PZ-HIST-23-000233

Menu Reports Help

File Date: 09/07/2023

Application Status: Pending

Assigned To: Alexander Castro

Description of Work: The scope of work for this project shall include the exterior restoration of the building including masonry restoration, window and door replacements, roof and integral gutt better represent the historic storefront.

Application Detail: Detail

Application Type: Historic Preservation

Documents:

File Name	Document Group	Category	Description	Type	Docun
104-110 Jefferson St_9...	PLNG_COA	Photos	Plans and photos	application/pdf	Uploac
2023-08-01 90% Project...	PLNG_COA	Product Specs	Specs	application/pdf	Uploac
Owner letter 94-110 Je...	PLNG_COA	Owners Authoriz...		application/pdf	Uploac

Show all

Address: 104 JEFFERSON ST, HARTFORD, CT 06106

Owner Name: H H MANAGEMENT SERVICES INC

Owner Address: 80 SEYMOUR ST, HARTFORD, CT 06106 331

Application Name:

Parcel No: 226553180

Contact Info:

Name	Organization Name	Contact Type	Contact Primary Address	Status
Dave Casale	Hartford Health...	Owner	Mailing, 129 Patricia ...	Active

Licensed Professionals Info:

Primary	License Number	License Type	Name	Business Name	Business License #
Yes	ARI.0014484	ARCHITECT	LAURA CROSSKEY		

Job Value: $0.00

Total Fee Assessed: $200.00

Total Fee Invoiced: $200.00

Balance: $150.00

Custom Fields: PLNG_COA_CF

GIS Information

Zoning District
MS-1

Zoning Overlay
_

FEMA Flood Zone
_

Land Use Per Assessor
_

NRZ
FROG HOLLOW NRZ

Neighborhood
SOUTH GREEN

Local Historic District
_

Historic District
_

Historic Landmark/Site

State Historic District
_

Dispersion met?
No

Identify Dispersion
_

National Historic District
Jefferson Seymour

General Project Information

Is this application a result of a violation notice?
No

Zoning Enforcement Case ID #
_

Is this a contributing building or structure?
No

Is this proposed work visible from the street?
No

Historic Review Types

New Construction/Addition
No

Exterior Alteration
No

Demolition
No

Signage
Yes

Solar Panel
No

Other

Repair

Does this project include a demolition?
No

If a demolition request, what alternatives have you sought?
n/a

Exterior Alterations

Windows	**Doors**
√	√
Porches/Walkways	**Siding**
√	√
Roofs	**Mechanical Appurtenances**
√	

Other
see documents

Describe the existing conditions and materials
see documents

Describe the proposed materials
see documents

Hardships and Reason for Hardships

Is this an owner-occupied principal residence?
No

Is this a non-owner occupied residential building containing six (6) or fewer dwelling units?
No

Is this a commercial and industrial building?
No

Is this a request for demolition where there is no feasible and prudent alternative to demolition?
No

Other Payment Required

Green Infrastructure Fund	**Amount**
	–
City Tree Fund	**Amount**
	–
Complete Street Fund	**Amount**
	–

Describe Reason for Payments
–

Reason for Request

Reason for Request
–

Recommendation

Recommendation

–

Adverse Impacts on Neighboring Lands **Suitability as Presently Zoned**

– –

Consistency with POCD

–

This is a dynamic label.

PLNG_COA_DIGEPLAN
Enhanced Doc List

–

Reason for Hardship
Cost of historic preservation recommendations: **Economic circumstances of the applicant:Lack of availa**

Impact of the historic preservation recommendations on the district as a whole and on property value

Dates and Notices

Application Received	**Open Hearing Deadline**	**Close Hearing Deadline**
–	–	–
Decision Deadline	**Extensions Requested?**	**If yes, describe how the dates abc**
–	–	–
Notice sent to NRZ/CRCOG	**Legal Ad #1**	**Legal Ad #2**
–	–	–
Sign Affidavit Received	**Certificate of Mailings Returned**	**Notice of Decision Published**
–	–	–
Recordation Date	**Approval Expiration Date**	**Sign Deposit Check #**
–	–	–
Sign Deposit Date Received	**Sign Deposit Check Amount**	**Public Hearing Date**
–	–	–
Public Hearing Time	**Meeting Link or Location**	**Document Link**
–	–	–

Certificate of Compliance

As-Built Drawing Date	**Type of Bond**	**Escrow Account #**
–	–	–
Bonding Company Name	**Bonding Contact Name**	**Bonding Primary Phone #**
–	–	–
Bonding Email	**Drawings Number of Sheets**	**Drawings Last Revised**
–	–	–

Prior Approvals

Type of Permit/Authorization	Issued By	Issued Date	Expiration Date

Resolution Clauses

Type	Comment

Workflow Status:

Task	Assigned To	Status	Status Date	Action By
Application Intake	Alexander Castro			
Planning and Zoning Re...				
Public Notice				
Historic Commission				
Notice of Decision				
Appeal Period				
Permit Issuance				
Permit Status				
Certificate of Plannin...				
Case Complete				

Condition Status:

Name	Short Comments	Status	Apply Date	Severity	Action By

Application Comments:

View ID	Comment	Date

Initiated by Product: ACA

Scheduled/Pending Inspections:

Inspection Type	Scheduled Date	Inspector	Status	Comments

Resulted Inspections:

Inspection Type	Inspection Date	Inspector	Status	Comments

Exterior Restoration of 104-110 Jefferson Street

Hartford, CT 06103
90% Submission
August 1, 2023

Owner:
Hartford HealthCare
Hartford HealthCare Corporation
100 Pearl Street,
Hartford, CT 06103
860-696-6167

Architect:
Crosskey Architects LLC
750 Main Street
Hartford, CT 06103
860-724-3000

SYMBOL LEGEND

Symbol	Description
1 / A-8 — Detail # / Sheet #	Indicates reference to building section
1 / A-8 — Detail # / Sheet #	Indicates reference to construction detail
1 / A-8 — Solid indicates elev. direction	Indicates elevation
x'-y"	Indicates dimension from face of framing
Enlarged Detail — AA / A1.1 (Plan detail number / Sheet detail found on) — Construction detail reference	
A	Indicates window. See window schedule for more information.
100	Door reference tag. See Door Schedule.
A	Indicates wall construction assembly.
	Indicates handicap accessibility

NOTES

SCOPE OF WORK DESCRIPTION:

The c. 1900 historic building on the corner of Jefferson and Seymour Street is a four story mixed-use building listed as a contributing building to the Jefferson-Seymour Street Historic District listed on the National Register of Historic Places.

The scope of work for this project shall include the exterior restoration of the building including masonry restoration, window and door replacements, roof and integral gutter replacement, and replacement of the storefront to better represent the historic storefront.

Note: Reference RESTORATION NOTES on subsequent sheets for guidance on restorative work.

DEFINITIONS:

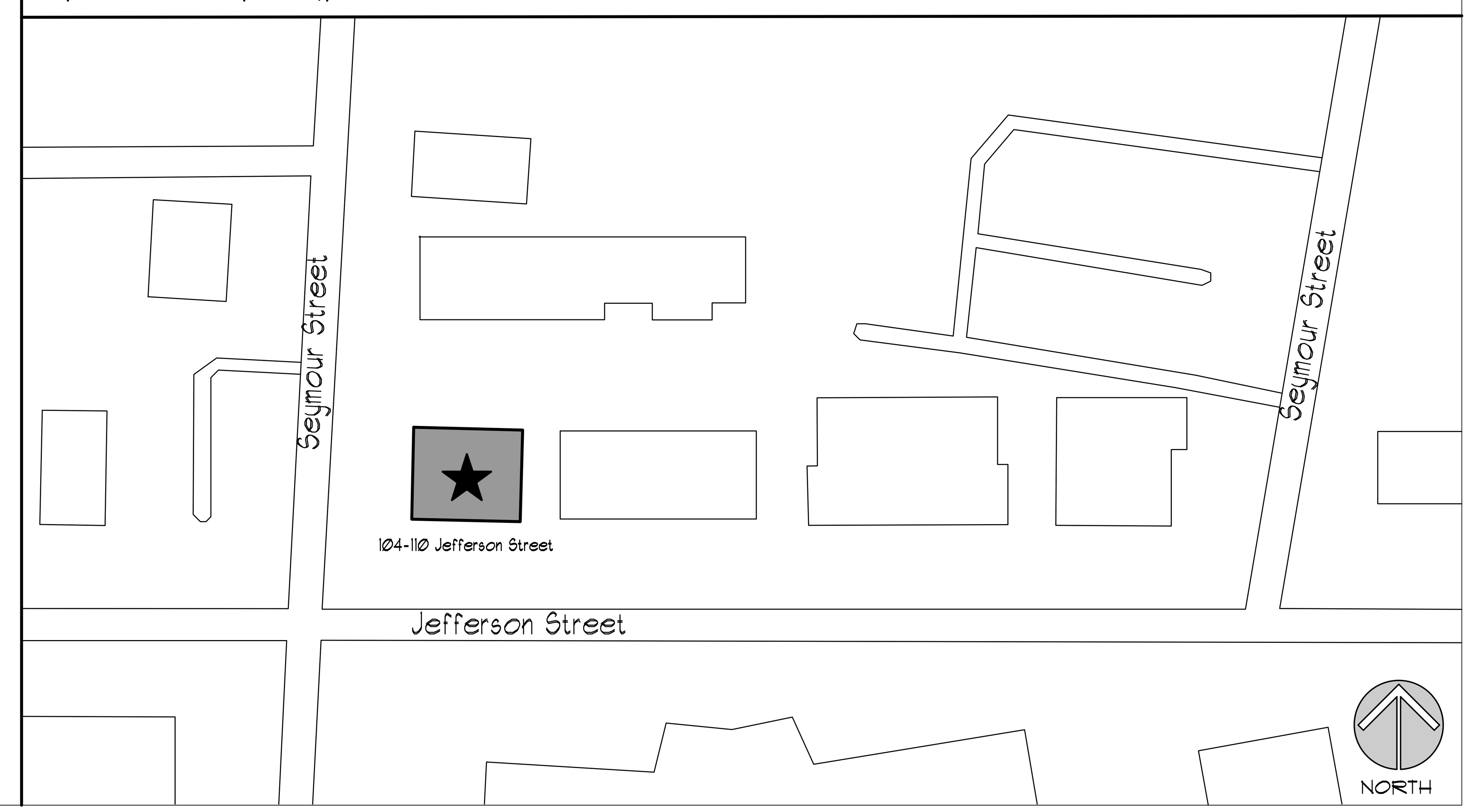
RESTORE	Renovate to original "like new" condition. If portions of work are damaged beyond repair, consult architect and replace w/ new to replicate original.
CLEAN	Remove dirt, soil, debris and any foreign elements adhered to the surface per Preservation Brief #1 - Cleaning and Water Repellent treatments for Historic Masonry Buildings. Consult with Architect on method of cleaning.
REPLACE	Remove existing and provide & install new material. Replacement material shall match existing component.
REFINISH	Renovate existing finish to original "like new" condition.
REFURBISH	Clean, restore, refinish to match original "like new" condition.
MATCH EXISTING	Area of work shall replicate in every respect similar elements, finishes, joinery, etc., which are existing. If existing work is to be improved, items noted to match existing shall match the improved condition.
**NOTE:	In all of the above, consult w/ Architect and refer to plans.

DRAWING INDEX

ABBREVIATIONS

ABBREV	Abbreviation
AFF	Above finished Floor
AP	Applied Decoration
APPROX	Approximate
ARCH	Architectural
B	Baluster
BA	Braced Arch
BD	Board
BK	Bracket (Chamfered)
BLDG	Building
BR	Bottom Rail
℄	Center Line
C	Column or Column Component
CB	Collar Beam
CJ	Control Joint
CLG	Ceiling
CLKG	Caulking
CLR	Clear
CONT	Continuous
CTR	Center
D	Diagonal Baluster
DB	Deck Beam
DIA	Diameter
DIM	Dimension
DWG	Drawing
E	East
EA	Each
EJ	Extended Joist
EL	Elevation
EQ	Equal
EXG	Existing
EXT	Exterior
FJ	Floor Joist
FLRG	Flooring
FT	Foot or Feet
GB	Gutter Bracket
GC	General Contractor
GR	Grille
HGT	Height
HORIZ	Horizontal
IN	Inch
INT	Interior
JB	Jigsawn Bracket
KP	Kingpost
LB	Lateral Beam
LF	Lineal Foot
MAX	Maximum
MD	Medallion
MFR	Manufacturer
MIN	Minimum
MISC	Miscellaneous
MTD	Mounted
MTL	Metal
N	North
NIC	Not In Contract
NO	or # Number
NOM	Nominal
NTS	Not To Scale
OC	On Center
OPNG	Opening
OPP	Opposite
P	Intermediate Post
PD	Pendant
PTD	Painted
R	Intermediate Railing
RA	Rafter
RB	Ridge Beam
RD	Roof Decking
REFR	Reference
REQ'D	Required
RI	Riser
RK	Rake Board
RT	Rafter Tail
S	South
SC	Scotia
SF	Square Foot
SIM	Simliar
SK	Skirting
SQ	Square
ST	Strut
STD	Standard
SW	Stickwork
T	Trim
T&B	Top & Bottom
T&G	Tongue & Groove
TO	Top of
TR	Top Rail
TYP	Typical
VIF	Verify in Field
W	West
W/	With
WB	Wall Base
WD	Wood
W/O	Without

LOCATION DIAGRAM



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Exterior Restoration of 104-110 Jefferson St.

Hartford, CT.

Hartford HealthCare Corporation

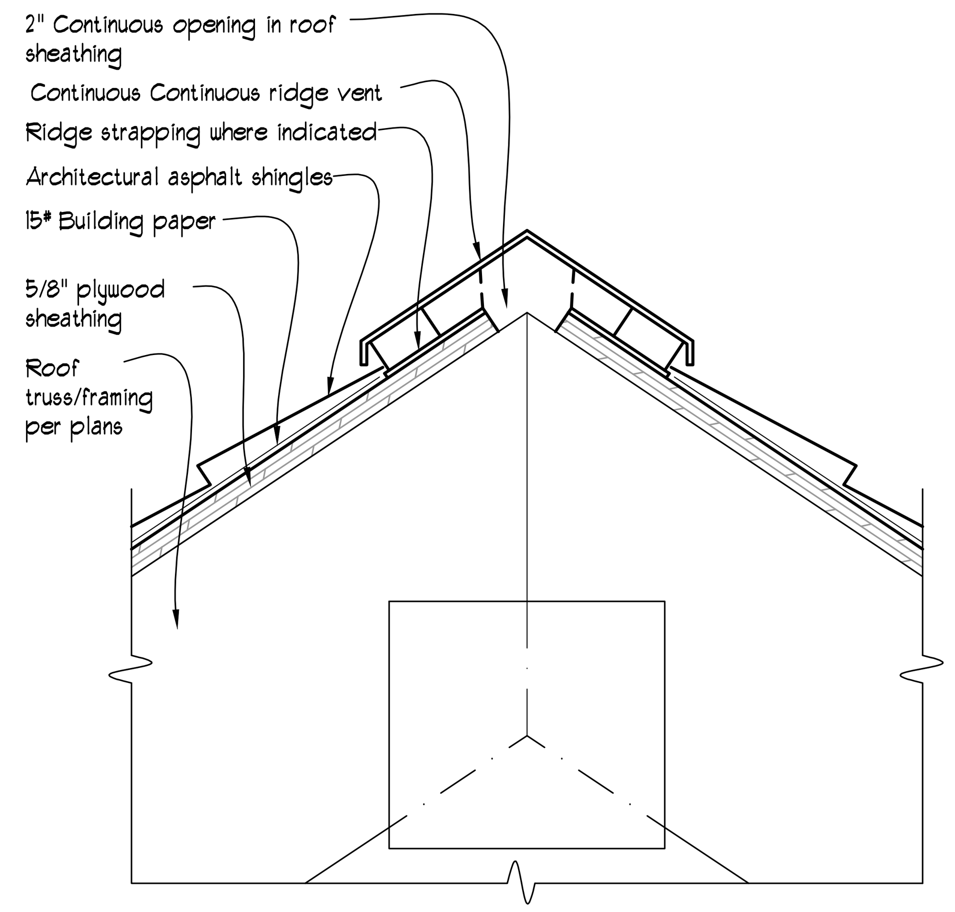
100 Pearl Street, Hartford, CT 06103

90% Submission Set
NOT FOR CONSTRUCTION

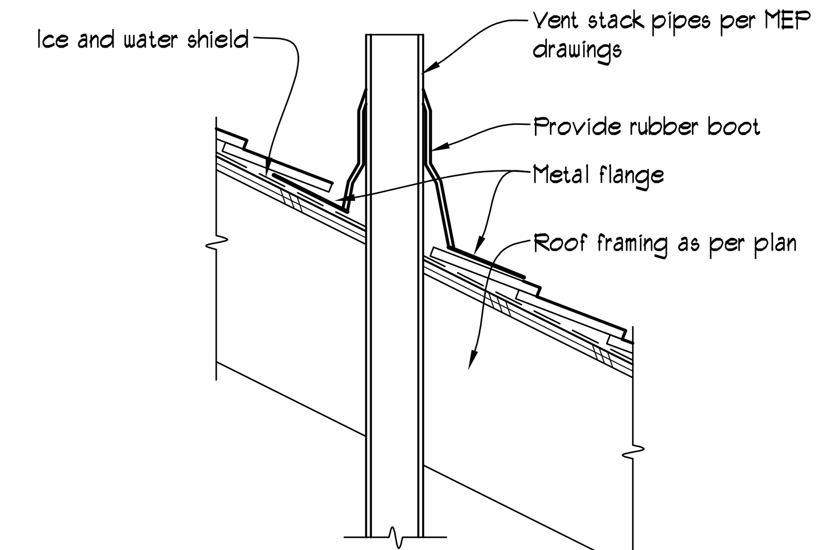
Drawn: RM
Date: August 1, 2023
Revisions

General Information & Drawing Index

G-1

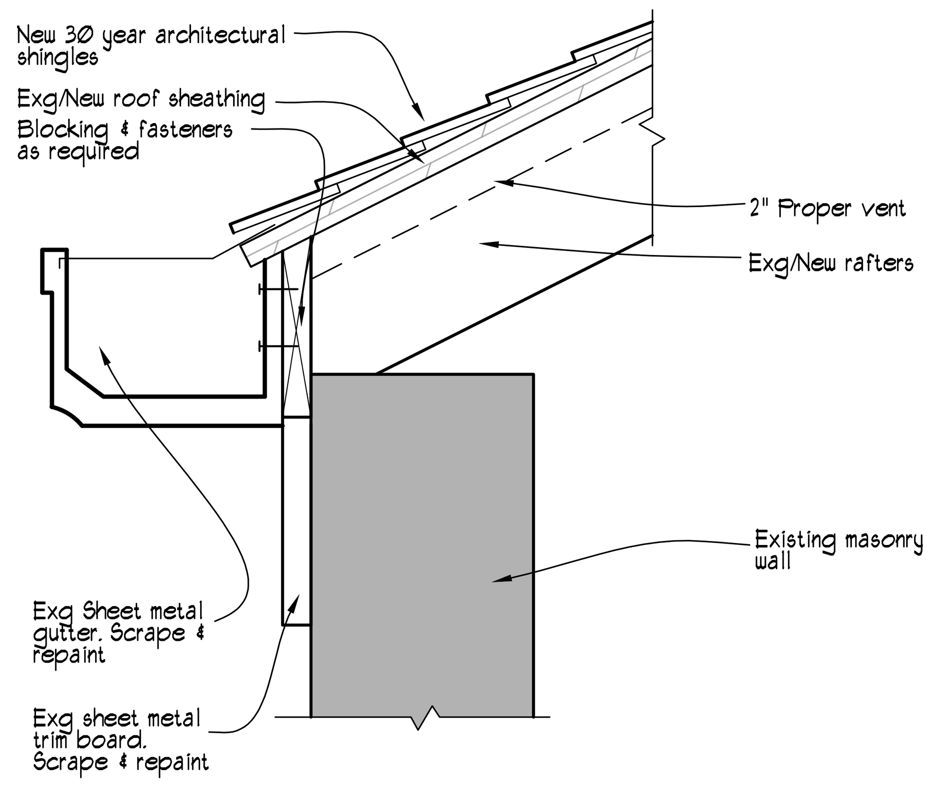


5 TYP. CONTINUOUS RIDGE VENT DETAIL
SCALE: 3"=1'-0"

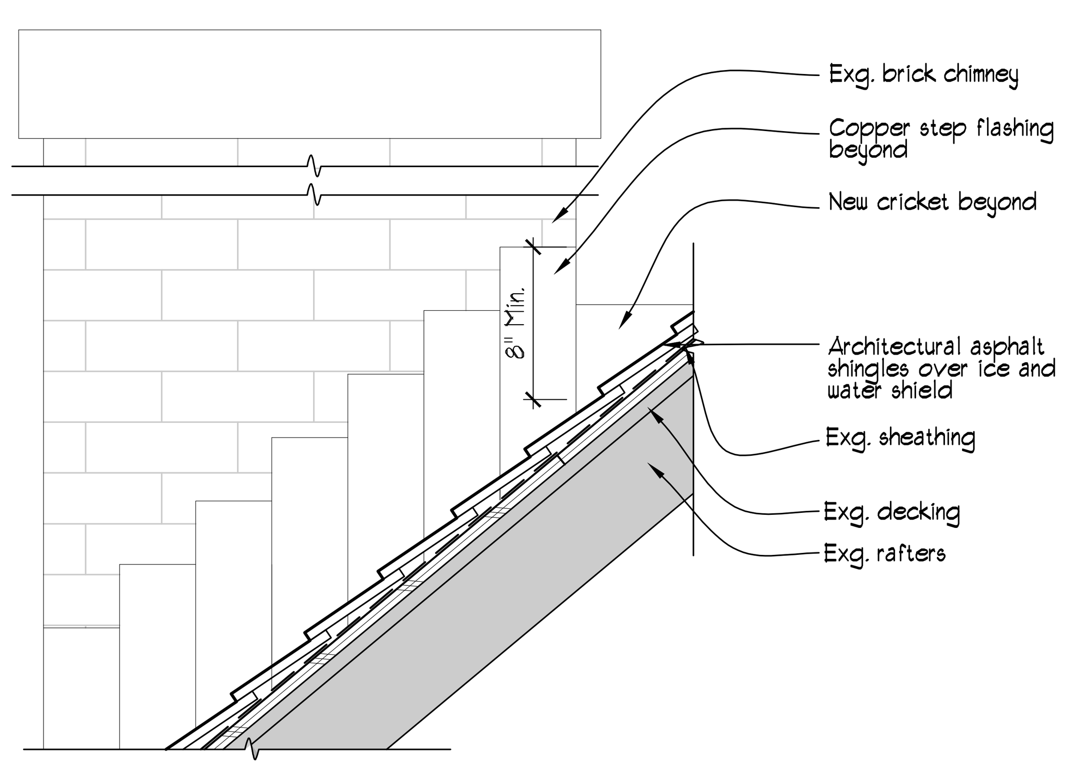


4 VENT STACK DETAIL
SCALE: 1 1/2"=1'-0"

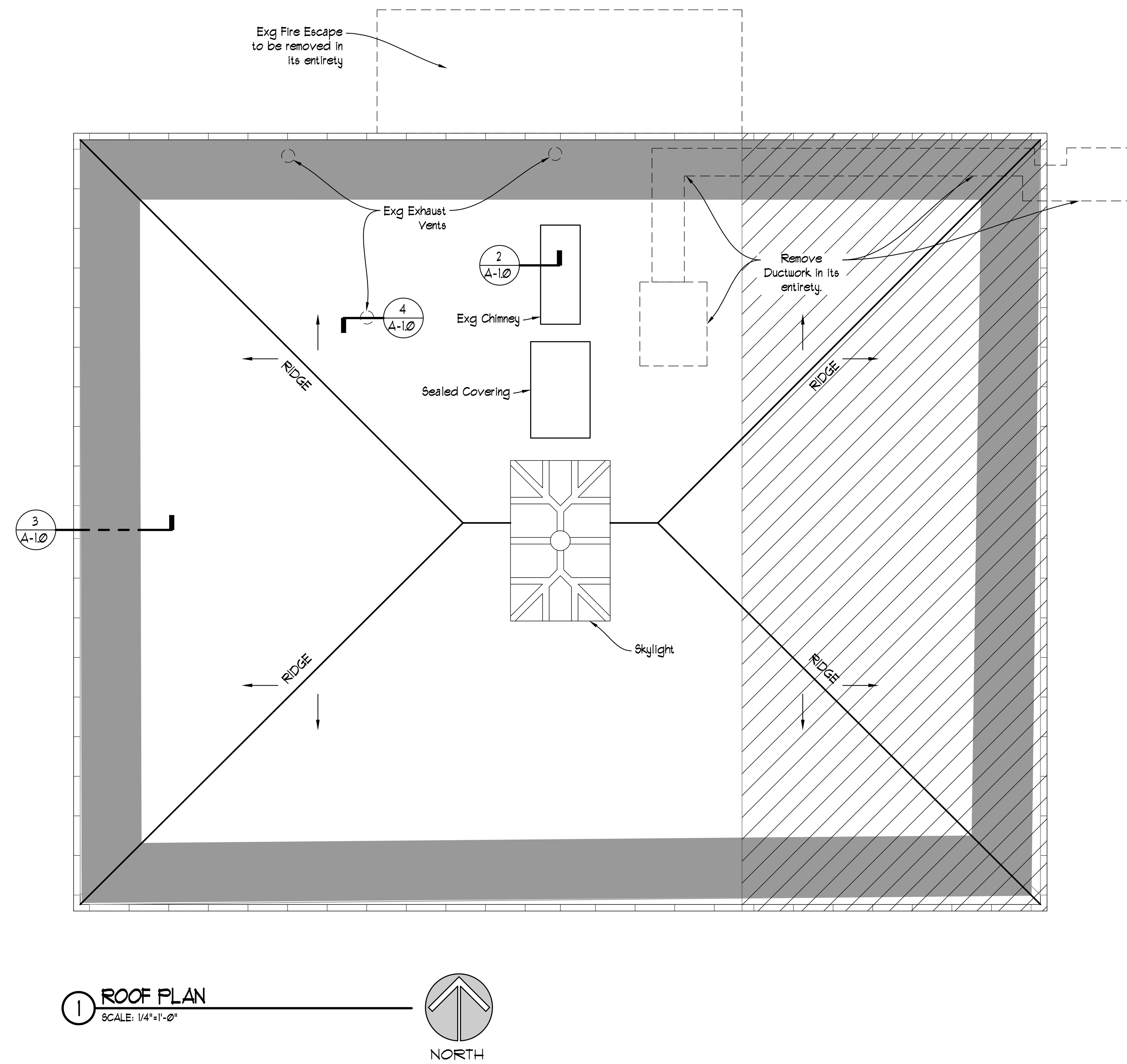
NOTE: Angle vents in attic shown in Mech. drawings.



3 INTEGRAL GUTTER
SCALE: 1 1/2"=1'-0"



2 DETAIL @ CHIMNEY
SCALE: 1 1/2"=1'-0"



1 ROOF PLAN
SCALE: 1/4"=1'-0"

NEW WORK GENERAL NOTES

1. ALL MATERIALS ARE TO BE NEW UNLESS NOTED OTHERWISE.
2. CONTRACTOR SHALL REMOVE AND RE-INSTALL ANY ITEM OR COMPONENT AS REQUIRED FOR NEW ROOF SHINGLES INSTALLATION, WHETHER OR NOT SPECIFICALLY SHOWN ON DRAWING.
3. ROOFING SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS TO MAINTAIN A TOTAL SYSTEM WARRANTY.
4. CONTRACTOR SHALL PROVIDE ANY WOOD BLOCKING REQUIRED FOR THE COMPLETION OF WORK.
5. ALL ROOF ACCESSORIES TO BE REPLACED. CONTRACTOR TO VERIFY SIZE, LOCATION & QUANTITY OF ALL PENETRATIONS SUCH AS PLUMBING VENT PIPES, MECHANICAL VENTS, ROOF HATCHES , ETC. INSTALL THE REQUIRED ROOFING AND FLASHING PER MANUFACTURER'S INSTALLATION INSTRUCTIONS AROUND THESE PENETRATIONS SO AS TO CREATE A WEATHER TIGHT SEAL AND MAINTAIN SYSTEM WARRANTY.
6. THE EXISTING PLYWOOD SHEATHING BELOW ASPHALT SHINGLES TO REMAIN. CONTRACTOR TO REVIEW EXISTING CONDITIONS & SUBMIT DOCUMENTATION TO ARCHITECT FOR APPROVAL OF QUANTITY & UNIT PRICE IN CASE REPLACEMENT IS REQUIRED.
7. NEW RIDGE VENTS AT EXISTING LOCATIONS. REFER TO NEW WORK NOTES FOR MORE INFORMATION.

ROOF PLAN LEGEND

INDICATES EXISTING ROOF COMPONENT TO BE REMOVED.

INDICATES ARE TO RECEIVE NEW ROOF RAFTERS AND SHEATHING TO MATCH EXISTING ADJACENT. ASSUME FULL REPLACEMENT, FROM EAVE TO RIDGE.

INDICATES AREA OF ROOF TO RECEIVE ROOF REPLACEMENT: REMOVE EXISTING SHINGLES & INSTALL 2-PLY ARCHITECTURAL SHINGLES, AS SPECIFIED, OVER 15# ROOFING FELT OVER. REPLACE ROTTED PLYWOOD SHEATHING WHERE REQUIRED TO MATCH EXISTING.

INDICATES AREA OF ROOF TO RECEIVE ICE & WATER SHIELD OVER EXISTING/NEW SHEATHING

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Hartford HealthCare Corporation
100 Pearl Street, Hartford, CT 06103

90% Submission Set
NOT FOR CONSTRUCTION

Drawn: RM
Date: August 1, 2023
Revisions

Roof Plan

A-1.0

1 SOUTH ELEVATION
SCALE: 1/4"=1'-0"

2 SOUTH ELEVATION EXG. CONDITIONS
SCALE: 1/4"=1'-0"

MATERIALS LEGEND

- Indicates 3" or 4" exterior clapboard or flatboard wood siding as noted.
- Indicates 5" exterior wood shake shingles with octagon cut shingles on 2nd course.
- Indicates 3" flat stock siding.
- Indicates exterior brick masonry.
- Indicates brownstone masonry.

RESTORATION LEGEND

X Restoration Key Note Tag

Areas clouded indicates visibly documented area of extreme deterioration/rot.

Keynotes are meant to supplement specifications and Preservation briefs referenced in these drawings.

LIST OF REQUIRED MOCKUPS

Below is a list of mock-ups required for review and approval by architect.

1. Exterior Masonry Cleaning.
2. Exterior Mortar Repointing.
3. Replacement Brick.
4. Patching of Stone (brownstone)
5. Restored Window.
6. Wood Component replacement

WOOD PRESERVATION & RESTORATION NOTES

W1. Using an ice pick or awl, test wood for soundness and inspect wood to determine scope and cause of deterioration from water damage.

W2. Remove paint per Preservation Brief #10 - Exterior Paint Problems on Historic Woodwork.

W3. Dry wood thoroughly before treating decayed area.

W4. Scrape away any loose deterioration per Preservation Brief #10, until only undamaged wood remains.

W5. For areas too heavily deteriorated, remove the absolute minimum required to prevent future water damage. Splice in new material scarf joint sloped to building exterior which matches existing.

W6. Replace any missing or unrepairable wood members. Material and construction to match existing/surrounding area.

W7. Treat decayed areas of wood displaying evidence of rot with wood preservative per USDA Forest Service Guide for Use of Wood Preservatives in Historic Structures.

W8. Putty, epoxy patch, or epoxy inject all cracks and holes in wood unless noted otherwise to achieve a matching aesthetic to that of the original wood member. If/when necessary, epoxy patching compounds can be used to build up missing sections and decayed members.

W9. After removal of rot and patching/repair is complete, waterproof entire wood member with three applications of boiled linseed oil (one application every 24 hours).

W10. Once linseed oil has set, paint wood member according to "General Paint Type Recommendation" section of Preservation Brief #10 - Exterior Paint Problems on Historic Woodwork. Colors to be selected by Architect.

RESTORATION KEY NOTES

1. Indicates area of damaged Brownstone. Clean and patch/repair with 'Jahn M70 Limestone Repair Mortar' to match existing.
2. Restore brownstone sill/lintel. Patch with 'Jahn M70 Limestone Repair Mortar' or approved equal. Paint to match brownstone color.
3. Indicates window to be replaced. Refer to window schedule for additional information.
4. Replace damage or spalling brick sill with new to match existing.
5. Remove existing awning and repair/patch brick as required.
6. Remove exterior exhaust ductwork in its entirety.
7. Remove egress stair in its entirety.
8. Clean area of staining & environmental contaminates. Patch brick to match existing
9. Replace roofing. Replace damaged sheathing and roof rafters. Assume 50% replacement for each.. Reinstall 30 year asphalt shingles over underlayment as specified.
10. Replace storefront. Refer to Storefront Elevations for additional information.
11. Indicates existing brownstone sill/lintel to be replaced with new precast concrete product to match existing brownstone. Color, texture and profile shall match existing EXACTLY. Provide shop drawings & samples for review by Architect.
12. Denotes area of mortar to be re-pointed. Where located at masonry openings, repoint both the return and face of masonry. Assume for bidding: 50% repointing.
13. Remove existing satellite dishes in their entirety.
14. Restore Skylight replace any broken glass, refurbish frame, cut out & replace rotted metal. Repaint with metal paint & reset glass.
15. Remove paint & Graffiti per General Restoration Note 'V'.
16. CMU stair enclosure to remain. Remove the metal stair, and install plywood & membrane roofing above CMU enclosure. Patch & repair brick with new to match existing.
17. Secure existing doors in place.
18. Install security bars as per details on Window sheet A-6.0.
19. Remove aluminum plating above storefront windows and report what is behind.
20. Replace damage or spalling brick sill with new concrete sill per detail 8/A-6.1.
21. Rebuild chimney top & install new stone cap.

GENERAL RESTORATION NOTES

A. Repointing mortar shall match the color, texture, strength, joint width and joint profile of the existing historic masonry.

B. Clean exterior brick and stone surfaces of paint, black staining, rust staining, bio growth, environmental contaminants and efflorescence using mild detergents at water line pressure. Work shall be performed in accordance with Preservation Brief 1.

C. Clean and repaint all windows, doors and wood components including soffits, fascias, shingle moldings, cornice boards, rafter tails, brackets, cupola and roof finials. Scrape and sand areas of loose or flaking paint prior to repainting. Refer to Wood Preservation and Restoration Notes for additional Information.

D. Restore deteriorated window frame, sash, sill and all trim components. Refer to Preservation Brief 9. Refer to plans and window schedule for additional information.

I. Restore deteriorated door, frame and all trim components. Refer to plans and door schedule for additional information.

J. Restore all existing door & window hardware. Refer to specifications for details.

K. Re-set or re-fasten all loose wood members.

L. Contractor to notify Architect, if after evaluation, additional components may require replacement and/or if the replacement of a component requires dismantling of adjacent components.

M. G.C. shall field verify all dimensions and profiles of components to be replaced prior to removing existing component and provide shop drawings of all components to be replaced to the Architect for review.

N. All new wood components shall be Cedar of a clear (knot-free) grade and vertical grain.

O. All components removed as required for restoration or replaced shall be re-installed in the same manner as the existing component (i.e. mortise & tenon, dovetailed, wood plug, and/or metal fastenings). All new metal fastenings shall be hot-dipped galvanized.

P. Remove all ivy and vegetation from all facades.

Q. Close up all miscellaneous holes in brick walls, such as pipe penetrations, fastener holes and damaged, or missing masonry. New material to match existing.

S. Contractor to provide all demolition and dumpsters as is necessary to complete the work.

T. Notes on building elevations are not intended to limit the scope of work for repair, replacement and restoration of the building exterior. The contractor shall be required to repair and restore the entire building envelope.

U. If plans and specifications provide conflicting information, then the strictest, most expensive interpretation shall apply.

V. Remove paint & graffiti from all exposed brick surfaces unless noted otherwise. Graffiti removal must be accomplished using the gentlest means possible without damaging the surface of the masonry. This work must be accomplished in accordance with the guidance provided in Preservation Brief 38, 'Removing Graffiti from Historic Masonry'.

W. Prior to repointing any masonry, the contractor shall have existing masonry, brick and mortar tested by a testing laboratory to determine the proper strength of the new mortar mix. New masonry units and mortar shall match existing color, strength, composition and mixture. Repoint all mortar, joints deeper than $\frac{1}{4}$". Joint profile to match existing.

X. Clouded areas indicate areas of existing materials which require attention. Refer to keyed notes below for clarification.

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Hartford, CT.

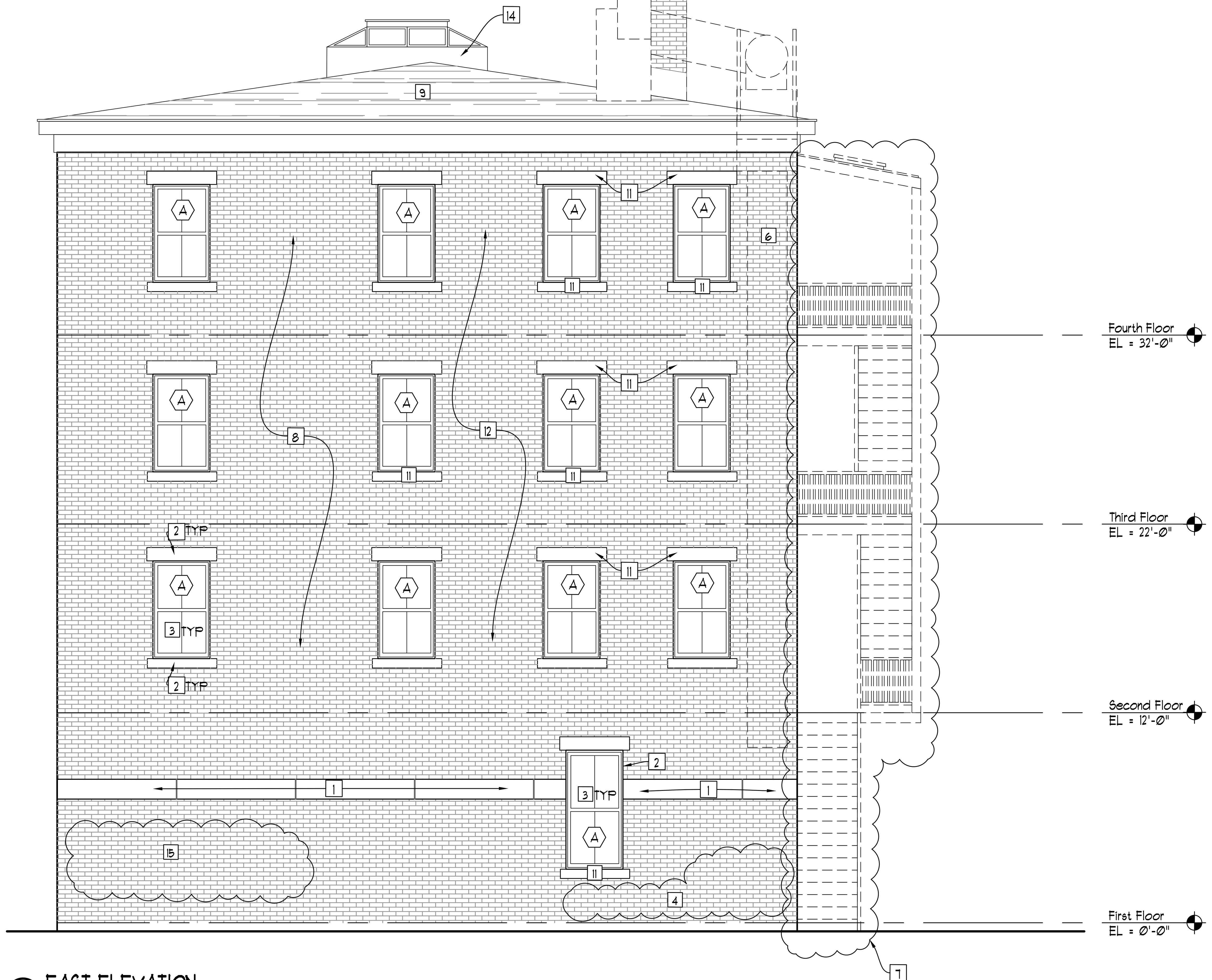
Hartford HealthCare Corporation
100 Pearl Street, Hartford, CT 06103

90% Submission Set
NOT FOR CONSTRUCTION

Drawn: RM
Date: August 1, 2023
Revisions

Exterior Elevations - South

A-2.0



1 EAST ELEVATION
SCALE: 1/4"=1'-0"

MATERIALS LEGEND

- Indicates 3" or 4" exterior clapboard or flatboard wood siding as noted.
- Indicates 5" exterior wood shake shingles with octagon cut shingles on 2nd course.
- Indicates 3" flat stock siding.
- Indicates exterior brick masonry.
- Indicates brownstone masonry.

RESTORATION LEGEND

X Restoration Key Note Tag

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Keynotes are meant to supplement specifications and Preservation briefs referenced in these drawings.

LIST OF REQUIRED MOCKUPS

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2. Exterior Mortar Repointing.
3. Replacement Brick
4. Patching of Stone (brownstone)
5. Restored Window.
6. Wood Component replacement

WOOD PRESERVATION & RESTORATION NOTES

W1. Using an ice pick or awl, test wood for soundness and inspect wood to determine scope and cause of deterioration from water damage.

W2. Remove paint per Preservation Brief #10 - Exterior Paint Problems on Historic Woodwork.

W3. Dry wood thoroughly before treating decayed area.

W4. Scrape away any loose deterioration per Preservation Brief #10, until only undamaged wood remains.

W5. For areas too heavily deteriorated, remove the absolute minimum required to prevent future water damage. Splice in new material scarf joint sloped to building exterior which matches existing.

W6. Replace any missing or unrepairable wood members. Material and construction to match existing/surrounding area.

W7. Treat decayed areas of wood displaying evidence of rot with wood preservative per USDA Forest Service Guide for Use of Wood Preservatives in Historic Structures.

W8. Putty, epoxy patch, or epoxy inject all cracks and holes in wood unless noted otherwise to achieve a matching aesthetic to that of the original wood member. If/when necessary, epoxy patching compounds can be used to build up missing sections and decayed members.

W9. After removal of rot and patching/repair is complete, waterproof entire wood member with three applications of boiled linseed oil (one application every 24 hours).

W10. Once linseed oil has set, paint wood member according to "General Paint Type Recommendation" section of Preservation Brief #10 - Exterior Paint Problems on Historic Woodwork. Colors to be selected by Architect.

RESTORATION KEY NOTES

1. Indicates area of damaged Brownstone. Clean and patch/repair with 'Jahn M70 Limestone Repair Mortar' to match existing.
2. Restore brownstone sill/lintel. Patch with 'Jahn M70 Limestone Repair Mortar' or approved equal. Paint to match brownstone color.
3. Indicates window to be replaced. Refer to window schedule for additional information.
4. Replace damage or spalling brick sill with new to match existing.
5. Remove existing awning and repair/patch brick as required.
6. Remove exterior exhaust ductwork in its entirety.
7. Remove egress stair in its entirety.
8. Clean area of staining & environmental contaminates. Patch brick to match existing
9. Replace roofing. Replace damaged sheathing and roof rafters. Assume 50% replacement for each.. Reinstall 30 year asphalt shingles over underlayment as specified.
10. Replace storefront. Refer to Storefront Elevations for additional information.
11. Indicates existing brownstone sill/lintel to be replaced with new precast concrete product to match existing brownstone. Color, texture and profile shall match existing EXACTLY. Provide shop drawings & samples for review by Architect.
12. Denotes area of mortar to be re-pointed. Where located at masonry openings, repoint both the return and face of masonry. Assume for bidding: 50% repointing.
13. Remove existing satellite dishes in their entirety.
14. Restore Skylight replace any broken glass, refurbish frame, cut out & replace rotted metal. Repaint with metal paint & reset glass.
15. Remove paint & Graffiti per General Restoration Note 'V'.
16. CMU stair enclosure to remain. Remove the metal stair, and install plywood & membrane roofing above CMU enclosure. Patch & repair brick with new to match existing.
17. Secure existing doors in place.
18. Install security bars as per details on Window sheet A-6.0.
19. Remove aluminum plating above storefront windows and report what is behind.
20. Replace damage or spalling brick sill with new concrete sill per detail 8/A-6.1.
21. Rebuild chimney top & install new stone cap.

GENERAL RESTORATION NOTES

A. Repointing mortar shall match the color, texture, strength, joint width and joint profile of the existing historic masonry.

B. Clean exterior brick and stone surfaces of paint, black staining, rust staining, bio growth, environmental contaminants and efflorescence using mild detergents at water line pressure. Work shall be performed in accordance with Preservation Brief 1.

C. Clean and repaint all windows, doors and wood components including soffits, fascias, shingle moldings, cornice boards, rafter tails, brackets, cupola and roof finials. Scrape and sand areas of loose or flaking paint prior to repainting. Refer to Wood Preservation and Restoration Notes for additional Information.

D. Restore deteriorated window frame, sash, sill and all trim components. Refer to Preservation Brief 9. Refer to plans and window schedule for additional information.

I. Restore deteriorated door, frame and all trim components. Refer to plans and door schedule for additional information.

J. Restore all existing door & window hardware. Refer to specifications for details.

K. Re-set or re-fasten all loose wood members.

L. Contractor to notify Architect, if after evaluation, additional components may require replacement and/or if the replacement of a component requires dismantling of adjacent components.

M. G.C. shall field verify all dimensions and profiles of components to be replaced prior to removing existing component and provide shop drawings of all components to be replaced to the Architect for review.

N. All new wood components shall be Cedar of a clear (knot-free) grade and vertical grain.

O. All components removed as required for restoration or replaced shall be re-installed in the same manner as the existing component (i.e. mortise & tenon, dovetailed, wood plug, and/or metal fastenings). All new metal fastenings shall be hot-dipped galvanized.

P. Remove all ivy and vegetation from all facades.

Q. Close up all miscellaneous holes in brick walls, such as pipe penetrations, fastener holes and damaged, or missing masonry. New material to match existing.

S. Contractor to provide all demolition and dumpsters as is necessary to complete the work.

T. Notes on building elevations are not intended to limit the scope of work for repair, replacement and restoration of the building exterior. The contractor shall be required to repair and restore the entire building envelope.

U. If plans and specifications provide conflicting information, then the strictest, most expensive interpretation shall apply.

V. Remove paint & graffiti from all exposed brick surfaces unless noted otherwise. Graffiti removal must be accomplished using the gentlest means possible without damaging the surface of the masonry. This work must be accomplished in accordance with the guidance provided in Preservation Brief 38, 'Removing Graffiti from Historic Masonry'.

W. Prior to repointing any masonry, the contractor shall have existing masonry, brick and mortar tested by a testing laboratory to determine the proper strength of the new mortar mix. New masonry units and mortar shall match existing color, strength, composition and mixture. Repoint all mortar, joints deeper than $\frac{1}{4}$". Joint profile to match existing.

X. Clouded areas indicate areas of existing materials which require attention. Refer to keyed notes below for clarification.

Crosskey Architects LLC
Architecture Preservation Planning
750 Main Street, Hartford, CT 06103
T: (860)724-3000 F: (860)724-3013

Exterior Restoration of 104-110 Jefferson St.

Hartford, CT.

Hartford HealthCare Corporation
100 Pearl Street, Hartford, CT 06103

90% Submission Set
NOT FOR CONSTRUCTION

Drawn: RM
Date: August 1, 2023
Revisions

Exterior Elevations - East

A-2.1

1 NORTH ELEVATION
SCALE: 1/4"=1'-0"

MATERIALS LEGEND

- Indicates 3" or 4" exterior clapboard or flatboard wood siding as noted.
- Indicates 5" exterior wood shake shingles with octagon cut shingles on 2nd course.
- Indicates 3" flat stock siding.
- Indicates exterior brick masonry.
- Indicates brownstone masonry.

RESTORATION LEGEND

X Restoration Key Note Tag

Areas clouded indicates visibly documented area of extreme deterioration/rot.

Keynotes are meant to supplement specifications and Preservation briefs referenced in these drawings.

LIST OF REQUIRED MOCKUPS

Below is a list of mock-ups required for review and approval by architect.

1. Exterior Masonry Cleaning.
2. Exterior Mortar Repointing.
3. Replacement Brick
4. Patching of Stone (brownstone)
5. Restored Window.
6. Wood Component replacement

WOOD PRESERVATION & RESTORATION NOTES

W1. Using an ice pick or awl, test wood for soundness and inspect wood to determine scope and cause of deterioration from water damage.
W2. Remove paint per Preservation Brief #10 - Exterior Paint Problems on Historic Woodwork.
W3. Dry wood thoroughly before treating decayed area.
W4. Scrape away any loose deterioration per Preservation Brief #10, until only undamaged wood remains.
W5. For areas too heavily deteriorated, remove the absolute minimum required to prevent future water damage. Splice in new material scarf joint sloped to building exterior which matches existing.
W6. Replace any missing or unrepairable wood members. Material and construction to match existing/surrounding area.
W7. Treat decayed areas of wood displaying evidence of rot with wood preservative per USDA Forest Service Guide for Use of Wood Preservatives in Historic Structures.
W8. Putty, epoxy patch, or epoxy inject all cracks and holes in wood unless noted otherwise to achieve a matching aesthetic to that of the original wood member. If/when necessary, epoxy patching compounds can be used to build up missing sections and decayed members.
W9. After removal of rot and patching/repair is complete, waterproof entire wood member with three applications of boiled linseed oil (one application every 24 hours).
W10. Once linseed oil has set, paint wood member according to "General Paint Type Recommendation" section of Preservation Brief #10 - Exterior Paint Problems on Historic Woodwork. Colors to be selected by Architect.

RESTORATION KEY NOTES

1. Indicates area of damaged Brownstone. Clean and patch/repair with 'Jahn M70 Limestone Repair Mortar' to match existing.
2. Restore brownstone sill/lintel. Patch with 'Jahn M70 Limestone Repair Mortar' or approved equal. Paint to match brownstone color.
3. Indicates window to be replaced. Refer to window schedule for additional information.
4. Replace damage or spalling brick sill with new to match existing.
5. Remove existing awning and repair/patch brick as required.
6. Remove exterior exhaust ductwork in its entirety.
7. Remove egress stair in its entirety.
8. Clean area of staining & environmental contaminates. Patch brick to match existing
9. Replace roofing. Replace damaged sheathing and roof rafters. Assume 50% replacement for each.. Reinstall 30 year asphalt shingles over underlayment as specified.
10. Replace storefront. Refer to Storefront Elevations for additional information.
11. Indicates existing brownstone sill/lintel to be replaced with new precast concrete product to match existing brownstone. Color, texture and profile shall match existing EXACTLY. Provide shop drawings & samples for review by Architect.
12. Denotes area of mortar to be re-pointed. Where located at masonry openings, repoint both the return and face of masonry. Assume for bidding: 50% repointing.
13. Remove existing satellite dishes in their entirety.
14. Restore Skylight replace any broken glass, refurbish frame, cut out & replace rotted metal. Repaint with metal paint & reset glass.
15. Remove paint & Graffiti per General Restoration Note 'V'.
16. CMU stair enclosure to remain. Remove the metal stair, and install plywood & membrane roofing above CMU enclosure. Patch & repair brick with new to match existing.
17. Secure existing doors in place.
18. Install security bars as per details on Window sheet A-6.0.
19. Remove aluminum plating above storefront windows and report what is behind.
20. Replace damage or spalling brick sill with new concrete sill per detail 8/A-6.1.
21. Rebuild chimney top & install new stone cap.

GENERAL RESTORATION NOTES

A. Repointing mortar shall match the color, texture, strength, joint width and joint profile of the existing historic masonry.
B. Clean exterior brick and stone surfaces of paint, black staining, rust staining, bio growth, environmental contaminants and efflorescence using mild detergents at water line pressure. Work shall be performed in accordance with Preservation Brief 1.
C. Clean and repaint all windows, doors and wood components including soffits, fascias, shingle moldings, cornice boards, rafter tails, brackets, cupola and roof finials. Scrape and sand areas of loose or flaking paint prior to repainting. Refer to Wood Preservation and Restoration Notes for additional Information.
D. Restore deteriorated window frame, sash, sill and all trim components. Refer to Preservation Brief 9. Refer to plans and window schedule for additional information.
I. Restore deteriorated door, frame and all trim components. Refer to plans and door schedule for additional information.
J. Restore all existing door & window hardware. Refer to specifications for details.
K. Re-set or re-fasten all loose wood members.
L. Contractor to notify Architect, if after evaluation, additional components may require replacement and/or if the replacement of a component requires dismantling of adjacent components.
M. G.C. shall field verify all dimensions and profiles of components to be replaced prior to removing existing component and provide shop drawings of all components to be replaced to the Architect for review.
N. All new wood components shall be Cedar of a clear (knot-free) grade and vertical grain.
O. All components removed as required for restoration or replaced shall be re-installed in the same manner as the existing component (i.e. mortise & tenon, dovetailed, wood plug, and/or metal fastenings). All new metal fastenings shall be hot-dipped galvanized.
P. Remove all ivy and vegetation from all facades.
Q. Close up all miscellaneous holes in brick walls, such as pipe penetrations, fastener holes and damaged, or missing masonry. New material to match existing.
S. Contractor to provide all demolition and dumpsters as is necessary to complete the work.
T. Notes on building elevations are not intended to limit the scope of work for repair, replacement and restoration of the building exterior. The contractor shall be required to repair and restore the entire building envelope.
U. If plans and specifications provide conflicting information, then the strictest, most expensive interpretation shall apply.
V. Remove paint & graffiti from all exposed brick surfaces unless noted otherwise. Graffiti removal must be accomplished using the gentlest means possible without damaging the surface of the masonry. This work must be accomplished in accordance with the guidance provided in Preservation Brief 38, 'Removing Graffiti from Historic Masonry'.
W. Prior to repointing any masonry, the contractor shall have existing masonry, brick and mortar tested by a testing laboratory to determine the proper strength of the new mortar mix. New masonry units and mortar shall match existing color, strength, composition and mixture. Repoint all mortar, joints deeper than $\frac{1}{4}$". Joint profile to match existing.
X. Clouded areas indicate areas of existing materials which require attention. Refer to keyed notes below for clarification.

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T: (860)724-3000 F: (860)724-3013

Exterior Restoration of 104-110 Jefferson St.
Hartford, CT.

Hartford HealthCare Corporation
100 Pearl Street, Hartford, CT 06103

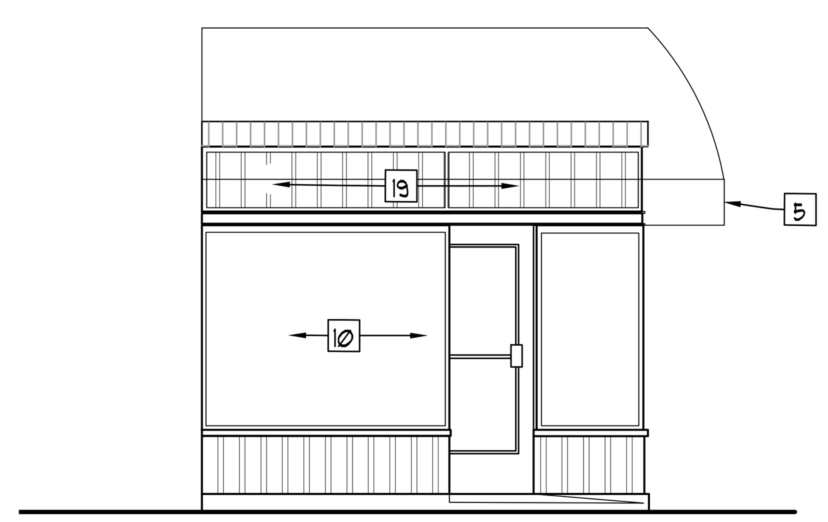
90% Submission Set
NOT FOR CONSTRUCTION

Drawn: RM
Date: August 1, 2023
Revisions

Exterior Elevations - North

A-2.2

1 WEST ELEVATION
SCALE: 1/4"=1'-0"



2 SOUTH ELEVATION EXG. CONDITIONS
SCALE: 1/4"=1'-0"

MATERIALS LEGEND

- Indicates 3" or 4" exterior clapboard or flatboard wood siding as noted.
- Indicates 5" exterior wood shake shingles with octagon cut shingles on 2nd course.
- Indicates 3" flat stock siding.
- Indicates exterior brick masonry.
- Indicates brownstone masonry.

RESTORATION LEGEND

X Restoration Key Note Tag

Areas clouded indicates visibly documented area of extreme deterioration/rot.

Keynotes are meant to supplement specifications and Preservation briefs referenced in these drawings.

LIST OF REQUIRED MOCKUPS

Below is a list of mock-ups required for review and approval by architect.

1. Exterior Masonry Cleaning.
2. Exterior Mortar Repointing.
3. Replacement Brick
4. Patching of Stone (brownstone)
5. Restored Window.
6. Wood Component replacement

WOOD PRESERVATION & RESTORATION NOTES

W1. Using an ice pick or awl, test wood for soundness and inspect wood to determine scope and cause of deterioration from water damage.
W2. Remove paint per Preservation Brief #10 - Exterior Paint Problems on Historic Woodwork.
W3. Dry wood thoroughly before treating decayed area.
W4. Scrape away any loose deterioration per Preservation Brief #10, until only undamaged wood remains.
W5. For areas too heavily deteriorated, remove the absolute minimum required to prevent future water damage. Splice in new material scarf joint sloped to building exterior which matches existing.
W6. Replace any missing or unrepairable wood members. Material and construction to match existing/surrounding area.
W7. Treat decayed areas of wood displaying evidence of rot with wood preservative per USDA Forest Service Guide for Use of Wood Preservatives in Historic Structures.
W8. Putty, epoxy patch, or epoxy inject all cracks and holes in wood unless noted otherwise to achieve a matching aesthetic to that of the original wood member. If/when necessary, epoxy patching compounds can be used to build up missing sections and decayed members.
W9. After removal of rot and patching/repair is complete, waterproof entire wood member with three applications of boiled linseed oil (one application every 24 hours).
W10. Once linseed oil has set, paint wood member according to "General Paint Type Recommendation" section of Preservation Brief #10 - Exterior Paint Problems on Historic Woodwork. Colors to be selected by Architect.

RESTORATION KEY NOTES

1. Indicates area of damaged Brownstone. Clean and patch/repair with 'Jahn M70 Limestone Repair Mortar' to match existing.
2. Restore brownstone sill/lintel. Patch with 'Jahn M70 Limestone Repair Mortar' or approved equal. Paint to match brownstone color.
3. Indicates window to be replaced. Refer to window schedule for additional information.
4. Replace damage or spalling brick sill with new to match existing.
5. Remove existing awning and repair/patch brick as required.
6. Remove exterior exhaust ductwork in its entirety.
7. Remove egress stair in its entirety.
8. Clean area of staining & environmental contaminates. Patch brick to match existing
9. Replace roofing. Replace damaged sheathing and roof rafters. Assume 50% replacement for each.. Reinstall 30 year asphalt shingles over underlayment as specified.
10. Replace storefront. Refer to Storefront Elevations for additional information.
11. Indicates existing brownstone sill/lintel to be replaced with new precast concrete product to match existing brownstone. Color, texture and profile shall match existing EXACTLY. Provide shop drawings & samples for review by Architect.
12. Denotes area of mortar to be re-pointed. Where located at masonry openings, repoint both the return and face of masonry. Assume for bidding: 50% repointing.
13. Remove existing satellite dishes in their entirety.
14. Restore Skylight replace any broken glass, refurbish frame, cut out & replace rotted metal. Repaint with metal paint & reset glass.
15. Remove paint & Graffiti per General Restoration Note 'V'.
16. CMU stair enclosure to remain. Remove the metal stair, and install plywood & membrane roofing above CMU enclosure. Patch & repair brick with new to match existing.
17. Secure existing doors in place.
18. Install security bars as per details on Window sheet A-6.0.
19. Remove aluminum plating above storefront windows and report what is behind.
20. Replace damage or spalling brick sill with new concrete sill per detail 8/A-6.1.
21. Rebuild chimney top & install new stone cap.

GENERAL RESTORATION NOTES

A. Repointing mortar shall match the color, texture, strength, joint width and joint profile of the existing historic masonry.
B. Clean exterior brick and stone surfaces of paint, black staining, rust staining, bio growth, environmental contaminants and efflorescence using mild detergents at water line pressure. Work shall be performed in accordance with Preservation Brief 1.
C. Clean and repaint all windows, doors and wood components including soffits, fascias, shingle moldings, cornice boards, rafter tails, brackets, cupola and roof finials. Scrape and sand areas of loose or flaking paint prior to repainting. Refer to Wood Preservation and Restoration Notes for additional Information.
D. Restore deteriorated window frame, sash, sill and all trim components. Refer to Preservation Brief 9. Refer to plans and window schedule for additional information.
I. Restore deteriorated door, frame and all trim components. Refer to plans and door schedule for additional information.
J. Restore all existing door & window hardware. Refer to specifications for details.
K. Re-set or re-fasten all loose wood members.
L. Contractor to notify Architect, if after evaluation, additional components may require replacement and/or if the replacement of a component requires dismantling of adjacent components.
M. G.C. shall field verify all dimensions and profiles of components to be replaced prior to removing existing component and provide shop drawings of all components to be replaced to the Architect for review.
N. All new wood components shall be Cedar of a clear (knot-free) grade and vertical grain.
O. All components removed as required for restoration or replaced shall be re-installed in the same manner as the existing component (i.e. mortise & tenon, dovetailed, wood plug, and/or metal fastenings). All new metal fastenings shall be hot-dipped galvanized.
P. Remove all ivy and vegetation from all facades.
Q. Close up all miscellaneous holes in brick walls, such as pipe penetrations, fastener holes and damaged, or missing masonry. New material to match existing.
S. Contractor to provide all demolition and dumpsters as is necessary to complete the work.
T. Notes on building elevations are not intended to limit the scope of work for repair, replacement and restoration of the building exterior. The contractor shall be required to repair and restore the entire building envelope.
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X. Clouded areas indicate areas of existing materials which require attention. Refer to keyed notes below for clarification.

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Exterior Restoration of 104-110 Jefferson St.
Hartford, CT.

Hartford HealthCare Corporation
100 Pearl Street, Hartford, CT 06103

90% Submission Set
NOT FOR CONSTRUCTION

Drawn:	RM
Date:	August 1, 2023
Revisions	

Exterior Elevations -West

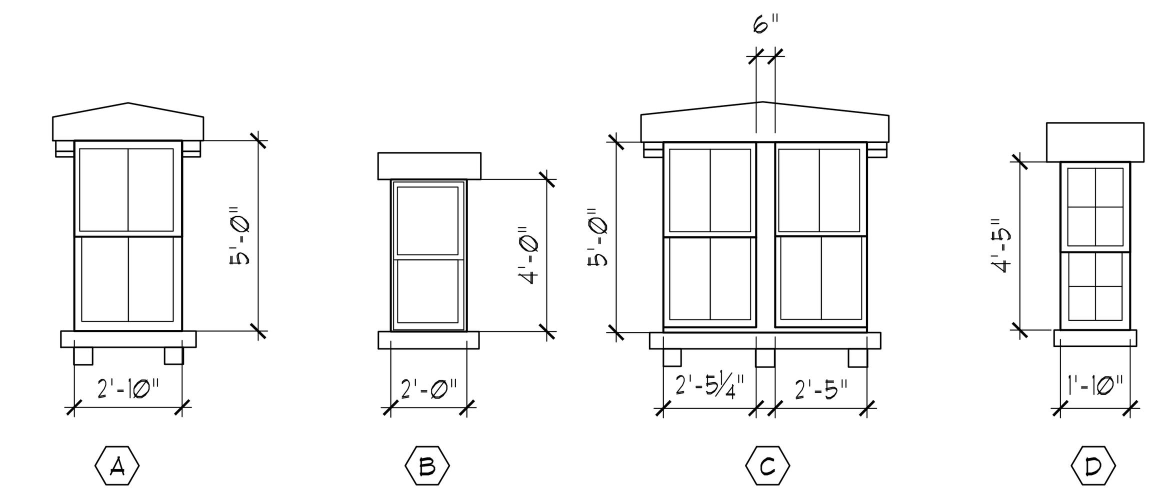
A-2.3

WINDOW SCHEDULE

WINDOW	ETR/REPLACE	SIZE	Manufacturer	TYPE	REMARKS
A	Replace	5'-Ø" h x 2'-1Ø" w	Kolbe	Double hung	Two-over-two divided light
B	Replace	4'-Ø" h x 2'-Ø" w	Kolbe	Double hung	One-over-one
C	Replace	5'-Ø" h x 2'-5" w	Kolbe	Double hung	Two-over-two divided light
D	Replace	4'-5" h x 1'-1Ø" w	Kolbe	Double hung	Four-over-four divided light

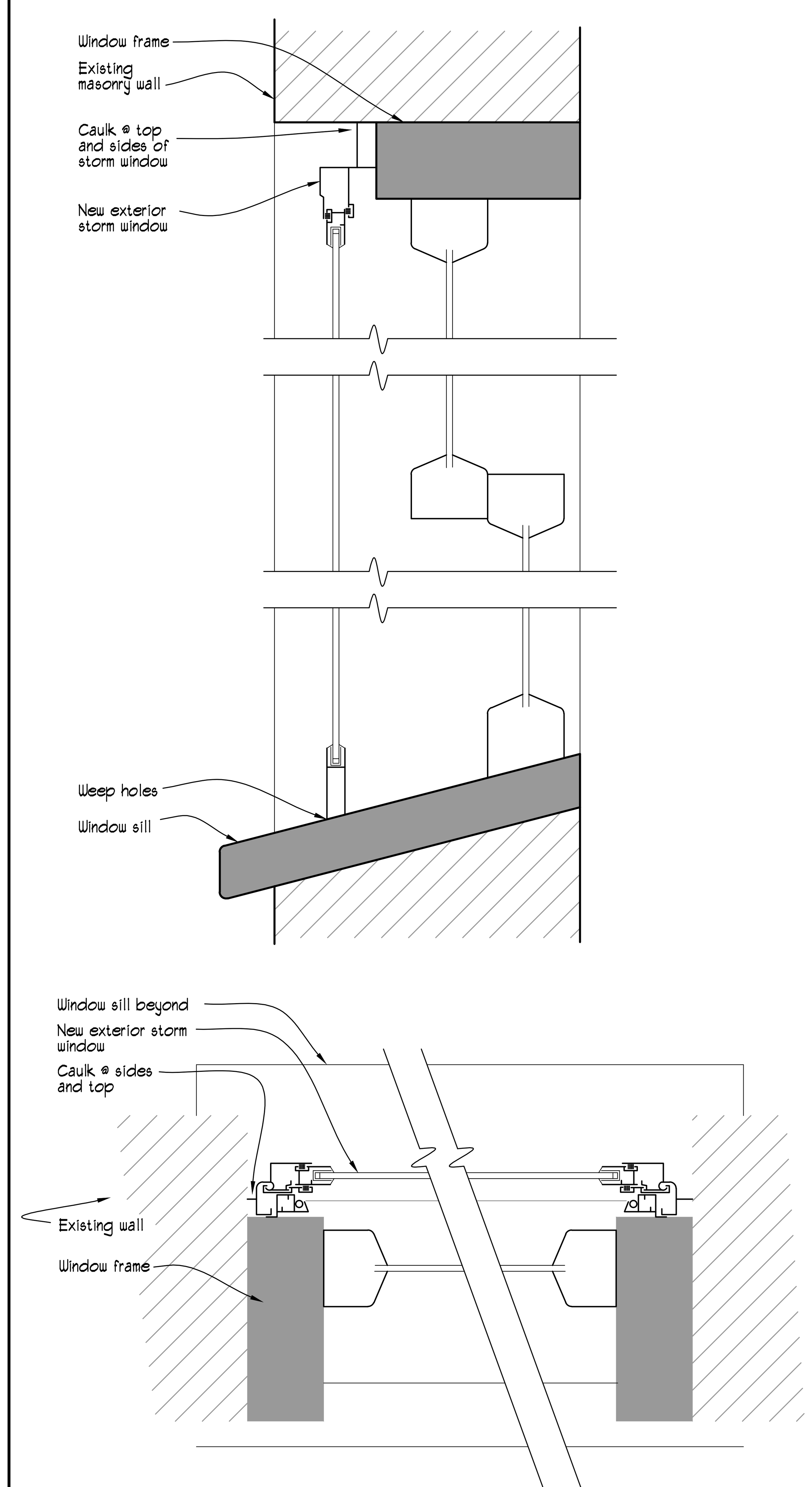
WINDOW GENERAL NOTES

1. Window Replacement Basis of Design: Kolbe Windows & Doors± Heritage Series'
2. Exterior Storm Window Basis of Design: Allied Window, Inc., Historic One Lite Windows. Vented storm windows with aluminum frames & scratch resistant acrylic glazing. Shall be added to all windows.
3. Window Security Bars: Restore existing security bars. Provide new to match existing at first floor and basement windows..
4. Window Schedule does not indicate quantities of windows. G.C. shall be responsible for calculating quantities
4. Provide shop drawings showing all window and installation details for architect's review and approval.
5. Provide tempered glass at all sashes where all of the following occurs:
   - 5.1. the exposed edge of an individual pane is greater than 9 square feet.
   - 5.2. the bottom edge of the glazing is less than 18 inches above the floor.
   - 5.3. the top edge of the glazing is greater than 36 inches above the floor.
   - 5.4. one of more walking surfaces are within 36 inches, measured horizontally and in a straight line, of the plane of the glazing.
6. Masonry opening may vary. Field verify ALL masonry openings prior to ordering new replacement windows.

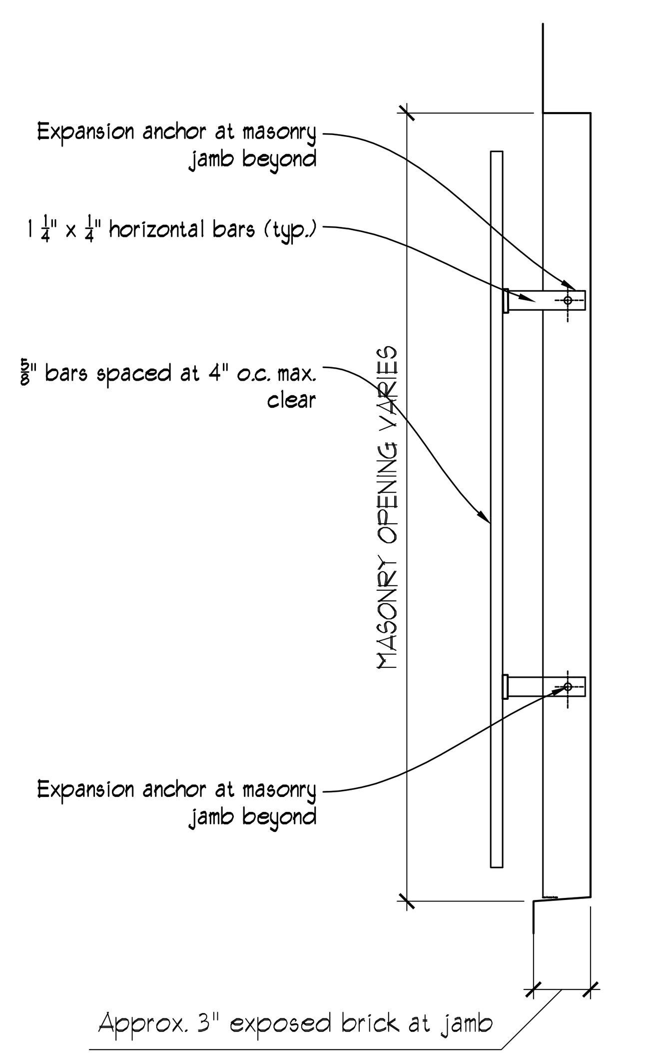


WINDOW ELEVATIONS
SCALE: 1/4"=1'-Ø"

6 TYPICAL EXISTING WINDOW @ EXTERIOR

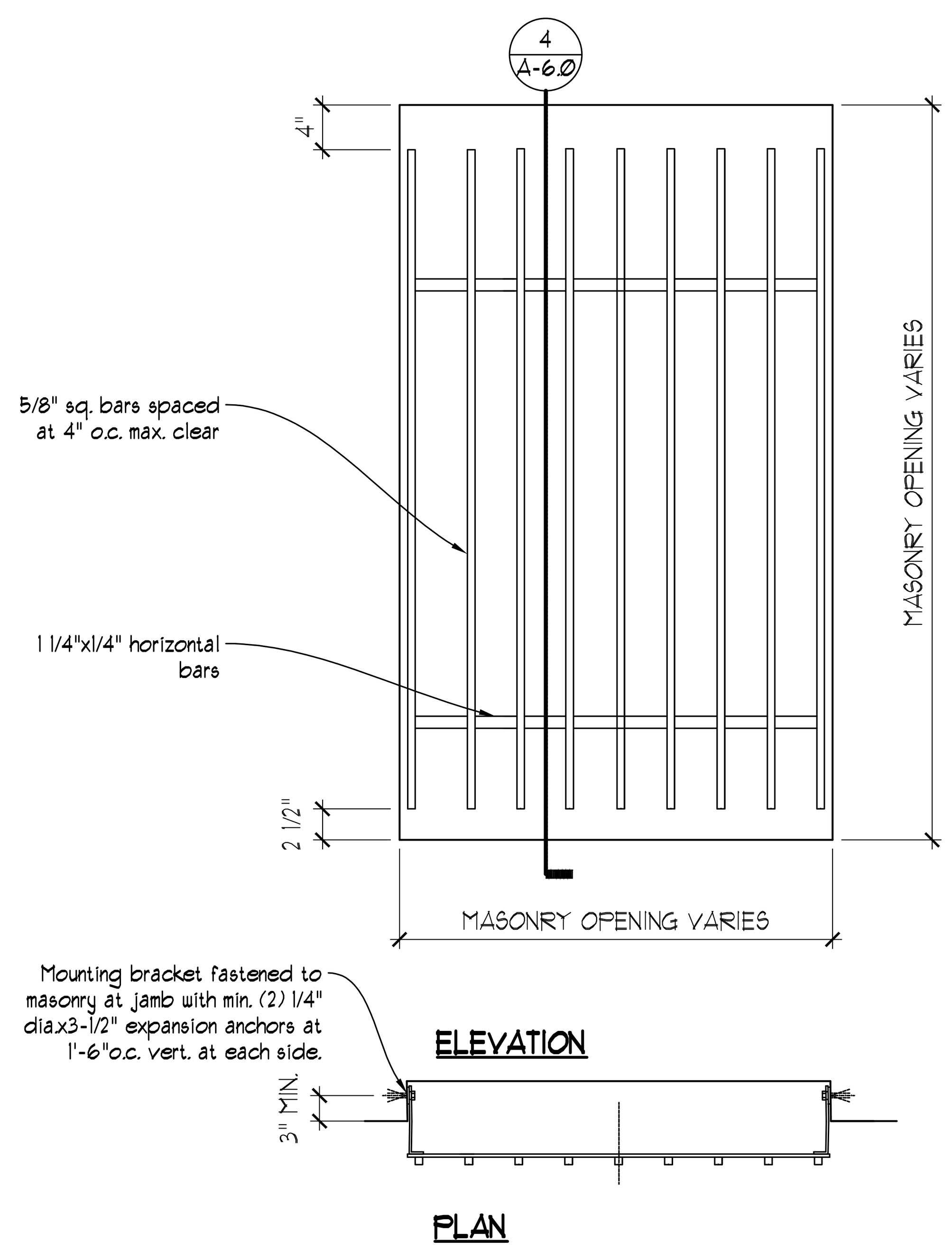


5 STORM WINDOW DETAIL
SCALE: 6"=1'-Ø"

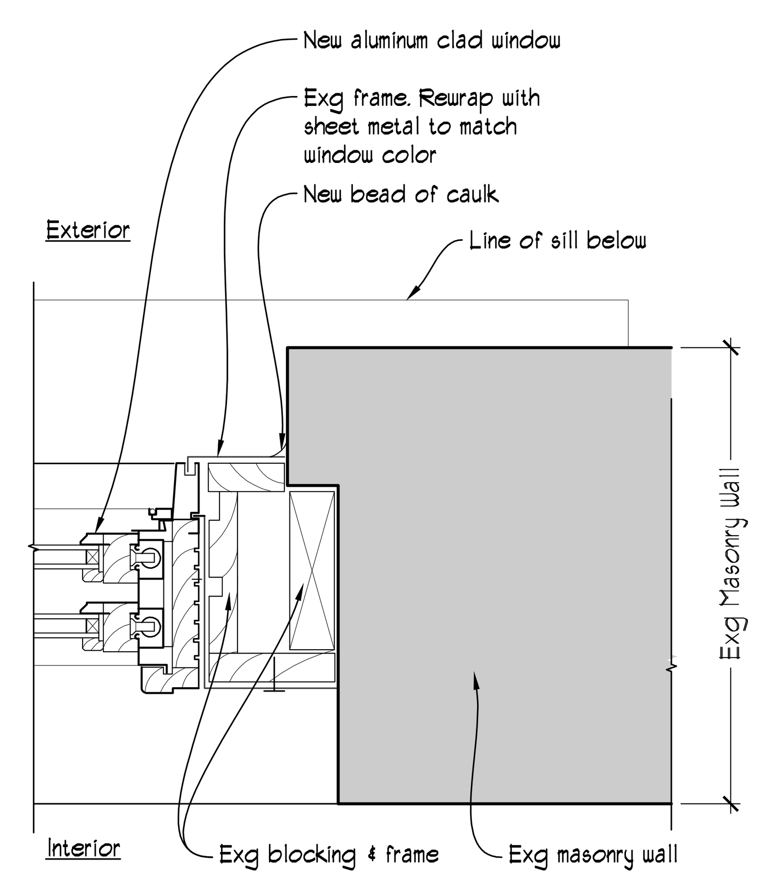


NOTES:
1. Provide shop drawings for architect's review
2. All basement and first floor windows to receive security bars unless noted otherwise.

