Newspapers later sold its job shop, which had been printing auction bills and other small-sheet work, ending the need for its lead typesetting equipment. These were taken to the Mancos Times-Tribune Building for storage. Throughout the 1980s and 1990s, although the editors of the *Mancos Times-Tribune* were employees of Cortez Newspapers, the original office was maintained and editors worked on the premises at least part of the week. In the early 1990s, a temporary plaster board partition wall was erected to aid in heating the front part of the building, keeping the contents of the back room concealed untouched.

The Durango Herald purchased the Cortez Newspapers group in 1999, of which the *Mancos Times-Tribune* was a part. The building was vacated shortly after in the early 2000s. Sometime thereafter, the conglomeration of local southwestern newspapers, which includes the *Cortez Journal* and the *Dolores Sun*, was purchased by Ballantine Communications Inc., based in Durango, Colorado. *The Mancos Times-Tribune* is still in publication today, but is done so entirely online.

The Ballantine family has expressed a strong commitment to continue publishing the newspaper, to preserve the building, and to curate the historical typesetting and printing equipment and eventually make it available for public view. In 2013-14 the building was documented by members of the Historic Preservation Program at the University of Pennsylvania, using archival research, photography, and measured drawings, and a detailed condition survey was prepared. Its contents were inventoried and placed in storage, and the Cranston printing press was rehabilitated and made operable by Matthew Neff of the University's Common Press.



Figure 1.7 Profs. Frank Matero (left) and John Hinchman (right) assessing a linotype machine inside the Mancos Times-Tribune Building (Shinn, “Preservationists Protect History at Mancos Times,”).

Historic Preservation in Mancos

There is currently a strong desire within the community for preservation of their town. Four buildings are listed on both the National and State Registers of Historic Places, with one archeological district on the state register.³⁰ The Mancos-Times Tribune building being the first property locally designated by the Mancos Historic Commission earlier this year. Given the town’s small population, the proportion of listed buildings is quite a feat.

Historic preservation is not a new phenomenon in Mancos, but an increased enthusiasm in the area’s heritage has emerged within the past few years. The Mancos Valley Historical Society was ‘reorganized’ in November 2013 and now hosts regular monthly meetings.³¹ Two historically sensitive rehabilitation projects have been undertaken in listed buildings in recent

³⁰ “Listings by County – Montezuma County,” historycolorado.org, historycolorado.org/archaeologists/montezuma-county#mancos.

³¹ “Home,” mancosvalleyhistoricalsociety.com.

years. The Bauer Bank block (Figure 1.8), constructed 1905, underwent restoration in 1997. The project, led by Charlie Mitchell, received the Hart Archaeology Award for commitment to archaeology and historic preservation from History Colorado the following year.³² By 2003, the Mancos Opera House (Figure 1.9), directly across from the Mancos Time-Tribune Building, had received \$166,800 in State Historical Fund grants for structural stabilization and assessment.³³



Figure 1.8 Bauer Bank Block (“Hart & Governor Awards,” *History Colorado*, historycolorado.org/archaeologists/hart-governor-awards).

³² “Hart & Governor Awards,” *History Colorado*, historycolorado.org/archaeologists/hart-governor-awards.

³³ Alyson McGee, “The Community and Economic Benefits of Historic Preservation and the Arts,” *History Colorado*, historycolorado.org, historycolorado.org/archaeologists/community-and-economic-benefits-historic-preservation-and-arts.



Figure 1.9 Mancos Opera House (“National Register #87002183,” NoeHill Travels in the American West: Colorado, noehill.com, noehill.com/co_montezuma/nat1987002183.asp, date taken: July 17, 2010).

The proportionally large number of listings for a small town demonstrates the historic consciousness of local residents, but only recently has preservation become a function of the municipal government. A historic preservation code, which included establishing review criteria and a nomination process, was written with the help of a consultant around 2009.³⁴ The code was not utilized or enforced until 2014, when Betsy Harrison of the Mancos Common Press submitted an application for designation for the Mancos Times-Tribune Building. The application was later approved by the Mancos Board of Trustees on May 14 of that year, making it the first property to be locally designated on the “Mancos Local Historic Register” and holding a special place for the future of preservation in this community.³⁵

³⁴ “May 21, 2014 Minutes,” Minutes and Agendas – Planning and Zoning Committee, mancoscolorado.com, mancoscolorado.com/admindocs/MinutesPZ/20140521Minutes.pdf, 8.

³⁵ “May 14, 2014 Minutes,” Minutes and Agendas – Board of Trustees, mancoscolorado.com, mancoscolorado.com/admindocs/Minutes/2014Minutes/20140514Minutes.pdf, 3.

Until very recently, the Mancos Planning and Zoning Commission also served as the Historic Preservation Board, but in June 2014, the Commission began researching potential changes to its preservation code. The Commission hosted a joint workshop with the Board of Trustees and a representative of History Colorado, along with two public hearings on the proposed changes. These changes included making the Historic Preservation Board an independent body, separating it from the Planning and Zoning Commission, while also simplifying the process of listing on the local registry those properties already recognized at the state or local level and reducing the minimum age for designation consideration from fifty to thirty years. An ordinance which included all proposed changes was approved by the Commission at their March 18, 2015 meeting and later codified by the Board of Trustees on March 25, 2015.³⁶ Included within this ordinance was an addition to the city code which recognizes that “historic preservation has a positive impact on the sustainability of a community.”³⁷ It also strengthened the regulation of designated properties, requiring, rather than simply *requesting* as in the previous code, that their owners consult with the Historic Preservation Board before making any alterations.³⁸ These changes mark an increased interest towards preservation by both local residents and highlight gains in its political traction as government officials view it as a defensible public good.

³⁶ “March 25, 2015 Packet,” Minutes and Agendas – Board of Trustees, mancoscolorado.com, mancoscolorado.com/admindocs/Minutes/2015Minutes/20150325BoTPacket.pdf, 36.

³⁷ *Ibid*, 39.

³⁸ *Ibid*, 44.

Chapter 2 – Literature Review

No conservation program can be written without first understanding the materials and systems that comprise a structure and the various proven techniques used to conserve them. The following review is divided according to the material discussed and includes all three dimensions within each section.

The date range for published sources contemporaneous to the Mancos Times-Tribune Building spanned from the last decade of the nineteenth century through the first two decades of the twentieth century.

Ornamental Pressed Sheet Iron

Much of the literature published on sheet metal has taken the form of treatises which aim to primarily inform other tradesmen on a whole host of subjects related to sheet metal. One of the first trade manuals to discuss sheet metal was *The Practical Metal Worker's Assistant* published in Philadelphia in 1864 by Byrne. It is an enormous and comprehensive volume which encompassed an immense swath of metal related topics from forging to electroplating and includes a short chapter on sheet metal. W. J. E. Crane in his 1888 treatise *The Sheet Metal Worker's Guide* was the first work in England that published patterns on “galvanized iron cornice work.” There are many books on sheet metal, but the vast majority are concerned with pattern cutting and geometry and neglect the fabrication processes related to architectural elements. For many years, there was a lack of a comprehensive work which covered the subject of architectural sheet metal. It was not until the establishment of the trade journals that there was an interest and will to publish such a document. Oberlin Smith claimed that his 1899 treatise *Press-Working of Metals* was the first single volume devoted exclusively to pressed sheet metal.

The most useful and detailed information about decorative sheet metal and its industry was published in trade journals of the mid-late nineteenth and early twentieth centuries. They served as platforms to promote and improve the industry as well as providing advertising vehicles for companies. Foremost among them was *The Metal Worker*, which published weekly, beginning in 1874 and whose stated purpose was “to represent certain branches of the metal working industries which, until that time, had had no representation.” Another short lived but influential journal was *The Sheet Metal Builder*, which published an edition monthly, beginning in April 1874 but was sold and incorporated with *The Metal Worker* in August 1876.¹ Its first publication it described itself and its goals as follows:

The Sheet Metal Builder undertakes the collection and dissemination of information concerning all kinds of Sheet Metal work employed in Building. It attempts the collection of facts and data and the systematic arrangement of the same for the use of Architects, Builders, Cornice-Makers, Tanners and Roofers.²

Articles were also found in non-industry specific contemporary journals such as *Building Age*, *Carpentry and Builder*, *National Builder* and *The Decorator and Furnisher*.

Trade catalogues were first used by manufacturers as way to advertise their products beginning in the first half of the nineteenth century by American companies. *The Compendium of Architectural Sheet Metal* was one of the earliest to include sheet metal cornices along with other sheet metal ornamentation and was first published in 1876 by the Kittredge Cornice & Ornament Company. During the second half the nineteenth century, manufacturers began to increasingly take on the sole responsibility of advertising their productions. By this era, trade catalogues took on a more vital role, becoming the chief marketing tool for many industries, including sheet metal manufacturers.³ Manufacturers sent catalogues to builders and contractors who would pass them

¹ Thomas M. Harboe, “The History and Technology of the Sheet Metal Cornice,” Master’s Thesis in Historic Preservation, Columbia University, 1984, 18.

² Ibid, 13.

³ Pamela H. Simpson, *Cheap, Quick and Easy: Imitative Architectural Materials, 1870-1930*. Knoxville, TN: The University of Tennessee Press, 1999, 46.

along to common consumers, the real intended audience. These catalogues were designed to attract and impress consumers with the variety and quality of their products. Over the years, catalogues became more elaborate and longer in length as competition among manufacturers became fiercer.⁴

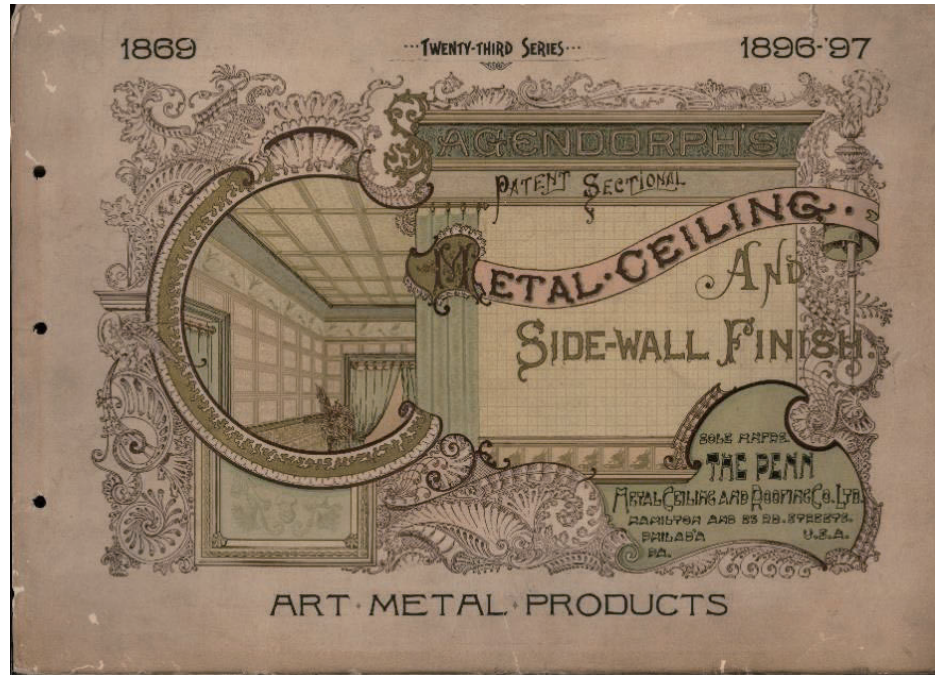


Figure 2.1 Cover of an 1896 trade catalogue from the Penn Metal Ceiling and Roofing Co. (Penn Metal Ceiling and Roofing Co. Ltd., *Metal Ceiling and Side-wall Finish*, cover).

Trade catalogues are an excellent source for illuminating both the products and manufacturing processes of the industry. The text within the catalogues is rather limited as the bulk of each catalogue is devoted to photographs or engravings of the manufacturers' wares. Illustrated trade catalogues for building materials were published primarily from the last quarter of the nineteenth century well into the mid twentieth century. They contain a wealth of information on technical aspects of fabrication and installation, but few provide insight into the

Pamela H. Simpson, "Ornamental Sheet Metal in the United States, 1870-1930" *Journal of Architectural and Planning Research* 11, no. 4 (1994): 300.

⁴ Pamela H. Simpson. *Cheap, Quick and Easy*, 48.

trade itself. They do not outline a history of the industry or the technological developments within it. The Avery Library at Columbia University and the Hagley Museum and Library both have large holdings of these kinds of trade catalogues.

The secondary sources mentioned below have included a limited number of these catalogues as part of their research, but the digitization of a large number of catalogues made freely available online affords a more extensive examination of their contents at the present time. My research specifically used the Association for Preservation Technology's Building Technology Heritage Library available at archive.org.

Some catalogues were devoted exclusively to a particular sheet metal element, such as the cornice or ceiling, while others included a much larger variety of sheet metal forms. Those which advertised only one type of product were shorter than those which were all-encompassing. This was reflective of the division within the sheet metal industry. Some companies were able to devote themselves to producing a single type of decorative elements, while others offered a more extensive product line. The typical product line of a company might have included large elements such as: finials, etc. and smaller motifs such as: modillions, brackets, leaves, garlands, etc.

The sheet metal industry began to expand rapidly in the beginning decades of the twentieth century as the number of uses for it increased and the techniques for manipulating it became more intricate and diverse. In response to this, a surge of treatises was published during this time to instruct sheet metal workers in the new processes of fabrication and forming metal. These have much the same purpose and were generally organized the same way as older, nineteenth century treatises, but these were for written for a new generation of sheet metal workers working with new machines and product designs. These treatises typically began with introductory lessons in practical geometry followed by discussions and diagrams on sheet metal tools, machinery and finalized shapes. Unlike the past, these treatises generally were focused on newly expanded uses of sheet metal for purely utilitarian purposes and did not include discussions

on architectural sheet metal elements such as cornices or ceiling tiles. An example of this form of treatise was the *XXth Century Sheet Metal Worker*, published in 1910 by H. E. Osborne. Within this same vein of instruction manuals are pattern books, such as *The New Metal Worker Pattern Book* which provide step-by-step instructions and visual diagrams on creating a multitude of shapes. *Roofing and Sheet Metal Work* by William Lowndes and D. Knickerbacker Boyd is an exception to this characterization of early twentieth century treatises and focuses on architectural uses of sheet metal, including cornices.

While primarily focused on new uses of sheet metal, some sources still addressed fabrication methods for sheet metal cornices and ceilings. One of the most popular appears to have been William Neubecker's *Sheet Metal Work*, which had four editions between 1919 and 1938. It included instructions for cornice work, but not any interior work. . Broemel's *Sheet Metal Worker's Manual* is in the same fashion, focusing on cornice work. These two sources provided the most information about the processes used in shaping architectural sheet metal. The 1925 *Instruction Manual for Sheet-Metal Workers* laid out step by step how to install sheet metal cornices and ceilings and included very helpful section views of the work. A later publication, *Roofing and Sheet Metal Work* from 1939, included a short section specifically about cornices and includes some interesting section drawings. It also contains a general discussion about sheet metal ornamentation that is applicable to cornices and ceilings.

In the past half century, architectural sheet metal has been neglected as a subject of intense research and interpretation. This is despite the dramatic shifts in architectural historiography within that same time to focus equally if not emphasize the mundane, everyday forms of architecture. Perhaps this sentiment has not pervaded the specific realm of architectural materials as deeply as it has architectural form and style. Ornamental and architectural sheet metal is often seen as a ubiquitous and imitative material, and thereby either forgotten by ambivalence by or outright hostility against its seemingly low quality nature.

There are only a handful of published secondary sources which address decorative pressed sheet metal and these provide general surveys rather than in depth analysis. Mary Dierickx has published two journal articles on the subject, one which focuses exclusively on metal ceilings and the other which discusses the entire realm of stamped metal ornamentation. Mike Jackson wrote a small piece relating historic metal ceilings and modern fire codes that included some historic information. Pamela Simpson wrote a brief history of the decorative sheet metal industry in the United States in the late nineteenth and the early twentieth centuries for the *Journal of Architectural and Planning Research* in 1994 which included profiles of some of the major manufacturers including the Mesker Brothers, W. H. Mullins and W. F. Norman. She also published two articles for *Perspectives in Vernacular Architecture* about imitative materials, one in 1989 about concrete block and another in 1995 about pressed metal ceilings. In 1999, these two subjects were included in her much broader survey of imitative materials titled *Cheap, Quick and Easy*. The book includes two chapters on ornamental sheet metal devoted to exterior and interior uses, respectively. Her 1995 article was copied almost verbatim, but it was expanded to include metal side walls. Both chapters provide a historical survey of the various uses of architectural sheet metal and the industry which produced it. Also included is a discussion of sheet metal's advantages and disadvantages and an overview of the debate around its imitative nature. *Metals in America's Historic Buildings*, one of the preeminent works on the subject, devotes a mere half page to chronicling the history of pressed sheet metal, emphasizing its uses as a roofing material. Thomas M. Harboe wrote on a specific topic in his 1984 historic preservation master's thesis for the Columbia University, entitled "The History and Technology of the Sheet Metal Cornice." The thesis is broad in scope within a narrow topic, covering the history of the trade, the common materials used in them and the processes of manufacture and installation.

No sources could be found, either in my own research or in consulting with Melissa Meighan and Adam Jenkins, both metals conservators, which spoke directly about the

conservation of pressed sheet iron. In speaking with Adam Jenkins, he thinks the typical response to sheet iron deterioration is simply to replace it. Often by the time deteriorated elements are addressed by a building owner, there are no other viable options due to the extent of deterioration on the thin material.

Since there were no specific sources on sheet metal conservation, general surveys about the conservation of metals became the focus of my research. Both the aforementioned *Metals in America's Historic Buildings* and *Metals* in English Heritage's updated Practical Building Conservation series address the history of metallurgy and metalworking before addressing the causes of deterioration and treatment for specific types of metals.

Concrete

Most sources found which were published during the above timeline were focused more on the testing of concrete rather than its use as an architectural material. Many of the treatises contemporaneous to the Mancos Times-Tribune Building included cements and concrete along with plasters and limes, rather than a standalone subject. Concrete appears to not have attained the ubiquitous status that it would come to hold in a short time. One contemporaneous source published a year after the building's construction was aptly titled *A Treatise on Concrete – Plain and Decorated*.

Sources were researched which specifically address the repair of cracks in concrete walls, which is the main concrete-related issue in the Mancos Times-Tribune Building. There have been a number of books published within the last twenty five years that discuss concrete repair in great detail and specifically address the problem of cracking. Most of the sources are not written by preservation-minded individuals, but by materials scientists or engineers. The most recent of these are *Concrete Structures - Protection, Repair and Rehabilitation* written by R. Dodge Woodson in 2009 and *Concrete Repair - A Practical Guide* by Michael G. Grantham from 2011.

Concrete Pathology, was edited by the conservation architect, Susan Macdonald, was a more broad survey of concrete's history, characteristics and problems, and did not provide specific information about crack and void repairs. *Guide to Concrete Repair* by W. Glenn Smoak is more specific and devotes individual sections about a material used in concrete repair, detailing the materials used to make it, and its preparation, application and curing. Smoak gives the parameters for each repair, discussing when and when not to use it. Smoak and Perkins agree that a resin injection, either epoxy or polyurethane depending upon the situation, is the best method for crack repair.

Plaster

A number of works contemporary to the Mancos Times Building have taken on the technology of plastering as a single subject. George Bankart's, *The Art of the Plasterer*, published in 1866, discusses the historical development of plasterwork in Britain and Ireland from the sixteenth to eighteenth centuries and is focused only on decorative plasterwork. He is also dismissive of most developments after the beginning of the eighteenth century. William Miller's 1897 work, *Plastering: Plain and Decorative*, appears to be the canonical work on the subject produced during this time period. The book's breadth of knowledge is extensive, providing a review of the history of plastering with chapters devoted to the material itself, its various applications along with writings on related materials, such as concrete. W. Verrall's *The Modern Plasterer* is in the same vein as Miller's work, but Verrall wished to update the knowledge on the subject. Both these works are written by Englishmen, but America produced their own treatises as well, including *Mortars, Plasters and Stuccos* by Fred Hodgeson, the 3rd edition published in 1916, and *Plaster and Plastering* by W. S. Lowndes in 1924. Later works continued in this treatise tradition, such as J. T. Sawyer's *Plastering* from 1951, and John R. Diehl's *Manual of*

Lathing and Plastering from 1960. While they fall out of the chronological scope of my research, they highlight the continued interest of the subject well into the twentieth century.

A 2002 Historic Scotland publication challenged many of the treatments recommended by other sources. It adhered to traditional methods rather than some of the more contrived treatments suggested by others. John Ashurst's popular *Mortars, Plasters and Renders in Conservation* was the exception and also recommended using traditional methods over more modern ones. Since the Historic Scotland publication was the most modern source and from a highly reputable institution, its recommendations were used over those from other older sources. The Historic Scotland publication was wary of using any modern adhesives and suggested only using traditional methods for strengthening or consolidation, while Bernard Feilden advocated the use of an acrylic resin. Feilden also advocated using plaster containing vermiculite rather than a tradition lime plaster. An English Heritage publication from 1991 recommended using plaster of Paris in plaster repairs and John Ashurst recommended using a mixture of mostly gypsum with a bit of lime.

Mixtures of different plaster coats were given in the Historic Scotland publication, and Ashurst's book, with both in agreement. No specific mixtures were found for creating cementitious plaster, though Ashurst provides a number of different ones for mortar.

The only source which wrote in detail about repairing loose plaster was Morgan W. Phillips', "Adhesives for the Reattachment of Loose Plaster." It was quite influential when it was first published, being cited in Bernard Feilden's book and in *Conserving Buildings* by George Weaver and Frank Matero.

Windows

Within the last twenty years, the writings on historic window repair have been prolific and the subject has become ubiquitous within the worlds of traditional craftsmen and preservation

academics alike. There are various forms of writings on window restoration and typically depend on the targeted audience. For preservation-minded homeowners or do-it-yourselfers, there are a multitude of informal blog posts on websites devoted to traditional crafts and trades along with more substantial and reviewed articles published by magazines such as *Old House Journal* or *This Old House*. Many reiterate very similar information about the procedure to follow in window restoration or repair and how the process is tied to sustainability. The proliferation of publications related to the topic of historic window restoration stem from the low skill level and low cost of materials needed to undertake a project. Despite the repeated restatement of information and rather straightforward process of historic window repair, the interest among the general public is very high and the number of publications on the subject will increase. Taking full advantage of these facts, *Old Windows Made Easy* by Scott Sidler is set to be released in March 2015 which acknowledges the large number of writings on the subject and vows to get straight to the subject, distilling the information from previous works and providing a step-by-step guide to repairing a single window type-the double hung sash window.

The more scholarly works published by preservation organizations such as English Heritage or the National Park Service take the form of short technical notes which include more detailed information and broaden their scope to include subjects such as project planning. These publications are tailored more to the professional preservationist. Also tailored to this audience and a publishing trend within the last twenty years have been monographs devoted to historic windows and their repair.

Unlike other sources that treated the subject of window restoration as a step by step guide or organized information around specific problems, *Windows: History, Repair and Conservation*, edited by Michael Tutton and Elizabeth Hirst, focuses its information around specific materials used in windows and the typical problems and treatments associated with each. The difference may be that it is written from a United Kingdom perspective, where a large variety of window

types and materials used in window construction are encountered. All the other sources were written from an American perspective, where wooden sash windows are predominantly encountered. Therefore, these American authors take as a given that the great majority of their audience will be working with that type of window.

Chapter 3 – Mancos Times-Tribune Building Assessment

Before undertaking any kind of technical study and treatment research on a building or structure, a physical assessment of its components must be conducted which includes a description and diagnosis of active and historic conditions or pathologies. For the assessment of the Mancos Times-Tribune Building, the structure was divided into systems with a technical description and condition assessment included for each. Only general descriptions of the building's technology and construction are given here with a more thorough discussion included in the next chapter. Conditions are described in-depth here with recommendations and treatment options provided in a subsequent chapter.

Much of the following survey is adapted from a historic structure assessment written by Prof. Frank G. Matero as part of a History Colorado grant application for the building. The assessment was conducted during two site visits, one in December 2013 and another on August 13, 2014, accompanied by the author.

Building Site

The building sits on a narrow rectangular lot measuring twenty feet in width and 105 feet in length, oriented on a north/south axis, and stretching from the sidewalk along Grand Avenue to the Mancos River (Figure 3.1). The building is situated on the front half of its lot with the rear portion containing no other structures and being mostly un-vegetated until the river's edge. As the western terminus of a four unit block, the building has always been connected with its eastern neighbor by a shared concrete party wall and exposed on the west. The adjacent lot to the west is currently vacant. The area behind the building and the adjacent lot are covered in gravel. The grade of the building and adjacent lots gradually slope at a roughly fifteen degree angle towards the Mancos River, leveling out near its banks (Figure 3.2).



Figure 3.1 Building site with adjacent vacant lot (Author 2014).



Figure 3.2 Sloping grade of the site and adjacent lot (Author 2014).

The site is in overall good condition. Its slope allows for adequate drainage, and being covered in gravel, deters erosion.

Building Climate

The building's structure provides very little insulation from exterior temperatures, allowing for significant changes in its internal climate throughout the year and even along the course of a single day. It shares a party wall to its west with a climate controlled occupied structure, but its remaining elevations - a bay windowed façade, uninsulated concrete sidewall and corrugated metal over wooden boarding rear wall - provide very little insulation. The building currently lacks climate control and has only had localized heating sources in its past.

Foundation

The east and west supporting walls and interior concrete flooring sit on a distinct concrete footing which in turns rests on a larger subsurface foundation of unknown depth (Figure 3.4). The footing contains very large aggregate, possible river rock from the nearby Mancos River, some of which are cobble size. It is exposed at the southern half of the building, but covered by the site's grade at its northern half. The foundation has a flat, even top upon which the footing was poured. It is almost entirely below grade, but its topmost edge is exposed at the southern end of the building. It appears to have the same size aggregate as the footing, without the cobbles, but it was not excavated for complete assessment.

The exposed and excavated portions of the foundation appears to be in good condition and are performing well. The surface of the footing has weathered to a degree, removing mostly cement binder along with some aggregate, creating a rough appearance. This weathering is occurring at a slow rate and has not compromised the foundation's structural integrity. The visible footing is solid with no apparent cracks or major loss of material. No damage from rising damp is visible.

A very large, mature cottonwood tree was allowed to grow at the rear of the building, closely abutting the corner of the south and west walls (Figure 3.3). Its growth undermined the rear wall, causing cracking and uplifting of rear concrete floor of the interior and south foundation. The tree was recently cut down, but its root mass and the displacement it caused still remain.



Figure 3.3 Stump of tree compromising the foundation and floor (Author 2014).



Figure 3.4 Two-part foundation with west supporting wall above (Author 2014).¹

Supporting Walls

The east party wall and exposed west wall provide the building's structure by supporting the roof and anchoring the north (façade) and south infill walls. They are constructed of poured in place concrete of an eight inch width. The west wall reveals the horizontal wooden plank formwork and ties used in its construction. The building's low-pitched roof is also distinctly outlined in the west wall. The walls were constructed in two sections of differing heights in response to the site's grade, forming duo-stepped parapets topped with a white sheet metal coping which similarly caps the north and south walls. The wall was poured in lifts and not divided vertically in line with the parapets. The only covering on the exposed west wall is a coating of white paint (Figure 3.5).

¹ Note the distinct boundary between the flat foundation exposed just below the surface of the soil and the rougher footing above.



Figure 3.5 Exposed west wall (Author 2014).

The supporting walls are in overall good condition. The concrete itself is of good composition, with minor conditions which are natural to the material. No freeze/thaw damage is present. There has been some weathering along the topmost portion of the parapets and on the very southern edge of the west wall (Figure 3.6), removing mostly cement binder along with some aggregate and the paint finish, creating a rough appearance. The weathering is caused by the abrasion of rainwater and its slightly acidic nature from the presence of carbonic acid. Small holes are present in a regular pattern are present on the west wall, formed from the removal of iron ties after the formwork was removed.



Figure 3.6 Weathering on southern edge of exposed west wall (Author 2014).

Two vertical and one horizontal cracks are visible on the west exterior (Figure 3.7) and another vertical crack on the east party wall (Figure 3.10), raising concerns about the structural integrity of the walls. All cracks have a linear path with no other cracks branching off from them. The three vertical cracks cut across the entire and widths of their walls and are visible on the building's interior (Figures 3.8, 3.9 and 3.10). The more northern (primary) crack on the west wall also cuts along its entire height and the vertical crack on the east wall likely does as well (Figures 3.7 and 3.8). This crack is also wider and more severe than the other two on that wall. The horizontal crack is along the lower portion of the west wall, beginning at the primary crack

and terminating at the southern edge of the wall. The vertical crack locations on either wall do not correspond to each other, with the east wall crack located between the two on the west. All adjacent crack faces are in plane.

The cause of these cracks cannot be confidently determined without a more detailed assessment and characterization. It appears that the primary vertical crack on the west wall is wider and more defined at its apex than its base, suggesting it was caused by settlement and a loss of support at the building's southern edge. Then, rather than having the force of the wall evenly distributed throughout itself, a fulcrum was created on both walls as the northern foundation remained stable and the southern lost support, placing downward force upon the foundation. The tensile strength of concrete is usually about 200-300 psi and cracks can form once the internal pressure of the concrete exceeds this.²

Settlement is the most plausible cause of the vertical cracks, but there are two other possibilities: expansion and displacement. The wall is one rigid mass with no expansion joints, making it highly susceptible to forces, loads and movement. It also lacks any climate control or any insulation, making it subject to drastic shifts in temperature as explained above. Concrete can “undergo length changes of about 0.5 inch per 100 linear feet for an 80 °F temperature change.”³ The wall itself could have formed its own expansion joint to relieve internal pressures. If this was the cause though, then the primary crack would have a uniform width. The other possibility is displacement by the large cottonwood tree at the rear of the building which could have exerted enough upward force on the foundation and thereby the floor and walls, to cause the crack. If this were the case however, the primary crack would be the inverse of what is currently observed, with the crack being wider at its base than its apex. The horizontal crack appears to be related to

² W. Glenn Smoak, *Guide to Concrete Repair* (Washington, D.C.: U.S. Department of the Interior, 1997), 37.

³ *Ibid*, 37.

construction and appears stable. Crack gauges are currently installed on the two primary vertical cracks and will be monitored for any movement to determine if the cracks are active.



Figure 3.7 Southern portion of exposed west wall with cracks highlighted (Author 2014).



Figure 3.8 Primary crack on west wall seen from the interior (Author 2014).



Figure 3.9 Secondary crack on west wall seen from the interior (Author 2014).



Figure 3.10 Crack on east wall seen from the interior (Author 2014).

Roof

The low-pitched roof is constructed of sawn wooden two inch by ten inch rafters, spaced every sixteen inches on center, running east to west and resting directly on top of the concrete sidewalls (Figure 3.11). The rafters are blocked for alignment, to resist rotation and to support a roof of eight inch wide decking boards. These are covered with plywood board and a rolled composite membrane, covered in tar and painted a silver grey color. Judging from its outline in the west sidewall, the roof has two slopes for shedding water (Figure 3.5). The first covers the vast majority of the roof and it at a low, continuous slope angled towards the south elevation.

This slope sharply drops off and levels out at the north elevation. Drainage openings were not observed on the façade, nor were any gutters or downspouts visible anywhere on the building.



Figure 3.11 View of the roofing system showing rafters and decking boards (Author 2014).⁴

The entire roofing system is overall in very good condition. The roof framing is structurally sound and bears no evidence of rot or active water penetration. Superficial charring, likely from an early stove fire, is evident near the south wall where it was originally placed. The fire did not compromise the load-bearing capacity of the framing. The outer roofing surface is also in very good with no tears, bubbles, or serious defects in the membrane allowing water infiltration. The flashing appears tight.

Rear (South) Wall

The rear wall is constructed of horizontal boards of varying widths (10"-12" x 1") nailed to a wooden framing system and covered with vertically oriented sheets of unfinished corrugated

⁴ The dark staining in the right corner is tar from the roof, not water infiltration.

iron. All materials on this wall are believed to be original to the building's construction. The boards are also attached to the concrete side walls with inset wooden posts that act as nailers. Recent plywood and corrugated iron additions cover the wall's openings, serving to re-enclose the building envelope and prevent weather or pest infiltration (Figure 3.3).

The original wall configuration consisted of a central door flanked by two wooden, double hung, two-over-two sash windows. This configuration can be seen in the only known photo of the building's interior that is contemporaneous to its construction (Figure 1.6). The door (now missing) was likely identical, or in a similar style, to the original front door still remaining. The panes are rather large, oriented vertically and are held in place by a glazing compound. They are surrounded on the interior with plain board trim and a projecting sill, which extends to the exterior.

The rear wall is in poor condition in terms of performance, and its historic integrity has been degraded due to the loss of the original door and two original window sashes. The original doorway was enlarged at some point with all traces of the door and its surround being removed. Two inch by four inch wooden framers have been recently installed within the opening created by this expansion, to provide increased support for the wall. The upper sash of the east window and the lower sash of the west window have also been lost (Figure 3.12). The remaining sashes have lost their panes and their glazing is deteriorated, but the wooden stiles, rails and muntins are structurally sound. The window surrounds have been retained and are in good condition. The unprotected corrugated iron has uniformly oxidized, forming a corrosion product of iron oxide, or rust, but appears structurally sound. The boards beneath are in good condition and have held up extremely well given their age and exposure. Wood checks are present, but those are a natural occurrence from the boards shrinking and expanding due to moisture content (Figure 3.6). Most importantly, no rot is visible on the wood.



Figure 3.12 Interior view of rear wall showing entryway and windows (Author 2014).

North Wall (Façade)

The north elevation is the real face of the building, providing its character and uniqueness as opposed to the simple and utilitarian nature of the other walls. The façade is in a western commercial vernacular style, utilizing a simple form with applied ornamentation of mass production rather than bespoke specialization. The façade is three bays in width and one and a half stories in height, and can be visually divided into two horizontal sections.



Figure 3.13 Façade of the Mancos Times-Tribune Building (Author 2014).

The lower portion of the building is comprised of a recessed entrance door centered between two wooden, three-over-three rectangular display windows. These windows are fixed in place and lack any operable openings. Their function is to provide light rather than ventilation like the sash windows in the rear wall which are meant to provide both. The windows are constructed with large flat glass panes which are held in place with interior applied quarter round wood moldings (Figure 3.14). Wooden muntins and mullions of uniform dimensions with flat faces and rounded edges provide the window's structure. A flat, wider sash at the tops and bottoms of the windows provide additional support. The upper row of windows has been painted white on their interiors to hide the installation of a drop ceiling. The first two columns of each window are flush with the building elevation with the third turning at a forty-five degree angle to form the recessed entryway. An additional of identical dimensions and style acts as a transom

above the entrance. The display windows are supported by a plain concrete base (Figure 3.15) and are bookended by decorative cast concrete quoins applied to the structural sidewalls and have smooth faces and curved edges (Figure 3.16). As viewed from the west wall, the quoins appear to be installed on the entire height of the façade, but are covered by the architrave and cornice on their upper portions.



Figure 3.14 Interior view of display window woodwork (Author 2014).



Figure 3.15 Concrete base of display windows (Author 2014).



Figure 3.16 Decorative concrete block attached to west sidewall (Author 2014).

The building's front entrance is a series of two doors: a wood-framed outer screen door and a solid wood entrance door. The screen door is possibly original and was likely installed to allow for ventilation on an otherwise impervious wall. With the back windows and front door open, and the screen blocking any unwanted pests, a draft could be created throughout the interior space, providing much needed relief during the hot, dry summers. The main entrance door is constructed of solid, plain-faced stiles and rails with a lower panel and surrounding coves and an upper plate glass window outlined by a thin raise bead with the two sections being divided by a large middle rail. A decorative cast metal handle, likely made of bronze or brass, is placed low on

the door, directly above the paneled base (Figure 3.17). It is made of a curved thumb latch pull attached to an oval field with floral patterns at the top and base and connecting ivy along the edges. A keyhole is set a few inches above the thumb piece.



Figure 3.17 Decorative thumb latch front door handle (Author 2014).

The upper portion of the building is comprised of an undecorated, ribbed metal architrave and capped with a decorative sheet metal cornice (Figure 3.18). The cornice itself is made up of two separate sheet metal sections. The frieze and the cornice made up one section and the ending trusse, so called by the industry, makes up the other. It is termed a trusse because it projects

beyond the moldings which terminate against its side.⁵ Two pieces are used to create the first section with a connecting seam visible just east of the elevation's center. The frieze has a repeating, raised relief pattern of a ribboned swag between triglyphs with thin, brush-like guttae set on a flat field. Half spheres in relief are set between the triglyphs. The upper cornice pattern is made of a central row of curved dentils surrounded by thin corona moldings. The trusse has flat sides and a flat, angled surface with pressed reliefs of the outlines of two rectangles surrounded by horizontal lines on its base and very simple variations of an akroterion surrounded by honeysuckle at its top. The shapes in relief are painted white with the rest of the cornice painted a kind of dark mint green. The white metal coping, wrapping around from the west sidewall, is attached to the very top of the cornice, puncturing it.



Figure 3.18 Decorative pressed metal cornice and architrave (Author 2014).

The façade is in overall excellent condition and has its original elements retained in their entirety. The windows are in very good condition with the only observed damage being two cracked panes in the upper row, but the woodwork is structurally sound with no indications of rot. The bottom part of the concrete base has begun to deteriorate, likely caused by de-icing salts (Figure 3.15). The salts enter into pores of the concrete when dissolved in water and then when they dry, they expand, creating pressure against the pore, causing the concrete to crack and erode.

⁵ William Neubecker, *Sheet Metal Work* (Chicago, IL: American Technical Society, 1919), 195.

The architrave and cornice are also in excellent condition. All joints appear tight and there are no signs of rust.

Interior Walls and Floor

The building's interior was originally designed as an open plan with very simple finishes. It currently consists mainly of three components: an unfinished concrete floor, plastered walls and a decorative, rolled sheet metal ceiling (Figure 3.19).



Figure 3.19 Southern view of the building's interior (Author 2014).

The solid concrete floor currently lacks any coverings or finishes, but red and green square tile was laid in the front office space of the building after publication operations ceased. Much is retained, but portions of the western section have been damaged or removed. A plain-faced baseboard follows the edges of the east, south and west walls. At the north section of the interior space, the recessed entryway creates an area for display or seating. This area is flush with the entrance door and is covered with bead board wainscot paneling with a grey finish (Figure

3.20). The three remaining walls are covered in cementitious plaster which is applied directly to the east and west sidewalls and onto strips of mill-sawn wooden lath on the south wall. All three walls currently have the same finish. A twenty inch ornamental paper board band has been revealed which was situated directly below the pressed metal ceiling, though it is not original to the building as shown in the before mentioned historic photograph (Figure 1.6).



Figure 3.20 Front of eastern window display area (Author 2014).

This photograph also shows that the original ceiling was plastered, meaning the current pressed metal ceiling was added at a later date. Its installation was likely prompted by an interior fire, evidenced by charred roof rafters. Residual lath and plaster from the original ceiling is present on every other ceiling joist indicating that the ceiling framing was originally reinforced with additional nailers and that the existing framing once supported the original plaster ceiling. It was likely damaged during the fire and completely removed during the metal ceiling installation.

The ornamental metal ceiling is attached to a series of joists $1\frac{1}{2}'' \times 7\frac{1}{4}''$ running east to west 16'' on center and hung from the roof framing by a simple nailed truss system (Figure 3.21).

The truss system is comprised of a series of 6" x 3/4" king posts placed midway on each joist running down the center of the ceiling and a series of diagonal braces of the same dimensions spanning the middle of each half joist length to the ends of the roof rafters.



Figure 3.21 Underside of pressed metal ceiling fastened to horizontal rafters and nailers (Author 2014).

The ornamental pressed sheet metal ceiling is composed of eight feet by two feet manufactured roll lengths nailed directly to the underside of the joists and added nailers laid between them. The design is a square grid with an inset repeated polygonal design and simple, three petal floral motif in each corner of the squares (Figure 3.22). The ceiling abuts the walls with a thin, quarter round applied wood molding. Splices and patches are evident in the ceiling relating to the original drive shaft mounts for the belt-system used to drive the presses and the various stove installations. This indicates the belt-driven system was still in place when the later ceiling was installed.



