CITY OF CARMEL-BY-THE-SEA
HISTORIC RESOURCES BOARD
Staff Report

August 16, 2021

TO:	Historic Resources Board Commissioners
SUBMITTED BY:	Evan Kort, Associate Planner
SUBJECT:	**DR 21-114 (The Conservatory)** Consideration of a Determination of Consistency with the Secretary of Interior's Standards for a Design Review Application (DR 21-114, The Conservatory) for a remodel and structural seismic retrofit of an historic structure, know as the China Arts Building, which includes new acoustic infrastructure, as well as new elevator and stairway additions, a new skylight, and exterior windows located on Dolores Street 2 northwest of 7th Avenue in the Central Commercial (CC) Zoning District and Downtown Conservation District (CD) Overlay (APN: 010-147-006; Block 91, lots 6, 8, 10).

RECOMMENDATION:

Staff recommends that the Historic Resources Board adopt a resolution issuing a Determination of Consistency with the Secretary of the Interior's Standards for a remodel and structural seismic retrofit of an historic structure, known as the China Arts Center, which includes new acoustic infrastructure, as well as new elevator and stairway additions to the roof and a new skylight and exterior windows located at Dolores Street, 2 northwest of 7th Avenue in the Central Commercial (CC) Zoning District and Downtown Conservation District (CD) Overlay. APN: 010-147-006 (attachment 1).

BACKGROUND/SUMMARY:

BACKGROUND AND PROJECT DESCRIPTION

The project site is located on Dolores Street, 2 northwest of 7th Avenue on a 4,000 square foot lot. The applicant is proposing to seismically retrofit and remodel an historic building, known as the China Arts Center, into a private multi-story, music recording studio. The project also includes a complete interior remodel with the addition of a new elevator and stairway enclosure on the roof, a new skylight, new windows and doors, and a new "sound lock" entry on Dolores Street.

The China Art Center is a multi-story commercial building constructed in the Mission Revival style. Designed by San Francisco architect H.H. Winner and constructed by Hugh Comstock, the subject property is listed as a Carmel-by-the-Sea historic resource under the Historic Context Statement's theme of Architectural Development in Carmel and is significant under California Criterion 3, in the area of architecture as an example of the Mission Revival Style. The character defining features of the building appear primarily on the front elevation and are the:

- Gabled roof massing, with wide overhangs containing carved wood brackets;
- Clay-barrel tile roofing material;

Dolores Street) elevation, in keeping with this Standard."

Staff Response: Staff concurs with the Phase II response.

Standard 2: The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize the property will be avoided.

Phase II Response: "The proposed alterations will modify interior spatial relationships, but the great hall space with its painted wood beams and the arched windows on the north elevation will be retained and rehabilitated. The remaining character-defining features on the primary (east) elevation will be retained and rehabilitated, to satisfy this Standard."

Staff Response: Staff concurs with the Phase II response.

Standard 3: Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.

Phase II Response: "The proposed alterations do not add conjectural features or elements from other historic properties that would confuse the remaining character-defining features of the subject property."

Staff Response: Staff concurs with the Phase II response.

Standard 5: Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.

Phase II Response: "The distinctive Mission Revival-style details of the east elevation, including the character defining features listed above will be retained and rehabilitated, in keeping with this Standard."

Staff Response: Staff concurs with the Phase II response.

Standard 6: Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.

Phase II Response: "Decorative cement plaster details will be repaired using accepted techniques that will match the existing cement plaster in color, texture and method of application/detailing. The original wood brackets supporting the roof and in the great hall will be repaired (if needed) using Dutchman techniques that remove a minimum amount of deteriorated material. If wood replacement is necessary, it will match the original detail in size, profile and method of application."

Staff Response: Staff has included Recommendation Condition of Approval #1 which requires any repair to the decorative cement plaster to be done in-kind to match the existing cement plaster in color, texture and method of application/detailing. Recommended Condition of Approval #2 has been included which requires any repair to the original wood brackets

West (rear) Elevation

The proposed design inserts new openings in the solid concrete, rear-elevation wall. The openings will contain steel casement windows of a different pane system than the historic windows, in keeping with this Standard. The rear elevation is considered the least primary elevation, faces the alley and alterations to rear elevations are considered appropriate according to the Standards.

The proposed rooftop elevator shaft structure will be visible from 7th Avenue; however, the bulk and massing of this feature is in scale with the surrounding rooftop projections and appears to be appropriate (refer to Attachment 6).
With the exception of the recommendations listed above, the proposed building alterations meet this Standard."

Staff Response: Staff concurs with the Phase II response regarding the proposed skylight, windows, and elevator shaft structure.

While a detail of the proposed entry glazing system was not provide, staff has dimensioned the proposed steel framing elements that divide the glazing system to be 2"x2" based on the elevation drawings on sheet A3.0 (refer to Attachment 5). The proposed entry glazing system was designed to mimic the multi-pane effect of the steel industrial sash windows on either side of the building entrance, however, the Phase II Evaluation concluded the framing system may detract from the character defining features of the building. As such, it is recommended that the applicant revise the design of the new entry glazing system to have fewer panels or thinner steel framing elements to make this glazing system as transparent as possible to allow the entrance's character defining features to be more visible.

With the exception of the wood doors and Moorish entrance, and a portion of the recessed entrance vestibule, the remaining character defining features of the building (listed in the Background and Project Description section, above) are located outside of the proposed sound lock entry and would remain unobstructed by the addition of the new glazing system. While the character defining features of the building would still be visible through, or unobstructed by, the proposed glazing system, the addition of a new element at the front of the building may still detract from the existing primary elevation and character defining features of the building's entrance.

As the conclusion of the evaluation states the recommendation is intended to "make [the entry glazing system] less obtrusive and allow the entrance's character defining features to be more visible," Staff has included Recommended Condition of Approval #4 stating, "the glazing system shall be revised to include fewer glass panels and thinner steel framing elements to make this glazing system as transparent as possible."

Additionally, Recommended Condition of Approval #5 has been included which requires, "a detail of the glazing system that includes type/opacity of glass, width of framing elements and method of connection to the existing cement plaster arch shall be provided," as stated in the Phase II evaluation. Recommended Condition of Approval #5 continues to state, "the glazing system shall maintain transparent glass and the connection shall be designed to minimize damage to the existing plaster during installation and ensure the glazing system can be easily removed in the future."

The Board may accept the Recommended Conditions listed above as drafted by Staff, strike the Recommended Condition and accept the entry as currently proposed, modify the will be consistent with Standard #9 and therefore would meet Finding #3.

The only new additions visible from the right-of-way are the new glass sound lock doors at the front entry on Dolores Street and the new elevator addition on the roof which is partially visible from 7th Avenue. As described in the discussion for Standard #9 (above), "The proposed rooftop elevator shaft structure will be visible from 7th Avenue; however, the bulk and massing of this feature is in scale with the surrounding rooftop projections and appears to be appropriate." As such, the new roof top addition would not adversely impact the historic resource or adjacent historic resources. The discussion under standard #9 also recommends using a glazing system for the new sound lock entry with fewer panels or thinner steel framing elements to make this glazing system as transparent as possible to view the entry's character defining features. Provided this recommendation is carried out, the new entry would be a minimal change to the existing elevation and would not impact the historic resource or adjacent historic properties. With the recommended Conditions of Approval, the project is consistent with the Secretary's Standards and would not adversely affect the subject historic resource or adjacent historic resources and therefore would meet Finding #4.

Historic Evaluation Summary: The California Environmental Quality Act (CEQA) requires environmental review for alterations to historic resources that are not consistent with the Secretary of the Interior's Standards. The proposed alterations to the China Arts Building were reviewed by the City's Historic Preservation Consultant and a Phase II Historic Assessment was prepared for the project (refer to Attachment 2). The Assessment includes an analysis of the proposed changes based on the Secretary of the Interior's Standards for the Treatment of Historic Properties. The Assessment concludes that the project meets the Secretary of the Interior's Standards for rehabilitation. The proposed alterations to the China Arts Building does not impact the character-defining features or overall historic integrity of the building.

EXECUTIVE SUMMARY

The applicant is proposing a seismic retrofit and remodel of the building into a multi-story, private music recording studio. Interior modifications include a basement enlargement, Level 2 interior hallway addition and new electrical, HVAC, plumbing and acoustic infrastructure. The primary exterior alterations include the addition of a "sound lock" entry door used for sound attenuation to the historic entrance on Dolores Street and window additions to the rear (west) elevation, as well roof top additions to accommodate a new stairway and elevator.

FISCAL IMPACT:

N/A

ATTACHMENTS:

Attachment 1 - Resolution
Attachment 2 - China Art Center Historic Assessment
Attachment 3 - DPR 523
Attachment 4 - Preservation Briefs
Attachment 5 - Project Plans
Attachment 6 - Renderings

WHEREAS, notice of the public hearing was published on August 13, 2021, in compliance with State law (California Government Code 65090) indicating the date and time of the public hearing; and

WHEREAS, on August 16, 2021, the Historic Resources Board held a public hearing to receive public testimony regarding the Application, including without limitation, information provided to the Historic Resources Board by City staff and public testimony on the project; and

WHEREAS, this Resolution and its findings are made based upon evidence presented to the Historic Resources Board at its August 16, 2021 hearing including but not limited to, the staff report and attachments submitted by the Community Planning and Building Department; and

WHEREAS, the Historic Resources Board did hear and consider all said reports, attachments, recommendations and testimony herein above set forth and used their independent judgement to evaluate the project; and

WHEREAS, the facts set forth in the recitals are true and correct and are incorporated herein by reference; and

WHEREAS the Historic Resources Board of the City of Carmel-by-the-Sea finds that pursuant to Carmel Municipal Code (CMC) Section 17.32.140, the following required findings for issuance of a Determination of Consistency with the Secretary of the Interior Standards can be made in this case:

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships;
2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize the property will be avoided;
3. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved;
4. *Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence;*
5. *Archeological resources will be protected and preserved in place;*
6. *New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work shall be differentiated from the old and will be compatible with the historic materials, features, size, scale, and proportion, and massing to protect the integrity of the property and its environment; and*
7. *New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.*

WHEREAS the Historic Resources Board of the City of Carmel-by-the-Sea finds that pursuant to Carmel Municipal Code (CMC) Section 17.20.280.A, the following required findings for historic properties located in the Downtown Conservation District Overlay can be made in this case:

1. The historic character of the property will be retained and preserved. Distinctive materials, features, spaces, and spatial relationships that characterize the property will be preserved.
2. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize the property will be preserved.

	the existing plaster during installation and ensure the glazing system can be easily removed in the future.	
6.	**Conditions of Approval.** The Conditions of Approval listed above (HRB Conditions of Approval) shall be incorporated into the Design Review Conditions of Approval and any action taken by the Planning Department or Planning Commission, as necessary.	✓

PASSED AND ADOPTED BY THE HISTORIC RESOURCES BOARD OF THE CITY OF CARMEL-BY-THE-SEA this 16th day of August, 2021, by the following vote:

AYES:

NOES:

ABSENT:

ABSTAIN:

APPROVED: ATTEST:

______________________ ______________________

Erik Dyar
Chair

Margi Perotti
Historic Resources Board Secretary

Project Methodology

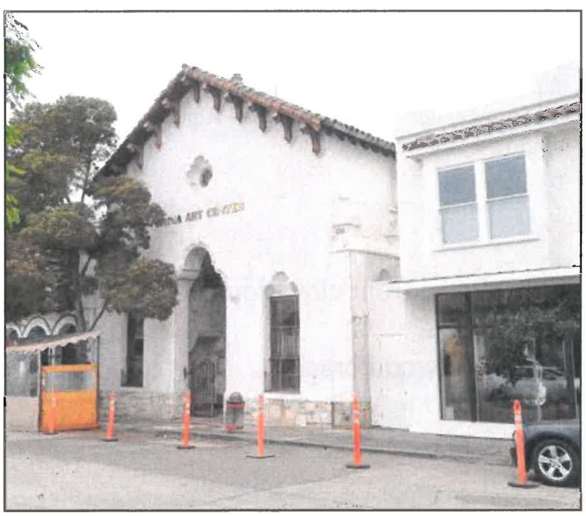
PAST reviewed all relevant project files located at the City of Carmel-by-the-Sea planning and building departments as part of the project. A site visit was conducted on July 13, 2021 to assess the building's existing conditions and to understand the proposed building alterations. PAST also reviewed relevant sections of the City's Historic Context Statement and the 2002 DPR523 forms by Richard Janick, architectural historian.

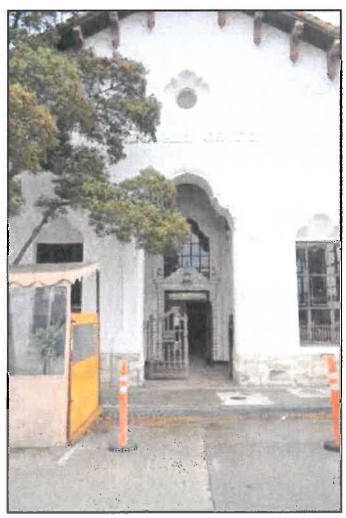
Summary Property History

The subject property contains the China Art Center (1929 – formerly the Monterey County Trust & Savings Building), a multi-story commercial building constructed in the Mission Revival style. Designed by San Francisco architect H.H. Winner and constructed by Hugh Comstock, the subject property is listed as a Carmel-by-the-Sea historic resource under the Historic Context Statement's theme of Architectural Development in Carmel and is significant under California Criterion 3, in the area of architecture as an example of the Mission Revival Style.[1]

Property Description

The subject property contains the China Art Center, a multi-story commercial building constructed in the Mission Revival style (**Figures 1 - 4**).





Figures 1 and 2. Left image shows the Dolores Street (east) elevation. Right image details the arched entrance, with character-defining cement plaster details, Carmel-stone base course and wood entry gates in front of the vestibule.

[1] Janick, Richard N. *China Art Center* (DPR523 forms), 10/18/2002.

Evaluation of Proposed Alterations

The Secretary of the Interior's Standards

The *Secretary of the Interior's Standards for the Treatment of Historic Properties* (*Standards*) provides the framework for evaluating the impacts of additions and alterations to historic buildings. The *Standards* describe four treatment approaches: preservation, rehabilitation, restoration and reconstruction. The *Standards* require that the treatment approach be determined first, as a different set of standards apply to each approach. For the proposed project, the treatment approach is rehabilitation. The *Standards* describe rehabilitation as:

> In *Rehabilitation*, historic building materials and character-defining features are protected and maintained as they are in the treatment Preservation; however, an assumption is made prior to work that existing historic fabric has become damaged or deteriorated over time and, as a result, more repair and replacement will be required. Thus, latitude is given in the Standards for Rehabilitation and Guidelines for Rehabilitation to replace extensively deteriorated, damaged, or missing features using either traditional or substitute materials. Of the four treatments, only Rehabilitation includes an opportunity to make possible an efficient contemporary use through alterations and additions.[2]

The ten *Standards* for rehabilitation are:

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.
2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.
7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.

[2] *The Secretary of the Interior's Standards for the Treatment of Historic Properties* (accessed via http://www.nps.gov/hps/tps/standguide/).

The proposed alterations will modify interior spatial relationships, but the great hall space with its painted wood beams and the arched windows on the north elevation will be retained and rehabilitated. The remaining character-defining features on the primary (east) elevation will be retained and rehabilitated, to satisfy this *Standard*.

3. *Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.*

The proposed alterations do not add conjectural features or elements from other historic properties that would confuse the remaining character-defining features of the subject property.

4. *Changes to a property that have acquired historic significance in their own right will be retained and preserved.*

This *Standard* does not apply because no changes to the property have acquired historic significance.

5. *Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.*

The distinctive Mission Revival-style details of the east elevation, including the character defining features listed above will be retained and rehabilitated, in keeping with this *Standard*.

6. *Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.*

Decorative cement plaster details will be repaired using accepted techniques that will match the existing cement plaster in color, texture and method of application/detailing. The original wood brackets supporting the roof and in the great hall will be repaired (if needed) using Dutchman techniques that remove a minimum amount of deteriorated material. If wood replacement is necessary, it will match the original detail in size, profile and method of application.

7. *Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.*

Physical treatments to repair existing cement plaster details, wood details and steel window sash will be undertaken with accepted methods for a given substrate, in keeping with this *Standard*.

8. *Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.*

This *Standard* does not apply, as archaeological features are not identified at the site.

9. *New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work shall be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.*

plaster repaired in kind. Maintenance and conservation of the historic wood entry gates is recommended, as the entry gates are a character-defining feature.

West (rear) Elevation

It would be difficult to reverse the changes to the rear elevation window openings, as they will require demolition of the existing concrete wall to create the window openings. It should be noted that the building alterations on rear and non-primary elevations are encouraged by the *Standards*.

Conclusion

In conclusion, the proposed alterations to the existing China Art Building would meet the *Standards*, as the primary historic character defining features will be retained and rehabilitated. This report recommends further study of the east-elevation vestibule glazing system to make it less obtrusive and allow the entrance's character defining features to be more visible.

Because the proposed alterations to the building meet the *Standards*, the alterations are considered as mitigated to a level of less than a significant impact on the historic resource and do not constitute a substantial adverse change to the historic resource, thus conforming to the requirements of the California Environmental Quality Act (CEQA).

Please contact me if you have any questions about this evaluation.

Sincerely,

Seth Bergstein

Seth A. Bergstein, Principal

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
BUILDING, STRUCTURE, AND OBJECT RECORD

Primary # Attachment 3
HRI #

NRHP Status Code 5S1

Resource Name or #: (Assigned by recorder) *Monterey County Trust & Savings*

B1. Historic Name: *Monterey County Trust & Savings*
B2. Common Name: *China Art Center*
B3. Original Use: *Commercial* B4. Present Use: *Commercial*
B5. Architectural Style: *Spanish Mission Revival*
B6. Construction History: (Construction date, alterations, and date of alterations)

1. *Permit #2215 (November 19, 1929) - Build large 40'x100' commercial building. Reinforced concrete ($30,000) Contractor: Hugh Comstock; Owner: Monterey County Trust & Savings Banks* *(See Continuation Sheet)*

B7. Moved? ☒ No ☐ Yes ☐ Unknown Date : Original Location:
B8. Related Features: *None*

B9a. Architect: *H. H. Winner, San Francisco* b. Builder: *Hugh Comstock*
B10. Significance: Theme: *Architectural Development in Carmel* Area: *Carmel-by-the-Sea*
Period of Significance: *1880-1940* **Property Type:** *Commercial* **Applicable Criteria:** *CR#3*
(Discuss importance in terms of historical or architectural context as defined by theme, period and geographic scope. Also address integrity.)