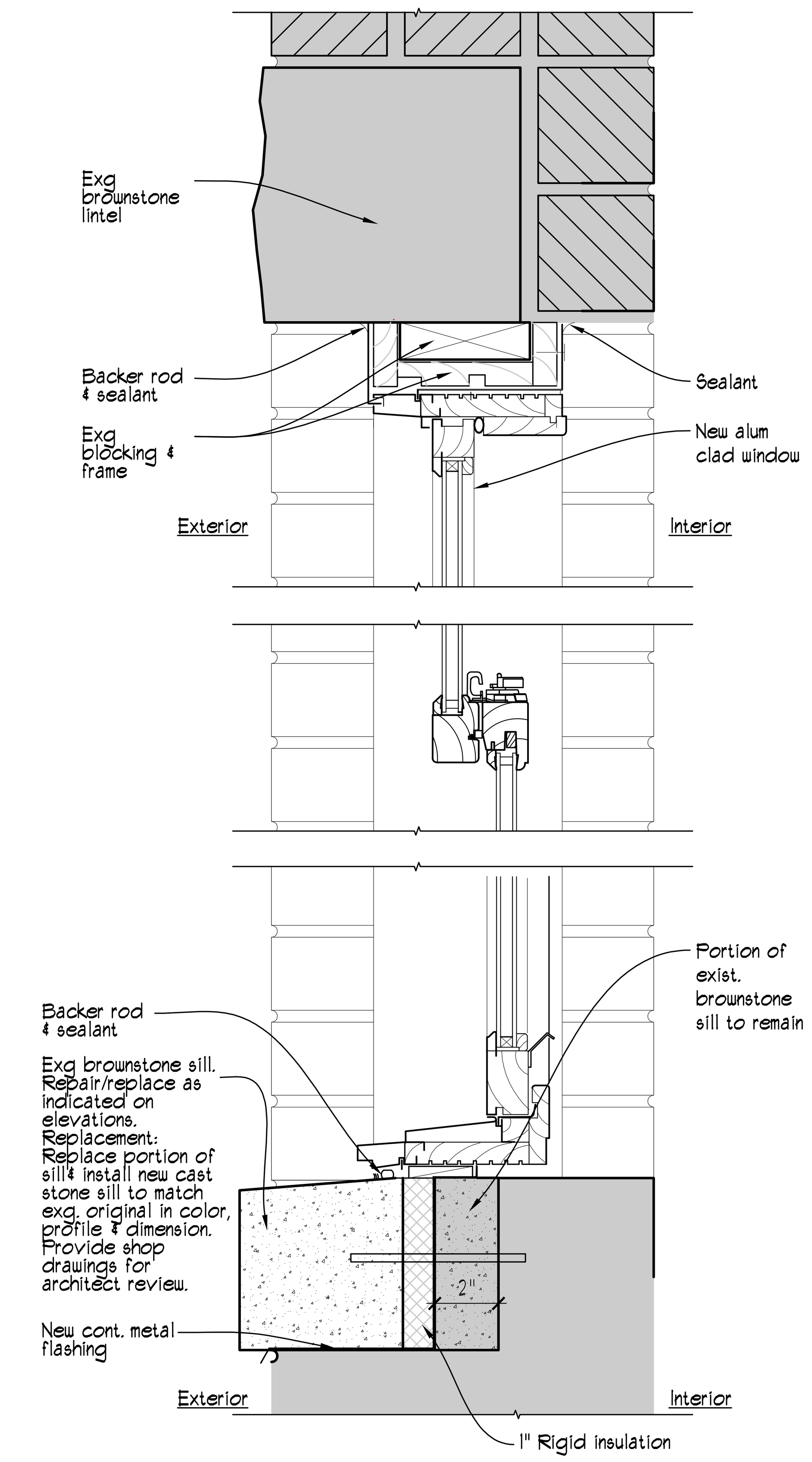
4 SECURITY BARS SECTION
SCALE: 1/2"=1'-Ø"



3 SECURITY BARS PLANS & ELEVATION
SCALE: 1/2"=1'-Ø"



2 PROPOSED JAMB DETAIL
SCALE: 3"=1'-Ø"



1 REPLACEMENT WINDOW @ EXG FRAME
SCALE: 3"=1'-Ø"

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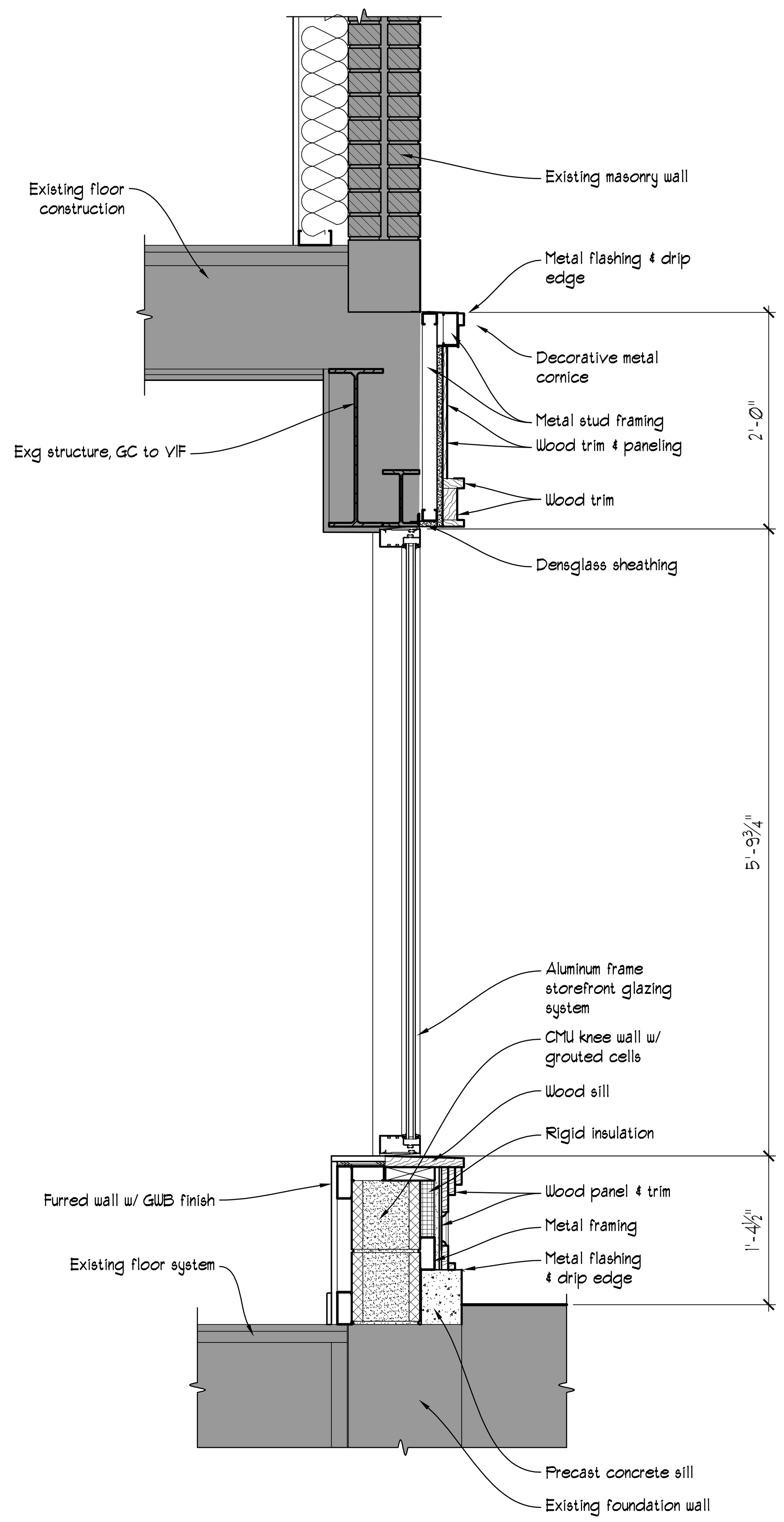
Hartford HealthCare Corporation
100 Pearl Street, Hartford, CT 06103

90% Submission Set
NOT FOR CONSTRUCTION

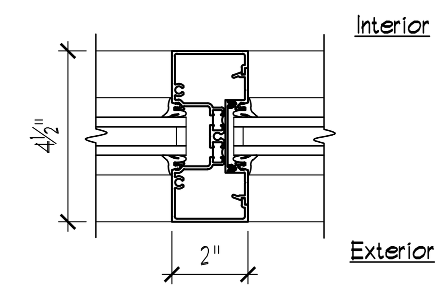
Drawn: RM
Date: August 1, 2023
Revisions

Window Elevations, Schedule & Details

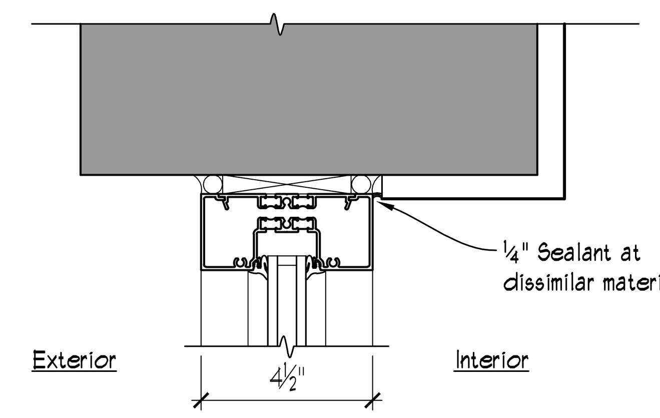
A-6.0



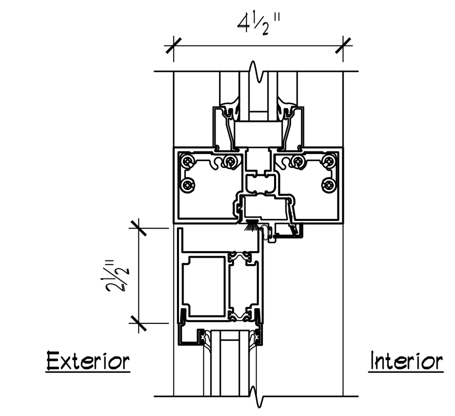
8 STOREFRONT SECTION
SCALE: 1"=1'-0"



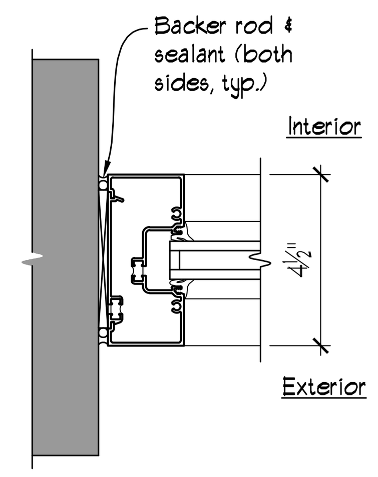
7 TYPICAL MULLION
SCALE: 3"=1'-0"



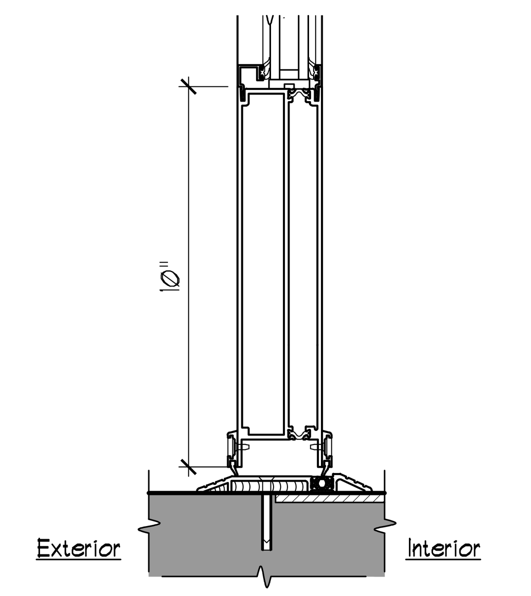
6 HEAD DETAIL
SCALE: 3"=1'-0"



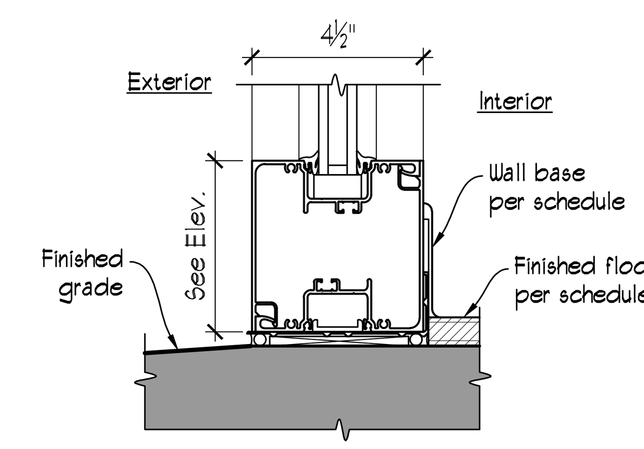
5 HEAD DETAIL
SCALE: 3"=1'-0"



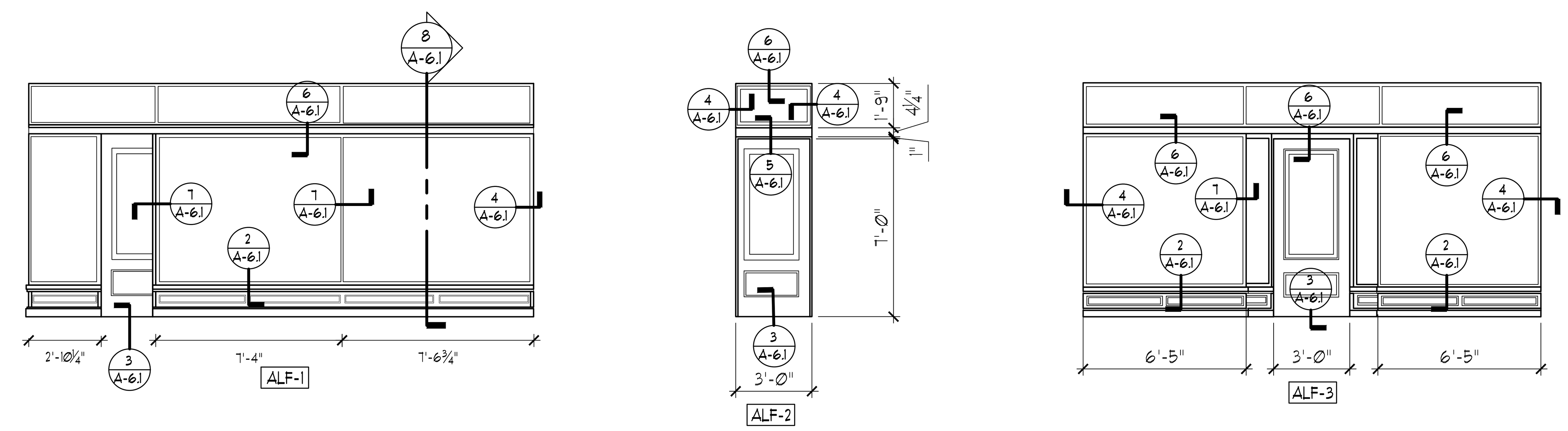
4 JAMB DETAIL
SCALE: 3"=1'-0"



3 SILL DETAIL @ DOOR
SCALE: 3"=1'-0"



2 SILL DETAIL @ PANEL
SCALE: 3"=1'-0"



1 STOREFRONT ELEVATIONS
SCALE: 1/4"=1'-0"

Crosskey Architects
LLC
Architecture Preservation Planning
750 Main Street, Hartford, CT 06103
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Exterior Restoration of 104-110 Jefferson St.

Hartford, CT.

Hartford HealthCare Corporation

100 Pearl Street, Hartford, CT 06103

90% Submission Set
NOT FOR CONSTRUCTION

Drawn: RM
Date: August 1, 2023
Revisions

Storefront Elevations & Details

A-6.1

Project Manual & Specifications

Exterior Restoration of

Hartford Hospital Historic Properties

94-100, 104-110 & 146 Jefferson Street
247 Washington Street & 123 Retreat Avenue

Hartford, CT

90% SPECIFICATIONS
August 1, 2023

Owner:	By: Hartford Healthcare
Architect:	By: Crosskey Architects, LLC
Construction Manager:	By:
Bonding Company:	By:

Crosskey Architects LLC
Architecture | Preservation | Planning

750 Main Street, Suite 150 , Hartford, CT 06103 Phone: (860)724-3000

SECTION 00 01 02

PROJECT DIRECTORY

PROJECT:	Hartford Hospital Historic Properties 94-100, 104-110 & 146 Jefferson Street 247 Washington Street 123 Retreat Avenue Hartford, CT 06106
OWNER:	Hartford Healthcare 129 Patricia M. Genova Drive Newington, CT 06111 Phone: (860) 696-6167
ARCHITECT:	Crosskey Architects LLC 750 Main Street Suite 150 Hartford, CT 06103 Phone: 860-724-3000

END OF SECTION

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SECTION 00 01 10

TABLE OF CONTENTS

GENERAL INFORMATION AND FORMS

END OF SECTION

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SECTION 00 01 15

LIST OF DRAWINGS

94-100 Jefferson Street

Cover

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ARCHITECTURAL DRAWINGS

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A-2.1	Exterior Elevations - East
A-2.2	Exterior Elevations - South
A-2.3	Exterior Elevations - West
A-5.0	Details

104-110 Jefferson Street

Cover

GENERAL INFORMATION SHEETS

G-1	General Information & Drawing Index

ARCHITECTURAL DRAWINGS

A-1.0	Roof Plan
A-2.0	Exterior Elevations - North
A-2.1	Exterior Elevations - East
A-2.2	Exterior Elevations - South
A-2.3	Exterior Elevations - West
A-6.0	Storefront Elevations & Details
A-6.1	Window Elevations, Schedules & Details

146 Jefferson Street

Cover

GENERAL INFORMATION SHEETS

G-1	General Information & Drawing Index

ARCHITECTURAL DRAWINGS

A-2.0	Exterior Elevations - North
A-2.1	Exterior Elevations - East
A-2.2	Exterior Elevations - South
A-2.3	Exterior Elevations - West
A-6.0	Storefront Elevations & Details
A-6.1	Window Elevations, Schedules & Details

END OF SECTION

DOCUMENT 00 11 16

INVITATION TO BID

OWNER: Hartford Healthcare
129 Patricia M. Genova Drive
Newington, CT 06111

ARCHITECT: Crosskey Architects, LLC.
750 Main Street
Suite 150
Hartford, CT 06103

TO ALL BIDDERS

1. The Architect will receive bids in triplicate on or before 3:00 p.m., _____________ 2023 at the Crosskey Architects, LLC office, 750 Main Street, Suite 150, Hartford, CT 06103.

2. Bids will be received for furnishing all labor, materials, tools and equipment necessary for the project scope of work consisting of the exterior restoration of 94-100, 104-110 & 146 Jefferson Street, 247 Washington Street, and 123 Retreat Ave and associated site work.

3. The Contract will include demolition, general construction work, site improvements, new building construction, interior construction, mechanical, plumbing, and electrical work, and all other work necessary for or incidental to the completion of the project.

4. The successful bidder will be required to furnish 100% Performance and Payment Bond or Bonds, in the forms included in the Specifications, as well as a certified statement of financial condition, as of a date not exceeding ninety (90) days prior to the date thereof.

5. Proposed form of Contract Documents, including Plans and Specifications, are on file at the office of the above mentioned Architect.

6. General contractors may obtain a copy of the Plans and Specifications by depositing One Hundred Fifty Dollars ($150.00) per set with said Architect. The amount of the deposit will be refunded to each bidder who returns the Plans and Specifications in good condition within fifteen (15) days after the bid due date.

7. The Owner reserves the right to reject any or all bids and to waive any informalities in bidding. All Bid Documents must be completely filled in when submitted.

8. No bid shall be withdrawn for a period of ninety (90) days subsequent to the opening of bids or until the next work day immediately following said period, if such period ends on a weekend or a State holiday, without the consent of the above mentioned Owner.

9. General Information:

Readiness to Proceed
The bidder selected to perform the work described herein shall apply for building permits immediately after entering into a construction contract with the owner. The duration of construction will be no greater than **[12 months].**

Permits and Certificates of Occupancy
The General Contractor selected to perform the construction activities will be responsible for obtaining and paying for all building permits. Also, it is the express responsibility of the Contractor to obtain Certificates of Occupancy and present them to the owner at the conclusion of construction.

Utilities
The Contractor will coordinate and perform all connection of utilities including gas, water and electric. The cost of the utility connections is the responsibility of the Contractor. During the construction period, the owner will not provide electric, gas or water services. All utilities required by the Contractor during construction will be provided by the Contractor. The Contractor will be responsible for provision of temporary heat.

Other Provisions
1) The abatement of lead and asbestos will be completed by others.
2) It should be noted that there are lead contaminated components in the general construction debris. Workers will require protection when completing the general interior demolition of the properties.

Fencing
Prior to the commencement of work, the selected Contractor will as part of the scope of services install a construction fence on the boundaries of the site. The fence will be 72 inches tall, 11 gauge with 2-inch mesh. The Contractor will install a twelve-foot working gate on the driveway curb cut. This gate will be locked each day at the close of business and at any time that work is not ongoing on the site.

Payment
The Contractor will present a request for payment together with the appropriate original lien waivers. Payment will be made within 30 calendar days after the Owner receives all appropriate documentation including the City of Hartford submissions outlined above.

Insurance Requirements
As part of the response to this request for proposals and upon request by the owner at any time, evidence of the following must be provided to the owner. The bidder shall submit a statement indicating awareness and acceptance.

A. **Comprehensive General Liability**
$2,000,000 Aggregate Limit
$1,000,000 Products/Completed Operations Aggregate
$1,000,000 Personal and Advertising Injury
$1,000,000 Each Occurrence
$50,000 Fire Damages
$5,000 Medical Expense
No Deductible or Retention

Broad Form CGL Endorsement
Premises-Operation Coverage

B. Contractual Insurance

Independent Contractors Coverage
Owners and Contractors Protective
X.C.U. (Explosion/Collapse/Underground)
Non-owned and hired auto
Umbrella Liability as required by contract
Partnership named as additional Insured and others as required
1986 Occurrence Form

C. Certificate of Insurance for Subcontractor's Workers Compensation

Statutory Employer's Liability
$1,000,000 Bodily Injury by Accident
$1,000,000 Bodily Injury by Disease
$1,000,000 Bodily Injury by Each Employee

D. Business Automobile liability Insurance: on an occurrence basis, covering owned, scheduled, hired, and non-owned automobiles used by or on behalf of the G.C., and providing insurance for bodily injury, property damage, and contractual liability.

Limits of Liability: $1,000,000 each accident – combined single limit of bodily injury and property damage.

E. 100% Payment and Performance Bond (In lieu of a payment and performance bond, a letter of credit may be accepted for some projects amount equal to 25% of the cost of construction.)
Umbrella or Excess Liability Insurance: beyond the general liability, automotive liability, and employer's liability: written on an occurrence basis; coverage may be written on an excess or following form basis, but in any event, it shall be no less broad than the underlying liability policies; the Authority's interest as an additional insured as for General Liability coverage shall also extend to the Umbrella or Excess Liability Coverage.

Limits of Liability: $5,000,000 (however, the Authority reserves the right to require additional limit of liability coverage).

Contractor Environmental Impairment liability Insurance (pollution Insurance: Contractors involved in pollution remediation (including but not limited to the removal of lead or asbestos containing materials) and mold coverage.

Limits of Liability: the greater of fifty percent (50%) of the contract cost or $3,000,000 (however, the Authority reserves the right to require additional limits of liability coverage).

Crosskey Architects LLC

per:

Laura J. Crosskey, AIA
President

enc.

END OF DOCUMENT

DOCUMENT 00 21 13

INSTRUCTIONS TO BIDDERS

PART 1. SUMMARY

1.01 DOCUMENT INCLUDES

A. Invitation
   1. Bid Submission
   2. Intent
   3. Work Identified in the Contract Documents
   4. Contract Time

B. Bid Documents and Contract Documents
   1. Definitions
   2. Contract Documents Identification
   3. Availability
   4. Examination
   5. Queries/Addenda
   6. Product/System Substitutions

C. Site Assessment
   1. Site Examination
   2. Preview of the site

D. Qualifications
   1. Qualifications
   2. Subcontractors/Suppliers/Others

E. Bid Submission
   1. Submission Procedure
   2. Bid Ineligibility

F. Bid Enclosures/Requirements
   1. Security Deposit
   2. Performance Assurance
   3. Bid Form Requirements
   4. Fees for Changes in the Work
   5. Bid Form Signature
   6. Additional Bid Information

G. Offer Acceptance/Rejection
   1. Duration of Offer
   2. Acceptance of Offer

1.02 RELATED DOCUMENTS

A. Document 00 11 16 - Invitation To Bid.

C. Document 00 41 13 - Bid Form.

D. Document 00 43 20 - Supplements to Bid Form.

PART 2. INVITATION

2.01 BID SUBMISSION

A. Bids signed and under seal, executed, and dated will be received by the Owner at the Crosskey Architects, LLC office, 750 Main Street, Suite 150, Hartford, CT 06103 before 3:00 p.m. local time on the ___ day of ________, 2023.

B. Offers submitted after the above time may be returned to the Bidder unopened.

C. Offers will be opened publicly immediately after the time for receipt of Bids.

D. Amendments to the submitted offer will be permitted if received in writing prior to Bid closing and if endorsed by the same party or parties who signed and sealed the offer.

E. Owner reserves the right to reject any or all bids and waive any bid procedures or formalities.

2.02 INTENT

A. Contract in accordance with the Contract Documents.

2.03 WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

A. Work of this proposed Contract comprises general construction & renovation.

B. Location: 94-100, 104-110, & 146 Jefferson Street, 247 Washington Street, & 123 Retreat Avenue, Hartford, CT.

2.04 CONTRACT TIME

A. Perform the Work in [**365**] calendar days.

B. The Bidder may suggest a revision to the Contract Time with a specific adjustment to the Bid Price.

PART 3. BID DOCUMENTS AND CONTRACT DOCUMENTS

3.01 DEFINITIONS

A. Bid Documents: Contract Documents supplemented with Invitation to Bid, Instructions to Bidders, Bid Form and Appendix A, Bid securities, identified herein.

B. Contract Documents: Defined in AIA A201 Article 1 including issued Addenda.

C. Bid, Offer, or Bidding: Act of submitting an offer under seal.

D. Bid Price: Monetary sum identified by the Bidder in the Bid Form.

3.02 CONTRACT DOCUMENTS IDENTIFICATION

A. The Contract Documents are identified as The Exterior Restoration of 94-100, 104-110, & 146 Jefferson Street, 247 Washington Street, & 123 Retreat Avenue, Hartford, CT prepared by the Architect, Crosskey Architects LLC, located at 750 Main Street, Suite 150, Hartford, CT and identified in the Project Manual.

3.03 AVAILABILITY

A. Bid Documents may be obtained at _______ p: 860.724.3000.

B. Bid Documents are made available only for the purpose of obtaining offers for this project. Their use does not grant a license for other purposes.

3.04 EXAMINATION

A. Bid Documents may be viewed at the office of the Architect.

B. Upon receipt of Bid Documents verify that documents are complete. Notify Architect should the documents be incomplete.

C. Immediately notify the Architect upon finding discrepancies or omissions in the Bid Documents.

3.05 QUERIES/ADDENDA

A. Direct questions in writing to [Principal/ Project Manager – Crosskey Architects], email lcrosskey@crosskey.com.

B. Addenda may be issued during the Bidding period. All Addenda become part of the Contract Documents. Include resultant costs in the Bid Price.

C. Verbal answers are not binding on any party.

D. Clarifications requested by Bidders must be in writing not less than 7 days before date set for receipt of Bids. The reply will be in the form of an Addendum, a copy of which will be forwarded to known recipients.

3.06 PRODUCT/SYSTEM SUBSTITUTIONS

A. Substitute products will be considered if submitted as an attachment to the Bid Form.

B. The submission shall provide sufficient information to determine acceptability of such products.

C. Provide complete information on required revisions to other Work to accommodate each substitution, the value of additions to or reductions from the Bid Price, including revisions to other Work.

D. Provide Products as specified unless substitutions are submitted in this manner and subsequently accepted.

E. Approval to submit substitutions prior to submission of Bids is not required.

F. **Contractor shall reimburse Owner for Architect's time spent reviewing substitutions.**

PART 4. SITE ASSESSMENT

4.01 SITE EXAMINATION

A. Examine the project site before submitting a bid.

B. The Bidder is required to contact the Architect at the following address and phone number in order to arrange a date and time to visit the project site:

Laura Crosskey
Crosskey Architects LLC
750 Main Street, Suite 150, Hartford, CT 06103
Phone: 860.724.3000

4.02 PREBID CONFERENCE

A. A mandatory pre-bid walk-thru of the site will be conducted on **_______**, 2023 at 9:00

AM at the project site.

B. All general contract and major subcontract Bidders are invited.

C. Representatives of the Owner and Architect will be in attendance.

D. Information relevant to the Bid Documents will be recorded in an Addendum, issued to Bid Document recipients.

PART 5. QUALIFICATIONS

5.01 SUBCONTRACTORS/SUPPLIERS/OTHERS

A. The Owner reserves the right to reject a proposed Subcontractor for reasonable cause.

B. Refer to AIA Article 5 of General Conditions.

PART 6. BID SUBMISSION

6.01 SUBMISSION PROCEDURE

A. Bidders shall be solely responsible for the delivery of their Bids in the manner and time prescribed.

B. Submit two copies of the executed offer on the Bid Forms provided, signed and sealed with the required security in a closed opaque envelope, clearly identified with Bidder's name, project name and Owner's name on the outside.

C. Improperly completed information, irregularities in security deposit or bid bond, may be cause not to open the Bid Form envelope and declare the Bid invalid or informal.

D. An abstract summary of submitted Bids will be made available to all Bidders following Bid opening.

6.02 BID INELIGIBILITY

A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, may at the discretion of the Owner, be declared unacceptable.

B. Bid Forms, Appendices, and enclosures which are improperly prepared may at the discretion of the Owner, be declared unacceptable.

C. Failure to provide security deposit, bonding or insurance requirements may at the discretion of the Owner, invalidate the Bid.

PART 7. BID ENCLOSURES/REQUIREMENTS

7.01 SECURITY DEPOSIT

A. Bids shall be accompanied by a security deposit as follows:

1. Bid Bond of a sum no less than 5 percent of the Bid Price/Sum on AIA A310 Bid Bond Form.

   OR

2. Certified check in the amount of 5% of the Bid Price.

B. Endorse the Bid Bond in the name of the Owner as obligee, signed and sealed by the Contractor as principal and the Surety.

OR

C. Endorse the certified check in the name of the Owner.

D. The security deposit will be returned after delivery to the Owner of the required Performance and Labor and Materials Payment Bond(s) by the accepted Bidder.

E. Do not include the cost of Bid Security in the Bid Price.

F. After a Bid has been accepted, all securities will be returned to the respective Bidders.

G. If no contract is awarded, all security deposits will be returned.

H. Bonding Company be listed on the most recent IRS Circular 570.

7.02 PERFORMANCE ASSURANCE

A. Accepted Bidder: Provide a Performance and Payment bond as described in Document 00 60 50.1 - Supplementary General Conditions.

B. Include the cost of performance assurance bonds in the Bid Price and identify the cost when requested by the Owner.

7.03 BID FORM REQUIREMENTS

A. Complete all requested information in the Bid Form and Appendices.

7.04 FEES FOR CHANGES IN THE WORK

A. Include in the Bid Form, the overhead and profit fees on own Work and Work by Subcontractors, applicable for Changes in the Work, whether additions to or deductions from the Work on which the Bid Price is based.

B. Include in the Bid Form, the fees proposed for subcontract work for changes (both additions and deductions) in the Work. The Contractor shall apply fees as noted, to the Subcontractor's gross (net plus fee) costs on additional work.

7.05 BID FORM SIGNATURE

A. The Bid Form shall be signed by the Bidder, as follows:

1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature. Affix seal.
2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature. Affix seal to each signature.
3. Corporation: Signature of a duly authorized signing officer(s) in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the Bid is signed by officials other than the President and Secretary of the company, or the President/Secretary/Treasurer of the company, a copy of the by-law resolution of the Board of Directors authorizing them to do so, must also be submitted with the Bid Form in the Bid envelope.
4. Joint Venture: Each party of the joint venture shall execute the Bid Form under their respective seals in a manner appropriate to such party as described above,

similar to the requirements of a Partnership.

7.06 ADDITIONAL BID INFORMATION

A. Appendix A –List of Unit Prices

B. Appendix B – List of Alternates

C. Appendix C – List of Subcontractors

PART 8. OFFER ACCEPTANCE/REJECTION

8.01 DURATION OF OFFER

A. Bids shall remain open to acceptance and shall be irrevocable for a period of ninety (90) days after the Bid closing date.

8.02 ACCEPTANCE OF OFFER

A. The Owner reserves the right to accept or reject any or all offers.

B. The Owner will select the lowest responsible bid from a qualified bidder. Lowest bid means the lowest price offered in section 00 41 13, 1. Offer.

END OF DOCUMENT

DOCUMENT 00 41 13

BID FORM

TO: Hartford Healthcare
129 Patricia M. Genova Drive
Newington, CT 06111

PROJECT: Hartford Hospital Historic Properties
94-100, 104-110 & 146 Jefferson Street
247 Washington Street
123 Retreat Avenue
Hartford, CT 06106

Date: __________

Submitted by:
(full name)

____

(full address)

____

____

1. OFFER

Having examined the Place of the Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by Crosskey Architects LLC, Architect for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Price of:

$____($__________) dollars.

We have included herewith, the required security deposit/Bid Bond as required by the Instruction to Bidders.

Sales tax is not included in the Bid Price, as the Owner is tax exempt.

All Cash Allowances described in Section 01 26 00 - Contract Considerations are included in the Bid Price.

2. ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for 90 days from the Bid closing date.

If this Bid is accepted by the Owner within the time period stated above, we will:
Execute the Agreement within 15 days of receipt of acceptance of this Bid.

Furnish the required Performance and Labor & Material Bonds within 7 days of receipt of acceptance of this Bid.
Commence work within 15 days after executing the agreement.

If this Bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bond(s), the security deposit shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this Bid and the Bid upon which the Contract is signed.

In the event our Bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

3. CONTRACT TIME

If this Bid is accepted, we will:
Complete the Work in **two hundred Seventy (270)** calendar days from acceptance of this Bid.

4. CHANGES TO THE WORK

When the Architect establishes that the method of valuation for Changes in the Work will be net cost plus a percentage fee in accordance with General Conditions, our percentage fee will be:

_______percent overhead and profit on the net cost of our own Work;

_______percent on the cost of work done by any Subcontractor.

On work deleted from the Contract, our credit to the Owner shall be the Architect approved net cost plus

_______of the overhead and profit percentage noted above.

5. ADDENDA

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

Addendum #________________Dated______________________________

Addendum #________________Dated______________________________

Addendum #________________Dated______________________________

6. APPENDICES

Submit Appendices in Document 00 43 20 - Supplements to Bid Forms as directed in Document 00 11 16 – Instructions to Bidders.

7. BID FORM SIGNATURE(S)

The Corporate Seal of

____

(Bidder - please print the full name of your Proprietorship, Partnership, or Corporation)

was hereunto affixed in the presence of:

____

(Authorized signing officer (Title)

(Seal)

____

(Authorized signing officer (Title)

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

This page is intentionally left blank.

DOCUMENT 00 43 20

SUPPLEMENTS TO BID FORM

TO: Hartford Healthcare
129 Patricia M. Genova Drive
Newington, CT 06111

PROJECT: Hartford Hospital Historic Properties
94-100, 104-110 & 146 Jefferson Street
247 Washington Street
123 Retreat Avenue
Hartford, CT 06106

Date:___________________________________

Submitted by:
(full name)

____

(full address)

____

____

In accordance with Document 00 21 13 - Instructions to Bidders and Document 00 41 13 - Bid Form, we include the Supplements To Bid Form Appendices listed below. The information provided shall be considered an integral part of the Bid Form.

These Appendices are as follows:

Document 00 43 21 – **Appendix A – List of Unit Prices**: Include a listing of unit prices specifically requested by the Contract Documents.
Document 00 43 22 - Appendix B – List of Alternatives: Include the cost variation to the Bid Price applicable to the Work described in Section 01 26 00.
Document 00 43 23 - Appendix C – List of Subcontractors: Include the names of all Subcontractors and the portions of the Work they will perform.

SUPPLEMENTS TO BID FORM SIGNATURE(S)

The Corporate Seal of

____

(Bidder - please print the full name of your Proprietorship, Partnership, or Corporation)

was hereunto affixed in the presence of:

____

(Authorized signing officer Title)

(Seal)

____

(Authorized signing officer Title)

(Seal)

END OF SUPPLEMENTS TO BID FORM

DOCUMENT 00 43 22

APPENDIX A - LIST OF UNIT PRICES

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

(Bidder)____

TO:	Hartford Healthcare 129 Patricia M. Genova Drive Newington, CT 06111
PROJECT:	Hartford Hospital Historic Properties 94-100, 104-110 & 146 Jefferson Street 247 Washington Street 123 Retreat Avenue Hartford, CT 06106

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

We propose and agree that, should the amount of work required be increased or decreased, by a request of the Owner, the following Unit Prices will be the basic price for computing extra cost or credit. It is understood that the right is reserved by the above mentioned Owner to reject or negotiate any or all of the Unit Prices.

Each Unit Price includes all equipment, tools, labor, permits, fees, overhead and profit, etc. incidental to completion of the work involved and the disposal of surplus or unsuitable material in accordance with the Plans and Specifications or as directed by the Architect. Unit Prices will be decreased ten percent (10%) if change requested is a reduction in work.

ITEM DESCRIPTION – Provide unit pricing as follows:	PRICE/UNIT
94-100 Jefferson Street	
1. Exterior masonry repointing.	$_________per square foot.
2. Replacement of rotted/deteriorated sheathing	$_________per square foot.
3. Window Restoration of typical window (approx.. 3’-4” x 6’-2’)	$_________ea.
4. Window replacement of typical window (approx.. 3’-4” x 6’-2’)	$_________ea.
5. Replacement of deteriorated brownstone sill w/ cast stone sill	$_________per linear foot.
6. Replace existing flashing	$_________per linear foot.
7. Replacement of soffit board.	$_________per linear foot.
8. Replacement of fascia board.	$_________per linear foot.
104-110 Jefferson Street	
1. Exterior masonry repointing.	$_________per square foot.
2. Replacement of rotted/deteriorated sheathing	$_________per square foot.

3. Replacement of deteriorated/damaged rafters $__________per linear foot.
4. Replacement of deteriorated brownstone sill w/ cast stone sill $__________per linear foot.

146 Jefferson Street

1. Exterior masonry repointing. $__________per square foot.
2. Replacement tile at front entry $__________per square foot.
3. Replacement of deteriorated brownstone sill w/ cast stone sill $__________per linear foot.
4. Replacement of tile roof coping $__________ea.

END OF SECTION

DOCUMENT 00 43 23

APPENDIX B - LIST OF ALTERNATES

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

(Bidder)____

TO: Hartford Healthcare
129 Patricia M. Genova Drive
Newington, CT 06111

PROJECT: Hartford Hospital Historic Properties
94-100, 104-110 & 146 Jefferson Street
247 Washington Street
123 Retreat Avenue
Hartford, CT 06106

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

The following amounts shall be added to or deducted from the Bid Price. Refer to Section 01 26 00 – Contract Modification Procedures Part 1.9 Alternates. This form requests a "difference" in bid price by adding to or deducting from the base bid price using the Alternates listed below.

94-100 Jefferson Street

Bid Alternate #1: Remove all plywood from windows at building rear elevation. Restore all windows. Assume windows are existing and in a condition to restore at each opening. If not, windows to be replaced with replica per unit price. Install exterior storm windows and security bars at all first floor and basement windows.

END OF SECTION

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DOCUMENT 00 43 24

APPENDIX C - LIST OF SUBCONTRACTORS

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

(Bidder) ____

TO: Hartford Healthcare
129 Patricia M. Genova Drive
Newington, CT 06111

PROJECT: Hartford Hospital Historic Properties
94-100, 104-110 & 146 Jefferson Street
247 Washington Street
123 Retreat Avenue
Hartford, CT 06106

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

In accordance with the bid documents, we hereby submit a completed List of Subcontractors. The Owner reserves the right to reject a proposed Subcontractor for reasonable cause. Refer to AIA Article 5 of General Conditions.

The following work will be performed (or provided) by Subcontractors and coordinated by us. This list comprises the all of the subcontractors to be employed on this project:

WORK SUBJECT	***SUBCONTRACTOR***	***CONTRACT VALUE***

END OF SECTION

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DOCUMENT 00 60 01.1

AGREEMENT - AIA

1 AGREEMENT

AIA Document A101 Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum (2017 Edition), forms the basis of Contract between the Owner and Contractor.

END OF SECTION

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DRAFT

AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor
where the basis of payment is a Stipulated Sum

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

and the Contractor:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

« »
« »
« »

The Architect:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[« »] The date of this Agreement.

[« »] A date set forth in a notice to proceed issued by the Owner.

[« »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

« »

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[« »] Not later than « » (« ») calendar days from the date of commencement of the Work.

[« »] By the following date: « »

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » ($ « »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

« »

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

« »

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« »

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the « » day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the « » day of the « » month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than « » (« ») days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;
.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;
.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

« »

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

« »

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

« »

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

« »

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« »

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

« » % « »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

« »
« »
« »
« »

§ 6.2 Binding Dispute Resolution
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[« »] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

« »

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

« »

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

« »
« »
« »
« »
« »
« »

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

« »
« »
« »
« »
« »
« »

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds
§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

« »

§ 8.7 Other provisions:

« »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS
§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds
.3 AIA Document A201™–2017, General Conditions of the Contract for Construction
.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

« »

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[« »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

« »

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

« »

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

DOCUMENT 00 60 10.1

PERFORMANCE BOND & PAYMENT BOND - AIA

1. GENERAL CONDITIONS

AIA Document A312 PERFORMANCE BOND & PAYMENT BOND (2010 Edition), are the Bond Forms to be provided for this project.

Bonding company for Performance & Payment bond to posses a rating of ‘A’ or better and be listed on the most recent IRS Circular 570.

END OF SECTION

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DRAFT **AIA® Document A312™ – 2010**

Payment Bond

CONTRACTOR:
(Name, legal status and address)

« »« »
« »

SURETY:
(Name, legal status and principal place of business)

« »« »
« »

OWNER:
(Name, legal status and address)
« »« »
« »

CONSTRUCTION CONTRACT
Date: « »
Amount: $ « »
Description:
(Name and location)
« »
« »

BOND
Date:
(Not earlier than Construction Contract Date)
« »
Amount: $ « »
Modifications to this Bond: « » None « » See Section 18

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signature: ______________________
Name and Title: « »« »

SURETY
Company: *(Corporate Seal)*

Signature: ______________________
Name and Title: « »« »

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**
« »
« »
« »

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)
« »
« »
« »
« »
« »
« »

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions
§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

« »

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:	« »« »	Name and Title:	« »« »
Address:	« »	Address:	« »

DRAFT **AIA® Document A312™ – 2010**

Performance Bond

CONTRACTOR:
(Name, legal status and address)

« »« »
« »

SURETY:
(Name, legal status and principal place of business)

« »« »
« »

OWNER:
(Name, legal status and address)

« »« »
« »

CONSTRUCTION CONTRACT
Date: « »
Amount: $ « »
Description:
(Name and location)
« »
« »

BOND
Date:
(Not earlier than Construction Contract Date)
« »
Amount: $ « »
Modifications to this Bond: « » None « » See Section 16

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signature: ______________
Name and Title: « »« »

SURETY
Company: *(Corporate Seal)*

Signature: ______________
Name and Title: « »« »

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

« »
« »
« »

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

« »
« »
« »
« »
« »
« »

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

« »

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:	« »« »	Name and Title:	« »« »
Address:	« »	Address:	« »

DOCUMENT 00 60 20.1

GENERAL CONDITIONS – AIA A201

1. GENERAL CONDITIONS

AIA Document A201 General Conditions of the Contract for Construction (2017 Edition) are the General Conditions between the Owner and Contractor.

END OF SECTION

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AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

« »
« »

THE OWNER:
(Name, legal status and address)

« »« »
« »

THE ARCHITECT:
(Name, legal status and address)

« »« »
« »

TABLE OF ARTICLES

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 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. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization
Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation
In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service
§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice
§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission
The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance
Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or

relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, 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.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work
If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work
If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR
§ 3.1 General
§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor
§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures
§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials
§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty
§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes
The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws
§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions
If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site
The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching
§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up
§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work
The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights
The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification
§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General
§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract
§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications
The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term “Subcontractor” does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term “Sub-subcontractor” is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor’s Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor’s Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

.1 defective Work not remedied;

.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

.5 damage to the Owner or a Separate Contractor;

.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or

.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments
§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment
If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion
§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use
§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property
If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances
§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest
Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract

Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause
§ 14.2.1 The Owner may terminate the Contract if the Contractor
- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:
- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience
§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent
- **.1** that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience
§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall
- **.1** cease operations as directed by the Owner in the notice;
- **.2** take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- **.3** except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation
§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration
§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder
§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party

provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

SECTION 01 10 07

GENERAL PROJECT GUIDELINES

PART 1 – GENERAL

1.1 SAFETY PRECAUTIONS

PREFACE: This standard includes general project guidelines provided to supplement specific repair and preventive maintenance procedures. Not all of these requirements will be applicable given the level of difficulty of the procedure. However, where applicable, these guidelines should be used in addition to recommendations provided by the regional historic preservation officer (RHPO). The information is listed in the order it might appear in the usual CSI section format.

A. The supervisor should ensure that all workers wear adequate, approved protective clothing and are provided with protective equipment during work operations and as required at other times.

B. Check manufacturer's literature for precautions and effects of products and procedures on adjacent building materials, components, and especially vegetation. Take appropriate protective measures.

C. All workers must be protected from the effects of chemicals during repair or cleaning operations.
  1. DO NOT save unused portions of stain-removal materials.
  2. DO NOT store any chemicals in unmarked containers.
  3. EXCELLENT VENTILATION MUST BE PROVIDED WHEREVER ANY SOLVENT IS USED. USE RESPIRATORS WITH SOLVENT FILTERS. NOTE: SOME OF THE SOLVENTS LISTED COULD BE KNOWN CARCINOGENS AND MAY BE BANNED IN SOME STATES.
  4. No use of organic solvents indoors should be allowed without substantial air movement. Use only spark-proof fans near operations involving flammable liquids.
  5. Provide adequate clothing and protective gear where the chemicals are indicated to be dangerous.
  6. Have available antidote and accident treatment chemicals where noted.
  7. Avoid skin contact and inhalation of any chemical. Rubber or plastic gloves should be worn when handling hazardous (flammable or toxic) chemicals.
     a. Follow storage and handling procedures printed on the container labels of the cleaning solutions, provide good ventilation while working, and thoroughly wash hands after completion of the work.
     b. Provide protective clothing which must be worn and protective creams for exposed skin areas.
     c. Accidental contact with unprotected skin to these materials must be treated immediately by washing with soap and water, never with solvents.
     d. Exercise care to avoid skin contact to tool cleaning solvents and to provide adequate ventilation for clean-up operations.

D. When removing bird droppings: Bird droppings may expose workers to the effects of cryptococcosis and histoplasmosis which endanger the human respiratory system. Public health authorities should be consulted for appropriate precautions.

1. All contractor personnel must wear a National Institute for Occupational Safety and Health (NIOSH) approved full face respirator with a high efficiency particulate air (HEPA) filter for screening particles of 0.3 micron size. Dust and particle masks are not appropriate.
2. Respirators must be used in accordance with OSHA regulation, 29 CFR 1910.134 and GSA policy, PBS P 5900.2C, Chapter 3, section 8. This includes fit-testing of respirators, maintenance, training, and storage requirements.
3. All contractor personnel must wear protective coveralls, gloves, boots, and hats.
4. Prior to removal, all excrement must be saturated with water under low pressure to prevent debris from becoming airborne.
5. On historic structures, only non-metallic tools (such as plastic spatulas and brushes with natural fiber or nylon bristles, or their equivalent) must be used to remove the excrement.
6. Removed excrement must be collected in plastic bags, sealed, and disposed of by the contractor at a sanitary landfill.
7. All work must be performed from the outside of the building. Building occupants and the general public must be kept clear of the work site during all operations. It is the contractor's responsibility to provide all barricades, signage, etc. necessary for public protection.

E. When removing paint:

1. Paint being removed most likely will contain lead. All workers must wear protective clothing (including hair), goggles and respirators with proper filters.
2. No food or drink shall be allowed near any work station so as to prevent contamination from paint, paint chips, dust or chemical removers which contain lead and other toxic substances.
3. Protective clothing shall be removed at the end of each day and kept at the site to prevent workers from tracking dust and paint chips to other parts of the site or to their homes.
4. Wash hands and face often, especially before eating and at the end of the day.
5. All waste material shall be collected at the end of each work day and disposed of in a manner consistent with local environmental regulations. It is considered Hazardous Waste.

1.2 HISTORIC STRUCTURES PRECAUTIONS

A. The principal aim of any work must be to halt the process of deterioration and stabilize the item's condition. Repair is a second option which becomes necessary only where preservation is not sufficient to ensure mid- to long-term survival. Repair should always be based on the fundamental principle of 'minimal disturbance'. The following are good practices which arise from this principle:

1. Retention of as much existing material as possible; repairing and consolidating rather than renewing.
2. The use of additional material or structure to reinforce, strengthen, prop, tie, and/or support existing material or structure.

3. The use of reversible processes wherever possible.
4. The use of traditional materials and techniques. New work should be distinguishable to the trained eye, on close inspection, from the old.
5. The item should be recorded before, during and after the work.
    a. No smoking will be allowed by personnel performing work on or about Historic Structures.
    b. RHPO's approval is required for any change, addition or removal of historic structural fabric or historic property.
    c. RHPO should be notified of any visible change in the integrity of the material or component whether environmental, such as biological attack, ultraviolet degradation, freeze, thaw, etc., or structural defects, such as cracks, movement, or distortion.
    d. Architectural features will be repaired rather than replaced wherever possible. Repair or replacement of missing features will be based on accurate duplications rather than on conjectural designs.
    e. Work which requires existing features to be removed, cleaned and reused shall be accomplished without damage to the material itself, to adjacent materials, or the substrate.
    f. Existing features removed from the building which are to be reinstalled shall be carefully labeled and stored within the building in a place where they will not be damaged or obstruct other work.
    g. New or replacement materials/features will be permanently marked in an unobtrusive manner to distinguish them from original fabric. The manner of identification and location of these marks shall be recorded in permanent building records.
    h. Identify the historic importance of the material or feature. The item's merit, in terms of age, uniqueness of design, materials, size, technological development, association with persons or events, exceptional workmanship or design qualities, must be understood before decisions regarding repair, maintenance and preservation can be made.
    i. Statement of Non-Compliance: Wherever it is necessary to proceed with the use of products, under conditions which do not comply with the requirements (because of time schedule difficulties or other reasons which the supervisor determines that are crucial to the project), prepare a written statement for the RHPO's Record indicating the nature of the non-compliance, the reasons for proceeding, the extra or precautionary measures taken to ensure the best possible work, and the names of the individuals concurring with the decisions to proceed with the work.
    j. When cleaning, avoid overcleaning. Aim for achieving 85% clean. Most damage occurs when attempting to clean the last 15%.
        1) Do not use acids or flame tools to strip paint from stone, as it will damage the surface.
        2) Do not use steel or metal spatulas or tools to scrape stone because of the likelihood of scratching, chipping, gouging, or otherwise marring the surface.

1.3 SUBMITTALS

A. Product Data (when applicable):

1. Submit to RHPO manufacturer's technical data for each product indicated

including chemical analysis, recommendations for their application and use, and any other available technical data. Include test reports and certifications substantiating that products comply with requirements.

2. MANUFACTURERS OFFERING OTHER THAN BRAND NAME ITEMS IDENTIFIED IN THE PROCEDURE SHOULD FURNISH ADEQUATE INFORMATION TO ENSURE THAT A DETERMINATION CAN BE MADE AS TO EQUALITY OF THE PRODUCT(S) OFFERED (SEE THE CLAUSE ENTITLED BRAND NAME OR EQUAL SET FORTH IN SECTION 552.210-74 OF THE GSA ACQUISITION REGULATION).

B. Samples:

1. Clearly labelled samples of all materials to be used on the job should be submitted to the RHPO for approval before work starts.
2. The approved samples will become the standard materials used on the job. Substitutions will not be permitted without written approval from the RHPO.
3. Quality Control Submittals:
   a. Submit written program for each phase of process including protection of surrounding materials during operations. Describe in detail materials, methods and equipment to be used for each phase of work.
   b. If alternative methods and materials to those indicated are proposed for any phase of work, provide written description to RHPO, including evidence of successful use on other, comparable projects, and program of testing to demonstrate effectiveness for use on this project.
   c. The contractor should supply proof of work on this type of project by submitting a list of pertinent projects the subcontractor has worked on which includes the scope of work, the budget for the scope of work, and a way to
   d. contact the owner and architect of each project.

4. Design Data/Test Reports/Certificates:
   a. Routine testing of proposed materials, and of final work for compliance with the procedure will be carried out by the RHPO or his\her appointed representative.
   b. Cleaning methods should be tested prior to selecting the one for use. The simplest and least aggressive method(s) should be selected.
   c. The level of cleanliness desired also should be determined. A like-new appearance is both inappropriate and requires an overly harsh cleaning method.
   d. If test results show that performance criteria are not met, removal and repair of rejected work should be performed.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Restoration Specialist: Work must be performed by a firm having not less than five years successful experience in comparable projects and employing personnel skilled in the processes and operations indicated. Project supervisor must have five years of experience in work similar to this procedure. Additional personnel must also have experience.

2. A supervisory craftsperson will be present when a craftsperson begins to perform the work in order to explain any procedures. Any modification of the written procedures will be made at that time.
3. The supervisory craftsperson shall also be present during the work to instruct personnel as required.
   a. Source of Materials: Obtain materials from a single source for each type material required.

B. Regulatory Requirements:
1. Engage an approved independent testing laboratory to examine materials prior to use and continuously inspect the work for compliance with this procedure and any related documents.
2. The required research report and manufacturer's data shall be at the site and used for reference.
3. Conform with all applicable safety guidelines.
4. For Cleaning: Comply with municipal and Federal regulations governing cleaning, chemical waste disposal, scaffolding and protection of adjacent surfaces.

C. Mock-ups: After acceptance of the list of materials and proposed method of cleaning, repair or refinishing, a representative sample area shall be cleaned, repaired or refinished as specified.
1. Employ the method proposed and accepted for use. Obtain acceptance of the sample area from the RHPO before proceeding with remainder of the procedure.
2. Maintain the sample area in its accepted condition until final acceptance of the completed work. Manufacturer's Representative should be present during mock-up and its inspection for approval. Sample work should be performed in an area approved by the RHPO.
3. A SMALLER TEST FOR EACH PRODUCT SHOULD BE DONE ON EACH MATERIAL IN AN INCONSPICUOUS AREA TO CHECK FOR ADVERSE EFFECTS AND DAMAGE TO THE MATERIAL.
   a. For Cleaning
      1) Before cleaning, all drains to be used should be tested to ensure they are functioning properly. Any clogged drains should be reported immediately.
      2) During cleaning, prevent cleaning residue from entering the drains or drain lines. Drains or drain lines that become blocked with cleaner residue must be cleaned out immediately.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver materials to site in manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers.

B. Acceptance at Site: Handle materials in accordance with project safety guidelines and manufacturer's recommendations.

C. Storage and Protection:
   1. Every effort must be made to use and reuse materials that are original to the structure. When removed from their rightful place, these materials must be stored under cover inside the building where they cannot be damaged.
   2. When pieces are to be removed, mark pieces inconspicuously in a consistent manner as to their original location. Document original position and label accordingly.
   3. If salvage material is to be used, treat it as new or original material with regard to its storage.
   4. Protect all materials during storage and construction from wetting by rain, snow or ground water, and from intermixture with earth or other types of materials.
   5. Protect materials from deterioration by moisture and temperature.
      a. Store cementitious materials off ground, under cover and in a dry location. Protect liquid components from freezing.
      b. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.
      c. Store all chemicals in metal cabinets. No cans shall be left open or out of the cabinet overnight.

1.6 PROJECT/SITE CONDITIONS

A. Environmental Requirements:
   1. Proceed with the work only when forecasted weather conditions are favorable.
   2. Wet weather: Do not attempt repairing of feature in raining or foggy weather. Do not apply primer, paint, putty, or epoxy when the relative humidity is above 80%. Do not remove exterior elements of structures when rain is in the forecast or in progress.
   3. Work in the shade when the temperature is above 75 degrees F. Work around the structure in the shade away from the sun.
   4. Do not perform exterior wet work when the air temperature is below 40 degrees F.
   5. NEVER begin cleaning, patching, etc. when there is any likelihood of frost or freezing.
   6. If cleaning is done in very hot, sunny weather, the feature/area should be shielded from excessive heat by hanging protective netting or tarpaulins around it.
   7. No cleaning shall be executed when either the air or the masonry surface temperature is below 45 degrees F, unless adequate, approved means are provided for maintaining a 45 degrees F temperature of the air and materials during, and for 48 hours subsequent to, cleaning.
   8. Perform cleaning and rinsing of the exterior masonry only during daylight hours.
   9. Hot weather maximum application temperatures:
      a. paint - 85 degrees F
      b. putty - 80 degrees F
      c. epoxy - 80 degrees F

   10. Cold weather minimum application temperatures:
      a. paint - 50 degrees F

b. putty - 50 degrees F
c. epoxy - 55 degrees F

B. Existing Conditions: Check manufacturer's literature for precautions and effects of products and procedures on adjacent building materials, components, and especially vegetation.

1.7 SEQUENCING AND SCHEDULING

A. Preventive Maintenance and Repair activities should be scheduled during appropriate environmental conditions to avoid weather related failures.

B. Submit a work schedule indicating the proposed timing and extent of the work.

C. Co-ordinate the work schedule with that of other trades on site.

D. When cyclical maintenance work requires the use of high ladders and other access equipment, perform as many work items as possible.

1.8 PROTECTION

A. Do not change sources or brands of materials during the course of the work.

B. All necessary precautions shall be taken to protect all parts of the building not being cleaned or repaired from effects of the work, including excessive amounts of water that should not be allowed to pond in any area. Also provide protection as required to prevent damage to adjacent property.

C. Provide protection against the spread of dust, debris and water at or beyond the work area by suitable enclosures of sheeting and tarpaulins.

D. Provide masking or covering on adjacent surfaces and permanent equipment. Secure coverings without the use of adhesive type tape or nails. Impervious sheeting which produces condensation should not be used.

E. Prevent the entry of dust, debris and water into the building by sealing all openings.

F. Provide protection from water damage to building, structure, or building contents as required.

G. Protect all landscape work adjacent to or within maintenance work areas:
1. Provide plank barriers to protect tree trunks. Bind spreading shrubs.
2. Covering should allow plants to breathe and should be removed at the end of each work day. Do not cover plant material with a waterproof membrane for more than 8 hours at one time.
3. Set scaffolding and ladder legs away from plants. Pruning requests should be directed to the RHPO.

H. Test all drains and other water removal systems to assure that drains and systems are functioning properly prior to performing any cleaning operations. Notify Contracting Officer or designated representative immediately of any and all drains or systems that are found to be stopped or blocked. Contractor shall repair drains if so directed by the Contracting Officer or designated representative. Do not begin work of this Section until the drains are in working order.

I. Provide a method to prevent solids such as stone or mortar residue from entering the drains or drain lines. Contractor shall be responsible for cleaning out drains and drain lines that become blocked or filled by sand or any other solids because of work performed under this Contract.

J. Scaffolding, ladders and working platforms, required for the execution of this work should be provided. These items should not be attached to the building.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END OF SECTION

SECTION 01 10 10

SUMMARY

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Contract Description.
B. Work Covered by Contract Documents
C. Phase Construction
D. Work under separate Contracts
E. Owner-furnished Products
F. Work Restrictions
G. Specifications and Drawing Conventions

1.2 PROJECT INFORMATION

A. Project Identification:
   1. Project Location: 94-100, 104-110 & 146 Jefferson Street, 247 Washington Street & 123 Retreat Avenue, Hartford, CT 06106.
   B. Owner: Hartford Healthcare, 129 Patricia M. Genova Drive, Newington, CT 06111.
   1. Owner's Point of Contact: David Cas

C. Architect: Crosskey Architects, llc, 750 Main Street, Suite 150, Hartford, CT 06103.
   1. Architect's Point of Contact: Laura Crosskey.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
   a. The exterior restoration of above listed properties including but not limited to the replacement/restoration of windows and doors, roofing replacements, brick restoration, and exterior wood trim restoration. Refer to individual building construction drawings for building specific scope.

B. Type of Contract: Fixed-Fee.

1.4 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the work of this Contract with work performed under separate contracts.

B. Subsequent Work: Owner will award separate contract(s) for the following additional work to be performed at site following Substantial Completion. Completion of that work will depend on the successful completion of preparatory work under this Contract.

1.5 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on the use of public streets and with other requirements of authorities having jurisdiction.

B. On-site Work Hours: Limit work in the existing building to normal business working hours of 8:00am to 5:00pm, Monday through Friday, unless otherwise indicated.

1. Weekend Hours: 9:00am to 5:00pm
2. Hours for Core Drilling or similar noisy activities shall be limited to the hours of 10:00am to 5:00pm.

C. Noise Vibration and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Construction Manager not less than two days in advance of proposed disruptive operations.

D. Non Smoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows or outdoor-air intakes.

E. Controlled Substances: Use of Tobacco Products and other controlled substances within the existing building is not permitted.

F. Employee Screening: Comply with Owner’s requirements for drug and background screening of Contractor Personnel working on Project Site.

1.6 SPECIFICATION AND DRAWING CONVENTIONS

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit five copies, or via electronic format, of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use CSI Form 13.1A (example can be found after this section).
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
      b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. Certificates and qualification data, where applicable or requested.
      g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
      h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
      i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
      j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in

delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
n. Sample of Warranty (ies) with side-by-side comparison with that specified.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution provides sustainable design characteristics that specified product provided for achieving LEED prerequisites and credits.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 3 – EXECUTION

(Not Used)

END OF SECTION

Crosskey Architects LLC

SUBSTITUTION REQUEST
(After the Bidding/Negotiating Phase)

Substitution Request Number: ____________________

From: ____________________

Date: ____________________

A/E Project Number: ____________________

Contract For: ____________________

Project: ____________________

____

To: ____________________

____

Re: ____________________

Specification Title: ____________________ Description: ____________________

Section: __________ Page: __________ Article/Paragraph: ____________________

Proposed Substitution: ____________________

Manufacturer: __________ Address: ____________________ Phone: ____________________

Trade Name: ____________________ Model No.: ____________________

Installer: __________ Address: ____________________ Phone: ____________________

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: ____________________

____

____

☐ Point-by-point comparative data attached — REQUIRED BY A/E

Reason for not providing specified item: ____________________

____

Similar Installation:

Project: ____________________ Architect:_ Address: ____________________

Owner: ____________________

____________________ Date Installed: ____________________

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain ____________________

____

Savings to Owner for accepting substitution: ____________________ ($__________).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] __________ days.

Supporting Data Attached: ☐Drawings ☐Product Data ☐ Samples ☐ Tests ☐ Reports ☐ __________

Crosskey Architects LLC

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase — Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: ______________________________

Signed by: ______________________________

Firm: ______________________________

Address: ______________________________

____

Telephone: ______________________________

Attachments: ☐

A/E's REVIEW AND RECOMMENDATION

☐ Approve Substitution - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.
☐ Approve Substitution as noted - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.
☐ Reject Substitution - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by:______________________________ Date:______________

OWNER'S REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order.
☐ Substitution rejected - Use specified materials.

Signed by:______________________________ Date:______________

Additional Comments: ☐Contractor ☐Subcontractor ☐Supplier ☐Manufacturer ☐A/E

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SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Inspection and testing allowances.
B. Schedule of Values.
C. Application for Payment.
D. Change procedures.
E. Defect Assessment.
F. Measurement and Payment - Unit Prices.
G. Alternates.
H. Requests for Information
I. Inspections for substantial completion and final completion

1.2 RELATED SECTIONS

A. Owner - Contractor Agreement: Contract sum/price including allowances.
B. Section 01 33 00 - Submittals: Schedule of Values.
C. Section 01 60 00 – Product Requirements: Product substitutions and alternates.

1.3 INSPECTION AND TESTING ALLOWANCES

A. Costs Included in Allowances: Cost of engaging an inspection or testing firm, execution of inspection or tests, reporting results.

B. Costs Not Included in the Allowance:
   1. Incidental labor and facilities required to assist inspection or testing firm.
   2. Costs of testing laboratory services required by Contractor separate from Contract Document requirements.
   3. Costs of retesting upon failure of previous tests as determined by Architect/Engineer.

C. Payment Procedures:
   1. Submit one copy of the inspection or testing firm's invoice with next application for payment.
   2. Pay invoice on approval by Architect/Engineer.

D. Include the sum of $5,000.00 for payment of inspection and testing laboratory services specified in Section 01 40 00. Differences in cost will be adjusted by change order.

1.4 SCHEDULE OF VALUES

A. Submit typed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.

B. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

C. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Split line items into subcatagories for materials and labor. Identify bonds, insurance and site mobilization costs.

D. Include in each line item, the amount of each Allowance specified in this Section.

E. Revise schedule with each Application For Payment, to list approved change orders.

1.5 APPLICATIONS FOR PAYMENT

A. Submit five 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.

1.6 CHANGE PROCEDURES

A. The Architect/Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized and will issue supplemental instructions.

B. The Architect/Engineer may issue a Proposal Request, which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change, the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within seven days.

C. The Contractor may propose a change by submitting request for change to the Architect/Engineer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum/Price and Contract Time with full documentation in the form of unit costs and quantities for Material and Labor. Document any requested substitutions in accordance with Section 01 60 00.

   1. <u>Stipulated Sum/Price Change Order:</u> Based on Proposal Request and Contractor's fixed price quotation.
   2. <u>Unit Price Change Order:</u> For pre-determined unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of work, which are not pre-determined, execute Work under a Construction Change Authorization. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Change Order.

D. Construction Change Authorization: Architect/Engineer may issue a directive, on AIA Form G713 Construction Change Authorization signed by the Owner, instructing the Contractor to proceed with a 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. Contractor will promptly execute the change.

E. Change Order Forms: AIA G701 Change Order.

F. Execution of Change Orders: Architect will issue change orders for signature of parties as provided in the Conditions of the Contract.

G. **<u>Contractor shall reimburse Owner for Architect's time spent reviewing proposed change orders more than twice (original and 1 revision) for the same item or scope of work.</u>**

H. Contractor shall reimburse Owner for Architect's time spent evaluating an extensive number of claims submitted by the Contractor in connection with the Work.

1.7 DEFECT ASSESSMENT

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

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

1.8 MEASUREMENT AND PAYMENT - UNIT PRICES

A. Authority: Measurement methods are delineated in the individual specification sections.

B. Take measurements and compute quantities. The Architect will verify measurements and quantities.

C. Unit Quantities: Quantities and measurements indicated in the Bid Form are for contract purposes only. Actual quantities provided shall determine payment.

D. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.9 ALTERNATES

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

B. Coordinate related work and modify surrounding work as required.

C. Schedule of Alternates:
   1. Refer to Section 00 41 23 and Bid Form.

1.10 REQUESTS FOR INFORMATION

A. Contractor shall reimburse Owner for Architect's time spent responding to the Contractor's requests for information where such information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor prepared coordination drawings, or prior Project correspondence or documentation.

B. Refer to Section 01 31 00.

1.11 INSPECTIONS FOR SUBSTANTIAL COMPLETION AND FINAL COMPLETION

A. Contractor shall reimburse Owner for Architect's time spent inspecting any portion of the Work more than twice to determine final completion or to determine whether such portion of the Work is substantially complete in accordance with the requirements of the Contract Documents."

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION

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SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Coordination.
B. Requests for Information
C. Field engineering
D. Pre-construction conference.
E. Site mobilization conference.
F. Progress meetings.
G. Pre-installation conferences.

1.2 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate space requirements and installation of mechanical and electrical work, which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

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

F. 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 REQUESTS FOR INFORMATION (RFIs)

A. Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

B. RFI to include a detailed, legible description of item needing information or interpretation and the following:
   1. Project Date
   2. Date
   3. Name of Contractor
   4. Name of Architect
   5. RFI number, numbered sequentially
   6. RFI subject
   7. Specification Section number, title and related paragraphs as appropriate.

8. Drawing number and detail references, as appropriate.
9. Field dimensions and conditions, as appropriate.
10. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or Contract Sum, Contractor shall state impact in the RFI.
11. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. Architect will review each RFI, determine action required and respond. Allow ten working days for Architect's response for each RFI. RFIs received by Architect after 1:00pm EST will be considered as received the following day. If it is necessary for a Consultant to review an RFI allow for fifteen working days for both Architect and Consultant response for each RFI.

D. Architect's action may include a request for additional information, in which Architect's time for response will date from the time of receipt of additional information.

E. Architect's action that may result in a change to the Contract Time or Contract Sum may be eligible for Contractor to submit a Change Proposal in accordance with 01 26 00 Contract Modification Procedures.
   1. If Contractor believe the RFI response warrants change in Contract Time of Contract Sum, notify the Architect in writing within ten business days or receipt of the RFI response.

1.4 FIELD ENGINEERING

A. Employ a Land Surveyor registered in the State of Connecticut and acceptable to the Architect/Engineer.

B. Contractor to locate and protect survey control and reference points.

C. Control datum for survey is that established by Owner provided survey as shown on Drawings.

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

E. Submit a copy of registered site drawing and certificate signed by the Land Surveyor that the elevations and locations of the Work are in conformance with the Contract Documents.

1.5 PRECONSTRUCTION CONFERENCE

A. Owner will schedule a conference after Notice of Award.

B. Attendance Required: Owner, Architect/Engineer & Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties in Contract, and the Architect/Engineer.

6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders and Contract closeout procedures.
7. Scheduling.

1.6 SITE MOBILIZATION CONFERENCE

A. Owner will schedule a conference at the Project site prior to Contractor occupancy.

B. Attendance Required: Owner, Architect/Engineer, and Contractor, Contractor's Superintendent & major Subcontractors.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Procedures for testing.
9. Procedures for maintaining record documents.
10. Requirements for start-up of equipment.
11. Inspection and acceptance of equipment put into service during construction period.

1.7 PROGRESS MEETINGS

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

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings. Contractor will record meetings and distribute copies within seven days to Architect, Owner, participants, and those affected by decisions made.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect/Engineer as appropriate to agenda topics for each meeting.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems, which impede 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.

1.8 PREINSTALLATION CONFERENCES

A. When required in individual specification Section, convene a pre-installation conference at work site prior to commencing work of the Section.

B. Require attendance of parties directly affecting, or affected by, work of the specific Section.

C. Notify Architect/Engineer four days in advance of meeting date.

D. Prepare agenda, preside at conference, record minutes, and distribute copies within two days after conference to participants, with two copies to Architect/Engineer.

E. Review conditions of installation, preparation and installation procedures, and coordination with related work.

PART 2 – PRODUCTS
(Not Used)

PART 3 – EXECUTION
(Not Used)

END OF SECTION

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Periodic Construction Photographs
   2. Photographic documentation for submittal with Pay Requisitions.
   3. Final Completion Construction Photographs.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan and Digital Photographs are to be submitted monthly with Pay requisitions, as documentation of the work completed.

B. Key Plan: Submit key plan of project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

C. Digital Photographs: Submit image files within three days of taking photographs.
   1. Digital Camera: Minimum sensor resolution of 8 megapixels
   2. Format: Minimum 3200 x 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
   3. Identification: Provide the following information with each image description in file metadata tag:
      a) Name of project
      b) Name and contract information for photographer
      c) Name of Architect and Construction Manager/ General Contractor
      d) Name of Contractor
      e) Date Photograph was taken
      f) Description of vantage point, indicating location, direction (by compass point_, and elevation or story of construction

1.3 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 – PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 – EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly, show the work. Photographs with blurry or out-of-focus areas will not be accepted.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
   1. Aerial Photography: Where applicable provide a monthly photograph of the project site & building each month of the Construction process for submission with pay requisitions/ for Owner records.

D. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since the last photographs were taken.

E. Final Completion Construction Photographs: Take 20 color photographs after the date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.
   1. Do not include Date Stamp.

F. Additional photographs: Architect or Construction Manager may request photographs in addition to periodic photographs specified. Additional photographs include, but are not limited to, the following:
   1. Three-day notice will be given, where feasible.
   2. In emergency situations, take additional photographs within 24 hours of request
   3. Circumstances that could require additional photographs include, but are not limited to, the following:
      a) Immediate follow-up when on-site events result in construction damage or losses
      b) Owner's request for special publicity photographs

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including but not limited to the following:
   1. Submittal schedule.
   2. Shop Drawings.
   3. Product Data.
   4. Samples.
   5. Quality assurance submittals.
   6. Proposed "Substitutions/Equals".
   7. Warrantee samples.
   8. Coordination Drawings.
   9. O & M Manuals

B. Administrative Submittals: Refer to other Division 01 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
   1. Permits.
   2. Applications for Payment.
   3. Performance and payment bonds.
   4. Contractor’s construction schedule.
   5. Daily construction reports.
   6. Construction Photographs.
   7. Insurance certificates.
   8. List of subcontractors.

C. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 01 26 00 "Contract Modification Procedures" specifies requirements for submittal of requests for equals and substitutions.
   2. Section 01 26 00 "Contract Modification Procedures " specifies requirements for submittal of the Schedule of Values.
   3. Section 01 31 00 "Project Management and Coordination " specifies requirements governing preparation and submittal of required Coordination Drawings.
   4. Division 01 Section 01 31 00 " Project Management and Coordination " specifies requirements for submittal and distribution of meeting and conference minutes.
   5. Division 01 Section 01 40 00 "Quality Control" specifies requirements for submittal of inspection and test reports and mockups.
   6. Division 01 Section 01 77 00 "Contract Closeout" specifies requirements for submittal of Project Record Documents and warranties at project closeout.

1.3 DEFINITIONS

A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended and as identified in the Specification Divisions 02 - 48.

1. Preparation of Coordination Drawings is specified in Section 01 31 00 "Project Management and Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.

B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.4 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
   a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
   b. The Architect reserves the right to reject incomplete submitted packages.
3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for re-submittals.
   a. Allow **14** days for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
   b. If an intermediate submittal is necessary, process the same as the initial submittal.
   c. Allow **14** days for reprocessing each submittal.
   d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

B. Submittal Preparation: Place a permanent label, title block or 8-1/2 inches x 11 inches cover page approved by the Architect, on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. The minimum number of copies required for each submittal shall be seven (7) or as determined otherwise at the pre-construction conference or by the Construction Administrator.
2. Provide a space approximately 4 inches by 5 inches on the label, beside the title block or on the cover page on Shop Drawings to record the Contractor's review and approval markings and the action taken.
3. Include the following information on the label for processing and recording action taken.

a. Project Name.
b. Date.
c. Name and address of the Architect, Construction Administrator, and Owner Representative.
d. Name and address of the Contractor.
e. Name and address of the subcontractor.
f. Name and address of the supplier.
g. Name of the manufacturer.
h. Number and title of appropriate Specification Section.
i. Drawing number and detail references, as appropriate.
j. Indicate either initial or resubmittal.
k. Indicate deviations from Contract Documents.
l. Indicate if "equal" or "substitution".

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. Copy the Construction Administrator on the transmittal. The Architect will return all submittals to the Contractor after action is taken with a complete copy of the submittal package and one complete copy of the submittal package. The Architect will not accept submittals received from sources other than the Contractor.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

1.5 SUBMITTAL SCHEDULE

A. After development and review by the Owner and Architect acceptance of the Contractor's Construction or CPM schedule prepare a complete schedule of submittals. Submit the schedule to the Construction Administrator within thirty (30) days of Contract Award.

1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction or CPM Schedule.
2. Prepare the schedule in chronological order. Provide the following information:

a. Schedule date for the initial submittal.
b. Related section number.
c. Submittal category (Shop Drawings, Product Data, or Samples).
d. Name of Subcontractor.
e. Description of the part of Work covered.
f. Scheduled date for resubmittal.
g. Scheduled date for the Architect's final release of approval.

B. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's Construction or CPM Schedule.
2. Initial Submittal: Submit concurrently with start-up construction schedule. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each specification section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same specification section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow **14 days** for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination with related submittals not yet received. Additional time will be required if processing must be delayed to permit review of related subsequent submittals.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow **14 days** for review of each resubmittal.
4. Mass Submittals: Six (6) or more submittals in one (1) day or twenty (20) or more submittals in one (1) week. If "Mass Submittals" are received, Architect's review time stated above may be extended as necessary to perform proper review. Architect will review "Mass Submittals based upon priority determined by Architect after consultation with Owner and Contractor.

E. Distribution: Following response to the initial submittal, print and distribute copies to the Construction Administrator, Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

F. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Construction Administrator at weekly intervals:
   1. List of subcontractors at the site.
   2. Approximate count of personnel at the site.
   3. High and low temperatures, general weather conditions.
   4. Accidents and unusual events.
   5. Meetings and significant decisions.
   6. Stoppages, delays, shortages, and losses.
   7. Meter readings and similar recordings.
   8. List of equipment on site and identify if idle or in use.
   9. Orders and requests of governing authorities.
   10. Change Orders received, start and end dates.
   11. Services connected, disconnected.
   12. Equipment or system tests and startups.
   13. Partial Completion's, occupancies.
   14. Substantial Completion's authorized.
   15. Equals or Substitutions approved or rejected.

1.7 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
   1. Dimensions.
   2. Identification of products and materials included by sheet and detail number.
   3. Compliance with specified standards.
   4. Notation of coordination requirements.
   5. Notation of dimensions established by field measurement.
   6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
   7. Submit digital prints as directed by the Construction Administrator. The Contractor's submittal shall identify the specification section and/or drawing number applicable to the submittal.
   8. Details shall be large scale and/or full size.

C. The Contractor shall review the Shop Drawings, stamp with this approval, and submit them with reasonable promptness and in orderly sequence so as to cause no delay in his Work or in the Work of any subcontractor. Shop Drawings shall be properly identified as specified for item, material, workmanship, and project number. At the submission, the Contractor shall inform the Architect, in writing of any deviation in the shop drawings from the requirements of the Contract Documents.

D. The Architect will review and comment on shop drawings with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the project and with the information given in the Contract Documents. Refer to Article 5 of the General Conditions. Shop Drawings received by the Architect that indicate insufficient study of drawings and specifications, illegible portions or gross errors, will be rejected outright. Such rejections shall not constitute an acceptable reason for granting the Contractor additional time to perform the work.

E. The Contractor shall make any corrections required by the Architect and shall resubmit the required number of corrected copies of Shop Drawings until fully reviewed.

F. Upon final review submit digital prints, same as submitted, for use by the Construction Administrator.

G. The Architect's review and comments on Shop Drawings shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents.

H. Only final reviewed Shop Drawings are to be used on the Project site.

I. The Work installed shall be reviewed in accordance with the Shop Drawings and the drawings and specifications. Final Review of the Shop Drawings by the Architect shall constitute acceptance by the Owner and the Architect of a variation or departure that is clearly identified. If the contractor believes notations made by the A/E increases the value or scope of the CD's, the contractor must provide written notice to the CA within seven (7) days of this issue. Final reviewed Shop Drawings shall not replace or be used as a vehicle to issue or incorporate change orders or substitutions. Substitutions shall be submitted in accordance with Division 01 Section 01 25 00 "Substitution Procedures".

1.8 SHOP DRAWING FOR FIRE PROTECTION SYSTEMS

A. Shop drawings for fire protection systems shall comply with all of the requirements in the section above "Shop Drawings". In addition, Sprinkler system shop drawings and hydraulic calculations must be stamped by a professional engineer licensed in the state of Connecticut. Two (2) sets of information shall be submitted to local jurisdiction for review.