Figure 3.22 Pattern of the pressed metal ceiling (Author 2014).

Sometime after the building ceased to be used for publications, a drop ceiling and wall was added to divide the front quarter of the space. These new additions were made of sheet rock fastened to two by four lumber supports anchored to the roof framing (Figure 3.23). This was most likely added to reduce the heating costs for the office of the *Mancos Times-Tribune*, operating in the divided front quarter. To construct the drop ceiling frame, the pressed metal ceiling was cut through and pulled back rather than cutting complete holes (Figure 3.24). The dividing wall and two central drop ceiling supports have been removed, but the side ceiling supports remain throughout along with the sheet rock on the front quarter of the space (Figures 3.23, 3.24 and 3.25).



Figure 3.23 Northern view of the space between the drop ceiling and the pressed metal ceiling (Author 2014).



Figure 3.24 Remaining drop ceiling framing showing the cut pressed metal ceiling (Author 2014).



Figure 3.25 Peeled back pressed metal ceiling for removed drop ceiling supports and cut rectangle for removed stove (Author 2014).

Much of the furnishings in the interior are original and are deemed of historic value. The historic photo of the interior (Figure 1.6) shows that the shelving on the east wall (Figure 3.19) is original and has not been moved in nearly one-hundred years. A small chest with slender drawers is visible along the south wall in that photograph and is likely the chest of typeset still present (Figure 3.26). The Cranston press is in its original location and was recently restored to working order (Figure 3.27).



Figure 3.26 Possibly original typeset chest (Author 2014).

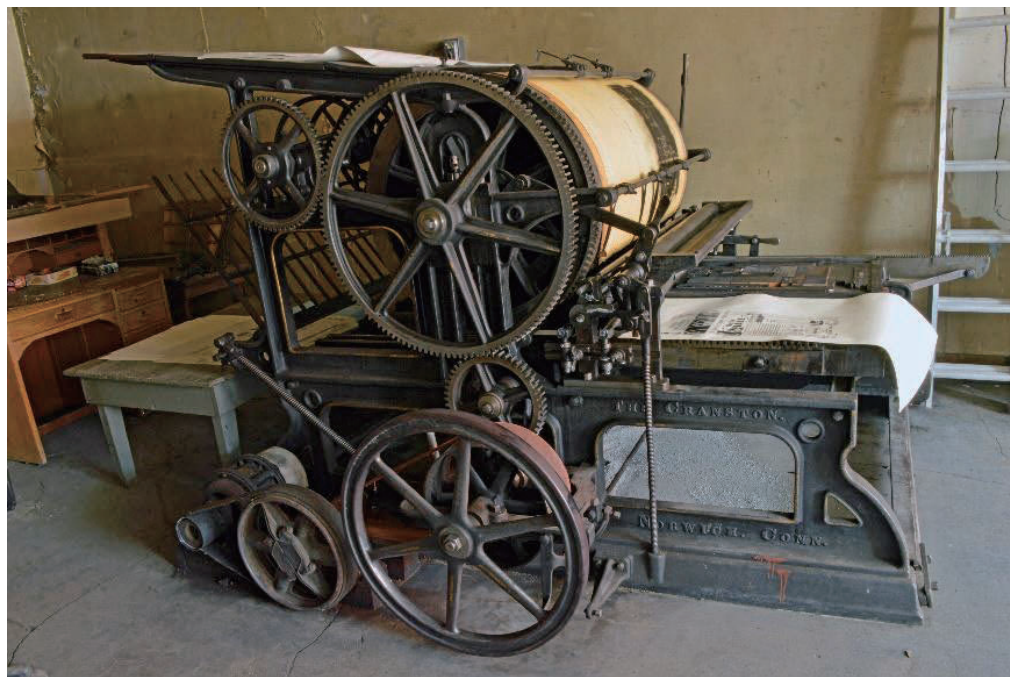


Figure 3.27 The Cranston Press in its original location (Author 2014).

The interior is in overall good condition with specific elements in fair to poor condition. The pressed metal ceiling has accumulated a significant layer of dirt on both of its sides and its most recent finish is deteriorating and losing adhesion with the underlying layers. These two conditions are not isolated, but occurring across the entire ceiling. The ceiling has been cut and pulled back in numerous places, as detailed above, but in most instances, the metal is retained and can be repaired. The east and west plaster walls are in very good conditions, with the loss of some finishes being the only visible pathology. The plaster is not cracking, losing adhesion with the concrete substrate or becoming friable. The plaster and finishes on the south wall are in poor condition. The south wall in general has been under heavy distress throughout its recent history which is reflected on the state of the plaster. The rear entryway appears to have only recently been stabilized with wood framers, before which, heavy loads were exerted on the central wall. The sashes also appear to have been damaged for quite some time allowing for water infiltration. The plywood board were only added within the last two years to help weatherize the wall. There is a section of lost plaster above the eastern window (Figure 3.28) and expanded entryway (Figure 3.29). A number of cracks have formed on the central portion and the most recent finish is losing adhesion with its underlying layer. Much of the plaster on the south wall is loose and easily removable. The concrete floor has formed a few large cracks and a network of smaller ones across the majority of its surface, typically associated with alkali-aggregate reactivity and shrinkage from hydration. The cracks are an aesthetical issue only.⁶ Tree root activity has caused cracking and displacement in an area of the interior from the southwest corner to the front of the original back door.

⁶ John Broomfield, "The Identification and Assessment of Defects, Damage and Decay," in *Concrete: Building Pathology*, ed. Susan Macdonald (Oxford, U.K.: Blackwell Science, Ltd., 2003), 148. W. Glenn Smoak, *Guide to Concrete Repair*, 23, 37.



Figure 3.28 Plaster loss above east window on south wall (Author 2014).



Figure 3.29 Loss of plaster and most recent finish on middle section of south wall (Author 2014).

Mechanical Systems

The mechanical systems in the building are in rather poor condition. As mentioned above, the building currently lacks any kind of climate control systems, either air conditioning or heating. It also lacks plumbing or any kind of water systems. The building does contain an electrical system, one being a modern addition, but the other is quite outdated.

Originally a cast iron stove was installed at the rear and was attached to sheet metal tubing which ventilated out the southeast corner of the roof, as revealed by a historic photograph of the interior (Figure 1.6). The stove was later moved to the center of the building as evidenced by a remaining metal vent in the roof (Figure 3.25). The last known source of heat was a gas heater which served the front section of the interior after the space was partitioned. It has since been removed.

The building was wired for electricity from its original construction, as a historic photograph of the interior shows a pendant ceiling light at the rear of the space (Figure 1.6). Two electrical systems currently exist in the building, one likely being the original and another more modern system currently in use. Both are connected to electrical boxes on the south wall. (Figures 3.3 and 3.12) The modern surface mounted electrical box supports three 10 KA switches and currently feeds the two modern temporary ceiling fluorescent fixtures. The older electrical box is inset into the wall and supports six copper circuit breakers, now dysfunctional. Both boxes are surface mounted.



Figure 3.30 Historic wiring for single suspended bulbs (Author 2014).

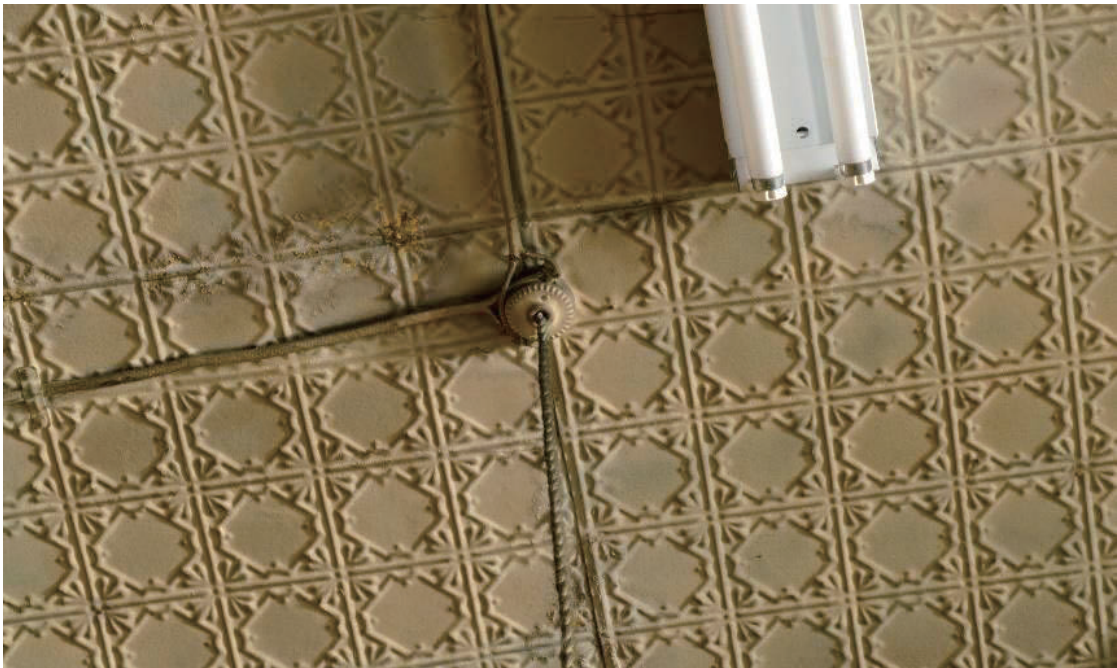


Figure 3.31 Detail of historic wiring (Author 2014).

Chapter 4 – Technical Study of Building Materials and Systems in Their Contemporary Context

This chapter combines historical research of technical sources contemporaneous to the construction of the Mancos Times-Tribune Building sources and conclusions from material analysis to characterize the various buildings components and their construction methods used in the Mancos Times-Tribune Building. Specifically, the components addressed are: the pressed sheet metal cornice and ceiling, the interior plaster, the interior wallpaper and the concrete sidewalls. Each section details the material's technological development and the processes used in its construction and installation in regards to its specific application in the building. In general, the focus of the study was on contemporaneous technology, materials and methods, but a broader historical development of each material was also researched for context. For example, the technical study on plaster is specific to cementitious plasters and not plasters as a broader subject.

Pressed Sheet Iron Cornices and Steel Ceilings

The topic of architectural sheet metal is incredibly vast, encompassing a number of different metals and their alloys being shaped into innumerable forms used for interior and exterior architectural ornamentation. This section is a technical study on the historic development and contemporaneous manufacturing and installation processes used in creating sheet iron and steel cornices and ceilings. The scope is specific and does not address other sheet metal features typically associated with those specific elements, such as whole facades on the exterior and sidewalls on the interior, although they are related. The metallurgy or forging and fabrication processes of making sheet iron and sheet steel was not included in this scope. The focus is rather on the machinery and techniques used to shape such sheets for decorative applications. First a narrative history of sheet iron cornices and metal ceilings will be given, followed by a discussion

of the fabrication and installation methods of pressed sheet iron in general and specifically those found in the Mancos Times Tribune Building.

Historical Survey

Iron did not become extensively used for architectural purposes until the first era of the Industrial Revolution during the late eighteenth and early nineteenth centuries. It was cast to form doors, columns, beams, and even whole facades. It was wrought to form ornamental work on railings, balconies, fencing, and gates. As rolled sheets, iron was mostly used for undecorated, utilitarian purposes such as roofing and guttering during this time. Milling of sheet metal began in the United States after the Revolutionary War and the end of colonial-era bands on manufacturing.¹ The first sheet iron produced in America was rolled at a mill owned by Robert Morris along the Delaware River across from Trenton, New Jersey.² Some early American examples of sheet iron in this form include the replacement of the slate roof of the White House with sheet iron in 1804³ and U.S. Capital wings and the 1814 roof of Princeton's Nassau Hall.⁴ The process for corrugating sheet iron was patented by a "Mr. Palmer" in Britain in 1829. The first use of the material in an American building is not definitively known. William Strickland may have been the first architect to specify the use of corrugated iron for an American building in his 1834 design for market buildings along High Street in Philadelphia, though the design was likely not carried out.⁵

¹ Pamela H. Simpson, "Ornamental Sheet Metal in the United States, 1870-1930" *Journal of Architectural and Planning Research* 11, no. 4 (1994): 296.

² Margot Gayle and David W. Look, AIA, "Part I. A Historical Survey of Metals," in *Metals in America's Historic Buildings* (Washington, D.C.: U.S. Department of the Interior, 1992), 74.

Charles E. Peterson, "Iron in Early American Roofs," *The Smithsonian Journal of History* 3, no. 3 (1968): 43.

³ Margot Gayle and David W. Look, AIA, "Part I. A Historical Survey of Metals," 74.

⁴ Pamela H. Simpson, *Cheap, Quick and Easy: Imitative Architectural Materials, 1870-1930* (Knoxville, TN: The University of Tennessee Press, 1999), 32.

⁵ Charles E. Peterson, "Iron in Early American Roofs," 45-46.

It cannot be said with certainty at what date and on what building the first sheet metal cornice was erected, however, a well-cited article from an 1893 edition of *The Metal Worker* gives a seemingly fabled account of the origins of the sheet iron cornice. The article relates a story from Cincinnati in 1834 that was first reported in *The Ohio Valley Manufacturer* in which an iron worker witnessed two men crushed to death by a stone cornice that was being hoisted into place on a building. The worker wanted to find a safer and lighter alternative to heavy stone and so set to work on shaping galvanized iron sheets to form a cornice. According to the article, the first building to install a sheet iron cornice was the old National Theater in Cincinnati, though it did not give an exact date of when that occurred. A new machine to shape the Theater cornice was manufactured by J. M. Robinson & Co. of that city, which was called a cornice brake.⁶

Cornice brakes were introduced in the 1830s as the first machines to bent sheet metal into decorative profiles. So while the very first use of a sheet iron cornice may be lost to history, it can be concluded with certainty that the first sheet metal cornices were developed during the 1830s. While they were introduced in this era, they did not gain popularity until the 1850s. The enormous versatility of form of the sheet iron cornice, combined with its enticing modernity and cheap price, gave it mass appeal. For these reasons, it would have been alluring to a growing middle class, eager to flaunt their relative affluence. Its widespread growth is also connected with the increased popularity of the Italianate style in both commercial and residential architecture which emphasized ornament and flamboyance.⁷

Sheet iron was first used to create ceiling elements beginning in the 1870s. Early ceilings were simple in design and utilitarian in purpose, being small, curved sheets of corrugated iron

⁶ Thomas M. Harboe, "The History and Technology of the Sheet Metal Cornice" (master's thesis, Columbia University, 1984), 23-24.

Pamela H. Simpson, *Cheap, Quick and Easy*, 35.

⁷ Thomas M. Harboe, "The History and Technology of the Sheet Metal Cornice", 2. Simpson, *Cheap, Quick and Easy*, 35.

which rested on the flanges of iron floor beams meant to serve as a fireproof layer between building floors (Figure 4.1). Sometimes these were covered with concrete to provide additional fireproofing. This method of fireproofing originally used brick arches, but the iron sheets could be installed more quickly.⁸ “Gilbert Patent Corrugated Iron Arched Ceilings” are the earliest known metal ceilings manufactured in the United States, being used as early as 1868 and were included in an 1872 catalogue for the Philadelphia Architectural Iron Company.⁹ One of the first patents for a metal ceiling was taken out by Henry Adler of Pittsburgh in 1875. It was described as a “sheet metal ceiling consisting of panels secured in position by concealed fastenings, cap pieces and ornamental corner pieces.”¹⁰ In 1884, Albert Northrop, also of Pittsburgh, was issued one of the first commercial metal ceiling patents. His ceilings utilized the corrugated panels of this early era, but were laid along wooden furring strips fastened to ceiling joists. Although his panels had an undecorated, uniform design, he suggested his customers vary the direction of the corrugation during installation or add embossed rosettes at the corners (Figure 4.2).¹¹

⁸ Gayle and Look, “Part I. A Historical Survey of Metals,” 74.

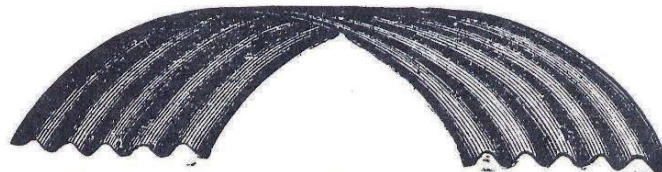
⁹ Mary Dierickx, “Metal Ceilings in the U.S.” *Bulletin of the Association for Preservation Technology* 7, no. 2 (1975): 84.

¹⁰ Simpson, *Cheap, Quick and Easy*, 56.

¹¹ *Ibid*, 56.

CURVED CORRUGATED IRON.

FIG. 13.



Curved to any specified radius, for roofs and ceilings.

FIG. 14.

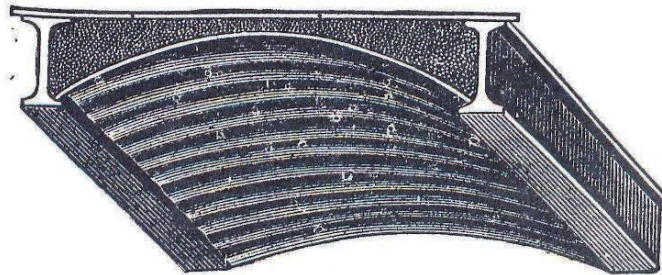


Figure 4.1 Early form of iron ceilings, serving a utilitarian rather than a decorative purpose (Simpson, *Cheap Quick and Easy*, 55).

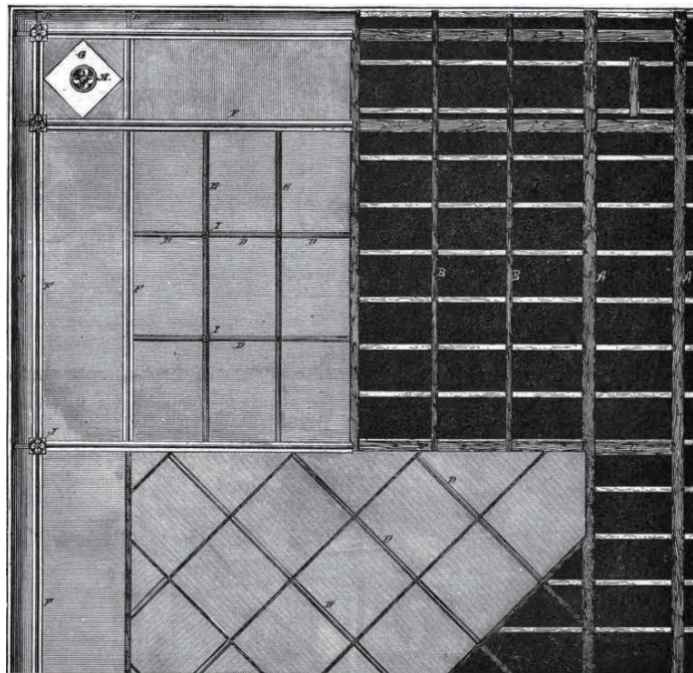


Figure 4.2 Corrugated iron ceilings offered by H. S. Northrop of New York (“Northrop’s Paneled Ceilings,” 53).¹²

¹² A variation of the original design by Albert Northrop.

Decorated iron ceiling panels were introduced to the United States in the mid-1880s by German manufacturers. These early decorated forms were stamped corrugated iron panels with more elaborate applied zinc embosses. These types of ceilings were first used in France and Germany before becoming available the United States, Canada and Australia and later, Britain. American manufacturers would not produce decorative metal ceilings themselves until the late 1880s after experimentations with imported German forms.¹³

In the 1890s, American manufacturers began to replace these earlier iron ceiling forms with panels of stamped sheet steel. Sheet steel was first developed in the United States in the 1860s. Just like sheet iron before it, its architectural use was mostly utilitarian in the first decades after its introduction. Unlike sheet iron, in which the absence of press-working machinery prohibited its decorative use, the early steel making processes were expensive, reducing its overall production. By the late 1880s, monumental innovations in the open-hearth process increased steel production and made it much more affordable. Steel's strength meant that larger and thinner panels could be made. Steel withstood the stamping process better than iron and could hold a much higher relief, allowing for elaborate designs.¹⁴

The W. R. Kinnear Company patented the first steel ceiling in 1888 (Figure 4.3). *Carpentry and Building* featured the panels in an article citing that they were “unlike any others in the market.”¹⁵ These early panels used 28-30 gauge steel, referred to by Kinnear as “soft sheet steel”¹⁶, and were die-pressed as single units. There was no separate applications of decorative metal motifs as in earlier ceilings; these were single pieces. Panels were typically two feet in width, but varied in length from two to four feet. The metal ceiling industry quickly flourished as manufacturers emulated Kinnear's design or innovated their own. By the turn of the twentieth

¹³ Simpson, *Cheap, Quick and Easy*, 56.

¹⁴ *Ibid*, 34, 57-58.

¹⁵ “Kinnear's Metallic Ceilings,” *Carpentry and Building* X, no. 11 (Nov 1888): 229.

¹⁶ *Ibid*, 230.

century steel had widely replaced iron in many architectural features including cornices, building fronts and ceilings.¹⁷

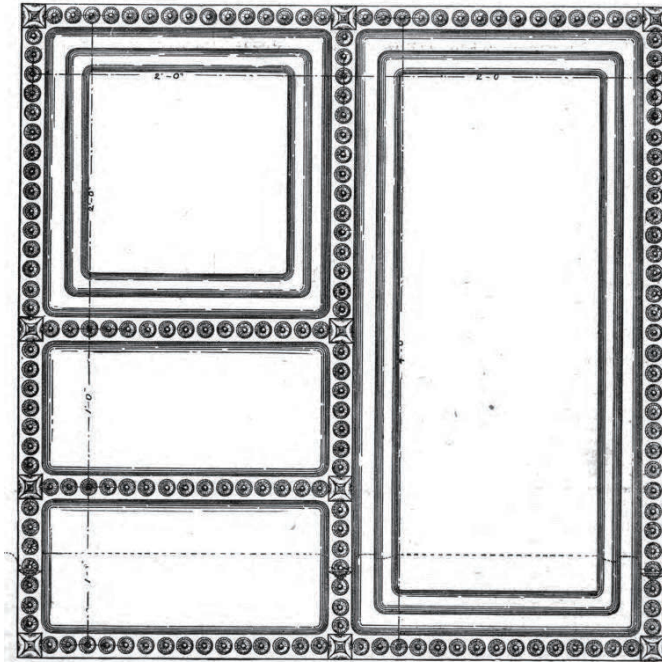


Figure 4.3 Illustration of Kinnear's 1888 steel ceiling panel ("Kinnear's Metallic Ceilings," 229).

The form of metal ceiling found in the Mancos Times-Tribune Building, that of rolled steel sheets, is not addressed in any secondary sources. It is unclear where the production of that form falls within the history of pressed sheet metal. Long sheets of sheet iron had been in production since the end of the eighteenth century, but the early metal ceiling forms seemed to evolve from small panels, rather than long sheets. It was not found when the machinery used to create the pressed rolled sheets was developed. Given these considerations, no firm date or era can be confirmed for the introduction of that form.

The architectural sheet metal industry first developed in the 1880s in Ohio, in cities such as Cincinnati, Canton and Salem and eastern Pennsylvania, mainly Pittsburgh. Later

¹⁷ Simpson, *Cheap, Quick and Easy* 57-58.

manufacturing became centered in Michigan, Missouri, Indiana, New York and West Virginia.¹⁸ Companies first offered sheet metal ceilings along with a line of other products such as roofing and cornices, but during the height of the material's popularity, certain companies specialized solely in metal ceilings.¹⁹ By the 1890s, sheet metal exterior ornamentation and interior walls and ceilings had become accepted and popular. In 1896, *Architecture and Building* began a separate advertising column for metal ceilings.²⁰ By 1900, the industry was booming. Select manufacturers had gained national prominence and were selling their products all across the United States, as well as trading internationally, primarily to South and Central American countries. Trade catalogues were published in Spanish to reach this market.²¹ The Berger Manufacturing Company, whose main office and works were in Canton, Ohio, claimed in its 1927 to have "the largest sheet metal works in the world" and had control over every aspect of production, from extraction of ores, to their refinement to the manufacturing itself.²²

Although ornamental architectural sheet metal was introduced in the 1850s, it did not gain popularity until the early 1870s which would continue until the 1930s. After reaching their peak of popularity between 1895 and 1915,²³ pressed sheet metal ceilings began to decline in the 1920s and 1930s and the industry all but became extinct by the end of the 1940s. There are three main reasons for this decline. The Great Depression created economic hardships for all segments of society, including both producers and consumers of metal ceilings, and likely many factories shut down and never reopened. On the consumer side, opulence and decoration were not as

¹⁸ Simpson, "Ornamental Sheet Metal in the United States," 298.

Dierickx, "Metal Ceilings in the U.S." 83.

¹⁹ Dierickx, "Metal Ceilings in the U.S." 83.

²⁰ Mary Dierickx, "Leaves of Iron: Stamped Metal Ornament," *The Journal of Decorative and Propaganda Arts* 9 (Summer 1988): 47.

²¹ Simpson, *Cheap, Quick and Easy*, 34, 68.

²² Berger Manufacturing Company, "Berloy Steel Ceilings Catalog No. 27," (1927) APT Building Technology Heritage Library at archive.org,

archive.org/details/BerloySteelCeilingsACompleteSeriesOfPeriodDesignsAndUnits, 5.

²³ Dierickx, "Metal Ceilings in the U.S." 83.

readily sought after as in previous decades. Then, during the Second World War, steel and iron were rationed for military purposes. In the post-war era, smoother, less ornate surfaces became popular for both commercial and domestic buildings and the advent of dropped acoustical-tile ceilings became the norm for office spaces. With a lower demand, companies either closed for good, or switched to fabricating other forms of sheet metal, such as automobile parts or air conditioning ventilation.²⁴ Sheet metal cornices had already greatly declined because of changes in architectural tastes.²⁵ The W. F. Norman Corporation of Nevada, Missouri still produces architectural sheet metal products using original dies and machinery housed in its original building. The company offers reproductions of any design from their 1892 catalogue.²⁶

Manufacture and Installation of Sheet Metal Cornices and Ceilings

The following is an in-depth description of the processes used to manufacture and install sheet metal iron cornices and ceilings. It begins by providing a short historical context before addressing cornices and then ceilings. Common methods are described, and related to the elements in the Mancos Times-Tribune Building in both similarities and differences.

Since pre-historic times, metal has been beaten into flat sheets and used for various architectural purposes, from roof coverings to drain pipes (Figure 4.4). The fabrication of sheet metal likely began not long after the development of refined ores and was made by hand using blunt tools such as a hammer. The method of making sheet metal remained relatively unchanged until the introduction of water-powered rolling mills in the late seventeenth century, right at the cusp of the industrial era. A mill turned large, rotating iron cylinders to press metal into sheets that were thinner and more uniform than those made by hand. Malleable metals such as gold,

²⁴ Simpson, "Ornamental Sheet Metal...", 307.

Dierickx, "Leaves of Iron: Stamped Metal Ornament," 59.

²⁵ Simpson, *Cheap, Quick and Easy*, 31.

²⁶ W. F. Norman Corporation. "Home Page," wfnorman.com.

copper, zinc, iron, and later in the nineteenth century, steel, were best suited to this process.²⁷

The processes used in sheet metal manufacture at the time of the construction of the Mancos Times-Tribune Building were essentially identical in concept to those used centuries earlier.

Flattening, punching, shearing and shaping could all be accomplished in Antiquity. All that had changed was the sophistication of the tools used and the accuracy, uniformity and rapidity of production.²⁸

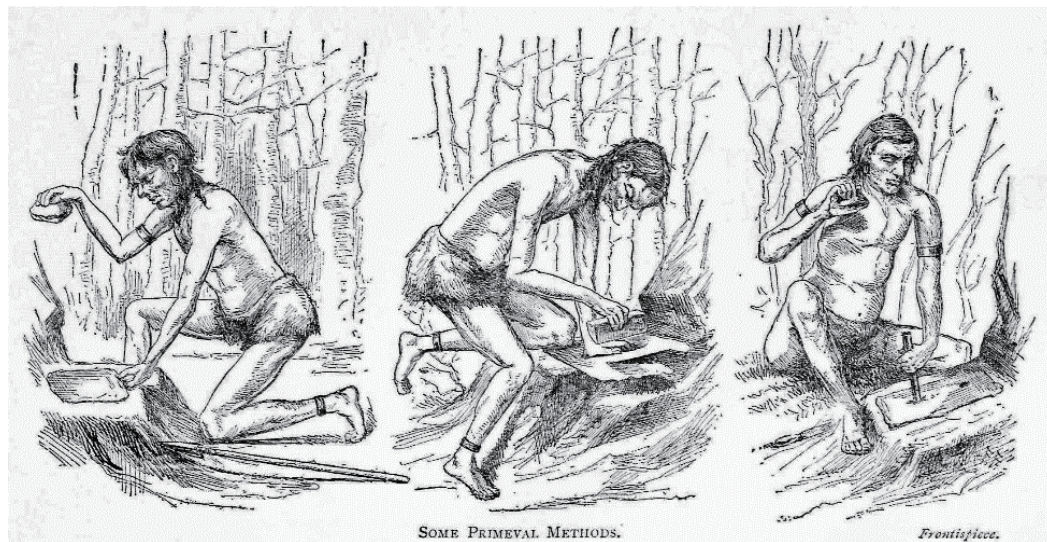


Figure 4.4 Illustration of pre-historic sheet metal working (Smith, frontispiece).

When iron cornices gained popularity in America in the 1850s, much of the sheet metal work was performed on a small scale in tinsmith shops and was considered a skilled craft. As America became more industrialized, the process shifted to mass production in factories run by unskilled laborers. This shift was rather rapid as Pamela Simpson notes that “Between 1870 and 1930, there were at least forty-five major sheet metal companies with national distribution

²⁷ Simpson, *Cheap, Quick and Easy*, 31.

²⁸ Oberlin Smith, *Press-Working of Metals* (New York: John Wiley & Sons, 1899), 15.

operating in ten different states.”²⁹ She also notes that the development of the architectural sheet metal industry was indicative of a:

Pattern of capital investment in new industrialization during the second half of the 19th century, a rapid expansion of business, and considerable pride in that rise to success. Mass production, mass distribution, and mass advertising meant that products like sheet metal architectural ornaments were readily available - not just in industrial centers, but everywhere.³⁰

In the sheet metal industry and in common parlance, the notion of a cornice is different from what has been termed historically as such in architecture. A ‘cornice’ “as ordinarily used, designates any molded projection which finishes or crowns the part to which it is affixed. Hence, common usage accepts the term cornice, as meaning the entire entablature, while by strict definition it is restricted to the upper division of the entablature.”³¹ (Figure 4.5)

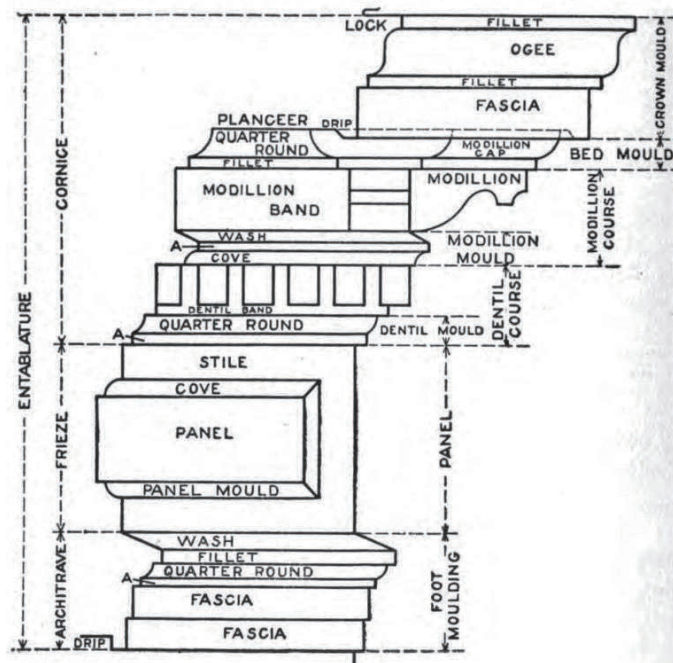


Figure 4.5 Drawing labelling the various architectural nomenclature of an ornate entablature (Neubecker, 194).

²⁹ Simpson, “Ornamental Sheet Metal in the United States,” 298.

³⁰ Ibid, 300.

³¹ Kittredge Cornice & Ornament Co., *The Compendium of Architectural Sheet Metal Work* (Philadelphia, PA: Henry Carey Baird & Co, 1877), 6.

During the early years of sheet metal cornice fabrication, their designs were largely duplications of those used in wood cornices, which themselves were imitations of stone cornices. By 1919 though, the state of sheet metal cornice design was such that they were no longer imitative. Designs were being made solely for sheet metal.³² As the Mancos Times-Tribune Building was constructed in 1911, the design of cornices may have been in a transitional period. The source of its design cannot be concluded.

Prior to a cornice's shaping, its profile was drawn on paper at full scale. A pattern cutter would transfer it onto a thin sheet of metal called a "stretchout" which noted every bend and curve which had to be made. The stretchout was also used to mark the exact width of the cornice which was cut then from a large sheet on a squaring shear. The length of metal was then taken to a squaring-pricking machine which cut the piece to its proper length, squared its ends and made pricks into the piece itself along the breaks labelled by the stretchout. The final step before shaping was to a crimping machine which made sharp-angled corrugations width-wise across the piece. This process removed the natural buckle found in almost all sheet metal and increased its strength. The corrugations were very fine and did not affect the width of the piece.³³

Sheet metal cornices attained their shape by being formed on a "brake" (Figure 4.6). Brakes had a "capacity for forming lock and angles in a wide range of sizes and of unusually large lengths."³⁴ The length of sheet metal would be set in a stationary position and a hinged "jaw", referred to also as a "bending leaf" or "folding bar," would be lowered to make the "brake" or bend in the sheet. Even into the twentieth century, this operation was performed by manual labor. Wooden forms, or clamps, were used to create rounded bends. By the 1880s, ninety-six inches (eight feet) had become the most common length used in cornice work. As

³² William Neubecker, *Sheet Metal Work* (Chicago, IL: American Technical Society, 1938), 193.

³³ Harboe, "The History and Technology...", 76-77.

³⁴ L. Broemel, *Sheet Metal Worker's Manual* (Chicago, IL: Frederick J. Drake & Co., 1918), 57.

technology developed, motor-driven brakes could form ten foot lengths. There were also cornice brakes specifically designed to form steel rather than iron.³⁵

If the cornice was galvanized, as the one installed on the Mancos Times-Tribune likely is, it was set outside to weather for a period of two – six months. This allowed a layer of zinc oxide to develop, further protecting the cornice and which roughened the surface for better paint adhesion. An applied treatment could greatly speed up the process of oxidation. Identical recipes were published in 1876 and 1925 which read: “Dissolve 2oz. copper chloride, 2oz. copper nitrate and 2oz. sal ammoniac in 1 gal. clear soft water, and when the solution is complete add 2oz. of crude hydrochloric acid.” The solution was brushed on and allowed to dry for at least twenty-four hours prior to painting.³⁶

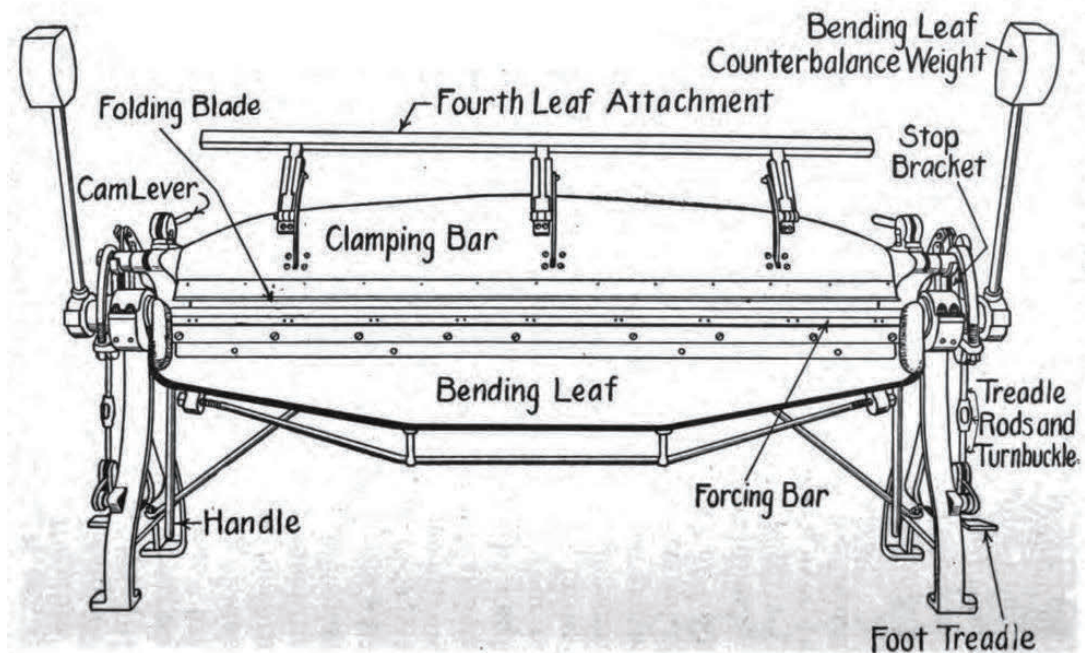


Figure 4.6 Diagram of a cornice brake (Broemel, 59).

³⁵ Broemel, 60-63.
Harboe, 68-69, 77-78.
Neubecker, *Sheet Metal Work*, 200-201.
³⁶ Harboe, 88.

Cornice manufacturers required their clients to send measurements of the intended walls with their order to properly fulfill it (Figure 4.7). This included a sketch of the building in plan with dimensions labeled, the number and location of brackets and modillions marked and any other pertinent information included. The drawings did not have to be to scale, but the annotated dimensions had to be accurate and legible. An elevation drawing was also often submitted. Similar drawings are shipped by the manufacturer with the order (Figure 4.8), termed “construction drawings”, and typically included an elevation of the building, a plan of the building and cornice and full-sized profile sections of the cornice showing joints which was commonly called a “lookout pattern.”³⁷

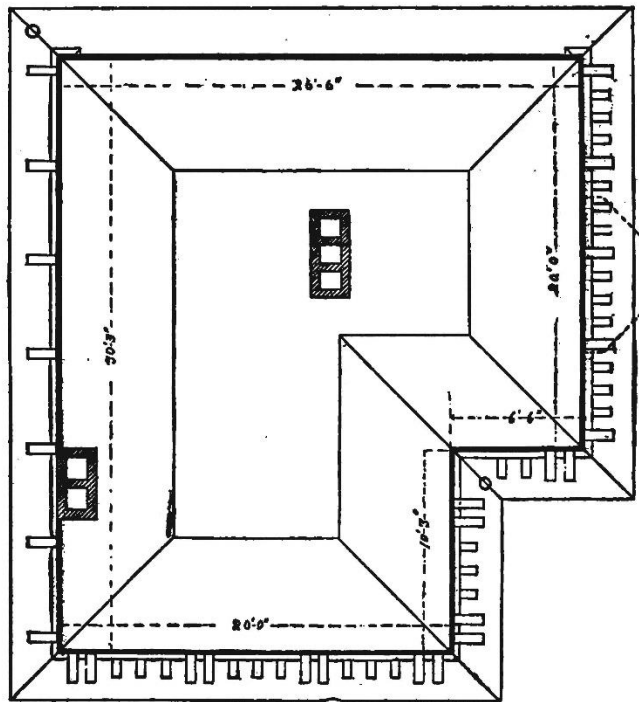


Figure 4.7 Example of a plan drawing estimating cornice work by client (Kittredge Cornice & Ornament Co., 200).

³⁷ Kittredge Cornice & Ornament Co., *The Compendium of Architectural Sheet Metal Work*, 364-365, 377.