The Monterey County Trust and Savings Bank qualifies under California Register Criteria #3 as an example of the "Mission Revival Style" designed by architects H. H. Winner Co. of San Francisco and built by local contractor Hugh Comstock and subcontractor M. J. Murphy. The prominent Mission Style elements on the main facade are: 1) an overhanging Spanish tiled gabled roof with carved wooden elbow corbels set within a curving molded scalloped frieze; 2) the inset central quatrefoil window. The molded arched entryway and inset arched windows with low wrought-iron railings are also derived from the various California missions.

The Mission Style became popular in the 1880s as an offshoot of restoration efforts of preservationists such as Harry Downie at Carmel Mission, and was primarily expressed in applying mission details to a wide variety of commercial and civic structures throughout the state as a homage to the mission heritage.

This building also represents the expansion of Hugh Comstock's building styles from the Fairty-Tale houses into the realm of commercial building construction and design.

(See Continuation Sheet)

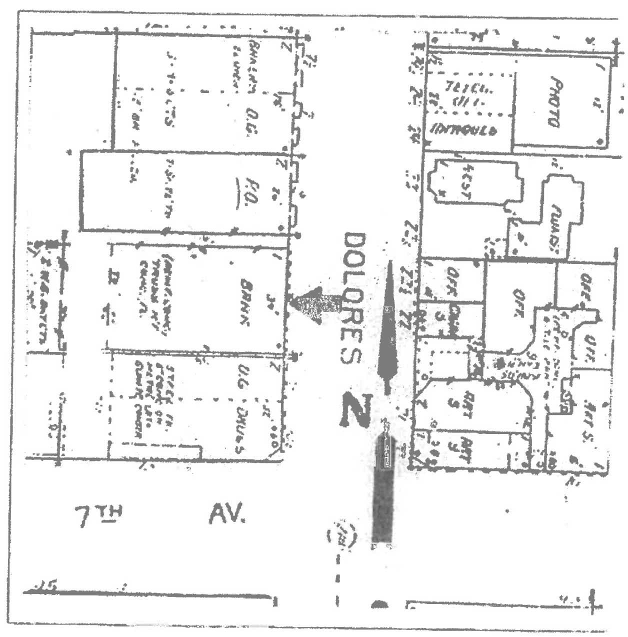
B11. Additional Resource Attributes: (List attributes and codes)
B12. References:

1. *Carmel Building Records, Planning Department, City Hall, Carmel*
2. *Carmel Historic Context Statement of 1997*
3. *"Work Has Started on Carmel Unit of County Bank," Peninsula Daily Herald, Nov. 26, 1929.* *(See Continuation Sheet)*

B13. Remarks: *Zoning AD/ED/CD CHCS 1997*

B14. Evaluator: *Richard N. Janick*
Date of Evaluation: *10/18/2002*

(This space reserved for official comments.)



B. 10 Significance (Continued from Page 3)

By the late 1920s, M. J. Murphy had long been Carmel's most prolific builder who had produced many commercial and residential designs with the Mission Style motif.

M. J. MURPHY - BUILDER, CONTRACTOR

Michael J. Murphy was a pioneer builder and contractor in the earliest era of Carmel, and therefore helped to shape the entire architectural character of the village. He was born in Minden, Utah in 1884 of hardworking parents of limited means. Young Murphy managed to finish high school, but then had to begin to earn a living as a house painter. In 1902, he visited Carmel and became attracted to the area. He married in 1904 and returned to Carmel to live. His son Frank was "the first white boy child" to be born in Carmel.

Murphy continued to be a house painter until after the San Francisco earthquake and fire of 1906 when a number of residents of that city came to Carmel to live in their summer homes and created a demand for housing. Although Murphy had no formal training as an architect or builder, he had learned enough about the trade while working as a house painter to be able to design and build simple structures that would suffice for those who came to live for the summer or reside temporarily until San Francisco was rebuilt. Murphy was soon in business erecting the simple board and batten structures so common in Carmel at the time.

Murphy continued to be a house painter until after the San Francisco earthquake and fire of 1906 when a number of residents of that city came to Carmel to live in their summer homes and created a demand for housing. Although Murphy had no formal training as an architect or builder, he had learned enough about the trade while working as a house painter to be able to design and build simple structures that would suffice for those who came to live for the summer or reside temporarily until San Francisco was rebuilt. Murphy was soon in business erecting the simple board and batten structures so common in Carmel at the time.

At the same time, Franklin Devendorf of the Carmel Development Company had purchased much of the land in Carmel, and began to subdivide and sell the parcels. Devendorf knew Murphy and had taken a liking to him. Therefore, when he needed more houses for his lots to satisfy his prospective buyers, he helped Murphy set up a construction business. Because of his passion to be the best, Murphy went to great lengths to make certain that his structures were solidly built of quality materials. As his reputation in this regard blossomed, more and more people wanted a Murphy house. Murphy obliged and built houses all over the Monterey Peninsula, using his own designs and doing much of the work himself. In 1914, Murphy established his own contracting business, opened up a lumber and building supply store and hired many workers.

To assure a supply of crushed rock and gravel, Murphy erected a rock crusher in Carmel Valley. He obtained his rock from the shore of the Pacific Ocean and his gravel from the Carmel River. His team of horses and his wagons became a familiar sight in the area. People turned to him for assistance when they needed help. When the surf piled up the sand and blocked the mouth of the river causing the water to back up and flood the artichoke fields, the farmers called on Murphy who took his earth scraper and a team of horses to open up the channel. When high winds lashed the area and threatened to topple trees, Murphy came to the rescue by tying a sturdy rope around several closely grouped trees, thereby enabling the trees to reinforce each other and resist the force of the wind. He also helped to plant trees in Carmel to stabilize the soil exposed by building activity, and to prevent the soil from being washed into the sea by the heavy rains.

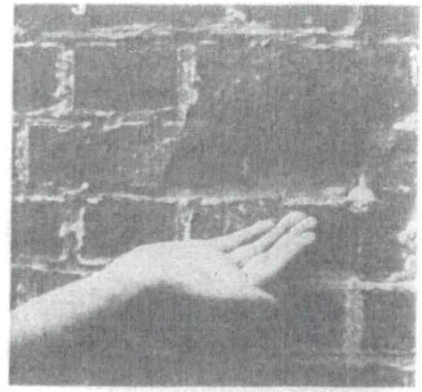
As Murphy's own business grew, he added more carpenters, stone masons, plumbers, electricians, plasterers and painters to his staff. He needed administrative and managerial help, so he hired J. O. Handley as his General Manager. Handley remained in this capacity until he began his own construction supply business, Handley and Handley (later becoming H&H). While most of the structures that Murphy erected were of his own design, he was also the contractor for a number of well known architects - Julia Morgan, Bernard Ralph Maybeck, and Robert Stanton among them. In designing his buildings, Murphy would talk to the customer, visit the site to get a visual image of the proposed structure on the site, and then go home and put it on paper. His designs were simplified drawings, but were complete and accurate enough so that major changes could be made. Murphy was a most active and prolific builder in the area and did as much to give Carmel its character as any other single person. Handley has stated "that Murphy built more than half the houses in Carmel."

Among his most notable structures are the Pine Inn, which he completely remodeled with his own design, the La Playa Hotel, the Carmel Highlands Inn, the Carmel Art Association, the Holiday House, the Carmel Texaco Station, the Sundial Lodge, the Farley Building, the Carmel City Hall (originally All Saints Episcopal Church), and the Dansk Building. The Harrison Memorial Library was partially designed by Bernard Ralph Maybeck and constructed by Murphy. However, there are no known plans of the library to be found. According to Murphy's daughter, Mrs. Rosalie Gladney, Bernard Maybeck who lived in San Francisco, would come down periodically from the city, view the progress, consult with Murphy, and return to the city on the afternoon train. It is generally conceded that Murphy had as much to do with the design of this building as Maybeck

(See Continuation Sheet Page 5)

Attachment 4

6 PRESERVATION BRIEFS



Dangers of Abrasive Cleaning to Historic Buildings

Anne E. Grimmer

U.S. Department of the Interior
National Park Service
Cultural Resources
Heritage Preservation Services

> "The surface cleaning of structures shall be undertaken with the gentlest means possible. Sandblasting and other cleaning methods that will damage the historic building materials shall not be undertaken."—The Secretary of the Interior's "Standards for Historic Preservation Projects."

Abrasive cleaning methods are responsible for causing a great deal of damage to historic building materials. To prevent indiscriminate use of these potentially harmful techniques, this brief has been prepared to explain abrasive cleaning methods, how they can be physically and aesthetically destructive to historic building materials, and why they generally are not acceptable preservation treatments for historic structures. There are alternative, less harsh means of cleaning and removing paint and stains from historic buildings. However, careful testing should preceed general cleaning to assure that the method selected will not have an adverse effect on the building materials. A historic building is irreplaceable, and should be cleaned using only the "gentlest means possible" to best preserve it.

What is Abrasive Cleaning?

Abrasive cleaning methods include all techniques that physically abrade the building surface to remove soils, discolorations or coatings. Such techniques involve the use of certain *materials* which impact or abrade the surface under pressure, or abrasive *tools and equipment*. Sand, because it is readily available, is probably the most commonly used type of grit material. However, any of the following materials may be substituted for sand, and all can be classified as abrasive substances: ground slag or volcanic ash, crushed (pulverized) walnut or almond shells, rice husks, ground corncobs, ground coconut shells, crushed eggshells, silica flour, synthetic particles, glass beads and micro-balloons. Even *water* under pressure can be an abrasive substance. Tools and equipment that are abrasive to historic building materials include wire brushes, rotary wheels, power sanding disks and belt sanders.

The use of water in combination with grit may also be classified as an abrasive cleaning method. Depending on the manner in which it is applied, water *may* soften the impact of the grit, but water that is too highly pressurized can be very abrasive. There are basically two different methods which can be referred to as "wet grit," and it is important to differentiate between the two. One technique involves the addition of a stream of water to a regular sandblasting nozzle. This is done primarily to cut down dust, and has very little, if any, effect on reducing the aggressiveness, or cutting action of the grit particles. With the second technique, a very small amount of grit is added to a pressurized water stream. This method may be controlled by regulating the amount of grit fed into the water stream, as well as the pressure of the water.

Why Are Abrasive Cleaning Methods Used?

Usually, an abrasive cleaning method is selected as an expeditious means of quickly removing years of dirt accumulation, unsightly stains, or deteriorating building fabric or finishes, such as stucco or paint. The fact that sandblasting is one of the best known and most readily available building cleaning treatments is probably the major reason for its frequent use.

Many mid-19th century brick buildings were painted immediately or soon after completion to protect poor quality brick or to imitate another material, such as stone. Sometimes brick buildings were painted in an effort to produce what was considered a more harmonious relationship between a building and its natural surroundings. By the 1870s, brick buildings

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siderable time, skill and expense, and which might not have been necessary had a gentler method been chosen. Erosion and pitting of the building material by abrasive cleaning creates a greater surface area on which dirt and pollutants collect. In this sense, the building fabric "attracts" more dirt, and will require more frequent cleaning in the future.

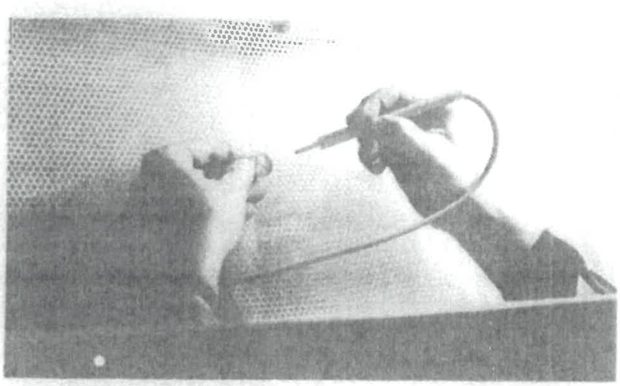
In addition to causing physical and aesthetic harm to the historic fabric, there are several adverse environmental effects of dry abrasive cleaning methods. Because of the friction caused by the abrasive medium hitting the building fabric, these techniques usually create a considerable amount of dust, which is unhealthy, particularly to the operators of the abrasive equipment. It further pollutes the environment around the job site, and deposits dust on neighboring buildings, parked vehicles and nearby trees and shrubbery. Some adjacent materials not intended for abrasive treatment such as wood or glass, may also be damaged because the equipment may be difficult to regulate.

Wet grit methods, while eliminating dust, deposit a messy slurry on the ground or other objects surrounding the base of the building. In colder climates where there is the threat of frost, any wet cleaning process applied to historic masonry structures must be done in warm weather, allowing ample time for the wall to dry out thoroughly before cold weather sets in. Water which remains and freezes in cracks and openings of the masonry surface eventually may lead to spalling. High-pressure wet cleaning may force an inordinate amount of water into the walls, affecting interior materials such as plaster or joist ends, as well as metal building components within the walls.

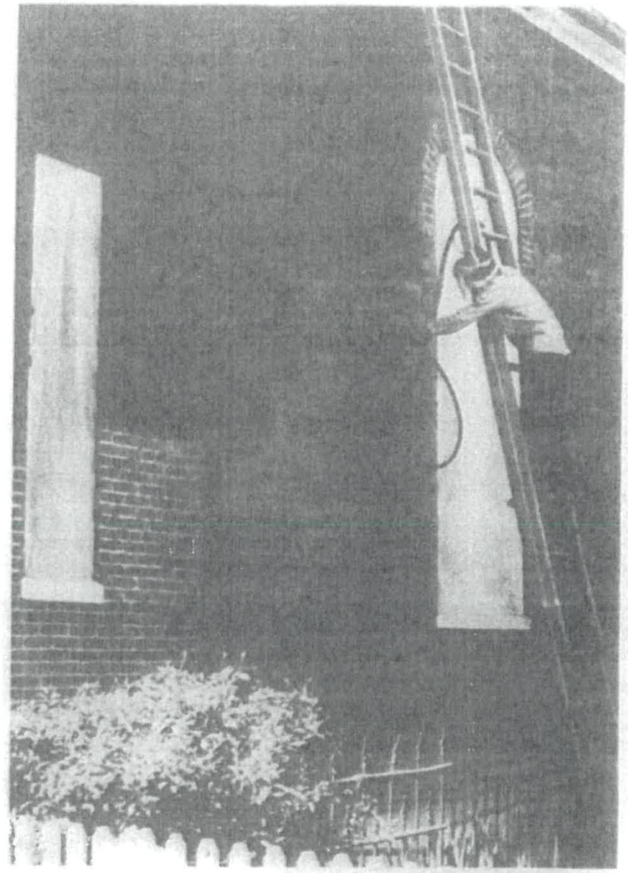
Variable Factors

The greatest problem in developing practical guidelines for cleaning any historic building is the large number of variable and unpredictable factors involved. Because these variables make each cleaning project unique, it is difficult to establish specific standards at this time. This is particularly true of abrasive cleaning methods because their inherent potential for causing damage is multiplied by the following factors:

— the type and condition of the material being cleaned;
— the size and sharpness of the grit particles or the mechanical equipment;
— the pressure with which the abrasive grit or equipment is applied to the building surface;
— the skill and care of the operator; and
— the constancy of the pressure on all surfaces during the cleaning process.



Micro-Abrasive Cleaning. *This small, pencil-sized micro-abrasive unit is used by some museum conservators to clean small objects. This particular micro-abrasive unit is operated within the confines of a box (approximately 2 cubic feet of space), but a similar and slightly larger unit may be used for cleaning larger pieces of sculpture, or areas of architectural detailing on a building. Even a pressure cleaning unit this small is capable of eroding a surface, and must be carefully controlled.*



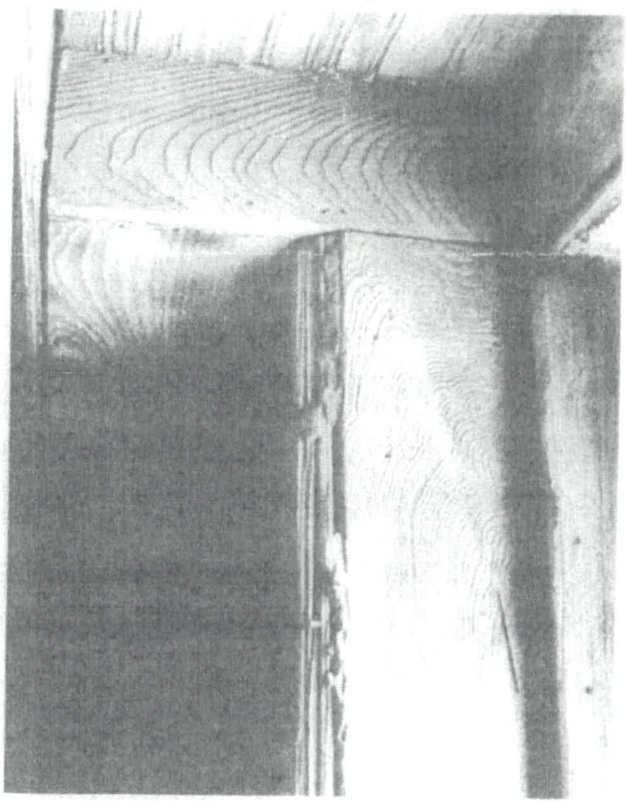
"Line Drop." *Even though the operator of the sandblasting equipment is standing on a ladder to reach the higher sections of the wall, it is still almost impossible to have total control over the pressure. The pressure of the sand hitting the lower portion of the wall will still be greater than that above, because of the "line drop" in the distance from the pressure source to the nozzle. (Hugh Miller)*

Pressure: The damaging effects of most of the variable factors involved in abrasive cleaning are self evident. However, the matter of pressure requires further explanation. In cleaning specifications, pressure is generally abbreviated as "psi" (pounds per square inch), which technically refers to the "tip" pressure, or the amount of pressure at the nozzle of the blasting apparatus. Sometimes "psig," or pressure at the gauge (which may be many feet away, at the other end of the hose), is used in place of "psi." These terms are often incorrectly used interchangeably.

Despite the apparent care taken by most architects and building cleaning contractors to prepare specifications for pressure cleaning which will not cause harm to the delicate fabric of a historic building, it is very difficult to ensure that the same amount of pressure is applied to all parts of the building. For example, if the operator of the pressure equipment stands on the ground while cleaning a two-story structure, the amount of force reaching the first story will be greater than that hitting the second story, even if the operator stands on scaffolding or in a cherry picker, because of the "line drop" in the distance from the pressure source to the nozzle. Although technically it may be possible to prepare cleaning specifications with tight controls that would eliminate all but a small margin of error, it may not be easy to find professional cleaning firms willing to work under such restrictive conditions. The fact is that many professional building cleaning firms do not really understand the extreme delicacy of historic building fabric, and how it differs from modern construction materials. Consequently, they may acposed to kiln-dried masonry materials such as brick and architectural terra-cotta, building stones are generally homogeneous in character at the time of a building's construction. However, as the stone is exposed to weathering and environmental pollutants, the surface may become friable, or may develop a protective skin or patina. These outer surfaces are very susceptible to damage by abrasive or improper chemical cleaning.