1.9 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, schedules, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
   1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
      a. Manufacturer's printed recommendations.
      b. Compliance with trade association standards.
      c. Compliance with recognized testing agency standards.
      d. Application of testing agency labels and seals.
      e. Notation of dimensions verified by field measurement.
      f. Notation of coordination requirements.
   2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
   3. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
   4. Submittals: Submit digital copies of each required submittal; submit printed copies where required for maintenance manuals. The Architect will retain one (1) and will return the other marked with action taken and corrections or modifications required.

a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
   a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
   b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.10 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
   1. Store, mount or display Samples on site in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following:
   a. Specification Section number and reference.
      b. Generic description of the Sample.
      c. Sample source.
      d. Product name or name of the manufacturer.
      e. Compliance with recognized standards.
      f. Availability and delivery time.
   2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
      a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show approximate limits of the variations.
      b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
      c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
      d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
   3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices, unless otherwise noted in specification section.
      a. The Architect will review and return preliminary submittals with the Architects notation, indicating selection and other action.
   4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit three (3) sets. The Architect will return one (1) set marked with the action taken.
   5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.

a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.
a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.11 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 01 Section 01 40 00 "Quality Control."

1.12 ARCHITECT'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.
1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:
1. **Furnish as Corrected**: When the Architect marks a submittal "**Furnish as Corrected**," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Submit corrected copies for record. Final payment depends on that compliance.
2. Returned for Resubmittal: When the Architect marks a submittal "Rejected, or Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
a. Do not use, or allow others to use, submittals marked "**Rejected**, or **Revise and Resubmit**" at the Project Site or elsewhere where Work is in progress.
3. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "**Reviewed**."

C. Unsolicited Submittals: The Architect will discard unsolicited submittals without action.

PART 2 – PRODUCTS

(Not Applicable)

PART 3 – EXECUTION

(Not Applicable)

END OF SECTION

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SECTION 01 35 16

ALTERATION PROJECT PROCEDURES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Products and installation for patching and extending Work.
B. Transition and adjustments.
C. Repair of damaged surfaces, finishes, and cleaning.

1.2 RELATED SECTIONS

A. Section 01 31 00 – Project Management and Coordination: Work sequence, Owner occupancy, Maintenance of utility services.
B. Section 01 31 00 – Project Management and Coordination, Cutting and patching.
C. Section 01 50 00 – Construction Facilities and Temporary Controls: Temporary enclosures, Protection of installed work, Cleaning during construction.
D. Section 02 41 19.16 – Minor Demolition for Remodeling: Removal and storage of products to be reinstalled in this Section.

PART 2 – PRODUCTS

2.1 PRODUCTS FOR PATCHING AND EXTENDING WORK

A. New Materials: As specified in product Sections; match existing Products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspection and testing Products where necessary, referring to existing Work as a standard.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that demolition is complete, and areas are ready for installation of new Work.

B. Beginning of restoration work means acceptance of existing conditions.

3.2 PREPARATION

A. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

C. Remove debris and abandoned items from area and from concealed spaces.

D. Prepare surface and remove surface finishes to provide for proper installation of new work and finishes.

E. Close openings in exterior surfaces to protect existing work and salvage items from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.

3.3 INSTALLATION

A. Coordinate work of alterations and renovations to expedite completion sequentially and to accommodate Owner occupancy.

B. Project & Finishes: Complete in all respects including operational mech./elec. work.

C. Remove, cut, and patch Work in a manner to minimize damage and to provide a means of restoring Products and finishes to original or specified condition.

D. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.

E. Install Products as specified in individual Sections.

3.4 TRANSITIONS

A. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patched Work to match existing adjacent Work in texture and appearance.

B. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect/Engineer.

3.5 ADJUSTMENTS

A. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

B. Where a change of plane of 1/4 inch or more occurs, submit recommendation for providing a smooth transition for Architect/Engineer review or request instructions from Architect/Engineer.

C. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

D. Fit work at penetrations of surfaces.

3.6 REPAIR OF DAMAGED SURFACES

A. Patch or replace portions of existing surfaces, which are damaged, lifted, discolored, or showing other imperfections.

B. Repair substrate prior to patching finish.

3.7 FINISHES

A. Finish surfaces as specified in individual Product Sections.

B. Finish patches to product uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.8 CLEANING

A. In addition to cleaning specified in Section 01 77 00, clean Owner occupied areas of work.

END OF SECTION

SECTION 01 40 00

QUALITY CONTROL

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Quality assurance and control of installation.
B. References.
C. Field samples.
D. Mock-up.
E. Inspection and testing laboratory services.
F. Manufacturers' field services and reports.

1.2 RELATED SECTIONS

A. Section 01 30 00 – Submittals Procedures: Submission of Manufacturers' Instructions and Certificates.
B. Section 01 60 00 – Product Requirements: Requirements for material and product quality.

1.3 QUALITY ASSURANCE/CONTROL OF INSTALLATION

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

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

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

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

E. Perform work by persons qualified to produce workmanship of specified quality.

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

G. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

1.4 REFERENCES

A. Conform to reference standard by date of issue current on date for receiving bids.

B. Obtain copies of standards when required by Contract Documents.

C. Should specified reference standards conflict with Contract Documents, request clarification for Architect/Engineer before proceeding.

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.5 FIELD SAMPLES

A. Install field samples at the site as required by individual specifications Sections for review.

B. Acceptable samples represent a quality level for the Work.

C. Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by Architect/Engineer.

1.6 MOCK-UP

A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Where mock-up is specified in individual Sections to be removed, clear area after mock-up has been accepted by Architect/Engineer.

1.7 INSPECTION AND TESTING LABORATORY SERVICES

A. Owner will appoint and employ services of an independent firm to perform inspection and testing. Contractor shall pay for services from an allowance specified in Section 01 31 00.

B. The independent firm will perform inspections, tests, and other services specified in individual specification Sections and as required by the Architect/Engineer.

C. Reports will be submitted by the independent firm to the Architect/Engineer, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

D. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.
   1. Notify Architect/Engineer 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.

E. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer. Contractor shall pay for required retesting.

F. Testing and source quality control may occur on or off the project site. Perform off-site testing as required by the Architect or the Owner.

G. Testing does not relieve Contractor to perform Work to contract requirements.

1.8 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. Submit qualifications of observer to Architect/Engineer 30 days in advance of required observations. Observer subject to approval of Architect/Engineer.

B. 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.

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

D. Submit report within 30 days of observation to Architect/Engineer for review.

1.9 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. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

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

PART 2 – PRODUCTS

(Not used)

PART 3 – EXECUTION

(Not used)

END OF SECTION

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SECTION 01 50 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, heat, telephone service, water, and sanitary facilities.

B. Temporary Controls: Barriers, enclosures and fencing, protection of the Work, and water control.

C. Construction Facilities: Access roads, truck access routes, parking, progress cleaning, and project signage.

1.2 TEMPORARY ELECTRICITY

A. Cost: By Contractor; Provide and pay for power service required from Utility source.

B. Provide temporary electric feeder from electrical service at location as directed.

C. Contractor will pay cost of energy used.

D. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.

E. Provide main service disconnect and overcurrent protection at convenient location, feeder switch at source distribution equipment.

F. Permanent convenience receptacles may be utilized during construction.

G. Provide adequate distribution equipment, wiring, and outlets to provide single-phase branch circuits for power and lighting.

1.3 TEMPORARY LIGHTING

A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft.

B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.

C. Provide and maintain 0.25 watt/sq ft H.I.D. lighting to interior work areas after dark for security purposes.

D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

E. Maintain lighting and provide routine repairs.

F. Permanent building lighting may be utilized during construction.

1.4 TEMPORARY HEAT

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

B. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

C. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.

1.5 TEMPORARY VENTILATION

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

1.6 TELEPHONE & FACSIMILE SERVICE

A. Provide, maintain and pay for telephone and facsimile service to field office at time of project mobilization.

1.7 TEMPORARY WATER SERVICE

A. Provide, maintain and pay for suitable quality water service required.

B. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

1.8 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures.

1.9 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide protection for plant life designated to remain. Replace damaged plant life.

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

D. Provide temporary roofing as required.

1.10 TEMPORARY FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6-foot high fence around construction sites; equip with vehicular and pedestrian gates with locks.

1.11 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.

1.12 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather-tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification Sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

B. Provide temporary roofing as required.

1.13 PROTECTION OF INSTALLED WORK

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 minimize damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.14 SECURITY

A. Provide security and facilities to protect Work, and operations from unauthorized entry, vandalism, or theft.

1.15 ACCESS ROADS/TRUCK ACCESS ROUTES

A. Construct and maintain temporary roads accessing public thoroughfares to serve construction area.

B. Extend and relocate as Work progress requires. Provide detours necessary for unimpeded traffic flow.

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

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

E. Existing on-site roads may be used for construction traffic.

F. Follow truck access routes as shown on drawings attached to this specification section, pages 01 50 00-5 & 01 50 00-6.

1.16 PARKING

A. Arrange for temporary parking to accommodate construction personnel.

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

1.17 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a 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 the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Remove waste materials, debris, and rubbish from site periodically and dispose off-site.

1.18 PROJECT IDENTIFICATION

A. Temporary Signs - Provide three (3) project signs of exterior grade plywood and wood frame construction, painted, with die cut vinyl, self-adhesive letters and self-adhesive logo, to Owner's design and colors.

B. Erect on site at location established by Architect/Engineer.

C. No other signs are allowed without Owner permission except those required by law.

1.19 FIELD OFFICES

A. Office: Weather-tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture, drawing rack and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Locate office on site in existing building or job trailer.

1.20 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.

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

D. 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. Transportation and handling.
C. Storage and protection.
D. Product options.
E. Substitutions.

1.2 RELATED SECTIONS

A. Section 00 21 13 - Instructions to Bidders: Product options and substitution procedures.
B. Section 01 40 00 - Quality Control: Product quality monitoring.

1.3 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. Provide interchangeable components of the same manufacturer, for similar components.

1.4 TRANSPORTATION AND HANDLING

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

B. Promptly inspect shipments to assure that 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.

1.5 STORAGE AND PROTECTION

A. Store and protect Products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive Products in weather-tight, climate controlled enclosures.

B. For exterior storage of fabricated Products, place on sloped supports, above ground.

C. Provide off-site storage and protection when site does not permit on-site storage or protection.

D. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. Store loose granular materials on solid flat surfaces in a well-drained area. Provide mixing with foreign matter.

F. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of Products to permit access for inspection. Periodically inspect to assure Products are undamaged and are maintained under specified conditions.

1.6 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 manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

1.7 SUBSTITUTIONS

A. Architect/Engineer will consider requests for Substitutions only within 15 days after date of Owner-Contractor Agreement.

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 the Contractor:
   1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
   2. Will provide the same warranty for the Substitution as for the 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 and/or redesign services associated with approval by architect, engineer and other authorities.**

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 the 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 shop drawings, Product data, and certified test results attesting to the proposed Product equivalence.
   3. The Architect will notify Contractor, in writing, of decision to accept or reject request.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION
(Not used)

END OF SECTION

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SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
   1. Section 02 41 19 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for commencement of the work.

1.5 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For waste management coordinator.

1.6 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements.

B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste**.** Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use:
1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
5. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
   a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
1. Pulverize concrete to maximum 4-inch size.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
   1. Pulverize masonry to maximum 4-inch size.
   2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.
   1. Structural Steel: Stack members according to size, type of member, and length.
   2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

J. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
   1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Carpet Tile: Remove debris, trash, and adhesive.
   1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

N. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   2. Polystyrene Packaging: Separate and bag materials.
   3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
   4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:
   1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.

2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
   1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.

E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 75 16

STARTUP PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Starting systems.
B. Demonstration and instructions.
C. Testing, adjusting, and balancing.

1.2 RELATED SECTIONS

A. Section 01 40 00 - Quality Control: Manufacturers field reports.
B. Section 01 77 00 - Contract Closeout: System operation and maintenance data and extra materials.

1.3 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect/Engineer and Owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions, which may cause damage.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of responsible Contractors' personnel in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Section 01 40 00 that equipment or system has been properly installed and is functioning correctly.

1.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate Project equipment instructed by a qualified manufacturers' representative who is knowledgeable about the Project.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled times, at equipment location.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.5 TESTING, ADJUSTING, AND BALANCING

A. Contractor will employ services of an independent firm to perform testing and adjusting. Contractor shall pay for services.

B. Reports will be submitted by the independent firm to the Architect/Engineer indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 77 00

CONTRACT CLOSEOUT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Closeout Procedures.
B. Final Cleaning.
C. Adjusting.
D. Project Record Documents.
E. Operation and Maintenance Data.
F. Warranties.
G. Spare Parts and Maintenance Materials.

1.2 RELATED SECTIONS

A. Section 01 50 00 - Construction Facilities and Temporary Controls: Progress cleaning.
B. Section 01 75 16 – Demonstration & Training: System start-up, testing, adjusting, and balancing.
C. Section 26 61 00 – Commissioning of Electrical

1.3 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 Architect/Engineer's inspection.

B. Provide submittals to Architect/Engineer and Owner that are required by governing or other authorities.

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

1.4 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition.

D. Replace filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

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

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

1.5 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the Work:
   1. Contract Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other Modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Store Record Documents separate from documents used for construction.
   7. Record information concurrent with construction progress.

B. 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.

C. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract Drawings.

D. Delete Architect/Engineer title block and seal from all documents.

E. Submit documents to Architect/Engineer with claim for final Application for Payment.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit one set prior to final inspection, bound in 8-1/2 x 11 inch (216 x 279 mm) text pages, three D side ring capacity expansion binders with durable plastic covers.

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

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

D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, type on 30 pound white paper.
   Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
   Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. 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.

Part 3: Project documents and certificates, including the following:

a. Shop drawings and product data.
b. Air and water balance reports.
c. Certificates.
d. Photocopies of warranties and bonds.

E. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Architect/Engineer comments. Revise content of documents as required prior to final submittal.

F. Submit final volumes revised, within ten days after final inspection.

1.8 WARRANTIES

A. Provide notarized copies.

B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.

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

D. Submit prior to final Application for Payment.

E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.9 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

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

PART 2 – PRODUCTS

(Not used)

PART 3 – EXECUTION

(Not used)

END OF SECTION

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SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 – GENERAL

1.1 SUMMARY

A. SECTION INCLUDES:

1. Information described under this section:

   a. Definitions
   b. Coordination
   c. Submittals
   d. Performance
   e. Miscellaneous

1.2 DEFINITIONS

A. "CUTTING AND PATCHING"

1. Includes cutting into existing construction to provide for the installation or performance of other work and subsequent patching required to restore surfaces to their original condition.
2. Includes cutting to uncover conditions for access or inspection and/or to obtain samples for testing and verify of existing conditions.
3. Work performed during the initial fabrication, erection or installation processes is <u>not</u> considered to be "cutting and patching" under this definition. Drilling of holes to install fasteners and similar operations is also <u>not</u> considered to be "cutting and patching".
4. "DEMOLITION" and "SELECTIVE DEMOLITION" are recognized as related-but-separate categories of work.

1.3 DESCRIPTION

A. Refer to other sections of these specifications for specific cutting and patching requirements and limitations applicable to individual units of work.

1. Unless otherwise specified, requirements of this section apply to mechanical and electrical work.
2. Refer to Division 23 and Division 26 sections for additional requirements and limitations on cutting and patching of mechanical and electrical work.

1.4 SUBMITTALS

A. PROCEDURAL PROPOSAL FOR CUTTING AND PATCHING:

1. Where prior approval of cutting and patching by Owner or Architect is required, submit proposed procedures for this work well in advance of the time work will be performed and request approval to proceed.
2. Include the following information, in the submittal (if applicable):

   a. Describe nature of the work and how it is to be performed, indicating why cutting and patching cannot be avoided.
   b. Describe anticipated results of the work in terms of changes to existing work, including structural, operational and visual changes as well as other significant elements.

c. List products to be used and firms that will perform work.
d. Give dates when work is expected to be performed.
e. List utilities that will be disturbed or otherwise be affected by work, including those that will be relocated and those that will be out-of-service temporarily.
f. Indicate how long utility service will be disrupted.
g. Describe protection to existing plant, equipment and products.
h. Provide dust-proof enclosures where required by Owner.
i. Where cutting and patching of structural work involves the addition of reinforcement, submit details and engineering calculations to show how that reinforcement is integrated with original structure to satisfy requirements.

1.5 QUALITY ASSURANCE

A. REQUIREMENTS FOR STRUCTURAL WORK: Do not cut and patch structural work without Architects review and written approval.

B. OPERATIONAL AND SAFETY LIMITATIONS:

1. Do not cut and patch operational elements of safety related components in a manner that would result in a reduction of their capacity to perform in the manner intended.
2. Provide any or all of the following as required for specific work being undertaken:

a. Shoring, bracing, and sheeting.
b. Water/moisture/dust/smoke barriers, membranes and flashings.

C. VISUAL REQUIREMENTS:

1. Do not cut and patch exposed work in a manner that would, in the Architect's opinion, result in lessening the building's aesthetic qualities.
2. Do not cut and patch work in a manner that would result in substantial visual evidence of cut and patch work.
3. Remove and replace work judged by the Architect to be cut and patched in a visually unsatisfactory manner.

1.6 COORDINATION

A. The mechanical and electrical subcontractors shall be responsible for the timely and accurate layout of their work.

B. Where timely notice is not provided, cutting of completed surfaces of the building shall be done by the Contractor at the expense of the subcontractor at fault.

C. Each Subcontractor unless noted otherwise by the Contractor shall be responsible for all cutting operations required for their work.

D. Each Subcontractor shall provide the appropriate fire or sound-rated seals and closures and/or escutcheon plates to close openings created for their work.

1. Any holes drilled incorrectly cut or patched are to be repaired to the satisfaction of the Architect.

E. Any openings required to be cut through the roof system shall include installation of headers and blocking to support remaining deck and other material above.

F. All openings in walls shall include installation of headers or lintels to support wall materials and masonry above the opening.

PART 2 – PRODUCTS

2.1 MATERIALS

A. GENERAL:

1. Except as otherwise indicated, or as directed by the Architect, use materials for patching that are identical to existing materials.
2. If identical materials are not available, or cannot be used, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect.
3. Use materials for cutting and patching that will result in equal-or-better performance characteristics.

PART 3 – EXECUTION

3.1 INSPECTION

A. Before the start of cutting work, meet at the work site with all parties involved in cutting and patching.

B. Review areas of potential interference and conflict between the various trades.

C. Coordinate layout of the work and resolve potential conflicts before proceeding with the work.

3.2 PREPARATION

A. TEMPORARY SUPPORT: To prevent failure provide temporary support of work to be cut.

B. PROTECTION:

1. Protect other work during cutting and patching to prevent damage.
2. Provide protection from adverse weather conditions for that part of the project that may be exposed during cutting and patching operations.
3. Protect existing products, machine personnel and equipment from harm and dust.

3.3 PERFORMANCE

A. GENERAL:

1. Employ skilled workers to perform cutting and patching work.

B. CUTTING:

1. Cut the work using methods that are least likely to damage work to be retained or adjoining work.

C. PATCHING:

1. Patch with seams which are durable and as invisible as possible.
2. Comply with specified tolerances for the work.
   a. Where feasible, inspect and test patched areas to demonstrate integrity of work.
   b. Restore exposed finishes of patched areas and where necessary extend finish restoration into retained adjoining work in a manner which will eliminate evidence of patching and refinishing.

3.4 CLEANING

A. Thoroughly clean areas where work is performed.

END OF SECTION

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SECTION 04 01 20

UNIT MASONRY RESTORATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes maintenance of unit masonry consisting of brick masonry restoration and cleaning as follows:
  1. Unused anchor removal.
  2. Repairing unit masonry, including replacing units.
  3. Painting steel uncovered during the work.
  4. Repointing joints.
  5. Preliminary cleaning, including removing plant growth.
  6. Cleaning exposed unit masonry surfaces.

B. Related Sections:
  1. Division 1 Section "General Preservation Project Guidelines".
  2. Division 1 Section “Mock-ups”.
  3. Division 3 Section "Unit Masonry Assemblies" for new clay masonry construction.
  4. Division 7 Section "Water Repellents" for water repellents applied to clay masonry.
  5. Division 7 Section "Sheet Metal Flashing and Trim" for metal flashing installed in or on restored clay masonry.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Division 1 Section "Unit Prices."
  1. Unit prices apply to authorized work covered by quantity allowances for areas that exceed the base bid. Refer to drawings for more info.
  2. Unit prices apply to additions to and deletions from Work as authorized by Change Orders.

1.4 DEFINITIONS

A. Very Low-Pressure Spray: Under 100 psi.

B. Low-Pressure Spray: 100 to 400 psi ; 4 to 6 gpm.

C. Medium-Pressure Spray: 400 to 800 psi ; 4 to 6 gpm.

D. High-Pressure Spray: 800 to 1200 psi ; 4 to 6 gpm.

E. Saturation coefficient in paragraph below is also called "C/B ratio."

F. Saturation Coefficient: Ratio of the weight of water absorbed during immersion in cold water to weight absorbed during immersion in boiling water; used as an indication of resistance of masonry units to freezing and thawing.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.

B. Shop Drawings: For the following:
   1. Provisions for expansion joints or other sealant joints.
   2. Provisions for flashing, lighting fixtures, conduits, and weep holes as required.
   3. Replacement and repair anchors. Include details of anchors within individual masonry units, with locations of anchors and dimensions of holes and recesses in units required for anchors.

C. Samples for Initial Selection: For the following:
   1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches long by 1/4 inch wide, set in aluminum or plastic channels.
      a. Have each set contain a close color range of at least three Samples of different mixes of colored sands and cements that produce a mortar matching the cleaned masonry when cured and dry.
      b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each Sample was made.
   2. Patching Compound: Submit sets of patching compound Samples in the form of plugs (patches in drilled holes) in sample units of masonry representative of the range of masonry colors on the building.
      a. Have each set contain a close color range of at least three Samples of different mixes of patching compound that matches the variations in existing masonry when cured and dry.
   3. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For the following:
   1. Each type of masonry unit to be used for replacing existing units. Include sets of Samples as necessary to show the full range of shape, color, and texture to be expected.
      a. For each brick type, provide straps or panels containing at least four bricks. Include multiple straps for brick with a wide range.
   2. Each type, color, and texture of pointing mortar in the form of sample mortar strips, 6 inches long by 1/4 inch wide, set in aluminum or plastic channels.
      a. Include with each Sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry, of each type of sand and brand names of cementitious materials and pigments if any.

1.6 QUALITY ASSURANCE

A. Restoration Specialist Qualifications: Engage an experienced masonry restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience installing standard unit masonry is not sufficient experience for masonry restoration work.

B. Source Limitations: Obtain each type of material for masonry restoration (face brick, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.

C. Cleaning and Repair Appearance Standard: Cleaned and repaired surfaces are to have a uniform appearance as viewed from 20 feet away by Architect. Perform additional paint and stain removal, general cleaning, and spot cleaning of small areas that are noticeably different, so that surface blends smoothly into surrounding areas.

D. Mockups: Prepare mockups of restoration and cleaning to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation.
   1. Masonry Repair: Prepare sample areas for each type of masonry material indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than 2 adjacent whole units or approximately 48 inches in least dimension. Erect sample areas in existing walls unless otherwise indicated, to demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
      a. Patching: Three small holes at least 1 inch in diameter for each type of masonry material indicated to be patched, so as to leave no evidence of repair.
   2. Repointing: Rake out joints in 2 separate areas, each approximately 36 inches high by 48 inches wide for each type of repointing required and repoint one of the areas.
   3. Cleaning: Clean an area approximately 25 sq. ft. for each type of masonry and surface condition.
      a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not use cleaners and methods known to have deleterious effect.
   4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons.

B. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.

E. Store lime putty covered with water in sealed containers.

F. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.

B. Repair masonry units and repoint mortar joints only when air temperature is between 40 and 90 deg F and is predicted to remain so for at least 7 days after completion of the Work unless otherwise indicated.

C. Cold-Weather Requirements: Comply with the following procedures for masonry repair and mortar-joint pointing unless otherwise indicated:
   1. When air temperature is below 40 deg F, heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between 40 and 120 deg F
   2. When mean daily air temperature is below 40 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 7 days after repair and pointing.

D. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and windbreaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F and above unless otherwise indicated.

E. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.

F. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least 7 days after completion of cleaning.

1.9 COORDINATION

A. Coordinate masonry restoration and cleaning with public circulation patterns at Project site. Some work is near public circulation patterns. Public circulation patterns cannot be closed off entirely, and in places can be only temporarily redirected around small areas of work. Plan and execute the Work accordingly.

1.10 SEQUENCING AND SCHEDULING

A. Order replacement materials at earliest possible date to avoid delaying completion of the Work.

B. Order sand and gray Portland cement for pointing mortar immediately after approval of mockups. Take delivery of and store at Project site a sufficient quantity to complete Project.

C. Perform masonry restoration work in the following sequence:
   1. Remove plant growth below only if cleaning precedes repairs and repointing. For this, masonry and joints must be sufficiently sound to prevent water and chemicals from penetrating into building.
   2. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
   3. Remove paint.
   4. Clean 100% of masonry surfaces.
   5. here water repellents, specified in Division 7, are to be used on or near masonry work, delay application of these chemicals until after pointing.
   6. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
   7. Repair masonry, including replacing existing masonry with new masonry materials.

8. Rake out mortar from joints to be repointed.
9. Point mortar and sealant joints.
10. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.
11. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
12. Remove paint.
13. Clean masonry surfaces.

D. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units to comply with "Masonry Unit Patching" Article. Patch holes in mortar joints to comply with "Repointing Masonry" Article.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Face Brick: Provide face brick, including specially molded, ground, cut, or sawed shapes where required to complete masonry restoration work.
   1. Provide units with colors, color variation within units, surface texture, size, and shape to match existing brickwork and with physical properties within 10 percent of those determined from preconstruction testing of selected existing units.
   2. Tolerances as Fabricated: Comply with tolerance requirements in ASTM C 216, Type FBX.
   3. Date Identification: Emboss in the clay body on an interior surface of each unit in easily read 1/2-inch- high characters, "MADE 2020." Manufacturer's name may also be embossed.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II, white or gray or both where required for color matching of exposed mortar.
   1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Factory-Prepared Lime Putty: ASTM C 1489.

D. Quicklime: ASTM C 5, pulverized lime.

E. Mortar Sand: ASTM C 144 unless otherwise indicated.
   1. For pointing mortar, provide sand with rounded edges.
   2. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.

F. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

G. Water: Potable.

2.3 MANUFACTURED REPAIR MATERIALS

A. Masonry Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching masonry.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cathedral Stone Products, Inc.; Jahn M100 Terra Cotta and Brick Repair Mortar.
      b. Conproco Corporation; Mimic.
      c. Edison Coatings, Inc.; Custom System 45.
   2. Use formulation that is vapor- and water permeable (equal to or more than the masonry unit), exhibits low shrinkage, has lower modulus of elasticity than the masonry units being repaired, and develops high bond strength to all types of masonry.
   3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
   4. Formulate patching compound used for patching brick and terra cotta in colors and textures to match each masonry unit being patched. Provide not less than three colors to enable matching the color, texture, and variation of each unit.

2.4 PAINT REMOVERS

A. Solvent-Type Paint Remover: Manufacturer's standard water-rinsable, solvent-type gel formulation for removing paint coatings from masonry.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. ABR Products, Inc.; Super Bio Strip Gel.
      b. Diedrich Technologies Inc.; 505 Special Coatings Stripper.
      c. Dumond Chemicals, Inc.; Peel Away 2.
      d. Hydroclean, Hydrochemical Techniques, Inc.; Hydroclean HT-300 Solvent Paint Remover.
      e. Price Research, Ltd.; Price Strip-All.
      f. PROSOCO; Sure Klean Fast Acting Stripper.

B. Low-Odor, Solvent-Type Paint Remover: Manufacturer's standard low-odor, water-rinsable solvent-type gel formulation, containing no methanol or methylene chloride, for removing paint coatings from masonry.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. ABR Products, Inc.; Super Bio Strip Gel.
      b. Cathedral Stone Products, Inc.; S-301.
      c. Dumond Chemicals, Inc.; Peel Away 6.
      d. PROSOCO; Enviro Klean Safety Peel 1.

2.5 CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

C. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium polyphosphate, 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.

D. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Price Research, Ltd.; Price Marble Cleaner-Gel.
      b. PROSOCO; Sure Klean 942 Limestone and Marble Cleaner.

2.6 ACCESSORY MATERIALS

A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. ABR Products, Inc.; Rubber Mask.
      b. Price Research, Ltd.; Price Mask.
      c. PROSOCO; Sure Klean Strippable Masking.

B. Setting Buttons: Resilient plastic buttons, nonstaining to masonry, sized to suit joint thicknesses and bed depths of masonry units without intruding into required depths of pointing materials.

C. Masking Tape: Nonstaining, nonabsorbent material, compatible with pointing mortar, joint primers, sealants, and surfaces adjacent to joints; that will easily come off entirely, including adhesive.

D. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.
   1. Use coating requiring no better than SSPC-SP 3, "Power Tool Cleaning" surface preparation according to manufacturer's literature or certified statement.
   2. Use coating with a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Miscellaneous Products: Select materials and methods of use based on the following, subject to approval of a mockup:
   1. Previous effectiveness in performing the work involved.
   2. Little possibility of damaging exposed surfaces.
   3. Consistency of each application.
   4. Uniformity of the resulting overall appearance.
   5. Do not use products or tools that could do the following:
      a. Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
      b. Leave a residue on surfaces.

2.7 MORTAR MIXES

A. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix to ASTM C 5 and manufacturer's written instructions.

B. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
   1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

C. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.
   1. Mortar Pigments: Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.

D. Do not use admixtures in mortar unless otherwise indicated.

E. Mortar Proportions: Mix mortar materials in the following proportions:
   1. Pointing Mortar for Brick: 1 part Portland cement, 2 parts lime, and 6 parts sand.
      a. Add mortar pigments to produce mortar colors required.
   2. Pointing Mortar for Terra Cotta: 1 part white Portland cement, 1 part lime, and 6 parts sand.
      a. Add mortar pigments to produce mortar colors required.
   3. Rebuilding (Setting) Mortar: Same as pointing mortar.
   4. Rebuilding (Setting) Mortar: Comply with ASTM C 270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to Portland cement and lime.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from masonry restoration work.
   1. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.

B. Prevent mortar from staining face of surrounding masonry and other surfaces.
   1. Cover sills, ledges, and projections to protect from mortar droppings.
   2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
   3. Immediately remove mortar in contact with exposed masonry and other surfaces.
   4. Clean mortar splatters from scaffolding at end of each day.

3.2 UNUSED ANCHOR REMOVAL

A. Remove masonry anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.
   1. Remove items carefully to avoid spalling or cracking masonry.
   2. Where directed, if an item cannot be removed without damaging surrounding masonry, do the following:

a. Cut or grind off item approximately 3/4 inch beneath surface and core drill a recess of same depth in surrounding masonry as close around item as practical.
b. Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.

3. Patch the hole where each item was removed unless directed to remove and replace the masonry unit.

3.3 BRICK REMOVAL AND REPLACEMENT

A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated or are to be reused. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
   1. When removing single bricks, remove material from center of brick and work toward outside edges.

B. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

C. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.

D. Remove in an undamaged condition as many whole bricks as possible.
   1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
   2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
   3. Store brick for reuse. Store off ground, on skids, and protected from weather.
   4. Deliver cleaned brick not required for reuse to Owner unless otherwise indicated.

E. Clean bricks surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.

F. Replace removed damaged brick with other removed brick in good quality, where possible, or with new brick matching existing brick, including size. Do not use broken units unless they can be cut to usable size.

G. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
   1. Maintain joint width for replacement units to match existing joints.
   2. Use setting buttons or shims to set units accurately spaced with uniform joints.

H. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min.. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.

1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
2. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.

3.4 MASONRY UNIT PATCHING

A. Repointing shall match the color, texture, joint width and joint profile of the existing historic masonry. Specifications and repointing samples shall be reviewed and approved by the State Historic Preservation Office before proceeding with this work.

B. Patch the following masonry units unless another type of replacement or repair is indicated:
   1. Units with holes.
   2. Units with chipped edges or corners.
   3. Units with small areas of deep deterioration.

C. Remove and replace existing patches unless otherwise indicated or approved by Architect.

D. Patching Bricks:
   1. Remove loose material from masonry surface. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch thick, but not less than recommended by patching compound manufacturer.
   2. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of masonry unit.
   3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
   4. Rinse surface to be patched and leave damp, but without standing water.
   5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
   6. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
   7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
   8. Keep each layer damp for 72 hours or until patching compound has set.

3.5 WIDENING JOINTS

A. Do not widen a joint, except where indicated or approved by Architect.

B. Location Guideline: Where an existing masonry unit abuts another or the joint is less than 1/8 inch, widen the joint for length indicated and to depth required for repointing after obtaining Architect's approval.

C. Carefully perform widening by cutting, grinding, routing, or filing procedures demonstrated in an approved mockup.

D. Widen joint to width equal to or less than predominant width of other joints on building. Make sides of widened joint uniform and parallel. Ensure that edges of units along widened joint are in alignment with joint edges at unaltered joints.

3.6 CLEANING MASONRY, GENERAL

A. Cleaning of masonry shall be accomplished using the gentlest means possible without damaging the surface of the masonry. Specifications and test cleaning samples shall be reviewed and approved by the Connecticut Commission on Culture and Tourism before proceeding with this work.

B. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.

C. Use only those cleaning methods indicated for each masonry material and location.
   1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
   2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
      a. Equip units with pressure gages.
      b. **Power Washers are not to be used.** Line pressure water cleaning only.
   3. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
   4. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
   5. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.

D. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.

E. Water Application Methods:
   1. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches from surface of masonry and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.

F. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
   1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.

G. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.7 PRELIMINARY CLEANING

A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil and debris from open masonry joints to whatever depth they occur.

B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.
1. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.
2. Remove paint and calking with alkaline paint remover.
    a. Comply with requirements in "Paint Removal" Article.
    b. Repeat application up to two times if needed.
3. Remove asphalt and tar with solvent-type paint remover.
    a. Comply with requirements in "Paint Removal" Article.
    b. Apply paint remover only to asphalt and tar by brush without prewetting.
    c. Allow paint remover to remain on surface for 10 to 30 minutes.
    d. Repeat application if needed.

3.8 PAINT REMOVAL

A. Paint Removal with Solvent-Type Paint Remover:
1. Remove loose and peeling paint using high-pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply thick coating of paint remover to painted masonry with natural-fiber cleaning brush, deep-nap roller, or large paint brush.
3. Allow paint remover to remain on surface for period recommended by manufacturer. Agitate periodically with stiff-fiber brush.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.

3.9 CLEANING BRICKWORK

A. Detergent Cleaning:
1. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
2. Rinse with cold water applied by low-pressure spray to remove detergent solution and soil.
3. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

3.10 REPOINTING MASONRY

A. Repointing shall match the color, texture, joint width and joint profile of the existing historic masonry. Specifications and repointing samples shall be reviewed and approved by the Connecticut Commission on Culture & Tourism before proceeding with this work.

B. Rake out and repoint joints to the following extent:
1. All joints in areas indicated.
2. Joints where mortar is missing or where they contain holes.

3. Cracked joints where cracks can be penetrated at least 1/4 inch by a knife blade 0.027 inch thick.
4. Cracked joints where cracks are 1/8 inch or more in width and of any depth.
5. Joints where they sound hollow when tapped by metal object.
6. Joints where they are worn back 1/4 inch or more from surface.
7. Joints where they are deteriorated to point that mortar can be easily removed by hand, without tools.
8. Joints where they have been filled with substances other than mortar.
9. Joints indicated as sealant-filled joints.

C. Do not rake out and repoint joints where not required.

D. Rake out joints as follows, according to procedures demonstrated in approved mockup:

1. Remove mortar from joints to depth of joint width plus 1/8 inch, but not less than 1/2 inch or not less than that required to expose sound, unweathered mortar.
2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.
    a. Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without Architect's written approval based on approved quality-control program.

E. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

F. Pointing with Mortar:

1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
3. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch . Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours including weekends and holidays.
    a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
    b. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.

6. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

G. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.11 FINAL CLEANING

A. Cleaning of exterior masonry shall be accomplished using the gentlest means possible without damaging the surface of the masonry. Specifications and test cleaning samples shall be reviewed and approved by the Connecticut Commission on Culture & Tourism before proceeding with this work.

B. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

C. Wash adjacent woodwork and other non-masonry surfaces. Use detergent and soft brushes or cloths.

D. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.

E. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash pavement surfaces to remove mortar, dust, dirt, and stains.

3.12 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare test reports. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

B. Notify inspectors in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors have had reasonable opportunity to make inspections of work areas at lift device or scaffold location.

END OF SECTION

SECTION 04 01 20.53

GENERAL CLEANING OF EXTERIOR BRICK MASONRY

PART 1 – GENERAL

1.1 SUMMARY

A. This procedure includes guidance on cleaning exterior brick masonry.

B. Safety Precautions:

1. The work specified herein requires knowledge of older materials and methods and a high degree of skill to execute properly. This work should be performed only by an experienced, pre-qualified contractor. It is not recommended that building maintenance personnel perform this work.
2. This outline specification contains recommended materials which may be toxic. The manufacturers literature on application techniques, appropriate protection for workers and disposal procedures for materials should be complied with in conjunction with all regulatory requirements referenced in this document.

C. See 01 10 07 for General Preservation Project Guidelines to be reviewed along with this procedure. These guidelines cover the following sections:

1. Safety Precautions
2. Historic Structures Precautions
3. Submittals
4. Quality Assurance
5. Delivery, Storage and Handling
6. Project/Site Conditions
7. Sequencing and Scheduling
8. General Protection (Surface and Surrounding)
These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the State Historic Preservation Officer (SHPO).

1.2 SUBMITTALS

A. Product Data:

1. Submit manufacturer's product literature instructions for use, and Material Safety Data Sheets (MSDS) to the Architect or the designated representative for all cleaning materials.
2. Prior to commencing the cleaning operations, the Contractor shall submit to the Architect or the designated representative a written description of the entire methods and procedures proposed for cleaning the masonry including, but not limited to: Method of application, dilution of application, temperature of application, length of time of surface contact, method of rinsing surface (temperature, pressure, and duration), repetition of procedures, etc.
3. Prior to commencing the cleaning operations, the Contractor shall submit to the Architect or the designated representative for approval, a written description of proposed materials and methods of protection for preventing damage to adjacent materials, vehicular and pedestrian traffic, and the building interior during the cleaning of masonry.

B. Samples:
   1. The Contractor shall clean a sample panel(s), approximately 2' x 2' in area, on each type of masonry included in the work of this section for approval by the Architect. Locations of sample panels to be selected by the Architect or the designated representative.
   2. Adjust the chemical concentrations, working pressures and methodologies during test panel cleaning, as directed by the Architect or the designated representative.
   3. Sample panels shall be cleaned by the Contractor using methods, materials, and working pressures previously submitted and approved. Sample panel cleaning shall be performed in the presence of the Architect or the designated representative. The working pressures during sample panel cleaning shall be varied up to the previously submitted and approved capacities to determine the best working pressure.
   4. Where chemical cleaners and poultices are tested, the manufacturer's representative shall be present during testing.
   5. The Contractor shall obtain written approval from the Architect or the designated representative of cleaning methods, working pressures, materials, equipment used and sample panels before proceeding with building cleaning operations. For this written approval purpose, the Contractor shall allow a minimum of seven calendar days after completion of sample cleaning to permit the Architect of the designated representative to study the sample panels for negative reaction. Retain approved panels in unaltered condition, suitably designated during construction as a standard for judging completed work.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Comply with municipal and federal regulations governing all work included in this section and including, but not limited to waste disposal.
   2. General Objective: The objectives of masonry cleaning are to remove dirt, grime and coatings from masonry without damaging underlying material and to give all masonry a clean, uniform appearance without blotches, streaks, runs, or any other kind of spotty appearance. Too aggressive cleaning shall not be acceptable.
   3. Cleaning Standard: Prepare sample panels for approval which shall establish a standard for general brick and stone cleaning. General cleaning shall not commence until written approval is obtained from the Architect or the designated representative.
   4. Contractor: The work of this section shall be performed by a specialist possessing a minimum of five (5) years of specialized experience in the cleaning of historic architectural masonry similar to that which is required by this project. Contractors shall submit to the Architect or the designated representative references of previous work justifying their experience. The Architect or the designated representative reserves the right to approve or disapprove the use of Contractors contingent upon their experience.
   5. In the event that the Contractor wishes to modify any cleaning method specified, he shall submit his proposal in writing for consideration and review. The Architect of the designated representative will have the right to ask for test samples before final approval. Any such modifications or changes shall be at no additional cost to the Owner.

B. Regulatory Requirements: Comply with municipal and Federal regulations governing the cleaning, chemical waste disposal, product safety, scaffolding and protection to workers and adjacent properties.

1.4 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

1. No cleaning shall be executed when air or masonry surface temperature is below 45 degrees (F.), unless adequate, approved means are provided for maintaining a 45 degrees (F.), temperature of the air and materials during, and for 48 hours subsequent to, cleaning.
2. Perform cleaning and washing of the exterior masonry only during hours of natural daylight

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. ProSoCo, Inc. http://www.prosoco.com/

B. Diedrich Technologies, Inc. http://www.diedrichtechnologies.com/

2.2 MATERIALS

A. Masonry Cleaner: Commercially available very mild blend of inhibited acidic ingredients and wetting agents specifically formulated for restorative cleaning of brick and natural stone surfaces such as "Sure Klean Restoration Cleaner" (ProSoCo, Inc.), "101 G Granite, Terra Cotta and Brick Resoration Cleaner" (Diedrich Technologies), or approved equal.
Masonry cleaner should have the following physical characteristics:

Form: Clear liquid
Ph: 1.2
Specific Gravity (Typical): 1.05

B. Water: Potable, non-staining and free of oils, acids, alkalis and organic matter.

C. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film forming, strippable masking material for protecting glass, metal and polished stone surfaces from damaging effect of acidic and alkaline masonry cleaners, such as "Sure Klean Strippable Masking" (ProSoCo, Inc.), or approved equal.

2.3 EQUIPMENT

A. Brushes: Natural fiber bristle only. The use of wire brushes or steel wool is not permitted.

B. Garden hose with fan tip nozzles. **Power washers are not to be used.**

PART 3 – EXECUTION

3.1 PREPARATION

A. Protection:

1. Take all necessary precautions and measures to protect surrounding materials on the site, surfaces of the building not being cleaned, adjacent buildings, pedestrians and vehicles from coming in contact with cleaning chemicals, over spray, or run-off. Products used for masonry cleaning may be harmful to painted, polished, glazed, or metallic surfaces. Any damage to materials caused by the cleaning operations is unacceptable and shall be repaired or replaced by the Contractor to the satisfaction of the Architect or the designated representative at no cost to the Owner.
2. Provide protection from water damage to building, structure, or building contents as required.
3. Protect trees and plants around the building from contamination or damage as directed by the Architect or the designated representative. The Contractor shall be responsible for replacing with new stock, any trees, shrubbery or grass damaged by the cleaning operations.

4. Test all drains and other water removal systems to assure that drains and systems are functioning properly prior to performing any cleaning operations. Notify Architect or the designated representative immediately of any and all drains or systems that are found to be stopped or blocked. Contractor shall repair drains if so directed by the Architect or the designated representative. Do not begin work of this Section until the drains are in working order.
5. Provide a method to prevent solids such as stone or mortar residue from entering the drains or drain lines. Contractor shall be responsible for cleaning out drains and drain lines that become blocked or filled by sand or other solids because of work performed under this Contract.

3.2 ERECTION, INSTALLATION, APPLICATION

A. Dilute masonry cleaner with 16 parts water to 1 part concentrate, or use appropriate dilution based on sample panel cleaning. When diluting, always pour water into empty bucket first, then carefully add concentrate. Handle in rubber or polyethylene buckets only. Acidic liquids and fumes will attack metal.

B. After protecting all non-masonry surfaces, thoroughly wet the area to be cleaned.

C. Apply the cleaning solution liberally using low pressure spray (50 psi), roller or densely filled (tampico) masonry washing brush. Do not apply restoration cleaner with high pressure spray. Such application will drive the chemicals deep into the surface, making it difficult to rinse completely. Discoloration to the surface may result.

D. Allow the cleaning solution to remain on the surface for three to five minutes in accordance with approved test procedures. Light scrubbing of the surface will improve cleaning results. Caution: Do not allow cleaning solution to "dry in" to the masonry - bleaching may result.
   1. Begin rinsing with low pressure flood rinse to remove initial acidic residue with minimum risk of wind drift.
   2. Then rinse the treated area thoroughly using pressurized cold water. Rinse water pressure shall not exceed 300 psi, and shall be sprayed through nozzles fitted with 15 to 20" wide tips. Nozzles shall be held perpendicular to the surface at a working distance of 1.4 to 2.0 feet. All pressure pumps shall be equipped with working pressure gauges.
   3. Rinse from the bottom of the treated area to the top flushing each section of the surface with a concentrated stream of water. To avoid streaking on vertical walls, take care to keep the wall below wet and rinsed free of cleaner and residues.
   4. Application of rinse water is extremely important to assure that all surface staining matters and cleaning residues are thoroughly flushed from the treated surface.

E. Surrounding stone surfaces below the section of brick to be cleaned shall be pre-wetted and rinsed periodically during cleaning operations to prevent etching of stone.

F. The surfaces below the sections of brick to be cleaned shall be protected from run-off.

G. Repeat procedures if necessary to remove heavier build-up of soiling.

END OF SECTION

SECTION 04 01 20.54

REMOVING & REPLACING DETERIORATED BRICK MASONRY

PART 1 – GENERAL

1.1 SUMMARY

A. This procedure includes guidance on removing and replacing deteriorated brick masonry. It should be used in conjunction with the procedure on repointing historic masonry. For guidance on repointing, see 04 01 20.55 "Repointing Masonry Using Lime Mortar".

B. See 01 10 07 for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:

1. Safety Precautions
2. Historic Structures Precautions
3. Submittals
4. Quality Assurance
5. Delivery, Storage and Handling
6. Project/Site Conditions
7. Sequencing and Scheduling
8. General Protection (Surface and Surrounding)
9. These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the State Historic Preservation Officer (SHPO).

1.2 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

1. Do not proceed with brick replacement 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.
2. Wet Weather: Do not apply or mix mortar on outside surfaces with standing water or outside during rain.
3. Cold Weather, winter construction is not allowed without consent of RHPO; Winter construction when surface temperature of masonry is below 40o F. or air temperature is predicted to be below 40o F. within 48 hours. See #6 below.
4. 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 with water-misted burlap in hot weather to reduce evaporation; Pointing work should be done in the shade; Work around the building during the day so that the fresh work will be shielded from direct sunlight to reduce evaporation rate. High temperatures can cause flash setting of cements and rapid evaporation of water in the mix, leading to lack of development of final strength by the cement.
5. All materials must be kept above 40 degrees F.
6. Special Precautions and Notes: Do not allow masonry to freeze until mortar is thoroughly dry and hardening almost complete (approx. three days time); The setting of lime mortar is very much slower than that of cement mortar because the curing requires the absorption of carbon dioxide to form hard lime carbonates; It is a very lengthy process, so do not expect it to become hard immediately, especially at the core of large masses of masonry.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Salvaged Brick: Approved by SHPO, sound, crack free, clean brick without face chips larger than 1/2 inch, salvaged from removal of removed face brick work of same type.

B. Replacement Brick: Approved by SHPO.

C. Brick slips: Approved by SHPO.

D. Mortar to match existing (see 04100-03-S "Preparing Lime Mortar for Repointing Masonry").

2.2 EQUIPMENT

A. Trowel
B. Joint tools
C. Chisel
D. Hawk
E. Hammer
F. Stiff bristle brushes

PART 3 – EXECUTION

3.1 EXAMINATION

A. Deterioration of brick due to moisture is evident as spalling, erosion, cracking, peeling paint, and deteriorated mortar joints.

B. Some causes of brick deterioration include:
1. Rising damp,
2. the accumulation of dissolved acids carried by rainwater and condensation,
3. soluble salts crystallizing in the pores of the brick face,
4. alternate freezing and thawing, and e) the accumulation of dirt and air-borne particles on the exterior surface.

3.2 PREPARATION

A. Surface Preparation:
1. Wet brick having absorption rates greater than 0.025 oz. per sq. inch per minute.
   a. On the flat side of a brick, deposit water on an area approximately the size of a 25 cent coin.
   b. If the water disappears in less than 30 seconds, wet the bricks.

2. Absorptive brick should be thoroughly soaked in the pile each afternoon prior to the day they are to be used.
3. Cover the bricks with tarps or heavy paper to prevent evaporation.
4. Wet brick as necessary during the day; Sprinkle the brick pile with a hose for a period long enough for water to run down the side of the pile; Use wetting methods which ensure that each masonry unit is nearly saturated but surface dry when laid; (DO NOT wet stone masonry units).
5. Repair flashing if necessary.
6. Where fresh masonry joins existing work, clean the exposed surface of the set masonry by removing loose brick and mortar and wet lightly to obtain the best possible bond with the new work.

3.3 ERECTION, INSTALLATION, APPLICATION

A. Replacing Deteriorated Masonry with Brick slips: The use of brick slips should be limited to replacement of individual bricks or to small areas of brickwork.

NOTE: Brick slips are brick facings about 1 inch thick. They are used when damage to adjacent sound brickwork is likely to occur if full-size replacement is attempted.

1. Cut out the deteriorated masonry to a regular shape.
2. Clean the cavity of loose mortar and other debris by hand using a chisel and stiff bristle brushes.
3. Solidly set the slip in a bed of mortar.

B. Replacing Deteriorated Units with Full-Size Bricks:

1. Carefully remove deteriorated brick units by hand using a hammer and chisel.
2. Rebuild back-up and substrate as required to replace any unsound material that was removed.
3. Clean the cavity of loose mortar and other debris by hand using a chisel and stiff bristle brushes.
4. Lightly wet the exposed brick surfaces.
5. Lay brick units with completely filled bed and head joints; Butter ends with sufficient mortar to fill head joints and shove into place.

   NOTE: Lay masonry plumb and true following the coursing and patterns of the adjacent existing sound construction; Level off work at required heights and form beds to build-in salvaged or moved materials.

6. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.
7. Blend new work into existing work smoothly with no lines of demarcation and no change of pattern or coursing.
8. Rake all joints in replacement work to receive tuck pointing; Joints up to 3/8" in width shall be raked to a depth of 1/2"; Joints 3/8" in width shall be raked to a depth of 1".
9. Brush all excess mortar from the wall surface frequently during the work; Protect all existing surfaces from mortar dripping and splashing.

3.4 ADJUSTING/CLEANING

A. Clean off adjacent surfaces which have been spattered during the course of the work. Rinse immediately with clean, clear water.

B. Wipe all excess mortar as the work progresses. Dry brush at the end of each day's work.

C. After mortar is thoroughly set and cured, remove loose mortar and dirt from new masonry surfaces.

D. Wash down the masonry surface with clean, clear water.

END OF SECTION

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SECTION 04 01 20.58
MASONRY RESTORATION AND REPOINTING

PART 1-GENERAL

1.1 SUMMARY OF WORK

A. Extent of masonry restoration work is as shown on the Drawings and as specified herein.
1. The drawings endeavor to show the extent of masonry restoration work required. The contractor shall review the Drawings, Photographs and make a Pre-bid field visit to verify all work whether shown or not shown on the Drawings.

B. The work includes, but is not limited to: (Examples)
1. Repairing cracks and voids in stone construction.
2. Patching stone structures and stone sills.
3. Repointing mortar joints.
4. Application of water repellent/light consolidant

1.2 QUALITY ASSURANCE

A. Restoration Specialist: Work must be performed by a firm having not less than 5 years successful experience in comparable masonry restoration projects and employing personnel skilled in the restoration process and operations indicated.
1. Only skilled journeymen masons who are familiar and experienced with the materials and methods specified and are familiar with the design requirements shall be used for masonry restoration.
2. One skilled journeyman mason, trained and Certified by the specified stone repair system manufacturer, shall be present at all times during masonry restoration and shall personally direct the work.

B. Field -Construction Mock-ups: Prior to start of general masonry restoration, prepare the following sample panels and sample areas on building where directed by Architect. Obtain Architect's acceptance of visual qualities before proceeding with the work. Retain acceptable panels in undisturbed condition, suitably marked, during restoration as a standard for judging completed work.
1. Coating removal: Demonstrate materials and methods to be used for coating removal for each type of masonry surface and condition with sample panel 4 sq. ft. in area. The removal method or methods shall be tested on an inconspicuous area of the building.
2. Crack Repair: Prepare a sample area for each type of crack repair required for stone. Repair shall demonstrate methods and quality of workmanship expected for crack repair.
3. Patching: Prepare on-building sample of each type of stone and masonry construction to be patched. Patching and mold shall demonstrate methods and quality of workmanship expected of repair work.
4. Repointing: Prepare 2 separate sample areas of approximately 5' high by 5' wide for each type of repointing required, one for demonstrating methods and quality of workmanship expected in removal of mortar from joints and the other for demonstrating quality of materials and workmanship expected in pointing mortar joints. Sample areas shall be located in an inconspicuous yet readily accessible place.

C. Patching, Repointing and Coating work: The samples of each type of repair work shall be done in an area that will be exposed to the same weathering conditions as the building. Allow samples to cure at least three days before obtaining acceptance of color, texture and detailing match. Samples shall be viewed from an approved distance.

D. Source of Materials: Obtain materials for patching, coating, sealing, crack repair and repointing from a single manufacturer source to ensure match quality, color, texture and detailing.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each product specified. Include test data and certifications substantiating that products comply with requirements.

B. Submit the following items in time to prevent delay of the work and to allow adequate time for review and resubmittals, if needed. Do not order materials or start work before receiving the written approval:

1. Written certificates from the patching materials manufacturer should be submitted stating that all installers of the patching material have successfully completed a training workshop for installation of the patching material, or have met alternative workmanship qualifications acceptable to the manufacturer, or provide written certification from the manufacturer that on-site training services have been contracted for.
2. Safety Data Sheets (SDS) as appropriate.
3. Certificates, except where the material is labeled with such certification, by the producers, of the materials, that all materials supplied comply with all the requirements of these specifications and the appropriate standards.
4. Color-match patch samples fabricated on pieces of appropriate masonry from or on the building using the specified repair mortar as required. A minimum of three color shades shall be provided, representing the range of colors present in the existing stonework.
5. Written verification that all specified items will be used. Provided purchase orders, shipping tickets, receipts, etc. to prove that the specified materials were ordered and received.

C. Restoration Program: Submit written program for each phase of restoration process including protection of surrounding material on building and site during operations. Describe in detail material methods and equipment to be used for each phase of restoration work.

D. SUBSTITUTIONS

1. If alternative methods and materials to those indicated are proposed for any phase of restoration work, provide written description, including evidence of at least 10 years' successful use on other, comparable projects, and program of testing to demonstrate effectiveness for use on this project. Provide documentation showing compliance with the requirements for substitutions and the following information:
    a. Coordination information, including a list of changes needed to other work that will be necessary to accommodate the substitution.
    b. A comparison of the substitution with the specified products and methods, including performance, durability, and visual effect.
    c. Product data, including specifications for products and installation procedures.
    d. Samples, where applicable, or as requested.

e. A statement indicating the effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the substitution on contract completion time.
f. Cost information, including a proposal of the net change, if any, in the contract sum.
g. Certification that the substitution conforms to the contract documents and is appropriate for the applications indicated. Material substitution requests must be accompanied by independent laboratory test reports from a lab designated by the architect to establish equivalent performance levels and specification compliance. Testing shall be paid for by the submitting party.
h. The Contractor's waiver of rights to additional payment or time that may become necessary because of the failure of the substitution to perform adequately.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original unopened containers and packaging, bearing labels as to type and names of products and manufacturers, color numbers and batch numbers.

B. Deliver and store restoration material in manufacturer's original, unopened containers with the grade, batch and production data shown on the container or packaging.

C. Protect restoration materials during storage and construction from wetting by rain, snow or ground water, and from staining or intermixture with earth or other types of materials.

D. Protect grout, mortar and other materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

E. Comply with the manufacturer's written specifications and recommendations for mixing, application, and curing of grouts and patching materials.

1.5 PROTECTION / SITE CONDITIONS

A. Protect persons, motor vehicles, building site and surrounding buildings from injury resulting from masonry restoration work.

B. Do not perform any masonry patching unless air temperatures are between 50 degrees Fahrenheit (10 deg. C) and 90 degrees Fahrenheit (32 deg. C) and will remain so for at least 48 hours after completion of work.

C. Prevent masonry patching materials from staining the face of masonry or other surfaces to be left exposed. Immediately remove all patching materials that come in contact with such surfaces.

D. Cover partially completed work when work is not in progress.

E. Protect sills, ledges and projections from droppings.

1.6 SEQUENCING / SCHEDULING

A. Perform masonry restoration work in the following sequence:

1. Repair and/or replace existing roof gutters, flashing, drains and/or leaders as indicated.
2. Remove coatings, stains and foreign material from all stone surfaces.
3. Rake-out existing mortar from joints of masonry indicated to be restored.
4. Repoint existing mortar joints of masonry indicated to be repointed.
5. Wash building exterior as per Section 01 10 07.
6. Patch and repair existing stone structures as indicated.
7. Provide water repellent/consolidant treatment for masonry structures as indicated.

PART 2 - PRODUCTS

2.1 REPOINTING MORTAR MATERIALS

A. Repointing mortar shall be a pre-mixed, pre-colored, custom-matched cement-lime based mixture formulated to comply with the requirements of ASTM C-270 Type __ mortar.
   1. Products: The following shall be assumed to meet the quality and performance requirements specified:
      a. "SPEC-JOINT 46", by Edison Coatings, Inc., Plainville, CT, (860)747-2220, or approved equal.
      b. If proposed equal is submitted, thorough lab testing shall be required to establish equivalent performance levels. An independent testing laboratory shall be utilized as determined by the Architect and paid for by the submitting party.

2.2 CRACK INJECTION MATERIALS

A. Cementitious crack filler shall be an ultra-fine, superplasticized, polymer- modified injection grout. Cementitious grout shall be suitable for application in wet or dry cracks, shall develop direct tensile bond strength of 200 psi minimum, shall exhibit less than 0.06% drying shrinkage, and shall have a linear coefficient of thermal expansion of 0.000004 to 0.000008 inches/inch per degree Fahrenheit.
   1. Products: The following shall be assumed to meet the quality and performance requirements specified:
      a. PUMP-X 53i, as manufactured by Edison Coatings, Inc., Plainville, CT, Phone (860) 747-2220.

2.3 PATCHING MATERIAL

A. Patching material shall be a premixed, cementitious material with acrylic latex-modifier, formulated to match the color and texture of the existing stone. Material must be vapor permeable, frost and salt resistant, shall develop direct tensile bond strength of 200 psi minimum, shall exhibit less than 0.06% drying shrinkage, and shall have a linear coefficient of thermal expansion of 0.000005 to 0.000008 inches/inch per degree Fahrenheit. Material shall be compatible with substrate, including but not limited to, porosity, tensile, and compressive strength. Modulus of elasticity shall be 50,000 to 100,000 psi. Non-latex mortars shall be unacceptable. Material shall have a minimum 10-year successful performance history for similar projects.
   1. Products: Subject to compliance with requirements, provide the following:
      a. "Custom System 45 Type SD RL-1" by Edison Coatings, Inc., Plainville, CT (860) 747-2220 for usage at existing brownstone
      b. If proposed substitute is submitted, thorough lab testing shall be required to establish equivalent performance levels. An independent testing laboratory

shall be utilized as determined by the Architect and paid for by the submitting party.

2.4 REINFORCING MATERIALS

A. Pins / Threaded rods: Type and size are specified herein and as indicated on the Contract Drawings, if not indicated, as per structural engineer's recommendation. Anchors and dowels shall be fabricated from ANSI Type 302/304 stainless steel.

B. Mechanical anchors and dowels (for deep repairs and overhanging repairs): Stainless steel threaded road (ASTM F-593) with a diameter as indicated on Contract Drawings, bent and cut to lengths required to achieve embedments shown on Contract Drawings. Cut end of rod square.

C. Adhesive: Adhesive shall be a two-component epoxy gel, with minimum 4% elongation, 300 psi direct tensile bond strength, 10,000 psi tensile strength. Product shall be applicable to metals, masonry, concrete and other substrates as required, and shall be appropriate for use at ambient temperatures from zero degrees to 100 degrees Fahrenheit (-18 to 38 degrees Celsius).

1. Products: Subject to compliance with requirements, provide the following:
    a. FLEXI-WELD 520T, as manufactured by Edison Coatings, Inc., Plainville, CT (860)747-2220.
    b. If proposed equal is submitted, thorough lab testing shall be required to establish equivalent performance levels. An independent testing laboratory shall be utilized as determined by the Architect and paid for by the submitting party.

D. Water Repellent/Consolidant: Water repellent/light consolidant shall be a breathable, two-component, proprietary self-crosslinking hybrid system. Product shall be colorless, low viscosity, two component penetrating treatment with minimum 96% moisture vapor transmission per Oklahoma DOT method, maximum 1% water absorption per Ontario MTC method, and which meets the freeze-thaw requirements of Ontario MTC (50 cycles) and the wind-driven rain resistance requirements of US Federal Specification TT-C-555B. Product shall be non-yellowing and UV resistant for a minimum 1500 hours per ASTM G53-84.

1. Products: Subject to compliance with requirements, provide the following:
    a. SYSTEM 90-II, as manufactured by Edison Coatings, Inc., Plainville, CT (860) 747-2220.

PART 3 - EXECUTION

3.1 CLEANING EXISTING MASONRY AND STONE

A. General:

1. Proceed with cleaning in an orderly manner, work from top to bottom of each staging area and from one end of each elevation to the other.
2. Use only those cleaning methods indicated for each masonry material and location.
3. Perform each cleaning method indicated in a manner which results in uniform coverage of all surfaces, including corners, moldings, interstices and which produces an even effect without streaking or damage to masonry surfaces.
4. Rinse off chemical residue and soil working upwards from bottom to top of each treated area at each stage or scaffold setting.

3.2 MASONRY REPOINTING

A. Sealant Removal & Stone Repointing

1. Carefully remove existing sealants from stone joints using approved methods. Damage to edges of stone units must be avoided. Remove sealant to its full depth, and rake back existing masonry mortar beneath the sealants to provide a minimum of 3/4" depth for repointing, or until sound mortar is reached, whichever is greater.
2. Wet surfaces to ensure that stone is nearly saturated but surface dry when repointed. Completely fill bed, head and collar joints. Maintain joint width to match existing.
3. When mortar is thumbprint hard, tool exposed mortar joints to match joints of original stonework

3.3 LOCATE AND MARK AREA TO BE REPAIRED / RESTORED

A. Work areas are approximately shown on drawing. Locate areas to be repaired/restored by sounding with a hammer to detect hollow and deteriorated areas.

B. Mark locations using chalk or crayon.

3.4 WORKMANSHIP OF PATCHING MATERIAL

A. Patching material workmanship shall comply with all applicable recommendations of material manufacturer's written specifications and requirements and/or as modified in this and following sections.

B. Mixing of patching material: Mix the patching material in accordance with Manufacturer's printed instructions.

C. Do not use any additives, such as bonding agents, accelerators, or retarders, in the patching material without prior written approval from the Manufacturer.

3.5 SURFACE PREPARATION: (for all patching work)

A. Patching and repair work for spalled and deteriorated materials shall be accomplished with the approved Patching material, according to manufacturer's printed instructions and as specified herein.

B. At areas to receive patches, remove all loose, spalled and deteriorating materials. If required cut away an additional 1/4 to 1/2 inch of the substrate that may be in the process of deteriorating and to ensure the surface to be patched is solid and stable. Saw cut edges of all repair areas to a minimum 1/4" depth. "Sound" remaining substrate with a hammer to verify its integrity.

C. Remove any soil, mortar, dust and other debris or foreign material from areas to receive patch.

D. Cut out sections shall be squared off at the edges. Do not overcut corners of the patch; stop short of corner and chip out remainder by hand without damaging surrounding masonry. Do not allow any feathered edges in the patch areas.

E. Roughen the substrate surface as necessary to achieve the surface roughness required by manufacturer for good bond, but do not damage the substrate surface. Moisten substrate surfaces as per manufacturer's directions.

F. For very dry or porous surfaces, pre-wet the substrate ahead of time to prevent the substrate from drawing moisture out of the patch too quickly. Re-wet the surface just before applying the patching material.

3.6 PATCHING REPAIR WORK

A. Prepare and mix Patching material in accordance with manufacturer's directions.

B. Patching material shall be applied by trowel, casting-in-place or other techniques recommended by approved materials manufacturer for each specific field condition.

C. Air, surface and product temperature must all be above minimum temperature of 50 deg F (10 deg C) at time of application and must be maintained above minimum until product has dried thoroughly.

D. Apply patching material in one layer or several layers, according to the depth of the repairs. Comply with manufacturer's instructions when applying multiple layers for thickness of each layer, setting-up time for each layer, surface preparation between layers, etc., to ensure sound adhesion between layers. Final application of repair mortar shall be at the desired surface level and shall be tooled, shaped or carved as required to achieve proper surface profile and texture. Surfaces shall be tooled to replicate the texture, and detailing of the original surface. Do not sponge float the patch. Keep tools clean by frequent washing in clean water, but remove excess water to avoid introducing water into patch surfaces.

E. Under hot conditions, as directed by Manufacturer, moisten repaired areas, cover and cure in accordance with manufacturer's directions. Keep patches moist and out of direct sun for at least the first day.

F. To avoid rapid evaporation, do not patch in direct sunlight. If necessary, shade or cover work with tarpaulin or wet burlap.

3.7 PATCHING FOR DEEP OR OVERHANGING REPAIR

A. At areas of large, deep and overhanging repairs the installation of mechanical keying or anchoring is required. The decision whether to anchor and how frequently to provide anchors shall be based on structural requirements, the conditions of the substrate, patch dimensions and weight, and the extent to which patch integrity will rely on self adhesion alone. Typical procedures are outlined in this section and shall be modified as required.

B. Drill 1/4" to 1/2" diameter holes at various angles, spaced 4 to 6 inches apart in staggered rows. Clean holes using compressed, oil-free air.

C. Insert stainless steel rods into drilled holes. Set depth and projection of rods so that at least 3/4" of patching material is placed over the rods, which are secured into the holes with the specified adhesive.

D. Prepare and mix patching material in accordance with manufacturer's directions. Comply with all safety precautions, environmental limitations and work time limitations.

E. Dampen patch area immediately prior to application of patching material and apply bond coat to create a good bond. Using a masonry brush, apply bondcoat to patch area, working into corners, edges and profile. Apply bond coat only to area of patch that can be covered with patch material mix before bond coat dries. Work bond coat into pieces of the substrate and under and around mechanical anchors. Do not apply excess bond coat; do not leave standing in puddles on the substrate. Do not allow bond coat material to run down onto surfaces which will not be repaired.

F. Apply patching material to deep sections by building up in a series of multiple lifts. Comply with manufacturer's instructions for thickness of each layer, setting-up time for each layer, and surface preparation between layers to ensure sound restoration. Work patching material into all corners of patch area and under and around mechanical anchors; including the existing coated reinforcements.

G. To re-create original ornamentation, apply an extra-thick patch. Then after the patch is partially cured the patching material shall be carved, using molding profiles and/or straight edges to restore original ornamentation. In all cases, finish patch so that it is as indistinguishable as possible from adjacent surfaces.

H. Clean any patching material residue from area surrounding the patch by sponging as many times, as necessary with clean water. This should be done before patching material sets.

I. Moisten, cover and cure repaired areas in accordance with manufacturer's directions.

3.8 CASTING NEW ELEMENTS OR SECTIONS

A. In designated areas, new elements or sections shall be cast in place using specified patching compound with superplasticized admixture.

B. Prepare surfaces and install anchors in accordance with Section 3.7, above.

C. Construct molds made of wood, sheet metal, plastic, rubber molding compound or other suitable material, and fasten mold to repair area as required to secure mold during casting process.

D. Interior face of mold shall be treated for clean release of patching compounds. This may be achieved by use of polyethylene lining, high-gloss polyurethane coating, or use of approved proprietary form release agent. No form oils, silicones or teflon release agents shall be used.

E. Prepare mixture of superplasticized patching compound, using slow speed (250-450 rpm) paddle mixer. Mix consistency should be a viscous, plastic mortar. Do not add excessive liquid to produce an excessively thinned mixture.

F. Pour, pump or pack the mixture into the mold, rodding, vibrating or tapping the mold with a rubber mallet while filling. Add material in shallow increments, vibrating or tapping to remove air bubbles and to allow the material to completely slump into the mold pattern after each addition. Once filling has begun, do not interrupt the process until the mold is completely filled.

G. Allow mold to remain in place for 24 to 48 hours to assure complete through-set. Carefully strip forms to avoid damaging the “green” casting. Rub, sand or stone surfaces as required to match texture of adjacent surfaces.

3.9 REPAIRING CRACKS AND VOIDS

A. Prepare cracked area in accordance to manufacturer's written instructions. Typical procedures are outlined in this section and shall be modified according to approved materials manufacturer.

B. Crack repair for hairline and microscopic cracks:
   1. Inject cementitious crack repair material into designated cracks, using syringes, grouting pumps, or other types of injection apparatus suitable for size of crack, distance crack injection material must travel and viscosity of material used. Seal surfaces as required to prevent crack injection material from leaking out and to facilitate pumping. Take caution not to strain the face of adjacent surfaces.
   2. Immediately wipe spills off surfaces with clean, wet rag and allow injection material to cure as required.

C. Crack repair for cracks larger than 1/16" and voids larger that 1/8" mm:
   1. Remove loose and spalling materials, cut into crack to a minimum depth of 3/8 inches and a width of 3/16 inch. If embedded reinforcements are rusted then cut-material deep enough to expose the rusting reinforcements and remove material around reinforcement to provide a minimum of 3/4 inch clearance for patch material.
   2. Clean and coat exposed reinforcements at patch work with an approved rust-preventative agent.
   3. Fill enlarged areas of crack repair with patching material, following repair procedures outlined in this section under Part 3, "Patch for typical repair work" and/or Part 3, "Patching for deep or overhanging repair."

D. Inject cementitious crack repair material into designated voids and cracks, using syringes, grouting pumps, or other types of injection apparatus suitable for size of crack, distance crack repair material must travel and viscosity of material used. Seal surfaces as required to prevent crack injection material from leaking out and to facilitate pumping. Take caution not to strain the face of adjacent surfaces. Immediately wipe spills off surfaces with clean rag and compatible solvent.

E. Unacceptable patches are defined as those with hairline cracks or showing separation from repair edges, or on which "hollow spots" can be detected by light impact. Remove unsound patches and refill to provide patches free of those defects.

F. Final Cleaning: No steam cleaning or additional pressure cleaning shall be performed within 28 days of patch installation. No acid or alkali cleaning agents shall be used except as recommended and/or approved by patch manufacturer.

END OF SECTION

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SECTION 04 50 00.20

REMOVING SALTS/EFFLORESCENCE FROM BRICK AND STONE MASONRY

PART 1 – GENERAL

1.1 SUMMARY

A. This procedure includes guidance on removing salt deposits/efflorescence from brick and stone masonry.

B. Efflorescence is a condition where white (salt) deposits form on the surface of the masonry. The formation of salts is usually a sign of excessive amounts of moisture in the masonry. Salt deposits on the masonry surface may develop from:

1. Soluble compounds within the masonry or in the soil.
    a. In the presence of water, these compounds gradually migrate to the wall surface, where they remain when the water evaporates.
    b. These types of surface deposits are water soluble and can usually be removed by washing the wall with water from a garden hose supplemented by scrubbing with a stiff bristle brush.
2. Improper or insufficient rinsing of masonry after chemical cleaning or repointing.
3. The penetration of rain into the masonry through deteriorated mortar joints and other failures in exterior envelope (lack/failing flashing, expansion joint caulking missing, etc.).
4. Exposure to air pollution, which can result in the formation of thick sulfate (salt) crusts on the underside of molding sand eaves, areas not regularly washed by rainfall.
5. Capillary movement of moisture through masonry, the drying out of walls associated with a damp proofing treatment or the elimination of a ground water source may increase the amount of salt at or near the wall surface.

C. These deposits are generally not harmful to the building, just unattractive. However, they should be washed from the surface as soon as possible. Some salt deposits are water-soluble for only a brief period after reaching the atmosphere. Carbon dioxide in the atmosphere eventually converts these salts into water-insoluble carbonates, which are impossible to remove without the use of acids.

NOTE: THE REMOVAL OF SALT DEPOSITS USING ACID IS NOT DESCRIBED IN THIS PROCEDURE.

1.2 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Do not do exterior wet work when the air temperature is below 40 degrees F.

B. NEVER begin cleaning when there is any likelihood of frost or freezing.

PART 2---PRODUCTS

2.1 MATERIALS

A. Clean, potable water

2.2 EQUIPMENT

A. Garden hose and nozzle

B. Stiff bristle brushes (nonmetallic)

C. Wood or plastic scrapers

PART 3---EXECUTION

3.1 EXAMINATION

A. Before proceeding with steps to remove efflorescence, first decide the cause and extent of the problem and make repairs as required:

1. Determine the age of the structure: Efflorescence on older buildings is typically caused by the presence of soluble salts in the construction combined with moisture.
2. Determine the location of the efflorescence: Examination may show where the water is entering.
   a. Are the salt crystals accumulating on the joints or on the units?
   b. Can any changes in the wall composition or in
   c. the adjacent surroundings be recognized that might show the source of the problem?

3. Examine the condition of the masonry:
   a. CAREFULLY EXAMINE the wall for open gaps or cracks in joints and around openings that could allow water to enter the building.
      1) Are joints properly caulked or sealed?
      2) Are flashings and drips in good condition?
      3) Are there open or eroded mortar joints in copings or in sills?

   b. Carefully note the condition and profile of the mortar joints.
   c. Repair cracks in masonry and/or repoint as necessary before proceeding with the cleaning operations.

4. Examine wall sections and details of construction: Carefully examine roof and wall junctures and flashing details for possible sources of moisture entry. Horizontal projects such cornices and vertical elements such as parapets and chimneys are areas of potential risk.
5. Examine laboratory test reports on the materials: The problem may stem from the composition or misuse of the material.

3.2 ERECTION, INSTALLATION, APPLICATION

A. Dry brush the surface with a stiff bristle (nonmetallic) brush, or wash it with clean, clear water from a garden hose, supplemented by scrubbing with a stiff bristle brush if necessary

B. Remove sulfate crusts using a heavy wooden scraper.

C. If efflorescence is a persistent problem, it may be necessary to reduce the level of soluble salts present within the masonry. Two methods of masonry desalination are described in 04500-03-R. Refer to this procedure for guidance.

END OF SECTION

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SECTION 04 51 00.70

TYPES OF CLEANING DETERGENTS

PART 1 – GENERAL

This standard includes general information on the different types of cleaning detergents, their typical uses, and their advantages and limitations. Sample products are listed when known.

PART 2 – MATERIALS

2.1 SOAP

A. Uses:
1. A surfactant (Surface Active Agent).
2. Soaps are produced from naturally occurring fats and oils.
3. Soapless or synthetic detergents are manufactured from organic chemicals usually derived from petroleum

B. Advantages:
1. Very effective as a bactericide.
2. It will form gels, emulsify oil and lower the surface tension of water. A lower surface tension allows the soap to come in contact with greater surface area than with water alone.

C. Disadvantages:
1. When used in hard water, soap can produce a scum - calcium and magnesium salts present in hard water react with the soap to cause this to happen. Soapless or synthetic detergents do not leave a residual film behind.
2. Considerable rinsing is required to remove soap scum.
3. Soap may produce a greasy build-up on the surface which can be slippery.
4. More expensive than synthetic detergents.

D. Sample Products:
1. "Joy", "Ivory" (Procter & Gamble Co.)

2.2 ANIONIC DETERGENTS

A. Uses:
1. Commonly known as a "neutral" detergent.
2. The most widely used soapless detergent.
3. Available in both liquid or powder.
4. Manufactured from strong alkalis and weak acids.
5. Effectiveness is even greater when combined with a non-ionic detergent.
6. These detergents produce foam when used in excess quantities and, therefore, should only be used in the recommended amounts.

B. Advantages:
1. Safe for use on all floors and should not affect any pigment present in the floor covering.

2. Can safely be used on waxed or unwaxed floors or floors treated with a water emulsion floor wax or solvent-based wax.
3. Can be used in conjunction with mopping equipment or a polishing/scrubbing machine.
4. More effective than non-ionic detergents in the wetting of metal surfaces.
5. Very effective in removing inorganic dirt and soil.
6. Greater dirt carrying capacity than non-ionic detergents.
7. Fairly inexpensive.

C. Disadvantages:
1. Not very effective in hard water.
2. More difficult to rinse than non-ionic detergents.
3. Produces considerable foam.

D. Sample Products:
1. Natural soaps

2.3 NON IONIC DETERGENTS

A. Uses:
1. These detergents do not ionize or carry a charge when dissolved in water.
2. They are manufactured from alkalis and acids of equal strengths and are, therefore, neither alkaline or acid. They have a pH value of 7.
3. Compatible with many ingredients and can, therefore, be included in a wide variety of formulations.
4. Acts as a foam booster when combined with other detergents such as anionic detergents.

B. Advantages:
1. Safe for use on all surfaces.
2. Produce less foam than anionic detergents.
3. Because of their low foam characteristics, they may be effectively used in conjunction with scrubbing machines or other cleaning equipment.
4. Easier to rinse.
5. More effective for use in hard water than anionic detergents.
6. Very effective for removing oils and grease.

C. Disadvantages:
1. Less effective than anionic detergents in the wetting of metal surfaces.
2. Generally more expensive than anionic detergents.
3. Mostly available in liquid form.

D. Sample Products:
1. "Orvus" (Procter & Gamble Co.)
2. "Joy" or "Ivory Liquid" (Procter & Gamble Co.) "Zyfo" (Industrial Soap Co.) cleaner concentrate, a controlled suds, silicate buffered, non-ionic, rinseless-type synthetic detergent, containing no
3. soap, free alkali, solvents, abrasives, acids, caustics or the like.
4. "Igepal 630" (Sigma-Aldrich Corporation)

2.4 CATIONIC DETERGENTS

A. Uses:
   1. These detergents carry a positive charge when dissolved in water.
   2. Manufactured from weak alkalis and strong acids. They are acidic in nature with a pH value less than 7.

B. Advantages:
   1. Have low-foam characteristics.
   2. These detergents carry anti-static properties and are effective in repelling dust. The positive charge in a cationic solution repels the positive charge carried by dust in the atmosphere.
   3. Very effective as a bactericide, disinfectant and deodorizer.

C. Disadvantages:
   1. More expensive than anionic and non-ionic detergents.
   2. Used alone, these detergents are very ineffective. They are usually combined with non-ionic detergents for better cleaning effectiveness.
   3. These detergents CANNOT be blended with anionic detergents, as each will cancel the other out, rendering the detergent completely ineffective.

D. Sample Products:
   1. Dish- and hand-washing soaps

2.5 AMPHOTERIC DETERGENTS

A. Uses:
   1. Also called ampholitic detergents.
   2. These detergents have both acidic and alkaline properties.
   3. Mainly used in specialty formulations.
   4. Limited quantities are used in shampoos, medicated liquid soaps and aerosol shampoos.

