HURST-ROSCHE, INC.

CONTRACT DOCUMENTS

and

ADMINISTRATIVE SPECIFICATIONS

RENOVATION
SESSER OPERA HOUSE
PO BOX 517
302 W. FRANKLIN AVE.
SESSER, FRANKLIN COUNTY, ILLINOIS

Prepared for

City of Sesser
302 West Franklin Street
Sesser, Illinois 62884

Prepared by

Hurst-Rosche, Inc.
5 Bank Square
East St. Louis, Illinois
H-R 860-3192

February 2, 2024
(issued for bid)

Bid Package No. _____

DOCUMENT 000110 - TABLE OF CONTENTS
(issued for bid)
RENOVATION
SESSER OPERA HOUSE
PO BOX 517
302 W. FRANKLIN AVE.
SESSER, FRANKLIN COUNTY, ILLINOIS
HR # 860-3192

Section Title

PROCUREMENT AND CONTRACTION REQUIREMENTS GROUP
DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS
INTRODUCTORY INFORMATION

PROCUREMENT REQUIREMENTS

CONTRACTING REQUIREMENTS

SPECIFICATIONS GROUP
GENERAL REQUIREMENTS SUBGROUP
DIVISION 01 - GENERAL REQUIREMENTS

END OF SECTION

DOCUMENT 001116 - INVITATION TO BID

Project: **RENOVATION**
SESSER OPERA HOUSE
PO BOX 517
302 W. FRANKLIN AVE.
SESSER, FRANKLIN COUNTY, ILLINOIS
HR # 860-3192

Owner: **CITY OF SESSER**
302 WEST FRANKLIN STREET
SESSER, ILLINOIS 62884

Architect/Engineer: **HURST-ROSCHE, INC.**
5 BANK SQUARE
EAST ST. LOUIS, ILLINOIS 62203

Date: **April 1, 2024**

The Owner will receive Bids until 10:30 AM local prevailing time on April 24, 2024, at the office of Hurst-Rosche, Inc., 5 Bank Square, East St. Louis, Illinois 62203 for the following work:

SCOPE OF WORK: Portions of this work shall comply with U.S. Department of the Interior, National Park Service Cultural Resources Heritage Preservation Services Briefs. This Work is highlighted with **bold type** in the following package descriptions.

Furthermore, Work is divided into the following bid packages.

Package 1 – Exterior Restoration
Base Bid – Roof restoration (installation of additional rigid insulation substrate and limited replacement, replacement of prefinished metal gutters, & new sheet metal flashing and accessories.), replacement of roof clearstory windows, **repair / replacement terra cotta parapet cap, façade restoration, and tuckpointing**.

Package 2 – Mechanical
Base Bid – Replace HVAC equipment (including RTUs, a furnace, & condensing unit).
Alt Bid A – replace standpipe and valves for Fire Protection

Package 3 – Interior finishes
Base Bid – **theater area walls, ceiling, foyer, light fixtures.**
Alt Bid A – **stage and backstage finishes, cleaning, painting, & stage curtain**

Package 4 – Doors and windows
Base Bid – **clean & repair existing windows**
Alt Bid A – **clean & repair existing doors & hardware**, replace 2 existing HM doors.

A non-mandatory Pre-bid walk through will be held on April 8, 2024, at 9:00 AM, prevailing time at the project site, 106 West Franklin Street, Sesser, Illinois 62884. Attendance is recommended but not mandated.

The successful bidder shall enter into the Project Labor Agreement (Section 00 52 15 of the Contract Documents) with the Egyptian Building and Construction Trades Council (EBTC) and their affiliated local craft unions, for all work as included within these drawings and specifications as a condition of being awarded a contract resulting from this solicitation. Any levels of Subcontractors shall enter into the same Project Labor Agreement.

Drawings and specifications will be available as of April 1, 2024 for viewing on the internet at: www.hurst-rosche.com. The documents are being provided for reference purposes only. Bidders must obtain clean copies of bid forms from the offices of Hurst-Rosche, Inc. by paying a non-refundable amount of $10.00 to submit a bid for this project.
.

Bidding Documents, Drawings and Specifications, may be examined by prospective pre-qualified bidders and material suppliers at the offices of Hurst-Rosche, Inc., 5 Bank Square East St. Louis, Illinois, and the following Plan Rooms:

Southern Illinois Builders Association
1468 Green Mount Road
P.O. Box 1390
O'Fallon, Illinois 62269

The Owner requires the Project to be substantially complete within 90 calendar days following issuance of Notice to Proceed.

Bidders will be required to provide Bid security of a sum no less than 5 percent of the Bid Price. The bid security shall be either certified check, cashier's check, bank money order or bid bond issued by surety licensed to conduct business in the State of Illinois. Hereinafter this bid security shall be referred to as the bid bond.

Submit two copies of your Bid on the Bid Form provided. Your Bid will be required to be submitted under a condition of irrevocability for a period of 30 days after submission.

The Owner reserves the right to accept or reject any or all Bids or any part thereof, to waive any informality in bidding, and to accept bids deemed most favorable to the Owner.

The Architect's services terminate following the opening of bids and recommendation of award. The Owner / City will administer the award of Contract for Construction and Construction.

CITY OF SESSER

JASON ASHMORE, MAYOR

END OF DOCUMENT

DOCUMENT 002114 - INSTRUCTIONS TO BIDDERS - AIA

1.1 SUMMARY

A. Document Includes:
1. Instructions to Bidders.
2. Site examination.
3. Prebid conference.

B. Related Documents:
1. Document 001116 - Invitation to Bid.
2. Document 004113 - Bid Form - Stipulated Sum.
3. Document 004300 - Procurement Form Supplements: Appendices A and B.
4. Document 007214 - General Conditions – AIA Stipulated Sum.
5. Document 007313 - Supplementary Conditions – AIA.

1.2 INSTRUCTIONS TO BIDDERS

A. **The Architect's services terminate with the following the opening of bids and recommendation of award. The Owner / City will administer the award of Contract for Construction and Constructio**.

B. These Instructions to Bidders amend or supplement AIA Document A701-1997 - Instructions to Bidders and other provisions of Bidding Documents and Contract Documents.

C. To be considered all bids must be in accordance with these Instructions to Bidders.

D. For those interested parties, drawings and specifications will be available as of April 1, 2024 for viewing & download on the internet at: www.hurst-rosche.com. Bidders must obtain clean copies of bid forms from the offices of Hurst-Rosche, Inc. by paying a non-refundable amount of $10.00 to submit a bid for this project.

1.3 SITE EXAMINATION

A. Bidders shall carefully examine documents and construction site to obtain first-hand knowledge of existing conditions. Contractors will not be given extra payments for conditions which can be determined by examining site and these documents.

B. A visit to Project site has been arranged for Bidders on April 8, 2024.

1.4 THE SCHEDULE FOR BIDDING THIS PROJECT IS AS FOLLOWS

A. Plans Available: **April 1, 2024**

B. Pre-Bid walk through: **April 8, 2024**
9:00 AM
106 West Franklin St.
Sesser, IL 62884

C. **Latest Time to Submit Request for Interpretation:** **April 16, 2024**

Latest Time to Issue an Addendum: **April 19, 2024**

D. **Bid Opening** **April 24, 2024**
10:30 AM
Hurst-Rosche, Inc.
5 Bank Square
East St. Louis, IL

E. All requests for interpretations shall be in writing via mail or e-mail addressed to the Architect/Engineer. All questions must be submitted on the "Request for Interpretation Pre-Bid Question and Comment Form" included at the end of this section, and questions not submitted in accordance with this form and specified time frame will not be accepted. Any and all interpretations and supplemental instructions will be made by addendum to the Drawings and Specifications and forwarded to all bidders either by mail or e-mail transmittal. All responses by the Architect/Engineer must be in writing to be binding. Any response general in nature or affecting these Instructions to Bidders shall be sent via addendum as previously described. All bidders are required to return the signature page of the addendum signed to the Architect within 24 hours after receipt. Failure of any bidder to receive any such addendum or interpretations shall not relieve such bidder from an obligation under the bid as submitted. All addenda so issued shall become part of the Contract Documents. Oral interpretations, changes or corrections will not be binding and Bidders shall not rely upon such interpretations, changes and corrections. Each Bidder shall ascertain prior to submitting Bid that all addenda issued have been received and shall acknowledge receipt in Bid.

Questions shall be directed to:
e-mail: jnold@hurst-rosche.com

F. Materials, products and equipment described in Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Each such request shall include name of material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment or other work that incorporation of the substitute would require shall be included. The burden of proof of the merit of proposed substitute is upon the proposer. Architect's decision of approval or disapproval of a proposed substitution shall be final. If the Architect approves any proposed substitution prior to receipt of Bids, such approval will be set forth in an addendum. Bidders shall not rely upon approvals made in any other manner. No substitutions will be considered after the contract award unless specifically provided in the Contract Documents.

G. Bids shall be made on unaltered Bid Forms furnished by the Architect. Fill in all blank spaces and submit two (2) copies. Bids shall be signed with name typed below signature. Where bidder is a corporation, bids must be signed with legal name of corporation followed by name of state of incorporation and legal signature of an officer authorized to bind the corporation to a contract.

H. Each bidder submitting a bid shall submit on form provided a list of any subcontractors he proposes to use with the bid. Failure to do so could disqualify the bid.

I. Each bidder shall designate on the attached bid form one person who shall serve as the bidder's contact person for all matters pertaining to the bid. In absence of such designation, the person who signs the bid shall be deemed the bidder contact.

J. Each bid shall be accompanied by bid bond made payable to the Owner, in the amount of five percent (5%) of the bid price. Security shall be either certified check, cashier's check, bank money order or bid bond issued by surety licensed to conduct business in the State of Illinois. Successful bidder's security will be retained until he has signed the contract and furnished required payment and performance bonds. Owner reserves the right to retain security of the next two (2) lowest bidders until the lowest bidder enters into contract or until thirty (30) days after bid opening, whichever is shorter. All other bid security will be returned as soon as practicable. If any bidder refuses to enter into a contract, Owner will retain bid security as liquidated damages, but not as a penalty.

K. All costs associated with the preparation and submission of a bid are the sole responsibility of the bidder. These costs shall not be chargeable to the Owner by any successful or unsuccessful bidder. All bids become the property of the Owner and shall not be returned except in the case of a late submission.

L. Simultaneously, with delivery of the executed contract, the successful bidder, at its own expense, shall furnish surety in the form of a performance bond and a labor and material payment bond in the amount of one hundred percent (100%) of the contract amount. Surety for such bonds shall be a company duly authorized and licensed in the State of Illinois and acceptable to the Owner. The Attorney-In-Fact who signs bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

M. All copies of the bid, bid security and any other documents required to be submitted with bid shall be enclosed in a sealed opaque envelope. Envelope shall be addressed to the **City of Sesser, c/o Hurst-Rosche, Inc., 5 Bank Square, East St. Louis, Illinois 62203** and shall be identified with project name, bidder's name and address. Mailed bid envelopes shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof. Oral, telephonic or telegraphic Bids are invalid and will not receive consideration. Bids shall be deposited at the location designated in the Invitation to Bid prior to time and date designated for opening, or any extension thereof made by addendum. Bidder shall assume full responsibility for timely delivery at location designated for receipt of Bids. Bids received after time and date for receipt of bids will be returned unopened.

N. A bid may not be modified, withdrawn or canceled during the thirty (30) days immediately following bid opening, and each bidder so agrees in submitting his Bid. Any bidder may withdraw, cancel or modify its bid, at any time prior to scheduled time

for opening of bids, by letter or telegram actually received by Owner prior to bid time, or, with proper identification, by personally securing bid submitted; if by telegram, written confirmation over signature of bidder shall be mailed and postmarked on or before date and time of bid opening. Withdrawn bids may be resubmitted up to bid opening time provided that they are in full compliance with these Instructions to Bidders.

O. Protests

1. Any bidder who submitted a bid and believes the bid was improperly rejected or that the bid selected by the Owner is not in the best interest of the Owner may submit a written notice of intent to protest the bid to the Owner within seven (7) days. The Owner shall consider all protests before execution of a contract. Each protest must specify the reasons supporting the protest. The Owner may require that additional information be provided. Failure to supply such required information shall be cause for dismissal of the protest.
2. The Owner shall immediately investigate the allegations against the Owners actions and shall issue a written response to the protest.
3. This provision allowing for the submission of protest shall not confer any right on any bidder but is intended solely to assist the Owner in determining the best responsible bid.

P. Any complaint or protest of the bidding procedure must be filed by the bidder to the Owner. Within 7 days of bid opening the bidder shall notify the Owner in writing of his intent to protest bidding. The bidder shall perfect this notice of intent within 7 days.

Q. Owner reserves right to disqualify bids and bidders, before or after opening, upon evidence of collusion with intent to defraud or other illegal practices upon part of bidder, lack of responsibility as evidenced by poor workmanship and progress of past work, incomplete work which, in judgment of Owner, might hinder or prevent prompt completion of additional work if awarded, for being in arrears on existing contracts, in litigation with the Owner, or having defaulted on a previous contract.

R. Bidder's attention is directed to the fact that all Federal and Illinois State Laws, municipal ordinances and regulations of any and all authority having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the contract the same as though herein written out in full. Successful Bidders shall be required to comply with 775 ILCS 10 concerning equal employment opportunities; comply with 30 ILCS 570 concerning the employment of citizens of the State of Illinois; comply with 820 ILCS 265 concerning substance abuse prevention on public works projects; and comply with 820 ILCS 130 concerning prevailing wages and the Davis-Bacon Wage Act (40 USC 276a through 276a-5) as defined by the United States Department of Labor..

S. Any successful bidder that is a corporation organized in a state other than Illinois shall furnish to the Owner, upon request, a properly certified copy of its current Certificate of Authority to do business in the State of Illinois, such certificate is to remain on file with the Owner.

T. Any successful bidder that is a corporation organized in the State of Illinois shall furnish at its own cost to the Owner, if requested, a Certificate of Good Standing issued by the Secretary of State, such certificate is to remain on file with the Owner.

U. Owner is exempt from payment of Illinois Department of Revenue's Use and Sales Tax on material entering permanently into structure.

V. Bids will be opened as announced in Invitation for Bids.

W. Owner reserves the right to reject any or all bids or any part thereof, to waive any informalities in bidding and to accept bids deemed most favorable to the Owner.

X. Notwithstanding any delay in preparation and execution of the formal Contract Agreement, each bidder shall be prepared, upon written notice of bid acceptance, to commence work within ten (10) days following receipt of official written Notice to Proceed, or on date stipulated in such notice.

Y. Any work in providing or preparing to provide the services specified herein that is commenced by the successful bidder prior to execution of a written contract agreement shall be at the bidder's expense.

Z. Accepted bidder shall assist and cooperate with the Owner in preparing the formal Contract Agreement, and, within fifteen (15) days following its presentation, shall execute same and return it to Owner.

AA. The Owner requires the Project to be substantially complete within 120 calendar days following issuance of Notice to Proceed.

END OF DOCUMENT

H-R Project No.: 860-3192

Hurst-Rosche, Inc. E-mail:
jnold@hurst-rosche.com

REQUEST FOR INTERPRETATION PRE-BID QUESTION AND COMMENT FORM

(All information entered shall be typed in black).

PROJECT NAME: Renovation of Sesser Opera House, 106 West Frankllin St., City of Sesser, Illinois

BIDDER: SUBMITTED BY (Name): Date:

ADDRESS: CITY: STATE: PHONE: Sheet of

Question No.	Page (or Drawing Sheet) Number	Drawing No. or Spec. Section Article & Paragraph Number	Question by Bidder

NOTE: ***ANY AND ALL QUESTIONS PERTAINING TO THIS BID MUST BE TYPED AND SUBMITTED ON THIS FORM AND MAILED OR E-MAILED TO RECEIVE A RESPONSE.***

END OF SECTION 002114.

DOCUMENT 004113 - BID FORM - STIPULATED SUM

To: **CITY OF SESSER**
302 WEST FRANKLIN STREET
SESSER, ILLINOIS 62884

Project: **RENOVATION**
SESSER OPERA HOUSE
PO BOX 517
302 W. FRANKLIN AVE.
SESSER, FRANKLIN COUNTY, ILLINOIS
HR # 860-3192

Date: _____

Submitted by: _____
(full name)

(full address) _____
_____
_____

Contact Name: _____

1. OFFER

(Portions of this work shall comply with U.S. Department of the Interior, National Park Service Cultural Resources Heritage Preservation Services Briefs. This Work is highlighted with **bold type** in the following package descriptions.

Package 1 – Exterior Restoration
Base Bid – Roof restoration (installation of additional rigid insulation substrate and limited replacement, replacement of prefinished metal gutters, & new sheet metal flashing and accessories.), replacement of roof clearstory windows, **repair / replacement terra cotta parapet cap, façade restoration, and tuckpointing:**
Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by Hurst-Rosche, Inc., Architect/Engineer for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of _____ dollars, ($_____), in lawful money of the United States of America.

Package 2 – Mechanical
Base Bid – Replace HVAC equipment (including RTUs, a furnace, & condensing unit):
Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by Hurst-Rosche, Inc., Architect/Engineer for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of _____ dollars, ($_____), in lawful money of the United States of America.

Package 3 – Interior finishes
Base Bid – **theater area walls, ceiling, foyer, light fixtures**
Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by Hurst-Rosche, Inc., Architect/Engineer for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of _____ dollars, ($_____), in lawful money of the United States of America.

Package 4 – Doors and windows
Base Bid – **clean & repair existing windows:**
Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by Hurst-Rosche, Inc., Architect/Engineer for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of _____ dollars, ($_____), in lawful money of the United States of America.

We have included the security Bid Bond as required by the Instruction to Bidders.

All applicable State of Illinois and City of Sesser taxes are excluded from the Bid Price.

2. REVIEW OF BID DOCUMENTS

The bidder represents that he is skilled and experienced in the use and interpretation of drawings and specifications such as those included in the bid documents for this contract. He has carefully reviewed the drawings, specifications and other bid documents, and has found them free of ambiguities and sufficient for bid purposes. Further, the Bidder has carefully examined the site of the work and, from his own observations, has satisfied himself as to the nature and location of the work; the character, quality and quantity of materials; the difficulties likely to be encountered; and any other items which may affect the performance of the Work. He has based his bid solely on these documents and observations, and has not relied in any way on any explanation or interpretation, oral or written, from any other source.

3. CONTRACTOR'S FEE FOR CHANGES IN WORK

Undersigned herein indicates a single percentage, not to exceed 12% for own forces and not to exceed 8% for subcontractors, for overhead and profit to be added to net extra job cost for changes in the work required to be performed by:

a) Own Forces ___% b) Subcontractors ___%

Undersigned herein indicates a single percentage, not less than 10% for own forces and not less than 5% for subcontractors, for overhead and profit to be added to net credit for job costs for changes in the work required to be performed by:

a) Own Forces ___% b) Subcontractors ___%

Percentages named above shall not include any items of insurance, bond or taxes since these are considered job cost items in contractor's quotations for changes in the work.

Any percentages indicated which are higher or lower than the maximum or minimum in the typewritten language herewith, shall be disregarded and typewritten figure used.

4. CONTRACT TIME

Undersigned agrees that, if awarded the Contract for Work bid upon herein, work will start on date designated in a written Notice to Proceed order issued by the City and will be completed in accordance with the contract documents, with all phases of work completed and operational and ready for acceptance by the Owner no later than as required by the Contract Agreement.

5. ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Price.

Addendum # _____ Dated _____; Addendum # _____ Dated _____
Addendum # _____ Dated _____; Addendum # _____ Dated _____

6. APPENDICES

The following documents are attached to and made a condition of the Bid:

Document 004300 - Procurement Form Supplements including:
Appendix A - List of Subcontractors.
Appendix B – List of Alternates

7. EQUAL EMPLOYMENT OPPORTUNITY

During performance of this contract, Contractor agrees as follows:

a. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

b. The contractor will in all solicitations or advertisements for employees placed by or on

behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

c. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract of understanding, notice advising the labor union or worker's representative of the contractor's commitments under Section 202 of Executive Order 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

d. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and by the rules, regulations, and relevant orders of the Secretary of Labor.

e. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by the rules, regulations, and order of the Secretary of Labor pursuant thereto, and will permit access to his books, records and accounts by the Department of the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.

f. In the event of the contractor's non-compliance with the nondiscrimination clauses of this contract or with any such rules, regulations or orders, this contract may be canceled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies involved as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

g. The contractor will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the Department may direct as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that in the event the contractor becomes involved in, or is threatened with, litigation with the subcontractor or vendor as a result of such direction by the Department, the contractor may request the United States to enter into such litigation to protect the interest of the United States.

8. NOT BARRED

The contractor by submitting its bid certifies that the Contractor is not barred from bidding on the contract as a result of a conviction for either bid-rigging or bid-rotating. 720 ILCS 5/33/E-11.

9. DRUG FREE WORKPLACE

The Contractor by submitting its bid certifies that it will provide a drug free workplace and that it is in compliance with the requirements of the Drug Free Workplace Act 30 ILCS 580.1 et. seq., and the Substance Abuse Prevention on Public Works Projects Act PA095-0635.

10. SEXUAL HARASSMENT POLICY

The Contractor by submitting its bid certifies that it has a written sexual harassment, (ii) a description of sexual harassment, utilizing examples; (iv) an internal complaint process including penalties (v) the legal resource, investigative and compliant process through the Illinois Department of Human Rights: (vi) directions on how to contact the Department and Commission; and (vii) protection against retaliation for exercising rights under the policy in accordance with 775 ILCS 5/2-105(A)(4).

11. DEBARMENT AND SUSPENSION

Contracts funded with Federal grant monies may not be awarded to contractors that have been debarred or suspended from receiving Federal monies pursuant to the Federal Excluded Parties List System.

12. BYRD ANTI-LOBBYING AMENDMENT

Contractors that apply or bid for an award of $100,000 must certify that they have not used Federal funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award.

13. BID FORM SIGNATURES

The Corporate Seal of

_____

(Bidder - print the full name of your firm)
was hereunto affixed in the presence of:

_____

(Authorized signing officer Title)

(Seal)

_____

(Authorized signing officer Title)

(Seal)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

END OF DOCUMENT

DOCUMENT 004300 - PROCUREMENT FORM SUPPLEMENTS

To: **CITY OF SESSER**
302 WEST FRANKLIN STREET
SESSER, ILLINOIS 62884

Project: **RENOVATION**
SESSER OPERA HOUSE
PO BOX 517
302 W. FRANKLIN AVE.
SESSER, FRANKLIN COUNTY, ILLINOIS
HR # 860-3192

Date: _____

Submitted by: _____
(full name)
(full address) _____
_____
_____

Contact Name: _____

In accordance with Document 002114 - Instructions to Bidders - AIA and Document 004113 - Bid Form - Stipulated Sum, we include the Appendices to Bid Form Supplements listed below. The information provided shall be considered an integral part of the Bid Form.

The following Appendices are attached to this document:

Appendix A - List of Subcontractors: Include names of all Subcontractors and portions of the Work each Subcontractor will perform

Appendix B - List of Alternates: Include cost variation to Bid Sum applicable to the Work described in Section 01 20 00 - Price and Payments.

BID FORM SUPPLEMENTS SIGNATURES

The Corporate Seal of

_____
(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

_____
(Authorized signing officer Title)

(Seal)

_____
(Authorized signing officer Title)

(Seal)

APPENDIX A - LIST OF SUBCONTRACTORS

Herewith is the list of subcontractors referenced in the bid submitted by:

(Bidder) _____

To (Owner) CITY OF SESSER

Dated _____ and which is an integral part of the Bid Form.

The following work will be performed (or provided) by subcontractors and coordinated by us:

WORK SUBJECT	NAME

APPENDIX B - LIST OF ALTERNATES

The following is the list of alternates referenced in the bid submitted by:

(Bidder) _____

To (Owner) CITY OF SESSER

Dated _____ and which is an integral part of the Bid Form.

The following amounts shall be added to or deducted from the Bid Sum. Refer to Section 01 20 00 - Price and Payment Procedures. Schedule of Alternates for description of alternates.

Package 2 Alt Bid A (Add / Deduct) $_____

Package 3 Alt Bid A (Add / Deduct) $_____

Package 4 Alt Bid A (Add / Deduct) $_____

END OF DOCUMENT

DOCUMENT 005214 - AGREEMENT FORM - AIA

1.1 SUMMARY

A. Document Includes:
1. Contract Agreement.

B. Related Documents:
1. Document 007214 - General Conditions – AIA Stipulated Sum.
2. Document 007313 - Supplementary Conditions - AIA.

1.2 CONTRACT AGREEMENT BETWEEN OWNER AND CONTRACTOR

A. THIS AGREEMENT, made and entered into as of the _____ day of _____ in the year of Two Thousand and Twenty Three by and between _____ hereinafter and in the Contract Documents called "Contractor" and the CITY OF SESSER, hereinafter and in the Contract Documents called "Owner."

B. WITNESSETH: That for and in consideration of the mutual covenants and agreements, hereinafter stated, Contractor and Owner covenant and agree as follows:

C. THE CONTRACT WORK:

1. Contractor covenants and agrees to furnish all labor, materials, equipment, transportation, construction plant and facilities necessary to perform all Work required by the Contract Documents, for the Project entitled:

a. RENOVATION
SESSER OPERA HOUSE
PO BOX 517
302 FRANKLIN AVE.
SESSER, FRANKLIN COUNTY, ILLINOIS
HR # 860-3192

as shown on Drawings and described in Specifications prepared by Hurst-Rosche, Inc., acting as, and in these Contract Documents referred to as Architect/Engineer and covenants and agrees to do and perform all acts and things required of Contractor by this Contract and the Contract Documents.

D. TIME OF COMPLETION:

1. The Owner requires the Project to be substantially complete within 120 calendar days following issuance of Notice to Proceed.

E. CONTRACT SUM AND TERMS OF PAYMENT:

1. Contract Sum: The Owner, if Contractor shall faithfully fulfill and perform this Contract, covenants and agrees to pay Contractor in current funds, subject to additions and deductions by Change Order as provided in the Contract Documents, the sum of _____ ($_____), which sum

shall constitute the Contract Sum, said Contract Sum being derived from Contractor's Bid dated_____. It is understood and agreed that should there be any increase in wage rates, or in cost of materials or equipment, or in any other of Contractor's costs or should Contractor be compelled to pay premium wages, or for overtime work, during the life of this Contract and/or prior to completion of Contractor's work thereunder, Contractor shall absorb all such increased costs, without addition to the Contract Sum except when otherwise expressly provided in Contract Documents.

2. Payments: Owner shall make payments for work performed under the Contract as provided in Article Nine of the General Conditions and in accordance with other applicable articles of the Supplementary Conditions and Contract Documents.

3. Contractor's Fees for Changes in Work: In accordance with Contractor's bid, it is agreed that the following percentages for overhead and profit shall be applied on work added to or omitted from the Contract by written Change Order approved by Owner in advance of performance of the work.

Additional Work performed by:

1. Own Forces ____% 2. Subcontractors ___%

Omitted Work originally required by:

1. Own Forces ____% 2. Subcontractors ____%

Note: Taxes (when applicable) are considered as incidentals, as well as bonds and insurance costs and are not included in the percentages listed above nor should they be added to change orders submitted.

F. CONTRACT DOCUMENTS:

1. Contract Documents include the Contract Agreement, Contractor's Bid as accepted by Owner, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, and all Addenda issued prior to and all Modifications issued after execution of the Contract Agreement.

2. Bidder’s attention is directed to the fact that all Federal and Illinois State Laws, municipal ordinances and regulations of any and all authority having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the contract the same as though herein written out in full. Successful Bidders shall be required to comply with 777 ILCS 10 concerning equal employment opportunities; comply with 30 ILCS 570 concerning the employment of citizens of the State of Illinois; comply with 820 ILCS 265 concerning substance abuse prevention on public works projects; and comply with 820 ILCS 130 concerning prevailing wages.

3.

G. ILLINOIS LABOR:

Contractor shall comply with all Illinois statutory requirements regarding labor, including, but not limited to, the following:

1. Illinois Public Act 77-1552 and Chapter 48, Sections 39S-1 through 39S-12 of the Illinois Revised Statutes regulating wages of laborers, mechanics and other workers employed in any public works and known as the "Prevailing Wage Act," which provides in part that all laborers, mechanics and workers performing work under the Contract shall be paid not less than the prevailing rate of wages as determined by the Illinois Department of Labor (820 ILCS 130).

2. Illinois Public Act 83-1472, Article 2 and Chapter 48, Sections 2201 through 2207, 1984 of the Illinois Revised Statutes pertaining to hiring of Illinois labor and known as the "Illinois Preference Act (30 ILCS 570)."

3. "Illinois Human Rights Act of 1980," Chapter 68, Illinois Revised Statutes, and the Rules and Regulations, Title 44, Section 750 of the Illinois Administrative Code, Illinois Department of Human Rights; pertaining to equal employment opportunity (777 ILCS 10).

H. PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND:

1. Within ten (10) days immediately following date of his receipt of this contract, Contractor shall furnish Owner the signed Contract and Performance Bond and Labor and Material Payment Bond as required by and in accordance with the terms of Contract Documents in a penal sum of one hundred percent (100%) of the Contract sum.

2. In the event Contractor fails to furnish Owner such Contract and Bonds within said period, this Contract shall thereupon become null and void at Owner's option, exercised by written registered notice and mailed to Contractor by said Owner within five (5) days thereafter. Owner may then retain and enforce as liquidated damages, bid guarantee heretofore deposited with it in connection with Contractor's proposal for this Contract or the difference between his bid and a subsequent awarded bid, whichever is lesser.

I. IN WITNESS HEREOF, the parties hereto have executed this agreement as of the day and year first written above.

OWNER:

CITY OF SESSER

BY _____

TITLE Jason Ashmore, Mayor of Sesser

CONTRACTOR:

Attest: _____

BY _____ BY _____

Secretary

TITLE _____

(Corporate Seal)

END OF DOCUMENT

AGREEMENT BETWEEN
EGYPTIAN BUILDING AND CONSTRUCTION TRADES COUNCIL
AND
THE CITY COUNCIL OF THE CITY OF SESSER, ILLINOIS

1. This agreement is entered into to facilitate the timely completion of construction and renovation projects at The City of Sesser, Illinois (The City). Skilled craftsmen are needed by The City to achieve the quality of workmanship essential to meeting public expectations and interests. Furthermore, the parties to this Agreement believe it to be in their mutual interest to promote the efficiency of construction operations and provide for peaceful settlement of labor disputes without strikes or lockouts, thereby promoting the public interest in assuring the timely and economical completion of the work. It is also the intent of the parties to set out standard working conditions for the efficient performance of work at The City, to establish and maintain harmonious relations between all parties to the Agreement, to secure optimum productivity and to eliminate strikes, lockouts, or delays in the performance of work at The City.

2. The City agrees to include the attached Project Labor Agreement or mutually agreed successor versions, as a part of Requests for Proposal on all construction projects with a project cost estimated by The City of $75,000 or greater.

3. Any firm, Union affiliated or not, may bid on the project. Successful bidders must become party to the Project Labor Agreement to be awarded a contract.

4. The Egyptian Building and Construction Trades Council (EBTC), its member Unions, agents, affiliates, and surrogates agree to not stop, delay, interrupt, strike, picket, harass, or interfere in any way with construction projects, contractors, or employees engaged in any City projects with an estimated cost of $75,000 or greater and projects undertaken by City employees. Any interference, whether lawful or not, shall terminate this Agreement.

5. In the event that no qualified bidders bid on a project or portion thereof, The City reserves the right to request new proposals without including the Project Labor Agreement.

6. The term of this Agreement is five (5) years beginning October 12, 2017 and ending October 11, 2022.

7. This Agreement shall be null and void and unenforceable to the extent that any of its provisions hinder or prevent The City from lawfully obtaining funds from the State of Federal government, or any agency thereof.

8. Neither party to this Agreement shall be obliged to enter into any negotiations for the renewal or extension of this Agreement.

THE CITY COUNCIL OF THE CITY OF SESSER, ILLINOIS

11-9-17

Mayor — Date

EGYPTIAN BUILDING AND CONSTRUCTION TRADES COUNCIL

Eric Perkins 11/9/17

For the Egyptian Building and Construction Trades Council — Date

EGYPTIAN BUILDING & CONSTRUCTION TRADES COUNCIL
PROJECT LABOR AGREEMENT

NAME OF PROJECT:

This Agreement is entered into this_____day of_____, _____ by and between _____ and the Egyptian Building and Construction Trades Council for and on behalf of its affiliates, hereinafter referred to as the Union. This Agreement shall apply to work performed by the Employer and its Contractors and Subcontractors on Construction known as the _____ hereinafter referred to as the Project.

ARTICLE 1 - INTENT AND PURPOSES

1.1 It is mutually understood that the following terms and conditions relating to employment of workmen covered by this Agreement have been written in order to promote efficiency of construction operations and provide for peaceful settlement of labor disputes without strikes or lockouts, thereby promoting the public interest in assuring the timely and economical completion of the work. It is also the intent of the parties to set out standard working conditions for the efficient prosecution of said construction work, herein to establish and maintain harmonious relations between all parties of the Agreement, to secure optimum productivity and to eliminate strikes, lockouts, or delays in the prosecution of the work.

(a) Therefore, the following provisions will be binding upon _____and all its sub-contractors (herein jointly referred to as Contractor),who shall be required to sign the Participation Agreement, attached hereto as Schedule A, and the Unions during the term of this Agreement and any renewal thereafter. The Unions hereby consent to apply the terms and conditions of this Project Agreement to said sub-contractors upon their signing the Participation Agreement. It is understood that each sub-contractor will be considered and accepted by the Unions as a separate employer for the purposes of collective bargaining. It is further agreed that the employees working under this Agreement shall constitute a bargaining unit separate and distinct from all others. This Agreement may be modified by mutual consent in writing by the parties signatory hereto.

1.2 The Contractor agrees to be bound by the terms of the Collective Bargaining Agreements and amendments thereto of the

affiliates of the Egyptian Building and Construction Trades Council and the applicable employers association, if any. Such agreements are incorporated herein by reference. In order to comply with the requirements of the various fringe benefit funds to which the Contractor is to contribute, the Contractor shall sign such participation agreements as are necessary.

1.3 It is mutually understood that where the provisions of this Agreement are at variance with any other agreement between the Contractor and the Union, the language of this Agreement shall prevail, except that the work of the International Union of Elevator Constructors on this Project shall be performed under the terms of its National Agreements, with the exception of Article XI, XII, and XIII of this Project Agreement, which shall apply to such work.

1.4 The Contractor and the Union agree that should the Collective Bargaining Agreement (CBA) of any Egyptian Building and Construction Trades Council (E.B.C.T.C.) Affiliate signatory to this Agreement expire prior to the completion of this project, the expired contracts' terms will be maintained until a new CBA is ratified. The wages, and fringe benefits included in any new CBA will be retroactive to the termination date of the expired CBA.

ARTICLE II - RECOGNITION

2.1 The Contractor recognizes the E.B.C.T.C. and the signatory affiliates as the sole and exclusive bargaining representatives for its craft employees employed on the jobsite. E.B.C.T.C. affiliates signatory to this Agreement will have recognition on the project for their craft.

ARTICLE III - ADMINISTRATION OF AGREEMENT

3.1 In order to assure that all parties have a clear understanding of the Agreement, to promote harmony and address potential problems, a pre-job conference will be held with the Contractor, E.B.C.T.C. Representatives and all signatory parties prior to the start of any work on the project.

3.2 Representatives of the Contractor and the E.B.C.T.C. shall meet as required but not less than once a month to review the operation of this Agreement. The representatives at this meeting shall be empowered to resolve any dispute over the intent and application of the Agreement.

3.3 The Contractor shall make available in writing to the E.B.C.T.C. no less than one week prior to these meetings, a job

status report, planned activities for the next 30 day period, actual numbers of craft employees on the project and estimated numbers of employees by craft required for the next 30 day period. The purpose of this report is to allow time to address any potential jurisdictional problems and to ensure that no party signatory to the Agreement is hindering the continuous progress of the project through a lack of planning or shortage of manpower.

ARTICLE IV - HOURS OF WORK OVERTIME SHIFTS & HOLIDAYS

4.1 The standard work day shall be an established consecutive eight (8) hour period between the hours of 7:00 a.m. and 5:00 p.m. with one-half hour designated as unpaid period for lunch. The standard work week shall be five (5) consecutive days of work commencing on Monday. Starting time which is to be established at the pre-job conference will be applicable to all craft employees on the project. Should job conditions dictate a change in the established starting time and/or a staggered lunch period on certain work of the project or with individual crafts, the Contractor, Business Managers of the crafts involved and the E.B.C.T.C. shall mutually agree to such changes. If work schedule change cannot be mutually agreed to between these parties, the hours fixed in the Agreement shall prevail.

4.2 All time before and after the established work day of eight (8) hours, Monday through Friday and all the time on Saturday shall be paid for at the rate of time and one-half. All time on Sundays and Holidays shall be paid for at the rate of double time.

(a) Fringe benefit payments for all overtime work shall be paid in accordance with each craft's Current Collective Bargaining Agreement.

4.3 Shifts may be established when considered necessary by the Contractor.

(a) Shift hours and rates for a two(2) shift operation shall be as follows:

(1) First Shift - Employees shall be required to work eight (8) hours for eight (8) hours pay plus one-half (1/2) hour unpaid lunch period.

(2) Second Shift - Employees shall receive 10% above their basic hourly wage and shall be required to work eight (8) hours

for eight (8) hours pay plus one-half (1/2) hour unpaid lunch period.

(b) Shift hours and rates for a three(3) shift operation shall be as follows:

(1) First Shift - Employees shall be required to work eight (8) hours for eight hours pay plus one-half (1/2) hour unpaid lunch period.

(2) Second Shift - Employees shall receive 10% above their basic hourly wage and shall be required to work seven and one-half (7 1/2) hours for eight (8) hours pay plus one-half (1/2) hour unpaid lunch period.

(3) Third Shift - Employees shall receive 10% above their basic hourly wage and shall be required to work seven (7) hours for eight (8) hours pay plus one-half (1/2) hour unpaid lunch period.

(c) Shifts shall be established and continue for a minimum of five (5) consecutive days.

(d) If only two shifts are to be worked, the Contract-or may regulate starting times of the two shift operation to maximize utilization of daylight hours.

(e) Any shift which continues indefinitely shall be considered overtime as long as it continues, excluding the first (8) hours, should they be regular hours as described above.

4.4 Recognized Holidays shall be as follows: New Year's Day, Memorial Day, Fourth of July, Labor Day, Veterans Day (November 11th), Thanksgiving and the day after, and Christmas Day. Holidays which fall on Sunday shall be observed on the following Monday, Saturday holidays shall be observed on the prior Friday.

ARTICLE V - ABSENTEEISM

5.1 The Contractor and the Union agree that chronic and/or unexcused absenteeism is undesirable and must be controlled. Employees that develop a record of such absenteeism shall be identified by the Contractor to the appropriate referral

facility and the Contractor shall support such action with the work record of the involved employee. Any employee terminated for such absenteeism shall not be eligible for rehire on the project for a period of no less than ninety (90) days.

ARTICLE VI - MANAGEMENT RIGHTS

6.1 The Contractor retains and shall exercise full and exclusive authority and responsibility for the management of its operations, except as expressly limited by the terms of this Agreement.

ARTICLE VII - GENERAL WORKING CONDITIONS

7.1 Employment begins and ends at the project site.

7.2 Employees shall be at their place of work at the starting time and shall remain at their place of work until quitting time. The parties reaffirm their policy of a fair days work for a fair days pay.

7.3 The Contractor may utilize brassing, time clocks or other systems to check employees in and out. Should such procedures be required, the techniques and rules regarding such procedures shall be established by mutual consent of the parties at the pre-job conference.

7.4 There shall be no limit on production by workmen nor restrictions on the full use of tools or equipment. Craftsmen using tools shall perform any work of the trades and shall work under the direction of the craft foreman. There shall be no restrictions on efficient use of manpower other than as may be required by safety regulations.

7.5 Crew Foreman shall be utilized as per the existing collective bargaining agreements. The Contractor agrees to allow crew Forman ample time to direct and supervise their crew. The Union agrees there will be no restrictions placed on crew foreman's ability to handle tools and materials.

7.6 The Contractor may utilize the most efficient methods or techniques of construction, tools or other labor saving devices to accomplish the work. Practices not a part of the terms and conditions of this Agreement will not be recognized.

7.7 Should overtime work be required, the Contractor will have the right to assign specific employees and/or crews to

perform such overtime work as is necessary to accomplish the work.

7.8 The Contractor may establish such reasonable project rules as the Contractor deems appropriate. These rules will be reviewed and established at the pre-job conference and posted at the project site by the Contractor.

7.9 It is recognized that specialized or unusual equipment may be installed on the project and in such cases, the Union recognizes the right of the Contractor to involve the equipment supplier or vendor's personnel in supervising the setting of the equipment. These personnel may make modifications and final alignment which may be necessary prior to and during the start-up procedure, in order to protect factory warranties.

7.10 In order to promote a harmonious relationship between the equipment or vendor's personnel and the Building Trades craftsmen, a meeting shall be held between the Contractor and the E.B.C.T.C. prior to any involvement on the project by these personnel. The Contractor will inform the E.B.C.T.C. of the nature of involvement by these personnel and the numbers of personnel to be involved, allowing ample time for the Union representatives to inform their stewards prior to the start of any work.

7.11 Equipment or material delivered to the job site will be unloaded promptly without regard to jurisdictional disputes which will be handled as per the provisions of this Agreement. The Contractor will supply E.B.C.T.C. with delivery schedules, allowing as much time as possible to insure the appropriate crafts will be available to unload the materials or equipment.

ARTICLE VIII - SAFETY

8.1 The employees covered by the terms of this Agreement shall at all times while in the employ of the Contractor be bound by the safety rules and regulations as established by the Contractor in accordance with the Construction Safety Act and OSHA.

(a) These rules and regulations will be published and posted at conspicuous places throughout the project.

8.2 In accordance with the requirements of OSHA, it shall be the exclusive responsibility of each Contractor on a jobsite

to which this Agreement applies, to assure safe working conditions for its employees and compliance by them with any safety rules contained herein or established by the Contractor. Nothing in this Agreement will make the E.B.C.T.C. or any of its affiliates liable to any employees or to other persons in the event that injury or accident occurs.

ARTICLE IX - SUBCONTRACTING

The Project Contractor agrees that neither it nor any of its contractors or subcontractors will subcontract any work to be done on the Project except to a person, firm or corporation who is or agrees to become party to this Agreement. Any contractor or subcontractor working on the Project, shall, as a condition to working on said Project, become signatory to and perform all work under the terms of this Agreement. The furnishing of materials, supplies or equipment and the delivery thereof shall be in no case be considered subcontracting.

ARTICLE X - UNION REPRESENTATION

10.1 Authorized representatives of the E.B.C.T.C. and its signatory affiliates shall have access to the project provided they do not interfere with the work of the employees and further provided that such representatives fully comply with the visitor and security rules established for the project.

10.2 Each E.B.C.T.C. affiliate which is a party to this Agreement, shall have the right to designate a working journeyman as a steward. Such designated steward shall be a qualified worker performing the work of that craft and shall not exercise any supervisory functions. Each steward shall be concerned with the employees of the steward's employer and not with the employees of any other employer.

10.3 The working steward will be paid at the applicable wage rate for the job classification in which he is employed.

10.4 The working steward shall not be discriminated against because of his activities in performing his duties as steward, and except as otherwise provided in local agreements, shall be the last employee in his craft to be laid off in any reduction in force. Stewards will be subject to discharge to the same extent that other employees are only after notification to the Union Representative. The Contractor will permit stewards sufficient time to perform the duties inherent to a steward's responsibilities. Stewards will be offered available

overtime work if qualified.

ARTICLE XI - DISPUTES AND GRIEVANCES

Section 1: This Agreement is intended to provide close co-operation between management and labor. Each of the Unions will assign a representative to this Project for the purpose of completing the construction of the Project economically, efficiently, continuously, and without interruption, delays, or work stoppages.

Section 2: The Contractors, Unions, and the employees, collectively and individually, realize the importance to all parties to maintain continuous and uninterrupted performance of the work of the Project, and agree to resolve disputes in accordance with the grievance-arbitration provisions set forth in this Article.

Section 3: Any questions or dispute arising out of and during the term of this Project Agreement (other than trade jurisdictional disputes) shall be considered a grievance and subject to resolution under the following procedures:

Step 1. (a) When any employee subject to the provisions of this Agreement feels he or she is aggrieved by a violation of this Agreement, he or she, through his or her local union business representative or job steward, shall, within five (5) working days after the occurrence of the violation, give notice to the work-site representative of the involved Contractor stating the provision(s) alleged to have been violated. The business representative of the local union or the job steward and the work-site representative of the involved Contractor and the Project Contractor shall meet and endeavor to adjust the matter within three (3) working days after timely notice has been given. The representative of the Contractor shall keep the meeting minutes and shall respond to the Union representative in writing (copying the Project Contractor) at the conclusion of the meeting but not later than twenty-four (24) hours thereafter. If they fail to resolve the matter within the prescribed period, the grieving party may, within forty-eight (48) hours thereafter, pursue Step 2 of the Grievance Procedure, provided the grievance is reduced to writing, setting forth the relevant information concerning the alleged grievance, including a short description thereof, the date on which the grievance occurred, and the provision(s) of the Agreement alleged to have been violated.

(b) Should the Local Union(s) or the Project

Contractor or any Contractor have a dispute with the other party and, if after conferring, a settlement is not reached within three (3) working days, the dispute may be reduced to writing and proceed to Step 2 in the same manner as outlined herein for the adjustment of an employee complaint.

Step 2. The International Union Representative and the involved Contractor shall meet within seven (7) working days of the referral of a dispute to this second step to arrive at a satisfactory settlement thereof. Meeting minutes shall be kept by the Contractor. If the parties fail to reach an agreement, the dispute may be appealed in writing in accordance with the provisions of Step 3 within seven (7) calendar days thereafter.

Step 3. (a) If the grievance has been submitted but not adjusted under Step 2, either party may request in writing, within seven(7) calendar days thereafter, that the grievance be submitted to an Arbitrator mutually agreed upon by them. The Contractor and the involved Union shall attempt mutually to select an arbitrator, but if they are unable to do so, they shall request the American Arbitration Association to provide them with a list of arbitrators from which the Arbitrator shall be selected. The rules of the American Arbitration Association shall govern the conduct of the arbitration hearing. The decision of the Arbitrator shall be final and binding on all parties, the fee and expenses of such Arbitration shall be borne equally between the Contractor and the involved Local Union(s).

(b) Failure of the grieving party to adhere to the time limits established herein shall render the grievance null and void. The time limits established herein may be extended only by written consent of the parties involved at the particular step where the extension is agreed upon. The Arbitrator shall have the authority to make decisions only on issues presented to him or her, and he or she shall not have authority to change, amend, add to or detract from any of the provisions of this Agreement.

Section 4. The Project Contractor and Owner shall be notified of all actions at Steps 2 and 3 and shall, upon their request, be permitted to participate in all proceedings at these steps.

ARTICLE XII -- JURISDICTIONAL DISPUTES

Section 1. The assignment of work will be solely the responsibility of the Contractor performing the work involved;

and such work assignments will be in accordance with the Plan for the Settlement of jurisdictional Disputes in the Construction Industry (the 'Plan') or any successor Plan.

Section 2. All jurisdictional disputes on this Project, between or among Building and Construction Trades Unions and employees, parties to this Agreement, shall be settled and adjusted according to the present Plan established by the Building and Construction Trades Department or any other plan or method of procedure that may be adopted in the future by the Building and Construction Trades Department. Decisions rendered shall be final, binding and conclusive on the Contractors and Unions parties to this Agreement.

Section 3. All jurisdictional disputes shall be resolved without the occurrence of any strike, work stoppage, or slow-down of any nature, and Contractor's assignment shall be adhered to until the dispute is resolved. Individuals violating this section shall be subject to immediate discharge.

Section 4. Each Contractor will conduct a pre-job conference with the Egyptian Building and Construction Trades Council prior to commencing work. The Project Contractor and the Owner will be advised in advance of all such conferences and may participate if they wish.

ARTICLE XIII - WORK STOPPAGES AND LOCKOUTS

13.1 During the term of this Agreement there shall be no strikes, picketing, work stoppages, slow downs or other disruptive activity for any reason by the E.B.C.T.C., its affiliates or by any employee and there shall be no lockout by the Contractor. Failure of any Union or employee to cross any picket line established at the project site is a violation of this Article.

13.2 The E.B.C.T.C and its affiliates shall not sanction, aid or abet, encourage or continue any work stoppages, picketing or other disruptive activity and will not make any attempt of any kind to dissuade others from making deliveries to or performing services for or otherwise doing business with the Contractor at the project site. Should any of these prohibited activities occur the Union will take the necessary action to end such prohibited activities.

13.3 No employee shall engage in any activities which

violate this Article. Any employee who participates in or encourages any activities which interfere with the normal operation of the project shall be subject to disciplinary action, including discharge, and if justifiably discharged for the above reasons, shall not be eligible for rehire on the same project for a period of not less than ninety (90) days.

13.4 Neither the E.B.C.T.C. or its affiliates, shall be liable for acts of employees for which it has no responsibility. The principal officer or officers of the E.B.C.T.C. will immediately instruct, order and use the best efforts of his office to cause the affiliated union or unions to cease any violations of this Article. The E.B.C.T.C. in its compliance with this obligation shall not be liable for unauthorized acts of its affiliates. The principal officer or officers of any involved affiliate will immediately instruct, order or use the best effort of his office to cause the employees the union represents to cease any violations of this Article. A union complying with this obligation shall not be liable for unauthorized acts of employees it represents. The failure of the Contractor to exercise its right in any instance shall not be deemed a waiver of its right in any other instance.

13.5 In lieu of any action at law or equity, any party shall institute the following procedure when a breech of this Article is alleged, after all involved parties have been notified of the fact.

(a) The party invoking this procedure shall notify an individual to be mutually agreed upon, whom

the parties agree shall be the permanent arbitrator under this procedure. In the event the permanent arbitrator is unavailable at any time, he shall appoint his alternate. Notice to the arbitrator shall be by the most expeditious means available, with notice by telegram or any effective written means to the party alleged to be in violation and all involved parties.

(b) Upon receipt of said notice the arbitrator named above shall set and hold a hearing within twenty-four (24) hours if it is contended the violation still exists but not before twenty-four (24)

hours after the telegraph notice to all parties involved as required above.

(c) The Arbitrator shall notify the parties by telegram or any other effective written means, of the place and time he has chosen for this hearing. Said hearing shall be completed in one session. A failure of any party or parties to attend said hearing shall not delay the hearing of evidence or issuance of an Award by the Arbitrator.

(d) The sole issue at the hearing shall be whether or not a violation of this Article has in fact occurred. The Award shall be issued in writing within three (3) hours after the close of the hearing, and may be issued without an Opinion. If any party desires an Opinion, one shall be issued within fifteen (15) days, but its issuance shall not delay compliance with, or enforcement of, the Award. The Arbitrator may order cessation of the violation of this Article, and such Award shall be served on all parties by hand or registered mail upon issuance.

(e) Such Award may be enforced by any court of competent jurisdiction upon the filing of the Agreement and all other relevant documents referred to hereinabove in the following manner.

Telegraphic notice of the filing of such enforcement proceedings shall be given to the other party. In the proceeding to obtain a temporary order enforcing the Arbitrator's Award as issued under Section 13.5 of this Article, all parties waive the right to a hearing and agree that such proceedings may be exparte. Such agreement does not waive any party's right to participate in a hearing for a final order of enforcement. The Court's order or orders enforcing the Arbitrator's Award shall be served on all parties by hand or by delivery to their last known address or by registered mail.

(f) Any rights created by statue or law governing arbitration proceedings inconsistent with the above procedure or which interfere with c compliance therewith are hereby waived by parties to whom they accrue.

(g) The fees and expenses of the Arbitrator shall be borne by the party or parties found in violation, or in the event no violation is found, such fees and expenses shall be borne by the moving party.

ARTICLE XIV - DRUG ABUSE PREVENTION, DETECTION & AWARENESS PROGRAM

14.1 Believing that a drug free work place is consistent with a safe work environment, the Union agrees to adhere to a Drug Abuse Prevention, Detection & Awareness Program, should the Contractor and/or owner require all employees to be drug tested.

ARTICLE XV - GENERAL SAVINGS CLAUSE

15.1 If any Article or provision of this Agreement shall be declared invalid, inoperative or unenforceable by any competent authority of the executive, legislative, judicial or administrative branch of the Federal or State government, the Employer and the Union shall suspend the operation of such Article or provisions during the period of its invalidity and shall substitute by mutual consent, in its place and stead, an Article or provision which will meet the objections to its validity and which will be in accord with the intent and purpose of the Article or provision in question.

15.2 If any Article or provision of this Agreement shall be held invalid, inoperative or unenforceable by operation of law or by any of the above mentioned tribunals of competent jurisdiction, the remainder of this Agreement or the application of such Article or provision to persons or circumstances other than those as to which it has been held invalid, inoperative or unenforceable shall not be affected thereby.

ARTICLE XVI: HELMENTS TO HARDHATS

Section 1. The Employers and the Unions recognize a desire to facilitate the entry into the building and construction trades of veterans who are interested in careers in the building and construction industry. The Employers and Unions agree to utilize the services of the Center for Military Recruitment, Assessment and Veterans Employment (hereinafter "Center") and

the Center's "Helmets to Hardhats" program to serve as a resource for preliminary orientation, assessment of construction aptitude, referral to apprenticeship programs of hiring halls, counseling and mentoring, support network, employment opportunities and other needs as identified by the parties.

Section 2. The Unions and Employers agree to coordinate with the Center to create and maintain an integrated database of veterans interested in working on this Project and of apprenticeship and employment opportunities for this Project. To the extent permitted by law, the Unions will give credit to such veterans for bona fide, provable past experience.

ARTICLE XVII - TERMS OF AGREEMENT

16.1 This Agreement shall be in full force as of and from the date shown above to and including the end of all construction by the Contractor.

EGYPTIAN BUILDING TRADES

NAME OF PROJECT:

DATE:_____

THE UNDERSIGNED PARTIES AGREES TO BE BOUND BY THE TERMS OF THE ATTACHED PROJECT LABOR AGREEMENT:

COMPANY NAME:_____

ADDRESS:_____

_____

_____

PHONE NUMBER:_____

AUTHORIZED SIGNATURE:_____

DATE:_____

EGYPTIAN BUILDING AND CONSTRUCTION TRADES COUNCIL
106 North Monroe St.
WEST FRANKFORT, IL 62896
(618) 932-2102

AUTHORIZED SIGNATURE:_____

DATE:_____

SCHEDULE A

PARTICIPATION AGREEMENT

PROJECT:

The undersigned, a subcontractor to _____agrees to be bound to the attached Project Agreement negotiated between _____and the Egyptian Building and Construction Trades Council.

_____ _____

Subcontractor By

_____

Project Name

_____

Date

CONTRACTOR'S AFFIDAVIT FOR FINAL COMPLETION
(To be filed with final request for payment)

STATE OF_____)

COUNTY OF _____)

_____, being first duly sworn upon oath deposes and says:

That he/she is _____ of _____
_____

hereinafter termed "The Contractor" for all work upon the hereinafter termed "Said Project," work for the CITY OF SESSER, under that certain contract between said Contractor and said Owner, bearing date of _ _____ pertaining to said work.

Affiant further states, of his/her own knowledge, that all bills incurred by the Contractor, for services, labor and material furnished, for work done by the Contractor under said Contract, or in connection with said project have been paid and all subcontractors who have furnished services, labor or materials have no claim or demand against Owner for any services, labor and/or materials furnished and/or work done by them upon said Project.

Affiant further states that this affidavit is made on behalf of the Contractor for the purpose of obtaining payment of the sum of

_____($_____) dollars, which affiant states, upon his/her own knowledge, constitutes the full balance due the Contractor for all services, labor and materials furnished and work done to and upon Said Project by the Contractor whether under and pursuant to provisions of said Contract and all subsequent modifications thereof and changes therein or otherwise; and that payment of the sum to the Contractor will constitute payment in full on everything due for such services, labor, materials and work, and will fully satisfy any and all claims or demands which Contractor may have or assert against said Owner, arising out of anything done or furnished by the Contractor or occurring in connection with said Project and/or Contract.

_____
CONTRACTOR

By _____

Title _____

Subscribed and Sworn to before me the _____ day of_____, 20___.

_____
NOTARY PUBLIC

(PARTIAL) (FINAL)
WAIVER OF LIEN

STATE OF _____
}SS
COUNTY OF _____

TO WHOM IT MAY CONCERN:

WHEREAS the undersigned has been employed by CITY OF SESSER, hereinafter known as the OWNER,

To Furnish: _____

For the project known as: RENOVATION SESSER OPERA HOUSE

For the premises known as: SESSER OPERA HOUSE

Address: P. O. Box 517, 302 W. FRANKLIN AVE, ILLINOIS 62884

THE undersigned, for and in consideration of the dollar amount shown below and other good and valuable considerations, do(es) hereby waive and release under the mechanics' lien statutes of the State where the project premises are located, to the extent of the payment recited below is received by the undersigned and is applicable to lienable labor, services, materials, fixtures, or apparatus, any and all lien or claim or right of lien on the above-described premises and the improvements, fixtures and appurtenances thereon, and on the monies or other considerations due or to become due from the Owner and on all other project-related monies from whatever source, on the account of the above-mentioned labor, services, materials, fixtures, or apparatus furnished by the undersigned for or in connection with the above-described premises.

_____
(Payment amount written in long form)

PAYMENT AMOUNT _____

_____
(Company Name)

_____
(Address)

_____
(City/State/Zip)

_____
(Signature of Officer)

Sworn to and subscribed before me this _____ day of _____.

(Notary Public)

My commission expires: _____

AFFIDAVIT OF PAYMENT TO MATERIAL SUPPLIERS AND SUBCONTRACTORS

STATE OF _____

COUNTY OF _____

_____, being first duly sworn upon oath deposes and says, that he/she entered into a Contract with the CITY OF SESSER, known as the Owner, for furnishing of labor, work services, materials, fixtures, and supplies for RENOVATION SESSER OPERA HOUSE at the following described real estate: PO BOX 517, 302 W. FRANKLIN AVE. SESSER, FRANKLIN COUNTY, ILLINOIS.

That for the purpose of said Contract, the following persons, firms or corporations have been contracted with to furnish, have furnished or prepared, or will furnish or prepare labor, services, materials, fixtures, apparatus, machinery or supplies, or are furnishing and preparing material for said construction; that there are due or to become due to them respectively, the amounts set opposite their names for said labor, services, materials, fixtures, apparatus, machinery and supplies as stated; that there are no other contractors outstanding and there is nothing due or to become due any person, firm, or corporation, for labor, services, materials, fixtures, machinery, apparatus, or supplies, other than as stated herewith.

MATERIAL SUPPLIER AND/OR SUBCONTRACTOR	CONTRACT ITEM	CONTRACT AMOUNT	AMOUNT PAID TO DATE	AMOUNT DUE OR TO BECOME DUE

_____
CONTRACTOR

Subscribed and sworn to before me, a Notary Public, this _____day of _____; A.D. 20____.