Building stones are frequently cut into ashlar blocks or "dressed" with tool marks that give the building surface a specific texture and contribute to its historic character as much as ornately carved decorative stonework. Such detailing is easily damaged by abrasive cleaning techniques; the pattern of tooling or cutting is erased, and the crisp lines of moldings or carving are worn or pitted.

Occasionally, it may be possible to clean small areas of rough-cut granite, limestone or sandstone having a heavy dirt encrustation by using the "wet grit" method, whereby a small amount of abrasive material is injected into a controlled, pressurized water stream. However, this technique requires very careful supervision in order to prevent damage to the stone. Polished or honed marble or granite should *never* be treated abrasively, as the abrasion would remove the finish in much the way glass would be etched or "frosted" by such a process. It is generally preferable to underclean, as too strong a cleaning procedure will erode the stone, exposing a new and increased surface area to collect atmospheric moisture and dirt. Removing paint, stains or graffiti from most types of stone may be accomplished by a chemical treatment carefully selected to best handle the removal of the particular type of paint or stain without damaging the stone. (See section on the "Gentlest Means Possible".)



Abrasive Cleaning of Wood. *This wooden windowsill, molding and paneling have been sandblasted to remove layers of paint in the rehabilitation of this commercial building. Not only is some paint still embedded in cracks and crevices of the woodwork, but more importantly, grit blasting has actually eroded the summer wood, in effect raising the grain, and resulting in a rough surface.*

Wood: Most types of wood used for buildings are soft, fibrous and porous, and are particularly susceptible to damage by abrasive cleaning. Because the summer wood between the lines of the grain is softer than the grain itself, it will be worn away by abrasive blasting or power tools, leaving an uneven surface with the grain raised and often frayed or "fuzzy." Once this has occurred, it is almost impossible to achieve a smooth surface again except by extensive hand sanding, which is expensive and will quickly negate any costs saved earlier by sandblasting. Such harsh cleaning treatment also obliterates historic tool marks, fine carving and detailing, which precludes its use on any interior or exterior woodwork which has been hand planed, milled or carved.

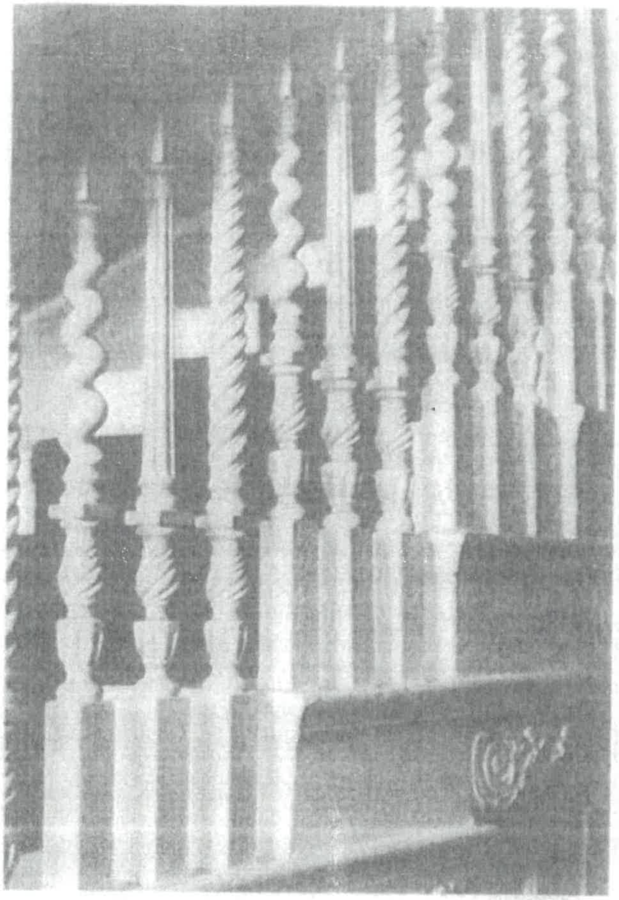
Metals: Like stone, metals are another group of building materials which vary considerably in hardness and durability. Softer metals which are used architecturally, such as tin, zinc, lead, copper or aluminum, generally should not be cleaned abrasively as the process deforms and destroys the original surface texture and appearance, as well as the acquired patina. Much applied architectural metal work used on historic buildings—tin, zinc, lead and copper—is often quite thin and soft, and therefore susceptible to denting and pitting. Galvanized sheet metal is especially vulnerable, as abrasive treatment would wear away the protective galvanized layer.

In the late 19th and early 20th centuries, these metals were often cut, pressed or otherwise shaped from sheets of metal into a wide variety of practical uses such as roofs, gutters and flashing, and façade ornamentation such as cornices, friezes, dormers, panels, cupolas, oriel windows, etc. The architecture of the 1920s and 1930s made use of metals such as chrome, nickel alloys, aluminum and stainless steel in decorative exterior panels, window frames, and doorways. Harsh abrasive blasting would destroy the original surface finish of most of these metals, and would increase the possiblity of corrosion.

However, conservation specialists are now employing a sensitive technique of glass bead peening to clean some of the harder metals, in particular large bronze outdoor sculpture. Very fine (75–125 micron) glass beads are used at a low pressure of 60 to 80 psi. Because these glass beads are completely spherical, ther are no sharp edges to cut the surface of the metal. After cleaning, these statues undergo a lengthy process of polishing. Coatings are applied which protect the surface from corrosion, but they must be renewed every 3 to 5 years. A similarly delicate cleaning technique employing glass beads has been used in Europe to clean historic masonry structures without causing damage. But at this time the process has not been tested sufficiently in the United States to recommend it as a building conservation measure.

Sometimes a very fine *smooth* sand is used at a low pressure to clean or remove paint and corrosion from copper flashing and other metal building components. Restoration architects recently found that a mixture of crushed walnut shells and copper slag at a pressure of approximately 200 psi was the only way to remove corrosion successfully from a mid-19th century terne-coated iron roof. Metal cleaned in this manner must be painted immediately to prevent rapid recurrence of corrosion. It is thought that these methods "work harden" the surface by compressing the outer layer, and actually may be good for the surface of the metal. But the extremely complex nature and the time required by such processes make it very expensive and impractical for large-scale use at this time.

Cast and wrought iron architectural elements may be gently sandblasted or abrasively cleaned using a wire brush to remove layers of paint, rust and corrosion. Sandblasting was, in fact, developed originally as an efficient maintenance procedure for engineering and industrial structures and heavy machinery—iron and steel bridges, machine tool frames, engine frames, and railroad rolling stock—in order to clean and prepare them for repainting. Because iron is hard, its surface,



Do not Abrasively Clean these Interiors. *Most historic residential and some commercial interior spaces contain finished plaster and wooden elements such as this stair balustrade and paneling which contribute to the historic and architectural character of the structure. Such interiors should not be subjected to abrasive techniques for the purpose of removing paint, dirt, discoloration or plaster.*

useful in removing thick encrustations of soot. A limewash or absorbent talc, whiting or clay poultice with a solvent can be used effectively to draw out salts or stains from the surface of the selected areas of a building façade. It is almost impossible to remove paint from masonry surfaces without causing some damage to the masonry, and it is best to leave the surfaces as they are or repaint them if necessary.

Some physicists are experimenting with the use of pulsed laser beams and xenon flash lamps for cleaning historic masonry surfaces. At this time it is a slow, expensive cleaning method, but its initial success indicates that it may have an increasingly important role in the future.

There are many chemical paint removers which, when applied to painted wood, soften and dissolve the paint so that it can be scraped off by hand. Peeling paint can be removed from wood by hand scraping and sanding. Particularly thick layers of paint may be softened with a heat gun or heat plate, providing appropriate precautions are taken, and the paint film scraped off by hand. Too much heat applied to the same spot can burn the wood, and the fumes caused by burning paint are dangerous to inhale, and can be explosive. Furthermore, the hot air from heat guns can start fires in the building cavity. Thus, adequate ventilation is important when using a heat gun or heat plate, as well as when using a chemical stripper. A torch or open flame should never be used.

Preparations for Cleaning: It cannot be overemphasized that all of these cleaning methods must be approached with caution. When using any of these procedures which involve water or other liquid cleaning agents on masonry, it is imperative that *all* openings be tightly covered, and all cracks or joints be well pointed in order to avoid the danger of water penetrating the building's facade, a circumstance which might result in serious moisture related problems such as efflorescence and/or subflorescence. Any time water is used on masonry as a cleaning agent, either in its pure state or in combination with chemical cleaners, it is very important that the work be done in warm weather when there is no danger of frost for several months. Otherwise water which has penetrated the masonry may freeze, eventually causing the surface of the building to crack and spall, which may create another conservation problem more serious to the health of the building than dirt.

Each kind of masonry has a unique composition and reacts differently with various chemical cleaning substances. Water and/or chemicals may interact with minerals in stone and cause new types of stains to leach out to the surface immediately, or more gradually in a delayed reaction. What may be a safe and effective cleaner for certain stain on one type of stone, may leave unattractive discolorations on another stone, or totally dissolve a third type.

Testing: Cleaning historic building materials, particularly masonry, is a technically complex subject, and thus, should never be done without expert consultation and testing. No cleaning project should be undertaken without first applying the intended cleaning agent to a representative test patch area in an inconspicuous location on the building surface. The test patch or patches should be allowed to weather for a period of time, preferably through a complete seasonal cycle, in order to determine that the cleaned area will not be adversely affected by wet or freezing weather or any by-products of the cleaning process.

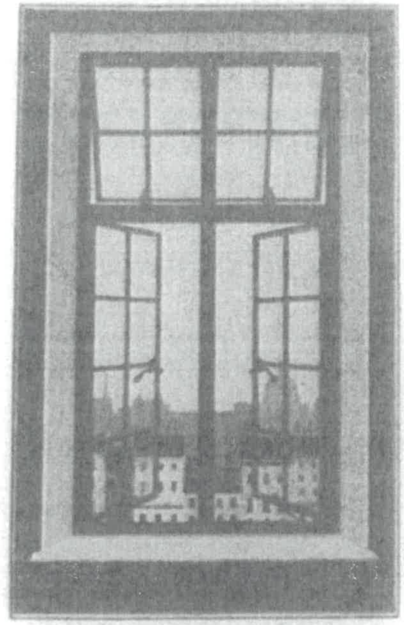
Mitigating the Effects of Abrasive Cleaning

There are certain restoration measures which can be adopted to help preserve a historic building exterior which has been damaged by abrasive methods. Wood that has been sandblasted will exhibit a frayed or "fuzzed" surface, or a harder wood will have an exaggerated raised grain. The only way to remove this rough surface or to smooth the grain is by laborious sanding. Sandblasted wood, unless it has been extensively sanded, serves as a dustcatcher, will weather faster, and will present a continuing and ever worsening maintenance problem. Such wood, after sanding, should be painted or given a clear surface coating to protect the wood, and allow for somewhat easier maintenance.

There are few successful preservative treatments that may be applied to grit-blasted exterior masonry. Harder, denser stone may have suffered only a loss of crisp edges or tool marks, or other indications of craft technique. If the stone has a compact and uniform composition, it should continue to weather with little additional deterioration. But some types of sandstone, marble and limestone will weather at an accelerated rate once their protective "quarry crust" or patina has been removed.

Softer types of masonry, particularly brick and architectural terra-cotta, are the most likely to require some remedial treatment if they have been abrasively cleaned. Old brick, being essentially a soft, baked clay product, is greatly susceptible to increased deterioration when its hard, outer skin is removed through abrasive techniques. This problem can be minimized by painting the brick. An alternative is to treat it with a clear sealer or surface coating but this will give the masonry a glossy or shiny look. It is usually preferable to paint the brick rather than to apply a transparent sealer since

13 PRESERVATION BRIEFS



The Repair and Thermal Upgrading of Historic Steel Windows

Sharon C. Park, AIA

U.S. Department of the Interior
National Park Service
Cultural Resources
Heritage Preservation Services

The Secretary of the Interior's "Standards for Rehabilitation" require that where historic windows are individually significant features, or where they contribute to the character of significant facades, their distinguishing visual qualities must not be destroyed. Further, the rehabilitation guidelines recommend against changing the historic appearance of windows through the use of inappropriate designs, materials, finishes, or colors which radically change the sash, depth of reveal, and muntin configuration; the reflectivity and color of the glazing; or the appearance of the frame.

Windows are among the most vulnerable features of historic buildings undergoing rehabilitation. This is especially the case with rolled steel windows, which are often mistakenly not deemed worthy of preservation in the conversion of old buildings to new uses. The ease with which they can be replaced and the mistaken assumption that they cannot be made energy efficient except at great expense are factors that typically lead to the decision to remove them. In many cases, however, repair and retrofit of the historic windows are more economical than wholesale replacement, and all too often, replacement units are unlike the originals in design and appearance. If the windows are important in establishing the historic character of the building (see fig. 1), insensitively designed replacement windows may diminish—or destroy—the building's historic character.

This *Brief* identifies various types of historic steel windows that dominated the metal window market from 1890-1950. It then gives criteria for evaluating deterioration and for determining appropriate treatment, ranging from routine maintenance and weatherization to extensive repairs, so that replacement may be avoided where possible.[1] This information applies to do-it-yourself jobs and to large rehabilitations where the volume of work warrants the removal of all window units for complete overhaul by professional contractors.

This *Brief* is not intended to promote the repair of ferrous metal windows in every case, but rather to insure that preservation is always the first consideration in a rehabilitation project. Some windows are not important elements in defining a building's historic character; others are highly significant, but so deteriorated that repair is infeasible. In such cases, the *Brief* offers guidance in evaluating appropriate replacement windows.

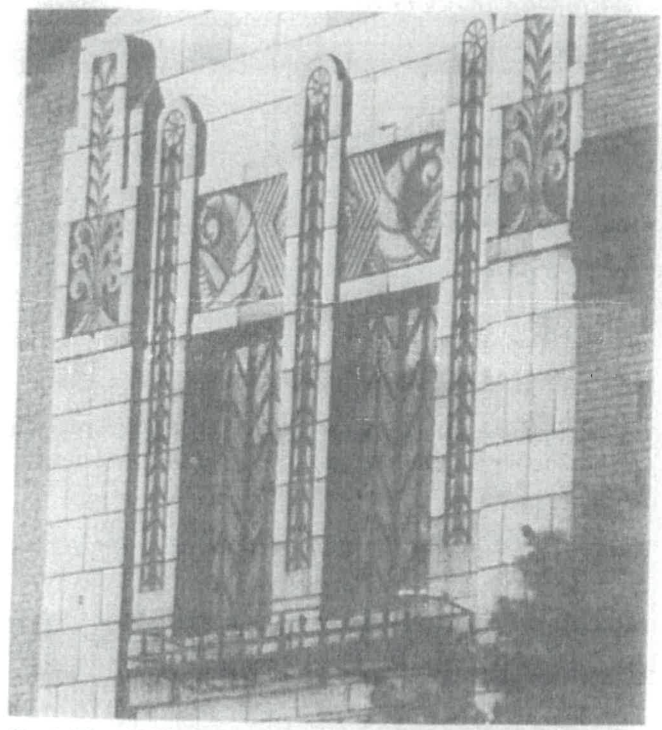


Fig. 1 Often highly distinctive in design and craftsmanship, rolled steel windows play an important role in defining the architectural character of many later nineteenth and early twentieth century buildings. Art Deco, Art Moderne, the International Style, and Post World War II Modernism depended on the slim profiles and streamlined appearance of metal windows for much of their impact. Photo: William G. Johnson.

[1] The technical information given in this brief is intended for most ferrous (or magnetic) metals, particularly rolled steel. While stainless steel is a ferrous metal, the cleaning and repair techniques outlined here must not be used on it as the finish will be damaged. For information on cleaning stainless steel and non-ferrous metals, such as bronze, Monel, or aluminum, refer to *Metals in America's Historic Buildings* (see bibliography).

EVALUATION

Historic and Architectural Considerations

An assessment of the significance of the windows should begin with a consideration of their function in relation to the building's historic use and its historic character. Windows that help define the building's historic character should be preserved even if the building is being converted to a new use. For example, projecting steel windows used to introduce light and an effect of spaciousness to a warehouse or industrial plant can be retained in the conversion of such a building to offices or residences.

Other elements in assessing the relative importance of the historic windows include the design of the windows and their relationship to the scale, proportion, detailing and architectural style of the building. While it may be easy to determine the aesthetic value of highly ornamented windows, or to recognize the importance of streamlined windows as an element of a style, less elaborate windows can also provide strong visual interest by their small panes or projecting planes when open, particularly in simple, unadorned industrial buildings (see fig. 5).

One test of the importance of windows to a building is to ask if the overall appearance of the building would be changed noticeably if the windows were to be removed or radically altered. If so, the windows are important in defining the building's historic character, and should be repaired if their physical condition permits.

Physical Evaluation

Steel window repair should begin with a careful evaluation of the physical condition of each unit. Either drawings or photographs, liberally annotated, may be used to record the location of each window, the type of operability, the condition of all three parts—sash, frame and subframe—and the repairs essential to its continued use.

Specifically, the evaluation should include: presence and degree of corrosion; condition of paint; deterioration of the metal sections, including bowing, misalignment of the sash, or bent sections; condition of the glass and glazing compound; presence and condition of all hardware, screws, bolts, and hinges; and condition of the masonry or concrete surrounds, including need for caulking or resetting of improperly sloped sills.

Corrosion, principally rusting in the case of steel windows, is the controlling factor in window repair; therefore, the evaluator should first test for its presence. Corrosion can be light, medium, or heavy, depending on how much the rust has penetrated the metal sections. If the rusting is merely a surface accumulation or flaking, then the corrosion is light. If the rusting has penetrated the metal (indicated by a bubbling texture), but has not caused any structural damage, then the corrosion is medium. If the rust has penetrated deep into the metal, the corrosion is heavy. Heavy corrosion generally results in some form of structural damage,through delamination, to the metal section, which must then be patched or spliced. A sharp probe or tool, such as an ice pick, can be used to determine the extent of corrosion in the metal. If the probe can penetrate the surface of the metal and brittle strands can be dug out, then a high degree of corrosive deterioration is present.

In addition to corrosion, the condition of the paint, the presence of bowing or misalignment of metal sections, the amount of glass needing replacement, and the condition of the masonry or concrete surrounds must be assessed in the evaluation process. These are key factors in determining whether or not the windows can be repaired in place. The more complete the inventory of existing conditions, the easier it will be to determine whether repair is feasible or whether replacement is warranted.