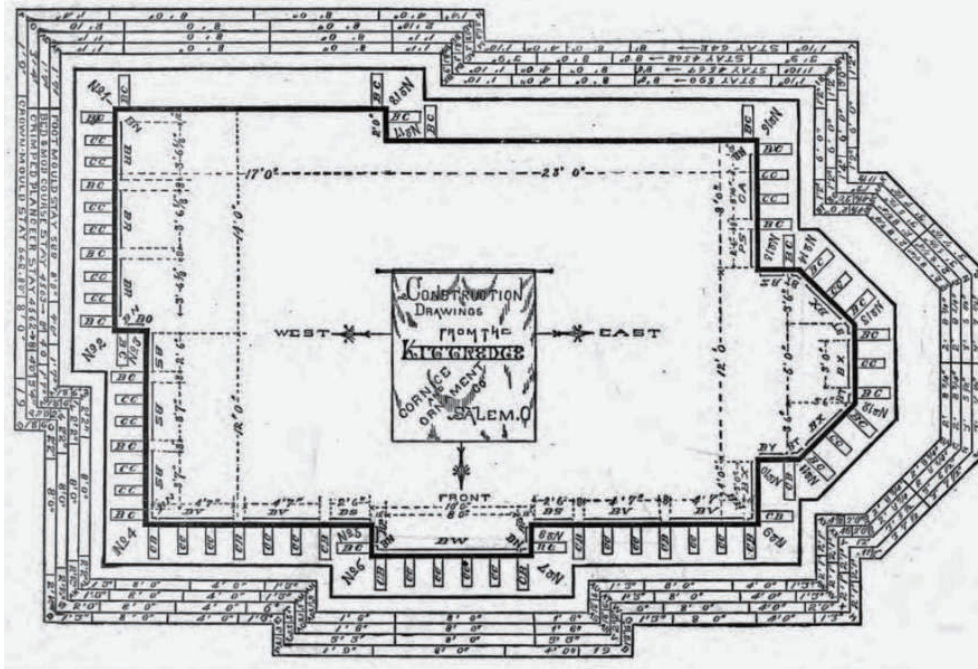


Figure 4.8 Example of a construction drawing submitted with order from a cornice manufacturer (Kittredge Cornice & Ornament Co., 379).

Sheet metal cornices had to be supported by the wall to which they were fastened. There was no standard method to achieve the proper support and distribution of forces, as this was dependent upon the shape, volume and mass of the cornice. All support systems relied on “lookouts” which were anchored to the wall and onto which the cornice itself, or other structural elements were fastened. The lookouts were generally made of wood timbers or sheet metal. The length and number of lookouts depended upon the height and width of the cornice. Both wooden and metal lookouts spanned the width of the wall, anchoring themselves to it, and projected out the wall’s front.³⁸ A simple wooden lookout system is illustrated in Figure 4.9 and a metal system in Figure 4.10 with a more elaborate metal system in Figure 4.11.

³⁸ William S. Lowndes and D. Knickerbacker Boyd, *Roofing and Sheet Metal Work* (Scranton, PA: International Textbook Company, 1939), 38 -42.

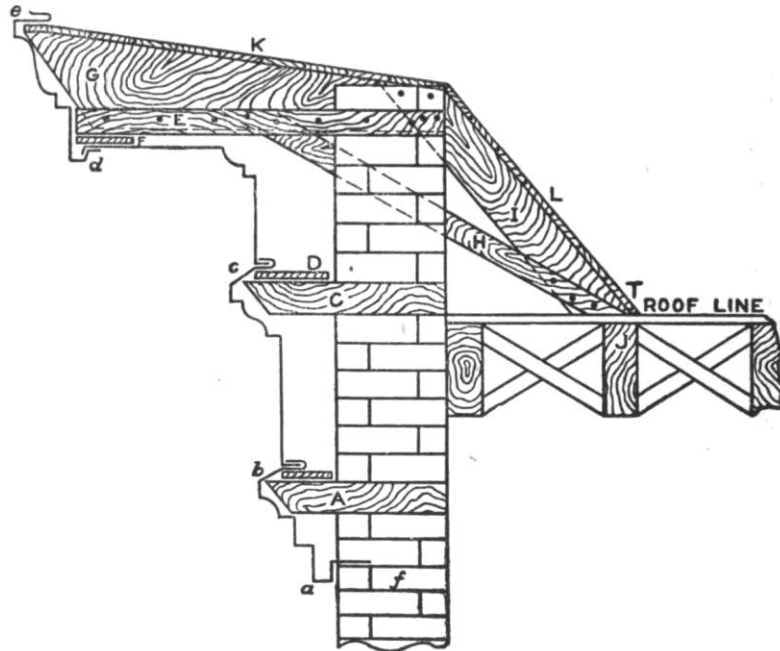


Figure 4.9 Section of a sheet metal cornice with wooden supports (Neubecker, 198).

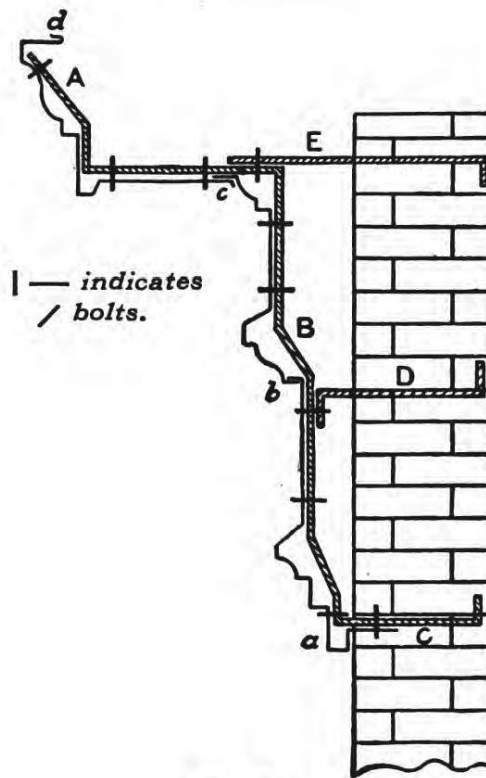


Figure 4.10 Section of a sheet metal cornice with iron supports (Neubecker, 217).

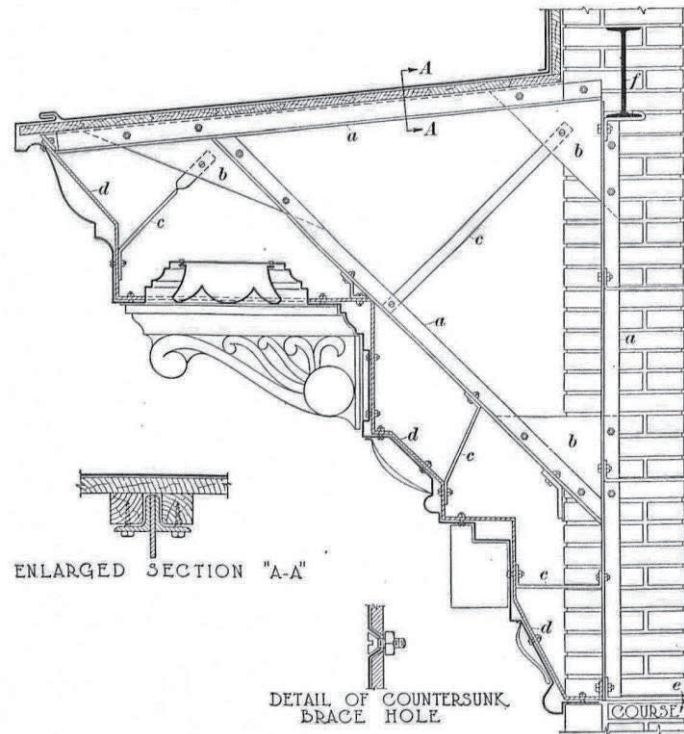


Figure 4.11 Section of a large sheet metal cornice with iron or steel supports (Lowndes and Boyd, 40).

The following details the typical process of installing a more elaborate cornice than that found in the Mancos Times-Tribune Building and one that is attached to a brick wall, rather than a wood frame wall (Figures 4.9 and 4.12). Installation began with the lowest piece, the foot molding or the architrave, whose extended drip is set tight against the wall. The brickwork was then taken up a couple courses where a wooden lookout is placed. A thin board was fastened to the lookout and the top of the foot molding is anchored onto this. The second piece, or frieze, was installed in the same manner with the bottom hooking into the top of the foot molding. The process was repeated again with a more substantive lookout being constructed for the protruding crown molding. A more fire-proof method followed the same procedure, but substituted metal for wood (Figures 4.10 and 4.11).³⁹

³⁹ Neubecker, 198-199.

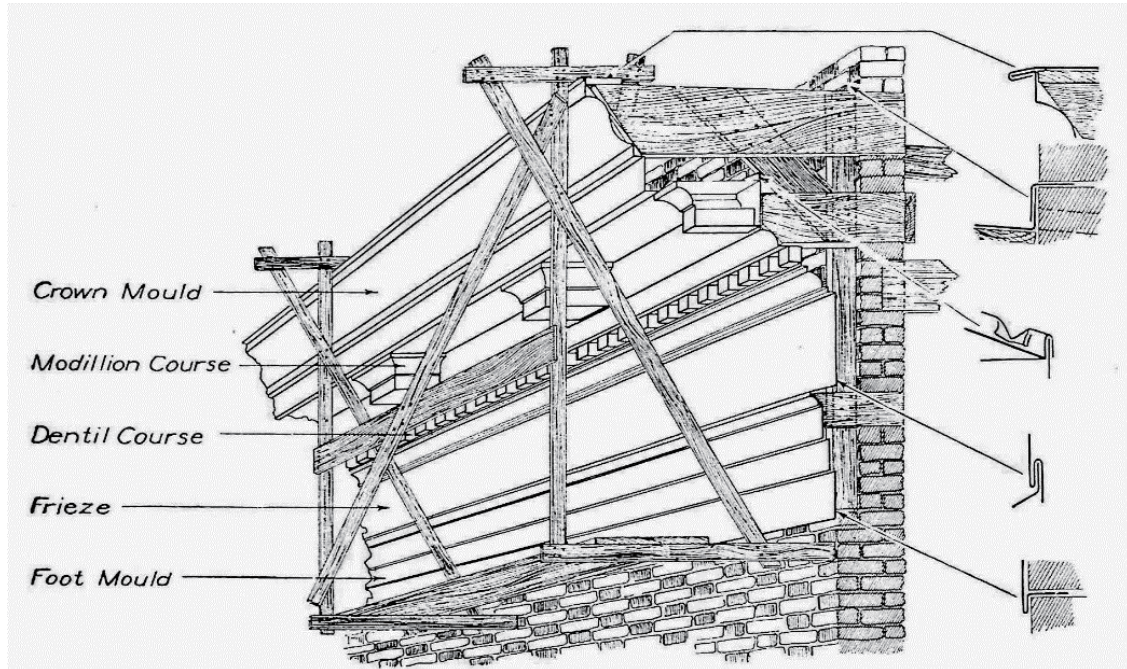
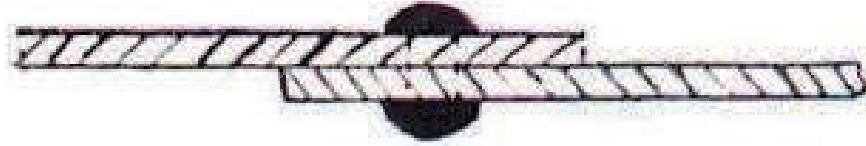


Figure 4.12 Diagram of an elaborate exterior sheet metal cornice (Selvidge and Christy, 97).

The cornice of the Mancos Times-Tribune Building was shaped as a single unit with no divisions between its frieze and crowning cornice. The end trusse also appears to have been fabricated as a single piece. The cornice is fairly planar with a very short projection on the upper third of its body. A horizontal lookout was probably not needed for support. The cornice, like the architrave below it, is fastened to the internal wooden supports providing structure for the upper portion of the north wall. The roofing rafters likely end flush with the north wall with the cornice fastening to the face of the last rafter. The projecting portion of the cornice is likely fastened to a length of wooden blocking.

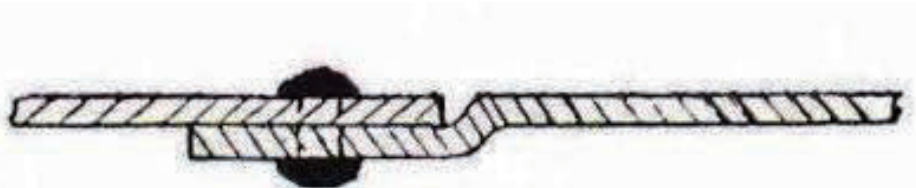
The joint which connects the length of cornice on the Mancos Times-Tribune Building with its eastern neighbor is formed using a plain lap joint (Figure 4.13) in which the two sheets lap over each other for a distance of about 1 ¼" and riveted closely. This is unlike a joggled joint (Figure 4.14), in which one flat sheet laps over one with a recess to accept it to create a flush joint

whose open edge would have then been soldered. The joint may also have interior reinforcement through which it was connected.⁴⁰



PLAIN LAP

Figure 4.13 Diagram of a plain lap joint used in sheet metal installation (Butler, 65).



JOGGLED

Figure 4.14 Diagram of a joggle joint used in sheet metal installation (Butler, 65).

The sheet metal cornice of the Mancos Times-Tribune Building is executed in a very simple design, a simplicity not found in the more intricate designs of the researched catalogues. It is likely then, that the cornice was purchased from a company located in the West which was producing more vernacular designs on less sophisticated machinery. Given the cornice's age and its exterior location, it is likely made of either steel or zinc galvanized iron and not pure iron. The actual metal used cannot be confidently concluded however, as no sample was taken of the metal

⁴⁰ Lowndes and Boyd, 44.

John C. Butler, *Sheet Metal: Theory and Practice* (New York: John Wiley & Sons, 1944), 64.

substrate and therefore, no analysis undertaken like that of the interior metal ceiling. But given the unsafe working conditions of leaning an extension ladder against the facade, this was abandoned.

Metal ceiling panels and rolls were formed by “press-working”, a particular type of fabrication in which a machine, called a press, uses shaped dies to exert pressure on a sheet of metal to form a design. Within this broad category, the specific process used to create sheet metal cornices and ceilings were historically termed “bending,” which involves pushing the surfaces of the metal to be pushed out of their original planes into a new shape while maintaining its original thickness.⁴¹ Exterior cornices, and interior sheets and panels were all shaped using different processes and machinery, but all can be characterized as being “press-worked” metals. Pressed sheet metal is typically formed using cold methods, although heat is applied in some instances. When a metal is worked cold, it is usually necessary to anneal it before shaping.⁴² The thickness of sheet metal is determined by standard wire gauges, with thicknesses increasing as the gauge number decreased (Figure 4.15).⁴³ Much of the sheet steel used for ceiling work was 28, 29 or 30 gauge, being less than 1/64th of an inch thick.⁴⁴ Standard gauges could not be found for cornice work.

⁴¹ Smith, 154.

⁴² Ibid, 12.

⁴³ Ibid, 109.

⁴⁴ Dierickx, “Leaves of Iron: Stamped Metal Ornament,” 50.

Mike Johnson, “Main Street and Building Codes: The ‘Tin Ceiling’ Challenge” *APT Bulletin* 34, no. 4 (2003): 29.

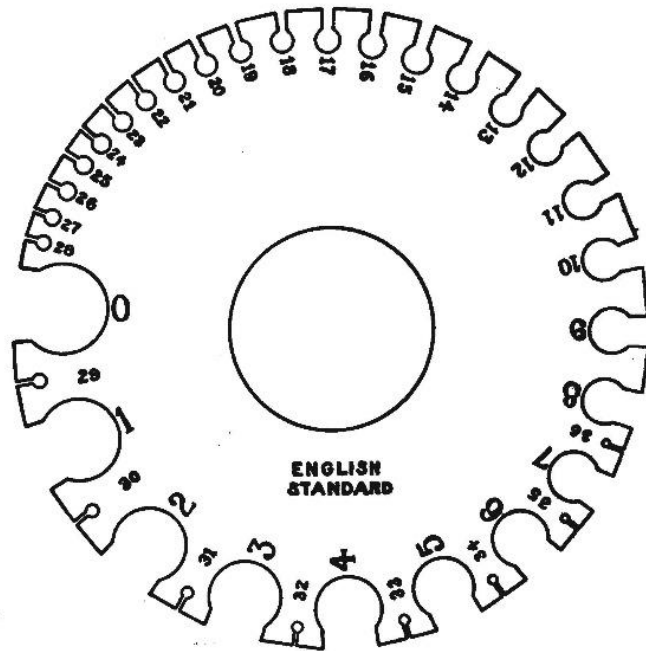


Figure 4.15 English standard wire gauge (Broemel, 138).

The actual design of a sheet of pressed metal or the form it is shaped by the use of dies. Dies are termed as being: “a pair of special tools so related to one another that when properly guided and approached toward each other, with sufficient pressure, they will produce a definite, uniform, and permanent change upon each one of certain similar pieces of suitable material placed between them.”⁴⁵

Prior to the actual pressing of metal ceiling elements, dies had to be designed and fabricated. The following outlines the design process used to create dies for stamped metal ceiling panels, and is taken from an article profiling Berger’s Manufacturing Company of Canton, Ohio.⁴⁶ A design would be drawn at full scale on paper which would then be used to sculpt a three-dimensional model into a slab of clay. Larger manufacturers, such as Berger and others,

⁴⁵ Smith, 73.

⁴⁶ “The Art of Making Steel Ceilings,” *The National Builder* 54, no. 4 (1912): 104-105.

employed skilled artists to create these designs.⁴⁷ A plaster Paris negative shell cast would be taken of the model and from this a positive plaster cast which is finished smooth and given two coats of shellac. The finished plaster cast serves as a mold onto which molten iron would be poured to create a negative metal die. The negative die was allowed to cool before milling and finishing. Then, molten zinc would be poured onto the negative iron die to create a positive die. Only large manufacturers such as Berger's Manufacturing Company could employ their own design departments. Other manufacturers had to purchase already cast dies.

With the dies created or obtained, the manufacturing process could begin. Two different types of presses were used to create stamped ceiling panels: a 'draw press' which used mechanical pressure and a 'drop hammer press' which exerted force using a hammer.⁴⁸ A press can be described as: "A machine in which a bed or anvil is approached by a ram or hammer, having a reciprocating motion in a line approximately at right angles to said bed, and the said ram being suitably guided in the framework of the machine so that it may always move in the same path."⁴⁹ The setup of a typical metal press consisted of lower die held in place by a bolster and an upper die attached to a movable press ram. For stamped ceiling panels, the stronger iron die would have been fastened to the stationary bed and the zinc die to the moving hammer or ram (Figure 4.16). Once pressed, the edges would be cut smooth by a worker.⁵⁰

⁴⁷ Boston Metal Ceiling and Manufacturing Co., "The Bosco Line, Catalog E," (1929) APT Building Technology Heritage Library at archive.org.

archive.org/details/TheBoscoLineOfNewEnglandMadeSuperiorLapJointMetalCeilings, 1.

⁴⁸ Smith, 105.

⁴⁹ *Ibid*, 16.

⁵⁰ *Ibid*, 76-77.

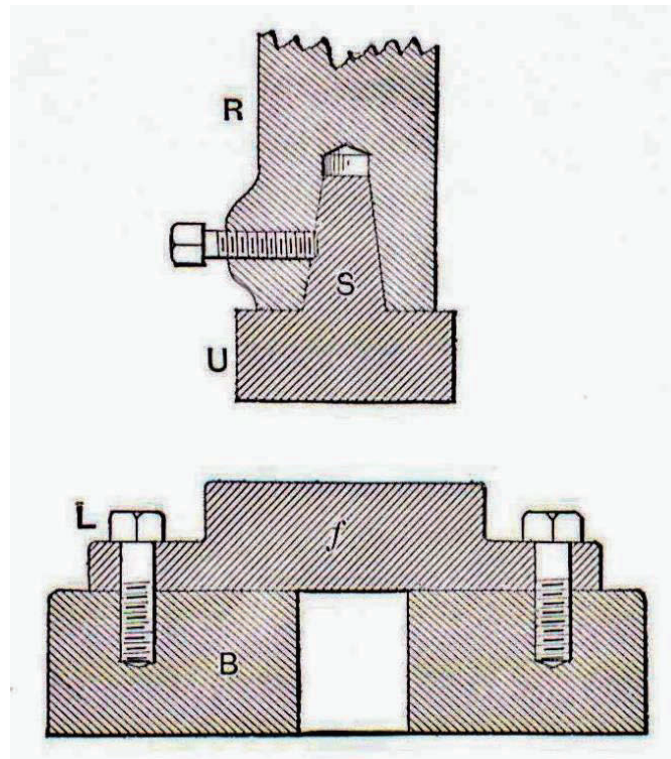


Figure 4.16 Line drawings of a simplified drop hammer press (Smith, 77).⁵¹

The sheet steel ceiling of the Mancos Times-Tribune Building was most likely fabricated using a “roller feeding” press in which a pair of cylindrical “feed rolls” moved a sheet of metal as it was impressed with a design from a die. This type of press-working falls within the category of “press-feeding.” The rollers themselves did not form the sheet metal, rather they were used to supply the press and move the sheet along. The description of the machinery lines up with the fabrication observed on the ceiling in-situ: “Automatic roller-(or roll-) feeding is mostly applicable to very long sheets or bars, especially to those which are thin enough to be wound upon a reel” (Figure 4.17).⁵² Sometimes a pair of “feed rolls” would be employed on the same sheet. The machine would be supplied from a roll of sheet metal and would maintain this feed

⁵¹ ‘R’ is the ram holding ‘S’, the upper die. ‘B’ is the bolster holding ‘f’ the lower die.

⁵² Smith, 236.

through the forward motion of the rolls until the roll was exhausted.⁵³ Theoretically, though a description was not found in any text, the pressed outgoing sheet would automatically be wound around a new roll.

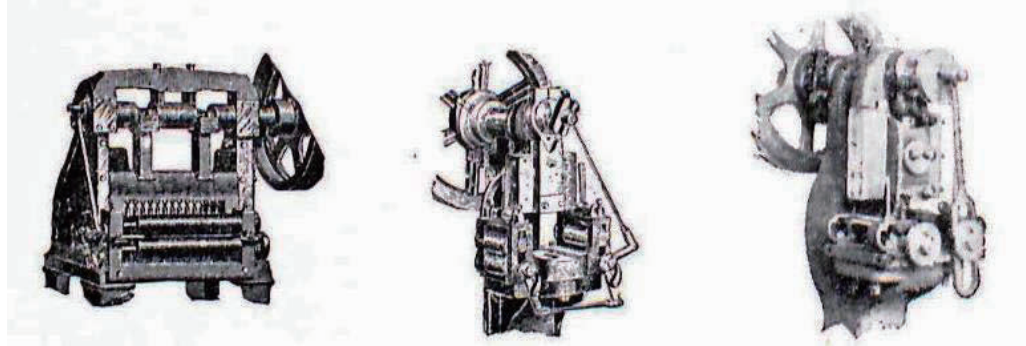


Figure 4.17 Three different types of roller feeding press (Smith, 236).

Adding a coat of primer to architectural ironwork was a common practice used by manufacturers to prevent rusting during transportation of an order.⁵⁴ Sometimes it was applied prior to shaping⁵⁵ and was often applied to both sides of a piece using a brush.⁵⁶ It was a general notion that protection of the metal was the responsibility of the manufacturer, “for it often happens that the seeds of decay are sown between the time of the iron leaving the works and being erected.”⁵⁷ In the Mancos Times-Tribune Building, its steel ceiling was coated only on one side with a grey ‘shop’ or ‘factory’ prime by its manufacturer prior to shipment and was likely applied with a roller or a brush.⁵⁸ Grey was noted as a common primer color in many

⁵³ Smith, 233, 236.

⁵⁴ “Decorating a Metal Ceiling,” *Carpentry and Building* (Jul 1908), 250.

⁵⁵ “The Art of Making Steel Ceilings,” 104-105.

⁵⁶ Berger Manufacturing Company, “Berloy Steel Ceilings Catalog No. 27,” 11.

⁵⁷ Pamela W. Hawkes, “Paints for Architectural Cast Iron,” *Bulletin of the Association for Preservation Technology*, 11, no. 1 (1979): 17.

⁵⁸ “The Art of Making Steel Ceilings,” 104-105.

publications⁵⁹ and lead⁶⁰ or zinc⁶¹ white. Zinc was revealed during the XRF analysis (Appendix B) and may have been used in the primer as zinc oxide as its use was mentioned as a quality paint for iron in the nineteenth century.⁶² Prior to additional painting, the surface was cleaned of any grease or dirt. For steel ceilings the suggested method was an application of naphtha.⁶³ The same 1908 article mentioned above also specified a paint recipe for steel ceilings:

The first coat of paint should be semi-flat in order to have it adhere well. A priming made from keg lead with any desired color matter, ground in oil, thinned with equal parts of coach japan, rubbing varnish and turpentine, will give the desired result. Any other paint, glossy or flat, will adhere well to this coating.⁶⁴

Lead was not found in the XRF analysis of the finished side of the metal ceiling, but the first two layers were likely oil-based paints. While the ceiling in the Mancos Times-Tribune was painted a single color, those in higher class establishments could be polychrome (Figure 4.18). Some catalogues suggested proper color palettes to be used on their metal ceilings.⁶⁵

⁵⁹ "Decorating a Metal Ceiling," 250.

Dierickx, "Metal Ceilings in the U.S.," 87.

Boston Metal Ceiling and Manufacturing Co., "The Bosco Line, Catalog E," 2.

⁶⁰ Metal Shingle & Siding Co., "Ceilings & Side Walls: Catalogue No. 60," (1900) APT Building Technology Heritage Library at archive.org, archive.org/details/CeilingsSideWallsCatalogueNo60, 6.

⁶¹ Northrop Coburn & Dodge Co., "Catalogue 9," (1900) APT Building Technology Heritage Library at archive.org, wainscotingarchive.org/details/NorthropsStampedSteelCeilingsSidewallsWainscoting, 3.

⁶² Hawkes, "Paints for Architectural Cast Iron," 20.

"The Art of Making Steel Ceilings," *The National Builder* 54, no. 4 (1912): 104-105.

⁶³ "Decorating a Metal Ceiling," 250.

⁶⁴ "Decorating a Metal Ceiling," 250.

⁶⁵ Berger Manufacturing Company, "Berloy Steel Ceilings Catalog No. 23," (1920) APT Building Technology Heritage Library at archive.org, archive.org/details/BerloyMetalCeilingsCat.No.23, 10.



Figure 4.18 Suggested color palette of an elaborate metal ceiling (“Metal Ceiling and Side-wall Finish,” II).

A complete design for a metal ceiling could be made up of many components with a field of tile or sheets and surrounds of moldings or cornices. Elaborate center pieces were also used (Figure 4.19). Trade catalogues showcase an unimaginable number of patterns with varying degrees of complexity. Some tiles were complete designs and this motif would be repeated throughout the ceiling (Figure 4.20), but others were only part of a 2, 4, 6 or 8 tile design (Figure 4.21).⁶⁶ Tiles and sheets came in all manner of styles such as Rococo, Moorish, Gothic Empire and Colonial (Figures 4.22 and 4.23). The Berger Manufacturing Company claimed to be the first company to produce metal ceilings in accurate and authentic designs of various periods or styles,⁶⁷ and was doing so at least by 1900.⁶⁸

⁶⁶ Dierickx, “Metal Ceilings in the U.S.,” 85.

⁶⁷ Berger Manufacturing Company, “Berloy Steel Ceilings Catalog No. 23,” 4.

⁶⁸ “Art in Metal Ceilings,” *The American Architect and Building News* (Apr 7, 1900): A2.



Figure 4.19 Elaborate centerpiece measuring eight feet in diameter (Northrop, Coburn & Dodge Co., 13).

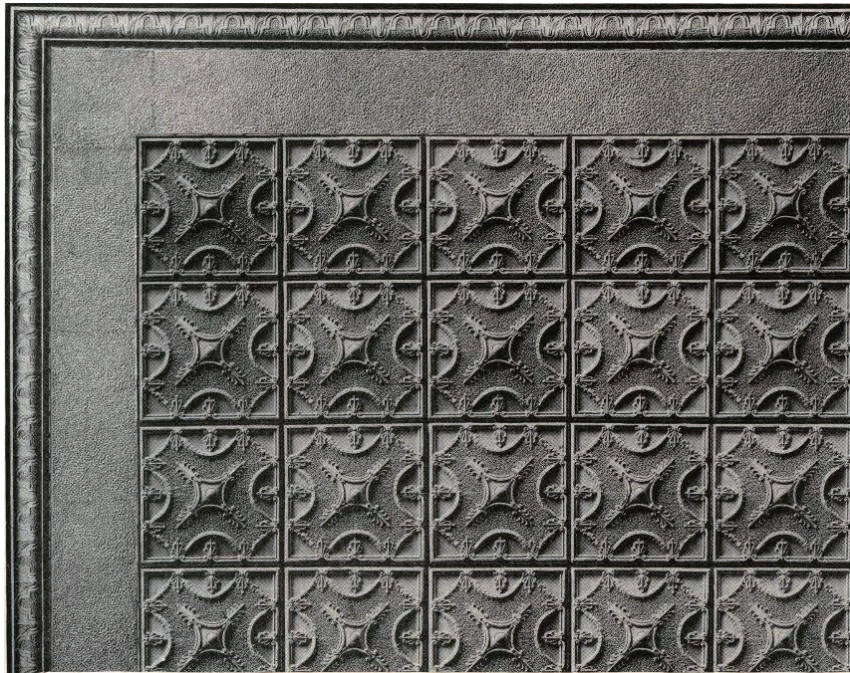


Figure 4.20 Ceiling with a repeating pattern (Western Ceiling and Stamping Company, 71).

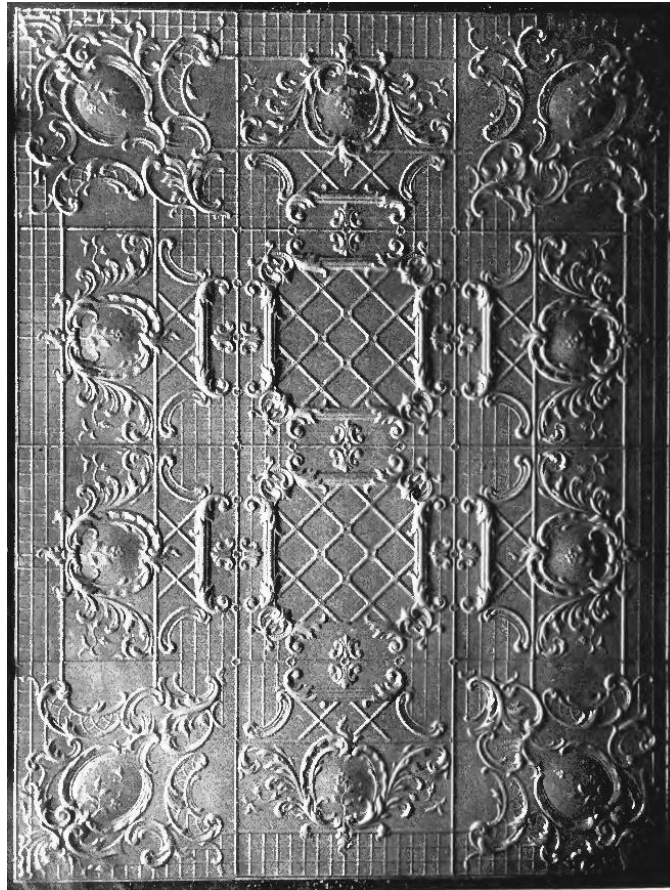


Figure 4.21 Ceiling made up of multiple patterns (Pedlar People Limited, 10).



Figure 4.22 Highly decorative stamped steel panel (Berger Manufacturing Company, “Berloy Steel Ceilings Catalog No. 27,” 22).

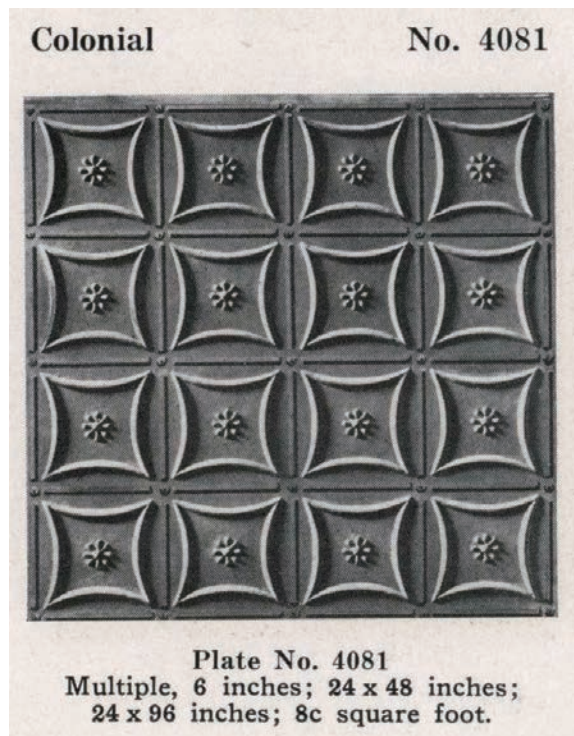


Figure 4.23 Stamped steel panel with a more restrained design (Berger Manufacturing Company, “Berger Steel Ceilings Catalog No. 27,” 24).

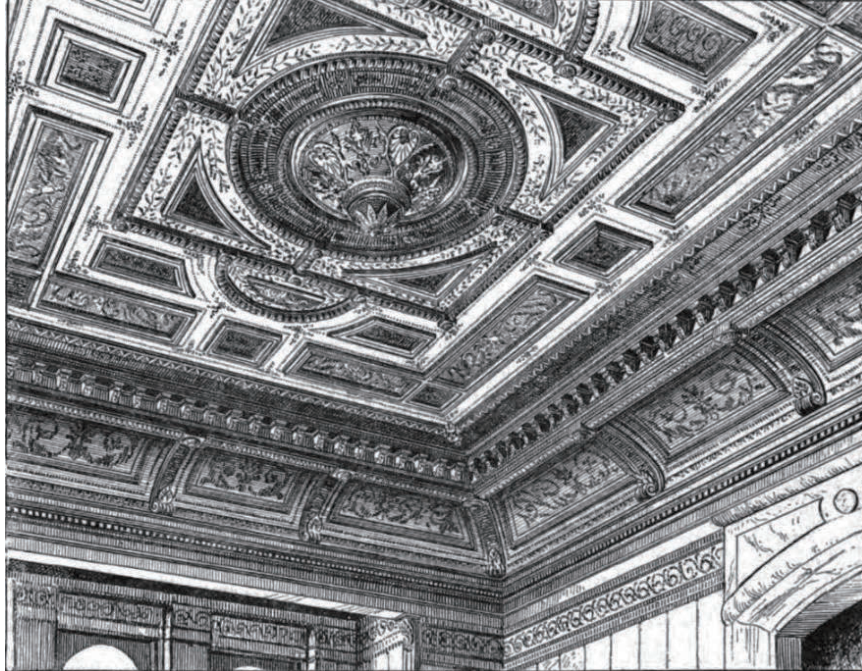


Figure 4.24 Illustration showing the elaborate decorative capability of metal ceilings (“Sheet Metal Ceilings and Center Pieces,” 63).

Similarly to sheet metal cornice manufacturers, ceiling manufacturers required their clients to send measurements of the intended spaces with their order to properly fulfill it. This included a sketch of the room or rooms in plan with dimensions marked and notes of any kind of obstructions present in the ceiling which would not be covered (Figure 4.25). The direction of the floor joists were also noted.⁶⁹ The drawings did not have to be to scale, but the annotated dimensions had to be accurate and legible. Measurements from the top of windows and doors to the base of the ceiling needed to also be included in order to correctly size cornices or other ornamentations not flush with the ceiling. The height of a cornice was doubled then added to each room dimension to get the final measurement. Working plans for proper installation of the pieces were included with an order (Figure 4.26), so if the provided dimensions were incorrect,

⁶⁹ Berger Manufacturing Company, “Berloy Steel Ceilings Catalog No. 23,” 7.

discrepancies would occur for which the manufacturers held no responsibility. These plans were very detailed, showing the exact placement of every single piece to be installed.⁷⁰

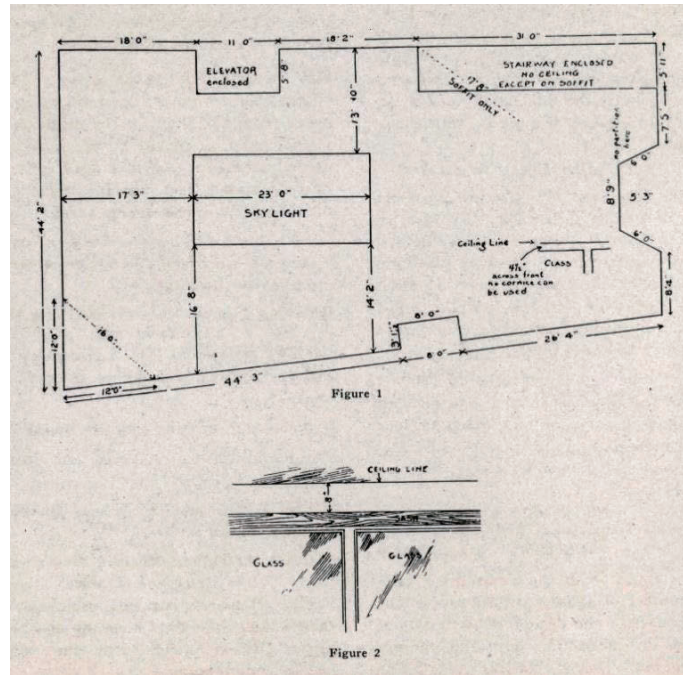


Figure 4.25 Example of measurements proved by the Berger Manufacturing Company (Berger Manufacturing Company, “Berloy Steel Ceilings Catalog No. 23,” 7).

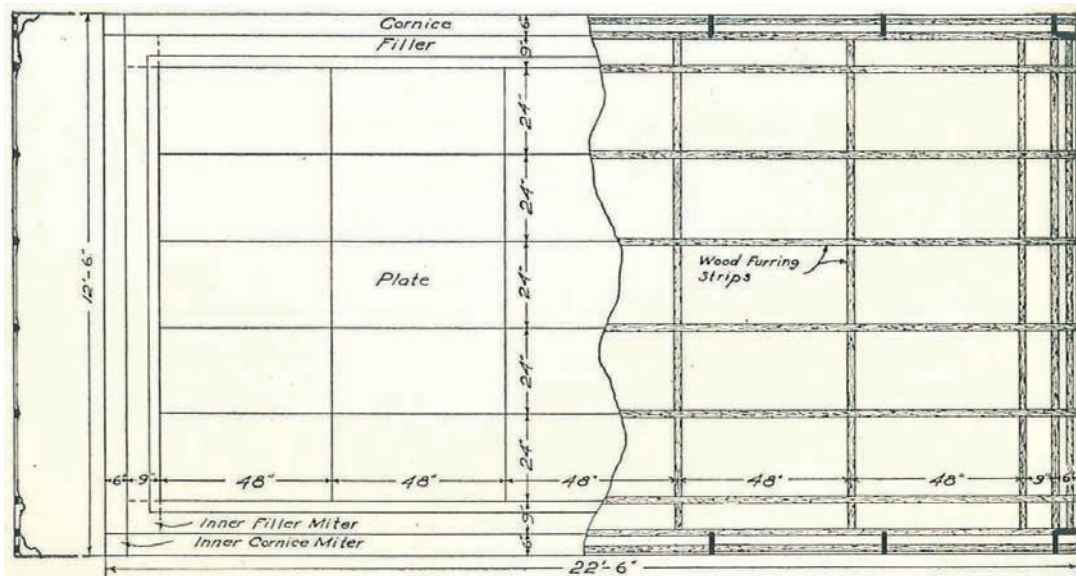


Figure 4.26 Example of a manufacturer’s working drawing (Canton Steel Ceiling Company, 4).

⁷⁰ Berger Manufacturing Company, “Berloy Steel Ceilings Catalog No. 23,” 9.