_____
NOTARY PUBLIC

CONSENT OF SURETY COMPANY TO FINAL PAYMENT
(To be filed with final request for payment)

PROJECT: RENOVATION
SESSER OPERA HOUSE
PO BOX 517
302 W. FRANKLIN AVE.
SESSER, FRANKLIN COUNTY, ILLINOIS
HR # 860-3192

TO (Owner): CITY OF SESSER
302 WEST FRANKLIN STREET
SESSER, ILLINOIS 62884

CONTRACTOR:
(Name, address)

CONTRACT DATE: BOND NO.:

In accordance with the provisions between Owner and Contractor indicated above, _____
_____
_____ SURETY COMPANY, hereby approves of final payment to Contractor, and agrees that final payment to Contractor shall not relieve Surety Company of any of its obligations to Owner, as set forth in Surety Company's bond.

IN WITNESS WHEREOF, Surety Company has hereunto set its hand this _____ day of _____, 20___.

_____ _____
Attest: Surety Company

(Seal):

_____
Signature of Authorized Representative

_____
Title

DOCUMENT 007214 - GENERAL CONDITIONS – AIA STIPULATED SUM

1.1 SUMMARY

A. Document Includes:
   1. General Conditions.

B. Related Documents:
   1. Document 005214 – Agreement Form – AIA Stipulated Sum.
   2. Document 007313 – Supplementary Conditions - AIA.

1.2 GENERAL CONDITIONS

A. AIA Document A201-2007, General Conditions of the Contract for Construction, is the General Conditions of the Contract.

1.3 SUPPLEMENTARY CONDITIONS

A. Refer to Document 007313 for modifications to General Conditions.

END OF DOCUMENT

DOCUMENT 007313 - SUPPLEMENTARY CONDITIONS - AIA

1.1 SUMMARY

A. Document Includes:
   1. General Conditions.
   2. Supplementary Conditions.

B. Related Documents:

   1. Document 004113 – Bid Form – Stipulated Sum
   2. Document 005214 – Agreement Form - AIA

1.2 GENERAL CONDITIONS

A. The General Conditions of the Contract for Construction, AIA Document A201, Sixteenth Edition, 2007, Articles 1 through 15, is a part of this Contract and is incorporated herein as fully as if here set forth. Copies of the General Conditions are on file and may be reviewed at _____, or may be obtained from the American Institute of Architects, St. Louis Chapter, 911 Washington St., #225, St. Louis, Missouri 63101-1203.

1.3 SUPPLEMENTARY CONDITIONS

A. The following supplements modify, change, delete from or add to the "General Conditions of the Contract for Construction," AIA Document A201, Sixteenth Edition, 2007. Where any Article of the General Conditions is modified or changed or any Paragraph, Subparagraph or Clause thereof is modified, changed or deleted by these supplements, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

1.4 REFERENCE TO DIVISION 01

A. Where provisions of General Conditions relate to project administrative or work-related requirements of the Contract, and those provisions differ from those specified in Division 01, provisions outlined in Division 01 shall prevail.

1.5 ARTICLE 1: GENERAL PROVISIONS

A. 1.5.1 In the second line following the word "Specifications" insert the words "and Project Manual,".

B. 1.6 TRANSMISSION OF DATA IN DIGITAL FORM: Add new subparagraph 1.6.1:

   1.6.1 Electronic drawings provided by the Owner are for informational purposes only and are not intended for any other use. The paper copies provided are a true representation of the completed design and if discrepancies should exist between

the paper copy and the electronic copy, the paper copy shall govern.

C. Delete Subparagraph 1.1.8 its entirety and substitute the following:

1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2. If the Initial Decision Maker is not specifically identified in the Agreement, the responsibilities of the Initial Decision Maker shall default to the City.

D. DEFINITIONS: Add Paragraph 1.1.9

1.1.9 PROJECT MANUAL

The Project Manual is the collection of documents which includes the bidding requirements, sample forms and, certain Contract Documents such as the Conditions of the Contract and the Specifications.

1.6 ARTICLE 2: OWNER

A. 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER:

B. Delete Subparagraphs 2.2.3 and 2.2.5 in their entireties and substitute the following:

2.2.3 The Owner shall, at the request of the Contractor, furnish to Contractor any survey or other similar descriptive information of project site that Owner has in his possession. Upon demonstration of need by Contractor for specific additional survey information, Owner shall obtain and furnish such information to Contractor.

2.2.5 Contractor will be furnished, free of charge, 4 copies of Drawings, Specifications, and Project Manual as set forth in Division 1 of the Specifications. Additional copies will be furnished to Contractor at cost of reproduction, postage and handling.

1.7 ARTICLE 3: CONTRACTOR

3.2. REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR: Add Subparagraphs 3.2.5 and 3.2.6:

3.2.5 The Contractor by executing the Contract represents that he has carefully examined the Site of the Work at each location and that he has full knowledge of and fully understands the facilities, site conditions, difficulties and restrictions attending performance of the Work. Contractor further represents that he has taken all required measurements and carefully inspected existing constructions, irregularities and interferences which may affect the Work. No additional compensation will be allowed for conditions increasing Contractor's cost which were not known to or appreciated by him prior to executing the Contract if they

could have been discovered by him following the foregoing procedures and thoroughly informing himself of all existing conditions affecting the Work.

3.2.6 Contractor will not, however, be required to excavate, penetrate or demolish any constructions or other work and conditions prior to executing the Contract in order to uncover and/or expose concealed conditions that affect the Work. If, during course of construction, Contractor uncovers conditions that affect the work that could not have been known and understood by the above described careful examination of conditions affecting the Work, he shall promptly notify the City, in writing, who will determine if claims for additional costs or extensions of time are justified. If such claims are found to be justified, Contract will be modified in accordance with Article 7 of the General Conditions.

1.8 ARTICLE 4: ARCHITECT

A. 4.1 GENERAL: Delete Subparagraph 4.1.1 in its entirety and substitute the following:

4.1.1 The Owner shall retain an architect or engineer lawfully licensed to practice architecture or engineering or an entity lawfully practicing architecture or engineering in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

B. 4.1 GENERAL: Delete Subparagraph 4.1.3 in its entirety and substitute the following:

4.1.3 The Architect services terminate with the preparation of the plans and specifications. **The Owner / City will administer the Contract.**

1.9 ARTICLE 5: SUBCONTRACTORS

A. 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK: Add new Subparagraph 5.2.1.1.:

5.2.1.1. Contractor shall submit the names of those to whom he intends to award a Subcontract on Appendix A of Specification Section 004300 to be submitted with the Contractor’s bid.

1.10 ARTICLE 6: CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

A. 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS: Delete Subparagraph 6.1.3 in its entirety and substitute the following:

6.1.3 General Contractor shall have responsibility of coordinating efforts of all contractors and to maintain overall direction of job progress. Each Contractor shall

coordinate operational methods with other contractors and encourage communications among all trades. All Contractors shall make other contractors aware of any problems, delays in materials shipments or lack of work force, and assist other contractors in maintaining job momentum and direction of overall project.

1.11 ARTICLE 9: PAYMENTS AND COMPLETION

A. 9.3 APPLICATIONS FOR PAYMENT: Add new Subparagraph 9.3.1.3

9.3.1.3.: Until Substantial Completion, the Owner will pay 90 percent of the amount due Contractor on account of approved progress payments.

1.12 ARTICLE 11: INSURANCE AND BONDS

A. 11.1.1 In the first line following the word "maintain," insert the words "in a company or companies licensed to do business in the state in which the project is located and rated 'A' or better by A.M. Best Co.."

B. Add new Subparagraph 11.1.1.9:

11.1.1.9 General Liability Insurance shall be comprehensive, on occurrence, and shall include:

- Premises and Operations.
- Independent Contractors.
- Products and Completed Operations.
- Broad Form Property Damage.
- Personal Injury.
- Explosion, Collapse and Underground damage where the hazard exists.
- Contractual liability.

C. Add the following Sub-Subparagraphs to Subparagraph 11.1.2:

11.1.2.1 The insurance required by Subparagraph 11.1.1 shall be on a project specific basis and written for not less than the following, or greater if required by law:

1. Worker's Compensation:

a. State: Statutory
b. Applicable Federal: Statutory
c. Employer's Liability: $500,000

2. Comprehensive General Liability:

a. Bodily Injury:

$1,000,000 Combined Single Limit

b. Property Damage:

$1,000,000 Combined Singled Limit

Limit Coverage for bodily injury and property damage per occurrence and in the same aggregate limit will be accepted in lieu of the separate limits specified above.

3. Personal Injury:

$ 1,000,000 Combined single limit including owned non-owned, and hired motor vehicle.

4. Comprehensive Automobile Liability:

a. Bodily Injury:

$1,000,000 Combined single limit including owned, non-owned, and hired motor vehicle.

b. Property Damage:

$1,000,000 Combined single limit including owned, non-owned, and hired motor vehicle

c. $1,000,000 Combined Single

Limit coverage for bodily injury and property damage per occurrence and in the same aggregate limit will be accepted in lieu of the separate limits specified above.

11.1.2.2 Umbrella Form Liability Coverage:

An Umbrella Form Liability coverage to not less than $2,000,000 for any one occurrence and subject to the same aggregate over the Employer's Liability, Comprehensive General Liability, and Comprehensive Automobile Liability coverage is required.

D. Add the following Subparagraph 11.1.3.1:

11.1.3.1 Contractor shall furnish one copy each of Certificates of Insurance herein required for each copy of the Agreement which shall specifically set forth evidence of all coverage required by Paragraph 11.1. The Certificate of Insurance is to be accompanied by AIA Document G715TM-1997 (Supplemental Attachment for ACORD Certificate of Insurance 25-S). Contractor shall furnish to the Owner copies of any endorsements that are subsequently issued amending coverage or limits. The Contractor shall furnish to the Owner notice of any policy cancellation at least 30 days (10 days for non payment of premiums) prior to the effective date

of cancellation. The Contractor shall submit copies of subcontractor's Certificates of Insurance prior to the beginning of work.

E. Add the following Subparagraph 11.1.4.1:

11.1.4.1 The Owner shall be named as additional insureds on ISO form 20331001 by endorsement for the purpose of coverage only with no liability for premium payments. All policies and coverages shall include a waiver of subrogation in favor of the Owner,, and all subconsultants.

F. 11.3. PROPERTY INSURANCE: Delete Subparagraph 11.3.1 in its entirety and substitute the following:

11.3.1: The General Contractor shall be responsible to maintain property (builder's risk) insurance upon the completed value of all work at the site under this contract to the full insurable value thereof. This insurance shall include the interests of the Owner, the General Contractor, Subcontractors, and Sub-subcontractors in the work and as their interests may appear in the work, and shall be an all-risk type policy, including theft, subject to the exclusions generally accepted in the insurance industry. This coverage is not intended to, and shall not, provide coverage for tools, equipment, scaffolding, forms, or other devices used by the Contractors or Subcontractors in performing work under this contract.

11.3.1.2 Delete this Paragraph in its entirety.

G. Delete Subparagraphs 11.3.1.3 in its entirety and substitute the following:

11.3.1.3 If the property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

1.13 ARTICLE 13: MISCELLANEOUS PROVISIONS

A. Add new paragraph 13.8 as follows:

13.8 REFERENCED STANDARDS

13.8.1 No provision of any referenced standard specification, manual or code; whether or not specifically incorporated by reference in the Contract Documents; shall be effective to change the duties and responsibilities of Owner, Contractor or Architect, or any of their consultants, agents or employees from those set forth in the Contract Documents, nor shall it be effective to assign to Architect, or any of Architect's consultants, agents or employees, any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of Articles 1 through 15.

END OF SECTION

ARTICLE 25: PREVAILING RATE OF WAGES

25.1 Pursuant to Illinois Compiled Statutes 820 ILCS 130/0.01 et seq., these specifications list on the following pages, the Illinois Department of Labor prevailing rate of wages for the county where the contract is being performed and for each craft or type of worker needed to execute the contract and the Davis-Bacon Wage Act (40 USC 276a through 276a-5) as defined by the United States Department of Labor.

Franklin County Prevailing Wage Rates posted on 12/7/2023

						Overtime										
Trade Title	**Rg**	**Type**	**C**	**Base**	**Foreman**	**M-F**	**Sa**	**Su**	**Hol**	**H/W**	**Pension**	**Vac**	**Trng**	**Other Ins**	**Add OT 1.5x owed**	**Add OT 2.0x owed**
ASBESTOS ABT-GEN	All	ALL		32.51	32.96	1.5	1.5	2.0	2.0	8.03	18.20	0.00	0.90	0.00	0.00	0.00
ASBESTOS ABT-MEC	All	BLD		26.45	27.45	1.5	1.5	2.0	2.0	10.20	8.75	0.00	0.50	0.00	0.00	0.00
BOILERMAKER	All	BLD		41.50	45.00	1.5	1.5	2.0	2.0	7.07	26.56	0.00	1.06		0.00	0.00
BRICK MASON	All	BLD		35.00	37.10	1.5	1.5	2.0	2.0	9.60	11.50	0.00	0.95	0.00	0.00	0.00
CARPENTER	All	BLD		41.33	43.83	1.5	1.5	2.0	2.0	10.00	10.55	0.00	0.70	0.00	0.00	0.00
CARPENTER	All	HWY		39.77	41.27	1.5	1.5	2.0	2.0	10.00	10.55	0.00	0.70	0.00	0.00	0.00
CEMENT MASON	All	BLD		32.31	33.81	1.5	1.5	2.0	2.0	10.00	10.62	0.00	0.50	0.00	0.00	0.00
CEMENT MASON	All	HWY		33.05	34.05	1.5	1.5	2.0	2.0	10.00	10.37	0.00	0.50	0.00	0.00	0.00
CERAMIC TILE FINISHER	All	BLD		28.08		1.5	1.5	2.0	2.0	9.05	7.69	1.00	0.85	0.00	0.00	0.00
ELECTRIC PWR EQMT OP	All	ALL	1	48.67		1.5	1.5	2.0	2.0	8.35	13.63	0.00	0.49	0.00	0.00	0.00
ELECTRIC PWR EQMT OP	All	ALL	2	43.40		1.5	1.5	2.0	2.0	8.35	12.15	0.00	0.43	0.00	0.00	0.00
ELECTRIC PWR GRNDMAN	All	ALL		35.64		1.5	1.5	2.0	2.0	8.35	9.98	0.00	0.36	0.00	0.00	0.00
ELECTRIC PWR LINEMAN	All	ALL		61.16	65.32	1.5	1.5	2.0	2.0	8.35	17.12	0.00	0.61	0.00	0.00	0.00
ELECTRICIAN	All	ALL		48.83	52.33	1.5	1.5	2.0	2.0	10.07	16.11	0.00	0.97		9.15	18.30
ELECTRONIC SYSTEM TECH	All	BLD		37.93	40.93	1.5	1.5	2.0	2.0	9.30	8.53	0.00	0.40		4.75	9.48
ELEVATOR CONSTRUCTOR	All	BLD		57.69	64.90	2.0	2.0	2.0	2.0	16.07	20.56	4.61	0.70		0.00	0.00
FLOOR LAYER	All	BLD		38.73	40.23	1.5	1.5	2.0	2.0	10.00	10.55	0.00	0.70	0.00	0.00	0.00
GLAZIER	All	BLD		30.87	32.37	1.5	1.5	2.0	2.0	7.59	11.14	0.00	0.30	0.05	0.00	0.00
HEAT/FROST INSULATOR	All	BLD		33.44	34.94	1.5	1.5	2.0	2.0	7.60	14.14	0.00	0.48	0.00	0.00	0.00
IRON WORKER	All	ALL		31.99	34.24	1.5	1.5	2.0	2.0	10.55	15.00	0.00	0.65	0.00	0.00	0.00
LABORER	All	BLD		31.51	31.96	1.5	1.5	2.0	2.0	8.03	18.20	0.00	0.80	0.00	0.00	0.00
LABORER	All	HWY		31.51	31.96	1.5	1.5	2.0	2.0	8.03	18.20	0.00	0.80	0.00	0.00	0.00
LABORER	All	O&C		23.63	24.08	1.5	1.5	2.0	2.0	8.03	18.20	0.00	0.80	0.00	0.00	0.00
MACHINIST	All	BLD		55.74	59.74	1.5	1.5	2.0	2.0	9.93	8.95	1.85	1.47		0.00	0.00
MARBLE FINISHER	All	BLD		28.08		1.5	1.5	2.0	2.0	9.05	7.69	1.00	0.85	0.00	0.00	0.00
MARBLE MASON	All	BLD		33.62		1.5	1.5	2.0	2.0	9.05	9.25	1.00	0.94	0.00	0.00	0.00
MILLWRIGHT	All	BLD		41.33	43.83	1.5	1.5	2.0	2.0	10.00	10.55	0.00	0.70	0.00	0.00	0.00

Franklin County Prevailing Wage Rates posted on 12/7/2023

MILLWRIGHT	All	HWY		39.77	41.27	1.5	1.5	2.0	2.0	10.00	10.55	0.00	0.70	0.00	0.00	0.00
OE RIVER 1	All	RIV	1	36.48	37.48	1.5	1.5	2.0	2.0	11.85	13.45	0.00	4.15		0.00	0.00
OE RIVER 2	All	RIV	2	33.03	37.48	1.5	1.5	2.0	2.0	11.85	13.45	0.00	4.15		0.00	0.00
OPERATING ENGINEER	All	ALL	1	36.38	37.38	1.5	1.5	2.0	2.0	11.85	13.45	0.00	4.15		0.00	0.00
OPERATING ENGINEER	All	ALL	2	34.48	37.38	1.5	1.5	2.0	2.0	11.85	13.45	0.00	4.15		0.00	0.00
OPERATING ENGINEER	All	ALL	3	27.08	37.38	1.5	1.5	2.0	2.0	11.85	13.45	0.00	4.15		0.00	0.00
OPERATING ENGINEER	All	O&C	1	27.29	27.29	1.5	1.5	2.0	2.0	11.85	13.45	0.00	4.15		0.00	0.00
OPERATING ENGINEER	All	O&C	2	25.86	25.86	1.5	1.5	2.0	2.0	11.85	13.45	0.00	4.15		0.00	0.00
OPERATING ENGINEER	All	O&C	3	20.31	20.31	1.5	1.5	2.0	2.0	11.85	13.45	0.00	4.15		0.00	0.00
PAINTER	All	BLD		31.82	33.32	1.5	1.5	2.0	2.0	7.85	12.57	0.00	0.55	0.00	0.00	0.00
PAINTER	All	HWY		36.12	37.62	1.5	1.5	2.0	2.0	7.85	12.57	0.00	0.55	0.00	0.00	0.00
PAINTER OVER 30 FT.	All	BLD		33.82	35.32	1.5	1.5	2.0	2.0	7.85	12.57	0.00	0.55	0.00	0.00	0.00
PAINTER PWR EQMT	All	BLD		32.82	34.32	1.5	1.5	2.0	2.0	7.85	12.57	0.00	0.55	0.00	0.00	0.00
PAINTER PWR EQMT	All	HWY		37.12	38.62	1.5	1.5	2.0	2.0	7.85	12.57	0.00	0.55	0.00	0.00	0.00
PILEDRIVER	All	BLD		41.33	43.83	1.5	1.5	2.0	2.0	10.00	10.55	0.00	0.70	0.00	0.00	0.00
PILEDRIVER	All	HWY		39.77	41.27	1.5	1.5	2.0	2.0	10.00	10.55	0.00	0.70	0.00	0.00	0.00
PIPEFITTER	All	BLD		41.50	45.65	1.5	1.5	2.0	2.0	11.20	12.55	0.00	2.35	0.00	0.00	0.00
PLASTERER	All	BLD		32.31	33.81	1.5	1.5	2.0	2.0	10.00	10.62	0.00	0.50	0.00	0.00	0.00
PLUMBER	All	BLD		41.50	45.65	1.5	1.5	2.0	2.0	11.20	12.55	0.00	2.35	0.00	0.00	0.00
ROOFER	All	BLD		30.85	31.85	1.5	1.5	2.0	2.0	9.75	6.55	0.00	0.00		0.00	0.00
SHEETMETAL WORKER	All	ALL		39.53	41.03	1.5	1.5	2.0	2.0	11.05	9.81	2.37	0.71	1.88	0.00	0.00
SPRINKLER FITTER	All	BLD		47.09	50.09	1.5	1.5	2.0	2.0	11.45	14.92	0.00	0.52		0.00	0.00
STONE MASON	All	BLD		35.00	37.10	1.5	1.5	2.0	2.0	9.60	11.50	0.00	0.95	0.00	0.00	0.00
TERRAZZO FINISHER	All	BLD		28.08		1.5	1.5	2.0	2.0	9.05	7.69	1.00	0.85	0.00	0.00	0.00
TERRAZZO MASON	All	BLD		33.62		1.5	1.5	2.0	2.0	9.05	9.25	1.00	0.94	0.00	0.00	0.00
TRUCK DRIVER	All	ALL	1	42.25	46.61	1.5	1.5	2.0	2.0	15.39	7.73	0.00	0.25	0.00	0.00	0.00
TRUCK DRIVER	All	ALL	2	42.83	46.61	1.5	1.5	2.0	2.0	15.39	7.73	0.00	0.25	0.00	0.00	0.00
TRUCK DRIVER	All	ALL	3	43.15	46.61	1.5	1.5	2.0	2.0	15.39	7.73	0.00	0.25	0.00	0.00	0.00
TRUCK DRIVER	All	ALL	4	43.50	46.61	1.5	1.5	2.0	2.0	15.39	7.73	0.00	0.25	0.00	0.00	0.00
TRUCK DRIVER	All	ALL	5	44.61	46.61	1.5	1.5	2.0	2.0	15.39	7.73	0.00	0.25	0.00	0.00	0.00

Franklin County Prevailing Wage Rates posted on 12/7/2023

TRUCK DRIVER	All	O&C	1	33.80	37.26	1.5	1.5	2.0	2.0	15.39	7.73	0.00	0.25	0.00	0.00	0.00
TRUCK DRIVER	All	O&C	2	34.26	37.26	1.5	1.5	2.0	2.0	15.39	7.73	0.00	0.25	0.00	0.00	0.00
TRUCK DRIVER	All	O&C	3	34.52	37.26	1.5	1.5	2.0	2.0	15.39	7.73	0.00	0.25	0.00	0.00	0.00
TUCKPOINTER	All	BLD		35.00	37.10	1.5	1.5	2.0	2.0	9.60	11.50	0.00	0.95	0.00	0.00	0.00

Legend
Rg Region
Type Trade Type - All,Highway,Building,Floating,Oil & Chip,Rivers
C Class
Base Base Wage Rate
OT M-F Unless otherwise noted, OT pay is required for any hour greater than 8 worked each day, Mon through Fri. The number listed is the multiple of the base wage.
OT Sa Overtime pay required for every hour worked on Saturdays
OT Su Overtime pay required for every hour worked on Sundays
OT Hol Overtime pay required for every hour worked on Holidays
H/W Health/Welfare benefit
Vac Vacation
Trng Training
Other Ins Employer hourly cost for any other type(s) of insurance provided for benefit of worker.

Explanations FRANKLIN COUNTY

The following list is considered as those days for which holiday rates of wages for work performed apply: New Years Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day and Veterans Day in some classifications/counties. Generally, any of these holidays which fall on a Sunday is celebrated on the following Monday. This then makes work performed on that Monday payable at the appropriate overtime rate for holiday pay. Common practice in a given local may alter certain days of celebration. If in doubt, please check with IDOL.

Oil and Chip Resealing (O&C) means the application of road oils and liquid asphalt to coat an existing road surface, followed by application of aggregate chips or gravel to coated surface, and subsequent rolling of material to seal the surface.

EXPLANATION OF CLASSES

ASBESTOS - GENERAL - removal of asbestos material/mold and hazardous materials from any place in a building, including mechanical systems where those mechanical systems are to be removed. This includes the removal of asbestos materials/mold and hazardous materials from ductwork or pipes in a building when the building is to be demolished at the time or at some close future date.

ASBESTOS - MECHANICAL - removal of asbestos material from mechanical systems, such as pipes, ducts, and boilers, where the mechanical systems are to remain.

Franklin County Prevailing Wage Rates posted on 12/7/2023

CERAMIC TILE FINISHER, MARBLE FINISHER, TERRAZZO FINISHER

Assisting, helping or supporting the tile, marble and terrazzo mechanic by performing their historic and traditional work assignments required to complete the proper installation of the work covered by said crafts. The term "Ceramic" is used for naming the classification only, and is in no a limitation of the product handled. Ceramic takes into consideration most hard tiles.

LABORER - OIL AND CHIP RESEALING ONLY

Hook and unhook chip box from aggregate truck; distribute material within chip box; perform flagging work related to oil and chip resealing; hand spray oil fluids; handle traffic control, including setting-up and maintaining barricades, drums, cones, delineators, signs and other such items, as well as laying-out and applying or removing temporary roadway markings used to control traffic in job site related to oil and chip resealing; and perform clean- up related to oil and chip resealing.

ELECTRIC POWER LINEMAN

Construction, maintenance and dismantling of overhead and underground electric power lines, including high voltage pipe type cable work, and associated structures and equipment.

ELECTRIC POWER EQUIPMENT OPERATOR - CLASS 1

Operation of all crawler type equipment D-4 and larger from the ground to assist the Electric Power Linemen in performing their duties.

ELECTRIC POWER EQUIPMENT OPERATORS - CLASS 2

Operation of all other equipment from the ground to assist the Electric Power Linemen in performing their duties.

ELECTRIC POWER GROUNDMAN

Applies to workers who assist the Electric Power Lineman from the ground.

ELECTRONIC SYSTEMS TECHNICIAN

Installation, service and maintenance of low-voltage systems which utilizes the transmission and/or transference of voice, sound, vision, or digital for commercial, education, security and entertainment purposes for the following: TV monitoring and surveillance, background/foreground music, intercom and telephone interconnect, field programming, inventory control systems, microwave transmission, multi-media, multiplex, radio page, school, intercom and sound burglar alarms and low voltage master clock systems.

Excluded from this classification are energy management systems, life safety systems, supervisory controls and data acquisition systems not intrinsic with the above listed systems, fire alarm systems, nurse call systems and raceways exceeding fifteen feet in length.

Franklin County Prevailing Wage Rates posted on 12/7/2023

TRUCK DRIVER - BUILDING, HEAVY AND HIGHWAY CONSTRUCTION Class 1. Drivers on 2 axle trucks hauling less than 9 ton. Air compressor and welding machines and brooms, including those pulled by separate units, truck driver helpers, warehouse employees, mechanic helpers, greasers and tiremen, pickup trucks when hauling materials, tools, or workers to and from and on-the-job site, and fork lifts up to 6,000 lb. capacity.

Class 2. Two or three axle trucks hauling more than 9 ton but hauling less than 16 ton. A-frame winch trucks, hydrolift trucks, vactor trucks or similar equipment when used for transportation purposes. Fork lifts over 6,000 lb. capacity, winch trucks, four axle combination units, and ticket writers.

Class 3. Two, three or four axle trucks hauling 16 ton or more. Drivers on water pulls, articulated dump trucks, mechanics and working forepersons, and dispatchers. Five axle or more combination units.

Class 4. Low Boy and Oil Distributors.

Class 5. Drivers who require special protective clothing while employed on hazardous waste work.

TRUCK DRIVER - O & C - (Oil and Chip Resealing)

It involves driving of contractor or subcontractor owned, leased, or hired pickup, dump, service, or oil distributor trucks. Includes transporting materials and equipment (including, but not limited to oils, aggregate supplies, parts, machinery and tools) to or from the job site; distributing oil or liquid asphalt and aggregate; stock piling material; and maintaining trucks at job site related to oil and chip resealing.

Class 1. Distributors, liquid asphalt hauling and hauling of asphalt rubber-tired rollers.

Class 2. Stockpiling.

Class 3. Tandem hauling to job site.

OPERATING ENGINEERS - BUILDING, HEAVY AND HIGHWAY CONSTRUCTION

Class 1. All Off Road Material Hauling Equipment, All Terrain Crane, Articulated Dump,Asphalt Machine Spreader, Asphalt Plant Assistant Operator, Asphalt Plant Operator, Asphalt Widener, Assistant Operator on Rotomills, Autograder, Automatic Slipform Pavers, Backend Man on Asphalt Machine, Backhoes, Barrel Grappler Devices (All), Blacksmith,Blade Operators (All), Boat Engineer, Boat Operators (All) Bridges, Dams & Waterways, Boat Pilots requiring certification and or licensing, Boilers, Boom or Winch Cat, Boom or Winch Type Trucks, Boring Machines – Horizontal, Clamshell, Orange Peel Operator, Concrete Breaker, Concrete Groover, Concrete Grinder, Concrete Curb Machine, Concrete Finish Machine or Spreader Operator, Concrete Mixer Paver, Concrete Pump Truck, Concrete Plant Operator, Concrete Wheel Saw Operators, Cranes (All) Truck/Track/Rubber, Crane (Overhead) Operator, Derrick Guy or Derrick Trucks, Dingo, Ditching Machines (All), Dozer Operators, Dragline or Shovel Operators, Dredge Booster Pump, Dredge Engineman, Dredge Operator/Leverman, Drill Cat w/Compressor Mounted, Drilling or Boring Machine Rotary - Self-Propelled, Endloaders (All) Track/Rubber Elevating Grader, Flexplane, Forklifts/Tele-Handlers (All), Geothermal Well Drilling, GPS on machines already under the jurisdiction of Local 318, Gradall, Greasers, Heavy Equipment Robotics Operator, Horizontal Directional Drill Locate Box, Hydro Excavation Equipment, Self Propelled or Pull Type (All), Hi-Lift,

Hoists, Hoisting Engine, Horizontal Directional Drill Operator, Incinerators (Haz-Mat only), Laser Screed, Locomotive/Operator, Master Mechanic, Marooka Buggies, Mixers 21 cu. ft. or over, Motor Patrol, Pile driver Operator, Post Driving Equipment, Pulls & Scrappers, Power Pac & Controls (Pile Driving), Pug mill, Pulverizer or Tillers, Push Cats, Quad Trac, Rotating Cab Forklifts, Rotomills, Rubber Tired Farm Tractor with Attachments over 1/2 yd., Self-Propelled Chip Spreader, Self-Propelled Roller w/Attachments, Shot Blaster/Bridge Deck, Shuttle Buggie, Side booms, Skid loader (Skid steers), Skimmer Scoop, Spyder Cranes, Stationary Rock Slinger, Trackhoe and All Attachments, Trench Machine Operator, Tuggers, Ultra High Pressure Water Jet Cutting Machine, Vacuum, Vacuum Blasting Machine Operator, Vac Jet, Welders, Well or Caisson Drills, Well Point Pumps - 2 or more, Wood Chipper w/Tractor.

Class 2. (Oilers) Shall be classified as Assistant Operators, Air Track Drill w/Compressor, All Machines used to Sweep, Clean, Broom or remove debris or snow, Any type Tractor pulling Roller or Disc, Automatic Bins or Scales w/compressor or generator, Bulk cement Plant w/Separate Compressor, Concrete Curb Machine requiring Electronics, Concrete Plant Assistant Operators, Concrete or Pump crete Pumps, Deck Hand on Boats, Dredge Assistant Operator/Mate, Power Broom, Self-Propelled Roller/Compactor, Straw Mulcher Blower, Stump Cutter Machine, Two Air Compressors (220 CFM or over), Two Air Track Drills, Air compressor w/valve driving piling, Assistant Operator (where required, refer to Article VII, Section 9), Elevator Operator, Form Grader, Man Lift (Scissor Lift) when lifting materials, Pile driver activating air or hydraulic valve regardless of location, Rubber-Tired Farm Type Tractor w/Blade/Bulldozer/Auger/Hi-Lift of 1/2 yd. or less, Self-Propelled Concrete Saw, Self-propelled Robotics roller in use two (2) continuous hours or more shall be manned by an operating engineer, Self-Propelled Vibrator, Truck Crane assistant operator, Two Conveyors.

Class 3. Mechanic in permanent shops without separate signed Collective Bargaining Agreements Nov. 1 thru March 31, Air Compressor (220 CFM or over) One, Air Track Drill (one), Automatic Bin, Belt Drag Machine, Bulk Cement Plant w/Built-in Compressor running off same motor or electric motor, Fireman or Switchman, Mechanical plasterer applicator, Pipe Tract Jack, Self-Propelled Form Tamper, Trac-Air, Mixers - less than 21 cu.ft, Mortar Mixer w/ski or pump, Mud jacks, One Well Point Pump Wood Chipper One Operating Engineer may operate or maintain any combination of the following pieces of equipment, not to exceed four (4), which shall be within reasonable distance; such combination may include the equipment in this classification: Air Compressor (under 220 CFM) Four Light Plants Generators Pumps Conveyors Motor Driven Heaters (2) Welding Machines Ulmac or Equal Spreader.

OPERATING ENGINEER - O & C (Oil and Chip Resealing ONLY.)

Includes the operation of all motorized heavy equipment used in oil and chip resealing, including but not limited to operating self-propelled chip spreaders, and all types of rollers (both hard and rubber tired); and other duties pertaining to the operation or maintenance of heavy equipment related to oil and chip resealing.

Class 1. See Class 1 above for types of equipment operated.

Class 2. See Class 2 above for types of equipment operated.

Class 3. See Class 3 above for types of equipment operated.

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OPERATING ENGINEER RIVER WORK 1 - operate the following machines when working on River Work and Levee Work on the Mississippi and Ohio Rivers, Lakes and Tributaries: All Off Road Material Hauling Equipment, All Terrain Crane, All Power Boat Operators, Articulated Dump, Asphalt Machine Spreader, Asphalt Plant Operator, Asphalt Widener, Autograder, Automatic Slipform Pavers, Backhoes, Barrell Grappler Devices (All), Blacksmith, Blade Operators (All), Boat Engineer, Boat Operators (All) Bridges, Dams & Waterways, Boat Pilots requiring certification and or licensing, Boilers, Boom or Winch Cat, Boom or Winch Type Trucks, Boring Machines – Horizontal, Clamshell, Orange Peel Operator, Concrete Breaker, Concrete Curb Machine, Concrete Finish Machine or Spreader Operator, Concrete Mixer Paver, Concrete Pump Truck, Concrete Plant Operator, Concrete Wheel Saw Operators, Cranes (All) Truck/Track/Rubber, Crane (Overhead) Operator, Derrick Guy or Derrick Trucks, Dingo, Ditching Machines (All), Dozer Operators, Dragline or Shovel Operators, Dredge Booster Pump, Dredge Engineman, Dredge Operator/Leverman, Drill Cat w/Compressor Mounted, Drilling or Boring Machine Rotary - Self-Propelled, Endloaders (All) Track/Rubber Elevating, Grader, Flexplane, Forklifts/Tele-Handlers (All), Geothermal Well Drilling, GPS on machines already under the jurisdiction of Local 318, Gradeall, Greasers, Heavy Equipment Robotics Operator, Horizontal Directional Drill Locate Box Hydro Excavation Equipment, Self-Propelled or Pull Type (All), Hi-Lift, Hoists, Hoisting Engine, Horizontal Directional Drill Operator, Incinerators (Haz-Mat only), Laser Screed,Locomotive/Operator, Marooka Buggies, Master Mechanic, Mixers 21 cu. ft. or over, Motor Patrol, Piledriver Operator, Post Driving Equipment, Pulls & Scrappers, Power Pac & Controls (Pile Driving), Pugmill, Pulverizer or Tillers, Push Cats, Quad Trac, Rotating Cab Forklifts, Rotomill, Rubber Tired Farm Tractor with Attachments over 1/2 yd., Self-Propelled Chip Spreader, Self-Propelled Roller w/Attachments, Shuttle Buggie, Sidebooms, Skidloader (Skidsteers), Skimmer Scoop, Spyder Cranes, Trackhoe and all Attachments, Trench Machine Operator, Tuggers, Ultra High-Pressure Water Jet Cutting Machine, Vacuum, Vacuum Blasting Machine Operator, Vac Jet, Welders, Well or Caisson Drills, Well Point Pumps - 2 or more, Wood Chipper w/Tractor.

OPERATING ENGINEER RIVER 2 - when working on River Work and Levee Work on the Mississippi and Ohio Rivers, Lakes and Tributaries Assistant Operators Required on: All Terrain Cherry Picker w/over 65 ton Lifting Capacity, Crane, Deckhand on all rivers, lakes, and tributaries, Dinky or Standard Locomotive, Ditching Machine (80 H.P. and over), Dragline, Dredge, Gradall, Guy Derrick, Assistant Operators or Fireman on Crane, Pile Driver, Shovel, Trenching Machine, Truck Crane.

Other Classifications of Work:

For definitions of classifications not otherwise set out, the Department generally has on file such definitions which are available. If a task to be performed is not subject to one of the classifications of pay set out, the Department will upon being contacted state which neighboring county has such a classification and provide such rate, such rate being deemed to exist by reference in this document. If no neighboring county rate applies to the task, the Department shall undertake a special determination, such special determination being then deemed to have existed under this determination. If a project requires these, or any classification not listed, please contact IDOL at 217-782-1710 for wage rates or clarifications.

LANDSCAPING

Landscaping work falls under the existing classifications for laborer, operating engineer and truck driver. The work performed by landscape plantsman and landscape laborer is covered by the existing classification of laborer. The work performed by landscape operators (regardless of equipment used or its size) is covered by the classifications of operating engineer. The work performed by landscape truck drivers (regardless of size of truck driven) is covered by the classifications of truck driver.

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DRAWING NO.	TITLE
G-101	COVER SHEET
G-102	GENERAL NOTES, ABBREVIATIONS
A-101	FLOOR PLAN, GENERAL NOTES, KEY NOTES
A-102	ROOF PLAN
A-103	ROOF PLAN - ROOFING REPAIRS
A-201	NORTH ELEVATION, SOUTH ELEVATION AND NOTES
A-301	WEST ELEVATION, EAST ELEVATION AND NOTES
A-302	ROOF NORTH ELEVATION AND WINDOW DETAILS
A-303	ROOF EAST AND WEST ELEVATIONS
A-401	WEST ELEVATION, EAST ELEVATION AND NOTES
A-501	ROOF DETAILS
A-502	ROOF DETAILS
M/F-101	MECHANICAL PLAN / DETAILS
M-102	MECHANICAL SPECIFICATION
E-101	ELECTRICAL SPECIFICATION

All drawings dated February 2, 2024

END 008600.

SECTION 01 10 00 - SUMMARY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Contract description.

B. Contractor's use of site.

C. Owner occupancy.

D. Specification Conventions.

E. Contractor’s Duties.

F. Contract Documents.

1.2 CONTRACT DESCRIPTION

Portions of this work shall comply with U.S. Department of the Interior, National Park Service Cultural Resources Heritage Preservation Services Briefs. This Work is highlighted with **bold type** in the following package descriptions.

Furthermore, Work is divided into the following bid packages.

Package 1 – Exterior Restoration
Base Bid – Roof restoration (installation of additional rigid insulation substrate and limited replacement, replacement of prefinished metal gutters, & new sheet metal flashing and accessories.), replacement of roof clearstory windows, **repair / replacement terra cotta parapet cap, façade restoration, and tuckpointing**.

Package 2 – Mechanical
Base Bid – Replace HVAC equipment (including RTUs, a furnace, & condensing unit).
Alt Bid A – replace standpipe and valves for Fire Protection

Package 3 – Interior finishes
Base Bid – **theater area walls, ceiling, foyer, light fixtures.**
Alt Bid A – **stage and backstage finishes, cleaning, painting, & stage curtain**

Package 4 – Doors and windows
Base Bid – **clean & repair existing windows**
Alt Bid A – **clean & repair existing doors & hardware**, replace 2 existing HM doors.

Perform Work of Contract under lump sum price with Owner in accordance with Conditions of Contract.

1.3 CONTRACTOR'S USE OF SITE

A. Limit use of site to allow:
1. Owner occupancy.

2. Parking and access by City personnel.
3. Work by others and Work by Owner.

B. Access to Site: Limited to normal working hours.

C. Construction Operations: Limited to areas noted on Drawings.

D. Allow for public use of all adjoining streets and sidewalks.

1.4 OWNER OCCUPANCY

A. The Owner will occupy the site during the entire period of construction for use of normal operations.

B. Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.5 SPECIFICATION CONVENTIONS

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words “shall be” are included by inference where a colon (:) is used within sentences or phrases.

1.6 CONTRACTOR’S DUTIES

A. Except as specifically noted, Contractor shall provide and pay for:
1. All labor, materials, and equipment used for construction of and/or incorporated into the project.
2. All tools, construction equipment and machinery.
3. Required building permits, and all inspection fees by governmental authorities. Any permits or fees required by other governmental authorities are the responsibility of the Contractor.
4. Other facilities and services necessary for proper execution and complete of work.

B. Owner is exempt from sales tax on product permanently incorporated in work.
1. Obtain sales tax exemption certificate number from Owner.
2. Place exemption certificate number on invoices for materials incorporated in work.
3. Upon completion of work, file with Owner a notarized statement that all purchases made under exemption certificate were entitled to be exempt and furnish copies of invoice to Owner.
4. Pay legally assessed penalties for improper use of exemption certificate number.

C. Comply with codes, ordinances, rules, regulations, orders, and other legal requirements of public authorities which bear on performance of work.

D. Promptly submit written notice to City of observed variance of contract documents from legal requirements.

1. It is not the Contractor's responsibility to make certain that drawings and specifications comply with codes and regulations.
    a. Appropriate modifications to contract documents will account for/reflect necessary changes.
    b. Assume responsibility for work known to be contrary to such requirements if written notice is not provided by the Contractor to the City.

E. Enforce strict discipline and good order among employees.

F. Do not unreasonably encumber site with materials or equipment.

G. Do not load structure with weight that will endanger structure.

H. Assume full responsibility for protection and safe-keeping of products stored on premises.

I. Move any stored products which interfere with operations of Owner or other Contractors.

J. Obtain and pay for use of additional storage or work areas needed for operations.

K. Contractor shall maintain building free from entrance of water at all times during construction.

L. Contractor shall furnish, erect and maintain temporary ladders, ramps, or hoists as may be required for performance of his work.
    1. All such equipment shall be substantially designed, constructed, and maintained in accordance with applicable federal, state, and local laws, ordinances, and regulations, and shall be promptly removed when no longer needed.

M. Contractor shall design, furnish, erect, maintain, and move all ladders and scaffolding required for this work.
    1. All ladders and scaffolding shall be designed, constructed, and maintained in accordance with applicable federal, state, and local law, ordinances, and regulations, and shall be promptly removed when no longer needed.

1.7 CONTRACT DOCUMENTS

A. Contractor will be furnished free of charge four (4) copies of drawings and specifications.

B. On request, additional copies will be furnished to Contractor at cost of reproduction, postage and handling.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Schedule of values.

B. Applications for payment.

C. Change order procedures.

D. Defect assessment.

E. Alternates.

1.2 SCHEDULE OF VALUES

A. Submit printed schedule on AIA Form G703 - Continuation Sheet for G702. Contractor's standard form or electronic media printout will be considered.

B. Submit Schedule of Values in duplicate within 15 days after date established in Notice to Proceed.

C. Format: Utilize Table of Contents of this Project Manual, material section titles on drawings and material schedule line items on drawings. Identify each line item with number and title. Identify site mobilization, bonds and insurance.

D. Revise schedule to list approved Change Orders, with each Application for Payment.

1.3 APPLICATIONS FOR PAYMENT

A. Electronic submittal is preferred. If physical submittal is necessary, refer to subparagraph A.4 below.
   1. Submit each application on AIA Form G702-Application and Certificate for Payment.
   2. Email: Prepare submittals as PDF package and transmit to city by sending via email. Include PDF transmittal letter as specified for Submittals in Section 01 33 00.
   3. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with project identification, "Application for Payment" and application number.
   4. If physical submittal, submit three copies of each application on AIA Form G702-Application and Certificate for Payment.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Submit updated construction schedule with each Application for Payment.

D. For payment of stored materials (when permitted by the contract), include a line for Stored Materials on the Pay Application. (The contractor may wish to submit a sample payment application for City Approval or request a payment application from the City.) A separate schedule listing the stored and installed materials should be included as well as supplier price quotes justifying the price of the stored materials. The payments for stored materials will be deducted from the application as they are installed. All payments of stored materials shall be in accordance with paragraph K of this Section.

E. Payment Period: Submit applications for payment to City for processing no later than 10 days prior to date established for progress payment meeting.

F. Submit with transmittal letter as specified for Submittals in Section 01 33 00.

G. Submit lien waivers.

H. Substantiating Data: When City requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:
   1. Current construction photographs specified in Section 01 33 00.
   2. Partial release of liens from major subcontractors and vendors.
   3. Record documents as specified in Section 01 70 00, for review by Owner which will be returned to Contractor.
   4. Affidavits attesting to off-site stored products.
   5. Construction progress schedules, revised and current as specified in Section 01 32 16.

I. Application for Progress Payment No. 1 shall be accompanied by a notarized statement on Contractor's letterhead as follows:
   1. I certify that the funds requested for the accompanying Pay Request No. 1 will be used to pay all just and lawful bills against the undersigned and his subcontractors for labor, material and equipment employed in the performance of the work. I further certify that such bills will be paid no later than ten (10) calendar days from date of receipt of the Owner's disbursement.
   2. Execute statement with signature of a responsible officer of contracting firm.

J. Each subsequent application for progress payment shall be accompanied by the following supporting documents:
   1. Partial or final waivers of lien in monetary amount from Contractor, each material supplier and/or subcontractor reflecting amounts incorporated into preceding request for progress payment.
   2. A notarized Affidavit of Payment to Material Suppliers and Subcontractors.
      a. Affidavit shall be submitted in exact text as exhibit furnished by City, signed by Contractor or Subcontractor.
      b. Include unit item, actual amount of contract without overhead or profit, amount paid to date and amount to become due (balance of account).

K. Progress payments will be made for materials and equipment not incorporated in the work provided that:
   1. Such materials and equipment have been delivered to and suitable stored at site or some other location approved in writing by Owner. All such materials stored

off-site shall be marked or tagged with identification of project to which they are assigned.

2. Contractor submits evidence of title to such materials and equipment.
3. Care and custody of such materials and equipment and all costs incurred for movement and storage shall be responsibility of Contractor.
4. Such materials and equipment are suitably insured by Contractor. Contractor shall submit a certificate of insurance showing the Owner as an additional insured and showing amount of insurance overage of suitable proof that material and equipment are stored in a bonded warehouse.

L. Refer to Section 01 70 00 for submittal requirements for application for final payment and related closeout procedures and requirements.

1.4 CHANGE ORDER PROCEDURES

A. Submittals: Submit name of individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. The City will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions in writing.

C. The City may issue a Proposal Request including a detailed description of proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with stipulation of overtime work required and the period of time during which the requested price will be considered valid. Contractor will prepare and submit estimate within 10 days.

D. Contractor may propose changes by submitting a request for change to City, describing proposed change and its full effect on the Work. Include a statement describing reason for the change, and effect on Contract Sum/Price and Contract Time with full documentation and a statement describing effect on Work by separate or other Contractors. Document requested substitutions in accordance with Section 01 60 00.

E. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute Work under Construction Change Directive. Changes in Contract Sum/Price or Contract Time will be computed as specified for Change Order.

F. City may issue directive, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute change.

G. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract. City will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.

H. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.

I. Document each quotation for change in cost or time with sufficient data to allow evaluation of quotation.

J. Execution of Change Orders: City will issue Change Orders for signatures of parties as provided in Conditions of the Contract.

K. Correlation Of Contractor Submittals:
1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
3. Promptly enter changes in Project Record Documents.

1.5 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the City, it is not practical to remove and replace the Work, the City will direct appropriate remedy or adjust payment.

C. Individual specification sections may modify these options or may identify specific formula or percentage sum/price reduction.

D. Owner or Owner's representative have the authority to assess defects and identify payment adjustments, is final.

E. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from transporting vehicle.
4. Products placed beyond lines and levels of required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected products.

1.6 ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work.

C. Schedule of Alternates:
Portions of this work shall comply with U.S. Department of the Interior, National Park Service Cultural Resources Heritage Preservation Services Briefs. This Work is

highlighted with **bold type** in the following package descriptions.

Furthermore, Work is divided into the following bid packages.

Package 2 – Mechanical
Alt Bid A – replace standpipe and valves for Fire Protection

Package 3 – Interior finishes
Alt Bid A – **stage and backstage finishes, cleaning, painting, & stage curtain**

Package 4 – Doors and windows
Alt Bid A – **clean & repair existing doors & hardware**, replace 2 existing HM doors.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination and project conditions.

B. Field engineering.

C. Preconstruction meeting.

D. Progress meetings.

1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various sections of the Contract Documents to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion.

C. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 FIELD ENGINEERING

A. Employ Land Surveyor registered in State of Illinois and acceptable to Ownerr.

B. Verify set-backs and easements; confirm drawing dimensions and elevations.

C. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

D. Maintain complete and accurate log of control and survey work as Work progresses.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to City loss or destruction of reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to City.

1.4 PRECONSTRUCTION MEETING

A. Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner, but no later than 15 days after execution of the Agreement.

B. Attendance Required: Owner and Contractor.

C. Agenda:
1. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
2. Designation of personnel representing parties in Contract.
3. Procedures and processing of field decisions, submittals, substitutions, applications for payment, proposal requests, Change Orders and Contract closeout procedures.
4. Scheduling.

D. Entity responsible for conducting meeting will record significant discussions. Distribute minutes of the meeting to each party present and to other parties requiring information, including Owner, within five days of the meeting.

1.5 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum monthly intervals.

B. Attendance Required: Job superintendent, major subcontractors and suppliers, Owner, as appropriate to agenda topics for each meeting.

C. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems impeding planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to Work.

D. Entity responsible for conducting meeting will record significant discussions. Distribute minutes of the meeting to each party present and to other parties requiring information, including Owner, within five days of the meeting.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Format.

B. Schedules.

C. Submittals.

D. Review and evaluation.

E. Updating schedules.

F. Distribution.

1.2 FORMAT

A. Listings: Reading from left to right, in ascending order for each activity. Identify each activity with applicable specification section number.

B. Diagram Sheet Size: 8-1/2”x11”

1.3 SCHEDULES

A. The Contractor shall have the option of scheduling a date of Substantial Completion which is earlier than the date established by the Contract Documents for the date of Substantial Completion; provided, however, in such event, such earlier date of Substantial Completion will be recognized by the Owner only as a matter of convenience to the Contractor and shall not change the date for Substantial Completion established by the Contract Documents or be otherwise binding on the Owner or anyone under the Owner’s control.
   1. Changes that reduce the amount of float but do not extend the Substantial Completion date established by the Contract Documents, are not justification for claims based on delays or additional compensation.

B. Illustrate order and interdependence of activities and sequence of work; how start of given activity depends on completion of preceding activities, and how completion of activity may restrain start of subsequent activities.

C. Illustrate complete sequence of construction by activity, identifying work of separate stages. Indicate dates for submittals including dates for Owner furnished items and return of submittals; dates for procurement and delivery of critical products; and dates for installation and provision for testing. Include legend for symbols and abbreviations used.

D. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.

3. Estimated duration of activity, in maximum 15 day intervals.
4. Earliest start date.
5. Earliest finish date.
6. Actual start date.
7. Actual finish date.
8. Latest start date.
9. Latest finish date.
10. Monetary value of activity, keyed to Schedule of Values.
11. Percentage of activity completed.
12. Responsibility.

E. Required Sorts: List activities in sorts or groups:
1. By preceding work item or event number from lowest to highest.
2. Listing of activities on critical path.

F. Coordinate contents with schedule of values in Section 01 33 00.

1.4 SUBMITTALS

A. Submit under transmittal letter form specified in Section 01 33 00.

1.5 REVIEW AND EVALUATION

A. Review and evaluate project status to determine work behind schedule and work ahead of schedule.

1.6 UPDATING SCHEDULES

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity. Update diagrams to graphically depict current status of Work.

C. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

D. Indicate changes required to maintain Date of Substantial Completion.

E. Prepare narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken or proposed and its effect [including effects of changes on schedules of separate contractors].

1.7 DISTRIBUTION

A. Following joint review, distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.

B. Construction progress schedules.

C. Proposed products list.

D. Product data.

E. Shop drawings.

F. Test reports.

G. Certificates.

H. Manufacturer's instructions.

I. Manufacturer's field reports.

J. Construction photographs.

1.2 SUBMITTAL PROCEDURES

A. Transmit each submittal with shop drawing submittal form found at the end of this section, which identifies the project, contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.

B. Electronic submittals are preferred whenever possible. If physical submittals are necessary, refer to the following section, appropriate to the type of submittal.
   1. Email: Prepare submittals as PDF package and transmit to City by sending via email. Include PDF transmittal form. Include information in email subject line as requested by City.
   2. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

C. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

D. Schedule submittals to expedite Project.

E. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.

F. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.

G. Allow space on submittals for Contractor's review stamp.

H. When revised for resubmission, identify changes made since previous submission.

I. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

J. Submittals not requested will not be recognized or processed.

K. The City's review of Contractor's submittals will be limited to examination of an initial submittal and TWO (2) resubmittals. The Owner is entitled to obtain reimbursement from the Contractor for amounts paid toa consultant for evaluation of additional resubmittals.

1.3 CONSTRUCTION PROGRESS SCHEDULES

A. Prepare Construction Progress Schedule in accordance with Section 01 32 16.

B. Submit initial schedules within 20 days after date established in Notice to Proceed. After review, resubmit required revised data within 10 days.

C. Submit revised Progress Schedules with each Application for Payment.

D. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.

E. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

F. Submit computer generated network analysis diagram as specified in Section 01 32 16.

G. Indicate delivery dates for Owner furnished products.

H. Revisions To Schedules:
   1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
   2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
   3. Prepare narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect.

1.4 PROPOSED PRODUCTS LIST

A. Within 15 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PRODUCT DATA

A. Product Data: Submit to City for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Submit number of copies Contractor requires, plus 3 copies City will retain.

C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00.

1.6 SHOP DRAWINGS

A. Shop Drawings: Submit to City for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Submit number of opaque reproductions Contractor requires, plus 3 copies city will retain.

C. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00.

1.7 TEST REPORTS

A. Submit for city’s knowledge as contract administrator or for Owner.

B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.8 CERTIFICATES

A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to City, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to City.

1.9 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to City for delivery to Owner in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.10 MANUFACTURER'S FIELD REPORTS

A. Submit reports for City’s benefit as contract administrator or for Owner.

B. Submit report in duplicate within 30 days of observation to City for information.

C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.11 CONSTRUCTION PHOTOGRAPHS

A. Take photographs as evidence of existing project conditions:

B. Identify each print on back. Identify name of Project, orientation of view, date and time of view.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

SHOP DRAWING SUBMITTAL

PROJECT: WINDOW, DOOR & HVAC REPLACEMENT
City Hall
302 West Franklin Street
City of Sesser, Franklin County, Illinois

DATE: _____

A/E PROJECT NO: 860-1671

CONTRACTOR: _____

PRESENTED BY:
(Subcontractor/Supplier)

_____
Company Name

_____
Address

_____
Phone/Fax

_____
Contact Person

ITEM: _____

SPEC SECTION: _____

_____

By approving and submitting these shop drawings, product data and samples, we represent that we have determined and verified all materials, field measurements and field construction criteria related thereto, or will do so, and that we have checked and coordinated information contained within submittal with requirements of the work and contract documents.

_____
Contractor's Signature

_____
Date

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality control and control of installation.

B. Tolerances

C. References.

D. Testing and inspection services.

E. Manufacturers' field services.

F. Examination.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. When manufacturers' instructions conflict with Contract Documents, request clarification before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

A. For products or workmanship specified by association, trades, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of Contract Documents, except where specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. When specified reference standards conflict with Contract Documents, request clarification before proceeding.

E. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of City shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.5 TESTING AND INSPECTION SERVICES

A. Owner will employ and pay for specified services of an independent firm to perform testing and inspection.

B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by City.

C. The Contractor will perform testing services when indicated by the pertinent specifications section.

D. When testing services require laboratory services, the following will apply:
   1. Laboratory: Authorized to operate in State of Illinois.
   2. Laboratory Staff: Maintain full time specialist on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

E. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Owner.

F. Reports will be submitted by independent firm to City and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

G. Cooperate shall cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   1. Notify City and independent firm 24 hours prior to expected time for operations requiring services.
   2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

H. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

I. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm or other firm on instructions by City. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.

J. Agency Responsibilities:
1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with City and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify City and Contractor of observed irregularities or non-conformance of Work or products.
6. Perform additional tests required by City.
7. Attend preconstruction meetings and progress meetings.

K. Agency Reports: After each test, promptly submit one copy of report to City and to Contractor. When requested by City, provide interpretation of test results. Include the following:
1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and specifications section.
6. Location in Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
10. Conformance with Contract Documents.

L. Limits On Testing Authority:
1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency or laboratory may not approve or accept any portion of the Work.
3. Agency or laboratory may not assume duties of Contractor.
4. Agency or laboratory has no authority to stop the Work.

1.6 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to City 30 days in advance of required observations.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Refer to Section 01 33 00 - SUBMITTAL PROCEDURES, MANUFACTURERS' FIELD REPORTS article.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify utility services are available, of correct characteristics, and in correct locations.

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities:
   1. Temporary electricity.
   2. Temporary lighting for construction purposes.
   3. Temporary heating.
   4. Temporary cooling.
   5. Temporary ventilation.
   6. Temporary water service.
   7. Temporary sanitary facilities.

B. Construction Facilities:
   1. Vehicular access.
   2. Parking.
   3. Progress cleaning and waste removal.
   4. Traffic regulation.

C. Temporary Controls:
   1. Barriers.
   2. Enclosures and fencing.
   3. Security.
   4. Water control.
   5. Dust control.
   6. Erosion and sediment control.
   7. Noise control.
   8. Pollution control.

D. Removal of utilities, facilities, and controls.

1.2 TEMPORARY ELECTRICITY

A. Provide and pay for power service required from utility source as needed for construction operation.

B. Complement existing power service capacity and characteristics as required for construction operations.

C. Permanent convenience receptacles may be utilized during construction.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels or as construction project requires.

B. Maintain lighting and provide routine repairs.

1.4 TEMPORARY HEATING

A. Provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.

1.5 TEMPORARY COOLING

A. Provide and pay for cooling devices and cooling as needed to maintain specified conditions for construction operations.

1.6 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.7 TEMPORARY WATER SERVICE

A. Provide and pay for suitable quality water service as needed to maintain specified conditions for construction operations. Connect to existing water source. Owner to provide water free of charge for testing purposes. Exercise measures to conserve energy.

1.8 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of project mobilization.

1.9 VEHICULAR ACCESS

A. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.

B. Provide unimpeded access for emergency vehicles. Maintain 12 foot wide driveways with turning space between and around combustible materials.

C. Provide and maintain access to fire hydrants and control valves free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Use designated existing on-site roads for construction traffic.

F. Access to site from limited access highways not permitted except at permitted access points.

1.10 PARKING

A. Arrange for surface parking areas to accommodate construction personnel.

B. When site space is not adequate, provide additional off-site parking.

C. Do not allow heavy vehicles or construction equipment in parking areas.

D. Do not allow vehicle parking on existing pavement.

E. Use of existing on-site streets and driveways used for construction traffic is not permitted.

F. Permanent Pavements And Parking Facilities:
   1. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

G. Maintenance:
   1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
   2. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

H. Mud From Site Vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.11 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing spaces.

C. Collect and remove waste materials, debris, and rubbish from site weekly and dispose off-site.

1.12 TRAFFIC REGULATION

A. Signs, Signals, And Devices:
   1. Post Mounted and Wall Mounted Traffic Control and Informational Signs: As approved by authority having jurisdiction.
   2. Traffic Control Signals: As approved by authority having jurisdiction.
   3. Traffic Cones and Drums, Flares and Lights: As approved by authority having jurisdiction.
   4. Flagperson Equipment: As required by authority having jurisdiction.

B. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

C. Flares And Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

D. Haul Routes:
   1. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.

E. Traffic Signs And Signals:
   1. Provide signs at approaches to site and on site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.