Rehabilitation Work Plan

Following inspection and analysis, a plan for the rehabilitation can be formulated. The actions necessary to return windows to an efficient and effective working condition will fall into one or more of the following categories: routine maintenance, repair, and weatherization. The routine maintenance and weatherization measures described here are generally within the range of do-it-yourselfers. Other repairs, both moderate and major, require a professional contractor. Major repairs normally require the removal of the window units to a workshop, but even in the case of moderate repairs, the number of windows involved might warrant the removal of all the deteriorated units to a workshop in order to realize a more economical repair price. Replacement of windows should be considered only as a last resort.

Since moisture is the primary cause of corrosion in steel windows, it is essential that excess moisture be eliminated and that the building be made as weathertight as possible before any other work is undertaken. Moisture can accumulate from cracks in the masonry, from spalling mortar, from leaking gutters, from air conditioning condensation runoff, and from poorly ventilated interior spaces.

Finally, before beginning any work, it is important to be aware of health and safety risks involved. Steel windows have historically been coated with lead paint. The removal of such paint by abrasive methods will produce toxic dust. Therefore, safety goggles, a toxic dust respirator, and protective clothing should be worn. Similar protective measures should be taken when acid compounds are used. Local codes may govern the methods of removing lead paints and proper disposal of toxic residue.

ROUTINE MAINTENANCE

A preliminary step in the routine maintenance of steel windows is to remove surface dirt and grease in order to ascertain the degree of deterioration, if any. Such minor cleaning can be accomplished using a brush or vacuum followed by wiping with a cloth dampened with mineral spirits or denatured alcohol.

adapted for abrasive cleaning such as an electric drill with a wire brush or a rotary whip attachment. Adjacent sills and window jambs may need protective shielding.

Rust can also be removed from ferrous metals by using a number of commercially prepared anti-corrosive acid compounds. Effective on light and medium corrosion, these compounds can be purchased either as liquids or gels. Several bases are available, including phosphoric acid, ammonium citrate, oxalic acid and hydrochloric acid. Hydrochloric acid is generally not recommended; it can leave chloride deposits, which cause future corrosion. Phosphoric acid-based compounds do not leave such deposits, and are therefore safer for steel windows. However, any chemical residue should be wiped off with damp cloths, then dried immediately. Industrial blow-dryers work well for thorough drying. The use of running water to remove chemical residue is never recommended because the water may spread the chemicals to adjacent surfaces, and drying of these surfaces may be more difficult. Acid cleaning compounds will stain masonry; therefore plastic sheets should be taped to the edge of the metal sections to protect the masonry surrounds. The same measure should be followed to protect the glazing from etching because of acid contact.

Measures that remove rust will ordinarily remove flaking paint as well. Remaining loose or flaking paint can be removed with a chemical paint remover or with a pneumatic needle scaler or gun, which comes with a series of chisel blades and has proven effective in removing flaking paint from metal windows. Well-bonded paint may serve to protect the metal further from corrosion, and need not be removed unless paint build-up prevents the window from closing tightly. The edges should be feathered by sanding to give a good surface for repainting.

Next, any *bare* metal should be wiped with a cleaning solvent such as denatured alcohol, and dried immediately in preparation for the application of an anti-corrosive primer. Since corrosion can recur very soon after metal has been exposed to the air, the metal should be primed immediately after cleaning. Spot priming may be required periodically as other repairs are undertaken. Anti-corrosive primers generally consist of oil-alkyd based paints rich in zinc or zinc chromate.[2] Red lead is no longer available because of its toxicity. All metal primers, however, are toxic to some degree and should be handled carefully. Two coats of primer are recommended. Manufacturer's recommendations should be followed concerning application of primers.

REPAIR

Repair in Place

The maintenance procedures described above will be insufficient when corrosion is extensive, or when metal window sections are misaligned. Medium to heavy corrosion that has not done any structural damage to the metal sections can be removed either by using the chemical cleaning process described under "Routine Maintenance" or by sandblasting. Since sandblasting can damage the masonry surrounds and crack or cloud the glass, metal or plywood shields should be used to protect these materials. The sandblasting pressure should be low, 80-100 pounds per square inch, and the grit size should be in the range of #10-#45. Glass peening beads (glass pellets) have also been successfully used in cleaning steel sections. While sandblasting equipment comes with various nozzle sizes, pencil-point blasters are most useful because they give the operator more effective control over the direction of the spray. The small aperture of the pencil-point blaster is also useful in removing dried putty from the metal sections that hold the glass. As with any cleaning technique, once the bare metal is exposed to air, it should be primed as soon as possible. This includes the inside rabbeted section of sash where glazing putty has been removed. To reduce the dust, some local codes allow only wet blasting. In this case, the metal must be dried immediately, generally with a blow-drier (a step that the owner should consider when calculating the time and expense involved). Either form of sandblasting metal covered with lead paints produces toxic dust. Proper precautionary measures should be taken against toxic dust and silica particles.

Bent or bowed metal sections may be the result of damage to the window through an impact or corrosive expansion. If the distortion is not too great, it is possible to realign the metal sections without removing the window to a metal fabricator's shop. The glazing is generally removed and pressure is applied to the bent or bowed section. In the case of a muntin, a protective 2 x 4 wooden bracing can be placed behind the bent portion and a wire cable with a winch can apply progressively more pressure over several days until the section is realigned. The 2 x 4 bracing is necessary to distribute the pressure evenly over the damaged section. Sometimes a section, such as the bottom of the frame, will bow out as a result of pressure exerted by corrosion and it is often necessary to cut the metal section to relieve this pressure prior to pressing the section back into shape and making a welded repair.

Once the metal sections have been cleaned of all corrosion and straightened, small holes and uneven areas resulting from rusting should be filled with a patching material and sanded smooth to eliminate pockets where water can accumulate. A patching material of steel fibers and an epoxy binder may be the easiest to apply. This steel-based epoxy is available for industrial steel repair; it can also be found in auto body patching compounds or in plumber's epoxy. As with any product, it is important to follow the manufacturer's instructions for proper use and best results. The traditional patching technique—melting steel welding rods to fill holes in the metal sections—may be difficult to apply in some situations; moreover, the window glass must be removed during the repair process, or it will crack from the expansion of the heated metal sections. After these repairs, glass replacement, hinge lubrication, painting, and other cosmetic repairs can be undertaken as necessary.

[2]Refer to Table IV. Types of Paint Used for Painting Metal in *Metals in America's Historic Buildings*, p. 139. (See bibliography).

Attachment 4

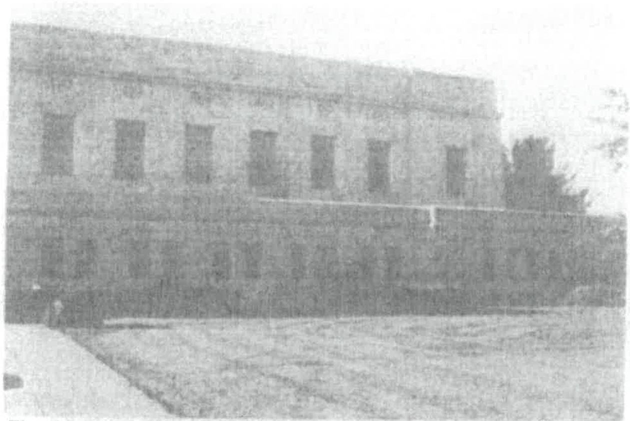


Fig. 6 a. View of the flanking wing of the State Capitol where the rolled steel casement windows are being removed for repair.

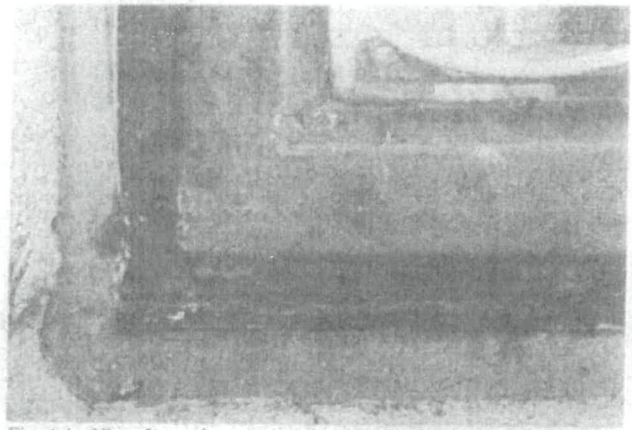


Fig. 6 b. View from the exterior showing the deteriorated condition of the lower corner of a window prior to repair. While the sash was in relatively good condition, the frame behind was rusted to the point of inhibiting operation.

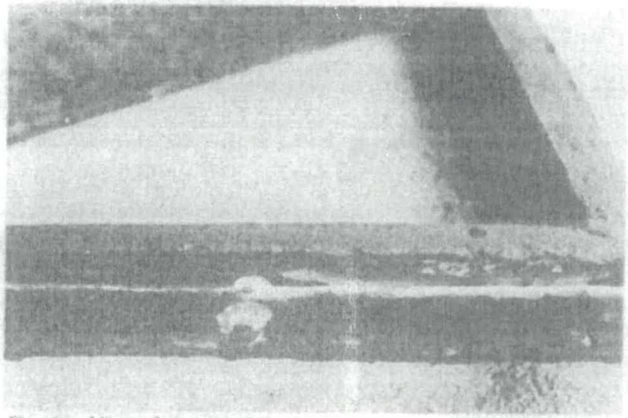


Fig. 6 c. View of the rusted frame which was unscrewed from the subframe and removed from the window opening and taken to a workshop for sandblasting. In some cases, severely deteriorated sections of the frame were replaced with new sections of milled bar steel.

Fig. 6 d. View looking down towards the sill. The subframes appeared very rusted, but were in good condition once debris was vacuumed and surface rust was removed, in place, with chemical compounds. Where necessary, epoxy and steel filler was used to patch depressions in order to make the subframe serviceable again.

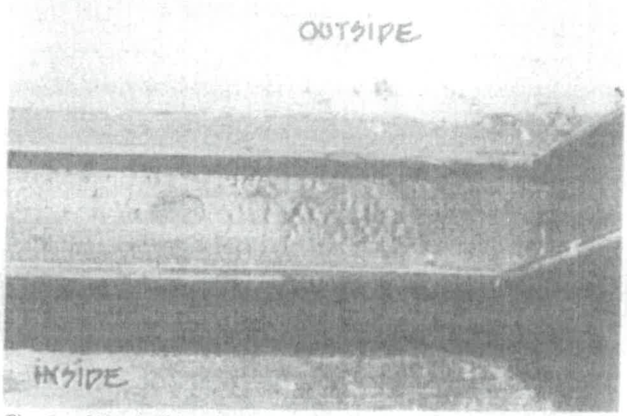


Fig. 6 e. View looking down towards the sill. The cleaned frame was reset in the window opening. The frame was screwed to the refurbished subframe at the jamb and the head only. The screw holes at the sill, which had been the cause of much of the earlier rusting, were infilled. Vinyl weatherstripping was added to the frame.

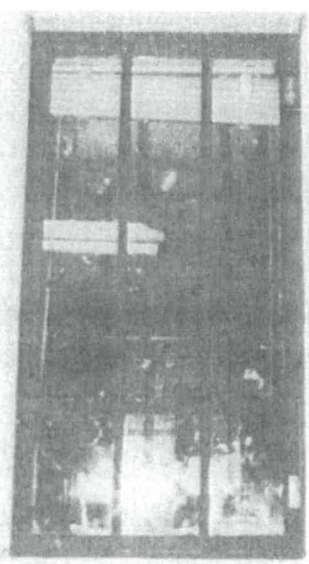


Fig. 6 f. View from the outside of the completely refurbished window. In addition to the steel repair and the installation of vinyl weatherstripping, the exterior was caulked with polyurethane and the single glass was replaced with individual lights of thermal glass. The repaired and upgraded windows have comparable energy efficiency ratings to new replacement units while retaining the historic steel sash frames and subframes.

Fig. 6. The repair and thermal upgrading of the historic steel windows at the State Capitol, Lincoln, Nebraska. This early twentieth century building, designed by Bertram Goodhue, is a National Historic Landmark. Photos: All photos in this series were provided by the State Building Division.

Work Item	Recommended Techniques	Tools, Products and Procedures	Notes
	*(Must be done in a workshop)		
5. Patching depressions	Epoxy and steel filler	Epoxy fillers with high content of steel fibers; plumber's epoxy or autobody patching compound.	Epoxy patches generally are easy to apply, and can be sanded smooth. Patches should be primed.
	Welded patches	Weld in patches using steel rods and oxy-acetylene torch or arc welder.	Prime welded sections after grinding connections smooth.
6. Splicing in new metal sections	*Cut out decayed sections and weld in new or salvaged sections	Torch to cut out bad sections back to 45° joint. Weld in new pieces and grind smooth.	Prime welded sections after grinding connection smooth.
7. Priming metal sections	Brush or spray application	At least one coat of anti-corrosive primer on bare metal. Zinc-rich primers are generally recommended.	Metal should be primed as soon as it is exposed. If cleaned metal will be repaired another day, spot prime to protect exposed metal.
8. Replacing missing screws and bolts	Routine maintenance	Pliers to pull out or shear off rusted heads. Replace screws and bolts with similar ones, readily available.	If new holes have to be tapped into the metal sections, the rusted holes should be cleaned, filled and primed prior to redrilling.
9. Cleaning, lubricating or replacing hinges and other hardware	Routine maintenance, solvent cleaning	Most hinges and closure hardware are bronze. Use solvents (mineral spirits), bronze wool and clean cloths. Spray with non-greasy lubricant containing anti-corrosive agent.	Replacement hinges and fasteners may not match the original exactly. If new holes are necessary, old ones should be filled.
10. Replacing glass and glazing compound	Standard method for application	Pliers and chisels to remove old glass, scrape putty out of glazing rabbet, save all clips and beads for reuse. Use only glazing compound formulated for metal windows.	Heavy gloves and other protective gear needed for the operator. All parts saved should be cleaned prior to reinstallation.
11. Caulking masonry surrounds	Standard method for application	Good quality (10 year or better) elastomeric caulking compound suitable for metal.	The gap between the metal frame and the masonry opening should be caulked; keep weepholes in metal for condensation run-off clear of caulk.
12. Repainting metal windows	Spray or brush	At least 2 coats of paint compatible with the anti-corrosive primer. Paint should lap the glass about 1/8" to form a seal over the glazing compound.	The final coats of paint and the primer should be from the same manufacturer to ensure compatibility. If spraying is used, the glass and masonry should be protected.

Fig. 7. STEPS FOR CLEANING AND REPAIRING HISTORIC STEEL WINDOWS. Compiled by Sharon C. Park, AIA.

Thermal Glazing

The third weatherization treatment is to install an additional layer of glazing to improve the thermal efficiency of the existing window. The decision to pursue this treatment should proceed from careful analysis. Each of the most common techniques for adding a layer of glazing will effect approximately the same energy savings (approximately double the original insulating value of the windows); therefore, cost and aesthetic considerations usually determine the choice of method. Methods of adding a layer of glazing to improve thermal efficiency include adding a new layer of transparent material to the window; adding a separate storm window; and replacing the single layer of glass in the window with thermal glass.

The least expensive of these options is to install a clear material (usually rigid sheets of acrylic or glass) over the original window. The choice between acrylic and glass is generally based on cost, ability of the window to support the material, and long-term maintenance outlook. If the material is placed over the entire window and secured to the frame, the sash will be inoperable. If the continued use of the window is important (for ventilation or for fire exits), separate panels should be affixed to the sash without obstructing operability (see fig. 9). Glass or acrylic panels set in frames can be attached using magnetized gaskets, interlocking material strips, screws or adhesives. Acrylic panels can be screwed directly to the metal windows, but the holes in the acrylic panels should allow for the expansion and contraction of this material. A compressible gasket between the prime sash and the storm panel can be very effective in establishing a thermal cavity between glazing layers. To avoid condensation, 1/8" cuts in a top corner and diagonally opposite bottom corner of the gasket will provide a vapor bleed, through which moisture can evaporate. (Such cuts, however, reduce thermal performance slightly.) If condensation does occur, however, the panels should be easily removable in order to wipe away moisture before it causes corrosion.

The second method of adding a layer of glazing is to have independent storm windows fabricated. (Pivot and austral windows, however, which project on either side of the window frame when open, cannot easily be fitted with storm windows and remain operational.) The storm window should be compatible with the original sash configuration. For example, in paired casement windows, either specially fabricated storm casement windows or sliding units in which the vertical meeting rail of the slider reflects the configuration of the original window should be installed. The decision to place storm windows on the inside or outside of the window depends on whether the historic window opens in or out, and on the visual impact the addition of storm windows will have on the building. Exterior storm windows, however, can serve another purpose besides saving energy: they add a layer of protection against air pollutants and vandals, although they will partially obscure the prime window. For highly ornamental windows this protection can determine the choice of exterior rather then interior storm windows.

The third method of installing an added layer of glazing is to replace the original single glazing with thermal glass. Except in rare instances in which the original glass is of special interest (as with stained or figured glass), the glass can be replaced if the hinges can tolerate the weight of the additional glass. The rolled metal sections for steel windows are generally from 1" - 1 1/2" thick. Sash of this thickness can normally tolerate thermal glass, which ranges from 3/8" - 5/8". (Metal glazing beads, readily available, are used to reinforce the muntins, which hold the glass.) This treatment leaves the window fully operational while preserving the historic appearance. It is, however, the most expensive of the treatments discussed here. (See fig. 6f).

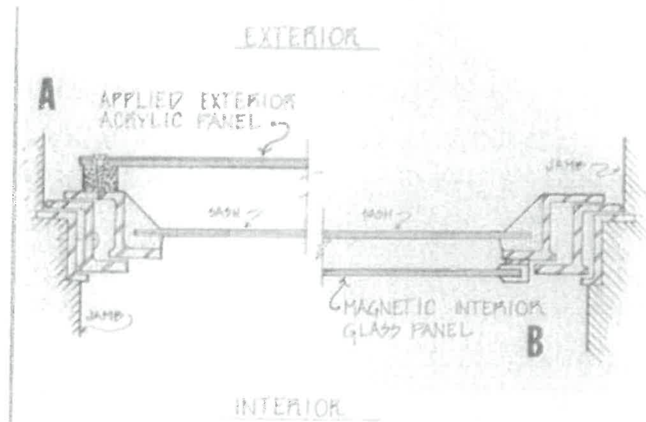


Fig. 9 Two examples of adding a second layer of glazing in order to improve the thermal performance of historic steel windows. Scheme A (showing jamb detail) is of a 1/4" acrylic panel with a closed cell foam gasket attached with self-tapping stainless steel screws directly to the exterior of the outwardly opening sash. Scheme B (showing jamb detail) is of a glass panel in a magnetized frame affixed directly to the interior of the historic steel sash. The choice of using glass or acrylic mounted on the inside or outside will depend on the ability of the window to tolerate additional weight, the location and size of the window, the cost, and the long-term maintenance outlook. Drawing: Sharon C. Park, AIA.