The following outlines how a typical pressed metal ceiling was installed (Figures 4.27 and 4.28). The instructions are for ceiling panels with a cornice surround, so differences between its installation process and that found in the Mancos Times-Tribune Building are noted in the following paragraph. All work would have followed the instructions outlined on the manufacturer's working drawings. To begin, a scaffold was erected for the laborers at a height which allowed only a three inch clearance between the tops of their heads and the floor joists above when they stood upright. A chalk line would be struck at the exact center of the room at right angles to the joists. This was referred to as the 'start line.' Additional chalk lines would be struck parallel to the 'start line' at intervals that corresponded to the width of the ceiling pieces, typically twelve or twenty-four inches. Thin furring strips of soft wood, such as dry spruce,⁷¹ were then fastened to the joists, centered over the chalk lines. The strips were similar to plaster lath, but wider, typically measuring 7/8" in height and 1 1/4 - 2" in width. Larger manufacturers could supply them directly to customers, some charged for them,⁷² others included them with an order.⁷³ Additional chalk lines were marked at right angles to the furring strips and nail cross strips, known as nailers, were toenailed between them to match the edges of the ceiling pieces. The pieces were nailed to these strips which gave them additional support and a surface for fastening which the joists themselves could not provide. It was crucial that these be level as well as centered both lengthwise and crosswise to the edges of ceiling pieces. Shims or wedges could be inserted between the strip and the joist to make them level. The final preparatory step before

⁷¹ Boston Metal Ceiling and Manufacturing Co., "The Bosco Line, Catalog E," 3.

⁷² "Berloy Steel Ceilings Catalog No. 23," 9.

"Erecting Sheet Metal Ceilings from Working Drawings," 521.

⁷³ Eller Manufacturing Co. "Stamped Steel Ceilings," (n.d.) APT Building Technology Heritage Library at archive.org, archive.org/details/StampedSteelCeilings, 1.

installing the ceiling pieces was to strike a chalk line along the center of the central furring strip across its entire length.⁷⁴

Installation of the ceiling pieces would begin at the back of the room, placing them flush with the central line. The pieces were laid in courses, moving from the central line out to the edges of the room and then beginning a new course above this, until the ceiling was full. To install cornices or moldings, wooden brackets were fastened to furring strips on the side walls at four feet intervals with extra brackets for mitres and connections. Any open space between the flat field and the cornice would be closed with filler sheets. The foot of the cornice or molding was to be fastened first before the top edge to allow for the underlapping of filler if necessary.⁷⁵

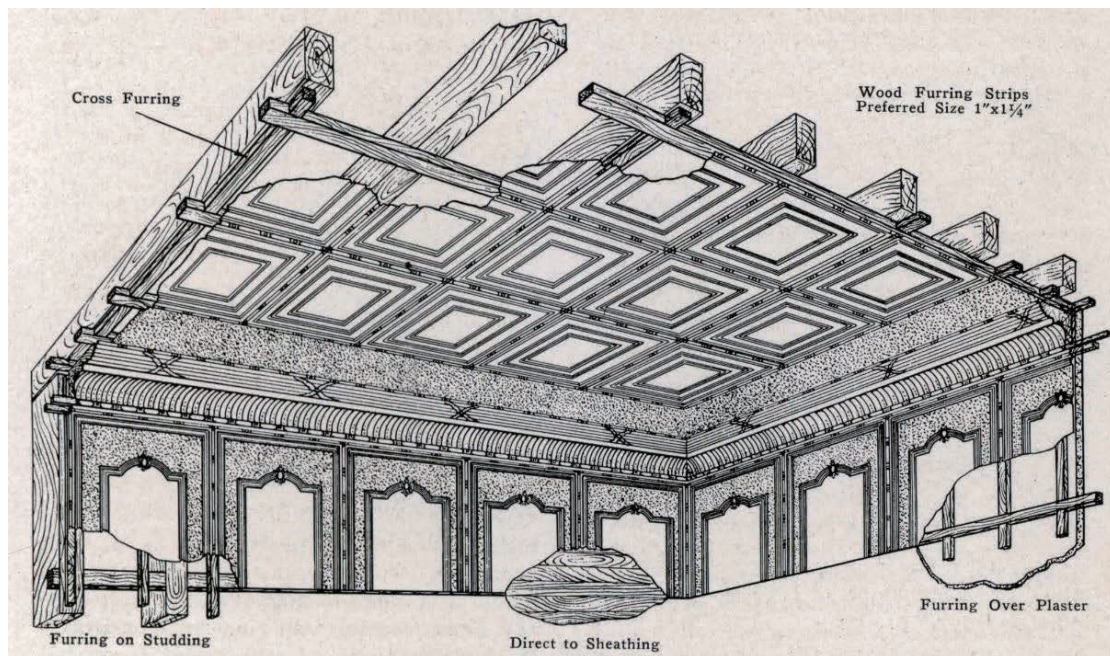


Figure 4.27 Diagram showing the proper installation of furring strips for both ceilings and sidewalls (Berger Manufacturing Company, “Berloy Steel Ceilings Catalog No. 27,” 11).

⁷⁴ R. W. Selvidge and Elmer W. Christy, *Instruction Manual for Sheet-Metal Workers* (Peoria, IL: The Manual Arts Press, 1925): 92-93.

“Erecting Sheet Metal Ceilings from Working Drawings,” 521-522.

⁷⁵ “Berloy Steel Ceilings Catalog No. 23,” 7.

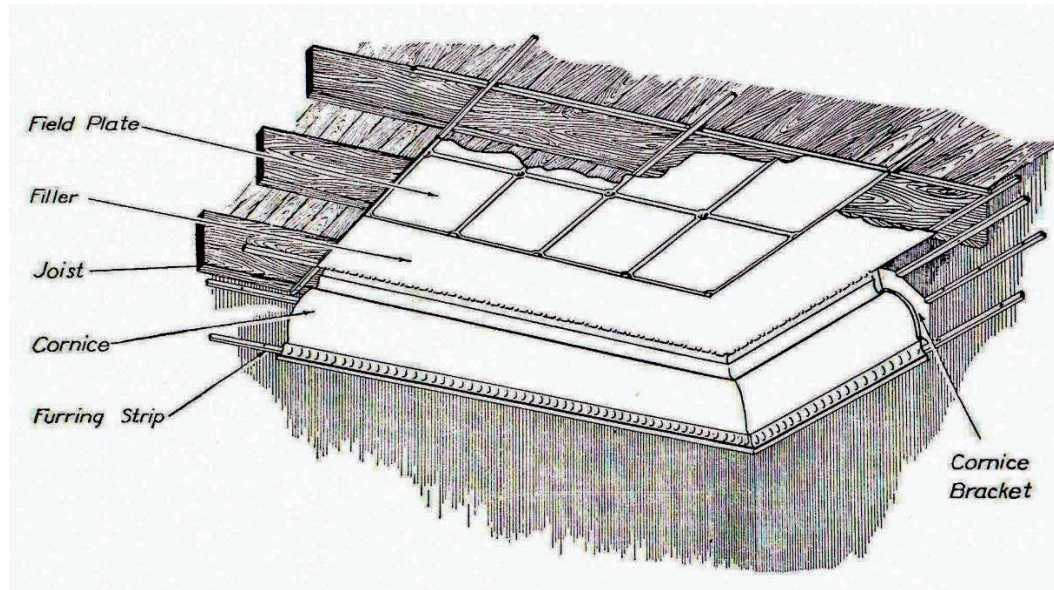


Figure 4.28 Diagram showing the proper installation of a metal ceiling and cornice with pieces labeled (Selvidge and Christy, 93).

The ceiling sheet of the Mancos Times-Tribune Building ran perpendicular to the rafters. The framing system for the ceiling is only made up of nailers and the sheets are nailed directly to them and the roof rafters. The installation process was probably similar to that outlined above with the first piece going directly in the center of the room with the edge sheets being trimmed if need be. The sheets were manufactured in eight feet by two feet lengths, and some trade catalogues were found which advertised such a product (Figure 4.29). In the catalogues, they were advertised as field plates to be used with a filler and molding or cornice.⁷⁶ The newspaper may have only been able to afford the field plates, but still wanted a more ornate and fireproof material than the original plaster in the building. The recent fire in the building was likely a greater consideration in their choice of a metal ceiling than aesthetics.

⁷⁶ Boston Metal Ceiling and Manufacturing Co., "The Bosco Line, Catalog E," 5.



Figure 4.29 Sheet steel field plate with filler and molding (Boston Metal Ceiling and Manufacturing Co., 5).

Uses of Sheet Metal Ceilings and Cornices

While there was virtually no limit on the types of buildings which used exterior sheet metal cornices, the use of interior sheet metal ceilings was more restrained. Today, sheet metal ceilings are mainly associated with commercial buildings while sheet metal cornices are associated with both residential and commercial buildings. These associations are partly due to where these elements have survived, but are due in great part to the perceptions and values consumers ascribed to each.⁷⁷ An 1897 issue of *Architecture and Building* noted the quick expansion in uses of metal ceilings, writing:

Since their first introduction the use of metal ceilings and sidewalls has vastly extended, until now they may be found not only in stores and office buildings, but in churches, schools, hospitals and some of the finest residences, many who

⁷⁷ Simpson, *Cheap, Quick and Easy*, 66.

at first hesitated to adopt them are using them in work calling for high-class treatment.⁷⁸

Trade catalogues contain images of their use in more common places such as stores, office buildings and restaurants, and in more high-style buildings such as churches, theaters and banks (Figure 4.30).

In 1903, *Architecture and Builder* remarked: “It is probably only a matter of time and cost before metal ceilings will become the rule instead of the exception for most houses.”⁷⁹ That optimism would never come to fruition. Despite its use in a wide array of building types, the sale of metal ceilings for use in domestic homes was fairly limited. It was a problem of expense and taste. Plastering and wallpapering was still cheaper at smaller scale and traditionally, ordinary homes did not have elaborate decorative ceilings. Wealthier homeowners who were able to afford such elaborations prior to the advent of metal ceilings were more likely to use ornamental plaster. Despite manufacturers’ attempts to market metal ceilings as a form of high art, they were still considered a low quality, imitative material to be found in common commercial buildings.⁸⁰

⁷⁸ “Metal Ceilings,” *Architecture and Building* 27, no. 19 (Nov 6, 1897): 172.

⁷⁹ Mary Dierickx, “Metal Ceilings in the U.S.,” 85.

⁸⁰ Simpson, *Cheap, Quick and Easy*, 66.



Figure 4.30 Metal ceiling of St. Leonard's Church in Boston (Northrop Coburn & Dodge Co., 45).⁸¹

Advantages of Metal Ceilings

In their catalogues, manufacturers highlighted a set of advantages of sheet metal ceilings to show their superiority over those made of plaster and lath. The advantages seemed to have been agreed upon by the industry early on, as the same arguments recur in numerous catalogues regardless of geography or date. "The advantages of Steel ceilings over wood and plaster are obvious. They give perfect protection against fire, water, dust, vermin and rodents, do not crack and collapse and never shrink or warp."⁸² They were also noted as being easy and impervious to germs, thus being highly sanitary. These claims correspond directly to problems with plaster ceilings: "It stains readily; it is very porous and may fill with germs of disease, and a very little vibration causes it to crack and fall off in patches, rending it unsightly..."⁸³

⁸¹ Radically different from the typical notion of a pressed metal ceiling, such as that present in the Mancos Times-Tribune Building, this image showcases the versatility of sheet metal's form and use in its application as a ceiling covering.

⁸² "Berloy Steel Ceilings Catalog No. 23," 11.

⁸³ "Metal Ceilings," *The American Architect and Building News* (Oct 4, 1890): A2.

One aspect often highlighted in their trade catalogues was the high degree of ornamentation which could be achieved at a relatively low cost through sheet metal.

Metal ceilings, on account of their indestructible qualities, are more economical than lath and plaster, and hence less expensive than any form of ceiling yet discovered. Once erected, they require no renewals and when tastefully decorated with the proper mineral waterproof paint, never require redecorating, as little soap and water will restore a ceiling to its original brilliancy... The first cost of a steel ceiling is its last cost... A steel ceiling is fireproof to the extent that it prevents a fire from leaving the room in which it starts. It is impervious to moisture, and being germ and vermin proof, is more sanitary than glazed tile, which costs probably four times as much.⁸⁴

Nearly every available catalogue researched touted sheet iron's fire resistance as compared to plaster or wood, the materials it was meant to replace. The industry promoted scientific fire test demonstrations to give evidence to their claims of durability, such as one reported in the *New York Record and Guide* in 1914. Another test held by the Association of Metal Ceiling Contractors of Greater New York put sheet iron up against plaster and wood. The metal ceiling resisted 1,369°F temperatures for one hour and ten minutes, the entire duration of the test, while wood lath and plaster ceilings failed after twelve minutes.⁸⁵ The results demonstrated the superiority of iron and were subsequently featured in many trade catalogues.⁸⁶ Catalogues also showed photographs of burnt interiors which had used metal ceilings to show how they remained intact while the plaster was destroyed (Figure 4.31).

⁸⁴ F. E. Smith, "The Contractor's Steel Ceiling Business," *Sheet Metal* (Jan 1914): 637.

⁸⁵ "Berloy Steel Ceilings Catalog No. 23," 9.

⁸⁶ Simpson, *Cheap, Quick and Easy*, 50.

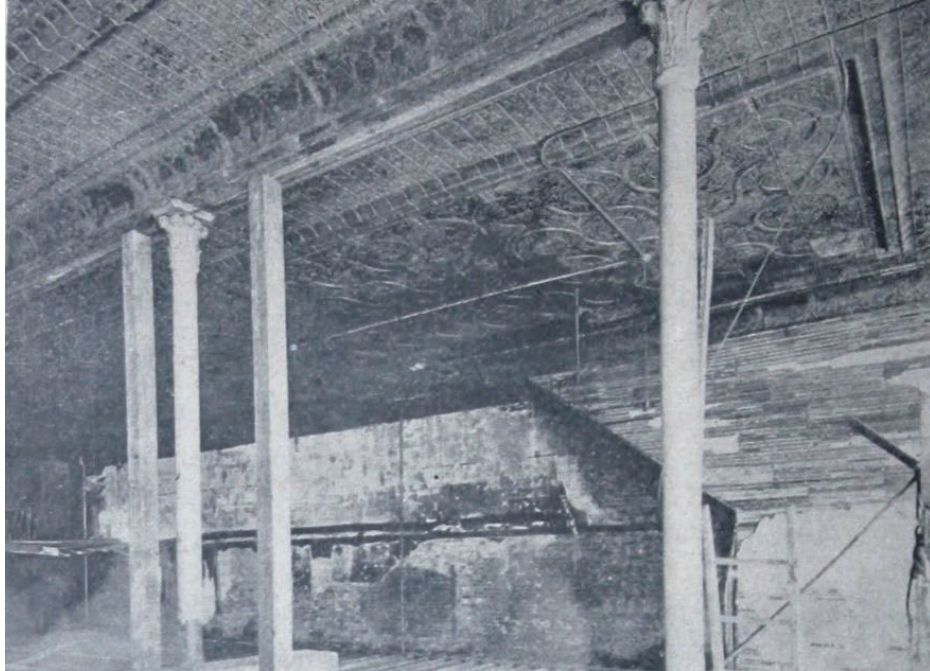


Figure 4.31 Burned out interior with a metal ceiling intact (Canton Art Metal Company, 2).

A Note on the Debate of Sheet Metal Authenticity

The Sheet Metal Pavilion erected at the 1876 Philadelphia Centennial Exhibition by the Kittredge Cornice and Ornament Company of Salem, Ohio was one of the highlights of early days of the material in the United States (Figure 4.32). It was constructed of leaded and galvanized sheet iron with pressed zinc ornamentation and was meant to be a “practical illustration of the adaptability of sheet metals to architectural and general building purposes.”⁸⁷ Its exterior was unpainted and “left as it came from the mills and ships, that those interested may better understand the exact condition of the material before it is painted.”⁸⁸ The response it received was a microcosm of bitter debate beginning to ensue and the stark divide which began to develop within the architectural field towards decorative sheet metal and imitative materials in general. The official exhibition publication claimed that all who witness the Pavilion would be

⁸⁷ Simpson, “Ornamental Sheet Metal in the United States,” 295.

⁸⁸ Harboe, 32.

impressed by the “durability, architectural effects and low price” of the relatively new material.⁸⁹ On the other hand the editors of the *Architect and Building News* dubbed it as “perhaps the most offensive building on the grounds” having “coarse ornamentation of the most pretentious kind.”⁹⁰ And of sheet metal they wrote: “Galvanized iron is a very valuable material for its uses, and its uses are many: there is no need of pressing it into the place of other materials where they will serve better.”⁹¹ Expanding upon this idea in a latter edition after receiving a letter in defense of sheet metal,⁹² the editors wrote that iron has inherent properties that make it suitable for certain architectural uses, and that it is not capable of replicating what stone is better able to achieve. Their concern was of the “misuse of the material” which “trust it into places and use[d] it in forms for which we think it unfit, and to oust other materials which in their places we consider to be appropriate.”⁹³ In summation, they stated:

There is sufficient and better use to be made of the metal. Besides its constructive uses, which are many, there are grills, gates and railings, there are roof coverings and roof ornaments, which cannot well be made of stone, and for which in many cases metal is the most desirable material; and there are ways of using it which do honor to its distinctive qualities without forcing it handicapped into an unequal competition with other materials on their own ground.⁹⁴

⁸⁹ Simpson, *Cheap, Quick and Easy*, 30.

⁹⁰ “Centennial Architecture II,” *American Architect and Building News* (Jun 10, 1876): 187.

⁹¹ *Ibid*, 187.

⁹² “An Argument for Sheet Metal in Architecture,” *American Architect and Building News* (Jul 22, 1876): 239-240.

⁹³ “Sheet Metal Architecture,” *American Architect and Building News* (Jul 22, 1876): 234.

⁹⁴ *Ibid*, 234.



Figure 4.32 Sheet Metal Pavilion at the Philadelphia Centennial Celebration (freelibrary.org).

Both sheet iron cornices and ceiling began as decorative elements imitative of other materials, wood or stone and plaster, respectively. Cheaper than stone and more durable than wood, it gained wide appeal from those desired elaborate ornamentation but couldn't afford more prestigious materials. While embraced by the masses, it faced hostility from those who considered themselves to have a more refined taste.⁹⁵ Upon the introduction of sheet iron cornices in the 1850s, it gained wide mass appeal it was initially dismissed as being a "servile imitation of other materials",⁹⁶ such as stone, and sharply criticized by the tastemakers of the era.⁹⁷ Sheet iron and steel ceilings met this same criticism later on when its use became

⁹⁵ Harboe, 4.

⁹⁶ Ibid, 40.

⁹⁷ Ibid, 4.

widespread as well. These criticisms did not stop the material from growing in popularity and any well written opposition was easily dismissed by those who saw the immense practicality of the material. Attitudes toward architectural sheet metal gradually evolved and it became valued in its own right, such that William Neubecker was able to write in 1919 that:

A sheet-metal cornice is not now imitative. It possesses a variety and beauty peculiarly its own. No pattern is too complex or too difficult. Designs are satisfactorily executed in sheet metal which are impossible to produce in any other material. By the free and judicious application of pressed metal ornaments, a product is obtained that equals carved work. For boldness of figure, sharp and clean-cut lines, sheet-metal work takes the lead of all competitors.⁹⁸

Conservation Considerations for Decorative Sheet Iron

Unlike copper or lead, architectural applications of iron are susceptible to atmospheric corrosion, in which the metal reacts with oxygen, producing a layer of iron oxide commonly known as rust. Rust is highly porous allowing continual oxidation of the iron until it is completely consumed.⁹⁹ This was especially problematic for early uses of sheet iron because of its thinness and particular use as a protective covering intended to provide a complete barrier against the elements. Copper and lead readily form protective patinas when exposed to the atmosphere. Patinas themselves are products of atmospheric corrosion, but halts once an initial layer is formed, creating a protective barrier between the atmosphere and the metal underneath which inhibits any further progression of the corrosion.

Traditionally, three methods have been used to prevent iron corrosion on architectural elements made of sheet iron: painting, tinsplating or terneplating and galvanizing. Painting is the treatment most commonly been used for uncoated iron, but requires frequent maintenance and repainting. The processes of tinsplating and terneplating involve dipping sheets of iron into molten pure tin for tinsplating or mixture of tin (typically 15-20%) and lead for terneplating to form a

⁹⁸ Neubecker, 193.

⁹⁹ Gayle and Look, 72.

protective coating.¹⁰⁰ These methods were predominantly used on roofing materials, and so are not applicable to the iron elements on the Mancos Times-Tribune Building. The final technique, galvanizing, coats iron with a protective layer of zinc and was developed simultaneously by French and British scientists in the 1830s.¹⁰¹ The process was introduced to the United States in the 1840s and galvanized iron sheets were readily available by the 1850s.¹⁰² Galvanized iron could also be painted,¹⁰³ but a special treatment had to be applied. A recipe and application directions for such a treatment was featured in a 1908 trade journal article:

One ounce each of copper nitrate, copper chloride and sal ammoniac are dissolved in one-half gallon of water, and when this is effected add one ounce of commercial or crude hydrochloric acid. The solution must be made in an earthen or glass jar or bottle, not in tin cans or other metal. . . Apply to the metal with a soft brush and let stand for at least 12 hours, when a grayish film will have formed. Go over this with the duster, then go ahead with any good oil paint that you wish to use, and you need not apprehend any risk of peeling.¹⁰⁴

Poured in Place, Unreinforced Concrete

Concrete is composed of cement, sand, and gravel or crushed stone, mixed with water. By 1912 in America, Portland cement had become the preferred type of cement. It had a greater uniformity and strength than natural cement. In 1912, it was understood as being:

material obtained by finely pulverizing clinker produced by burning to semi-fusion an intimate artificial mixture of finely ground calcareous and argillaceous materials, this mixture consisting approximately of 3 parts lime carbonate to 1 part silica, alumina and iron oxide.¹⁰⁵

¹⁰⁰ Simpson, *Cheap, Quick and Easy*, 33.

¹⁰¹ Arthur Channing Downs, Jr., "Zinc for Paint and Architectural Use in the 19th Century," *Bulletin of the Association for Preservation Technology*, 8, no. 4 (1976): 82.

Peterson, "Iron in Early American Roofs," 46.

¹⁰² Harboe, 4.

Simpson, *Cheap, Quick and Easy* 34.

¹⁰³ Hawkes, 18.

¹⁰⁴ "Decorating a Metal Ceiling," 250.

¹⁰⁵ Frederick W. Taylor and Sanford E. Thompson, *A Treatise on Concrete – Plain and Reinforced*, 2nd ed. (New York: John Wiley & Sons, 1912), 48.

The sand and gravel or crushed stone were referred to as aggregate. It was recommended that the sand used to in a concrete mix be clean and well graded. This could be tested by simply picking up a handful of the desired sand; if it is dirty, it will badly discolor the palm. Dirty aggregate was known to affect the strength of concrete.¹⁰⁶

According to a 1912 treatise, “a medium mixture” was recommended for “retaining walls” and “building walls”, among other uses, and was made using a proportion of 1 part Portland cement to 2 ½ parts sand to 5 parts gravel or broken stone. The sidewalls of the Mancos Times-Tribune Building may have been made of a concrete which used a similar formulation.¹⁰⁷

Green softwood lumber, typically spruce, fir or pine was typically used for form construction in the early twentieth century. Green wood was preferred because it was less affected by water in the concrete. Pine was the preferred species as it was easily worked and didn't deform after weathering. A typical form was made of one – two inch thick horizontal boards held in place by studs set at no more than two feet apart for one inch boards and no more than five feet for two inch boards. Stud placement was also dependent on consistency of the concrete. The form had to be water tight for the concrete to properly cure. Sometimes the forms were oiled to fill the pores of the wooden planks and prevent them from absorbing water in the concrete. If a smooth face was desired for the concrete, the board faces themselves should have been dressed and their edges tongued and grooved or beveled.¹⁰⁸ A description of the formwork used in the Mancos Times-Tribune Building was described in Chapter 3. This kind of intricate work was not implemented the building, evidenced by its rough edges.

¹⁰⁶Frederick W. Taylor and Sanford E. Thompson, *A Treatise on Concrete*, 11-13.

¹⁰⁷ *Ibid*, 14.

¹⁰⁸ *Ibid*, 19, 293-296.

A gang of at least six men, plus a foreman, was needed to properly mix and lay concrete, even for a small job. Four men were used to wheel and mix the concrete while two placed and rammed it.¹⁰⁹

Concrete of the early twentieth century was either hand or machine mixed. As a machine was unlikely to be used for the Mancos Times-Tribune Building, the hand mixing process will be outlined. To clarify: the concrete was not actually mixed by hand, but used manual labor just the same. Prior to anything else, a mixing platform was constructed, having dimensions of at least fifteen by twenty feet (Figure 4.33). It had a floor of two inch planks which were attached to two by four inch “stringer” set five feet apart with a two – three inch strip around its edge to retain material. A measuring box was used to attain the correct proportions of each component of the concrete. For the best mixture, the measured sand should be evenly spread atop the mixing board and the measured cement likewise atop the sand. After the sand and cement were measured and placed on the mixing platform, two men commenced to turning the mixture. Two other men additionally measured the gravel to be added, then joined the other men in turning the mixture. Water was added in buckets and allowed to settle for a while before turning. There were at least five different methods of mixing cement at the turn of the century. It was estimated that a four man crew could mix and wheel 10 ½ batches in ten hours.¹¹⁰

¹⁰⁹ Taylor and Thompson, 20-21.

¹¹⁰ Ibid, 21-23, 251-255.

Ira Osborn Baker, *A Treatise on Masonry Construction*, 10th ed. (New York: John Wiley & Sons, 1909), 170.

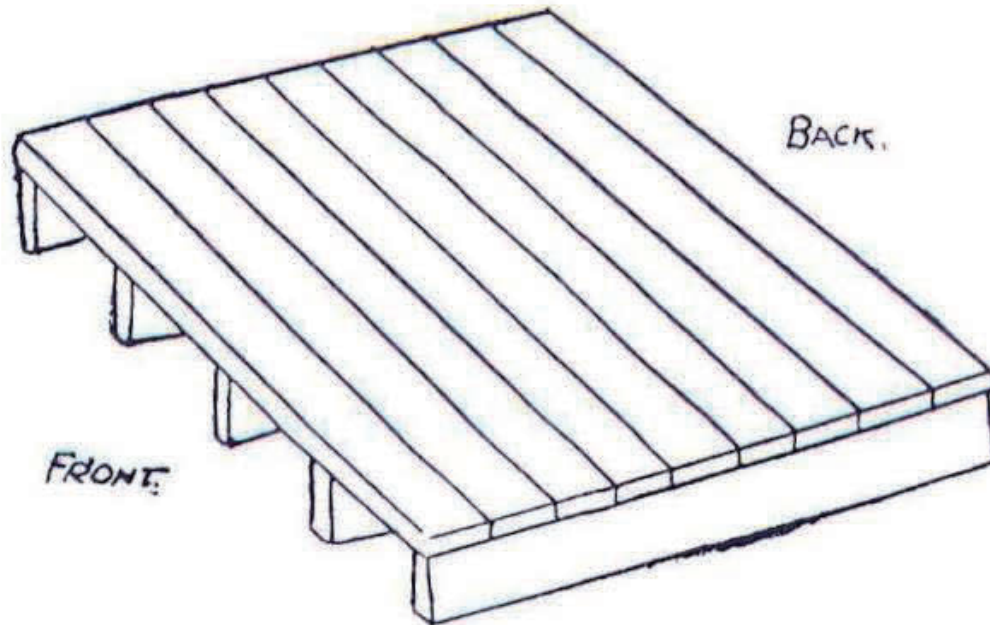


Figure 4.33 Diagram of a mixing platform (Verrall, 82).

After mixing the cement, it was deposited into a form. If the concrete was mixed wet, it could be applied in layers six to eight inches thick. If it was mixed dry, it could be applied in layers twelve to sixteen inches thick. Based upon this, it can be assumed that the sidewalls were made with wet cement.¹¹¹ After concrete was laid in a form, it was rammed to compact it and force out as much air as possible. This was done manually with a pole with a wide flat head.¹¹²

The formwork used in constructing the sidewalls of the Mancos Times-Tribune Building was likely constructed of boards and studs as already described, but also held together through horizontal wire ties (Figure 4.34). Ties were used on large walls when externally braced formwork was structurally insufficient. They were passed between two planks and wrapped around the stud on either side of the form and tightened by being twisted with a stick. After the

¹¹¹ Ira Osborn Baker, *A Treatise on Masonry Construction*, 172.

¹¹² Taylor and Thompson, 281-282.

concrete gains an initial set and the form is deconstructed, the wire is cut back a bit from the surface and the hold is covered with concrete.¹¹³

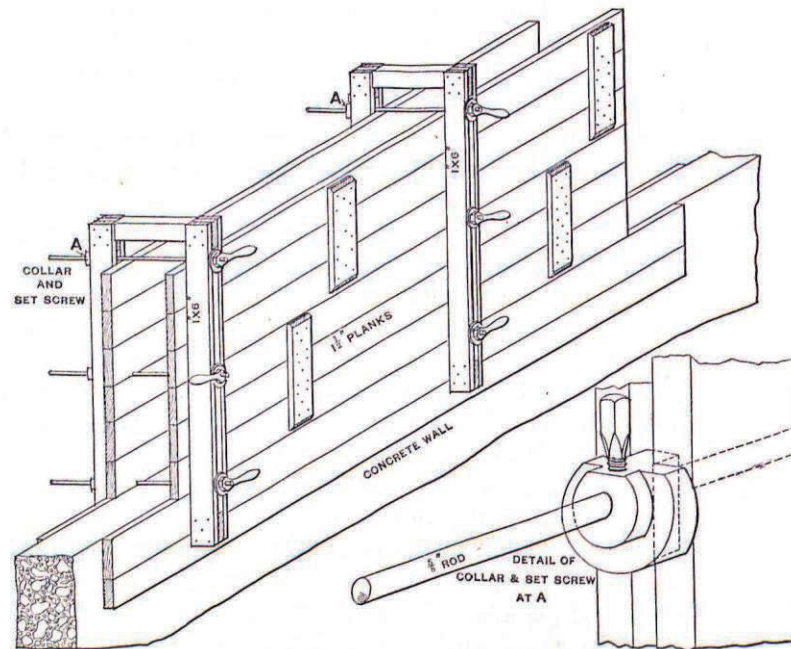


Figure 4.34 Diagram of common formwork with ties (Taylor and Thompson, 622).

Cementitious Plaster

Following a gravimetric analysis and other characterization tests, the mortar used in the Mancos Times-Tribune Building was concluded to have a binder made of a Portland cement and lime mixture. The plaster is flat and non-decorative, used only to cover the concrete sidewalls and the framed north and south walls. Given these characterizations, the technical study was specific to plasters of a cementitious compositions of interior non-decorative uses.

Lime was the essential component for all types of mortars and plasters for thousands of years with its earliest uses found in modern day Palestine and Turkey which were dated to c

¹¹³ Baker, 161.

12,000 B.C.¹¹⁴ Lime putty was used in most interior plasterwork until the early twentieth century. It is derived from limestone containing calcium carbonate (CaCO_3) which is heated, or burnt, which drives off carbon dioxide to form quicklime (CaO). Water is added in a process called slaking which forms calcium hydroxide (Ca(OH)_2). This hydrated lime is what is used in plasterwork.¹¹⁵

Timber lath was introduced as a background material for plaster in the sixteenth century and allowed plaster to be applied to interior walls and ceilings. Lath was made from straight-grained timber which was split or sawn to form narrow strips generally about 3/8" thick and 1-1/2" wide. Very early lath could be as wide as 4". Early lath used oak or beech, but later soft woods, such as pine and fir, were used. Plasterers split and fixed the lath, which were spaced about 1/4"-3/8" apart and fastened with nails (Figure 4.35). Plasterwork on lath was in popular use until the 1930s. Metal lath was introduced in the late nineteenth century, but wooden lath remained popular. The substitution of timber lath with metal lath and plasterboard eventually brought an end to its use.¹¹⁶

¹¹⁴ Kerstin Elert et al, "Lime Mortars for the Conservation of Historic Buildings," *Studies in Conservation*, 47, no. 1 (2002), 62.

Simpson and Brown Architects, *Conservation of Plasterwork*, rev. ed., Technical Advice Notes (Historic Scotland, 2002), 3.

¹¹⁵ Natalie Shivers, *Walls and Moldings: How to Care for Old and Historic Wood and Plaster* (Washington, D.C.: The Preservation Press, 1990), 139.

¹¹⁶ Simpson and Brown Architects, *Conservation of Plasterwork*, 6.

Christopher Brereton, *The Repair of Historic Buildings: Advice on Principles and Methods*, Aspects of Conservation (London: English Heritage, 1991), 67.

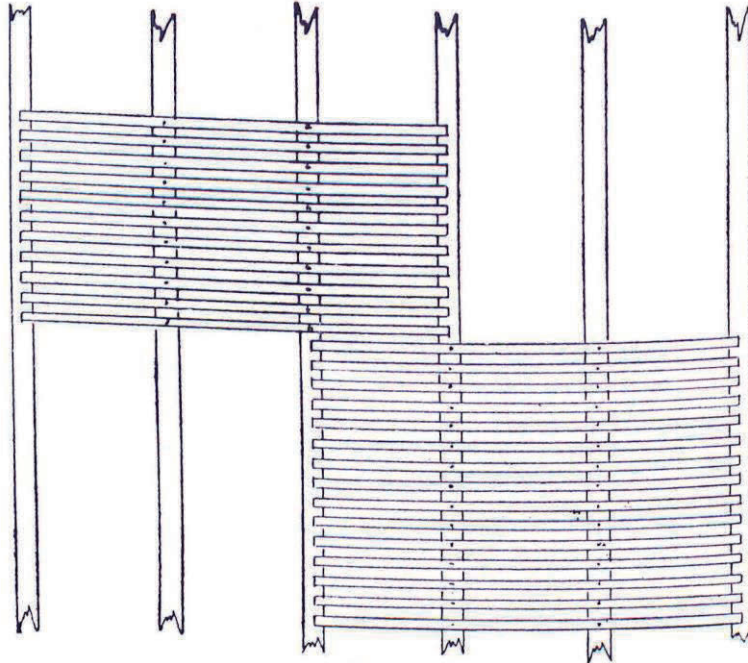


Figure 4.35 Example of wooden lath on studs (Verrall, 162).

Artificial cements, of the kind used in the plaster of the Mancos Times-Tribune Building, were first developed in the early nineteenth century. One of the earliest pioneers was James Frost, who, in 1811, patented an artificial cement made by lightly calcining ground chalk and clay together. Joseph Aspdin of Leeds patented the first type of Portland cement in 1824 which was produced at his plant at Wakefield. His method crushed and calcined a hard limestone which was mixed with clay and ground into a powder which was mixed with water to form a slurry. The mix was fired once, broken up and then fired a second time. Low temperatures were used in his firings though, so the strength of the cement was not high. The technology developed quickly, such that, by the 1850s, the methods for making modern cements had been established. This involved grinding chalk and clay together in a wet mill then firing the slurry at temperatures of between 1300°C - 1500°C. The chalk converts to quicklime which chemically unites with the clay to form clinkers of Portland cement. The mixture is reground and re-fired which is then powdered and

distributed.¹¹⁷ A similar process would have been used to create the cement in the plaster of the Mancos Times-Tribune Building.

Cement-lime-sand mortars and plasters have been used since the early twentieth century.¹¹⁸ Portland cement plasters were mostly used for exterior plastering or in the interior when dampness was likely to occur. A mix of only Portland cement and sand is difficult to manipulate, so often lime or gypsum was added to increase workability, as was characterized in the Mancos Times-Tribune Building plaster.¹¹⁹

Plasterwork on lath was usually applied in three coats. First, the plaster to be applied was mixed in a box or container with a mortar hoe. The first coat, known as the “scratch” coat, was made of coarse plaster and applied to the lath using a hawk to hold the plaster. A trowel was used to apply the plaster diagonally across the face of the lath and forced through the gaps and form “keys.” The formation of wide keys was integral to the stability and performance of the plaster. When the coat was firm, but not totally set, was scratched with a tool to provide an underkey for the second coat (Figures 4.36 and 4.37). Then the “straightening” or “brown” coat was applied to provide a solid, planer surface followed by the “finishing” coat which formed a smooth, hard surface. The first two coats were both about 3/8” thick while the finish coat was only about 1/8” or less and was made with a large proportion of lime with a small portion of fine sand.¹²⁰

¹¹⁷ John Ashurst, *Mortars, Plasters and Renders in Conservation*, 2nd ed. (Ecclesiastical Architect's and Surveyor's Association, 2002), 27-28.

¹¹⁸ *Ibid*, 55.

¹¹⁹ John R. Diehl, A.I.A., *Manual of Lathing and Plastering* (New York: Noble Offset Printers, Inc., 1960), 37-38.

John Parnell Allen, *Practical Building Construction*, 2nd ed. (London: Crosby, Lockwood and Son, 1897), 334.

¹²⁰ Simpson and Brown Architects, *Conservation of Plasterwork*, 5-6.
Natalie Shivers, *Walls and Moldings....*, 136-138.

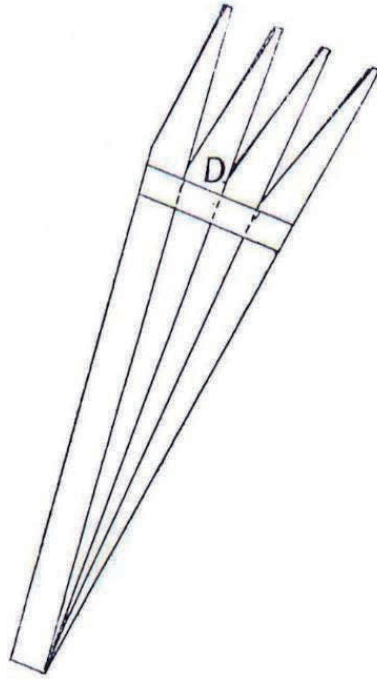


Figure 4.36 Tool for creating scratchwork on plaster (Verrall, 171).

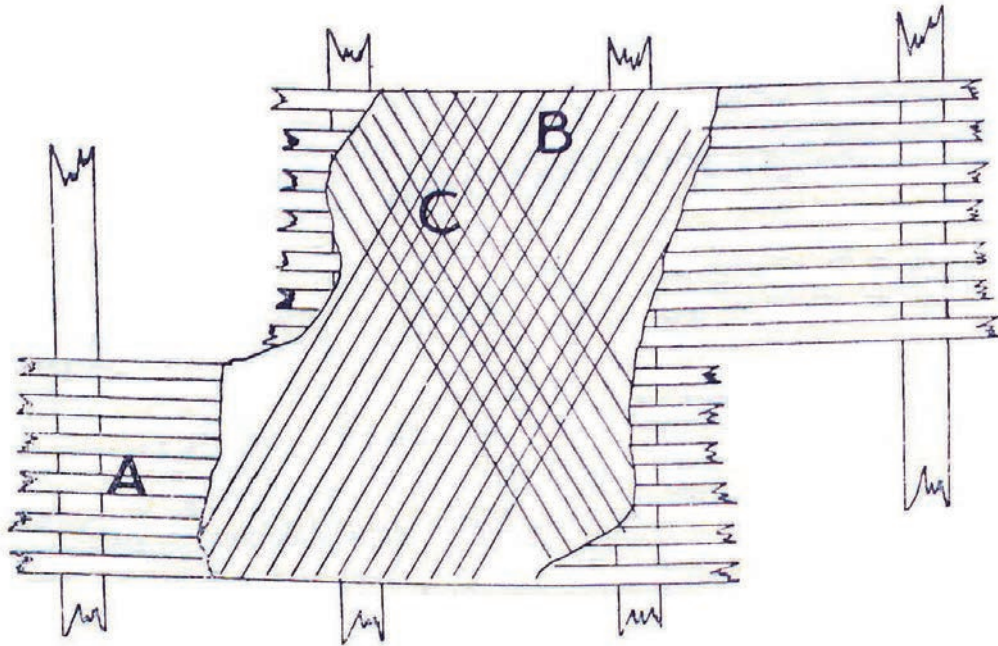


Figure 4.37 Plasterwork showing underkeys on scratchcoat (Verrall, 172).

Wallpaper

The wallpaper present in the Mancos Times-Tribune Building is a flat paperboard border made of wood pulp either painted or printed with a design. The design of the paperboard is obscured by a layer of over painting, so the method of printing cannot be determined. Given the vernacular nature of the building and its occupants, hand painting can be ruled out. It was printed using machinery. Therefore, this section will be focused on the development and use of paper wallpaper rather than the entirety of the subject.