2. Provide, operate, and maintain traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.
3. Relocate as Work progresses, to maintain effective traffic control.

F. Removal:
1. Remove equipment and devices when no longer required.
2. Repair damage caused by installation.
3. Remove post settings to depth of 2 feet.

1.13 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to allow for Owner's use of site, and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.14 ENCLOSURES AND FENCING

A. Construction: Plastic construction netting or chain link.

1.15 SECURITY

A. Security Program:
1. Protect Work from theft, vandalism, and unauthorized entry.
2. Initiate program at project mobilization.
3. Maintain program throughout construction period until Owner occupancy.

1.16 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.17 DUST CONTROL

A. Execute Work by methods to minimize raising dust from construction operations.

B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

1.18 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal area. Prevent erosion and sedimentation.

B. Minimize surface area of bare soil exposed at one time.

C. Provide temporary measures including berms, dikes, and drains, and other devices to prevent water flow.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.19 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise produced by construction operations.

1.20 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

B. Comply with pollution and environmental control requirements of IEPA.

1.21 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to final inspection.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

F. Comparable product.

G. Product selection procedures.

H. Comparable products.

1.2 PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

C. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

D. Basis-of-Design Products specified by naming a specific manufacturer's product, including make or model number or other designation, to establish the significant qualifies related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.6 PRODUCT SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for Substitutions during bidding period to requirements specified in this section.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that Bidder:
   1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
   2. Will provide same warranty for Substitution as for specified product.
   3. Will coordinate installation and make changes to other Work, which may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.
   5. Will reimburse Owner for review or redesign services associated with re-approval by authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

F. Substitution Submittal Procedure:
   1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
   2. Submit CSI Form 13.1.A; include point-by-point comparison of data; attach Product literature.
   3. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
   4. City will notify Contractor in writing of decision to accept or reject request.

1.7 COMPARABLE PRODUCT

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced.
   1. Include Specification Section number and title and Drawing numbers and titles. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
   2. City's Action: If necessary, city will request additional information or documentation for evaluation within one week of receipt of a comparable product request. City will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
      a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
      b. Use product specified if City does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: City will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, City may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Starting of systems.

D. Demonstration and instructions.

E. Testing, adjusting, and balancing.

F. Protecting installed construction.

G. Project record documents.

H. Operation and maintenance data.

I. Manual for materials and finishes.

J. Manual for equipment and systems.

K. Spare parts and maintenance products.

L. Product warranties and product bonds.

M. Maintenance service.

1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for City review.

B. Provide submittals to City required by authorities having jurisdiction.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.

C. Clean site; sweep paved areas, rake clean landscaped surfaces.

D. Remove rocks from grassed or landscaped areas.

E. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Prohibit traffic from landscaped areas.

1.5 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.
   7. Required Permits.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings: Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   3. Field changes of dimension and detail.
   4. Details not on original Contract drawings.

G. Submit documents to City with claim for final Application for Payment.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11 inch text pages, three D side ring binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section or as accepted by the Owner. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Originals of warranties and bonds.

1.7 MANUAL FOR MATERIALS AND FINISHES

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes fifteen days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form within 10 days after final inspection.

E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.

F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

H. Additional Requirements: As specified in individual product specification sections.

I. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.8 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes fifteen days prior to final inspection. Draft copy to be reviewed and returned after final inspection, with Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form within 10 days after final inspection.

E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

G. Include color-coded wiring diagrams as installed.

H. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and special operating instructions.

I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

J. Include servicing and lubrication schedule, and list of lubricants required.

K. Include manufacturer's printed operation and maintenance instructions.

L. Include sequence of operation by controls manufacturer.

M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

N. Include control diagrams by controls manufacturer as installed.

O. Include Contractor's coordination drawings, with color-coded piping diagrams as installed.

P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

R. Include test and balancing reports as specified in Section 01 40 00.

S. Additional Requirements: As specified in individual product specification sections.

T. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.9 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.10 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.

F. Submit prior to final Application for Payment.

G. Time Of Submittals:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.11 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in specification sections during warranty period.

B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.

D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02 41 19 – SELECTIVE STRUCTURE DEMOLITION

1. GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolishing designated building equipment and fixtures.
   2. Demolishing designated construction.
   3. Cutting and alterations for completion of the Work.
   4. Protecting items designated to remain.
   5. Removing demolished materials.
   6. Salvaging items for reinstallation.

1.2 SUBMITTALS

A. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.

B. Shop Drawings:
   1. Indicate demolition and removal sequence.
   2. Indicate location and construction of temporary work.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, and subsurface obstructions.

B. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.4 QUALITY ASSURANCE

A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.

B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.

C. Obtain required permits from authorities having jurisdiction.

1.5 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.6 SCHEDULING

A. Schedule Work to coincide with new construction.

B. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation in adjoining spaces.

C. Coordinate utility and building service interruptions with Owner.
   1. Do not disable or disrupt building fire or life safety systems without three days prior written notice to Using Agency.
   2. Schedule tie-ins to existing systems to minimize disruption.
   3. Coordinate Work to ensure smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.
   4. Maintain operation of existing exterior freezer.

1.7 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

2. PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

3. EXECUTION

3.1 PREPARATION

A. Notify affected utility companies before starting work and comply with their requirements.

B. Mark location and termination of utilities.

C. Erect, and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public, Using Agency, and existing improvements indicated to remain.

D. Provide appropriate temporary signage including signage for exit or building egress.

E. Do not close or obstruct building egress path.

F. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Using Agency.

3.2 SALVAGE REQUIREMENTS

A. Salvage and protect material and equipment to remain as necessary to complete work. Reinstall upon completion of work.

B. Salvage terra cotta roof tile and wall cap and reinstall as noted on drawings. Return unused salvaged material to Owner.

3.3 DEMOLITION

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Protect existing windows and doors throughout demolition and construction.

C. Maintain protected egress from and access to adjacent existing buildings at all times. Provide protected pathway from kitchen to existing freezer during periods when freezer access is required, as indicated by Owner.

D. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer.

E. Disconnect and remove designated utilities within demolition areas as necessary to complete work. Coordinate with Owner prior to disconnection.

F. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.

G. Demolish in orderly and careful manner. Protect existing improvements, and supporting structural members.

H. Carefully remove building components indicated to be reused.
   1. Disassemble components as required to permit removal.
   2. Package small and loose parts to avoid loss.
   3. Mark components and packaged parts to permit reinstallation.
   4. Store components, protected from construction operations, until reinstalled.

I. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

J. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

K. Remove temporary Work.

3.4 REINSTALLATION

A. Reinstall items as indicated on drawings.

3.5 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

END OF SECTION

SECTION 04 05 13

MASONRY MORTAR AND GROUT – TUCK POINTING

PART 1 GENERAL

1.1 WORK INCLUDES

A. Base Bid:
   1. General Contractor provide:

B. Establish construction zone protection, building protection and adjacent site protection.

C. Replace fractured and/or spalled masonry units where shown on drawings.

D. Cut and tuck point existing mortar joints where shown on drawings.

1.2 QUALITY ASSURANCE

A. Masonry restoration contractor shall have not less than five years documented experience doing work specified herein.

B. Workmen shall be experienced in use of equipment on this project. Contractor shall use full-time foreman who has minimum of three years of experience in all phases of masonry restoration used in this project.

1.3 REGULATORY REQUIREMENTS

A. Contractor shall comply with the requirements of EPA regulations, OSHA regulations, and all applicable State and local government regulations governing work within this specification.

B. Building Code Requirements for Masonry Structures (ACI 530-92/ASCE 5-92/TMS 402-92).

C. Contractor shall comply with requirements from the U.S. National Park Service’s Preservation Briefs 1 & 2 and shall meet the Secretary of the Interiors Standards for Rehabilitation.

1.4 SUBMITTALS

A. Proof of experience requirement for firm doing the actual work.

B. Submit manufacturer's product data.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handles masonry mortar and grout materials in accordance with Section 01 61 00 - Common Product Requirements, supplemented as follows:
   1. Deliver prepackaged, dry-blended mortar mix to project site in labelled plastic-lined bags each bearing name and address of manufacturer, production codes or batch numbers, and color or formula numbers.

2. Maintain mortar, grout and packaged materials clean, dry, and protected against dampness, freezing, traffic and contamination by foreign materials.
3. Store integral water-repellent mortar admixture in an area where temperature is maintained between 4° C and 43° C. Do not allow integral water-repellent mortar admixture to freeze. Discard any frozen admixture.

1.6 EXISTING SITE CONDITIONS

A. Examine the existing wall areas to be repaired. The exact amount of work to be performed can only be established by a thorough examination of the site.
1. Ambient Conditions: maintain materials and surrounding air temperature to:

B. Minimum 5° C prior to, during, and 48 hours after completion of masonry work.

C. Maximum 32° C prior to, during, and 48 hours after completion of masonry work.

1.7 WARRANTIES

A. Warrant for a period of one year the masonry repairs against:
1. Loss of bond between mortar and masonry units.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mortar: ASTM C270, Type N, match existing in color:
1. Water shall be potable, clean and free from acids, alkalies, or organic materials.
2. Sand shall conform to ASTM C144, and shall be hard, sharp, clean, well graded, and free of organic material.
3. Lime shall conform to ASTM C207, type S, Hydrated lime for Masonry Purposes. Air entrained lime shall not be used.
4. Cement shall conform to ASTM C150, type II Portland Cement. It shall not contain more than 0.6 percent alkali to avoid efflorescence. Air entrained mortar shall not be used.
5. The use of admixtures will not be permitted without the prior written approval of Architect/Engineer.

B. Expansion Joint Sealants:
1. Sealant material shall be a one component exterior type urethane non- sag (gun) grade with elasticity to provide +25% movement capability. Color of sealant shall match existing mortar color. Comply with Federal Specification TT-S-00230C, Type II, Class A. Acceptable manufacturers:
a. Tremco, DyMonic
b. SIKA Corporation, Sikaflex-1a.
c. Sonneborn Building Products, Sonolastic NP-1.
2. Backer rod shall be round polyethylene closed-cell foam of such diameter to assure compression when placed, and be compatible with the sealant selected.

C. Cleaning Agents
   1. Acceptable manufacturers:
      a. ProSoCo
      b. Hydrozo
      c. Diedrich

PART 3 EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Do not lay masonry or stonework, repoint, install sealant, wash down, or wet surfaces, when temperature may drop below 40 F within 24 hours.

3.2 PLOT PREPARATION

A. Protect existing adjacent windows, roofing and coping from damage due to repair operations. One of the adjacent roofs is city property. The other is Privately Owned. Contractor to acquire written approval from private owner to access roof for repairs.

B. Protect elements surrounding the work of this section from damage or disfiguration.

C. Protect parking lot surface, sidewalks below the work area.

D. Protect roof membrane and flashings from damage. Use plywood panels to protect roofing from punctures and other damage.

E. Where materials are attached to the masonry (such as roof flashing, downspouts and collectors, etc) temporarily remove same to sufficiently allow access to the masonry for required work. Re-attach or re-install at end of project. Provide new attachment hardware where missing, finished to match existing. Repair to existing condition any damage to such materials caused by this Contractor, or replace with like kind.

3.3 REPOINTING

A. Remove existing construction. (Contractor to follow the U.S. National Park Service's Preservation Brief's 1, 2, and 11 for all repairs.)
   1. Remove the damaged or fractured existing mortar joints to a minimum depth of 1", or as much as may be necessary to reach sound material. Take care to avoid damaging existing masonry units or enlarging width of joints. Mechanical tools such as saws or impact hammers will be permitted only on specific written approval of Architect/Engineer and demonstrated ability by operators to use without damage to masonry.
   2. Repair or replace existing masonry units damaged by cutting, spalling and chipping caused by routing operations.
   3. Thoroughly remove loose material from joints using a hose stream under normal pressure or by low-pressure compressed air.
   4. Repair existing masonry units that are cracked or fractured.
   5. Final preparation of the joint shall be done by hand.

B. Preparation.

1. Mortar mixing.
    a. Mortar should be mixed carefully to obtain uniformity of visual and physical characteristics, and comply with ASTM-C270.
    b. Material proportions by volume to produce type N minimum strength:
        1. One part cement, one part lime, 6 parts sand.
    c. Thoroughly mix lime, Portland Cement and sand prior to adding water.
    d. Add one half the water volume and mix for 5 minutes. Remaining water should be added in small amounts until desired consistency is reached.
    e. Mortar should be used within 30 minutes of final mixing.
    f. Re-tempering is not permitted.

C. Filling the joints.

1. After carefully routing and cleaning joints, wet joints thoroughly and then apply fresh re-pointing mortar. Allow water to soak into joints, but joints shall not be visibly wet with standing water during tuck pointing.
2. Fill mortar joints in layers not over 1/4" thick with each layer applied with pressure as soon as previous layer has partially dried. Do not tool each layer smooth; leave surface rough to help bond of subsequent layers. Compress the final packing as much as possible to completely fill joint. Compact joints solidly before final tooling.
3. Tool joints to match existing. Take care to not spread mortar over edges of brick onto exposed surfaces. Do not featheredge mortar. Cure mortar by maintaining in a damp condition for 5 days.
4. Allow mortar to fully harden for 10 days after completion of work.
5. Thoroughly clean exposed masonry surfaces of excess mortar and foreign matter using stiff nylon or bristle brushes and cleaning agent.

3.4 CLEANING-GENERAL

A. Promptly as work proceeds and upon completion, remove excess mortar, smears, efflorescence and droppings.

1. Before cleaning verify that all mortar joints in area to be cleaned have been repointed and are sufficiently hard for cleaning.
2. Test areas to be cleaned to determine the most effective cleaning method starting with the gentlest means possible utilizing brush and water wash at low to medium pressure. If alkaline or acidic cleaning methods are necessary, mask off areas below to protect finishes that may be damaged by chemical cleaners.
3. Start cleaning at the lowest designated wall area and proceed to the top of the wall always keeping surfaces wet below the area being cleaned and rinse frequently to reduce the potential for streaking.
4. After the designated area has been cleaned, wash down the wall areas below.
5. The use of abrasive cleaning will not be permitted.

B. Clean adjacent and adjoining surface of marks arising out of execution of work of this section.

C. At end of each day’s work, sweep up and remove sand, mortar droppings, dust, dirt, debris, and rubbish.

D. At completion of this work, remove all construction aids and ensure that all sand, mortar droppings, debris, and rubbish have been removed.

END OF SECTION

1 PRESERVATION BRIEFS

Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings

Robert C. Mack, AIA
Anne Grimmer

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

Inappropriate cleaning and coating treatments are a major cause of damage to historic masonry buildings. While either or both treatments may be appropriate in some cases, they can be very destructive to historic masonry if they are not selected carefully. Historic masonry, as considered here, includes stone, brick, architectural terra cotta, cast stone, concrete and concrete block. It is frequently cleaned because cleaning is equated with improvement. Cleaning may sometimes be followed by the application of a water-repellent coating. However, unless these procedures are carried out under the guidance and supervision of an architectural conservator, they may result in irrevocable damage to the historic resource.

The purpose of this Brief is to provide information on the variety of cleaning methods and materials that are available for use on the *exterior* of historic masonry buildings, and to provide guidance in selecting the most appropriate method or combination of methods. The difference between water-repellent coatings and waterproof coatings is explained, and the purpose of each, the suitability of their application to historic masonry buildings, and the possible consequences of their inappropriate use are discussed.

The Brief is intended to help develop sensitivity to the qualities of historic masonry that makes it so special, and to assist historic building owners and property managers in working cooperatively with architects, architectural conservators and contractors (Fig. 1). Although specifically intended for historic buildings, the information is applicable to all masonry buildings. This publication updates and expands *Preservation Brief 1: The Cleaning and Waterproof Coating of Masonry Buildings*. The Brief is not meant to be a cleaning manual or a guide for preparing specifications. Rather, it provides general information to raise awareness of the many factors involved in selecting cleaning and water-repellent treatments for historic masonry buildings.

Figure 1. Low-to medium-pressure steam (hot-pressurized water washing), is being used to clean the exterior of the U.S. Tariff Commission Building, the first marble building constructed in Washington, D.C., in 1839. This method was selected by an architecural conservator as the "gentlest means possible" to clean the marble. Steam can soften heavy soiling deposits such as those on the cornice and column capitals, and facilitate easy removal. Note how these deposits have been removed from the right side of the cornice which has already been cleaned.

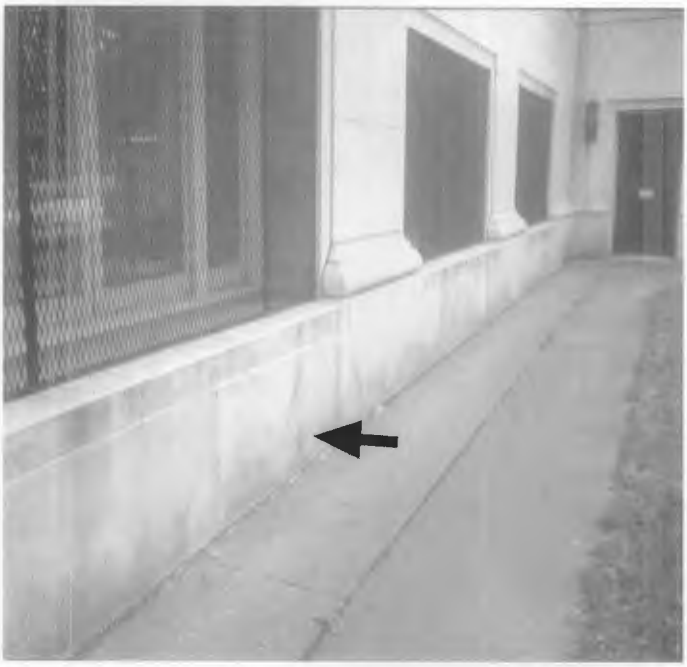

Figure 2. Biological growth as shown on this marble foundation can usually be removed using a low-pressure water wash, possibly with a non-ionic detergent added to it, and scrubbing with a natural or synthetic bristle brush.

Figure 3. This small test area has revealed a red brick patch that does not match the original beige brick. This may explain why the building was painted, and may suggest to the owner that it may be preferable to keep it painted.

Preparing for a Cleaning Project

Reasons for cleaning. First, it is important to determine whether it is appropriate to clean the masonry. The objective of cleaning a historic masonry building must be considered carefully before arriving at a decision to clean. There are several major reasons for cleaning a historic masonry building: **improve the appearance of the building** by removing unattractive dirt or soiling materials, or non-historic paint from the masonry; **retard deterioration** by removing soiling materials that may be damaging the masonry; or **provide a clean surface** to accurately match repointing mortars or patching compounds, or to conduct a condition survey of the masonry.

Identify what is to be removed. The general nature and source of dirt or soiling material on a building must be identified to remove it in the *gentlest means possible* — that is, in the most effective, yet least harmful, manner. Soot and smoke, for example, require a different cleaning agent to remove than oil stains or metallic stains. Other common cleaning problems include biological growth such as mold or mildew, and organic matter such as the tendrils left on masonry after removal of ivy (Fig. 2).

Consider the historic appearance of the building. If the proposed cleaning is to remove paint, it is important in each case to learn whether or not unpainted masonry is historically appropriate. And, it is necessary to consider why the building was painted (Fig. 3). Was it to cover bad repointing or unmatched repairs? Was the building painted to protect soft brick or to conceal deteriorating stone? Or, was painted masonry simply a fashionable treatment in a particular historic period? Many buildings were painted at the time of construction or shortly thereafter; retention of the paint, therefore, may be more appropriate historically than removing it. And, if the building appears to have been painted for a long time, it is also important to think about whether the paint is part of the character of the historic building and if it has acquired significance over time.

Consider the practicalities of cleaning or paint removal. Some gypsum or sulfate crusts may have become integral with the stone and, if cleaning could result in removing some of the stone surface, it may be preferable not to clean. Even where unpainted masonry is appropriate, the retention of the paint may be more practical than removal in terms of long range preservation of the masonry. In some cases, however, removal of the paint may be desirable. For example, the old paint layers may have built up to such an extent that removal is necessary to ensure a sound surface to which the new paint will adhere.

Study the masonry. Although not always necessary, in some instances it can be beneficial to have the coating or paint type, color, and layering on the masonry researched before attempting its removal. Analysis of the nature of the soiling or of the paint to be removed from the masonry, as well as guidance on the appropriate cleaning method, may be provided by professional consultants, including architectural conservators, conservation scientists and preservation architects. The State Historic Preservation Office (SHPO), local historic district commissions, architectural review boards and preservation-oriented websites may also be able to supply useful information on masonry cleaning techniques.

Understanding the Building Materials

The construction of the building must be considered when developing a cleaning program because inappropriate cleaning can have a deleterious effect on the masonry as well as on other building materials. The masonry material or materials must be correctly identified. It is sometimes difficult to distinguish one type of stone from another; for example, certain sandstones can be easily confused with limestones. Or, what appears to be natural stone may not be stone at all, but cast stone or concrete. Historically, cast stone and architectural terra cotta were frequently used in combination with natural stone, especially for trim elements or on upper stories of a building where, from a distance, these substitute materials looked like real stone (Fig. 4). Other features on historic buildings that appear to be stone, such as decorative cornices, entablatures and window hoods, may not even be masonry, but metal.

Identify prior treatments. Previous treatments of the building and its surroundings should be researched and building maintenance records should be obtained, if available. Sometimes if streaked or spotty areas do not seem to get cleaner following an initial cleaning, closer inspection and analysis may be warranted. The discoloration may turn out not to be dirt but the remnant of a water-repellent coating applied long ago which has darkened the surface of the masonry over time (Fig. 5). Successful removal may require testing several cleaning agents to find something that will dissolve and remove the coating. Complete removal may not always be possible. Repairs may have been stained to match a dirty building, and cleaning may make these differences apparent. De-icing salts used near the building that have dissolved can migrate into the masonry. Cleaning may draw the salts to the surface, where they will appear as efflorescence (a powdery, white substance), which may require a second treatment to be removed. Allowances for dealing with such unknown factors, any of which can be a potential problem, should be included when investigating cleaning methods and materials. Just as more than one kind of masonry on a historic building may necessitate multiple cleaning approaches, unknown conditions that are encountered may also require additional cleaning treatments.

Figure 4. The foundation of this brick building is limestone, but the decorative trim above is architectural terra cotta intended to simulate stone.

Figure 5. Repeated water washing did not remove the staining inside this limestone porte cochere. Upon closer examination, it was determined to be a water-repellent coating that had been applied many years earlier. An alkaline cleaner may be effective in removing it.

Choose the appropriate cleaner. The importance of testing cleaning methods and materials cannot be over emphasized. Applying the wrong cleaning agents to historic masonry can have disastrous results. Acidic cleaners can be extremely damaging to acid-sensitive stones, such as marble and limestone, resulting in etching and dissolution of these stones. Other kinds of masonry can also be damaged by incompatible cleaning agents, or even by cleaning agents that are usually compatible. There are also numerous kinds of sandstone, each with a considerably different geological composition. While an acid-based cleaner may be safely used on some sandstones, others are acid-sensitive and can be severely etched or dissolved by an acid cleaner. Some sandstones contain water-soluble minerals and can be eroded by water cleaning. And, even if the stone type is correctly identified, stones, as well as some bricks, may contain unexpected impurities, such as iron particles, that may react negatively with a particular cleaning agent and result in staining. Thorough understanding of the physical and chemical properties of the masonry will help avoid the inadvertent selection of damaging cleaning agents.

Figure 6. Timed water soaking can be very effective for cleaning limestone and marble as shown here at the Marble Collegiate Church in New York City. In this case, a twelve-hour water soak using a multi-nozzle manifold was followed by a final water rinse. Photo: Diane S. Kaese, Wiss, Janney, Elstner Associates, Inc., N.Y., N.Y.

Other building materials also may be affected by the cleaning process. Some chemicals, for example, may have a corrosive effect on paint or glass. The portions of building elements most vulnerable to deterioration may not be visible, such as embedded ends of iron window bars. Other totally unseen items, such as iron cramps or ties which hold the masonry to the structural frame, also may be subject to corrosion from the use of chemicals or even from plain water. The only way to prevent problems in these cases is to study the building construction in detail and evaluate proposed cleaning methods with this information in mind. However, due to the very likely possibility of encountering unknown factors, any cleaning project involving historic masonry should be viewed as unique to that particular building.

Cleaning Methods and Materials

Masonry cleaning methods generally are divided into three major groups: water, chemical, and abrasive. *Water methods* soften the dirt or soiling material and rinse the deposits from the masonry surface. *Chemical cleaners* react with dirt, soiling material or paint to effect their removal, after which the cleaning effluent is rinsed off the masonry surface with water. *Abrasive methods* include blasting with grit, and the use of grinders and sanding discs, all of which mechanically remove the dirt, soiling material or paint (and, usually, some of the masonry surface). Abrasive cleaning is also often followed with a water rinse. *Laser cleaning*, although not discussed here in detail, is another technique that is used sometimes by conservators to clean small areas of historic masonry. It can be quite effective for cleaning limited areas, but it is expensive and generally not practical for most historic masonry cleaning projects.

Although it may seem contrary to common sense, masonry cleaning projects should be carried out starting at the bottom and proceeding to the top of the building always keeping all surfaces wet below the area being cleaned. The rationale for this approach is based on the principle that dirty water or cleaning effluent dripping from cleaning in progress above will leave streaks on a dirty surface but will not streak a clean surface as long as it is kept wet and rinsed frequently.

Water Cleaning

Water cleaning methods are generally the *gentlest means possible*, and they can be used safely to remove dirt from all types of historic masonry.* There are essentially four kinds of water-based methods: soaking; pressure water washing; water washing supplemented with non-ionic detergent; and steam, or hot-pressurized water cleaning. Once water cleaning has been completed, it is often necessary to follow up with a water rinse to wash off the loosened soiling material from the masonry.

Soaking. Prolonged spraying or misting with water is particularly effective for cleaning limestone and marble. It is also a good method for removing heavy accumulations of soot, sulfate crusts or gypsum crusts that tend to form in protected areas of a building not regularly washed by rain. Water is distributed to lengths of punctured hose or pipe with non-ferrous fittings hung from moveable scaffolding or a swing stage that continuously mists the surface of the masonry with a very fine spray (Fig. 6). A timed on-off spray is another approach to using this cleaning technique. After one area has been cleaned, the apparatus is moved on to another. Soaking is often used in combination with water washing and is also followed by a final water rinse. Soaking is a very slow method – it may take several days or a week—but it is a very gentle method to use on historic masonry.

Water Washing. Washing with low-pressure or medium-pressure water is probably one of the most commonly used methods for removing dirt or other pollutant soiling from historic masonry buildings (Fig. 7). Starting with a very low pressure (100 psi or below), even using a garden hose, and progressing as needed to slightly higher pressure —generally no higher than 300-400 psi—is always the recommended way to begin. Scrubbing with natural bristle or synthetic bristle brushes—never metal which can abrade the surface and leave metal particles that can stain the masonry—can help in cleaning areas of the masonry that are especially dirty.

Water Washing with Detergents. Non-ionic detergents –which are not the same as soaps –are synthetic organic compounds that are especially effective in removing oily soil. (Examples of some of the numerous proprietary non-ionic detergents include Igepal by GAF, Tergitol by Union Carbide and Triton by Rohm & Haas.) Thus, the addition of a non-ionic detergent, or surfactant, to a low- or medium-pressure water wash can be a useful aid in the cleaning

*Water cleaning methods may not be appropriate to use on some badly deteriorated masonry because water may exacerbate the deterioration, or on gypsum or alabaster which are very soluble in water.

process. (A non-ionic detergent, unlike most household detergents, does not leave a solid, visible residue on the masonry.) Adding a non-ionic detergent and scrubbing with a natural bristle or synthetic bristle brush can facilitate cleaning textured or intricately carved masonry. This should be followed with a final water rinse.

Steam/Hot-Pressurized Water Cleaning. Steam cleaning is actually low-pressure hot water washing because the steam condenses almost immediately upon leaving the hose. This is a gentle and effective method for cleaning stone and particularly for acid-sensitive stones. Steam can be especially useful in removing built-up soiling deposits and dried-up plant materials, such as ivy disks and tendrils. It can also be an efficient means of cleaning carved stone details and, because it does not generate a lot of liquid water, it can sometimes be appropriate to use for cleaning interior masonry (Figs. 8-9).

Potential hazards of water cleaning. Despite the fact that water-based methods are generally the most gentle, even they can be damaging to historic masonry. Before beginning a water cleaning project, it is important to make sure that all mortar joints are sound and that the building is watertight. Otherwise water can seep through the walls to the interior, resulting in rusting metal anchors and stained and ruined plaster.

Some water supplies may contain traces of iron and copper which may cause masonry to discolor. Adding a chelating or complexing agent to the water, such as EDTA (ethylene diamine tetra-acetic acid), which inactivates other metallic ions, as well as softens minerals and water hardness, will help prevent staining on light-colored masonry.

Any cleaning method involving water should never be done in cold weather or if there is any likelihood of frost or freezing because water within the masonry can freeze, causing spalling and cracking. Since a masonry wall may take over a week to dry after cleaning, no water cleaning should be permitted for several days prior to the first average frost date, or even earlier if local forecasts predict cold weather.

Most essential of all, it is important to be aware that using water at too high a pressure, a practice common to "power washing" and "water blasting", is very abrasive and can easily etch marble and other soft stones, as well as some types of brick (Figs. 10-11). In addition, the distance of the nozzle from the masonry surface and the type of nozzle, as well as gallons per minute (gpm), are also important variables in a water cleaning process that can have a significant impact on the outcome of the project. This is why it is imperative that the cleaning be closely monitored to ensure that the cleaning operators do not raise the pressure or bring the nozzle too close to the masonry in an effort to "speed up" the process. The appearance of grains of stone or sand in the cleaning effluent on the ground is an indication that the water pressure may be too high.

Figure 7. Glazed architectural terra cotta often may be cleaned successfully with a low-pressure water wash and hand scrubbing supplemented, if necessary, with a non-ionic detergent. Photo: National Park Service Files.

Chemical Cleaning

Chemical cleaners, generally in the form of proprietary products, are another material frequently used to clean historic masonry. They can remove dirt, as well as paint and other coatings, metallic and plant stains, and graffiti. Chemical cleaners used to remove dirt and soiling include **acids, alkalies** and **organic compounds.** Acidic cleaners, of course, should not be used on masonry that is acid sensitive. Paint removers are **alkaline**, based on **organic solvents** or other chemicals.

Chemical Cleaners to Remove Dirt

Both alkaline and acidic cleaning treatments include the use of water. Both cleaners are also likely to contain surfactants (wetting agents), that facilitate the chemical reaction that removes the dirt. Generally, the masonry is wet first for both types of cleaners, then the chemical cleaner is sprayed on at very low pressure or brushed onto the surface. The cleaner is left to dwell on the masonry for an amount of time recommended by the product manufacturer or, preferably, determined by testing, and rinsed off with a low- or moderate-pressure cold, or sometimes hot, water wash. More than one application of the cleaner may be necessary, and it is always a good practice to test the product manufacturer's recommendations concerning dilution rates and dwell times. Because each cleaning situation is unique, dilution rates and dwell times can vary considerably. The masonry surface may be scrubbed lightly with natural or synthetic bristle brushes prior to rinsing. After rinsing, pH strips should be applied to the surface to ensure that the masonry has been neutralized completely.

Figure 8. (Left) Low-pressure (under 100 psi) steam cleaning (hot-pressurized water washing), is part of the regular maintenance program at the Jefferson Memorial, Washington, D.C. The white marble interior of this open structure is subject to constant soiling by birds, insects and visitors. (Right) This portable steam cleaner enables prompt cleanup when necessary. Photos: National Park Service Files.

Acidic Cleaners. Acid-based cleaning products may be used on **non-acid sensitive** masonry, which generally includes: granite, most sandstones, slate, unglazed brick and unglazed architectural terra cotta, cast stone and concrete (Fig. 12). Most commercial acidic cleaners are composed primarily of hydrofluoric acid, and often include some phosphoric acid to prevent rust-like stains from developing on the masonry after the cleaning. Acid cleaners are applied to the pre-wet masonry which should be kept wet while the acid is allowed to "work", and then removed with a water wash.

Alkaline Cleaners. Alkaline cleaners should be used on **acid-sensitive** masonry, including: limestone, polished and unpolished marble, calcareous sandstone, glazed brick and glazed architectural terra cotta, and polished granite. (Alkaline cleaners may also be used sometimes on masonry materials that are not acid sensitive—after testing, of course—but they may not be as effective as they are on acid-sensitive masonry.) Alkaline cleaning products consist primarily of two ingredients: a non-ionic detergent or surfactant; and an alkali, such as potassium hydroxide or ammonium hydroxide. Like acidic cleaners, alkaline products are usually applied to pre-wet masonry, allowed to dwell, and then rinsed off with water. (Longer dwell times may be necessary with alkaline cleaners than with acidic cleaners.) Two additional steps are required to remove alkaline cleaners after the initial rinse. First the masonry is given a slightly acidic wash—often with acetic acid–to neutralize it, and then it is rinsed again with water.

Chemical Cleaners to Remove Paint and Other Coatings, Stains and Graffiti

Removing paint and some other coatings, stains and graffiti can best be accomplished with alkaline paint removers, organic solvent paint removers, or other cleaning compounds. The removal of layers of paint from a masonry surface usually involves applying the remover either by brush, roller or spraying, followed by a thorough water wash. As with any chemical cleaning, the manufacturer's recommendations regarding application procedures should always be tested before beginning work.

Alkaline Paint Removers. These are usually of much the same composition as other alkaline cleaners, containing potassium or ammonium hydroxide, or trisodium phosphate. They are used to remove oil, latex and acrylic paints, and are effective for removing multiple layers of paint. Alkaline cleaners may also remove some acrylic, water-repellent coatings. As with other alkaline cleaners, both an acidic neutralizing wash and a final water rinse are generally required following the use of alkaline paint removers.

Organic Solvent Paint Removers. The formulation of organic solvent paint removers varies and may include a combination of solvents, including methylene chloride, methanol, acetone, xylene and toluene.

Figure 9. (Left) This small steam cleaner—the size of a vacuum cleaner—offers a very controlled and gentle means of cleaning limited, or hard-to-reach areas or carved stone details. (Right) It is particularly useful for interiors where it is important to keep moisture to a minumum, such as inside the Washington Monument, Washington, D.C., where it was used to clean the commemorative stones. Photos: Audrey T. Tepper.

Figure 10. High-pressure water washing too close to the surface has abraded and, consequently, marred the limestone on this early-20th century building.

Other Paint Removers and Cleaners. Other cleaning compounds that can be used to remove paint and some painted graffiti from historic masonry include paint removers based on N-methyl-2-pyrrolidone (NMP), or on petroleum-based compounds. Removing stains, whether they are industrial (smoke, soot, grease or tar), metallic (iron or copper), or biological (plant and fungal) in origin, depends on carefully matching the type of remover to the type of stain (Fig. 13). Successful removal of stains from historic masonry often requires the application of a number of different removers before the right one is found. The removal of layers of paint from a masonry surface is usually accomplished by applying the remover either by brush, roller or spraying, followed by a thorough water wash (Fig. 14).

Potential hazards of chemical cleaning. Since most chemical cleaning methods involve water, they have many of the potential problems of plain water cleaning. Like water methods, they should not be used in cold weather because of the possibility of freezing. Chemical cleaning should never be undertaken in temperatures below 40 degrees F (4 degrees C), and generally not below 50 degrees F. In addition, many chemical cleaners simply do not work in cold temperatures. Both acidic and alkaline cleaners can be dangerous to cleaning operators and, clearly, there are environmental concerns associated with the use of chemical cleaners.

Figure 11. Rinsing with high-pressure water following chemical cleaning has left a horizontal line of abrasion across the bricks on this late-19th century row house.

If not carefully chosen, chemical cleaners can react adversely with many types of masonry. Obviously, acidic cleaners should not be used on acid-sensitive materials; however, it is not always clear exactly what the composition is of any stone or other masonry material. For, this reason, testing the cleaner on an inconspicuous spot on the building is always necessary. While certain acid-based cleaners may be appropriate if used as directed on a particular type of masonry, if left too long or if not adequately rinsed from the masonry they can have a negative effect. For example, hydrofluoric acid can etch masonry leaving a hazy residue (whitish deposits of silica or calcium fluoride salts) on the surface. While this efflorescence may usually be removed by a second cleaning—although it is likely to be expensive and time-consuming—**hydrofluoric acid** can also leave calcium fluoride salts or a colloidal silica deposit on masonry which may be impossible to remove (Fig. 15). Other acids, particularly **hydrochloric (muriatic) acid**, which is very powerful, should not be used on historic masonry, because it can dissolve lime-based mortar, damage brick and some stones, and leave chloride deposits on the masonry.

Figure 12. A mild acidic cleaning agent is being used to clean this heavily soiled brick and granite building. Additional applications of the cleaner and hand-scrubbing, and even poulticing, may be necessary to remove the dark stains on the granite arches below. Photo: Sharon C. Park, FAIA.

Alkaline cleaners can stain sandstones that contain a ferrous compound. Before using an alkaline cleaner on sandstone it is always important to test it, since it may be difficult to know whether a particular sandstone may contain a ferrous compound. Some alkaline cleaners, such as **sodium hydroxide (caustic soda or lye)** and **ammonium bifluoride**, can also damage or leave disfiguring brownish-yellow stains and, in most cases, should not be used on historic masonry. Although alkaline cleaners will not etch a masonry surface as acids can, they are caustic and can burn the surface. In addition, alkaline cleaners can deposit potentially damaging salts in the masonry which can be difficult to rinse thoroughly.

Abrasive and Mechanical Cleaning

Generally, abrasive cleaning methods are not appropriate for use on historic masonry buildings. Abrasive cleaning methods are just that—abrasive. Grit blasters, grinders, and sanding discs all operate by *abrading* the dirt or paint off the surface of the masonry, rather than *reacting* with the dirt and the masonry which is how water and chemical methods work. Since the abrasives do not differentiate between the dirt and the masonry, they can also remove the outer surface of the masonry at the same time, and result in permanently damaging the masonry. Brick, architectural terra cotta, soft stone, detailed carvings, and polished surfaces are especially susceptible to physical and aesthetic damage by abrasive methods. Brick and architectural terra cotta are fired products which have a smooth, glazed surface which can be removed by abrasive blasting or grinding (Figs. 18-19). Abrasively-cleaned masonry is damaged aesthetically as well as physically, and it has a rough surface which tends to hold dirt and the roughness will make future cleaning more difficult. Abrasive cleaning processes can also increase the likelihood of subsurface cracking of the masonry. Abrasion of carved details causes a rounding of sharp corners and other loss of delicate features, while abrasion of polished surfaces removes the polished finish of stone.

Figure 13. Sometimes it may be preferable to paint over a thick asphaltic coating rather than try to remove it, because it can be difficult to remove completely. However, in this case, many layers of asphaltic coating were removed through multiple applications of a heavy duty chemical cleaner. Each application of the cleaner was left to dwell following the manufacturer's reccommendations, and then rinsed thoroughly. (As much as possible of the asphalt was first removed with wooden scrapers.) Although not all the asphalt was removed, this was determined to be an acceptable level of cleanliness for the project.

Figure 14. Chemical removal of paint from this brick building has revealed that the cornice and window hoods are metal rather than masonry.

Mortar joints, especially those with lime mortar, also can be eroded by abrasive or mechanical cleaning. In some cases, the damage may be visual, such as loss of joint detail or increased joint shadows. As mortar joints constitute a significant portion of the masonry surface (up to 20 per cent in a brick wall), this can result in the loss of a considerable amount of the historic fabric. Erosion of the mortar joints may also permit increased water penetration, which will likely necessitate repointing.

Figure 15. The whitish deposits left on the brick by a chemical paint remover may have resulted from inadequate rinsing or from the chemical being left on the surface too long and may be impossible to remove.

Poulticing to Remove Stains and Graffiti

a

b

c

d

Figure 16. (a) The limestone base was heavily stained by runoff from the bronze statue above. (b) A poultice consisting of copper stain remover and ammonia mixed with fuller's earth was applied to the stone base and covered with plastic sheeting to keep it from drying out too quickly. (c) As the poultice dried, it pulled the stain out of the stone. (d) The poultice residue was removed carefully from the stone surface with wooden scrapers and the stone was rinsed with water. Photos: John Dugger.

Graffiti and stains, which have penetrated into the masonry, often are best removed by using a poultice. A poultice consists of an absorbent material or clay powder (such as kaolin or fuller's earth, or even shredded paper or paper towels), mixed with a liquid (solvent or other remover) to form a paste which is applied to the stain (Figs. 16-17). As it dries, the paste absorbs the staining material so that it is not redeposited on the masonry surface. Some commercial cleaning products and paint removers are specially formulated as a paste or gel that will cling to a vertical surface and remain moist for a longer period of time in order to prolong the action of the chemical on the stain. Pre-mixed poultices are also available as a paste or in powder form needing only the addition of the appropriate liquid. The masonry must be pre-wet before applying an alkaline cleaning agent, but not when using a solvent. Once the stain has been removed, the masonry must be rinsed thoroughly.

Figure 17. A poultice is being used to remove salts from the brownstone statuary on the facade of this late-19th century stone church. Photo: National Park Service Files.

Figure 18. The glazed bricks in the center of the pier were covered by a signboard that protected them being damaged by the sandblasting which removed the glaze from the surrounding bricks.

Figure 19. A comparison of undamaged bricks surroundng the electrical conduit with the rest of the brick facade emphasizes the severity of the erosion caused by sandblasting.

Abrasive Blasting. Blasting with abrasive grit or another abrasive material is the most frequently used abrasive method. *Sandblasting* is most commonly associated with abrasive cleaning. Finely ground silica or glass powder, glass beads, ground garnet, powdered walnut and other ground nut shells, grain hulls, aluminum oxide, plastic particles and even tiny pieces of sponge, are just a few of the other materials that have also been used for abrasive cleaning. Although abrasive blasting is not an appropriate method of cleaning historic masonry, it can be safely used to clean some materials. Finely-powdered walnut shells are commonly used for cleaning monumental bronze sculpture, and skilled conservators clean delicate museum objects and finely detailed, carved stone features with very small, micro-abrasive units using aluminum oxide.

A number of current approaches to abrasive blasting rely on materials that are not usually thought of as abrasive, and not as commonly associated with traditional abrasive grit cleaning. Some patented abrasive cleaning processes—one dry, one wet —use finely-ground glass powder intended to "erase" or remove dirt and surface soiling only, but not paint or stains (Fig. 20). Cleaning with baking soda (sodium bicarbonate) is another patented process. Baking soda blasting is being used in some communities as a means of quick graffiti removal. However, it should not be used on historic masonry which it can easily abrade and can permanently "etch" the graffiti into the stone; it can also leave potentially damaging salts in the stone which cannot be removed. Most of these abrasive grits may be used either dry or wet, although dry grit tends to be used more frequently.

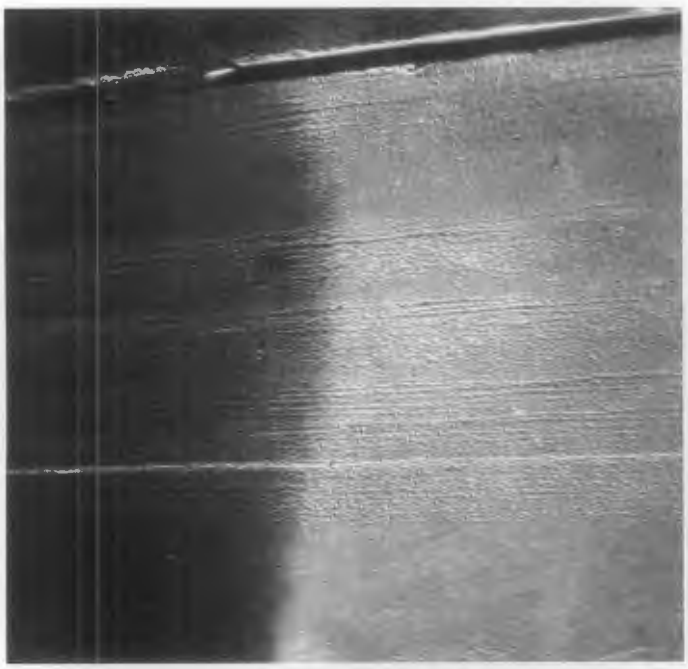

Figure 20. (Left) A comparison of the limestone surface of a 1920s office building before and after "cleaning" with a proprietary abrasive process using fine glass powder clearly shows the effectiveness of this method. But this is an abrasive technique and it has "cleaned" by removing part of the masonry surface with the dirt. Because it is abrasive, it is generally not recommended for large-scale cleaning of historic masonry, although it may be suitable to use in certain, very limited cases under controlled circumstances. (Right) A vacum chamber where the used glass powder is collected for environmentally safe disposal is a unique feature of this particular process. The specially-trained operators in the chamber wear protective clothing, masks and breathing equipment. Photos: Tom Keohan.

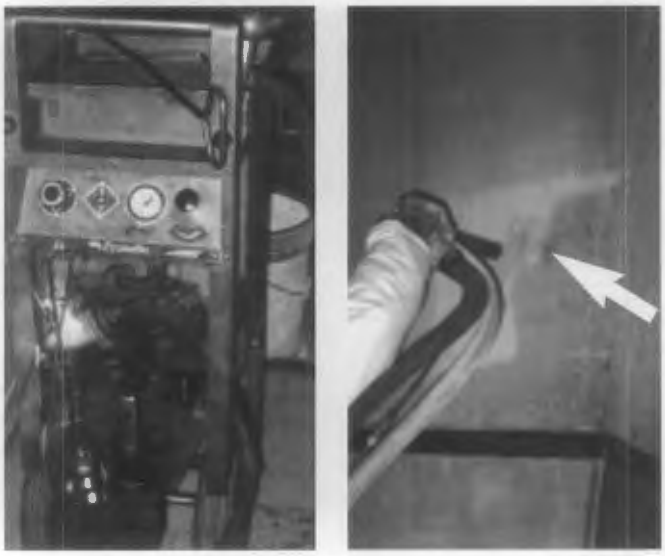

Figure 21. Low-pressure blasting with ice pellets or ice crystals (left) is an abrasive cleaning method that is sometimes recommended for use on interior masonry because it does not involve large amounts of water. However, like other abrasive materials, ice crystals "clean" by removing a portion of the masonry surface with the dirt, and may not remove some stains that have penetrated into the masonry without causing further abrasion (right). Photos: Audrey T. Tepper.

Ice particles, or pelletized dry ice (carbon dioxide or CO_2), are another medium used as an abrasive cleaner (Fig. 21). This is also too abrasive to be used on most historic masonry, but it may have practical application for removing mastics or asphaltic coatings from some substrates.

Some of these processes are promoted as being more environmentally safe and not damaging to historic masonry buildings. However, it must be remembered that they are abrasive and that they "clean" by removing a small portion of the masonry surface, even though it may be only a minuscule portion. The fact that they are essentially abrasive treatments must always be taken into consideration when planning a masonry cleaning project. *In general, abrasive methods should not be used to clean historic masonry buildings.* In some, very limited instances, highly-controlled, gentle abrasive cleaning may be appropriate on selected, hard-to-clean areas of a historic masonry building if carried out under the watchful supervision of a professional conservator. But, abrasive cleaning should never be used on an entire building.

Grinders and Sanding Disks. Grinding the masonry surface with mechanical grinders and sanding disks is another means of abrasive cleaning that should not be used on historic masonry. Like abrasive blasting, grinders and disks do not really clean masonry but instead grind away and abrasively remove and, thus, damage the masonry surface itself rather than remove just the soiling material.

Planning A Cleaning Project

Once the masonry and soiling material or paint have been identified, and the condition of the masonry has been evaluated, planning for the cleaning project can begin.

Testing cleaning methods. In order to determine the *gentlest means possible*, several cleaning methods or materials may have to be tested prior to selecting the best one to use on the building. Testing should always begin with the gentlest and least invasive method proceeding gradually, if necessary, to more complicated methods, or a combination of methods. All too often simple methods, such as low-pressure water wash, are not even considered, yet they frequently are effective, safe, and not expensive. Water of slightly higher pressure or with a non-ionic detergent additive also may be effective. It is worth repeating that these methods should always be tested prior to considering harsher methods; they are safer for the building and the environment, often safer for the applicator, and relatively inexpensive.

The level of cleanliness desired also should be determined prior to selection of a cleaning method. Obviously, the intent of cleaning is to remove most of the dirt, soiling material, stains, paint or other coating. A "brand new" appearance, however, may be inappropriate for an older building, and may require an overly harsh cleaning method to be achieved. When undertaking a cleaning project, it is important to be aware that some stains simply may not be removable. It may be wise, therefore, to agree upon a slightly lower level of cleanliness that will serve as the standard for the cleaning project. The precise amount of residual dirt considered acceptable may depend on the type of masonry, the type of soiling and difficulty of total removal, and local environmental conditions.

Cleaning tests should be carried out in an area of sufficient size to give a true indication of their effectiveness. It is preferable to conduct the test in an inconspicuous location on the building so that it will not be obvious if the test is not successful. A test area may be quite small to begin, sometimes as small as six square inches, and gradually may be increased in size as the most appropriate methods and cleaning agents are determined. Eventually the test area may be expanded to a square yard or more, and it should include several masonry units and mortar joints (Fig. 22). It should be remembered that a single building may have several types of masonry and that even similar materials may have different surface finishes. Each material and different finish should be tested separately. Cleaning tests should be evaluated only after the masonry has dried completely. *The results of the tests may indicate that several methods of cleaning should be used on a single building.*

When feasible, test areas should be allowed to weather for an extended period of time prior to final evaluation. A waiting period of a full year would be ideal in order to expose the test patch to a full range of seasons. If this is not possible, the test patch should weather for at least a month or two. For any building which is considered historically important, the delay is insignificant compared to the potential damage and disfigurement which may result from using an incompletely tested method. *The successfully cleaned test patch should be protected as it will serve as a standard against which the entire cleaning project will be measured.*

Environmental considerations. The potential effect of any method proposed for cleaning historic masonry should be evaluated carefully. Chemical cleaners and paint removers may damage trees, shrubs, grass, and plants. A plan must be provided for environmentally safe removal and disposal of the cleaning materials and the rinsing effluent before beginning the cleaning project. Authorities from the local regulatory agency—usually under the jurisdiction of the federal or state Environmental Protection Agency (EPA) should be consulted prior to beginning a cleaning project, especially if it involves anything more than plain water washing. This advance planning will ensure that the cleaning effluent or run-off, which is the combination of the cleaning agent and the substance removed from the masonry, is handled and disposed of in an environmentally sound and legal manner. Some alkaline and acidic cleaners can be neutralized so that they can be safely discharged into storm sewers. However, most solvent-based cleaners cannot be neutralized and are categorized as pollutants, and must be disposed of by a licensed transport, storage and disposal facility. Thus, it is always advisable to consult with the appropriate agencies before starting to clean to ensure that the project progresses smoothly and is not interrupted by a stop-work order because a required permit was not obtained in advance.

Vinyl guttering or polyethylene-lined troughs placed around the perimeter of the base of the building can serve to catch chemical cleaning waste as it is rinsed off the building. This will reduce the amount of chemicals entering and polluting the soil, and also will keep the cleaning waste contained until it can be removed safely. Some patented cleaning systems have developed special equipment to facilitate the containment and later disposal of cleaning waste.

Concern over the release of volatile organic compounds (VOCs) into the air has resulted in the manufacture of new, more environmentally responsible cleaners and paint removers, while some materials traditionally used in cleaning may no longer be available for these same reasons. Other health and safety concerns have created additional cleaning challenges, such as lead paint removal, which is likely to require special removal and disposal techniques.

Cleaning can also cause damage to non-masonry materials on a building, including glass, metal and wood. Thus, it is usually necessary to cover windows and doors, and other features that may be vulnerable to chemical cleaners. They should be covered with plastic or polyethylene, or a masking agent that is applied as a liquid which dries to form a thin protective film on glass, and is easily peeled off after the cleaning is finished. Wind drift, for example, can also damage other property by carrying cleaning chemicals onto nearby automobiles, resulting in etching of the glass or spotting of the paint finish. Similarly, airborne dust can enter surrounding buildings, and excess water can collect in nearby yards and basements.

Safety considerations. Possible health dangers of each method selected for the cleaning project must be considered before selecting a cleaning method to avoid harm to the

Figure 22. Cleaning test areas may be quite small at first and gradually increase in size as testing determines the "gentlest means possible". Photo: Frances Gale.

cleaning applicators, and the necessary precautions must be taken. The precautions listed in Material Safety Data Sheets (MSDS) that are provided with chemical products should always be followed. Protective clothing, respirators, hearing and face shields, and gloves must be provided to workers to be worn at all times. Acidic and alkaline chemical cleaners in both liquid and vapor forms can also cause serious injury to passers-by (Fig. 23). It may be necessary to schedule cleaning at night or weekends if the building is located in a busy urban area to reduce the potential danger of chemical overspray to pedestrians. Cleaning during non-business hours will allow HVAC systems to be turned off and vents to be covered to prevent dangerous chemical fumes from entering the building which will also ensure the safety of the building's occupants. Abrasive and mechanical methods produce dust which can pose a serious health hazard, particularly if the abrasive or the masonry contains silica.

Water-Repellent Coatings and Waterproof Coatings

To begin with, it is important to understand that waterproof coatings and water-repellent coatings are not the same. Although these terms are frequently interchanged and commonly confused with one another, they are completely different materials. **Water-repellent coatings** –often referred to incorrectly as "sealers", but which do not or should not seal– are intended to keep liquid water from penetrating the surface but to allow water vapor to enter and leave, or pass through, the surface of the masonry (Fig. 24). Water-repellent coatings are generally *transparent*, or clear, although once applied some may darken or discolor certain types of masonry while others may give it a glossy or shiny appearance. **Waterproof coatings** seal the surface from liquid water and from water vapor. They are usually *opaque*, or pigmented, and include bituminous coatings and some elastomeric paints and coatings.

Water-Repellent Coatings

Water-repellent coatings are formulated to be vapor permeable, or "breathable". They do not seal the surface completely to water vapor so it can enter the masonry wall as well as leave the wall. While the first water-repellent coatings to be developed were primarily acrylic or silicone resins in organic solvents, now most water-repellent coatings are water-based and formulated from modified siloxanes, silanes and other alkoxysilanes, or metallic stearates. While some of these products are shipped from the factory ready to use, other waterborne water repellents must be diluted at the job site. Unlike earlier water-repellent coatings which tended to form a "film" on the masonry surface, modern water-repellent coatings actually penetrate into the masonry substrate slightly and, generally, are almost invisible if properly applied to the masonry. They are also more vapor permeable than the old coatings, yet they still reduce the vapor permeability of the masonry. Once inside the wall, water vapor can condense at cold spots producing liquid water which, unlike water vapor, cannot escape through a water-repellent coating. The liquid water within the wall, whether from condensation, leaking gutters, or other sources, can cause considerable damage.

Water-repellent coatings are not consolidants. Although modern water repellents may penetrate slightly beneath the masonry surface, instead of just "sitting" on top of it, they do not perform the same function as a consolidant which is to "consolidate" and replace lost binder to strengthen deteriorating masonry. Even after many years of laboratory study and testing few consolidants have proven very effective. The composition of fired products such as brick and architectural terra cotta, as well as many types of building stone, does not lend itself to consolidation.

Some modern water-repellent coatings which contain a binder intended to replace the natural binders in stone that have been lost through weathering and natural erosion are described in product literature as both a water repellent and a consolidant. The fact that newer water-repellent coatings penetrate beneath the masonry surface instead of just forming a layer on top of the surface may indeed convey at least some consolidating properties to certain stones. However, a water-repellent coating cannot be considered a consolidant. In some instances, a water-repellent or "preservative" coating, if applied to already damaged or spalling stone, may form a surface crust which, if it fails, may exacerbate the deterioration by pulling off even more of the stone (Fig. 25).

Is a Water-Repellent Treatment Necessary?

Water-repellent coatings are frequently applied to historic masonry buildings for the wrong reason. They also are often applied without an understanding of what they are and what they are intended to do. And these coatings can be very difficult, if not impossible, to remove from the masonry if they fail or become discolored. Most importantly, the application of water-repellent coatings to historic masonry is usually unnecessary.

Figure 23. A tarpaulin protects and shields pedestrians from potentially harmful spray while chemical cleaning is underway on the granite exterior of the U.S. Treasury Building, Washington, D.C.

Most historic masonry buildings, unless they are painted, have survived for decades without a water-repellent coating and, thus, probably do not need one now. Water penetration to the interior of a masonry building is seldom due to porous masonry, but results from poor or deferred maintenance. Leaking roofs, clogged or deteriorated gutters and downspouts, missing mortar, or cracks and open joints around door and window openings are almost always the cause of moisture-related problems in a historic masonry building. **If historic masonry buildings are kept watertight and in good repair, water-repellent coatings should not be necessary.**

Rising damp (capillary moisture pulled up from the ground), or condensation can also be a source of excess moisture in masonry buildings. A water-repellent coating will not solve this problem either and, in fact, may be likely to exacerbate it. Furthermore, a water-repellent coating should never be applied to a damp wall. Moisture in the wall would reduce the ability of a coating to adhere to the masonry and to penetrate below the surface. But, if it did adhere, it would hold the moisture inside the masonry because, although a water-repellent coating is permeable to water vapor, liquid water cannot pass through it. In the case of rising damp, a coating may force the moisture to go even higher in the wall because it can slow down evaporation, and thereby retain the moisture in the wall.

Excessive moisture in masonry walls may carry waterborne soluble salts from the masonry units themselves or from the mortar through the walls. If the water is permitted to come to the surface, the salts may appear on the masonry surface as efflorescence (a whitish powder) upon evaporation. However, the salts can be potentially dangerous if they remain in the masonry and crystallize

Figure 24. Although the application of a water-repellent coating was probably not needed on either of these buildings, the coating on the brick building (above), is not visible and has not changed the character of the brick. But the coating on the brick column (below), has a high gloss that is incompatible with the historic character of the masonry.

beneath the surface as subflorescence. Subflorescence eventually may cause the surface of the masonry to spall, particularly if a water-repellent coating has been applied which tends to reduce the flow of moisture out from the subsurface of the masonry. Although many of the newer water-repellent products are more breathable than their predecessors, they can be especially damaging if applied to masonry that contains salts, because they limit the flow of moisture through masonry.

When a Water-Repellent Coating May be Appropriate

There are some instances when a water-repellent coating may be considered appropriate to use on a historic masonry building. Soft, incompletely fired brick from the 18th- and early-19th centuries may have become so porous that paint or some type of coating is needed to protect it from further deterioration or dissolution. When a masonry building has been neglected for a long period of time, necessary repairs may be required in order to make it watertight. If, following a reasonable period of time after the building has been made watertight and has dried out completely, moisture appears actually to be penetrating through the repointed and repaired masonry walls, then the application of a water-repellent coating may be considered *in selected areas only*. This decision should be made in consultation with an architectural conservator. And, if such a treatment is undertaken, it should not be applied to the entire exterior of the building.

Anti-graffiti or barrier coatings are another type of clear coating—although barrier coatings can also be pigmented—that may be applied to exterior masonry, but they are not formulated primarily as water repellents. The purpose of these coatings is to make it harder for graffiti to stick to a masonry surface and, thus, easier to clean. But, like water-repellent coatings, in most cases the application of anti-graffiti coatings is generally not recommended for historic masonry buildings. These coatings are often quite shiny which can greatly alter the appearance of a historic masonry surface, and they are not always effective (Fig. 26). Generally, other ways of discouraging graffiti, such as improved lighting, can be more effective than a coating. However, the application of anti-graffiti coatings may be appropriate in some instances on vulnerable areas of historic masonry buildings which are frequent targets of graffiti that are located in out-of-the-way places where constant surveillance is not possible.