WINDOW REPLACEMENT

Repair of historic windows is always preferred within a rehabilitation project. Replacement should be considered only as a last resort. However, when the extent of deterioration or the unavailability of replacement sections renders repair impossible, replacement of the entire window may be justified. In the case of significant windows, replacement in kind is essential in order to maintain the historic character of the building. However, for less significant windows, replacement with compatible new windows may be acceptable. In selecting compatible replacement windows, the material, configuration, color, operability, number and size of panes, profile and proportion of metal sections, and reflective quality of the original glass should be duplicated as closely as possible.

A number of metal window manufacturing companies produce rolled steel windows. While stock modern window designs do not share the multi-pane configuration of

21 PRESERVATION BRIEFS

Repairing Historic Flat Plaster— Walls and Ceilings

Marylee MacDonald

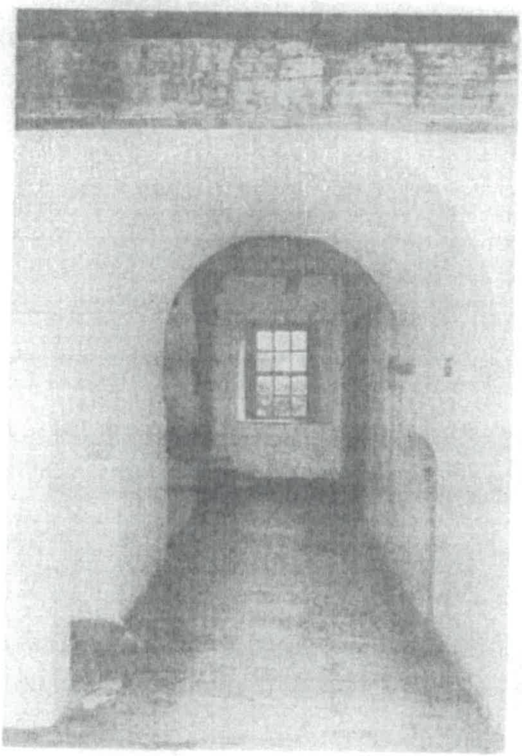
U.S. Department of the Interior National Park Service
Preservation Assistance Division Technical Preservation Services

Plaster in a historic building is like a family album. The handwriting of the artisans, the taste of the original occupants, and the evolving styles of decoration are embodied in the fabric of the building. From modest farmhouses to great buildings, regardless of the ethnic origins of the occupants, plaster has traditionally been used to finish interior walls.

A versatile material, plaster could be applied over brick, stone, half-timber, or frame construction. It provided a durable surface that was easy to clean and that could be applied to flat or curved walls and ceilings.

Plaster could be treated in any number of ways: it could receive stenciling, decorative painting, wallpaper, or whitewash. This variety and the adaptability of the material to nearly any building size, shape, or configuration meant that plaster was the wall surface chosen for nearly all buildings until the 1930s or 40s (Fig. 1).

Historic plaster may first appear so fraught with problems that its total removal seems the only alternative. But there are practical and historical reasons for saving it. First, three-coat plaster is unmatched in strength



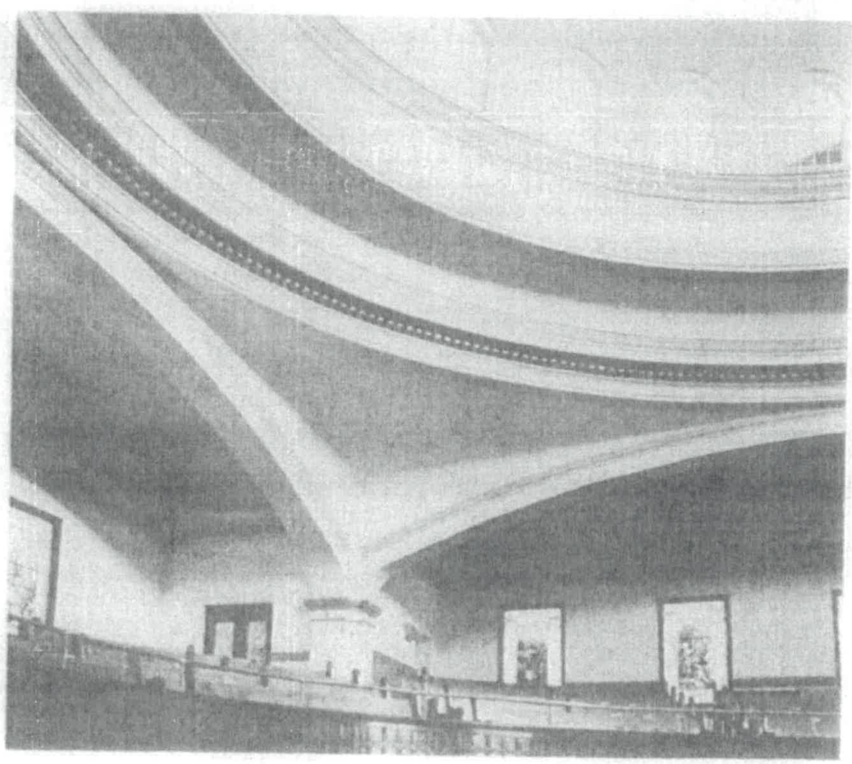


Fig. 1. Left: Schifferstadt, Frederick, Maryland, 1756. Right: First Christian Church, Eugene, Oregon, 1911. Although these two structures are separated in history by over 150 years and differences in size, ethnic origin, geography, construction techniques, and architectural character, their builders both used plaster as the interior surface coating for flat and curved walls. Photo left: Kay Weeks. Photo right: Kaye Ellen Simonson.

Historical Background

Plasterers in North America have relied on two materials to create their handiwork—lime and gypsum. Until the end of the 19th century, plasterers used lime plaster. Lime plaster was made from four ingredients: lime, aggregate, fiber, and water. The lime came from ground-and-heated limestone or oyster shells; the aggregate from sand; and the fiber from cattle or hog hair. Manufacturing changes at the end of the 19th century made it possible to use gypsum as a plastering material. Gypsum and lime plasters were used in combination for the base and finish coats during the early part of the 20th century; gypsum was eventually favored because it set more rapidly and, initially, had a harder finish.

Not only did the basic plastering material change, but the method of application changed also. In early America, the windows, doors, and all other trim were installed before the plaster was applied to the wall (Fig. 4). Generally the woodwork was prime-painted before plastering. Obtaining a plumb, level wall, while working against built-up mouldings, must have been difficult. But sometime in the first half of the 19th century, builders began installing wooden plaster "grounds" around windows and doors and at the base of the wall. Installing these grounds so that they were level and plumb made the job much easier because the plasterer could work from a level, plumb, straight surface. Woodwork was then nailed to the "grounds" after the walls were plastered (Fig. 5). Evidence of plaster behind trim is often an aid to dating historic houses, or to discerning their physical evolution.

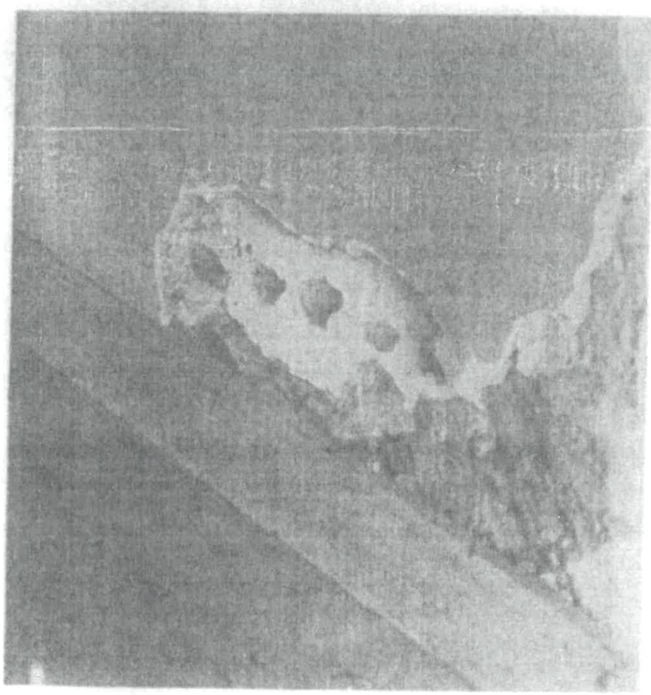


Fig. 4. The builders of this mid-18th century house installed the baseboard moulding first, then applied a mud and horse hair plaster (called paling) to the masonry wall. Lime was used for the finish plaster. Also shown are the hacking marks which prepared the wall for a subsequent layer of plaster. Photo: Kay Weeks

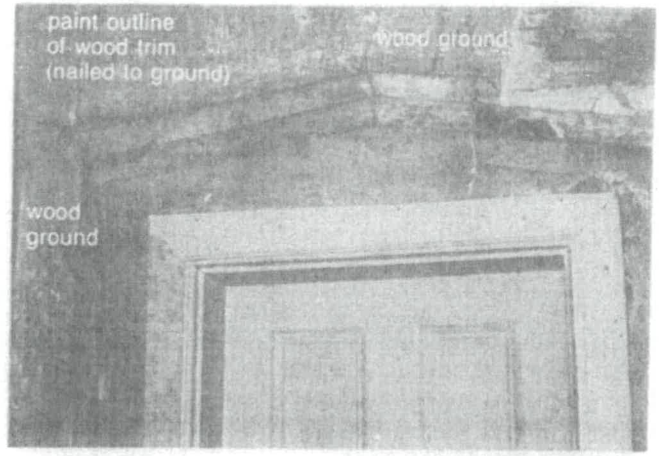
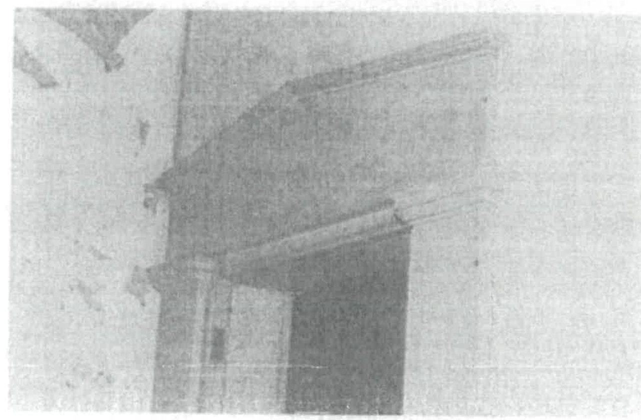


Fig. 5 (a). The photo above shows the use of wooden plaster "grounds" nailed to the wall studs of the mid-19th century Lockwood House in Harpers Ferry, West Virginia. This allowed the plasterer to work flush with the surface of the grounds. Afterwards, the carpenter could nail the finish woodwork to the ground, effectively hiding the joint between the plaster and the ground. The trim was painted after its installation, leaving a paint outline on the plaster. Fig. 5 (b). The photo below shows door trim and mouldings in place after the plastering was complete. Photos: Kaye Ellen Simonson.



Lime Plaster

When building a house, plasterers traditionally mixed bags of quick lime with water to "hydrate" or "slake" the lime. As the lime absorbed the water, heat was given off. When the heat diminished, and the lime and water were thoroughly mixed, the lime putty that resulted was used to make plaster.

When lime putty, sand, water, and animal hair were mixed, the mixture provided the plasterer with "coarse stuff." This mixture was applied in one or two layers to build up the wall thickness. But the best plaster was done with three coats. The first two coats made up the coarse stuff; they were the *scratch* coat and the *brown* coat. The finish plaster, called "setting stuff" contained a much higher proportion of lime putty, little aggregate, and no fiber, and gave the wall a smooth white surface finish.

Compared to the 3/8-inch-thick layers of the scratch and brown coats, the finish coat was a mere 1/8-inch thick. Additives were used for various finish qualities.

Metal Lath. Metal lath, patented in England in 1797, began to be used in parts of the United States toward the end of the 19th century. The steel making up the metal lath contained many more spaces than wood lath had contained. These spaces increased the number of keys; metal lath was better able to hold plaster than wood lath had been.

Rock Lath. A third lath system commonly used was rock lath (also called plaster board or gypsum-board lath). In use as early as 1900, rock lath was made up of compressed gypsum covered by a paper facing. Some rock lath was textured or perforated to provide a key for wet plaster. A special paper with gypsum crystals in it provides the key for rock lath used today; when wet plaster is applied to the surface, a crystalline bond is achieved.

Rock lath was the most economical of the three lathing systems. Lathers or carpenters could prepare a room more quickly. By the late 1930s, rock lath was used almost exclusively in residential plastering.

Common Plaster Problems

When plaster dries, it is a relatively rigid material which should last almost indefinitely. However, there are conditions that cause plaster to crack, effloresce, separate, or become detached from its lath framework (Fig. 7). These include:

- Structural Problems
- Poor Workmanship
- Improper Curing
- Moisture

Structural Problems

Overloading. Stresses within a wall, or acting on the house as a whole, can create stress cracks. Appearing as diagonal lines in a wall, stress cracks usually start at a door or window frame, but they can appear anywhere in the wall, with seemingly random starting points.

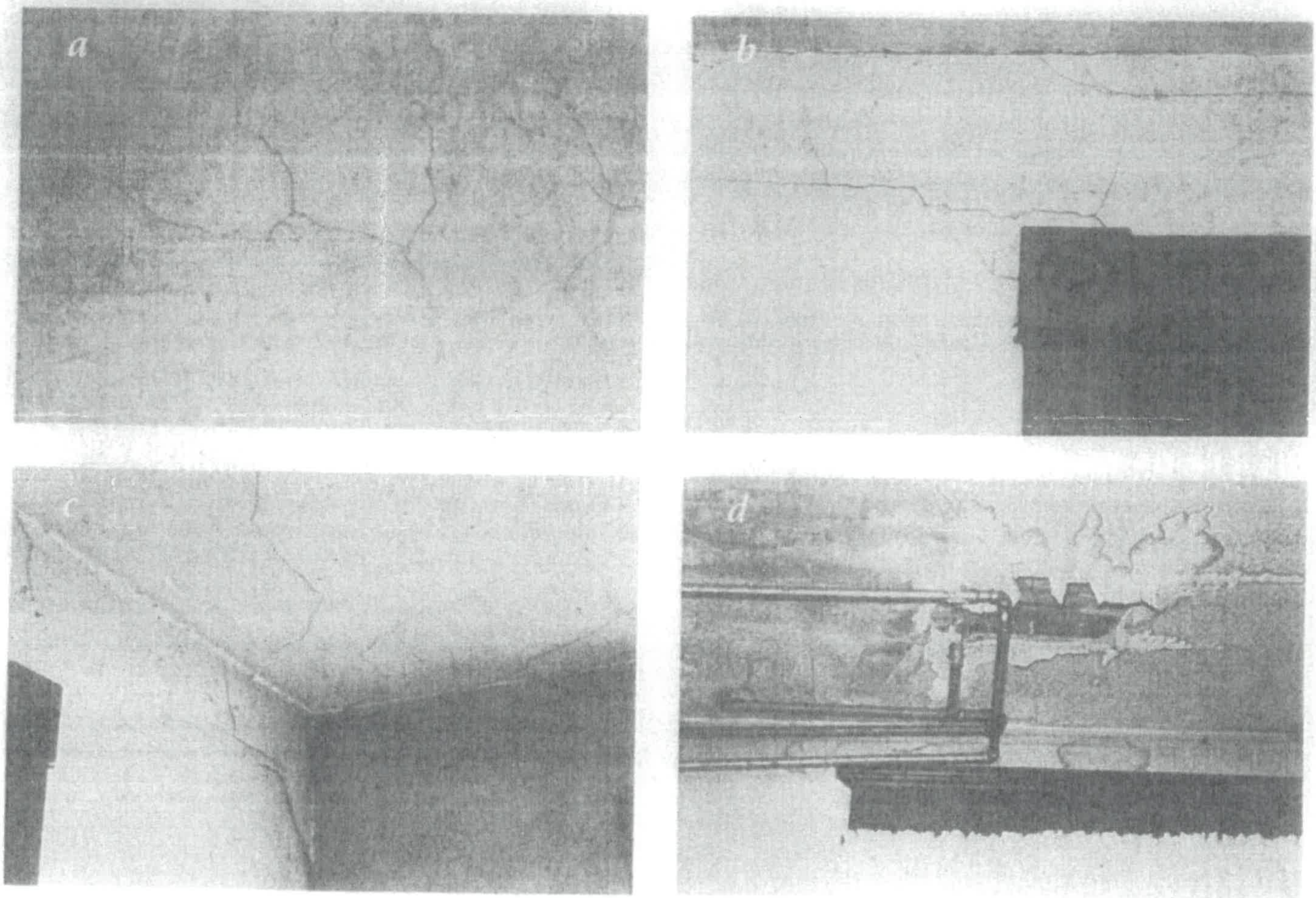


Fig. 7 (a) to (d). A series of photographs taken in different rooms of an early 20th century house in West Virginia reveal a variety of plaster wall surface problems, most of which can easily be remedied through sensitive repair: Hairline cracks (a) in an otherwise sound wall can be filled with joint compound or patching plaster. The wall can also be canvassed or wallpapered. Stress cracks (b) in plaster over a kitchen door frame can be repaired using fiberglass mesh tape and joint compound. Settlement cracks (c) in a bedroom can be similarly repaired. The dark crack at the juncture between walls, however, may be a structural crack and should be investigated for its underlying cause. Moisture damage (d) from leaking plumbing on the second floor has damaged both wallpaper and plaster in the dining room. After fixing the leaking pipes, the wall covering and rotted plaster will need to be replaced and any holes repaired. Photos: Kay Weeks.

glue, gelatin, starch, molasses, or vegetable oil. If the plasterer has used too much retardant, however, a gypsum plaster will not set within a normal 20 to 30 minute time period. As a result, the surface becomes soft and powdery.

Inadequate plaster thickness. Plaster is applied in three coats over wood lath and metal lath—the scratch, brown, and finish coats. In three-coat work, the scratch coat and brown coat were sometimes applied on successive days to make up the required wall thickness. Using rock lath allowed the plasterer to apply one base coat and the finish coat—a two-coat job.

If a plasterer skimped on materials, the wall may not have sufficient plaster thickness to withstand the normal stresses within a building. The minimum total thickness for plaster on gypsum board (rock lath) is 1/2 inch. On metal lath the minimum thickness is 5/8 inch; and for wood lath it is about 3/4 to 7/8 inch. This minimum plaster thickness may affect the thickness of trim projecting from the wall's plane.

Improper Curing

Proper temperature and air circulation during curing are key factors in a durable plaster job. The ideal temperature for plaster to cure is between 55-70 degrees Fahrenheit. However, historic houses were sometimes plastered before window sashes were put in. There was no way to control temperature and humidity.