B. Advantages:
   1. These are greatly affected by changes in pH. They behave like anionic detergents at pH values greater or equal to 8. They behave like non-ionic detergents at pH values between 8 and 6. They behave like cationic detergents at a pH below 4. NOTE: At a high pH, detergency powers are increased; at a low pH, detergency powers are reduced.
   2. Non-toxic, non-irritating, germicidal and compatible with anionic, non-ionic and cationic detergents.

C. Disadvantages:
   1. Fairly expensive.

2.6 ALKALINE DETERGENTS

A. Uses:
   1. Alkaline detergents are water-soluble alkalis having detergent properties, but containing no soap.
   2. Usually range in pH from 9 to 12.5.
   3. Used in applications where a strong detergent is required such as removing water emulsion waxes, scuffmarks and heavy accumulations of dirt.

4. Generally used for "hard surface" cleaning.
5. High alkalinity is important in saponifying fats and neutralizing acids found in many types of dirt.
6. They are the most used of all cleaning materials.
7. Some materials used in formulating alkaline detergents include sodium carbonate, trisodium phosphate, sodium silicate, sodium tripolyphosphate and to a lesser extent, sodium bicarbonate, sodium sulphate and certain silicates.

CAUTION: Take precautions when using alkaline detergents on linoleum. These detergents can remove the linseed oil component in linoleum and adversely affect the wood flour component.

B. Advantages:
1. They remove a wider range of dirt and soil than any other type of detergent. Economical.
2. Can be used with a wide variety of cleaning equipment.
3. Low foam properties in the better alkaline detergents.

C. Disadvantages:
1. DO NOT ALLOW to remain in contact with the skin for any length of time. Wear rubber gloves.
2. Alkaline detergents may remove water emulsion floor waxes.
3. Alkaline detergents may also affect pigment by causing it to fade or yellow.
4. Some alkaline cleaners (especially those containing sodium hydroxide) may tend to form soluble salts which crystalize as efflorescence on the surface.
5. Alkaline detergents must be rinsed thoroughly in order to prevent a white powdery residue from remaining on the surface.
6. Multiple applications may cause damage to the surface.
7. Contact of bronze or copper with alkaline cleaners will cause the metals to corrode.

D. Sample Products:
1. Most common is Trisodium Phosphate (TSP):
   a. NOTE: This chemical is banned in some states such as California. Regulatory information as well as alternative or equivalent chemicals may be requested from the environmental protection agency (EPA) regional office and/or the state office of environmental quality.
   b. Strong base-type powdered cleaning material sold under brand names.
   c. Other chemical or common names include Sodium Orthophosphate; Tribasic sodium phosphate; Trisodium orthophosphate; TSP*; Phosphate of soda*; (also sold under brand names such as Red Devil).
   d. Potential Hazards: Castic to flesh.
   e. Available from chemical supply house, grocery store or supermarket or hardware store.
   f. Commercial TSP supplied by Red Devil, Inc., 2400 Vauxhall Road, Union, NJ 07083-1933, 201/688-6900 or 800/423- 3845.

2. Sodium Hydroxide (NaOH):
   a. A white brittle solid that is a strong caustic base used especially in making soap, rayon, and paper

b. Other chemical or common names include Caustic soda*; Hydrate of soda*; Hydrated oxide of sodium*; Lye*; Mineral alkali*; Soda lye*; Sodic hydrate*; Sodium hydrate*
c. Potential Hazards: Caustic to flesh and Flammable (When in contact with organic solvents)
d. Available from chemical supply house, drugstore or pharmaceutical supply distributor, hardware store, or paint store.

3. Potassium Hydroxide (KOH):
   a. A white deliquescent solid that dissolves in water with much heat to form a strongly alkaline and caustic liquid; used chiefly in making soap and as a reagent.
   b. Other chemical or common names include Potassium hydrate; Caustic potash*; Caustic potassa*; Hydrate of potassa*; Potassa*.
   c. Potential Hazards: TOXIC AND CORROSIVE TO FLESH.
   d. Available from chemical supply house, drugstore or pharmaceutical supply distributor, hardware store, or garden and lawn supply center.

4. Ammonium Hydroxide or Ammonia (NH4OH):
   a. CAUTION: DO NOT MIX AMMONIA WITH CHLORINE BLEACHES, A POISONOUS GAS WILL RESULT! DO NOT USE BLEACH ON BIRD DROPPINGS.
   b. A weakly basic compound that is formed when ammonia dissolves in water and that exists only in solution.
   c. Other chemical or common names include Ammonia water*; Aqua ammonia*; Household ammonia*.
   d. Potential hazards: TOXIC; MAY IRRITATE THE EYES.
   e. Available from chemical supply house, grocery store or
   f. Pharmaceutical supply distributor, or hardware store. Spic 'n' Span (Procter & Gamble Co.)

2.7 CAUSTIC MATERIALS

A. Uses:
   1. Caustic materials are based on caustic soda, sodium hydroxide, caustic potash or potassium hydroxide.
   2. EXTREMELY strong materials with a high pH value.
   3. Used where VERY STRONG alkaline solutions are required such as in clearing blocked drains.
   4. Available in solid or concentrated liquid forms.
   5. Caustic potash is hygroscopic (absorbs water from the air) and is NOT recommended for use in powdered formulations that are to remain moisture-free
   6. CAUTION: Never use caustic materials on floor coverings. The strong alkalinity will produce irreversible damage.

B. Disadvantages:
   1. Can produce irreversible discoloration.
   2. Safety hazard to user: Corrosive to flesh and flammable when in contact with organic solvents.
   3. Produces a significant increase in temperature when dissolved in water at high levels.

4. Difficult to rinse from surfaces. However, caustic potash is more soluble than caustic soda.
5. Lack the ability to absorb liquid ingredients in powdered formulations.
6. Extremely corrosive to soft metals such as aluminum and zinc and ceramic or glazed surfaces.
7. Avoid contact between caustic soda and liquid surfactants - contact may result in a decrease in its effectiveness and discoloration in the product.

C. Sample Products:
1. Liquid Plumber (The Clorox Company)
2. Oven Cleaners

2.8 ACID CLEANERS

A. Uses:
1. Composed primarily of compounds based on phosphoric acid, sodium bisulphate, oxalic acid, gluconic acid and
2. hydrochloric acid.
3. Acid cleaners are usually formulated as aqueous solutions.
4. DO NOT ALLOW acids to come in contact with skin or clothing. Protect hands by wearing rubber gloves. Wash with soapy
5. water immediately if skin comes in contact with an acid cleaner.
6. Hydrofluoric acid (HF) is the most commonly used acid cleaner and the only cleaner known not to leave soluble salts in
7. masonry; usually applied in a 2-5% dilute water solution.

CAUTION: Acid cleaners can be detrimental to many types of surfaces such as paint, stainless steel, aluminum and almost all floor types. Not recommended for use on limestone, marble or light-colored brick, unless applied in very low concentrations (3%) and rinsed immediately with copious amounts of water. Never use acid cleaners in combination with bleach or hypochlorite solutions. This combination will produce a toxic chlorine gas.

B. Advantages:
1. Effective in removing cement, plaster or concrete spill because acids will attack alkaline materials.
2. Suitable for use on sandstone and granite.

C. Disadvantages:
1. Acids may damage surrounding materials such as glass, bronze, painted surfaces, wood, limestone and marble, vegetation and humans.
2. Disposal of run-off must be carefully controlled.
3. Drainage of toxic chemicals may not be permissible in some cities.

D. Sample Products:
1. Weak acids include white vinegar (acetic acid) and lemon juice (citric acid)
2. Rust removers - usually contain oxalic acid; "Zud"
3. Cleaning products for removing hard water deposits - usually contain phosphoric acid.
4. Toilet bowl cleaners - usually contain diluted concentrations of hydrochloric and sulfuric acids.

2.9 DETERGENT CRYSTALS

A. Uses:

1. Also called alkaline degreasers.
2. Used primarily in industrial applications.
3. Detergent crystals contain few ingredients - one being sodium metasilicate which is soluble in hot or cold water.
4. Detergent crystals, when mixed with water, create a strong alkaline solution that is effective in removing oil, grease and wax.
5. See also Alkaline Detergents above.

B. Advantages:

1. Less expensive than solvent-based emulsions.
2. They can be used on any type of floor because they are water-based and solvent-free.

2.10 SOLVENT-BASED DETERGENT WAX REMOVERS

A. Uses:

1. Composed of hydrocarbon solvents such as white spirit and water.
2. NOTE: THESE WAX REMOVERS CAN ONLY BE USED ON FLOORS NOT ADVERSELY AFFECTED BY WHITE SPIRIT OR SIMILAR SOLVENTS.
3. Manufactured in many different strengths. The two most common include
   a. those containing almost all solvent and a little water (usually clear, transparent liquids),
   b. those with equal proportions of solvent and water (usually white, opaque liquids).

4. Solvent-based detergents are used primarily for removing solvent-based waxes, oil and grease.
5. Widely used for removing paste and liquid types of solvent wax from floors.
6. The solvent component of the remover penetrates and softens the wax. The emulsifying and wetting agents hold the wax in suspension for removal by mopping with warm water.

B. Advantages:

1. Safe and effective for use on wood, wood composition, cork, magnesite, linoleum, concrete and stone floors. Non-flammable.
2. Better than paraffin and white spirit in removing wax, oil and grease because of the presence of an emulsifying agent in the solvent-based remover, which suspends the dirt for removal.
3. Less material is required to soften the wax than with paraffin or white spirit. Paraffin and white spirit tend to evaporate quickly leaving loosened dirt behind to harden again on the surface.

C. Disadvantages:

1. DO NOT USE on asphalt, thermoplastic tiles, PVC (vinyl) asbestos or rubber floors. Solvents will damage these types of floors.

END OF SECTION

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SECTION 04 51 00.80

CLEANING HISTORIC MASONRY-
REMOVAL OF ATMOSPHERIC SOILING, STAINING, AND BIOLOGICAL GROWTH

PART 1 – GENERAL

1.1 DESCRIPTION

A. This specification provides guidance for the cleaning of atmospheric soiling, stains, and biological growth from historic masonry materials.
   1. This specification has been developed for use on historic properties (defined as any district, site, building, structure, or object that is listed in or eligible for listing in the National Register of Historic Places) and provides an overview of accepted practices. Site-specific specifications, when appropriate, will be provided by the Architect.
   2. All work described herein, and related work must conform to the Secretary of the Interior's Standards for the Treatment of Historic Properties.
   3. Contractor shall provide all labor, material, equipment, and operations required to complete the rehabilitation work indicated herein.
   4. All work described herein, and related work must have the approval of a Cultural Resources Manager, Conservator, Historic Architect, or other professional who meets the standards outlined in the Secretary of the Interior's Standards – Professional Qualifications Standards pursuant to 36 CFR.

1.2 SECTION INCLUDES

A. Cleaning of historic masonry Removal of atmospheric soiling
   1. Removal of stains
   2. Removal of biological growth

1.3 RELATED SECTIONS

A. Section 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections and should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the GSA Historic Preservation (HP) Staff and Project Team:

B. Safety Precautions
   1. Historic Structures Precautions
   2. Submittals
   3. Quality Assurance
   4. Delivery, Storage and Handling
   5. Project/Site Conditions
   6. Sequencing and Scheduling
   7. General Protection (Surface and Surrounding)

1.4 QUALITY ASSURANCE

A. The Contractor performing the work described in this Section shall have a minimum of five (5) years experience in masonry cleaning and restoration and shall have successfully completed at least three (3) projects of similar scope within the previous five (5) years. He/she shall demonstrate a working knowledge of The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings.

B. Field Supervisor Qualifications: Full-time supervisors experienced in historic treatment work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on Project site during times that historic treatment work is in progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.

C. Worker Qualification: Persons who are experienced in historic treatment work of types they will be performing.

1.5 SUBMITTAL

A. Contractor shall submit to the Architect, GSA HP Staff or Project Team:

1. A detailed schedule of the areas to be cleaned, including an assessment of the problem surfaces, as well as proposed mockups and associated procedures, methods, products, and dwell times.
2. Once cleaning mockups are completed and approved by GSA HP Staff, Contractor shall submit proposed masonry cleaning procedures, application methods, dwell times, etc. for full scale project.
3. The manufacturer's product literature for all proprietary cleaning products. Product literature shall include specification data, Safety Data Sheets (SDS), and instructions for storage, handling, and use.
4. A project safety plan to include at minimum: any personal protective equipment to be used by the contractor staff such as disposable clothing, gloves and safety glasses, procedures for emergencies and accidents, documentation of staff training in use of equipment and/or chemical products as required by the manufacturers.

1.6 MOCK-UPS

A. The Contractor, at inconspicuous locations designated by the GSA HP Staff, shall prepare test panels using the appropriate cleaning methods, to determine the best method. The "best method" shall be defined as that which successfully cleans the masonry with no, or minimal, damage to the masonry substrate.

B. Size of test panels shall be determined by the GSA HP Staff or Project team.

C. The methods used, their application, etc. shall be in accordance with manufacturer's instructions and shall duplicate those procedures proposed for the overall masonry cleaning process. The GSA HP Staff shall conduct a thorough evaluation of each method after masonry cleaning is complete, to determine the best method for the overall work.

D. The testing shall include an evaluation of the materials and techniques proposed for the protection of surrounding areas from the chemicals used to clean the masonry. Evaluation must include the method to be used to collect the cleaning effluent.

E. Methods and materials for sealing cracks and openings prior to cleaning, shall be included in the mockups and approved by the GSA HP Staff.

F. For proprietary cleaning systems, a representative of the cleaning materials. manufacturer(s) shall be present during the preparation and execution of the test areas.

G. Approved test panel(s) shall become part of the work and shall serve as the quality standard for all similar work.

1.7 DELIVERY, STORAGE, AND HANDLING (as applied to products and materials)

A. Contractor shall:

1. Deliver restoration cleaning and testing materials and proprietary products to the project site in manufacturer's or distributor's packaging, undamaged, complete with application instructions and Safety Data Sheets (SDS)
2. Transport and store cleaning agents, chemicals, and solvents within the temperature range recommended by the manufacturer and away from direct sunlight. Handle all materials according to manufacturer's instructions.
3. All chemical products must be new and delivered to the site in unopened packaging.
4. Collect and dispose of waste material, packaging, debris, and effluent associated with the masonry cleaning work in accordance with local, state, and Federal environmental regulations.

1.8 SAFETY

A. Contractor shall only use chemical products whose safety data sheets (SDS) have been reviewed and considered acceptable by the Government. Any project surfaces containing lead-based paint, as disclosed by the Government, shall be handled by the contractor in accordance with OSHA (29 CFR 1926.62), EPA (40 CFR 261) and State regulations. Any lead-based paint or coating that is removed in a project resulting from this scope shall undergo Toxicity Characteristic Leaching Procedure(TCLP) testing by the contractor. Contractor shall dispose of any lead-paint waste as hazardous if it fails the TCLP.

B. Any paint or coating required to be removed which has not been disclosed by the Government to contain lead, shall be tested for lead by the contractor. All paints or coatings testing positive shall be handled and disposed of as lead-based.

C. Contractor shall isolate the work area with cones, tape or similar means as possible for the duration of the project, to prevent unauthorized individuals from entering the immediate work are.

D. For any work required on elevated surfaces (4 feet or more above the ground) Contractor shall install and use any ladders, scaffolding or platforms in accordance with OSHA regulations (29 CFR Subpart M).

E. Contractor and sub-contractor employees shall wear all required and appropriate PPE while on site.

1.9 PROJECT / SITE CONDITIONS

A. The work of this Section shall be executed only when the air and surface temperatures are 40 degrees Fahrenheit and rising or less than 90 degrees F and falling. Minimum temperature for masonry cleaning shall be 50 degrees F and above for at least two hours after completion and above freezing for at least 24 hours after completion. Work shall not commence when rain, snow, or below-freezing temperatures are expected within the next 24 hours. All surfaces shall be free of standing water, frost, and ice.

B. The Contractor is responsible for protecting existing adjacent areas and materials during the execution of the work and shall provide all necessary protection and follow all necessary work procedures to avoid damage to existing material assemblies and vegetation not a part of the work of this Section.

C. At a minimum, Contractor shall:
1. Protect woodwork, glass, and metal adjacent to masonry areas to be cleaned, from overspray and possible chemical or water damage from cleaning operations. Cover all window openings with waterproof plastic to prevent leakage to the building interior. Through cracks shall be sealed.
2. Protect surrounding vegetation from runoff during cleaning operations.
3. Exterior masonry cleaning work areas should be accessed from the exterior only. Under no circumstances are hoses to be run or equipment transported through the building during exterior masonry cleaning operations.
4. If necessary, Contractor shall erect waterproof enclosures around areas where cleaning operations are in progress to protect nearby property and passers-by from overspray of cleaning chemicals or rinse water.

D. If applicable, Contractor shall coordinate masonry cleaning operations with the other trades involved in exterior and interior restoration work, including but not limited to masonry restoration, sealing, and painting. Masonry cleaning is to be completed prior to restoration of windows, doors, and metalwork, and prior to any exterior painting in the affected areas.

E. All Contractor personnel performing masonry cleaning operations shall be provided by the Contractor with gloves, respirators, protective clothing and any other personal protective equipment (PPE) as recommended by the manufacturer of the masonry cleaning products and required by local, state, and Federal regulations.

F. Contractor shall complete installation of temporary sealants at window and door perimeters prior to starting cleaning operations where required to prevent leakage to the interior.

PART 2 – PRODUCTS

2.1 MASONRY CLEANING OF ATMOSPHERIC SOILING

A. Investigations and Method Selection
1. Identification of material types, surface and substrate conditions, previous treatments, and the nature, cause and pattern of the soiling type for each area shall be determined. Testing may require additional technical expertise from a materials scientist, architectural conservator, microbiologist, and/or other technical expert. Contractor shall choose the gentlest method possible to remove the soiling without damaging the substrate material.
2. Contractor shall conduct cleaning test patches, usually less than 6 inch by 6 inch, in unobtrusive locations on the masonry to be cleaned. The purpose of the test patch is to determine the gentlest, most effective method to remove soiling from the masonry. Several cleaning methods are generally tested side by side.

B. The method of cleaning and the level of clean shall be approved by the GSA HP Staff. Contractor shall protect adjacent materials, installed non masonry materials, and openings.

C. Cleaning shall be undertaken through the mildest, least abrasive method as per testing.

2.2 CLEANING METHODS

A. The gentlest cleaning methods should be tried first. The gentlest method for masonry is water and soft bristle brushes.

B. Water washing: Washing the surface with low jet pressure, not to exceed 300 pounds per square inch (psi), for water soluble dirt and chemical compounds, psi is to be determined during mockup with GSA HP Staff approval, lowest possible pressure will be used to achieve desired results. Optimal water pressure and wand distance are to be determined during execution of cleaning test patches. Note that most commercial pressure washing systems operate at significantly higher pressures than those recommended. Use of a pressure regulator to reduce pressures may be needed.

C. Nebulous Sprays: Application of intermittent mist spray under low pressure to dampen surface. Optimal water pressure, time cycles, and duration of the cleaning technique are to be determined during execution of cleaning test patches.

D. Detergents: Formulations made with dilutions of cleansers, surfactants, and chelating agents in water. pH Neutral or non-ionic detergents or surfactants are added to water for use on hydrophobic stains.

E. Masonry Cleaners: Proprietary cleaning solutions containing detergents, acidic or alkaline compounds. If this type of product is proposed, great care must be exercised in product selection and preparation of test panels to identify potentially detrimental effects on the masonry and surrounding surfaces. Raw acids and/or alkalis may not be used for masonry cleaning.

F. Poultices: A paste or slurry made with absorbent material or powder-inert clay, such as kaolin or sepiolite, diatomaceous earth (fuller's earth); or Cellulose products such as pulp cellulose, shredded paper that is mixed with a cleaning solution (a liquid reagent such as water, organic solvent, among others).

G. Water used for cleaning of historic masonry cleaning shall be potable and free of injurious amounts of oil, soluble salts, alkali, acids, and other impurities that might stain or otherwise damage masonry, use of an in-line water filter may be necessary.

H. Materials

1. Off-the-shelf chemical masonry cleaners as tested and approved or approved equivalent product.
2. Clean, potable water to remove chemical residue.
3. Phenolphthalein or pH testing strips: Used to test pH of a surface after cleaning masonry with chemicals.
4. Appropriate neutralizer as specified in masonry cleaner product information.

2.3 EQUIPMENT FOR MASONRY CLEANING

A. Pipes and hoses used for water cleaning shall be plastic or other similar material that is not subject to corrosion.

B. Soft natural bristle brushes shall be used for scrubbing. Metal bristle brushes and brushes with metal ferrules are not to be used.

C. Hoses, fittings, and equipment to be used for application of proprietary cleaning compounds shall be solvent, acid, or alkali-resistant as recommended by the manufacturer of the cleaning products.

D. Buckets, trowels, and other tools, to be used for mixing, storing and application of poultices, shall be solvent-resistant plastic. Wood scrapers and trowels are permitted. No metal tools or containers are to be used.

E. Water/rinsing method: Surfaces shall be rinsed with water after cleaning. Rinsing shall be undertaken until pH strips indicate that the rinse water and masonry surface have been neutralized. Rinse water will be collected and disposed of in accordance with Federal, State, and Local environmental standards. Rates of water pressure should start at 100 psi or below and shall be no higher than 400 psi with minimal saturation, psi is as determined during mockup and approved by GSA HP Staff, lowest possible pressure will be used to achieve desired results.

F. SURFACES MUST BE FULLY NEUTRALIZED FOLLOWING CLEANING. Contractor must test pH levels of masonry to ensure neutralization.

2.4 MASONRY CLEANING OF STAINS

A. Contractor shall choose the gentlest method possible to remove the stain without damaging the substrate.

B. Contractor shall conduct masonry cleaning test patches, no greater than 6 inches by 6 inches, in discrete locations, as determined by the GSA HP Staff. The test patches will determine the gentlest, most successful method of removing the stains.

C. The method and level of “clean” shall be approved by the GSA HP Staff.

2.5 MASONRY CLEANING BIOLOGICAL GROWTH AND BIRD DROPPINGS

A. Substrate type and condition, and the nature and cause of biological growth shall be determined to create an appropriate cleaning plan. Chosen cleaning method shall be approved by the GSA HP Staff.

B. Contractor shall conduct masonry cleaning of biological growth and/or bird dropping patches, no greater than 6 inches by 6inches, in discrete locations, as determined by the GSA HP Staff. The test patches will determine the gentlest, most successful method of removing the stains.

C. The method and level of “clean” shall be approved by the GSA HP Staff.

D. Treat areas of algae/moss growth with an antifungal agent prior to general masonry cleaning.

Part 3 – EXECUTION

3.1 GENERAL

A. The cleaning test patches shall be performed by the Contractor and reviewed by the GSA HP Staff, to determine the mildest successful cleaning method.

B. Contractor shall submit testing and cleaning schedules, including approved methods and materials.

C. Contractor shall protect all adjacent materials and landscaping from chemicals and chemical runoff.

D. Runoff and waste from cleaning will be collected and treated according to local, state and Federal regulations, as applicable

E. Contractor shall remove and store light fixtures, downspouts, and other appurtenances to ensure full access to wall surfaces, unless otherwise noted by the Architect, GSA HP Staff or Project Team. Anchor holes and penetrations from appurtenances must be temporarily filled with removable sealant or protected with cover plates.

F. Contractor shall remove climbing plants and plant debris from the masonry prior to cleaning. With the approval of the GSAHP Staff, invasive vines shall be cut close to the ground and allowed to wither and dry. Drying may take up to two weeks. Dry vines shall be carefully removed and the façade surface cleaned with a natural bristle brush prior to other treatments.

3.2 MASONRY CLEANING

A. Surface Preparation for Cleaning

1. Building shall be watertight prior to cleaning, through cracks and openings shall be sealed or covered, as used in the mockup and approved by the GSA HP Staff.
2. Nebulous Spray Water Mist
    a. The sprayer should be designed for the job. Sprayer shall include a timed shutoff valve for on/off cycling. Cycles can range from 3 seconds on and 40 seconds off to 4 hours on and 4 hours off for a period of 24 hours. Work should start from the top of the building and proceed downward. Natural bristle brushes can be used during misting.

3. Chemical Cleaning
    a. Masonry surfaces are to be saturated with water prior to application of chemical cleaning products.
    b. Cleaning of masonry walls shall be performed from the bottom of the wall toward the top.
    c. Manufacturer's specifications shall be followed for all products used.
    d. Contractor shall use natural fiber brushes or very low-pressure spray (not to exceed 100 psi) for product application, psi is as determined during mockup and approved by GSA HP Staff, lowest possible pressure will be used to achieve desired results. High-pressure spray equipment shall not be used for the application of any cleaning product.
    e. Soft natural bristle brushes may be used to agitate the cleaning product.
    f. Following product dwell, loosened soiling shall be removed using a low-pressure water rinse. Do not allow the cleaning products to dry on

masonry surfaces, or to dwell beneath scaffolding or other access or temporary protection supports. Rinse surfaces from top to bottom using a 45 degree fan-tip nozzle with a nozzle pressure not to exceed 400 psi and a flow of approximately 4 gpm. Psi is as determined during mockup and approved by GSA HP Staff, lowest possible pressure will be used to achieve desired results. A minimum distance of 18 inches between the nozzle tip and the masonry surface shall be maintained.

g. SURFACES MUST BE FULLY NEUTRALIZED FOLLOWING CLEANING. Contractor must test pH levels of masonry to ensure neutralization.
h. Following cleaning. Contractor shall remove all temporary protection and inspect all areas for cleaning related damage.

4. Removal of Algal Growth, Moss, and Bird Droppings (Biological Staining)
   a. Living plants must be killed and allowed to dry prior to removal from masonry surfaces.
   b. The Contractor may apply a biocidal product such as a quaternary ammonium product to colonies of moss, or other biological contaminants. After at least 24 hours, the Contractor may remove colonies of moss, loose growth, and accumulations of bird droppings from masonry surfaces to be cleaned using wooden scrapers.
   c. Contractor shall apply selected cleaning agent in accordance with manufacturer's instructions and approved test panel.
   d. Following required dwell time, agitate with a soft bristle brush to lift and remove embedded growth. Contractor shall rinse surfaces from top to bottom using a 45 degree fan-tip nozzle with a nozzle pressure not to exceed 400 psi and a flow of approximately 4 gpm. Psi is as determined during mockup and approved by GSA HP Staff, lowest possible pressure will be used to achieve desired results. A minimum distance of 18inches between the nozzle tip and the masonry surface shall be maintained.
   e. Heavily soiled areas may be spot cleaned as needed.
      1) Spot cleaning may be performed no sooner than 2 weeks after general cleaning has been completed
      2) Surfaces shall be thoroughly wet prior to application of spot cleaner. Apply approved product using a synthetic brush, roller or low-pressure spray and allow to dwell, but not dry, on surface. Dwell time to be in accordance with approved test panel.
      3) Following completed dwell time, rinse surfaces from top to bottom using a 45 degree fan-tip nozzle with a nozzle pressure not to exceed 400 psi and a flow of approximately 4 gpm. Psi is as determined during mockup and approved by GSA HP Staff, lowest possible pressure will be used to achieve desired results. A minimum distance of 18 inches between the nozzle tip and the masonry surface shall be maintained.
      4) Apply neutralizing rinse (if required) according to manufacturer's instructions. Rinse from surface, bottom

up, according to manufacturer's instructions. Test pH levels of masonry to confirm neutralization.

3.3 FINAL REPORT

A. Contractor shall:

1. Provide a final report of completed work, including all approved submittals, mockups and photographs of the areas cleaned that were taken before, during, and after the work. Report shall also include:
    a. A written summary of the project.
    b. Results upon final inspection and approval.
    c. Discussion of steps taken or new findings not specified in the initial documentation.
    d. Any applicable ongoing care and warranty requirements.

END OF SECTION

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SECTION 047200

CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall panels
2. Trim units.
3. Decorative elements.
4. Mortar materials.
5. Accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples for Initial Selection: For colored mortar.

D. Samples for Verification:

1. For each color and texture of cast stone required, 4 inches square in size.
2. For each trim shape required, 4 inches in length.

E. Full-Size Samples: For each color, texture, engraving and **shape** of cast stone unit required.

1. Make available for Architect's review at Project site.
2. Make Samples from materials to be used for units used on Project immediately before beginning production of units for Project.
3. Approved Samples may be installed in the Work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

1. Include copies of material test reports, indicating compliance of cast stone with ASTM C1364.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C1364.

1. Provide test reports based on testing within previous six months.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by [**CSI**] [**or**] [**APA**] [**or**] [**PCI for Group A, Category AT**].

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockup for masonry veneer, sill and lintel replacement including accessories.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone to avoid delaying the Work and to minimize the need for on-site storage.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.6 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Cast Stone: Obtain cast stone units from single source from single manufacturer.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

2.2 CAST STONE MATERIALS

A. General: Comply with ASTM C1364.

B. Portland Cement: ASTM C150/C150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C114. Provide natural color or white cement as required to produce cast stone color indicated.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C33/C33M; gradation and colors as needed to produce required cast stone textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C33/C33M, gradation and colors as needed to produce required cast stone textures and colors.

E. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

F. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.

3. Air-Entraining Admixture: ASTM C260/C260M. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water-Reducing Admixture: ASTM C494/C494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C494/C494M, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C494/C494M, Type E.

G. Reinforcement:

1. Deformed steel bars complying with ASTM A615/A615M, Grade 40. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.

   a. Epoxy Coating: ASTM A775/A775M.
   b. Galvanized Coating: ASTM A767/A767M.

2. Plain-Steel, Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
3. Galvanized-Steel, Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.
4. Fiber Reinforcement: ASTM C1116/C1116M.

H. Embedded Anchors and Other Inserts: Fabricated from steel complying with ASTM A36/A36M and hot-dip galvanized to comply with ASTM A123/A123M.

2.3 CAST STONE UNITS

A. Custom Cast Stone Inc., 734 E. 169th Street, Westfield, IN 46074. Toll Free (888) 776-9960. Phone (317) 896-1700. Fax (317) 896-1701.Cast Stone Units: Comply with ASTM C1364.

1. Units are manufactured using the vibrant dry tamp method.
2. Wall Panels: To match existing

3. Trim units including window sills, lintels, surrounds, wall caps, belt courses, water tables, quoins, keystones, items as indicated on Drawings.
4. Decorative elements including steps and risers.

B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

C. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch whichever is greater, but in no case by more than 1/4 inch

3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

D. Cure Units as Follows:

1. Cure units in enclosed, moist curing room at 95 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

   a. No fewer than five days at mean daily temperature of 70 deg F (21 deg C) or above.
   b. No fewer than seven days at mean daily temperature of 50 deg F (10 deg C) or above.

E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

F. Colors and Textures: Match existing units

2.4 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666.

B. Dowels: 1/2-inch- (12-mm-) diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666.

2.5 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C1364.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

A. Set cast stone as indicated in TMS 604.

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints to match existing, unless otherwise indicated.
2. Build anchors and ties into mortar joints as units are set.
3. Fill dowel holes and anchor slots with mortar.
4. Fill collar joints solid as units are set.
5. Build concealed flashing into mortar joints as units are set.
6. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
7. Keep joints at shelf angles open to receive sealant.

E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

G. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

H. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of width indicated, but not less than 3/8 inch (10 mm).
4. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed **1/8 inch in 10 ft. (3 mm in 3 m)** maximum.

B. Variation from Level: Do not exceed **1/8 inch in 10 ft. (3 mm in 3 m)** maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch (1.5 mm), except where variation is due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION

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SECTION 05 72 00.20

INSTALLING NEW BRASS, CAST-IRON AND STEEL ORNAMENTAL HANDRAILS AND RAILING SYSTEMS TO MATCH HISTORIC

PART 1 – GENERAL

1.1 SUMMARY

A. This procedure includes guidance on replacing deteriorated handrails and railing systems with new or original factory refurbished brass, steel or iron ornamental rails to match the historic.

B. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:

1. Safety Precautions
2. Historic Structures Precautions
3. Submittals
4. Quality Assurance
5. Delivery, Storage and Handling
6. Project/Site Conditions
7. Sequencing and Scheduling
8. General Protection (Surface and Surrounding) These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the Regional Historic Preservation Officer (RHPO).

1.2 REFERENCES

A. **American Society for Testing and Materials (ASTM),**
100 Barr Drive,
West Conshohocken, PA 19428,
610-832-9585 or FAX 610-832-9555.

B. **American Iron and Steel Institute (AISI),**
1000 - 16th Street,
NW, Washington, DC 20036.

C. **Copper Development Association (CDA),**
Box 1840,
Greenwich Office Park 2,
Greenwich, CT 06836.

D. **Steel Structures Painting Council,**
4400 Fifth Avenue,
Pittsburgh, PA 15213.

E. **National Association of Architectural Metal Manufacturers (NAAMM),**
221 N. LaSalle Street,
Chicago, IL 60601.

1.3 DEFINITIONS

A. Definitions in ASTM E 985 for railing-related terms apply to this section.

1.4 SYSTEM DESCRIPTION

A. General: In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

B. For cold-formed structural steel**:** AISI "Specification for Design of Cold-Formed Steel Structural Members".

C. For copper alloys use a safety factor of 1.65 applied to minimum yield strength of alloy.

D. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by using metals that are compatible with one another. In some instances the corrosion can be prevented by inserting a plastic insulator between the dissimilar materials.

F. Thermal Movements: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of handrails and railings to prevent buckling, opening up of joints, and over-stressing of components, connections, and other detrimental effects. Base design calculation on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.

1.5 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product specified.

C. Shop drawings showing fabrication and installation of handrails and railings including plans, elevations, sections, details of components, and attachments to other units of Work.

1.6 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.

B. Engineering Responsibility: Engineer handrails and railing systems by qualified professional engineer legally authorized to practice in jurisdiction where Project is located.

C. Engineer Qualifications: Professional engineer legally authorized to practice in jurisdiction where project is located and experienced in providing engineering services of the kind indicated for handrails and railings similar in material, design, and extent to that indicated for this Project and that have a record of successful in- service performance.

D. Restoration Specialist: Work must be performed by a firm having not less than 5 years successful experience in comparable restoration projects and employing personnel skilled in the restoration processes and operations indicated.

1.7 DELIVERY, STORAGE AND HANDLING

A. Storage and Protection: Store handrails and railing systems in clean, dry location, away from uncured concrete and masonry, protected against damage of any kind. Cover with waterproof paper, tarpaulin, or polyethylene sheeting; allow for air circulation inside the covering.

1.8 PROJECT/SITE CONDITIONS

A. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

1.9 SEQUENCING AND SCHEDULING

A. Mount handrails only on completed surfaces. Do not support handrails temporarily by any means not satisfying structural performance requirements.

PART 2---PRODUCTS

2.1 MANUFACTURERS

A. Stan Chemical Company,
01 Berlin Street,
East Berlin, CT 06023
203/828-0571

2.2 MATERIALS

NOTE: Provide metal forms and types that comply with requirements of referenced standards and that are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.

A. Copper Alloys: Provide CDA copper alloy of type and form indicated to comply with the following requirements:
1. Extruded Brass Shapes: Alloy suitable to produce US3 finish.
2. Seamless Brass Tube: Alloy suitable to produce US3 finish.
3. Composition Brass Castings: Alloy suitable to produce US3 finish.

B. Steel and Iron: Provide steel and iron in the form indicated complying with the following requirements:
1. Cold-Formed Steel Tubing: ASTM A 500, grade B, unless otherwise indicated or required by structural loads.

2. For exterior installations and as required, provide tubing with hot-dip galvanized coating per ASTM A 53.

C. Steel Plates, Shapes, and Bars: ASTM A 36.

D. Malleable Iron Castings: ASTM A 47, grade 32510.

2.3 ACCESSORIES

A. Grout and Anchoring Cement:

1. Non-shrink Nonmetallic Grout: Premixed, factory- packaged, non-staining, noncorrosive, nongaseous grout. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this procedure such as "Bonsal Construction Grout" (W. R Bonsal Co.), "Diamond-Crete Grout" (Concrete Service Materials Co.), "Euco N-S Grout"(Euclid Chemical Co.), or approved equal.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, non-staining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

C. Paint:

1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with SSPC-Paint- 20.
2. Zinc Chromate Primer

D. Fasteners:

1. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railing to other types of construction indicated and capable of withstanding design loadings.
   a. For steel railings and fittings use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
   b. For copper alloy railings provide fasteners fabricated from same base metal as railing components or from type 304.

2. Fasteners for Interconnecting Railing Components: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
   a. Provide concealed fasteners for interconnection of handrail and railing components and for their attachment toother work except where exposed fasteners are unavoidable.
   b. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

3. Cast-In-Place and Post-installed Anchors in Concrete: Cast-in-place anchors and expansion anchors fabricated from corrosion-resistant materials with capability to sustain, without failure, load imposed within a safety factor of 4, as determined

by testing per ASTM E 488, conducted by a qualified independent testing laboratory.

2.4 FABRICATION

A. General: Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than that required to support structural loads.

B. Preassemble railing systems in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

C. Form changes in direction of railing members by insertion of prefabricated elbow fittings, by radius bends of radius as designated, and by bending, as required.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

E. Welded Connections: Fabricate railing systems and handrails for connection of members by welding. For connections made during fabrication, weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface match those adjacent.

F. Non-welded Connections: Fabricate railing systems and handrails for connection of members by means of railing manufacturer's standard concealed mechanical fasteners and fittings unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using epoxy structural adhesive where this represents manufacturer's standard splicing method.

G. Brackets, Flanges, Fittings, and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors for connection of handrail and railing members to other construction.

H. Provide inserts and the anchorage devices for connecting handrails and railing systems to concrete or masonry work. Fabricate anchorage devices capable of withstanding loadings imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.

I. For existing cast iron posts to be reset in concrete: Examine existing anchors to determine if suitable for reuse. Do not reuse unless in good condition. Provide new anchors where necessary of same configurations as existing.

J. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

K. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

L. Cut, reinforce, drill, and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

M. For handrails and railing systems that are exposed to exterior or to moisture from condensation or other sources, provide weepholes or other means for evacuation of entrapped water in hollow sections of railing members.

N. Fabricate joints that will be exposed to weather in a manner to exclude water.

O. Close exposed ends of handrail and railing members by use of manufacturer's standard prefabricated end fittings.

P. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of the railing and wall is 1/4 inch or less.

Q. Fillers: Provide steel sheet or plate filler of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses. Size fillers to produce adequate bearing to prevent bracket rotation and over-stressing of substrate.

R. Finishes:
1. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are not acceptable if they are within1/2 of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved samples and they are assembled or installed to minimize contrast.

S. Copper Alloy Finishes: Finish designations prefixed by "CDA" conform with the system established by the Copper Development Association for designating copper alloy finish systems.
1. Buffed Finish: CDA M21 (Mechanical Finish: buffed, smooth specular).
2. Buffed Finish, Lacquered: CDA M21 Mechanical Finish: buffed, smooth specular; Coating: clear organic, air dry, such as "Incralac" (Stan Chemical Company), or approved equal. Apply by air-spray in 2 coats per manufacturer's directions, with interim drying, to a total thickness of 1.0 mil.

T. Galvanized Finish:

1. General: Hot-dip galvanize items indicated to be galvanized to comply with ASTM A 123 for galvanizing iron and steel products made form rolled, pressed, and forged steel shapes, castings, plates, bars, and strips.
2. For exterior steel railings and handrails formed from steel tubing with galvanized finish, galvanize fittings, brackets, fasteners, sleeves, and other ferrous components.
3. Factory-Primed Finish: Apply air-dried primer immediately following cleaning and pretreatment, to provide a minimum dry film thickness of 2.0 mils per applied coat, to surfaces that will be exposed after assembly and installation and to concealed, non-galvanized surfaces.
4. Apply shop primer to uncoated surfaces of handrails and railing components, except those with galvanized finish or to be embedded in concrete or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting. Shop Primer: Manufacturer's or Fabricator's standard, fast-curing, lead-free, "universal" primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3---EXECUTION

3.1 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to project site.

3.2 ERECTION, INSTALLATION, APPLICATION

A. General:

1. Fit exposed connections accurately together to form tight, hairline joints.
2. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of handrails and railings. Set handrails and railing accurately in location, alignment, and elevation, measured from established lines and levels and free from rack. TAKE CARE SO AS NOT TO DAMAGE ADJACENT HISTORIC MATERIALS, SUCH AS MARBLE, GRANITE, ORLIMESTONE.
3. Do not weld, cut, or abrade surfaces of handrails and railing components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.
4. Set posts plumb within a tolerance of 1/4 inch in 12 feet.
5. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
6. Field Welding: Comply with the following requirements:
   a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   b. Obtain fusion without undercut or overlap.
   c. Remove welding flux immediately.

d. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

7. Corrosion Protection: Coat concealed surfaces of concrete, masonry, wood, or dissimilar metals, which will be in contact with grout, with a heavy coat of bituminous paint or zinc chromate primer.
8. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by structural loads. MATCH ORIGINAL LOCATION AND SPACING TO AVOIDGHOST MARKS.
9. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railing to in-place construction. INSPECT AND REUSE SOUND CONNECTIONS WHEN POSSIBLE.

B. Railing Connections:
1. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact or use manufacturer's standard fitting designed for this purpose.
2. Non-Welded Connections: Use manufacturer's standard mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed lock screws using plastic filler cement colored to match finish of handrails and railing systems.

C. Anchoring Posts:
1. Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's directions.
   a. Non-shrink, nonmetallic grout: Exterior anchors, if in good condition, may be reused if suitable. To be set in new concrete stairs.
   b. Interior posts may be set in existing anchor holes if suitable.

2. Cover interior anchorage joint with a flange of the same metal as post; attach to post by welding after placement of anchoring material.
3. Leave exterior anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8-inch buildup, sloped away from post. For installations exposed on exterior or to flow of water, seal anchoring material to comply with grout manufacturer's directions.
4. For steel railings, weld flanges to post and bolt to metal supporting surfaces.

D. Anchoring Rail Ends:
1. Anchor rail ends to concrete and masonry with required flanges, connected to rail ends and anchored into wall construction with post-installed anchors and bolts.
2. Anchor rail ends to metal surfaces with required flanges. Weld flanges to rail ends, and bolt flanges to metal surfaces.

E. Attachment of Handrails to Walls:

INSPECT AND RE-USE SOUND CONNECTIONS WHEN POSSIBLE. ALSO WHEN POSSIBLE, MATCH ORIGINAL LOCATION AND SPACINGTO AVOID GHOST MARKS.

1. Attach handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1- 1/2-inch clearance from inside face of handrail and finished wall surface.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
3. Secure wall brackets and wall return fittings to building construction. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
4. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lab bolt, as applicable.
5. For hollow masonry anchorage, use toggle bolts with square heads.
6. For steel framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.

3.3 PROTECTION

A. Protect finishes of railing systems and handrails from damage during cleaning period by use of temporary protective coverings approved by railing manufacturer. Remove protective covering at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION

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SECTION 06 01 40.51

GENERAL CLEANING OF PAINTED OR WAXED WOOD SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. This procedure includes guidance for periodically cleaning painted or waxed wood surfaces.

B. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:

1. Safety Precautions
2. Historic Structures Precautions
3. Submittals
4. Quality Assurance
5. Delivery, Storage and Handling
6. Project/Site Conditions
7. Sequencing and Scheduling
8. General Protection (Surface and Surrounding) These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the Regional Historic Preservation Officer (RHPO).

C. For guidance on refinishing wood surfaces, see 06400-10-R.

PART 2 - PRODUCTS

2.1 MATERIALS

NOTE: Chemical products are sometimes sold under a common name. This usually means that the substance is not as pure as the same chemical sold under its chemical name. The grade of purity of common name substances, however, is usually adequate for stain removal work, and these products should be purchased when available, as they tend to be less expensive. Common names are indicated below by an asterisk (*).

A. Non-Ionic detergent such as "Joy" or "Ivory Liquid", or trisodium phosphate (TSP)

1. Trisodium Phosphate:
   NOTE: THIS CHEMICAL IS BANNED IN SOME STATES SUCH AS CALIFORNIA. REGULATORY INFORMATION AS WELL AS ALTERNATIVE OR EQUIVALENT CHEMICALS MAY BE REQUESTED FROM THE ENVIRONMENTAL PROTECTION AGENCY (EPA) REGIONAL OFFICE AND/OR THE STATE OFFICE OF ENVIRONMENTAL QUALITY.
   - Strong base-type powdered cleaning material sold under brand names.
   - Other chemical or common names include Sodium Orthophosphate; Tribasic sodium phosphate; Trisodium orthophosphate; TSP*; Phosphate of soda*; (also sold under brand names such as).
   - Potential Hazards: CORROSIVE TO FLESH.

- Available from chemical supply house, grocery store or supermarket or hardware store.

B. Mineral Spirits:

1. A petroleum distillate that is used especially as a paint or varnish thinner.
2. Other chemical or common names include Benzine* (not Benzene); Naphtha*; Petroleum spirits*; Solvent naphtha*.
3. Potential Hazards: TOXIC AND FLAMMABLE.
4. Safety Precautions:
    - AVOID REPEATED OR PROLONGED SKIN CONTACT.
    - ALWAYS wear rubber gloves when handling mineral spirits.
    - If any chemical is splashed onto the skin, wash immediately with soap and water.
5. Available from construction specialties distributor, hardware store, paint store, or printer's supply distributor.

-OR-

Turpentine: Available from hardware store or paint store.

-OR-

Denatured Alcohol:

- Other chemical or common names include Methylated spirit*.
- Potential hazards: TOXIC AND FLAMMABLE.
- Available from hardware store, paint store or printer's supply distributor.
- Denatured alcohol should be a satisfactory substitute for ethyl alcohol for stain removing purposes.

C. Paste wax

D. Liquid bleach

E. Clean, potable water

2.2 EQUIPMENT

A. 000 steel wool

B. Two buckets (solution and rinse)

C. Two sponges (solution and rinse)

D. Supply of soft dry wiping cloths

E. Ladder

F. Drop cloth

G. 16" electric floor machine

H. Lamb's wool buffing pads

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection:

1. Cover all surfaces and equipment not to be cleaned. Coverings must be adhered without adhesive tape or nails. Impervious sheeting that produces condensation shall not be used.
2. Make sure work area is well ventilated and wear protective clothing and rubber gloves.
3. When cleaning, always rub along the grain of the wood.
4. Change cloths as often as necessary to be effective in cleaning.

B. Surface Preparation: Thoroughly dust and/or vacuum surfaces before washing.

3.2 ERECTION, INSTALLATION, APPLICATION

A. Cleaning Painted Wood Surfaces:

1. To clean spots, rub area gently with a clean, damp sponge and dry with a clean wiping cloth.
2. If water alone will not remove spot, use a non- ionic detergent or TSP solution as described below, rinse thoroughly, and wipe dry. If this cleaning procedure leaves a noticeable difference between treated and untreated areas, cleaning is not being performed properly or frequently enough.
   - Wash dirt and grease using a solution of 3 quarts warm water mixed with 2/3 cup trisodium phosphate (TSP) and non-ammoniated detergent. If mildew is a problem add 1 quart of liquid bleach.
   - Start at a lower corner of room, moisten 5 to 10 square feet of surface, then scrub with a medium bristle brush to remove dirt. Thoroughly rinse surface, two rinses may be required, and wipe dry with clean wiping cloth.
   - Continue process on lower portion of walls around entire room, slightly overlapping preceding section.
     ALWAYS WASH THE LOWER PORTION FIRST BECAUSE SOLUTION STREAKS RUNNING DOWN A DIRTY WALL CANNOT BE REMOVED. Proceed to wash upper wall surfaces and ceiling, including any painted wood ornament, from ladder.

B. Cleaning Waxed Wood Surfaces:

NOTE: WAX IS AN IMPORTANT MAINTENANCE AGENT WHICH PROTECTS AGAINST MATERIAL ABRASION AND WETTING. ITS ADVANTAGE IS THAT IT IS EASY TO APPLY AND EASY TO REMOVE. IT CAN BE RECONDITIONED WITHOUT STRIPPING BY APPLYING MORE WAX AND REBUFFING. THE SOLVENT IN THE WAX RECONDITIONS THE PREVIOUS COAT AND MINIMIZES BUILD-UP.

1. For walls:
   - Follow the above wall washing techniques, but keep the surface as dry as possible. Cleaning solution should contain only non-ionic detergent and water.

- Working in a well-ventilated area, remove paste wax by rubbing hard with a coarse cloth soaked in turpentine.
- Remove stubborn dirt spots by scrubbing lightly with 000 steel wool. Change cloth or steel wool when they become clogged with old wax.
- Apply wax with a clean, soft cloth. Waxing unpainted wood surfaces is imperative for protection from moisture and abrasion. Use a paste or microcrystalline wax that is removable by water or turpentine.
- Place a small amount on the cloth and wipe it over surface leaving a thin, even coating. Wipe off any stray wax grains.
- Buff wax before it hardens. NOTE: Paste wax can be reconditioned by applying more wax and rebuffing. The solvent in the paste wax reconditions previous coats and minimizes build-up.

2. For floors:
NOTE: BE SURE THE WAX IS DESIGNATED FOR USE ON HARDWOOD FLOORS. DO NOT USE A LIQUID WAX WITH A WATER-BASE (I.E. FUTURE). NATIONAL OAK FLOORING MANUFACTURERS ASSOCIATION (NOFMA) RECOMMENDS USING ONLY A SOLVENT-BASE PRODUCT.
   - Place a small amount of wax on dampened, clean, soft cloth and wipe it over the floor leaving a thin and even coating. It is not necessary to go right to the baseboards because the buffing operation will spread the wax to the edges of the room in every place except the inside corners.
   - Buff floor using a 16" electric floor machine and lamb's wool pads. Reverse or replace pads as they become dirty. Buff to high gloss.
   NOTE: TAKE CARE NOT TO DAMAGE ADJACENT SURFACES.
   - After polishing, sweep the floor to pick up stray wax grains that are loose on the floor. Wash all equipment before the wax hardens.

3.2 ADJUSTING/CLEANING

A. BOTH PASTE WAX AND TURPENTINE ARE FLAMMABLE, DISPOSE OF USED CLOTHS PROPERLY IN A METAL SAFETY CONTAINER TO GUARD AGAINST SPONTANEOUS COMBUSTION.

END OF SECTION

SECTION 06 05 73.93

ERADICATION OF INSECTS IN WOOD

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This procedure includes guidance on treating wood construction to control termites by injecting infested areas with termiticide.

1.2 SUMMARY

A. Termites, beetles, and carpenter ants cause less visible, but more serious problems than more visible insects.

B. Termites are wood eating insects which attack primarily soft sapwood. They are most active in locations with high moisture and usually enter the wood at or below ground level. Beetles also eat wood, even in dry areas above ground. Carpenter ants burrow into wood to make a home, not to find food; they seldom are a serious problem.

1.3 REFERENCES

A. See "General Project Requirements" for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)
   These guidelines should be reviewed before performing this procedure and should be followed, when applicable, along with recommendations from the Regional Historic Preservation Officer (RHPO).

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and application instructions to RHPO for approval before proceeding with treatment operations.

1.5 QUALITY ASSURANCE

A. In addition to requirements of these specifications comply with manufacturer's instructions and recommendations for work, including preparation of substrate and application.

B. Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of treatment solution.

C. Use only termiticides which bear a Federal registration number of the U.S. Environment Protection Agency.

1.6 PROJECT/SITE CONDITIONS

A. Restrictions: Do not apply treatment solution except as otherwise required in construction operations. Apply in an industry standard manner such that contamination by toxic or hazardous chemicals does not occur in any adjacent or occupied areas.

1.7 WARRANTY

A. Furnish written warranty certifying that applied termiticide treatment will prevent infestation of termites and, that if termite activity is discovered during warranty period, Contractor will retreat discovered during repair or replace damage caused by termite infestation.

B. Provide warranty for a period of 5 years from date of treatment, signed by Applicator and Contractor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. PRG, Inc. (Preservation Resource Group)
Rockville, MD

2.2 MATERIALS

A. Emulsifiable concentrate termiticide for dilution with water, specially formulated to prevent infestation by termites such as "Bora-Care" (PRG, Inc.), or approved equal.
   1. A high-concentration solution containing the active ingredient disodium collaborate tetra hydrate formulated in a specially patented carrier system.
   2. Provides a high-degree of repellency and rapid elimination of active infestation in a single application.
   3. EPA registered for preventive and remedial treatments; odorless; colorless; long lasting.
   4. Penetrates the wood, eliminates active infestations and provide long-term protection against future infestations.
   5. NOTE: Other solutions or methods of application may be used as recommended by manufacturer or applicator if also acceptable to the RHPO and approved for intended application by jurisdictional authorities.

2.3 EQUIPMENT

A. Spray equipment for application of termiticide concentrate as recommended by termiticide manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all wood portions of a building for insect damage least once each year. Look for signs of insect activity, such as:
   1. Clay tubes on pieces of wood
   2. Small holes in the wood
   3. Small unexplained piles of sawdust

B. If any of these signs appear between inspections, an insect control specialist should be called in to make a thorough investigation.

3.2 PREPARATION

A. Remove foreign matter which could decrease effectiveness of treatment on areas to be treated.

3.3 ERECTION, INSTALLATION AND APPLICATION

NOTE: TERMITICIDE TREATMENT WILL NOT STRENGTHEN DETERIORATED WOOD. STRUCTURAL MEMBERS THAT ARE NO LONGER SOUND MUST BE REPAIRED OR REPLACED.

A. For Spot Treatment of Infested Areas:
   1. Dilute termiticide concentrate with water according to manufacturer's instructions. NOTE: FUEL OIL IS NOT PERMITTED AS A DILUENT.
   2. Saturate the infested and surrounding area with diluted termiticide using a spray. Apply at rate recommended by manufacturer.
      NOTE: BE SURE TO TREAT THE ENTIRE INFESTED MEMBER TO ENSURE THAT THE ACTIVE INGREDIENT IN THE CONCENTRATE REMAINS AT A LEVEL HIGH ENOUGH FOR EFFECTIVE CONTROL. WOOD THAT HAS NOT BEE TREATED WILL NOT BE PROTECTED.

B. Post signs in areas of application to warn workers that termiticide treatment has been applied. Remove signs when areas are covered by other construction.

C. Reapply treatment solution to areas disturbed by subsequent construction activities following application.

END OF SECTION

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SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Structural floor, wall, and roof framing.
2. Built-up structural beams and columns.
3. Sill gaskets.
4. Preservative treatment of wood.

B. Related Sections include the following:

1. Division 02 Section "Termite Control" for site application of borate treatment to wood framing.
2. Section 06 10 53 – Miscellaneous Rough Carpentry
3. Section 06 13 23 – Heavy Timber Framing
4. Section 06 15 00 – Wood Decking
5. Section 06 16 00 – Sheathing
6. Section 06 16 13 – Insulating Sheathing
7. Section 06 17 33 – Wood I-Joists
8. Section 06 17 53 – Shop Fabricated Wood Trusses
9. Section 06 18 00 – Glue Laminated Construction

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Timber: Lumber of 5 inches nominal or greater in least dimension.

D. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

C. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

D. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Power-driven fasteners.
5. Powder-actuated fasteners.
6. Expansion anchors.
7. Metal framing anchors.

1.5 QUALITY ASSURANCE

A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

B. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

1. Dimension lumber framing.
2. Timber.
3. Rim boards.
4. Miscellaneous lumber.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA UC4A.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Maximum Moisture Content 19 percent.

B. Interior Partitions: Construction grade or better, any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB, or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Northern species; NLGA.

7. Eastern softwoods; NeLMA.
8. Western woods; WCLIB or WWPA.

C. Exterior and Load-Bearing Walls: No. 2 grade or better, any of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Mixed southern pine; SPIB.
5. Spruce-pine-fir; NLGA.
6. Douglas fir-south; WWPA.
7. Hem-fir; WCLIB or WWPA.
8. Douglas fir-larch (north); NLGA.
9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

D. Ceiling Joists (Non-Load-Bearing): No. 2 grade or better, any of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Douglas fir-larch (north); NLGA.
5. Mixed southern pine; SPIB.
6. Spruce-pine-fir; NLGA.
7. Hem-fir; WCLIB or WWPA.
8. Douglas fir-south; WWPA.
9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
10. Northern species; NLGA.
11. Eastern softwoods; NeLMA.
12. Western woods; WCLIB or WWPA.

E. Joists, Rafters, and Other Framing Not Listed Above: No. 2 grade or better, any of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Mixed southern pine; SPIB.
5. Spruce-pine-fir; NLGA.
6. Douglas fir-south; WWPA.
7. Hem-fir; WCLIB or WWPA.
8. Douglas fir-larch (north); NLGA.
9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

F. Exposed Exterior Framing Indicated to Receive a Stained or Natural Finish: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade: As indicated above for load-bearing construction of same type.
2. Species and Grade: Hem-fir (north), No. 1 grade; NLGA.
3. Species and Grade: Southern pine, No. 1 grade; SPIB.
4. Species and Grade: Douglas fir-larch; No. 1 grade; WCLIB, or WWPA.
5. Species and Grade: Mixed southern pine, No. 1 grade; SPIB.
6. Species and Grade: Spruce-pine-fir, No. 1 grade; NLGA.
7. Species and Grade: Douglas fir-south; No. 1 grade; WWPA.

8. Species and Grade: Hem-fir; No. 1 grade; WCLIB, or WWPA.
9. Species and Grade: Douglas fir-larch (north); No. 1 grade; NLGA.
10. Species and Grade: Spruce-pine-fir (south), No. 1 grade; NeLMA, WCLIB, or WWPA.
11. Species and Grade: Eastern hemlock-balsam fir or eastern hemlock-tamarack; No. 1 grade; NeLMA.
12. Species and Grade: Beech-birch-hickory, No. 1 grade; NeLMA.
13. Species and Grade: Northern red oak, No. 1 grade; NeLMA.
14. Species and Grade: Redwood, No. 1 grade; RIS.
15. Species and Grade: Mixed oak, No. 1 grade; NeLMA.
16. Species and Grade: Mixed maple, No. 1 grade; NeLMA.
17. Species and Grade: Western cedars, No. 1 grade; WCLIB, or WWPA.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.
7. Utility shelving.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content of any species.

C. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content and any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB, or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

D. For exposed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
2. Mixed southern pine, No. 2 grade; SPIB.
3. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
4. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

E. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 3 grade; SPIB.
2. Hem-fir or hem-fir (north), Standard or 3 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Standard or 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods, No. 3 Common grade; NeLMA.
5. Northern species, No. 3 Common grade; NLGA.
6. Western woods, Standard or No. 3 Common grade; WCLIB or WWPA.

F. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

G. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

H. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2

2.7 METAL FRAMING ANCHORS

A. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings or comparable products by one of the following:

1. Alpine Engineered Products, Inc.
2. Cleveland Steel Specialty Co.
3. Harlen Metal Products, Inc.
4. KC Metals Products, Inc.
5. Simpson Strong-Tie Co., Inc.
6. Southeastern Metals Manufacturing Co., Inc.
7. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Shear wall panels: Equal to Simpson Strongwall panels of the size indicated on the Drawings.

D. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 0.040 inch thick with hemmed edges.

2.8 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

B. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

E. Do not splice structural members between supports, unless otherwise indicated.

F. Place horizontal members laid flat, crown side-up.

G. Construct double joist headers at floor and ceiling openings. Frame rigidly into joists.

H. Construct double joists under wall studding.

I. Bridge framing in excess of 8 feet (2.3 m) span at mid-span members. Fit solid blocking at ends of members.

J. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

K. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

L. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

M. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

N. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the 2005 Connecticut Building Code.

O. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

P. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

Q. Place sill gasket directly on foundation. Puncture gasket clean and fit tight to protruding foundation anchor bolts.

R. Coordinate installation of wood decking, glue laminated and plywood web joists.

S. All wood contact with concrete or masonry to be pressure treated.

3.2 STUD INSTALLATION

A. Stud Spacing: 16 inches (400 mm) on center. Unless noted otherwise on the drawings.

B. Wall & Partition Heights: Full height to floor or roof/ceiling construction above.

C. Frame all walls and partitions with double top plates. All top plates to be lapped.

D. Door Opening Framing: Install double studs at doorframe jambs. Install stud jacks on each side of opening, at frame head height, and between studs and adjacent studs.

E. Blocking: Nail wood blocking to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, cabinetry, and future grab bars in all units.

F. Coordinate installation of bucks, anchors, blocking, electrical and mechanical work placed in or behind partition framing.

3.3 WOOD SLEEPERS, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.4 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring horizontally and vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

3.5 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

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SECTION 06 16 00

SHEATHING

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Wall and roof sheathing.
B. Subfloor sheathing and overlay.
C. Miscellaneous framing and sheathing.

1.2 RELATED WORK

A. Section 01 26 00 – Contract Modification Procedures: Unit Prices.
B. Section 03 20 00 – Concrete Reinforcing: Setting anchors in concrete.
C. Section 05 50 00 - Metal Fabrications: Metal Fabrications.
D. Section 06 10 00 – Rough Carpentry
E. Section 06 10 53 – Miscellaneous Rough Carpentry.
F. Section 06 20 00 - Finish Carpentry.

1.3 REFERENCES

A. ALSC - American Lumber Standards Committee: Softwood Lumber Standards.
B. ANSI A135.4 - Basic Hardwood.
C. APA - American Plywood Association.
D. AWPA - American Wood Preservers' Association: Book of Standards.
E. FS - TT-W-571 - Wood Preservation: Treating Practices.
F. NFPA - National Forest Products Association.
G. SFPA - Southern Forest Products Association.
H. WCLIB - West Coast Lumber Inspection Bureau: Standard Grading Rules for West Coast Lumber.
I. WWPA - Western Wood Products Association.
J. AWPA (American Wood Preservers Association) C20 - Structural Lumber Fire Retardant Treatment by Pressure Process.
K. AWPA (American Wood Preservers Association) C2 – Wood Preservative Treatment by Pressure Process.

1.4 QUALITY ASSURANCE

A. Lumber Grading Agency: Certified by ALSC.

B. Plywood Grading Agency: Certified by APA.

C. Compliance with: AWC-2005 National Design Specifications, 2001 Wood Frame Construction Manual & 2005 Special Design Provisions for Wind and Seismic Supplement.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable codes for size and type of fasteners requirements.

B. Conform to UL requirements to achieve rating indicated on drawings.

C. All products used shall not contain Formaldehyde.

D. Preservatives used shall not contain chromium or arsenic.

PART 2 – PRODUCTS

2.1 PLYWOOD MATERIALS

A. Roof Sheathing: APA Structural I, Grade C-D; unsanded, fire retardant where noted.

B. Wall Sheathing: APA Structural I, Grade C-D; unsanded.

C. Floor Sheathing: APA Structural I, Grade C-D; unsanded.

D. Underlayment: APA Structural I, Grade C-D; sanded.

2.2 SHEATHING AND UNDERLAYMENT LOCATIONS

A. Flat Roof Sheathing: 3/4-inch thick, 48 x 96 inch sized sheets, square edges.

B. Roof Sheathing over existing sheathing: 3/8-inch thick, 48 x 96 inch sized sheets, square edges.

C. Above Grade Wall Sheathing: 1/2-inch thick, 48 x 96 inch sized sheets, square edges.

D. Floor Sheathing: 3/4-inch thick, 48 x 96 inch sized sheets, square edges.

E. Floor Underlayment: 3/8-inch thick, 48 x 96 inch sized sheets.

2.3 ACCESSORIES

A. Fasteners: Hot-dipped galvanized steel for exterior, high humidity, and treated wood locations; plain finish elsewhere; size and type to suit condition.

B. Anchors and Connectors: As shown on the Drawings; manufactured by TECO or Simpson. Where connectors or anchors are not noted, provide appropriate galvanized items.

C. Joist Hangers: Galvanized steel, sized to suit joists and framing conditions; manufactured by TECO or Simpson.

D. Anchors: Adhesive expanding bolt type for anchorage to masonry. Bolts or ballistic fasteners for anchorage to steel.

E. Sill Gasket: 1/4 inch thick, plate width; 6 inch wide; glass fiber strip.

F. Subfloor Glue: Waterproof, air cure type, cartridge dispensed; manufactured by DAP.

G. Drywall Screws: Bugle head, steel, power driven type length of three times thickness of sheathing.

H. Tape for Sheathing Seams: 25 mil thick, 4 inches wide; Basis of Design: Grace Vycor Plus

I. Building Wrap: 12.1 mil, 10 perms, Class A Flame spread; Basis of Design: Typar Metro Wrap or an approved equal

2.4 WOOD TREATMENT

A. Fire retardant: AWPA UCFB, Exterior Type, chemically treated and pressure impregnated; capable of providing a maximum flame spread/smoke development rating of 0 to 75.

B. Wood Preservative (Pressure Treatment): AWPA UC4A using water borne preservative with 0.25 percent retainage.

C. Wood Preservative (Surface Application): green colored, manufactured by Osmose.

PART 3 – EXECUTION

3.1 SHEATHING

A. Secure roof sheathing perpendicular to framing members with ends staggered. Secure sheet edges over firm bearing.

B. Secure wall sheathing horizontally perpendicular to wall studs, with ends staggered, over firm bearing.

C. Secure subfloor perpendicular to floor framing with end joints staggered. Secure sheet edges over firm bearing. Attach sheathing with subfloor glue and drywall screws.

D. Install plywood to simple span.

E. Tape all horizontal & vertical joints between wall Sheathing panels.

F. Secure flooring underlayment after dust and dirt generating activities have ceased and prior to application of finished flooring. Apply perpendicular to subflooring. Stagger end joints of underlayment. Secure with screw type fasteners.

3.2 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) maximum from true position.

B. Surface Flatness of Floor: 1/4 inch in 10 feet (2 mm/m) maximum.

END OF SECTION

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SECTION 06 20 13

EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior wood trim.
2. Wood siding.
3. Wood soffits.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view[**and for framing exposed to view**].
2. Section 061533 "Wood Patio Decking" for elevated decks, including stairs and railings.

1.3 DEFINITIONS

A. MDO: Plywood with a medium-density overlay on the face.

B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

D. Samples for Verification:

1. For each species and cut of lumber and panel products, with half of exposed surface finished; 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For wood siding and soffits, 50 sq. in. for board types and 8 by 10 inches for panels.

1.5 INFORMATIONAL SUBMITTALS

A. Compliance Certificates:

1. For lumber that is not marked with grade stamp.
2. For preservative-treated wood that is not marked with treatment-quality mark.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.

C. Sample Warranties: For manufacturer's warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 30 year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2 year experience installing similar products.

C. Evaluation Reports: The panels shall have evaluation reports (ER) from ICC-ESR 1862, State of Florida and Texas T.D.I. as assurance of quality and that they meet all applicable building codes.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship is approved by Architect.
3. Replace mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.9 WARRANTY

A. Manufacturer's Warranty for Wood Siding, Soffits, and Trim: Manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, deformation or deterioration beyond normal weathering.
2. Warranty Period for Siding, Soffits, and Trim: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece.

B. Softwood Plywood: DOC PS 1.

C. Hardboard: ANSI A135.4.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Water-Repellent Preservative Treatment by Nonpressure Process: AWPA N1; dip, spray, flood, or vacuum-pressure treatment.

1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC)[**, combined with an insecticide containing chloropyrifos (CPF)**] <**Insert requirement**>.

2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
3. Application: [**Items not required to be pressure-preservative treated**] [**Exterior trim**] [**and**] [**wood siding**] <**Insert application**>.

B. Preservative Treatment by Pressure Process: AWPA U1; Use Category [**UC3a**] [**UC3b**].

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction[**and containing no arsenic or chromium**].
3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
4. Do not use material that is warped or does not comply with requirements for untreated material.
5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.

    a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece

6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

    a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

2.3 EXTERIOR TRIM

A. Lumber Trim for Painted Finish:
1. Species and Grade: Western red cedar; NLGA, WCLIB, or WWPA [**Grade A**] [**Grade B**].
2. Maximum Moisture Content: [**19**] [**15**] percent[**with at least 85 percent of shipment at 12 percent or less**].
3. Finger Jointing: [**Not allowed**] [**Allowed if made with wet-use adhesive complying with ASTM D5572**].
4. Face Surface: [**Surfaced (smooth)**] [**Saw textured**].
5. Factory Priming: Factory coated on both faces and all edges, with exterior primer compatible with topcoats specified.

B. Moldings for Painted Finish: MMPA WM 4, P-grade wood moldings, made from kiln-dried stock to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."

1. Species: Western red cedar
2. Finger Jointing: [**Not allowed**] [**Allowed if made with wet-use adhesive complying with ASTM D5572**].

2.4 LUMBER SOFFITS

A. Provide kiln-dried lumber siding complying with DOC PS 20.

B. Species and Grade: Western red cedar; NLGA, WCLIB, or WWPA [**Grade A**] [**Grade B**].

C. Pattern: V-edge, smooth-faced tongue and groove, actual face width (coverage) and thickness of [3-1/8 by 9/16 inch (79 by 14 mm)] [3-1/8 by 23/32 inch (79 by 18 mm)] [5-1/8 by 23/32 inch (130 by 18 mm)] [6-7/8 by 23/32 inch (175 by 18 mm)].

D. Pattern: Beaded ceiling, tongue and groove, actual face width (coverage) and thickness of [3-1/8 by 3/8 inch (79 by 9.5 mm)] [3-1/8 by 7/16 inch (79 by 11 mm)].

2.5 FABRICATION

A. Back out or kerf backs of standing and running trim wider than 5 inches (125 mm), except members with ends exposed in finished work.

B. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed.

1. Cut to required lengths and prime ends.
2. Comply with requirements in Section 099113 "Exterior Painting."

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut exterior finish carpentry to fit adjoining work.
3. Refinish and seal cuts as recommended by manufacturer.
4. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
5. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
6. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 INSTALLATION OF STANDING AND RUNNING TRIM

A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary.

1. Use scarf joints for end-to-end joints.
2. Stagger end joints in adjacent and related members.

B. Fit exterior joints to exclude water.

1. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
2. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

C. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.5 INSTALLATION OF SIDING

A. Install siding to comply with manufacturer's written instructions and warranty requirements.

B. Diagonal Lumber Siding:

1. Begin application at corner, with tongue edge up.
2. Install subsequent courses with tongue-and-groove edges tightly fitted together.

   a. Nail at each stud.

3. Leave 1/8-inch (3-mm) gap at trim and corners unless otherwise recommended by manufacturer, and apply sealant.
4. Butt joints only over framing or blocking, nailing top and bottom on each side and staggering joints in subsequent courses.
5. Install prefabricated outside corners as recommended by manufacturer of siding materials.

C. Flashing: Install metal flashing as recommended by siding manufacturer.

D. Finish: Apply finish within two weeks of installation.

3.6 ADJUSTING

A. Replace exterior finish carpentry that is damaged or does not comply with requirements.

1. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

B. Adjust joinery for uniform appearance.

3.7 CLEANING

A. Clean exterior finish carpentry on exposed and semiexposed surfaces.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

3.8 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 06 30 00.10

EPOXY REPAIR FOR DETERIORATION AND DECAY IN WOOD MEMBERS

PART 1 - GENERAL

1.1 SUMMARY

A. This procedure includes guidance on stabilizing decayed wood members with epoxy consolidant and filler.

1. For reference you may see:

   a. the American Wood Protection Association

   b. John Leeke's Historic Home Works

B. Deterioration and decay in wood results from moisture infiltration, accompanying fungal growth and insect infestation. Failure of paint, caulk and sealant leaves the wood surface underneath it susceptible to these perils.

C. Some sources of moisture may include the original moisture in green wood, rainwater, condensation, ground water, piped water, and water released by water-conducting fungus through the process of decay itself.

D. Epoxy repair may be appropriate if:

1. the piece to be repaired is historically significant. Epoxy repair makes it possible to retain most of an original component by selectively repairing only the damaged area.
2. if the piece is decorative and replacement would be too expensive or seemingly impossible to replicate.

E. Epoxy repair may NOT be appropriate if:

1. the piece is a structural member. Epoxy has adequate compression strength, but is not the best choice to repair a member in tension. In this case, replacement is usually a better option.
2. the wood to be repaired is to remain unpainted (as the epoxy is quite different in appearance than wood). In this case, appearances will matter to a greater degree, and the wood should be selectively replaced.
3. if the area to be repaired is large, as epoxy repair can be expensive.

F. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:

1. Safety Precautions
2. Historic Structures Precautions
3. Submittals
4. Quality Assurance
5. Delivery, Storage and Handling
6. Project/Site Conditions
7. Sequencing and Scheduling
8. General Protection (Surface and Surrounding)

These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the Regional Historic Preservation Officer (RHPO).

PART 2 - PRODUCTS

2.1 MANUFACTERS

A. ConServ Epoxy LLC
B. Abatron, Inc.
C. Roux Laboratories

2.2 MATERIALS

A. Epoxy consolidant and epoxy filler, both are multiple part compounds. Purchase by the gallon unless a large amount of epoxying needs to be done. Use one of the following, or approved equal:
   1. "Con Serv (T) Flexible Consolidant 100"
      (ConServ Epoxy LLC): Cures slowly with a 5 to 7 hour application time to allow deep penetration. Complete hardness is achieved in 3 to 6 days.
   2. "Con Serv (T) Flexible Patch 200" (ConServ Epoxy LLC): A four part putty-like filler; Not easy to mix in small amounts; Consistency and hardness are easily controlled with this material.
      NOTE: The above products of ConServ Epoxy LLC are recommended for treatment of thicker wood such as window sills. Because of its slower curing time, it allows for deeper penetration into members.
   3. "Liquidwood-1" Consolidant (Abatron): Solidifies in a short period of time.
   4. "Woodepox-2" Adhesive Paste (Abatron): A two-part paste mix; final hardness is determined by varying the ratio of the two parts. The LiquidWood can be used as a thinner, but this reduces the flexibility of the filler.
      NOTE: The above products of Abatron, Inc., are recommended for use on smaller members such as window sashes where deep penetration of consolidant is not required. The quick drying feature is an advantage for small, but repetitive, jobs. Abatron carries many different types of wood consolidants with varying degrees of penetration.

B. Oil clay that can be purchased from a hobby store (used to keep consolidant from leaking through cracks).

C. Nitrile Rubber Gloves (Abatron)

D. Disposable vinyl gloves: Available from drug store or pharmaceutical supply distributor in 50 count or larger boxes.
   Latex gloves should be avoided because many people have developed a severe allergic reaction to latex. To avoid this problem, look for products labeled as hypoallergenic.

2.3 EQUIPMENT

A. Plastic bottles, like those used for hair dye, to apply the consolidant; having many on hand is recommended. Cleaning of the bottles for reuse is possible.

B. Applicator bottles: Available from drug store and sold for hair dye application usually in 8 fl. oz. size; Also available in bulk from Roux Laboratories (see paragraph 2.01 (a.) above. Roux hair-color applicators lend themselves easily to cleaning and reuse.

C. Rags of different sizes to wipe up spills before epoxy has a chance to harden, small rags are recommended for quick one time uses such as wiping off spouts and caps.

D. Thin wooden sticks, approximately 8" long for scooping out paste and mixing consolidant.

E. Goggles and a respirator for protection from fumes.

F. Putty knives for application of filler

G. Channel lock pliers for opening stuck caps

H. Allen wrench to clean out cap holes

I. Needle nose pliers to pull out hardened epoxy

J. 1/8"x8"x12" Masonite boards for mixing paste filler

K. Carbon dioxide fire extinguisher: Curing epoxy creates heat that may cause fire

L. Rotary saw

M. Air compressor

N. Drill

O. Stiff bristle brushes

PART 3 - EXECUTION

3.1 EXAMINATION

A. Detect rot using the "Pick Test":
   1. Insert an ice pick into the wood at a slight angle.
   2. Lift the pick out. If the wood splinters in long pieces, the wood is ok. If the wood snaps where the pick is being lifted, the wood is decayed.

B. When rot is discovered:
   1. Determine the source of moisture infiltration and eliminate it.
      a. If rot is only present on the surface, drying is all that is necessary to stop the spread of decay and kill off any growth.

   2. If source of moisture is unknown, treat the wood with a preservative.
      a. Preservatives are caustic chemicals and should be handled with care.
      b. A particularly dangerous wood preserving chemical used frequently in the past was called pentachlorophenol (a.k.a. penta). It is now a controlled industrial preservative, considered extremely toxic and any use except by specially trained conservators should be avoided at all costs. If you have old stock of this chemical in storage, proper means of disposal should be sought out. CAUTION: THIS CHEMICAL IS CARCINOGENIC AND ITS USE IS BANNED IN MANY STATES.

3. Preservatives will eliminate fungal growth, but will not restore strength to deteriorated wood material.

3.2 PREPARATION

A. Surface Preparation Always follow the recommendations for use provided by the manufacturer of the filler or consolidant chosen.
   1. Dry affected wood member completely to arrest further decay. Dry in place if possible or remove the member and keep in a cool dry place until dry.
      CAUTION: IF THIS PRECAUTION IS NOT TAKEN, THE EPOXY CAN ACTUALLY TRAP MOISTURE UNDERNEATH IT IN THE WOOD FIBERS AND ACCELERATE THE DECAY PROCESS.
   2. Have all materials at hand before the mixing process begins.
   3. Label all caps and lids so that a cap or lid is not placed on the wrong container or it may remain there permanently.

3.3 ERECTION, INSTALLATION, APPLICATION

CAUTION: AS EPOXIES CURE, HEAT IS PRODUCED. FOR THIS REASON, EPOXIES SHOULD BE USED IN SMALL QUANTITIES TO DETER EXTENSIVE HEAT BUILD-UP. CARE SHOULD BE TAKEN WHEN USING EPOXY ON A HOT DAY. Use caution when disposing of epoxy-covered components such as mixing and application bottles, resin-coated clean-up towels, papers and wood scraps.

A. Repair decayed wood using epoxy wood consolidant. Always follow the recommendations for use provided by the manufacturer of the filler or consolidant chosen.
   1. Drill 1/4" or 3/16" holes in affected wood to receive epoxy consolidant:
      a. Drill holes at an angle and spaced approximately 2" on center in staggered rows. The top of one hole should line up with the bottom of the next hole.
         CAUTION: BE SURE NOT TO DRILL THROUGH THE ENTIRE SURFACE FOR CONSOLIDANT WILL LEAK OUT FROM BEHIND.
      b. Dam any surface cracks with oil clay (this is old-fashioned modeling clay) so that epoxy will not leak.
   2. Remove sawdust and dirt from drilled holes by blowing (by mouth or with the aid of a common drinking straw), vacuuming, or use of stiff bristle brushes.
   3. Following manufacturer's instructions, thoroughly mix the consolidant components.
   4. Using a large plastic syringe or squeeze bottle and tube spout, carefully squirt the consolidant into the pre-drilled holes. Completely saturate the wood, moving from hole to hole refilling until the wood can hold no more. More than one application may be needed to force air out of voids.
   5. Wipe off any excess consolidant or spills and cover the treated area to protect until cured as directed by epoxy manufacturer.
   6. If severed pieces need to be re-attached, glue them in place with a mixture of consolidant and filler, according to the manufacturer's instructions.

B. When the consolidant has cured, fill the voids in the surface with epoxy filler (wood-epoxy putty):
   1. Mix the two part epoxy filler according to manufacturer’s instructions until consistency of a glazing compound is uniform and compound can be worked with a putty knife.