Some water-repellent coatings are recommended by product manufacturers as a means of keeping dirt and pollutants or biological growth from collecting on the surface of masonry buildings and, thus, reducing the need for frequent cleaning. While this at times may be true, in some cases a coating may actually retain dirt more than uncoated masonry. Generally, the application of a water-repellent coating is not recommended on a historic masonry building as a means of preventing biological growth. Some water-repellent coatings may actually encourage biological growth on a masonry wall. Biological growth on masonry buildings has traditionally been kept at bay through regularly-scheduled cleaning as part of a maintenance plan. Simple cleaning of the masonry with low-pressure water using a natural- or synthetic-bristled scrub brush can be very effective if done on a regular basis. Commercial products are also available which can be sprayed on masonry to remove biological growth.

In most instances, a water-repellent coating is not necessary if a building is watertight. The application of a water-repellent coating is not a recommended treatment for historic masonry buildings unless there is a specific

Figure 25. The clear coating applied to this limestone molding has failed and is taking off some of the stone surface as it peels. Photo: Frances Gale.

problem which it may help solve. If the problem occurs on only part of the building, it is best to treat only that area rather than an entire building. Extreme exposures such as parapets, for example, or portions of the building subject to driving rain can be treated more effectively and less expensively than the entire building. Water-repellent coatings are not permanent and must be reapplied periodically although, if they are truly invisible, it can be difficult to know when they are no longer providing the intended protection.

Figure 26. The anti-graffiti or barrier coating on this column is very shiny and would not be appropriate to use on a historic masonry building. The coating has discolored as it has aged and whitish streaks reveal areas of bare concrete where the coating was incompletely applied.

Testing a water-repellent coating by applying it in one small area may not be helpful in determining its suitability for the building because a limited test area does not allow an adequate evaluation of such a treatment. Since water may enter and leave through the surrounding untreated areas, there is no way to tell if the coated test area is "breathable." But trying a coating in a small area may help to determine whether the coating is visible on the surface or if it will otherwise change the appearance of the masonry.

Waterproof Coatings

In theory, waterproof coatings usually do not cause problems as long as they exclude all water from the masonry. If water does enter the wall from the ground or from the inside of a building, the coating can intensify the damage because the water will not be able to escape. During cold weather this water in the wall can freeze causing serious mechanical disruption, such as spalling.

In addition, the water eventually will get out by the path of least resistance. If this path is toward the interior, damage to interior finishes can result; if it is toward the exterior, it can lead to damage to the masonry caused by built-up water pressure (Fig. 27).

In most instances, waterproof coatings should not be applied to historic masonry. The possible exception to this might be the application of a waterproof coating to below-grade exterior foundation walls as a last resort to stop water infiltration on interior basement walls. **Generally, however, waterproof coatings, which include *elastomeric paints*, should almost never be applied above grade to historic masonry buildings.**

Figure 27. Instead of correcting the roof drainage problems, an elastomeric coating was applied to the already saturated limestone cornice. An elastomeric coating holds moisture in the masonry because it does not "breathe" and does not allow liquid moisture to escape. If the water pressure builds up sufficiently it can cause the coating to break and pop off as shown in this example, often pulling pieces of the masonry with it. Photo: National Park Service Files.

Summary

A well-planned cleaning project is an essential step in preserving, rehabilitating or restoring a historic masonry building. Proper cleaning methods and coating treatments, when determined necessary for the preservation of the masonry, can enhance the aesthetic character as well as the structural stability of a historic building. Removing years of accumulated dirt, pollutant crusts, stains, graffiti or paint, if done with appropriate caution, can extend the life and longevity of the historic resource. Cleaning that is carelessly or insensitively prescribed or carried out by inexperienced workers can have the opposite of the intended effect. It may scar the masonry permanently, and may actually result in hastening deterioration by introducing harmful residual chemicals and salts into the masonry or causing surface loss. Using the wrong cleaning method or using the right method incorrectly, applying the wrong kind of coating or applying a coating that is not needed can result in serious damage, both physically and aesthetically, to a historic masonry building. Cleaning a historic masonry building should always be done using the *gentlest means possible* that will clean, but not damage the building. It should always be taken into consideration before applying a water-repellent coating or a waterproof coating to a historic masonry building whether it is really necessary and whether it is in the best interest of preserving the building.

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Acknowledgments

Robert C. Mack, FAIA, is a principal in the firm of MacDonald & Mack Architects, Ltd., an architectural firm that specializes in historic buildings in Minneapolis, Minnesota.
Anne Grimmer is a Senior Architectural Historian in the Technical Preservation Services Branch, Heritage Preservation Services Program, National Park Service, Washington, D.C.

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This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Comments on the usefulness of this publication may be directed to: Sharon C. Park, FAIA, Chief, Technical Preservation Services Branch, Heritage Preservation Services Program, National Park Service, 1849 C Street, N.W., Suite NC200, Washington, D.C. 20240 (www2.cr.nps.gov/tps).

Front Cover: Chemical cleaning of the brick and architectural terra cotta frieze on the 1880s Pension Building, Washington, D.C. (now the National Building Museum), is shown here in progress. Photo: Christina Henry.

Photographs used to illustrate this Brief were taken by Anne Grimmer unless otherwise credited.

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2 PRESERVATION BRIEFS

Repointing Mortar Joints in Historic Masonry Buildings

Robert C. Mack, FAIA
John P. Speweik

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

Figure 1. After removing deteriorated mortar, an experienced mason repoints a portion of this early-20th century limestone building. Photo: Robert C. Mack, FAIA.

Masonry — brick, stone, terra-cotta, and concrete block — is found on nearly every historic building. Structures with all-masonry exteriors come to mind immediately, but most other buildings at least have masonry foundations or chimneys. Although generally considered "permanent," masonry is subject to deterioration, especially at the mortar joints. Repointing, also known simply as "pointing"or—somewhat inaccurately—"tuck pointing"*, is the process of removing deteriorated mortar from the joints of a masonry wall and replacing it with new mortar (Fig. 1). Properly done, repointing restores the visual and physical integrity of the masonry. Improperly done, repointing not only detracts from the appearance of the building, but may also cause physical damage to the masonry units themselves.

The purpose of this Brief is to provide general guidance on appropriate materials and methods for repointing historic masonry buildings and it is intended to benefit building owners, architects, and contractors. The Brief should serve as a guide to prepare specifications for repointing historic masonry buildings. It should also help develop sensitivity to the particular needs of historic masonry, and to assist historic building owners in working cooperatively with architects, architectural conservators and historic preservation consultants, and contractors. Although specifically intended for historic buildings, the guidance is appropriate for other masonry buildings as well. This publication updates *Preservation Briefs 2: Repointing Mortar Joints in Historic Brick Buildings* to include all types of historic unit masonry. The scope of the earlier Brief has also been expanded to acknowledge that the many buildings constructed in the first half of the 20th century are now historic and eligible for listing in the National Register of Historic Places, and that they may have been originally constructed with portland cement mortar.

*Tuckpointing technically describes a primarily decorative application of a raised mortar joint or lime putty joint on top of flush mortar joints.

Historical Background

Mortar consisting primarily of lime and sand has been used as an integral part of masonry structures for thousands of years. Up until about the mid-19th century, lime or quicklime (sometimes called lump lime) was delivered to construction sites, where it had to be slaked, or combined with water. Mixing with water caused it to boil and resulted in a wet lime putty that was left to mature in a pit or wooden box for several weeks, up to a year. Traditional mortar was made from lime putty, or slaked lime, combined with local sand, generally in a ratio of 1 part lime putty to 3 parts sand by volume. Often other ingredients, such as crushed marine shells (another source of lime), brick dust, clay, natural cements, pigments, and even animal hair were also added to mortar, but the basic formulation for lime putty and sand mortar remained unchanged for centuries until the advent of portland cement or its forerunner, Roman cement, a natural, hydraulic cement.

Portland cement was patented in Great Britain in 1824. It was named after the stone from Portland in Dorset which it resembled when hard. This is a fast-curing, hydraulic cement which hardens under water. Portland cement was first manufactured in the United States in 1872, although it was imported before this date. But it was not in common use throughout the country until the early 20th century. Up until the turn of the century portland cement was considered primarily an additive, or "minor ingredient" to help accelerate mortar set time. By the 1930s, however, most masons used a mix of equal parts portland cement and lime putty. Thus, the mortar found in masonry structures built between 1873 and 1930 can range from pure lime and sand mixes to a wide variety of lime, portland cement, and sand combinations.

In the 1930s more new mortar products intended to hasten and simplify masons' work were introduced in the U.S. These included **masonry cement**, a premixed, bagged mortar which is a combination of portland cement and ground limestone, and **hydrated lime**, machine-slaked lime that eliminated the necessity of slaking quicklime into putty at the site.

Identifying the Problem Before Repointing

The decision to repoint is most often related to some obvious sign of deterioration, such as disintegrating mortar, cracks in mortar joints, loose bricks or stones, damp walls, or damaged plasterwork. It is, however, erroneous to assume that repointing alone will solve deficiencies that result from other problems (Fig. 2). The root cause of the deterioration—leaking roofs or gutters, differential settlement of the building, capillary action causing rising damp, or extreme weather exposure—should always be dealt with prior to beginning work. Without appropriate repairs to eliminate the source of the problem, mortar deterioration will continue and any repointing will have been a waste of time and money.

Use of Consultants. Because there are so many possible causes for deterioration in historic buildings, it may be desirable to retain a consultant, such as a historic architect or architectural conservator, to analyze the building. In addition to determining the most appropriate solutions to the problems, a consultant can prepare specifications which reflect the particular requirements of each job and can provide oversight of the work in progress. Referrals to preservation consultants frequently can be obtained from State Historic Preservation Offices, the American Institute for Conservation of Historic and Artistic Works (AIC), the Association for Preservation Technology (APT), and local chapters of the American Institute of Architects (AIA).

Figure 2. Much of the mortar on this building has been leached away by water from a leaking downspout. The downspout must be replaced and any other drainage problems repaired before repointing. Photo: Robert C. Mack, FAIA.

Finding an Appropriate Mortar Match

Preliminary research is necessary to ensure that the proposed repointing work is both physically and visually appropriate to the building. Analysis of unweathered portions of the historic mortar to which the new mortar will be matched can suggest appropriate mixes for the repointing mortar so that it will not damage the building because it is excessively strong or vapor impermeable. Examination and analysis of the masonry units—brick, stone or terra cotta—and the techniques used in the original construction will assist in maintaining the building's historic appearance (Figs. 3-4). A simple, non-technical, evaluation of the masonry units and mortar can provide information concerning the relative strength and permeability of each–critical factors in selecting the repointing mortar—while a visual analysis of the historic mortar can provide the information necessary for developing the new mortar mix and application techniques.

Although not crucial to a successful repointing project, for projects involving properties of special historic significance, a mortar analysis by a qualified laboratory can be useful by providing information on the original ingredients. However, there are limitations with such an analysis, and replacement mortar specifications should not be based solely on laboratory analysis. Analysis requires interpretation, and there are important factors which affect the condition and performance of the mortar that cannot be established through laboratory analysis. These may include: the original water content, rate of curing, weather conditions during original construction, the method of mixing and placing the mortar, and the cleanliness and condition of the sand. *The most useful information that can come out of laboratory analysis is the identification of sand by*

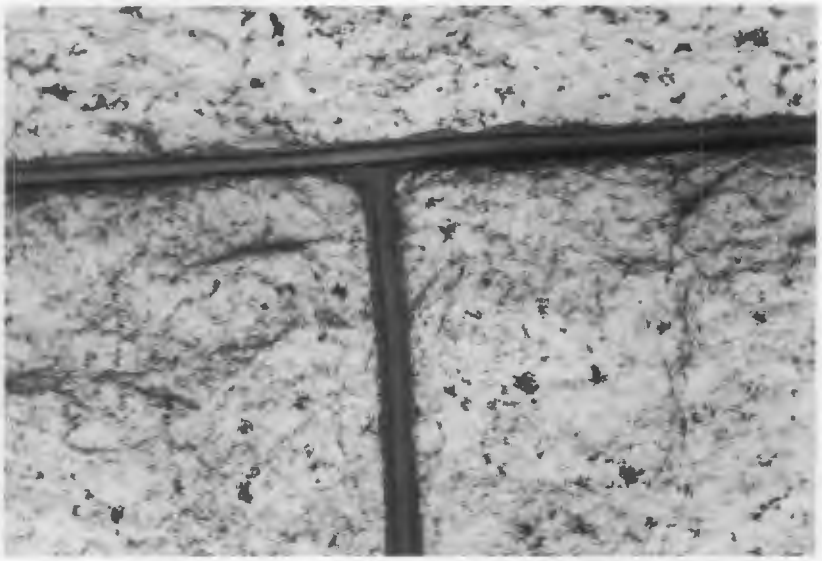


Figure 3. Good-quality repointing closely replicates the original in composition, texture, joint type and profile on this 19th century brick building (left), and on this late-19th century granite on H.H. Richardson's Glessner House in Chicago (right). Photos: Charles E. Fisher: Sharon C. Park, FAIA.

gradation and color. This allows the color and the texture of the mortar to be matched with some accuracy because sand is the largest ingredient by volume.

In creating a repointing mortar that is compatible with the masonry units, the objective is to achieve one that matches the historic mortar as closely as possible, so that the new material can coexist with the old in a sympathetic, supportive and, if necessary, sacrificial capacity. The exact physical and chemical properties of the historic mortar are not of major significance as long as the new mortar conforms to the following criteria:

- The new mortar must match the historic mortar in color, texture and tooling. (If a laboratory analysis is undertaken, it may be possible to match the binder components and their proportions with the historic mortar, if those materials are available.)
- The sand must match the sand in the historic mortar. (The color and texture of the new mortar will usually fall into place if the sand is matched successfully.)
- The new mortar must have **greater vapor permeability** and be **softer** (measured in compressive strength) than the masonry units.
- The new mortar must be **as vapor permeable** and **as soft or softer** (measured in compressive strength) than the historic mortar. (Softness or hardness is not necessarily an indication of permeability; old, hard lime mortars can still retain high permeability.)

Properties of Mortar

Mortars for repointing should be softer or more permeable than the masonry units and no harder or more impermeable than the historic mortar to prevent damage to the masonry units. It is a common error to assume that hardness or high strength is a measure of appropriateness, particularly for lime-based historic mortars. Stresses within a wall caused by expansion, contraction, moisture migration, or settlement must be accommodated in some manner; in a masonry wall these

Figure 4. (left) The poor quality of this repointing–it appears to have been "tooled" with the mason's finger–does not match the delicacy of the original beaded joint on this 19th-century brick wall. (right) It is obvious that the repointing on this "test patch" is not an appropriate replacement mortar joint for this early-19th century stone foundation. Photos: Lee H. Nelson, FAIA.

stresses should be relieved by the mortar rather than by the masonry units. A mortar that is stronger in compressive strength than the masonry units, will not "give," thus causing the stresses to be relieved through the masonry units—resulting in permanent damage to the masonry, such as cracking and spalling, that cannot be repaired easily (Fig. 5). While stresses can also break the bond between the mortar and the masonry units, permitting water to penetrate the resulting hairline cracks, this is easier to correct in the joint through repointing than if the break occurs in the masonry units.

Permeability, or rate of vapor transmission, is also critical. High lime mortars are more permeable than denser cement mortars. Historically, mortar acted as a bedding material–not unlike an expansion joint–rather than a "glue" for the masonry units, and moisture was able to migrate through the mortar joints rather than the masonry units. When moisture evaporates from the masonry it deposits any soluble salts either on the surface as *efflorescence* or below the surface as *subflorescence*. While salts deposited on the surface of masonry units are usually relatively harmless, salt crystallization within a masonry unit creates pressure that can cause parts of the outer surface to spall off or delaminate. If the mortar does not permit moisture or moisture vapor to migrate out of the wall and evaporate, the result will be damage to the masonry units.

Components of Mortar

Sand. Sand is the largest component of mortar and the material that gives mortar its distinctive color, texture and cohesiveness. Sand must be free of impurities, such as salts or clay. The three key characteristics of sand are: particle shape, gradation and void ratios.

Figure 5. The use of hard, portland-cement mortar that is less permeable than the soft bricks has resulted in severe damage to this brick wall. Moisture trapped in the wall was unable to evaporate through the mortar which is intended to be sacrificial, and thus protect the bricks. As a result the moisture remained in the walls until water pressure eventually popped the surface off the bricks. Photo: National Park Service Files.

When viewed under a magnifying glass or low-power microscope, particles of sand generally have either rounded edges, such as found in beach and river sand, or sharp, angular edges, found in crushed or manufactured sand. For repointing mortar, rounded or natural sand is preferred for two reasons. It is usually similar to the sand in the historic mortar and provides a better visual match. It also has better working qualities or plasticity and can thus be forced into the joint more easily, forming a good contact with the remaining historic mortar and the surface of the adjacent masonry units. Although manufactured sand is frequently more readily available, it is usually possible to locate a supply of rounded sand.

The gradation of the sand (particle size distribution) plays a very important role in the durability and cohesive properties of a mortar. Mortar must have a certain percentage of large to small particle sizes in order to deliver the optimum performance. Acceptable guidelines on particle size distribution may be found in ASTM C 144 (American Society for Testing and Materials). However, in actuality, since neither historic nor modern sands are always in compliance with ASTM C 144, matching the same particle appearance and gradation usually requires sieving the sand.

A scoop of sand contains many small voids between the individual grains. A mortar that performs well fills all these small voids with binder (cement/lime combination or mix) in a balanced manner. Well-graded sand generally has a 30 per cent void ratio by volume. Thus, 30 per cent binder by volume generally should be used, unless the historic mortar had a different binder: aggregate ratio. This represents the 1:3 binder to sand ratios often seen in mortar specifications.

For repointing, sand generally should conform to ASTM C 144 to assure proper gradation and freedom from impurities; some variation may be necessary to match the original size and gradation. Sand color and texture also should match the original as closely as possible to provide the proper color match without other additives.

Lime. Mortar formulations prior to the late-19th century used lime as the primary binding material. Lime is derived from heating limestone at high temperatures which burns off the carbon dioxide, and turns the limestone into quicklime. There are three types of limestone—calcium, magnesium, and dolomitic—differentiated by the different levels of magnesium carbonate they contain which impart specific qualities to mortar. Historically, calcium lime was used for mortar rather than the dolomitic lime (calcium magnesium carbonate) most often used today. But it is also important to keep in mind the fact that the historic limes, and other components of mortar, varied a great deal because they were natural, as opposed to modern lime which is manufactured and, therefore, standardized. Because some of the kinds of lime, as well as other components of mortar, that were used historically are no longer readily available, even when a conscious effort is made to replicate a "historic" mix, this may not be achievable due to the differences between modern and historic materials.

Lime, itself, when mixed with water into a paste is very plastic and creamy. It will remain workable and soft indefinitely, if stored in a sealed container. Lime (calcium hydroxide) hardens by carbonation absorbing carbon dioxide primarily from the air, converting itself to calcium carbonate. Once a lime and sand mortar is mixed and placed in a wall, it begins the process of carbonation. If lime mortar is left to dry too rapidly, carbonation of the mortar will be reduced, resulting in poor adhesion and poor durability. In addition, lime mortar is slightly water soluble and thus is able to re-seal any hairline cracks that may develop during the life of the mortar. Lime mortar is soft, porous, and changes little in volume during temperature fluctuations, thus making it a good choice for historic buildings. *Because of these qualities, high calcium lime mortar may be considered for many repointing projects, not just those involving historic buildings.*

For repointing, lime should conform to ASTM C 207, Type S, or Type SA, Hydrated Lime for Masonry Purposes. This machine-slaked lime is designed to assure high plasticity and water retention. The use of quicklime which must be slaked and soaked by hand may have advantages over hydrated lime in some restoration projects if time and money allow.

Lime putty. Lime putty is slaked lime that has a putty or paste-like consistency. It should conform to ASTM C 5. Mortar can be mixed using lime putty according to ASTM C 270 property or proportion specification.

Portland cement. More recent, 20th-century mortar has used portland cement as a primary binding material. A straight portland cement and sand mortar is extremely hard, resists the movement of water, shrinks upon setting, and undergoes relatively large thermal movements. When mixed with water, portland cement forms a harsh, stiff paste that is quite unworkable, becoming hard very quickly. (Unlike lime, portland cement will harden regardless of weather conditions and does not require wetting and drying cycles.) Some portland cement assists the workability and plasticity of the mortar without adversely affecting the finished project; it also provides early strength to the mortar and speeds setting. Thus, it may be appropriate to add some portland cement to an essentially lime-based mortar even when repointing relatively soft 18th or 19th century brick under some circumstances when a slightly harder mortar is required. The more portland cement that is added to a mortar formulation the harder it becomes—and the faster the initial set.

For repointing, portland cement should conform to ASTM C 150. White, non-staining portland cement may provide a better color match for some historic mortars than the more commonly available grey portland cement. But, it should not be assumed, however, that white portland cement is always appropriate for all historic buildings, since the original mortar may have been mixed with grey cement. The cement should not have more than 0.60 per cent alkali to help avoid efflorescence.

Masonry cement. Masonry cement is a preblended mortar mix commonly found at hardware and home repair stores. It is designed to produce mortars with a compressive strength of 750 psi or higher when mixed

MORTAR ANALYSIS

Methods for analyzing mortars can be divided into two broad categories: **wet chemical** and **instrumental**. Many laboratories that analyze historic mortars use a simple **wet-chemical** method called *acid digestion*, whereby a sample of the mortar is crushed and then mixed with a dilute acid. The acid dissolves all the carbonate-containing minerals not only in the binder, but also in the aggregate (such as oyster shells, coral sands, or other carbonate-based materials), as well as any other acid-soluble materials. The sand and fine-grained acid-insoluble material is left behind. There are several variations on the simple acid digestion test. One involves collecting the carbon dioxide gas given off as the carbonate is digested by the acid; based on the gas volume the carbonate content of the mortar can be accurately determined (Jedrzejewska, 1960). Simple acid digestion methods are rapid, inexpensive, and easy to perform, but the information they provide about the original composition of a mortar is limited to the color and texture of the sand. The gas collection method provides more information about the binder than a simple acid digestion test.

Instrumental analysis methods that have been used to evaluate mortars include polarized light or thin-section microscopy, scanning electron microscopy, atomic absorption spectroscopy, X-ray diffraction, and differential thermal analysis. All instrumental methods require not only expensive, specialized equipment, but also highly-trained experienced analysts. However, instrumental methods can provide much more information about a mortar. Thin-section microscopy is probably the most commonly used instrumental method. Examination of thin slices of a mortar in transmitted light is often used to supplement acid digestion methods, particularly to look for carbonate-based aggregate. For example, the new ASTM test method, ASTM C 1324-96 "Test Method for Examination and Analysis of Hardened Mortars" which was designed specifically for the analysis of modern lime-cement and masonry cement mortars, combines a complex series of wet chemical analyses with thin-section microscopy.

The drawback of most mortar analysis methods is that mortar samples of known composition have not been analyzed in order to evaluate the method. Historic mortars were not prepared to narrowly defined specifications from materials of uniform quality; they contain a wide array of locally derived materials combined at the discretion of the mason. While a particular method might be able to accurately determine the original proportions of a lime-cement-sand mortar prepared from modern materials, the usefulness of that method for evaluating historic mortars is questionable unless it has been tested against mortars prepared from materials more commonly used in the past.

Lorraine Schnabel.

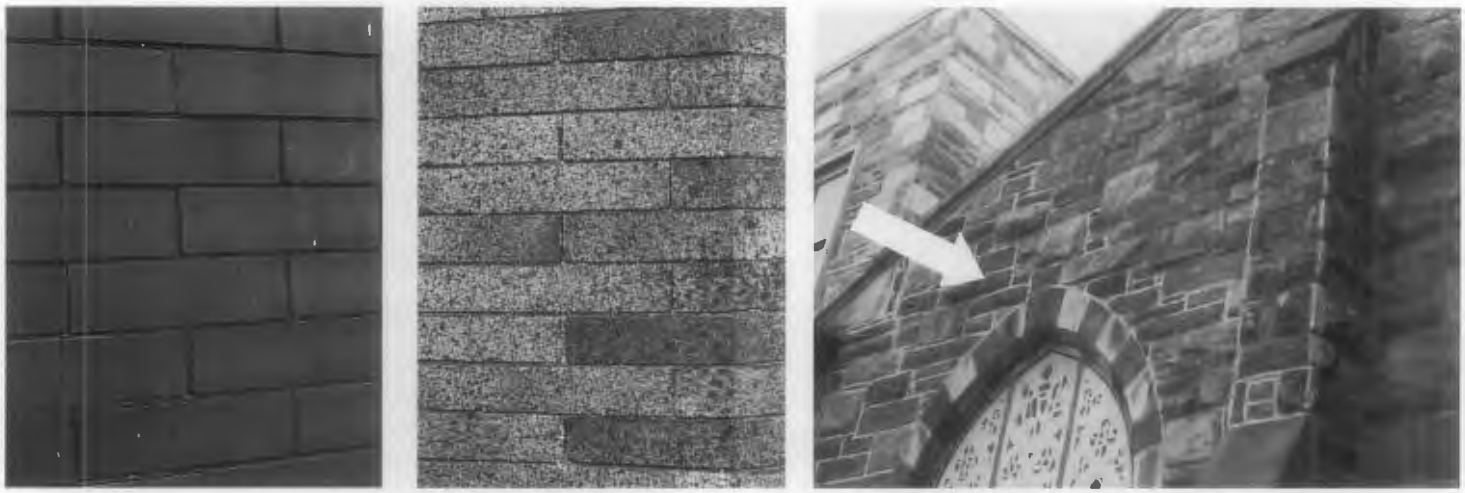


Figure 6. Tinted mortar. (left)Black mortar with a beaded joint was used here on this late-19th century hard pressed red brick and, (center) a dark brown tinted mortar with an almost flush joint was used on this early-20th century Roman brick. (right) When constructed at the turn-of-the-century, this building was pointed with a dark gray mortar to blend with the color of the stone, but the light-colored mortar used in spot repointing has destroyed this harmony and adversely impacts the building's historic character. Photos: Anne Grimmer.

with sand and water at the job site. It may contain hydrated lime, but it always contains a large amount of portland cement, as well as ground limestone and other workability agents, including air-entraining agents. Because masonry cements are not required to contain hydrated lime, and generally do not contain lime, they produce high strength mortars that can damage historic masonry. *For this reason, they generally are not recommended for use on historic masonry buildings.*

Lime mortar (pre-blended). Hydrated lime mortars, and pre-blended lime putty mortars with or without a matched sand are commercially available. Custom mortars are also available with color. In most instances, pre-blended lime mortars containing sand may not provide an exact match; however, if the project calls for total repointing, a pre-blended lime mortar may be worth considering as long as the mortar is compatible in strength with the masonry. If the project involves only selected, "spot" repointing, then it may be better to carry out a mortar analysis which can provide a custom pre-blended lime mortar with a matching sand. In either case, if a preblended lime mortar is to be used, it should contain Type S or SA hydrated lime conforming to ASTM C 207.

Water. Water should be potable—clean and free from acids, alkalis, or other dissolved organic materials.

Other Components

Historic components. In addition to the color of the sand, the texture of the mortar is of critical importance in duplicating historic mortar. Most mortars dating from the mid-19th century on—with some exceptions—have a fairly homogeneous texture and color. Some earlier mortars are not as uniformly textured and may contain lumps of partially burned lime or "dirty lime", shell (which often provided a source of lime, particularly in coastal areas), natural cements, pieces of clay, lampblack or other pigments, or even animal hair. The visual characteristics of these mortars can be duplicated through the use of similar materials in the repointing mortar.

Replicating such unique or individual mortars will require writing new specifications for each project. If possible, suggested sources for special materials should be included. For example, crushed oyster shells can be obtained in a variety of sizes from poultry supply dealers.

Pigments. Some historic mortars, particularly in the late 19th century, were tinted to match or contrast with the brick or stone (Fig. 6). Red pigments, sometimes in the form of brick dust, as well as brown, and black pigments were commonly used. Modern pigments are available which can be added to the mortar at the job site, but they should not exceed 10 per cent by weight of the portland cement in the mix, and carbon black should be limited to 2 per cent. Only synthetic mineral oxides, which are alkali-proof and sun-fast, should be used to prevent bleaching and fading.

Modern components. Admixtures are used to create specific characteristics in mortar, and whether they should be used will depend upon the individual project. *Air-entraining agents*, for example, help the mortar to resist freeze-thaw damage in northern climates. *Accelerators* are used to reduce mortar freezing prior to setting while *retarders* help to extend the mortar life in hot climates. Selection of admixtures should be made by the architect or architectural conservator as part of the specifications, not something routinely added by the masons.

Generally, modern chemical additives are unnecessary and may, in fact, have detrimental effects in historic masonry projects. The use of antifreeze compounds is not recommended. They are not very effective with high lime mortars and may introduce salts, which may cause efflorescence later. A better practice is to warm the sand and water, and to protect the completed work from freezing. No definitive study has determined whether air-entraining additives should be used to resist frost action and enhance plasticity, but in areas of extreme exposure requiring high-strength mortars with lower permeability, air-entrainment of 10-16 percent may be desirable (see formula for "severe weather exposure" in **Mortar Type and Mix**). Bonding agents are not a substitute for proper joint preparation, and they should generally be avoided. If the joint is properly prepared, there will be a good bond between the new mortar and the adjacent surfaces. In addition, a bonding agent is difficult to remove if smeared on a masonry surface (Fig. 7).

Mortar Type and Mix

Mortars for repointing projects, especially those involving historic buildings, typically are custom mixed in order to ensure the proper physical and visual qualities. These materials can be combined in varying proportions to create a mortar with the desired performance and durability. The actual specification of a particular mortar type should take into consideration all of the factors affecting the life of the building including: current site conditions, present condition of the masonry, function of the new mortar, degree of weather exposure, and skill of the mason. Thus, no two repointing projects are exactly the same. Modern materials specified for use in repointing mortar should conform to specifications of the American Society for Testing and Materials (ASTM) or comparable federal specifications, and the resulting mortar should conform to ASTM C 270, Mortar for Unit Masonry.

Specifying the proportions for the repointing mortar for a specific job is not as difficult as it might seem. Five mortar types, each with a corresponding recommended mix, have been established by ASTM to distinguish high strength mortar from soft flexible mortars. The ASTM designated them in decreasing order of approximate general strength as Type M (2,500 psi), Type S (1,800 psi), Type N (750 psi), Type O (350 psi) and Type K (75 psi). (The letters identifying the types are from the words MASON WORK using every other letter.) Type K has the highest lime content of the mixes that contain portland cement, although it is seldom used today, except for some historic preservation projects. The designation "L" in the accompanying chart identifies a straight lime and sand mix. Specifying the appropriate ASTM mortar by proportion of ingredients, will ensure the desired physical properties. Unless specified otherwise, measurements or proportions for mortar mixes are always given in the following order: cement-lime-sand. Thus, a Type K mix, for example, would be referred to as 1-3-10, or 1 part cement to 3 parts lime to 10 parts sand. Other requirements to create the desired visual qualities should be included in the specifications.

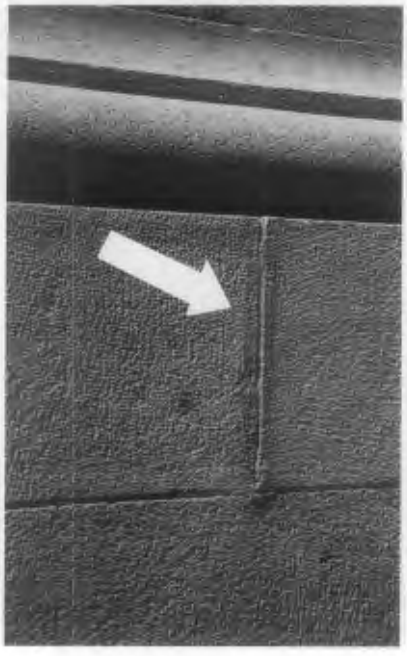


Figure 7. The dark stain on either side of the vertical joint on this sandstone watertable probably resulted from the use of a bonding agent that was not properly cleaned off the masonry after repointing. Photo: Anne Grimmer.

Figure 8. Due to inadequate joint preparation, the repointing mortar has not adhered properly and is falling out of the joint. Photo: Robert C. Mack, FAIA.

The strength of a mortar can vary. If mixed with higher amounts of portland cement, a harder mortar is obtained. The more lime that is added, the softer and more plastic the mortar becomes, increasing its workability. A mortar strong in compressive strength might be desirable for a hard stone (such as granite) pier holding up a bridge deck, whereas a softer, more permeable lime mortar would be preferable for a historic wall of soft brick. Masonry deterioration caused by salt deposition results when the mortar is less permeable that the masonry unit. A strong mortar is still more permeable than hard dense stone. However, in a wall constructed of soft bricks where the masonry unit itself has a relatively high permeability or vapor transmission rate, a soft, high lime mortar is necessary to retain sufficient permeability.

Budgeting and Scheduling

Repointing is both expensive and time consuming due to the extent of handwork and special materials required. It is preferable to repoint only those areas that require work rather than an entire wall, as is often specified. But, if 25 to 50 per cent or more of a wall needs to be repointed, repointing the entire wall may be more cost effective than spot repointing. Total repointing may also be more sensible when access is difficult, requiring the erection of expensive scaffolding (unless the majority of the mortar is sound and unlikely to require replacement in the foreseeable future). Each project requires judgement based on a variety of factors. Recognizing this at the outset will help to prevent many jobs from becoming prohibitively expensive.

In scheduling, seasonal aspects need to be considered first. Generally speaking, wall temperatures between 40 and 95 degrees F (8 and 38 degrees C) will prevent freezing or excessive evaporation of the water in the mortar. Ideally, repointing should be done in shade, away from strong sunlight in order to slow the drying process, especially during hot weather. If necessary, shade can be provided for large-scale projects with appropriate modifications to scaffolding.

The relationship of repointing to other work proposed on the building must also be recognized. For example, if paint removal or cleaning is anticipated, and if the mortar joints are basically sound and need only selective repointing, it is generally better to postpone repointing

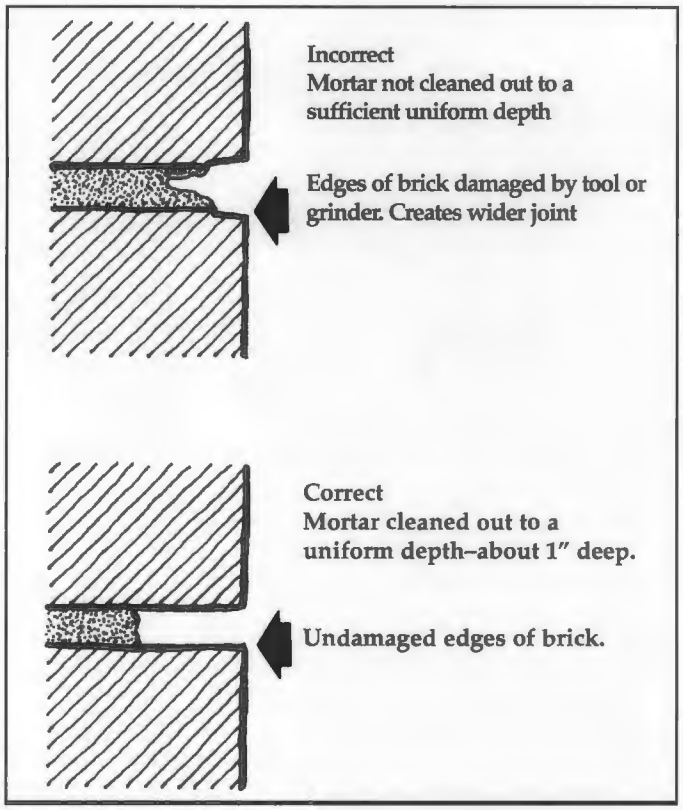


Figure 9. Comparison of incorrect and correct preparation of mortar joints for repointing. Drawing: Robert C. Mack, FAIA, and David W. Look, AIA.

until after completion of these activities. However, if the mortar has eroded badly, allowing moisture to penetrate deeply into the wall, repointing should be accomplished before cleaning. Related work, such as structural or roof repairs, should be scheduled so that they do not interfere with repointing and so that all work can take maximum advantage of erected scaffolding.

Building managers also must recognize the difficulties that a repointing project can create. The process is time consuming, and scaffolding may need to remain in place for an extended period of time. The joint preparation process can be quite noisy and can generate large quantities of dust which must be controlled, especially at air intakes to protect human health, and also where it might damage operating machinery. Entrances may be blocked from time to time making access difficult for both building tenants and visitors. Clearly, building managers will need to coordinate the repointing work with other events at the site.

Contractor Selection

The ideal way to select a contractor is to ask knowledgeable owners of recently repointed historic buildings for recommendations. Qualified contractors then can provide lists of other repointing projects for inspection. More commonly, however, the contractor for a repointing project is selected through a competitive bidding process over which the client or consultant has only limited control. In this situation it is important to ensure that the specifications stipulate that masons must have a minimum of five years' experience with repointing historic masonry buildings to be eligible to bid on the project. Contracts are awarded to the lowest *responsible* bidder, and bidders who have performed poorly on other projects usually can be eliminated from consideration on this basis, even if they have the lowest prices.

The contract documents should call for unit prices as well as a base bid. Unit pricing forces the contractor to determine in advance what the cost addition or reduction will be for work which varies from the scope of the base bid. If, for example, the contractor has fifty linear feet less of stone repointing than indicated on the contract documents but thirty linear feet more of brick repointing, it will be easy to determine the final price for the work. Note that each type of work—brick repointing, stone repointing, or similar items—will have its own unit price. The unit price also should reflect quantities; one linear foot of pointing in five different spots will be more expensive than five contiguous linear feet.

Execution of the Work

Test Panels. These panels are prepared by the contractor using the same techniques that will be used on the remainder of the project. Several panel locations—preferably not on the front or other highly visible location of the building—may be necessary to include all types of masonry, joint styles, mortar colors, and other problems likely to be encountered on the job. If cleaning tests, for

Figure 10. Using a hammer and masonry chisel is the least damaging and, thus, generally the preferred method of removing old mortar in preparation for repointing historic masonry. Photo: John P. Speweik.

Figure 11. The damage to the edges and corners of these historic bricks was caused by using a mechanical grinder to rake out the joints. Note the overcutting of the head joint and the damage to the arises (corners) of the bricks. Photo: Lee H. Nelson, FAIA.

example, are also to be undertaken, they should be carried out in the same location. Usually a 3 foot by 3 foot area is sufficient for brickwork, while a somewhat larger area may be required for stonework. These panels establish an acceptable standard of work and serve as a benchmark for evaluating and accepting subsequent work on the building.

Joint Preparation. Old mortar should be removed to a minimum depth of 2 to 2- $^1/_2$ times the width of the joint to ensure an adequate bond and to prevent mortar "popouts" (Fig. 8). For most brick joints, this will require removal of the mortar to a depth of approximately $^1/_2$ to 1 inch; for stone masonry with wide joints, mortar may need to be removed to a depth of several inches. Any loose or disintegrated mortar beyond this minimum depth also should be removed (Fig. 9).

Although some damage may be inevitable, careful joint preparation can help limit damage to masonry units. The traditional manner of removing old mortar is through the use of hand chisels and mash hammers (Fig. 10). Though labor-intensive, in most instances this method poses the least threat for damage to historic masonry units and produces the best final product.

The most common method of removing mortar, however, is through the use of power saws or grinders. The use of power tools by unskilled masons can be disastrous for historic masonry, particularly soft brick. Using power saws on walls with thin joints, such as most brick walls, almost always will result in damage to the masonry units by breaking the edges and by overcutting on the head, or vertical joints (Fig. 11).

However, small pneumatically-powered chisels generally can be used safely and effectively to remove mortar on historic buildings as long as the masons maintain appropriate control over the equipment.

Figure 12.. A power grinder, operated correctly by a skilled mason may be used in preparation for repointing to cut wide, horizontal mortar joints, typical of many early-20th century brick structures without causing damage to the brick. Note the use of protective safety equipment. Photo: Robert C. Mack, FAIA.

Under certain circumstances, thin diamond-bladed grinders may be used to cut out *horizontal* joints only on hard portland cement mortar common to most early-20th century masonry buildings (Fig. 12). Usually, automatic tools most successfully remove old mortar without damaging the masonry units when they are used in combination with hand tools in preparation for repointing. Where horizontal joints are uniform and fairly wide, it may be possible to use a power masonry saw to assist the removal of mortar, such as by cutting along the middle of the joint; final mortar removal from the sides of the joints still should be done with a hand chisel and hammer. Caulking cutters with diamond blades can sometimes be used successfully to cut out joints without damaging the masonry. Caulking cutters are slow; they do not rotate, but vibrate at very high speeds, thus minimizing the possibility of damage to masonry units (Fig. 13). Although mechanical tools may be used safely in limited circumstances to cut out horizontal joints in preparation for repointing, they should never be used on vertical joints because of the danger of slipping and cutting into the brick above or below the vertical joint. Using power tools to remove mortar without damaging the surrounding masonry units also necessitates highly skilled masons experienced in working on historic masonry buildings. Contractors

Figure 13. (left) In preparation for repointing, the mortar joints on these granite steps are first cut out mechanically (note the vacuum attached to the cutting tool in foreground to cut down on dust). (right) Final removal of the old mortar is done by hand to avoid damage to the edges of the joints. Mechanical preparation of horizontal joints by an experienced mason may sometimes be acceptable, especially where the joints are quite wide and the masonry is a very hard stone. Photos: Anne Grimmer.

should demonstrate proficiency with power tools before their use is approved.

Using any of these power tools may also be more acceptable on hard stone, such as quartzite or granite, than on terra cotta with its glass-like glaze, or on soft brick or stone. The test panel should determine the acceptability of power tools. If power tools are to be permitted, the contractor should establish a quality control program to account for worker fatigue and similar variables.

Mortar should be removed cleanly from the masonry units, leaving square corners at the back of the cut. Before filling, the joints should be rinsed with a jet of water to remove all loose particles and dust. At the time of filling, the joints should be damp, but with no standing water present. For masonry walls—limestone, sandstone and common brick—that are extremely absorbent, it is recommended that a continual mist of water be applied for a few hours before repointing begins.

Mortar Preparation. Mortar components should be measured and mixed carefully to assure the uniformity of visual and physical characteristics. Dry ingredients are measured by volume and thoroughly mixed before the addition of any water. Sand must be added in a damp, loose condition to avoid over sanding. Repointing mortar is typically pre-hydrated by adding water so it will just hold together, thus allowing it to stand for a period of time before the final water is added. Half the water should be added, followed by mixing for approximately 5 minutes. The remaining water should then be added in small portions until a mortar of the desired consistency is reached. The total volume of water necessary may vary from batch to batch, depending on weather conditions. It is important to keep the water to a minimum for two reasons: first, a drier mortar is cleaner to work with, and it can be compacted tightly into the joints; second, with no excess water to evaporate, the mortar cures without shrinkage cracks. Mortar should be used within approximately 30 minutes of final mixing, and "retempering," or adding more water, should not be permitted.

Using Lime Putty to Make Mortar. Mortar made with lime putty and sand, sometimes referred to as roughage or course stuff, should be measured by volume, and may require slightly different proportions from those used with hydrated lime (Fig. 14). No additional water is usually needed to achieve a workable consistency because enough water is already contained in the putty. Sand is proportioned first, followed by the lime putty, then mixed for five minutes or until all the sand is thoroughly coated with the lime putty. But mixing, in the familiar sense of turning over with a hoe, sometimes may not be sufficient if the best possible performance is to be obtained from a lime putty mortar. Although the old practice of chopping, beating and ramming the mortar has largely been forgotten, recent field work has confirmed that lime putty and sand rammed and beaten with a wooden mallet or ax handle, interspersed by chopping with a hoe, can significantly improve workability and performance. The intensity of this action increases the overall lime/sand contact and removes any surplus water by compacting the other ingredients. It may also be advantageous for larger projects to use a mortar pan mill for mixing. Mortar pan mills which have a long tradition in Europe produce a superior lime putty mortar not attainable with today's modern paddle and drum type mixers.

For larger repointing projects the lime putty and sand can be mixed together ahead of time and stored indefinitely, on or off site, which eliminates the need for piles of sand on the job site. This mixture, which resembles damp brown sugar, must be protected from the air in sealed containers with a wet piece of burlap over the top or sealed in a large plastic bag to prevent evaporation and premature carbonation. The lime putty and sand mixture can be recombined into a workable plastic state months later with no additional water.

If portland cement is specified in a lime putty and sand mortar—Type O (1:2:9) or Type K (1:3:11)—the portland cement should first be mixed into a slurry paste before adding it to the lime putty and sand. Not only will this ensure that the portland cement is evenly distributed throughout the mixture, but if dry portland cement is added to wet ingredients it tends to "ball up," jeopardizing dispersion. (Usually water must be added to the lime putty and sand anyway once the portland cement is introduced.) Any color pigments should be added at this stage and mixed for a full five minutes. The mortar should be used within 30 minutes to 1 ½ hours and it should not be retempered. Once portland cement has been added the mortar can no longer be stored.

Filling the Joint. Where existing mortar has been removed to a depth of greater than 1 inch, these deeper areas should be filled first, compacting the new mortar in several layers. The back of the entire joint should be filled successively by applying approximately ¼ inch of mortar, packing it well into the back corners. This

Figure 14. Mixing mortar using lime putty: (a) proportioning sand; (b) proportioning lime putty; (c) placing lime putty on top of sand; (d) mixing sand over lime putty; (e) hand mixing mortar; and, (f) sample of mortar after mixing. Photos: John P. Speweik.

application may extend along the wall for several feet. As soon as the mortar has reached thumb-print hardness, another ¼ inch layer of mortar—approximately the same thickness—may be applied. Several layers will be needed to fill the joint flush with the outer surface of the masonry. It is important to allow each layer time to harden before the next layer is applied; most of the mortar shrinkage occurs during the hardening process and layering thus minimizes overall shrinkage.

When the final layer of mortar is thumb-print hard, the joint should be tooled to match the historic joint (Fig. 15). Proper timing of the tooling is important for uniform color and appearance. If tooled when too soft, the color will be lighter than expected, and hairline cracks may occur; if tooled when too hard, there may be dark streaks called "tool burning," and good closure of the mortar against the masonry units will not be achieved.

If the old bricks or stones have worn, rounded edges, it is best to recess the final mortar slightly from the face of the masonry. This treatment will help avoid a joint which is visually wider than the actual joint; it also will avoid creation of a large, thin featheredge which is easily damaged, thus admitting water (Fig. 16). After tooling, excess mortar can be removed from the edge of the joint by brushing with a natural bristle or nylon brush. Metal bristle brushes should never be used on historic masonry.

Curing Conditions. The preliminary hardening of high-lime content mortars—those mortars that contain more lime by volume than portland cement, i.e., Type O (1:2:9), Type K (1:3:11), and straight lime/sand, Type "L"(0:1:3) —takes place fairly rapidly as water in the mix is lost to the porous surface of the masonry and through evaporation. A high lime mortar (especially Type "L") left to dry out too rapidly can result in chalking, poor adhesion, and poor durability. Periodic wetting of the repointed area after the mortar joints are thumb-print hard and have been finish tooled may significantly accelerate the carbonation process. When feasible, misting using a hand sprayer with a fine nozzle can be simple to do for a day or two after repointing. Local conditions will dictate the frequency of wetting, but initially it may be as often as every hour and gradually reduced to every three or four hours. Walls should be covered with burlap for the first three days after repointing. (Plastic may be used, but it should be tented out and not placed directly against the wall.) This helps keep the walls damp and protects them from direct sunlight. Once carbonation of the lime has begun, it will continue for many years and the lime will gain strength as it reverts back to calcium carbonate within the wall.

***Aging* the Mortar.** Even with the best efforts at matching the existing mortar color, texture, and materials, there will usually be a visible difference between the old and

Figure 15. The profile of the repointed joints on the left replicate the historic joints around the corner to the right on the front of this stone building in Leesburg, VA. The contractor's pride in the repointing work is evident by the signature in the vertical joint. Photo: Anne Grimmer.

new work, partly because the new mortar has been matched to the unweathered portions of the historic mortar. Another reason for a slight mismatch may be that the sand is more exposed in old mortar due to the slight erosion of the lime or cement. Although spot repointing is generally preferable and some color difference should be acceptable, if the difference between old and new mortar is too extreme, it may be advisable in some instances to repoint an entire area of a wall, or an entire feature such as a bay, to minimize the difference between the old and the new mortar. If the mortars have been properly matched, usually the best way to deal with surface color differences is to let the mortars age naturally. Other treatments to overcome these differences, including cleaning the non-repointed areas or staining the new mortar, should be carefully tested prior to implementation.

Staining the new mortar to achieve a better color match is generally not recommended, but it may be appropriate in some instances. Although staining may provide an initial match, the old and new mortars may weather at different rates, leading to visual differences after a few seasons. In addition, the mixtures used to stain the mortar may be harmful to the masonry; for example, they may introduce salts into the masonry which can lead to efflorescence.

Cleaning the Repointed Masonry. If repointing work is carefully executed, there will be little need for cleaning other than to remove the small amount of mortar from the edge of the joint following tooling. This can be done with a stiff natural bristle or nylon brush after the mortar has dried, but before it is initially set (1-2 hours). Mortar that has hardened can usually be removed with a wooden paddle or, if necessary, a chisel.

Further cleaning is best accomplished with plain water and natural bristle or nylon brushes. If chemicals must

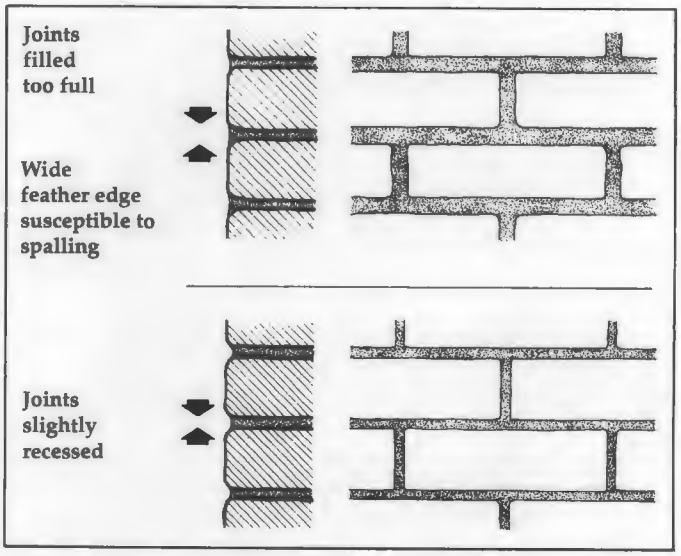


Figure 16. Comparison of visual effect of full mortar joints vs. slightly recessed joints. Filling joints too full hides the actual joint thickness and changes the character of the original brickwork. Drawing: Robert C. Mack, FAIA.

be used, they should be selected with extreme caution. Improper cleaning can lead to deterioration of the masonry units, deterioration of the mortar, mortar smear, and efflorescence. New mortar joints are especially susceptible to damage because they do not become fully cured for several months. Chemical cleaners, particularly acids, should never be used on dry masonry. The masonry should always be completely soaked once with water before chemicals are applied. After cleaning, the walls should be flushed again with plain water to remove all traces of the chemicals.

Several precautions should be taken if a freshly repointed masonry wall is to be cleaned. First, the mortar should be fully hardened before cleaning. Thirty days is usually sufficient, depending on weather and exposure; as mentioned previously, the mortar will continue to cure even after it has hardened. Test panels should be prepared to evaluate the effects of different cleaning

Figure 17. This photograph shows the significant visual change to the character of this historic brick building that has resulted from improper repointing procedures and a noticeably increased thickness of the mortar joints. Photo: Lee H. Nelson, FAIA.

Mortar Types			
(Measured by volume)			
Designation	Cement	Hydrated Lime or Lime Putty	Sand
M	1	1/4	3 - 3 3/4
S	1	1/2	4 - 4 1/2
N	1	1	5 - 6
O	1	2	8 - 9
K	1	3	10 - 12
"L"	0	1	2 1/4 - 3

Suggested Mortar Types for Different Exposures			
	Exposure		
Masonry Material	Sheltered	Moderate	Severe
Very Durable: granite, hard-cored brick, etc.	O	N	S
Moderately Durable: limestone, durable stone, molded brick	K	O	N
Minimally Durable: soft hand-made brick	"L"	K	O

methods. Generally, on newly repointed masonry walls, only very low pressure (100 psi) water washing supplemented by stiff natural bristle or nylon brushes should be used, except on glazed or polished surfaces, where only soft cloths should be used.**

New construction "bloom" or efflorescence occasionally appears within the first few months of repointing and usually disappears through the normal process of weathering. If the efflorescence is not removed by natural processes, the safest way to remove it is by dry brushing with stiff natural or nylon bristle brushes followed by wet brushing. Hydrochloric (muriatic) acid, is generally ineffective, and it should not be used to remove efflorescence. It may liberate additional salts, which, in turn, can lead to more efflorescence.

Surface Grouting is sometimes suggested as an alternative to repointing brick buildings, in particular. This process involves the application of a thin coat of cement-based grout to the mortar joints and the mortar/brick interface. To be effective the grout must extend slightly onto the face of the masonry units, thus widening the joint visually. The change in the joint appearance can alter the historic character of the structure to an unacceptable degree. In addition, although masking of the bricks is intended to keep the grout off the remainder of the face of the bricks, some level of residue, called "veiling," will inevitably remain. Surface grouting cannot substitute for the more extensive work of repointing, and it is not a recommended treatment for historic masonry.

**Additional information on masonry cleaning is presented in *Preservation Briefs 1: The Cleaning and Waterproof Coating of Masonry Buildings*, Robert C. Mack, AIA, Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior, 1975; and *Keeping it Clean: Removing Exterior Dirt, Paint, Stains & Graffiti from Historic Masonry Buildings*, Anne E. Grimmer, Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior, 1988.

Summary

For the Owner/Administrator. The owner or administrator of a historic building should remember that repointing is likely to be a lengthy and expensive process. First, there must be adequate time for evaluation of the building and investigation into the cause of problems. Then, there will be time needed for preparation of the contract documents. The work itself is precise, time-consuming and noisy, and scaffolding may cover the face of the building for some time. Therefore, the owner must carefully plan the work to avoid problems. Schedules for both repointing and other activities will thus require careful coordination to avoid unanticipated conflicts. The owner must avoid the tendency to rush the work or cut corners if the historic building is to retain its visual integrity and the job is to be durable.

For the Architect/Consultant. Because the primary role of the consultant is to ensure the life of the building, a knowledge of historic construction techniques and the special problems found in older buildings is essential. The consultant must assist the owner in planning for logistical problems relating to research and construction. It is the consultant's responsibility to determine the *cause* of the mortar deterioration and ensure that it is corrected before the masonry is repointed. The consultant must also be prepared to spend more time in project inspections than is customary in modern construction.

For the Masons. Successful repointing depends on the masons themselves. Experienced masons understand the special requirements for work on historic buildings and the added time and expense they require. The entire masonry crew must be willing and able to perform the work in conformance with the specifications, even when the specifications may not be in conformance with standard practice. At the same time, the masons should not hesitate to question the specifications if it appears that the work specified would damage the building.

Visually Examining the Mortar and the Masonry Units

A simple in-situ comparison will help determine the hardness and condition of the mortar and the masonry units. Begin by scraping the mortar with a screwdriver, and gradually tapping harder with a cold chisel and mason's hammer. Masonry units can be tested in the same way beginning, even more gently, by scraping with a fingernail. This relative analysis which is derived from the 10-point hardness scale used to describe minerals, provides a good starting point for selection of an appropriate mortar. It is described more fully in "The Russack System for Brick & Mortar Description" referenced in **Selected Reading** at the end of this Brief.

Mortar samples should be chosen carefully, and picked from a variety of locations on the building to find unweathered mortar, if possible. Portions of the building may have been repointed in the past while other areas may be subject to conditions causing unusual deterioration. There may be several colors of mortar dating from different construction periods or sand used from different sources during the initial construction. Any of these situations can give false readings to the visual or physical characteristics required for the new mortar. Variations should be noted which may require developing more than one mix.

1) Remove with a chisel and hammer three or four unweathered samples of the mortar to be matched from several locations on the building. (Set the largest sample aside—this will be used later for comparison with the repointing mortar). Removing a full representation of samples will allow selection of a "mean" or average mortar sample.

2) Mash the remaining samples with a wooden mallet, or hammer if necessary, until they are separated into their constituent parts. There should be a good handful of the material.

3) Examine the powdered portion—the lime and/or cement matrix of the mortar. Most particularly, note the color. There is a tendency to think of historic mortars as having white binders, but grey portland cement was available by the last quarter of the 19th century, and traditional limes were also sometimes grey. Thus, in some instances, the natural color of the historic binder may be grey, rather than white. The mortar may also have been tinted to create a colored mortar, and this color should be identified at this point.

4) Carefully blow away the powdery material (the lime and/or cement matrix which bound the mortar together).

5) With a low power (10 power) magnifying glass, examine the remaining sand and other materials such as lumps of lime or shell.

6) Note and record the wide range of color as well as the varying sizes of the individual grains of sand, impurities, or other materials.

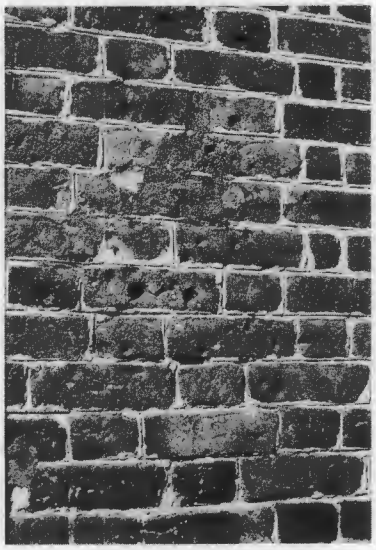
Other Factors to Consider

Color. Regardless of the color of the binder or colored additives, the sand is the primary material that gives mortar its color. A surprising variety of colors of sand may be found in a single sample of historic mortar, and the different sizes of the grains of sand or other materials, such as incompletely ground lime or cement, play an important role in the texture of the repointing mortar. Therefore, when specifying sand for repointing mortar, it may be necessary to obtain sand from several sources and to combine or screen them in order to approximate the range of sand colors and grain sizes in the historic mortar sample.

Figure 19. Mortar joints of 18th century brick buildings were often as much as 1/2 inch wide, cut flush and struck with a grapevine joint, but for window and door surrounds where a finer quality rubbed brick was used, mortar joints were very thin. Photo: National Park Service Files.

Pointing Style. Close examination of the historic masonry wall and the techniques used in the original construction will assist in maintaining the visual qualities of the building (Fig. 18). Pointing styles and the methods of producing them should be examined. It is important to look at both the horizontal and the vertical joints to determine the order in which they were tooled and whether they were the same style. Some late-19th and early-20th century buildings, for example, have horizontal joints that were raked back while the vertical joints were finished flush and stained to match the bricks, thus creating the illusion of horizontal bands. Pointing styles may also differ from one facade to another; front walls often received greater attention to mortar detailing than side and rear walls (Fig. 19). **Tuckpointing** is not true repointing but the

Figure 20. This stone garden wall was tuckpointed to match the tuckpointing on the c. 1920s house on the property. Photo: Anne Grimmer.