The popularity of wallpapers grew as the paper making process developed. The first paper making process was developed in China in the second century A.D. Knowledge of the process slowly traveled westward, reaching central Europe in the eleventh century. The first English paper mill was erected about 1490 and earliest known wallpaper in that country soon followed, being dated to around 1509.¹²¹

In colonial America, almost all wallpaper used was imported from Britain as imports from other nations were heavily tariffed. After gaining independence from Britain, French imports began to increase in the country. Domestic production of wallpaper also began to increase during this time, mainly adhering to the British practices.¹²²

Mechanization of paper and later wallpaper production was first developed in England, before spreading to the United States. The first machine made paper in America was produced in 1817 by Thomas Gilpin of Delaware. The first mechanically printed wallpapers in the United States were produced by Howell & Brothers of Philadelphia in 1844 using an English steam-

¹²¹ E. A. Entwistle, *The Book of Wallpaper: A History and an Appreciation* (London: Arthur Barker, 1954), 23-24.

¹²² Jane C. Nylander, *Fabrics for Historic Buildings: A Guide to Selecting Reproduction Fabrics* (New York: John Wiley & Sons, 1990), 25.

Richard C. Nylander, "An Ocean Apart: Imports and the Beginning of American Manufacture," in *The Papered Wall: The History, Pattern and Techniques of Wallpaper*, 2nd ed., Lesley Hoskins, ed. (New York: Thames & Hudson, Inc., 2005), 114, 120-122.

powered machine. An earlier account credits Josiah Bumstead & Son with inventing a hand-cranked machine in 1835 which printed wallpaper in one color. Regardless of the exact first example, the 1840s was the period of greatest experimentation with mechanizing all aspects of wallpaper printing, on both sides of the Atlantic.¹²³ Prior to mechanization, wallpaper was made from pasting together small handmade sheets of paper. The United States became the leading manufacturer of wallpaper in the late nineteenth century. It was also during this era that “wallpaper was no longer considered only a finish; it became an essential part of a room’s overall design.”¹²⁴ By 1890, annual production in America was one hundred million rolls.¹²⁵ Wallpaper only grew in popularity heading into the twentieth century as mail order catalogues, such as those offered by Sears, Roebuck & Company, presented a staggering number of designs to middle class consumers. It was also during this time that wallpaper friezes grew in size, being eighteen to twenty-one inches in width.¹²⁶ The paperboard in the Mancos Times-Tribune Building was a part of this trend, being twenty inches in width.

Early wallpapers were made of textiles fibers or as described in the eighteenth century “the coarsest and cheapest rags and woolen stuff.”¹²⁷ Wood pulp began to be commercially used for making paper in Britain in the 1850s and was introduced in America in 1855. Most papers used in wallpapers were made on either a white or écreu-colored paper.¹²⁸ Wallpaper made from wood pulp is brittle, and brown from acids present in the pulp.¹²⁹ This is characteristic of what is

¹²³ Richard C. Nylander, “An Ocean Apart: Imports and the Beginning of American Manufacture,” 129-130.

¹²⁴ Jane C. Nylander, *Fabrics for Historic Buildings*, 143.

¹²⁵ Catherine Lynn Frangiamore, *Wallpapers in Historic Preservation* (Washington, D.C.: U.S. Department of the Interior, 1977), 1.

¹²⁶ Jane C. Nylander, 209.

¹²⁷ Catherine Lynn Frangiamore, *Wallpapers in Historic Preservation*, 3, 6.

¹²⁸ Phyllis Ackerman, *Wallpaper: Its History, Design and Use* (New York: Frederick A. Stokes Company, 1923), 102.

¹²⁹ Frangiamore, 6.

observed in the paperboard of the Manos Times-Tribune, so it can be concluded with some confidence that it is made of wood pulp.

Phyllis Ackerman outlines the typical process of manufacturing wallpaper in 1925, a summary of which will be given here. The account is in close proximity to the construction date of the Manos Times-Tribune Building, so it is likely that very similar processes were used in making the wallpaper present there. Only a few companies at the time were prosperous enough to own the processes to make their own paper and dies. Most manufacturers purchased both the paper and dies elsewhere and merely printed and prepared finished wallpaper at their works. Most printing was done using a cylinder press, usually forged of brass and covered in either canvas, felt or rubber. A roll of paper was fed under a set of these covered drums to be printed with a design. Each cylinder was engraved in relief with a particular design, corresponding to a single color. Ink was continually supplied to the cylinder through a trough below it. A small roller constantly stirred the ink while a continuous cloth, called the sieve cloth, passed through the trough and onto the large drum. If colors were printed on top of each other, the first layer was dried before applying the second. Once the paper is fully printed and had dried, it is rolled onto roll.¹³⁰

Most dyes used at that time for wallpapers were synthetic water colors. The dyes were delivered to a plant and all a manufacturer did to make them ready for printing was add a certain amount of heavy glue to increase adhesive strength. Metallic paints were also becoming more popular and less expensive than they had been at the turn of the twentieth century. Oil paints were also used, although rarely, mostly for leather effects.¹³¹

¹³⁰ Phyllis Ackerman, *Wallpaper: Its History, Design and Use*, 94-96, 100.

¹³¹ *Ibid*, 101.

Chapter 5 – Materials Analysis

This chapter details the methodologies and procedures of the technical analyzes used to characterize selected elements of the Mancos Times-Tribune Building. While visual inspection and architectural archeology can reveal vital information about a building's construction, instrumental and chemical analysis provides additional evidence to support and inform decisions made regarding a structure. In some cases it can confirm assumptions suggested by historical and visual analysis and in others it can offer alternative evidence at odds with past conclusions.

A discussion of the results of the outlined analyzes is included the following chapter.

Sampling Methodology

The project's methodological approach focused on determining the original interior and exterior appearance of the Mancos Times-Tribune Building and better understanding the construction methods of its original components. The tests were meant to augment the historical research of the building systems and were not the main focus of the thesis. Therefore, the tests are not comprehensive nor intensive.

Samples were taken from various elements which provided a representative survey of the materials used in the construction of the building. Samples were only taken of features or furnishings which were deemed original to the building's construction or historically integral to its significance. Most features fell under the first category, while the pressed metal ceiling and the two sampled furnishings fit under the second. In some cases, multiple samples were taken from a single building element as different areas can be painted different colors contemporaneously, depending upon the stylistic approach taken.

All samples were taken during a site visit of the Mancos Times-Tribune Building on August 13, 2014. Samples were extracted with a crescent scalpel, penetrating into the substrate

and turning in a counter-clockwise motion, keeping the blade close to the surface at all times. After extraction, the sample was inspected for quality, specifically, determining if the substrate was retained and if it provided a full stratigraphy of all applied finishes. Those extractions without a substrate or whose stratigraphy was damaged during extraction were rejected and another sample was taken. Quality samples were placed in a plastic re-sealable bag with the sample number written with a permanent marker. Numbers were given in the sequence that the samples were taken. The prefix “MTT” was given for “Mancos Times-Tribune”. Details of the sample locations were taken on site, but photographs of each area were neglectfully not taken. Given the excellent condition of the metal cornice, substrates were not included in its sampling as this would prove detrimental to its future performance. No open seams or other exposed edges were available from where a sample could be cut.

Three categories of analyses were used to address the questions of the building’s appearance and composition: examination of the finishes of various surfaces, an identification test of the pressed metal ceiling and characterization tests of the plaster.

Finishes Analysis

In general, there are two main reasons for conducting a finishes analysis: to document the finishes chronology before a project is undertaken which might endanger the existing layers or to identify the appropriate paint scheme for an interpretive period.¹ Also, Mary A. Jabolonski writes that:

There are two principal categories of physical paint examination: paint color investigations and paint analysis....A paint color investigation is an examination of the layers of paint or other finishes that have been applied to a substrate over the years. It is not a paint analysis. A full paint analysis includes the analysis of

¹ Historic New England, “Paint Analysis,” *Property Care White Papers* series, rev. ed., 2014, historicnewengland.org/preservation/preserving-historic-sites/property-care-white-papers/painting, 2.

the components of the layers of finish including binder and pigments used as well as color.²

Given these definitions, the finishes analysis conducted for the Mancos Times-Tribune Building can be characterized as a paint color investigation to determine the original paint scheme of both the interior and exterior of the building as it was constructed in 1911. One of the goals of the forthcoming restoration campaign is to recreate the original appearance of the building and the conclusions of this analysis will provide the basis of that recreation.

The paint investigation was limited to visible and ultraviolet light microscopy examination. The color and chronology of the observed finishes in each sample were determined. Colors were not quantified with a color system given the difficulty in this determination through microscopic examination alone.³ Pigment identification was deemed unnecessary given the amount of time needed for such an undertaking and that exact paint replication will not be specified in the forthcoming restoration.

The samples were first examined under a stereo microscope to ensure their quality after transportation and to trim them to fit into embedding trays. In some cases, multiple samples were taken of the same area, so then the best sample had to be determined. Problems were encountered with some of the some of the samples, ultimately leading to some not being used. The paint layers on the sample from the back window surround (MTT 06) did not adhere well to the substrate and was flaking off. The same was true of the baseboard sample (MTT 08). There was not a large enough sample for embedding from the cornice field (MTT 12).

² Mary A. Jabolonski, "Do You See What I See? Historic Paint Color Investigations." in *Paint Research in Building Conservation*, Line Bregnhoi, et al, ed. London: Archetype Publications, Ltd., 2006, 45.

³ Mads Christensen, "Material Analysis in Relation to Architectural Paint Research," in *Paint Research in Building Conservation*, Line Bregnhoi, ed. London: Archetype Publications, Ltd., 2006, 16.

After selecting and preparing samples, an initial bed of a polyester resin⁴ was prepared in a mini ice cube tray and allowed to cure. Each sample was then centrally placed in an individual cube, oriented horizontally with their substrates upward and their flatter finish layer against the resin. This orientation was to prevent any bubbles from forming in the voids created between the initial layer and the uneven substrate and layering. Identification labels were also set on this layer. The cubes were then filled with another layer of resin to permanently embed them. The cubes were placed in a fume hood to cure under the light and heat of a 100 watt bulb for three days.

Once the resin had fully cured and the samples were taken out of their trays, their top surfaces were hand-sanded flat with a 100 grit paper attached to a wood block to remove the meniscuses that had formed. A cross section of each sample was then cut using a Buchler® Isomet™ low speed micro-saw (Figure 6.3). These cross sections were then hand-polished unmounted with a micro-abrasive alumina powder⁵ on a felt cloth, lubricated with Stoddard solvent to remove the cuts left by the micro-saw. The polishing technique used was to apply firm, even pressure by hand, moving the sample in figure eight motions, and rotating it ninety degrees every twenty motions (at least) (Figures 6.1 and 6.2). Samples were examined under a Leica MZ16 stereomicroscope after every 360 degree cycle to assess the polishing. Initially, three inch circles of aluminum oxide paper of 6000, 8000 and 12000 grit lubricated with Stoddard solvent were also used, but it was determined that a quality polish could be attained from only using a felt cloth and micro-abrasives. The samples were only polished on one side since reflected light microscopy was to be used rather than transmitted light. Once finely polished, the samples were mounted to glass microscope slides using Cargille Meltmount™, properly labelled and stored upright in a labeled microscope slide storage box.

⁴ The resin used was Bio-plastic catalyzed with a methyl ethyl ketone peroxide.

⁵ Abrasive used was a Buehler Micropolish II, 0.05 micron.



Figure 5.1 Author polishing samples on aluminum oxide paper (Jocelyn Chan 2015).



Figure 5.2 Detail view of polishing (Jocelyn Chan 2015).



Figure 5.3 Author loading a sample into the Isomet™ chuck (Jocelyn Chan 2015).

The samples were examined with a Nikon Alphaphot-2-YS2 compound microscope under reflected light with visible illumination provided by fiber optics from a halogen light source and ultraviolet illumination provided by a mercury bulb and viewed under a Nikon BA 1A filter, which is used to identify autofluorescing layers. Directly prior to observation, a drop of Stoddard solvent and glass cover slide was added to each cross section to facilitate a clear image. Each sample was viewed at the appropriate magnification for viewing a complete stratigraphy. Typically, this was at 100x magnification, but others required a larger field of view at forty times magnification. The next level on the microscope, 200x magnification would have provided more

detailed examinations of the samples, but a complete stratigraphy could not be viewed at one time and the close proximity of the lens to the sample blocked much of the light from the fiber optics. Viewing at this magnification would have been possible under transmitted light.

Photomicrographs were taken at the exact same location of each sample first under visible light and then under UV light only if it revealed new layers or made others more distinct.

While the original finish of the building's original components was the focus of the analysis, each sample's complete stratigraphy was examined and annotated. Each layer was numbered in chronological order, beginning from the substrate or lowest layer. A separate numbering system used a 'P' or an 'F' to show which layers were speculated as being prime coats and which were finishes. The thickness of the original finish layer, that included both the prime and finish layers, was roughly measured using the average of three separate measurements using the Nikon NIS Elements BR software. Subsequent layers were not measured directly, but only given a relative measurement as being lesser, greater or equal to the original finish. The data sheets with cross section photomicrographs, a paint stratigraphy and other notes for each sample are included in Appendix B.

After determining the pressed metal ceiling paint stratigraphy, these layers were carefully exposed on the bulk sample and color matched. A strip of the sample surface was cleaned using cotton swabs and saliva. A crescent scalpel was used to remove each layer, down to the metal substrate. The layers were observed under a Leica MZ16 stereomicroscope illuminated using fiber optics of an Intralux 5000-1 halogen light source with a daylight filter. Each layer was color matched under this illumination using the Munsell color system.

Plaster Characterization

It was assumed that the plaster on all three walls is original and is of the same composition. Meaning, the findings of one sample would be representative of the rest. Therefore,

only one set of each analysis was conducted on one sample. MTT 21 was selected because of its large size compared to the other plaster samples.

Two analyses were conducted to characterize the plaster used in the Mancos Times-Tribune Building, a gravimetric analysis of the bulk sample and a sieve analysis of the remaining aggregate. A gravimetric analysis determines the approximate proportion by weight, of the three principal components of a historic mortar: aggregate, binder, and fines. It involves microscopic examination of the bulk sample, acid dissolution of the binder, and mechanical separation of the fine and coarse fraction (aggregate). An in-depth sieve analysis is used to describe and classify granular samples based on physical attributes including grain size, shape, color, and sorting.

A sample for analysis was removed from the bulk sample with a chisel and hammer, with the post-extraction location noted in Figure 6.4. Two pieces were removed to have a combined sample of at least thirty grams for the chemical digestion. An additional sample was taken for observation under a Leica MZ16 stereoscope with illumination by a Leica KL 2500 LCD source at 3050K.

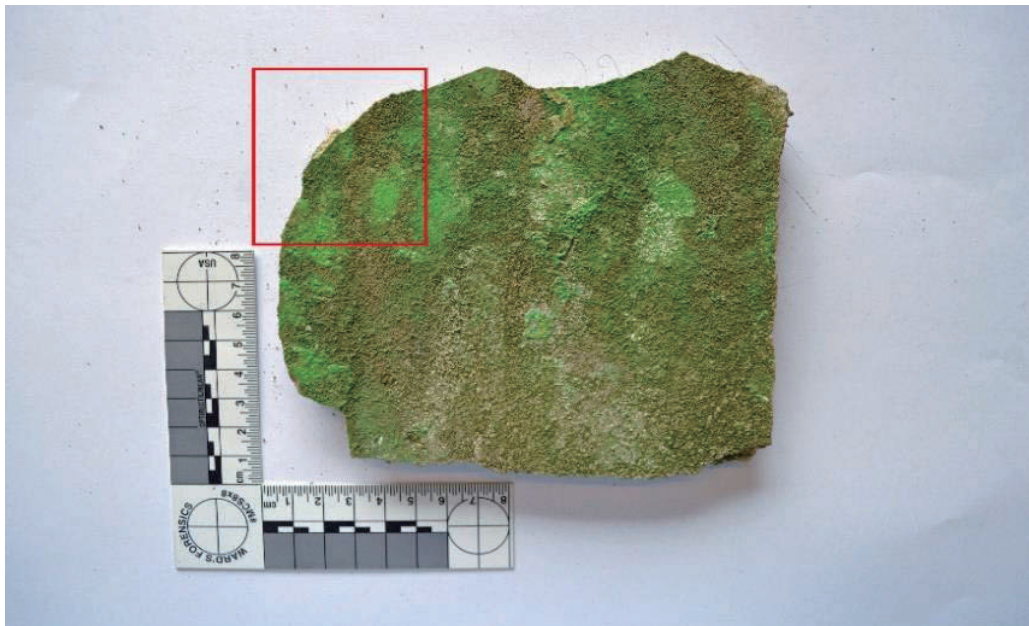


Figure 5.4 Location of removed plaster sample used for analysis (Author 2015).

The sample for digestion was placed in a ceramic mortar and crushed into a powder with a ceramic pestle (Figure 6.5). All contents of the mortar were carefully brushed onto a glass petri dish and placed in a chemically untreated oven set at 55°C for twenty-four hours to evaporate any present water. The sample was allowed to cool in a desiccator at 20.8°C and relative humidity of 32%. The ground sample was examined under a Leica MZ16 stereoscope with illumination by a Leica KL 2500 LCD source at 3050K and 12.5x magnification.



Figure 5.5 Crushed plaster sample (Author 2015).

With the sample ground and dried, the chemical digestion was next. A 600 mL beaker was massed and the powdered sample was added to it, using a natural bristle brush to remove as much of the contents as possible. The beaker with the sample was again massed. The sample was slightly dampened with deionized water. Several drops of 15% hydrochloric acid (HCl) were added to test a reaction, but none was observed. The beaker was then filled to the 250mL marker with 14% HCl with a very slight observable reaction of periodic bursts from the aggregate (Figure

6.6). The sample was constantly agitated by a Teflon stir bar on a mechanical stir plate with a watch glass placed on top of the beaker (Figure 6.7). Stirring was continuous for twelve hours after which no reaction between the acid and the plaster were observed.

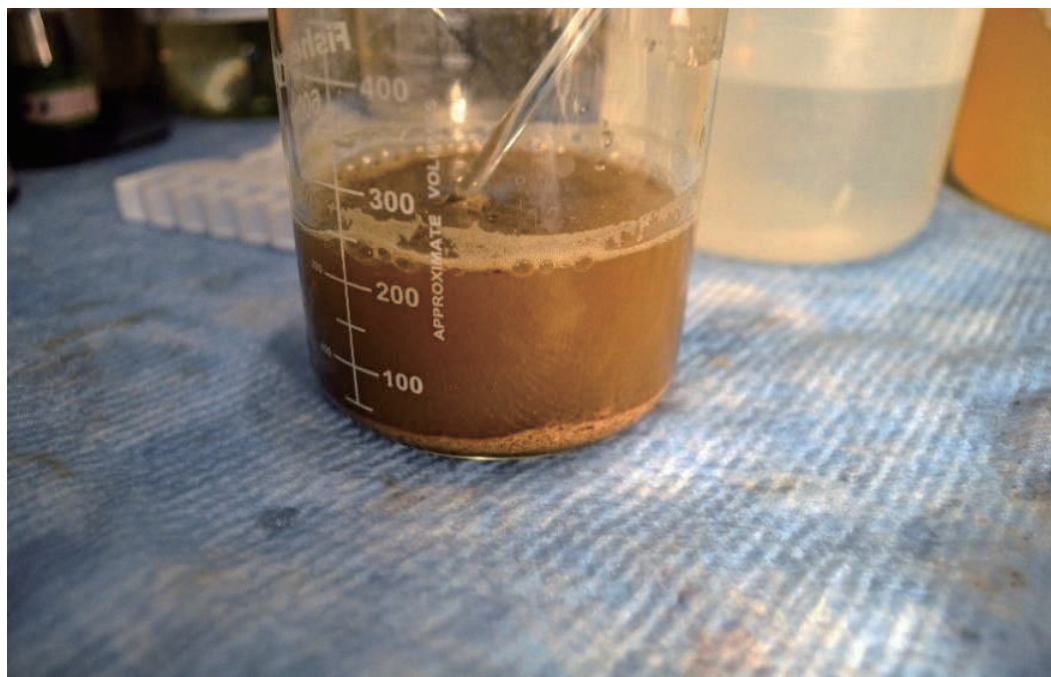


Figure 5.6 Sample immediately after the addition of 14% HCl (Author 2015).

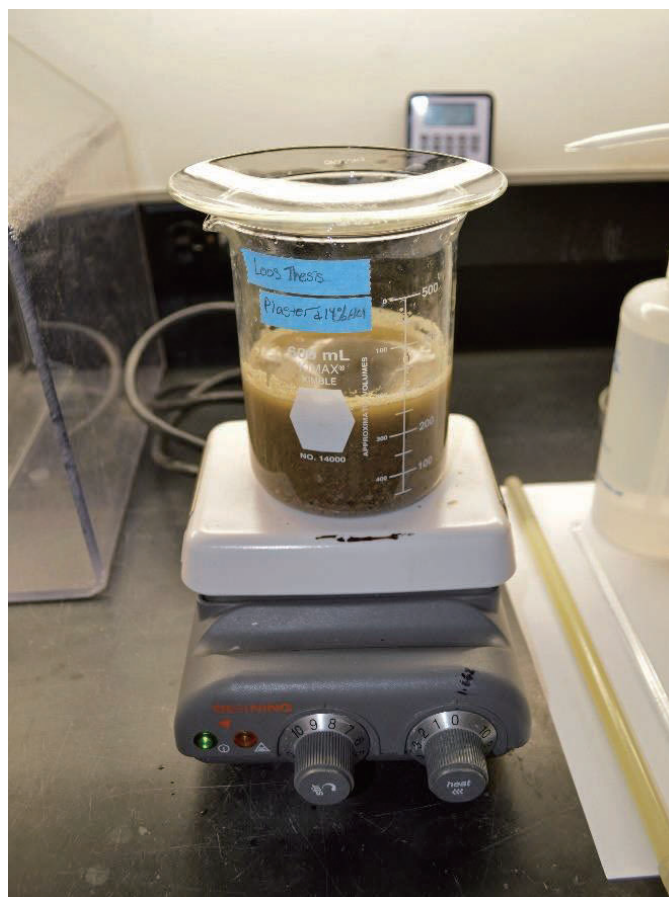


Figure 5.7 Stirring of plaster sample on plate (Author 2015).

The fines were then separated from the rest of the sample. A twenty-four centimeter diameter #4 grade filter paper was labelled with archival ink pen then massed. It was folded into quarters and placed in large glass funnel. The funnel was held in place with a funnel support on an instrument stand and positioned over a 500mL Erlenmeyer flask (Figure 6.8). The filter paper was wetted with deionized water to adhere it to the funnel. The fines were suspended using a jet of deionized water from a wash bottle. The beaker itself was swirled to augment the suspension. Then, with a glass stirring rod held on top of the beaker with one end over the beak to direct the water and suspended fines, the beaker was directed over the funnel at a very low angle to allow the water and suspended fines to flow onto the filter paper (Figure 6.9). Each time the water level reached the large particles of the sample, the flow would be stopped and the sample washed and

swirled again to suspend the fines. And again, the water and suspended fines would be directed onto the filter paper. This procedure was repeated until only clean water was observed after washing and swirling. Afterwards, the remaining aggregate in the beaker and the fines in the filter paper were placed in a chemically treated oven set at 58°C for twenty-four hours.



Figure 5.8 Setup of the fines separation (Author 2015).



Figure 5.9 Author filtering suspended fines (Shuyi Yin 2015).

After cooling in a desiccator, both the filter paper and the beaker and their contents were massed. The contents of the beaker were poured into a small sieve stack using a natural bristle brush to remove as much of the contents as possible. The stack was covered and agitated for ten minutes held at a 20° angle, and shook horizontally, not vertically, turning the stack to a different orientation every twenty-five agitations. The aggregate held at each sieve was brushed into pre-massed boats and massed again. The contents of each boat were examined under the Leica stereoscope to describe its texture and the overall color was matched under daylight filter fiber optics using the Munsell color system.

Metal Identification

A sample (MTT 19) of the pressed metal ceiling was taken to both analyze the finish stratigraphy and to identify the kind of metal it was constructed of and to determine if it was galvanized. Given an understanding of decorative sheet metal, the ceiling was predetermined to be ferrous. The real unknown and the main question to be answered by analysis was whether or not the metal had been galvanized. A positive identification of zinc would confirm this. Chemical spot tests were initially planned to determine the composition of the metal, but these were forgone after testing with portable X-Ray Florescence Spectroscopy (XRF) during a workshop on October 13, 2014, led by Bruce Kaiser, a designer of a portable XRF machine and expert on the technique and the interpretation of its produced data.

XRF only provides a pure elemental analysis of a sample, but this was sufficient to determine the type of metal used in the ceiling. The technique is generally qualitative in nature, but quantitative data can be interpreted from the results. Such interpretation requires a practitioner who is skilled and knowledgeable with the technique and was needed for this project.

The sample was analyzed by a Bruker Tracer spectrometer at fifteen and forty kilovolts with no filter. Both the finished side and the underside of the sample were analyzed. Each sample

area was cleaned with prior to analysis; the underside with acetone and the finished side with deionized water.

Chapter 6 – Discussion of Analysis Results

Original Paint Scheme

Exterior

All the wooden elements of the exterior façade, meaning the entirety of the door and the bay windows, were originally painted with a tan cream prime coat then finished with the light grey paint, save for the molding around the panel on the lower part of the door, which was a cream or light orange paint.

The door has had a uniform color scheme throughout most of its life. The panel molding is an outlier and does not display the stratigraphies of any other component. Because of its cream color, the first layer could easily be characterized as a prime coat, but given its large width and overlying dirt layer indicative of long exposure, it was determined to be a finish layer instead (Figure 6.1). Some layers of the bead board were lost between extraction and embedding, as the component's current green finish is not present. The more modern layers must have had very low adhesion, as there are no remnants of any layers above the third. The three layers that are present still reveal its stratigraphy to be different than that of the other components. It also has more distinct dirt layers than other components, indicating that it was exposed longer and painted less frequently than other areas.



Figure 6.1 Sample MTT 04 showing its original cream orange finish (Author 2015).

The stile and rail components of the door have followed identical paint schemes throughout the life of the building, but the panel and its bead board schemes are divergent; the bead board from the beginning and the panel beginning with its third finish (Figures 6.1 and 6.2). The stiles, rails and panel share identical grey and brown first and second layers, but with the third repainting, the stiles and rails are painted a dark green while the panel is painted a grey very similar to the original finish. There is a period of bichromy on the door before the schemes of the three components follow the same sequence after the application of a light pink layer. Currently, all components of the door are finished with a dark green paint.

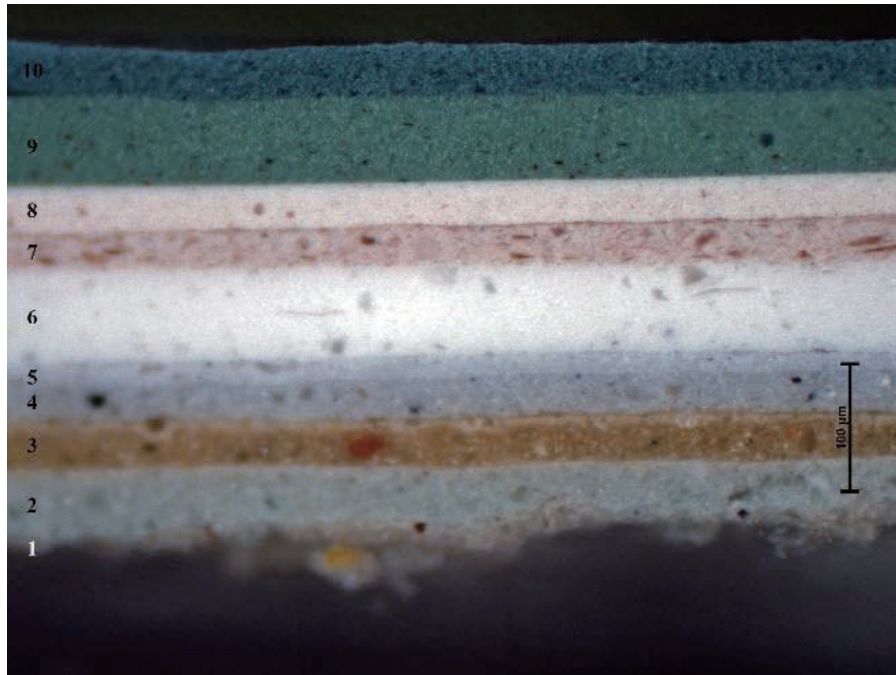


Figure 6.2 Comparison between the finish stratigraphies of the panel (MTT 03, top) middle rail (MTT 02, bottom) and of the front door (Author 2015).

Both the mullions and muntins which make up the windows have very similar stratigraphies and follow a similar sequence as that found on the door (Figures 6.2 and 6.3). The vertical and horizontal elements follow somewhat different stratigraphies, with the observed layers on the mullion being identical to those on the stiles and rails of the door, with the current finish being the only difference (Figures 6.2 and 6.3). Older layers on the mullion sample (MTT 16) were removed before the application of its first layer, as there is no prime coat present and the layer is a dark green finish identical to that seen on the door samples (MTT 01 and 02). Since the observed layers on this sample correspond so well to those seen on the door, it can be assumed that its first three layers, now removed, matched those seen on the door samples (MTT 01 and 02). Its original finish then was a grey paint above a tan cream prime coat. The two vertical samples have identical stratigraphies, but similar to what happened with the horizontal sample, sample MTT 14 had its original layers removed before the application of its first layer, a dark green paint. The same assumptions made about MTT 16 can be applied here. The other vertical element sample (MTT 17) has retained a complete stratigraphy and has a tan cream prime and grey paint as its original finish. Currently, all components of the windows are finished with a white paint.

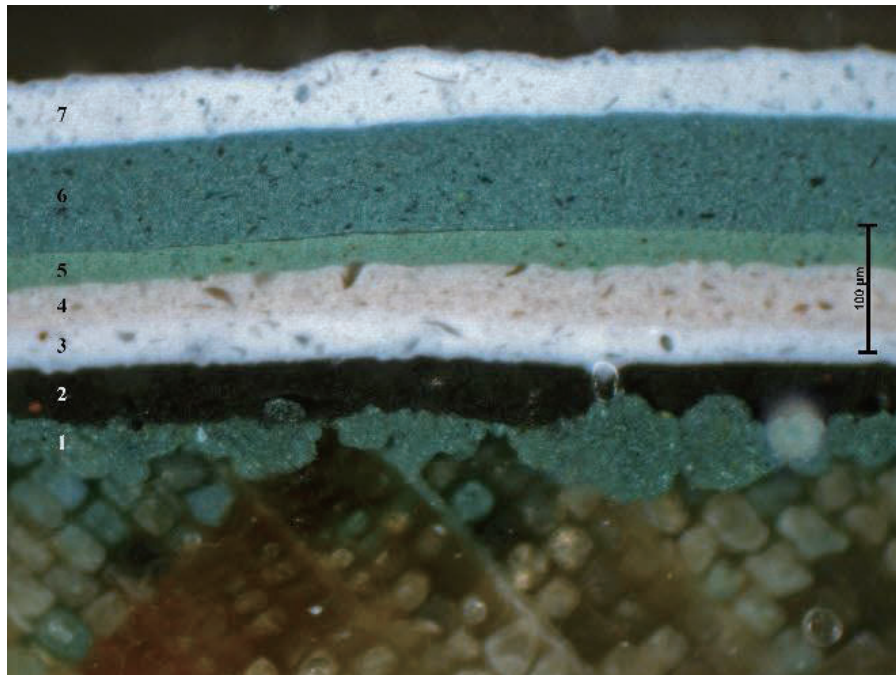
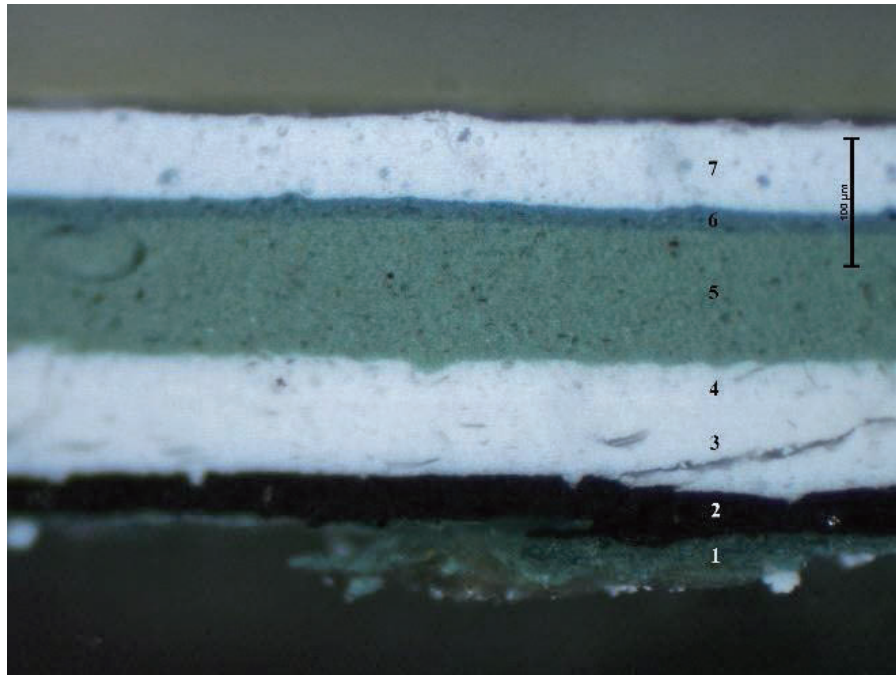


Figure 6.3 Comparison between the finish stratigraphies of a horizontal element (MTT 14, top) with a vertical element (MTT 16, bottom) on the façade windows (Author 2015).

The concrete base below the windows has three layers of white paint on it, but they all appear to be of a more recent application because of their wide widths (Figure 6.4). Therefore, it is concluded that the concrete base was originally unfinished.

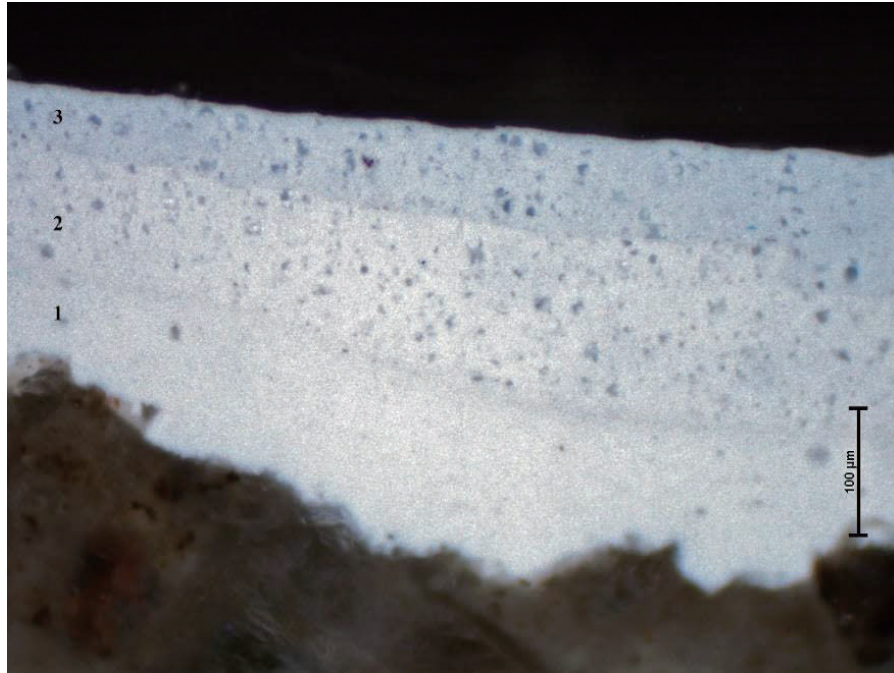
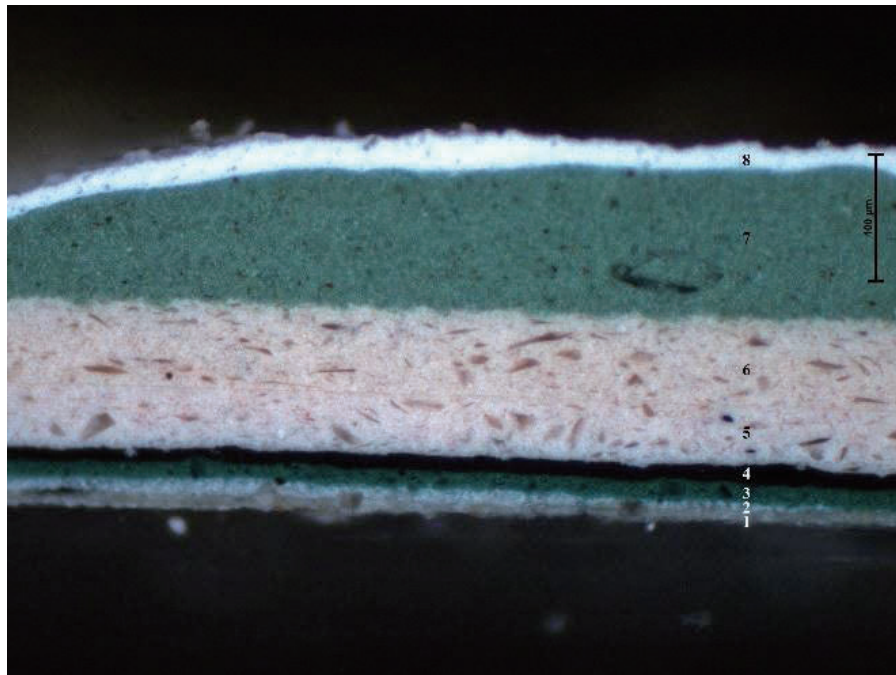


Figure 6.4 Cross section of concrete base finishes (MTT 18) showing modern paints (Author 2015).

The samples taken from the metal architrave and cornice were difficult to interpret so no conclusions can be drawn, only informed assumptions. This difficulty stems from the sampling procedure outline earlier in which samples were scraped from the surface, rather than cut. A cut sample would have retained the metal substrate and caused less distress to the finishes stratigraphy, but would have caused undue damage to a feature in excellent condition.

The chronology of the architrave sample stratigraphy is completely illegible and didn't retain a substrate. Only white paints were observed, but is in no discernable order, along with an unknown gritty substance, possibly bronzing powder. In samples taken of the frieze (MTT 13) and the ornamental relief (MTT 15), the metal substrate was not retained, but their stratigraphies are legible and in a chronological order. In both samples, it appears that the original finish was a grey prime coat, applied by the

manufacturer, finished with a grey paint applied later (Figure 6.5). After this similar first layer, their stratigraphies diverge, with the frieze following a similar paint scheme to that found on the stiles and rails of the front door and the relief following a completely different scheme. Therefore, it was very likely that the cornice was polychromed with the ornaments in relief painted a different color than the rest of the piece.