2. Apply the filler to the surface:
   a. For large voids, apply filler in 1" thick layers to reduce heat build-up that may undermine repairs.
   b. Build up filler layers slightly above the wood surface to allow for planing and sanding smooth after it has cured.

3. When the filler has cured, sand or plane the surface smooth.
4. Apply a wood preservative to the surrounding wood surfaces, prime and paint the entire surface.

END OF SECTION

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SECTION 06 31 00.10

APPLYING A WATER-REPELLENT PRESERVATIVE TO WOOD

PART 1 GENERAL

1.1 SUMMARY

A. This specification provides guidance on applying a water-repellent preservative (WRP) to wood. This coating will prolong the service life of wood and provide some protection against agents of deterioration.

B. NOTE: WATER REPELLENTS AND WATER-REPELLENT PRESERVATIVES ARE ONLY EFFECTIVE ON UNPAINTED WOOD. IF APPLYING TO PREVIOUSLY PAINTED WOOD, BRUSH WRP THOROUGHLY INTO ANY JOINTS OR CRACKS AND WIPE ANY EXCESS OFF OF PAINTED SURFACES. ALLOW PROPER DRYING TIMES.

C. Natural causes of deterioration include decay, ultraviolet degradation, insect infestation and excess moisture.

D. WRPs are often recommended for humid climates. Their use can significantly reduce the problems of peeling, flaking, blistering, etc. of painted wood surfaces.

E. Some types of problems resulting from the weathering process include:
   1. Fungi and/or mildew growth.
   2. Warped boards.
   3. Loose fasteners.
   4. Changes in surface texture resulting in cracks and checks.

F. In addition to opaque paints, various so-called "natural" finishes and colored stains provide WRP protection.

G. Like when preparing paint, proper surface preparation and application are vital to long-lasting protection.

H. Read "General Project Guidelines" along with this specification. These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the Regional Historic Preservation Officer (RHPO). The guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

1.2 DEFINITIONS

A. Water-Repellent Preservatives (WRPs):

1. Natural, colorless liquids which, when brushed onto or soaked into the wood, render the wood impervious to liquid water, inhibit the growth of mildew and other fungi, and provide protection against termite and other insect infestation.
2. Their use reduces warping and checking and prevents water staining at edges of boards and at the end grain.
3. WRPs do not, however, protect wood from water vapor or ultraviolet degradation.
4. WRPs contain no coloring agents but their application will cause wood to darken somewhat. The resulting color is typically a golden tan, although the color will vary according to the type of wood.
5. WRPs can be used as a natural finish.

B. Water Repellents

1. Similar in composition and function to WRPs, except that water repellents do not contain a fungicide or mildewcide.
2. Additionally, water repellents do not provide adequate protection against decay and ultraviolet degradation. Therefore, they should not to be used as the only finish.
3. NOTE: The appearance of the phrase "mildew-resistant" on a water repellent does not mean the product is a preservative. Therefore, read the label carefully when purchasing a WRP.

1.3 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

1. Unless otherwise recommended by the manufacturer, the ambient temperature shall be between 50 and 95 degrees Fahrenheit when applying either a stain or WRP.
2. Do not apply a WRP when the relative humidity exceeds 85% or the moisture content of the wood exceeds 12%, as measured by an electronic moisture meter.
3. Do not apply a WRP in the direct sun. They shall be applied only when the surface to be treated is in the shade and the sun is shining on the opposite elevation:
   a. The west elevation should be treated in the morning when the sun is shining on the east elevation.
   b. The north elevation should be treated around noon when the sun is shining on the south elevation
   c. The east elevation should be treated in the afternoon when the sun is shining on the west elevation.
   d. The south elevation should be treated in the late afternoon when it is in full shade.

4. Do not apply WRPs to damp surfaces, in misty or rainy weather, in the snow or where there is visible ice or frost on the surfaces.

1.4 MAINTENANCE

A. On smooth wood surfaces, a WRP will remain effective for about a year.

1. If the first application was applied to the point of refusal (total saturation), it may remain effective for two years.
2. On rough or weathered wood, expect a WRP to remain effective from one to three years.

B. To determine if a WRP finish is still effective, splash some water on the surface.

1. If the water beads up, the WRP is still providing the necessary protection.
2. If the water soaks into the wood and/or the wood has a blotchy appearance (caused by mildew), it is necessary to retreat.

C. Before applying a new coat of WRP, clean the old surface with a nonferrous bristle brush.

D. To kill any mildew, wash with a solution of 1/3 cup of household detergent (NO AMMONIA), 1 quart 5% bleach, and 3 quarts warm water.

E. Rinse well and let dry thoroughly before reapplying the WRP.

F. After the treated wood has achieved a uniform tan color, retreatment will be required every 2 to 4 years.

PART 2---PRODUCTS

2.1 MANUFACTURERS

A. American Building Restoration Products, Inc.
Franklin, WI
1-800-346-7532

B. Rust-Oleum, woodcare products division
1-800-901-0411

2.2 MATERIALS

NOTE: It is very important to be aware of how different manufacturers' repellents react to being top-coated with paints of varying chemical compositions (latex/oil/alkyd/etc.). Be sure to fully investigate manufacturer's datasheets and application guidelines before moving forward with any work.

A. WRP
1. Use a commercial WRP such as "X-100 Natural Seal Stain" (ABR Products, Inc.), "Wolman F&P Finish and Preservative" (Rust-Oleum), "Wolman Woodlife Classic Clear Wood Preservative" (Rust-Oleum) or approved equal.

-OR-

2. Prepare home-made WRP based on the USDA Forest Products Laboratory formula (see "Preparing a Non-Toxic Water-Repellent Preservative" for guidance on preparation).
3. For warranty purposes, using a commercial product is often preferable.

B. Household detergent (NO AMMONIA).

C. Household Bleach:
1. Other chemical or common names include sodium hypochlorite (NaOCl), bleaching solution; laundry bleach, and solution of chlorinated soda.
2. Potential Hazards: CAUSTIC TO FLESH.
3. Available from chemical supply house, grocery store, supermarket, hardware store or janitorial supply distributor.

4. Clean, clear water.

2.3 EQUIPMENT

A. Brushes:
   1. Use natural bristle paint brushes for oil/alkyd preservatives. Precondition brushes by soaking them in raw linseed oil for 24 hours.
   2. Use nylon bristle brushes for applying latex water-based preservatives.
   3. Do not use the same brush for both types of stain.
   4. For thin, runny stains, foam pad applicators can be used.
   5. Stiff natural bristle scrub brushes.

PART 3---EXECUTION

3.1 PREPARATION

A. Surface Preparation: The surface should be free of all loose fibers, dust and grease before application of a WRP.

3.2 ERECTION, INSTALLATION, APPLICATION

A. Dipping is the most effective means of treatment, especially for the ends of wood members. Brushing to the point of refusal (total saturation) is the next best method of treatment.
   1. For treated lumber, dip freshly cut surfaces before installation, 10 seconds to 3 minutes.
   2. For untreated lumber, dip, brush or spray with preservative. Pay particular attention to end grain and joints.
   3. For wood shingles, dip before installation, with a second coat brushed onto the surface after installation.
   4. On fixed surfaces, use a minimum of two successive coats.
   5. For pieces that are removable, soak for 10 seconds to 3 minutes.

   NOTE: On a smooth surface, 1 gallon of WRP will cover approximately 250 square feet, depending on the manufacturer. On a rough surface, it will cover only 100-150 square feet.

B. Allow adequate time for WRP treatment to dry before repainting so that paint will adhere properly. Always follow the manufacturer's instructions.
   1. In general, if the surfaces have been brush-treated, a drying time of 48 hours at 70 degrees Fahrenheit is generally sufficient.
   2. Longer drying times will be required if ambient temperatures are below 70 degrees Fahrenheit at any time during this drying period.
   3. Wood that has been dipped for 10 seconds will need a minimum of one week of similar, ideal drying time.
   4. If is too cold in the evenings for any paint film to dry properly (i.e. if it falls below 50 degrees Fahrenheit overnight), only apply a WRP at this time, and wait for warmer weather (even if this means waiting for springtime) to prime and paint over it.

C. In addition to adequate drying times, some wood surfaces treated with water repellents/WRPs must be allowed time to weather before they can be painted. Follow the manufacturer's instructions, as the weathering time can vary from six months to two years.

3.3 ADJUSTING/CLEANING

A. Caulking joints is an important part of surface preparation. You should generally caulk after a WRP or water repellent has been applied. However, check the manufacturer's specifications for both the preservative and the caulk being used, to ensure compatibility and attain maximum performance.

END OF SECTION

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SECTION 06 40 01.10

REPAIRING WATER DAMAGED WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This procedure includes guidance on repairing woodwork stained from minor water damage.

B. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the Regional Historic Preservation Officer (RHPO).

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood stain

B. Wood bleach: Solution of sodium perborate, hydrogen peroxide or proprietary mixture suitable for oak.

C. Wood filler, colored to match wood

D. Sandpaper: Extra fine grit

E. Mild cleaner such as "Murphy's Oil Soap" or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation:
   1. Mask all adjacent surfaces and protect other exposed surfaces in the work area.
   2. Fill any splits in existing wood and sand smooth prior to sealer application.

3.2 ERECTION, INSTALLATION, APPLICATION

A. Select an inconspicuous area on which to test materials and application for each method type required. Test area must be approved by the Contracting Officer.

B. After each test area has been prepared, receive approval from the Contracting Officer before commencing general application.

C. Check area with a moisture meter to verify that wood does not have moisture on surface.

D. Sand stained areas to bare wood.

E. If bare wood is stained, apply wood bleach to remove stain. Minimize flow of bleach onto areas not stained. Allow to dry and sand wood lightly to remove chemical residue.

F. Fill wood if required and apply stain of color to match existing.

3.3 ADJUSTING/CLEANING

A. Wash woodwork with mild detergent and water.

B. Dry immediately with clean cloth.

C. Finish to match historic finish.

END OF SECTION

SECTION 06 40 13

EXTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Roof Eave Trim
   2. Exterior Door Components
   3. Window & Window Frame Components
   4. Dormer Trim
   5. Dormer Components

B. Related Sections include the following:
   1. Division 6 Section "Finish Carpentry" for exterior carpentry exposed to view that is not specified in this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product and process indicated and incorporated into items of exterior architectural woodwork during fabrication, finishing, and installation.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of blocking and nailers, including concealed blocking and reinforcement specified in other Sections.

C. Product Certificates: For each type of product, signed by product manufacturer.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of exterior architectural woodwork indicated for construction, finishes, installation, and other requirements.
   1. Provide AWI Quality Certification Program labels indicating that woodwork, including installation, complies with requirements of grades specified.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation of exterior woodwork only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.6 COORDINATION

A. Coordinate sizes and locations of framing, blocking, reinforcements, and other related units of Work specified in other Sections to ensure that exterior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. New wood species shall match existing.

2.2 INSTALLATION MATERIALS

A. Nails: stainless steel.

B. Screws: stainless steel.

1. Provide self-drilling screws for metal framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts, unless otherwise indicated. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.3 FABRICATION, GENERAL

A. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

B. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and seal with a water-resistant coating suitable for exterior applications.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.

C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with same grade specified in Part 2 for type of woodwork involved.

B. Install woodwork true and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk concealed fasteners and blind nailing. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork.

E. Refer to Division 9 Sections for final finishing of installed architectural woodwork.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; replace woodwork where not possible to repair. Adjust joinery for uniform appearance.

B. Clean woodwork on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

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SECTION 06 43 00.10

SECURING AN EXTERIOR WOODEN BALUSTRADE

PART 1 - GENERAL

1.1 SUMMARY

A. This procedure includes guidance on repairing a wooden balustrade, including the handrail, the footrail and the balusters.

B. An exterior wooden balustrade system is particularly susceptible to decay for a number of reasons:
   1. Individual members are usually ornamentally turned or carved, exposing a large degree of end grain in proportion to the size of the member to wear and weather.
   2. The handrail takes all the weight from forces applied to the balustrade. It is usually connected to a column or post with a butt joint which does not allow for the transfer of any load to the column and exposes the end grain to weather; therefore, making this joint highly prone to moisture infiltration and the handrail to decay.
   3. Decay in a baluster typically occurs at the joints, particularly at the footrail if the top surface of the footrail is not sloped to shed water.
   4. Decay may also occur in the footrail if the bottom surface is too close to the ground. If the footrail is not adequately supported, the entire balustrade assembly will sag.

1.2 DEFINITIONS

A. Balustrade - The components consist of the handrail, footrail and balusters. The handrail and footrail are joined at the ends to a column or post. The balusters are vertical members that connect the rails.

1.3 SYSTEM DESCRIPTION

A. A wooden balustrade in proper condition is rigid and free from decay. It is designed with sloping surfaces to repel water and has properly caulked, tight joints.

1.4 MAINTENANCE

A. Periodically (late spring and late fall) inspect and clean surfaces.

B. Check condition of caulking and replace as necessary.

C. Clean with a mild soap and water and scrub with a soft bristle brush. Do not allow cleaning solution to remain on surface for more than 10 minutes.

D. Rinse surface thoroughly with clear water twice. Corners should be scrubbed with a tapered-end hand brush or hand held mop strands.

E. Use sponge along with clean water to rinse. Remove streaks with a damp chamois and water.

F. Remove mildew, moss, fungal growth, and vegetation with a 50/50 mixture liquid bleach and water. Scrub with a natural or nylon bristle brush and rinse thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood screws

B. Galvanized finish nails

C. Replacement baluster

D. Wood dowels

E. Mild soap

F. 5% liquid bleach solution

G. Clean, potable water

2.2 EQUIPMENT

A. Ice pick (for determining the presence of decay)

B. Waste container

C. Corn broom

D. Dust pan

E. Supply of treated rags

F. Wood glue

G. Hammer

H. Screwdriver

I. Drill

J. Chisel for mortising

K. Wood blocking

L. Replacement piece (if needed)

M. Two buckets (for extra solution and rinse)

N. Two sponges (for solution and rinse)

O. Brushes and string mop

P. Supply of dry wiping cloths and chamois

Q. Broom and garden sprayer

PART 3 - EXECUTION

3.1 EXAMINATION

A. Regularly inspect for dirt build-up. Cleaning should be done regularly, see Section 1.04 above for maintenance guidelines.
   1. Inspect for paint that is worn, chipped, peeling, blistered, or flaking. A proper paint seal is imperative to the protection of the wood from decay. If paint is peeling, decay may already be underway.
   2. Probe the wood with an ice pick to determine the existence of rot.
   3. Inspect for the signs of biological attack and insect infestation such as mold, fungus, bore holes, and sawdust piles.

3.2 PREPARATION

A. Protection:
   1. Mask or cover adjacent surfaces and permanent equipment during repair and maintenance. Coverings must be adhered without adhesive tape or nails. Impervious sheeting that produces condensation shall not be used.
   2. Protect landscape work adjacent to or within work area. Protect tree trunks with plank barriers. Tie up spreading shrubs. Protective covering must allow plants to breathe and be removed at end of the work day. Scaffolding legs must be placed away from plants. Plants cannot be pruned without prior approval of historic architect or horticulturist.
   3. Scaffolding, ladders, and working platforms shall not be attached in any way to building. If ladder must lean against building, legs shall be covered with fabric so as not to mar surface of building.

3.3 ERECTION, INSTALLATION AND APPLICATION

A. Repairing a Handrail - Where the handrail is connected to the column with a butt joint, it may be re-attached and secured in a series of different ways:
   1. If wood is still relatively sound:
      a. Drill pilot holes to avoid splitting the wood when nailing.
      b. Toenail the handrail back in place. Use galvanized finish nails because they are more weather resistant and grip the wood better.
         NOTE: THIS IS THE LEAST EFFECTIVE METHOD OF ATTACHMENT.-
         OR-

   2. If enough wood is present to accept a screw, toescrew the handrail back in place. Use a galvanized, bronze, or stainless steel screw. Countersink it and plug the hole before painting.
      NOTE: THIS METHOD OF REATTACHMENT IS BETTER THAN TOENAILING. THE SCREW HAS THE ABILITY TO DRAW THE MEMBERS TOGETHER AND HOLD THEM THERE.
      -OR-

   3. Install a kneel plate to secure the handrail in place.

a. Cut a kneel plate from extruded angle metal or barstock or purchase as a prefabricated corner brace.
b. Mortise it into the end of the rail.
c. Position it and screw it in place on the post.
d. Lower the handrail down over the kneel plate and adhere the kneel plate to the bottom of the rail with a screw.

4. Repairing a Loose Baluster:
   NOTE: BALUSTERS ARE USUALLY SECURED BY TOENAILING.
   a. Remove nail and secure with a screw. Countersink screw and plug hole. If baluster can be rotated, it can be secured with a dowel screw (threaded at both ends).
   b. If top and bottom of baluster are the same and baluster bottom is decayed while the top is sound, baluster can be inverted with the appropriate filler to repair the baluster bottom.
   c. If baluster is ornately carved, try using epoxy consolidant.
      NOTE: EPOXY CONSOLIDANT SHOULD BE CONSIDERED WHEN WORKING WITH HISTORIC MATERIALS SINCE EPOXIES ENABLE ONE TO SAVE AS MUCH OF THE ORIGINAL MATERIAL AS POSSIBLE.
   d. If baluster has a square cut end, a replacement can be made for the end only and connected to the existing baluster with a wood dowel and glue.
   e. If baluster must be replaced, use wood of the same species and age as original if possible. Replicate original exactly and install as original was installed.

5. Repairing a Footrail:
   a. If footrail is sound, but sagging, it is probably inadequately supported.
      1) Support footrail at least every 4 feet.
         NOTE: Verify historic appearance first. If railing is on a significant elevation, it may not be appropriate to add new support features.
      2) Add properly treated blocking as required. Consult historic architect for appropriate blocking type and size.

   b. If footrail must be replaced, mill new piece with a sloped surface to shed water.
      NOTE: MAKE SURE THAT A CLEARANCE OF 3" TO NOT MORE THAN 4" EXISTS BETWEEN FOOTRAIL AND FLOOR.

6. If pieces are completely taken apart, back prime all end grain surfaces before reinstallation.
7. After all reassembly has been completed and all surfaces have been sanded ready for repainting, caulk all joints with a paintable caulk, i.e., where handrail meets support post, top and bottom of balusters at their connection with handrail and footrail, and where support block of footrail meets the floor.

END OF SECTION

SECTION 07 30 00

ROOFING UNDERLAYMENT

PART 1 – GENERAL

1.1 SUMMARY

A. This Section specifies a self-adhering sheet membrane used as underlayment for sloped roofs.
   1. Severe climate application

B. Related Sections: Refer to the following specification sections for coordination:
   1. Section 06 10 00 - Rough Carpentry.
   2. Section 07 31 13 - Asphalt Shingles.
   3. Section 07 31 29 - Wood Shingles and Shakes.
   4. Section 07 32 00 - Roof Tiles.

C. Referenced Standards: Comply with the requirements of the following standards published by ASTM International to the extent referenced in this section.
   1. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
   2. ASTM D461 - Standard Test Methods for Felt.
   3. ASTM D 903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
   4. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
   5. ASTM D3767 - Standard Practice for Rubber—Measurement of Dimensions.
   6. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
   7. ASTM G90 – EMMAqua test.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and applicable codes at the location of the project.

B. Manufacturer: Minimum 10 years' experience producing roofing underlayment.

C. Installer: Minimum 2 years' experience with installation of similar underlayment.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened factory labeled packages. Protect from damage.

B. Cover materials and store in dry condition between temperatures of 40 and 90 degrees F (5 and 32 degrees C). Use within one year of date of manufacture. Do not store at elevated temperatures as that will reduce the shelf life of the product.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: GCP Applied Technologies, Inc, 62 Whittemore Avenue, Cambridge, MA 02140, Toll Free 866-333-3726, www.gcpat.com.

2.2 MATERIALS

A. Self-Adhering Sheet Membrane Roof Underlayment: Provide Grace Ice and Water Shield by GCP Applied Technologies, Inc. with the following characteristics:
   1. Material: Cold applied, self-adhering membrane composed of a high strength polyethylene film coated on one side with a layer of rubberized asphalt adhesive and interwound with a disposable release sheet. An embossed, slip resistant surface is provided on the polyethylene.
   2. Color: Gray-black.
   3. Membrane Thickness: 40 mil (1.02 mm) ASTM D3767 procedure A (Section 9.1).
   4. Tensile Strength, Membrane: 250 psi (1720 kN/m2) ASTM D412 (Die C modified).
   5. Elongation, Membrane: 250% ASTM D412 (Die C modified).
   6. Low Temperature Flexibility: Unaffected @ -20°F (-29°C) ASTM D1970.
   7. Adhesion to Plywood: 3.0 lbs/in. width (525 N/m) ASTM D903.
   8. Permeance (Max): 0.05 Perms (2.9 ng/m2s Pa) ASTM E96.
   9. Material Weight Installed (Max): 0.3 lb/ft2 (1.3 kg/m2) ASTM D461.
   10. Primer: Water-based Perm-A-Barrier WB Primer by GCP Applied Technologies, Inc.
   11. Code and Standards Compliance: Grace Ice and Water Shield meets the following:
       a. Underwriters Laboratories Inc. Class A fire classification under fiber-glass shingles and Class C under organic felt shingles (per ASTM E108/UL 790).
       b. Underwriters Laboratories Inc. Classified Sheathing Material Fire Resistance Classification with Roof Designs: P225, P227, P230, P237, P259, P508, P510, P512, P514, P701, P711, P717, P722, P723, P732, P734, P736, P742, P803, P814, P818, P824
       c. ICC ESR-1677 approval according to AC-48 Acceptance Criteria for Self-Adhered underlayments used as Ice Barriers.
       d. Miami-Dade County Code Report NOA 12-1115.02.
       e. Canadian Construction Materials Centre (CCMC) 13670-L
       f. City of Los Angeles RR 25330
       g. Florida State Approval Report No. FL289-R3

PART 3 – EXECUTION

3.1 EXAMINATION

A. Prior to start of installation, inspect existing conditions to ensure surfaces are suitable for installation of roofing underlayment. Verify flashing has been installed. Starting work indicates installers acceptance of existing conditions.

3.2 INSTALLATION

A. Installation: Install roofing underlayment on sloped surfaces at locations indicated on the Drawings, but not less than at hips, ridges, eaves, valleys, sidewalls and chimneys, and surfaces over interior space within 36 inches (914 mm) from the inside face of the exterior wall. Strictly comply with manufacturer's installation instructions including but not limited to the following:
   1. Schedule installation such that underlayment is covered by roofing within the published exposure limit of the underlayment.
   2. Do not install underlayment on wet or frozen substrates.

3. Install when surface temperature of substrate is a minimum of 40 degrees F (5 degrees C) and rising.
4. Remove dust, dirt, loose materials and protrusions from deck surface.
5. Install membrane on clean, dry, continuous structural deck. Fill voids and damaged or unsupported areas prior to installation.
6. Prime concrete and masonry surfaces using specified primer at a rate of 500-600 square feet per gallon (12-15 sqm/L). Priming is not required for other suitable clean and dry surfaces.
7. Install membrane such that all laps shed water. Work from the low point to the high point of the roof at all times. Apply the membrane in valleys before the membrane is applied to the eaves. Following placement along the eaves, continue application of the membrane up the roof. Membrane may be installed either vertically or horizontally after the first horizontal course.
8. Side laps minimum 3-1/2 inches (89 mm) and end laps minimum 6 inches (152 mm) following lap lines marked on underlayment.
9. Patch penetrations and damage using manufacturer’s recommended methods.

3.3 CLEANING AND PROTECTION

A. Protection: Protect from damage during construction operations and installation of roofing materials. Promptly repair any damaged or deteriorated surfaces.

B. Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired in the opinion of the Architect.

C. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protective film and reclean as necessary immediately before final acceptance.

END OF SECTION

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SECTION 07 31 00

SLATE ROOFING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division 0 and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide all labor, equipment, materials and services required to perform the work of this Section as indicated on the Drawings and specified herein.

B. This Section includes, but is not limited to, the following:

1. Removal of existing slate shingles and installation of new slate shingles.
2. Installation of new underlayments.
3. Installation of new mitered hips.
4. Installation of new metal ridges.
5. Such other Work as specified herein or shown in the Drawings.

C. Related Sections:

1. Section 06 10 53 – Miscellaneous Rough Carpentry
2. Section 07 52 00 – Modified Bituminous Roofing
3. Section 07 62 00 – Sheet Metal Flashing and Trim

1.3 REFERENCES AND STANDARDS

A. Comply with applicable requirements of the most recent editions of the following standards and others referenced in this Section. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. National Slate Association – Slate Roofs: Design and Installation Manual, 2010 Edition.
2. ASTM C406 – Standard Specification for Roofing Slate.
3. ASTM D226 – Standard Specification for Asphalt-Saturated Organic Felt Used in roofing and waterproofing.
4. ASTM D4869 – Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing.
5. ASTM D1970 – Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

1.4 SUBMITTALS

A. Submittals shall be made in accordance with Section 01 33 00.

B. Product Data

1. Underlayment(s) and underlayment fasteners.
2. Slate shingles and slating nails.

1.5 SAMPLES

A. Samples

1. Three to five slate shingles of each color, showing the full, natural range of color variation to be expected in the finished work.
   a. For uniform slate roofs, submit sample slates of size specified herein, with nail holes punched [drilled].

1.6 QUALITY ASSURANCE

A. Work of this Section shall comply with applicable standards indicated or implied.

B. Provide products from a single quarry during the course of the Work for consistency of quality and appearance.

C. Slate roofing contractor shall be a member in good standing of the National Slate Association, www.slateassociation.org.

D. Slate roofing contractor shall have at least 10-years experience in the installation of new slate roofing/repair of existing slate roofing and shall have successfully completed at least three slate roofing projects within the past five years similar in scope and scale to the Project specified herein. Foreman or superintendent shall have similar experience and shall provide full-time supervision of installers.

1.7 INSTALLATION ASSURANCE

A. Slates shall be installed by skilled and experienced roofers who will fit and fasten each slate. Each roofer proposed for the Project should be interviewed to determine that person's relevant experience.

B. The roofer shall proceed with slate shingle installation only after all penetrating work has been completed correctly, the substrate is dry, and weather conditions are favorable.

1.8 SEQUENCING/ SCHEDULING

A. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Coordinate work of this Section with interfacing, adjoining, and related roofing work for proper sequencing of each installation.

B. Do not disrupt activities in occupied spaces.

C. When multiple trades are accessing the same work area, coordinate the work sequence so as not to hinder the project schedule or detract from the quality of the work.

1.9 WARRANTY

A. Slate Shingle Supplier Warranty: Submit slate shingle supplier warranty, signed by the supplier and covering the slate shingles described in this Section, in which the supplier agrees to replace slate shingles that fail in materials and deliver the replacement slate to the original point of destination. The duration of this warranty shall be 75 years from date of original supply.

B. Roofing Installer Warranty: Submit roofing installer warranty, signed by roofing installer and covering Work of this Section, in which the roofing installer agrees to repair or replace slate roofing that fails in materials or workmanship within the following warranty period.

1. Warranty Period: Five years from date of substantial completion.

C. Additional Roofing Installer Warranty: The roofing installer agrees to return to the job site one year from the date of substantial completion of the Work to replace any broken or missing slates created as a result of normal, installation-related, shedding.

2.1 MANUFACTURERS

A. W.R. Grace & Co. for membrane waterproofing

2.2 ROOFING MATERIAL

A. Manufacturer: Vermont Structural Slate Company (“VSS”) for roofing slates, or approved equal.
3 Prospect Street
Fair Haven, VT 05743

B. Classification: Slate shall meet the requirements of Grade S1 per ASTM C-406-06.

1. Color: Colors are be selected to best match the proportions and range of colors of the existing roof slates.
2. Slate types shall match existing roofing slates.
3. Size: Slate lengths and widths to match the proportions of the range sizes of existing roofing slates.
4. Shape: Slate shingles shall match existing roofing slates.
5. Exposure: To match existing.
6. Headlap: To match existing.
7. Thickness: To match existing.
8. Nail Holes: Each slate shall be machine punched or drilled for two nails located for proper headlap.

C. Physical Requirements

1. Slates with a strong grain must be produced "on the grain", that is, the direction of the grain of the stone must be parallel to the long dimension of the shingle. Slates shall be randomly selected from each shipment and tested for grain direction to ensure proper fabrication.
2. Slates with broken corners on the exposed ends shall not be installed when either the base or leg of the right triangular piece broken off is greater than 1 1/2 inches. Slates with broken corners are acceptable for cutting stock.

3. The curvature of shingles shall not exceed 1/8 inch in 12 inches. Curved slates shall be trimmed and holed to permit them to be laid with the convex side facing up.
4. "Knots" and "knurls" are rounded defects that affect the smoothness of split. They are acceptable on the exposed portion of the top face but on other parts will prevent close contact of shingles. Shingles having knots or knurls on the covered portions projecting in excess of 1/16 inch shall not be used if they prevent proper fit and contact.
5. Slates shall be free from ribbons.
6. Not more than 1% of broken slates, including those having cracks materially precluding ringing when sounded, shall be accepted.
7. Face dimensions shall not differ from those specified by more than 1/8 inch.

2.3 UNDERLAYMENTS

A. Felt: No. 43 unperforated asphalt-saturated organic felt, 36"-wide rolls complying with ASTM D226 Type II or ASTM D4869 Type IV.

B. Underlayment Accessories: Corrosion resistant, large head fasteners of sufficient length to prevent wind event blow-off, or as recommended by underlayment manufacturer.

C. Ice Dam Protection Membrane Self-Adhering Underlayment, polyethylene faced for ice dam protection at eaves and where shown in the Detail Drawings: ASTM D 1970, minimum of 30 mils thick; slip-resistant, polyethylene-film or granule surfaced laminated to SBS-modified asphalt adhesive, with release-sheet backing; cold applied.

1. Products:
   a. "Grace Ice & Water Shield HT," GCP Applied Technologies, Inc., Cambridge, MA 02140, (617) 876-1400 or (877) 423-6491
   b. "WeatherLock G," Owens Corning, Toledo, OH 43659, (800) 438-7465

2.4 ACCESSORIES

A. Slate hooks for slate repair work: For slates with a 3" headlap and measuring up to ¾" thick, 3" long, 10-gauge, solid copper, Type 304 stainless steel, or Type 304 stainless steel powder coated black or bronze with 3/8" hook or 3/4" hook.

1. Custom slate hooks for headlaps greater than 3" shall be same material as specified above, fabricated to required length. Consult vendors for availability.

B. Nail head covers (bibs) for slate repair work: 16 oz. or 20 oz. copper, Grade HOO (cold rolled), complying with ASTM B370, or lead coated copper complying with ASTM B101, Type 1, Class A. Bibs shall measure 3" to 4" wide by 8" long. Snip bibs along their long sides to form barbs and/or bend to a slightly concave or S-shape prior to insertion to help prevent the bibs from sliding out.

C. Cants for starter course of slate shingles: Wood cants, standard 3/16"-1/4" thick plaster lath, tapered horse feather shims, or ripped rot-resistant lumber. Fabricate to height and width required to permit first and subsequent courses of slate to lie flat atop underlying courses.

1. Where shown in the Detail Drawings, brake inverted V-shaped cants directly into metal drip edge flashings and gutter liners located at the roof eaves. Fabricate cant to height required to permit first and subsequent courses of slate to lie flat atop underlying courses.

D. Wire used for hanging slates to avoid nailing thru underlying flashings: 99.99% pure copper wire conforming to ASTM B3, 0.051" diameter, minimum.

E. Sealant adhesive for use as adhesive dabs below hip and ridge slates: Exterior, non-sag, gun grade, single-component, sealant adhesive complying with ASTM C 920, Type S, Grade NS, Class 12.5, use group NT, I, M, and O, or Design Professional approved alternate sealant adhesive. Color shall be manufacturer's standard color matching that of the slate as closely as possible.

F. Sealant for exposed nail heads (e.g., last ridge slate to be installed): Exterior, non-sag, gun grade, single-component, urethane sealant complying with ASTM C 920, Type S, Grade NS, Class 25, use group NT, M, A and O, or Design Professional approved alternate sealant. Color shall be manufacturer's standard color matching that of the slate as closely as possible.

G. Wood Nailers: See Section 061053.

2.5 CAULKING

A. The roofer shall use approved waterproof elastic slaters' cement; color to match slate.

2.6 FLASHING

A. The roofer shall use copper flashing in accordance with Section 07 60 00 Sheet Metal Flashing & Trim.

2.7 SNOW GUARDS

A. To the greatest extent possible, existing snowguards shall be removed and reinstalled. Where existing snowguards become damaged during the course of roofing removal, they shall be replaced by new snowguards to match the existing in type, material, configuration, and placement.

PART 3 – EXECUTION

3.1 GENERAL

A. Examine the roof deck and verify that it is satisfactory condition and ready to receive the new roof underlayment and slate shingle system.

1. Verify that the roof deck is well secured to the roof framing, free of warping or cupping, free of projecting fasteners, and the edges between boards are flush.

2. Verify that the roof deck is clean, dry, and free of dew, frost, or other contaminants that might interfere with the laying or long-term durability of the slate roof system.

3. Report deficiencies in the roof deck to the Design Professional prior to commencing work.

B. Slating shall begin at the roof eave and progress toward the ridge/top of the roof slope.

C. Sorting: Sort slate shingles for thickness prior to installation on the roof. Sort shingles by hand into three thicknesses as follows:

1. Thin: For use in slate courses closest to the ridge.

2. Thicker: For use in slate courses in "middle" courses.

3. Thickest: For use in the slate courses closest to the eave.

4. The goal is to create a roof of smooth, uniform appearance. Slate of different thicknesses shall not be used adjacent to each other.

5. To the extent possible, transitions between the different thicknesses of slate should occur at hips, ridges, vertical walls, and other non-conspicuous locations, rather than in the field of the roof, to preclude obvious discontinuities in thickness.

D. Blending: To help account for the natural variation in the coloration of the slate shingles, blend slates from several different pallets as it is brought to the roof surface to help provide for a more uniform overall appearance.

1. Blending may occur prior to, or in association with sorting.

E. Culling: No broken or cracked slate shall be used. Sound each slate for defects by tapping with a slate hammer or other metal object as it is being installed. Reject and dispose of all slates that do not emit a sharp, clear ring when tapped (p.16), or set aside for potential review by Supplier.

1. Cull and discard, or set aside for potential review by Supplier, warped and cupped slate shingles, those that are out of square, those with knots, knurls, or cramps on their unexposed faces, and slates with visible inclusions of iron pyrite.

2. Cull and discard, or set aside for potential review by Supplier, slates that are unusually thin or thick (i.e., slates that will be subject to breakage, cause excessive shadow lines, or cause the butt ends of overlying slates to stick up) as well as those with curvature or twist greater than 1/8" in 12" across the width of the slate.

F. Nail holes made on site in slates shall be punched or drilled from the back of the slate to produce a small recess, or countersink, on the exposed face of the slate to accept the nail head.

1. Drill nail holes in slates where a nail used to secure a clip, cleat, or lock strip associated with a flashing must pass through an underlying slate. Similarly, drill nail holes in slates that taper to a point or have a small nailing area, such as hip slates.

G. Slates cut on site shall be cut from the back of the slate to maintain a beveled edge on the exposed

H. Slate Order: As work progresses, check that the quantity of slate remaining on site is sufficient to complete the Project. Order additional quantities of slate in a timely manner, as required, so as not to delay final completion of the project and to allow proper blending of the slate.

3.2 REMOVAL OF EXISTING SLATE SHINGLES

A. Slate Roof Replacement

1. Starting at the top of each roof slope, carefully remove all slate shingles and associated underlayments down to the roof deck.
   a. Remove existing slate shingles.
   b. Properly dispose of slate.
   c. Deck irregularities: Identify broken, warped, cracked, rotted, or otherwise deteriorated or irregular roof decking and framing that would make the substrate unsuitable as a substrate for new underlayments and new slate roofing, and report to the Design Professional.
   d. During the course of the work, protect from damage all roofing, flashings, rainwater conduction systems, and other building and site elements scheduled to remain. Protect interior finishes and contents from moisture damage during the course of the Work.
   e. Clean work area and surrounding areas at grade to remove all slate chips, roofing nails, and other debris on a daily basis and at the end of project. The site shall be left clean.
   f. Remove no more slate than can be reinstalled or made weathertight by the end of the day.

g. Comply with the requirements of Section 024119 – Selective Demolition.

3.3 UNDERLAYMENT INSTALLATION

A. Verify that the roof deck is ready to accept the roof underlayment. Notify Design Professional in writing of any unsuitable conditions, such as voids, damage, or unsupported areas.

1. Mechanical fasteners used to secure the roof decking shall be set flush with the surface of the decking and fastened into solid blocking or framing members.

2. All surfaces shall be clean, dry, and free of oil, grease, dirt, frost, dew, and other contaminants that could cause damage to the roof underlayment.

3. Decking shall be smooth, planar, continuous, and have adjacent edges set flush.

B. Ice Dam Protection Membrane: Install ice dam protection membrane at eaves, extending up slope at least 2 feet beyond interior side of exterior wall line, measured in a horizontal plane, or as indicated in the Detail Drawings.

1. Install ice dam protection membrane full length of valleys and in crickets as shown in the Detail Drawings, lapping bottom end on top of ice dam protection membrane installed at the roof eave.

2. Install ice dam protection membrane stripping along the top edge of metal gutter liners and crickets as shown in the Detail Drawings.

3. At vertical walls, dormer cheek walls, party walls, chimneys, etc., extend ice dam protection membrane up the vertical surface 4 inches, minimum, or as shown in the Detail Drawings.
   a. See Paragraph C., below, for flashing of pipe penetrations.

4. Prior to installation of ice dam protection membrane, vacuum roof deck to remove all dust and debris. Install ice dam protection membrane directly to the roof deck in accordance with membrane manufacturer's instructions. Lap sides 3-1/2", minimum, in direction to shed water. Lap ends 6" minimum. Roll all laps with roller.

   a. Prime roof deck as recommended by the ice dam protection membrane manufacturer if good adhesion is not obtained and when temperatures fall below 50 degrees Fahrenheit.

5. Cover ice dam protection membrane with roof underlayment as outlined below.

3.4 FELT UNDERLAYMENT

A. Install double layer of specified felt underlayment in horizontal courses in shingle fashion to shed water, beginning at eave line and covering entire roof area. Install an 18" wide starter course of underlayment at the roof eave and completely cover with full-width first course. Install the second course such that it laps the first course 20". Install succeeding courses laid 17" to the weather (lapping previous courses 19", providing for a 2" headlap). Lap ends of felt 6", minimum. Stagger end laps of each layer a minimum of 6 feet. Secure felt along laps, ends, and in field of felt with specified fasteners as necessary to properly hold the felt in place and protect the building from water infiltration until covered with slate shingles. Fasteners placed along laps shall be spaced at no more than 36" on center.

B. Felt shall lap hips and ridges 12" to form double thickness.

C. At vertical walls, extend felt underlayment up the vertical surface 4" minimum, unless otherwise shown in the Detail Drawings.

D. Flash penetrations through the roof using specified ice dam protection membrane to provide for a secure and watertight assembly. Ensure ice dam protection membrane target flashing is large enough to permit top edge of metal flashing to be installed to be stripped-in with ice dam protection membrane (i.e., stripping to be centered on top edge of metal flashing and be installed directly to the metal flashing and directly to previously installed ice dam protection membrane).

E. At roof eaves, the first layer of felt underlayment shall lap below the metal drip edge and the second layer of felt shall lap on top of the metal drip edge. At rakes, both layers of felt underlayment shall extend below metal drip edge.

F. Cover roof underlayment with slate shingles as soon as possible. Remove and replace felts that have become wrinkled or damaged, or that have been exposed on the roof for more than 30 days. Maximum length of exposure for felts shall be 30 days.

G. The roof decks shall be treated with a self-adhering membrane of rubberized asphalt integrally bonded to polyethylene sheeting. Follow manufacturer's literature for membrane application. Areas to be sheeted with membrane are hips, eaves, low slope areas, all slope changes or tie-ins and protrusions through the roof.

H. Replace damaged roof underlayments immediately. Do not install slate shingles over damaged underlayment.

I. Upon completion roof underlayment shall be smooth and free of punctures, holes, gashes, wrinkles, deep scuffs, and other defects that could compromise the underlayment’s ability to serve as a temporary roof and secondary water shedding membrane.

3.5 SLATE INSTALLATION

A. Protection of Roof Surfaces

1. The roof is to be properly staged to allow safe work surfaces, such as brackets and planks, that prevent unnecessary foot traffic on the slates.
2. Where foot traffic is unavoidable, roof ladders, hook ladders, chicken ladders, foam pads, or other such devices shall be used to protect the slates.
3. Workers are to avoid walking on the slate surfaces during, and after, installation.

B. Laying Out the Roof

1. Check that the eave is straight and level, and the ridge is parallel or perpendicular to the eave.
2. Snap a line for locating the starter course equal to the vertical dimension of the starter slate minus the specified overhang (1½”, or as otherwise shown on Detail Drawings). Set the starter course parallel to the eave. If the eave is not straight, make small adjustments in successive courses until the course lines are straight and parallel.
3. Chalk the line for the first course by measuring up from the eave the length of the slate, minus the specified overhang.
4. Chalk the line for the last full course at the ridge (finishing course), making sure it has the proposer exposure. Adjust the exposure of the courses approaching the ridge in small increments to obtain the required exposure of the finishing course (see subparagraph 5).
5. Snap horizontal lines based on the exposure of the slate, making small adjustments as needed so the courses end up parallel to the ridge and the exposure remains within ¼” of adjacent courses. When within 5 to 10 feet of the top of the slope, re-measure, and adjust the exposure in the remaining courses in small increments (1/8” to 1/4” per course) as

needed for proper coursing. Do not reduce the headlap; always decrease the exposure so as to increase the headlap. (This same procedure applies to the laying out of courses at the bottom and top of dormers to assure that the courses line up.)

6. When laying out a roof with uniform width slates, snap two vertical lines near the center of the roof to establish the slate's bond lines. The space between the two vertical lines should be equal to one-half the width of the slate.

7. If the eave and/or ridge are not horizontal, establish a level line as a reference for snapping the course lines. Slate courses shall run horizontally.

J. Field Slates

1. Exposure and Headlap

   a. All standard field slates shall be installed with a minimum 3" headlap when the roof slope is 8:12 up to 20:12.

   b. All standard field slates shall be installed with a minimum 4" headlap when the roof slope is 4:12 up to 8:12.

   c. All standard field slates shall be installed with a minimum 2" headlap when the roof slope is greater than 20:12.

2. Offset: Slate side joints shall be positioned as near the mid-point of the underlying slates as possible, and not less than 3" from the underlying joints.

3. Joint Spacing: Slates shall be laid nearly touching side-to-side, or with a gap of approximately 1/16" between slates. Small adjustments can be made in joint spacing and/or slate width as needed when approaching rakes or walls to avoid use of excessively narrow slates; no slate shall measure less than 6" in width.

4. Fastening – Nailing and Wiring

   a. Secure each slate to the roof deck with two nails set in holes pre-punched or drilled at the quarry, or punched by hand on site.

   b. Slates measuring ¾" or more in thickness and 20-inches or more in length, shall be secured with four nails each. Place the two additional nails approximately 2" above the regular nail holes.

   c. Set each nail with the head set in the countersink left by the punching of the nail hole; nails must not be over-driven, nor under-driven; nail heads shall touch the slate lightly, without producing strain on the slate and such that the slates hang from the nails.

   d. Slates located adjacent to flashings shall be nailed to avoid puncturing the flashing material. Move one or both of the nails up, or closer to the center of the slate; secure the slate with a second nail placed one above the other on one side of the slate; or, secure the slate with copper wire fastened to the roof deck upslope of the top edge of the flashing.

5. Shapes: The slate shape shall be rectangular.

K. Valleys

1. Valleys shall be open.

   a. Open Valleys

      i. Slates at the edges of valleys shall be cut in neat and straight lines.

ii. Valley slates are to be cut from the back of the slate to maintain a beveled slate edge.

iii. Clip the upper corner of valley slates to allow the slate to lay correctly and to direct moisture toward the valley centerline.

iv. For fabrication of valley flashing, see section 076200.

v. Lay slate a minimum of 3”-4” each side of the valley centerline. Taper outward 1/16” per foot from top to bottom to allow for release of ice.

vi. When fastening slates, do not puncture valley flashing with nails. Use wider slates as needed; place two nails, one above the other along the edge of the slate farthest from the valley centerline; or, hang slates from copper wire secured above the top edge of the valley flashing.

vii. Adjust width of slates approaching a valley to avoid the need to cut slate to a point at the valley; width of the butt of the valley slate shall be 3” minimum.

L. Penetrations

1. Slate shall be neatly fitted around pipes, ventilators, and other roof penetrations.

a. Do not nail through flashings.

b. Trim slates neatly.

c. See Section 076200 for flashings.

M. Flashings

1. Integrate flashings as slates are being installed.

a. See section 07 60 00, Sheet Metal Flashing and Trim.

b. Flashing shall be installed where there are roof plane intersections, where the roof abuts walls, parapets, dormers and chimneys, at roof penetrations, and where shown on the Drawings.

c. See *Slate Roofs: Design and Installation Manual*, 2010 Edition for typical flashing installations not shown in the Detail Drawings.

N. Slate repair

1. Where individual slates must be installed in the field of the roof after the installation is complete, such as where a roof bracket has been removed or where a broken slate must be removed and replaced, such installation shall be made in accordance with the slate repair procedures specified in Paragraph 3.7, below.

O. Coordinate slate installation with the installation of snow retention devices specified in Section 07 72 53.

3.6 HIP SLATES

A. Install hip slates in a mitered hip pattern, as shown in the Detail Drawings and in accordance with approved test panels. Coordinate with installation of new copper hip flashings (see Section 07 60 00) and associated wood blocking.

1. Ensure roof underlayment is whole and overlaps the hip a minimum of 6” to 12” in each direction.

B. Secure each hip slate with 3 or 4 nails arranged in a triangular or diamond pattern. In addition, set the bottom edge of each slate in dabs of specified adhesive.

1. Nails holes in hip slates may be drilled, instead of punched, in order to limit breakage and loss of section around the nail holes. Nail holes through underlying slate shingles shall be drilled, not punched.

C. Snap chalk lines to provide straight hip lines. Accommodate lack of trueness in structural framing of hips by selectively trimming slates or using slightly wider slates in localized areas as required to produce a line that is straight.

3.7 CLEAN-UP AND ADJUSTMENT

A. Work areas shall be left neat and clean at the end of each work day.

B. Remove debris from gutters and downspouts (if any) at the end of each work day and upon completion of the work to ensure unrestricted flow of water from the roof.

C. Upon completion of work, remove all roofing equipment, excess material, and debris from all roof surfaces and grounds.

D. While removing equipment, material, and debris from roof surfaces, inspect all work to ensure completeness, aesthetics, and undamaged workmanship. Broom clean slate shingles as roof jacks and planks (or other means of access) are being removed from the roof.

E. Dispose of debris in accordance with all local, state, and federal regulations or in the manner as stated elsewhere in the Contract Documents.

F. Remedy any incomplete work and replace any damaged, broken, poorly lying, or otherwise offending roofing slates using the repair methods specified in Paragraph 3.7, above.

G. Upon completion of clean up and adjustments, advise the Design Professional that the work is ready for final inspection and punch listing by the Design Professional.

END OF SECTION

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SECTION 07 31 13

ASPHALT SHINGLES

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Granular surfaced asphalt shingle roofing.
B. Moisture shedding underlayment, eave, valley, and ridge protection.
C. Associated protective flashings and accessories.
D. Ridge ventilator.

1.2 RELATED WORK

A. Section 06 16 00 - Sheathing: Roof sheathing.
B. Section 07 30 00 – Roofing Underlayment
C. Section 07 62 00 - Sheet Metal Flashing and Trim: Edge and cap flashings.
D. Section 07 71 23 - Gutters and Downspouts.

1.3 REFERENCES

A. ASTM B209/B209M - Aluminum and Aluminum-Alloy Sheet and Plate.
B. ASTM D224 - Smooth-Surfaced Asphalt Roll Roofing (Organic Felt).
C. ASTM D225 - Asphalt Shingles Surfaced with Mineral Granules.
D. ASTM D226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
E. ASTM D228 - Testing Asphalt Roll Roofing, Cap Sheets and Shingles.
F. ASTM D249 - Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules.
E. ASTM D2178 - Asphalt Glass (Felt) Used in Roofing and Waterproofing.
F. ASTM D2822 - Asphalt Roof Cement.
G. ASTM D3018 - Class A Asphalt Shingles Surfaced with Mineral Granules.
H. ASTM D3462 - Asphalt Shingles Made From Glass Felt and Surfaced With Mineral Granules.
I. ASTM D4586 - Asphalt Roof Cement, Asbestos Free.
J. NRCA - Steep Roofing Manual.
K. UL 55B - Class C Asphalt Organic-Felt Sheet Roofing and Shingles.
L. UL 580 - Tests for Wind Uplift Resistance of Roof Assemblies.
M. UL 790 - Tests for Fire Resistance of Roof Covering Materials.

1.4 SUBMITTALS FOR REVIEW

A. Section 01 33 00 - Submittals: Procedures for submittals.

B. Product Data: Provide data indicating material characteristics, performance criteria, limitations.

C. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern; for color selection.

1.5 SUBMITTALS FOR INFORMATION

A. Section 01 33 00 - Submittals: Procedures for submittals.
B. Manufacturer's Instructions: Indicate installation criteria and procedures.
C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Steep Roofing Manual.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for UL 55B Class C rating, ASTM D3462 Class A, UL 790 fire resistance and UL 580 wind uplift for shingle types specified.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Material and Equipment: Environmental conditions affecting products on site.

B. Do not install eave edge protection and shingles when ambient air or wind chill temperatures are below 45 degrees F.

PART 2 – PRODUCTS

2.1 ACCEPTABLE ASPHALT SHINGLES MANUFACTURERS

A. GAF, Timberline HDZ
B. Substitutions: Under provisions of Section 01 60 00.

2.2 ROOFING MATERIALS

A. Asphalt Shingles: ASTM D3462, Glass fiber mat base, 2-ply mineral granule surfaced type; 300 lb/square; self-sealing type; square type tab; 30 year warranty, color selected by Architect.

B. Underlayment: Cellulose fiber building paper, water repellent breather type. ANSI/ASTM D226; No. 15 (73 kg/sq m) un-perforated asphalt felt.

C. Eave & Valley (Ice & Water Shield) Protection: Sheet barrier of rubberized asphalt bonded to sheet polyethylene, 40 mil total thickness, with strippable treated release paper; as manufactured by GCP Applied Technologies, Inc.

D. Nails: Aluminum or hot-dip galvanized 11 or 12 gauge sharp pointed conventional roofing nails with barbed shanks, minimum 3/8” diameter head and of sufficient length to penetrate minimum ¾” into solid decking or to penetrate through plywood sheathing. Provide minimum 6 nails per shingle.

E. Plastic Cement: ANSI/ASTM D2822; asphaltic type with mineral fiber components.

F. Lap Cement: Fibrated cutback asphaltic type, as recommended for use as an adhesive in the cold application of asphalt roofing or underlayment; free of toxic solvents.

G. Ridge Vents: Fibrous plastic mat that does not permit direct water or weather entry; ‘Cobra’ style as manufactured by GAF.

2.3 FLASHING MATERIALS

A. Aluminum Sheet: ASTM B209, .032 inch thick; mill finish, shop pre-coated with baked on enamel coating of color to be selected

B. Bituminous Paint: Acid and alkali resistant type; black color.

C. Nails: Standard round wire roofing type of hot-dipped zinc-coated steel; minimum 19/64 inch (8 mm) head diameter and 0.104 inch (3 mm) shank diameter; of sufficient length to penetrate 1/2 inch into roof sheathing.

2.4 FLASHING FABRICATION

A. Form flashings to profiles indicated on Drawings, and to protect roof assembly and shed water. Form sections square, true, and accurate to profile, in maximum possible lengths, free from distortion and other defects detrimental to appearance or performance.

B. Hem exposed edges of flashings minimum 1/4 inch on underside.

C. Apply bituminous paint on concealed surfaces of flashings.

PART 3 – EXECUTION

3.1 INSTALLATION - GENERAL

A. Install in accordance with manufacturer’s instructions. At roof slopes lower than 4:12, install per manufacturer’s low-slope applications.

3.2 EXAMINATION

A. Section 01 31 50 - Coordination and Meetings: Verification of existing conditions prior to beginning work.

B. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.

C. Verify roof openings are correctly framed.

D. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.3 PREPARATION

A. Broom clean deck surfaces under eave protection and underlayment.

3.4 INSTALLATION – EAVE AND VALLEY (ICE DAM) PROTECTION

A. Place eave edge and gable edge metal flashings tight with fascia boards. Weather lap joints 2 inches and seal with plastic cement. Secure flange with nails spaced 6 inches o.c.

B. Apply rubberized asphalt/polyethylene sheet eave protection in accordance with manufacturer's instructions.

C. Apply lap cement at rate of approximately 1¼ gal/100 sq ft over underlayment starter strip.

D. Extend eave protection membrane minimum 2 ft up-slope beyond interior face of exterior wall.

3.5 INSTALLATION - PROTECTIVE UNDERLAYMENT

A. Place one ply of underlayment over area not protected by eave protection, with ends and edges weather lapped minimum 6 inches. Stagger end laps of each consecutive layer. Nail in place.

B. Install protective underlayment perpendicular to slope of roof and weather lap minimum 4 inches over eave protection.

C. Weather lap and seal watertight with plastic cement items projecting through or mounted on roof.

3.6 INSTALLATION - METAL FLASHING AND ACCESSORIES

A. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.

B. Secure in place with nails at 8 inches oc. Conceal fastenings.

C. Flash and seal work weather tight, projecting through or mounted on roofing with plastic cement.

3.7 INSTALLATION - ASPHALT SHINGLES

A. Install shingles in accordance with manufacturer's instructions.

B. Place shingles in straight coursing pattern with 5 inch weather exposure to produce double thickness over full roof area.

C. Project first course of shingles 3/4 inch beyond fascia boards.

D. Extend shingles 1/2 inch beyond face of gable edge fascia boards.

E. Extend shingles on both slopes across valley in a weave pattern and fasten. Extend shingles a minimum of 12 inches beyond valley center line to achieve woven valley, concealing the valley protection.

F. Cap hips and ridges with ridge vent covered with individual shingles, maintaining 5 inch weather exposure. Place to avoid exposed nails.

G. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counter flashings.

H. Complete installation to provide weather tight service.

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Assurance: Field inspection.

3.9 PROTECTION OF FINISHED WORK

A. Section 01 77 00 - Contract Closeout: Protecting installed work.

B. Do not permit traffic over finished roof surface.

END OF SECTION

SECTION 07 53 23

ELASTOMERIC EPDM SHEET ROOFING, FULLY ADHERED

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Elastomeric fully adhered sheet Membrane Roofing System with insulation.

1.2 RELATED SECTIONS

A. Section 06 10 53 – Miscellaneous Rough Carpentry: Roof curbs
B. Section 06 16 00 - Sheathing: Plywood sheathing and repairs to roof deck.
C. Section 07 62 00 Sheet Metal Flashing & Trim
D. Section 07 71 00 – Prefabricated Roof Specialties: Roof Vents & Drains
E. Section 07 71 23 - Gutters and Downspouts.

1.3 SYSTEM DESCRIPTION

A. Elastomeric sheet membrane roof assembly including structure to conform to UL requirements for a Class C rated assembly, and FM Class I/ I-90 requirements for wind uplift resistance.

1.4 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00, Paragraph Quality Assurance.

1.5 QUALITY ASSURANCE

A. Perform in accordance with Section 01 40 00 - Quality Control.

B. Perform Work in accordance with Underwriters Laboratories Inc. UL Class C Fire Hazard Classification; Factory Mutual Engineering Corporation FM Roof assembly Classification wind uplift requirement of I90, FM Construction Bulletin 1-28, Class 1 Construction.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install membrane during inclement weather or when air temperature may fall below 50 degrees.

1.7 WARRANTY

A. Provide 15 year 'Total System" warranty under provisions of Section 01 40 00, Quality Control.

B. Provide 15-year warranty for labor.

1.8 ACCEPTANCE OF COMPLETED WORK

A. Acceptance of completed work will be based on its conformance to the contract as delineated in Section 01 40 00, Quality Control. Non-conforming work will be rejected; the Owner is not obligated to accept non-conforming work at a reduced price.

PART 2 – PRODUCTS

2.1 MEMBRANE MATERIALS

A. Manufacturers:
  1. Carlisle System

2. Firestone System

B. Membrane: EPDM materials; non-reinforced .060-inch-thick, white color as selected. EPDM membrane shall conform to ASTM D-4637.

Physical Property	Test Method	Minimum Test Result
Color		Black
Specific Gravity	ASTM D-297	1.12
Tensile Strength	ASTM D-412	1300 psi
Elongation at Break	ASTM D-412	300%
Tear Resistance (Die C)	ASTM D-624	175 lb./in.
Sheet Composition	ASTM D-297	
% Polymer that is EPDM		100
% Sheet that is Polymar		30

C. Cements and Primers:
1. Cements and Primers used for splicing, patching, and flashing shall be compatible with the membrane and substrate materials furnished, and shall be furnished by the same manufacturer as the membrane elastomer, and meet the manufacturer's published specifications for the same.
2. Any deviations from manufacturer's furnished products must be approved in writing by the manufacturer and accepted by the Architect prior to installation.

D. Flashings:
1. General: Flashings shall be as approved by manufacturer to comply with their 15 year "Total System" warranty.
2. Elastomeric Flashing: Elastomeric flexible flashing shall be furnished in uncured condition and shall meet or exceed the following test values:

Property	Test Method	Test Value
Test Strength	ASTM D-412	1200 psi
Elongation @ break	ASTM D-412	400%
Brittleness Temperature	ASTM D-746	-40ºC
Tear Resistance Die C	ASTM D-624	140 lb./in.
Resistance to Ozone	ASTM D-1149	No Cracks

E. Pre-Fabricated Flashing Accessories:
1. Molded Pipe Flashing - black, cured, pre-cast base flashing for pipes and conduit up to 6" in diameter installed with splicing cement and seam sealant. Provide in sizes as necessary and supply with stainless steel clamp. Install in accordance with manufacturers' requirements, clamp tightly and apply sealant to top of neck.
2. Physical Properties - cured prefabricated flashing shall meet the same properties as non-cured flashings.

2.2 MEMBRANE FASTENING

A. SEALANTS:
1. Lap sealant shall be a one-part elastomeric caulking/adhesive sealant furnished by elastomeric membrane manufacturer according to his latest published catalog. Shelf life shall be marked clearly on container: "Do not use after ___________;" and use will not be permitted of expired material. Store and apply according to manufacturer's installation instructions.
2. Sealant for difficult to flash penetrations or objects shall be an elastomeric, pourable material furnished by membrane manufacturer according to his latest published

catalog. Shelf life shall be marked clearly on containers: "Do not use after ________;" and use will not be permitted of expired material. Store and apply according to manufacturer's installations instructions.

3. Water cut-off sealant is to be used for end of day stopping point and shall be an elastomeric sealant to adhere and seal space at edge of membrane and substrate. It will be furnished by elastomeric membrane manufacturer and meet their latest published catalog requirements. Store and apply according to manufacturer's installation instructions.
4. Other sealers, tack coats, and tapes used shall be compatible to the elastomeric membrane and shall be as furnished and recommended by membrane manufacture. Use shall be according to manufacturer's recommendations and within the shelf life period designated on the containers. Asphalt or coat tar derivative products are not to be use in this construction.

B. FASTENERS:

1. Fasteners shall be as recommended by the elastomeric membrane manufacturer for the type of deck, type and thickness of insulation, and fastening requirements of the manufacturer's system, UL, local building code or insurance requirements, whichever is most stringent.
2. Fastener spacing shall meet FM approval Guide for I-90 Zone I windstorm rating when used with the selected insulation.
3. Fasteners shall be galvanized steel or other non-corroding material employing plastic washers of a size recommended by the EPDM manufacturer. Washers, batten strips, and metal flashings or clips will be protected from contact with dissimilar metals in fasteners or companion accessories to preclude electrolytic corrosion.
4. Length of penetration into substrate deck, wall, or nailer shall be sufficient to prevent backing out by vibration, shrinkage, or swelling action. Contractor to establish layout of fasteners, to insure proper attachment through the top flange of the steel deck prior to adhering membrane. Any fasteners through the ribs of decking will not be considered acceptable placement.

2.3 INSULATION MATERIALS

A. Manufacturers:

1. Refer to manufacturer's "Total System" warranty requirement.

B. Insulation: FS HHI197212/2 Class 1 Polyisocyanurate with glass fiber felt facers. Provide minimum 1 layer, 1/2 inch minimum thickness, square edges, minimum R total = 2.5 aged value or tapered insulation as noted. Use largest acceptable sheets.

2.4 ACCESSORIES

A. Flexible Flashings: Same material as membrane; white color; as recommended by manufacturer.

B. Hard rubber edging with extension to cover roof edge blocking.

C. Termination bars, water cut-off mastic and fasteners.

D. Reinforced EPDM (Reinforced Universal Securement Strip): .060 thick EPDM, reinforced.

E. ½” Protection Board.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work; deck is clean and smooth, free of snow or ice; properly sloped to drains.

B. Verify roof openings, curbs, and protrusions through roof are solidly set; cant strips and reglets are in place.

C. Notify Architect 48 hours prior to application of insulation and roofing membrane.

D. Notify Architect immediately of any deficiencies in the deck, parapets, or any substrates.

3.2 INSULATION APPLICATION

A. Place insulation with long sides of boards parallel with deck so that side joints between boards do not exceed 1/4. Mechanically fasten insulation to deck to meet FM I -90, Zone II requirements.

B. Minimum Total Insulation Thickness: 1/2 inch or as required to achieve an overall insulation R value of 2.5.

C. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

D. All gaps greater than 1/4" shall be filled with acceptance insulation. Under no circumstances shall the membrane be left unsupported over a space greater than 1/4". Tapered or feathered insulation shall be installed around all roof drains so as to provide proper slope for drainage.

3.3 MEMBRANE APPLICATION

A. Apply membrane and mechanical attachment devices in accordance with manufacturer's instructions with spray and/or roller.

B. Mechanically attach membrane to roof assembly at perimeter according to FM and manufacturer's requirements.

C. Apply adhesive at a rate of according to manufacturer's recommendations, evenly and continuously. Allow adhesive to dry to consistency prescribed by manufacturer before adhering membrane.

D. Roll out membrane and allow the membrane to relax for a minimum of 30 minutes before attachment. Bond sheet to substrate except those areas directly over or within 3 inches of a working crack or expansion joint. Work out air bubbles, wrinkles, and fishmouths. Firmly press sheet into place without stretching.

E. Install perimeter mechanical fasteners in accordance with manufacturers' instructions.

F. Shingle joints on sloped substrate in direction of drainage. Clean both mating surfaces at splice area with seam cleaner, apply adhesive to both surfaces, lap adjoining sheets a minimum of 4" and seal with a roller. Apply in-seam sealant and RUSS strips as delineated. Apply lap sealant to all seams.

G. Continue membrane up vertical surfaces minimum 8 or as noted. Reinforce membrane with multiple thickness of membrane material over joints.

H. Seal items penetrating membrane with counterflashing membrane material. Install membrane flashings. Seal watertight to membrane.

3.4 FLASHINGS AND ACCESSORIES

A. All EPDM flashings to be a minimum of 0.60 inch thick material as recommended by manufacturer.

B. Apply flexible flashings to seal membrane to vertical elements. Strip in with a minimum of 6" wide EPDM flashing material.

C. Coordinate installation of roof drains, sumps and related flashings.

D. Seal flashings and flanges of items penetrating membrane.

END OF SECTION

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SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Coping, parapet, flashings, gravel stop, drip edge,
B. Fascias Systems and Galvanized water dams.
C. Counterflashings over base flashings.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 04 20 00 – Unit Masonry

1.3 RELATED SECTIONS

A. Section 07 31 00 – Slate Roofing
B. Section 07 31 13 – Asphalt Shingles
C. Section 07 71 23 - Gutters and Downspouts.
D. Section 07 92 00 - Joint Sealers.
E. Section 09 91 00 - Painting: Prime and finish painting.

1.4 REFERENCES

A. AISI (American Iron and Steel Institute) - Stainless Steel - Uses in Architecture.
B. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate.
C. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.
D. ASTM B32 - Solder Metal.
E. ASTM B209 - Aluminum and Alloy Sheet and Plate.
F. ASTM B370 - Copper Sheet and Strip for Building Construction.
G. ASTM B486 - Paste Solder.
H. ASTM D226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
I. ASTM D4586 - Asphalt Roof Cement, Asbestos-Free.
J. CDA (Copper Development Association) - Contemporary Copper, A Handbook of Sheet Copper Fundamentals, Design, Details and Specifications.
K. CDA - Copper Roofing - A Practical Handbook.
L. FS O-F-506 - Flux, Soldering, Paste and Liquid.
M. NRCA (National Roofing Contractors Association) - Roofing Manual.
N. SMACNA - Architectural Sheet Metal Manual.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples, 12 x 12 inch in size illustrating typical standing seam, seam, external corner, internal corner, junction to vertical dissimilar surface, material and finish.

D. Submit two samples 12 x 12 inch in size illustrating metal finish color.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA standard details and requirements.

B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Fabricator and Installer: Company specializing in sheet metal flashing work with 5 years documented experience.

1.8 PRE-INSTALLATION CONFERENCE

A. Convene one week prior to commencing work of this section, under provisions of Section 01 31 00.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.

B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials, which may cause discoloration or staining.

1.10 COORDINATION

A. Coordinate work under provisions of Section 01 31 00.

B. Coordinate with the work of Section 07 65 26 for installing flashing reglets.

PART 2 – PRODUCTS

2.1 SHEET MATERIALS

A. Copper: ASTM B370, cold rolled 20 oz/sq ft thick; natural finish.

B. Aluminum Sheet: ASTM B209, .032 inch thick; mill finish, shop pre-coated with baked on enamel coating of color to be selected.

C. Pre-Coated Galvanized Steel: ASTM A446, Grade A, G90 zinc coating; 24 gage core steel, shop pre-coated with modified silicone coating of color to be selected.

D. Lead Coated Copper: ASTM B101 Type 1, Class A, soft temper, 20 oz/sq ft.

2.2 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.

B. Underlayment: ASTM D226 No. 15 asphalt saturated roofing felt.

C. Ice & Watershield: Specified in Section 07 30 00.

D. Slip Sheet: Rosin sized building paper.

E. Primer: Zinc chromate type.

F. Protective Backing Paint: Zinc chromate alkyd.

G. Sealant: Specified in Section 07 92 00.

H. Bedding Compound: Rubber-asphalt.

I. Plastic Cement: ASTM D4586, Type I.

J. Reglets: Surface mounted and Recessed type, galvanized steel.

K. Insulating tape: 1/8 inch thick bituminous self adhesive for use between dissimilar metals.

2.3 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of type sheet metal, same material as sheet, minimum 2 inches wide, interlockable with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2-inch miter and seam corners.

E. Form material with standing seams.

F. Pre-tin edges of copper sheet. Solder shop formed metal joints. After soldering, remove flux. Wipe and wash solder joints clean. Weather seal joints.

G. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

H. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

I. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and brake edges.

2.4 FINISH

A. Prepare copper surfaces in accordance with Section 09 91 00.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

3.3 INSTALLATION

A. Conform to drawing details on the drawings and in the SMACNA manual.

B. Insert flashings into reglets to form tight fit. Secure in place with wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

C. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

D. Apply plastic cement compound between metal flashings and felt flashings.

E. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

F. Seal metal joints watertight.

G. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

H. Provide insulating tape where necessary to prevent contact of dissimilar metals.

3.4 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 40 00.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.5 SCHEDULE

A. Brake metal fascia and trim: Pre-coated Aluminum. Color: To be selected. Profiles as shown on the Drawings.

B. Flashing in contact with masonry: Copper.

C. Parapet coping flashing - Copper. Color: To be selected. Profiles as shown on the Drawings.

END OF SECTION

SECTION 07 71 23

GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pre-coated Aluminum gutters and downspouts.
B. Aluminum Conductor Head and downspouts.
C. Prefabricated Scuppers & Through-wall Scuppers
D. Down Spout Nozzles

1.2 RELATED SECTIONS

A. Section 07 31 13 – Asphalt Shingles
B. Section 07 53 23 – Elastomeric EPDM Sheet Roofing, Fully Adhered.
C. Section 07 62 00 - Sheet Metal Flashing and Trim.
D. Section 07 71 00 – Prefabricated Roof Specialties: rain leader boots.
E. Section 09 90 00 - Painting: Field painting of metal surfaces.

1.3 REFERENCES

A. ASTM B209 - Aluminum and Aluminum Alloy Sheet and Plate.
B. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
C. SMACNA - Architectural Sheet Metal Manual.

1.4 SUBMITTALS

A. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

B. Submit shop drawings & Product data under provisions of Section 01 33 00.

C. Indicate on shop drawings, general construction, configurations, jointing methods and locations, fastening methods, locations and installation details.

D. Provide product data on prefabricated components.

E. Submit Samples under the provisions of Section 01 33 00.

F. Submit three samples 12 inches in length illustrating component design, finish, color and configuration.

1.5 QUALITY ASSURANCE

A. Conform to SMACNA Manual Drawings for nominal sizing of components for rainfall intensity determined by a storm occurrence of 1 in 5 years.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01 60 00.

B. Store and protect products under provisions of Section 01 60 00.

C. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to aid ventilation. Slope to drain.

D. Prevent contact with materials during storage, which may cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Architectural Metals; 8188 S. State Road, M-66, Portland, MI 48875; Tel: 616.374.0161; Fax: 616.374.0785; web: www.archmetalsinc.com

B. Englert Inc.; 1200 Amboy Avenue, Perth Amboy, NJ 08861; Tel: 800.364.5378; Fax: 888.389.0520; Web: www.englertinc.com

C. Berger Building Products; 805 Pennsylvania Boulevard, Feasterville, PA 19053; Tel: 215.355.1200; Fax: 215.355.7738; www.bergerbp.com

D. Alcoa Building Products (Aluminum Coil Stock), 201 Isabella Street, Pittsburgh, PA 15212-5858; Tel: 412.553.4545; Fax: 412.553.4498

E. Rutland Gutter Supply llc (Copper Gutters & Accessories), 10895 Rocket Boulevard, Orlando, FL 32824; Tel: 407.859.1119; Fax: 407.859.1123; www.rutland guttersupply.com

F. Jay R. Smith Mfg. Co., 2781 Gunter Park DR E, Montgomery, AL 36109; Tel: 334.277.8520; www.jrsmith.com

G. Substitutions: Under provisions of Section 01 60 00.

2.2 MATERIALS

A. Aluminum Sheet: ASTM B209, 3003 Aluminum alloys, 0.032-inch-thick; shop precoated with 3 coats of paint coating, color as selected by architect.

B. Copper Sheet: ASTM B 370, minimum temper H00 (cold rolled) except where temper 060 is required for forming:
   a. Hung Gutters and Downspouts: 16 oz. per sq. ft

2.3 COMPONENTS

A. Gutters: To match existing

B. Gutter: To match existing

C. Gutter: To match existing

D. Downspouts: To match existing

E. Downspout outlet/ nozzle:
   a. Cast Bronze and Flange; Jay R. Smith Mfg. Co. Model 1770 or 1775 (with Hinged Cover)
   b. Roof scupper; Rutland Gutter Supply Model Lion Head Rain Spout

F. Gutter Cover Guards: 20gauge bronze mesh or fabricated units with selvaged edges and non-corrosive fasteners. Select material for compatibility with gutters and downspouts.

2.4 ACCESSORIES

A. Elbow: To match existing

B. Gooseneck Pipe: Profiled to match downspout

C. Anchorage Devices: Type recommended by fabricator.

D. Gutter Supports: Brackets/ hanger to match Gutter material & finish

E. Downspout Supports: Pipe Straps to match Downspout material & finish

F. Mitres & End Caps: Profiled to suit gutter & downspout

G. Rain Diverters: 7 ½” x 2 5/8” x 5’ with ¼” hemmed edges & overall thickness of 0.019 inches

H. Joint Fasteners: Profiled to suit gutter & downspout

I. Downspout Strainers: Profiled to suit downspout

J. Gutter Screens: Profiled to suit gutter

K. Downspout Header/ Collector Head:

2.5 FABRICATION

A. Form gutters and downspouts of profiles and sizes indicated.

B. Form conductor head to profile and sizes indicated.

C. Field measure site conditions prior to fabricating work.

D. Fabricate with required connection pieces.

E. Form sections square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance.

F. Hem exposed edges of metal.

2.6 FINISHES

A. Backpaint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

B. Baked Enamel Finish: AA-C12C42R1x (cleaned with inhibited chemicals, conversion coated with an acid-chromate-flourise-phosphase treatment, and painted with organic coating specified below). Apply baked enamel finish in strict compliance with paint manufacturer’s specification for cleaning, conversion coating and paint.

1. Organic Coating: Manufacturer’s standard thermosetting acrylic enamel, minimum 0.8 mil dry film thickness.

C. Natural Weathering mill finished copper. No applied finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work & conditions are as indicated on shop drawings.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install conductor heads, gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Join lengths with formed seams sealed watertight. Flash & seal gutters to downspouts & accessories.

C. Apply backing paint to metal back surfaces.

D. Apply bituminous protective backing on surfaces in contact with dissimilar materials.

E. Slope gutters 1/16 inch per foot minimum.

F. Seal metal joints watertight.

G. Connect downspouts to storm sewer system. Seal connection watertight.

END OF SECTION

SECTION 07 90 00.20

REPLACING DETERIORATED CAULK AT MASONRY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. This procedure includes guidance on caulking all joints on horizontal or sloping existing masonry surfaces including, but not limited to: cornices, parapets, window sills, platforms steps and other wash surfaces.

B. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the Regional Historic Preservation Officer (RHPO).

1.2 REFERENCES

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by references thereto:
   1. TT-S-001543A Sealing Compound, Silicone Rubber Base (for (COMM-NBS) Caulking, Sealing and Glazing in Buildings and Other Structures).
   2. UU-T-00106D Tape, Pressure-Sensitive Adhesive, Masking, Paper.

1.3 SYSTEM DESCRIPTION

A. General: Caulking or sealant shall be provided in joints as indicated or specified. Materials shall conform to the respective specifications and other requirements specified. The work specified herein shall be performed by workers skilled in such work.

B. Sealant Formulation Intended Application: Each container brought to the jobsite shall be marked for the intended use. The color shall be one of the manufacturer's standard colors as closely matching the adjacent surfaces as possible. The sealant formulation shall conform to the requirements specified herein.

C. Thinners or other additives shall not be used to modify the formula.

1.4 SUBMITTALS

A. Samples:

1. Materials: Prior to delivery of the caulking and sealant to the jobsite, a one-cartridge or equivalent representative sample of the caulking and sealant specified herein shall be furnished. The sample shall be accompanied by certified laboratory test reports showing that the caulking and sealant to be furnished have been tested within the last 12 months and meet the requirements of the applicable specifications. The sample container shall include the same information on the label as specified herein for containers delivered to the job.
2. Joints: Before work is started, a sample of each type of joint shall be caulked or sealed where directed. The samples shall show the materials, workmanship bond, and color of materials as specified or selected for the work. The materials, workmanship, bond, and color throughout the project shall match that of the approved sample joint.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Materials shall be delivered to the job in the manufacturers' original unopened containers. The containers shall include the following information on the label: supplier, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time when applicable at the standard conditions for laboratory tests. All materials shall be carefully handled and stored to prevent inclusion of foreign materials, or components outdated as indicated by shelf life shall not be used.

1.6 P ROJECT/SITE CONDITIONS

A. Environmental Requirements: The ambient temperature shall be within the limits of 40 and 90 F when the caulking and sealants are applied.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sealant shall be a cone-component, elastomeric-type compound conforming to TT-S-1543, class A. The compound shall be supplied in a ready-to-use form which requires no on-the-job mixing.

B. Backup material shall be closed-cell polyethylene foam. Backup material shall be nonabsorbent, nonstaining, and compatible with the sealant used. Tube or rod stock when used shall be rolled into the joint cavity.

C. Bond-preventive materials shall be one of the following, as recommended by the sealant manufacturer.

D. Polyethylene Tape, Pressure-sensitive Adhesive: The adhesive is required only to hold tape to the construction materials as indicated.

E. Masking tape shall conform to UU-T-106.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation:

1. The joint design, shape, and spacing shall be as indicated by the RHPO. The surfaces of joints to be sealed shall be dry. Oil, grease, dirt, chalk, particles or mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed form all joint surfaces to be sealed. Oil or grease shall be removed with solvent and surfaces shall be wiped with clean cloths.
2. Concrete and Masonry Surfaces: Where surfaces have been treated with curing compounds, oil, or other such materials they shall be removed by wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.
3. Steel surfaces to be in contact with sealant shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by a solvent that leaves no residue.

3.2 ERECTION, INSTALLATION, APPLICATION

A. Joint Types and Sealants: Unless otherwise specified, for all joints requiring sealant on horizontal or sloping surfaces. The joint shapes and sizes shall be indicated below unless otherwise specified:

Sealant (No.)	(Type)	Sealant Form
TT-S-001543A	Type II	Ready to Use

B. Paper masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or compound smears. Masking tape shall be removed within ten minutes after joint has been filled and tooled.

C. Bond-preventive materials for rubber-base sealant shall be installed on the bottom of the joint cavity and other surfaces indicated to prevent the sealant from adhering to the surfaces covered by the bond-preventive materials. The materials shall be carefully applied to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond- preventative materials. At the option of the Contractor, backstop material with bond-breaking characteristics may be installed in lieu of bond-preventive materials specified.

D. Backstops: The back or bottom of joints constructed deeper than indicated shall be packed tightly with backstop material to provide a joint of depth indicated.

E. Elastomeric Type Sealant: Compound shall be gun-applied with a nozzle of proper size to fit the width of joint indicated and shall be forced into grooves with sufficient pressure to expel air and fill the groove solidly. Sealant shall be uniformly smooth and free of wrinkles. Joints shall be tooled slightly concave after sealant is installed. When tooling white or light-color sealant, dry or water-wet tool shall be used.

3.3 ADJUSTING/CLEANING

A. The surfaces adjoining the caulked and sealed joints shall be cleaned of smears and other soiling resulting from the caulking and sealing application as work progresses.

END OF SECTION

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SECTION 07 90 00.30

REPLACING DETERIORATED SEALANT

PART 1 - GENERAL

1.1 SUMMARY

A. This procedure includes guidance on removing deteriorated or inappropriate sealant and replacing with new sealant at appropriate locations.

B. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding) These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the Regional Historic Preservation Officer (RHPO).

1.2 REFERENCES

A. **American Society for Testing and Materials (ASTM),**
   100 Barr Drive,
   West Conshohocken, PA 19428
   610-832-9585 or FAX 610-832-9555.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type joint sealer required, including instructions for joint preparation and joint sealer application.

B. Samples: Submit manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available, for each product exposed to view. Color selection by RHPO.

C. Backer Rod Sample: Submit 12" long sample of proposed backer rod. Submit certification from sealant manufacturer that backer rod is compatible with sealant.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Installer of sealant work shall have at least 5 years experience in the successful installation of sealant systems specified for this project.
   2. If requested by the Contracting Officer, installer shall submit a statement describing the firm's qualifications, experience of the personnel performing the work, and list of successful completed projects. Include the name and address of the project owner and of the RHPO.