Dryouts, freezing, and sweat-outs. When temperatures were too hot, the plaster would return to its original condition before it was mixed with water, that is, calcined gypsum. A plasterer would have to spray the wall with alum water to re-set the plaster. If freezing occurred before the plaster had set, the job would simply have to be re-done. If the windows were shut so that air could not circulate, the plaster was subject to sweat-out or rot. Since there is no cure for rotted plaster, the affected area had to be removed and replastered.

Moisture

Plaster applied to a masonry wall is vulnerable to water damage if the wall is constantly wet. When salts from the masonry substrate come in contact with water, they migrate to the surface of the plaster, appearing as dry bubbles or efflorescence. The source of the moisture must be eliminated before replastering the damaged area.

Sources of Water Damage. Moisture problems occur for several reasons. Interior plumbing leaks in older houses are common. Roofs may leak, causing ceiling damage. Gutters and downspouts may also leak, pouring rain water next to the building foundation. In brick buildings, dampness at the foundation level can wick up into the above-grade walls. Another common source of moisture is splash-back. When there is a paved area next to a masonry building, rainwater splashing up from the paving can dampen masonry walls. In both cases water travels through the masonry and damages interior plaster. Coatings applied to the interior are not effective over the long run. The moisture problem must be stopped on the outside of the wall.

Repairing Historic Plaster

Many of the problems described above may not be easy to remedy. If major structural problems are found to be the source of the plaster problem, the structural problem should be corrected. Some repairs can be made by removing only small sections of plaster to gain access. Minor structural problems that will not endanger the building can generally be ignored. Cosmetic damages from minor building movement, holes, or bowed areas can be repaired without the need for wholesale demolition. However, it may be necessary to remove deteriorated plaster caused by rising damp in order for masonry walls to dry out. Repairs made to a wet base will fail again.

Canvassing Uneven Wall Surfaces

Uneven wall surfaces, caused by previous patching or by partial wallpaper removal, are common in old houses. As long as the plaster is generally sound, cosmetically unattractive plaster walls can be "wallpapered" with strips of a canvas or fabric-like material. Historically, canvassing covered imperfections in the plaster and provided a stable base for decorative painting or wallpaper.

Filling Cracks

Hairline cracks in wall and ceiling plaster are not a serious cause for concern as long as the underlying plaster is in good condition. They may be filled easily with a patching material (see **Patching Materials,** page 13). For cracks that re-open with seasonal humidity change, a slightly different method is used. First the crack is widened slightly with a sharp, pointed tool such as a crack widener or a triangular can opener. Then the crack is filled. For more persistent cracks, it may be necessary to bridge the crack with tape. In this instance, a fiberglass mesh tape is pressed into the patching material. After the first application of a quick-setting joint compound dries, a second coat is used to cover the tape, feathering it at the edges. A third coat is applied to even out the surface, followed by light sanding. The area is cleaned off with a damp sponge, then dried to remove any leftover plaster residue or dust.

When cracks are larger and due to structural movement, repairs need to be made to the structural system *before* repairing the plaster. Then, the plaster on each side of the crack should be removed to a width of about 6 inches down to the lath. The debris is cleaned out, and metal lath applied to the cleared area, leaving the existing wood lath in place. The metal lath usually prevents further cracking. The crack is patched with an appropriate plaster in three layers (i.e., basecoats and finish coat). If a crack seems to be expanding, a structural engineer should be consulted.

Fig. 11. Repairs are being made to the historic plaster in an early 20th century residence in Tennessee. A fairly sizeable hole in three-coat plaster extends to the wood lath. Expanded metal lath has been cut to fit the hole, then attached to the wood lath with a tie-wire. Two ready-mix gypsum base coats are in the process of being applied. After they set, the finish coat will be smooth-troweled gauged lime to match the existing wall. Photo: Walter Jowers.

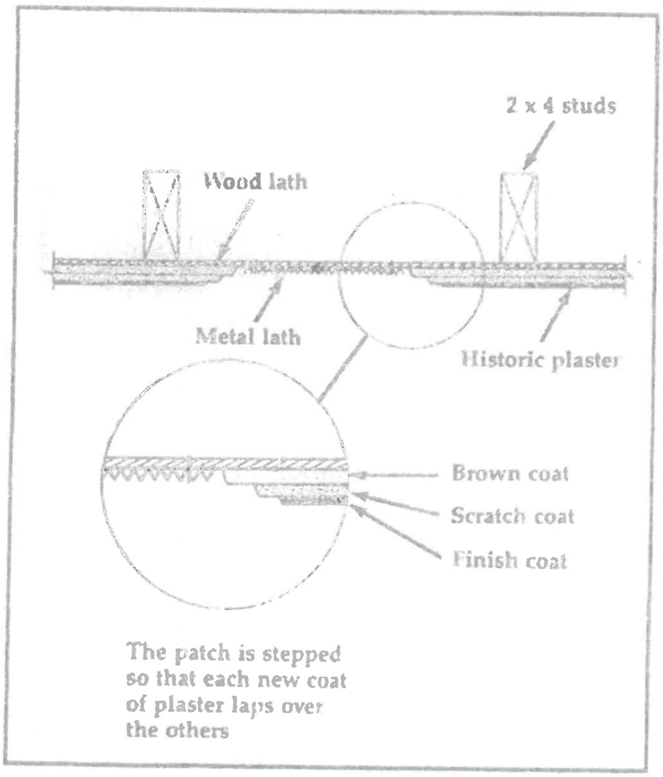


Fig. 12. This explains how a hole in historic plaster is repaired over the existing wood lath. First, metal lath is secured over the wood lath with a tie wire, then the new plaster is applied in three layers, "stepped" so that each new coat overlaps the old plaster to create a good adhesive bond. Drawing: Kaye Ellen Simonson.

Patching Holes in Ceilings

Hairline cracks and holes may be unsightly, but when portions of the ceiling come loose, a more serious problem exists (Fig. 13). The keys holding the plaster to the ceiling have probably broken. First, the plaster around the loose plaster should be examined. Keys may have deteriorated because of a localized moisture problem, poor quality plaster, or structural overloading; yet, the surrounding system may be intact. If the areas surrounding the loose area are in reasonably good condition, the loose plaster can be reattached to the lath using flat-head wood screws and plaster washers (Fig. 14). To patch a hole in the ceiling plaster, metal lath is fastened over the wood lath; then the hole is filled with successive layers of plaster, as described above.

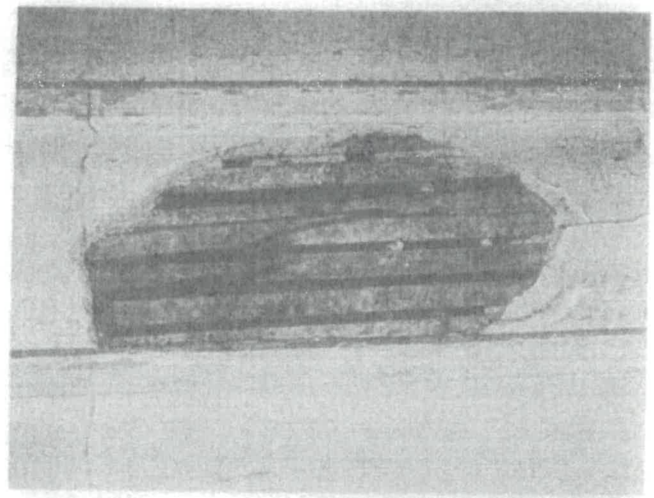


Fig. 13. This beaded ceiling in one of the bedrooms of the 1847 Lockwood House, Harpers Ferry, West Virginia, is missing portions of plaster due to broken keys. This is attributable, in part, to deterioration of the wood lath. Photo: Kaye Ellen Simonson.

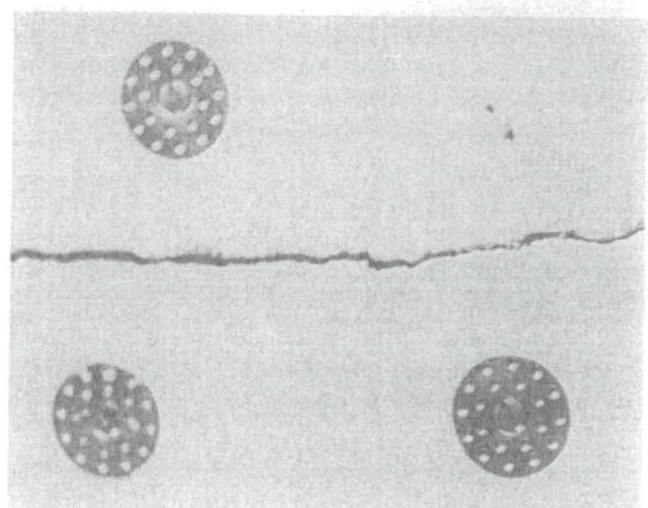


Fig. 14. In a late 18th century house in Massachusetts, flat-head wood screws and plaster washers were used to reattach loose ceiling plaster to the wood lath. After the crack is covered with fiberglass mesh tape, both the taped crack and the plaster washers will be skim-coated with a patching material. Photo: John Obed Curtis.

many of these problems can be avoided and the historic lath can be retained (Fig. 16). The ceiling should still be sprayed unless a vapor barrier is placed behind the metal lath.

Replastering over new metal lath. An alternative to re-using the old wood lath is to install a different lathing system. Galvanized metal lath is the most expensive, but also the most reliable in terms of longevity, stability, and proper keying. When lathing over open joists, the plasterer should cover the joists with kraft paper or a polyethylene vapor barrier. Three coats of wet plaster are applied consecutively to form a solid, monolithic unit with the lath. The scratch coat keys into the metal lath; the second, or brown, coat bonds to the scratch coat and builds the thickness; the third, or finish coat, consists of lime putty and gauging plaster.

Replastering over new rock lath. It is also possible to use rock lath as a plaster base. Plasterers may need to remove the existing wood lath to maintain the woodwork's reveal. Rock lath is a 16x36-inch, 1/2-inch thick, gypsum-core panel covered with absorbent paper with gypsum crystals in the paper. The crystals in the paper bond the wet plaster and anchor it securely. This type of lath requires two coats of new plaster—the brown coat and the finish coat. The gypsum lath itself takes the place of the first, or scratch, coat of plaster.

Painting New Plaster

The key to a successful paint job is proper drying of the plaster. Historically, lime plasters were allowed to cure for at least a year before the walls were painted or papered. With modern ventilation, plaster cures in a shorter time; however, fresh gypsum plaster with a lime finish coat should still be perfectly dry before paint is applied—or the paint may peel. (Plasterers traditionally used the "match test" on new plaster. If a match would light by striking it on the new plaster surface, the plaster was considered dry.) Today it is best to allow new plaster to cure two to three weeks. A good alkaline-resistant primer, specifically formulated for new plaster, should then be used. A compatible latex or oil-based paint can be used for the final coat.

A Modern Replacement System

Veneer Plaster. Using one of the traditional lath and plaster systems provides the highest quality plaster job. However, in some cases, budget and time considerations may lead the owner to consider a less expensive replacement alternative. Designed to reduce the cost of materials, a more recent lath and plaster system is less expensive than a two-or-three coat plaster job, but only slightly more expensive than drywall. This plaster system is called veneer plaster.

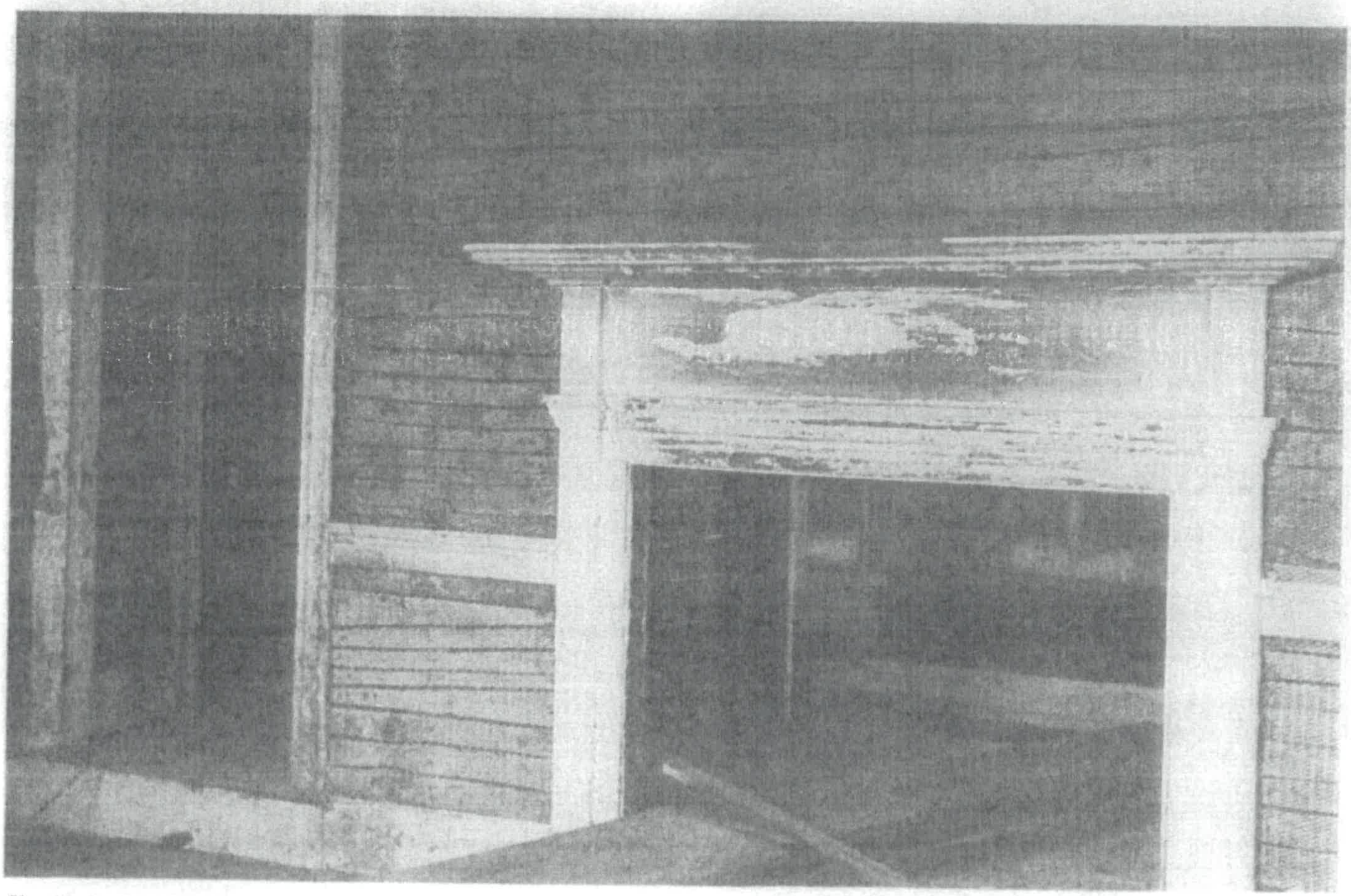


Fig. 16. In the restoration of a ca. 1830s house in Maine, split-board lath has been covered with expanded metal lath in preparation for new coats of plaster. This method permits the early lath to be saved while the metal lath, with its superior keying, serves as reinforcement. Photo: National Park Service files.

Patching Materials

Plasterers generally use ready-mix base-coat plaster for patching, especially where large holes need to be filled. The ready-mix plaster contains gypsum and aggregate in proper proportions. The plasterer only needs to add water.

Another mix plasterers use to patch cracks or small holes, or for finish-coat repair, is a "high gauge" lime putty (50 percent lime; 50 percent gauging plaster). This material will produce a white, smooth patch. It is especially suitable for surface repairs.

Although property owners cannot duplicate the years of accumulated knowledge and craft skills of a professional plasterer, there are materials that can be used for do-it-yourself repairs. For example, fine cracks can be filled with an all-purpose drywall joint compound. For bridging larger cracks using fiberglass tape, a homeowner can use a "quick-setting" joint compound. This compound has a fast drying time—60, 90, or 120 minutes. Quick-setting joint compound dries because of a chemical reaction, not because of water evaporation. It shrinks less than all-purpose joint compound and has much the same workability as ready-mix base-coat plaster. However, because quick-set joint compounds are hard to sand, they should only be used to bed tape or to fill large holes. All-purpose joint compound should be used as the final coat prior to sanding.

Homeowners may also want to try using a ready-mix perlited base-coat plaster for scratch and brown coat repair. The plaster can be hand-mixed in small quantities, but bagged ready-mix should be protected from ambient moisture. A "mill-mixed pre-gauged" lime finish coat plaster can also be used by homeowners. A base coat utilizing perlite or other lightweight aggregates should only be used for making small repairs (less than 4 ft. patches). For large-scale repairs and entire room re-plastering, see the precautions in Table 1 for using perlite.

Homeowners may see a material sold as "patching plaster" or "plaster of Paris" in hardware stores. This dry powder cannot be used by itself for plaster repairs. It must be combined with lime to create a successful patching mixture.

When using a lime finish coat for any repair, wait longer to paint, or use an alkaline-resistant primer.

TABLE 1
REPLASTERING
Selected Plaster Bases/Compatible Basecoats and Finish Coats

Traditional Plaster Bases	*Compatible Basecoats*	*Compatible Finish Coats*
OLD WOOD LATH	gypsum/sand plaster gypsum/perlite plaster [2]	lime putty/gauging plaster lime putty/gauging plaster
METAL LATH	gypsum/sand plaster (high strength) gypsum/perlite plaster [2]	lime putty/gauging plaster lime putty/gauging plaster
GYPSUM (ROCK) LATH PANELS	gypsum/sand plaster gypsum/perlite plaster [2]	lime putty/gauging plaster lime putty/gauging plaster
UNGLAZED BRICK/CLAY TILE	gypsum/perlite plaster [2] (*masonry* type)	lime putty/gauging plaster
Modern Plaster Base	***Compatible Basecoat***	***Compatible Finish Coat***
GYPSUM CORE VENEER PANELS (BLUE BOARD)	veneer plaster	veneer plaster *or* lime putty/gauging plaster

[1] On traditional bases (wood, metal, and rock lath), the thickness of base coat plaster is one of the most important elements of a good plaster job. Grounds should be set to obtain the following minimum plaster thicknesses: (1) Over rock lath—1/2" (2) Over brick, clay tile, or other masonry—5/8" (3) Over metal lath, measured from face of lath—5/8" (4) Over wood lath—7/8". In no case should the total plaster thickness be less than 1/2". The allowance for the finish coat is approximately 1/16" which requires the base coat to be 7/16" for 1/2" grounds. This is a *minimum* base coat thickness on rock lath. The standard for other masonry units and metal lath is 5/8" thick, including the finish. Certain types of construction or fire ratings may require an increase in plaster thickness (and/or an increase in the gypsum to aggregate ration) but never a thinner application of plaster than recommended above. Job experience indicates that thin applications of plaster often evidence cracking where normal applications to standard grounds do not. This condition is a direct result of the inability of thin section areas to resist external forces as adequately as thicker, normal applications of plaster.