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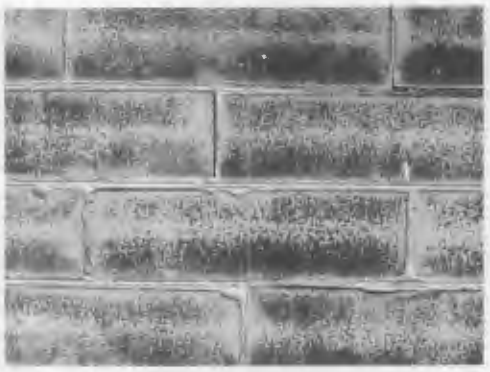

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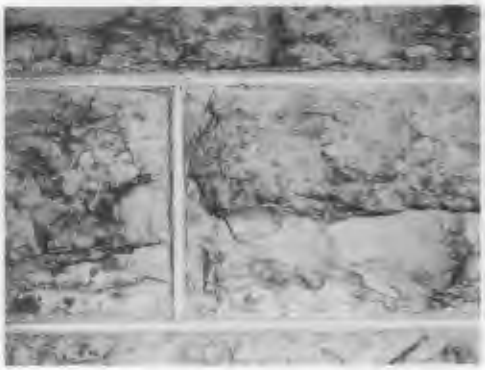

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Figure 18. A cross-section of mortar joint types. (a) Grapevine joints on a mid-18th century brick building; (b) flush joints on a mid-to-late 19th century brick building; (c) beaded joints on a late-19th century brick building; (d) early-20th century beaded joints on rough-cut limestone where the vertical joints were struck prior to the horizontal joints; (e) raked joints on 1920s wire brick; (f) horizontal joints on a 1934 building designed by Frank Lloyd Wright were raked back from the face of the bricks, and the vertical joints were filled with a red-tinted mortar to emphasize the horizontality of the narrow bricks, and struck flush with the face of the bricks; (g) the joints on this 20th century glazed terra-cotta tile building are raked slightly, emphasizing the glazed block face. Photos: National Park Service Files (a,b,e); Robert C. Mack, FAIA (c,d,f,g).

application of a raised joint or lime putty joint on top of flush mortar joints (Fig. 20). **Penciling** is a purely decorative, painted surface treatment over a mortar joint, often in a contrasting color.

Masonry Units. The masonry units should also be examined so that any replacement units will match the historic masonry. Within a wall there may be a wide range of colors, textures, and sizes, particularly with hand-made brick or rough-cut, locally-quarried stone. Replacement units should blend in with the full range of masonry units rather than a single brick or stone.

Matching Color and Texture of the Repointing Mortar

New mortar should match the unweathered interior portions of the historic mortar. The simplest way to check the match is to make a small sample of the proposed mix and allow it to cure at a temperature of approximately 70 degrees F for about a week, or it can be baked in an oven to speed up the curing; this sample is then broken open and the surface is compared with the surface of the largest "saved" sample of historic mortar.

If a proper color match cannot be achieved through the use of natural sand or colored aggregates like crushed marble or brick dust, it may be necessary to use a modern mortar pigment.

During the early stages of the project, it should be determined how closely the new mortar should match the historic mortar. Will "quite close" be sufficient, or is "exactly" expected? The specifications should state this clearly so that the contractor has a reasonable idea how much time and expense will be required to develop an acceptable match.

The same judgment will be necessary in matching replacement terra cotta, stone or brick. If there is a known source for replacements, this should be included in the specifications. If a source cannot be determined prior to the bidding process, the specifications should include an estimated price for the replacement materials with the final price based on the actual cost to the contractor.

Conclusion

A good repointing job is meant to last, at least 30 years, and preferably 50-100 years. Shortcuts and poor craftsmanship result not only in diminishing the historic character of a building, but also in a job that looks bad, and will require future repointing sooner than if the work had been done correctly (Fig. 17). The mortar joint in a historic masonry building has often been called a wall's "first line of defense." Good repointing practices guarantee the long life of the mortar joint, the wall, and the historic structure. Although careful maintenance will help preserve the freshly repointed mortar joints, it is important to remember that mortar joints are intended to be sacrificial and will probably require repointing some time in the future. Nevertheless, if the historic mortar joints proved durable for many years, then careful repointing should have an equally long life, ultimately contributing to the preservation of the entire building.

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Useful Addresses

Brick Institute of America
11490 Commerce Park Drive
Reston, VA 22091

Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

National Lime Association
200 N. Glebe Road, Suite 800
Arlington, VA 22203

Acknowledgments

Robert C. Mack, FAIA, is a principal in the firm of MacDonald & Mack, Architects, Ltd., an architectural firm that specializes in historic buildings in Minneapolis, Minnesota. **John P. Speweik, CSI**, Toledo, Ohio, is a 5th-generation stonemason, and principal in U.S. Heritage Group, Inc., Chicago, Illinois, which does custom historic mortar matching. **Anne Grimmer**, Senior Architectural Historian, Heritage Preservation Services Program, National Park Service, was responsible for developing and coordinating the revision of this Preservation Brief, incorporating professional comments, and the technical editing.

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The original version of this brief, *Repointing Mortar Joints in Historic Brick Buildings*, was written by Robert C. Mack in 1976, and was revised and updated in 1980 by Robert C. Mack, de Teel Patterson Tiller, and James S. Askins.

Front Cover: Repointing a historic brick building using a lime-based mortar. Traditional lime mortars have a consistency that enables the mortar to cling to a repointing tool while in a vertical position. Photo: John P. Speweik.

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SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes perimeter wood blocking and nailers, misc. wood framing, and preservative treatment of wood.

B. Related Sections:
   1. Section 07 53 04 – Elastomeric Membrane Roofing (EPDM).

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A208.1 - Mat-Formed Wood Particleboard.

B. American Wood-Preservers' Association:
   1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
   2. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.

C. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. National Fire Protection Association:
   1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

E. The Redwood Inspection Service:
   1. RIS - Standard Specifications for Grades of California Redwood Lumber.

F. Southern Pine Inspection Bureau:
   1. SPIB - Standard Grading Rules for Southern Pine Lumber.

G. Underwriters Laboratories Inc.:
   1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

H. U. S Department of Commerce National Institute of Standards and Technology:
   1. DOC PS 1 - Construction and Industrial Plywood.
   2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
   3. DOC PS 20 - American Softwood Lumber Standard.

I. West Coast Lumber Inspection Bureau:
   1. WCLIB - Standard Grading Rules for West Coast Lumber.

J. Western Wood Products Association:

1. WWPA G-5 - Western Lumber Grading Rules.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit technical data on wood preservative and fire-retardant treatment materials and application instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
1. Lumber Grading Agency: Certified by DOC PS 20.
2. Wood Structural Panel Grading Agency: Certified by EWA - The Engineered Wood Association.
3. Lumber: DOC PS 20.
4. Wood Structural Panels: DOC PS 1 or DOC PS 2.

B. Surface Burning Characteristics:
1. Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84 NFPA 255 UL 723.

C. Apply label from agency approved by authority having jurisdiction to identify each preservative treated and fire retardant treated material.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber Grading Rules: AP&PA. SPIB. WCLIB.

B. Miscellaneous Framing: Stress Group D, S/P/F, species, grade 19 percent maximum moisture content after treatment, pressure preservative treat.

C. Plywood: APA/EWA Rated Sheathing Structural I, Grade C-D; Exposure Durability 2; un-sanded.

2.2 ACCESSORIES

A. Fasteners and Anchors:
1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
2. Nails and Staples: ASTM F1667.
3. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

2.3 FACTORY WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA C1 using water borne preservative with 0.25 percent retainage.

B. Fire Retardant Treatment: Pressure treatment, AWPA C20 for lumber and AWPA C27 for plywood, Interior Type, chemically treated and pressure impregnated; capable of providing a maximum flame spread/smoke development of 25/450.

C. Moisture Content After Treatment:
   1. Lumber: Maximum 19 percent.
   2. Structural Panels: Maximum 15 percent.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify substrate conditions are ready to receive blocking, curbing and framing.

3.2 PREPARATION

A. Coordinate placement of blocking, curbing and framing items.

3.3 INSTALLATION

A. Set members level and plumb, in correct position.

B. Place horizontal members, crown side up.

C. Construct curb members of solid wood sections.

D. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

E. Coordinate curb installation with installation of decking and support of deck openings, and parapet construction.

F. Space framing and furring 16 inches on center.

G. Secure sheathing to framing members with ends over firm bearing and staggered.

3.4 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment.

B. Brush apply two coats of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings and treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.5 SCHEDULES

A. Roof Blocking and Nailers: S/P/F species, 19 percent maximum moisture content, pressure preservative treatment.

END OF SECTION

SECTION 07 53 04 - ELASTOMERIC MEMBRANE ROOFING (EPDM)

PART 1 GENERAL

1.1 SUMMARY

A. Section includes membrane roofing system, base flashings, rigid insulation, and related components.

B. Related Sections:
1. Section 06 10 53 – Misc. Rough Carpentry
2. Section 07 62 00 - Sheet Metal Flashing and Trim.

1.2 REFERENCES

A. ASTM International:
1. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
2. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

B. FM Global:
1. FM DS 1-28 - Wind Loads to Roof Systems and Roof Deck Securement.

C. National Roofing Contractors Association:
1. NRCA - The NRCA Roofing and Waterproofing Manual.

D. Single Ply Roofing Institute:
1. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

E. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.
2. UL 790 - Tests for Fire Resistance of Roof Covering Materials.
3. UL 1256 - Fire Test of Roof Deck Construction.
4. UL 1897 - Uplift Tests for Roof Covering Systems.

1.3 SYSTEM DESCRIPTION

A. Elastomeric Sheet Membrane Conventional Roofing System: Single ply membrane system with membrane flashings, rigid roof insulation, and adhesive applied membrane.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to applicable NFPA for roof assembly fire hazard requirements.

B. UL 790: Class A Fire Hazard Classification.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Shop Drawings: Indicate joint and termination detail conditions, conditions of interface with other materials. Indicate membrane layout and seam locations.

C. Product Data: Submit characteristics on membrane materials, adhesives, seaming materials, flashing materials, and insulation.

D. Manufacturer's Installation Instructions: Submit special precautions required for seaming membrane.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

F. Manufacturer's Field Reports: Indicate procedures followed; ambient temperatures, humidity, wind velocity during application.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual- Latest Edition.

B. Provide periodic inspections and approval performed by roofing manufacturer’s technical representative during the installation of roofing materials at intervals not exceeding each 30% of the total roof system installation. Written inspection report must be submitted to Architect/Engineer within 72 hours of inspection.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the specified roof system with minimum five years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum five years experience, and approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Preinstallation meetings.

B. Convene minimum one week prior to commencing Work of this section.

C. Manufacturer’s representative shall review preparation, installation, and detailing procedures required to obtain the specified roof system warranty.

D. Mandatory Startup Technical Service provided by manufacturer’s representative must be completed prior to installation of new roof system membrane.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver products in manufacturer’s original containers, dry, undamaged, with seals and labels intact.

C. Store products in weather protected environment, clear of ground and moisture.

D. Protect foam insulation from direct exposure to sunlight.

E. Store adhesives and solvent-based liquids away from excessive heat, sparks, and open flame.

F. Store adhesives and sealants at temperature above 40º F.

G. Store Products on roof deck in a manner to prevent deformation of deck and overloading the structure. Properly secure to prevent movement due to wind or other forces.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roofing membrane during inclement weather or when ambient temperatures are below 40 degrees F.

B. Do not apply roofing membrane to damp or frozen substrate surface or when precipitation is expected or occurring.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.11 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with installation of associated roof penetrations and metal flashings, as Work of this section proceeds.

C. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Care should be exercised to provide protection for the interior of the building and to ensure water does not flow beneath any completed sections of the membrane system.

D. Do not disrupt activities in occupied spaces.

E. Before beginning work, the roofing contractor must secure approval from the building owner's representative for the following:
   1. Areas permitted for personnel parking.
   2. Access to the site.
   3. Areas permitted for storage of materials and debris.

4. Areas permitted for the location of cranes, hoists and chutes for loading and unloading materials to and from the roof.

F. Interior stairs, elevators, or lifts may not be used for removing debris or delivering materials, except as authorized by the building owner's representative.

1.12 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish 20-year manufacturer's warranty including coverage of materials and installation and resulting damage to building resulting from failure to resist penetration of moisture. Warranty must be transferable with no dollar amount limitation and a minimum 72 Mph wind speed coverage.
1. Furnish 2-year warranty on workmanship by Roofing Contractor.
2. Provide all testing, inspections, and surveys required to obtain the specified roof system warranty.

1.13 SAFETY

A. The contractor shall be solely responsible for all means and methods as they relate to safety and shall comply with all applicable local, state and federal requirements. All related personnel shall be instructed daily of the full-time requirement to maintain a safe environment for the contractor’s personnel and facility's occupants.

PART 2 PRODUCTS

2.1 SINGLE PLY ROOFING - FULLY ADHERED

A. Manufacturers:
1. Versico; VersiGard (.060 inch non-reinforced)
2. Firestone Building Products Co.; RubberGard Max (.060 inch non-reinforced)
3. Carlisle SynTec Systems; Sure-Seal Design ‘A’ (.060 inch non-reinforced)
4. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. All components of the roof system shall be manufactured, supplied, or accepted in writing by the roof system manufacturer.

B. Membrane: 60-mil thick, non-reinforced black EPDM membrane.

C. Adhesive Materials:
1. Field Membrane and Flashing Adhesive: Cold-applied synthetic polymer bonding adhesive as recommended by membrane manufacturer.
2. Thinner and Primers: As recommended by adhesive manufacturer, compatible with sheet membrane.

D. Insulation: ASTM C1289, Type II, Class I, faced rigid cellular polyisocyanurate roof insulation, with the following characteristics:
   1. Board Density: 2.0 pcf nominal.
   2. Compressive Strength: 20 psi minimum (Grade 2).
   3. Thermal Resistance: Long Term Thermal Resistance (LTTR) R-Value: 5.7/inch.

2.3 ACCESSORIES

A. Insulation fasteners: Mechanical screw-type fasteners and plates, FM approved and approved by the roof system manufacturer.

B. Sealant: One component urethane, non-sag, non-curing, gun grade elastomeric sealant provided by the roof system manufacturer.

C. Joint Filler: Extruded closed-cell polyethylene foam or polyethylene jacketed polyurethane foam, non-bleeding, non-staining, oversized 30 to 50 percent.

D. Surface Mounted Termination: Extruded aluminum termination bar and related fasteners by roof system manufacturer.

E. Provide all adhesives, fasteners, tape, sealants, and primer/solvent materials as recommended by membrane manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Inspect existing conditions prior to commencing work, including elements subject to damage or movement during work of this section.

B. After uncovering existing work, inspect conditions affecting performance of work.

C. Verify surfaces and site conditions are ready to receive Work.

D. Verify substrate is clean and smooth, free of depressions, waves, or projections, properly sloped to drains and valleys, and suitable for installation of roof system.

E. Verify substrate surfaces are dry and free of snow or ice.

F. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and reglets, and crickets are in place.

3.2 PREPARATION

A. Remove all loose debris from the deck surface.

B. The substrate surface shall be free of standing water, ice, or snow.

3.3 INSTALLATION

A. Insulation Application:
   1. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof. Stagger joints horizontally and vertically if multiple layers are provided.
   2. Fully-adhered system: Mechanically attach all insulation layers to the existing deck.
   3. Apply no more insulation than can be covered in the same day.

B. Membrane Application:
   1. Consult manufacturer's published installation instructions for complete installation information.
      a. Begin installation of roofing membrane in the presence of roof system manufacturer's technical personnel.
      b. The roofing membrane shall be fully adhered to properly installed and prepared substrate surface. The surface shall be clean, dry, smooth, and free from contamination.
      c. Fully-adhered system: Attach membrane with full coverage of cold adhesive to properly installed and prepared substrate in accordance with the roof manufacturer's published installation instructions.
      d. The membrane shall be cut to fit neatly around all penetrations and roof projections.
      e. Adjoining sheets of EPDM membrane shall be spliced together using 3" or 6" wide Seam Tape and Primer OR Factory Applied Seam Tape and Primer.

C. Flashings And Accessories:
   1. Apply flexible flashings to seal membrane to vertical elements.
   2. Fabricate roofing control and expansion joints to isolate roof into areas as indicated on Drawings. Make joints watertight.
   3. Coordinate installation of related flashings.
   4. Seal flashings and flanges of items penetrating membrane.

D. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

F. Fit work water-tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements.

B. Require site attendance of roofing materials' manufacturers prior to, during, and after installation of the Work.

3.5 CLEANING

A. Section 01 70 00 – Execution and Closeout Requirements

B. In areas where finished surfaces including the roofing membrane surface are soiled by Work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

C. The contractor must take all precautions necessary to protect the finished roof surface from being soiled by roofing asphalt or other work of this section. Clean, repair or replace defaced or disfigured finishes caused by Work of this section prior to substantial completion.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. The contractor must take all precautions necessary to protect areas of finished roof surface from being soiled during construction. Provide surface protection where traffic must continue over finished roof membrane.

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes metal roof edge, fascia, counter flashing, gutters, scuppers, and downspouts, and fabricated sheet metal items.

B. Related Sections:
   1. Section 07 53 04 – Elastomeric Membrane Roofing (EPDM).

1.2 REFERENCES

A. American Architectural Manufacturers Association:
   1. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
   2. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International:
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   3. ASTM B32 - Standard Specification for Solder Metal.
   4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   5. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   6. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
   7. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

C. Federal Specification Unit:
   1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - Architectural Sheet Metal Manual.

1.3 DESIGN REQUIREMENTS

A. Gutter and Downspout Components: Conform to SMACNA Manual for sizing components for rainfall intensity determined by storm occurrence of 1 in 10 years.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.

1.5 QUALIFICATIONS

A. Fabricator and Installer: Company specializing in sheet metal work with minimum five years experience.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

PART 2 PRODUCTS

2.1 SHEET METAL FLASHING, TRIM, GUTTERS AND DOWNSPOUTS

A. Materials:
   1. Galvalume:
      a. Aluminized Steel: Type 2, base metal is steel tested in accordance with ASTM-A-446 to meet or exceed a minimum yield point of 48,000 pounds per square inch. Coated by the continuous hot-dip method uniformly on both sides with commercially pure aluminum. The coating shall be saturated with iron but contains no silicon. Minimum weight of coating, by triple-spot test is 0.60 ounce determined in accordance with Military Specification MIL-S-4174-A.
      b. Downspouts, shall be 24 gauge. Gutters shall be shall be 22 gauge. Non-embossed steel with cold-formed configuration.

c. Finish: Factory applied 2 coat oven cured Fluropon coating with minimum 70 percent solids content for Kynar resin over a primer in accordance with the manufacturer's written procedures. Color shall be as selected by the Architect/Engineer from the manufacturer's full color selection.

2.2 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.

2.3 FABRICATION

A. Form sections shape indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet metal, interlocking with sheet.

C. Form pieces in longest possible lengths. in single length sheets.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Gutters shall be installed by using aprons and hangers or combination hangers of the same material as the gutter. (NOTE: Spikes and ferrules or brackets attached to outside periphery of the gutter will not be allowed.)

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

C. Before starting work, verify governing dimensions at building; examine, clean and repair, if necessary, any adjoining work on which this work is in any way dependent for its proper installation.

3.2 INSTALLATION

A. Install clear sealant at all locations shown on details and where required.

B. Secure flashings in place using concealed fasteners. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

C. Slope gutters to drain to downspouts a minimum of 1/16 inch per foot.

D. Terminate downspouts with 45-degree discharge elbow or tie-in to existing underground drainage leader as indicated on drawings.

E. Seal all metal joints watertight.

3.3 FIELD QUALITY CONTROL

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Inspection will involve surveillance of Work during installation to ascertain compliance with specified requirements.

3.4 SCHEDULE

A. Gutters and Scuppers:
   1. Material: Galvalume.
   2. Thickness: 22 gauge.
   3. Finish: Kynar 500, factory applied 2 coat oven-cured Fluropon coating with minimum 70 percent solids content for Kynar resin over a primer in accordance with the manufacturer's written procedures. Color shall be as selected by the Architect/Engineer from the manufacturer's full color selection.

B. Downspouts, drip edge, and counter flashing:
   1. Material: Galvalume.
   2. Thickness: 24 gauge.
   3. Finish: Kynar 500, factory applied 2 coat oven-cured Fluropon coating with minimum 70 percent solids content for Kynar resin over a primer in accordance with the manufacturer's written procedures. Color shall be as selected by the Architect/Engineer from the manufacturer's full color selection.

END OF SECTION

SECTION 08 01 52.91

WOOD WINDOWS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 DESCRIPTION OF WORK

A. General: Provide all labor, materials, equipment, and services required to complete wood window restoration as specified herein, and required by existing conditions and authorities having jurisdiction.

B. Wood window restoration may include, but is not limited to, the following:
1. Restore damaged and inoperable wood window sash while maintaining current profiles.
2. Restore existing and provide new window balance hardware at all operable sash to accommodate use.
3. Replace all broken and unsound sash cord.
4. Restore existing window hardware and provide new in-kind window hardware where existing hardware is missing or is too damaged or deteriorated to be restorable.
5. Restore all window trim disturbed for work of this Section to sound condition and existing appearance.
6. Paint and finish all wood elements as necessary to match original finishes.
7. Glue or replace cracked, broken or missing glass.
8. Remove all deteriorated putty and replace with new.
9. Consolidate and repair deteriorated wood sills, framing members and sash rails and stiles.
10. Replace all broken or deteriorated parting strips.
11. Reinstall repaired window sash.
12. Clean all glass.

C. Intent: It is the specific intent of this Section that repairs will maximize the retention of historic fabric while making the windows weather resistant for long-term use and serviceable for cyclical maintenance.

1.3 QUALITY ASSURANCE

A. Craftspeople: Wood window restoration shall be carried out by a steady crew of skilled craftspeople who are thoroughly experienced with materials and methods specified.

B. Laws, Codes, and Regulations: All work of this Section shall comply with all applicable federal, state, and local laws, codes, and regulations.

C. Knowledge of Site: Bidders shall visit site prior to bid and carefully examine Project scope and conditions that may affect proper execution of work of this Section and

determine or verify dimensions and quantities. Contractor's submission of bid shall be acknowledgment that s/he is thoroughly familiar with Project scope and site conditions.

D. Access for Inspection, Documentation and Approvals: Provide Preservation Manager access on a regular basis to all locations on which mockups are being carried out, on which work is ongoing, and where work has been completed to allow for inspections, documentation and approvals. Provide means of access and safety precautions required to facilitate inspections and approvals.

E. Contractor shall comply with requirements from the U.S. National Park Service's Preservation Briefs 9 & 11 and shall meet the Secretary of the Interiors Standards for Rehabilitation.

1.4 SUBMITTALS

A. General: Submit the following in compliance with the requirements of the Conditions of the Contract. Revise and resubmit each item as required to obtain Preservation Manager's approval.

B. Product Literature: Manufacturer's published technical data for each product to be used in work of this Section including recommendations for application and use, test reports and certificates verifying that product complies with specified requirements, and Material Safety Data Sheets (MSDS).

C. Documentation: Documentation in the form of high-resolution (1 megabyte minimum) JPEG images on CDROM showing the existing condition of all elements of windows to be removed for work of this Section, all elements adjacent to elements that are to be removed, and all other window elements that will be in any way affected by work of this Section. Show overall trim and details of all damage or deterioration that might be attributed to damage resulting from work of this Section.

D. Wood Treatment Data: Chemical treatment manufacturer's instructions for handling, storage, installation, and finishing treated materials if applicable.

1.5 CONTRACTOR RESPONSIBILITY

A. Bidders shall visit the site beforehand to make themselves familiar with specific conditions relating to this Section.

B. Comply with relevant ASTM standards for all materials.

C. All Subcontractors are bound by the same requirements as the Contractor. Subcontractors shall not begin work unless approved by the Preservation Manager.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle all products and materials to prevent damage, deterioration, or degradation and intrusion of foreign material.

B. Discard and remove from site deteriorated or contaminated materials and products that have exceeded their expiration dates. Replace with fresh materials.

1.7 PROJECT CONDITIONS

A. Protection of Persons: Take all necessary precautions to protect all persons, whether engaged in work of this Section or not, from all hazards of any kind associated with the work of this Section.

B. Protection of Window Opening: After removal of the sash, all window openings shall be closed with plywood or acrylic panels fitted to each individual window and secured by non-destructive anchoring system. The panel shall be adequately weathertight and not permit any moisture to enter the building.

C. Protection of Building: Protect building elements and finishes from damage or deterioration caused by work of this Section. Repair any damage to materials or finishes to Preservation Manager's satisfaction at no additional cost.
   1. Take all necessary precautions to prevent fire and spread of fire.
   2. Take all necessary precautions to protect building elements and finishes from damage by precipitation during work of this Section. Protect openings at all times. Repair or replace to Preservation Manager's satisfaction all building elements and materials damaged by weather resulting from window openings that did not sufficiently exclude weather at no additional cost.

D. Coordination: Coordinate work of this Section with work specified in other sections to ensure proper completion of the Work. Every effort shall be made to accommodate the needs of Historic New England staff in relation to scheduling.

1.8 ENVIRONMENTAL CONDITIONS

A. General: Perform work only when temperature of products being used, temperatures of existing and new materials, and air temperature and humidity comply with product manufacturer's requirements and requirements of this Section. In case of conflict, the most stringent requirements shall govern.

B. Use of Epoxy Resins: Mix and apply epoxy resins only when temperatures are between 50 deg F and 80 deg F.

1.9 LEAD-CONTAINING PAINT (LCP)

A. General: Perform all work that disturbs lead-containing paint (LCP), handle all material that involves lead-containing paint, and transport and dispose of all lead-containing paint and residue in compliance with all applicable federal, state, and local laws and regulations for identification, removal, labeling, handling, containerization, transportation, and disposal of lead-containing material including, but not limited to, those referenced herein.

B. U.S. Department of Labor OSHA Regulations: Including but not limited to: Title 29, Code of Federal Regulations (CFR) Section 1926.62: "Lead Exposure in Construction" and Title 29, CFR Section 1910.1200: "Hazard Communication Standard."

C. U.S. Environmental Protection Agency (USEPA) Regulations: Including but not limited to: Title 40 CFR Part 262: "Standards Applicable to Generators of Hazardous Waste" and Part 263: "Standards Applicable to Transporters of Hazardous Waste."

D. U.S. Department of Transportation (USDOT) Regulations: Including but not limited to: 49 CFR Parts 172, 173, 174, 175, 177, 178, 179, and 180.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

A. Grade and Quality: Materials shall conform to requirements of this Section and shall be new, free from defects, and of recent manufacture.

B. Manufacturer's Instructions: Comply with material manufacturers' instructions for use of products (including surface preparation, mixing, applying, drying, etc.). In case of conflict with requirements of this Section, the more stringent requirements shall govern.

2.2 WOOD

A. Lumber shall be of sound stock, solid wood without finger joints or other joints within members, thoroughly seasoned, and kiln-dried to a moisture content not exceeding 8 percent.

B. Wood shall be free from defects or blemishes on surfaces exposed to view that will show after paints and finishes have been applied. Materials that do not comply with specifications for quality and grade, are in any way defective, or are otherwise not in proper condition will be rejected.

C. Wood for New Sash as necessary, Other New Elements, and Repairs of Existing Elements shall match profile and grade of existing windows in species, quality, cut, and grain pattern in kind.

D. Preservative treatment shall be used for new wood after machining.

2.3 ADHESIVES

A. Adhesive for Dutchman Repairs, Member Replacement, and Fabrication of New Sash: Epoxy resin glue designed for use with wood. Provide West System as manufactured by Gougeon Brothers, Inc., 706 Martin Street, Bay City, Michigan 48706 or approved equivalent. Provide the following materials: 105 Resin and 206 Slow Hardener or approved equivalent.

B. Adhesive for glass repair: Provide HXTAL NYL-1 Epoxy adhesive.

2.4 FASTENERS FOR CONSTRUCTION OF WOOD SASH

A. General: All fasteners for construction of new sash shall be stainless steel or nonferrous metal of appropriate size and configuration for use intended and approved by Preservation Manager.

2.5 HARDWARE AND ACCESSORIES

A. General: Provide each restored window with full complement of hardware and fasteners matching that on original windows. Use salvaged, restored existing hardware insofar as possible and new hardware to match existing hardware where hardware is missing or existing hardware is damaged or deteriorated so as to be unrestorable.
   1. Restored Existing Hardware: Restore all existing hardware to be reused following requirements of Article 3.11 “Restoration of Existing Historic Hardware,” below.
   2. New Hardware: Provide new hardware and fasteners to match existing hardware and fasteners in all respects.

B. Sash Lifts: Restore any existing sash lifts insofar as possible and new sash lifts to match existing sash lifts in material, configuration, size, and finish where existing sash lifts are missing or damaged so as to be non-restorable.

C. Sash Locks: Restore any existing sash locks insofar as possible and new sash locks to match existing sash locks in material, configuration, size, and finish where existing sash locks are missing or damaged so as to be non-restorable.

D. Sash Pulleys: Clean, lubricate and reuse sash pulleys. Replace sash pulleys if necessary to operate the windows with sash chains.

E. Sash Cord: Replace all sash cords with minimum breaking strain capacity of 350 kg.

F. Sash Weights: Ensure that sash weights allow full operation of each sash and allow sash to be balanced at any position in which it is placed. Add weights to existing sash weights or replace existing sash weights with new heavier weights to balance heavier sash if necessary.

G. Screws for Attaching Restored Existing Hardware: Clean, salvage existing screws insofar as possible. Where screws are missing or damaged so as to be unsalvageable, provide new screws to match existing screws in material, size, and configuration.

H. Screws for Attaching Replacement Hardware: New screws matching screws in existing hardware.

2.6 PAINTING AND FINISHING MATERIALS

A. General: Paint shall be of premium quality and match existing color exactly unless otherwise specified and shall comply with requirements of contract document. Primer shall be either oil-based or 100% acrylic and finish paint shall be 100% acrylic.

B. Glazing Putty: Putty is to be best quality pure linseed or soybean oil from manufacturer approved by Preservation Manager.

2.7 HARDWARE RESTORATION MATERIALS

A. Non-metallic Cleaning Pads: Scotch-Brite pads, extra fine, manufactured by 3M Co., or approved equal.

B. Wadding Cloth: “Never-Dull Magic Wadding Polish,” manufactured by The George Basch Co., Inc., 19 Hanse Avenue, P.O. Box 188, Freeport, NY 11520, or approved equal.

C. Paste Wax for Cold Application: White or clear paste wax, mixtures of microcrystalline wax, carnuba wax, and mild solvent, in paste form, such as Trewax clear, or Butcher’s Bowling Alley Paste Wax available from White Diamond Co., Marlboro, MA. Do not use emulsion-type waxes or amber-tinted waxes.

D. Thinner: Mineral spirits or turpentine.

E. Lacquer: Clear, non-yellowing, acrylic emulsion, water-based coating, formulated with corrosion inhibitor benzotriazole, such as #11650 Eco-Borne clear lacquer as manufactured by G.J. Nikolas & Co., Inc., 2800 Washington Blvd., Bellwood, IL 60104 (708) 544-0320, or approved equal.

2.8 FABRICATION OF NEW SASH

A. Coordinate dimensions with actual measurements of window openings and adjacent construction to match in kind.

B. Fabricate components to match originals in kind.

C. Join moldings to match construction of original sash exactly.

D. Machine sash elements to receive glazing panels. Machine sash elements of movable sash to receive weatherstripping, if appropriate, and hardware.

PART 3 EXECUTION

3.1 SAFETY

A. Protection: Protect people, adjoining building surfaces, collections and landscape elements, et al from injury resulting from window restoration work. Use drop cloths or other coverings as necessary to protect interior finishes, floor and collections and exterior landscape material from dust and debris, etc.

1. Erect temporary protection over pedestrian walkways and at those points of entry and exit that must remain operational during restoration.

3.2 INSPECTION AND DOCUMENTATION

A. Examine the areas and conditions where window restoration is to be executed. Take all necessary field measurements. Notify the Preservation Manager of conditions detrimental to the proper and timely completion of Work. Do not proceed until unsatisfactory conditions are corrected.

B. General: Document all elements of windows to be restored for work of this Section, all elements adjacent to elements that are to be removed, and all other window elements that will be in any way affected by work of this Section. Show overall window elements and details of all damage or deterioration that might be considered as resulting from work of this Section. Key all notes to photographs to, clearly identifying portions of existing elements included in each photograph.

C. Form of Documentation: Document existing construction with high resolution (1 megabyte minimum) JPEG images on CDROM.

3.3 REMOVALS

A. General: Remove all window components that require removal for restoration or for proper installation.
   1. To minimize breakage, paint lines at the edges of window stops and parting strips must be cut/scribed first with a sharp knife before moldings are removed.
   2. All nails will be removed by pulling them through the back of the moldings only. Representative nails will be tagged for Historic New England records.
   3. Identify and label each component that is to be removed and repaired for reinstallation with window opening designator and location in jamb. Record numbers and locations of components.
   4. Remove adjacent elements as required to modify or replace elements of window jambs, heads, and sills that must be altered to accommodate new window sash. Use all care necessary to prevent damage or deterioration of elements removed and elements remaining in place. Restore or replace all elements damaged during work of this Section to Preservation Manager’s satisfaction at no additional cost.
   5. Store removed elements in a secure location safe from theft, damage, and deterioration.
   6. Protect window openings to prevent water entry or human intrusion.

B. Glass Removal: All glass will be removed to accommodate sash restoration.
   1. Label each pane of glass with location and orientation within the sash so that the historic glass can be returned to its original location and orientation. Use painters tape to label glass and consistently label on either interior or exterior to avoid confusion at reinstallation.
   2. Remove all face glazing compound from each window sash using steam, infrared heat or other approved method.
   3. Cracked glass is only to be replaced with prior approval of Owner. Fractured panes should be glued if at all possible, rather than replaced. Any replacement of glass in to be done in kind and all replaced glass is to be dated in corner under glazing for future identification.

C. Paint Removal: All paint will be removed from sash as needed in order to insure successful adhesion of new paint, excepting a 2” section to be retained for future paint analysis.
   1. All paint removal shall be executed in compliance with all applicable federal, state, and local regulations.
   2. Steam or heat will be used to carefully remove the paint while limiting the damage to the wood substrate.
   3. As possible, depending on the technique used for paint removal, a two-inch band of undisturbed paint will be left on the interior and exterior of each pair of sash. Lightly feather the edges of each paint band. These bands will be used if future chromo-chronology is ever executed. If preserving areas of paint on the sash is not possible, craftsperson is to select samples from crevices where paint layers are most accumulated and best preserved and to provide labeled samples to Historic New England.

D. Hardware Removal: All hardware will be removed as needed in order to restore sash and hardware.
   1. Scribe paint around hardware so that removal of hardware does not splinter adjacent wood.
   2. Remove paint from hardware so that any crews may be loosened.
   3. Tag and retain all hardware and screws.
   4. Allow Preservation Manager to review all hardware so that a determination may be made as to whether hardware will be reinstalled.

3.4 DUTCHMAN REPAIRS

A. General: Provide dutchman repairs where wood is structurally compromised. Wood repairs will not be made for aesthetic purposes. Dutchman repairs shall provide continuous smooth surfaces matching planes and profiles of wood members being repaired. Dutchman shall match wood being repaired in specie and cut. In wood for clear finish, grain pattern of dutchman shall match grain pattern of wood into which it is inserted.

B. Preparation: Neatly cut out existing opening as required to provide a prismatic void. Wherever possible create voids that will provide mechanical attachments as in dovetails. The amount of wood removed should be minimized but the amount should include all damaged wood and extend just past damaged wood to prevent spread of any fungus contained therein. Cut away area will provide ample glue surface.

C. Dutchman: Cut dutchman to exactly fit void, with exposed portion matching original profile of woodwork and just slightly proud of original surface. Orient grain of dutchman parallel to grain of element being patched. Where deterioration or loss at end of component requires dutchman repair, use a diagonal scarf joint for end-to-end joint between dutchman and remaining portion of component.

D. Installation: Clean glue surfaces with acetone or denatured alcohol. Insert dutchman using specified adhesive and clamp in place until glue is set. Where clamping is not feasible, use small brads; remove brads and fill holes after adhesive has set.

E. Surfacing: Plane or scrape dutchman to provide smooth continuous surface coplanar with adjacent wood. Do not damage or alter profile or finish of adjacent wood.

3.5 COMPONENT REPLACEMENT

A. General: Fabricate new components for any components which are deteriorated in entirety and cannot be repaired with Dutchmen and epoxy.

B. In kind replacement: Except as specifically indicated otherwise, provide replacement elements of same specie with configurations, profiles, dimensions and joinery et al exactly matching those of existing elements.
   1. Profiles: Remove coatings from profiles of existing elements before recording profiles to produce molding cutters to match existing profiles.
   2. Molding Cutters: Cut custom blades as required to match original profiles and label knifes with project code.

C. Machining and Surfacing: Machine and surface all new and replacement wood elements to provide smooth even surfaces without saw marks or plane marks. Wood with surface irregularities, including but not limited to scratches, saw marks, and plane knife marks, visible after finish has been applied will be rejected and shall be replaced with properly finished wood elements at no additional cost.

3.6 SASH INSTALLATION

A. General: Install new and restored sash as per contract. At completion of installation, windows shall be complete with all components and with unblemished paint and finish coats. All operating sash shall operate smoothly over entire height, and weatherstripping, if specified, shall provide weatherproof seal.

B. Sash Balances: If specified install sash with sash chains/cords and weights properly adjusted to allow sash to close securely, open completely to top of track, and remain stationary at any position in track.

C. Sash Hardware: Install any hardware, including sash lifts and sash locks, on restored sash in the same locations as originally. Adjust sash locks for smooth easy operation and firm, secure locking.

D. Wax: Treat unpainted sides of stiles and frame with wax for ease of window operation and wood protection.

E. Weatherstripping: If specified, install weatherstripping following manufacturer’s requirements to ensure smooth operation and weathertight closure.

3.7 ADJUSTING

A. General: Adjust operating sash and hardware to provide a tight fit at contact points and weatherstripping, if specified, and to provide smooth operation and a weathertight closure. Lubricate hardware and moving parts.

3.8 GLAZING

A. General: Re-glaze all window lites using approved pure linseed oil or soybean oil glazing putty. Glazing points shall be used to set glass.

B. Clean glass prior to glazing with non-ammoniated formula before reinstallation.

C. Panes with multiple fractures will be replaced in kind and the date will be etched date in corner beneath where new glazing will cover. Fractured glass will be repaired as possible by gluing with HXTAL NY-1.

3.9 CLEANING

A. Clean interior and exterior surfaces promptly after installation. Take care to avoid damage to historic and protective coatings and finishes.

B. Use only cleaners which do not contain ammonia. Windex, 409 and like products are not acceptable as they accelerate paint film deterioration.

3.10 PAINTING

A. General: Paint and finish new and restored elements of frames and trim to match original finishes and/or as specified by Historic New England contract documents. Prime and paint sash in controlled environment according to manufacturers instructions.

B. Prepare substrates for repairs by hand sanding with 100grit paper. The sides of the stiles (unpainted edges) of double hung windows do not need to be sanded unless special conditions require it.

C. After substrate is sanded, vacuum all surfaces and remove remaining dust with barely damp dust-free cloth. Allow surfaces to dry completely before priming.

D. Apply water repellant wood preservative to all surfaces of the sash.

E. Apply one coat of alkyd or 100% acrylic primer to all surfaces of the sash including putty beds (shellac based paint cannot be applied over glazing). On all window sash, extend primer and paint 1/16” onto glass to seal glazing. If sash is operable, it is important to paint bottom edge to prevent water intrusion.

F. Lightly sand surfaces after the primer has dried and clean of all dust.

G. Apply two topcoats of premium quality 100% acrylic paint to all surfaces. Color to match existing exactly unless otherwise specified.

H. Immediately after installation touch-up any disturbed areas of paint.

3.11 RESTORATION OF EXISTING HARDWARE

A. General: Remove historic sash hardware from existing sash to be replaced and remove sash pulleys from jambs. Store hardware in plastic bags or containers identified with sash number to ensure that each unit of hardware is reinstalled in its original location.

B. Remove lacquer coatings with acetone or lacquer thinner.

C. Strip paint coatings by dipping in chemical paint stripper.

D. After removal of paint and other coatings, thoroughly rinse in appropriate solvent and wipe dry with soft cloths.

E. Replacement Parts: Provide replacement parts, including operating parts and fasteners, matching original parts in metal and alloy, configuration, size, and finish for all missing and damaged parts.

F. Remove scratches and buff surfaces using like metal cleaning and polishing pads and polishing compound as necessary. Do not scratch finish with abrasive pads or wire brushes.

G. Provide lacquer finish on all copper alloy elements.
   1. Preparation
      a. Clean and degrease metal using solvent and burnishing with handheld bronze wool to provide surface free of dirt, dust, grease, oil, and other contaminants. Do not damage metal finish. If a surface is handled or contaminated, repeat cleaning and degreasing process.
      b. Drying: Ensure that metal surface is completely dry.
      c. Environment: Ensure that environment is dust-free before applying lacquer.
   2. Lacquer Application: Build up coatings to produce 2-mil dry film thickness. Spray lacquer using “hot spray,” “airless spray,” or “electrostatic spray” methods.
   3. Curing: Cure lacquer coatings by “baking” in shop at elevated temperatures following manufacturer’s recommendations.
   4. Waxing: Protect baked lacquer coatings by hand application of two coats of hard paste wax.

H. Lubricate operating parts.

I. Store units in protective packaging.

J. Provide all missing fasteners for hardware. Fasteners must match all visual aspects of existing fasteners.

3.12 PROTECTION

A. Protect windows from damage or deterioration until time of substantial completion.

END OF SECTION

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

Heritage Preservation Services

Preservation Briefs: 9

The Repair of Historic Wooden Windows

John H. Myers

The windows on many historic buildings are an important aspect of the architectural character of those buildings. Their design, craftsmanship, or other qualities may make them worthy of preservation. This is self-evident for ornamental windows, but it can be equally true for warehouses or factories where the windows may be the most dominant visual element of an otherwise plain building (see figure 1). Evaluating the significance of these windows and planning for their repair or replacement can be a complex process involving both objective and subjective considerations. The *Secretary of the Interior's Standards for Rehabilitation*, and the accompanying guidelines, call for respecting the significance of original materials and features, repairing and retaining them wherever possible, and when necessary, replacing them in kind. This **Brief** is based on the issues of significance and repair which are implicit in the standards, but the primary emphasis is on the technical issues of planning for the repair of windows including evaluation of their physical condition, techniques of repair, and design considerations when replacement is necessary.

Figure 1. *Windows are frequently important visual focal points, especially on simple facades such as this mill building. Replacement of the multi-pane windows here with larger panes could dramatically change the appearance of the building. The areas of missing windows convey the impression of such a change. Photo: John T. Lowe*

Much of the technical section presents repair techniques as an instructional guide for the do-it-yourselfer. The information will be useful, however, for the architect, contractor, or developer on large-scale projects. It presents a methodology for approaching the evaluation and repair of existing windows, and considerations for replacement, from which the professional can develop alternatives and specify appropriate materials and procedures.

Architectural or Historical Significance

Evaluating the architectural or historical significance of windows is the first step in planning for window treatments, and a general understanding of the function and history of windows is vital to making a proper evaluation. As a part of this evaluation, one must consider four basic window functions: admitting light to the interior spaces, providing fresh air and ventilation to the interior, providing a visual link to the outside world, and enhancing the appearance of a building. No single factor can be disregarded when planning window treatments; for example, attempting to conserve energy by closing up or reducing the size of window openings may result in the use of *more* energy by increasing electric lighting loads and decreasing passive solar heat gains.

Historically, the first windows in early American houses were casement windows; that is, they were hinged at the side and opened outward. In the beginning of the eighteenth century single- and double-hung windows were introduced. Subsequently many styles of these vertical sliding sash windows have come to be associated with specific building periods or architectural styles, and this is an important consideration in determining the significance of windows, especially on a local or regional basis. Site-specific, regionally oriented architectural comparisons should be made to determine the significance of windows in question. Although such comparisons may focus on specific window types and their details, the ultimate determination of significance should be made within the context of the whole building, wherein the windows are one architectural element (see figure 2).

After all of the factors have been evaluated, *windows should be considered significant to a building if they:* 1) are original, 2) reflect the original design intent for the building, 3) reflect period or regional styles or building practices, 4) reflect changes to the building resulting from major periods or events, or 5) are examples of exceptional craftsmanship or design. Once this evaluation of significance has been completed, it is possible to pro-

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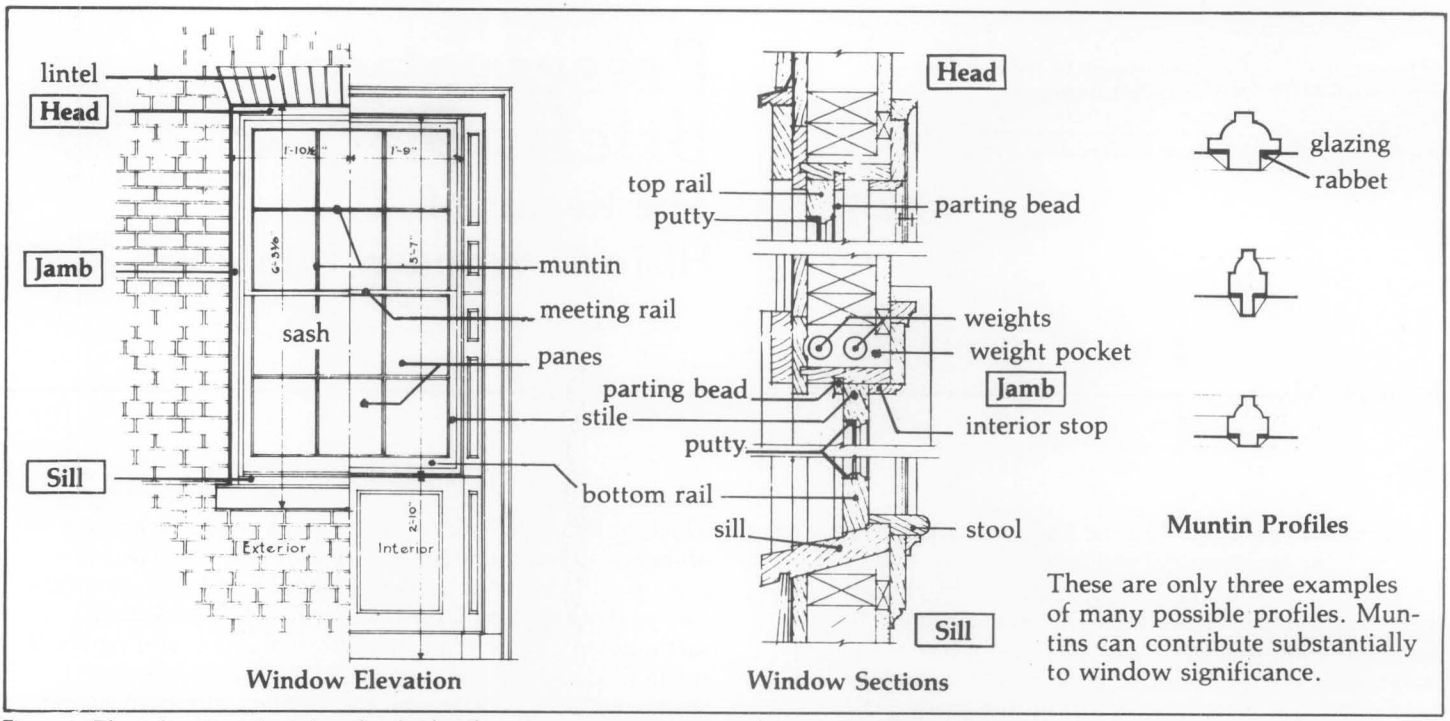

Figure 2. *These drawings of window details identify major components, terminology, and installation details for a wooden double-hung window.*

ceed with planning appropriate treatments, beginning with an investigation of the physical condition of the windows.

Physical Evaluation

The key to successful planning for window treatments is a careful evaluation of existing physical conditions on a unit-by-unit basis. A graphic or photographic system may be devised to record existing conditions and illustrate the scope of any necessary repairs. Another effective tool is a window schedule which lists all of the parts of each window unit. Spaces by each part allow notes on existing conditions and repair instructions. When such a schedule is completed, it indicates the precise tasks to be performed in the repair of each unit and becomes a part of the specifications. In any evaluation, one should note at a minimum, 1) window location, 2) condition of the paint, 3) condition of the frame and sill, 4) condition of the sash (rails, stiles and muntins), 5) glazing problems, 6) hardware, and 7) the overall condition of the window (excellent, fair, poor, and so forth).

Many factors such as poor design, moisture, vandalism, insect attack, and lack of maintenance can contribute to window deterioration, but moisture is the primary contributing factor in wooden window decay. All window units should be inspected to see if water is entering around the edges of the frame and, if so, the joints or seams should be caulked to eliminate this danger. The glazing putty should be checked for cracked, loose, or missing sections which allow water to saturate the wood, especially at the joints. The back putty on the interior side of the pane should also be inspected, because it creates a seal which prevents condensation from running down into the joinery. The sill should be examined to insure that it slopes downward away from the building and allows water to drain off. In addition, it may be advisable to cut a dripline along the underside of the sill. This almost invisible treatment will insure proper water run-off, particularly if the bottom of the sill is flat. Any conditions, including poor original design, which permit water to come in contact with the wood or to puddle on the sill must be corrected as they contribute to deterioration of the window.

One clue to the location of areas of excessive moisture is the condition of the paint; therefore, each window should be examined for areas of paint failure. Since excessive moisture is detrimental to the paint bond, areas of paint blistering, cracking, flaking, and peeling usually identify points of water penetration, moisture saturation, and potential deterioration. Failure of the paint should not, however, be mistakenly interpreted as a sign that the wood is in poor condition and hence, irreparable. Wood is frequently in sound physical condition beneath unsightly paint. After noting areas of paint failure, the next step is to inspect the condition of the wood, particularly at the points identified during the paint examination.

Each window should be examined for operational soundness beginning with the lower portions of the frame and sash. Exterior rainwater and interior condensation can flow downward along the window, entering and collecting at points where the flow is blocked. The sill, joints between the sill and jamb, corners of the bottom rails and muntin joints are typical points where water collects and deterioration begins (see figure 3). The operation of the window (continuous opening and closing over the years and seasonal temperature changes) weakens the joints, causing movement and slight separation. This process makes the joints more vulnerable to water which is readily absorbed into the end-grain of the wood. If severe deterioration exists in these areas, it will usually be apparent on visual inspection, but other less severely deteriorated areas of the wood may be tested by two traditional methods using a small ice pick.

An ice pick or an awl may be used to test wood for soundness. The technique is simply to jab the pick into a wetted wood surface at an angle and pry up a small sec-

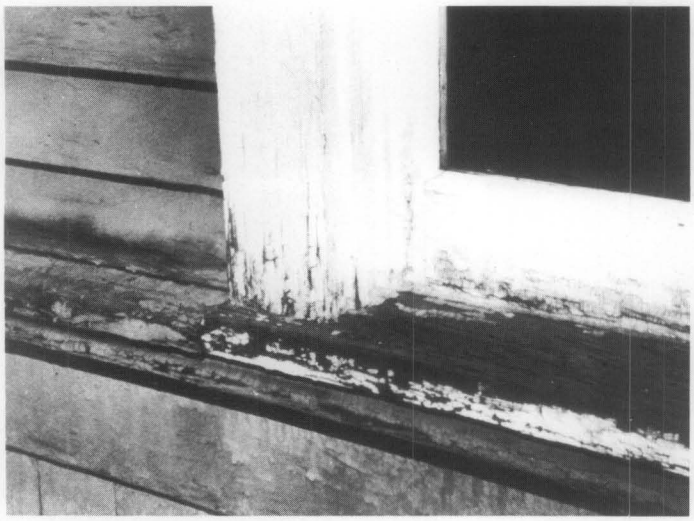

Figure 3. *Deterioration of poorly maintained windows usually begins on horizontal surfaces and at joints where water can collect and saturate the wood. The problem areas are clearly indicated by paint failure due to moisture. Photo: Baird M. Smith, AIA*

tion of the wood. Sound wood will separate in long fibrous splinters, but decayed wood will lift up in short irregular pieces due to the breakdown of fiber strength.

Another method of testing for soundness consists of pushing a sharp object into the wood, perpendicular to the surface. If deterioration has begun from the hidden side of a member and the core is badly decayed, the visible surface may appear to be sound wood. Pressure on the probe can force it through an apparently sound skin to penetrate deeply into decayed wood. This technique is especially useful for checking sills where visual access to the underside is restricted.

Following the inspection and analysis of the results, the scope of the necessary repairs will be evident and a plan for the rehabilitation can be formulated. Generally the actions necessary to return a window to "like new" condition will fall into three broad categories: 1) routine maintenance procedures, 2) structural stabilization, and 3) parts replacement. These categories will be discussed in the following sections and will be referred to respectively as Repair Class I, Repair Class II, and Repair Class III. Each successive repair class represents an increasing level of difficulty, expense, and work time. Note that most of the points mentioned in Repair Class I are routine maintenance items and should be provided in a regular maintenance program for any building. The neglect of these routine items can contribute to many common window problems.

Before undertaking any of the repairs mentioned in the following sections all sources of moisture penetration should be identified and eliminated, and all existing decay fungi destroyed in order to arrest the deterioration process. Many commercially available fungicides and wood preservatives are toxic, so it is extremely important to follow the manufacturer's recommendations for application, and store all chemical materials away from children and animals. After fungicidal and preservative treatment the windows may be stabilized, retained, and restored with every expectation for a long service life.

Repair Class I: Routine Maintenance

Repairs to wooden windows are usually labor intensive and relatively uncomplicated. On small scale projects this allows the do-it-yourselfer to save money by repairing all or part of the windows. On larger projects it presents the opportunity for time and money which might otherwise be spent on the removal and replacement of existing windows, to be spent on repairs, subsequently saving all or part of the material cost of new window units. Regardless of the actual costs, or who performs the work, the evaluation process described earlier will provide the knowledge from which to specify an appropriate work program, establish the work element priorities, and identify the level of skill needed by the labor force.

The routine maintenance required to upgrade a window to "like new" condition normally includes the following steps: 1) some degree of interior and exterior paint removal, 2) removal and repair of sash (including reglazing where necessary), 3) repairs to the frame, 4) weatherstripping and reinstallation of the sash, and 5) repainting. These operations are illustrated for a typical double-hung wooden window (see figures 4a-f), but they may be adapted to other window types and styles as applicable.

Historic windows have usually acquired many layers of paint over time. Removal of excess layers or peeling and flaking paint will facilitate operation of the window and restore the clarity of the original detailing. Some degree of paint removal is also necessary as a first step in the proper surface preparation for subsequent refinishing (if paint color analysis is desired, it should be conducted prior to the onset of the paint removal). There are several safe and effective techniques for removing paint from wood, depending on the amount of paint to be removed. Several techniques such as scraping, chemical stripping, and the use of a hot air gun are discussed in "Preservation Briefs: 10 Paint Removal from Historic Woodwork" (see Additional Reading section at end).

Paint removal should begin on the interior frames, being careful to remove the paint from the interior stop and the parting bead, particularly along the seam where these stops meet the jamb. This can be accomplished by running a utility knife along the length of the seam, breaking the paint bond. It will then be much easier to remove the stop, the parting bead and the sash. The interior stop may be initially loosened from the sash side to avoid visible scarring of the wood and then gradually pried loose using a pair of putty knives, working up and down the stop in small increments (see figure 4b). With the stop removed, the lower or interior sash may be withdrawn. The sash cords should be detached from the sides of the sash and their ends may be pinned with a nail or tied in a knot to prevent them from falling into the weight pocket.

Removal of the upper sash on double-hung units is similar but the parting bead which holds it in place is set into a groove in the center of the stile and is thinner and more delicate than the interior stop. After removing any paint along the seam, the parting bead should be carefully pried out and worked free in the same manner as the interior stop. The upper sash can be removed in the same manner as the lower one and both sash taken to a convenient work area (in order to remove the sash the interior stop and parting bead need only be removed from one side of the window). Window openings can be covered with polyethylene sheets or plywood sheathing while the sash are out for repair.

The sash can be stripped of paint using appropriate techniques, but if any heat treatment is used (see figure 4c), the glass should be removed or protected from the sudden temperature change which can cause breakage. An

Figure 4a. *The following series of photographs of the repair of a historic double-hung window use a unit which is structurally sound but has many layers of paint, some cracked and missing putty, slight separation at the joints, broken sash cords, and one cracked pane. Photo: John H. Myers*

Figure 4b. *After removing paint from the seam between the interior stop and the jamb, the stop can be pried out and gradually worked loose using a pair of putty knives as shown. To avoid visible scarring of the wood, the sash can be raised and the stop pried loose initially from the outer side. Photo: John H. Myers*

Figure 4c. *Sash can be removed and repaired in a convenient work area. Paint is being removed from this sash with a hot air gun while an asbestos sheet protects the glass from sudden temperature change. Photo: John H. Myers*

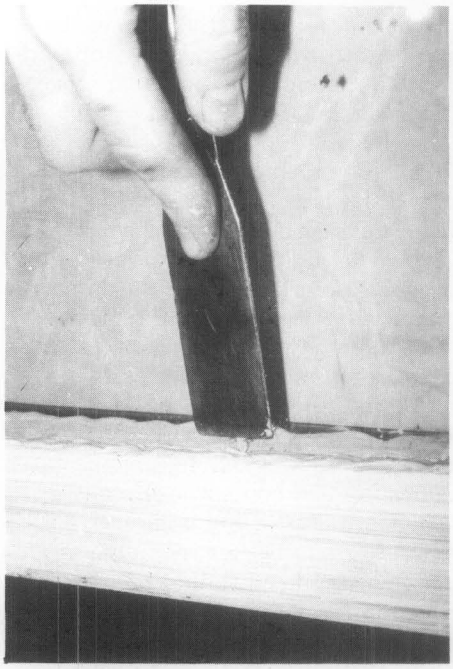

Figure 4d. *Reglazing or replacement of the putty requires that the existing putty be removed manually, the glazing points be extracted, the glass removed, and the back putty scraped out. To reglaze, a bed of putty is laid around the perimeter of the rabbet, the pane is pressed into place, glazing points are inserted to hold the pane (shown), and a final seal of putty is beveled around the edge of the glass. Photo: John H. Myers*

Figure 4e. *A common repair is the replacement of broken sash cords with new cords (shown) or with chains. The weight pocket is often accessible through a removable plate in the jamb, or by removing the interior trim. Photo: John H. Myers*

Figure 4f. *Following the relatively simple repairs, the window is weathertight, like new in appearance, and serviceable for many years to come. Both the historic material and the detailing and craftsmanship of this original window have been preserved. Photo: John H. Myers*

overlay of aluminum foil on gypsum board or asbestos can protect the glass from such rapid temperature change. It is important to protect the glass because it may be historic and often adds character to the window. Deteriorated putty should be removed manually, taking care not to damage the wood along the rabbet. If the glass is to be removed, the glazing points which hold the glass in place can be extracted and the panes numbered and removed for cleaning and reuse in the same openings. With the glass panes out, the remaining putty can be removed and the sash can be sanded, patched, and primed with a preservative primer. Hardened putty in the rabbets may be softened by heating with a soldering iron at the point of removal. Putty remaining on the glass may be softened by soaking the panes in linseed oil, and then removed with less risk of breaking the glass. Before reinstalling the glass, a bead of glazing compound or linseed oil putty should be laid around the rabbet to cushion and seal the glass. Glazing compound should only be used on wood which has been brushed with linseed oil and primed with an oil based primer or paint. The pane is then pressed into place and the glazing points are pushed into the wood around the perimeter of the pane (see figure 4d). The final glazing compound or putty is applied and beveled to complete the seal. The sash can be refinished as desired on the inside and painted on the outside as soon as a "skin" has formed on the putty, usually in 2 or 3 days. Exterior paint should cover the beveled glazing compound or putty and lap over onto the glass slightly to complete a weathertight seal. After the proper curing times have elapsed for paint and putty, the sash will be ready for reinstallation.