B. Regulatory Requirements: Work of this section shall comply with applicable standards indicated.

C. Certifications: Submit written certification from sealant manufacturer or manufacturer's representative that, after visiting the site and examining the conditions and locations where sealant will be installed, the sealant specified is correct for the use intended. If sealant is not correct for the situation, the manufacturer shall submit in writing to the RHPO the recommendation for the correct sealant to be used.

D. Field Samples:
   1. Provide products of listed or other approved manufacturers. Provide products from single source or manufacturer for each product during course of the work.

E. Mock-Ups:
   1. Contracting Officer will select a location for installer to install a 3 foot section of each sealant system specified.
   2. After curing and prior to approval of test panel, installer shall test adhesion of joint my manually trying to pull sealant from joint. Test shall be performed in the presence of the Contracting Officer and representative of sealant manufacturer.
   3. Approved test panels shall become an integral part of the work and serve as standard for similar work on this project.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver materials to the site in original unopened containers or bundles with labels informing about manufacturer, product name, color, expiration date for use, pot life, curing time and mixing instructions for multi-component products.

B. Store and handle materials to prevent their deterioration or damage by temperature changes, contaminants or other causes. Remove damaged material from the site to prevent use and replace with new material.

1.6 PROJECT/SITE CONDITIONS

A. Existing Conditions: Do not proceed with sealant work during inclement weather or forecast of inclement weather, or when temperature is above or below manufacturer's recommended limitations for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **Pecora Corporation**
165 Wambold Road
Harleysville, PA 19438
800/522-1285 or 215/723-6051
-or-
2601 Oakland Avenue
Garland, TX 75041
800/523-6688 or 214/278-8158

B. **Sika Corporation**
201 Polito Ave.
Lyndhurst, NJ 07071
201/933-8800

C. **Sonneborn Building Products**

D. **Tremco, Inc**.
3735 Green Rd.
Beachwood, OH 44122
800/321-7906

E. **Williams Products, Inc.**

F. **Bostik, Inc.**
Bostik Construction
Products 211 Boston St.
Middleton, MA 01949
800/726-7845

2.2 MATERIALS

A. Exterior sealant to be a non-sag, gun grade, sealant complying with ASTM C920, such as those manufactured by (Pecora Corp.), (Sika Corp.), (Sonneborn Building Products), (Tremco, Inc.), or approved equal. Color shall be selected by RHPO from manufacturer's full range of colors. See also 07900-01-S for guidance in selecting an appropriate sealant.

B. Traffic-type sealant for horizontal joints to be non- staining, non-sag, sealant complying with ASTM C920, such as those manufactured by (Pecora Corp.), (Sika Corp.), (Tremco, Inc.), or approved equal.

C. Backer rod to be a closed-cell polyethylene or polyurethane rod of diameter recommended by manufacturer for opening width; such as "Green Rod" (NMC, Inc.), "Chem-Rod/Closed" (Bostik Construction Products Division, Emhart), "Sonofoam Closed Cell Backer Rod" (Sonneborn Building Products), "Expand-O-Foam" (Williams Products, Inc.), or approved equal. Verify compatibility of backer rod and sealant before installation.

D. Joint primer and cleaner shall be as recommended by sealant manufacturer for joint surfaces. Contractor shall verify with manufacturer need for primer and correct product for type of material on which sealant will be applied. Manufacturer's literature shall not be used as basis for primer requirement.

E. Joint filler for traffic sealant joints shall be a reconstituted, closed cell sponge neoprene, having a density of 30 lbs. per cubic foot and conforming to ASTM D1752, Type I.

F. Bond breaker tape shall be an adhesive backed polyethylene tape compatible with sealant. Verify with sealant manufacturer prior to use.

G. Masking tape for protection of materials adjacent to joint to be a non-staining, non-absorbent type compatible with sealant and surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Inspect joints to receive sealant prior to commencing work for compliance with joint requirements, tolerances and other conditions affecting sealant performance. Do not proceed with sealant installation until corrections or adjustments have been made.

3.2 ERECTION, INSTALLATION, APPLICATION

A. Clean out joints to receive sealant of dirt, grease, or other foreign materials.

B. Vacuum or brush joints using non-ferrous brush and blow dry.

C. Install backer rod where joints are deeper than AB" or bond breaker tape if less than AB", into joint to provide sealant depth recommended by sealant manufacturer. Backer rod size shall be selected to allow for a minimum of 30% compression of the backing when inserted into the joint.

D. Tape shoulders of joint during installation and tooling of sealant to aid in the removal of excess sealant and to prevent staining of masonry. Remove tape after tooling of joint.

E. Fill joint completely with sealant in accordance with manufacturer's instructions.

F. Tool immediately after application to ensure firm, full contact with the inner faces of the joint. Finished bead shall be smooth, continuous, and slightly concave.

G. Clean excess sealant off adjacent surfaces immediately after tooling and removal of tape. Do not use any cleaners or agents that will stain the sealant or adjacent surfaces.

3.3 PROTECTION

A. Installer shall instruct the Contractor in the methods to be used to cure and protect the sealant from damage during construction period, other than normal wear and weathering.

B. Replace damaged or deteriorated sealants prior to completion of the project, and during warranty period of product by manufacturer.

END OF SECTION

SECTION 07 92 00

JOINT SEALERS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Preparing sealant substrate surfaces.
B. Sealant and backing
C. Acoustical Sealant

1.2 RELATED SECTIONS

A. Section 07 31 13 – Asphalt Shingles: Sealants used in conjunction with roofing.
B. Section 07 60 00 – Sheet Metal Flashing & Trim: Sealants used in conjunction with metal flashings.

1.3 REFERENCES

A. ANSI/ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
B. ANSI/ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).
C. ASTM C790 - Use of Latex Sealing Compounds.
D. ASTM C804 - Use of Solvent-Release Type Sealants.
E. ASTM C834 - Latex Sealing Compounds.
F. FS TT-C-00598 - Calking Compound, Oil and Resin Base Type.
G. FS TT-S-001657 - Sealing Compound, Single Component, Butyl Rubber Based, solvent Release Type.
H. FS TT-S-00227 - Sealing Compound: Elastomeric Type, Multi-Component.
I. FS TT-S-00230 - Sealing Compound: Elastomeric Type, Single Component.
J. FS TT-S-001543 - Sealing Compound, Silicone Rubber Base.
K. SWI (Sealing and Waterproofers Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 01 33 00.

B. Submit product data indicating sealant chemical characteristics, performance criteria, limitations and color availability.

C. Submit samples under provisions of Section 01 33 00.

D. Submit two samples 1/4 x 4 inches in size illustrating colors selected.

E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
F. Submit manufacturer's certificate under provisions of Section 01 40 00 that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

B. Applicator: Company specializing in applying the work of this Section with minimum three years documented experience, approved by sealant manufacturer.

C. Conform to Sealant and Waterproofers Institute requirements for materials and installation.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install solvent curing sealants in enclosed building spaces.

B. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate work under provisions of Section 01 31 00.

B. Coordinate the work of this Section with all Sections referencing this Section.

1.8 WARRANTY

A. Provide five-year warranty under provisions of Section 01 77 00.

B. Warranty: Include coverage of installed sealants and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 – PRODUCTS

2.1 SEALANTS

A. Acrylic Emulsion Latex: ASTM C834-76, single component; as selected; AC-20 manufactured by Pecora.

B. Butyl Sealant: FS TT-S-001657, black color; BC-158 manufactured by Pecora.

C. Polysulphide Sealant: FS TT-S-230C, Type II - non-sag, Class A; as selected; Synthacalk GC-9 manufactured by Pecora.

D. Polyurethane Sealant: FS TT-S-230C, Type I - self-levelling, Class A; as selected; manufactured by Pecora.

E. Silicone Sealant: FS TT-S-01543B, Class A, low modulus type; as selected; #864 manufactured by Pecora.

F. Acoustical, Fire-rated Sealant: USG Sheetrock Brand Acoustical Sealant by USG

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: ANSI/ASTM D1056 and D1565; Denverfoam or Greenrod oversized 30 to 50 percent larger than joint width; as recommended by Pecora.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.

B. Beginning of installation means installer accepts existing surfaces.

3.2 PREPARATION

A. Clean and prime joints in accordance with manufacturer's instructions.

B. Remove loose materials and foreign matter, which might impair adhesion of sealant.

C. Verify that joint backing and release tapes are compatible with sealant.

D. Perform preparation in accordance with ASTM C804 for solvent release and C790 for latex base sealants.

E. Protect elements surrounding the work of this Section from damage or disfiguration.

3.3 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions.

B. Measure joint dimensions and size materials to achieve required width/depth ratios.

C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.

D. Install bond breaker where joint backing is not used.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Tool joints channel shaped.

3.4 CLEANING AND REPAIRING

A. Clean work under provisions of Section 01 77 00.

B. Clean adjacent soiled surfaces.

C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.5 PROTECTION OF FINISHED WORK

A. Protect finished installation under provisions of Section 01 50 00.

B. Protect sealants until cured.

3.6 SCHEDULE

Location		Type	Color
A.	Brick	E.	Color to match new mortar
B.	Roofing	B.	Black
C.	Flashing & sheet metal	B.	Clear
D.	Doors	E.	Color to match doors
E.	Windows	E.	Color to match windows

END OF SECTION

SECTION 08 01 52.91

WOOD WINDOW RESTORATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wood Windows:
1. Awning windows.
2. Casement windows.
3. Double-hung windows.
4. Single-Hung windows.
5. Radius and geometric windows.

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 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. General: Submit the following in compliance with the requirements of the Conditions of the Contract. Revise and resubmit each item as required to obtain Architect & SHPO approval.

C. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.

3. Installation methods.
4. Documentation in the form of high-resolution (1MB min.) JPEG images on CD-ROM/ Flash drive 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 to work of this Section.
5. Wood Treatment Product Data: Chemical treatment manufacturer's instructions for handling, storage, installation and finishing treated materials if applicable.

D. Shop Drawings: Submit shop drawings indicating details of construction, flashings and relationship with adjacent construction.

E. Selection Samples: For each product specified, two complete sets of color chips representing manufacturer's full range of available finishes.

F. Verification Samples: For each product specified, two samples, minimum size 6 inches (150 mm) square, representing actual finishes.

G. Quality Assurance Submittals:
1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.

H. Closeout Submittals: Refer to Section 01 77 00 Closeout Submittals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Wood Window restoration shall be carried out be a steady crew of skilled craftspeople who are thoroughly experience with materials and methods specified.

B. Installer Qualifications: Where required by hazardous materials drawings, specifications & reports Wood Window restoration shall be carried out by a steady crew of skilled craftspeople who are certified to work with asbestos and lead containing materials, who are thoroughly experienced with the materials and methods specified.

C. Laws, Codes, and Regulations: All work of this section shall comply with all applicable federal, state and local laws, codes and regulations.

D. 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 acknowledgement that s/he is thoroughly familiar with Project Scope and site conditions.

E. Access for Inspection, Documentation and Approvals: Provide preservation Manager access on a regular basis to all location 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.

F. Mock-Up: Provide a mock-up for evaluation of installation techniques and workmanship.

1. Mock-ups shall incorporate surrounding construction, including wall assembly fasteners, flashing, and other related accessories installed in accordance with manufacturer's approved installation methods.
2. Do not proceed with remaining work until workmanship is approved by Architect.
3. Rework mock-up as required to produce acceptable work.
4. At Substantial Completion, approved mockups may become part of completed work or demolish mockups and remove from site as decided by owner.

G. Pre-installation Meeting: Conduct pre-installation meeting on-site two weeks prior to commencement of installation.

1.5 CONTRACTOR RESPONSIBILITY

A. Bidders shall visit the site beforehand to make themselves familiar with specific conditions relating to this Section.

B. All Subcontractors are bound by the same requirements as the Contractor. Subcontractors shall not begin work unless approved by the Architect/ SHPO.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards 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 note, 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 weather tight 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 Architect/ SHPO'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 Architect/ SHPO'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.

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 reference 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.

D. 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".

E. 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. Replacement Windows Basis-of-Design Product: Subject to compliance with requirements, provide Kolbe Windows & Doors; Heritage Series or comparable product.

B. Grade and Quality: Materials shall conform to requirements of this Section and shall be new, free from defects, and of recent manufacture.

C. Manufacturer's Instructions: Comply with material manufacturer's 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 in any ways 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 king.

D. Preservation 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. Adhesives for glass repair: Provide HXTAL NYL-1 Epoxy adhesive

2.4 FASTENERS FOR CONSTRUCTION OF WOOD SASH

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.

2.5 HAARDWARE 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 subsection 3.11 “Restoration of Existing Hardware”.
   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 in so far 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 as to be non-restorable.

C. Sash Locks: Restore any existing sash locks in so far 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 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 stain 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 in so far 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 Architect/ SHPO.

2.7 HARDWARE RESTORATION MATERIALS

A. Non-metallic Cleaning Pads: Scotch-Brite pads, extra fine, as 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, N.Y. 11520, or approved Equal.

C. Paste Wax for Cold Application: White or clear paste wax, mixture 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; p: 708.544.0320, or an 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 weather stripping, 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 hose points of entry and exist that must remain operational during restoration.

3.2 INSPECTION AND DOCUMENTATION

A. Install assemblies in accordance with manufacturer's installation guidelines and recommendations including the following.

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 anyway affected by work of this Section. Show overall window elements and detail 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 (1MB min.) JPEG images on CD-ROM/ Flash Drive.

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 SHPO records.
3. Identify and label each component that is to be removed and repaired for reinstallation with window opening designator and location on 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 SHPO'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 ensure 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 in future chromo-chronology is ever executed. If preserving areas of pain on the sash is not possible, craftsperson is to select samples from cervices where paint layers are most accumulated and best preserved and to provide labeled samples to Architect/ SHPO.

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 Architect/ SHPO 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 plans 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 patter 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 less at end of component required 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 of 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 weather stripping, 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. Weather-stripping: If specified, install weather stripping 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 weather-stripping, if specified, and to provide smooth operating and a weather sight 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 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 the 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 Architect. Prime and paint sash in controlled environment according to manufacturer's instructions.

B. Prepare substrate for repairs by hand sanding with 100grit paper. The sides of the stiles (unpainted edges) of double hung di 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 sash.

E. Apply on coat of alkyd or 100% acrylic primer to all surfaces of the sash including putty bed (shellac-based paint cannot be applied over glazing). On all window sash, extend primer and paint 1/16 inch 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 tow topcoats of premium quality 100% acrylic paint to all surfaces. Color to match existing unless otherwise specified.

H. Immediately after installation touch-up and 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 cloth.

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 compounds as necessary. Do not scratch finish with abrasive pads or wire brushes.

G. Provide lacquer finish on all coper alloy elements

1. Preparation

a. Clean and degrease metal using solvent and burnishing with handheld bronze wool to provide surface free of dust, dust, grease, oil, and other contaminants. Do not damage metal finish. If surface is handled of 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 product 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

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SECTION 08 14 00

EXTERIOR WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section specifies stile and rail wood doors of the following types:
   1. Exterior wood doors and sidelights.
   2. Exterior French and sash doors and sidelights.
   3. Interior wood doors and sidelights.
   4. Interior fire-rated wood doors.
   5. Custom wood doors.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections.
   1. Section 061000 - Rough Carpentry: For rough opening and blocking.
   2. Section 062000 - Finish Carpentry: For casing and trim.
   3. Section 087100 - Door Hardware: For operating and locking hardware.
   4. Section 099000 - Painting and Coating: For staining of doors and sidelights.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of stile-and-rail wood door including elevations and details of construction.

B. Shop Drawings: Submit shop drawings of wood doors including door type, door design number, door size, fire rating if applicable, hardware types and locations, hardware blocking requirements and location, panel layout, molding and sticking profile, vision panel, louver cutout or lite opening sizes and locations, and finishing.

C. Verification Samples: Submit two corner samples, minimum 6 inches by 6 inches representing actual products and materials specified indicating visual characteristics and finish. Include range samples if variation of appearance is anticipated.

D. Warranty: Submit manufacturer's standard warranty.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Company specializing in manufacturing doors with a minimum of five years documented experience.

B. Single Source Requirements: To the greatest extent practical, wood doors shall be supplied from a single manufacturer.

C. Sustainable Construction: Paneled door construction shall limit use of formaldehyde products during fabrication. Paneled door shall bear the Four Star rating from the Japanese Ministry of Land, Infrastructure, Transportation and be compliant with California's CARB Phase II program.

D. Project Conditions: Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions, recommendations and industry standards.

B. Store materials in manufacturer's original labeled packaging until ready for installation and in accordance with manufacturer's instructions. Protect from damage.

1.5 WARRANTY

A. Manufacturer’s Warranty: Provide manufacturer’s standard limited warranty that each panel door bearing the manufacturer’s brand and identification mark complies with Industry Standard WDMA I.S.6A and all revisions in effect as of the date of manufacture, and that each such door, at the time of the shipment, is of good material and workmanship and free from defects that would render such door unserviceable or unfit for the ordinary, recommended use. This limited warranty applies to new doors other than those sold "as is".

1. Warranty Period: Exterior Door and Fire Door Limited Warranty – One year.
2. Warranty Period: Innerbond® Panels – Lifetime.
3. Warranty Period: Interior Doors – 10 years.
4. Warranty Period: Nantucket® Collection (Black Locust, Sapele Mahogany, Nootka Cypress) – 10 years.
5. Warranty Period: Nantucket® Collection (Douglas Fir) – 5 years.
6. Warranty Period: Performance Series® with WaterBarrier® Technology – 5 years.
7. Warranty Period: Performance Series® with UltraBlock® Technology – 5 years.
8. Warranty Period: Insulated Glass – 5 years.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Acceptable Manufacturers

1. Simpson Door Company; 400 Simpson Ave.; McCleary, WA 98557. Toll Free Tel: 800 SIMPSON (746-7766). Email: SimpsonCustomerService@brandner.com. Web: www.simpsondoor.com.
2. YesterYear’s Vintage Doors, llc; 66 South Main Street; Hammond, NY 13646. Toll Free Tel: 800.787.2001. Email: infor@vontagedoors.com. Web: www.vintagedoors.com

2.2 EXTERIOR DOORS

A. Exterior Doors manufactured by Simpson Door Company.

1. Construction:
    a. Mortise-and-tenon joinery with face-driven pins.
    b. Two-piece laminated stile-and-rail construction.
    c. Divided lite doors made with SDL construction.
    d. Design pressure ratings of (Specify Design Pressure rating); with additional hardware if required.
2. Door Design: As per door schedule
3. Sidelight Design: As per door schedule
4. Wood Species: Douglas Fir, Sapele Mahogany, Nootka Cypress, Black Locust
5. Tenon and face pins made of Black Locust
6. Thickness: 1-3/4" or 2-1/4".
7. Stiles: As per door schedule
8. Panel Detail: As per door schedule
9. Moulding: As per door schedule
10. Glass Detail:
    a. 3/4" Insulated Glazing Options - P-516, Bronze, Grey, Green Solex or Azurelite, Glue Chip, White Laminate, Clear Laminate, Seedy Baroque, Low-E Argon
11. Extended Warranty: 10-year warranty on doors made from Sapele Mahogany, Nootka Cypress

and Black Locust.

12. Extended Warranty: 5-year warranty on doors made from Douglas Fir.

2.6 CUSTOM DOOR STYLE

A. Custom Doors Concept® Custom Door Gallery as manufactured by Simpson Door Company.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examine and prepare openings and substrates using the methods recommended by manufacturer.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction. Operate doors and adjust installation to provide proper operation of opening.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes: Kawneer Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.
   1. Types of Kawneer Aluminum Storefront Systems include:
      a. Trifab™ VG 451 Framing System – 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension; Non-Thermal; Front, Center, Back, Multi-Plane, Structural Silicone or Weatherseal Glazed (Type B); Screw Spline, Shear Block, Stick or Punched Opening Fabrication.
      b. Trifab™ VG 451 Framing System – Impact Glazing and Blast Mitigation.
      c. Trifab™ VG 451T Framing System – 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension; Thermal; Front, Center, Back, Multi-Plane, Structural Silicone or Weatherseal Glazed (Type B); Screw Spline, Shear Block, Stick or Punched Opening Fabrication.
      d. Trifab™ VG 451T Framing System – Impact Glazing and Blast Mitigation.

B. Related Sections:
   1. 07 25 00 – Weather Barriers
   2. 07 92 00 – Joint Sealants
   3. 08 32 13 - Sliding Aluminum-Framed Glass Doors
   4. 08 43 29 - Sliding Storefronts
   5. 08 44 13 - Glazed Aluminum Curtain Walls
   6. 08 44 33 - Sloped Glazing Assemblies
   7. 08 51 13 - Aluminum Windows
   8. 08 63 00 - Metal-Framed Skylights
   9. 08 80 00 - Glazing
   10. 10 71 13 - Exterior Sun Control Devices

1.3 Definitions

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 Performance Requirements

A. Storefront System Performance Requirements:
   1. Wind loads: Provide storefront system; include anchorage, capable of withstanding wind load design pressures of (____) lbs./sq. ft. inward and (____) lbs./sq. ft. outward. The design pressures are based on the (____) Building Code; (____) Edition.
   2. Air Leakage: The test specimen shall be tested in accordance with ASTM E 283. Air Leakage rate shall not exceed 0.06 cfm/ft2 (0.3 l/s · m2) at a static air pressure differential of 6.2 psf (300 Pa) with interior seal, or, rate shall not exceed 0.06 cfm/ft2 (0.3 l/s · m2) at a static air pressure differential of 1.6 psf (75 Pa) without interior seal. CSA A440 Fixed Rating.

3. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 psf (383 Pa) as defined in AAMA 501.
4. Uniform Load: A static air design load of 35 psf (1680 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
5. Seismic: When tested to AAMA 501.4, system must meet design displacement of 0.010 x the story height and ultimate displacement of 1.5 x the design displacement.
6. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
   a. Temperature Change (Range): 0 deg F (-18 deg C); 180 deg F (82 deg C).
   b. Test Interior Ambient-Air Temperature: [75 deg F (24 deg C)] .
   c. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5 for a minimum 3 cycles.
7. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:
   a. Glass to Exterior – 0.47 (low-e) or 0.61 (clear) or Project Specific (____) BTU/hr/ft2/°F.
   b. Glass to Center – 0.44 (low-e) or 0.61 (clear) or Project Specific (____) BTU/hr/ft2/°F.
   c. Glass to Interior – 0.41 (low-e) or 0.56 (clear) or Project Specific (____) BTU/hr/ft^2/°F.
8. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
   a. Glass to Exterior – 70_{frame} and 69_{glass} (low-e) or 69_{frame} and 58_{glass} (clear).
   b. Glass to Center – 62_{frame} and 68_{glass} (low-e) or 63_{frame} and 56_{glass} (clear).
   c. Glass to Interior – 56_{frame} and 67_{glass} (low-e) or 54_{frame} and 58_{glass} (clear).
9. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC): When tested to AAMA Specification 1801 and in accordance with ASTM E1425 and ASTM E90, the STC and OITC Rating shall not be less than:
   a. Glass to Exterior – 38 (STC) and 31 (OITC).
   b. Glass to Center – 37 (STC) and 30 (OITC).
   c. Glass to Interior – 38 (STC) and 30 (OITC).
10. Windborne-Debris-Impact Resistance Performance: Shall be tested in accordance with ASTM E 1886, information in ASTM E 1996 and TAS 201/203.
    a. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.
    b. Small-Missile Impact: For aluminum-framed systems located above 30 feet (9.1 m) of grade.
11. Blast Mitigation Performance: Shall be tested or proven through analysis to meet ASTM F1642, GSA-TS01, and UFC 04-010.01 performance criteria.

    To meet UFC 04-010.01, B-3.1 Standard 10 for Windows and Skylights, the following options are available:
    a. Section B-3.1.1 Dynamic analysis.
    b. Section B-3.1.2 Testing.
    c. Section B-3.1.3 ASTM F2248 Design Approach.

1.5 Submittals

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum-framed storefront system indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum-framed storefront system and components required.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed storefront.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:
   1. Joinery.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

G. Other Action Submittals:
   1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 Quality Assurance

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum-framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum-framed storefront system through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront system and are based on the specific system indicated. Refer to Division 01 Section “Product Requirements”. Do not modify size and dimensional requirements.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup for type(s) of storefront elevation(s) indicated, in location(s) shown on Drawings.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination”.

G. Structural-Sealant Glazing: Comply with ASTM C 1401, “Guide for Structural Sealant Glazing” for design and installation of structural-sealant-glazed systems.

H. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.7 Project Conditions

A. Field Measurements: Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 Warranty

A. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty.
1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Basis-of-Design Product:
1. Kawneer Company Inc.
2. Trifab™ VG 451 (Non-Thermal) or Trifab™ 451T (Thermal) Framing System
3. Trifab™ VG 451 (Non-Thermal) or Trifab™ 451T (Thermal) Framing System (Impact Glazing and Blast Mitigation)
4. System Dimensions: 2" x 4-1/2" (50.8 mm x 114.3 mm)
5. System Dimensions: As per Contract Drawings
6. Glass: Center, Exterior or Interior

B. Substitutions: Refer to Substitutions Section for procedures and submission requirements
1. Pre-Contract (Bidding Period) Substitutions: Submit written requests ten (10) days prior to bid date.
2. Post-Contract (Construction Period) Substitutions: Submit written request in order to avoid storefront installation and construction delays.
3. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
4. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for storefront system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum storefronts for a period of not less than ten (10) years. (Company Name)
5. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
6. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

C. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

2.2 Materials

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum framing members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 Storefront Framing System

A. Thermal Barrier (Trifab™ VG 451T):
   1. Kawneer IsoLock™ Thermal Break with a 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
      a. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

D. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action

E. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

F. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

2.4 Glazing Systems

A. Glazing: As specified in Division 08 Section "Glazing".

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
   1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
      a. Color: Black
   2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
      a. Color: Matching structural sealant.

2.5 Entrance Door Systems

A. Entrance Doors: As specified in Division 084113 Section "Aluminum-Framed Entrances and Storefronts".

B. Entrance Door Hardware: As specified in Division 084113 Section "Door Hardware".

2.6 Accessory Materials

A. Versoleil™ SunShade: An aluminum sunshade (consisting of outriggers, louvers, and fascia which may be selected from standard configurations), that is anchored directly to the vertical mullions. Outriggers shall be painted (Select from Kawneer's standard paints and colors. Custom colors are available upon request). Louvers and fascia shall be painted or anodized (Select from Kawneer's standard paints and colors, custom colors are available upon request or Kawneer's anodized finishes).

B. InLighten™ Light Shelf: aluminum light shelf system consisting of anchor channels, support beams, fascia trims and Aluminum Composite Material (ACM) panels that is anchored directly to the intermediate horizontal members.
   1. Light Shelf: Interior mounted shelf to reflect daylight deeper into interior space.
   2. Light Shelf System to consist of:
      a. Aluminum Composite Material (ACM) panel, 4mm thick.
      b. Translucent polycarbonate panel, 4mm/16mm thick.
      c. ACM finish on upper and lower surface shall be selected from Kawneer standard finishes.
      d. Extruded aluminum outriggers and fascia.
      e. Extruded aluminum anchor designed to secure to compatible verticals of framing system. Anchor shall be designed to engage shelf so as to allow the shelf to rotate down and hang on its own safely for cleaning.
      f. Extruded aluminum shear blocks designed to hinge on the anchors to allow rotating individual shelves for cleaning.

g. Panel /Shelf projection shall not exceed 30" (762mm).
h. Mullion spacing of framing system shall not exceed 6' (1.83 m) on center.
i. Panel /Shelf deflection shall not exceed L/120 of horizontal span length.

3. Framing System to Support Light Shelf shall be: (select appropriate framing system)
   a. Curtain Wall framing system.
   b. Storefront framing system.
4. Submittals.
   a. Manufacturer's Installation Instructions.
   b. Samples for Verification.
      1) Factory applied finish as selected by architect.
      2) Functioning Light Shelf sample demonstrating operation.
   c. Shop Drawings including:
      1) Plans, elevations, sections, fabrication and installation details.
      2) Validation from manufacturer of single-source for light shelf and framing system and compatibility between the system.

C. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants".

D. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.

2.7 Fabrication

A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fit joints; make joints flush, hairline and weatherproof.
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Provisions for field replacement of glazing.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

C. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

D. Storefront Framing: Fabricate components for assembly using manufacturer's standard installation instructions.

E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 Aluminum Finishes

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
   1. Kawneer Permanodic™ AA-M10C21A44 / AA-M45C22A44, AAMA 611, Architectural Class I Color Anodic Coating (Color __________).
   2. Kawneer Permanodic™ AA-M10C21A41 / AA-M45C22A41, AAMA 611, Architectural Class I Clear Anodic Coating (Color #14 Clear) (Optional).
   3. Kawneer Permanodic™ AA-M10C21A31, AAMA 611, Architectural Class II Clear Anodic Coating (Color #17 Clear) (Standard).
   4. Kawneer Permafluor™ (70% PVDF), AAMA 2605, Fluoropolymer Coating (Color __________).
   5. Kawneer Permadize™ (50% PVDF), AAMA 2604, Fluoropolymer Coating (Color __________).
   6. Kawneer Permacoat™ AAMA 2604, Powder Coating (Color __________)

PART 3 - EXECUTION

3.1 Examination

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight framed aluminum storefront system installation.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
   3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.

B. Install aluminum-framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 Field Quality Control

A. Field Tests: Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.

1. Testing: Testing shall be performed by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 503, including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 Water Infiltration Test.
   a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, whichever is greater.
   b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.2 psf (300 Pa).

B. Manufacturer's Field Services: Upon Owner’s written request, provide periodic site visit by manufacturer’s field service representative.

3.4 Adjusting, Cleaning, and Protection

A. Clean aluminum surfaces immediately after installing aluminum-framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

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SECTION 08 52 00

WOOD & ALUMINUM CLAD WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-clad wood windows.
2. Wood windows.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of wood windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for wood windows.

B. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Chain-of-Custody Qualification Data: For manufacturer and vendor.

C. Shop Drawings: For wood windows.

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

D. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

E. Samples for Initial Selection: For units with factory-applied finishes.

1. Include Samples of hardware and accessories involving color selection.

F. Samples for Verification: For wood windows and components required, prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches.
2. Exposed Hardware: Full-size units.

G. Product Schedule: For wood windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each type of wood window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

C. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical wall area as indicated on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

    a. Window: [**10**] <**Insert number**> years from date of shipment and issued to the owner at Substantial Completion.
    b. Glazing Units: [**Five**] [**10**] [**20**] <**Insert number**> years from date of shipment and issued to the owner at Substantial Completion.
    c. Aluminum-Cladding Finish: [**10**] [**20**] [**30**] <**Insert number**> years from date of shipment and issued to the owner at Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain wood windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

    1. Window Certification: WDMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

    1. Minimum Performance Class: [**R**] [**LC**] [**CW**] [**As indicated on Drawings**] <**Insert class**>.
    2. Minimum Performance Grade: [**15**] [**20**] [**25**] [**30**] [**35**] [**40**] [**45**] [**50**] [**As indicated on Drawings**] <**Insert grade**>.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F

D. Options in "Solar Heat-Gain Coefficient (SHGC)" Paragraph below are based on ENERGY STAR requirements. First option is for North-Central Climate Zone, second is for South-Central Climate Zone, and third is for Southern Climate Zone. Northern Climate Zone does not have a maximum SHGC.

E. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.42.

2.3 WOOD WINDOWS

A. Aluminum-Clad Wood Windows:

    1. Basis-of-Design Product: Subject to compliance with requirements, provide Kolbe Windows & Doors; Ultra Series or comparable product by one of the following:

        a. Loewen Windows.

b. Marvin Windows and Doors.

B. Wood Windows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Kolbe Windows & Doors; Heritage Series or comparable product by one of the following:

a. Loewen Windows.
b. Marvin Windows and Doors.

C. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Casement: Project out.
2. Awning: Project out.
3. Single hung.
4. Double hung.
5. Horizontal sliding.
6. Multi-panel folding.
7. Fixed.

D. Certified Wood: Wood products are to be certified as "FSC Pure"[**or "FSC Mixed Credit"**] in accordance with FSC STD-01-001 and FSC STD-40-004.

E. Certified Wood: Wood products are to be labeled in accordance with the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004, or be certified and labeled in accordance with the standards of the Programme for Endorsement of Forest Certification.

F. Certified Wood: Wood products are to [**contain not less than 60 percent**] [**be made from**] certified wood tracked through a chain-of-custody process. Certified wood documentation is to be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."

G. Certified Wood: Wood products are to be certified in accordance with the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.

H. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln-dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) deep by 2 inches (51 mm) wide; water-repellent preservative treated.

1. Exterior Aluminum Surfaces: Aluminum cladding with manufacturer's standard manufacturer's standard silicon modified polyester (SMP) coating complying with AAMA 2604.

a. SMP or PVDF Color: To match existing/as selected by Architect
b. Anodized Color: To match existing/as selected by Architect

2. Exterior Wood Surfaces: Manufacturer's standard factory-applied color finish.

   a. Paint Color: To match existing/as selected by Architect
   b. Wood Species: [**Pine**] [**Alder**] [**Bamboo**] [**Cherry**] [**Knotty alder**] [**Mahogany**] [**Maple**] [**Mixed grain fir**] [**Oak**] [**Sapele**] [**Spanish cedar**] [**Vertical grain fir**] [**Walnut**] [**White oak**] <**Insert species**>.

3. Interior Wood Surfaces: To match existing/as selected by Architect

   a. Wood Species: [**Pine**] [**Alder**] [**Bamboo**] [**Cherry**] [**Knotty alder**] [**Mahogany**] [**Maple**] [**Mixed grain fir**] [**Oak**] [**Sapele**] [**Spanish cedar**] [**Vertical grain fir**] [**Walnut**] [**White oak**] <**Insert color**>.
   b. Wood Stain Color: To match existing/as selected by Architect
   c. Paint Color: To match existing/as selected by Architect

4. Nailing Fin: Manufacturer's standard nailing fins for securing frame to structure during installation to hold unit plumb, square and true.
5. Installation Clips: Provide manufacturer's standard clips of sufficient strength to withstand design pressure indicated.

I. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.

   1. Kind: Fully tempered where indicated on Drawings.

J. Insulating-Glass Units: ASTM E2190.

   1. Glass: ASTM C1036, Type 1, Class 1, q3.

      a. Tint: Clear
      b. Kind: Fully tempered [**where indicated on Drawings**] <**Insert requirements**>.

   2. Lites: As indicated on Drawings
   3. Filling: Fill space between glass lites with argon.
   4. Low-E Coating: [**Pyrolytic on second surface**] [**Sputtered on second surface**] [**Sputtered on second or fourth surface**] [**Sputtered on second or fifth surface**].

K. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

   1. Dual Glazing System:

      a. Interior Lite: Glass
      b. Exterior Lite: Glass
      c. Nonmagnetic stainless steel, Series 300, or superior corrosion-resistant-coated metal hardware may be required to meet specific customer or regional needs and for protection against corrosive environments, such as in urban, coastal, or industrial areas.

L. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

M. Hung Window Hardware:

1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

N. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

O. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Grilles (False Muntins): Provide grilles in designs indicated to each sash lite.

1. Type: Exterior and interior, adhered to glass [**with**] [**without**] bars between the glass.
2. Material: To match adjacent finish of window sash.
3. Design: As indicated on Drawings
4. Bar Width: As indicated on Drawings
5. Interior Bar Profile: As indicated on Drawings
6. Exterior Aluminum Finish: Aluminum cladding with manufacturer's standard silicon modified polyester (SMP) coating complying with AAMA 2604.

   a. SMP or PVDF Color: To match existing
   b. Anodized Color: To match existing
   c. Mica Color: To match existing

7. Exterior Wood Finish: To match existing

   a. Exterior Paint Color: To match existing

8. Interior Wood Finish: To match existing

   a. Interior Stain Color: To match existing
   b. Interior Paint Color: To match existing

B. Casing: To match existing

2.5 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: [**Full, inside for project-out**] [**Full, outside for double-hung**] [**Half, outside for single-hung**] [**Full, outside for sliding**] [**Half, outside for sliding**] [**Interior, retractable for casements, awnings, or double hung**] [**Exterior, retractable for sliding**] sashes.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
2. Finish for Interior Screens: [**Baked-on organic coating in color selected by Architect from manufacturer's full range**] [**Wood veneer matching species and finish of adjacent sash**] <**Insert color**>.
3. Finish for Exterior Screens: [**Baked-on organic coating in color selected by Architect from manufacturer's full range**] [**Matching color and finish of cladding**].

C. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.

1. Wire-Fabric Finish: [**Brite coat aluminum**] [**Charcoal**].

2.6 FABRICATION

A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.

B. Glaze wood windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

E. [**Bow**] [**Bay**] Window Assemblies: Provide [**operating**] [**and**] [**fixed**] units in configuration indicated. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:

1. Angled mullion posts with interior and exterior trim.
2. Angled interior and exterior extension and trim.
3. Clear [**pine**] [**oak**] head and seat boards.
4. Top and bottom plywood platforms.
5. Exterior head and sill casings and trim.
6. Support brackets.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

2.7 WOOD FINISHES

A. Factory-Applied Primer: Provide manufacturer's standard factory-applied prime coat complying with WDMA T.M. on exposed exterior and interior wood surfaces.

2.8 ALUMINUM FINISHES

A. Silicon Modified Polyester (SMP): AAMA 2604; epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Kolbe Windows & Doors; Vantage Exterior SMP Finish or comparable product.

B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

C. Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

D. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**] [**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action (dissimilar materials, treated lumber, and so on) at points of contact with other materials.

D. For fin method of attachment, integrate window system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with window manufacturer's written instructions.

E. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating-foam sealant.

F. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

G. Leave windows closed and locked.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows is to take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance is to be performed in accordance with AAMA 502.
2. Air-Infiltration Testing:

    a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
    b. Allowable Air-Leakage Rate: [**1.5**] <**Insert number**> times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

    a. Test Pressure: [**Two-thirds**] <**Insert number**> times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
    b. Allowable Water Infiltration: No water penetration through the unit.

4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows are to be tested after perimeter sealants have cured.
5. Test Reports: Prepared in accordance with AAMA 502.

C. Windows will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 08 61 00.10

REHABILITATING WOOD WINDOWS

PART 1 – GENERAL

1.1 SUMMARY

A. This procedure includes guidance for the rehabilitation of wood windows. Outlined are the steps one might go through to complete repairs. Each step is cross-referenced to one or more procedures which covers the particular problem. The cross-referenced procedures should be reviewed prior to beginning window repairs and should be followed along with recommendations from the Regional Historic Preservation Officer (RHPO).

B. The steps in the repair of deteriorated sash include but are not limited to the following:
   1. Examination, survey and condition assessment of windows.
   2. Removal of existing sash, trim, etc.
   3. Repair of deteriorated wood through the use of epoxies, dutchmen and/or the replacement with new wood to match the existing appearance.
   4. Painting/refinishing sash and trim.
   5. Installation of repaired sash.

C. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding) These guidelines should be reviewed before performing this procedure and should be followed, when applicable, along with recommendations from the RHPO.

D. For general information on the repair of wood windows see 08610-01-S, "Preservation Briefs: 9 - The Repair of Historic Wooden Windows."

1.2 SUBMITTALS

A. Shop drawings for each type of window, including 1/4-inch scale wall elevations, typical unit elevations at 3/4- inch scale, glazing details, and full-size details of typical composite members, include window rehabilitation, wood and hardware replacement, reglazing details and weatherstripping.

B. The RHPO reserves the right to require additional samples that show fabrication techniques and construction and design of hardware and accessories.

1.3 SEQUENCING AND SCHEDULING

A. Rehabilitation of windows shall be completed before doing any interior restoration/rehabilitation work to insure weather-tight integrity of interior spaces.

PART 2---PRODUCTS

2.1 MATERIALS

NOTE: See specific procedures for materials and equipment requirements, and their manufacturers and sources.

PART 3---EXECUTION

3.1 EXAMINATION

A. Conduct a window-by-window survey to determine existing conditions and identify the specific work needs of each window.

B. For each window type, the survey should include color photographs which show design details for comparison to new work, and existing conditions.
   1. Full frame views, both interior and exterior.
   2. Close-up views of typical details, both interior and exterior.

3.2 ERECTION, INSTALLATION, APPLICATION

A. Carefully remove window stops, sash and trim as required. Remove only those features which cannot be repaired on- site. All disassembled parts should be indelibly marked or stamped on hidden parts so they can be returned to their exact location.
   1. See 06440-03-R, "Closing Open Joints in Wood Wall Ornament"

B. Replace rotted window sills as required.
   1. See 08610-04-R, "Replacing a Wood Window Sill"

C. Repair, replace, or rebuild all rotted or deteriorated wood features. These can include but are not limited to stiles, rails, muntins, joints, frame, trim. New work shall match existing profiles or shapes in every respect and shall be flush with existing adjacent surfaces.
   1. See 06300-01-R, "Epoxy Repair for Deterioration and Decay in Wooden Members"
   2. See 08611-01-R, "Sealing Leaky Wood Double-Hung Windows"
   3. See 06440-01-R, "Repairing Cracks and Checks in Wood Wall Ornament
   4. See 06440-03-R, "Closing Open Joints in Wood Wall Ornament"
   5. See 06440-04-R, "Repairing Scratches, Gouges and Dents in Wood Wall Ornament"
   6. See 09560-03-R, "Dutchman Repair of Wood Floor Boards"

D. Remove paint from both interior (where applicable) and exterior surfaces.
   1. See 06400-07-R, "Chemically Removing Paint From Wood Features"
   2. See 06400-02-S, "Supplemental Guidelines for Removing Paint from Interior and Exterior Wood Surfaces"
   3. See 06400-09-R, "Removing Paint From Wood Features Using Thermal Methods"

E. Remove all deteriorated glazing putty and broken glass. Replace glass and reglaze with a flexible elastomeric glazing compound. Clean the existing historic glass. See 08800-01-R, "Replacing Broken Glass in Wood and Metal Windows"

F. Reinstall windows. Inspect pull chains and weights at all double hung windows and adjust, clean or replace as required to ensure proper operation. Lubricate all working parts to assure smooth operation.
   1. See 08760-01-R, "Repairing Double-Hung Window Sash Weights and Cords/Chains"
   2. See 08712-01-R, "Resetting a Hinge Mortise"

G. Provide weatherstripping as required.
   1. See 08500-01-R, "Installing Weatherstripping on Metal Double-Hung Windows"

H. Refinish both interior and exterior sides of sash, frame and trim with appropriate paint, stain or natural finish as specified.
   1. See 06300-01-S, "Primers and Paints for Wood"
   2. See 06300-02-R, "Surface Preparation for Painting Wood"
   3. See 06400-10-R, "Refinishing Interior Wood"
   4. See 06310-01-S, "Preparing a Non-toxic Water-repellent Preservative"
   5. See 06310-01-P, "Applying a Water-repellent Preservative to Wood"
   6. See 09900-07-S, "General Guidelines for Painting Exterior and Interior Surfaces"
   7. See 06300-03-R, "Applying a Semi-Transparent or Opaque Stain to Wood"

I. Hardware:
   1. All window hardware shall be removed, marked for proper room number and location, boxed or packaged, and collected in a central location for the Contractor who shall polish all the hardware before reinstallation.
   2. All hardware to be removed before paint stripping, cleaned to bare metal and repaired to its original condition.
   3. Where hardware is missing or damaged, provide new hardware of same design and material as original hardware.

3.3 PROTECTION

A. Begin and maintain protection and other precautions required through the remainder of construction period to ensure that newly rehabilitated window units will not be damaged throughout the remainder of any restoration or rehabilitation work.

END OF SECTION

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SECTION 08 61 00.60

RESTORING WOOD WINDOW SASH AND FRAMES

PART 1 – GENERAL

1.1 SUMMARY

A. This procedure includes guidance on restoring the appearance of wood window sash and frames and preserving the wood. This includes removing the existing paint by hand, removing deteriorated glazing compound, treating weathered wood surfaces with wood preservative, reglazing as needed, priming and repainting.

B. The choice to fully restore wood windows can be an expensive investment, but the choice will likely reduce future maintenance costs and extend the life of the original windows.

C. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
1. Safety Precautions
2. Historic Structures Precautions
3. Submittals
4. Quality Assurance
5. Delivery, Storage and Handling
6. Project/Site Conditions
7. Sequencing and Scheduling
8. General Protection (Surface and Surrounding) These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the Regional Historic Preservation Officer (RHPO).

PART 2---PRODUCTS

2.1 MANUFACTURERS

A. Sarco Putty Company
B. The Sherwin Williams Co.
C. Benjamin Moore

2.2 MATERIALS

NOTE: As the state of coatings technology is in a constant state of flux, it is vital that proper research into product manufacturers be made. What used to be viewed to as the individual components primer and stain are now referred to as a coating system and are usually specified together for reasons concerning performance. We must adhere to a certain set of guides and carefully follow instructions to get the best coating system performance and maintain the manufacturer's warranty. Therefore, it has become vitally important on special portions of a project to utilize products which are found within the catalog of a single manufacturer, allowing us to attain traceable and warrantable results. In any case, we must understand the existing coatings on the surface to be refinished. If a surface is treated as if it was coated with varnish and it turns out to be shellac, polyurethane, or a natural rubbed wax finish, damage that could have been avoided may occur. Extreme caution is advised, and testing on hidden areas of a finished surface is advised. As time goes on and the materials used on our projects change because of scientific studies, it is important to realize that we once thought lead, mercury, PCB's and asbestos were safe products for everyday use. It is possible that some chemical we use today might be placed in the category of less-than-desirable materials in the future. When considering any coating project, it is incumbent upon the planner of the project to make sure they are fully aware of the history of previous materials used on a particular surface, understand the properties of adhesion and reactivity that may be exhibited between differing chemical compounds involved, and be prepared to fully record the coating materials they choose to use in the future. An area that is protected, such as a painted space behind a baseboard or a piece of trim where the original coatings might be seen in the future, should be carefully protected, recorded and remain undisturbed so that those layers can be studied in the future when new technology might lead to a better understanding of its qualities.

A. 80 to 120 grit sandpaper

B. Primer chosen for compatibility with the coating system (see introductory paragraphs to this section, above). The individual manufacturer will specify coating thicknesses, drying times under particular environmental conditions (temperature, humidity, direct sunlight, etc), and these details must be adhered to without fail.

C. Pure steam-distilled turpentine. For the usage specified below (E), turpentine is preferred over mineral spirits, despite its higher cost.

D. Boiled Linseed Oil. (This is a prepared product and does not need to be heated in the field). Users are cautioned that most latex-based products in use today will not perform well when they come in contact with fresh Linseed Oil. Utilize this product only when using more traditional coatings such as Alkyd-or thinner-based primers and paints, and always adhere to the manufacturer's guidelines. Allow sufficient drying time before applying any coating to a surface treated with Linseed Oil.

E. Wood Preservative: A mixed solution consisting of 60% boiled linseed oil and 40% turpentine. NOTE: WITH WOOD THAT ISVISIBLY DRYED-OUT AND DISPLAYS OPEN SPLITS IN ITS SURFACE, A GREATER PERCENTAGE OF LINSEED OIL IS ADVISABLE(such as 70% Linseed, 30% Turpentine).

F. Caulking Compound (a durable, flexible caulk that bonds well with the chosen coating system and the components it will come in contact with, such as DAP RELY-ON Latex Caulk).

G. Glazing Compound such as "Sarco Multi-Glaze Type M Glazing Compound", or approved equal.

H. Top coat (paint) chosen for compatibility with the desired coating system.

2.3 EQUIPMENT

A. Hand-held sheet Orbital Sanders (NO ROTARY DISK SANDERS or BELT SANDERS)

B. Stiff bristle brushes

C. Paint brushes

D. Putty knife

E. Triangular scraper

F. Appropriate personal protective equipment such as a NIOSH /OSHA rated dust mask certified for use with the materials present, gloves, eye protection, etc.

PART 3---EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Determine the type of wood used and understand its properties. Pine for instance is much softer than oak. Therefore, special care should be taken on the pine elements so as not to damage or obscure any detail.

3.2 ERECTION, INSTALLATION, APPLICATION

A. Remove paint from sash, frame, and sill by hand.

1. Carefully sand the surface by hand using 80 to 120 grit sandpaper. Hand-held orbital sanders may be used on large, flat surfaces, but disk or belt-sanders should be avoided. Follow the grain of the wood, and be sure not to remove details or profiles on edging. NOTE: THIS EQUIPMENT SHOULD BE USED BY EXPERIENCED OPERATORS ONLY. For alternative methods in removing paint from wood features, see 06400-07-R and 06400-09-R. CAUTION: PAINT ON OLDER SURFACES MAY CONTAIN LEAD. FOLLOW EPA REGULATIONS AND SAFETY GUIDELINESINCLUDING THOSE REQUIRED FOR THE IDENTIFICATION, REMOVAL AND DISPOSAL OF LEAD-BASED PAINT.
2. Reset all exposed nail heads and treat with a rust- inhibiting primer that is compatible with the chosen coating system. If utilizing an Alkyd-based primer, the product Penatrol may be added to aid in preventing the oxidation of old nail heads.

B. Remove deteriorated glazing compound and glazing. CAUTION: PUTTY ON OLDER SURFACES MAY CONTAIN LEAD OR ASBESTOS. FOLLOW EPA REGULATIONS AND SAFETYGUIDELINES INCLUDING THOSE REQUIRED FOR THE IDENTIFICATION, REMOVAL AND DISPOSAL OF THESE MATERIALS.

C. Brush apply the chosen, compatible wood preservative to all bare wood surfaces.

D. Caulk seam cracks and crevices in the surface with the caulking compound. Depending on the caulk chosen, time may have to be allowed to allow for preservative drying time.

E. Sand smooth the transitions between muntin/mullion and any original glazing that remains.

F. Replace glazing and apply the glazing compound smooth and evenly to the surface.

G. Apply final coats of paint to match the desired color and thickness. If glazing compound is exposed it should also be coated once it has dried.

END OF SECTION

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SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Glass for Mirrors.
B. Glass for Wood Doors.
C. Glass for Windows.
D. Glass for Hollow Metal Doors and Frames.
E. Glass for Borrowed Lights
F. Glass for hazardous locations

1.02 RELATED WORK

A. Section 06 20 00 – Finish Carpentry
B. Section 08 11 13 – Hollow Metal Doors and Frames
C. Section 08 41 13 – Aluminum-Framed Entrances & Store Fronts: Glass
D. Section 08 81 00 – Safety Glazing
E. Section 08 82 00 – Fire Rated Glass

1.03 REFERENCES

A. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
B. ASTM C669 - Glazing Compounds for Back Bedding and Face Glazing of Metal Sash.
C. ASTM C804 Use of Solvent Release Type Sealants.
D. ASTM C864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
E. ASTM C920 -Elastomeric Joint Sealants.
F. ASTM C1036 - Flat Glass.
G. ASTM C1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
H. ASTM C1172 - Laminated Architectural Safety Glass.
I. ASTM E84- Surface Burning Characteristics of Building Materials.
J. ASTM E283 - Test Method For Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
K. ASTM E330 Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
L. ASTM E546 - Test Method For Frost Point of Sealed Insulating Glass Units.
M. ASTM E576 - Test Method For Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
N. ASTM E773 - Test Method for Seal Durability of Sealed Insulating Glass Units.
O. ASTM E774 - Sealed Insulating Glass Units.
P. FGMA Glazing Manual.
Q. FGMA Sealant Manual.
R. Laminators Safety Glass Association - Standards Manual.
S. SIGMA - Sealed Insulated Glass Manufacturers Association.
T. CPSC 16 CFR Part 1201 for Category II materials.

1.04 PERFORMANCE REQUIREMENTS

A. Provide glass and glazing materials for continuity of building enclosure, vapor retarder, and air barrier:

1. In conjunction with materials described in Section 07 92 00.
2. To utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
3. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

B. Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass as measured in accordance with ASTM E330 & ASTM E283.

C. Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.

1.05 QUALITY ASSURANCE

A. Conform to Flat Glass Marketing Association (FGMA) Glazing Manual for glazing installation methods.

1.06 SUBMITTALS

A. Submit product data under provisions of Section 01 33 00.

B. Submit samples under provisions of Section 01 33 00.

C. Submit 12 x 12 inch samples of insulated glass units.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to site under provisions of Section 01 60 00.

B. Store and protect products under provisions of Section 01 60 00.

PART 2 PRODUCTS

2.01 ACCEPTABLE GLASS MANUFACTURERS

A. Pittsburg Plate Glass.

B. Saint-Gobain

C. Pilkington/ Libbey-Owens-Ford

D. Substitutions: Under provisions of Section 01 60 00.

2.02 GLASS MATERIALS

A. Float or Plate Glass: Clear, premium quality windows, 1/4 inch thick minimum at store fronts.

B. Fire Rated Glass: Clear, ¼ inch thick minimum, compliant with ANZI Z97.1 and CPSC 16CFR1201 (Cat. I and II), Rated as per Drawings.

C. Insulated Glass Units at Exterior Window Openings: Double pane units with aluminum double edge seal; both panes of clear glass with Low 'E'; argon gas-filled inter pane space purged with dry hermetic air; total thickness of 5/8 inch.

D. Insulated Glass Units at Aluminum Storefronts: Double pane units with aluminum edge seal; outer pane tinted glass with low E coating on no. 2 face, inner pane of clear glass;

interpane space purged with dry hermetic air; total thickness of one inch.

E. Mirror Glass (Type MR-A): Clear float type with copper & silver coating, organic overcoating, beveled edges, ¼" thick, sizes as shown on the plans.

F. Laminated Safety Glass: Two-ply laminated glass for safety/ burglary resistance; Insulating glass units with laminated glass lite(s). Two sheets of monolithic glass bonded together with a polyvinyl butyral interlayer by heat and pressure.

2.05 ACCEPTABLE GLAZING COMPOUND MANUFACTURERS

A. Dow Chemical.

B. Substitutions: Under provisions of Section 01 60 00.

2.06 GLAZING COMPOUNDS

A. Silicone Sealant: Single component, capable of water immersion without loss of properties; non-bleeding; non-staining; cured Shore A hardness of 15-25; dark brown color.

B. Verify glazing sealant is compatible with glazing accessories as supplied by door and window manufacturer. Notify Architect if non-silicone compatible accessories are supplied and require a field applied glazing sealant.

2.07 GLAZING ACCESSORIES

A. Supply glazing accessories in accordance with window and door manufacturer's standard shop glazing procedures and as shown on the drawings.

B. Supply field installed glazing accessories in accordance with window and door manufacturer's recommendations.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify wall surfaces are clean, free of obstructions, and ready for work of this Section.

B. Verify sashes are clean, free of obstructions, and ready for work of this Section.

C. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses.

3.03 MOUNTING/INSTALLATION OF MIRRORS

A. Apply 'wallboard' adhesive to back of mirror to ensure minimum coverage of 60%.

B. Set mirror to wall surface in locations shown on the drawings.

C. Apply pressure to mirror to ensure proper adhesion to wall surface.

3.04 EXTERIOR DRY METHOD (PREFORMED GLAZING)

A. Cut glazing tape or spline to length; install on glass pane. Seal corners by butting tape and dabbing with butyl sealant.

B. Place setting blocks at 1/4 points.

C. Rest glass on setting blocks and push against fixed stop with sufficient pressure to attain full contact at perimeter of pane.

D. Install removable stops without displacement of glazing spline. Exert pressure for full continuous contact.

E. Trim protruding tape edge.

3.05 EXTERIOR COMBINATION METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and set against permanent stops, 3/16 inch (5 mm) below sightline. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bed of butyl sealant along exterior void ensuring full contact with pane.

C. Place setting blocks at 1/4 points.

D. Rest glass on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane.

E. Install removable stops, spacer strips inserted between glass, and applied stops at 24 inch (600 mm) intervals, 1/4 inch (6 mm) below sightline. Place glazing tape on glass with tape 1/4 inch (6 mm) below sightline.

F. Fill gap between pane and applied stop with sealant to depth equal to bite of frame on pane, but not more than 3/8 inch (9 mm) below sightline.

G. Apply cap bead of sealant along exterior void, to uniform line, flush with sightline. Tool or wipe sealant surface with solvent for smooth appearance.

3.05 EXTERIOR WET METHOD (SEALANT AND SEALANT)

A. Place setting blocks at 1/4 points and install glass pane.

B. Install removable stops with pane centered in space by inserting spacer shims both sides at 24 inch (600 mm) intervals, 1/4 inch (6 mm) below sightline.

C. Fill gap between pane and stops with type sealant to depth equal to bite of frame on pane, but not more than 3/8 inch (9 mm) below sightline.

D. Apply sealant to uniform line, flush with sightline. Tool or wipe sealant surface with solvent for smooth appearance.

3.06 INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sightline.

B. Place setting blocks at 1/4 points.

C. Rest glass on setting blocks and push against tape for full contact at perimeter of pane.

D. Place glazing tape on free perimeter of pane in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.07 INTERIOR COMBINATION METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch (1.6 mm) above sightline.

B. Place setting blocks at 1/4 points.

C. Rest glass on setting blocks and push against tape to ensure full contact at perimeter of pane.

D. Install removable stops, spacer shims inserted between glass, and applied stops at 24-inch (600 mm) intervals, 1/4 inch (6 mm) below sightline.

E. Fill gap between pane and applied stop with sealant to depth equal to bite of frame on pane to uniform and level line.

F. Trim protruding tape edge.

3.08 INTERIOR WET METHOD (COMPOUND AND COMPOUND)

A. Install glass resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch (600 mm) centers, kept 1/4 inch (6 mm) below sightline.

B. Locate and secure glass pane using glaziers' clips.

C. Fill gaps between pane and stops with glazing compound until flush with sightline. Tool surface to straight line.

3.09 SCHEDULE

A. Exterior Storefront, Sidelights, Transoms, Doors: Low E, Insulated, Tempered Glass

B. Exterior & Interior Glazing: Low E, Clear, Insulated, Tempered Glass

C. Window Glazing: Low E, Clear, Insulated, Tempered Glass

D. Exterior Glazing at Bathrooms & Floor/ Ceiling Assemblies: Insulated, Frosted/ Spandrel/ Obscure Glass

E. Exterior Skylight Glazing: Low E, Tempered, Laminated Glass

F. Exterior Glazing with in Stairwells: Insulated, Tempered, laminated Glass

G. Interior Borrowed lights, Sidelights, Transoms, Doors in non-rated assemblies: Tempered Glass

H. Interior Sidelights, Transoms, Doors in Rated Assemblies: Fire Glass

I. Interior Storefront Assemblies: Tempered, Laminated Glass

J. Interior Privacy Glazing in non-rated assemblies: Obscured/ Frosted Tempered Glass

K. Interior Glass Shower Enclosure: Tempered, Laminated, Obscure Glass

L. Surface Mounted Lavatory/ Bathroom Mirrors: Mirror Glass

3.10 CLEANING

A. After installation, mark pane with an "X" by using plastic tape or removable paste.

B. Remove glazing materials from finish surfaces.

C. Remove labels after work is completed.

END OF SECTION

SECTION 09 01 90.61

SURFACE PREPARATION GUIDELINES FOR REPAINTING

PART 1 GENERAL

1.1 SUMMARY

A. This procedure includes guidance on preparing various surface types for repainting. These include metal and wood.

1.2 REFERENCES

A. See "General Project Guidelines" for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:

1. Safety Precautions
2. Historic Structures Precautions
3. Submittals
4. Quality Assurance
5. Delivery, Storage and Handling
6. Project/Site Conditions
7. Sequencing and Scheduling
8. General Protection (Surface and Surrounding)
These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with recommendations from the Regional Historic Preservation Officer (RHPO).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Red Devil, Inc.
Pryor, OK

2.2 MATERIALS

NOTE: Chemical products are sometimes sold under a common name. This usually means that the substance is not as pure as the same chemical sold under its chemical name. The grade of purity of common name substances, however, is usually adequate for stain removal work, and these products should be purchased when available, as they tend to be less expensive. Common names are indicated below by an asterisk (*).

A. Mineral spirits:

1. A petroleum distillate that is used especially as a paint or varnish thinner.
2. Other chemical or common names include Benzine* (not Benzene); Naphtha*; Petroleum spirits*; Solvent naphtha*.

3. Potential Hazards: TOXIC AND FLAMMABLE.

4. Safety Precautions:

   a. AVOID REPEATED OR PROLONGED SKIN CONTACT.

   b. ALWAYS wear rubber gloves when handling mineral spirits

   c. If any chemical is splashed onto the skin, wash immediately with soap and water.

   d. Available from construction specialties distributor, hardware store, paint store, or printer's supply distributor

B. Water-soluble detergent

C. Clean, potable water

D. Sandpaper

E. Trisodium Phosphate (TSP)

NOTE: THIS CHEMICAL IS BANNED IN SOME STATES SUCH AS CALIFORNIA. REGULATORY INFORMATION AS WELL ASALTERNATIVE OR EQUIVALENT CHEMICALS MAY BE REQUESTED FROM THE ENVIRONMENTAL PROTECTION AGENCY (EPA) REGIONAL OFFICE AND/OR THE STATE OFFICE OF ENVIRONMENTAL QUALITY.

1. Strong base-type powdered cleaning material sold under brand names.

2. Other chemical or common names include Sodium Orthophosphate; Tribasic sodium phosphate; Trisodium orthophosphate; TSP*; Phosphate of soda*; (also sold under brand names such as Red Devil).

3. Potential Hazards: CORROSIVE TO FLESH.

4. Available from chemical supply house, grocery store or supermarket or hardware store.

5. Chemical deglosser

6. White *shellac*, or other approved knot sealer

7. Primer

8. Varnish, or other approved sealer

2.3 EQUIPMENT

A. Wood and metal scrapers

B. Wire brushes (non-ferrous bristle)

C. Stiff bristle brushes

PART 3 EXECUTION

3.1 PREPARATION

A. Protection: Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

B. Surface Preparation: Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.2 ERECTION, INSTALLATION AND APPLICATION

A. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

B. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

1. Brick: Clean brick surfaces to be painted for loose or peeling paint, dirt, oil, or other foreign substances with scrapers, stiff bristle brushes and mineral spirits as required. Wash entire surface with a water-soluble detergent and rinse thoroughly with clean water to remove cleaner residue and soil.

2. Ornamental Metal: Clean ornamental metal surfaces to be painted of dirt, oil or other foreign substances with scrapers and solvent cleaners as required. Remove loose or peeling paint by gently wire brushing surfaces. Sandpaper smooth any rough edges created by removal of peeling or loose paint to create an even plane across surface.

3. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

    A. Touch-up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type shop primer.

    B. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum-based solvent.

4. New Wood:

    A. Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

B. Prime, stain or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, and paneling.

C. When transparent finish is required, use spar varnish for back priming.

D. Back prime paneling on interior partitions only where masonry, plaster or other wet wall construction occurs on backside.

E. Seal tops, bottoms, and cut-outs of unprimed wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job

5. Existing Wood:

A. Scrape existing wood surfaces to be painted with a flat blade scraper to remove all peeling or blistering paint finish. Sand surface to a smooth finish, flush with contiguous surfaces. To ensure bonding of new paint material, clean surfaces free of dirt, oil, dust or other foreign substances with trisodium phosphate (TSP) cleaning solution. Rinse thoroughly with clean water to remove cleaner residue and soil. Lightly sand or treat existing surfaces with a chemical paint bonding agent.

B. Clean existing wood surfaces to receive a clear finish with mineral spirits to remove dirt, oil, or other foreign substances and wipe with a clean cloth. Wipe entire surface with a pre-impregnated tack rag and immediately apply finish.

C. Mix and prepare painting materials in accordance with manufacturer's directions.

D. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

E. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.3 ADJUSTING/CLEANING

A. During progress of work, remove from site discarded materials, rubbish, cans and rags at end of each work day.

B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.4 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to RHPO.

B. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END OF SECTION

SECTION 09 01 90.62

SUPPLEMENTAL GUIDELINES FOR REMOVING PAINT

PART 1 GENERAL

1.1 PREFACE

THIS STANDARD IDENTIFIES THE CAUSES OF PAINT FAILURE ON WOOD SURFACES AND PROVIDES BASIC GUIDELINES FOR DECIDING TO WHAT EXTENT DETERIORATED PAINT LAYERS SHOULD BE REMOVED. THIS PROCEDURE SHOULD BE USED IN CONJUNCTION WITH "CHEMICALLY REMOVING PAINT FROM WOOD FEATURES", AND "REMOVING PAINT FROM WOOD FEATURES USING THERMAL METHODS".

1.2 SUMMARY

A. Exterior surfaces are painted both for aesthetics and for protection. Paint protects the wood substrate from ultraviolet degradation due to sunlight exposure and rotting due to excess moisture.

B. Interior wood surfaces are usually painted for decorative reasons rather than for protection.

C. Causes for premature paint failure:

1. Excess moisture in wood causes the wood to swell, breaking the bond between the wood and the paint.
2. Poor surface preparation interferes with the bond between the new paint layer(s) and the substrate.
3. The wrong type of paint used in the wrong way and/or in the wrong place.

1.3 TYPES OF PAINT FAILURE

A. PEELING/FLAKING:

Paint may peel for a number of reasons:

1. When applied over damp wood, (usually only a problem when water blasting has been used to remove loose paint)
2. If painting was begun too soon after heavy rains.

- NOTE: USE A MOISTURE METER TO DETERMINE THE AMOUNT OF MOISTURE IN THE WOOD. MAXIMUM MOISTURE CONTENT IS 14%.
- When excessive moisture inside the wall migrates to the outside. The moisture may come from poorly vented bathrooms, kitchens, and laundries, or leaky gutters and flashing, or broken plumbing; or lack of an adequate vapor barrier. When applied to a dirty or greasy surface. The paint will not adhere and will cause intercoat peeling. The new paint film will simply peel off leaving the bottom paint layers intact. This is especially a problem:

- under roof eaves and other protected areas not readily washed by rain.
- When sanding it.
- When an incompatible top coat is used.
- When the top coat is applied more than two weeks after the surface was painted with an oil-based primer. A soap-like material forms on the surface of the primer which needs to scrubbed off with detergent and water before the top coat is applied. If the surface is not scrubbed clean, the top coat will peel.

3. If the existing thickness of paint layers has reached or exceeded 16 mils and additional layers of paint have been added. Paint film thickness at 16 mils or more is said to have reached its saturation point. Additional layers of paint cause peeling for a number of reasons:
    - The thick paint layers are less permeable to water vapor. Since the moisture cannot evaporate, pressure builds up behind the paint and peeling or blisters result.
    - The individual layers of paint can no longer expand and contract at the same rate and the older, more brittle layers fail resulting in peeling and cracking.
4. When exterior wooden elements have exposed end grain. Water absorbed in these areas causes the wood to swell, which loosens the bond between the wood and the paint.
    - Susceptible areas include the ends of clapboard where they meet door and window trim or corner boards, butt and miter joints of clapboard and other trim pieces, and porch floor boards.
5. When water becomes trapped inside exterior hollow wooden elements such as columns or built-up fence newels, and adequate ventilation is not provided. Water vapor trapped inside can condense and settle at the base of the element, creating ideal conditions for rot.
6. When the surface has not been adequately washed. This is especially a problem if latex paint is applied over calcimine paint which is water soluble.
7. When protected areas are not readily washed by rain, causing dirt to accumulate on the surface. The dirt may have a tendency to attract and hold moisture against the building.
    - The prolonged presence of moisture, combined with the lack of sunlight, can cause the top layer of paint to expand and contract more frequently than the lower layers, often resulting in a breaking of the bond between the paint layers and the wood substrate.
    - Protected areas to watch include eaves, soffits, tops of walls, or areas protected by trees and other vegetation.
8. If the species of wood used in construction is not suited dimensionally to provide the least amount of stress on the paint film, given the expansion and contraction rates associated with normal changes in relative humidity. For example, edge-grain, or quarter-sawn, softwoods are more dimensionally stable than flat sawn boards, warping and shrinking less. This places less stress on the paint film, thereby reducing the likelihood of cracking and peeling.

B. BLISTERS:

Blisters may occur for several reasons:

1. If the paint was applied in direct sunlight. The paint film forms a skin before the thinners of the paint have had a chance to evaporate and a blister forms. Usually a sound layer of paint is visible when the blister is split open.

2. When paint has reached its saturation point as described above, or when paint has been applied to a wet surface. Usually bare wood is visible when the blister is split open.

3. If a primer containing zinc oxide, or a finish coat containing zinc oxide without a proper prime coat is used. Zinc oxide is hydrophilic, meaning it has a strong affinity for water and will readily absorb moisture.

C. CRAZING AND CRACKING:

Crazing and cracking usually occur:

1. When old, thick layers of paint can no longer expand and contract at the same rate as the wood substrate. Initially, only the top layers are affected. However, as water gets into these fine, hairline cracks, they eventually deepen and widen to form major cracks.

D. ALLIGATORING:

Alligatoring is an advanced stage of cracking where the deteriorated paint film takes on the appearance of alligator skin. It may occur:

1. When a top coat is applied over a glossy paint surface that has not first been roughened to provide a proper "tooth" for the new paint film.

E. WRINKLING:

Wrinkling is when the top layer of paint moves, or dries, while the paint underneath is also still drying, and also still moving, but at a different rate. This may occur:

1. When the top coat is applied too thickly or not fully brushed out, allowing the top of the paint film to dry before the bottom of the film dries.

2. When the second coat is applied before the first coat has had a chance to dry.

3. If the paint is applied in hotter weather than the manufacturer recommends. High temperatures cause the top of the paint film to dry too quickly, before the bottom of the film has had a chance to dry.

F. MILDEW:

Mildew is likely to occur:

1. On damp paint films.

2. On crazed, cracked or peeling paint surfaces. Paint layers that are crazed and cracked are cracks.

1.4 DECIDING WHEN AND HOW MUCH PAINT TO REMOVE

A. GENERAL:

It is important when making the decision to remove paint to determine why the paint is to be removed, because to do so is a time consuming and expensive job. (If the decision is made to remove all of the paint, samples of the existing paint layers should be taken to document and identify the paint colors used throughout the history of the building. A section of the existing paint film, located in an inconspicuous area, should be left alone and covered to allow for future study.)

- Paint should be removed when it has built up to the point of obscuring decorative details.
- Selective paint removal is also often done to expose a previous decorative finish such as graining or stenciling, or to restore a varnished or shellacked finish.
- The finish color and gloss should be consistent with the original finish treatment. Do not clear finish historic woodwork that was originally painted. Match new paint to historic paint color and gloss level as identified by qualified architectural conservator.

B. PEELING/FLAKING:

- For wholesale peeling and/or paint which has reached its saturation point:
  - Remove all of the paint before repainting.
- For localized paint failure:
  - Remove only the affected layers of paint.
  - Sand the edges of the sound paint to provide a smooth transition between the old and the new.
  - Spot prime the area and repaint as required and as described in procedure "Epoxy Repair For Deterioration And Decay In Wooden Members", "Surface Preparation For Painting Wood" and "General Guidelines for Painting Exterior and Interior Surfaces".

C. BLISTERS

For solvent blisters, or those where sound layers of paint are still visible under the blister:

- Remove only the failed layers of paint. It is usually not necessary to remove paint to the bare wood.
- Spot prime and repaint as required and as described in procedure "Epoxy Repair For Deterioration And Decay In Wooden Members", "Surface Preparation For Painting Wood" and "General Guidelines for Painting Exterior and Interior Surfaces".

For localized water blisters:

- Treat as for solvent blisters above if the surrounding paint is sound.
- For localized water blisters in conjunction with massive peeling of thick layers of paint:
  - Remove all of the paint.

- Prime and repaint as required and as described in procedure "Epoxy Repair For Deterioration And Decay In Wooden Members", "Surface Preparation For Painting Wood" and "General Guidelines for Painting Exterior and Interior Surfaces".

D. CRACKING AND CRAZING

- For surface crazing:
  - Sand the paint film only as necessary to remove the crazed layers of paint.
  - Repainting may or may not be necessary.
- For cracking that reveals bare wood or a dark varnished or shellacked surface:
  - Completely remove all paint.
  - Prime and repaint as required and as described in procedure "Epoxy Repair For Deterioration And Decay In Wooden Members", "Surface Preparation For Painting Wood" and "General Guidelines for Painting Exterior and Interior Surfaces".

E. WRINKLING

For wrinkles in paint surfaces:

- Sand the surface to the next unwrinkled layer.
- Repaint as required and as described in procedure "Epoxy Repair For Deterioration And Decay In Wooden Members", "Surface Preparation For Painting Wood" and "General Guidelines for Painting Exterior and Interior Surfaces".

F. ALLIGATORED

For paint that has alligatored to form deep cracks:

a. Completely remove all of the paint.

Prime and repaint as required and as described in procedure "Epoxy Repair For Deterioration And Decay In Wooden Members", "Surface Preparation For Painting Wood" and "General Guidelines for Painting Exterior and Interior Surfaces".

G. MILDEW

- For mildew growth:
  - Wash with a solution of bleach to kill the mildew. If the surface is also dirty, adding TSP if allowed by applicable law/regulation, or use appropriate substitute cleaner to the bleach solution will aid in the cleaning process.
- For mildew associated with cracks in the paint film or other type of paint deterioration:
  - Treat the paint film as directed above for complete paint removal and repaint as required and as described in procedure "Epoxy Repair For Deterioration And Decay In Wooden

Members", "Surface Preparation For Painting Wood" and "General Guidelines for Painting Exterior and Interior Surfaces".

1.5 PAINT REMOVAL TECHNIQUES

Paint removal is achieved through a variety of means:

- Thermal methods, such as heat plates and heat guns; See procedure 06400-09-R, "Removing Paint from Wood Features Using Thermal Methods" for guidance.
- Abrasive methods, such as by hand or with an orbital sander; See procedure "Surface Preparation For Painting Wood", "Procedures for Painting Wood Features" for guidance.
- Chemical methods; See procedure "Chemically Removing Paint from Wood Features", "Chemically Removing Paint from Wood Features" for guidance.
- Applications of the above methods should be reviewed in accordance with the Secretary of the Interior's "Standards for Rehabilitation Projects."

END OF SECTION

SECTION 09 30 13

CERAMIC TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tile and Accessories:
   1. Mosaics floor.
   2. Trim and Accessories.
   3. Setting Materials.

1.2 RELATED SECTIONS

A.Section 09 21 16 – Gypsum Board Assemblies
B.Section 07 92 00 – Joint Sealants.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A108.1A - Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
   2. ANSI A108.1B - Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
   3. ANSI A108.1C - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar -or- Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
   4. ANSI A108.4 - Specifications for Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.
   5. ANSI A108.5 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
   6. ANSI A108.6 - Specifications for Ceramic Tile Installed with Chemical-Resistant, Water-Cleanable Tile-Setting and -Grouting Epoxy.
   7. ANSI A108.8 - Specifications for Ceramic Tile Installed with Chemical-Resistant Furan Mortar and Grout.
   8. ANSI A108.9 - Specifications for Ceramic Tile Installed with Modified Epoxy Emulsion Mortar/Grout.
   9. ANSI A108.10 - Specifications for Installation of Grout in Tilework.
   10. ANSI A118.1 - Standard Specification for Dry-Set Portland Cement Mortar.
   11. ANSI A118.3 - Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.
   12. ANSI A118.4 - Latex-Portland Cement Mortar.
   13. ANSI A118.5 - Chemical-Resistant Furan Mortar and Grout.
   14. ANSI A118.6 - Standard Ceramic Tile Grouts.
   15. ANSI A118.7 - Polymer Modified Cement Grouts
   16. ANSI A118.8 - Modified Epoxy Emulsion Mortar/Grout.
   17. ANSI A118.9 - Test Methods and Specifications for Cementitious Backer Units
   18. ANSI A118.10 - Load bearing, Bonded, Waterproof Membranes for Thinset Ceramic Tile and Dimensional Stone.
   19. ANSI A118.11 - Exterior Grade Plywood (EGP) Latex-Portland Cement Mortar.
   20. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile.
   21. ANSI A137.1 - Specifications for Ceramic Tile.

B. ASTM International (ASTM):
  1. ASTM C 50 - Standard Practice for Sampling, Sample Preparation, Packaging, and Marking of Lime and Limestone Products.
  2. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.
  3. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.
  4. ASTM C 241 - Standard Test Method For Abrasion Resistance of Stone Subjected to Foot Traffic.
  5. ASTM C 503 - Standard Specification for Marble Dimension Stone.
  6. ASTM C 847 - Standard Specification for Metal Lath.
  7. ASTM C 1028 - Standard Test method for Determining the Static Coefficient of Friction or Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull meter Method.
  8. ASTM D 4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.

C. Tile Council of North America (TCNA): TCA Handbook for Ceramic Tile Installation, 2007.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: Tile on walkway surfaces shall be provided with the following values as determined by testing in conformance with ASTM C 1028.
  1. Level Surfaces: Minimum of 0.6 (Wet).

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
  1. Preparation instructions and recommendations.
  2. Storage and handling requirements and recommendations.
  3. Installation methods.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Selection Samples: Samples of actual tiles for selection.

E. Manufacturer's Certificate:
  1. Certify that products meet or exceed specified requirements.
  2. For each shipment, type and composition of tile provide a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum two years' experience.

B. Single Source Responsibility: Obtain each type and color of tile from a single source. Obtain each type and color of mortar, adhesive and grout from the same source.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging until ready for installation.

B. Protect adhesives and liquid additives from freezing or overheating in accordance with manufacturer's instructions.

C. Store tile and setting materials on elevated platforms, under cover and in a dry location and protect from contamination, dampness, freezing or overheating.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install adhesives in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during tiling and for a minimum of 7 days after completion.

1.9 EXTRA MATERIALS

A. Provide for Owner's use a minimum of 2 percent of the primary sizes and colors of tile specified, boxed and clearly labeled.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Daltile Corporation, which is located at: 7834 C.F. Hawn Fwy. P. O. Box 170130; Dallas, TX 75217; Toll Free Tel: 800-933-TILE; Tel: 214-398-1411; Fax: 214-309-4584; Email: lucia.franco@daltile.com; Web: www.daltile.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 TILE

A. Daltile, Mosaics, Vintage Hex.
1. Color: To Match Existing
2. Thickness: 1/4”
3. Size: 1.5”
4. Finish: Matte
5. Shade Variation: V4: Random
6. Water Absorption: ASTM C373 Result: < 0.5
7. Breaking Strength: ASTM C648 Result: > 250 lbs.
8. Scratch Hardness: ASTM MOHS Result: 4
9. Chemical Resistance: ASTM C650 Result: Resistant

B. General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types indicated on the Drawings and identified in the Schedule at the end of this Section. Tile shall also be provided in accordance with the following:
1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.
3. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed

tile surfaces.

2.3 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, stainless steel, brass, etc, style and dimensions to suit application, for setting using tile mortar or adhesive; use in the following locations:
   1. Open edges of floor tile.
   2. Transition between floor finishes of different heights.
   3. Thresholds at door openings.
   4. Expansion and control joints, floor and wall.

B. Stone Thresholds: Provide stone thresholds uniform in color and finish and fabricated as follows:
   1. Material:
      a. Marble, complying with ASTM C 503 for exterior use and with a minimum abrasive hardness of 10 when tested in accordance with ASTM C 241.
   2. Color/Finish: Color to be selected by Architect.
   3. Size:
      a. Fabricate full width of wall or frame opening; 1/2 inch (12 mm) thick; beveled one long edge with radiused corners on top side; without holes, cracks, or open seams.