[2] Perlite is a lightweight aggregate often used in gypsum plaster in place of sand. It performs well in cold weather and has a slightly better insulating value than sand. In a construction with metal lath, perlite aggregate is not recommended in the basecoat except under a sand or "float" finish. When gypsum perlite basecoats are used over any other base (i.e., wood, rock lath, brick) and the finish coat is to be a "white" finish coat (smooth troweled gauged lime putty) it is necessary to add fine silica sand or perlite fines to the finish coat. This measure prevents cracking of the "white" finish coat due to differential shrinkage.

23 PRESERVATION BRIEFS

Preserving Historic Ornamental Plaster

David Flaharty

U.S. Department of the Interior
National Park Service
Cultural Resources
Heritage Preservation Services

From the time America struggled for a new identity as a constitutional republic—and well into the 20th century—its architecture and its decorative detailing remained firmly rooted in the European classicism of Palladio, Wren, and Mansart.

Together with skilled masons and carpenters, ornamental plasterers saw their inherited trade flourish from the mid-18th century until the Depression years of the 1930s. During this two hundred year period, as the Georgian and Federal styles yielded to the revivals—Greek, Rococo, Gothic, Renaissance, and Spanish—decorative plaster reflected each style, resulting in the wide variety of ornamentation that survives. The traditional methods of producing and installing interior decorative plaster were brought from Europe to this country intact and its practice remains virtually unchanged to this day.

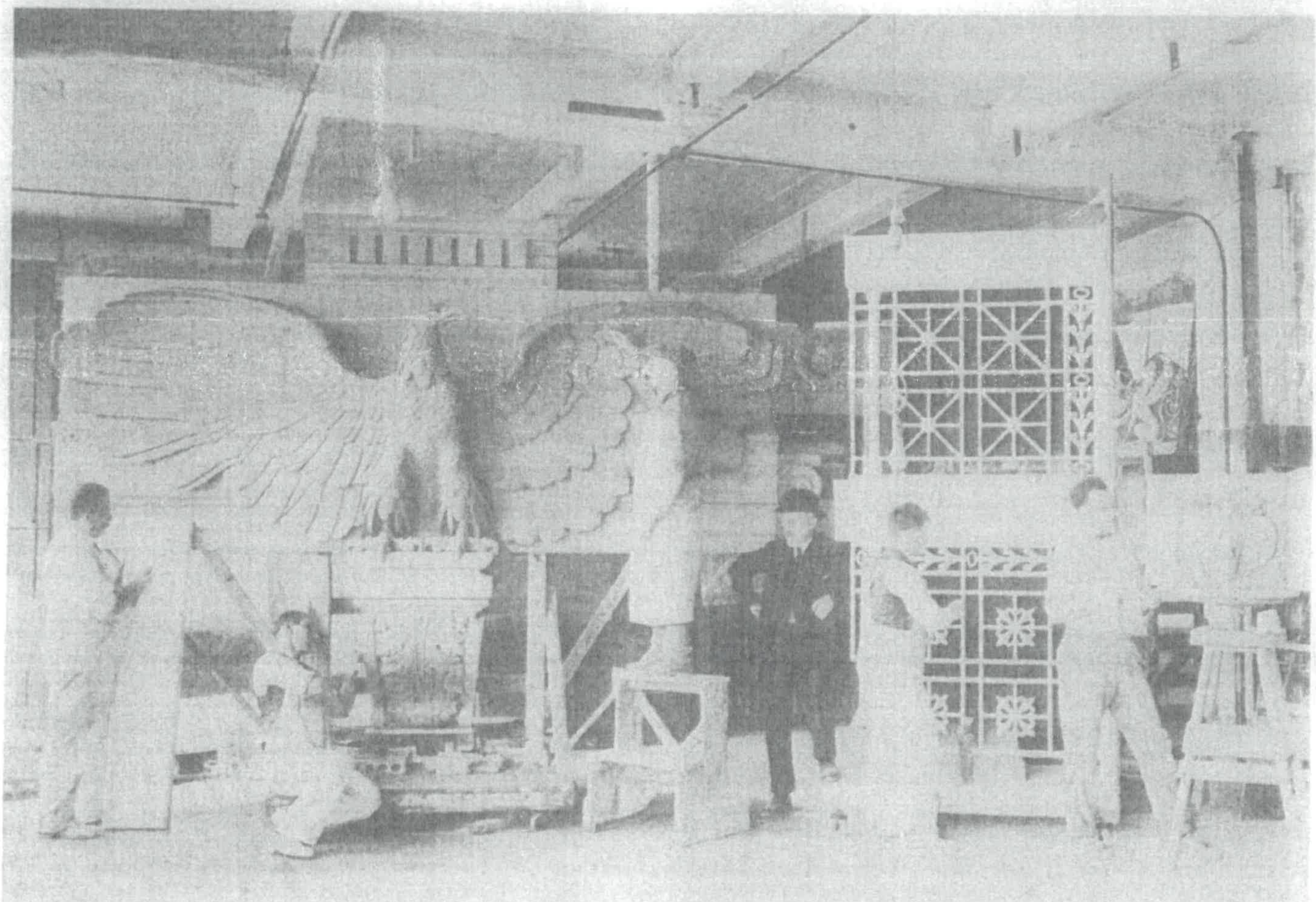


Fig. 1. Ornamental plaster studios employed the following personnel: Draftsmen to interpret architectural details in shop drawings; sculptors who modelled in clay; modelmakers who assembled sculpted, plain-run and pre-cast elements into an ornamental unit; moldmakers who made rigid or flexible negative tooling; casters who made production units; finishers (often the caster's wives) who cleaned the casts; and laborers who assisted skilled personnel in operating efficiently. This studio was in Philadelphia. c. 1915. Photo: Courtesy, M. Earle Felber.

Like flat walls and ceilings, historic *ornamental* plaster is made of gypsum and lime which are stable and durable materials. An extremely versatile material, plaster can be modelled, cast, incised, colored, stamped, or stencilled. However, as an integral part of the building system it is subject to the typical problems of water intrusion, structural movement, vibration and insensitive alterations, both incrementally and from adaptive use projects. This Preservation Brief has been prepared to assist property owners, architects, contractors, and Federal agency managers in identifying the causes of ornamental plaster failure, specifying repair and replacement techniques and engaging qualified professionals to do the work. The scope of this Brief is limited to the repair and restoration of **existing ornamental plaster;** certain forms of decorative plaster such as scagliola, composition ornament, and artificial Caen Stone are not addressed, nor is the design and installation of ornamental plasterwork in new construction. Finally, guidance on using substitute materials to match the historic appearance of ornamental plasterwork—a legitimate option within the *Secretary of Interior's Standards for Historic Preservation Projects*—is not discussed here, but will be the subject of another Brief on interiors.

The Ornamental Plaster Trade

Shop Personnel. As builders and architects were hired by an increasingly affluent clientele, ornamental plaster shops developed from the single artisan operations of the 18th century into the complex establishments of the early 20th century. American plaster studios employed immigrant and, later, native craftsmen (see Fig. 1). Plasterers' guilds were in existence in Philadelphia in the 1790s. In 1864, a plasterers' union was organized in the United States with members from the British Isles whose work there had been limited to palaces and churches. English and European craftsmen came to America where the demand for their skills had increased by the decade, offering them the unparalleled opportunity to open their own shops. Over the years, plaster elements became so popular in decorating interior spaces that a major industry was established. By the 1880s, catalogs were available from which property owners could select ornamentation for their splendid new buildings (see Fig. 2).

Methods of Production. Historically, ornamental plasterwork has been produced in two ways: it would be *run in place* (or on a bench) at the site; or *cast in molds* in a workshop. Plain plaster molding without surface ornamentation was usually created directly on the wall, or run on a flat surface such as a plasterer's workbench and attached to the wall after it set. Ornament such as coffering for ceilings, centers for light fixtures (medallions), brackets, dentils, or columns were cast in hide glue (gelatin) or plaster molds in an offsite shop, often in more than one piece, then assembled and installed in the building.

Decorative Plaster Forms—Cornices, Medallions, Coffers. Three decorative plaster forms in particular—the cornice, the ceiling medallion, and the coffered ceiling—historically comprised much of the ornamental plasterers' business. These forms appear individually or in combination from the 18th to 20th century, irrespective of stylistic changes.

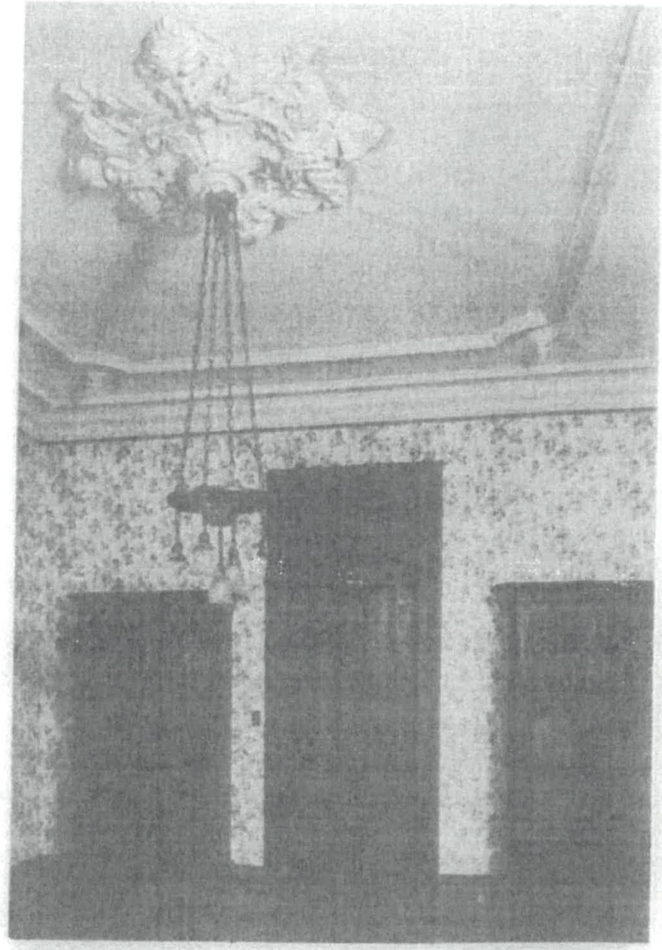


Fig. 2. This parlor medallion and pendant drops shown in a mid-19th century row house in Annapolis, Maryland were originally ordered from a catalog. A local plasterer ran the plain cornice and band ribbon, the curved corners of which were bench run, set with a plaster adhesive and pointed at the joints. Photo: M. E. Warren.

For example, an elaborate parlor cornice consisted of plain moldings made of gypsum and lime run atop temporary lattice strips around the room. Tooling for plain-run moldings called for a sheet metal template of the molding profile mounted on a wooden "horse" (see Figs. 3 and 4). Mitering was accomplished using a plaster and lime putty gauge (mix) tooled with miter rods at the joints (see Fig. 5). Decorative "enrichments" such as leaves, egg and dart moldings, and bead and reel units were cast in the shop and applied to the plain runs using plaster as an adhesive (see Fig. 6). Painting, glazing, and even gilding followed. Large houses often had plain- run cornices on the upper floors which were not used for entertaining; modest houses also boasted cornice work without cast enrichment.

Among the most dramatic of ornamental plaster forms is the parlor **ceiling medallion.** Vernacular houses often used plain-run concentric circles from which lighting fixtures descended, usually hung from a wrought iron hook embedded in the central ceiling joist. More

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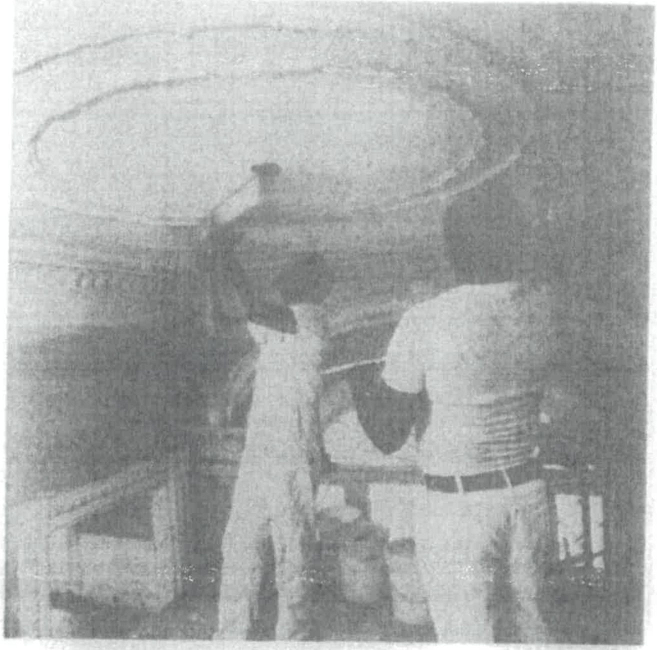

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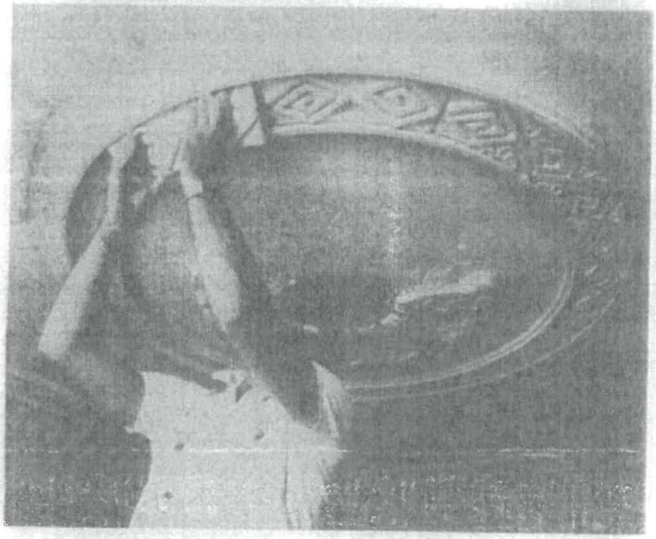


Fig. 7. Running and Enriching a Ceiling Medallion. The method of running and enriching a ceiling medallion remains the same today. (a) First, a plain-run surround is spun from a pivot point centered in the ceiling field. (b) Ornament layout is determined using plane geometric principles; segmented locations are deeply scratched to provide a rough surface for adequate bonding using plaster as an adhesive. Historically, cast enrichments could be bought from local suppliers and set individually, allowing architects to compose medallions to suit room dimensions and period motifs. Photos: Peter Sanders.

Fig. 8. Casting a Coffering Unit. Ceiling coffers are made the same way today except, historically, a hide glue mold was poured over an ornamental model whereas today urethane molding rubber is used. Now, as then, the plaster casts are made with steel channel irons embedded on the back of each panel. The coffers are hung from carrying irons fixed to the ceiling above by means of twisting wires to level each coffer to its neighbor. Afterward, the panels are fastened together and the joints pointed with plaster. Photo: David Flaharty.

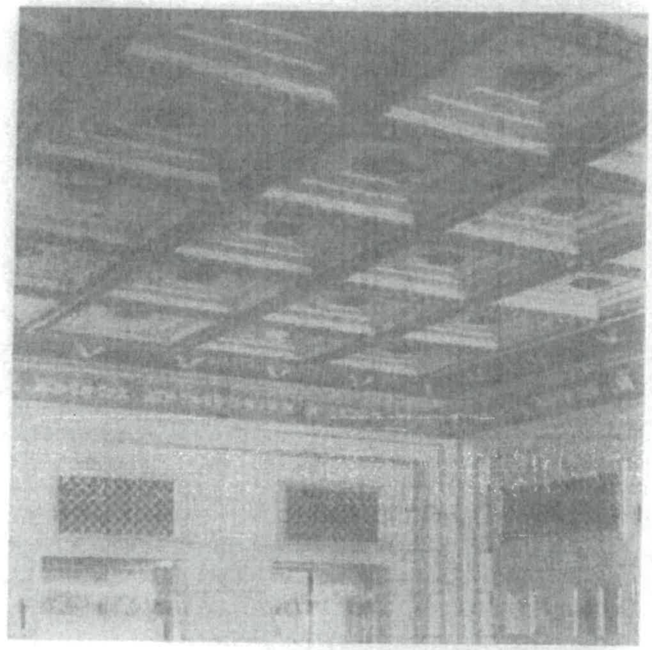


Fig. 9. The elaborate coffered ceiling was designed for the Willard Hotel in Washington, D.C. (1902–04) by Henry Janeway Hardenbergh. The coffered ceiling was restored as part of a rehabilitation project in the 1980s. Photo: Carol M. Highsmith.

Yet another significant decorative form is the **coffered ceiling.** Coffering units were cast in the shop or onsite, then installed with hanging wires to form the ceiling (see Fig 8). Ceiling design varied from period to period as to depth, panel shape, and ornamental complexity. Not always flat, coffering is seen inside domes, within barrel vaults and groin ceilings, along overhead ribs and soffits. Rosettes are usually centered in the panels and often enrich the intersections of elaborate stiles bordering the panels. Flat ceiling coffers are generally identical in reflected plan; on domed or barrel ceilings, coffers differ from course to course so as to appear identical from various sight lines. The finish treatment of a coffered ceiling frequently exhibits the height of the painter's craft. Foremost examples of ceiling coffering include the United States Capitol, and Washington D. C.'s Union Station. As a popular decorative form with inherent acoustical benefits, the coffered ceiling is seen across the United States in many large public spaces such as theaters, courthouses, railroad stations, and hotels (see Fig. 9).