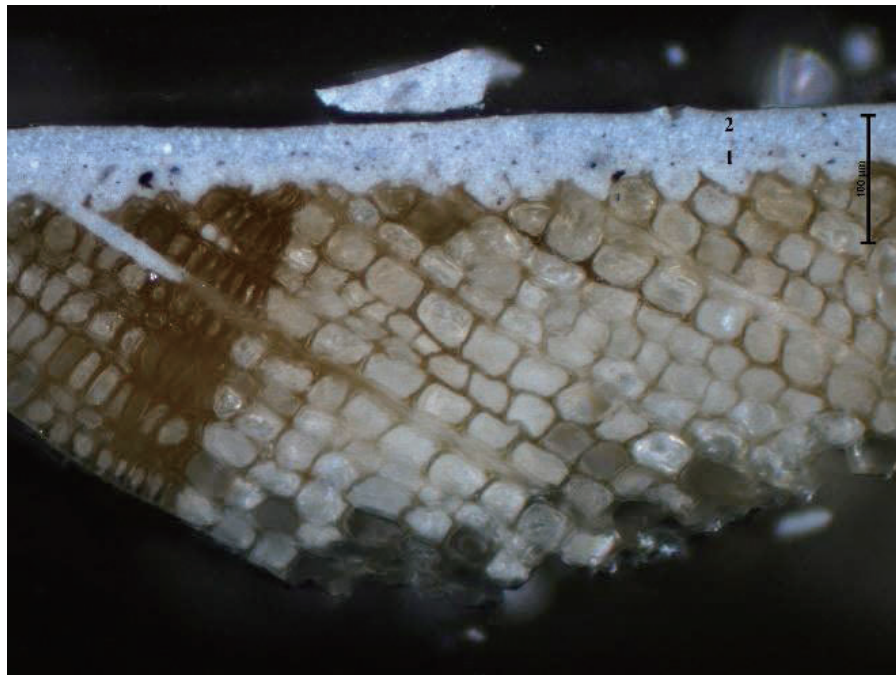
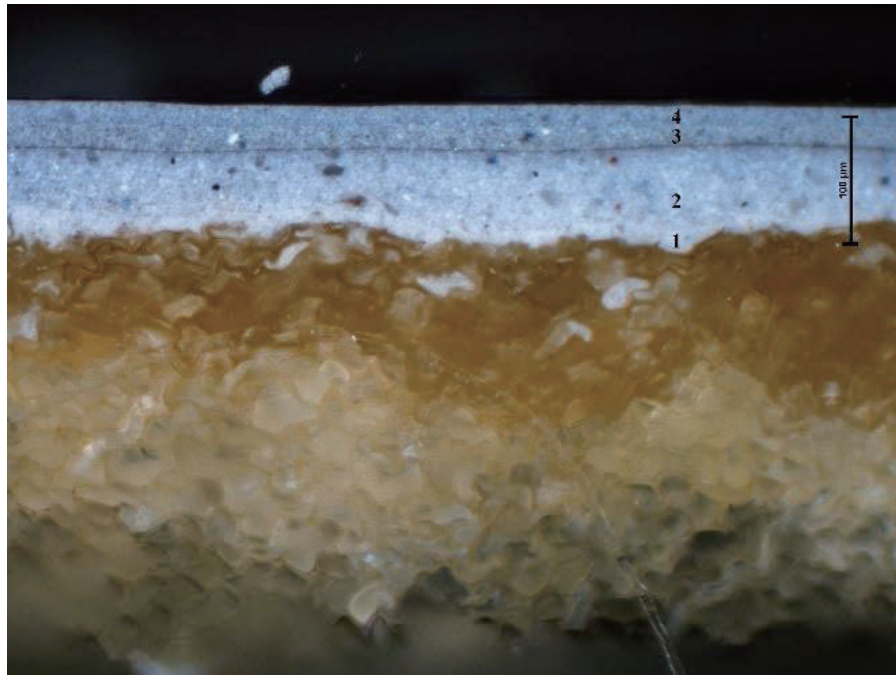


Figures 6.5 Comparison between the finish stratigraphies of the relief ornamentation (MTT 15, top) and the cornice frieze (MTT 13, bottom) (Author 2015).

Interior

The original finish on the interior plaster walls, similar to the exterior features, was a drab grey color. Based upon the diffuse absorption of the original grey finish by the rough plaster and the matte, chalky finish of the bulk sample surfaces, it is very likely that the type of paints used for the original finish was a distemper. Samples MTT 23 and 26 have more modern finishes made of oil, alkyd or acrylic based paints which have formed a more defined layer and easily flake off.

The original finishes on the interior of the shop front windows and rear sash windows were likely a grey paint similar to that used on the façade features, but cannot be unequivocally concluded though, as their low number of layers is suspect (Figure 6.6). Both samples have very similar stratigraphies of a prime coat and grey paint finishes. The prime coats are not the same tan cream as that seen on the front door and windows. The two oldest layers of each appear identical, with two additional layers on the shop front window.



Figures 6.6 Comparison between the finish stratigraphies of the interior east shop front window (MTT 05, top) and the interior sash of the rear east window (MTT 07, bottom) (Author 2015).

The pressed metal ceiling originally had a grey finish which was likely a shop prime, similar to that seen in the cornice samples. It appears that this layer remained the exposed finish for some time as a dirt layer is evident between it and the following golden-brown layer. This second layer must have been exposed for a long duration as it is deteriorated and the only other layer above it is a more modern white paint, characterized by its large width. An XRF test on the finished surface of the sample revealed the presence of titanium, zinc and calcium, suggesting a combination of titanium dioxide white with zinc oxide white and a whiting extender paint (Figure 6.7). A discussion of the zinc layer will be included in pressed metal section.

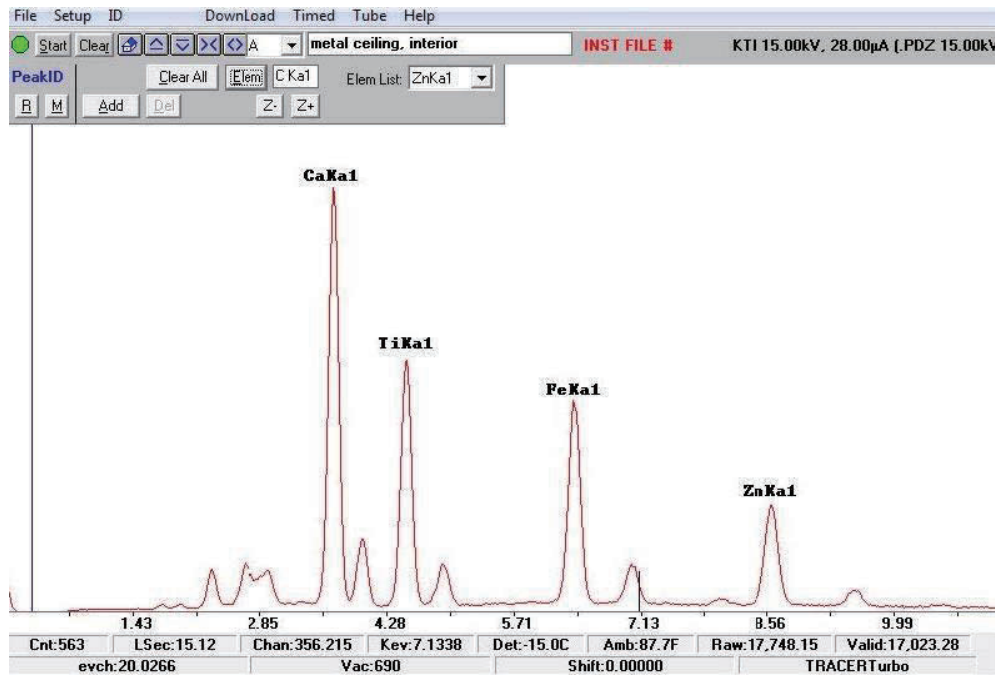


Figure 6.7 Graph of XRF data showing peaks for calcium, titanium, iron and zinc (from left to right).

An exposure of the finishes layers on the presses metal ceiling was conducted and each layer color matched using the Munsell system (Figure 6.8). The top of the original finish was colored by the following finish, so it was slightly scraped to reveal its true color. It was matched as 10GY 5/1. The second finish was matched as 2.5Y 8.5/6. The third, most recent finish, was matched as 2.5Y 8.5/4.



Figure 6.8 Exposure of pressed metal ceiling finishes stratigraphy (Author 2015).

Plaster Characterization

The plaster used in the interior was determined to have a natural hydraulic lime binder and a very high amount of aggregate (Figure 6.9). Black hair, likely horse hair was also abundant and used to increase the strength of the plaster. Visual examination indicated that the plaster was installed using the traditional three coat process of a scratch coat, brown coat and finish coat. Aggregate at the top of the sample is a smaller and better sorted than that of the main body and the lower portion has a rough texture of exposed aggregate.

Upon initial investigation, the grey color of the plaster suggests it is cementitious. It also has a fairly high Mohr's hardness for plaster, being between five and six. The gravimetric analysis displayed a

high solubility (13.4% of the sample's total weight was soluble in the hydrochloric acid) suggesting a lime/cement blend for the binder.



Figure 6.9 Photograph of bulk sample at 12.5x zoom showing multiple layers, colored aggregate and black hair (Author 2015).

Pressed Metal Ceiling Composition

XRF tests were conducted on multiple locations of the bulk pressed metal ceiling sample to analyze both the finishes and the metal itself. A test on a cleaned section of its unfinished side revealed a large presence of iron and a smaller presence of carbon (Figure 6.10). The carbon was not included on the data graph, but interpreted by Mr. Kaiser himself. The graph for publication was scaled down to include the large iron peak in its entirety thereby making the smaller elemental peaks illegible. No zinc was present in this test, but was revealed in a test on the finished side of the sample. Based on these two tests, it is concluded that the metal used for the ceiling is an un-galvanized mild steel. The zinc, a metal commonly used for galvanization, was also used in the nineteenth and early twentieth centuries in white

paints. Given the discrepancy of its occurrence between the two layers, it is concluded that zinc was only used in one of the finish layers and not as a coating for the metal.

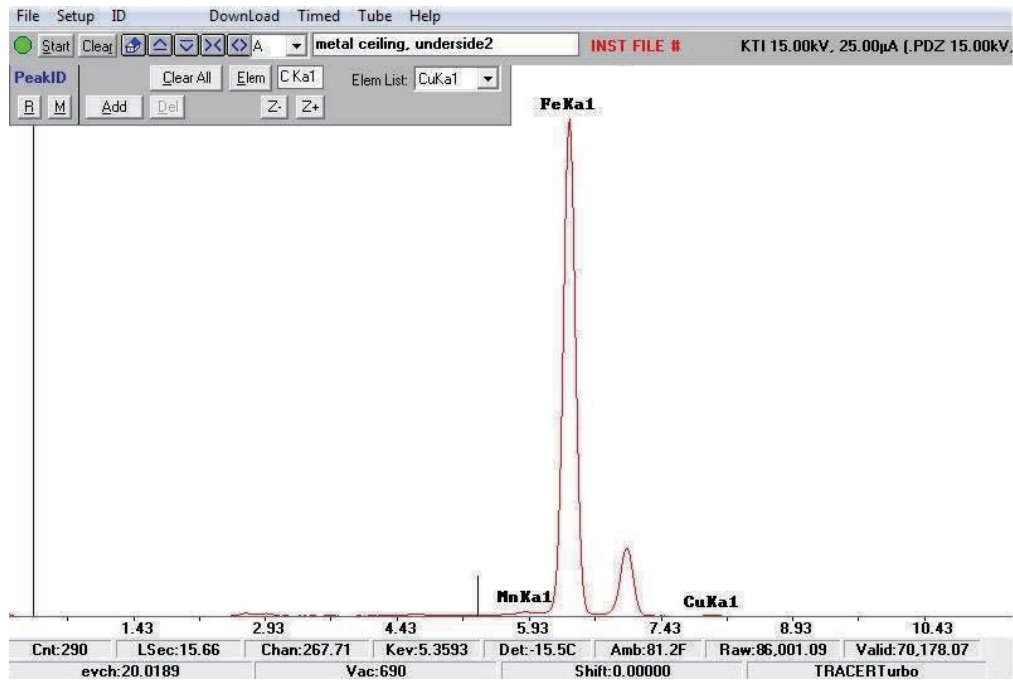


Figure 6.10 Graph of XRF data showing peak for iron.

Chapter 7 - Recommendations for Conservation

This chapter provides recommendations for repairs and treatments to the Mancos Times-Tribune Building. These recommendations were only formulated after gaining a detailed understanding of the building's history and a characterization its materials through historical research and scientific analysis. Their findings informed the treatment and repair research to reject those which would be incompatible and or insensitive to the historic fabric. The main goal for these recommendations was to have the building regain its historic authenticity, increase its performance and lengthen its service life. Unlike the other aspects of research to this thesis, the conservation research was focused on finding the most modern and well tested techniques and repairs available. All repairs and treatments are in accordance with the Secretary of the Interior's Standards for Rehabilitation and Restoration.

This chapter is a response to the building assessment of Chapter 3, so it is divided into the same sections.

Building Site

Remove the stumps at the southwest corner of the building. Before the hole is filled in, the damage and displacement of the foundation and concrete floor should be assessed in great detail. Once the extent and character of the damage has been properly assessed, then the hole should be filled in. The current assessment concluded that the stumps and root systems have not displaced the concrete footing of the sidewalls, but this should be verified once the stumps are removed.

Remove all vegetation growth on the southeast corner. The gutter belonging to the eastern adjacent building needs to be set back in place to prevent any future rain runoff from the building which can destabilize the foundation and encourage vegetation growth. Once the

vegetation has been removed, re-grad the entire rear site to an even, uniform slope to promote drainage.

Building Climate

Heating and air conditioning systems need to be installed, not only for comfort of the occupants, but also for the preservation of the building. A more constant interior temperature and an end to drastic shifts in temperature and relative humidity will do much to maintain the performance and service life of the building and its components. The current proposal is a natural gas forced hot air heating and air conditioning system which would be installed on the roof with ductwork installed above the metal ceiling. Vents will be installed in already damaged sections of the ceiling and returns along the back wall.¹

Foundation and Supporting Walls

Before any treatments are applied to the concrete sidewalls, further investigation and characterization of the vertical cracks needs to be conducted. The width of the cracks, along with any horizontal displacement from the wall plain needs to be fully measured and documented in the field. The crack gauges currently installed should be monitored to determine if the cracks are active or static. If the gauge has moved, it means that settlement is active along the west wall. Settlement is most likely to be active at the southwest corner of the building. If settlement is active, a soils engineer should be consulted to characterize the surrounding soil in order to fully understand its mechanics and the loads it can bear. They will give recommendations on how to best address the active settlement. A new concrete footing of increased surface area may need to be installed.

¹ Frank G. Matero, "Historic Structure Assessment - The Mancos Times-Tribune Building" (2014): 13.

Once the settlement issue has been addressed, and the sidewalls are stable, then their cracks need to be filled. Given the severity of the central vertical crack on the western wall, it should be filled with a material which will restore the original structural strength of the concrete wall. Therefore, the recommended treatment is to inject the crack with an epoxy resin. Crack injection is highly specialized work and should only be done by experienced contractors, but an outline of the procedure is given here. Prior to being filled, the crack should be routed out with a strong, flexible metal tool to remove all debris and organic material, then cleaned and flushed out with compressed air or forced water from a hose or pressure washer. The crack and surrounding area should be dry before injecting the epoxy resin so a proper bond can form. A completely solid epoxy resin should be used, meeting the standard specifications of ASTM C881/C881M-14 "Epoxy-Resin-Base Bonding Systems for Concrete." A type I epoxy binding system outlined in the standard would be the most appropriate for this situation. Once the crack is prepared, either holes are drilled at determined intervals along the crack or at angles through it, and the epoxy is injected under high pressure. For vertical cracks, the work usually should begin at the lowest point and works upwards. The epoxy will cure to form a fairly brittle material whose tensile and compressive strengths are greater than the surrounding concrete. After the epoxy has cured, it can be painted white to blend it in with the surrounding wall. ²

The filler for the other cracks does not need to structurally rebound the concrete, but merely to create a seal against water infiltration. To accomplish this, both the vertical and horizontal cracks on west wall should be filled with a Portland cement mortar containing an epoxy binding agent. The cracks should be prepared as outlined above, but remain saturated, not dry. The replacement mortar should be a 1:2 or 1:4 ratio of Portland cement to sand which has

² P. H. Perkins, *Repair, Protection and Waterproofing of Concrete Structures*, 3rd ed (London: E & FN Spon, 1997), 106-110.

W. Glenn Smoak, *Guide to Concrete Repair* (Washington, D.C.: U.S. Department of the Interior, 1997), 80-88.

passed through a no. 16 sieve. An epoxy resin, or a latex, should also be added to increase the mortar's bond strength. Only enough water to create plasticity is added. The mortar should be applied to the cracks with a 3/16" metal slicker. Mortar should be packed into the cracks as far as possible with the slicker and a flush profile created once filled. The mortar should remain saturated for fourteen days. It can be covered with plastic wrap to deter evaporation. Large patches of lost concrete on the vertical crack should also be repaired in this manner.³ If the cracks are deemed too small to receive the mortar, they can be filled with a high-performance silicone sealant.⁴

The holes present on the west wall from the removal of iron ties should be filled using a Portland cement dry pack. A dry pack is specifically used to fill small holes. The hole should be prepared in a similar fashion to the smaller cracks. It is a 1:2 ½ ratio mixture of Portland cement to sand which has passed through a no. 16 sieve, with just enough water added to hydrate the mortar. The mortar should be applied with a metal slicker and rammed into the hole with a rod and a hammer. A flush profile should be created once filled. The mortar should be saturated for fourteen days following the procedure outlined for the smaller cracks.⁵

Roof

No treatments, repairs or structural upgrades are needed for the roofing system. The roofing rafters are charred from a past fire, but appear structurally sound and are not in need of replacement or reinforcement.

³ W. Glenn Smoak, *Guide to Concrete Repair*, 45-48.

P. H. Perkins, *Repair, Protection and Waterproofing of Concrete Structures*, 97-98.

⁴ Paul Gaudette and Deborah Slaton, "Preservation of Historic Concrete," *Preservation Briefs* (Washington, D.C: U.S. Department of the Interior, 2007), 10.

⁵ W. Glenn Smoak, 48-50.

Peter H. Emmons, *Concrete Repair and Maintenance Illustrated* (Kingston, MA: Construction Publishers & Consultants, 1993), 170.

Rear (South) Wall

All original materials are to be maintained. The exterior needs to be made weatherproof, possibly by adding a vapor-permeable barrier between the wood cladding and the corrugated metal. Also, a new door needs to be installed, being sensitive to the design of the current entrance door. The interior plastering will be covered in a later section.

Windows

Before any repairs are made to the south wall windows, their condition should be assessed in more detail, specifically detailing any areas of wood rot. The findings of the current assessment showed no signs of rot or loss of material on the remaining window components, so options for addressing those issues, such as consolidation and resin fillers, will not be discussed. Primarily, the existing windows need to have their panes replaced and new glazing applied around them. Overall, the windows are in poor condition as outlined in Chapter 3.

First, the both existing sashes have to be removed. The process requires delicacy, patience and a light, rather than heavy, hand. The interior bead board holding the sash in place needs to be removed first. Using a wide chisel, or a similar tool with a wide, flat head, gently pry up the bead, working from its center to one end, until its free from the mitre then pull it completely out. “With the inner sash fully down, secure the cords with a wedge above the pulley wheel to stop them from running back through the pulley hole as the sashes are removed.”⁶ Manuever the sash out of its frame with the rope still attached. Remove the fasteners holding the rope and gently lower the weight.⁷

⁶ Alan Lamb, “Timber,” in *Windows: History, Repair and Conservation*, ed. Michael Tutton and Elizabeth Hirst (Shaftesbury, U.K.: Donhead Publishing Ltd., 2007), 270.

⁷ Alan Lamb, “Timber,” 270-271.

John Leeke. *Save America's Windows* (San Bernadino, CA: John Leek, 2009), 41-43.

Place the removed sashes on a stable, level work station, such as between two saw horses. All current glazing compound should now be removed and replaced. Use a hot-air gun to soften the hard and brittle glazing, to facilitate its removal, but take care not to scorch the wooden elements. Before resorting to the heat gun, remove as much glazing as possible with a sharp chisel. The hot-air gun should only be used on glazing which cannot be removed in this manner. With all the glazing removed, prime the newly exposed areas of wood with linseed oil to prevent the wood from drawing oil from the glazing itself.⁸

There are only a couple layers of paint present on the windows and they are performing quite well, so there is no need to completely remove them. Rather, hand sand the surfaces with 100 grit paper for removal and 220 for finishing. Lead safety is an issue given the age of the building. Perform all sanding in a well-ventilated area covered in a drop cloth to facilitate disposal of possible lead-containing debris. Protective equipment, including a respirator, Nitril gloves, and protective eyewear should be worn at all times during sanding. Ideally, Tyvek suits would be worn, but if these are not available, then the clothes worn during sanding should be immediately changed out of once finished. Do not apply new paint until the panes have been fitted and the glazing compound cured.⁹

The window is ready to receive its new panes. Lay the panes into the arises and insert two glazing points per edge of the pane into the sash. The new glazing compound should be made of calcium carbonate and linseed oil. Take a small amount of the compound, and roll it out like dough to form a small cylindrical shape. Form it round the edges of the pane and scrape away

⁸ New York Landmarks Conservancy, *Repairing Old and Historic Windows* (Washington, D.C.: The Preservation Press, 1992), 104-105.
Lamb, 278-279.

Kay D. Weeks and David W. Look, AIA, "Exterior Paint Problems on Historic Woodwork," *Preservation Briefs* (Washington, D.C: U.S. Department of the Interior, 1982),

⁹ John Leeke, *Save America's Windows*, 24, 45.

Terry Meany, *Working Windows: A Guide To The Repair And Restoration Of Wood Windows*, 3rd ed. (Lanham, MD: Lyons Press, 2008), 73-74, 89.

excess to form a forty-five degree angle. Allow to cure for at least three days. Once cured, tape off edges of pane and paint according to the original color scheme outlined in Chapter 6.

New sashes are to be made to replace those currently missing and should be identical to the existing sashes. It is not necessary to match the species of wood in the existing sashes, but wood chosen should have a tight, straight grain.¹⁰

North Wall (Façade)

The two cracked panes of the upper row of windows need to be replaced. The new panes should match the original in terms of thickness, color and opacity. No glazing is present on these windows, but are held in place by interior wooden moldings. Prior to their removal, two strips of masking tape should be placed across the entire length of the pane, forming an 'X'. This will help control the glass if it shatters during replacement. All four moldings around the pane should carefully be removed with a pry bar. The pivot should be on the wood frame of the window, not the pane itself. Label the location of each molding on an inside edge as they're removed so they can be placed back into their original position. If this is not done, then they may not line up correctly when reinstalled. The new pane is then placed in the frame and the moldings fastened around it, matching as best as possible the original nail holes. If the nails were not distorted when the moldings were removed, then they can be used again, but if they were, then new nails should be used that match the length, width and head profile of the originals.¹¹

The original paint scheme of the windows and door should be implemented as outlined in Chapter 6. Both elements should be lightly sanded with a fine grit paper. This is to create a rough surface to receive the paint and to remove any dirt and grease. It should not be so severe as to completely remove the current layer as the historic paint stratigraphy should be maintained for

¹⁰ Leeke, 47.

¹¹ Leeke, 45.

further investigations. Prior to painting, all windows and hardware should be covered with paper and taped down at their edges. A linseed-oil based primer and finish paint should be used for all elements.

Sheet Iron Cornice

No current treatments or repairs are needed on the exterior pressed sheet iron cornice. The cornice itself is in excellent condition with no physical damage or signs of atmospheric corrosion. All its seams and joints are tight and performing well and are in no need of modification to improve their performance.

Currently, its paint is adhering well with no sign of deterioration. It is likely to not need repainting for many years, but should be monitored for failure. When it does eventually need repainting, the following steps would be followed. First survey the cornice for any paint deterioration, if there is not, a new paint can be applied over the existing coatings. If paint has failed and is flaking off preparatory cleaning with an abrasive is required. An iron scraper and firm, non-ferrous bristled brushes should be used to remove the failed paint. Steel bristled brushes, or sand or dry abrasive blasting should be used. Cleaning and preparing the cornice is a prerequisite to repainting it. For well adhered paint, a mild detergent should be used for cleaning. New paint must be applied to a “firm, clean and dry surface”¹² to create strong adhesion between the new coating the existing ones. Good surface preparation will determine the performance and durability of the new coating. Repainting would be most thorough if the cornice could be disassembled, and prepped, primed and re-coated on both sides as individual pieces.¹³ This would be unnecessary for the Mancos Times-Tribune Building, given the lack of deterioration on the cornice, its tight joints and seams, and the associated additional expense.

¹² Sophie Godfraind, Dr. Robyn Pender and Bill Martin, eds., *Metals*, English Heritage Practical Building Conservation (Burlington, VA: Ashgate Publishing Company, 2012), 180.

¹³ *Ibid*, 207.

A paint should be selected that is tolerant of imperfect surfaces. The nature of the existing layers of paint on the cornice must be taken into consideration when selecting a paint. It was likely painted historically using oil and lead-based paints. Modern water-based paint systems can be applied to these types of paints with no issues, but alkyd paint systems pose a risk that their solvents will attack the oil in existing coatings. Bitumen paints should not be used as they are incompatible with any other paint systems. A three coat paint system should be used during repainting. An iron-oxide or zinc oxide oil-based primer should be applied first, followed by an alkyd intermediate and finish coat.¹⁴ The selected paints should be applied with a brush or a using a compressed air spray, as these will provide full and even coverage on the cornice's shaped elements. Roller should not be used because of the shaped surfaces involved. If using a brush, the layer should be thin and the brush marks smoothed out.¹⁵ Also, if the decision is made to recreate the building's historic finish scheme it should be implemented following the results of the paint investigation discussed in Chapter 6.

Interior Walls and Floor

Care should be taken so as not to damage the roofing system or the metal ceiling. Also, the insensitive, utilitarian fluorescent light fixtures should be removed and replaced with more historically accurate ones.

Remove the remaining tiles in the north portion of the interior, as they are un-historic addition and are in poor condition. Also remove the remaining sheet rock and wood supports from the drop ceiling installation. Once the stumps have been removed and the hole filled in,

¹⁴ John G. Waite, AIA, "Part II. Deterioration and Methods of Preserving Metal," in *Metals in America's Historic Buildings* (U.S. Department of the Interior: Washington, D.C., 1992), 139.

¹⁵ Sophie Godfraind, et al, *Metals*, 183, 186-189.

remove the damaged southwest section of the poured concrete floor with a pneumatic hammer and replace in kind.

Paperboard

Before any treatments are applied to the paperboard border, further investigation and characterization of its adherence to the plaster substrate should be conducted. Based on the findings of the current building assessment, two treatments need to be applied to the paperboard to restore it as best as possible to its original condition. First, the layers of paint which currently obscure it need to be removed without damaging the paperboard or its own finish. Second, any loose pieces of the paperboard need to be reattached to their plaster substrate.

After removing the layers of paint to reveal the paperboard underneath, any tears or loose pieces need to be re-adhered. Use a 2:1 mixture of wheat starch paste and methyl cellulose diluted to a consistency of heavy cream as the adhesive. Draw some of the mixture into a kitchen syringe and apply to the plaster behind the loose section. Apply pressure with a cotton ball to the section for several minutes. Fill in any areas of lost plaster with a chalk/gelatin putty, such as that used in painting conservation. Apply an even coat of putty, allow to harden, then sand smooth. The area should be in-painted with acrylic to match the pattern of the paperboard.¹⁶ The use of chemically pure wallpaper paste can also be used as an alternative adhesive material.¹⁷

Plaster Walls

Before any repairs are made of the plaster on the south wall, its condition should be assessed in more detail to determine which areas need replacement and which need restoration. The plaster is in poor condition as outlined in Chapter 3.

¹⁶ Thomas K. McClintock, "The In situ Treatment of the Wallpaper in the Study of the Longfellow National Historic Site," *Journal of the American Institute for Conservation*, 20, no. 2, (Spring 1981), 114.

¹⁷ Catherine Lynn Frangiamore, *Wallpapers in Historic Preservation* (Washington, D.C.: U.S. Department of the Interior, 1977), 45.

For original plaster that is loose or cracked, but still remaining, all efforts should be made to preserve it. The existing plaster should be stabilized before adding new plaster to replace areas of loss. Loose areas should be re-adhered to the surrounding plaster rather than removed and replaced in kind. Prior to any kind of treatment, the exposed plaster edges and cracks should be cleaned with a natural bristle brush to remove all dirt. For strengthening and consolidation of weak or friable areas, shellac or size should be used. Modern adhesives, such as epoxy resins, should be avoided as they are more difficult to control and predict. They can be moved by suction to unwanted areas of the plaster and cause irreversible damage. A diluted mixture of 1 part PVA to 10 parts water would be safe to use.¹⁸

Loose plaster should be reattached through the injection of a consolidant. Small 5mm holes should be drilled through the plaster at one foot intervals. All debris should be removed with a natural bristle brush. The holes should then be wet with a mixture by volume of 3 parts water, 3 parts denatured ethyl alcohol and 2 parts Rohm and Haas “Rhoplex MC-76,” which is an acrylic emulsion used as a masonry bonding agent. The mix is injected into the holes with a common kitchen syringe. The actual adhesive to be used is a mixture by volume of 3 parts “Rhoplex MC-76” to 1 part “Rhoplex LC-67” with “Acrysol ASE-60” added as a thickener. The holes should be filled with this mixture which should be injected with a kitchen injector.¹⁹

All areas of lost plaster should be replaced with in kind material. All gaps between lath should be cleared of any lingering keys and a brush or vacuum used to remove any dusty or debris. Any loose lath should be refastened with galvanized nails of equal length and thickness to the originals. All repair plaster should match the original in strength and composition. Newly introduced plaster should never be stronger or denser than that which is currently existing. The

¹⁸ Simpson and Brown Architects, *Conservation of Plasterwork*, rev. ed., Technical Advice Notes (Historic Scotland, 2002), 13.

¹⁹ Morgan W. Phillips, “Adhesives for the Reattachment of Loose Plaster,” *Bulletin of the Association for Preservation Technology* 12, no. 2 (1980): 44, 49, 55, 57.

thicknesses and number of coats should also be matched and in the end, be plumb with the original plaster. Modern hard-setting plasters, plasterboard and pure plaster of Paris are incompatible repair materials.²⁰

These recommendations should be following when preparing the mix of replacement mortar for the interior walls. Lime putty which has matured for at least sixty days should be used. The sand used in the mix should be varied according to the coat being applied. The grade of sand should be approximately 1-6mm for the scratch coat, 1-3mm for the straightening coat and 0.5-1.5mm for the finishing coat. All sand used should be “sharp, well graded, well washed and should contain no silt or salt contamination.”²¹ The matured lime putty and the various sands should be mixed to form coarse stuff or fine stuff and left to mature in a sealed container for an additional 30 days. Hair was abundant in the original plaster and so should be included with the repair plaster for the first two coats. It should be long, 1-4” in length, “strong, soft not springy, and free from grease or other impurities.”²² Before adding to the mix, the hair should be “well teased to break up any lumps.”²³ It should not be combined and allowed to mature with the coarse or fine stuff as it is susceptible alkaline attack. It should be added and well mixed nearer to the time of application. The scratch coat should have a lime putty to sand ratio of 1:2.5 or 3 with hair, the straightening coat should have the same ratio, but with less hair and the finishing coat a ratio of between 3:2 and 3:1 with no hair.²⁴ For all these formulations, ordinary Portland cement should be added in the same ratio as the lime.

²⁰ Simpson and Brown Architects, *Conservation of Plasterwork*, 13.

²¹ Ibid, 22.

²² Simpson and Brown Architects, 23.

²³ Ibid, 23.

²⁴ Ibid, 22-24.

John Ashurst, *Mortars, Plasters and Renders in Conservation*, 2nd ed. (Ecclesiastical Architect's and Surveyor's Association, 2002), 95.

With the gaps clean, the lath properly fastened, and the new plaster mixed, repairs can commence. First, the edges of old plaster which the new is adhering to should be scratched to form key. Then, the lath and sides of adjacent plaster should be saturated with a mixture of shellac in methylated spirit or 10% PVA in water solution, to prevent these porous areas from drawing water from the newly applied plaster. The scratch coat should be applied diagonally across the face of the lath with a steel laying trowel using firm, even pressure that forces the plaster through the lath to form keys. When the coat is firm, but not totally set, it should be scratched with a tool to provide an underkey for the second coat. This coat should be applied before the first coat is completely dry. Like the scratch coat, the straightening coat should be applied with firm, even pressure and allowed to set before the application of the finish layer.²⁵

Sheet Steel Ceiling

The steel ceiling needs two repairs: first, the areas which have been distorted should be reset and then the entire ceiling should be repainted.

The sections of the steel ceiling which have been cut and pulled back from the installation of the drop ceiling can be reformed. In discussions with Prof. Frank Matero and Prof. Andrew Fearon, a method of cold working was designed to accomplish this task, which essentially involves casting a mold of the repeating ceiling design and pressing the distorted areas back into place.

The wooden molding around the ceiling should first be removed, then sheets which have been damaged need to be carefully unfastened from the ceiling and placed on a flat, elevated working surface. The type of work outlined would be difficult to perform in situ. Prior to any

²⁵ Simpson and Brown Architects, 24-25; 30.

Alison Henry and John Stewart, eds., *Mortars, Renders and Plasters*, English Heritage Practical Building Conservation (Burlington, VA: Ashgate Publishing Company, 2011), 382.

Marylee MacDonald, "Repairing Historic Flat Plaster – Walls and Ceilings," *Preservation Briefs* (Washington, D.C: U.S. Department of the Interior, 1989), 8.

removals, the exact location and original orientation of each sheet needs to be visually and descriptively documented. A numbering system should be developed and the sheets should be physically marked on its underside. Any photos or descriptions should be numbered likewise to the corresponding sheet. Since the building sits proper to the cardinal directions, a north arrow could be drawn on the underside of each sheet to note its original orientation. This is not a substitute for proper documentation, though.

First molds need to be cast of either side of the ceiling. Since the motif is identical and repeated across all sheets, the same molds can be used for every bent area. Two casts should be made – a positive and a negative from either side of the ceiling. Select a sheet which has an unbent section of at least four square inches. Tape off an area of this dimension on both sides of the sheet. On the painted side, remove the deteriorating finishes according to the recommendations below. To clean the areas, brush on a 10% solution of cyclododecane diluted in naphtha and allow it to dry overnight. A mold of the design cannot be made directly from the sheet's surface due to the low viscosity of the molding material, so smaller impressions must be made. Cut two four square pieces of plywood and drill holes on a grid spaced evenly every three inches. Clean the holes of any debris. Firmly apply Reprisil^{®26} putty to the plywood mother mold to a depth of ¼", making sure the drilled holes are filled. Immediately press the mold against the sheet metal surface to gain its impression. After a couple minutes, remove the mold and allow to cure for at least one hour. Follow the same procedure for the other side. These actions should be done with strong linear movements so as not to distort the impression.

Once the molds have cured, they need to be prepped for casting. Fabricate a plywood box to tightly fit around each mold which can hold at least two inches of casting material without leaking. The box needs to be able to be disassembled after casting. Mock ups were not conducted

²⁶ Reprisil[®] is a hydrophilic vinyl polysiloxane impression material used in dentistry.

as part of this thesis, so the best methods will have to be developed in the field. The box may be four rectangular pieces of plywood held together by L brackets and small screws that do not penetrate through the plywood.

With the boxes fabricated, the casting can begin. The selected casting material was Poly 1512X Liquid Plastic.²⁷ It should be poured into the box to a depth of two inches and set with a one inch bolt, placed exactly perpendicular to the mold's surface. Separately, a threaded wooden rod should be prepared to receive the bolt and cast. This should be repeated for the other cast without the bolt and rod.

Once both the positive and the negative casts are made, the coldworking of the metal can begin. Place a metal sheet on a flat, stable work station. The cast without the bot or rod should be fastened to the work station surface. A corresponding side of a damaged section of a metal sheet should be lined up with the cast. The other cast should be firmly set against this and the rod beaten with a hammer.

If this proves unsuccessful, then the casting procedure should be repeated without the rod and bolts and the two casts set into a press or vice of some kind to allow for slow, even pressure to be exerted against the metal ceiling sheet.

Once the metal sheets have been reformed, they, along with the rest of the ceiling, need to be repainted. The ceiling sheets need to be adequately prepped to provide a clean surface to which the new paint can adhere. All loose, flaking and damaged paint should be removed following the recommendations outlined for the sheet metal cornice. Since the two finish layers of the ceiling are highly deteriorated, there is less concern for retaining its historic stratigraphy,

²⁷ Poly 1512X Liquid Plastic is "a 1A:1B mix, low viscosity, polyurethane liquid casting plastic that has a 5-minute working time and a ~30-minute demold time depending upon the size/mass of the pour." It is manufactured by the Polytek Development Corporation. Technical literature was found at: "Poly 1512X Liquid Plastic," *polytek.com*, <http://www.polytek.com/products/liquid-castingmold-shell-plastics-foams/polyurethane-liquid-casting-plastics/pourablebrushable-polyurethane-plastics/poly-15-series/poly-1512x/>

and so a chemical paint stripper may be used. The recommendations for repainting the metal ceiling are less stringent than those for the cornice since this metal is protected indoors. Iron or zinc oxide paints should be used and the original paint scheme restored.

The sheets need to completely dry after cleaning before applying the new paint. Certain climate conditions should be controlled when applying the new paint. The interior temperature should not fall below fifty degrees Fahrenheit nor should the relative humidity reach above eighty percent. Ideally, the temperature and humidity of the interior should remain fairly constant during application until the paint fully dries. Poor surface and climatic preparation will ensure the eventual failure of even the best paints.²⁸

²⁸ John G. Waite, AIA, "Part II. Deterioration and Methods of Preserving Metals," 136.

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Appendix A

Master Sample List and Bulk Sample Photographs

Table A1 Master Sample List

Sample No.	Date Sampled	Sampled by	Location	Sample Description	Tests	Cross Section
MTT 01	August 13, 2014	Samuel Loos	Exterior. Front door, lower left stile.	Two paint samples with attached wood substrate.	Determine original finish with microscopy.	X
MTT 02	August 13, 2014	Samuel Loos	Exterior. Front door, middle rail.	One paint sample with attached wood substrate.	Determine original finish with microscopy.	X
MTT 03	August 13, 2014	Samuel Loos	Exterior. Front door, center of panel.	Two paint samples with detached wood substrate.	Determine original finish with microscopy.	X
MTT 04	August 13, 2014	Samuel Loos	Exterior. Front door, molding of panel.	One paint sample with attached wood substrate.	Determine original finish with microscopy.	X
MTT 05	August 13, 2014	Samuel Loos	Interior. Stile of east shop front window.	One paint sample with attached wood substrate.	Determine original finish with microscopy.	X
MTT 06	August 13, 2014	Samuel Loos	Interior. Frame on back east window.	One paint sample with attached wood substrate. Layer of paint flaking off.	None.	
MTT 07	August 13, 2014	Samuel Loos	Interior. Sash of back east window.	One paint sample with attached wood substrate.	Determine original finish with microscopy.	X
MTT 08	August 13, 2014	Samuel Loos	Interior. Baseboard on west side.	One paint sample with attached wood substrate.	None.	
MTT 09	August 13, 2014	Samuel Loos	Interior. Typesetting bench, east side.	Multiple paint samples with attached wood substrate.	Determine original finish with microscopy.	X
MTT 10	August 13, 2014	Samuel Loos	Interior. Small typesetting bench.	One paint sample with attached wood substrate.	Determine original finish with microscopy.	X
MTT 11	August 13, 2014	Frank Matero	Exterior. Architrave, west side.	Multiple curled paint samples. No substrate.	Determine original finish with microscopy.	X
MTT 12	August 13, 2014	Frank Matero	Exterior. Background of cornice.	Paint flecks. No substrate.	None.	
MTT 13	August 13, 2014	Frank Matero	Exterior. Relief of cornice.	Multiple paint samples. No substrate.	Determine original finish with microscopy.	X
MTT 14	August 13, 2014	Samuel Loos	Exterior. Bay window rail.	One paint samples. No wood substrate	Determine original finish with microscopy.	X
MTT 15	August 13, 2014	Frank Matero	Exterior. Frieze of cornice.	Multiple paint samples. No substrate.	Determine original finish with microscopy.	X
MTT 16	August 13, 2014	Samuel Loos	Exterior. Bay window mullion.	One paint sample with attached wood substrate.	Determine original finish with microscopy.	X
MTT 17	August 13, 2014	Samuel Loos	Exterior. Bay window mutton.	One paint sample with attached wood substrate.	Determine original finish with microscopy.	X
MTT 18	August 13, 2014	Samuel Loos	Exterior. Concrete base below window.	Multiple concrete fragments.	Determine original finish with microscopy.	X
MTT 19	August 13, 2014	Frank Matero	Interior. Ceiling.	Cut rectangular piece from pressed metal ceiling.	Determine original finish with microscopy. XRF.	X
MTT 20	August 13, 2014	Frank Matero	Interior. Frieze on southeast corner of east wall.	Two rectangular samples of wallpaper.	Observation.	
MTT 21	August 13, 2014	Frank Matero	Interior. South wall, bottom section above baseboard.	One large square sample of plaster with remnants of keys and paint.	Determine original finish with microscopy. Acid digestion.	X
MTT 22	August 13, 2014	Frank Matero	Interior. Mid-section of wall.	One sample of plaster, broken into three pieces with remnants of keys and finish.	Determine original finish with microscopy.	X
MTT 23	August 13, 2014	Frank Matero	Interior. Mid-section of wall.	One sample of plaster with remnants of keys and finish.	Determine original finish with microscopy.	X
MTT 24	August 13, 2014	Frank Matero	Interior. Mid-section of wall.	One sample of plaster with remnants of keys and finish.	None.	
MTT 25	August 13, 2014	Frank Matero	Interior. Mid-section of wall.	Multiple samples of plaster with remnants of keys and finish.	None.	
MTT 26	August 13, 2014	Frank Matero	Interior. Upper section of wall, below paper board.	Two samples of plaster with remnants of keys and finish.	Determine original finish with microscopy.	X

MTT 19



Figure A.1 Front of sample (Author 2015).