2.4 SETTING MATERIALS

A. Epoxy Adhesive: ANSI A118.3, thinset bond type.
B. Epoxy Grout: ANSI A118.8, 100 percent solids epoxy grout; color as selected.
C. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced with 2 inch (50 mm) wide coated glass fiber tape for joints and corners:
   1. Thickness: 5/8 inch (16 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that sub-floor surfaces are dust-free, and free of substances which would impair bonding of setting materials to sub-floor surfaces, and are smooth and flat within tolerances specified in ANSI A137.1.
B. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
C. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Protect surrounding work from damage.
B. Remove any curing compounds or other contaminates.
C. Vacuum clean surfaces and damp clean.
D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
E. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.
F. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.3 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCA Handbook recommendations.

B. Lay tile to pattern indicated. Arrange pattern so that a full tile or joint is centered on each wall and that no tile less than 1/2 width is used. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

K. Allow tile to set for a minimum of 48 hours prior to grouting.

L. Grout tile joints. Use standard grout unless otherwise indicated.

M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCA Handbook Method F113, dry-set or latex-portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, install in accordance with TCA Handbook Method F122, with latex-portland cement grout.
   2. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F131.

B. Existing hardwood flooring:
   1. Salvage existing hardwood flooring and turn over to Owner for storage.
   2. Install cementitious Backer Board.
   3. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F143.

3.5 CLEANING

A. Clean tile and grout surfaces.

3.6 PROTECTION OF FINISHED WORK

A. Do not permit traffic over finished floor surface for 72 hours after installation.

B. Cover floors with kraft paper and protect from dirt and residue from other trades.

C. Where floor will be exposed for prolonged periods cover with plywood or other similar type walkways

3.7 SCHEDULE

A. Katherine Seymour Day House: Daltile, Vintage Hex, Relic Umber.

B. Visitor Center: Daltile, Vintage Hex, Artifact Gray.

END OF SECTION

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SECTION 09 91 00

GENERAL GUIDELINES FOR PAINTING

PART 1 GENERAL

1.1 SUMMARY

A. This procedure includes general guidelines for painting and finishing interior and exterior surfaces. General descriptions pertaining to surface preparation, priming and application of finish coats are also provided herein, where called for, should be used along with shop priming and surface treatment specified in other procedures.

B. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically shown not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the contracting officer will select from standard colors or finishes available.

C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces (except as may be specified in other repair procedures) and operating parts. Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. For guidance on surface preparation, see the following (references are to GSA Technical Documents):

1. For wood, see 06300-02-R.
2. For iron and steel, see 05010-05-R.

E. For general information on primers and paints, see the following:

1. For wood, see 06300-01-S.
2. For iron and steel, see 05010-13-S.

F. For guidance on paint removal, see the following:

1. For wood, see 06400-07-R, 06400-02-S, 06400-09-R.
2. For iron and steel, see 05010-05-R, 05010-16-R and 05010-17-R.
3. For masonry, see 04211-14-R.

1.2 DEFINITIONS

A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.3 SUBMITTALS

A. Product Data: (Submit to the appropriate Cultural Resources Manager (CRM) or designated representative for approval)

1. Provide manufacturers' technical information, label analysis, and application instructions for each material proposed for use.

2. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.

B. Samples: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.

1. Define each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture is achieved.

2. Provide a list of materials and application for each coat of each sample. Label each sample as to location and application.

1.4 QUALITY ASSURANCE

A. Qualifications: Restoration Specialist: Work must be done by a firm having not less than 10 years' successful experience in comparable painting restoration/rehabilitation projects and employing personnel skilled in the processes and operations indicated.

B. Source of Materials: Provide primers and undercoat paint produced by the same manufacturer as the finish coats. Primers and undercoat paints shall be made to be used with the selected finish coat.

C. Regulatory Requirements:

1. Codes and Standards: Comply with all pertinent codes and regulations, including the minimum standards for materials and application as set forth in the Architectural Specifications Manual, latest edition as published by Specification Services, Washington State Council Painting and Decorating Contractors of America (PDCA), 23830 Pacific Hwy. S., Suite 102, Kent, WA 98032, 206-878-6630.

2. Comply with applicable recommendations of the Steel Structures Painting Council (SSPC) and PDCA's Architectural Specifications Manual.

3. Where choice of painting method is to be selected from several options in SSPC and PDCA recommendations, obtain contracting officer's representatives review and approval before start of work.

D. Field Samples: On wall surfaces and other exterior and interior components, duplicate finishes of prepared samples.

1. Provide full-coat finish samples on at least 200 sq. ft. minimum of surface until required sheen, color and texture are obtained.

2. Simulate finished lighting conditions for review of in place work.

3. Final acceptance of colors will be from job-applied samples.

4. The contracting officer's representatives will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.

   a. Apply coatings in this room or surface according to the schedule or as specified.

   b. After finishes are accepted, this room or surface will be used for evaluation of coating systems of a similar nature.

E. Coordination of Work:

1. Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates.

2. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

3. Notify the contracting officer of problems anticipated using the materials specified.

F. Inspections and Tests: Work in this procedure is subject to inspection and testing according to the provisions of the Architectural Specifications Manual, latest edition. Payment for inspection and testing service is responsibility of the contractor. Notify Inspection Agency at least four full working days before starting work. Allow full access to the work and give full cooperation always with the Inspection Agency in the performance of their duties in inspection and testing of the work.

1. The Inspection Agency will make field control tests specified after this for surfaces requiring painting and finishing and shall notify the specifying authority, in writing, of any defects or problems before starting work in this specification, or after failure of, or defects in, the prime coat or substrate provided by other trades. Furnish approved or alternate materials for testing, from the source or job site, upon request of the Inspection Agency.

G. Inspection Agency: Paint testing and inspection shall be done by an independent Inspection Agency acceptable to the specifying authority and as endorsed by specification service.

H. Material Quality:

1. Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturers' product identification will not be acceptable.

2. Federal Specifications establish a minimum quality level for paint materials, except where other product identification is used. Provide written certification from the manufacturer that materials provided meet or exceed these criteria.

3. Products that comply with qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to the contracting officer's representative. Furnish material data and manufacturer's certificate of performance to contracting officer's representative for proposed substitutions.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturers' name and label and the following information:

1. Product name or title of material
2. Product description (generic classification or binder type)
3. Federal Specification number, if applicable
4. Manufacturers' stock number and date of manufacture
5. Contents by volume, for pigment and vehicle constituents
6. Thinning instructions
7. Application instructions
8. Color, name and number

B. Storage and Protection:

1. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F. (7 degrees C.). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

2. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

3. Do not open containers of coatings or components unless for immediate use. Keep containers closed when not in use.

1.6 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

1. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 500 F. (100 C.) and 900 F.(320 C.). Do not apply if, within 24 hours after application, temperature is expected to fall below 400 F. (40 C.).

2. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 450 F. (70 C.) and 950 F. (350 C.).

3. Do not apply paint in snow, rain, fog or mist when the relative humidity exceeds 85%, at temperatures less than 50 F. (30 C.) above the dew point, or to damp or wet surfaces.

4. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during applications and drying periods.

5. Do not apply paint when dust is present. Program surface preparation and painting so that dust and other contaminants from the surface preparation process and other work done will not fall or settle in wet, newly painted surfaces.

6. Do not apply paint to interior surfaces until the area is enclosed. Paint surfaces which will be inaccessible for painting.

7. Protect other work whether to be painted or not against defacement or damage by painting. Use masking materials to protect adjacent surfaces and materials.

8. Comply with manufacturers' instructions for paint curing period temperatures, humidity and time periods.

9. On wood, do not apply paint when the moisture content of the wood exceeds 12% as measured by an electronic moisture meter.

10. Lighting: Work under this section shall not proceed unless adequate lighting is available.

11. Ventilation: Assure that there is adequate ventilation for the type of coating and cleaning materials used. If necessary, consult paint manufacturer for recommendations.

12. Paint pots shall not be cleaned at sinks or other drainage facilities nor shall any debris be allowed to run into drainage lines of the building.

13. All fine arts, furniture and adjacent finishes shall be protected with drop cloths or other suitable methods from paint spatters, dirt or other damage during the progress of the work, and the contractor will be held responsible for any damage to fine arts incident to the work done under the contract.

PART 2 PRODUCTS

2.1 MATERIALS

A. Unless otherwise indicated, furnish scheduled products according to Chapters Five, Six and Seven of referenced Architectural Specifications Manual, including paint, varnish, stain, enamel, lacquer, fillers, and related products for prime, intermediate, and finish coats.

1. Materials not specifically suggested, but required, such as linseed oil, shellac, thinners and the like are to be of quality not less than required by applicable Federal or State Specification Standards.

B. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturer.

C. Color Pigments: Pure, nonfading, applicable types to suit substrates and service suggested.

1. Lead content in pigment, if any, is limited to contain no more than 0.06% lead, as lead metal based on the nonvolatile total (dry-film) of paint by weight.

NOTE: THE USE OF LEAD-BASE PAINTS HAS BEEN RESTRICTED SINCE 1978.

D. Paint may be thinned only when recommended by the manufacturer's printed instructions. Type of thinner and quantity shall be as specified by the manufacturer.

E. Primers

F. Undercoat Materials

G. Interior and Exterior Finish Paint Material

2.2 EQUIPMENT

A. For Brush Application:

1. Natural bristle brushes: Precondition by soaking in raw linseed oil for 24 hours.

B. For Roller Application:

1. Pipe rollers

C. For Mechanical Application:

1. Hot-air spray

2. Cold-air spray (automatic or hand)

3. Electrostatic air spray (powder or fluid)

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which painting will be done for compliance with requirements for application of paint.

B. Do not begin paint application until unsatisfactory conditions have been corrected.

C. Start of surface preparation/painting is the applicator's notice that the surfaces and conditions within a particular area are acceptable to begin work.

3.2 PREPARATION

NOTE: See also surface preparation procedures for specific materials referenced in Part 1 of this procedure.

A. Protection:

1. Do all preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.

2. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection before surface preparation and painting.

a. Remove these items if necessary for complete painting of the items and adjacent surfaces.

b. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

3. Adjacent surfaces shall be protected against spatters, stains, or soiling. Each coat of primer or paint shall be evenly spread without skips, runs, sags, and clogging, and allowed to dry before next coat is applied.

4. Provide ample illumination in areas where painting work is in progress to fully light the work being done.

a. Examine areas and conditions where painting is to be done and correct any defects before beginning paint application.

b. Starting to paint is applicator's notice that surface preparation is acceptable.

B. Surface Preparation: Clean and prepare new surfaces to be painted according to the manufacturer's instructions for each particular substrate condition.

1. Clean surfaces before applying paint or surface treatments.

a. Remove oil and grease before cleaning.

b. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

2. Hand sand between each undercoat and finish coats on smooth surface materials where oil and synthetic resin base paint and varnish systems are scheduled.

a. Use extra-fine sandpaper on painted surfaces.

b. Remove dust from surfaces after sanding with tack cloths.

c. Note any additional requirement for rubbed finishes on architectural woodwork, scheduled with that finish.

C. Materials Preparation: Carefully mix and prepare paint materials according to manufacturers' directions.

1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3. Use only thinners approved by the paint manufacturer, and only within recommended limits.

4. Tinting: Tint each undercoat a lighter shade to ease identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 ERECTION, INSTALLATION, APPLICATION

A. General:

1. Assume all responsibility for paint coats applied over surfaces and undercoats which have not been approved by CRM.

2. Remove paint and apply any additional coats of paint, as directed by CRM, where surface preparation and undercoats have not been approved before finish painting.

3. Provide finish coats that are compatible with primers used.

4. Where different colors meet, provide a clear line of natural juncture.

5. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.

6. Finish doors on tops, bottoms and side edges, the same as the exterior faces.

7. Paint the back sides of access panels, removable or hinged covers to match the exposed surfaces.

   a. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, and similar components are in place.

   b. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.

8. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces.

9. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.

10. Include field prime coats on metalwork in addition to any shop prime coats.

11. Sand lightly between each succeeding enamel and varnish coat.

NOTE: DO NOT PAINT OVER DIRT, RUST, SCALE, GREASE, MOISTURE, SCUFFED SURFACES, OR CONDITIONS DETRIMENTAL TO FORMATION OF A DURABLE SMOOTH PAINT FILM.

B. Scheduling Painting:

1. Apply the first coat to surfaces cleaned, pretreated, or otherwise prepared for painting when practicable after preparation and before subsequent surface deterioration.

2. Allow sufficient time between successive coats to allow proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Apply paint following manufacturers' directions. Use applicators and techniques best suited for substrate and type of material being applied.

NOTE: CLOUDINESS, SPOTTING, HOLIDAYS, LAPS, BRUSH MARKS,RUNS, SAGS, ROPINESS, OR OTHER SURFACE IMPERFECTIONS WILL NOT BE ACCEPTABLE.

1. Methods of Application:

a. Brush application:

1) Brush-out and work brush coats in both directions onto the surfaces in a uniform film.

2) Use brushes best suited for the type of material being applied.

3) Neatly draw all glass and color break lines.

b. Roller application:

1) Roll-out and work roller coats in both directions onto the surfaces in a uniform film.

2) Sleeves used on the rollers to be clean, full clipped pile, or as recommended by paint manufacturer for material and texture required.

3) Use brush at corners, fasteners, irregular surfaces or items, and other like conditions.

c. Mechanical application:

NOTE: USE MECHANICAL METHODS FOR PAINT APPLICATION ONLY WHEN ACCEPTABLE. CONSULT WITH CRM.

1) Spray painting, if permitted, should be accomplished using pressure settings, application technique, spray tip, mesh filter screens, and mesh tip strainer as recommended by the coating manufacturer.

2) Do not double back with spray equipment to build up film thickness of two coats in one pass.

2. Minimum Coating Thickness:

a. Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.

b. The number of coats and film thickness required is the same, despite the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface according to the manufacturer's directions.

3. Prime Coats: PRIME COAT APPLICATION SHOULD MATCH ORIGINAL FINISH APPLICATION.

NOTE: BRUSH APPLY ALL PRIME COATS UNLESS OTHERWISE ALLOWED TO USE ROLLER OR MECHANICAL APPLICATORS.

a. Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material required to be painted or finished and has not been prime coated by others.

b. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.

c. Omit primer on metal surfaces that have been shop-primed and touch up painted.

4. Top Coats: TOP COAT APPLICATION SHOULD MATCH ORIGINAL FINISH APPLICATION.

a. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.

b. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

c. For Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.

d. For Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

e. For Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

5. Completed Work:

a. Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

b. Finish painted surfaces shall be free of clouding due to no coverage of ground coats or surfaces to which applied. Finish coat shall match specified color.

1) Edges adjoining other materials or colors shall be true without overlapping.

2) Each coat shall be applied to ornamental work in a way that will not obscure ornament and texture.

3) Each coat shall be even.

3.4 FIELD QUALITY CONTROL

A. Architect reserves the right to invoke the following test procedure any time and as often as it deems necessary during the period when paint is being applied.

1. GSA may engage the services of an independent testing laboratory to sample the paint material being used. Samples of material delivered to the project will be taken, identified, sealed, and certified in the presence of the contractor.

2. The testing laboratory will do appropriate tests for the following characteristics as required by GSA.

a. Quantitative materials

b. Abrasion resistance

c. Apparent reflectivity

d. Flexibility

e. Washability

f. Absorption

g. Accelerated weathering

h. Dry opacity

i. Accelerated yellowness

j. Recoating

k. Skinning

l. Color retention

m. Alkali and mildew resistance

B. If the test results show that the paint materials do not comply with the specified requirements, stop the painting work, and remove noncomplying paint; repaint surfaces coated with the rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with the specified paint, the two coatings are non-compatible. Use corrective methods as directed.

END OF SECTION

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SECTION 10 14 19

DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Dimensional letters.

B. Related Sections:
   1. Division 1: Administrative, procedural and temporary work requirements.

1.2 REFERENCES

A. Signs and their installation shall comply with applicable provisions of the latest edition of the following standards and with requirements of authorities having jurisdiction:
   1. ADAAG – Americans with Disabilities Act Accessibility Guidelines; US Architectural and Transportation Barriers Compliance Board.
   2. International Code Council/American National Standards Institute A117.1-Standard on Accessible and Usable Buildings Facilities.
   3. National Fire Protection Association 101 Life Safety Code.

1.3 SUBMITTALS

A. Submittals for Review:
   1. Signage schedule in manufacturer's format for verification of text/copy.
   2. Approval drawings showing materials, construction detail, lay-out, copy, size and mounting methods.
   3. Engineering drawings for each sign type.
   4. Full size sample of each type of dimensional letter for verification of materials, color, pattern, overall quality, and for adherence to drawings and requirements indicated.

1.4 QUALIFICATIONS

A. Manufacturer specializing in manufacturing the products specified in this section with minimum five years experience. Obtain signs from one source and a single manufacturer.

1.5 WARRANTY

A. Provide manufacturer's warranty against defects in materials and workmanship for minimum 5 years.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Letters shall be Ethos as manufactured by Takeform, 1.800.528.1398, www.takeform.net or Architect approved equal.

B. Substitutions: Bidder must obtain prior written approval from the Architect and/or Owner to bid alternates or substitutions to the specification.

2.2 LETTER STANDARDS

A. General: Comply with requirements indicated for type, style, colors, finish, letter height, thickness and mounting methods.

2.3 LETTER TYPE – SOLID BRASS

A. Typeface: see drawings.

B. Color and Finish: see drawings.

C. Letter Height: see drawings.

D. Letter Thickness: see drawings.

E. Mounting Method: all fasteners shall be concealed. See drawings for mounting position and method.

PART 3 EXECUTION

3.1 SITE VISITS

A. Site visits – 3 site visits shall be required by the sign contractor:
   1. Prior to submission of bid for site assessment and evaluation.
   2. Post award for the purposes of meeting with Owners and project manager.
   3. Final walk-through and punchlist.

B. Programming – contractor shall perform all programming. Programming shall include location plan, message schedule, and/or plots. All programming materials shall be submitted for approval.

3.2 DELIVERY, STORAGE, PROTECTION

A. Package to prevent damage or deterioration during shipment, handling, storage and installation. Products should remain in original packaging until removal is necessary. Store products in a dry, indoor location.

3.3 EXAMINATION

A. Installer shall examine signs for defects, damage and compliance with specifications. Installation shall not proceed until unsatisfactory conditions are corrected.

3.4 INSTALLATION

A. General: Installation locations shall be in accordance with drawings. Locate signs where indicated using mounting methods in compliance with manufacturer's written instructions:
   1. The manufacturer shall coordinate installation schedules with the Owner and/or Construction Manager.
   2. Installation shall be performed by manufacturer’s personnel trained and certified in manufacturer’s methods and procedures.
   3. The manufacturer shall submit a CAD generated location plan noting the location of all signage and cross referenced to message schedule or plots for architect’s approval.
   4. Manufacturer to provide full scale plots prior to manufacturing to verify size, copy and letter location. Any location, message or mounting issue shall be submitted to architect for review.
   5. Letters shall be level, plumb, and at heights indicated with sign surfaces free from defects.

6. Upon completion of the work, installer shall remove unused or discarded materials, containers and debris from site.

END OF SECTION

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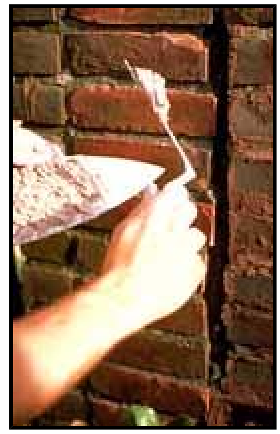
EXHIBIT 1

Preservation Brief 2:
Repointing Historic Masonry

2 Preservation Briefs

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

Repointing Mortar Joints in Historic Masonry Buildings



Robert C. Mack, FAIA, and John P. Speweik

A NOTE TO OUR USERS: The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

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. 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. 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.


Masons practice using lime putty mortar to repair historic marble. Photo: NPS files.

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).

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.


This late 19th century granite has recently been repointed with the joint profile and mortar color carefully matched to the original. Photo: NPS files.

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. 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 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.)

This mortar is the proper consistency for repointing historic brick. Photo: John P. Speweik.

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 carbnate 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.**

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 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 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.

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.

This early 19th century building is being repointed

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 ofthe outer surface to spall off or delaminate. If the mortar does not permitmoisture or moisture vapor to migrate out of the wall and evaporate, theresult will be damage to the masonry units.

with lime mortar. Photo: Travis McDonald.

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.

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.

Caulking was inappropriately used here in place of mortar on the top of the wall. As a result, it has not been durable. Photo: NPS files.

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 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. 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.

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.

Here, a hammer and chisel are being correctly used to prepare a joint for repointing. Photo: John P. Speweik.

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.

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 than 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.


When repairing this stone wall, the mason matched the raised profile of the original tuckpointing. Photo: NPS files.

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 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

A mechanical grinder improperly used to cut out the horizontal joint and incompatible repointing have seriously damaged the 19th century brick. Photo: NPS files.

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 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." For most brick joints, this will require removal of the mortar to a depth of approximately ½ 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

Unskilled repointing has

beyond this minimum depth also should be removed.

negatively impacted the character of this late-19th century building. Photo: NPS files.

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. 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.

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. 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. 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. Although mechanical tools may be safely used 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 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. 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 1½ 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 1/4 inch of mortar, packing it well into the back corners. This application may extend along the wall for several feet. As soon as the mortar has reached thumb-print hardness, another 1/4 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. 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. 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 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.

This 18th century pediment and surrounding wall exhibit distinctively different mortar joints. Photo: NPS files.

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 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 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: Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings, Robert C. Mack, FAIA, and Anne Grimmer, Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior, 2000; 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.*

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.

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. 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. **Tuckpointing** is not true repointing but the application of a raised joint or lime putty joint on top of flush mortar joints. **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.

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

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.

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. 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

National Lime Association
200 N. Glebe Road, Suite 800
Arlington, VA 22203

Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

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Washington, D.C. October, 1998

Home page logo: Soft mortar for repointing. Photo: John P. Speweik.

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Questions

EXHIBIT 2

Preservation Brief 4:
Roofing for Historic Buildings

Preservation Briefs

Some of the web versions of the Preservation Briefs differ somewhat from the printed versions. Many illustrations are new and in color; Captions are simplified and some complex charts are omitted. To order hard copies of the Briefs, see Printed Publications.

PRESERVATION BRIEFS

4

Roofing for Historic Buildings

Sarah M. Sweetser

Decorative roofing feature. Photo: HABS Collection, NPS.

Significance of the Roof return to top ▲

A weather-tight roof is basic in the preservation of a structure, regardless of its age, size, or design. In the system that allows a building to work as a shelter, the roof sheds the rain, shades from the sun, and buffers the weather.

During some periods in the history of architecture, the roof imparts much of the architectural character. It defines the style and contributes to the building's aesthetics. The hipped roofs of Georgian architecture, the turrets of Queen Anne, the Mansard roofs, and the graceful slopes of the Shingle Style and Bungalow designs are examples of the use of roofing as a major design feature.

But no matter how decorative the patterning or how compelling the form, the roof is a highly vulnerable element of a shelter that will inevitably fail. A poor roof will permit the accelerated deterioration of historic building materials—masonry, wood, plaster, paint—and will cause general disintegration of the basic structure. Furthermore, there is an urgency involved in repairing a leaky roof since such repair costs will quickly become prohibitive. Although such action is desirable as soon as a failure is discovered, temporary patching methods should be carefully chosen to prevent inadvertent damage to sound or historic roofing materials and related features. Before any repair work is performed, the historic value of the materials used on the roof should be understood. Then a complete internal and external inspection of the roof should be planned to determine all the causes of failure and to identify the alternatives for repair or replacement of the roofing.

Historic Roofing Materials in America return to top ▲

Clay Tile: European settlers used clay tile for roofing as early as the mid-17th century; many pantiles (S-curved tiles), as well as flat roofing tiles, were used in Jamestown, Virginia. In some cities such as New York and Boston, clay was popularly used as a precaution against such fires as those that engulfed London in 1666 and scorched Boston in 1679.

Repairs on this pantile roof were made with new tiles held in place with metal hangers. Photo: NPS files.

The plain or flat rectangular tiles most commonly used from the 17th through the beginning of the 19th century measured about 10" by 6" by 1/2," and had two holes at one end for a nail or peg fastener. Sometimes mortar was applied between the courses to secure the tiles in a heavy wind.

In the mid-19th century, tile roofs were often replaced by sheet-metal roofs, which were lighter and easier to install and maintain. However, by the turn of the century, the Romanesque Revival and Mission style buildings created a new demand and popularity for this picturesque roofing material.

Slate: Another practice settlers brought to the New World was slate roofing. Evidence of roofing slates have been found also among the ruins of mid-17th century Jamestown. But because of the cost and the time required to obtain the material, which was mostly imported from Wales, the use of slate was initially limited. Even in Philadelphia (the second largest city in the English-speaking world at the time of the Revolution) slates were so rare that "The Slate Roof House" distinctly referred to William Penn's home built late in the 1600s. Sources of native slate were known to exist along the eastern seaboard from Maine to Virginia, but difficulties in inland transportation limited its availability to the cities, and contributed to its expense. Welsh slate continued to be imported until the development of canals and railroads in the mid-19th century made American slate more accessible and economical.

Slate was popular for its durability, fireproof qualities, and aesthetic potential. Because slate was available in different colors (red, green, purple, and blue-gray), it was an effective material for decorative patterns on many 19th century roofs (Gothic and Mansard styles). Slate continued to be used well into the 20th century, notably on many Tudor revival style buildings of the 1920s.

Shingles: Wood shingles were popular throughout the country in all periods of building history. The size and shape of the shingles as well as the detailing of the shingle roof differed according to regional craft practices. People within particular regions developed preferences for the local species of wood that most suited their purposes. In New England and the Delaware Valley, white pine was frequently used: in the South, cypress and oak; in the far west, red cedar or redwood. Sometimes a protective coating was applied to increase the durability of the shingle such as a mixture of brick dust and fish oil, or a paint made of red iron oxide and linseed oil.

Replacement of particular historic details is important to the individual historic character of a roof, such as this rounded butt wood shingle roof. In the restoration, the drainage around a dormer was improved by the addition of carefully concealed modern metal flashing. Photo: NPS files.

Commonly in urban areas, wooden roofs were replaced with more fire resistant materials, but in rural areas this was not a major concern. On many Victorian country houses, the practice of wood shingling survived the technological advances of metal roofing in the 19th century, and near the turn of the century enjoyed a full revival in its namesake, the Shingle Style. Colonial revival and the Bungalow styles in the 20th century assured wood shingles a place as one of the most fashionable, domestic roofing materials.

Metal: Metal roofing in America is principally a 19th-century phenomenon. Before then the only metals commonly used were lead and copper. For example, a lead roof covered "Rosewell," one of the grandest mansions in 18th century Virginia. But more often, lead was used for protective flashing. Lead, as well as copper, covered roof surfaces where wood, tile, or slate shingles were inappropriate because of the roof's pitch or shape.

Galvanized sheet-metal shingles imitating the appearance of pantiles remained popular from the second half of the 19th century into the 20th century. Photo: NPS files.

Copper with standing seams covered some of the more notable early American roofs including that of Christ Church (1727–1744) in Philadelphia. Flat-seamed copper was used on many domes and cupolas. The copper sheets were imported from England until the end of the 18th century when facilities for rolling sheet metal were developed in America.

Sheet iron was first known to have been manufactured here by the Revolutionary War financier, Robert Morris, who had a rolling mill near Trenton, New Jersey. At his mill Morris produced the roof of his own Philadelphia mansion, which he started in 1794. The architect

Benjamin H. Latrobe used sheet iron to replace the roof on Princeton's "Nassau Hall," which had been gutted by fire in 1802.

The method for corrugating iron was originally patented in England in 1829. Corrugating stiffened the sheets, and allowed greater span over a lighter framework, as well as reduced installation time and labor. In 1834 the American architect William Strickland proposed corrugated iron to cover his design for the market place in Philadelphia.

Galvanizing with zinc to protect the base metal from rust was developed in France in 1837. By the 1850s the material was used on post offices and customhouses, as well as on train sheds and factories. In 1857 one of the first metal roofs in the South was installed on the U.S. Mint in New Orleans. The Mint was thereby "fireproofed" with a 20-gauge galvanized, corrugated iron roof on iron trusses.

Tin-plate iron, commonly called "tin roofing," was used extensively in Canada in the 18th century, but it was not as common in the United States until later. Thomas Jefferson was an early advocate of tin roofing, and he installed a standing-seam tin roof on "Monticello" (ca. 1770–1802). The Arch Street Meetinghouse (1804) in Philadelphia had tin shingles laid in a herringbone pattern on a "piazza" roof.

Tin shingles, commonly embossed to imitate wod or tile, or with a decorative design, were popular as an inexpensive, textured roofing material. Photo: NPS files.

However, once rolling mills were established in this country, the low cost, light weight, and low maintenance of tin plate made it the most common roofing material. Embossed tin shingles, whose surfaces created interesting patterns, were popular throughout the country in the late 19th century. Tin roofs were kept well-painted, usually red; or, as the architect A. J. Davis suggested, in a color to imitate the green patina of copper.

Terne plate differed from tin plate in that the iron was dipped in an alloy of lead and tin, giving it a duller finish. Historic, as well as modern, documentation often confuses the two, so much that it is difficult to determine how often actual "terne" was used.

Zinc came into use in the 1820s, at the same time tin plate was becoming popular. Although a less expensive substitute for lead, its advantages were controversial, and it was never widely used in this country.

Other Materials: Asphalt shingles and roll roofing were used in the 1890s. Many roofs of asbestos, aluminum, stainless steel, galvanized steel, and lead-coated copper may soon have historic values as well. Awareness of these and other traditions of roofing materials and their detailing will contribute to more sensitive preservation treatments.

Locating the Problem return to top ▲

Failures of Surface Materials

When trouble occurs, it is important to contact a professional, either an architect, a reputable roofing contractor, or a craftsman familiar with the inherent characteristics of the particular historic roofing system involved. These professionals may be able to advise on immediate patching procedures and help plan more permanent repairs. A thorough examination of the roof should start with an appraisal of the existing condition and quality of the roofing material itself. Particular attention should be given to any southern slope because year-round exposure to direct sun may cause it to break down first.

Wood: Some historic roofing materials have limited life expectancies because of normal organic decay and "wear." For example, the flat surfaces of wood shingles erode from exposure to rain and ultraviolet rays. Some species are more hardy than others, and heartwood, for example, is stronger and more durable than sapwood.

Ideally, shingles are split with the grain perpendicular to the surface. This is because if shingles are sawn across the grain, moisture may enter the grain and cause the wood to deteriorate. Prolonged moisture on or in the wood allows moss or fungi to grow, which will further hold the moisture and cause rot.

Metal: Of the inorganic roofing materials used on historic buildings, the most common are perhaps the sheet metals: lead, copper, zinc, tin plate, terne plate, and galvanized iron. In varying degrees each of these sheet metals are likely to deteriorate from chemical action by pitting or streaking. This can be caused by airborne pollutants; acid rainwater; acids from lichen or moss; alkalis found in lime mortars or portland cement, which might be on adjoining features and washes down on the roof surface; or tannic acids from adjacent wood sheathings or shingles made of red cedar or oak.

Corrosion from "galvanic action" occurs when dissimilar metals, such as copper and iron, are used in direct contact. Corrosion may also occur even though the metals are physically separated; one of the metals will react chemically against the other in the presence of an electrolyte such as rainwater. In roofing, this situation might occur when either a copper roof is decorated with iron cresting, or when steel nails are used in copper sheets. In some instances the corrosion can be prevented by inserting a plastic

Temporary stabilization or "mothballing" with materials, such as plywood and building paper, can protect the roof of a project until it can be properly repaired or replaced. Photo: NPS files.

insulator between the dissimilar materials. Ideally, the fasteners should be a metal sympathetic to those involved.

Iron rusts unless it is well-painted or plated. Historically this problem was avoided by use of tin plating or galvanizing. But this method is durable only as long as the coating remains intact. Once the plating is worn or damaged, the exposed iron will rust. Therefore, any iron-based roofing material needs to be undercoated, and its surface needs to be kept well-painted to prevent corrosion.

One cause of sheet metal deterioration is fatigue. Depending upon the size and the gauge of the metal sheets, wear and metal failure can occur at the joints or at any protrusions in the sheathing as a result from the metal's alternating movement to thermal changes. Lead will tear because of "creep," or the gravitational stress that causes the material to move down the roof slope.

Slate: Perhaps the most durable roofing materials are slate and tile. Seemingly indestructible, both vary in quality. Some slates are hard and tough without being brittle. Soft slates are more subject to erosion and to attack by airborne and rainwater chemicals, which cause the slates to wear at nail holes, to delaminate, or to break. In winter, slate is very susceptible to breakage by ice, or ice dams.

Tile: Tiles will weather well, but tend to crack or break if hit, as by tree branches, or if they are walked on improperly. Like slates, tiles cannot support much weight. Low quality tiles that have been insufficiently fired during manufacture, will craze and spall under the effects of freeze and thaw cycles on their porous surfaces.

Failures of Support Systems

Once the condition of the roofing material has been determined, the related features and support systems should be examined on the exterior and on the interior of the roof. The gutters and downspouts need periodic cleaning and maintenance since a variety of debris fill them, causing water to back up and seep under roofing units. Water will eventually cause fasteners, sheathing, and roofing structure to deteriorate. During winter, the daily freeze-thaw cycles can cause ice floes to develop under the roof surface. The pressure from these ice floes will dislodge the roofing material, especially slates, shingles, or tiles. Moreover, the buildup of ice dams above the gutters can trap enough moisture to rot the sheathing or the structural members.

Many large public buildings have built-in gutters set within the perimeter of the roof. The downspouts for these gutters may run within the walls of the building, or drainage may be through the roof surface or through a parapet to exterior downspouts. These systems can be effective if properly maintained; however, if the roof slope is inadequate for good runoff, or if the traps are allowed to clog, rainwater will form pools on the roof surface. Interior downspouts can collect debris and thus back up, perhaps leaking water into the surrounding walls. Exterior downspouts may fill with water, which in cold weather may freeze and crack the pipes. Conduits from the built-in gutter to the exterior downspout may also leak water into the surrounding roof structure or walls.

Failure of the flashing system is usually a major cause of roof deterioration. Flashing should be carefully inspected for failure caused by either poor workmanship, thermal stress, or metal deterioration (both of flashing material itself and of the fasteners). With many roofing materials, the replacement of flashing on an existing roof is a major operation, which may require taking up large sections of the roof surface. Therefore, the installation of top quality flashing material on a new or replaced roof should be a primary consideration. ***Remember, some roofing and flashing materials are not compatible***.

Roof fasteners and clips should also be made of a material compatible with all other materials used, or coated to prevent rust. For example, the tannic acid in oak will corrode iron nails. Some roofs such as slate and sheet metals may fail if nailed too rigidly.

If the roof structure appears sound and nothing indicates recent movement, the area to be examined most closely is the roof substrate—the sheathing or the battens. The danger spots would be near the roof plates, under any exterior patches, at the intersections of the roof planes, or at vertical surfaces such as dormers. Water penetration, indicating a breach in the roofing surface or flashing, should be readily apparent, usually as a damp spot or stain. Probing with a small pen knife may reveal any rot which may indicate previously undetected damage to the roofing membrane. Insect infestation evident by small exit holes and frass (a sawdustlike debris) should also be noted. Condensation on the underside of the roofing is undesirable and indicates improper ventilation. Moisture will have an adverse effect on any roofing material; a good roof stays dry inside and out.

Because of the roof's visibility, the slate detailing around the dormers is important to the character of this structure. Photo: NPS files.

Repair or Replace return to top ▲

Understanding potential weaknesses of roofing material also requires knowledge of repair difficulties. Individual slates can be replaced normally without major disruption to the rest of the roof, but replacing flashing on a slate roof can require substantial removal of surrounding slates. If it is the substrate or a support material that has deteriorated, many surface materials such as slate or tile can be reused if handled care fully during the repair. Such problems should be evaluated at the outset of any project to determine if the roof can be effectively patched, or if it should be completely replaced.

Will the repairs be effective? Maintenance costs tend to multiply once trouble starts. As the cost of labor escalates, repeated repairs could soon equal the cost of a new roof.

The more durable the surface is initially, the easier it will be to maintain. Some roofing materials such as slate are expensive to install, but if top quality slate and flashing are used, it will last 40–60 years with minimal maintenance. Although the installation cost of the roof will be high, low maintenance needs will make the lifetime cost of the roof less expensive.

Historical Research return to top ▲

In a restoration project, research of documents and physical investigation of the building usually will establish the roof's history. Documentary research should include any original plans or building specifications, early insurance surveys, newspaper descriptions, or the personal papers and files of people who owned or were involved in the history of the building. Old photographs of the building might provide evidence of missing details.

Along with a thorough understanding of any written history of the building, a physical investigation of the roofing and its structure may reveal information about the roof's construction history. Starting with an overall impression of the structure, are there any changes in the roof slope, its configuration, or roofing materials? Perhaps there are obvious patches or changes in patterning of exterior brickwork where a gable roof was changed to a gambrel, or where a whole upper story was added. Perhaps there are obvious stylistic changes in the roof line, dormers, or ornamentation. These observations could help one understand any important alteration, and could help establish the direction of further investigation.

Because most roofs are physically out of the range of careful scrutiny, the "principle of least effort" has probably limited the extent and quality of previous patching or replacing, and usually considerable evidence of an earlier roof surface remains. Sometimes the older roof will be found as an underlayment of the current exposed roof. Original roofing may still be intact in awkward places under later features on a roof. Often if there is any unfinished attic space, remnants of roofing may have been dropped and left when the roof was being built or repaired. If the configuration of the roof has been changed, some of the original material might still be in place under the existing roof. Sometimes whole sections of the roof and roof framing will have been left intact under the higher roof. The profile and/or flashing of the earlier roof may be apparent on the interior of the walls at the level of the alteration. If the sheathing or lathing appears to have survived changes in the roofing surface, they may contain evidence of the roofing systems. These may appear either as dirt marks, which provide "shadows" of a roofing material, or as nails broken or driven down into the wood,.rather than pulled out during previous alterations or repairs. Wooden headers in the roof framing may indicate that earlier chimneys or skylights have been removed. Any metal ornamentation that might have existed may be indicated by anchors or unusual markings along the ridge or at other edges of the roof. This primary evidence is essential for a full understanding of the roof's history.

Caution should be taken in dating early "fabric" on the evidence of a single item, as recycling of materials is not a mid-20th century innovation. Carpenters have been reusing materials, sheathing, and framing members in the interest of economy for centuries. Therefore, any analysis of the materials found, such as nails or sawmarks on the wood, requires an accurate knowledge of the history of local building practices before any final conclusion can be accurately reached. It is helpful to establish a sequence of construction history for the roof and roofing materials; any historic fabric or pertinent evidence in the roof should be photographed, measured, and recorded for future reference.

During the repair work, useful evidence might unexpectedly appear. It is essential that records be kept of any type of work on a historic building, before, during, and after the project. Photographs are generally the easiest and fastest method, and should include overall views and details at the gutters, flashing, dormers, chimneys, valleys, ridges, and eaves. All photographs should be immediately labeled to insure accurate identification at a later date. Any patterning or design on the roofing deserves particular attention. For example, slate roofs are often decorative and have subtle changes in size, color, and texture, such as a gradually decreasing coursing length from the eave to the peak. If not carefully noted before a project begins, there may be problems in replacing the surface. The standard reference for this phase of the work is Recording Historic Buildings, compiled by Harley J. McKee for the Historic American Buildings Survey, National Park Service, Washington, D.C., 1970.

Replacing the Historic Roofing Material return to top ▲

Professional advice will be needed to assess the various aspects of replacing a historic roof. With some exceptions, most historic roofing materials are available today. If not, an architect or preservation group who has previously worked with the same type material may be able to recommend suppliers. Special roofing materials, such as tile or embossed metal shingles, can be produced by manufacturers of related products that are commonly used elsewhere, either on the exterior or interior of a structure. With some creative thinking and research, the historic materials usually can be found.

Good design and quality materials for the roof surface, fastenings, and flashing minimize failures. Photo: NPS files.

Craft Practices: Determining the craft practices used in the installation of a historic roof is another major concern in roof restoration. Early builders took great pride in their work, and experience has shown that the " rustic" or irregular designs commercially labeled "Early American" are a 20th-century invention. For example, historically, wood shingles underwent several distinct operations in their manufacture including splitting by hand, and smoothing the surface with a draw knife. In modern nomenclature, the same item would be a "tapersplit" shingle which has been dressed. Unfortunately, the rustic appearance of today's commercially available "handsplit" and re-sawn shingle bears no resemblance to the handmade roofing materials used on early American buildings.

Early craftsmen worked with a great deal of common sense; they understood their materials. For example they knew that wood shingles should be relatively narrow; shingles much wider than about 6" would split when walked on, or they may curl or crack from varying temperature and moisture. It is important to understand these aspects of craftsmanship, remembering that people wanted their roofs to be weather-tight and to last a long time. The recent use of "mother goose" shingles on historic structures is a gross underestimation of the early craftsman's skills.

Supervision: Finding a modern craftsman to reproduce historic details may take some effort. It may even involve some special instruction to raise his understanding of certain historic craft practices. At the same time, it may be pointless (and expensive) to follow historic craft practices in any construction that will not be visible on the finished product. But if the roofing details are readily visible, their appearance should be based on architectural evidence or on historic prototypes. For instance, the spacing of the seams on a standing-seam metal roof will affect the building's overall scale and should therefore match the original dimensions of the seams.

Many older roofing practices are no longer performed because of modern improvements. Research and review of specific detailing in the roof with the contractor before beginning the project is highly recommended. For example, one early craft practice was to finish the ridge of a wood shingle roof with a roof "comb"—that is, the top course of one slope of the roof was extended uniformly beyond the peak to shield the ridge, and to provide some weather protection for the raw horizontal edges of the shingles on the other slope. If the "comb" is known to have been the correct detail, it should be used. Though this method leaves the top course vulnerable to the weather, a disguised strip of flashing will strengthen this weak point.

Detail drawings or a sample mockup will help ensure that the contractor or craftsman understands the scope and special requirements of the project. It should never be assumed that the modern carpenter, slater, sheet metal worker, or roofer will know all the historic details. Supervision is as important as any other stage of the process.

Alternative Materials return to top ▲

The use of the historic roofing material on a structure may be restricted by building codes or by the availability of the materials, in which case an appropriate alternative will have to be found.

Some municipal building codes allow variances for roofing materials in historic districts. In other instances, individual variances may be obtained. Most modern heating and cooking is fueled by gas, electricity, or oil--none of which emit the hot embers that historically have been the cause of roof fires. Where wood burning fireplaces or stoves are used, spark arrestor screens at the top of the chimneys help to prevent flaming material from escaping, thus reducing the number of fires that start at the roof. In most states, insurance rates have been equalized to reflect revised considerations for the risks involved with various roofing materials.

In a rehabilitation project, there may be valid reasons for replacing the roof with a material other than the original. The historic roofing may no longer be available, or the cost of obtaining specially fabricated materials may be prohibitive. But the decision to use an alternative material should be weighed carefully against the primary concern to keep the historic character of the building. If the roof is flat and is not visible from any elevation of the building, and if there are advantages to substituting a modern built-up composition roof for what might have been a flat metal roof, then it may make better economic and construction sense to use a modern roofing method. But if the roof is readily visible, the alternative material should match as closely as possible the scale, texture, and coloration of the historic roofing material.

Asphalt shingles or ceramic tiles are common substitute materials intended to duplicate the appearance of wood shingles, slates, or tiles. Fire-retardant, treated wood shingles are currently available. The treated wood tends, however, to be brittle, and may require extra care (and expense) to install. In some instances, shingles laid with an interlay of fire-retardant building paper may be an acceptable alternative.

Lead-coated copper, terne-coated steel, and aluminum/ zinc-coated steel can successfully replace tin, terne plate, zinc, or lead. Copper-coated steel is a less expensive (and less durable) substitute for sheet copper.

The search for alternative roofing materials is not new. As early as the 18th century, fear of fire caused many wood shingle or board roofs to be replaced by sheet metal or clay tile. Some historic roofs were failures from the start, based on overambitious and naive use of materials as they were first developed. Research on a structure may reveal that an inadequately designed or a highly combustible roof was replaced early in its history, and therefore restoration of a later roof material would have a valid precedent. In some cities, the substitution of sheet metal on early row houses occurred as soon as the rolled material became available.

Cost and ease of maintenance may dictate the substitution of a material wholly different in appearance from the original. The practical problems (wind, weather, and roof pitch) should be weighed against the historical consideration of scale, texture, and color. Sometimes the effect of the alternative material will be minimal. But on roofs with a high degree of visibility and patterning or texture, the substitution may seriously alter the architectural character of the building.

Temporary Stabilization return to top ▲

It may be necessary to carry out an immediate and temporary stabilization to prevent further deterioration until research can determine how the roof should be restored or rehabilitated, or until funding can be provided to do a proper job. A simple covering of exterior plywood or roll roofing might provide adequate protection, but any temporary covering should be applied with caution. One should be careful not to overload the roof structure, or to damage or destroy historic evidence or fabric that might be incorporated into a new roof at a later date. In this sense, repairs with caulking or bituminous patching compounds should be recognized as potentially harmful, since they are difficult to remove, and at their best, are very temporary.

Precautions return to top ▲

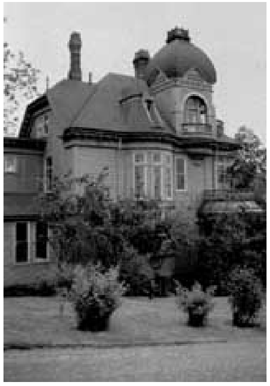
The architect or contractor should warn the owner of any precautions to be taken against the specific hazards in installing the roofing material. Soldering of sheet metals, for instance, can be a fire hazard, either from the open flame or from overheating and undetected smoldering of the wooden substrate materials.

Thought should be given to the design and placement of any modern roof appurtenances such as plumbing stacks, air vents, or TV antennas. Consideration should begin with the placement of modern plumbing on the interior of the building, otherwise a series of vent stacks may pierce the roof membrane at various spots creating maintenance problems as well as aesthetic ones. Air handling units placed in the attic space will require vents which, in turn, require sensitive design. Incorporating these in unused chimneys has been very successful in the past.

Whenever gutters and downspouts are needed that were not on the building historically, the additions should be made as unobtrusively as possible, perhaps by painting them out with a color compatible with the nearby wall or trim.

Maintenance return to top ▲

Although a new roof can be an object of beauty, it will not be protective for long without proper maintenance. At least twice a year, the roof should be inspected against a checklist. All changes should be recorded and reported. Guidelines should be established for any foot traffic that may be required for the maintenance of the roof. Many roofing materials should not be walked on at all. For some—slate, asbestos, and clay tile—a self-supporting ladder might be hung over the ridge of the roof, or planks might be spanned across the roof surface. Such items should be specifically designed and kept in a storage space accessible to the roof. If exterior work ever requires hanging scaffolding, use caution to insure that the anchors do not penetrate, break, or wear the roofing surface, gutters, or flashing.



Special problems inherent in the design of an elaborate historic roof can be controlled through regular maintenance. The shape and detailing are essential elements of the building's historic character,

Any roofing system should be recognized as a membrane that is designed to be self-sustaining, but that can be easily damaged by intrusions such as pedestrian traffic or fallen tree branches. Certain items should be checked at specific times. For example, gutters tend to accumulate leaves and debris during the spring and fall and after heavy rain. Hidden gutter screening both at downspouts and over the full length of the gutter could help keep them clean. The surface material would require checking after a storm as well. Periodic checking of the underside of the roof from the attic after a storm or winter freezing may give early warning of any leaks. Generally, damage from water or ice is less likely on a roof that has good flashing on the outside and is well ventilated and insulated on the inside. Specific instructions for the maintenance of the different roof materials should be available from the architect or contractor.

and should not be modified, despite the use of alternative surface materials. Photo: NPS files.

Summary and References return to top ▲

The essential ingredients for replacing and maintaining a historic roof are:

- **Understanding the historic character** of the building and being sympathetic to it.
- **Careful examination and recording** of the existing roof and any evidence of earlier roofs.
- **Consideration of the historic craftsmanship** and detailing and implementing them in the renewal wherever visible.
- **Supervision of the roofers** or maintenance personnel to assure preservation of historic fabric and proper understanding of the scope and detailing of the project.
- **Consideration of alternative materials** where the original cannot be used.
- **Cyclical maintenance** program to assure that the staff understands how to take care of the roof and of the particular trouble spots to safeguard.

With these points in mind, it will be possible to preserve the architectural character and maintain the physical integrity of the roofing on a historic building.

Acknowledgements

This Preservation Brief was written by **Sarah M Sweetser**, Architectural Historian, Technical Preservation Services Division. Much of the technical information was based upon an unpublished report prepared under contract for this office by John G. and Diana S. Waite. Some of the historical information was from Charles E. Peterson, FAIA, "American Notes," Journal of the Society of Architectural Historians. The illustrations for this brief not specifically credited are from the files of the Technical Preservation Services Division.

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. Technical Preservation Services (TPS), National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments for a broad public.

February 1978

Reading List return to top ▲

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Briggs, Martin S. *A Short History of the Building Crafts*. London: Oxford University Press, 1925. (Descriptions of historic roofing materials)

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National Slate Association. *Slate Roofs*. Reprint of 1926 edition, now available from the Vermont Structural Slate Co., Inc., Fairhaven, VT 05743. (An excellent reference for the many designs and details of slate roofs)

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EXHIBIT 3

Preservation Brief 6:
Dangers of Abrasive Cleaning

6 Preservation Briefs

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

Dangers of Abrasive Cleaning to Historic Buildings

Anne E. Grimmer

A NOTE TO OUR USERS: The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

"Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible." ***The Secretary of the Interior's Standards for Rehabilitation.***

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

What is Abrasive Cleaning?

Abrasive cleaning methods include all techniques that physically abrade the building surface to remove soils, discolorations or coatings. Such techniques involve the use of certain *materials* which impact or abrade the surface under

Abrasive cleaning can cause permanent damage to historic fabric, such as this brick wall. Photo: NPS files.

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

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

Why Are Abrasive Cleaning Methods Used?

Usually, an abrasive cleaning method is selected as an expeditious means of quickly removing years of dirt accumulation, unsightly stains, or deteriorating building fabric or finishes, such as stucco or paint.

The fact that sandblasting is one of the best known and most readily available building cleaning treatments is probably the major reason for its frequent use.

Brick molding next to the window has been severely abraded by sandblasting to remove paint. Photo: NPS files.

Many mid-19th century brick buildings were painted immediately or soon after completion to protect poor quality brick or to imitate another material, such as stone. Sometimes brick buildings were painted in an effort to produce what was considered a more harmonious relationship between a building and its natural surroundings. By the 1870s, brick buildings were often left unpainted as mechanization in the brick industry brought a cheaper pressed brick and fashion decreed a sudden preference for dark colors. However, it was still customary to paint brick of poorer quality for the additional protection the paint afforded.

It is a common 20th century misconception that all historic masonry buildings were initially unpainted. If the intent of a modern restoration is to return a building to its original appearance, removal of the paint not only may be historically inaccurate, but also harmful. Many older buildings were painted or stuccoed at some point to correct recurring maintenance problems caused by faulty construction techniques, to hide alterations, or in an attempt to solve moisture problems. If this is the case, removal of paint or stucco may cause these problems to reoccur.

Another reason for paint removal, particularly in rehabilitation projects, is to give the building a "new image" in response to contemporary design trends and to attract investors or tenants. Thus, it is necessary to consider the purpose of the intended cleaning. While it is clearly important to remove unsightly stains, heavy encrustations of dirt, peeling paint or other surface coatings, it may not be equally desirable to remove paint from a building which originally was painted. Many historic buildings which show only a slight amount of soil or discoloration are much better left as they are.

A thin layer of soil is more often protective of the building fabric than it is harmful, and seldom detracts from the building's architectural and/or historic character. Too thorough cleaning of a historic building may not only sacrifice some of the building's character, but also, misguided cleaning efforts can cause a great deal of damage to historic building fabric. Unless there are stains, graffiti or dirt and pollution deposits which are destroying the building fabric, it is generally preferable to do as little cleaning as possible, or to repaint where necessary. It is important to remember that a historic building does not have to look as if it were newly constructed to be an attractive or successful restoration or rehabilitation project.

Problems of Abrasive Cleaning

On the left, grit blasting has obliterated the vertical tooling marks from granite, a very dense stone. Photo: NPS files.

The crux of the problem is that abrasive cleaning is just that--abrasive. An abrasively cleaned historic structure may be physically as well as aesthetically damaged. Abrasive methods "clean" by eroding dirt or paint, but at the same time they also tend to erode the surface of the building material. In this way, abrasive cleaning is destructive and causes irreversible harm to the historic building fabric. If the fabric is brick, abrasive methods remove the hard, outer protective surface, and therefore make the brick more susceptible to rapid weathering and deterioration.

Grit blasting may also increase the water permeability of a brick wall. The impact of the grit particles tends to erode the bond between the mortar and the brick, leaving cracks or enlarging existing cracks where water can enter. Some types of stone develop a protective patina or "quarry crust" parallel to the worked surface (created by the movement of moisture towards the outer edge), which also may be damaged by abrasive cleaning. The rate at which the material subsequently weathers depends on the quality of the inner surface that is exposed.

Abrasive cleaning can destroy, or substantially diminish, decorative detailing on buildings such as a molded brickwork or architectural terra-cotta, ornamental carving on wood or stone, and evidence of historic craft techniques, such as tool marks and other surface textures.

In addition, perfectly sound and/or "tooled" mortar joints can be worn away by abrasive techniques. This not only results in the loss of historic craft detailing but also requires repointing, a step involving considerable time, skill and expense, and which might not have been necessary had a gentler method been chosen. Erosion and pitting of the building material by abrasive cleaning creates a greater surface area on which dirt and pollutants collect. In this sense, the building fabric "attracts" more dirt, and will require more frequent cleaning in the future.

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

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

Variable Factors

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

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

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

Despite the apparent care taken by most architects and building cleaning contractors to prepare specifications for pressure cleaning which will not cause harm to the delicate fabric of a historic building, it is very difficult to ensure that the same amount of pressure is applied to all parts of the building. For example, if the operator of the pressure equipment stands on the ground while cleaning a two-story structure, the amount of force reaching the first story will be greater than that hitting the second story, even if the operator stands on scaffolding or in a cherry picker, because of the "line drop" in the distance from the pressure source to the nozzle. Although technically it may be possible to prepare cleaning specifications with tight controls that would eliminate all but a small margin of error, it may not be easy to find professional cleaning firms willing to work under such restrictive conditions. The fact is that many professional building cleaning firms do not really understand the extreme delicacy of historic building fabric, and how it differs from modern construction materials. Consequently, they may accept building cleaning projects for which they have no experience.


Bronze statuary may be cleaned gently using crushed walnut shells. Photo: NPS files.

The amount of pressure used in any kind of cleaning treatment which involves pressure, whether it is dry or wet grit, chemicals or just plain water, is crucial to the outcome of the cleaning project. Unfortunately, no standards have been established for determining the correct pressure for cleaning each of the many historic building materials which would not cause harm. The considerable discrepancy between the way the building cleaning industry and architectural conservators define "high" and "low" pressure cleaning plays a significant role in the difficulty of creating standards.

Nonhistoric/Industrial: A representative of the building cleaning industry might consider "high" pressure water cleaning to be anything over 5,000 psi, or even as high as 10,000 to 15,000 psi! Water under this much pressure may be necessary to clean industrial structures or machinery, but would destroy most historic building materials. Industrial chemical cleaning commonly utilizes pressures between 1,000 and 2,500 psi.

Historic: By contrast, conscientious dry or wet abrasive cleaning of a historic structure would be conducted within the range of 20 to 100 psi at a range of 3 to 12 inches. Cleaning at this low pressure requires the use of a very fine 00 or 0 mesh grit forced through a nozzle with a 1/4-inch opening. A similar, even more delicate method being adopted by architectural conservators uses a micro-abrasive grit on small, hard-to-clean areas of carved, cut or molded ornament on a building facade. Originally developed by museum conservators for cleaning sculpture, this technique may employ glass beads, micro-balloons, or another type of micro-abrasive gently powered at approximately 40 psi by a very small, almost pencil-like pressure instrument. Although a slightly larger pressure instrument may be used on historic buildings, this technique still has limited practical applicability on a large scale building cleaning project because of the cost and the relatively few technicians competent to handle the task. In general, architectural conservators have determined that only through very controlled conditions can most historic building material be abrasively cleaned of soil or paint without measurable damage to the surface or profile of the substrate.

Yet some professional cleaning companies which specialize in cleaning historic masonry buildings use chemicals and water at a pressure of approximately 1,500 psi, while other cleaning firms recommend lower pressures ranging from 200 to 800 psi for a similar project. An architectural conservator might decide, after testing, that some historic structures could be cleaned properly using a moderate pressure (200-600 psi), or even a high pressure (600-1800 psi) water rinse. However, cleaning historic buildings under such high pressure should be considered an exception rather than the rule, and would require *very careful* testing and supervision to assure that the historic surface materials could withstand the pressure without gouging, pitting or loosening.

These differences in the amount of pressure used by commercial or industrial building cleaners and architectural conservators point to one of the main problems in using abrasive means to clean historic buildings: misunderstanding of the potentially fragile nature of historic building materials. There is no one cleaning formula or pressure suitable for all situations. Decisions regarding the proper cleaning process for historic structures can be made only after careful analysis of the building fabric, and testing.

How Building Materials React to Abrasive Cleaning Methods

Brick and Architectural Terra-cotta: Abrasive blasting does not affect all building materials to the same degree. Such techniques quite logically cause greater damage to softer and more porous materials, such as brick or architectural terra-cotta. When these materials are cleaned abrasively, the hard, outer layer (closest to the heat of the kiln) is eroded, leaving the soft, inner core exposed and susceptible to accelerated weathering. Glazed architectural terra-cotta and ceramic veneer have a baked on glaze which is also easily damaged by abrasive cleaning. Glazed architectural terra-cotta was designed for easy maintenance, and generally can be cleaned using detergent and water; but chemicals or steam may be needed to remove more persistent stains. Large areas of brick or architectural terra-cotta which have been painted are best left painted, or repainted if necessary.

Plaster and Stucco: Plaster and stucco are types of masonry finish materials that are softer than brick or terra-cotta; if treated abrasively these materials will simply disintegrate. Indeed, when plaster or stucco is treated abrasively it is usually with the intention of removing the plaster or stucco from whatever base material or substrate it is covering. Obviously, such abrasive techniques should not be applied to clean sound plaster or stuccoed walls, or decorative plaster wall surfaces.

Building Stones: Building stones are cut from the three main categories of natural rock: dense, igneous rock such as granite; sandy, sedimentary rock such as limestone or sandstone; and crystalline, metamorphic rock such as marble. As opposed to kiln-dried masonry materials such as brick and architectural terra-cotta, building stones are generally homogeneous in character at the time of a building's construction. However, as the stone is exposed to weathering and environmental pollutants, the surface may become friable, or may develop a protective skin or patina. These outer surfaces are very susceptible to damage by abrasive or improper chemical cleaning.

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


Very high-pressure water has scarred this granite. Photo: NPS files.

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

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

Metals: Like stone, metals are another group of building materials which vary considerably in hardness and durability. Softer metals which are used architecturally, such as tin, zinc, lead, copper or aluminum, generally should not be cleaned abrasively as the process deforms and destroys the original surface texture and appearance, as well as the acquired patina.


Decorative pressed metal interior or exterior features should not be cleaned abrasively. Photo:

Much applied architectural metal work used on historic buildings--tin, zinc, lead and copper--is often quite thin and soft, and therefore susceptible to denting and pitting. Galvanized sheet metal is especially vulnerable, as abrasive treatment would wear away the protective galvanized layer.

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

NPS files.

However, conservation specialists are now employing a sensitive technique of glass bead peening to clean some of the harder metals, in particular large bronze outdoor sculpture. Very fine (75125 micron) glass beads are used at a low pressure of 60 to 80 psi. Because these glass beads are completely spherical, there are no sharp edges to cut the surface of the metal. After cleaning, these statues undergo a lengthy process of polishing. Coatings are applied which protect the surface from corrosion, but they must be renewed every 3 to 5 years. A similarly delicate cleaning technique employing glass beads has been used in Europe to clean historic masonry structures without causing damage. But at this time the process has not been tested sufficiently in the United States to recommend it as a building conservation measure.

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

Cast iron may be abrasively cleaned, but must be painted immediately to prevent rust. Photo: NPS files.

Cast and wrought iron architectural elements may be gently sandblasted or abrasively cleaned using a wire brush to remove layers of paint, rust and corrosion. Sandblasting was, in fact, developed originally as an efficient maintenance procedure for engineering and industrial structures and heavy machinery--iron and steel bridges, machine tool frames, engine frames, and railroad rolling stock--in order to clean and prepare them for repainting. Because iron is hard, its surface, which is naturally somewhat uneven, will not be noticeably damaged by controlled abrasion. Such treatment will, however, result in a small amount of pitting. But this slight abrasion creates a good surface for paint, since the iron must he repainted immediately to prevent corrosion. Any abrasive cleaning of metal building components will also remove the caulking from joints and around other openings. Such areas must be recaulked quickly to prevent moisture from entering and rusting the metal, or causing deterioration of other building fabric inside the structure.

When is Abrasive Cleaning Permissible?

For the most part, abrasive cleaning is destructive to historic building materials. A limited number of special cases have been explained when it may be appropriate, if supervised by a skilled conservator, to use a delicate abrasive technique on some historic building materials. The type of "wet grit" cleaning which involves a small amount of grit injected into a stream of low pressure water may be used on small areas of stone masonry

Industrial interiors that are not finely milled may be abrasively cleaned, in some instances. Photo: NPS files.

(i.e., rough cut limestone, sandstone or unpolished granite), where milder cleaning methods have not been totally successful in removing harmful deposits of dirt and pollutants. Such areas may include stone window sills, the tops of cornices or column capitals, or other detailed areas of the facade.

This is still an abrasive technique, and without proper caution in handling, it can be *just as harmful to the building surface as any other abrasive cleaning method*. Thus, the decision to use this type of "wet grit" process should be made only after consultation with an experienced building conservator. Remember that *it is very time consuming and expensive to use any abrasive technique on a historic building in such a manner that it does not cause harm to the often fragile and friable building materials*.

At this time, and only under certain circumstances, abrasive cleaning methods may he used in the rehabilitation of interior spaces of warehouse or industrial buildings for contemporary uses.

Interior spaces of factories or warehouse structures in which the masonry or plaster surfaces do not have significant design, detailing, tooling or finish, and in which wooden architectural features are not finished, molded, beaded or worked by hand, may be cleaned abrasively in order to remove layers of paint and industrial discolorations such as smoke, soot, etc. It is expected after such treatment that brick surfaces will be rough and pitted, and wood will be somewhat frayed or "fuzzy" with raised wood grain. These nonsignificant surfaces will be damaged and have a roughened texture, but because they are interior elements, they will not be subject to further deterioration caused by weathering.

Historic Interiors That Should Not Be Cleaned Abrasively

Those instances (generally industrial and some commercial properties), when it may be acceptable to use an abrasive treatment on the interior of historic structures have been described. But for the majority of historic buildings, the Secretary of the Interior's *Guidelines for Rehabilitation* do not recommend "changing the texture of exposed wooden architectural features (including structural members) and masonry surfaces through sandblasting or use of other abrasive techniques to remove paint, discolorations and plaster

Decorative wood exterior or interior features should not be cleaned abrasively. Photo: NPS files.

Thus, it is not acceptable to clean abrasively interiors of historic residential and commercial properties which have *finished* interior spaces featuring milled woodwork such as doors, window and door moldings, wainscoting, stair balustrades and mantelpieces. Even the most modest historic house interior, although it may not feature elaborate detailing, contains plaster and woodwork that is architecturally significant to the original design and function of the house. Abrasive cleaning of such an interior would be destructive to the historic integrity of the building.

Abrasive cleaning is also impractical. Rough surfaces of abrasively cleaned wooden elements are hard to keep clean. It is also difficult to seal, paint or maintain these surfaces which can be splintery and a problem to the building's occupants. The force of abrasive blasting may cause grit particles to lodge in cracks of wooden elements, which will be a nuisance as the grit is loosened by vibrations and gradually sifts out. Removal of plaster will reduce the thermal and insulating value of the walls. Interior brick is usually softer than exterior brick, and generally of a poorer quality. Removing surface plaster from such brick by abrasive means often exposes gaping mortar joints and mismatched or repaired brickwork which was never intended to show. The resulting bare brick wall may require repointing, often difficult to match. It also may be necessary to apply a transparent surface coating (or sealer) in order to prevent the mortar and brick from "dusting." However. a sealer may not only change the color of the brick, but may also compound any existing moisture problems by restricting the normal evaporation of water vapor from the masonry surface.

"Gentlest Means Possible"

There are alternative means of removing dirt, stains and paint from historic building surfaces that can be recommended as more efficient and less destructive than abrasive techniques. The "gentlest means possible" of removing dirt from a building surface can be achieved by using a low-pressure water wash, scrubbing areas of more persistent grime with a natural bristle (never metal) brush. Steam cleaning can also be used effectively to clean some historic building fabric. Low-pressure water or steam will soften the dirt and cause the deposits to rise to the surface, where they can be washed away.

A third cleaning technique which may be recommended to remove dirt, as well as stains, graffiti or paint, involves the use of commercially available chemical cleaners or paint removers, which, when applied to masonry, loosen or dissolve the dirt or stains. These cleaning agents may be used in combination with water or steam, followed by a clear water wash to remove the residue of dirt and the chemical cleaners from the masonry. A natural bristle brush may also facilitate this type of chemically assisted cleaning, particularly in areas of heavy dirt deposits or stains, and a wooden scraper can be useful in removing thick encrustations of soot. A limewash or absorbent talc, whiting or clay poultice with a solvent can be used effectively to draw out salts or stains from the surface of the selected areas of a building facade. It is almost impossible to remove paint from masonry surfaces without causing some damage to the masonry, and it is best to leave the surfaces as they are or repaint them if necessary.

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

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

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

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

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

Mitigating the Effects of Abrasive Cleaning

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

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

Softer types of masonry, particularly brick and architectural terra-cotta, are the most likely to require some remedial treatment if they have been abrasively cleaned. Old brick, being essentially a soft, baked clay product, is greatly susceptible to increased deterioration when its hard, outer skin is removed through abrasive techniques. This problem can be minimized by painting the brick. An alternative is to treat it with a clear sealer or surface coating but this will give the masonry a glossy, or shiny look. It is usually preferable to paint the brick rather than to apply a transparent sealer since sealers reduce the transpiration of moisture, allowing salts to crystallize as subflorescence that eventually spalls the brick. If a brick surface has been so extensively damaged by abrasive cleaning and weathering that spalling has already begun, it may be necessary to cover the walls with stucco, if it will adhere.

Of course, the application of paint, a clear surface coating (sealer), or stucco to deteriorating masonry means that the historical appearance will be sacrificed in an attempt to conserve the historic building materials. However, the original color and texture will have been changed already by the abrasive treatment. At this point it is more important to try to preserve the brick, and there is little choice but to protect it from "dusting" or spalling too rapidly. As a last resort, in the case of severely spalling brick, there may be no option but to replace the brick--a difficult, expensive (particularly if custom-made reproduction brick is used), and lengthy process. As described earlier, sandblasted interior brick work, while not subject to change of weather, may require the application of a transparent surface coating or painting as a maintenance procedure to contain loose mortar and brick dust. (See ***Preservation Briefs: No. 1*** for a more thorough discussion of coatings.)

Metals, other than cast or wrought iron, that have been pitted and dented by harsh abrasive blasting usually cannot be smoothed out. Although fillers may be satisfactory for smoothing a painted surface, exposed metal that has been damaged usually will have to be replaced.

Summary

Sandblasting or other abrasive methods of cleaning or paint removal are by their nature destructive to historic building materials and should not be used on historic buildings except in a few well-monitored instances. There are exceptions when certain types of abrasive cleaning may be permissible, but only if conducted by a trained conservator, and if cleaning is necessary for the preservation of the historic structure.

There is no one formula that will be suitable for cleaning all historic building surfaces. Although there are many commercial cleaning products and methods available, it is impossible to state definitively which of these will be the most effective without causing harm to the building fabric. It is often difficult to identify ingredients or their proportions contained in cleaning products; consequently it is hard to predict how a product will react to the building materials to be cleaned. Similar uncertainties affect the outcome of other cleaning methods as they are applied to historic building materials. Further advances in understanding the complex nature of the many variables of the cleaning techniques may someday provide a better and simpler solution to the problems. But until that time, the process of cleaning historic buildings must be approached with caution through trial and error.

It is important to remember that historic building materials are neither indestructible, nor are they renewable. They must be treated in a responsible manner, which may mean little or no cleaning at all if they are to be preserved for future generations to enjoy. If it is in the best interest of the building to clean it, then it should be done "using the gentlest means possible."

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Washington, D.C. June, 1979

Home page logo: Undamaged historic brick (above). Sandblasted brick (below). Photo: Courtesy, Illinois

Historic Preservation Agency.

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. Technical Preservation Services (TPS), Heritage Preservation Services Division, National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments for a broad public.

Questions

EXHIBIT 4

Preservation Brief 9:
Repair of Historic Wood Windows

9 Preservation Briefs

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

The Repair of Historic Wooden Windows

John H. Myers

A NOTE TO OUR USERS: The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

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. 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.

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.

Windows are frequently important visual focal points, especially on simple facades such as this mill building. Replacement of the multi-pane windows with larger panes could dramatically alter the appearance of the building. Photo: NPS files.

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.

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 proceed 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 runoff, 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.

Deterioration of poorly maintained windows usually begins on horizontal surfaces and at joints, where water can collect and saturate the wood. Photo: NPS files.

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. 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 endgrain 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 section 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.

This historic double-hung window has many layers of paint, some cracked and missing putty, slight separation at the joints, broken sash cords, and one cracked pane. Photo: NPS files.

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

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. Photo: NPS files.

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, 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.

Sash can be removed and repaired in a convenient work area. Paint is being removed from this sash with a hot air gun. Photo: NPS files.

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. 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, the glass should be removed or protected from the sudden temperature change which can cause breakage. An 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.

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 weather-tight 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. 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.

Following the relatively simple repairs, the window is weathertight, like new in appearance, and serviceable for many years to come.Photo: NPS files.

The operations just discussed summarize the efforts necessary to restore a window with minor deterioration to "like new" condition. 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.

This illustrates a two-part expoxy 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: NPS files.

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 semirigid epoxies which saturate the porous decayed wood and then harden. The surface of the consolidated wood can then be filled with a semirigid epoxy patching compound, sanded and painted. Epoxy patching compounds can be used to build up 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. 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. More information on epoxies can be found in the publication "Epoxies for Wood Repairs in Historic Buildings," cited in the bibliography.

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.

Additional Reading

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Washington, D.C. 1981

Home page logo: Historic six-over-six windows--preserved. Photo: NPS files.

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. Technical Preservation Services (TPS), Heritage Preservation Services Division, National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments for a broad public.

Questions

EXHIBIT 5

Preservation Brief 16:
The Use of Substitute Materials on
Historic Building Exteriors

16 Preservation Briefs

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

The Use of Substitute Materials on Historic Building Exteriors

Sharon C. Park, AIA

A NOTE TO OUR USERS: The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

The Secretary of the Interior's Standards for Rehabilitation require that "deteriorated architectural features be repaired rather than replaced, wherever possible. In the event that replacement is necessary, the new material should match the material being replaced in composition, design, color, texture, and other visual properties." Substitute materials should be used only on a limited basis and only when they will match the appearance and general properties of the historic material and will not damage the historic resource.

Introduction

When deteriorated, damaged, or lost features of a historic building need repair or replacement, it is almost always best to use historic materials. In limited circumstances substitute materials that imitate historic materials may be used if the appearance and properties of the historic materials can be matched closely and no damage to the remaining historic fabric will result.

Great care must be taken if substitute materials are used on the exteriors of historic buildings. Ultraviolet light, moisture penetration behind joints, and stresses caused by changing temperatures can greatly impair the performance of substitute materials over time. Only after consideration of all options, in consultation with qualified professionals, experienced fabricators and contractors, and development of carefully written specifications should this work be undertaken.

In the reconstruction of the clock tower at Independence Hall, the substitute materials used were cast stone and wood with fiberglass and polyester bronze ornamentation. Photo: NPS files.

The practice of using substitute materials in architecture is not new, yet it continues to pose practical problems and to raise philosophical questions. On the practical level the inappropriate choice or improper installation of substitute materials can cause a radical change in a building's appearance and can cause extensive physical damage over time. On the more philosophical level, the wholesale use of substitute materials can raise questions concerning the integrity of historic buildings largely comprised of new materials. In both cases the integrity of the historic resource can be destroyed.

Some preservationists advocate that substitute materials should be avoided in all but the most limited cases. The fact is, however, that substitute materials are being used more frequently than ever in preservation projects, and in many cases with positive results. They can be cost-effective, can permit the accurate visual duplication of historic materials, and last a reasonable time. Growing evidence indicates that with proper planning, careful specifications and supervision, substitute materials can be used successfully in the process of restoring the visual appearance of historic resources.

This Brief provides general guidance on the use of substitute materials on the exteriors of historic buildings. While substitute materials are frequently used on interiors, these applications are not subject to weathering and moisture penetration, and will not be discussed in this Brief. Given the general nature of this publication, specifications for substitute materials are not provided. The guidance provided should not be used in place of consultations with qualified professionals. This Brief includes a discussion of when to use substitute materials, cautions regarding their expected performance, and descriptions of several substitute materials, their advantages and disadvantages. This review of materials is by no means comprehensive, and attitudes and findings will change as technology develops.

Historical Use of Substitute Materials

The tradition of using cheaper and more common materials in imitation of more expensive and less available materials is a long one. George Washington, for example, used wood painted with sand-impregnated paint at Mount Vernon to imitate cut ashlar stone. This technique along with scoring stucco into block patterns was fairly common in colonial America to imitate stone.

Molded or cast masonry substitutes, such as dry-tamp cast stone and poured concrete, became popular in place of quarried stone during the 19th century. These masonry units were fabricated locally, avoiding expensive quarrying and shipping costs, and were versatile in representing either ornately carved blocks, plain wall stones or rough cut textured surfaces. The end result depended on the type of patterned or textured mold used and was particularly popular in conjunction with mail order houses. Later, panels of cementitious permastone or formstone and less expensive asphalt and sheet metal panels were used to imitate brick or stone.

Metal (cast, stamped, or brake-formed) was used for storefronts, canopies, railings, and other features, such as galvanized metal cornices substituting for wood or stone, stamped metal panels for Spanish clay roofing tiles, and cast-iron column capitals and even entire building fronts in imitation of building stone.

Substitute materials need to be located with care to avoid damage. The fiberglass column base has chipped, whereas the historic cast iron would have remained sound. Photo: NPS files.

Terra-cotta, a molded fired clay product, was itself a substitute material and was very popular in the late 19th and early 20th centuries. It simulated the appearance of intricately carved stonework, which was expensive and time-consuming to produce. Terra cotta could be glazed to imitate a variety of natural stones, from brownstones to limestones, or could be colored for a polychrome effect.

Nineteenth century technology made a variety of materials readily available that not only were able to imitate more expensive materials but were also cheaper to fabricate and easier to use. Throughout the century, imitative materials continued to evolve. For example, ornamental window hoods were originally made of wood or carved stone. In an effort to find a cheaper substitute for carved stone and to speed fabrication time, cast stone, an early form of concrete, or cast-iron hoods often replaced stone. Toward the end of the century, even less expensive sheet metal hoods, imitating stone, also came into widespread use. All of these materials, stone, cast stone, cast iron, and various pressed metals were in production at the same time and were selected on the basis on the basis of the availability of materials and local craftsmanship, as well as durability and cost. The criteria for selection today are not much different.

Many of the materials used historically to imitate other materials are still available. These are often referred to as the traditional materials: wood, cast stone, concrete, terra cotta and cast metals. In the last few decades, however, and partly as a result of the historic preservation movement, new families of synthetic materials, such as fiberglass, acrylic polymers, and epoxy resins, have been developed and are being used as substitute materials in construction. In some respects these newer products (often referred to as high tech materials) show great promise; in others, they are less satisfactory, since they are often difficult to integrate physically with the porous historic materials and may be too new to have established solid performance records.

When to Consider Using Substitute Materials in Preservation Projects

Because the overzealous use of substitute materials can greatly impair the historic character of a historic structure, all preservation options should be explored thoroughly before substitute materials are used. It is important to remember that the purpose of repairing damaged features and of replacing lost and irreparably damaged ones is both to match visually what was there and to cause no further deterioration. For these reasons it is not appropriate to cover up historic materials with synthetic materials that will alter the appearance, proportions and details of a historic building and that will conceal future deterioration.

Some materials have been used successfully for the repair of damaged features such as epoxies for wood infilling, cementitious patching for sandstone repairs, or plastic stone for masonry repairs. Repairs are preferable to replacement whether or not the repairs are in kind or with a synthetic substitute material.

In general, four circumstances warrant the consideration of substitute materials: 1) the unavailability of historic materials; 2) the unavailability of skilled craftsmen; 3) inherent flaws in the original materials; and 4) code-required changes (which in many cases can be extremely destructive of historic resources).

Cost may or may not be a determining factor in considering the use of substitute materials. Depending on the area of the country, the amount of material needed, and the projected life of less durable substitute materials, it may be cheaper in the long run to use the original material, even though it may be harder to find.

The core of a deteriorated wood outrigger was first drilled out. Photos (left and right): Courtesy, Harrison Goodall.

An inert material was injected into the hollow outrigger, permitting the outer wood to be retained and preserved.

Due to many early failures of substitute materials, some preservationist are looking abroad to find materials (especially stone) that match the historic materials in an effort to restore historic buildings accurately and to avoid many of the uncertainties that come with the use of substitute materials.

1. The unavailability of the historic material.

The most common reason for considering substitute materials is the difficulty in finding a good match for the historic material (particularly a problem for masonry materials where the color and texture are derived from the material itself). This may be due to the actual unavailability of the material or to protracted delivery dates. For example, the local quarry that supplied the sandstone for a building may no longer be in operation. All efforts should be made to locate another quarry that could supply a satisfactory match. If this approach fails, substitute materials such as dry-tamp cast stone or textured precast concrete may be a suitable substitute if care is taken to ensure that the detail, color and texture of the original stone are matched. In some cases, it may be possible to use a sand-impregnated paint on wood as a replacement section, achieved using readily available traditional materials, conventional tools and work skills. Simple solutions should not be overlooked.

2. The unavailability of historic craft techniques and lack of skilled artisans.

These two reasons complicate any preservation or rehabilitation project. This is particularly true for intricate ornamental work, such as carved wood, carved stone, wrought iron, cast iron, or molded terra cotta. However, a number of stone and wood cutters now employ sophisticated carving machines, some even computerized. It is also possible to cast substitute replacement pieces using aluminum, cast stone, fiberglass, polymer concretes, glass fiber reinforced concretes and terra cotta. Mold making and casting takes skill and craftsmen who can undertake this work are available. Efforts should always be made, prior to replacement, to seek out artisans who might be able to repair ornamental elements and thereby save the historic features in place.