While the sash are out of the frame, the condition of the wood in the jamb and sill can be evaluated. Repair and refinishing of the frame may proceed concurrently with repairs to the sash, taking advantage of the curing times for the paints and putty used on the sash. One of the most common work items is the replacement of the sash cords with new rope cords or with chains (see figure 4e). The weight pocket is frequently accessible through a door on the face of the frame near the sill, but if no door exists, the trim on the interior face may be removed for access. Sash weights may be increased for easier window operation by elderly or handicapped persons. Additional repairs to the frame and sash may include consolidation or replacement of deteriorated wood. Techniques for these repairs are discussed in the following sections.

The operations just discussed summarize the efforts necessary to restore a window with minor deterioration to "like new" condition (see figure 4f). The techniques can be applied by an unskilled person with minimal training and experience. To demonstrate the practicality of this approach, and photograph it, a Technical Preservation Services staff member repaired a wooden double-hung, two over two window which had been in service over ninety years. The wood was structurally sound but the window had one broken pane, many layers of paint, broken sash cords and inadequate, worn-out weatherstripping. The staff member found that the frame could be stripped of paint and the sash removed quite easily. Paint, putty and glass removal required about one hour for each sash, and the reglazing of both sash was accomplished in about one hour. Weatherstripping of the sash and frame, replacement of the sash cords and reinstallation of the sash, parting bead, and stop required an hour and a half. These times refer only to individual operations; the entire process took several days due to the drying and curing times for putty, primer, and paint, however, work on other window units could have been in progress during these lag times.

Repair Class II: Stabilization

The preceding description of a window repair job focused on a unit which was operationally sound. Many windows will show some additional degree of physical deterioration, especially in the vulnerable areas mentioned earlier, but even badly damaged windows can be repaired using simple processes. Partially decayed wood can be waterproofed, patched, built-up, or consolidated and then painted to achieve a sound condition, good appearance, and greatly extended life. Three techniques for repairing partially decayed or weathered wood are discussed in this section, and all three can be accomplished using products available at most hardware stores.

One established technique for repairing wood which is split, checked or shows signs of rot, is to: 1) dry the wood, 2) treat decayed areas with a fungicide, 3) waterproof with two or three applications of boiled linseed oil (applications every 24 hours), 4) fill cracks and holes with putty, and 5) after a "skin" forms on the putty, paint the surface. Care should be taken with the use of fungicide which is toxic. Follow the manufacturers' directions and use only on areas which will be painted. When using any technique of building up or patching a flat surface, the finished surface should be sloped slightly to carry water away from the window and not allow it to puddle. Caulking of the joints between the sill and the jamb will help reduce further water penetration.

When sills or other members exhibit surface weathering they may also be built-up using wood putties or homemade mixtures such as sawdust and resorcinol glue, or whiting and varnish. These mixtures can be built up in successive layers, then sanded, primed, and painted. The same caution about proper slope for flat surfaces applies to this technique.

Wood may also be strengthened and stabilized by consolidation, using semi-rigid epoxies which saturate the porous decayed wood and then harden. The surface of the consolidated wood can then be filled with a semi-rigid epoxy patching compound, sanded and painted (see figure 5). Epoxy patching compounds can be used to build up

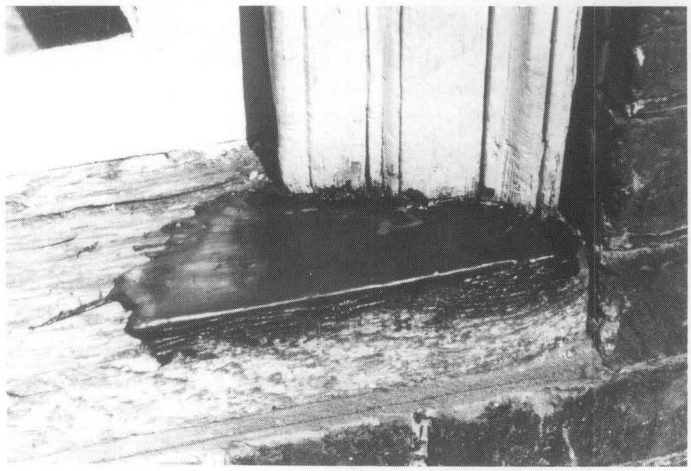

Figure 5. *This illustrates a two-part epoxy patching compound used to fill the surface of a weathered sill and rebuild the missing edge. When the epoxy cures, it can be sanded smooth and painted to achieve a durable and waterproof repair. Photo: John H. Myers*

missing sections or decayed ends of members. Profiles can be duplicated using hand molds, which are created by pressing a ball of patching compound over a sound section of the profile which has been rubbed with butcher's wax. This can be a very efficient technique where there are many typical repairs to be done. Technical Preservation Services has published *Epoxies for Wood Repairs in Historic Buildings* (see Additional Reading section at end), which discusses the theory and techniques of epoxy repairs. The process has been widely used and proven in marine applications; and proprietary products are available at hardware and marine supply stores. Although epoxy materials may be comparatively expensive, they hold the promise of being among the most durable and long lasting materials available for wood repair.

Any of the three techniques discussed can stabilize and restore the appearance of the window unit. There are times, however, when the degree of deterioration is so advanced that stabilization is impractical, and the only way to retain some of the original fabric is to replace damaged parts.

Repair Class III: Splices and Parts Replacement

When parts of the frame or sash are so badly deteriorated that they cannot be stabilized there are methods which permit the retention of some of the existing or original fabric. These methods involve replacing the deteriorated parts with new matching pieces, or splicing new wood into existing members. The techniques require more skill and are more expensive than any of the previously discussed alternatives. It is necessary to remove the sash and/or the affected parts of the frame and have a carpenter or woodworking mill reproduce the damaged or missing parts. Most millwork firms can duplicate parts, such as muntins, bottom rails, or sills, which can then be incorporated into the existing window, but it may be necessary to shop around because there are several factors controlling the practicality of this approach. Some woodworking mills do not like to repair old sash because nails or other foreign objects in the sash can damage expensive knives (which cost far more than their profits on small repair jobs); others do not have cutting knives to duplicate muntin profiles. Some firms prefer to concentrate on larger jobs with more profit potential, and some may not have a craftsman who can duplicate the parts. A little searching should locate a firm which will do the job, and at a reasonable price. If such a firm does not exist locally, there are firms which undertake this kind of repair and ship nationwide. It is possible, however, for the advanced do-it-yourselfer or craftsman with a table saw to duplicate moulding profiles using techniques discussed by Gordie Whittington in "Simplified Methods for Reproducing Wood Mouldings," *Bulletin* of the Association for Preservation Technology, Vol. III, No. 4, 1971, or illustrated more recently in *The Old House*, Time-Life Books, Alexandria, Virginia, 1979.

The repairs discussed in this section involve window frames which may be in very deteriorated condition, possibly requiring removal; therefore, caution is in order. The actual construction of wooden window frames and sash is not complicated. Pegged mortise and tenon units can be disassembled easily, *if* the units are out of the building. The installation or connection of some frames to the surrounding structure, especially masonry walls, can complicate the work immeasurably, and may even require dismantling of the wall. It may be useful, therefore, to take the following approach to frame repair: 1) conduct regular maintenance of sound frames to achieve the longest life possible, 2) make necessary repairs in place wherever possible, using stabilization and splicing techniques, and 3) if removal is necessary, thoroughly investigate the structural detailing and seek appropriate professional consultation.

Another alternative may be considered if parts replacement is required, and that is sash replacement. If extensive replacement of parts is necessary and the job becomes prohibitively expensive it may be more practical to purchase new sash which can be installed into the existing frames. Such sash are available as exact custom reproductions, reasonable facsimiles (custom windows with similar profiles), and contemporary wooden sash which are similar in appearance. There are companies which still manufacture high quality wooden sash which would duplicate most historic sash. A few calls to local building suppliers may provide a source of appropriate replacement sash, but if not, check with local historical associations, the state historic preservation office, or preservation related magazines and supply catalogs for information.

If a rehabilitation project has a large number of windows such as a commercial building or an industrial complex, there may be less of a problem arriving at a solution. Once the evaluation of the windows is completed and the scope of the work is known, there may be a potential economy of scale. Woodworking mills may be interested in the work from a large project; new sash in volume may be considerably less expensive per unit; crews can be assembled and trained on site to perform all of the window repairs; and a few extensive repairs can be absorbed (without undue burden) into the total budget for a large number of sound windows. While it may be expensive for the average historic home owner to pay seventy dollars or more for a mill to grind a custom knife to duplicate four or five bad muntins, that cost becomes negligible on large commercial projects which may have several hundred windows.

Most windows should not require the extensive repairs discussed in this section. The ones which do are usually in buildings which have been abandoned for long periods or have totally lacked maintenance for years. It is necessary to thoroughly investigate the alternatives for windows which do require extensive repairs to arrive at a solution which retains historic significance and is also economically feasible. Even for projects requiring repairs identified in this section, if the percentage of parts replacement per window is low, or the number of windows requiring repair is small, repair can still be a cost effective solution.

Weatherization

A window which is repaired should be made as energy efficient as possible by the use of appropriate weatherstripping to reduce air infiltration. A wide variety of products are available to assist in this task. Felt may be fastened to the top, bottom, and meeting rails, but may have the disadvantage of absorbing and holding moisture, particularly at the bottom rail. Rolled vinyl strips may also be tacked into place in appropriate locations to reduce infiltration. Metal strips or new plastic spring strips may be used on the rails and, if space permits, in

the channels between the sash and jamb. Weatherstripping is a historic treatment, but old weatherstripping (felt) is not likely to perform very satisfactorily. Appropriate contemporary weatherstripping should be considered an integral part of the repair process for windows. The use of sash locks installed on the meeting rail will insure that the sash are kept tightly closed so that the weatherstripping will function more effectively to reduce infiltration. Although such locks will not always be historically accurate, they will usually be viewed as an acceptable contemporary modification in the interest of improved thermal performance.

Many styles of storm windows are available to improve the thermal performance of existing windows. The use of exterior storm windows should be investigated whenever feasible because they are thermally efficient, cost-effective, reversible, and allow the retention of original windows (see "Preservation Briefs: 3"). Storm window frames may be made of wood, aluminum, vinyl, or plastic; however, the use of unfinished aluminum storms should be avoided. The visual impact of storms may be minimized by selecting colors which match existing trim color. Arched top storms are available for windows with special shapes. Although interior storm windows appear to offer an attractive option for achieving double glazing with minimal visual impact, the potential for damaging condensation problems must be addressed. Moisture which becomes trapped between the layers of glazing can condense on the colder, outer prime window, potentially leading to deterioration. The correct approach to using interior storms is to create a seal on the interior storm while allowing some ventilation around the prime window. In actual practice, the creation of such a durable, airtight seal is difficult.

Window Replacement

Although the retention of original or existing windows is always desirable and this **Brief** is intended to encourage that goal, there is a point when the condition of a window may clearly indicate replacement. The decision process for selecting replacement windows should *not* begin with a survey of contemporary window products which are available as replacements, but should begin with a look at the windows which are being replaced. Attempt to understand the contribution of the window(s) to the appearance of the facade including: 1) the pattern of the openings and their size; 2) proportions of the frame and sash; 3) configuration of window panes; 4) muntin profiles; 5) type of wood; 6) paint color; 7) characteristics of the glass; and 8) associated details such as arched tops, hoods, or other decorative elements. Develop an understanding of how the window reflects the period, style, or regional characteristics of the building, or represents technological development.

Armed with an awareness of the significance of the existing window, begin to search for a replacement which retains as much of the character of the historic window as possible. There are many sources of suitable new windows. Continue looking until an acceptable replacement can be found. Check building supply firms, local woodworking mills, carpenters, preservation oriented magazines, or catalogs or suppliers of old building materials, for product information. Local historical associations and state historic preservation offices may be good sources of information on products which have been used successfully in preservation projects.

Consider energy efficiency as one of the factors for replacements, but do not let it dominate the issue. Energy conservation is no excuse for the wholesale destruction of historic windows which can be made thermally efficient by historically and aesthetically acceptable means. In fact, a historic wooden window with a high quality storm window added should thermally outperform a new double-glazed metal window which does not have thermal breaks (insulation between the inner and outer frames intended to break the path of heat flow). This occurs because the wood has far better insulating value than the metal, and in addition many historic windows have high ratios of wood to glass, thus reducing the area of highest heat transfer. One measure of heat transfer is the U-value, the number of Btu's per hour transferred through a square foot of material. When comparing thermal performance, the lower the U-value the better the performance. According to *ASHRAE 1977 Fundamentals*, the U-values for single glazed wooden windows range from 0.88 to 0.99. The addition of a storm window should reduce these figures to a range of 0.44 to 0.49. A non-thermal break, double-glazed metal window has a U-value of about 0.6.

Conclusion

Technical Preservation Services recommends the retention and repair of original windows whenever possible. We believe that the repair and weatherization of existing wooden windows is more practical than most people realize, and that many windows are unfortunately replaced because of a lack of awareness of techniques for evaluation, repair, and weatherization. Wooden windows which are repaired and properly maintained will have greatly extended service lives while contributing to the historic character of the building. Thus, an important element of a building's significance will have been preserved for the future.

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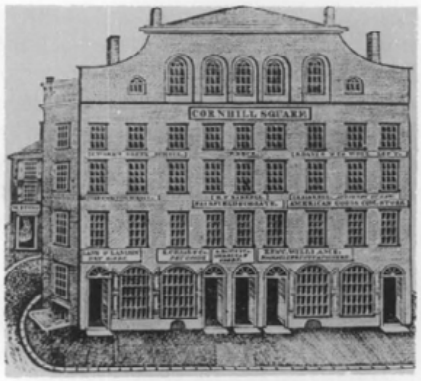

Rehabilitating Historic Storefronts

H. Ward Jandl

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

The storefront is the most important architectural feature of many historic commercial buildings. It also plays a crucial role in a store's advertising and merchandising strategy to draw customers and increase business. Not surprisingly, then, the storefront has become the feature most commonly altered in a historic commercial building. In the process, these alterations may have completely changed or destroyed a building's distinguishing architectural features that make up its historic character.

As more and more people come to recognize and appreciate the architectural heritage of America's downtowns, however, a growing interest can be seen in preserving the historic character of commercial buildings. The sensitive rehabilitation of storefronts can result not only in increased business for the owner but can also provide evidence that downtown revitalization efforts are succeeding (see figure 1).

Once a decision is made to rehabilitate a historic commercial building, a series of complex decisions faces the owner, among them:

- if the original storefront has survived largely intact but is in a deteriorated condition, what repairs should be undertaken?
- if the storefront has been modernized at a later date, should the later alterations be kept or the building restored to its original appearance or an entirely new design chosen?
- if the building's original retail use is to be changed to office or residential, can the commercial appearance of the building be retained while accommodating the new use?

This Preservation Brief is intended to assist owners, architects, and planning officials in answering such questions about how to evaluate and preserve the character of historic storefronts. In so doing, it not only addresses the

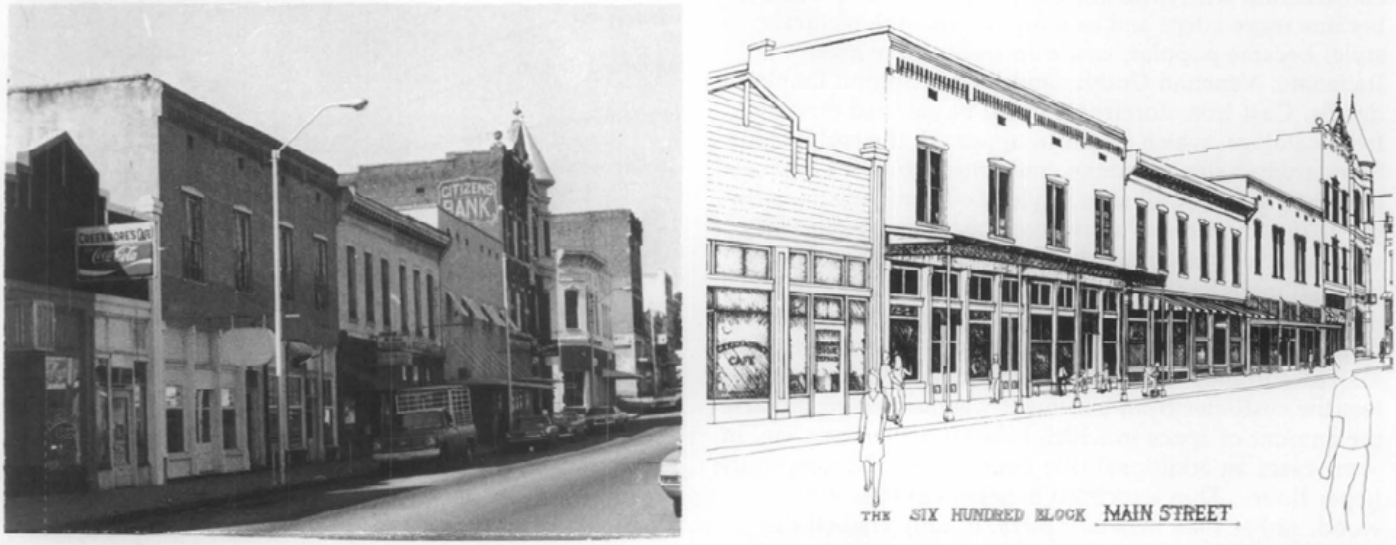

Figure 1. *Inappropriate storefront alterations over the years—metal cladding, oversized signs and canopies—have detracted from the character of this historic district in Van Buren, Arkansas. A carefully considered rehabilitation plan for Main Street, including the removal of poorly designed signs, false fronts and the selection of an appropriate exterior paint color palette, serves to enhance the visual environment and preserves the district's sense of time and place. Photo above: Bob Dunn; Drawing, David Fitts*

basic design issues associated with storefront rehabilitation, but recommends preservation treatments as well. Finally, although the Brief focuses on storefront rehabilitation, it is important to review this specific work in the broader context of preserving and maintaining the overall structure. Money spent on storefront rehabilitation may be completely wasted if repair and maintenance problems on the rest of the building are neglected.

Historical Overview

Commercial establishments of the 18th and early 19th centuries were frequently located on the ground floor of buildings and, with their residentially scaled windows and doors, were often indistinguishable from surrounding houses. In some cases, however, large bay or oriel windows comprised of small panes of glass set the shops apart from their neighbors. Awnings of wood and canvas and signs over the sidewalk were other design features seen on some early commercial buildings. The ground floors of large commercial establishments, especially in the first decades of the 19th century, were distinguished by regularly spaced, heavy piers of stone or brick, infilled with paneled doors or small paned window sash. Entrances were an integral component of the facade, typically not given any particular prominence although sometimes wider than other openings.

The ready availability of architectural cast iron after the 1840's helped transform storefront design as architects and builders began to experiment using iron columns and lintels at the ground floor level. Simultaneous advances in the glass industry permitted manufacturing of large panes of glass at a reasonable cost. The combination of these two technical achievements led to the storefront as we know it today—large expanses of glass framed by thin structural elements. The advertisement of the merchant and his products in the building facade and display windows quickly became critical factors in the competitive commercial atmosphere of downtowns. In the grouping of these wide-windowed facades along major commercial streets, the image of America's cities and towns radically changed.

The first cast iron fronts were simple post-and-lintel construction with little decoration. As iron craftsmen became more adept and as more ornate architectural styles became popular, cast iron fronts were given Italianate, Venetian Gothic, and French Second Empire details. Cast iron storefronts could be selected directly from catalogs, which began to appear in the early 1850's. Standardized sills, columns, and lintels could be arranged to create fronts of all sizes, styles and configurations. In the 1870's sheet metal storefronts became popular; they were also sold in standardized sizes and configurations through manufacturers' catalogs (see figure 2).

The typical 19th century storefront consisted of single or double doors flanked by display windows (see figure 3). The entrance was frequently recessed, not only to protect the customer from inclement weather but to increase the amount of space in which to display merchandise. In some cases an additional side door provided access to the upper floors. Thin structural members of cast iron or wood, rather than masonry piers, usually framed the storefront. The windows themselves were raised off the ground by wood, cast iron or pressed metal panels or bulkheads; frequently, a transom or series of transoms (consisting of single or multiple panes of glass) were

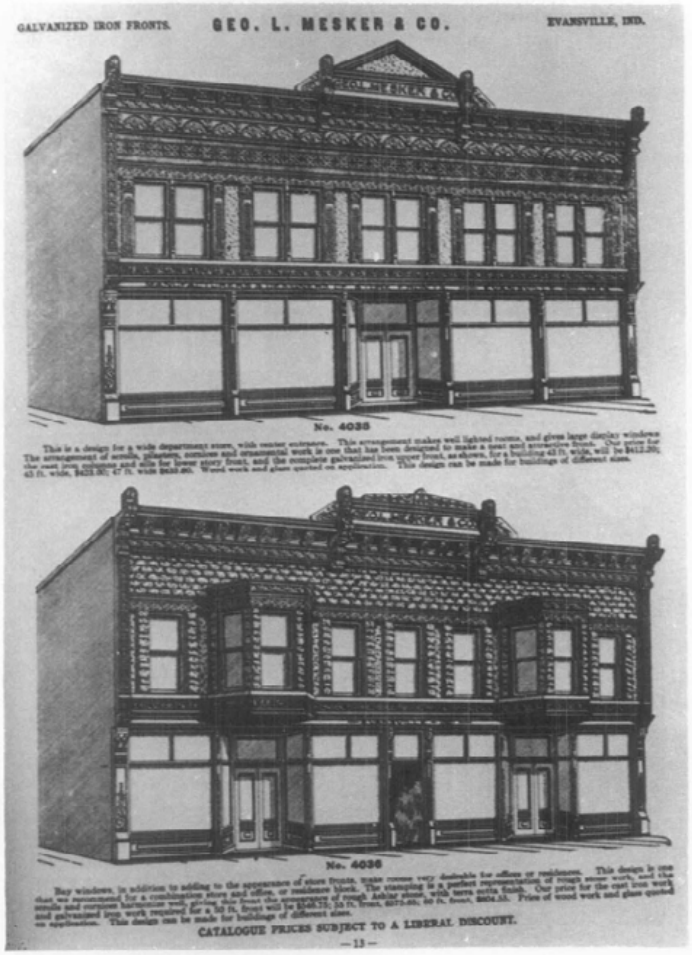

Figure 2. *These 19th century galvanized iron storefronts could be purchased from George L. Mesker & Co. in Evansville, Indiana.*

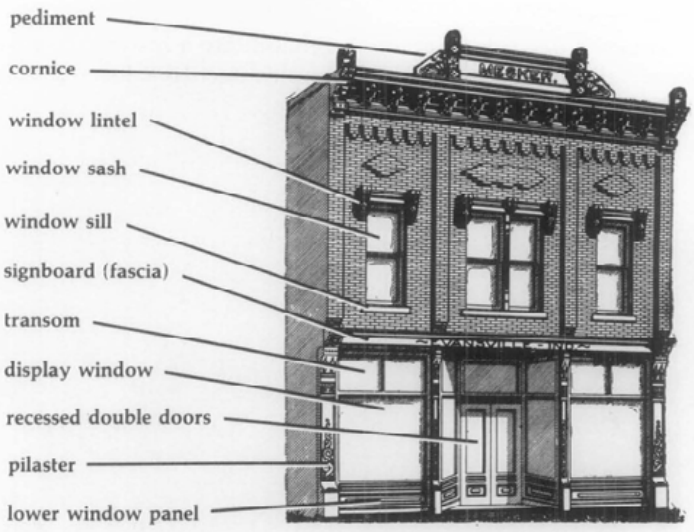

Figure 3. *Become familiar with the architectural features typical of historic commercial buildings. A close look at a storefront's construction materials, features and relationship to the upper stories will help in determining how much of the original facade remains.*

This particular storefront is No. 4016 in the George L. Mesker and Company catalog of 1905. One of Mesker's most popular designs, it featured cast-iron sills, columns and lintels, galvanized iron lintel and main cornice, window caps and pediment.

placed above each window and door. The signboard above the storefront (the fascia covering the structural beam) became a prominent part of the building. Canvas awnings, or in some cases tin or wooden canopies, often shaded storefronts of the late 19th century. Iron fronts were frequently put onto existing buildings as a way of giving them an up-to-date appearance. Except for expanding the display window area to the maximum extent possible and the increasing use of canvas awnings, few major technical innovations in storefront design can be detected from the 1850's through 1900.

The first decades of the 20th century saw the growing use of decorative transom lights (often using small prismatic glass panes) above display windows; in some cases, these transoms could be opened to permit air circulation into the store. Electric incandescent lights enabled storeowners to call attention to their entrance and display windows and permitted nighttime shopping. In the 1920's and 1930's a variety of new materials were introduced into the storefront, including aluminum and stainless steel framing elements, pigmented structural glass (in a wide variety of colors), tinted and mirrored glass, glass block and neon. A bewildering number of proprietary products also appeared during this period, many of which went into storefronts including Aklo, Vitrolux, Vitrolite, and Extrudalite. Highly colored and heavily patterned marble was a popular material for the more expensive storefronts of this period. Many experiments were made with recessed entries, floating display islands, and curved glass. The utilization of neon lighting further transformed store signs into elaborate flashing and blinking creations. During this period design elements were simplified and streamlined; transom and signboard were often combined. Signs utilized typefaces for the period, including such stylized lettering as "Broadway," "Fino" and "Monogram." Larger buildings of this period, such as department stores, sometimes had fixed metal canopies, with lighting and signs as an integral component of the fascia (see figure 4).

Because commercial architecture responds to a variety of factors—environmental, cultural, and economic, distinct regional variations in storefronts can be noted. Fixed metal canopies supported by guy wires, for example, were common in late 19th and early 20th century storefronts in southern states where it was advantageous to have shaded entrances all year long. Such a detail was less common in the northeast where moveable canvas awnings predominated. These awnings could be lowered in summer to keep buildings cooler and raised in winter when sunlight helps to heat the building.

Evaluating the Storefront

The important key to a successful rehabilitation of a historic commercial building is planning and selecting treatments that are sensitive to the architectural character of the storefront. As a first step, it is therefore essential to identify and evaluate the existing storefront's construction materials; architectural features; and the relationship of those features to the upper stores (see figure 5). This evaluation will permit a better understanding of the storefront's role in, and significance to, the overall design of the building. A second and equally important step in planning the rehabilitation work is a careful examination of the storefront's physical conditions to determine the extent and nature of rehabilitation work needed (see figure 6). In most cases, this examination is best undertaken by a qualified professional.

Figure 4. *This storefront in New York City designed by Raymond Loewy typifies the streamlined look of the 1930's. Added to an earlier buiding, the front utilizes glass, stainless steel and neon to make a modern statement. This is a good example of a later storefront which has acquired significance and should be retained in any rehabilitation.*

Figure 5. *In some cases, as in the storefront on the extreme left, it is a simple matter to determine original appearance by looking at neighboring storefronts. Removal of the board and batten fasciaboard, pent roof, and "colonial" style door, all of which could be undertaken at minimal cost, would restore the original proportions and lines of the building. Photo: Day Johnston*

Guidelines for Rehabilitating Existing Historic Storefronts

1. Become familiar with the style of your building and the role of the storefront in the overall design. Don't "early up" a front. Avoid stock "lumberyard colonial" detailing such as coach lanterns, mansard overhangings, wood shakes, nonoperable shutters, and small paned windows except where they existed historically.
2. Preserve the storefront's character even though there is a new use on the interior. If less exposed window area is desirable, consider the use of interior blinds and insulating curtains rather than altering the existing historic fabric.
3. Avoid use of materials that were unavailable when the storefront was constructed; this includes vinyl and aluminum siding, anodized aluminum, mirrored or tinted glass, artificial stone, and brick veneer.
4. Choose paint colors based on the building's historical appearance. In general do not coat surfaces that have never been painted. For 19th century storefronts, contrasting colors may be appropriate, but avoid too many different colors on a single facade.

Figure 6. *Storefronts of the 1940's, 50's, and 60's were frequently installed by attaching studs or a metal grid over an early front and applying new covering materials. If the existing storefront is a relatively recent addition with little or no architectural merit, begin by removing the covering materials in several places as was done here. If this preliminary investigation reveals evidence of an earlier front, such as this cast-iron column, carefully remove the later materials to assess the overall condition of the historic storefront. The black mastic visible on the lower masonry panels was used for installing pigmented structural glass. Some attachment methods for modern facings, such as mastic or metal lath, may have seriously damaged the original fabric of the buiding, and this must be taken into account in the rehabilitation process. Photo: Bob Dunn*

The following questions should be taken into consideration in this two-part evaluation:

Construction Materials, Features, and Design Relationships

Storefront's Construction Materials: What are the construction materials? Wood? Metal? Brick or other masonry? A combination?

Storefront's Architectural Features: What are the various architectural features comprising the storefront and how are they arranged in relationship to each other?

- Supporting Columns/Piers:
  What do the columns or piers supporting the storefront look like? Are they heavy or light in appearance? Are they flush with the windows or do they protrude? Are they all structural elements or are some columns decorative?
- Display Windows and Transoms:
  Are the display windows and transoms single panes of glass or are they subdivided? Are they flush with the facade or are they recessed? What is the proportion of area between the display windows and transom? Are there window openings in the base panels to allow natural light into the basement?
- Entrances:
  Are the entrances centered? Are they recessed? Is one entrance more prominent than the others? How is the primary retail entrance differentiated from other entrances? Is there evidence that new entrances have been added or have some been relocated? Are the doors original or are they later replacements?
- Decorative Elements:
  Are there any surviving decorative elements such as molded cornices, column capitals, fascia boards, brackets, signs, awnings or canopies? Is there a belt-course, cornice, or fascia board between the first and second floor? Are some elements older than others indicating changes over time?

Storefront's Relationship to Upper Stories: Is there a difference in materials between the storefront and upper stories? Were the storefront and floors above it created as an overall design or were they very different and unrelated to each other?

It is also worthwhile to study the neighboring commercial buildings and their distinctive characteristics to look for similarities (canopies, lighting, signs) as well as differences. This can help determine whether the storefront in question is significant and unique in its own right and/or whether it is significant as part of an overall commercial streetscape.

Physical Condition

Mild Deterioration: Do the surface materials need repair? Is paint flaking? Are metal components rusting? Do joints need recaulking where materials meet glass windows? Mild deterioration generally requires only maintenance level treatments.

Moderate Deterioration: Can rotted or rusted or broken sections of material be replaced with new material to match the old? Can solid material (such as Carrara glass) from a non-conspicuous location be used on the historic facade to repair damaged elements? Do stone or brick components need repointing? Is the storefront watertight with good flashing connections? Are there leaky gutters or air conditioner units which drip condensation on the storefront? Is caulking needed? Moderate deterioration generally requires patching or splicing of the existing elements with new pieces to match the deteriorated element.

Severe Deterioration: Have existing facing materials deteriorated beyond repair through vandalism, settlement, or water penetration? Is there a loss of structural integrity? Is the material rusted through, rotted, buckling, completely missing? Are structural lintels sagging? Are support columns settled or out of alignment? Severe deterioration generally requires replacement of deteriorated elements as part of the overall rehabilitaton.

In evaluating whether the existing storefront is worthy of preservation, recognize that good design can exist in any period; a storefront added in 1930 *may* have greater architectural merit than what is replaced (see figure 4). In commercial historic districts, it is often the diversity of

styles and detailing that contribute to the character; removing a storefront dating from 1910 simply because other buildings in the district have been restored to their 1860's appearance may not be the best preservation approach. If the storefront design is a good example of its period and if it has gained significance over time, it should be retained as part of the historical evolution of the building (this architectural distinctiveness could also be an economic asset as it may attract attention to the building).

Deciding a Course of Action

The evaluation of the storefront's architectural features and physical condition will help determine the best course of action in the actual rehabilitation work. The following recommendations, adapted from the Secretary of the Interior's "Standards for Rehabilitation" and the accompanying interpretive guidelines, are designed to ensure that the historic commercial character of the building is retained in the rehabilitation process.

If the original or significant storefront exists, repair and retain the historic features using recommended treatments (see following sections on rehabilitating metal, wood and masonry storefronts as well as the guidelines for rehabilitating existing historic storefronts found on page 3).

If the original or significant storefront no longer exists or is too deteriorated to save, undertake a contemporary design which is compatible with the rest of the buiding in scale, design, materials, color and texture; or undertake an accurate restoration based on historical research and physical evidence (see section on "Replacement Storefronts"). Where an original or significant storefront no longer exists and *no* evidence exists to document its early appearance, it is generally preferable to undertake a contemporary design that retains the commercial "flavor" of the building. The new storefront design should not draw attention away from the historic building with its detailing but rather should respect the existing historic character of the overall building. A new design that copies traditional details or features from neighboring buildings or other structures of the period may give the building a historical appearance which blends in with its neighbors but which never, in fact, existed. For this reason, use of conjectural designs, even if based on similar buildings elsewhere in the neighborhood or the availability of different architectural elements from other buildings or structures, is generally not recommended.

Rehabilitating Metal Storefronts

Rehabilitating metal storefronts can be a complex and time-consuming task. Before steps are taken to analyze or treat deteriorated storefronts, it is necessary to know which metal is involved, because each has unique properties and distinct preservation treatments. Storefronts were fabricated using a variety of metals, including cast iron, bronze, copper, tin, galvanized sheet iron, cast zinc, and stainless steel. Determining metallic composition can be a difficult process especially if components are encrusted with paint. Original architect's specifications (sometimes available from permit offices, town halls, or records of the original owner) can be important clues in this regard and should be checked if at all possible.

Iron—a magnetic, gray-white malleable metal, readily susceptible to oxidation. Cast iron, most commonly found in storefronts, is shaped by molds and can withstand great compressive loads. Rolled sheet iron, sometimes galvanized with zinc, also was used in storefront construction. Stainless steel began to appear in storefronts after 1930.

Zinc—a medium-hard, bluish-white metal, widely used as a protective coating for iron and steel. It is softer than iron and is nonmagnetic.

Copper—a nonmagnetic, corrosion-resistant, malleable metal, initially reddish-brown but when exposed to the atmosphere turns brown to black to green.

Bronze and brass—nonmagnetic, abrasive-resistant alloys combining copper with varying amounts of zinc, lead, or tin. These copper alloys, more commonly found in office buildings or large department stores, range in color from lemon yellow to golden brown to green depending on their composition and are well suited for casting (see figure 7).

Aluminum—a lightweight, nonmagnetic metal commonly found on storefronts dating from the 1920's and 30's. Its brightness and resistance to corrosion has made it a popular storefront material in the 20th century.

Figure 7. *Part of a large office building constructed in Washington, D.C. in 1928, this finely detailed bronze storefront is typical of many constructed during this period. It should be noted that the original grilles, spandrel panel and window above are all intact. Photo: David W. Look, AIA*

Repair and Replacement of Metal

Simply because single components of a storefront need repair or replacement should not be justification for replacing an entire storefront. Deteriorated metal architectural elements can be repaired by a variety of means, although the nature of the repair will depend on the extent of the deterioration, the type of metal and its location, and the overall cost of such repairs. Patches can be used to mend, cover or fill a deteriorated area. Such patches should be a close match to the original material to prevent galvanic corrosion. Splicing—replacement of a small section with new material—should be undertaken on structural members only when temporary bracing has been constructed to carry the load. Reinforcing—or bracing the damaged element with additional new metal material—can relieve fatigue or overloading in some situations.

If metal components have deteriorated to a point where they have actually failed (or are missing), replacement is the only reasonable course of action. If the components are significant to the overall design of the storefront, they should be carefully removed and substituted with components that match the original in material, size and detailing (see figure 8).

Figure 8. *When the Grand Opera House in Wilmington, Delaware, was rehabilitated, missing cast-iron columns were cast of aluminum to match the original; in this particular case, because these columns do not carry great loads, aluminum proved to be successful substitute. Photo: John G. Waite*

Before going to the expense of reproducing the original, it may be useful to check salvage yards for compatible components. Missing parts of cast iron storefronts can be replaced by new cast iron members that are reproductions of the original. New wooden patterns, however, usually need to be made if the members are large. This procedure tends to be expensive (it is usually impossible to use existing iron components as patterns to cast large elements because cast iron shrinks 1/5 inch per foot as it cools). In some situations, less expensive substitute materials such as aluminum, wood, plastics, and fiberglass, painted to match the metal, can be used without compromising the architectural character of the resource.

Cleaning and Painting

Cast iron storefronts are usually encrusted with layers of paint which need to be removed to restore crispness to the details. Where paint build-up and rust are not severe problems, handscraping and wire-brushing are viable cleaning methods. While it is necessary to remove all rust before repainting, it is not necessary to remove all paint. For situations involving extensive paint build-up and corrosion, mechanical methods such as low-pressure gentle dry grit blasting (80-100 psi) can be effective and economical, providing a good surface for paint. Masonry and wood surfaces adjacent to the cleaning area, however, should be protected to avoid inadvertent damage from the blasting. It will be necessary to recaulk and putty the heads of screws and bolts after grit blasting to prevent moisture from entering the joints. Cleaned areas should be painted immediately after cleaning with a rust-inhibiting primer to prevent new corrosion. Before any cleaning is undertaken, local codes should be checked to ensure compliance with environmental safety requirements.

Storefronts utilizing softer metals (lead, tin), sheet metals (sheet copper), and plated metals (tin and terneplate) should not be cleaned mechanically (grit blasting) because their plating or finish can be easily abraded and damaged. It is usually preferable to clean these softer metals with a chemical (acid pickling or phosphate dipping) method. Once the surface of the metal has been cleaned of all corrosion, grease, and dirt, a rust-inhibiting primer coat should be applied. Finish coats especially formulated for metals, consisting of lacquers, varnishes, enamels or special coatings, can be applied once the primer has dried. Primer and finish coats should be selected for chemical compatibility with the particular metal in question.

Bronze storefronts, common to large commercial office buildings and major department stores of the 20th century, can be cleaned by a variety of methods; since all cleaning removes some surface metal and patina, it should be undertaken only with good reason (such as the need to remove encrusted salts, bird droppings or dirt). Excessive cleaning can remove the texture and finish of the metal. Since this patina can protect the bronze from further corrosion, it should be retained if possible. If it is desirable to remove the patina to restore the original surface of the bronze, several cleaning methods can be used: chemical compounds including rottenstone and oil, whiting and ammonia, or precipitated chalk and ammonia, can be rubbed onto bronze surfaces with a soft, clean cloth with little or no damage. A number of commercial cleaning companies successfully use a combination of 5% oxalic acid solution together with *finely* ground India pumice powder. Fine glass-bead blasting (or peening) and crushed walnut shell blasting also can be acceptable mechanical methods if carried out in controlled circumstances under low (80-100 psi) pressure. Care should be taken to protect any adjacent wood or masonry from the blasting.

The proper cleaning of metal storefronts should not be considered a "do-it-yourself" project. The nature and condition of the material should be assessed by a competent professional, and the work accomplished by a com-pany specializing in such work.

Rehabilitating Wooden Storefronts

The key to the successful rehabilitation of wooden storefronts is a careful evaluation of existing physical conditions. Moisture, vandalism, insect attack, and lack of maintenance can all contribute to the deterioration of wooden storefronts. Paint failure should not be mistaken-

ly interpreted as a sign that the wood is in poor condition and therefore irreparable. Wood is frequently in sound physical condition beneath unsightly paint. An ice pick or awl may be used to test wood for soundness—decayed wood that is jabbed will lift up in short irregular pieces; sound wood will separate in long fibrous splinters.

Repair and Replacement of Wood

Storefronts showing signs of physical deterioration can often be repaired using simple methods. Partially decayed wood can be patched, built up, chemically treated or consolidated and then painted to achieve a sound condition, good appearance, and greatly extended life.

To repair wood showing signs of rot, it is advisable to dry the wood; carefully apply a fungicide such as pentachlorophenol (a highly toxic substance) to all decayed areas; then treat with 2 or 3 applications of boiled linseed oil (24 hours between applications). Afterward, fill cracks and holes with putty; caulk the joints between the various wooden members; and finally prime and paint the surface.

Partially decayed wood may also be strengthened and stabilized by consolidation, using semi-rigid epoxies which saturate porous decayed wood and then harden. The consolidated wood can then be filled with a semi-rigid epoxy patching compound, sanded and painted. More information on epoxies can be found in the publication "Epoxies for Wood Repairs in Historic Buildings," cited in the bibliography.

Where components of wood storefronts are so badly deteriorated that they cannot be stabilized, it is possible to replace the deteriorated parts with new pieces (see figure 9). These techniques all require skill and some expense, but are recommended in cases where decorative elements, such as brackets or pilasters, are involved. In some cases, missing edges can be filled and rebuilt using wood putty or epoxy compounds. When the epoxy cures, it can be sanded smooth and painted to achieve a durable and waterproof repair.

Figure 9. *Rather than replace an entire wooden storefront when there is only localized deterioration, a new wooden component can be pieced-in, as seen here in this column base. The new wood will need to be given primer and top coats of a high quality exterior paint—either an oil-base or latex system. Also wood that is flaking and peeling should be scraped and hand-sanded prior to repainting. Photo: H. Ward Jandl*

Repainting of Wood

Wooden storefronts were historically painted to deter the harmful effects of weathering (moisture, ultraviolet rays from the sun, wind, etc.) as well as to define and accent architectural features. Repainting exterior woodwork is thus an inexpensive way to provide continued protection from weathering and to give a fresh appearance to the storefront.

Before repainting, however, a careful inspection of all painted wood surfaces needs to be conducted in order to determine the extent of surface preparation necessary, that is, whether the existing layers of paint have deteriorated to the point that they will need to be partially or totally removed prior to applying the new paint.

As a general rule, removing paint from historic exterior woodwork should be avoided unless absolutely essential. Once conditions warranting removal have been identified, however, paint can be removed to the next sound layer using the gentlest method possible, then the woodwork repainted. For example, such conditions as mildewing, excessive chalking, or staining (from the oxidization of rusting nails or metal anchorage devices) generally require only thorough surface cleaning prior to repainting. Intercoat peeling, solvent blistering, and wrinkling require removal of the affected layer using mild abrasive methods such as hand scraping and sanding. In all of these cases of limited paint deterioration, after proper surface preparation the exterior woodwork may be given one or more coats of a high quality exterior oil finish paint.

On the other hand, if painted wood surfaces display continuous patterns of deep cracks or if they are extensively blistering and peeling so that bare wood is visible, the old paint should be completely removed before repainting. (It should be emphasized that because peeling to bare wood—the most common type of paint problem—is most often caused by excess interior or exterior moisture that collects behind the paint film, the first step in treating peeling is to locate and remove the source or sources of moisture. If this is not done, the new paint will simply peel off.)

There are several acceptable methods for total paint removal, depending on the particular wooden element involved. They include such thermal devices as an electric heat plate with scraper for flat surfaces such as siding, window sills, and doors or an electric hot-air gun with profiled scraper for solid decorative elements such as gingerbread or molding. Chemical methods play a more limited, supplemental role in removing paint from historic exterior woodwork; for example, caustic or solvent-base strippers may be used to remove paint from window muntins because thermal devices can easily break the glass. Detachable wooden elements such as exterior shutters, balusters and columns, can probably best be stripped by means of immersion in commercial dip tanks because other methods are too laborious. Care must be taken in rinsing all chemical residue off the wood prior to painting or the new paint will not adhere.

Finally, if the exterior woodwork has been stripped to bare wood, priming should take place within 48 hours (unless the wood is wet, in which case it should be permitted to dry before painting). Application of a high quality oil type exterior primer will provide a surface over which either an oil or latex top coat can be successfully used.

Rehabilitating Masonry Storefronts

Some storefronts are constructed of brick or stone, and like their metal and wooden counterparts, also may have been subjected to physical damage or alterations over time. Although mortar may have disintegrated, inappropriate surface coatings applied, and openings reduced or blocked up, careful rehabilitation will help restore the visual and physical integrity of the masonry storefront.

Repair and Replacement of Masonry

If obvious signs of deterioration—disintegrating mortar, spalling bricks or stone—are present, the causes (ground moisture, leaky downspouts, etc.) should be identified and corrected. Some repointing may be necessary on the masonry surface, but should be limited to areas in which so much mortar is missing that water accumulates in the mortar joints, causing further deterioration. New mortar should duplicate the composition, color, texture, and hardness, as well as the joint size and profile of the original. Badly spalling bricks may have to be replaced. Deteriorated stone may be replaced in kind, or with a matching substitute material; in some cases where not visually prominent, it may be covered with stucco, possibly scored to resemble blocks of stone.

Cleaning Masonry

Inappropriate cleaning techniques can be a major source of damage to historic masonry buildings. Historic masonry should be cleaned only when necessary to halt deterioration or to remove graffiti and stains, and always with the gentlest means possible, such as water and a mild detergent using natural bristle brushes, and/or a non-harmful chemical solution, both followed by a low-pressure water rinse.

It is important to remember that many mid-19th century brick buildings were painted immediately or soon after construction to protect poor quality brick or to imitate stone. Some historic masonry buildings not originally painted were painted at a later date to hide alterations or repairs, or to solve recurring maintenance or moisture problems. Thus, whether for reasons of historical tradition or practicality, it may be preferable to retain existing paint. If it is readily apparent that paint is not historic and is a later, perhaps unsightly or inappropriate treatment, removal may be attempted, but only if this can be carried out without damaging the historic masonry. Generally, paint removal from historic masonry may be accomplished successfully only with the use of specially formulated chemical paint removers. No abrasive techniques, such as wet or dry sandblasting should be considered. If non-historic paint cannot be removed without using abrasive methods, it is best to leave the masonry painted, although repainting in a compatible color may help visually.

Removing unsightly mastic from masonry presents a similarly serious problem. Its removal by mechanical means may result in abrading the masonry, and chemical and heat methods may prove ineffective, although solvents like acetone will aid in sofening the hardened mastic. If the mastic has become brittle, a flat chisel may be used to pop it off; but this technique, if not undertaken with care, may result in damaging the masonry. And even if total removal is possible, the mastic may have permanently stained the masonry. Replacement of these masonry sections marred by mastic application may be one option in limited situations; individual pieces of stone or bricks that have been damaged by inappropriate alterations may be cut out and replaced with new pieces that duplicate the original. However, since an exact match will be nearly impossible to achieve, it may be necessary to paint the repaired masonry in order to create a harmonious facade. Replacement of a large area with new materials may not be acceptable as it may give the building a new, non-historic appearance inappropriate to the building style and period.

Designing Replacement Storefronts

Where an architecturally or historically significant storefront no longer exists or is too deterioriated to save, a new front should be designed which is compatible with the size, scale, color, material, and character of the building. Such a design should be undertaken based on a thorough understanding of the building's architecture and, where appropriate, the surrounding streetscape (see figure 10). For example, just because upper floor windows are arched is not sufficient justification for designing arched openings for the new storefront. The new design should "read" as a storefront; filling in the space with brick or similar solid material is inappropriate for historic buildings. Similarly the creation of an arcade or other new design element, which alters the architectural and historic character of the building and its relationship with the street, should be avoided. The guidelines on page 8 can assist in developing replacement storefront designs that respect the historic character of the building yet meet current economic and code requirements.

Guidelines for Designing Replacement Storefronts

1. *Scale:* Respect the scale and proportion of the existing building in the new storefront design.
2. *Materials:* Select construction materials that are appropriate to the storefronts; wood, cast iron, and glass are usually more appropriate replacement materials than masonry which tends to give a massive appearance.
3. *Cornice:* Respect the horizontal separation between the storefront and the upper stories. A cornice or fascia board traditionally helped contain the store's sign.
4. *Frame:* Maintain the historic planar relationship of the storefront to the facade of the building and the streetscape (if appropriate). Most storefront frames are generally composed of horizontal and vertical elements.
5. *Entrances:* Differentiate the primary retail entrance from the secondary access to upper floors. In order to meet current code requirements, out-swinging doors generally must be recessed. Entrances should be placed where there were entrances historically, especially when echoed by architectural detailing (a pediment or projecting bay) on the upper stories.
6. *Windows:* The storefront generally should be as transparent as possible. Use of glass in doors, transoms, and display areas allows for visibility into and out of the store.
7. *Secondary Design Elements:* Keep the treatment of secondary design elements such as graphics and awnings as simple as possible in order to avoid visual clutter to the building and its streetscape.

Figure 10. *(A) This existing storefront, added in the 1950's to a late 19th century brick building, extends beyond the plane of the facade; faced with anodized aluminum and permastone, it does not contribute to the architectural and historic character of the building. (B) This replacement design uses "lumberyard colonial" detailing, such as barn-type doors, shutters, small paned windows, and a wood shake pent roof. The design, detailing, and choice of materials are clearly inappropriate to this commercial building. (C) This replacement design retains the 1950's projecting canopy but symmetrical placement of the doors relates well to the second floor windows above; this contemporary design is compatible with the scale and character of the building. (D) This replacement design accurately restores the original appearance of the building; based on historical research and physical evidence, it too is an acceptable preservation approach. Drawings: Sharon C. Park, AIA*

A restoration program requires thorough documentation of the historic development of the building prior to initiating work. If a restoration of the original storefront is contemplated, old photographs and prints, as well as physical evidence, should be used in determining the form and details of the original. Because storefronts are particularly susceptible to alteration in response to changing marketing techniques, it is worthwhile to find visual documentation from a variety of periods to have a clear understanding of the evolution of the storefront. Removal of later additions that contribute to the character of the building should not be undertaken.

Other Considerations

Pigmented Structural Glass

The rehabilitation of pigmented structural glass storefronts, common in the 1930's, is a delicate and often frustrating task, due to the fragility and scarcity of the material. Typically the glass was installed against masonry walls with asphaltic mastic and a system of metal shelf angles bolted to the walls on three-foot centers. Joints between the panels were filled with cork tape or an elastic joint cement to cushion movement and prevent moisture infiltration.

The decision to repair or replace damaged glass panels should be made on a case-by-case basis. In some instances, the damage may be so minor or the likelihood of finding replacement glass so small, that repairing, reanchoring and/or stabilizing the damaged glass panel may be the only prudent choice. If the panel is totally destroyed or missing, it may be possible to replace with glass salvaged from a demolition; or a substitute material, such as "spandrel glass," which approximates the appearance of the original. Although pigmented structural glass is no longer readily available, occasionally long-established glass "jobbers" will have a limited supply to repair historic storefronts.

Awnings

Where based on historic precedent, consider the use of canvas awnings on historic storefronts (see figure 11). Awnings can help shelter passersby, reduce glare, and conserve energy by controlling the amount of sunlight hitting the store window, although buildings with northern exposures will seldom functionally require them. Today's canvas awnings have an average life expectancy of between 4 and 7 years. In many cases awnings can disguise, in an inexpensive manner, later inappropriate alterations and can provide both additional color and a strong store identification. Fixed aluminum awnings and awnings simulating mansard roofs and umbrellas are generally inappropriate for older commercial buildings. If awnings are added, choose those that are made from soft canvas or vinyl materials rather than wood or metal; be certain that they are installed without damaging the building or visually impairing distinctive architectural features and can be operable for maximum energy conservation effect.

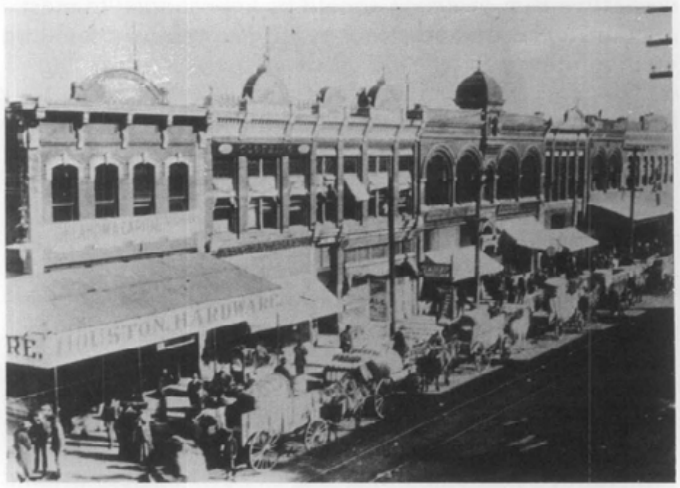

Figure 11. *Try to locate old photographs or prints to determine what alterations have been made to the storefront and when they were undertaken. Awnings were common elements of storefronts at the turn of the century. They can be equally useful today.*

Signs

Signs were an important aspect of 19th and early 20th century storefronts and today play an important role in defining the character of a business district. In examining historic streetscape photographs, one is struck by the number of signs—in windows, over doors, painted on exterior walls, and hanging over (and sometimes across) the street. While this confusion was part of the character of 19th century cities and towns, today's approach toward signs in historic districts tends to be much more conservative. Removal of some signs can have a dramatic effect in improving the visual appearance of a building; these include modern backlit fluorescent signs, large applied signs with distinctive corporate logos, and those signs attached to a building in such a way as to obscure significant architectural detailing. For this reason, their removal is encouraged in the process of rehabilitation. If new signs are designed, they should be of a size and style compatible with the historic building and should not cover or obscure significant architectural detailing or features. For many 19th century buildings, it was common to mount signs on the lintel above the first story. Another common approach, especially at the turn of the century, was to paint signs directly on the inside of the display windows. Frequently this was done in gold leaf. New hanging signs may be appropriate for historic commercial buildings, if they are of a scale and design compatible with the historic buildings. Retention of signs and advertising painted on historic walls, if of historic or artistic interest (especially where they provide evidence of early or original occupants), is encouraged.

Paint Color

Paint analysis can reveal the storefront's historic paint colors and may be worth undertaking if a careful restoration is desired. If not, the paint color should be, at a minimum, appropriate to the style and setting of the building. This also means that if the building is in a historic district, the color selection should complement the building in question as well as other buildings in the block. In general, color schemes for wall and major decorative trim or details should be kept simple; in most cases the color or colors chosen for a storefront should be used on other painted exterior detailing (windows, shutter, cornice, etc.) to unify upper and lower portions of the facade.

Windows

Glass windows are generally the most prominent features in historic storefronts, and care should be taken to ensure that they are properly maintained. For smaller paned windows with wooden frames, deteriorated putty should be removed manually, taking care not to damage wood along the rabbet. To reglaze, a bead of linseed oil-based putty should be laid around the perimeter of the rabbet; the glass pane pressed into place; glazing points inserted to hold the pane; and a final seal of putty beveled around the edge of the glass. For metal framed windows, glazing compound and special glazing clips are used to secure the glass; a final seal of glazing compound then is often applied. If the glass needs replacing, the new glass should match the original in size, color and reflective qualities. Mirrored or tinted glass are generally inappropriate replacements for historic storefronts. The replacement of cracked or missing glass in large windows should be undertaken by professional glaziers.

Code Requirements

Alterations to a storefront called for by public safety, handicapped access, and fire codes can be difficult design problems in historic buildings. Negotiations can be undertaken with appropriate officials to ensure that all applicable codes are being met while maintaining the historic character of the original construction materials and features. If, for instance, doors opening inward must be changed, rather than replace them with new doors, it may be possible to reverse the hinges and stops so that they will swing outward.

Summary

A key to the successful rehabilitation of historic commercial buildings is the sensitive treatment of the first floor itself (see figure 12). Wherever possible, significant storefronts (be they original or later alterations), including windows, sash, doors, transoms, signs and decorative features, should be repaired in order to retain the historic character of the building. Where original or early storefronts no longer exist or are too deteriorated to save, the commercial character of the building should nonetheless be preserved—either through an accurate restoration based on historic research and physical evidence or a contemporary design which is compatible with the scale, design, materials, color and texture of the historic building. The sensitive rehabilitation of historic storefronts will not only enhance the architectural character of the overall building but will contribute to rejuvenating neighborhoods or business districts as well.

Figure 12. *This photograph of three late 19th century commercial buildings clearly shows the impact of preserving and rehabilitating storefronts. The one on the right has been totally obscured by a "modern" front added in the 1950's. Although inappropriate alterations have taken place on the left storefront, it is still possible to determine the original configuration of the doors and display windows. The storefront in the middle has remained intact. Although in need of some minor maintenance work, the appeal of the original design and materials is immediately apparent.*

Additional Reading

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This publication has been prepared pursuant to the Economic Recovery Tax Act of 1981 which directs the Secretary of the Interior to certify rehabilitations of historic buildings that are consistent with their historic character; the advice and guidance provided in this brief will assist property owners in complying with the requirements of this law.

Preservation Briefs 11 has been developed under the technical editorship of Lee H. Nelson, AIA, Chief, Preservation Assistance Division, National Park Service, U.S. Department of the Interior, Washington, D.C. 20240. Comments on the usefulness of this information are welcomed and can be sent to Mr. Nelson at the above address.

Cover drawing: This woodcut of the Joy Building, built in 1808 in Boston, shows early storefronts with shutters; note the profusion of signs covering the facade, advertising the services of the tenants.

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SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 09 01 90 - Painting.

1.2 REFERENCES

A. ANSI/NAAMM HMMA 841, Tolerances and Clearances for Commercial Hollow Metal Doors and Frames.

B. ANSI/SDI A250.4, Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, and Frame Anchors.

C. ANSI/SDI A250.10, Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

D. ANSI/NFPA 80 , Standard for Fire Doors and Other Opening Protectives.

E. ANSI/NFPA 105, Standard for Smoke Door Assemblies and Other Opening Protectives.

F. ANSI/NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

G. ANSI/UL 10B, Standard for Fire Test of Door Assemblies.

H. ANSI/UL 10C, Standard for Positive Pressure Fire Tests of Door Assemblies.

I. ANSI/UL 1784, Standard for Air Leakage Tests of Door Assemblies L.

J. ASTM A 1008/A 1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy, and High Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

K. ASTM A 1011/A 1011M, Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy, and High Strength Low-Alloy with Improved Formability and Ultra High Strength.

1.3 TESTING AND PERFORMANCE

A. Physical Endurance Test - ANSI/SDI A250.4, "Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, and Frame Anchors"
   1. Test a 3 ft. x 7 ft. (914 mm x 2134 mm), 1.75 in. (44 mm) thick nominal size door and frame assembly representative of the construction and material to be provided.

2. Provide Performance Report, or Certificate of Compliance, from an Independent 3rd party which indicate compliance with the acceptance criteria of the standard for the level of duration required: [Level A - 1,000,000 cycles] [Level B - 500,000 cycles] or [Level C - 250,000 cycles].

B. Prime Paint Performance, ANSI/SDI A250.10 "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames".
1. Test a sheet steel specimen, replicating finish ‘as shipped’ with the product manufacturer’s production primer.
2. Provide Verification of Compliance from an Independent 3rd party which indicates compliance with the acceptance criteria of the standard.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications
1. Provide evidence of having personnel and plant equipment capable of fabricating hollow metal door and frame product of the types specified.
2. Provide evidence of having a written quality control system in place.

B. Quality Criteria
1. Compliance with Section 1.05 is required for all door and frame product provided under this Section.
2. Fabricate in accordance with the contract documents and approved submittal drawings.
3. Meet product quality standards and fabrication methods set by the Hollow Metal Manufacturers Association, HMMA, a division of the National Association of Architectural Metal Manufacturers, NAAMM.

1.5 SUBMITTALS

A. Submittal Drawings
1. Show dimensioned door and frame product elevations and sections.
2. Show listing of opening descriptions including locations, material thickness, and anchors.
3. Show location and details of openings.
4. Provide manufacturer's recommended installation instructions and procedures.