Figure A.2 Back of sample (Author 2015).

MTT 20



Figure A.3 Front of sample (Author 2015).



Figure A.4 Back of sample (Author 2015).

MTT 21



Figure A.5 Front of sample (Author 2015).



Figure A.6 Back of sample (Author 2015).

MTT 22



Figure A.7 Front of sample (Author 2015).



Figure A.8 Back of sample (Author 2015).

MTT 23

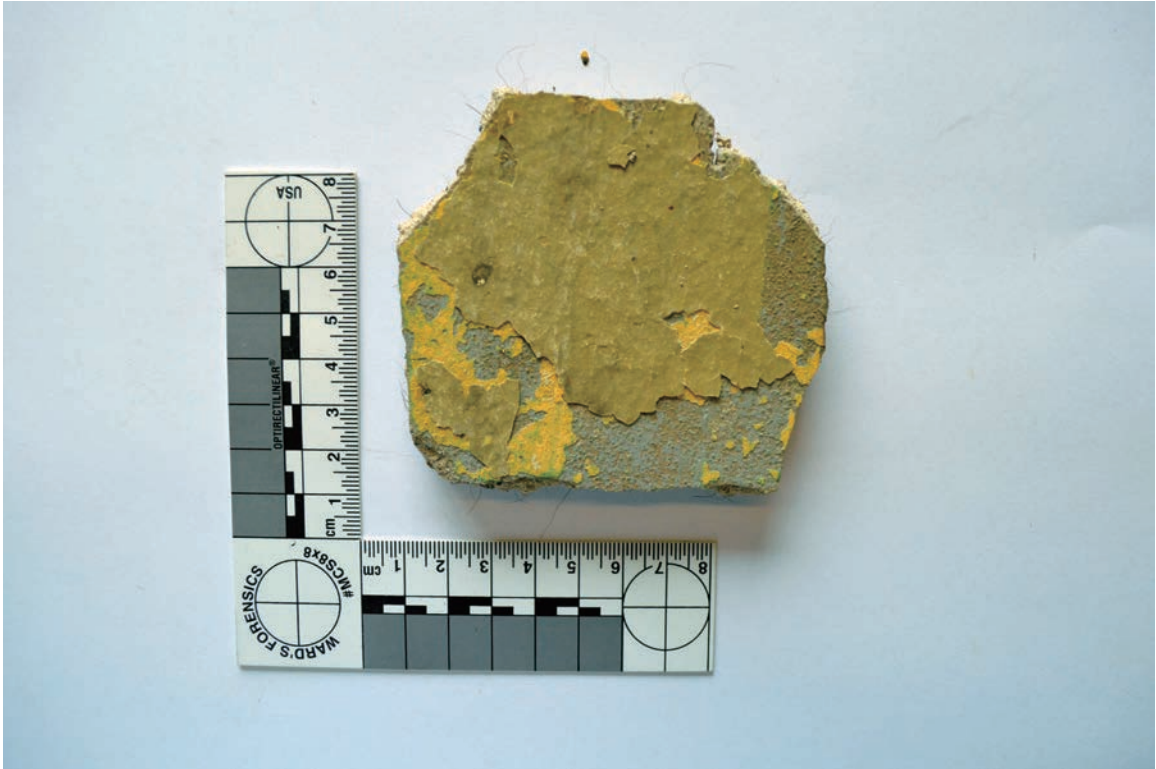


Figure A.9 Front of sample (Author 2015).



Figure A.10 Back of sample (Author 2015).

MTT 24



Figure A.11 Front of sample (Author 2015).



Figure A.12 Back of sample (Author 2015).

MTT 25



Figure A.13 Front of sample (Author 2015).



Figure A.14 Back of sample (Author 2015).

MTT 26



Figure A.15 Front of sample (Author 2015).

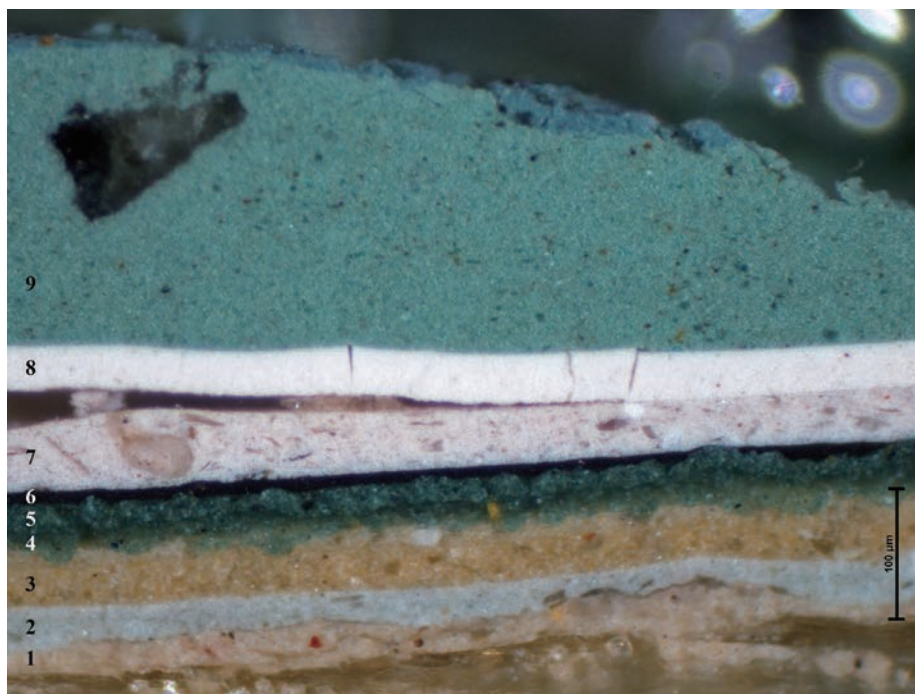


Figure A.16 Back of sample (Author 2015).

Appendix B

Data from Analysis

Appendix B
Paint Stratigraphy Analysis



Stratigraphy

Layers/Color/Measurement

9	F8	green	-
8	F7	white	-
7	F6	light pink	-
6	F5	black	-
5	F4	dark green	-
4	F3	dark green	-
3	F2	light golden brown	-
2	F1	light grey	48 um
1	P1	tan cream	
substrate			

Sample No.: MTT 01		Substrate: Wood	
Location: Exterior. Front door, lower left stile.			
Camera: Nikon DS-Fi1		Illumination: Intralux 5000-1 Reflected Quartz Haloge	
Microscope: Nikon ALPHASHOT-2 YS2		Magnification: 100x	
Date analyzed: 4 April 2015		Analyzed by: Samuel Loos	

Notes: Layer 1 is likely a prime coat for layer 2. At the sample's right edge, layer 1 is distressed, splitting in two and layer 8 is detaching from layer 7. The lighter tops of layer 2 and layer 3 indicate surface deterioration, possibly from UV radiation. Similarly observed in MTT 02, 03 and 17. Layers 3 and 4 appear to be two applications of the same finish. No additional layers were revealed or known layers made more distinct under UV.

Appendix B
Paint Stratigraphy Analysis



Stratigraphy

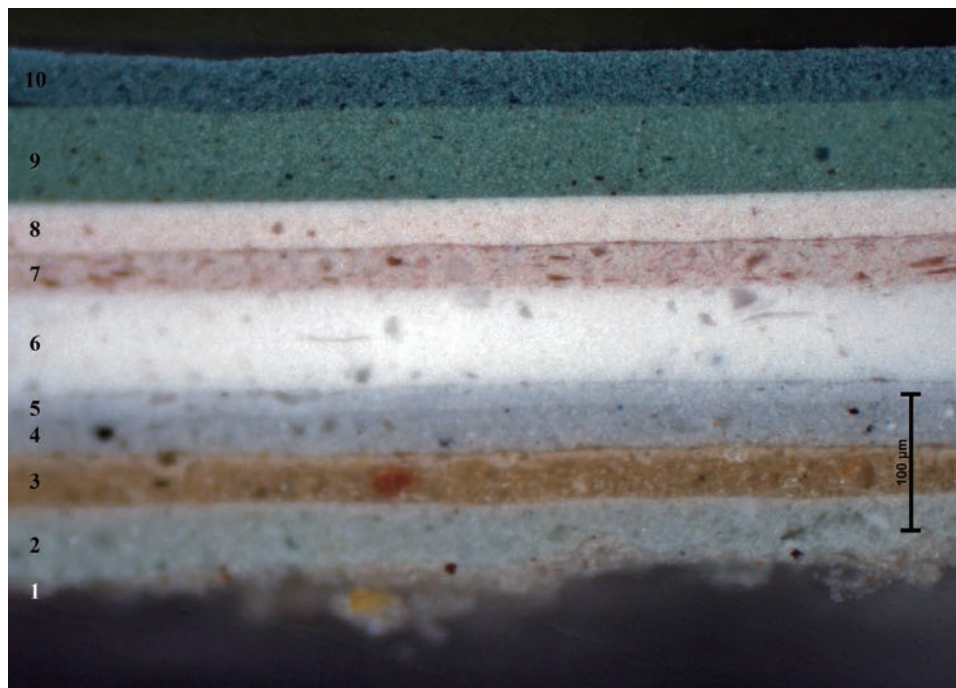
Layers/Color/Measurement

9	F8	dark green-blue	-
8	F7	green	+
7	F6	white	-
6	F5	light pink	-
5	F4	black	-
4	F3	dark green	-
3	F2	light golden brown	-
2	F1	light grey	57 um
1	P1	tan cream	
substrate			

Sample No.: MTT 02		Substrate: Wood	
Location: Exterior. Front door, middle rail.			
Camera: Nikon DS-Fi1		Illumination: Intralux 5000-1 Reflected Quartz Haloge	
Microscope: Nikon ALPHASHOT-2 YS2			Magnification: 100x
Date analyzed: 4 April 2015			Analyzed by: Samuel Loos

Notes: Layer 1 is likely a prime coat for layer 2. The lighter tops of layers 3 and 4 indicate surface deterioration, possibly from UV radiation. Similarly observed in MTT 01, 03 and 17. No additional layers were revealed or known layers made more distinct under UV.

Appendix B
Paint Stratigraphy Analysis



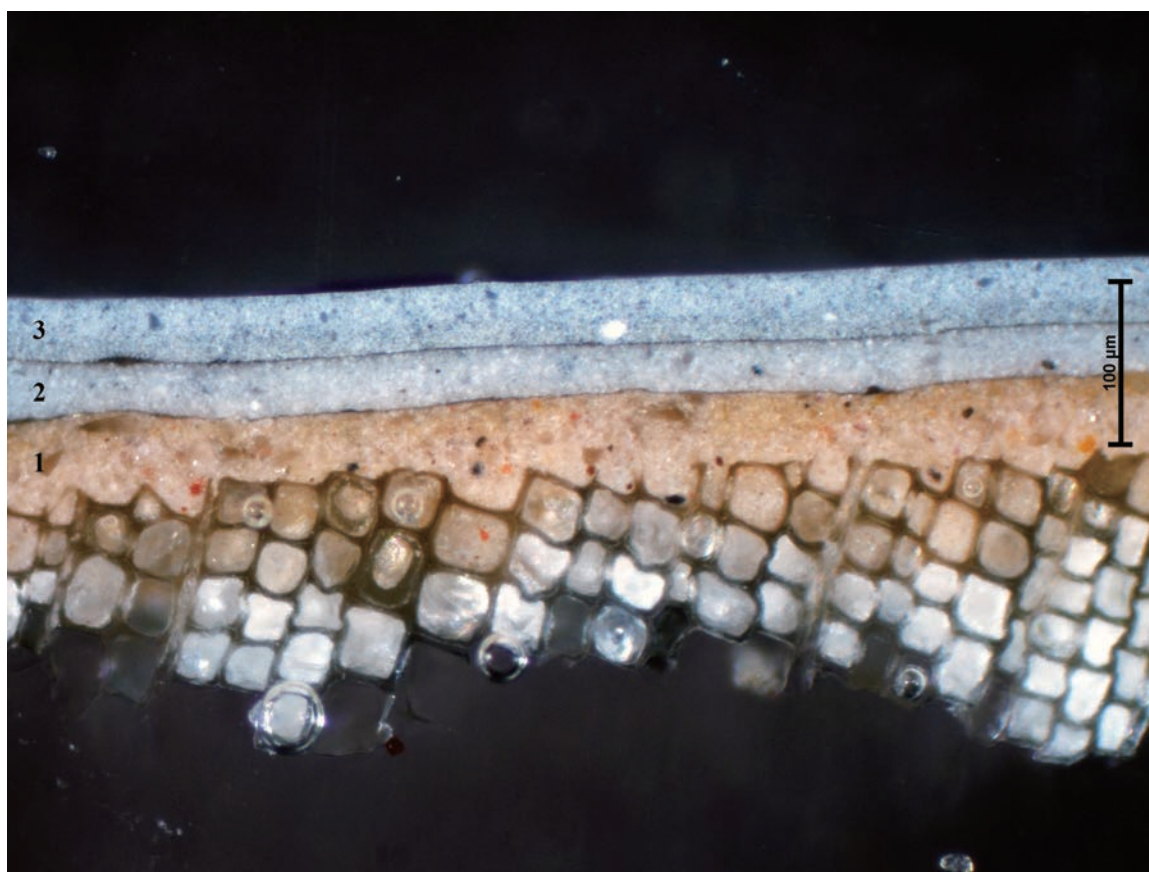
Stratigraphy

Layers/Color/Measurement

10	F9	dark green-blue	-
9	F8	green	+
8	F7	light cream	-
7	F6	light pink	-
6	F5	white	+
5	F4	light grey	-
4	F3	light grey	-
3	F2	light brown	-
2	F1	light grey	38 um
1	P1	tan cream	

Sample No.: MTT 03		Substrate: Absent	
Location: Exterior. Front door, center of panel.			
Camera: Nikon DS-Fi1		Illumination: Intralux 5000-1 Reflected Quartz Halogen	
Microscope: Nikon ALPHASHOT-2 YS2			Magnification: 100x
Date analyzed: 4 April 2015		Analyzed by: Samuel Loos	

Notes: Layer 1 is likely a prime coat for layer 2. Layer 1 is only a fragment, therefore measurements were not taken. The lighter tops of Layers 2 and 3 indicate surface deterioration, possibly from UV radiation. Similarly observed in MTT 01, 02 and 17. No additional layers were revealed or known layers made more distinct under UV.



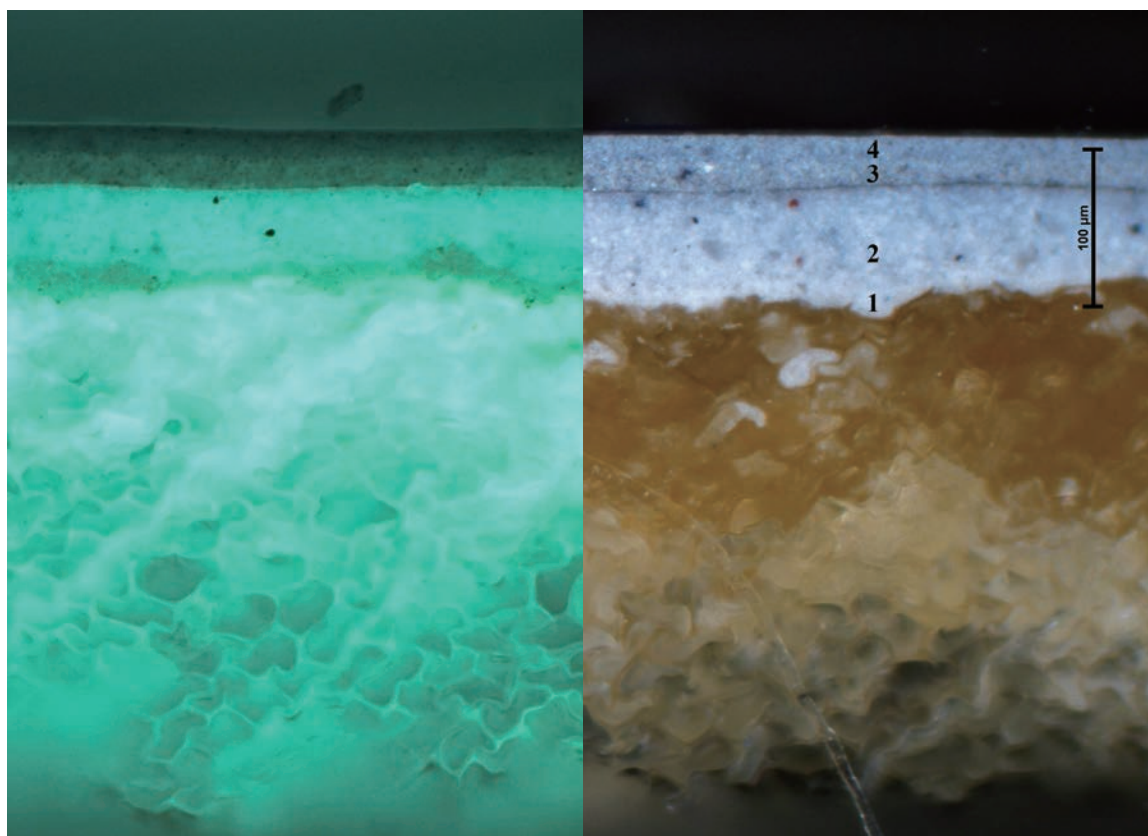
Stratigraphy

Layers/Color/Measurement

3	F3	light grey	-
2	F2	light grey	-
1	F1	cream orange	53 um
substrate			

Sample No.: MTT 04	Substrate: Wood
Location: Exterior. Front door, molding of panel.	
Camera: Nikon DS-Fi1	Illumination: Intralux 5000-1 Reflected Quartz Haloge
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 100x
Date analyzed: 4 April 2015	Analyzed by: Samuel Loos

Notes: Layer 1 is likely a prime coat for layer 2. Layer 1 darkens along its interface with layer 2. The three layers are not strongly adhered to each other. There are dirt layers atop layers 1 and 2. No additional layers were revealed or known layers made more distinct under UV.



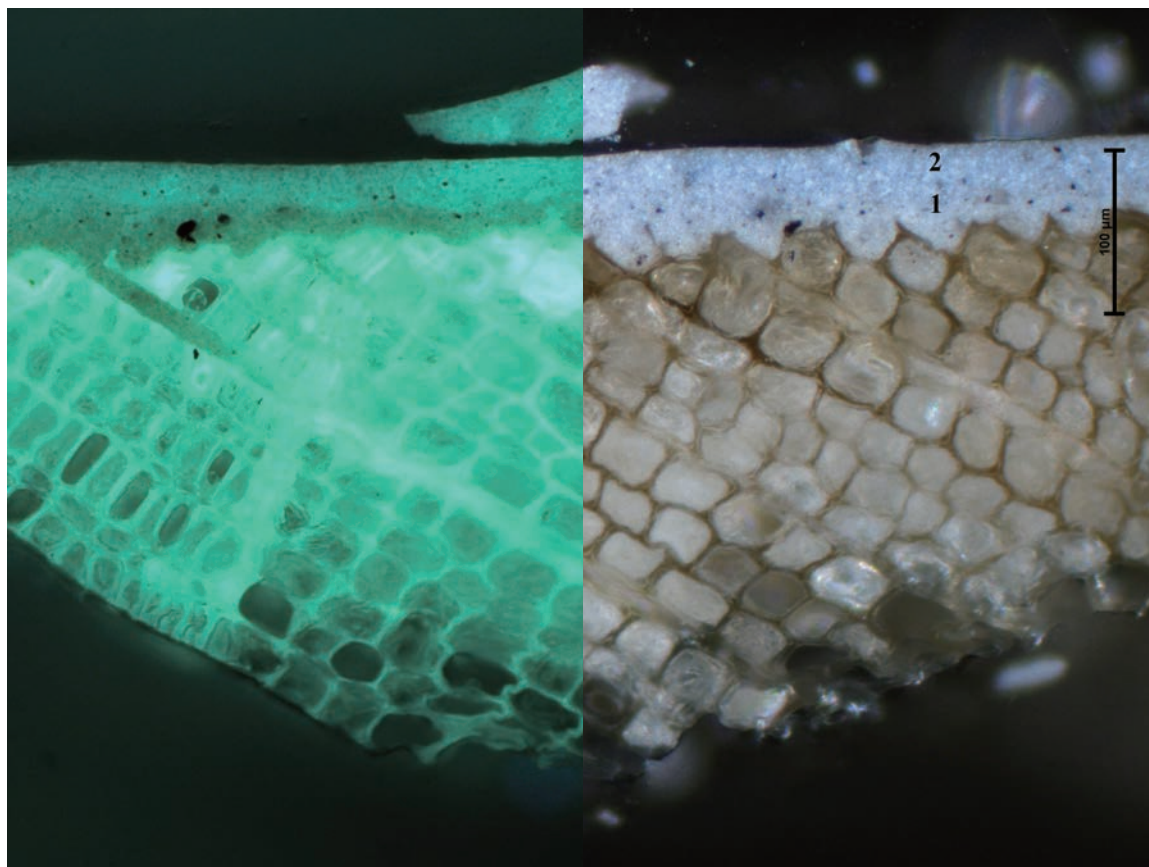
Stratigraphy

Layers/Color/Measurement

4	F3	light grey	-
3	F2	light grey	-
2	F1	light grey	67 um
1	P1	white grey	
substrate			

Sample No.: MTT 05		Substrate: Wood	
Location: Interior. Stile of east shop front window.			
Camera: Nikon DS-Fi1		Illumination: Reflected Quartz Halogen, Ultraviolet B 1A	
Microscope: Nikon ALPHASHOT-2 YS2			Magnification: 100x
Date analyzed: 4 April 2015		Analyzed by: Samuel Loos	

Notes: Layer 1 is likely a prime coat for layer 2. All three finishes are very similar in hue, but get progressively darker. The apparent prime is also very similar in hue. Layer 1 is a lighter hue and has larger pigment inclusions than layers 2 or 3. All layers were made more distinct under UV.



Stratigraphy

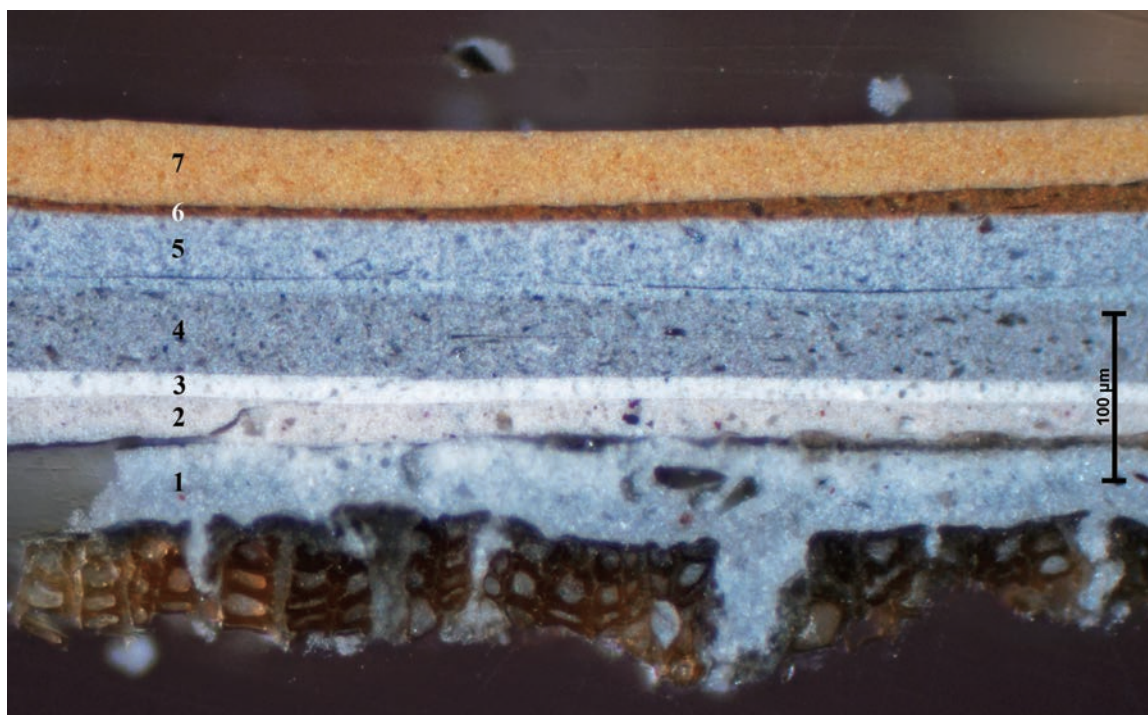
Layers/Color/Measurement

2	F1	light grey	46 um
1	P1	white grey	
substrate			

Sample No.: MTT 07		Substrate: Wood	
Location: Interior. Sash of back east window.			
Camera: Nikon DS-Fi1		Illumination: Reflected Quartz Halogen, Ultraviolet B 1A	
Microscope: Nikon ALPHASHOT-2 YS2			Magnification: 100x
Date analyzed: 4 April 2015		Analyzed by: Samuel Loos	

Notes: Layer 1 is likely a prime coat for layer 2. Both layers were more distinct under UV.

Appendix B
Paint Stratigraphy Analysis



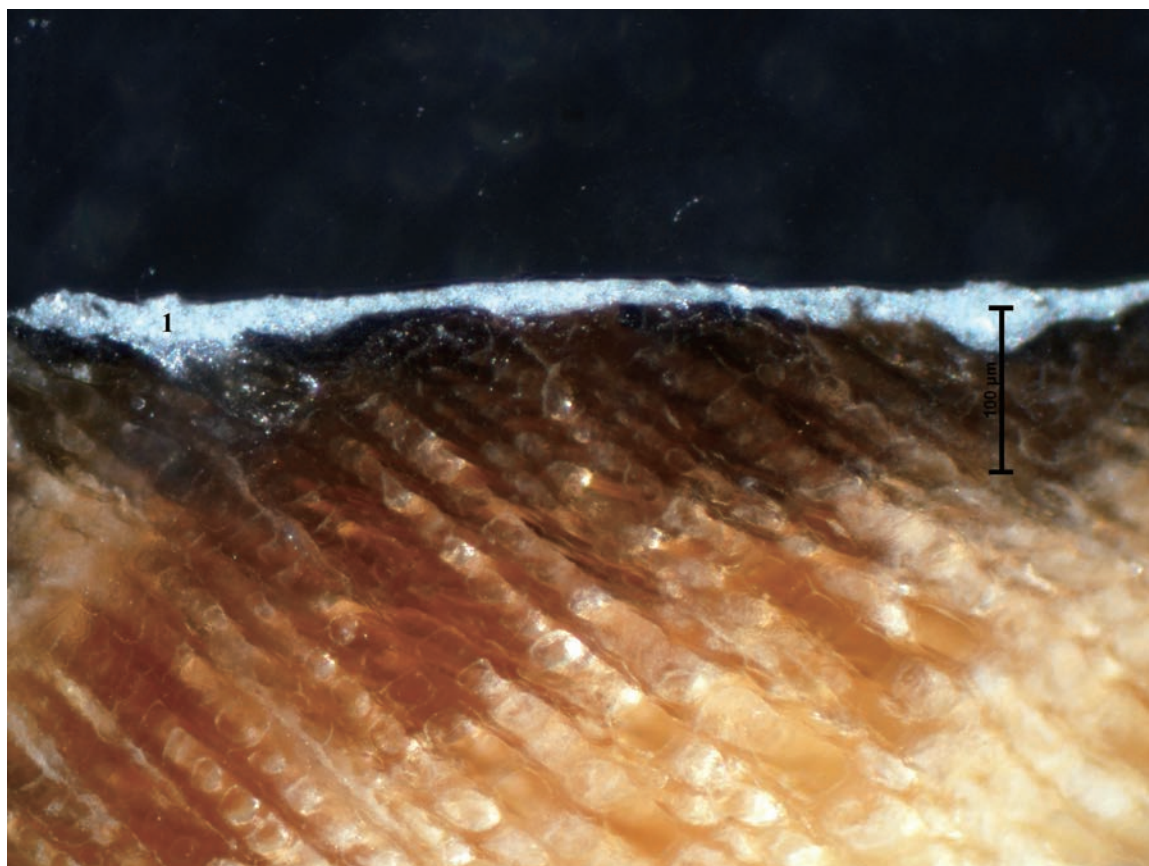
Stratigraphy

Layers/Color/Measurement

7	F7	light orange	+
6	F6	light brown	-
5	F5	grey-blue	-
4	F4	grey	-
3	F3	white	-
2	F2	cream	-
1	F1	light grey	50 um
substrate			

Sample No.: MTT 09	Substrate: Wood
Location: Interior. Typesetting bench, east side.	
Camera: Nikon DS-Fi1	Illumination: Intralux 5000-1 Reflected Quartz Haloge
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 100x
Date analyzed: 4 April 2015	Analyzed by: Samuel Loos

Notes: F1 appears to either be two coats of the same paint or its outer surface has been greatly discolored. The pigment in the lower section makes it unlikely that its a prime coat. Also, the pigment inclusions of the two sections overlap and mesh. Large dirt layer between F1 and F2. No additional layers were revealed or known layers made more distinct under UV.

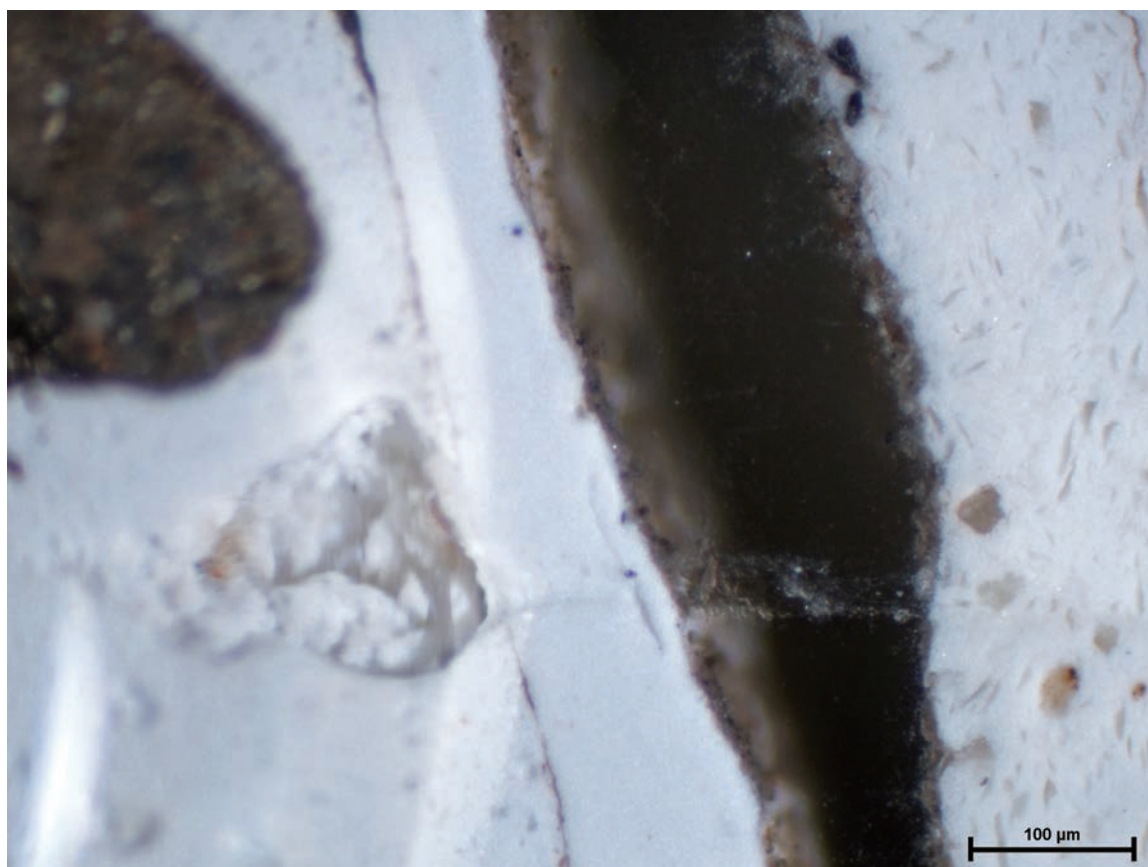


Stratigraphy
Layers/Color

1	F1	metallic grey
substrate		

Sample No.: MTT 10	Substrate: Wood
Location: Interior. Small typesetting bench.	
Camera: Nikon DS-Fi1	Illumination: Intralux 5000-1 Reflected Quartz Haloge
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 100x
Date analyzed: 4 April 2015	Analyzed by: Samuel Loos

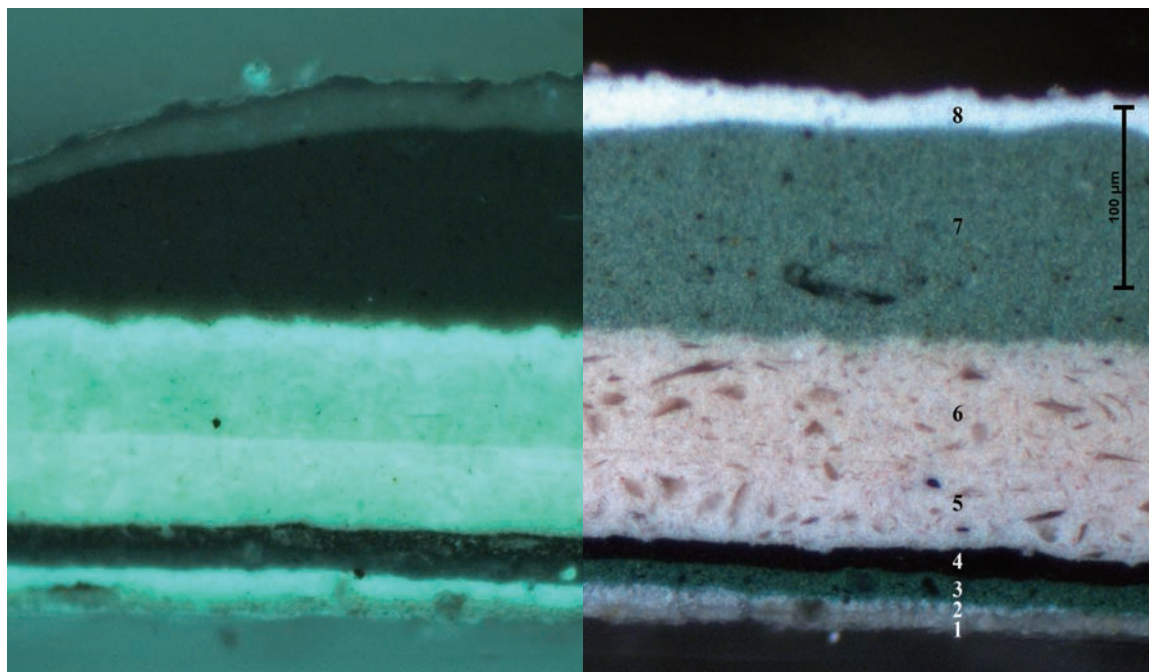
Notes: Layer 1 is not the original finish, so it was not measured. No additional layers were revealed or known layers made more distinct under UV.



Sample No.: MTT 11		Substrate: Absent	
Location: Exterior. Architrave, west side.			
Camera: Nikon DS-Fi1		Illumination: Intralux 5000-1 Reflected Quartz Haloge	
Microscope: Nikon ALPHASHOT-2 YS2		Magnification: 100x	
Date analyzed: 4 April 2015		Analyzed by: Samuel Loos	

Notes: There appear to be at least two, if not three white finishes, along with a grey-blue and light brown finish. Due to the extraction method used of scraping from a metal substrate, the sample is difficult to interpret as the stratigraphy has been disrupted. Because of this, the stratigraphy was not annotated. No additional layers were revealed or known layers made more distinct under UV.

Appendix B
Paint Stratigraphy Analysis



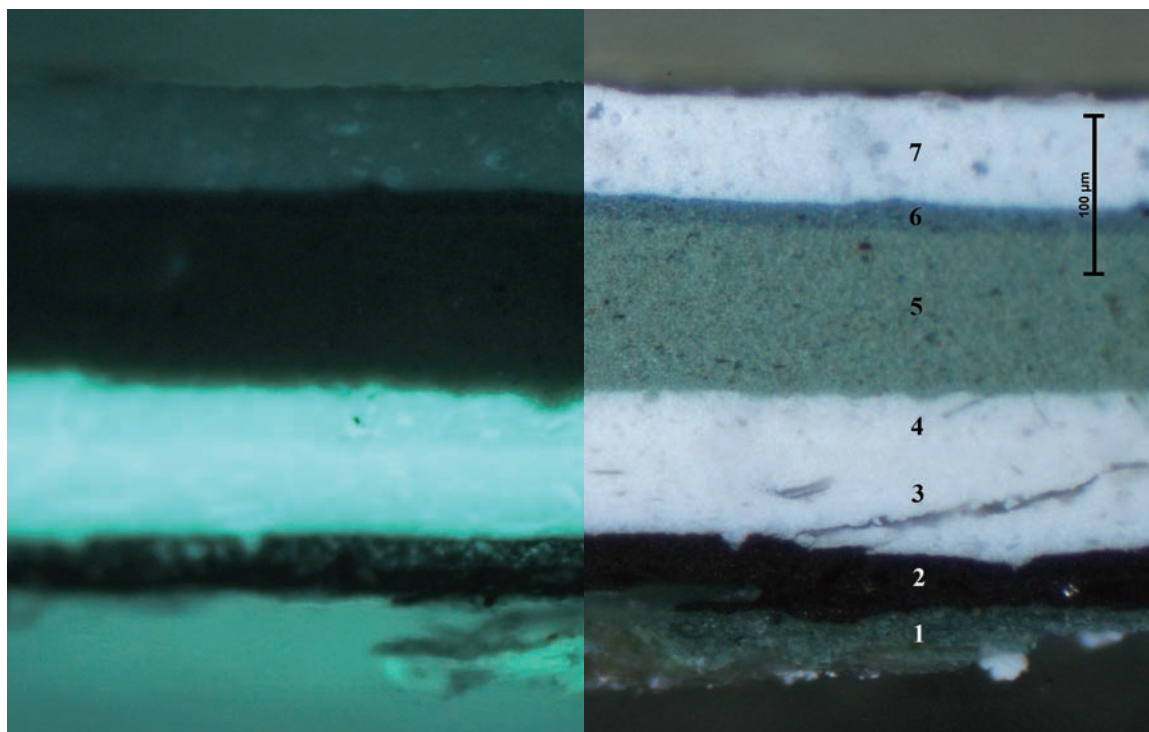
Stratigraphy
Layers/Color

8	F8	white
7	F7	green
6	F6	light pink
5	F5	light pink
4	F4	black
3	F3	bright green
2	F2	grey
1	P1	light grey

Sample No.: MTT 13	Substrate: Absent
Location: Exterior. Relief of cornice.	
Camera: Nikon DS-Fi1	Illumination: Reflected Quartz Halogen, Ultraviolet B 1A
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 100x
Date analyzed: 4 April 2015	Analyzed by: Samuel Loos

Notes: Layer 1 is likely a shop prime. The metal substrate was not extracted with this sample, so a complete stratigraphy could not be annotated, but given that the current finish is white, the chronology of the extracted layers could be annotated. Measurements were not taken as the original finish could not be determined. Layers 5 and 6 are identical, appearing to be two coats of the same paint, or the same paint applied at different times. Both are made more distinct under UV.