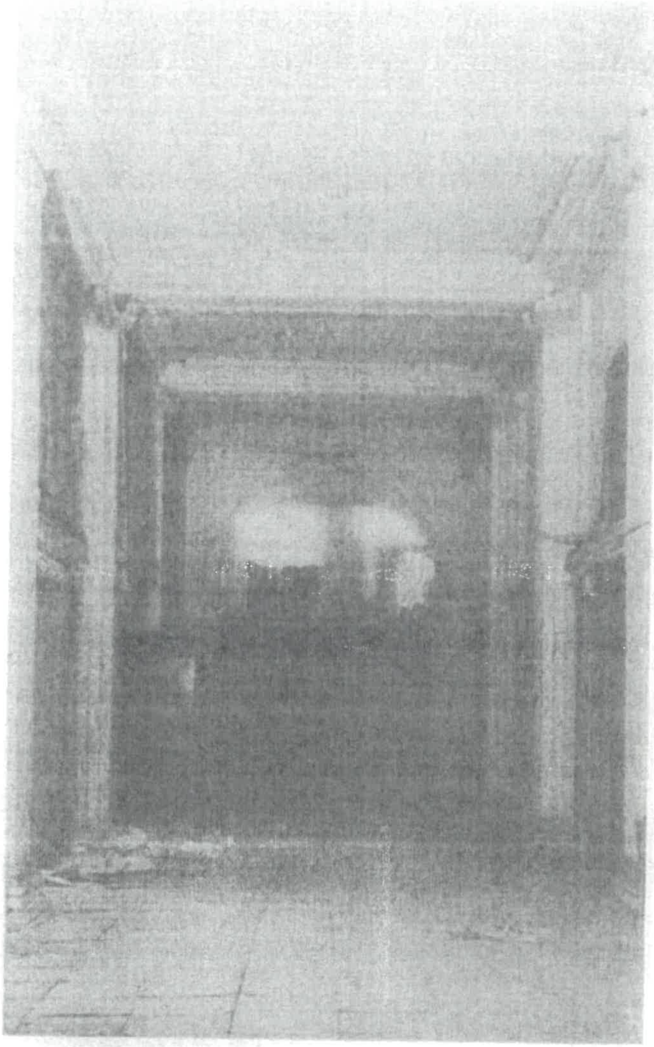


Fig. 13. Water intrusion and freeze/thaw cycles caused extensive efflorescence and ornamental plaster failure. The plaster needed almost total replacement within the rehabilitation project. Photo: Commercial Photographics.

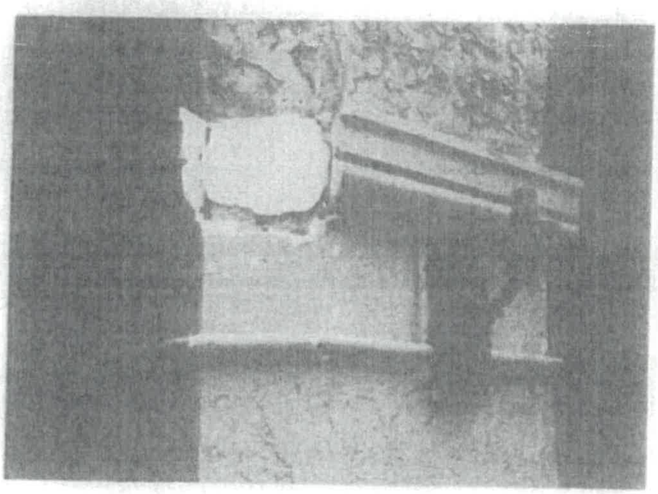


Fig. 14. A mitered portion of this impost capital abacus has fallen, revealing the plaster adhesive material. Repairs are made by obtaining a section through the abacus, making a bench-run length, cutting, fitting, and readhering the missing piece. Finally, the joints are pointed. Photo: Lee H. Nelson, FAIA.

In addition, keying and adhesive properties may be further jeopardized by **weak original mixes** (see Fig. 14) that were improperly applied. Substrate failure typically results from **faulty lathing or rusty lath nails**, causing ceilings to fall. In the 20th century, **vibration** from heavy vehicular traffic, nearby blasting, and even repeated sonic booms may contribute to damaging ornamental plaster. **Inadequate support** in an original design may also be to blame when particularly heavy units have simply broken off over time (Fig. 15). Finally, new mechanical systems, suspended ceilings and partition walls insensitively installed in adaptive use projects, show little regard for the inspired decorations of earlier periods (see Fig. 16).

Repairing and Replacing. Plaster failure is a matter of degree. For example, top coat failure can be repaired by

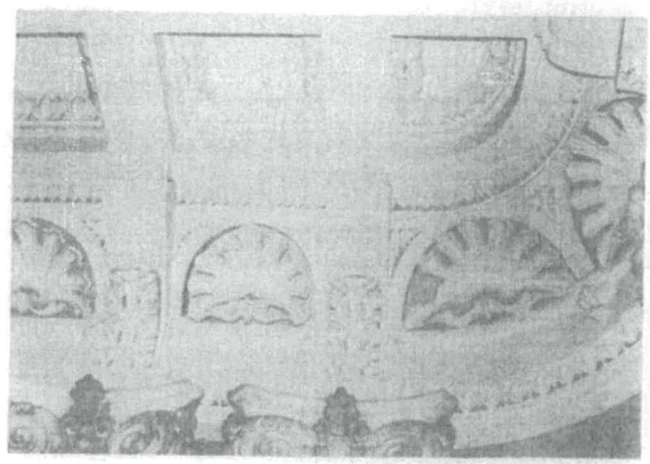


Fig. 15. U. S Treasury Cash Room, Washington, D.C. c. 1830. Designed by Robert Mills in the Greek Revival style, the unreinforced shell flutes most likely broke as a result of their weight. As part of an overall restoration of the room, the broken parts were molded on site, recast, then re-attached using wooden strips to pin them in place. Photo: Laurie R. Hammel.

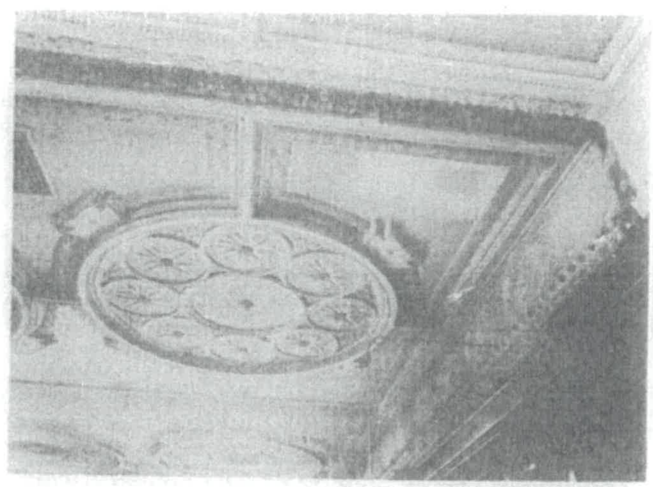


Fig. 16. The Auditorium Building, Chicago, Illinois, 1889, by Louis Sullivan. Earlier insensitive alterations were removed prior to restoration of the room. In the photo, a partition wall has already been removed; the electrical conduit and a ventilation grille followed. Plaster patching and painting were the final steps of restoration work. Photo: National Park Service files.

Molding Rubber. Familiarity with contemporary molding rubbers is desirable. There are several formulations currently on the market. In the past, flexible molds were made with hide glue melted in a double boiler and poured over plaster originals which had been prepared with an appropriate parting agent. Of the newer rubbers, latex (painted on the model coat by coat) is time consuming and has little dimensional accuracy, polysulfide distorts under pressure; and silicone is needlessly expensive. Urethane rubber, with a 30-durometer hardness, is the current choice. Urethanes are manufactured as pourable liquids and as thixotropic pastes so that they can be used on vertical or overhead surfaces. The paste is especially useful for onsite impressions of existing ornament; the liquid is best used in the shop much as hide glue or gelatin was historically. Urethane rubber has the ability to reproduce detail as fine as a fingerprint and does not degrade during most ornamental plaster projects. No flexible molding material lasts forever, so spare casts should be maintained for future remolding.

Molding Plaster. Molding plaster will also be in evidence; it is the product most similar to that used historically. This plaster is finely ground to accept the detail of the rubber molds, not so hard as to prohibit tooling, and combines readily with finish lime. High-strength plaster is available in varying densities, some with added components for specific purposes. Most shops maintain these varieties, but use molding plaster for typical work.

Sheet Metal Templates. The contractor's familiarity with sheet metal is critical. Accurate template blades are required to reproduce both straight and curved sections of moldings (see Fig. 3, above). The blades must be carefully cut, filed, and sanded in order to form exact reproductive units. A tour of a sizeable shop will include observation of running techniques and the results of this activity should be much in evidence. Regardless of size, these runs should be smooth and true when made by qualified craftsmen.

Models. Models, whether of capitals, cornices, medallions or cartouches, are made as whole units or in parts depending on project demands. Completeness, accurate dimensions, and attention to historic styles are essential ingredients of successful models. Each part of a model has a name, i.e., dentil, guilloche, rinceau or bolection molding, modillion, egg and dart, and the designers and restorers of these ornaments should know their names. Failure to identify these parts correctly should be of concern to a prospective client.

Molds. Molds are "negative forms" produced from completed models. Simple flood molds require a separator or barrier coat over the original and a surrounding fence to prevent the liquid rubber from leaking out. Larger or more complicated molds are made in pieces or with a layer of rubber supported by a plaster shell or mother mold attached to a wooden or metal frame. Following completion of a successful mold, the original model is discarded because it is now possible for it to be accurately reproduced.

Casting the Molds. Casting operations should appear clean and efficient. A skillful caster's output can be voluminous and often looks effortless as it is being produced. Raw materials are close at hand, molds are rarely without curing plaster in them, production is stored so as not to warp while it is still wet and each cycle, from mixing to pouring, setting, and demolding is accomplished so as not to waste time or break plaster casts. A good caster generally obviates the need for a finishing department.

Two other aspects should be noted. Shipping facilities are critical to move the product to the restoration site safely. Drawing and design space should be separate from the production floor. In summary, the modern ornamental plaster shop inevitably looks quite different from that pictured earlier in this Preservation Brief (see Fig. 1, above), but, with the exception of contemporary tools and materials, the operations are the same. The following sections discuss how repairs are made by today's plaster tradesmen.

Repairing Historic Ornamental Plaster

Cornice. A plain run or ornamented plaster cornice which has undergone damage or severe deterioration can often be repaired. Footage which is beyond repair should be identified and be carefully demolished to expose the underlying structure beneath to which the molding was secured. To replace the missing lengths, the first step is to obtain a cross-section, or profile, through the cornice from finish ceiling to finish wall lines. This is best accomplished using one of these methods:

1. A section through the cornice may be determined by sawing through the molding, inserting a sheet metal blank in the slot and tracing the profile directly on the template. This is considerably more accurate than the profile gauge, but will require repointing the saw kerf; alternatively, the cut may be made on one of the deteriorated pieces, provided it was removed as an intact unit.

2. The section may be obtained by making a thixotropic rubber impression of the molding, casting the result in fresh plaster and sawing through the cast to transfer the cross-section to a sheet metal template.

With the section determined, it is drawn onto 22-gauge galvanized sheet metal, cut with tin snips and carefully filed to the line. The template is checked periodically against the original profile to assure a perfect match. With the template blade finally complete, it is nailed to stock and slipper (see Fig. 3, above), ready for running the replacement footage.

Short lengths of new cornice are best run on a bench using gypsum and lime; the reproduction molding should be somewhat longer than the required length (see Fig 18). The new footage is cut and fit in place to match the existing cornice, then securely countersunk-screwed to studs, joists and/or blocking. The resulting joints are pointed with flat mitering rods, flush with adjacent members (see Fig. 5, above).

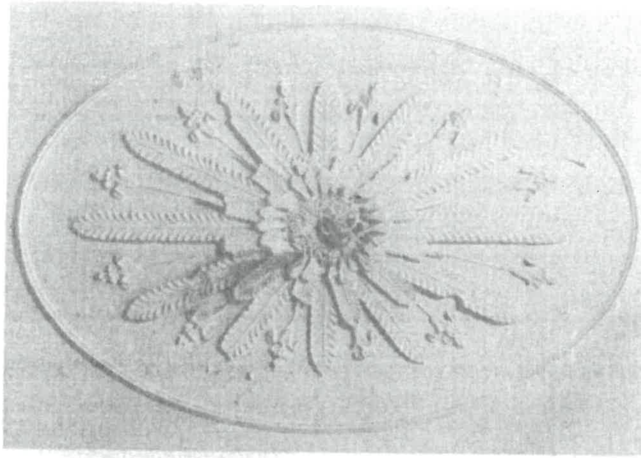
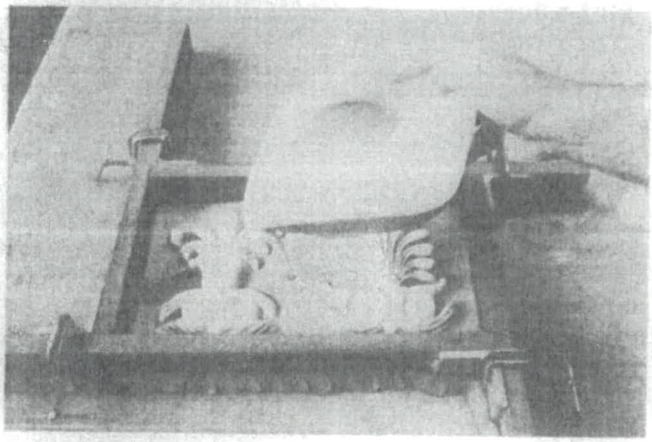


Fig. 19. Ceiling medallions may need repair or replacement. The ornamental plasterer takes impressions of the existing plaster, then casts new plaster elements. Adhesive plaster is used to reattach the new pieces. Left: Damaged elliptical medallion from Rockland, Fairmount Park, Philadelphia, Pennsylvania. Photo: David Flaharty. Right: Fragments of a medallion from the Bennett House, Charleston, South Carolina. The fragments serve as documentation for the replacement medallion. Photo: Peter Sanders.



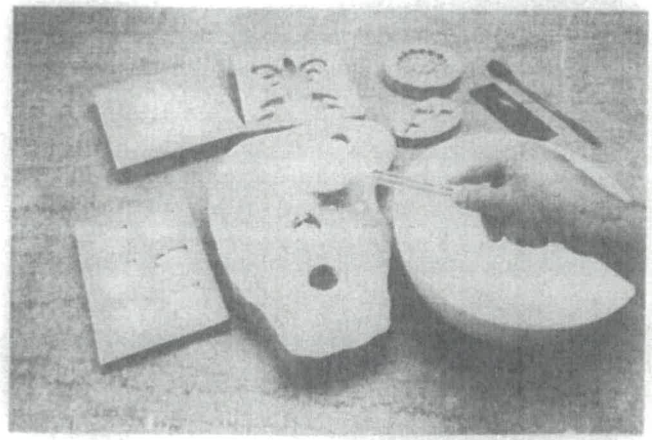


Fig. 20. Repairing a Medallion. Left: The plaster models shown are first lathered with a parting agent (liquid soap). To make a flood mold, urethane rubber is poured between wood fences clamped together and dammed with clay. Right: Casting plaster is then spooned into the two-part urethane mold. The mold showing six ornaments in the process of being cast is called a "gang mold." The others are simply single molds. Photos: David Flaharty.

Historic lighting fixtures often hung from elaborate ceiling medallions. When these fixtures were later converted to gas and electrical service, the central ornamental plaster canopies were sometimes damaged by insensitive tradesmen. More recent adaptive use projects may have caused additional damage.

Damaged ceiling medallions (see Fig. 19a) can be repaired by carefully removing representative plaster ornamentation, molding and recasting in the shop (see Fig. 20) and replacing the new enrichments so that they align perfectly with the original pattern. Polyvinyl acetate bonding agents are applied to the background and ornament so that the adhesive plaster grips tightly. Alternatively, a severely damaged medallion (see 19b) can be replaced using the fragments as physical documentation to cast a visually accurate replacement.

Sections of plain-run circular molding may also be repaired by determining a section through the run and the radius from molding to pivot point. As with cornices, the run should be made on a bench to a length greater than required, then cut and fit in place. Circular run sections are installed using plaster adhesives on bonded surfaces or modern construction adhesives after referring to manufacturers' instructions as to whether the adhesive is recommended for use on wet or dry materials. Coarse-threaded, galvanized screws are often countersunk to aid the bond; if possible, the screws should be inserted at points that will ultimately be covered with cast enrichments.

Ceiling medallions frequently appear in matching double parlors. It is not unusual for one ceiling to fail while its mate remains undamaged. The flat plastered ceiling over the location of the missing medallion often has a "ghost," confirming that a ceiling medallion once ornamented the parlor. The missing medallion may be remanufactured by securing a section, dimensions, and samples of cast enrichments from the surviving ornament and accurately following the original procedure (see Fig. 7, above). The ceiling on which the new work is to be set should be examined for its soundness and, if necessary, relathed (with self-furring metal lath) and or developer should secure the services of a reputable restoration contractor before proceeding further. It is clear as more and more projects are undertaken, that there is a wide disparity of skills within the trade today. This is partly due to the introduction of gypsum board as a substitute for traditional plastering. As gypsum board became popular after World War II, plasterers saw the demand for their skills decline. Plastering techniques were forgotten because they were often not passed down within shops and families. However, ornamental plaster studios have seen a resurgence in demand for their services in the last decade, particularly as more historic buildings are rehabilitated (see Fig. 24).

Locating an experienced contractor who is suitable for your **particular project** is the goal. First, many professional preservation organizations can provide references for suitable restoration contractors. Local plasterers' unions should also be able to identify contractors with experience in ornamental plaster restoration projects. Architects with preservation and restoration project experience may recommend contractors they feel have done a good job for them in the past. Museums with period rooms have engaged craftsmen to assemble the backgrounds for display of antique furniture and decorative arts. Finally, historical societies, either national, state, or municipally organized, may have funded projects which repaired and restored ornamental plaster.

Once several contractors have been identified, their specific abilities need to be evaluated. Prospective contractors should be invited to visit the job site to see and define the scope of work; written proposals, including prices, from all bidders, are essential for comparison. References should be provided and investigated. An outside consultant may be engaged or an informal adviser designated to aid in evaluating the experience and proposals of the bidders. To get a total picture, a completed project should ideally be visited by the prospective client with the contractor present to answer questions which often arise.

Finally, although this may not always be achievable, the bidder's studio may be visited, preferably on a normal working day (see **A 20th Century Shop Tour,** above.) Alternatively, the bidder may be visited while working onsite. Some ornamental plasterers simply do not have shops. They prefer to cast onsite, adhering the casts while the plaster is wet, and coordinating the job closely with the architect, who inspects each unit as it is cast and before it is installed.

Conclusion

Decorative plasterwork is usually a component of the historic character of interiors and, consequently, *The Secretary of the Interior's Standards for Historic Preservation Projects* call for its protection, maintenance, and repair. Where decorative plasterwork has deteriorated beyond repair, it should be replaced to match the old. Based on physical documentation, both repair and replacement can be accomplished using traditional molding plaster

Fig. 24. This plaster studio is well organized, with ample work space. Note the plaster casts hanging neatly on the wall. Photo: Berry and Homer, Philadelphia.

and casting procedures, together with the best of the modern molding materials available. Once a "lost art" after the Depression years, the skills of today's ornamental plasterers are increasingly in demand as part of historic preservation project teams. The ingenious and inspired decorative work created by our earlier architects and artisans can now be assured an extended life.