B. Samples, upon request, provide the following
1. Door: 1 ft. x 1 ft. (305 mm x 305 mm) corner section with hinge preparation showing top and internal construction.
2. Frame: 1 ft. x 1 ft. (305 mm x 305 mm) section showing assembled corner joint at head and jamb. Include hinge reinforcement [and grout guard] in one rabbet. When glazed frame product is specified, apply and install glazing stop as specified in the opposite rabbet. Apply glazing stop to both head and jamb section to show their intersection.
3. All samples submitted must represent, in all respects, the minimum quality of work to be furnished by the manufacturer. Do not fabricate any work represented by the samples until the samples are approved. Any deviation of fabrication quality compared to the approved samples is cause for rejection of the work.

1.6 DELIVERY STORAGE AND HANDLING

A. Deliver, store, handle and protect doors and frames in accordance with Section 01 61 00-Common Product Requirements.

B. Deliver, handle and store doors and frames at the job site in such a manner as to prevent damage.

C. Store doors and frames under cover with doors stored in a vertical position on blocking, clear of floor and with blocking between doors to permit air circulation.

1.7 QUALITY ASSURANCE

A. Conform to requirements to ANSI A117.1

B. Company specializing in manufacturing products specified with a minimum of five (5) years documented experience.

1.8 WARRANTY

A. Provide a written warranty for work of this section from manufacturer for failure due to defective materials and from contractor for failure due to defective installation workmanship, for one (1) year respectively from the date of Substantial Completion.

PART 2 PRODUCTS

2.1 STEEL

A. Used in the fabrication of hollow metal door and frame products shall meet one, or more, of the following requirements Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653/A653M, ZF75.

1. Cold-rolled steel conforming to ASTM A1008/A 1008M, "Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High Strength Low-Alloy and High Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable" and ASTM A 568/A 568M "Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low Alloy, Hot-Rolled and Cold-rolled, General Requirements for."
2. Hot-rolled, pickled and oiled (HRPO) steel conforming to ASTM A 1011/A 1011M, "Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy and High Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable" and ASTM A 568/A 568M "Standard Specification for Steel, Sheet, Carbon, Structural, and High Strength, Low Alloy, Hot-Rolled and Cold-rolled, General Requirements for."
3. Zinc-coated steel conforming to ASTM A 653/A 653M, "Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process" and ASTM A 924/A 924M, "Standard Specification for General Requirements for Steel Steet, Metallic Coated by the Hot-dipped Process".

2.2 HOLLOW METAL DOORS

A. Fabricate types, sizes, and construction in accordance with the contract documents and approved submittal drawing meeting the performance requirements of Section 1.05.

1. Face sheet thickness and steel type
    a. Exterior
        1) Face Sheets, steel thickness: [0.053 in. (1.3mm)] or [0.067 in. (1.7 mm)].
        2) Steel Type, zinc-coated, coating designation: [A40 (ZF120)], [A60 (ZF180)], [(G40 (Z120)] or [(G60 (Z180)].
2. Vertical Edges: Bend edges true and straight, and of minimum radius for the thickness of metal used. Edge profile on both vertical edges of doors as follows (unless hardware dictates otherwise)
    a. Single acting doors
        1) Hinge edge, Beveled - 1/8 in. in 2 in. (3.1 mm in 50.8 mm) or square.
        2) Lock edge, Beveled - 1/8 in. in 2 in. (3.1 mm in 50.8 mm).
        3) Double acting doors, rounded on 2-1/8 in. (54 mm) radius.
3. Vertical Edge Seams: [continuously welded] [intermittently welded] or [continuously interlocking or lock-tab].
    a. Continuously welded, extending the full height of the door. Finished smooth with no visible seam.
    b. Intermittently welded, projection, spot or tack weld 6 in. (152 mm) on center maximum spacing. Finished smooth with no visible welds or weld marks on the exposed edge, presenting either a [visible seam] or [seam filled and finished smooth such that it is not visible at both edges].
    c. Continuous interlocking or lock-tab, extending full height of the door. Results in a visible seam at both edges of the door.
4. Top and Bottom Edges
    a. Exterior locations; [provide an additional zinc coated flushing channel] or [provide zinc coated channel, top sealed flush and weep holes in bottom channel to permit the escape of entrapped moisture].
5. Nominal Thickness - 1.75 in. (44 mm)
6. Cores
    a. Honeycomb: "kraft" paper hexagonal cells, laminated to both face sheets.
    b. Polyisocyanurate: Rigid, pre-formed, closed cell board, conforming to ASTM C 591 (unfaced) or ASTM C 1289 faced, laminated to both face sheets.
    c. Polystyrene: Rigid, extruded, closed cell board, minimum 0.7 pound per cubic foot (11.2 kilograms per cubic foot) density, laminated to both face sheets.
    d. Polyurethane: Rigid cellular board laminated to both face sheets or foamed-in-placed, minimum 1.8 pound per cubic foot (29 kilograms per cubic meter) density, containing no urea formaldehyde resins.
    e. Steel stiffened: One piece formed steel channel, minimum 0.026 in. (152 mm) thick spanning the full thickness of the interior of the door. Spaced vertically with interior webs not more than 6 in. (152 mm) apart. Channel laminated to both face sheets. Fill voids between stiffeners with fiberglass or mineral rock wool batt-type insulation.

f. Steel stiffened, welded: One piece formed steel channel, minimum 0.026 in. (152 mm) thick spanning the full thickness of the interior of the door. Spaced vertically with the interior webs spaced not more than 6 in. (152 mm) apart. Channel welded to both face sheets maximum 5" (127 mm) on center. Fills spaces between stiffeners with fiberglass or mineral rock wool batt-type insulation.

g. Steel stiffened, welded: Two hat shaped formed steel channels, minimum 0.026 in. (152 mm) thick, together spanning the full thickness of the interior of the door. Spaced vertically not more than 6 in. (152 mm) apart. Channels welded to both face sheets maximum 5" (127 mm) on center. Fills spaces between stiffeners with fiberglass or mineral rock wool batt-type insulation.

h. Temperature Rise Rated (TRR): Internal construction in accordance with the individual's manufacturing listings.

i. Alternate proprietary core: Material engineered and tested to meet the performance and quality requirements of Sections 1.05 and 1.06. Alternate core construction submitted for Architect for approval during submittal process.

2.3 HOLLOW METAL PANELS

A. Construction

1. Fabricate types, size, and construction in accordance with the contract documents and approved submittal drawings.
   a. 1.75 in. (44 mm) nominal thick transom panel, fixed or removable.
      1) Materials and construction equivalent to that specified in Section 2.02 of this specification. Bottom channel [flush with applied astragal] or [rabbeted].
      2) Material equivalent to that specified in Section 2.02 of this specification and with inverted top and edge constructed interlocking channels with frame for concealed attachment.
   b. 1.75 in. (44 mm) nominal thickness side panel, fixed or removable.
      1) Materials and construction equivalent to that specified in Section 2.02 of this specification.
      2) Material equivalent to that specified in Section 2.02 of this specification and with inverted top, bottom, and edge constructed with interlocking channels with frame for concealed attachment.
      3) 1.75" (44 mm) nominal thick panels as outlined above are available with glazing moldings and stops as outlines in Section 2.02.8 of this specification.
   c. In-Fill Panels, thickness as required, fixed in position or removable, held in position with glazing stops. Face sheets laminated to manufacturer's standard solid backing.
2. Face sheet thickness and steel type
   a. Interior panels
      1) Face Sheets, steel thickness: [0.032 in. (0.8 mm)], [0.042 in. (1.0 mm)], [0.053 in. (1.3 mm)] or [0.067 in. (1.7 mm)].
      2) Steel Type, [cold-rolled], or [zinc coated min A25 (ZF75)], at manufacturers option unless specified otherwise.
   b. Exterior panels

1) Face Sheets, steel thickness: [0.053 in. (1.3mm)] or [0.067 in. (1.7 mm)].
2) Steel Type, Zinc-coated, coating designation: [A40 (ZF120)], [A60 (ZF180)], [(G40 (Z120)] or [(G60 (Z180)].

3. Finish hollow metal panels as specified in Section 2.07 of this specification.

B. Construction

1. Fabricate all finished work neat in appearance, square, and free of defects, warps and buckles. Pressed steel members shall be straight and of uniform profile throughout their lengths. Product shall be constructed in accordance with the contract documents and approved shop drawing meeting the performance criteria specified in Section 1.05.
   a. Provide jamb, header, transoms, mullion, and sill profiles in accordance with the frame schedule and as shown on the approved submittal drawings.
   b. Mark frame product with an identification number as shown on the approved submittal drawings.
2. Frame Types
   a. 3-sided:
      1) Exterior and thermal broken frame product: welded.

C. Thickness and Steel Type

1. Exterior Frame Products: Fabricate from [0.053 in. (1.3 mm)] [0.067 in. (1.7 mm)] or [0.093 in. (2.36 mm)] thick steel.
   a. Minimum 0.053 in. (1.3 mm) for frames to receive solid wood doors or hollow metal doors of same or less thickness face sheets.
   b. Minimum 0.067 in. (1.7 mm) for frames with single door openings exceeding 4 ft. (1219 mm) in width; pairs with either door exceeding 4 ft. (1219 mm) in width and for nominal door opening height exceeding 10 ft. (3048 mm).
   c. Steel type: [A40 (ZF120)], [A60 (ZF180)], [G40 (Z120)], or [G60 (Z180)].
3. Stop Height: Fabricate frame profile with stop heights of 0.625 in. (15.8 mm) minimum.
4. Corner Joint
   a. Fabricate with all contact edges closed tight.
      1) Where the two joining members faces are equal; provide faces mitered, and with stops mitered or butted.
      2) Where the two joining members faces are unequal; faces may be mitered or butted at manufacturers option. See NAAMM HMMA 820, "Hollow Metal Frames" for additional details.
5. Corner Joint Connections: [continuously welded] or [face welded].
   a. Continuously Welded
      1) Perimeter face joints (flush or indented): Continuously welded internally or externally with flush face joints finished smooth with seamless faces. Continuously weld internally the rabbets, stops and soffit.
      2) Internal flush face joints, continuously welded face joint and finished smooth with seamless faces. For additional information regarding the definition of a continuously welded frame, refer to HMMA's TechNote 820 TN02, "Continuously Welded Frames".

b. Face Welded
    1) Perimeter face joints (flush or indented): Continuously welded internally or externally with flush face joints finished smooth with seamless faces. Rabbets, stops, and soffit are not welded.

6. Thermally Broken Frame Product
    a. Where indicated in the contract documents.
    b. Separate interior and exterior sections by a continuous thermal break.
    c. Factory insulate closed sections.
    d. The installed provides insulation for open sections.
7. Cut-off Stops:
    a. Where specified, at heights and angle as shown on the approved submittal drawings, cap, weld, fill and grind smooth so that there are no visible seams below the cut-off stop.
8. Floor Anchors
    a. Minimum same thickness as frame, welded inside jambs. Provide two (2) holes for fasteners supplied and installed by others under Section [06 10 00] [09 20 00].
    b. Where specified or scheduled, provide adjustable floor anchors with no more than 2 in. (50.8 mm) height adjustment.
    c. For applications that do not permit the use of a floor anchor, substitute an additional jamb anchor at a location not to exceed 6 in. (150 mm) from the base of the jamb.
9. Jamb Anchors
    a. Provide frame product with anchorage appropriate to frame and wall construction.
    b. Masonry Type Steel adjustable anchors of the strap and stirrup or T-strap type not less than 0.053 in. (1.34 mm) thickness or 0.156 in. (4 mm) diameter wire type, for frame product to be installed in new masonry walls. Straps: 2 in. x 10 in. (50 mm x 254 mm) in size minimum, corrugated and/or perforated. Locate anchors at a maximum of 18 in. (457 mm) from top and bottom of the frame, spaced at maximum of 32 in. (813 mm) on center.
10. Head Reinforcements: Frame product installed in masonry walls with door openings greater than 48 in. (1219 mm) in width, provide a steel angle or channel stiffener factory welded into the head. Fabricate stiffeners not less than 0.093 in. (2.3 mm) in thickness, not longer than the door opening width. Stiffeners and frame product are not to be used as lintels or load bearing members.
11. Grout Guards: Fabricated from not less than 0.016 in. (0.4 mm) thick steel at hardware mortises on frame product to be grouted.
12. Shipping Spreader: For all door openings in welded frame product provide a temporary steel spreader welded to the base of the jambs or mullions to serve as bracing during shipping, and handling. Spreaders are not to be used for installation.
13. Shipping Splice: When shipping limitations or site access so dictate, or when advised by the contractor responsible for coordination or installation, fabricate frame product for large openings in sections designated for assembly in the field. Install alignment plates or angles at each joint of the same material and thickness as the frame in accordance with approved submittal drawings. Assembly of sections, welding, finishing, and prime painting by others under Section 06 11 00 or 09 20 00.

2.4 HARDWARE REINFORCEMENTS, PREPARATION AND LOCATION

A. Mortise, reinforce, drill, and tap at the factory for templated hardware only; in accordance with the approved hardware schedule and templates provided by the hardware supplier. Anchor hinges, thrust pivots, and pivot reinforced hinges are to be drill and tap by others after installation in the field.

B. Mortise and reinforce only for non-templated hardware or as specified by hardware manufacturers template instructions,

C. Reinforce for surface mounted hardware or continuous hinges in accordance with hardware template. Drilling and tapping by others.

D. Steel thickness for hardware reinforcements to be the manufacturer's standard as required to adequately support the door and hardware; but not less than:
   1. Full mortise hinges and pivots: 0.167 in. (4.24 mm), 0.123 in. (3.12 mm) angle or channel shaped type, or full height steel edge channel 0.067 in. (1.7 mm) thick with extruded holes that provide the same number of threads as 0.123 in. (3.1 mm) thick material.
   2. Lock fronts, mortised latching devices and strikes: 0.067 in. (1.7 mm) or 0.053 in. (1.3 mm) unitized reinforcement with extruded tapped holes that provide equivalent number of thread as 0.067 in. (1.7 mm).
   3. Concealed holders and surface mounted closers: 0.093 in. (2.3 mm).
   4. Internal reinforcements for other surface mounted hardware: 0.053 in. (1.3 mm).
   5. Power operated hardware, at mortised hardware only:
      a. Doors, provide access from hinge edge to device.
      b. Frames, provide grout guards with (1) 7/8" knock-out in each end, (Electrical Grout Guard).

E. Hardware Locations: All dimensions, except the hinge locations, are referenced from the floor as defines in Section 3.03.
   1. Hinges:
      a. Top: 5 in. (127 mm) from underside of frame rabbet at door opening to top of hinge.
      b. Bottom: 10 in. (254 mm) from floor to bottom of hinge.
      c. Intermediate: Centered between top and bottom hinges.
      d. Dutch doors: 5 in. (127 mm) from underside of frame rabbet at door opening to top of upper hinge; 10 in. (254 mm) from floor to bottom of lower hinge; and 5 in. (127 mm) from split line to top and bottom of lower and upper intermediate hinges, respectively.
   2. Locks and latches: 38 in. (965 mm) to centerline of knob or lever shaft.
   3. Deadlocks: 46 in. (1168 mm) to centerline of cylinder.
   4. Exit hardware: Centerline of cross bar as shown on hardware template or as shown on approved contract documents.
   5. Door pulls: 42 in. (1066 mm) to center of grip.
   6. Push/pull bars: 42 in. (1066 mm) to centerline of bar.
   7. Push plates: 46 in. (1168 mm) to centerline of plate.
   8. Roller latches: 46 in. (1168 mm) to centerline of latch.

2.5 FINISH

A. After fabrication fill and sand all tool marks and surface imperfections as required to make face sheets, vertical door edges, and frame weld joints free from irregularities and dressed smooth.
   1. Product which is specified to be fabricated from zinc coated steel: Touch-up areas where the zinc coating has been removed with zinc-rich primer prior to the coat of rust inhibitive primer.

B. Treat metal surfaces to ensure maximum paint adhesion and coat with a factory applied rust inhibitive direct to metal (DTM) primer coating to all exposed surfaces of the door and frame product.

C. Primer to meet the performance requirements of Section 1.05.

D. Primer must be cured prior to shipment.

PART 3 EXECUTION

3.1 SITE STORAGE AND PROTECTION OF MATERIALS

A. Contractor is responsible for receiving hollow metal door and frame products.
   1. Upon delivery, cardboard and/or other wrapping should be removed to thoroughly inspect all material for damage.
   2. Store materials on planks or dunnage in a dry location. Store doors and frame product in a vertical position, spaced by blocking. Cover materials to protect them from damage and to prevent exposure to adverse environmental elements, but in such a manner as to permit air circulation.
   3 Exposed hollow metal surfaces which have been scratched or otherwise marred during jobsite handling, must be promptly cleaned, finished smooth and treated for maximum paint adhesion and touched up with a rust inhibitive primer comparable to and compatible with the shop primer and finish paint specified in Section 09 90 00. All touch-up primer and finish paint must be formulated for Direct to Metal (DTM) applications.

3.2 INSTALLATION

A. Installer's qualifications: Perform installation with skilled, experienced and trained personnel whom shall have successful experience in installations of similar size and scope.
   1. Prior to installation performing the following:
      a. Check the area of floor on which the frame product is to be installed, and within the path of the door swing, for flatness and correct if necessary. Permissible installation tolerance shall not exceed +/- 1/16 in..
      b. Check doors and frame product for correct opening number, size, swing, fire rating, material thickness and hardware requirements. If product does not comply with contract documents, do not install and contact the manufacturer.
      c. Isolate and protect all interior surfaces of perimeter frame product sections to be installed in masonry or concrete walls from grout and antifreeze agents.

d. Remove temporary spreaders.
e. Refinish any marks caused by spreader removal to match original.

2. During the setting of frame product check and correct as necessary for opening width, opening height, squareness, alignment, twist and plumbness. Maintain installation tolerances within the following limits:
   a. Opening Width - Measured from rabbet to rabbet at top, middle, and bottom of frame + 0.0625 in (1.5 mm), – 0.0313 in (0.8 mm).
   b. Opening Height - Measured vertically between the frame head rabbet and top of floor or bottom of frame minus jamb extension at each jamb and across the head; ± 0.0468 in. (1.2 mm).
   c. Squareness - Measured at rabbet on a line from jamb, perpendicular to frame head; not to exceed 0.0625 in (1.5 mm).
   d. Alignment - Measured at jambs on a horizontal line parallel to the plane of the face; not to exceed 0.0625 in (1.5 mm).
   e. Twist - Measured at opposite face corners of jambs on parallel lines perpendicular to the plane of the door rabbet; not to exceed 0.0625 in (1.5 mm).
   f. Plumbness - Measured at the jambs on a perpendicular line from the head to the floor; not to exceed 0.0625 in (1.5 mm).
3. Grout guards, electrical grout guards, and junction boxes are intended to protect hardware mortises and tapped holes from masonry grout of 4 in. (101 mm) maximum slump consistency which is hand troweled in place. If a lighter consistency grout greater than 4 in. (101 mm) slump when tested in accordance with ASTM C 143/C 143M is to be used, special precautions must be taken in the field by the installer to protect the aforementioned.
4. Frame products are not intended or designed to act as forms for grout or concrete. Take precautions otherwise to ensure that frames are not deformed or damaged by the hydraulic forces that occur during this process.
5. Keep steel surfaces free of grout, tar, and/or other bonding materials or sealers. Promptly clean grout, tar, and/or other bonding materials or sealers off of door and frame products. If the primer is removed, damaged or negatively affected by this process; clean, finished smooth, and treated for maximum paint adhesion. Touch up with a rust inhibitive primer (comparable to and compatible with the shop applied primer and finish paint specified in Section 09 90 00). All touch-up primer and finish paint must be formulated for Direct to Metal (DTM) application.
6. Install labeled fire doors and frame product in accordance with the terms of their listings, ANSI/NFPA 80 or the local Authority Having Jurisdiction.
7. Maintain proper door edge clearances in accordance with Section 3.03, except for special conditions otherwise noted. Where necessary, metal hinge shims, furnished by the installer, are permitted to maintain clearances.
8. Exposed hollow metal surfaces which have been scratched or otherwise marred during installation and/or field welding, shall be promptly cleaned, finished smooth, and treated for maximum paint adhesion. Touch up with a rust inhibitive primer (comparable to and compatible with the shop applied primer and finish paint specified in Section 09 90 00). All touch-up primer and finish paint must be formulated for Direct to Metal (DTM) application.
9. Install hardware and glazing material in accordance with individual manufacturer's instructions.
10. Finish paint in accordance with Section 09 01 00.

END OF SECTION

SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

C. Section 01 78 00 - Closeout Submittals.

D. Section 07 26 00 - Vapor Retarders.

E. Section 07 92 00 - Joint Sealants.

F. Section 08 80 00 - Glazing.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA)
   1. AAMA/WDMA/CSA101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors and Skylights.
   2. 2605: Voluntary specification, performance requirements and test procedures for superior performing organic coatings on aluminum extrusions and panels
   3. 502: Air and Water Leakage Resistance testing of Installed Windows and Doors
   4. 611: Voluntary Specification for Anodized Architecturally Finished Aluminum

B. Aluminum Association (AA),
   1. AA-DAF 45, Designation System for Aluminum Finishes.

C. National Fenestration Rating Council (NFRC):
   1. 101: Procedure for Determining Fenestration Product Thermal Properties
      200: Procedure for Determining Solar Heat Gain Coefficients at Normal Incidence

1.3 SUBMITTALS

A. Submit Shop Drawings, Product Data and Samples per Section 01 33 00

B. Submit Quality Control Certificates indicating performance compliance per Section 01 33 00

C. Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim junction between combination units, elevations of unit, anchorage details, location of isolation coating, description of related components and exposed finishes fasteners, and caulking. Indicate location of manufacturer's nameplates.

D. Shop drawings to indicate continuation of air barrier and vapour barrier between wall assembly and aluminum window.

E. Submit one complete full size window sample of each type window.

F. Include frame, sash, sill, glazing and weatherproofing method, insect screens, surface finish and hardware. Show location of manufacturer's nameplates.

1.4 TEST REPORTS

A. Submit test reports from approved independent testing laboratories, certifying compliance with specifications, for:
1. Windows classifications
2. Air tightness
3. Water tightness
4. Wind load resistance
5. Condensation resistance
6. Forced entry resistance
7. Insect screens
8. Glazing
9. Safety drop - vertical sliding windows only
10. Sash strength and stiffness
11. Ease of operation - windows with operable lights
12. Mullian deflection - combination and composite windows
13. Anodized finish

1.5 CLOSEOUT SUBMITTALS

A. Provide operation and maintenance data for windows for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 WARRANTY

A. Provide a written warranty for work under this section from manufacturer for failure due to defective materials and from contractor for failure due to defective installation and workmanship, for five (5) years respectively from the date of Substantial Completion.

1.7 MOCK-UP

A. Construct mock-up showing typical window and spandrel section installed in wall opening. Accepted mock-up may form part of complete work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: EFCO Corporation – 403 Series, Kawneer Company – 451T Series, Vistawall Architectural Products – 3000 Series Store Front Frame.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00 – Substitution Procedures.

2.2 MATERIALS

A. Materials: to CSA-A440/A440.1 supplemented as follows:

B. All aluminum windows by same manufacturer.

C. Sash: aluminum thermally broken.

D. Main frame: aluminum thermally broken.

E. Glass: in accordance with Section 08 80 00 – Glazing.

F. Exterior metal sills: extruded aluminum of type and size to suit job conditions; minimum 3 mm thick, complete with joint covers, jamb drip deflectors, chairs, anchors, anchoring devices.

G. Isolation coating: alkali resistant bituminous paint.

2.3 WINDOW TYPE AND CLASSIFICATION

A. Types:
1. Casement window, insulating glass.

B. Classification rating: to AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
1. [Single Units]:
a. CW-PG50-FW
1) [Maximum frame size of 7’-5” (2261 mm) by 4-0” (1219 mm), tested to 1.57 psf Air, 12.1 psf Water, 75 psf Structural with annealed glass]

C. Energy ratings: windows to be Energy Star certified.

2.4 FABRICATION

A. Fabricate units square and true with maximum tolerance of plus or minus 1/16 inch for units with a diagonal measurement of 72 inches or less and plus or minus 1/8 inch for units with a diagonal measurement over 72 inches.

B. Face dimensions detailed are maximum permissible sizes.

C. Brace frames to maintain squareness and rigidity during shipment and installation.

2.5 ALUMINUM FINISHES

A. Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
1. Integral color anodic finish: designation AA- M32, C12, C22, A42, color to match sample.

2.6 ISOLATION COATING

A. Isolate aluminum from following components, by means of isolation coating:

B. Dissimilar metals except stainless steel, zinc, or white bronze of small area.

C. Concrete, mortar and masonry.

D. Wood.

2.7 GLAZING

A. Dual-Pane insulating annealed one lite glass with preserve film on interior and exterior panes
   1. Insulating glass per ASTM E2190
   2. Pane thickness shall be sized to rated design pressure per ASTM E-1300

PART 3 EXECUTION

3.1 EXAMIINATION AND PREPARATION

A. Verification of Condition:
   1. Before installation, verify openings are plumb, square and of proper dimensions as required in Section 01 71 00
   2. Report frame defects or unsuitable conditions to the General contractor before proceeding

B. Acceptance of Condition:
   1. Beginning of installation confirms acceptance of existing conditions

3.2 INSTALLATION

A. Assemble and install window/door unit(s) per manufacturer's instruction and reviewed shop drawing

B. Installation to comply with Section 01 73 00

C. Install sealant and related backing materials at perimeter of unit or assembly in accordance with Section 07 92 00. Do not use expansive foam sealant.

D. Install accessory items as required.

3.3 CAULKING

A. Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.

B. Apply sealant in accordance with Section 07 92 00 - Joint Sealants. Conceal sealant within window units except where exposed use is permitted by Owner.

3.4 FIELD QUALITY CONTROL

A. Unless otherwise specified, air leakage resistance tests shall be conducted at a uniform static pressure of 75 Pa (~1.57 psf). The maximum allowable rate of air leakage shall not exceed 2.3 L/sm2 (~0.45 cfm/ft^2)

B. Unless otherwise specified, water penetration resistance testing shall be conducted per AAMA 502 and ASTM E1105 at 2/3 of the fenestration products design pressure (DP) rating using “Procedure B” – cyclic static air pressure difference. Water penetration shall be defined in accordance with the test method(s) applied

3.5 CLEANING AND PROTECTION

A. Protect installed construction as required in Section 01 73 00

B. Remove visible labels and adhesive residue per manufacturer’s instruction

C. Leave windows and glass in a clean condition, final cleaning as required in Section 01 74 21

D. Protecting windows from damage by chemicals, solvents, paint or other construction operations that may cause damage

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 45 00 - Quality Control.

C. Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

D. Section 01 78 00 - Closeout Submittals.

E. Section 07 82 00 – Joint Sealants.

F. Section 08 11 14 – Metal Doors & Frames.

G. Section 08 51 13 – Aluminum Windows.

1.2 REFERENCES

A. American National Standards Institute (ANSI).
   1. ANSI/ASTM E330, Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

B. American Society for Testing and Materials (ASTM)
   1. ASTM C542, Specification for Lock-Strip Gaskets.
   2. ASTM D2240, Test Method for Rubber Property – Durometer Hardness.

C. Glass Association of North American (GANA)
   1. GANA Glazing Manual.
   2. GANA Laminated Glazing Reference Manual.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Provide continuity of building enclosure vapor and air barrier using glass and glazing materials as follow:
      a. Utilize inner light of multiple light sealed units for continuity of air and vapor seal.
   2. Size glass to withstand wind loads, dead loads and positive and negative live loads as measured in accordance with ANSI/ASTM E330 and NBC latest edition.
   3. Limit glass deflection to 1/200 with full recovery of glazing materials.

1.4 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's printed product literature, specifications and data sheet.

B. Manufacturer's Instructions:
   1. Submit manufacturer's installation instructions.

C. Closeout Submittals:
   1. Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

1.5 QUALITY ASSURANCE

A. Perform work in accordance with GANA Glazing Manual and Laminated Glazing Reference Manual for glazing installation methods. Provide shop inspection and testing for glass.

B. Provide certificate of quality compliance from manufacturer.

1.6 WARRANTY

A. Provide ten (10) year warranty for glazing units from the date of Substantial Completion.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Install glazing when ambient temperature is 50˚F minimum. Maintain ventilated environment for 24 hours after application.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

PART 2 PRODUCTS

2.1 MATERIALS: FLAT GLASS

A. Float glass: to ASTM C1279, Glazing quality, 5 mm minimum thickness.

2.2 MATERIALS: SEALED INSULATING GLASS

A. Insulating glass units: to ASTM E1300-16, double unit, minimum 1/8 inch overall thickness (as per NBCC for window area and climatic conditions.)
   1. Glass: to 2015 IBC Section 2406
   2. Glass thickness: minimum 1/8 inch each light (as per NBCC calculations for window area and climatic conditions.)
   3. Inter-cavity space thickness: ½ inch.
   4. Glass coating: surface number 2 (inside surface of outer light), low “E”.
   5. Inert gas: argon.
   6. Light transmittance: minimum 0.70.

B. Insulating glass units for exterior steel doors: to 2015 IBC 2406.4.1, double unit, minimum 1/8 inch overall thickness (as per NBCC for window area and climatic conditions.)
   1. Glass: to 2015 IBC Section 2406, tempered.
   2. Glass thickness: minimum 1/8 inch each light (as per NBCC for window area and climatic conditions.)
   3. Inner-cavity space thickness: ½ inch.
   4. Glass coating: surface number 2 (inside face of outer light), low “E”.
   5. Inert gas: argon.

2.3 MATERIALS

A. Sealant: 07 92 00 – Joint Sealants.

2.4 ACCESSORIES

A. Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D2240, minimum 4 inches x width of glazing rabbet space minus 1/16 inch x height.

B. Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 3 inches long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.

C. Glazing tape:
   1. Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; black color.

D. Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot, color as selected.

E. Glazing clips: manufacturer's standard type.

F. Lock-strip gaskets: to ASTM C542.

PART 3 EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.3 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

3.4 INSTALLATION: EXTERIOR – WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

A. Perform work in accordance with GANA Glazing Manual and GANA Laminated Glazing Reference Manual for glazing installation methods.

B. Cut glazing tape to length and set against permanent stops, 1/8 inch below sight line. Seal corners by butting tape and dabbing with sealant.

C. Apply heel bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapor seal.

D. Place setting blocks at 1/4 points, with edge block maximum 6 inches from corners.

E. Rest glazing on setting blocks and push against tape and heel of sealant with sufficient pressure to attain full contact at perimeter of light or glass unit.

F. Install removable stops with spacer strips inserted between glazing and applied stops 1/8 inch below sight line.

G. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, maximum 3/16 inch below sight line.

H. Apply cap head of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.5 INSTALLATION: INTERIOR DRY METHOD (TAPE AND TAPE)

A. Perform work in accordance with GANA Glazing Manual and GANA Laminated Glazing Reference Manual for glazing installation methods.

B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

C. Place setting blocks at 1/4 with edge block maximum 6 inches from corners.

D. Rest glazing on setting blocks and push against tape with sufficient pressure to attain full contact at perimeter of light or glass unit.

E. Place glazing tape on free perimeter of glazing in same manner described in 3.4.3. Apply heel bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapor seal.

F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

G. Knife trim protruding tape.

3.6 CLEANING

A. Perform cleaning after installation to remove construction and accumulated environmental dirt.

B. Remove traces of primer, caulking.

C. Remove glazing materials from finish surfaces.

D. Remove labels after work is complete.

E. Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacture's instructions.

F. Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.7 PROTECTION OF FINISHED WORK

A. After installation, mark light with an "X" by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

B. Repair damage to adjacent materials caused by glazing installation.

END OF SECTION

SECTION 09 01 90

PAINTING

PART 1 GENERAL

1.1 WORK INCLUDES

A. Paint materials

B. Accessory materials

1.2 DESCRIPTION

A. This work includes the painting and finishing of exterior surfaces throughout the Contract, including surface preparation, priming, and coats of paint specified.

B. The work includes the field painting of bare and covered pipes and of hangers, exposed steel and iron work, and primed metal surfaces of equipment except as otherwise indicated.

C. The work includes restoration of existing painted surfaces as indicated.

D. Paint exposed surfaces whether or not colors are designated in any schedule, except where the natural finish of the material is specifically indicated as a surface not to be painted. Where surfaces are not specifically identified, paint such surfaces the same as adjacent similar surfaces.

E. The paint systems specified indicate the basic painting systems. Deviations within the system, such as the use of two finish coats in lieu of undercoat and finish, will be permitted only where such procedure is recommended by the paint manufacturer and approved by the Owner.

F. The work includes the removal and replacement of sealant backing and sealant at all expansion and control joints in concrete masonry surfaces.

1.3 DEFINITIONS

A. The term “paint” as used herein means all coating systems materials, and includes primers, emulsions, enamels, stain, sealers and fillers, and other applied materials whether used as print, intermediate, or finish coats.

1.4 WORK NOT INCLUDED IN THIS SECTION

A. Nonferrous Metal Surfaces: Anodized aluminum, stainless steel, copper, and similar nonferrous metal materials will not require finish painting unless otherwise indicated or specified.

B. Operating Parts and Labels:
   1. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts, and expansion joints, will not require finish painting unless otherwise indicated.
   2. Do not paint over code-required labels, such as UL, FM and WH, or equipment identification, performance rating, name, or nomenclature plates.

C. Miscellaneous Surfaces: Rubber and elastomeric sealants, cementitious fireproofing, and machined surfaces of metal hardware and related fittings will not require finish painting.

1.5 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A13.1 Scheme for the Identification of Piping Systems

B. Painting and Decorating Contractors of America (PDCA):
   1. "Painting and Decorating Craftsman's Manual and Textbook"

C. Steel Structures Painting Council (SSPC):
   1. Steel Structures Painting Manual, Volume 2, "Systems and Specifications"

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Paint products and solvents shall comply with the latest regulations of governing authorities regarding permissible content of volatile organic compounds (VOC).

B. Quality Standards:
   1. Paints, enamels, stains, lacquers, and varnishes shall be applied in accordance with the manufacturers' latest specifications, instructions, and recommendations

C. Paint Coordination:
   1. Provide finish coats that are fully compatible with the prime paints used. Field-applied primers shall be supplied by the same manufacturer as the intermediate (if any) and finish coats used. Review prime paints to ensure compatibility of the coating system for each of the various substrates. Provide barrier coats over incompatible primers or remove and re-prime as required.

D. Paint Manufacturer's Review:
   1. Before purchasing paint materials, review the proposed paint systems, materials, and substrates with qualified representatives of the proposed paint products manufacturer. Obtain manufacturer's concurrence of the proposed paint systems, or any recommended changes thereto, before providing product data, samples, and mock-ups specified in Articles 1.8 and 1.9 herein.

1.7 SUBMITTALS

A. Manufacturers' Review: Submit record of paint manufacturer's review as specified.
Product Data:

B. Product Data:
   1. Submit a complete list of all materials proposed for use, together with manufacturers' product specifications for such products including backer rod and sealants.
   2. No claim by the Contractor concerning the unsuitability of any material specified, or the Contractor's inability to produce first class work with such materials, will be considered.

C. Colors and Samples:

   1. Colors: The Owner will prepare a Color Schedule with samples for guidance of the painter, and reserves the right to select, allocate, and vary colors on different surfaces throughout the project, subject to the limitation that not more than 15 percent of bright or deep colors will be selected.
   2. Samples:
      a. Before beginning work, prepare for approval a sample of each color, texture and finish required. Such samples, when approved, shall constitute standards for color, texture, and finish of completed work.
      b. Make samples 8 by 10 inches in size and upon materials corresponding with those to be finished on the project.
      c. When samples are rejected, a maximum of two additional modified samples may be required, in each instance, to obtain approval
      d. Approved samples shall be marked for identification and shall be distributed to the Owner as required.
      e. Mock-up for approval of final colors shall match the approved colors and samples.
      f. Samples for color and mock-up for sealant backing and sealant will be required for Owner approval.

1.8 MOCK-UP FOR APPROVAL OF FINAL COLORS

A. Final coat of paint and finish shall not be applied until the colors and textures have been approved by the Owner. To accomplish this, the Contractor shall paint a sample panel of approximately 24 square feet of the colors and textures selected on every surface of the building to be painted. The Owner will approve the sample panels or direct changes as desired.

B. The Contractor shall be on the job and be prepared to change sample panels to colors and textures desired. The Contractor shall notify the Owner at least three days in advance of when sample panels will be ready to receive approval.

1.9 DELIVERY AND STORAGE

A. Deliver paint materials to the site in original, unopened packages and containers with labels intact and seals unbroken.

B. Store materials, tools, and equipment in a locked, properly ventilated, designated storage space on the site, assigned for this purpose. Receiving, opening, and mixing of paint materials shall be performed in this storage space. Keep storage space neat, clean, and accessible at all times. Protect areas from paint spillage.

C. Place paint-soaked or solvent-soaked rags, waste, and other materials that might constitute a fire hazard in closable metal containers and remove from the premises at the close of each day's work. Take all necessary precautions to avoid fire danger.

1.10 WEATHER AND TEMPERATURE

A. Surfaces shall be painted only when they are free from moisture. No painting on exterior surfaces shall be performed less than 72 hours of actual drying weather after a rain, or during periods of dew or fog. Receiving surfaces shall be properly dried out before proceeding with the work.

B. No painting shall be performed when temperature is below 40 degrees F and above 90 degrees F or when the relative humidity is above 90 percent, unless recommended otherwise in writing by the paint manufacturer.

1.11 SCAFFOLDING AND PROTECTION

A. Furnish, maintain, and remove all scaffolding, ladders, and planks required for this work, and all drop Cloths for the protection of concrete walks, floors, adjacent surfaces, prefinished materials, building fixtures, and similar surfaces.

B. Painted and finished surfaces subject to damage or defacement due to other work in the station or building shall be properly protected and covered. The Contractor shall be responsible for damage to painted work and to that other work caused by painting operations under this Section until final acceptance by the Owner.

PART 2 PRODUCTS

2.1 PAINT QUALITY STANDARDS

A. Paint and painter's finish shall be the highest quality products of nationally recognized manufacturers specializing in the manufacture of paint products. Minimum percent solids (MPS) required for the paint products herein specified shall be as indicated in the following example: MPS:35.

B. Provide primer and undercoater paints produced by the same manufacturer as the intermediate and finish coats. Use thinners approved by the paint manufacturer which meet previously referenced regulatory requirements, and provide only to recommended limits.

C. Provide primers and undercoaters which are suitable for each surface to be painted and which are compatible with specified intermediate and finish paint coats.

D. Materials necessary to complete the painting work are herein generically specified. Except as otherwise specified, materials for any one paint system shall be by the same manufacturer.

E. Minimum dry film thicknesses (MDFT), in mils, and the number of coats required to obtain such thicknesses shall be in accordance with the paint manufacturer's application instructions and recommendations

2.2 PAINT MATERIALS

A. Type and Manufacture: The following products constitute the standards for the primers, intermediate, and finish coats of the paint systems herein specified in Articles 3.4 and 3.5.
   1. Ferrous Metal Primer: Alkyd, Anti-Corrosive for Metal
   2. Galvanized Metal Primer: As recommended in writing by topcoat manufacturer.
   3. Masonry Surface Conditioner: Acrylic latex masonry filler. MPS:35.
   4. Exterior Masonry Paint: Exterior 100 percent acrylic latex masonry paint. MPS:35.
   5. Exterior Wood Primer: Exterior wood primer as recommended by the manufacturer for the location and conditions. MPS:40.
   6. Exterior House and trim Paint: Exterior enamelized house and trim paint for wood and metal, MPS: 40.
   7. Enamel undercoat: Alkyd or acrylic latex enamel undercoater.MPS: 35.
   8. Semi-Gloss Enamel: Alkyd or acrylic latex enamel, semi-gloss sheen, washable. MPS: 35.
   9. Eggshell Enamel: Alkyd or acrylic latex enamel, eggshell, washable. MPS:35.
   10. Heavy-Duty Glass Enamel: Heavy-duty, industrial grade, polyurethane, gloss sheen. MPS:45.

B. Accessory Materials:
   1. Shellac: ASTM D207, Type I, bleached, No. 4, cut with pure grain alcohol.
   2. Thinner: As recommended by the manufacturer for the respective product.
   3. Spackle or Putty: Standard commercial product manufactured for the purpose, thoroughly mixed to prevent the possibility of shrinkage. Use exterior grade for exterior Work. Spackle or putty containing white lead will not be permitted for use on this Project.
   4. Sealant Backing: Compatible with substrate and sealant to meet ASTM 1330.
   5. Sealant: Silicone-type, non-staining, non-sag compatible with substrate to meet ASTM 920

PART 3 EXECUTION

3.1 PREPARATION OF SURFACES

A. Existing Painted Surfaces to be Painted:
   1. Concrete, Masonry, and Stucco Surfaces:
      a. Exterior concrete, masonry, and stucco surfaces shall be sandblasted by the “wet” sandblast method to remove all existing paint film from these surfaces.
         1) When “wet” sandblasting is not permitted by jurisdictional authority, surfaces shall be selectively power wire-brushed to remove loose and defective paint film. Edges of removed paint film shall be feathered out to conceal such edges in the finished work.
      b. Surfaces not to be sandblasted shall be properly masked and otherwise protected to preclude damage to these surfaces.

c. Protection of the public and adjacent buildings from the residue of sandblasting operations shall be provided in accordance with the requirements of the jurisdictional authority.

1) Wood Surfaces: All wood surfaces shall be power sanded as required to remove all peeling, flaking, blistering, loose, or otherwise defective existing paint surfaces.

2) Metal Surfaces: Immediately proceeding power-tool cleaning, pressure wash and rinse existing painted metal surfaces. Where access problems or the likelihood of damaging adjacent surfaces exist, wash and rinse. Existing painted metal surfaces shall be power-tool cleaned in accordance with SSPC-SP 3 to remove loose and defective paint surfaces, and then feathered smooth. Rust shall be completely removed. Then solvent clean surfaces in accordance with SSPC-SP 1 to remove dust and apply prime coat of Ferrous Metal Primer or Galvanized Metal Primer, as applicable, to existing surfaces as herein specified in Articles 3.4 and 3.5.

B. Hardware and Fixtures:

1. Hardware, hardware accessories, plates, lighting fixtures, and similar items in place shall be removed prior to painting and replaced upon completion of each space.
2. Heating and other equipment adjacent to walls shall be disconnected, using workers skilled in appropriate trades, and moved to permit wall surfaces to be painted. Following completion of painting, they shall be expertly replaced and reconnected.

C. Exposed Plumbing, Mechanical, and Electrical Items:

1. Items without factory finish such as conduits, pipes, ducts, grilles, registers, vents, access panels, and items of similar nature shall be finished to match adjacent wall and ceiling surfaces, unless otherwise directed. Paint visible surfaces behind vents, registers, and grilles flat black.
2. Wash exposed metal with solvent, prime and paint as scheduled or specified. Spray paint wherever practicable. Do not paint concealed conduits, piping, and ducts.

3.2 PAINT PERFORMANCE AND FIELD QUALITY ASSURANCE

A. Painting shall be performed by skilled and experienced painters, working under the supervision of a capable Supervisor. Materials shall be thinned only for proper workability and in compliance with the manufacturer’s specifications.

B. Paint material shall be evenly brushed or smoothly flowed on without runs or sagging, and free from drops, ridges, laps, and brush marks. Assure that all coats are thoroughly dry before applying succeeding coats. Sand surfaces between coats as necessary to produce a smooth finish and as may be required for adhesion of succeeding coats.

3.3 PAINT SYSTEMS

A. Provide three-coat work (unless otherwise specified), consisting of prime coat, intermediate coat and finish Coat, in texture and color as selected and approved by the Owner.

B. Exterior paint systems are specified and identified herein by letter and the systems specified correspond to the finishes indicated on the Owner's Schedule and Drawings.

C. The herein specified paint systems indicate the minimum dry mil film thickness (MDFT) required for the particular paint system. Paint shall be applied at the manufacturer's recommended rate to achieve the proper MDFT specified. If a manufacturer normally does not utilize an intermediate coat in its paint system to achieve the specified MDFT, then the intermediate coat may be omitted.

3.4 EXTERIOR PAINTING

A. Paint System "A" – Paint Finish on Concrete, Masonry, and Stucco: Prime Coat: Masonry Surface Conditioner, tinted toward finish color Intermediate Coat: Exterior Masonry Paint Finish Coat: Exterior Masonry Paint MDFT: 6

B. Paint System "B" – Paint Finish on Ferrous and Galvanized Metal: Prime Coat: For new ferrous metal: Field-apply Ferrous Metal Primer. For shop primed ferrous Metal: Apply touchup primer. For galvanized metal: Galvanized Metal Primer touch-up. For existing ferrous and galvanized metal: Rust-inhibitive primer as recommended by manufacturer of finish coats.

Intermediate Coat: Heavy-Duty Gloss Enamel

Finish Coat: Heavy-Duty Gloss Enamel MDFT: 6

C. Paint System "C" – Paint Finish on Wood: Prime Coat: Factory-primed (new surfaces). Exterior Wood Primer (existing surfaces).

Intermediate Coat: Exterior House and Trim Paint

Finish Coat: Exterior House and Trim Paint MDFT: 7

3.5 CLEANING

A. Clean and retouch the work as necessary for a first class job. All surfaces of the station or building and surrounding areas shall be left clean and neat in all respects, free from any paint spots, smears, smudges, or stain.

END OF SECTION

SECTION 09 03 20

STUCCO

PART 1 GENERAL

1.1 SUMMARY

A. This procedure includes guidance on patching loose stucco by removing deteriorated areas and applying new stucco.

B. Historic Structures Precautions:
1. The contractor will need to demonstrate in-house expertise & experience or engage a qualified stucco restoration specialist, when choosing the type of stucco to be used.
2. Provide a chemical analysis of the existing stucco and information as to how to match color, structure and texture.
3. Demonstrate an understanding & experience with historic practices and technology characteristic of the region, mix proportions, and detailed material specifications.
4. Contractor shall comply with requirements from the U.S. National Park Service's Preservation Briefs 22 and shall meet the Secretary of the Interiors Standards for Rehabilitation.

C. Division 00 - Procurement And Contracting Requirements & Division 01 - General Requirements for general project guidelines to be reviewed along with this procedure. These guidelines include the following sections:
1. Submittals
2. Quality Assurance
3. Delivery, Storage and Handling
4. Project/Site Conditions
5. Sequencing and Scheduling
6. General Protection (Surface and Surrounding).

1.2 QUALITY ASSURANCE

A. Stucco restoration contractor shall have not less than five years documented experience doing work specified herein.

B. Workmen shall be experienced in use of equipment on this project. Contractor shall use full-time foreman who has minimum of three years of experience in all phases of stucco restoration used in this project.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM),
100 Barr Drive, West Conshohocken, PA 19428,
610-832-9585 or FAX 610-832-9555.
1. ASTM C207, Type S
2. ASTM C150, Type I or II
3. ASTM C144

1.5 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

1. Weather: Do not proceed with patching under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation; Proceed with the work only when forecasted weather conditions are favorable for proper cure. Do not apply or mix mortar on outside surfaces with standing water or outside during rain.
2. Cold Weather, winter construction is not allowed. Winter construction (midwest region) is defined as any time between December 1 and March 1 and/or when surface temperature of masonry is below 40o F. or air temperature is predicted to be below 40o F. within 48 hours. All work must be suspended during frosty weather unless a heated enclosure is provided. Do not expose curing stucco to freezing temperatures.
3. Hot Weather: The surface temperature of the work, not the ambient temperature, should not be higher than 100o F.; Mortar mixing should be done only in the shade; Cover mortar in hot weather to reduce evaporation; Work around the building during the day so that the fresh work will be shielded from direct sunlight to reduce evaporation rate. Work shall not be done in full sun at temperatures above 80o F unless shading is provided. Burlap sacking and water misting may be necessary to control evaporation. Keep curing stucco out of the hot sun and away from harsh winds.
4. All materials must be kept above 40o F.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Brooklyn Animal Hair Manufacturing Company
175-185 Beard Street
Brooklyn, NY 11231
718/852-3592

2.2 MATERIALS

A. Hydrated Lime

B. Portland Cement

C. Sand

D. Cow hair (Brooklyn Animal Hair Manufacturing Company)

E. Clean, potable water

2.3 EQUIPMENT

A. Mortar box

B. Mixing hoe (with two holes in the blade)

C. Masonry bit

D. Wire cutters

E. Garden hose or spray bottle

F. Trowels

G. Chisels

H. Hammers

I. Hawks: Plywood or steel hawk (mortar board)

J. Brushes:
   1. Natural bristle brushes
   2. Stiff bristle brushes
   3. Wire brush

2.4 MIXES

NOTE: CONSULT WITH QUALIFIED STUCCO RESTORATION SPECIALIST TO DETERMINE WHICH OF THE FOLLOWING MIXES IS APPROPRIATE. ACTUAL MIX SHOULD BE DETERMINED BY ANALYSIS. IF ORIGINAL MIX IS KNOWN, OR IF PAST PATCHING MIX HAS BEEN USED SUCCESSFULLY, USE IT; OR ALTER STANDARD MIX TO MATCH ORIGINAL.

A. Lime/Sand Stucco Mix:
   1. Scratch and Brown Coats: Two coats doubled up to a thickness of about 5/8 inch.
      a. 5 parts hydrated lime
      b. 15 parts aggregate (match to original)
      c. 6 lb./cu. yd. hair (1/2- 2 inch length, free of dirt, grease and impurities)
      d. 2-3 parts (max.) Type II portland cement for workability
   2. Finish Coat:
      a. 1 part hydrated lime
      b. 3 parts aggregate (match to original)

B. High Lime Mortar Mix:
   1. 1 bag of hydrated lime
   2. 1 shovelful of white portland cement
   3. 3 cubic feet of sand (matched to original)
   4. Coarse aggregate matched to original (not to exceed 15% of total volume of hydrated lime)
   5. Hair or fiber (for scratch coat) matched to original if possible, about 1 pound of hair per 100 lb. bag of hydrated lime

C. Lime/Portland Cement Mortar (More lime makes the mixture more "plastic" but more likely to crack from shrinkage; more sand or aggregate makes the mixture harder to trowel smooth and weakens the mortar).

1. 1 to 1-1/2 bags hydrated lime
2. 1 bag portland cement
3. 5 to 6-1/2 cubic feet of sand
4. Coarse aggregate, hair, and fiber as above

PART 3 EXECUTION

3.1 EXAMINATION

A. Most stucco damage is caused by water infiltration.

B. Sometimes cracks occur due to different expansion rates of two surfaces. These cracks can then allow water infiltration.

C. When identifying the source of infiltration, examine:
1. Flashing: Check for holes, splits, or general corrosion. Replace if required. Copper, lead- coated copper, terne metal and terne-coated stainless steel are the best; aluminum is questionable. To prevent corrosion due to galvanic action, flashing metal should be compatible with other metals, such as gutters and downspouts or other flashing, used on the building.
2. Drip edges: A discontinuity formed into the underside of a window sill or wall component to force drops of water to fall free of the face of the building rather than move farther toward the interior. Check to see that they are free from paint or dirt build-up.
3. Gutters: Check to see that gutters are clear of debris (rust, tar patches) and have no open joints.
4. Walls outside of kitchens, bathrooms and chimney flues: Look for damaged stucco caused by water vapor migration. Remedy by altering water vapor transmission:
    a. Apply a vapor barrier paint on the interior walls.
    b. Caulk joints along interior window trim and baseboards.
    c. Properly vent bathrooms and kitchens.
    d. On a chimney, line the flue with a non-porous liner like stainless steel.
5. Termination of stucco at ground level: Stucco should terminate at least 4 inches above the ground.
6. Site Grading: Make sure the ground slopes away from the stucco wall.
7. Joints between parapet walls and roofs: Look for deteriorated and improperly installed flashing.
8. Plumbing: Repair any leaks.

D. Determine the extent of the damage:
1. Check for spongy areas by pushing against the stucco with your hand: any areas that move back and forth while making a squishy sound will need to be removed.
2. Tap the stucco with a hammer handle: a succession of sounds indicates loose stucco; Areas that do not move and make only one solid sound indicate good stucco.

3.2 ERECTION, INSTALLATION, APPLICATION

A. Removing Damaged Stucco:
1. Make cuts through the stucco around the damaged area either with a cold chisel or by drilling a series of holes with a masonry bit.
2. If possible, cut back the coats of old mortar in square layers; Undercut the area to provide a firm bonding for the patch. Cut to the lath; Pry off the old stucco with a broad flat tool like a nail puller.
3. Clean out all dust, dirt, and loose material with a wire brush.
4. Nail back to the sheathing any loose wood or metal lath under the old stucco.
5. Repair any small areas of lath that were damaged by nailing wire lath in place.
6. Replace any rusted corner beads with new corner beads.

B. Hand-Mixing the Mortar:
1. Place 1/2 the sand required for one bag of cement in one end of the mortar box; Spread the cement over the sand.
2. Lay the balance of the sand over the cement.
3. Place the amount of coarse aggregate or hair required for a bag of cement over the top of the sand.
4. Repeat as necessary until all of the required material is in the box.
5. Using a hoe, start at one end of the box and pull the hoe toward you in short choppy strokes until all of the materials are thoroughly mixed.
6. Pour the water into the box, and pull the dry material into the water using short choppy strokes; Continue to add water as needed to bring the mix to a soft, plastic mass.
7. Chop the hoe through the wet material until all the dry material has been wetted and pulled to the end of the box.
8. Change direction, and pull the mortar to the other end of the box.
9. Well combined materials will produce a uniform mortar color.

C. Applying Stucco Patch Using a Three-coat System:
1. Dampen wood lath by spraying lightly with a garden hose set for fine spray or use a spray bottle; A better method is to wet the lath with water containing photographer's wetting agent, i.e. Kodak Photo-Flo.
2. Apply first coat of stucco (scratch coat) 3/8 to 1/2 inch thick, matching the thickness of the original scratch coat.
3. Cross-hatch the first coat of mortar with a trowel or piece of wire lath to provide good keys for the second coat.
4. Cure for 18 to 24 hours.
5. Moisten the surface with water before applying the second coat.
6. Apply the second coat (brown coat) 3/8 to 1/2 inch thick, matching the thickness of the original scratch coat.
7. Finish the second coat with a wood float that has a small nail driven through it (only the nail tip protrudes) to provide good keys for the finish coat.
8. Cure coat for several days; Sprinkle it with water occasionally so that direct sun or dry weather does not cause it to dry too rapidly and crack.
9. Moisten the surface with water right before applying the top coat so that the first two coats do not draw water out of the fresh stucco.

10. Apply the top coat (finish coat) to a thickness of at least 1/8 inch, to be flush with surface.
11. Wait 1-3 hours, then wire brush, float or trowel top coat using mild pressure to duplicate existing finish appearance.

3.4 ADJUSTING/CLEANING

A. Wipe all excess mortar as the work progresses. Dry brush at the end of each day's work. After stucco is thoroughly set and cured, clean new masonry surfaces, walls, sills, overhangs, etc., of all loose stucco, and dirt. Patch all nail holes, cracks, etc., after which wash down all masonry walls, leaving them clean and neat.

END OF SECTION

22 PRESERVATION BRIEFS

The Preservation and Repair of Historic Stucco

Anne Grimmer

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

The term "stucco" is used here to describe a type of exterior plaster applied as a two-or-three part coating directly onto masonry, or applied over wood or metal lath to a log or wood frame structure. Stucco is found in many forms on historic structures throughout the United States. It is so common, in fact, that it frequently goes unnoticed, and is often disguised or used to imitate another material. Historic stucco is also sometimes incorrectly viewed as a sacrificial coating, and consequently removed to reveal stone, brick or logs that historically were never intended to be exposed. Age and lack of maintenance hasten the deterioration of many historic stucco buildings. Like most historic building materials, stucco is at the mercy of the elements, and even though it is a protective coating, it is particularly susceptible to water damage.

Stucco is a material of deceptive simplicity: in most cases its repair should not be undertaken by a property owner unfamiliar with the art of plastering. Successful stucco repair requires the skill and experience of a professional plasterer. Therefore, this Brief has been prepared to provide background information on the nature and components of traditional stucco, as well as offer guidance on proper maintenance and repairs. The Brief will outline the requirements for stucco repair, and, when necessary, replacement. Although several stucco mixes representative of different periods are provided here for reference, this Brief does not include specifications for carrying out repair projects. Each project is unique, with its own set of problems that require individual solutions.

Historical Background

Stucco has been used since ancient times. Still widely used throughout the world, it is one of the most common of traditional building materials (Fig. 1). Up until

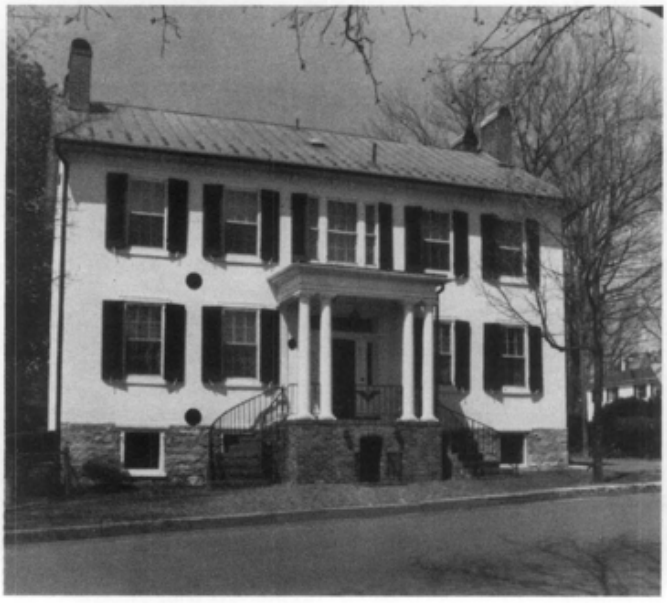


Fig. 1. These two houses in a residential section of Winchester, Virginia, illustrate the continuing popularity of stucco (a) from this early 19th century, Federal style house on the left, (b) to the English Cotswold style cottage that was built across the street in the 1930's. Photos: Anne Grimmer.

the late 1800's, stucco, like mortar, was primarily lime-based, but the popularization of portland cement changed the composition of stucco, as well as mortar, to a harder material. Historically, the term "plaster" has often been interchangeable with "stucco"; the term is still favored by many, particularly when referring to the traditional lime-based coating. By the nineteenth century "stucco," although originally denoting fine interior ornamental plasterwork, had gained wide acceptance in the United States to describe exterior plastering. "Render" and "rendering" are also terms used to describe stucco, especially in Great Britain. Other historic treatments and coatings related to stucco in that they consist at least in part of a similarly plastic or malleable material include: parging and pargeting, wattle and daub, "cob" or chalk mud, pisé de terre, rammed earth, briqueté entre poteaux or bousillage, half-timbering, and adobe. All of these are regional variations on traditional mixtures of mud, clay, lime, chalk, cement, gravel or straw. Many are still used today.

The Stucco Tradition in the United States

Stucco is primarily used on residential buildings and relatively small-scale commercial structures. Some of the earliest stucco buildings in the United States include examples of the Federal, Greek and Gothic Revival styles of the eighteenth and the nineteenth centuries that emulated European architectural fashions. Benjamin Henry Latrobe, appointed by Thomas Jefferson as Surveyor of Public Buildings of the United States in 1803, was responsible for the design of a number of important stucco buildings, including St. John's Church (1816), in Washington, D.C. (Fig. 2). Nearly half a century later Andrew Jackson Downing also advocated the use of stucco in his influential book *The Architecture of Country Houses*, published in 1850. In Downing's opinion, stucco was superior in many respects to plain brick or stone because it was cheaper, warmer and dryer, and could be "agreeably" tinted. As a result of his advice, stuccoed Italianate style urban and suburban villas proliferated in many parts of the country during the third quarter of the nineteenth century.