Appendix B
Paint Stratigraphy Analysis



Stratigraphy
Layers/Color

7	F7	white
6	F6	green-blue
5	F5	green
4	F4	off white
3	F3	off white
2	F2	black
1	F1	dark green
substrate		

Sample No.: MTT 14	Substrate: Wood fragment
Location: Exterior. Bay window rail.	
Camera: Nikon DS-Fi1	Illumination: Reflected Quartz Halogen, Ultraviolet B 1A
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 100x
Date analyzed: 4 April 2015	Analyzed by: Samuel Loos

Notes: Very small fragment of wood substrate retained in middle of sample. Much of the original finish was lost, so an accurate measurement could not be taken. Layers 3 and 4 are almost identical, appearing to be two coats of the same paint, or the same paint applied at different times. Both are made more distinct under UV.



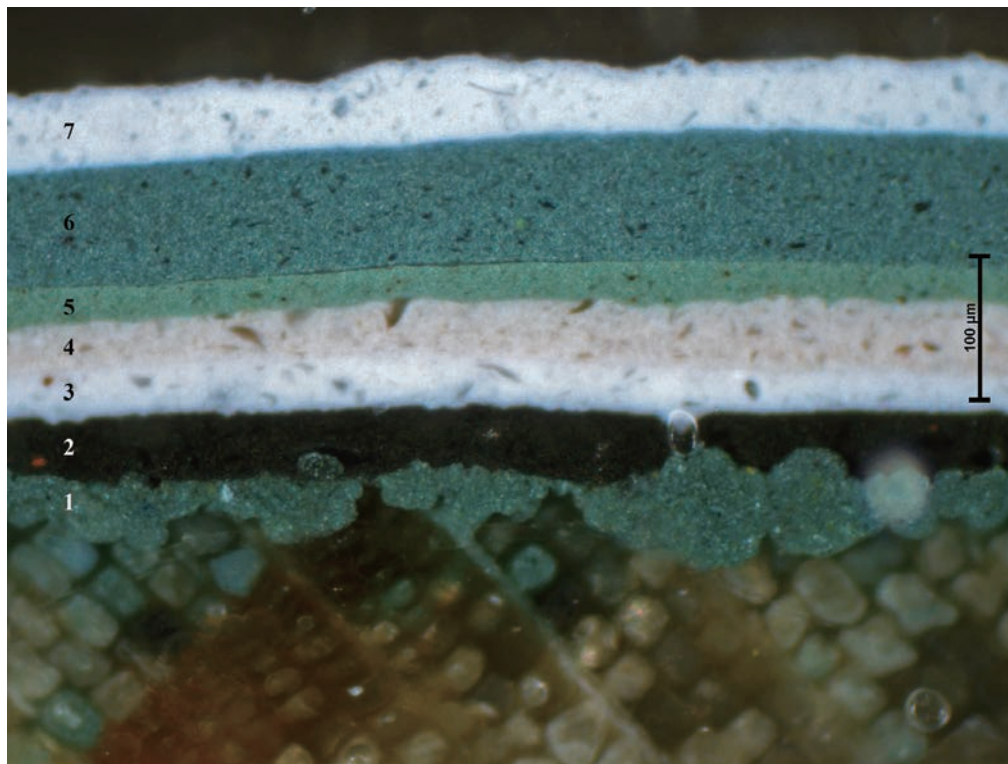
Stratigraphy
Layers/Color

10	F9	white
9	F8	green
8	F7	white
7	F6	off-white
6	F5	white
5	F4	dark green
4	F3	cream-gold
3	F2	golden-brown
2	F1	grey
1	P1	tan cream

Sample No.: MTT 15	Substrate: Absent
Location: Exterior. Frieze of cornice.	
Camera: Nikon DS-Fi1	Illumination: Intralux 5000-1 Reflected Quartz Haloge
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 40x
Date analyzed: 4 April 2015	Analyzed by: Samuel Loos

Notes: Due to the extraction method used of scraping from a metal substrate, the sample is difficult to interpret as the stratigraphy has been disrupted. Unlike sample MTT 1, though, some of the stratigraphy is legible and can be annotated. The chronology is only speculative. No additional layers were revealed or known layers made more distinct under UV.

Appendix B
Paint Stratigraphy Analysis



Stratigraphy

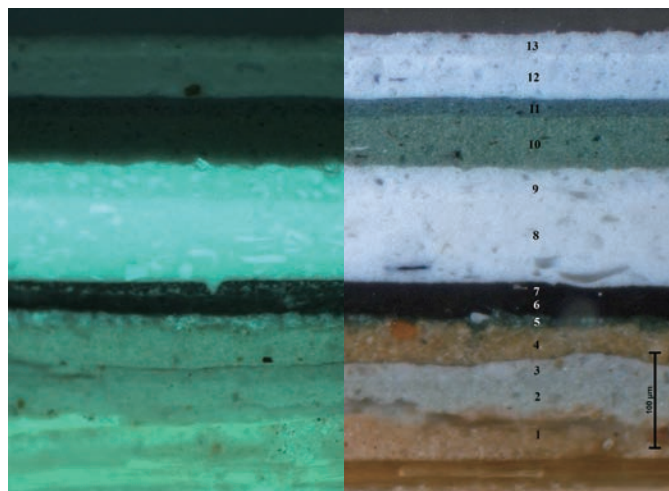
Layers/Color/Measurement

7	F7	white	+
6	F6	green	+
5	F5	light green	=
4	F4	cream	+
3	F3	off white	+
2	F2	black	+
1	F1	dark green	31 um
substrate			

Sample No.: MTT 16	Substrate: Wood
Location: Exterior. Bay window mullion.	
Camera: Nikon DS-Fi1	Illumination: Intralux 5000-1 Reflected Quartz Haloge
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 100x
Date analyzed: 5 April 2015	Analyzed by: Samuel Loos

Notes: Older layers were removed before the application of layer 1. No additional layers were revealed or known layers made more distinct under UV.

Appendix B Paint Stratigraphy Analysis

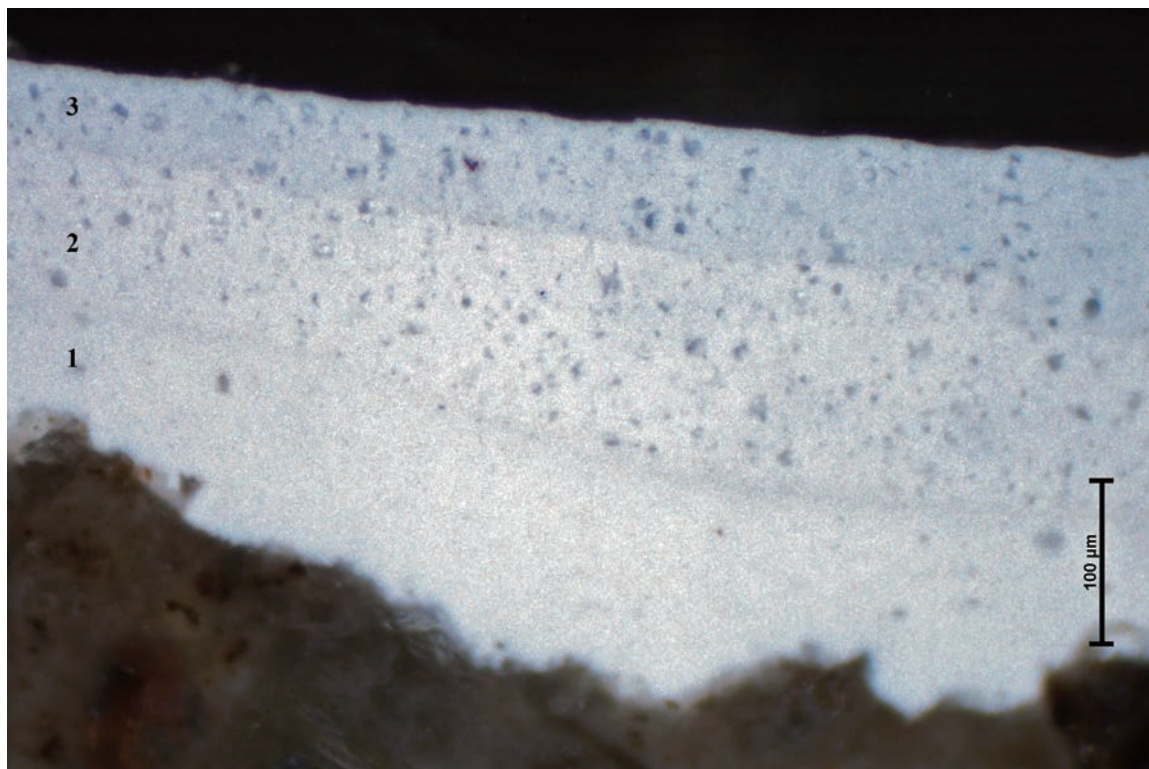


Stratigraphy
Layers/Color/Measurement

13	F12	white	-
12	F11	white	+
11	F10	green	-
10	F9	light green	+
9	F8	white	-
8	F7	white	+
7	F6	black	-
6	F5	black	-
5	F4	green	-
4	F3	light golden brown	=
3	F2	light grey	
2	F1	light grey	42 um
1	P1	tan cream	
substrate			

Sample No.: MTT 17		Substrate: Wood	
Location: Exterior. Bay window muntin.			
Camera: Nikon DS-Fi1		Illumination: Reflected Quartz Halogen, Ultraviolet B 1A	
Microscope: Nikon ALPHASHOT-2 YS2		Magnification: 100x	
Date analyzed: 5 April 2015		Analyzed by: Samuel Loos	

Notes: Layer 1 is deteriorating, losing its adhesion with layer 2. The lighter topsof layer 4 indicates surface deterioration, possibly from UV radiation. Similarly observed in MTT 01, 02 and 03. Layers 6 and 7 are indistinguishable under visible light. Layers 2, 3, 8 and 9 are made more distinct and layer 7 was revealed under UV.



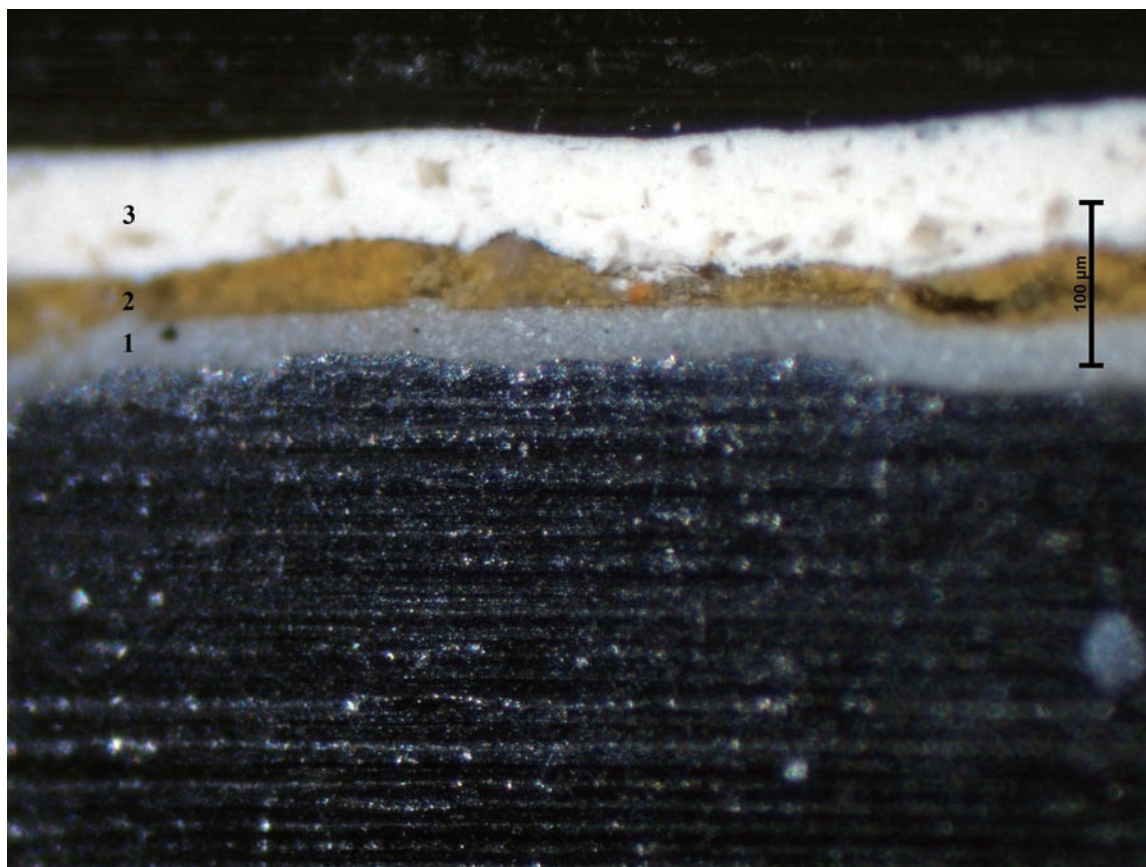
Stratigraphy

Layers/Color/Measurement

3	F3	white	-
2	F2	white	+
1	F1	white	92 um
substrate			

Sample No.: MTT 18	Substrate: Concrete
Location: Exterior. Concrete base below window.	
Camera: Nikon DS-Fi1	Illumination: Intralux 5000-1 Reflected Quartz Haloge
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 100x
Date analyzed: 5 April 2015	Analyzed by: Samuel Loos

Notes: All three finishes are almost indistinct from each other, being very similar in color. The boundaries between the three layers are difficult to perceive. Layers 2 and 3 contain air bubbles where layer 1 does not. No additional layers were revealed or known layers made more distinct under UV.



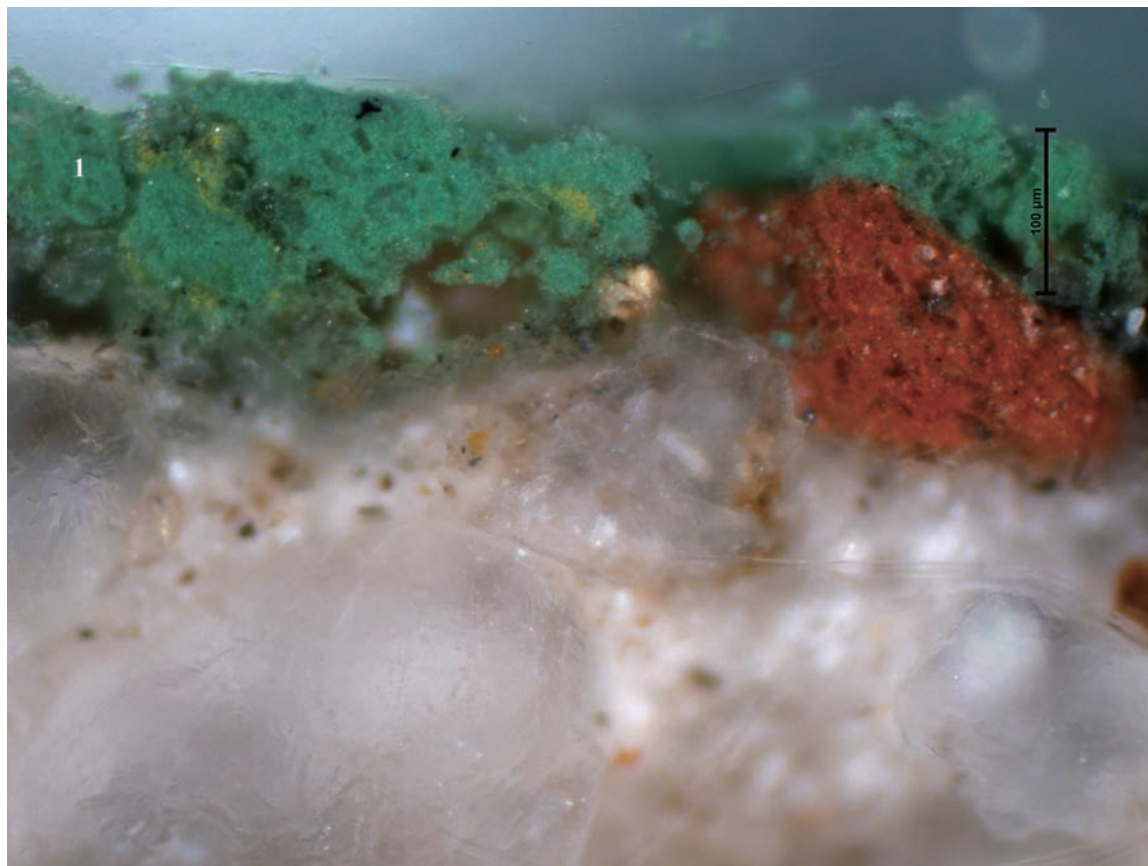
Stratigraphy

Layers/Color/Measurement

3	F3	off-white	+
2	F2	golden brown	=
1	P1	grey	30 um
substrate			

Sample No.: MTT 19	Substrate: Mild steel
Location: Interior. Ceiling.	
Camera: Nikon DS-Fi1	Illumination: Intralux 5000-1 Reflected Quartz Haloge
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 100x
Date analyzed: 5 April 2015	Analyzed by: Samuel Loos

Notes: Layer 1 is likely a shop prime. Layer 2 was exposed for a long time and shows deterioration and fracturing. No additional layers were revealed or known layers made more distinct under UV.



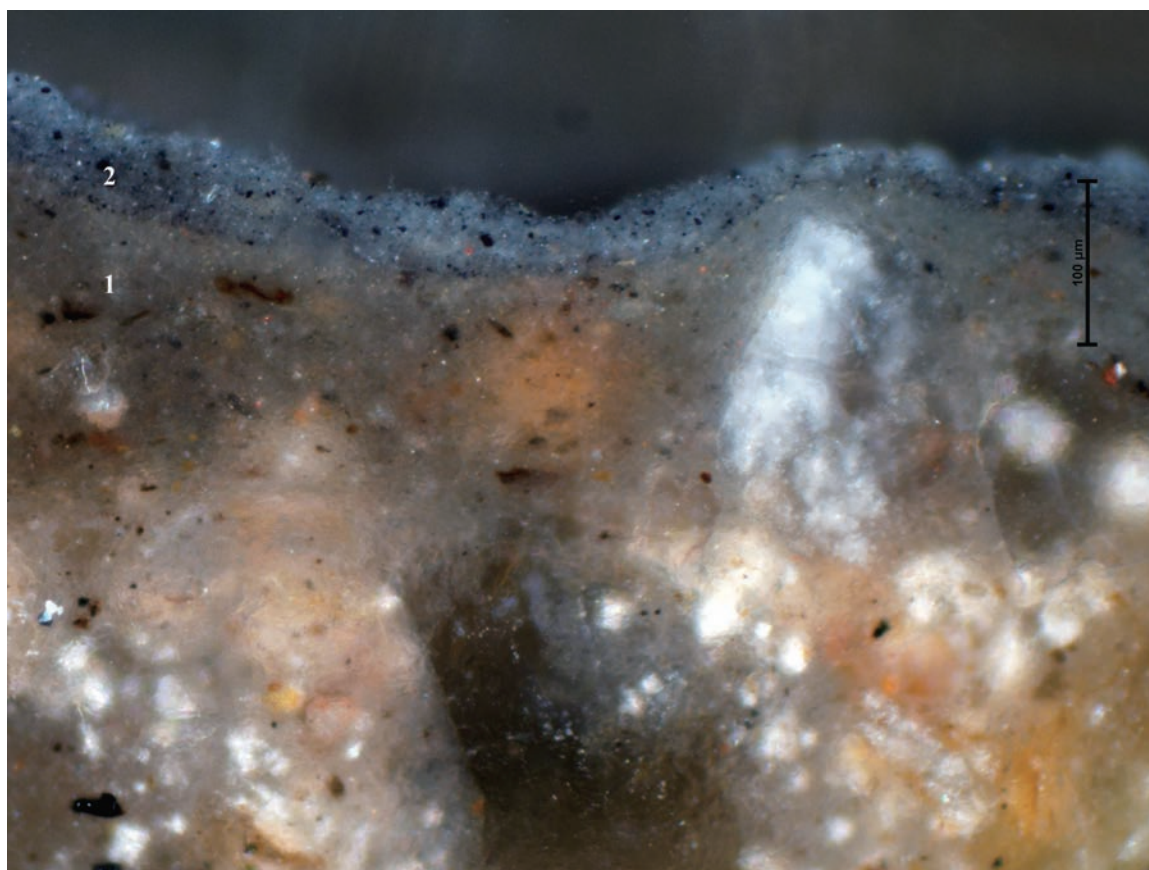
Stratigraphy

Layers/Color/Measurement

1	F1	bright green	30 um
substrate			

Sample No.: MTT 21	Substrate: Plaster
Location: Interior. South wall, bottom section above baseboard.	
Camera: Nikon DS-Fi1	Illumination: Intralux 5000-1 Reflected Quartz Haloge
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 100x
Date analyzed: 5 April 2015	Analyzed by: Samuel Loos

Notes: Given the date of the building and location on the interior, more layers were expected to be observed. One explanation could be the use of distemper paints, which could have washed away. Additional layers were observed on the bulk sample. No additional layers were revealed or known layers made more distinct under UV.



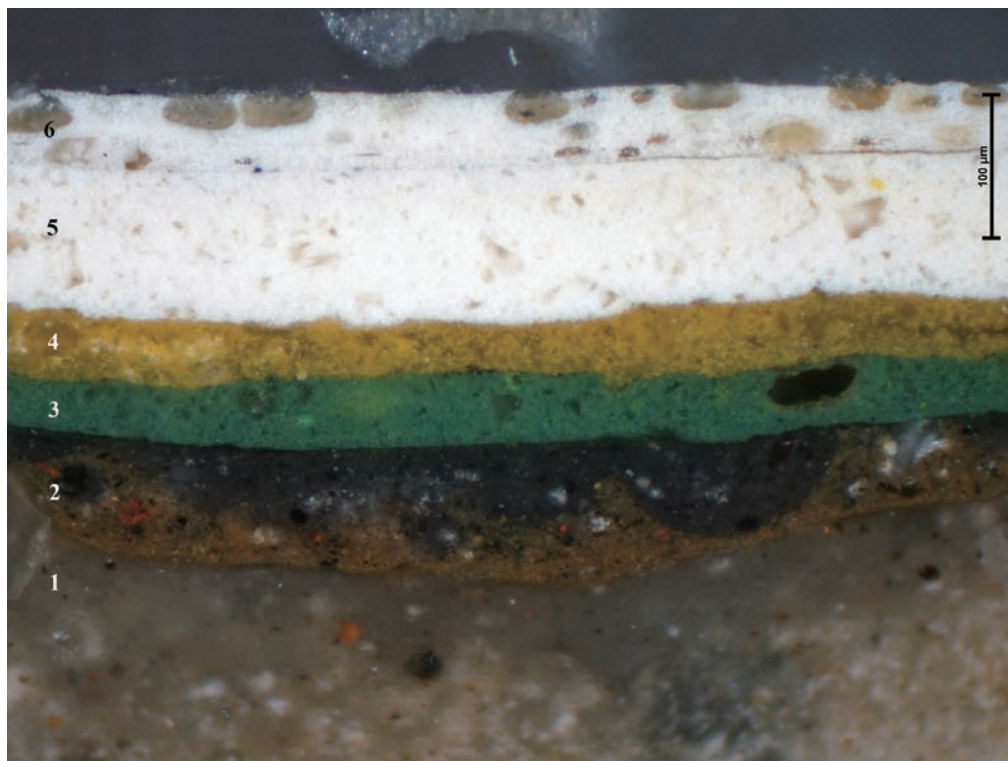
Stratigraphy
Layers/Color

2	F2	grey
1	F1	light purple grey
substrate		

Sample No.: MTT 22	Substrate: Plaster
Location: Interior. Mid section of wall.	
Camera: Nikon DS-Fi1	Illumination: Intralux 5000-1 Reflected Quartz Haloge
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 100x
Date analyzed: 5 April 2015	Analyzed by: Samuel Loos

Notes: F1 has penetrated into the plaster substrate, making it difficult to discern a clear boundary. Therefore, measurements were not taken. No additional layers were revealed or known layers made more distinct under UV.

Appendix B
Paint Stratigraphy Analysis



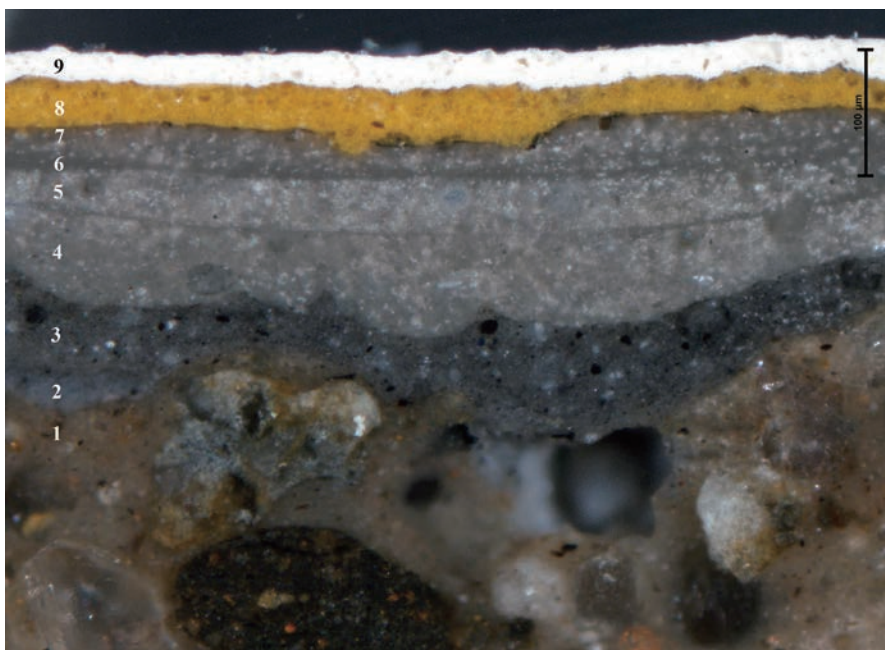
Stratigraphy
Layer/Color

6	F6	white
5	F5	off-white
4	F4	dark gold
3	F3	bright green
2	F2	brown/dark grey
1	F1	grey
		substrate

Sample No.: MTT 23	Substrate: Plaster
Location: Interior. Mid section of wall.	
Camera: Nikon DS-Fi1	Illumination: Intralux 5000-1 Reflected Quartz Haloge
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 100x
Date analyzed: 5 April 2015	Analyzed by: Samuel Loos

Notes: Layer 1 has deeply penetrated the plaster substrate, making it difficult to discern as a separate layer. Therefore, measurements were not taken. There is a darkening of F2 in some areas to a dark grey. Appears to just be a color change and not a separate layer. No additional layers were revealed or known layers made more distinct under UV.

Appendix B
Paint Stratigraphy Analysis



Stratigraphy
Layer/Color

9	F9	white
8	F8	dark gold
7	F7	light grey
6	F6	light grey
5	F5	light grey
4	F4	light grey
3	F3	grey
2	F2	grey
1	F1	grey
		substrate

Sample No.: MTT 26	Substrate: Plaster
Location: Interior. Upper section of wall, below paper board.	
Camera: Nikon DS-Fi1	Illumination: Intralux 5000-1 Reflected Quartz Haloge
Microscope: Nikon ALPHASHOT-2 YS2	Magnification: 50x
Date analyzed: 5 April 2015	Analyzed by: Samuel Loos

Notes: F1-3 and F2-5 appear to be of same campaign, just multiple coats of the same paint. F1 has penetrated the plaster substrate, making it difficult to discern a clear boundary. Therefore, measurements were not taken. No additional layers were revealed or known layers made more distinct under UV.

***Characterization of Plaster in the
Mancos Times-Tribune Building***

Table B.1 Sample Mass Readings and Description

	dry powdered sample + container	container	dry powdered sample	filter paper	filter paper + dry fines	dry fines	dry aggregate beaker	dry aggregate + beaker	dry aggregate
	M_0	M_C	M_I	M_2	M_3	M_F	M_{C1}	M_{C2}	M_4
sample	213.45g	174.03g	36.42	4.52g	11.25g	6.73g	174.03g	198.85g	24.82g
Site / Sample ID		The Mancos Times-Tribune Building, MTT 21							
Sampled by		Samuel Loos							
Sampled on		13 August 2015							
Analyzed by		Samuel Loos							
Analyzed on		10 April 2015							
Description		Bulk sample of plaster roughly measuring 5 ½” x 6” taken from the bottom section of the south wall of the building. Has a width of 1 ½ cm.							
Appearance		The plaster itself is a light grey and is covered with a light green finish, likely a chalky distemper. The plaster contains strands of hair for greater cohesion.							
Snap Strength		Medium snap strength. Low friable.							
Layering		Two confirmed layers, possibly a third. The primary central layer has poorly sorted aggregate while the thin finish layer aggregate is well sorted. There is possibly a third layer which was not attached to the sample. There is a brown, very friable layer of aggregate on the back of the primary layer.							
Bulk Color (Munsell)		Aggregate is highly varied, creating an non-uniform color throughout.							
Hardness (Mohs)		Between 5 and 6 on the surface. 2 on the sides.							

Appendix B
Plaster Characterization Data

Table B. 2 Notes and Calculations							
	Organics	Magnetic	Reactions	Color	Mass (G)	% Total Mass	Mass Ratio
Fines	Black hairs	-	-	-	6.73	18.5	2
Soluble	-	-	Very mild	-	4.87	13.4	1
Aggregate	Bleached hairs	yes	-	-	24.82	68.1	7

Table B.3 Sieve Test Data							
ASTM Sieve Number	Screen Size (µm)	Mass of container (g)	Mass of sample & container (g)	Mass retained (g)	Percent mass retained	Percent on or above	Percent Passing
		M_c	M_2	M_r ($M_2 - M_c$)	$\%M_r$ (M_r/M_2) *100%	$\%M_{rt}$ $\Sigma \%M_r$ (on or above)	$\%M_{pt}$ 100% - $M_{rt}\%$
8	2360	1.70	2.89	1.19	4.79	4.79	95.2
16	1180	1.61	4.83	3.22	13.0	17.8	82.2
30	600	1.83	6.57	4.74	19.1	36.9	63.1
50	300	2.04	9.55	7.51	30.3	67.2	32.8
100	150	1.80	6.98	5.18	20.9	88.1	11.9
200	75	1.82	1.89	0.07	0.282	88.3	11.7
PAN	0	1.78	4.65	2.87	11.6	100	0

Table B.4 Aggregate Characterization after Acid Digestion					
Sieve #	Size	Sphericity	Roundness	Sorting	Color
8	<i>very fine gravel</i>	Subequant	Sub-rounded	Very good	Varied
16	<i>very coarse sand</i>	Subelongate - equant	Angular - rounded	Good	Varied
30	<i>coarse sand</i>	Elongate - equant	Angular - rounded	Good	Varied
50	<i>medium sand</i>	Subelongate - equant	Angular - rounded	Very good	Varied
100	<i>fine sand</i>	Subelongate - equant	Angular - rounded	Very good	Varied
200	<i>very fine sand</i>	Intermediate - equant	Subangular - rounded	Very good	Varied
Pan	<i>silt & clay</i>	Elongate - equant	Very angular - rounded	Good	Varied

Photographs of Sieved Aggregates



Figure B.1 Aggregate from sieve #8 (Author 2015).



Figure B.2 Aggregate from sieve #16 (Author 2015).



Figure B.3 Aggregate from sieve #30 (Author 2015).



Figure B.4 Aggregate from sieve #50 (Author 2015).



Figure B.5 Aggregate from sieve #100 (Author 2015).

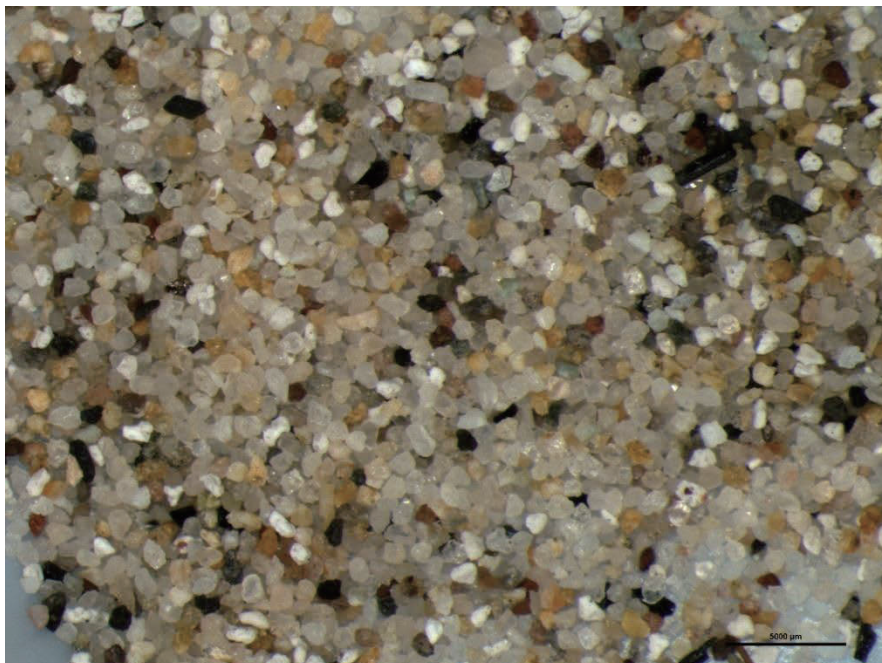


Figure B.6 Aggregate from sieve #200 (Author 2015).

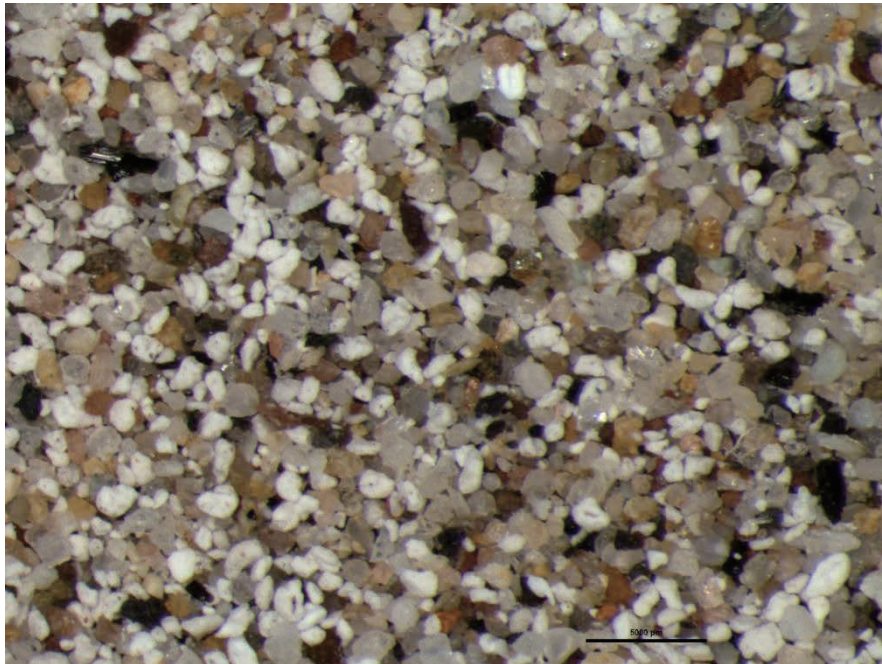


Figure B.7 Aggregate from pan (Author 2015).

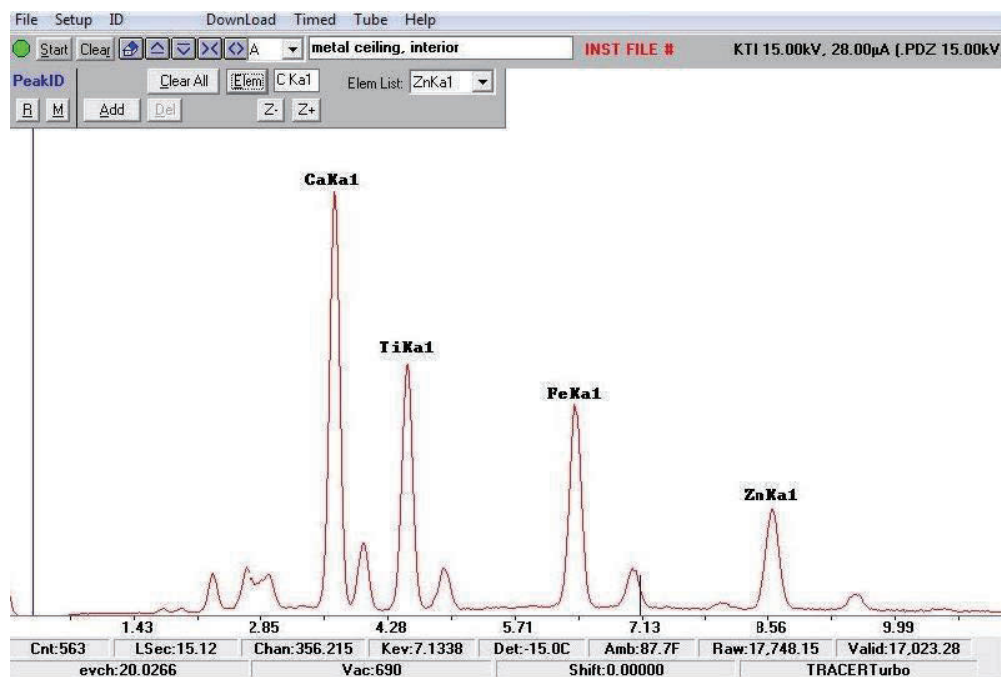


Figure B.8 Graph of XRF data from test on finished side of pressed metal ceiling sample (MTT 19), showing peaks for calcium, titanium, iron and zinc (from left to right).

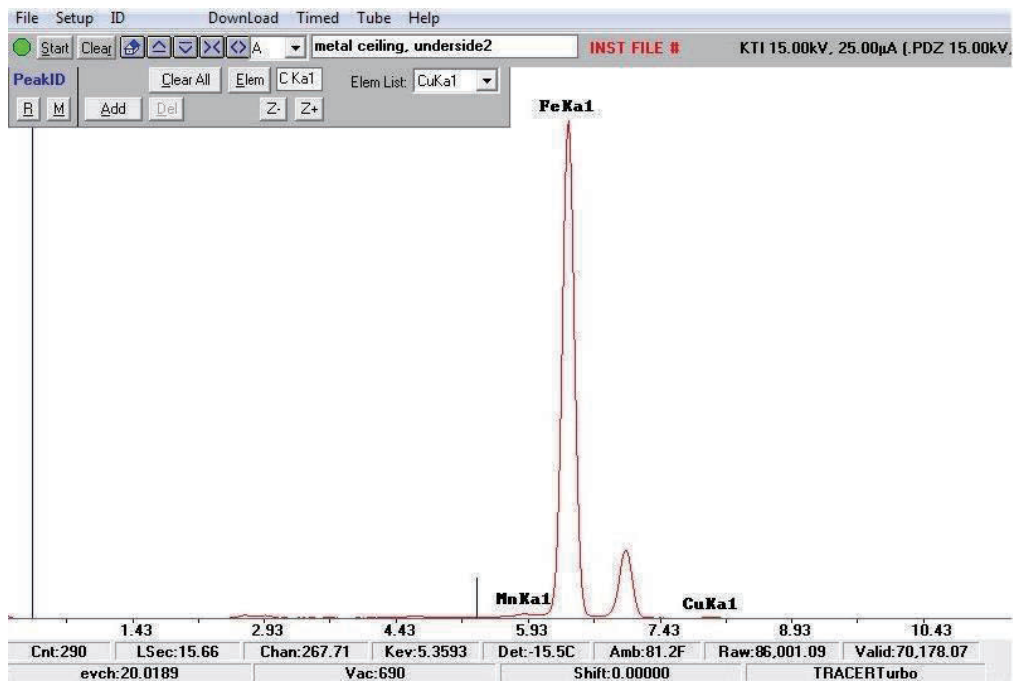


Figure B.9 Graph of XRF data from test on unfinished side of pressed metal ceiling sample (MTT 19), showing peaks for iron.

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