Revival Styles Promote Use of Stucco

The introduction of the many revival styles of architecture around the turn of the twentieth century, combined with the improvement and increased availability of portland cement resulted in a "craze" for stucco as a building material in the United States. Beginning about 1890 and gaining momentum into the 1930's and 1940's, stucco was associated with certain historic architectural styles, including: Prairie; Art Deco, and Art Moderne; Spanish Colonial, Mission, Pueblo, Mediterranean, English Cotswold Cottage, and Tudor Revival styles; as well as the ubiquitous bungalow and "four-square" house (Fig. 3). The fad for Spanish Colonial Revival, and other variations on this theme, was especially important in furthering stucco as a building material in the United States during this period, since stucco clearly looked like adobe (Fig. 4).

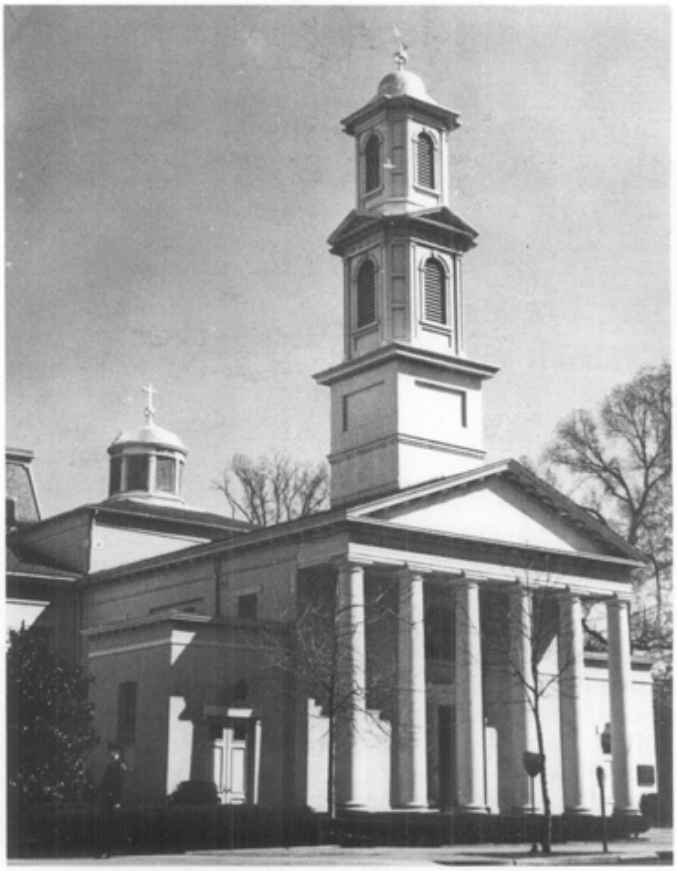


Fig. 2. St. John's Church, Washington, D.C., constructed of brick and stuccoed immediately upon completion in 1816, reflects the influence of European, and specifically English, architectural styles. Photo: Russell Jones, HABS Collection.

Fig. 3. The William Gray and Edna S. Purcell House, Minneapolis, Minnesota, was designed in 1913 by the architects Purcell and Elmslie in the Prairie style. Stuccoed in a salmon-pink, sand (float) finish, it is unusual in that it featured a 3-color geometric frieze stencilled below the eaves of the 2nd story. The Minneapolis Institute of Art has removed the cream-colored paint added at a later date, and restored the original color and texture of the stucco. Photo: Courtesy MacDonald and Mack Partnership.

Although stucco buildings were especially prevalent in California, the Southwest and Florida, ostensibly because of their Spanish heritage, this period also spawned stucco-coated, revival-style buildings all over the United States and Canada. The popularity of stucco as a cheap, and readily available material meant that by the 1920's, it was used for an increasing variety of building types. Resort hotels, apartment buildings, private mansions and movie theaters, railroad stations, and even gas stations and tourist courts took advantage of the "romance" of period styles, and adopted the stucco construction that had become synonymous with these styles (Fig. 5).

Fig. 4. The elaborate Spanish Colonial Revival style of this building designed by Bertram Goodhue for the 1915 Panama California Exposition held in San Diego's Balboa Park emphasizes the sculptural possibilities of stucco. Photo: C.W. Snell, National Historic Landmark Files.

A Practical Building Material

Stucco has traditionally been popular for a variety of reasons. It was an inexpensive material that could simulate finely dressed stonework, especially when "scored" or "lined" in the European tradition. A stucco coating over a less finished and less costly substrate such as rubblestone, fieldstone, brick, log or wood frame, gave the building the appearance of being a more expensive and important structure. As a weather-repellent coating, stucco protected the building from wind and rain penetration, and also offered a certain amount of fire protection. While stucco was usually applied during construction as part of the building design, particularly over rubblestone or fieldstone, in some instances it was added later to protect the structure, or when a rise in the owner's social status demanded a comparable rise in his standard of living.

Composition of Historic Stucco

Before the mid-to-late nineteenth century, stucco consisted primarily of hydrated or slaked lime, water and sand, with straw or animal hair included as a binder. Natural cements were frequently used in stucco mixes after their discovery in the United States during the 1820's. Portland cement was first manufactured in the United States in 1871, and it gradually replaced natural cement. After about 1900, most stucco was composed primarily of portland cement, mixed with some lime. With the addition of portland cement, stucco became even more versatile and durable. No longer used just as a coating for a substantial material like masonry or log, stucco could now be applied over wood or metal lath attached to a light wood frame. With this increased strength, stucco ceased to be just a veneer and became a more integral part of the building structure.

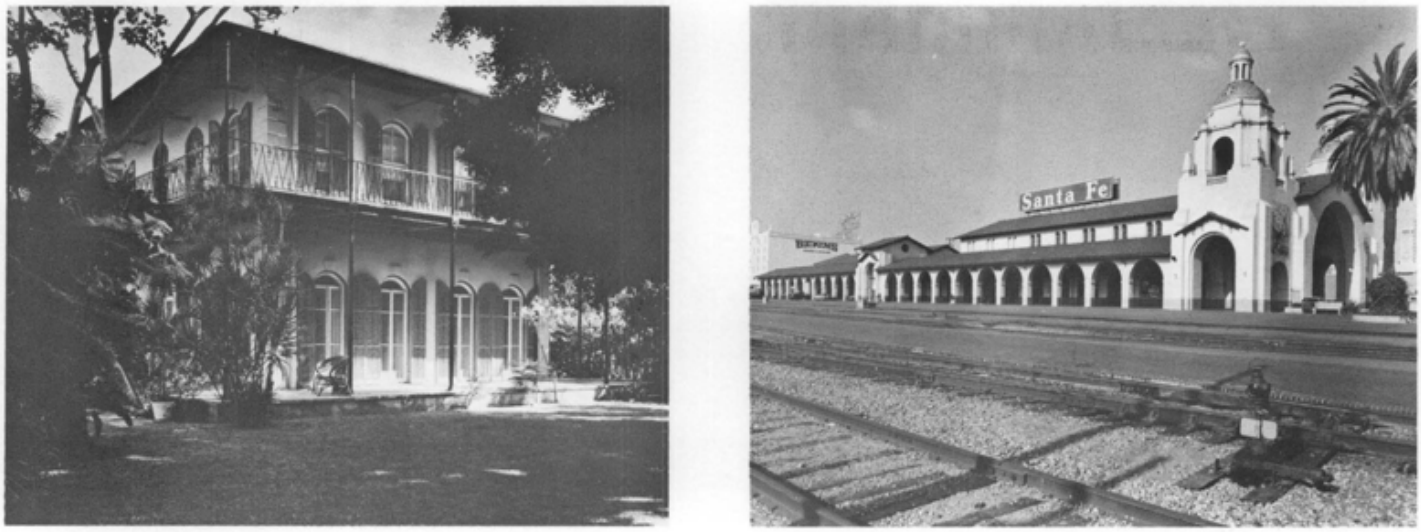


Fig. 5. During the 19th and 20th centuries stucco has been a popular material not only for residential, but also for commercial buildings in the Spanish style. Two such examples are (a) the 1851 Ernest Hemingway House, Key West, Florida, built of stuccoed limestone in a Spanish Caribbean style; and (b) the Santa Fe Depot (Union Station), San Diego, California, designed by the architects Bakewell and Brown in 1914 in a Spanish Colonial Revival style, and constructed of stucco over brick and hollow tile. Photos: (a) J.F. Brooks, HABS Collection, (b) Marvin Rand, HABS Collection.

Today, gypsum, which is hydrated calcium sulfate or sulfate of lime, has to a great extent replaced lime. Gypsum is preferred because it hardens faster and has less shrinkage than lime. Lime is generally used only in the finish coat in contemporary stucco work.

The composition of stucco depended on local custom and available materials. Stucco often contained substantial amounts of mud or clay, marble or brick dust, or even sawdust, and an array of additives ranging from animal blood or urine, to eggs, keratin or gluesize (animal hooves and horns), varnish, wheat paste, sugar, salt, sodium silicate, alum, tallow, linseed oil, beeswax, and wine, beer, or rye whiskey. Waxes, fats and oils were included to introduce water-repellent properties, sugary materials reduced the amount of water needed and slowed down the setting time, and alcohol acted as an air entrainer. All of these additives contributed to the strength and durability of the stucco.

The appearance of much stucco was determined by the color of the sand—or sometimes burnt clay, used in the mix, but often stucco was also tinted with natural pigments, or the surface whitewashed or colorwashed after stuccoing was completed. Brick dust could provide color, and other coloring materials that were not affected by lime, mostly mineral pigments, could be added to the mix for the final finish coat. Stucco was also marbled or marbleized—stained to look like stone by diluting oil of vitriol (sulfuric acid) with water, and mixing this with a yellow ochre, or another color (Fig. 6). As the twentieth century progressed, manufactured or synthetic pigments were added at the factory to some prepared stucco mixes.

Methods of Application

Stucco is applied directly, without lath, to masonry substrates such as brick, stone, concrete or hollow tile (Fig. 7). But on wood structures, stucco, like its interior counterpart plaster, must be applied over lath in order to obtain an adequate key to hold the stucco. Thus, when applied over a log structure, stucco is laid on horizontal wood lath that has been nailed on vertical wood furring strips attached to the logs (Fig. 8). If it is applied over a wood frame structure, stucco may be applied to wood or metal lath nailed directly to the wood frame; it may also be placed on lath that has been attached to furring strips. The furring strips are themselves laid over building paper covering the wood sheathing (Fig. 9). Wood lath was gradually superseded by expanded metal lath introduced in the late-nineteenth and early-twentieth century. When stuccoing over a stone or brick substrate, it was customary to cut back or rake out the mortar joints if they were not already recessed by natural weathering or

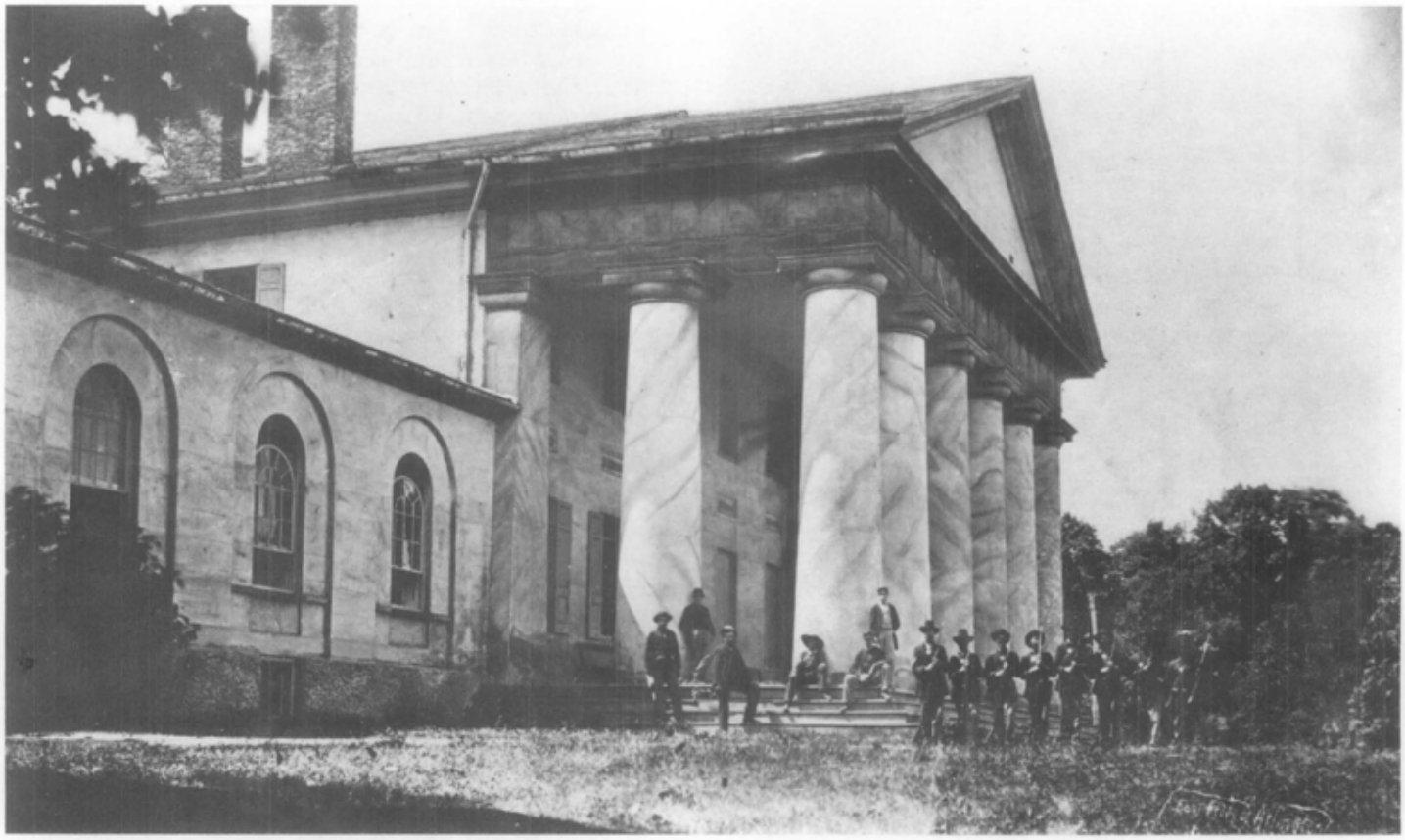


Fig. 6. Arlington House, Arlington, Virginia, was built between 1802–1818 of brick covered with stucco. It was designed by George Hadfield for George Washington Parke Custis, grandson of Martha Washington, and was later the home of Robert E. Lee. This photograph taken on June 28, 1864, by Captain Andrew J. Russell, a U.S. Signal Corps photographer, shows the stucco after it had been marbleized during the 1850's. Yellow ochre and burnt umber pigments were combined to imitate Sienna marble, and the stucco, with the exception of the roughcast foundation, was scored to heighten the illusion of stone. Photo: National Archives, Arlington House Collection, National Park Service.

Fig. 7. Patches of stucco have fallen off this derelict 19th century structure exposing the rough-cut local stone substrate. The missing wood entablature on the side and the rough wood lintel now exposed above a second-floor window, offer clues that the building was stuccoed originally. Photo: National Park Service Files.

Fig. 8. Removal of deteriorated stucco in preparation for stucco repair on this late-18th century log house in Middleway, West Virginia, reveals that the stucco was applied to hand-riven wood lath nailed over vertical wood strips attached to the logs. Photo: Anne Grimmer.

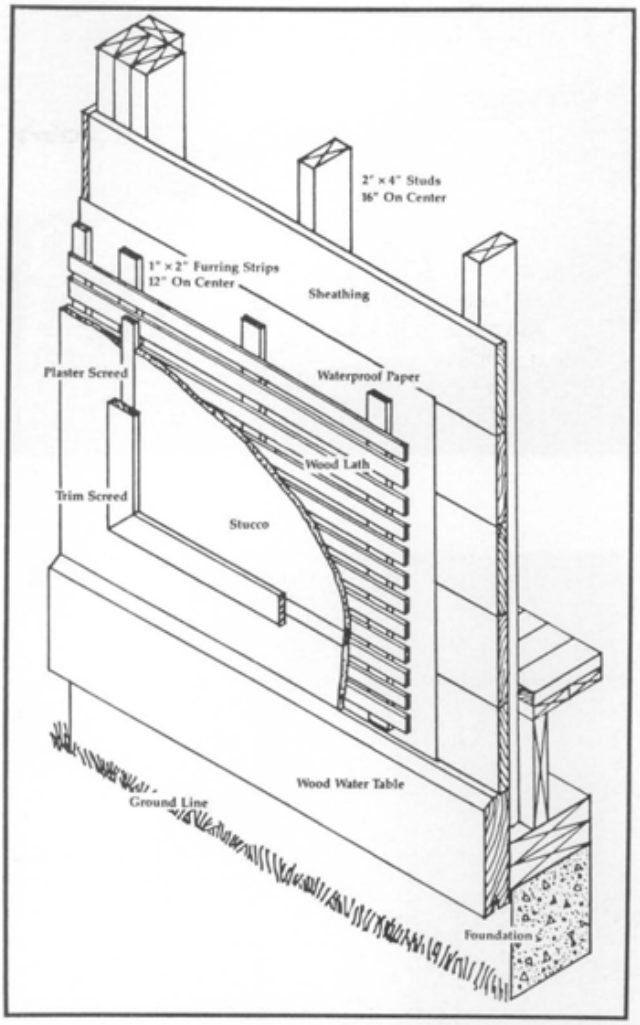


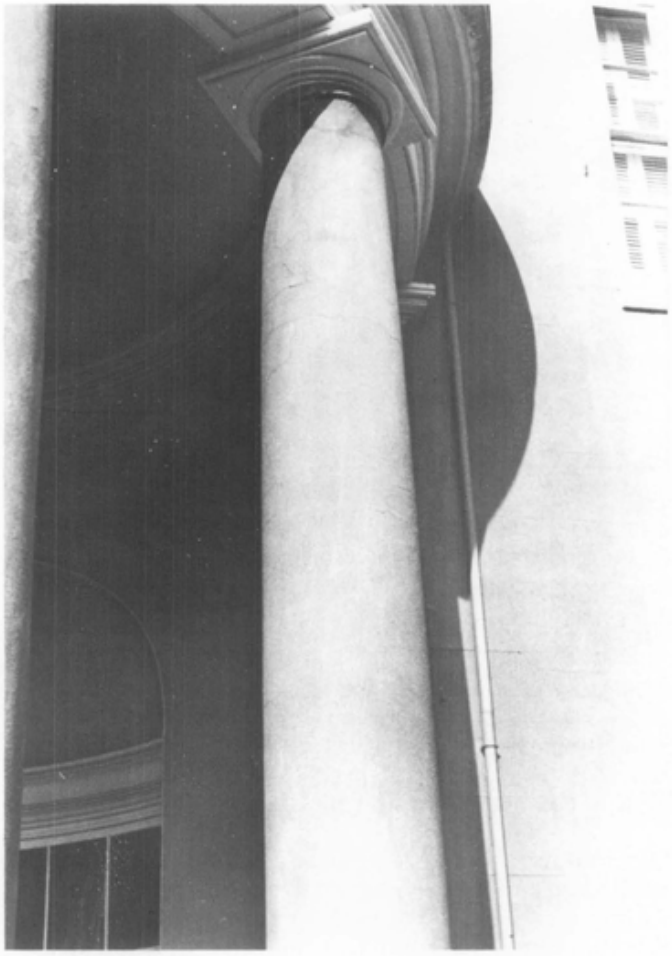
Fig. 9. This cutaway drawing shows the method of attachment for stucco commonly used on wood frame or balloon frame structures from the late-19th to the 20th century. Drawing: Brian Conway, "Illinois Preservation Series Number 2: Stucco."

erosion, and sometimes the bricks themselves were gouged to provide a key for the stucco. This helped provide the necessary bond for the stucco to remain attached to the masonry, much like the key provided by wood or metal lath on frame buildings.

Like interior wall plaster, stucco has traditionally been applied as a multiple-layer process, sometimes consisting of two coats, but more commonly as three. Whether applied directly to a masonry substrate or onto wood or metal lath, this consists of a first "scratch" or "pricking-up" coat, followed by a second scratch coat, sometimes referred to as a "floating" or "brown" coat, followed finally by the "finishing" coat. Up until the late-nineteenth century, the first and the second coats were of much the same composition, generally consisting of lime, or natural cement, sand, perhaps clay, and one or more of the additives previously mentioned. Straw or animal hair was usually added to the first coat as a binder. The third, or finishing coat, consisted primarily of a very fine mesh grade of lime and sand, and sometimes pigment. As already noted, after the 1820's, natural cement was also a common ingredient in stucco until it was replaced by portland cement.

A

B



C

D

Fig. 10. (a) Tudor Place, Washington, D.C. (1805–1816), was designed by Dr. William Thornton. Like its contemporary, Arlington House, it is stuccoed and scored, with a roughcast base, but here the stucco is a monochromatic sandstone color tinted by sand and mineral pigments (b). Although the original stucco was replaced in the early-20th century with a portland cement-based stucco, the family, who retained ownership until 1984 when the house was opened to the public, left explicit instructions for future stucco repairs. The mix recommended for repairing hairline cracks (c), consists of sharp sand, cement and lime, burnt umber, burnt sienna, and a small amount of raw sienna. Preparation of numerous test samples, the size of "a thick griddle cake," will be necessary to match the stucco color, and when the exact color has been achieved, the mixture is to be diluted to the "consistency of cream," brushed on the wall and rubbed into the cracks with a rubber sponge or float. Note the dark color visible under the eaves intended to replicate the stronger color of the original limewashed stucco (d). Photos: Anne Grimmer.

Both masonry and wood lath must be kept wet or damp to ensure a good bond with the stucco. Wetting these materials helps to prevent them from pulling moisture out of the stucco too rapidly, which results in cracking, loss of bond, and generally poor quality stuccowork.

Traditional Stucco Finishes

Until the early-twentieth century when a variety of novelty finishes or textures were introduced, the last coat of stucco was commonly given a smooth, troweled finish, and then scored or lined in imitation of ashlar. The illusion of masonry joints was sometimes enhanced by a thin line of white lime putty, graphite, or some other pigment. Some nineteenth century buildings feature a water table or raised foundation of rough-cast stucco that differentiates it from the stucco surface above, which is smooth and scored (Fig. 10). Other novelty or textured finishes associated with the "period" or revival styles of the early-twentieth century include: the English cottage finish, adobe and Spanish, pebble-dashed or dry-dash surface, fan and sponge texture, reticulated and vermiculated, roughcast (or wet dash), and sgraffito (Fig. 11).

Repairing Deteriorated Stucco

Regular Maintenance

Although A. J. Downing alluded to stuccoed houses in Pennsylvania that had survived for over a century in relatively good condition, historic stucco is inherently not a particularly permanent or long-lasting building material. Regular maintenance is required to keep it in good condition. Unfortunately, many older or historic buildings are not always accorded this kind of care.

Because building owners knew stucco to be a protective, but also somewhat fragile coating, they employed a variety of means to prolong its usefulness. The most common treatment was to whitewash stucco, often annually. The lime in the whitewash offered protection and stability and helped to harden the stucco. Most importantly, it filled hairline cracks before they could develop into larger cracks and let in moisture. To improve water repellency, stucco buildings were also sometimes coated with paraffin, another type of wax, or other stucco-like coatings, such as oil mastics.

Assessing Damage

Most stucco deterioration is the result of water infiltration into the building structure, either through the roof, around chimneys, window and door openings, or excessive ground water or moisture penetrating through, or splashing up from the foundation. Potential causes of deterioration include: ground settlement, lintel and door frame settlement, inadequate or leaking gutters and downspouts, intrusive vegetation, moisture migration within walls due to interior condensation and humidity, vapor drive problems caused by furnace, bathroom and kitchen vents, and rising damp resulting from excessive ground water and poor drainage around the foundation. Water infiltration will cause wood lath to rot, and metal lath and nails to rust, which eventually will cause stucco to lose its bond and pull away from its substrate.

Fig. 11. The Hotel Washington, Washington, D.C. (1916–1917), is notable for its decorative ***sgraffito*** *surfaces. Stucco panels under the cornice and around the windows feature classical designs created by artists who incised the patterns in the outer layer of red-colored stucco while still soft, thereby exposing a stucco undercoat of a contrasting color. Photo: Kaye Ellen Simonson.*

After the cause of deterioration has been identified, any necessary repairs to the building should be made first before repairing the stucco. Such work is likely to include repairs designed to keep excessive water away from the stucco, such as roof, gutter, downspout and flashing repairs, improving drainage, and redirecting rainwater runoff and splash-back away from the building. Horizontal areas such as the tops of parapet walls or chimneys are particularly vulnerable to water infiltration, and may require modifications to their original design, such as the addition of flashing to correct the problem.

Previous repairs inexpertly carried out may have caused additional deterioration, particularly if executed in portland cement, which tends to be very rigid, and therefore incompatible with early, mostly soft lime-based stucco that is more "flexible." Incompatible

repairs, external vibration caused by traffic or construction, or building settlement can also result in cracks which permit the entrance of water and cause the stucco to fail (Fig. 12).

Before beginning any stucco repair, an assessment of the stucco should be undertaken to determine the extent of the damage, and how much must be replaced or repaired. Testing should be carried out systematically on all elevations of the building to determine the overall condition of the stucco. Some areas in need of repair will be clearly evidenced by missing sections of stucco or stucco layers. Bulging or cracked areas are obvious places to begin. Unsound, punky or soft areas that have lost their key will echo with a hollow sound when tapped gently with a wooden or acrylic hammer or mallet.

Identifying the Stucco Type

Analysis of the historic stucco will provide useful information on its primary ingredients and their proportions, and will help to ensure that the new replacement stucco will duplicate the old in strength, composition, color and texture as closely as possible. However, unless authentic, period restoration is required, it may not be worthwhile, nor in many instances possible, to attempt to duplicate *all* of the ingredients (particularly some of the additives), in creating the new stucco mortar. Some items are no longer available, and others, notably sand and lime—the major components of traditional stucco—have changed radically over time. For example, most sand used in contemporary masonry work is manufactured sand, because river sand, which was used historically, is difficult to obtain today in many parts of the country. The physical and visual qualities of manufactured sand versus river sand, are quite different, and this affects the way stucco works, as well as the way it looks. The same is true of lime, which is frequently replaced by gypsum in modern stucco mixes. And even if identification of all the items in the historic stucco mix were possible, the analysis would still not reveal how the original stucco was mixed and applied.

There are, however, simple tests that can be carried out on a small piece of stucco to determine its basic make-up. A dilute solution of hydrochloric (muriatic) acid will dissolve lime-based stucco, but not portland cement. Although the use of portland cement became common after 1900, there are no precise cut-off dates, as stuccoing practices varied among individual plasterers, and from region to region. Some plasterers began using portland cement in the 1880's, but others may have continued to favor lime stucco well into the early-twentieth century. While it is safe to assume that a late-eighteenth or early-nineteenth century stucco is lime-based, late-nineteenth or early-twentieth century

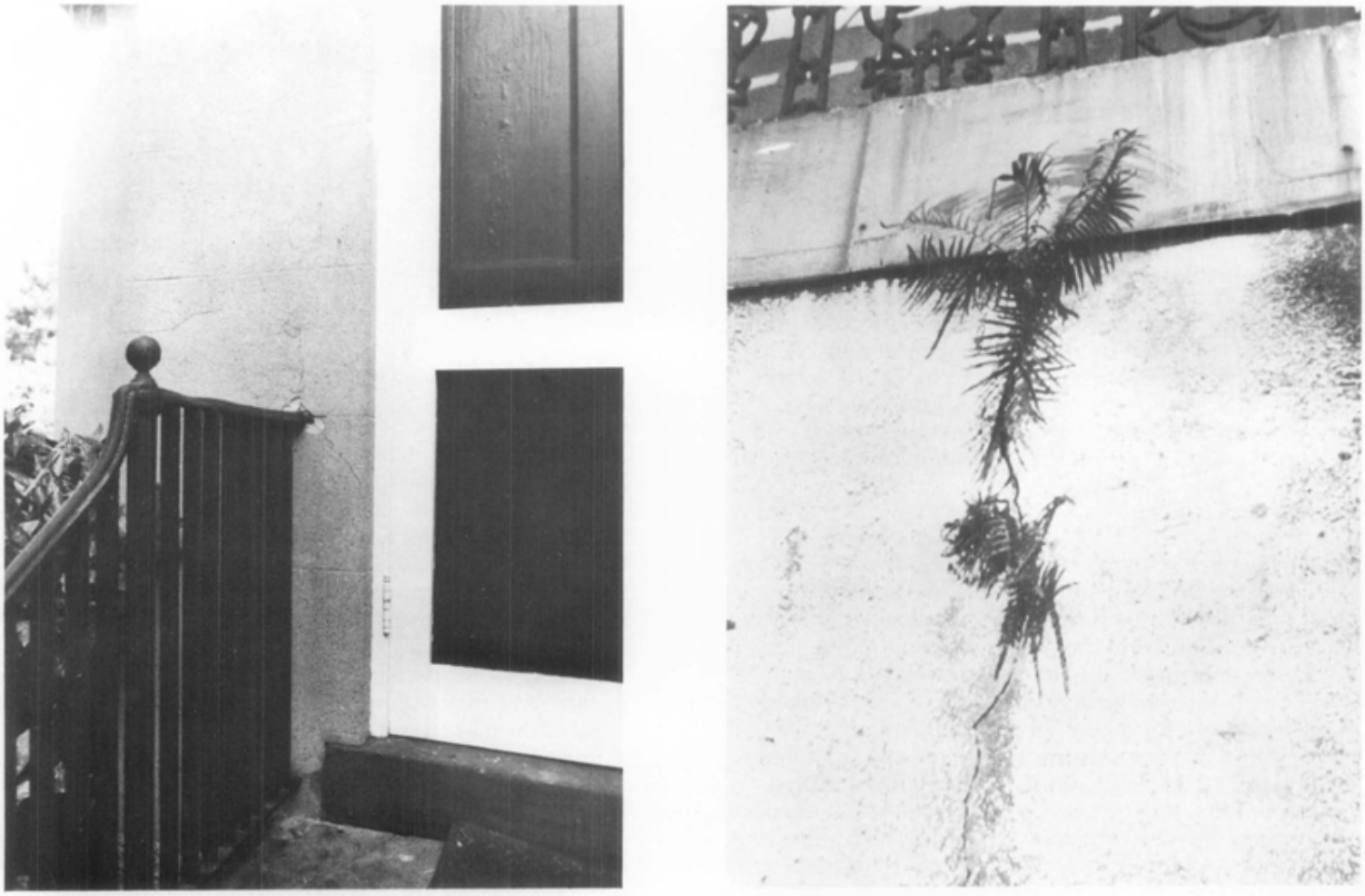


Fig. 12. (a) Water intrusion caused by rusting metal, or (b) plant growth left unattended will gradually enlarge these cracks, resulting in spalling, and eventually requiring extensive repair of the stucco. Photos: National Park Service Files.

Fig. 13. (a) In preparation for repainting, hairline cracks on this Mediterranean style stucco apartment building were filled with a commercial caulking compound; (b) dirt is attracted and adheres to the texture of the caulked areas, and a year after painting, these inappropriate repairs are highly obvious. Photos: Anne Grimmer.

stucco may be based on either lime or portland cement. Another important factor to take into consideration is that an early lime-stucco building is likely to have been repaired many times over the ensuing years, and it is probable that at least some of these patches consist of portland cement.

Planning the Repair

Once the extent of damage has been determined, a number of repair options may be considered. Small hairline cracks usually are not serious and may be sealed with a thin slurry coat consisting of the finish coat ingredients, or even with a coat of paint or whitewash. Commercially available caulking compounds are not suitable materials for patching hairline cracks. Because their consistency and texture is unlike that of stucco, they tend to weather differently, and attract more dirt; as a result, repairs made with caulking compounds may be highly visible, and unsightly (Fig. 13). Larger cracks will have to be cut out in preparation for more extensive repair. Most stucco repairs will require the skill and expertise of a professional plasterer (Fig. 14).

In the interest of saving or preserving as much as possible of the historic stucco, patching rather than wholesale replacement is preferable. When repairing heavily textured surfaces, it is not usually necessary to replace an entire wall section, as the textured finish, if well-executed, tends to conceal patches, and helps them to blend in with the existing stucco. However, because of the nature of smooth-finished stucco, patching a number of small areas scattered over one elevation may not be a successful repair approach unless the stucco has been previously painted, or is to be painted following the repair work. On unpainted stucco such patches are hard to conceal, because they may not match exactly or blend in with the rest of the historic stucco surface. For

Fig. 14. This poorly executed patch is not the work of a professional plasterer. While it may serve to keep out water, it does not match the original surface, and is not an appropriate repair for historic stucco. Photo: Betsy Chittenden.

this reason it is recommended, if possible, that stucco repair be carried out in a contained or well-defined area, or if the stucco is scored, the repair patch should be "squared-off" in such a way as to follow existing scoring. In some cases, especially in a highly visible location, it may be preferable to restucco an entire wall section or feature. In this way, any differences between the patched area and the historic surface will not be so readily apparent.

Repair of historic stucco generally follows most of the same principles used in plaster repair. First, all deteriorated, severely cracked and loose stucco should be removed down to the lath (assuming that the lath is securely attached to the substrate), or down to the masonry if the stucco is directly applied to a masonry substrate. A clean surface is necessary to obtain a good

bond between the stucco and substrate. The areas to be patched should be cleaned of all debris with a bristle brush, and all plant growth, dirt, loose paint, oil or grease should be removed (Fig. 15). If necessary, brick or stone mortar joints should then be raked out to a depth of approximately 5/8" to ensure a good bond between the substrate and the new stucco.

To obtain a neat repair, the area to be patched should be squared-off with a butt joint, using a cold chisel, a hatchet, a diamond blade saw, or a masonry bit. Sometimes it may be preferable to leave the area to be patched in an irregular shape which may result in a less conspicuous patch. Proper preparation of the area to be patched requires very sharp tools, and extreme caution on the part of the plasterer not to break keys of surrounding good stucco by "over-sounding" when removing deteriorated stucco. To ensure a firm bond, the new patch must not overlap the old stucco. If the stucco has lost its bond or key from wood lath, or the lath has deteriorated or come loose from the substrate, a decision must be made whether to try to reattach the old lath, to replace deteriorated lath with new wood lath, or to leave the historic wood lath in place and supplement it with modern expanded metal lath. Unless authenticity is important, it is generally preferable (and easier) to nail new metal lath over the old wood lath to support the patch. Metal lath that is no longer securely fastened to the substrate may be removed and replaced in kind, or left in place, and supplemented with new wire lath.

When repairing lime-based stucco applied directly to masonry, the new stucco should be applied in the same manner, directly onto the stone or brick. The stucco will bond onto the masonry itself without the addition of lath because of the irregularities in the masonry or those of its mortar joints, or because its surface has been scratched, scored or otherwise roughened to provide an additional key. Cutting out the old stucco at a diagonal angle may also help secure the bond between the new and the old stucco. For the most part it is not advisable to insert metal lath when restuccoing historic masonry in sound condition, as it can hasten deterioration of the repair work. Not only will attaching the lath damage the masonry, but the slightest moisture penetration can cause metal lath to rust. This will cause metal to expand, eventually resulting in spalling of the stucco, and possibly the masonry substrate too.

If the area to be patched is properly cleaned and prepared, a bonding agent is usually not necessary. However, a bonding agent may be useful when repairing hairline cracks, or when dealing with substrates that do not offer a good bonding surface. These may include dense stone or brick, previously painted or stuccoed

Fig. 15. (a) After reattaching any loose wood lath to the furring strips underneath, the area to be patched has been cleaned, the lath thoroughly wetted, and (b) the first coat of stucco has been applied and scratched to provide a key to hold the second layer of stucco. Photos: Betsy Chittenden.

masonry, or spalling brick substrates. A good mechanical bond is always preferable to reliance on bonding agents. Bonding agents should not be used on a wall that is likely to remain damp or where large amounts of salts are present. Many bonding agents do not survive well under such conditions, and their use could jeopardize the longevity of the stucco repair.

A stucco mix compatible with the historic stucco should be selected after analyzing the existing stucco. It can be adapted from a standard traditional mix of the period, or based on one of the mixes included here. Stucco consisting mostly of portland cement generally will not be physically compatible with the softer, more flexible lime-rich historic stuccos used throughout the eighteenth and much of the nineteenth centuries. The differing expansion and contraction rates of lime stucco and portland cement stucco will normally cause the stucco to crack. Choosing a stucco mix that is durable and compatible with the historic stucco on the building is likely to involve considerable trial and error, and probably will require a number of test samples, and even more if it is necessary to match the color. It is best to let the stucco test samples weather as long as possible—ideally one year, or at least through a change of seasons, in order to study the durability of the mix and its compatibility with the existing stucco, as well as the weathering of the tint if the building will not be painted and color match is an important factor. If the test samples are not executed on the building, they should be placed next to the stucco remaining on the building to compare the color, texture and composition of the samples with the original. The number and thickness of stucco coats used in the repair should also match the original.

After thoroughly dampening the masonry or wood lath, the first, scratch coat should be applied to the masonry substrate, or wood or metal lath, in a thickness that corresponds to the original if extant, or generally about 1/4″ to 3/8″. The scratch coat should be scratched or cross-hatched with a comb to provide a key to hold the second coat. It usually takes 24–72 hours, and longer in cold weather, for each coat to dry before the next coat can be applied. The second coat should be about the same thickness as the first, and the total thickness of the first two coats should generally not exceed about 5/8″. This second or leveling coat should be roughened using a wood float with a nail protruding to provide a key for the final or finish coat. The finish coat, about 1/4″ thick, is applied after the previous coat has initially set. If this is not feasible, the base coat should be thoroughly dampened when the finish coat is applied later. The finish coat should be worked to match the texture of the original stucco (Fig. 16).

Colors and Tints for Historic Stucco Repair

The color of most early stucco was supplied by the aggregate included in the mix—usually the sand. Sometimes natural pigments were added to the mix, and eighteenth and nineteenth-century scored stucco was often marbleized or painted in imitation of marble or granite. Stucco was also frequently coated with whitewash or a colorwash. This tradition later evolved into the use of paint, its popularity depending on the vagaries of fashion as much as a means of concealing repairs. Because most of the early colors were derived from nature, the resultant stucco tints tended to be mostly earth-toned. This was true until the advent of brightly colored stucco in the early decades of the twentieth century. This was the so-called "Jazz Plaster" developed by O.A. Malone, the "man who put color into California," and who founded the California Stucco Products Corporation in 1927. California Stucco was revolutionary for its time as the first stucco/plaster to contain colored pigment in its pre-packaged factory mix.

When patching or repairing a historic stucco surface known to have been tinted, it may be possible to determine through visual or microscopic analysis whether the source of the coloring is sand, cement or pigment. Although some pigments or aggregates used traditionally may no longer be available, a sufficiently close color-match can generally be approximated using sand, natural or mineral pigments, or a combination of these. Obtaining such a match will require testing and comparing the color of dried test samples with the original. Successfully combining pigments in the dry stucco mix prepared for the finish coat requires considerable skill. The amount of pigment must be carefully measured for each batch of stucco. Overworking the mix can make the pigment separate from the lime. Changing the amount of water added to the mix, or using water to apply the tinted finish coat, will also affect the color of the stucco when it dries.

Generally, the color obtained by hand-mixing these ingredients will provide a sufficiently close match to cover an entire wall or an area distinct enough from the rest of the structure that the color differences will not be obvious. However, it may not work for small patches conspicuously located on a primary elevation, where color differences will be especially noticeable. In these instances, it may be necessary to conceal the repairs by painting the entire patched elevation, or even the whole building.

Many stucco buildings have been painted over the years and will require repainting after the stucco repairs have been made. Limewash or cement-based paint, latex paint, or oil-based paint are appropriate coatings for stucco buildings. The most important factor to consider when repainting a previously painted or coated surface is that the new paint be compatible with any coating already on the surface. In preparation for repainting, all loose or peeling paint or other coating material not firmly adhered to the stucco must be removed by hand-scraping or natural bristle brushes. The surface should then be cleaned.

Cement-based paints, most of which today contain some portland cement and are really a type of limewash, have traditionally been used on stucco buildings. The ingredients were easily obtainable. Furthermore, the lime in such paints actually bonded or joined with the stucco and provided a very durable coating. In many regions, whitewash was applied annually during spring cleaning. Modern, commercially available premixed masonry and mineral-based paints may also be used on historic stucco buildings.

Fig. A

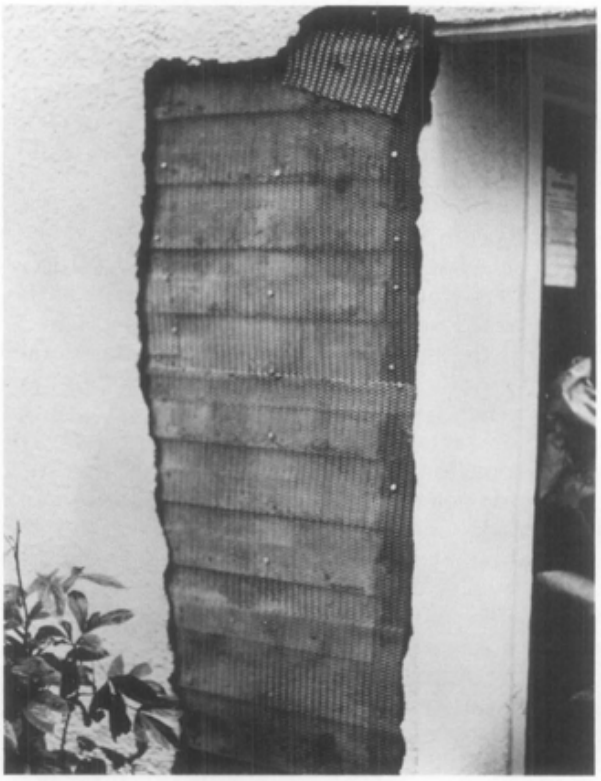


Fig. B

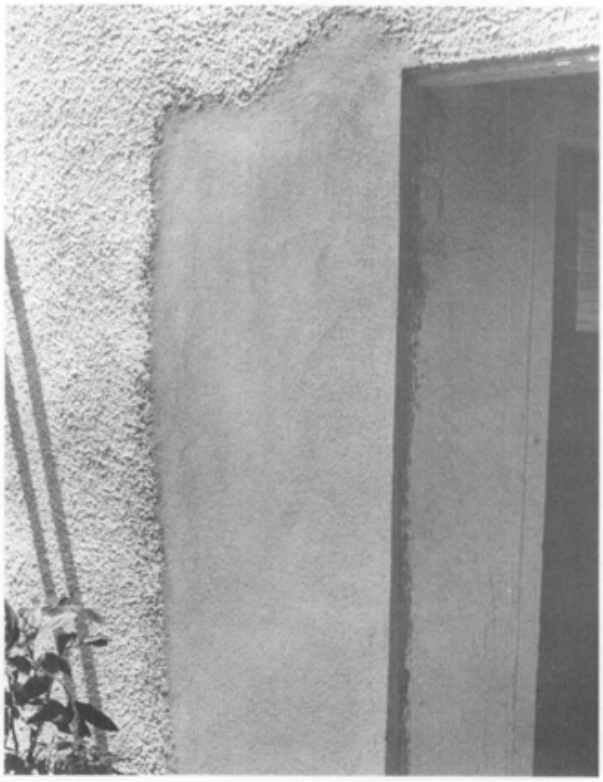


Fig. C

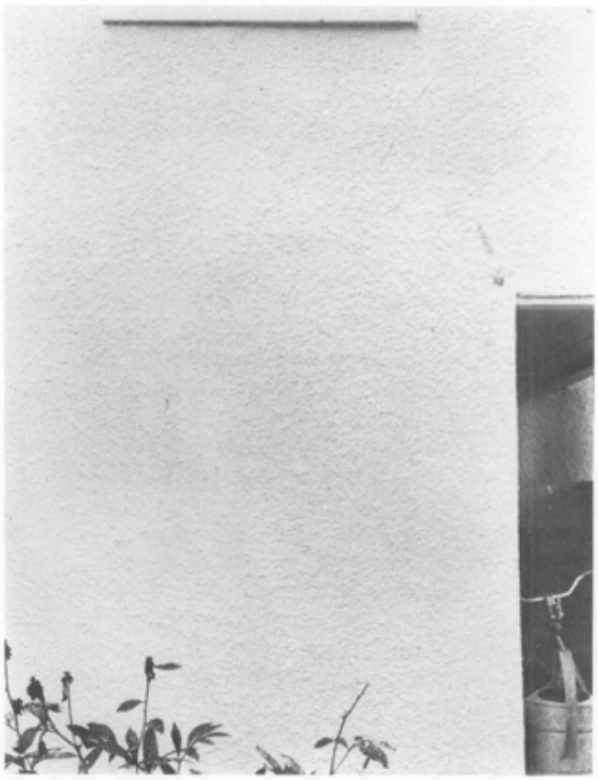


Fig. D

Fig. 16. (a) In preparation for stucco repair, this plasterer is mixing the dry materials in a mortar box with a mortar hoe (note the 2 holes in the blade), pulling it through the box using short choppy strokes. After the dry materials are thoroughly combined, water is added and mixed with them using the same choppy, but gradually lengthening stokes, making sure that the hoe cuts completely through the mix to the bottom of the box. (b) The deteriorated stucco has been cut away, and new metal lath has been nailed to the clapboarding in the area to be patched. (Although originally clapboarded when built in the 19th century, the house was stuccoed around the turn-of-the-century on metal lath nailed over the clapboard.) (c) The first, scratch coat and the second coat have been applied here, and await the spatterdash or rough-cast finish of the final coat (d) which was accomplished by the plasterer using a whisk broom to throw the stucco mortar against the wall surface. This well-executed patch is barely discernable, and lacks only a coat of paint to make it blend completely with the rest of the painted wall surface. Photos: Anne Grimmer.

If the structure must be painted for the first time to conceal repairs, almost any of these coatings may be acceptable depending on the situation. Latex paint, for example, may be applied to slightly damp walls or where there is an excess of moisture, but latex paint will not stick to chalky or powdery areas. Oil-based, or alkyd paints must be applied only to dry walls; new stucco must cure up to a year before it can be painted with oil-based paint.

Contemporary Stucco Products

There are many contemporary stucco products on the market today. Many of them are not compatible, either physically or visually, with historic stucco buildings. Such products should be considered for use only after consulting with a historic masonry specialist. However, some of these prepackaged tinted stucco coatings may be suitable for use on stucco buildings dating from the late-nineteenth or early-twentieth century, as long as the color and texture are appropriate for the period and style of the building. While some masonry contractors may, as a matter of course, suggest that a water-repellent coating be applied after repairing old stucco, in most cases this should not be necessary, since colorwashes and paints serve the same purpose, and stucco itself is a protective coating.

Cleaning Historic Stucco Surfaces

Historic stucco buildings often exhibit multiple layers of paint or limewash. Although some stucco surfaces may be cleaned by water washing, the relative success of this procedure depends on two factors: the surface texture of the stucco, and the type of dirt to be removed. If simply removing airborne dirt, **smooth unpainted stucco,** and **heavily-textured painted stucco** may sometimes be cleaned using a low-pressure water wash, supplemented by scrubbing with soft natural bristle brushes, and possibly non-ionic detergents. Organic plant material, such as algae and mold, and metallic stains may be removed from stucco using poultices and appropriate solvents. Although these same methods may be employed to clean **unpainted roughcast, pebble-dash, or any stucco surface featuring exposed aggregate,** due to the surface irregularities, it may be difficult to remove dirt, without also removing portions of the decorative textured surface. Difficulty in cleaning these surfaces may explain why so many of these textured surfaces have been painted.

When Total Replacement is Necessary

Complete replacement of the historic stucco with new stucco of either a traditional or modern mix will probably be necessary only in cases of extreme deterioration—that is, a loss of bond on over 40–50 per cent of the stucco surface. Another reason for total removal might be that the physical and visual integrity of the historic stucco has been so compromised by prior incompatible and ill-conceived repairs that patching would not be successful.

When stucco no longer exists on a building there is more flexibility in choosing a suitable mix for the replacement. Since compatibility of old and new stucco will not be an issue, the most important factors to consider are durability, color, texture and finish. Depending on the construction and substrate of the building, in some instances it may be acceptable to use a relatively strong cement-based stucco mortar. This is certainly true for many late-nineteenth and early-twentieth century buildings, and may even be appropriate to use on some stone substrates even if the original mortar would have been weaker, as long as the historic visual qualities noted above have been replicated. Generally, the best principle to follow for a masonry building is that the stucco mix, whether for repair or replacement of historic stucco, should be somewhat weaker than the masonry to which it is to be applied in order not to damage the substrate.

General Guidance for Historic Stucco Repair

A skilled professional plasterer will be familiar with the properties of materials involved in stucco repair and will be able to avoid some of the pitfalls that would hinder someone less experienced. General suggestions for successful stucco repair parallel those involving restoration and repair of historic mortar or plaster. In addition, the following principles are important to remember:

- Mix only as much stucco as can be used in one and one-half to two hours. This will depend on the weather (mortar will harden faster under hot and dry, or sunny conditions); and experience is likely to be the best guidance. Any remaining mortar should be discarded; it should not be retempered.

- Stucco mortar should not be over-mixed. (Hand mix for 10–15 minutes after adding water, or machine mix for 3–4 minutes after all ingredients are in mixer.) Over-mixing can cause crazing and discoloration, especially in tinted mortars. Over-mixing will also tend to make the mortar set too fast, which will result in cracking and poor bonding or keying to the lath or masonry substrate.

- Wood lath or a masonry substrate, but not metal lath, must be thoroughly wetted before applying stucco patches so that it does not draw moisture out of the stucco too rapidly. To a certain extent, bonding agents also serve this same purpose. Wetting the substrate helps retard drying.

- To prevent cracking, it is imperative that stucco not dry too fast. Therefore, the area to be stuccoed should be shaded, or even covered if possible, particularly in hot weather. It is also a good idea in hot weather to keep the newly stuccoed area damp, at approximately 90 per cent humidity, for a period of 48 to 72 hours.

- Stucco repairs, like most other exterior masonry work, should not be undertaken in cold weather (below 40 degrees fahrenheit, and preferably warmer), or if there is danger of frost.

Historic Stucco Textures

Most of the oldest stucco in the U.S. dating prior to the late-nineteenth century, will generally have a **smooth, troweled finish** (sometimes called a **sand** or **float finish**), possibly scored to resemble ashlar masonry units. Scoring may be incised to simulate masonry joints, the scored lines may be emphasized by black or white penciling, or the lines may simply be drawn or painted on the surface of the stucco. In some regions, at least as early as the first decades of the nineteenth century, it was not uncommon to use a **roughcast finish** on the foundation or base of an otherwise **smooth-surfaced** building (Fig. a). **Roughcast** was also used as an overall stucco finish for some outbuildings, and other less important types of structures.

A wide variety of decorative surface textures may be found on revival style stucco buildings, particularly residential architecture. These styles evolved in the late-nineteenth century and peaked in popularity in the early decades of the twentieth century. Frank Lloyd Wright favored a **smooth finish** stucco, which was imitated on much of the Prairie style architecture inspired by his work. Some of the more picturesque surface textures include: **English Cottage** or **English Cotswold finish**; **sponge finish** (Fig. b); **fan texture**; **adobe finish** (Fig. c), and **Spanish** or **Italian finish.** Many of these finishes and countless other regional and personalized variations on them are still in use.

The most common early-twentieth century stucco finishes are often found on bungalow-style houses, and include: **spatter** or **spatterdash** (sometimes called **roughcast, harling,** or **wetdash**), and **pebbledash** or **drydash.** The **spatterdash** finish is applied by throwing the stucco mortar against the wall using a whisk broom or a stiff fiber brush, and it requires considerable skill on the part of the plasterer to achieve a consistently rough wall surface. The mortar used to obtain this texture is usually composed simply of a regular sand, lime, and cement mortar, although it may sometimes contain small pebbles or crushed stone aggregate, which replaces one-half the normal sand content. The **pebbledash** or **drydash finish** is accomplished manually by the plasterer throwing or "dashing" dry pebbles (about 1/8″ to 1/4″ in size), onto a coat of stucco freshly applied by another plasterer. The pebbles must be thrown at the wall with a scoop with sufficient force and skill that they will stick to the stuccoed wall. A more even or uniform surface can be achieved by patting the stones down with a wooden float. This finish may also be created using a texturing machine (Figs. d–f illustrate 3 versions of this finish. Photos: National Park Service Files).

Fig. A

Fig. B

Fig. C

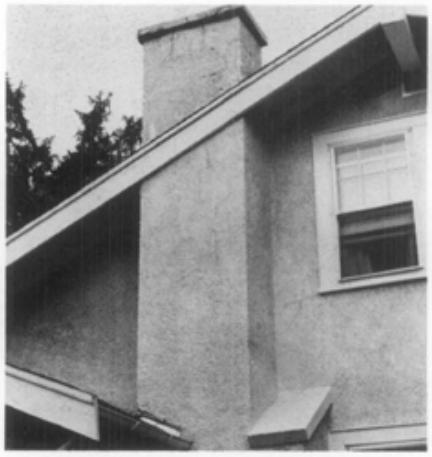


Fig. D

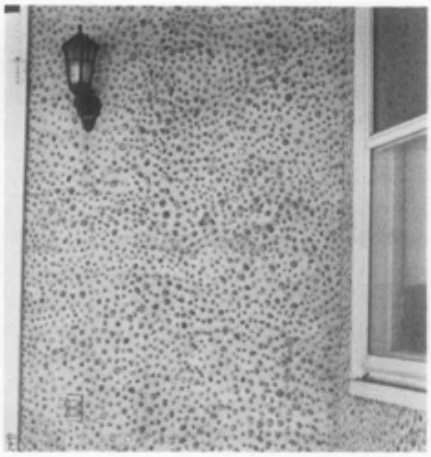


Fig. E

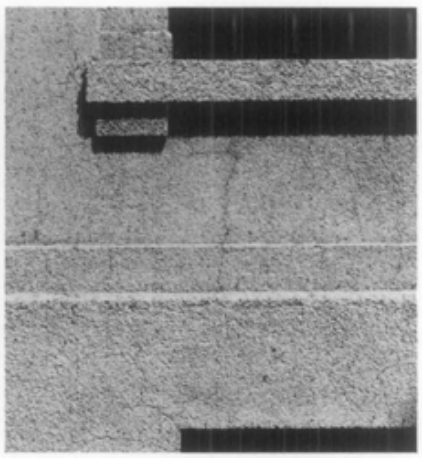


Fig. F

Summary

Stucco on historic buildings is especially vulnerable not only to the wear of time and exposure to the elements, but also at the hands of well-intentioned "restorers," who may want to remove stucco from eighteenth and nineteenth century structures, to expose what they believe to be the original or more "historic" brick, stone or log underneath. Historic stucco is a character-defining feature and should be considered an important historic building material, significant in its own right. While many eighteenth and nineteenth century buildings were stuccoed at the time of construction, others were stuccoed later for reasons of fashion or practicality. As such, it is likely that this stucco has acquired significance over time, as part of the history and evolution of a building. Thus, even later, non-historic stucco should be retained in most instances; and similar logic dictates that new stucco should not be applied to a historic building that was not stuccoed previously. When repairing historic stucco, the new stucco should duplicate the old as closely as possible in strength, composition, color and texture.

Mixes for Repair of Historic Stucco

Historic stucco mixes varied a great deal regionally, depending as they did on the availability of local materials. There are probably almost as many mixes that can be used for repair of historic stucco as there are historic stucco buildings. For this reason it is recommended that at least a rudimentary analysis of the existing historic stucco be carried out in order to determine its general proportions and primary ingredients. However, if this is not possible, or if test results are inconclusive, the following mixes are provided as reference. Many of the publications listed under "Selected Reading" include a variety of stucco mixes and should also be consulted for additional guidance.

Materials Specifications should conform to those contained in *Preservation Briefs 2: Repointing Mortar Joints in Historic Brick Buildings,* and are as follows:

- Lime should conform to ASTM C-207, Type S, Hydrated Lime for Masonry Purposes.
- Sand should conform to ASTM C-144 to assure proper gradation and freedom from impurities. Sand, or other type of aggregate, should match the original as closely as possible.
- Cement should conform to ASTM C-150, Type II (white, non-staining), portland cement.
- Water should be fresh, clean and potable.
- If hair or fiber is used, it should be goat or cattle hair, or pure manilla fiber of good quality, 1/2" to 2" in length, clean, and free of dust, dirt, oil, grease or other impurities.
- Rules to remember: More lime will make the mixture more plastic, but stucco mortar with a very large proportion of lime to sand is more likely to crack because of greater shrinkage; it is also weaker and slower to set. More sand or aggregate, will minimize shrinkage, but make the mixture harder to trowel smooth, and will weaken the mortar.

Soft Lime Stucco (suitable for application to buildings dating from 1700–1850)

A.J. Downing's Recipe for Soft Lime Stucco

1 part lime

2 parts sand

(A.J. Downing, "The Architecture of Country Houses," 1850)

Vieux Carre Masonry Maintenance Guidelines

Base Coats (2):

1 part by volume hydrated lime

3 parts by volume aggregate [sand]—size to match original

6 pounds/cubic yards hair or fiber

Water to form a workable mix.

Finish Coat:

1 part by volume hydrated lime

3 parts aggregate [sand]—size to match original

Water to form a workable mix.

Note: No portland cement is recommended in this mix, but if it is needed to increase the workability of the mix and to decrease the setting time, the amount of portland cement added should never exceed 1 part to 12 parts lime and sand.

("Vieux Carre Masonry Maintenance Guidelines," June, 1980.)

"Materials for Soft Brick Mortar and for Soft Stucco"

5 gallons hydrated lime

10 gallons sand

1 quart white, non-staining portland cement (1 cup only for pointing)

Water to form a workable mix.

(Koch and Wilson, Architects, New Orleans, Louisiana, February, 1980)

Mix for Repair of Traditional Natural Cement or Hydraulic Lime Stucco

1 part by volume hydrated lime

2 parts by volume white portland cement

3 parts by volume fine mason's sand

If hydraulic lime is available, it may be used instead of lime-cement blends.

("Conservation Techniques for the Repair of Historical Ornamental Exterior Stucco, January, 1990)

Early-twentieth century Portland Cement Stucco

1 part portland cement

2 1/2 parts sand

Hydrated lime = to not more than 15% of the cement's volume

Water to form a workable mix.

The same basic mix was used for all coats, but the finish coat generally contained more lime than the undercoats. ("Illinois Preservation Series No. 2: Stucco," January, 1980)

American Portland Cement Stucco Specifications (c. 1929)

Base Coats:

5 pounds, dry, hydrated lime

1 bag portland cement (94 lbs.)

Not less than 3 cubic feet (3 bags) sand (passed through a #8 screen)

Water to make a workable mix.

Finish Coat:

Use WHITE portland cement in the mix in the same proportions as above.

To color the stucco add not more than 10 pounds pigment for each bag of cement contained in the mix.

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Cover Photograph: St. James Church, Goose Creek, Berkeley County, South Carolina (1713–1719), is constructed of brick covered with stucco. Although much restored, it is notable for its ornamental stucco detailing, including rusticated quoins, cherub head "keystones" above the windows, flaming hearts, and a pelican in piety—symbol of the sacrament, in the pediment over the front door. Photo: Gary Hume.