3. Poor original building materials.

Cast aluminum has been used as a replacement material for cast iron. Photo: NPS files.

Some historic building materials were of inherently poor quality or their modern counterparts are inferior. In addition, some materials were naturally incompatible with other materials on the building, causing staining or galvanic corrosion. Examples of poor quality materials were the very soft sandstones which eroded quickly. An example of poor quality modern replacement material is the tin coated steel roofing which is much less durable than the historic tin or terne iron which is no longer available. In some cases, more durable natural stones or precast concrete might be available as substitutes for the soft stones and modern terne-coated stainless steel or lead-coated copper might produce a more durable yet visually compatible replacement roofing.

4. Code-related changes.

Sometimes referred to as life and safety codes, building codes often require changes to historic buildings. Many cities in earthquake zones, for example, have laws requiring that overhanging masonry parapets and cornices, or freestanding urns or finials be securely re-anchored to new structural frames or be removed completely. In some cases, it may be acceptable to replace these heavy historic elements with light replicas. In other cases, the extent of historic fabric removed may be so great as to diminish the integrity of the resource. This could affect the significance of the structure and jeopardize National Register status. In addition, removal of repairable historic materials could result in loss of Federal tax credits for rehabilitation. Department of the Interior regulations make clear that the Secretary of the Interior's Standards for Rehabilitation take precedence over other regulations and codes in determining whether a project is consistent with the historic character of the building undergoing rehabilitation.

Two secondary reasons for considering the use of substitute materials are their lighter weight and for some materials, a reduced need of maintenance. These reasons can become important if there is a need to keep dead loads to a minimum or if the feature being replaced is relatively inaccessible for routine maintenance.

Cautions and Concerns

In dealing with exterior features and materials, it must be remembered that moisture penetration, ultraviolet degradation, and differing thermal expansion and contraction rates of dissimilar materials make any repair or replacement problematic. To ensure that a repair or replacement will perform well over time, it is critical to understand fully the properties of both the original and the substitute materials, to install replacement materials correctly, to assess their impact on adjacent historic materials, and to have reasonable expectations of future performance.

Many high tech materials are too new to have been tested thoroughly. The differences in vapor permeability between some synthetic materials and the historic materials have in some cases caused unexpected further deterioration. It is therefore difficult to recommend substitute materials if the historic materials are still available. As previously mentioned, consideration should always be given first to using traditional materials and methods of repair or replacement before accepting unproven techniques, materials or applications.

Substitute materials must meet three basic criteria before being considered: they must be compatible with the historic materials in appearance; their physical properties must be similar to those of the historic materials, or be installed in a manner that tolerates differences; and they must meet certain basic performance expectations over an extended period of time.

A waterproof coating is an inappropraite substitute material to apply to adobe as it seals in moisture and may result in spalling. Photo: NPS files.

Matching the Appearance of the Historic Materials

In order to provide an appearance that is compatible with the historic material, the new material should match the details and craftsmanship of the original as well as the color, surface texture, surface reflectivity and finish of the original material. The closer an element is to the viewer, the more closely the material and craftsmanship must match the original.

Matching the color and surface texture of the historic material with a substitute material is normally difficult. To enhance the chances of a good match, it is advisable to clean a portion of the building where new materials are to be used. If pigments are to be added to the substitute material, a specialist should determine the formulation of the mix, the natural aggregates and the types of pigments to be used. As all exposed material is subject to ultraviolet degradation, if possible, samples of the new materials made during the early planning phases should be tested or allowed to weather over several seasons to test for color stability.

Fabricators should supply a sufficient number of samples to permit onsite comparison of color, texture, detailing, and other critical qualities. In situations where there are subtle variations in color and texture within the original materials, the substitute materials should be similarly varied so that they are not conspicuous by their uniformity.

Substitute materials, notably the masonry ones, may be more water-absorbent than the historic material. If this is visually distracting, it may be appropriate to apply a protective vapor-permeable coating on the substitute material. However, these clear coatings tend to alter the reflectivity of the material, must be reapplied periodically, and may trap salts and moisture, which can in turn produce spalling. For these reasons, they are not recommended for use on historic materials.

Matching the Physical Properties

While substitute materials can closely match the appearance of historic ones, their physical properties may differ greatly. The chemical composition of the material (i.e., presence of acids, alkalines, salts, or metals) should be evaluated to ensure that the replacement materials will be compatible with the historic resource. Special care must therefore be taken to integrate and to anchor the new materials properly. The thermal expansion and contraction coefficients of each adjacent material must be within tolerable limits. The function of joints must be understood and detailed either to eliminate moisture penetration or to allow vapor permeability. Materials that will cause galvanic corrosion or other chemical reactions must be isolated from one another.

To ensure proper attachment, surface preparation is critical. Deteriorated underlying material must be cleaned out. Noncorrosive anchoring devices or fasteners that are designed to carry the new material and to withstand wind, snow and other destructive elements should be used. Properly chosen fasteners allow attached materials to expand and contract at their own rates. Caulking, flexible sealants or expansion joints between the historic material and the substitute material can absorb slight differences of movement. Since physical failures often result from poor anchorage or improper installation techniques, a structural engineer should be a member of any team undertaking major repairs.

Some of the new high tech materials such as epoxies and polymers are much stronger than historic materials and generally impermeable to moisture. These differences can cause serious problems unless the new materials are modified to match the expansion and contraction properties of adjacent historic materials more closely, or unless the new materials are isolated from the historic ones altogether. When stronger or vapor impermeable new materials are used alongside historic ones, stresses from trapped moisture or differing expansion and contraction rates generally hasten deterioration of the weaker historic material. For this reason, a conservative approach to repair or replacement is recommended, one that uses more pliant materials rather than high-strength ones. Since it is almost impossible for substitute materials to match the properties of historic materials perfectly, the new system incorporating new and historic materials should be designed so that if material failures occur, they occur within the new material rather than the historic material.

Performance Expectations

While a substitute material may appear to be acceptable at the time of installation, both its appearance and its performance may deteriorate rapidly. Some materials are so new that industry standards are not available, thus making it difficult to specify quality control in fabrication, or to predict maintenance requirements and long term performance. Where possible, projects involving substitute materials in similar circumstances should be examined. Material specifications outlining stability of color and texture; compressive or tensile strengths if appropriate; the acceptable range of thermal coefficients, and the durability of coatings and finishes should be included in the contract documents. Without these written documents, the owner may be left with little recourse if failure occurs.

The tight controls necessary to ensure long-term performance extend beyond having written performance standards and selecting materials that have a successful track record. It is important to select qualified fabricators and installers who know what they are doing and who

The historic cornice was successfully replaced with a fiberglass cornice. Photo: NPS files.

can follow up if repairs are necessary. Installers and contractors unfamiliar with specific substitute materials and how they function in your local environmental conditions should be avoided.

The surfaces of substitute materials may need special care once installed. For example, chemical residues or mold release agents should be removed completely prior to installation, since they attract pollutants and cause the replacement materials to appear dirtier than the adjacent historic materials. Furthermore, substitute materials may require more frequent cleaning, special cleaning products and protection from impact by hanging window-cleaning scaffolding. Finally, it is critical that the substitute materials be identified as part of the historical record of the building so that proper care and maintenance of all the building materials continue to ensure the life of the historic resource.

Choosing an Appropriate Substitute Material

Once all reasonable options for repair or replacement in kind have been exhausted, the choice among a wide variety of substitute materials currently on the market must be made. The charts at the end of this Brief describe a number of such materials, many of them in the family of modified concretes which are gaining greater use. The charts do not include wood, stamped metal, mineral fiber cement shingles and some other traditional imitative materials, since their properties and performance are better known. Nor do the charts include vinyls or molded urethanes which are sometimes used as cosmetic claddings or as substitutes for wooden millwork. Because millwork is still readily available, it should be replaced in kind.

The charts describe the properties and uses of several materials finding greater use in historic preservation projects, and outline advantages and disadvantages of each. It should not be read as an endorsement of any of these materials, but serves as a reminder that numerous materials must be studied carefully before selecting the appropriate treatment. Included are three predominantly masonry materials (cast stone, precast concrete, and glass fiber reinforced concrete); two predominantly resinous materials (epoxy and glass fiber reinforced polymers also known as fiberglass), and cast aluminum which has been used as a substitute for various metals and woods.

Pros and Cons of Various Substitute Materials

Cast Aluminum

Material: Cast aluminum is a molten aluminum alloy cast in permanent (metal) molds or onetime sand molds which must be adjusted for shrinkage during the curing process. Color is from paint applied to primed aluminum or from a factory finished coating. Small sections can be bolted together to achieve intricate or sculptural details. Unit castings are also available for items such as column plinth blocks.

Application: Cast aluminum can be a substitute for cast iron or other decorative elements. This would include grillwork, roof crestings, cornices, ornamental spandrels, storefront elements, columns, capitals, and column bases and plinth blocks. If not self-supporting, elements are generally screwed or bolted to a structural frame. As a result of galvanic corrosion problems with dissimilar metals, joint details are very important.

Advantages:

- light weight (1/2 of castiron)
- corrosion-resistant, noncombustible
- intricate castings possible
- easily assembled, good delivery time
- can be prepared for a variety of colors
- long life, durable, less brittle than cast iron

Disadvantages:

- lower structural strength than castiron
- difficult to prevent galvanic corrosion with other metals
- greater expansion and contraction than castiron; requires
- gaskets or caulked joints
- difficult to keep paint on aluminum

Checklist:

- Can existing be repaired or replaced inkind?
- How is cast aluminum to be with other metals attached?
- Have full-size details been developed for each piece to be cast?
- How are expansion joints detailed?
- Will there be a galvanic corrosion problem?
-
- Are fabricators/installers experienced?

Cast Stone (dry tamped)

Material: Cast stone is an almost-dry cement, lime and aggregate mixture which is dry-tamped into a mold to produce a dense stone-like unit. Confusion arises in the building industry as many refer to high quality precast concrete as cast stone. In fact, while it is a form of precast concrete, the drytamp fabrication method produces an outer surface resembling a stone surface. The inner core can be either drytamped or poured full of concrete. Reinforcing bars and anchorage devices can be installed during fabrication.

Application: Cast stone is often the most visually similar material as a replacement for unveined deteriorated stone, such as brownstone or sandstone, or terra cotta in imitation of stone. It is used both for surface wall stones and for ornamental features such as window and door surrounds, voussoirs, brackets and hoods. Rubberlike molds can be taken of good stones on site or made up at the factory from shop drawings.

Advantages:

- replicates stone texture with good molds (which can come from extant stone) and fabrication
- expansion/contraction similar to stone
- minimal shrinkage of material
- anchors and reinforcing bars can be built in
- material is firerated
- range of color available
- vapor permeable

Disadvantages:

- heavy units may require additional anchorage
- color can fade in sunlight
- may be more absorbent than natural stone
- replacement stones are obvious if too few models and molds are made

Checklist:

- Are the original or similar materials available?
- How are units to be installed and anchored?
- Have performance standards been developed to ensure color stability?
- Have large samples been delivered to site for color, finish and absorption testing?
- Has mortar been matched to adjacent historic mortar to achieve a good color/tooling match?
- Are fabricators/installers experienced?

Glass Fiber Reinforced Concretes (GFRC)

Material: Glass fiber reinforced concretes are lightweight concrete compounds modified with additives and reinforced with glass fibers. They are generally fabricated as thin shelled panels and applied to a separate structural frame or anchorage system. The GFRC is most commonly sprayed into forms although it can be poured. The glass must be alkaline resistant to avoid deteriorating effects caused by the cement mix. The color is derived from the natural aggregates and if necessary a small percentage of added pigments.

Application: Glass fiber reinforced concretes are used in place of features originally made of stone, terra cotta, metal or wood, such as cornices, projecting window and door trims, brackets, finials, or wall murals. As a molded product it can be produced in long sections of repetitive designs or as sculptural elements. Because of its low shrinkage, it can be produced from molds taken directly from the building. It is installed with a separate noncorrosive anchorage system. As a predominantly cementitious material, it is vapor permeable.

Advantages:

- lightweight, easily installed
- good molding ability, crisp detail possible
- weather resistant
- can be left uncoated or else painted
- little shrinkage during fabrication
- molds made directly from historic features

- cements generally breathable
- material is firerated

Disadvantages:

- non-loadbearing use only
- generally requires separate anchorage system
- large panels must be reinforced
- color additives may fade with sunlight
- joints must be properly detailed
- may have different absorption rate than adjacent historic material

Checklist:

- Are the original materials and craftsmanship still available?
- Have samples been inspected on the site to ensure detail/texture match?
- Has anchorage system been properly designed?
- Have performance standards been developed?
- Are fabricators/installers experienced?

Precast Concrete

Material: Precast concrete is a wet mix of cement and aggregate poured into molds to create masonry units. Molds can be made from existing good surfaces on the building. Color is generally integral to the mix as a natural coloration of the sand or aggregate, or as a small percentage of pigment. To avoid unsightly air bubbles that result from the natural curing process, great care must be taken in the initial and longterm vibration of the mix. Because of its weight it is generally used to reproduce individual units of masonry and not thin shell panels.

Application: Precast concrete is generally used in place of masonry materials such as stone or terra cotta. It is used both for flat wall surfaces and for textured or ornamental elements. This includes wall stones, window and door surrounds, stair treads, paving pieces, parapets, urns, balusters and other decorative elements. It differs from cast stone in that the surface is more dependent on the textured mold than the hand tamping method of fabrication.

Advantages:

- easily fabricated, takes shape well
- rubber molds can be made from building stones
- minimal shrinkage of material
- can be load bearing or anchorage can be cast in
- expansion/contraction similar to stone
- material is firerated
- range of color and aggregate available
- vapor permeable

Disadvantages:

- may be more moisture absorbent than stone although coatings may be applied

- color fades in sunlight
- small air bubbles may disfigure units
- replacement stones are conspicuous if too few models and molds are made

Checklist:

- Is the historic material still available?
- What are the structural/anchorage requirements?
- Have samples been matched for color/texture/absorption? Have shop drawings been made for each shape?
- Are there performance standards?
- Has mortar been matched to adjacent historic mortar to achieve good color/tooling match?
- Are fabricators/installers experienced?

Fiber Reinforced Polymers (FRP, Fiberglass)

Material: Fiberglass is the most well known of the FRP products generally produced as a thin rigid laminate shell formed by pouring a polyester or epoxy resin gelcoat into a mold. When tack-free, layers of chopped glass or glass fabric are added along with additional resins. Reinforcing rods and struts can be added if necessary; the gel coat can be pigmented or painted.

Application: Fiberglass, a non load-bearing material attached to a separate structural frame, is frequently used as a replacement where a lightweight element is needed or an inaccessible location makes frequent maintenance of historic materials difficult. Its good molding ability and versatility to represent stone, wood, metal and terra cotta make it an alternative to ornate or carved building elements such as column capitals, bases, spandrel panels, beltcourses, balustrades, window hoods or parapets. Its ability to reproduce bright colors is a great advantage.

Advantages:

- lightweight, long spans available with a separate structural frame
- high ratio of strength to weight
- good molding ability
- integral color with exposed high quality pigmented gel-coat or takes paint well
- easily installed, can be cut, patched, sanded
- non-corrosive, rot-resistant

Disadvantages:

- requires separate anchorage system
- combustible (fire retardants can be added); fragile to impact.
- high coefficient of expansion and contraction requires frequently placed expansion joints
- ultraviolet sensitive unless surface is coated or pigments are in gelcoat
- vapor impermeability may require ventilation detail

Checklist:

- Can original materials be saved/used?
- Have expansion joints been designed to avoid unsightly appearance?
- Are there standards for color stability/durability?
- Have shop drawings been made for each piece?
- Have samples been matched for color and texture?
- Are fabricators/installers experienced?
- Do codes restrict use of FRP?

Epoxies (Epoxy Concretes, Polymer Concretes)

Material: Epoxy is a resinous two-part thermosetting material used as a consolidant, an adhesive, a patching compound, and as a molding resin. It can repair damaged material or recreate lost features. The resins which are poured into molds are usually mixed with fillers such as sand, or glass spheres, to lighten the mix and modify their expansion/contraction properties. When mixed with aggregates, such as sand or stone chips, they are often called epoxy concrete or polymer concrete, which is a misnomer as there are no cementitious materials contained within the mix. Epoxies are vapor impermeable, which makes detailing of the new elements extremely important so as to avoid trapping moisture behind the replacement material. It can be used with wood, stone, terra cotta, and various metals.

Application: Epoxy is one of the most versatile of the new materials. It can be used to bind together broken fragments of terra cotta; to build up or infill missing sections of ornamental metal; or to cast missing elements of wooden ornaments. Small cast elements can be attached to existing materials or entire new features can be cast. The resins are poured into molds and due to the rapid setting of the material and the need to avoid cracking, the molded units are generally small or hollow inside. Multiple molds can be combined for larger elements. With special rods, the epoxies can be structurally reinforced. Examples of epoxy replacement pieces include: finials, sculptural details, small column capitals, and medallions.

Advantages:

- can be used for repair/replacement
- lightweight, easily installed
- good casting ability; molds can be taken from building material can be sanded and carved.
- color and ultraviolet screening can be added; takes paint well
- durable, rot and fungus resistant

Disadvantages:

- materials are flammable and generate heat as they cure and may be toxic when burned
- toxic materials require special protection for operator and adequate ventilation while curing
- material may be subject to ultraviolet deterioration unless coated or filters added rigidity of material
- often must be modified with fillers to match expansion coefficients
- vapor impermeable

Checklist:

- Are historic materials available for molds, or for splicing-in as a repair option?
- Has the epoxy resin been formulated within the expansion/contraction coefficients of adjacent materials?
- Have samples been matched for color/finish?
- Are fabricators/installers experienced?
- Is there a sound substrate of material to avoid deterioration behind new material?
- Are there performance standards?

Summary

Substitute materials--those products used to imitate historic materials--should be used only after all other options for repair and replacement in kind have been ruled out. Because there are so many unknowns regarding the longterm performance of substitute materials, their use should not be considered without a thorough investigation into the proposed materials, the fabricator, the installer, the availability of specifications, and the use of that material in a similar situation in a similar environment.

Substitute materials are normally used when the historic materials or craftsmanship are no longer available, if the original materials are of a poor quality or are causing damage to adjacent materials, or if there are specific code requirements that preclude the use of historic materials. Use of these materials should be limited, since replacement of historic materials on a large scale may jeopardize the integrity of a historic resource. Every means of repairing deteriorating historic materials or replacing them with identical materials should be examined before turning to substitute materials.

The importance of matching the appearance and physical properties of historic materials and, thus, of finding a successful longterm solution cannot be overstated. The successful solutions illustrated in this Brief were from historic preservation projects involving professional teams of architects, engineers, fabricators, and other specialists. Cost was not necessarily a factor, and all agreed that whenever possible, the historic materials should be used. When substitute materials were selected, the solutions were often expensive and were reached only after careful consideration of all options, and with the assistance of expert professionals.

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Home page logo: Cast alumnimum used as a replacement for cast iron. Photo: NPS files.

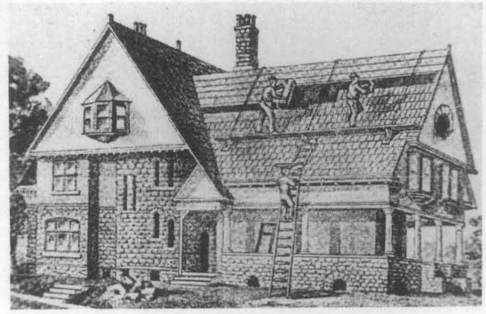
This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Technical Preservation Services (TPS), Heritage Preservation Services Division, National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments for a broad public.

Questions

EXHIBIT 6

Preservation Brief 29:
The Repair, Replacement, and
Maintenance of Historic Slate
Roofs

29 PRESERVATION BRIEFS



The Repair, Replacement, and Maintenance of Historic Slate Roofs

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Introduction

Slate is one of the most aesthetically pleasing and durable of all roofing materials. It is indicative at once of the awesome powers of nature which have formed it and the expertise and skill of the craftsman in hand-shaping and laying it on the roof. Installed properly, slate roofs require relatively little maintenance and will last 60 to 125 years or longer depending on the type of slate employed, roof configuration, and the geographical location of the property. Some slates have been known to last over 200 years. Found on virtually every class of structure, slate roofs are perhaps most often associated with institutional, ecclesiastical, and government buildings, where longevity is an especially important consideration in material choices. In the slate quarrying regions of the country, where supply is abundant, slate was often used on farm and agricultural buildings as well.

Because the pattern, detailing, and craftsmanship of slate roofs are important design elements of historic buildings, they should be repaired rather than replaced whenever possible. The purpose of this Preservation Brief is to assist property owners, architects, preservationists, and building managers in understanding the causes of slate roof failures and undertaking the repair and replacement of slate roofs. Details contributing to the character of historic slate roofs are described and guidance is offered on maintenance and the degree of intervention required at various levels of deterioration.

The relatively large percentage of historic buildings roofed with slate during the late nineteenth and early twentieth centuries means that many slate roofs, and the 60 to 125 year life span of the slates most commonly used, may be nearing the end of their serviceable lives at the end of the twentieth century. Too often, these roofs are being improperly repaired or replaced with alternative roofing materials, to the detriment of the historic integrity and appearance of the structure. Increased knowledge of the characteristics of slate and its detailing and installation on the roof can lead to more sensitive interventions in which original material is preserved and the building's historic character maintained. Every effort should be made to replace deteriorated slate roofs with new slate and to develop an effective maintenance and repair program for slate roofs that can be retained.

History of Slate Use in the United States

Although slate quarrying was not common in the United States until the latter half of the nineteenth century, slate roofing is known to have been used prior to the Revolution. Archeological excavations at Jamestown, Virginia, have unearthed roofing slate in strata dating from 1625-1650 and 1640-1670. Slate roofs were introduced in Boston as early as 1654 and Philadelphia in 1699. Seventeenth century building ordinances of New York and Boston recommended the use of slate or tile roofs to ensure fireproof construction.

In the early years of the Colonies, nearly all roofing slate was imported from North Wales. It was not until 1785 that the first commercial slate quarry was opened in the United States, by William Docher in Peach Bottom Township, Pennsylvania. Production was limited to that which could be consumed in local markets until the middle of the nineteenth century. Knowledge of the nation's abundant stone resources was given commercial impetus at this time by several forces, including a rapidly growing population that demanded housing, advances in quarrying technology, and extension of the railroad system to previously inaccessible markets. Two additional factors helped push the slate industry to maturity: the immigration of Welsh slate workers to the United States and the introduction of architectural pattern and style books (Figure 1). Slate production increased dramatically in the years following the Civil War as quarries were opened in Vermont, New York, Virginia, and Lehigh and Northampton Counties, Pennsylvania. By 1876, roofing slate imports had all but dried up and the United States became a net exporter of the commodity.

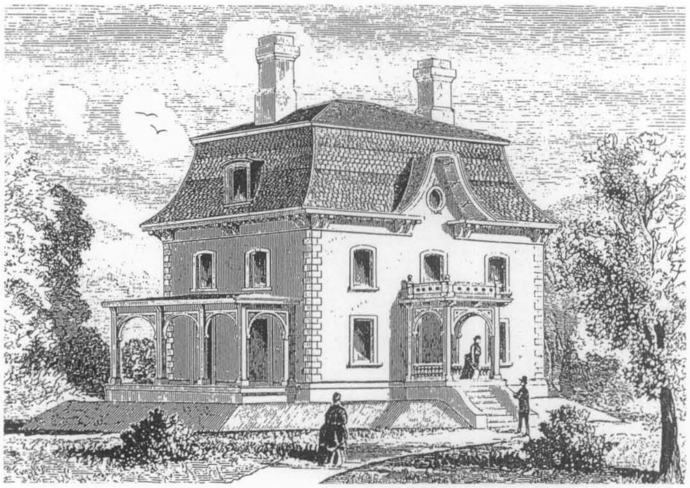


Figure 1. Architectural pattern books of the mid-nineteenth century awakened Americans to the availability and quality of slate for roofing purposes by incorporating slate roofs in their designs. Design XX, "A French Roof House," in A. J. Downing's Victorian Cottage Residences *is shown.*

The U.S. roofing slate industry reached its highest point in both quantity and value of output in the period from 1897 to 1914. In 1899, there were over 200 slate quarries operating in 13 states, Pennsylvania historically being the largest producer of all. The decline of the U.S. roofing slate industry began c.1915 and resulted from several factors, including a decline in skilled labor for both the fabrication and installation of slate and competition from substitute materials, such as asphalt shingles, which could be mass produced, transported and installed at a lower cost than slate. Only recently, with the increasing popularity of historic preservation and the recognition of the superiority of slate over other roofing materials, has slate usage begun to increase.

The Character and Detailing of Historic Slate Roofs

During some periods of architectural history, roof design has gone far beyond the merely functional and contributed much to the character of buildings. Roofs, by their compelling forms, have defined styles and, by their decorative patterns and colors, have imparted both dignity and beauty to buildings. The architectural styles prevalent during the latter half of the nineteenth and early twentieth centuries placed strong emphasis on prominent roof lines and greatly influenced the demand for slate. Slate, laid in multi-colored decorative patterns, was particularly well suited to the Mansard roofs of the Second Empire style, the steeply pitch roofs of the Gothic Revival and High Victorian Gothic styles, and the many prominent roof planes and turrets associated with the Queen Anne style. The Tudor style imitated the quaint appearance of some English slates which, because of their granular cleavage, are thick and irregular. These slates were often laid in a graduated pattern, with the largest slates at the eaves and the courses diminishing in size up the roof slope, or a textural pattern (Figure 2). Collegiate Gothic style buildings, found on many university campuses, were often roofed with slate laid in a graduated pattern.

The configuration, massing, and style of historic slate roofs are important design elements that should be preserved. In addition, several types of historic detailing were often employed to add visual interest to the roof, essentially elevating the roof to the level of an ornamental architectural element. When repairing or replacing a slate roof, original details affecting its visual character should be retained.

Before repairing or replacing an existing slate roof, it is important to document the existing conditions and detailing of the roof using written, visual, and physical evidence so that original features can be identified and preserved. Documentation should continue through the repair or replacement process as significant details, long obscured, are often rediscovered while carrying out these activities. Local histories, building records, old receipts and ledgers, historic photographs, sketches, and paintings, shadow lines and nail hole patterns on the roof deck, and bits of historic material left over from previous interventions (often found in eave cavities) are all useful sources of information which can be of help in piecing together the original appearance of the roof. Size, shape, color, texture, exposure, and coursing are among the most important characteristics of the original slates which should be documented and matched when repairing or replacing an historic slate roof.

Historically, three types of slate roofing—standard, textural, and graduated—were available according to the architectural effect desired. Standard grade slate roofs were most common. These are characterized by their uniform appearance, being composed of slates approximately 3/16″ (0.5cm) thick, of consistent length and width, and having a smooth cleavage surface. Thirty different standard sizes were available, ranging from 10″ (25cm) × 6″ to 24″ × 14″ (15cm × 61cm × 35cm). The slates were laid to break joints and typically had square ends and uniform color and exposure. Patterned and polychromatic roofs were created by laying standard slates of different colors and shapes on the roof in such a way as to create sunbursts, flowers, sawtooth and geometric designs, and even initials and dates (Figure 3). On utilitarian structures, such as barns and sheds, large gaps were sometimes left between each slate within a given course to reduce material and installation costs and provide added ventilation for the interior (Figure 4).

Figure 2. The quaint character of this Tudor style residence is derived, in part, from its textural roof.

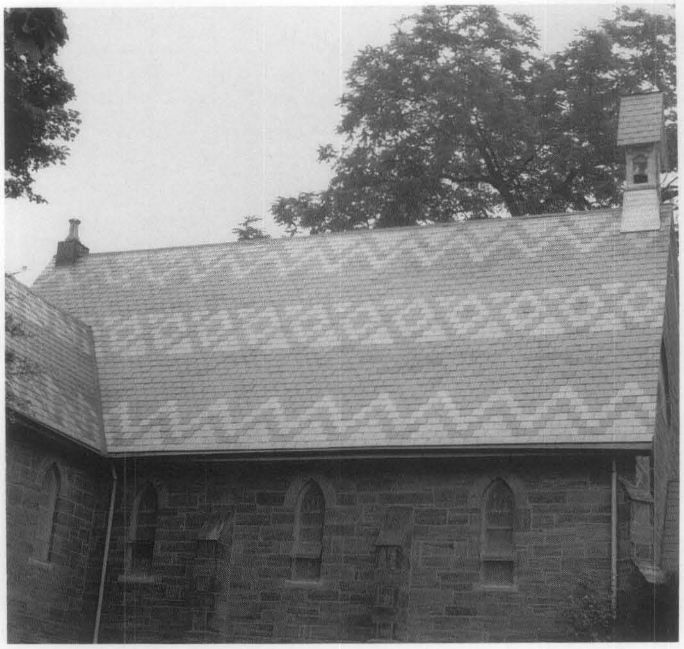


Figure 3. A sawtooth geometric design composed of red, green, and black slates makes this roof the most visually important feature of the building.

Figure 4. Widely spaced open slating was often used on utilitarian structures where ventilation was desirable. It provided an interesting texture and visual pattern to often plain structures.

Textural slate roofs incorporate slates of different thicknesses, uneven tails, and a rougher texture than standard slates. Textural slate roofs are perhaps most often associated with Tudor style buildings where slates of different colors are used to enhance the effect.

Graduated slate roofs were frequently installed on large institutional and ecclesiastical structures (Figure 5). The slates were graduated according to thickness, size, and exposure, the thickest and largest slates being laid at the eaves and the thinnest and smallest at the ridge. Pleasing architectural effects were achieved by blending sizes and colors.

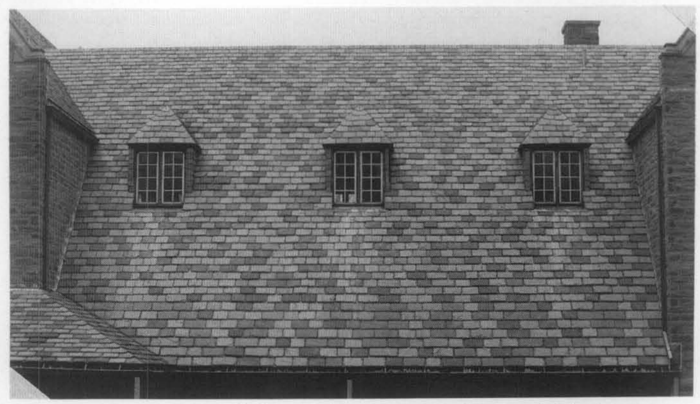


Figure 5. This graduated slate roof is composed of large, thick slates at the eave which are reduced in size and thickness as the slating progresses to the ridge.

Detailing at the hips, ridges and valleys provided added opportunity to ornament a slate roof. Hips and ridges can be fashioned out of slate according to various traditional schemes whereby the slates are cut and overlapped to produce a watertight joint of the desired artistic effect. Traditional slate ridge details are the saddle ridge, strip saddle ridge, and comb ridge, and for hips, the saddle hip, mitered hip, Boston hip, and fantail hip (Figure 6). A more linear effect was achieved by covering the ridges and hips with flashing called "cresting" or "ridge roll" formed out of sheet metal, terra cotta, or even slate (Figure 7). Snow guards, snow boards, and various types of gutter and rake treatments also contributed to the character of historic slate roofs (Figure 8).

Two types of valleys were traditionally employed, the open valley and the closed valley. The open valley is lined with metal over which slates lap only at the sides. Closed valleys are covered with slate and have either a continuous metal lining or metal flashing built in with each course. Open valleys are easier to install and maintain, and are generally more watertight than closed valleys. Round valleys are a type of closed valley with a concave rather than V-shaped section (Figure 9). Given the broader sweep of the round valley, it was not uncommon for roofers to interweave asphalt saturated felts rather than copper sheet in the coursing in order to cut costs.

Although principally associated with graduated and textural slate roofs, round valleys were infrequently employed due to the difficulty and expense of their installation.

Common types of sheathing used include wood boards, wood battens, and, for fireproof construction on institutional and government buildings, concrete or steel (Figure 10). Solid wood sheathing was typically constructed of tongue and groove, square edged, or shiplapped pine boards of 1" (2.5 cm) or 1 1/4" (3 cm) nominal thickness. Boards from 6" (15 cm) to 8" (20 cm) wide and tongue and groove boards were generally preferred as they were less likely to warp and curl.

Wood battens, or open wood sheathing, consisted of wood strips, measuring from 2" (5 cm) to 3" (7.5 cm) in width, nailed to the roof rafters. Spacing of the battens depended on the length of the slate and equaled the exposure. Slates were nailed to the batten that transected its mid-section. The upper end of the slate rested at least 1/2" (1.25 cm) on the batten next above. Open wood sheathing was employed primarily on utilitarian, farm, and agricultural structures in the North and on residential buildings in the South where the insulating value of solid wood sheathing was not a strict requirement. To help keep out dust and wind driven rain on residential buildings, mortar was often placed along the top and bottom edge of each batten, a practice sometimes referred to as torching.

Various Roofing Details

Figure 6. Hips are formed at the external angle of two roofing slopes. In (a), the hips at both the roof and the dormer are covered with metal. Note also the open valley and the built-in gutter. In (b), the dormer hip slates have been laid in a fantail pattern to help shed water. Note also the metal ridge cap.

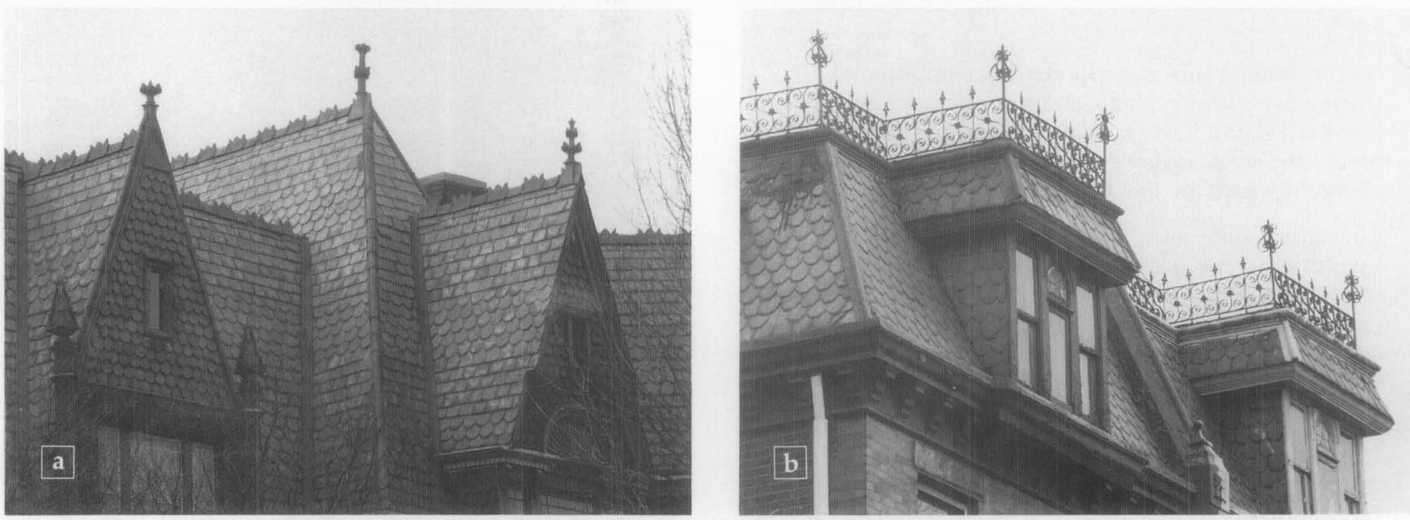


Figure 7. Ridge caps and cresting can be elaborate. Ridges are formed at the long horizontal juncture of two roofing slopes and capping protects this joint from moisture. In (a), a terra cotta capping with a decorative profile complements the finial over the various roof peaks. In (b), the mansard roof has a decorative iron cresting at the break between the lower and the upper roof slopes.

Figure 8. Eave details include snow guards, snow boards, gutter treatments. Snow guards are generally used in areas where ice and snow accumulate to avoid dangerous slides from the roof. In (a) the snow guards are set in two staggered rows above a pole gutter. In (b), the copper wire snow guards are set more frequently up a very steep gable.

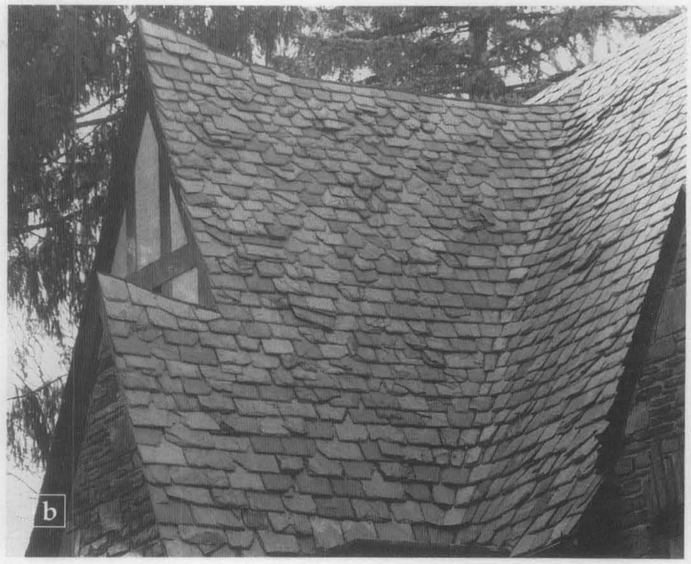


Figure 9. Valleys are formed at the internal angle of two roofing slopes. Flashing is often placed under the slate to increase moisture protect at this vulnerable joint. Shown in (a) is a closed valley where the slates are held tight to the valley line. (b) illustrates of a round valley where the transition between the two slopes is a continuous curve. It requires careful workmanship and an experienced roofer.

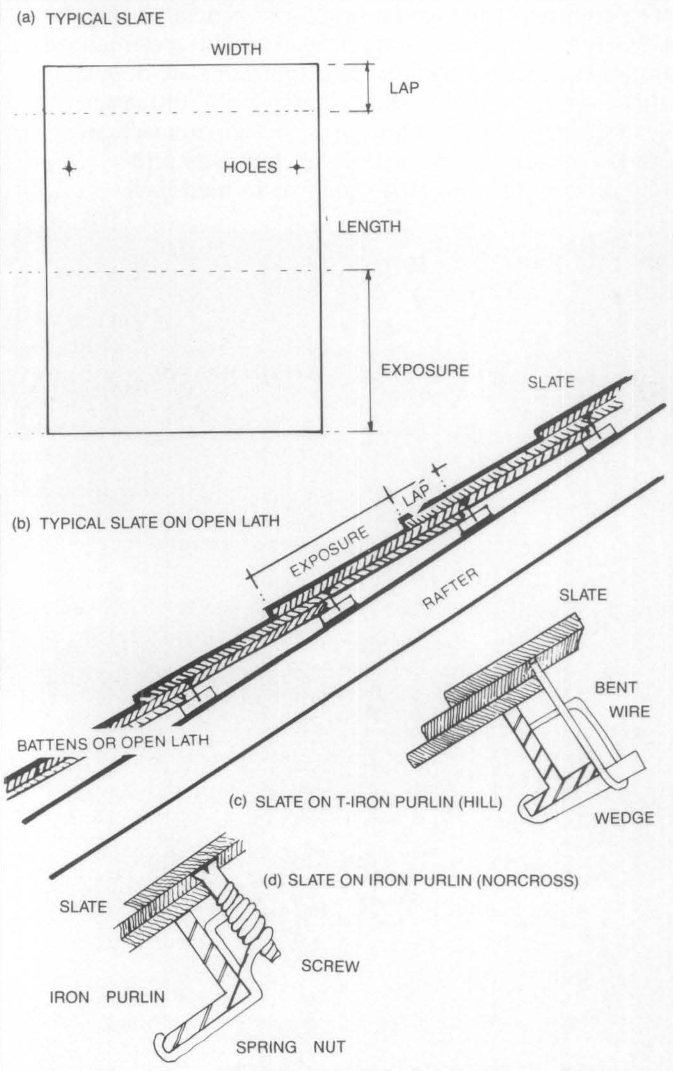


Figure 10. (a) shows a typical slate; exposure may be calculated by subtracting the headlap from the total length of the slate and dividing by two. Slates were typically nailed either to closed wooden decking or to open laths (b). In the late 19th century, with the concern for fireproof construction, special fasteners were developed to secure slate to steel purlins (c) 1881 patent to James G. Hill; (d) 1889 patent to Orlando W. Norcross).

Steel angles substituted for the wood battens in fireproof construction. The slates were secured using wire wrapped around the steel angle, where it was twisted-off tight. Alternately, any of a variety of special fasteners patented over the years could have been used to attach the slate to the steel angle (Figure 10). On roofs with concrete decks, slates were typically nailed to wood nailing strips embedded in the concrete.

Beginning in the late nineteenth century, asphalt saturated roofing felt was installed atop solid wood sheathing. The felt provided a temporary, watertight roof until the slate could be installed atop it. Felt also served to cushion the slates, exclude wind driven rain and dust, and ease slight unevenness between the sheathing boards.

Slate was typically laid in horizontal courses starting at the eaves with a standard headlap of 3″ (7.5 cm) (Figure 10). Headlap was generally reduced to 2″ (5 cm) on Mansard roofs and on particularly steep slopes with more than 20″ (50 cm) of rise per 12″ (30 cm) of run. Conversely, headlap was increased to 4″ (10 cm) or more on low pitched roofs with a rise of 8″ (20 cm) or less per 12″ (30 cm) of horizontal run. The minimum roof slope necessary for a slate roof was 4″ (10 cm) of rise per 12″ (30 cm) of run.

Where Does Slate Come From?

Slate is a fine grained, crystalline rock derived from sediments of clay and fine silt which were deposited on ancient sea bottoms. Superimposed materials gradually consolidated the sedimentary particles into bedded deposits of shale. Mountain building forces subsequently folded, crumpled, and compressed the shale. At the same time, intense heat and pressure changed the original clays into new minerals such as mica, chlorite, and quartz. By such mechanical and chemical processes bedded clays were transformed, or metamorphosed, into slate, whole

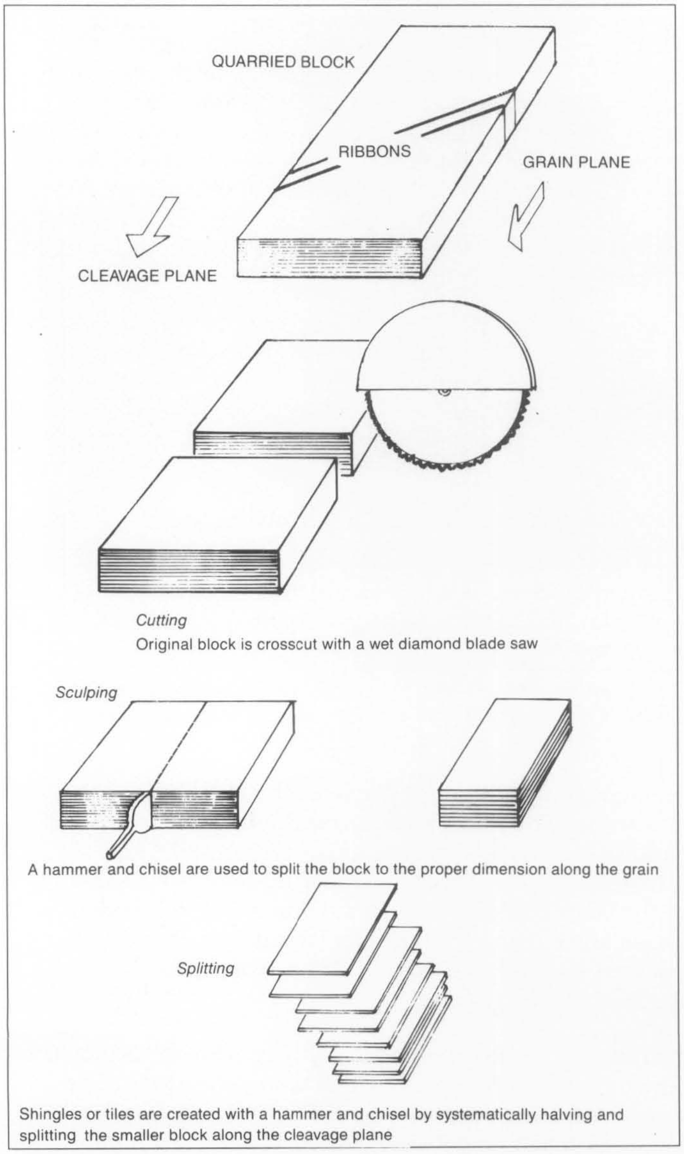


Figure 11. Slate roofing tiles or shingles are still manufactured using traditional methods brought to this country by Welsh immigrants in the nineteenth century. Shown above are the first 3 steps of cutting, sculping and splitting. Once the rough slate tile is made it is trimmed and punched for holes.

geologic ages being consumed in the process. Slates vary in composition, structure, and durability because the degree to which their determinant minerals have been altered is neither uniform nor consistent.

The adaptation of slate for roofing purposes is inextricably linked to its genesis. The manufacturing processes of nature have endowed slate with certain commercially amenable properties which have had a profound influence on the methods by which slate is quarried and fabricated (Figure 11), as well as its suitability for use as a roofing tile.

Slate roofing tiles are still manufactured by hand using traditional methods in a five step process: cutting, sculping, splitting, trimming, and hole punching. In the manufacturing process, large, irregular blocks taken from the quarry are first cut with a saw across the grain in sections slightly longer than the length of the finished roofing slate. The blocks are next sculped, or split along the grain of the slate, to widths slightly larger than the widths of finished slates. Sculping is generally accomplished with a mallet and a broad-faced chisel, although some types of slate must be cut along their grain. In the splitting area, the slightly oversized blocks are split along their cleavage planes to the desired shingle thickness. The splitter's tools consist of a wooden mallet and two splitting chisels used for prying the block into halves and repeating this process until the desired thinness is reached (Figure 12). The last two steps involve trimming the tile to the desired size and then punching two nail holes toward the top of the slate using a formula based on the size and exposure of the slate.

Minerals, the building blocks of rocks, through their characteristic crystalline structures define the physical properties of the rocks which they compose. Slate consists of minerals that are stable and resistant to weathering and is, therefore, generally of high strength, low porosity, and low absorption. The low porosity and low absorption of slate mitigate the deleterious action of frost on the stone and make it well adapted for roofing purposes. The two most important structural properties of slate are cleavage and grain.

The metamorphic processes of geologic change necessary to produce slate are dependent upon movements in the earth's crust and the heat and pressure generated thereby. For this reason, slate is found only in certain mountainous regions. The most economically important slate deposits in this country lie in the Mid-Atlantic and Northeastern states transversed by or bordering on the Appalachian Mountain chain. Variations in local chemistry and conditions under which the slate was formed have

Figure 12. In the splitting area, the slightly oversized blocks are split along their cleavage planes. The splitter's tools consist of a wooden mallet and splitting chisels. The process of halving the split portions is repeated until a tile or shingle of appropriate thinness is obtained.

Figure 13. Paper thin lamination can be seen flaking off of this weathered, 120 year piece of Pennsylvania Hard-Vein slate.

produced a wide range of colors and qualities and ultimately determine the character of the slate found in these areas.

Slate is available in a variety of colors. The most common are grey, blue-grey, black, various shades of green, deep purple, brick red, and mottled varieties. The presence of carbonaceous matter, derived from the decay of marine organisms on ancient sea floors, gives rise to the black colored slates. Compounds of iron generate the red, purple, and green colored slates.

Generally, the slates of Maine, Virginia, and the Peach Bottom district of York County, Pennsylvania are deep blue-black in color. Those of Virginia have a distinctive lustrous appearance as well due to their high mica content. The slates of Lehigh and Northampton Counties, Pennsylvania, are grayish-black in color. Green, red, purple, and mottled slates derive from the New York-Vermont district. The slate producing region of New York, which centers around Granville and Middle Granville, is particularly important because it contains one of the few commercial deposits of red slate in the world.

Slates are also classified as fading or unfading according to their color stability. Fading slates change to new shades or may streak within a short time after exposure to the atmosphere due to the presence of fine-grained disseminated pyrite. For example, the "weathering green" or "sea-green" slates of New York and Vermont are grayish green when freshly quarried. Upon exposure, from 20% to 60% of the slates typically weather to soft tones of orange-brown, buff, and gray while the others retain their original shade. Slates designated as unfading maintain their original colors for many years.

Color permanence generally provides no indication of the durability of slate. Rather, time has shown that the Vermont and New York slates will last about 125 years; Buckingham Virginia slates 175 years or more; and Pennsylvania Soft-Vein slates in excess of 60 years; Pennsylvania Hard-Vein slates and Peach Bottom slates, neither of which is still quarried, had life spans of roughly 100 and at least 200 years respectively. The life spans provided should be used only as a general guide in determining whether or not an existing slate roof is nearing the end of its serviceable life.

Ribbons are visible as bands on the cleavage face of slate and represent geologic periods during which greater amounts of carbonaceous matter, calcite, or coarse quartz particles were present in the sediment from which the slate was formed. Ribbons typically weather more and were most common in Pennsylvania slate quarries. As they were not as durable as clear slates, ribbon slate is no longer manufactured for roofing purposes. Mottled grey slates from Vermont are the closest match for Pennsylvania ribbon slate available today.

In recent years, slates from China, Africa, Spain and other countries have begun to be imported into the United States, primarily for distribution on the West Coast. The use of imported slates should probably be limited to new construction since their colors and textures often do not match those of U.S. slate.

Deterioration of Slate and Slate Roofs

The durability of a slate roof depends primarily on four factors: the physical and mineralogical properties of the slate; the way in which it is fabricated; installation techniques employed; and, regular and timely maintenance. The first three of these factors are examined below. The maintenance and repair of slate roofs are discussed in later sections of this Brief.

The natural weathering of roofing slate manifests itself as a slow process of chipping and scaling along the cleavage planes (Figure 13). Paper thin laminations flake off the surface of the slate and the slate becomes soft and spongy as the inner layers begin to come apart, or delaminate. The nature of the sound given off by a slate when tapped with one's knuckles or slating hammer is a fair indication of its condition. High-grade slate, when poised upon the fingertips and struck, will emit a clear, solid sound. Severely weathered slates are much less sonorous, and give off a dull thud when tapped.

The weathering of slate is chiefly due to mineral impurities (primarily calcite and iron sulfides) in the slate which, in concert with alternating wet/dry and hot/cold cycles, react to form gypsum (Figure 14). Because gypsum

Figure 14. The white blotches on these Pennsylvania Soft-Vein slates indicate areas where gypsum is leaching out onto the surface of the slates.

Figure 15. View of the underside of slates laid on open sheathing shows that delamination and flaking is just as bad or worse on the underside of slates as on the exposed surface. This is why most slates cannot be flipped over for reuse.

molecules take up about twice as much volume as calcite molecules, internal stresses result from the reaction, causing the slate to delaminate. This type of deterioration is as prominent on the underside of the roof as on the exposed surface due to the leaching and subsequent concentration of gypsum in this area (Figure 15). Consequently, deteriorated roofing slates typically cannot be flipped over and re-used.

The chemical and physical changes which accompany slate weathering cause an increase in absorption and a decrease in both strength and toughness. The tendency of old, weathered slates to absorb and hold moisture can lead to rot in underlying areas of wood sheathing. Such rot can go undetected for long periods of time since, often, there is no accompanying leak. Due to their loss of strength, weathered slates are more prone to breakage, loss of corners, and cracking.

Slates with low calcite content tend to weather slowly. Dense slates, with low porosity, likewise decay slower than slates with equal calcite, but with a greater porosity. The pitch of a roof can also affect its longevity. The steeper the pitch, the longer the slate can be expected to last as water will run off faster and will be less likely to be drawn under the slates by capillary action or driven under by wind forces. Spires and the steep slopes of Mansard roofs often retain their original slate long after other portions of the roof have been replaced. Areas of a roof subject to concentrated water flows and ice damming, such as along eaves and valleys, also tend to deteriorate more rapidly than other areas of the roof.

Mechanical agents, such as thermal expansion and contraction and the action of frost, are subordinate in the weathering of slate, coming into play only after the slate has been materially altered from its original state by the chemical transformation of calcite to gypsum. The more rapid deterioration of slates found on roof slopes with the most severe exposure to the sun, wind, and rain (typically, but not always, a southern exposure) may be attributable to the combined result of the deleterious effects of impurities in the slate and mechanical agents. Atmospheric acids produce only negligible deterioration in roofing slate.

It is difficult to assess the procedures by which a piece of slate has been fabricated without visiting the quarry and observing the process first hand. The location and size of nail holes, grain orientation, the condition of corners, and the number of broken pieces are all things which may be observed in a shipment of slate to judge the quality of its fabrication. Nail holes should be clean and with a shallow countersink on the face of the slate for the nail head; grain oriented along the length of the slate; and, corners left whole. An allowance for 10% breakage in shipment is typically provided for by the quarry.

Installation problems often involve the improper nailing and lapping of slates. The nailing of slates differs from that of other roofing materials. Slate nails should not be driven tight as is the case with asphalt and wood shingles. Rather, they should be set such that the slate is permitted to hang freely on the nail shank. Nails driven too far will crack the slate and those left projecting will puncture the overlying slate (Figure 16). Nail heads left exposed accelerate roof deterioration by providing a point for water entry. Non-ferrous slater's nails, such as solid copper or stainless steel, should always be used since plain steel and galvanized nails will usually rust out long before the slate itself begins to deteriorate. The rusting of nineteenth century cut nails is a common cause of slate loss on historic roofs.

When joints are improperly broken (i.e., when slates lap the joints in the course below by less than 3" [7.5 cm]), it is possible for water to pass between the joints, through the nail holes and ultimately to the underlying felt, where it will cause deterioration and leaks to develop. Insufficient headlap can also result in leaks as water entering the joints between slates may have a greater tendency to be wind blown beyond the heads of the slates in the course below.

Occasionally, individual slates are damaged. This may be caused by falling tree limbs, ice dams in gutters, valleys, and chimney crickets, the weight of a workman walking on the roof, or a naturally occurring fault in the slate unit. Whatever the form of damage, if it is caught soon enough, the roof can usually be repaired or selectively replaced and deterioration mitigated.

The ability to lay slate properly so as to produce a water-tight and aesthetically pleasing roof requires training, much practice, and the right tools (Figure 17). The

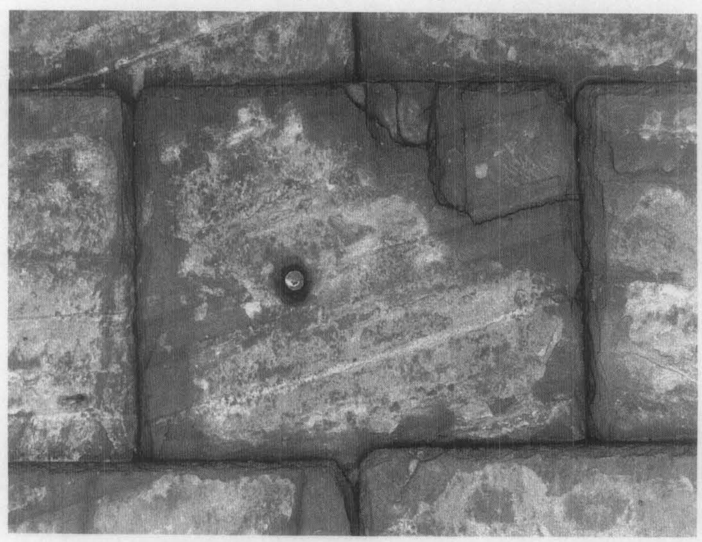


Figure 16. Detail view of a slate which has been punctured by the head of a nail used to secure the slate in the course below. Likely, the nail was not hammered in far enough when originally installed.

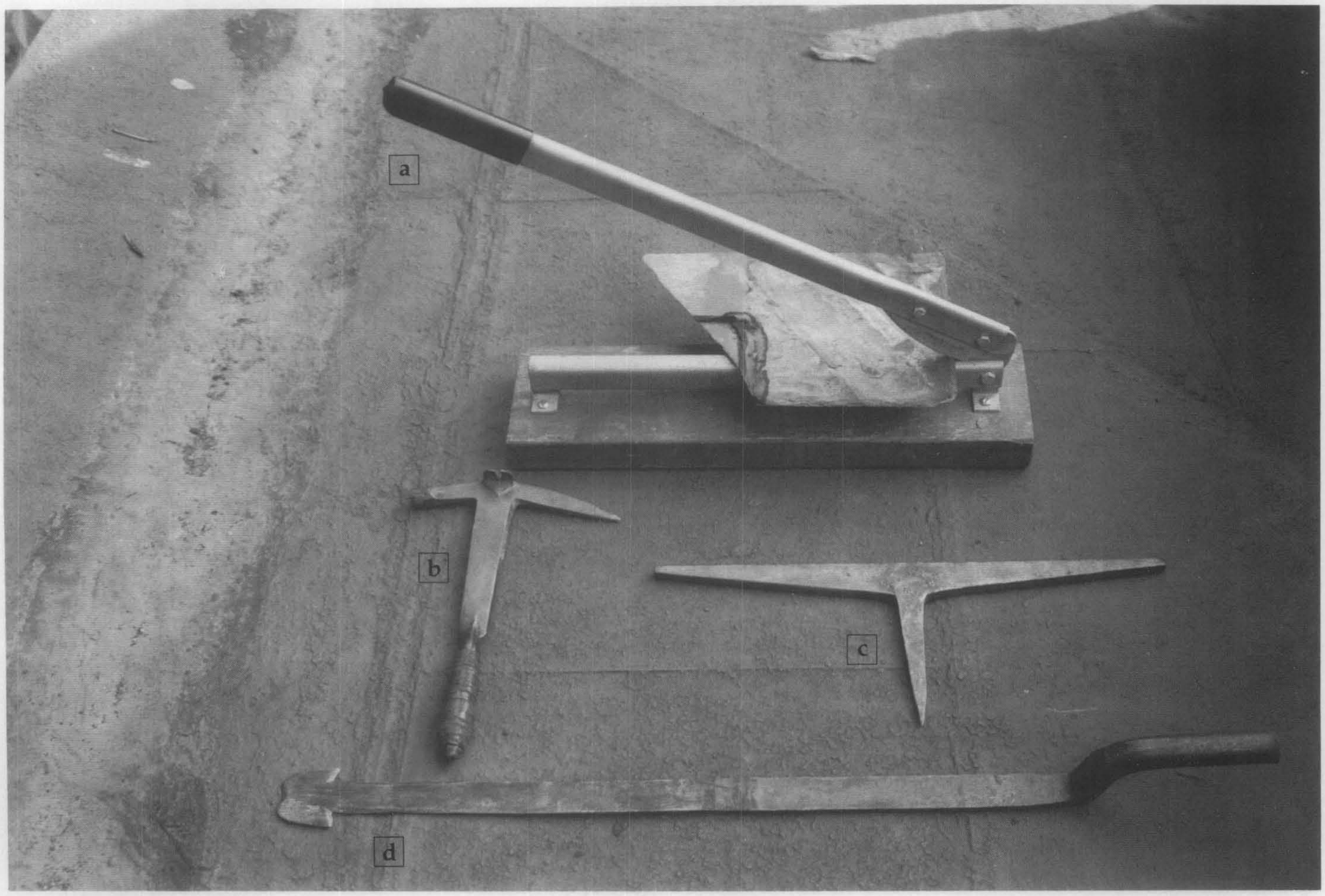


Figure 17. Slater's Tools. The cutter (a) is used to trim slate edges; the slate hammer (b) is used for hammering nails, trimming, cutting and punching holes in slates, and pulling roofing nails; the steak (c) is a T-shaped piece of iron upon which the slater places the edge of a slate to be trimmed; and the ripper (d) is slid under the slates to pull out the nails.

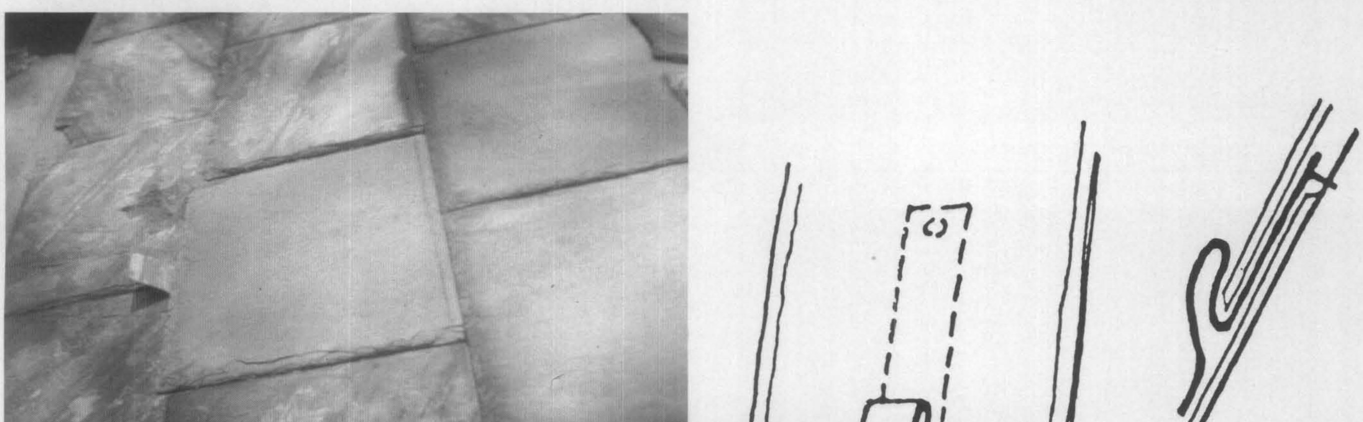
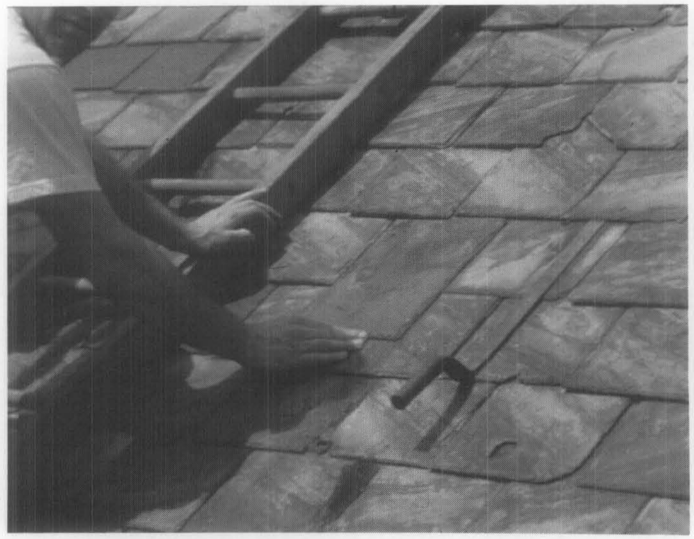


Figure 18. A method of securing replacement slates is shown. The copper strip is nailed to the roof sheathing just above the head of the slate in the course below. The replacement slate is then inserted and the copper tab folded over its tail. This type of repair is not recommended for northern climates where snow and ice can cause the copper tab to fold over, allowing the replacement slate to slide out of position as occurred here on the left.

Repair Sequence

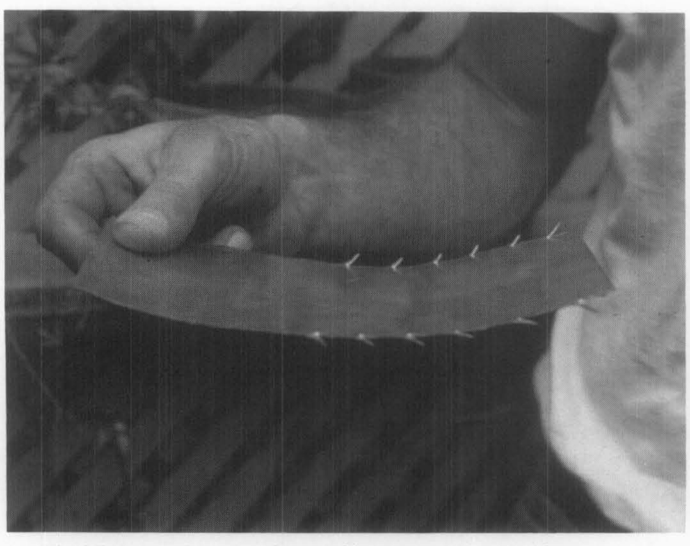
(a) A ripper is used to remove the nails from the deteriorated slate.



(b) A replacement slate is slid into place.

(c) A new slate is secured in place with a copper nail.

(d) A copper bib is formed to protect the newly created nail hole.



(e) The bib is cut along its edges and bent into a concave shape to create a friction fit.

(f) The slate hammer is used to push the bib in place over the nail head.

Figure 19. Above is a repair sequence for replacing a damaged slate.

The installation and repair of slate roofs should be entrusted only to experienced slaters.

Repairing Slate Roofs

Broken, cracked, and missing slates should be repaired promptly by an experienced slater in order to prevent water damage to interior finishes, accelerated deterioration of the roof and roof sheathing, and possible structural degradation to framing members (Figures 18 and 19).

The damaged slate is first removed by cutting or pulling out its nails with a ripper. If steel cut nails, rather than copper nails, were used in laying the roof, adjacent slates may be inadvertently damaged or displaced in the ripping process, and these, too, will have to be repaired. If the slate does not slide out by itself, the pointed end of the slate hammer can be punched into the slate and the slate dragged out. A new slate, or salvaged slate, which should match the size, shape, texture, and weathered color of the old slate, is then slid into place and held in position by one nail inserted through the vertical joint between the slates in the course above and approximately one inch below the tail of the slate two courses above. To prevent water penetration through the newly created nail hole, a piece of copper with a friction fit, measuring roughly 3″ (7.5 cm) in width and 8″ (20 cm) in length, is slid lengthwise under the joint between the two slates located directly above the new slate and over the nail. Alternate methods for securing the replacement slate include the use of metal hooks, clips, and straps that are bent over the tail end of the slate. The application of roofing mastic or sealants to damaged slates should *not* be considered a viable repair alternative because these materials, though effective at first, will eventually harden and crack, thereby allowing water to enter (Figure 20). Mastic also makes future repairs more difficult to execute, is unsightly, and, when applied to metal flashings, accelerates their corrosion.

When two or more broken slates lie adjacent to each other in the same course, or when replacing leaky valley flashings, it is best to form pyramids (i.e., to remove a diminishing number of slates from higher courses) to keep the number of bibs required to a minimum. When re-installing the slates, only the top slate in each pyramid will need a bib. Slates along the sides of the pyramid will receive two nails, one above the other, along the upper part of its exposed edge.

When many slates must be removed to effect a repair, the sheathing should be checked for rotted areas and projecting nails. Plywood is generally not a good replacement material for deteriorated wood sheathing due to the relative difficulty of driving a nail through it (the bounce produced can loosen adjacent slates). Instead, new wood boards of similar width and thickness to those being replaced should be used. Because the nominal thickness of today's dimension lumber is slightly thinner than that produced in the past, it may be necessary to shim the new wood boards so that they lie flush with the top surface of adjacent existing sheathing boards. Pressure treated lumber is not recommended due to its tendency to shrink. This can cause the slates to crack and become displaced.

To permit proper re-laying of the slate, the new roof sheathing must be of smooth and solid construction. At least two nails should be placed through the new boards at every rafter and joints between the ends of the boards should occur over rafters. Insufficient nailing will cause the boards to be springy, making nailing of the slates difficult and causing adjacent slates to loosen in the process. Unevenness in the sheathing will show in the finished roof surface and may cause premature cracking of the slate. Roof sheathing in valleys and along hips, ridges, and eaves may be covered with waterproof membrane underlayment rather than roofing felt for added protection against leakage.

In emergency situations, such as when severe hurricanes or tornadoes blow numerous slates off the roof, a temporary roof covering should be installed immediately after the storm to prevent further water damage to the interior of the building and to permit the drying out process to begin. Heavy gauge plastic and vinyl tarpaulins are often used for this purpose, though they are difficult to secure in place and can be blown off in high winds. Roll roofing, carefully stitched in to areas of the remaining roof, is a somewhat more functional solution that will allow sufficient time to document the existing roof conditions, plan repairs, and order materials (Figure 21).

Slate roof repair is viable for localized problems and damaged roofs with reasonably long serviceable lives remaining. If 20% or more of the slates on a roof or roof slope are broken, cracked, missing, or sliding out of position, it is usually less expensive to replace the roof than to execute individual repairs. This is especially true of older roofs nearing the end of their serviceable lives

Figure 20. This roof has been poorly repaired numerous times in the past. The installation of mastic to seal out moisture has only exacerbated the problem. A timely repair and good maintenance could have extended the life of this roof.

Figure 21. As a result of hurricanes and other disasters, it may be necessary to temporarily stabilize a roof until materials can be obtained and a qualified roofing contractor hired. Heavy roofing felt was stitched into this slate roof to stop moisture penetration until matching slate was obtained for repair. Significant slate roofs should not be stripped off and replaced with asphalt shingles. Photograph courtesy of the National Park Service.

because even the most experienced slater will likely damage additional slates while attempting repairs. Depending on the age of the slate, its expected serviceable life, and the cause(s) of deterioration, it may or may not be cost effective to salvage slates. Where deteriorated nails or flashings are the cause of the roof failure, salvage of at least some slates should be possible for use in repairs. When salvaging slates, each must be sounded to discover cracks and faults and the degree to which it has weathered. It is usually wise to salvage slates when only a portion of the roof is to be replaced. In this way, the salvaged slates may be used for future repairs to the remaining sections of the roof.

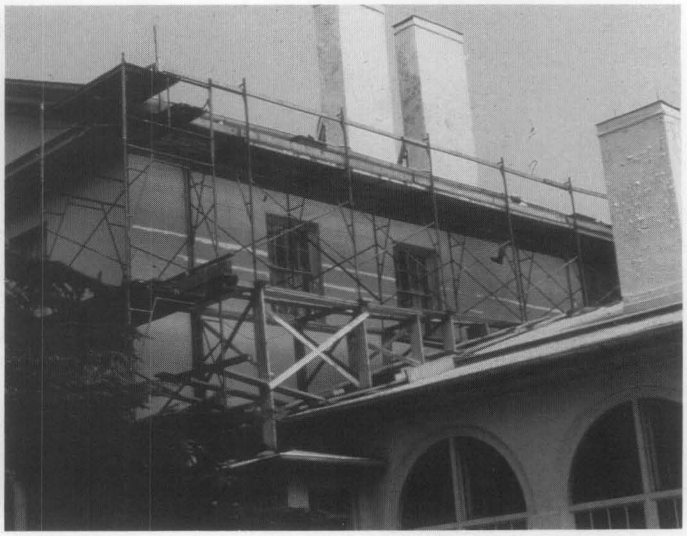
The Replacement of Deteriorated Roofs

Historic slate roofs should be repaired rather than replaced whenever possible. Before replacing a slate roof, check for isolated damage, corroded and worn flashings, leaky gutters, poor ventilation in the attic, and other possible sources of moisture. All too often slate roofs are mistakenly replaced when, in fact, they could have been effectively repaired. Deciding whether an historic slate roof should be repaired or replaced can be difficult and each roof must be judged separately (see guidance in shaded box on page 16).

If repair is not possible and a new slate roof must be installed, it is important to remember that more than just the replacement of the slate is involved (Figure 22). The old slate should be removed to prevent overloading of the roof timbers. Stripping should be done in sections, with felt installed, to avoid exposing the entire sub-roof to the weather. In the process, rotted wood sheathing should be replaced and the roof timbers checked for signs of stress, including deflection, cracking, and twisting. If such conditions are found, a structural engineer experienced in working with older buildings should be consulted. Other repairs, such as chimney repointing, which may require access to the roof should be completed before the new roof is put on.

Drawings and specifications for a new slate roof should be prepared by a restoration architect, especially if the project is going to be competitively bid or if the roof is particularly complex. Standard specifications, like those published in 1926 by the National Slate Association may be used as a basis for developing specifications appropriate for a particular project. The specifications and drawings should contain all the information necessary to replicate the original appearance of the roof as closely as possible. Certain changes may have to be accepted, however, since several types of slate once prominent in this country, such as ribbon slate, are no longer quarried. It is wise to

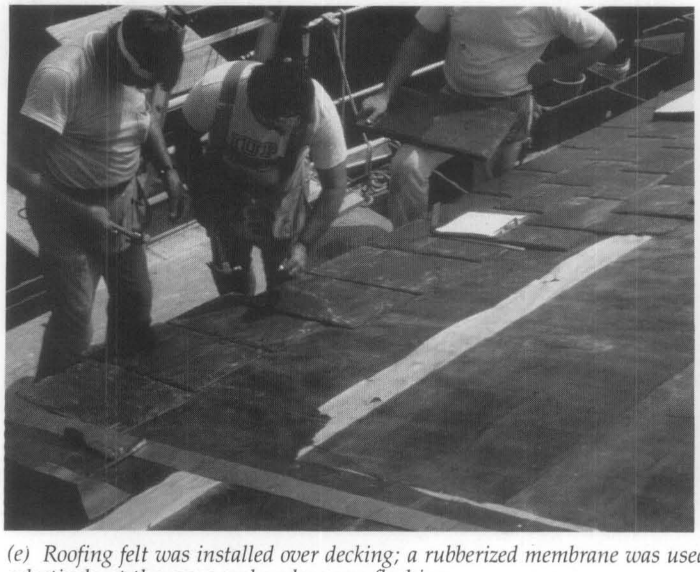
(a) Historic documentation was necessary to determine the historic configuration.



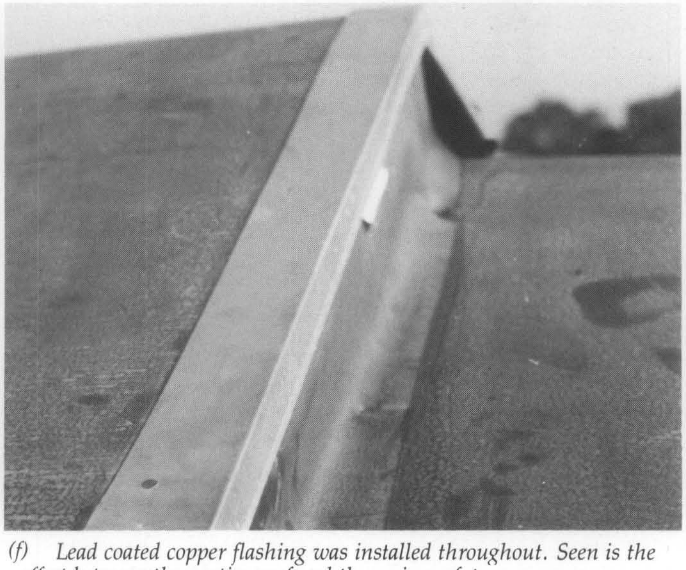
(b) Scaffolding was installed early to document existing conditions to determine extent of work.

(c) Slate was removed in sections to avoid stress on timber framing.

(d) Deteriorated sheathing was replaced and rafter tails were reinforced.

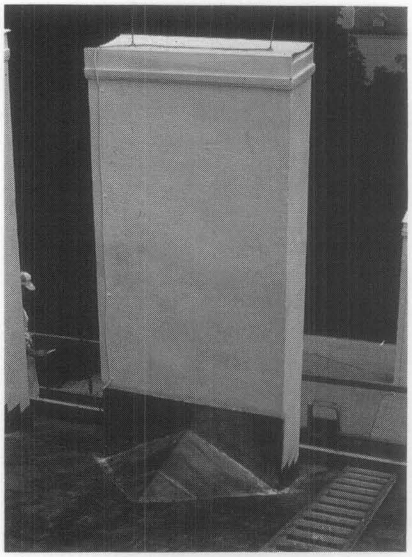


(e) Roofing felt was installed over decking; a rubberized membrane was used selectively at the eaves and under some flashing.

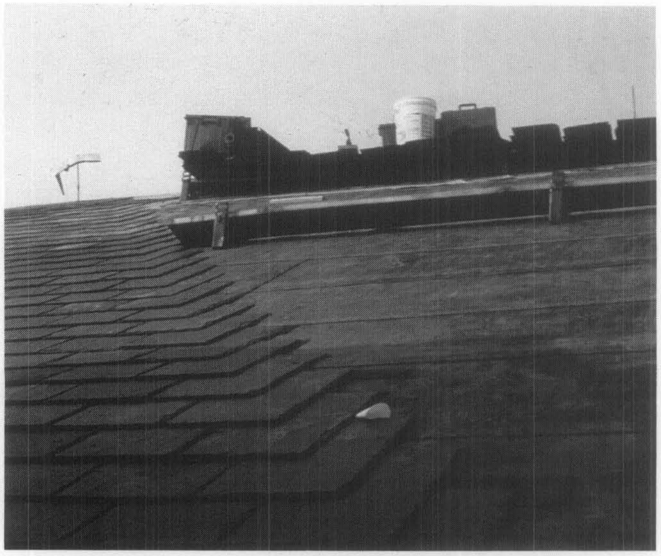


(f) Lead coated copper flashing was installed throughout. Seen is the offset between the portico roof and the main roof in progress.

Figure 22. Installing a new roof involves more than just slate. Above is a sequence of views of the roof replacement at Arlington House. Photographs courtesy of the National Park Service. *(Sequence continued on page 14.)*



(g) Masonry chimneys were repaired and metal crickets were fabricated at the chimneys.



(h) This installation pattern allows the slates to be laid in courses leaving a temporary path of travel to avoid stepping on installed slates.

(i) Although the gutters and snow boards were the last elements installed, their support brackets were installed as the slates were laid.

anticipate the replacement of older roofs so that proper planning can be undertaken and financial resources set aside, thereby, reducing the likelihood of rash last minute decisions.

Roofing slate is sold by the square in the United States. One square is enough to cover 100 square feet (13.3 square meters) of plain roof surface when laid with a standard headlap of 3" (7.5cm). When ordering slate, considerable lead time should be allowed as delivery may take anywhere from 4 to 12 weeks and even as long as 1 year for special orders. Orders for random widths of a particular slate can generally be filled more quickly than orders for fixed widths. Once on site, slates should be stored on edge, under cover on pallets.

A roof and its associated flashings, gutters, and downspouts function as a system to shed water. Material choices should be made with this in mind. For example, use a single type of metal for all flashings and the rainwater conductor system to avoid galvanic action. Choose materials with life spans comparable to that of the slate, such as non-ferrous nails. Use heavier gauge flashings or sacrificial flashings in areas that are difficult to access or subject to concentrated water flows.

Flashings are the weakest point in any roof. Given the permanence of slate, it is poor economy to use anything but the most durable of metals and the best workmanship for installing flashings. Copper is one of the best flashing materials, and along with terne, is most often associated with historic slate roofs. Copper is extremely durable, easily worked and soldered, and requires little maintenance. Sixteen-ounce copper sheet is the minimum weight recommended for flashings. Lighter weights will not endure the erosive action of dust and grit carried over the roof by rain water. Heavier weight, 20 oz. (565 grams) or 24 oz. (680 grams), copper should be used in gutters, valleys, and areas with limited accessibility. Lead coated copper has properties similar to copper and is even more durable due to its additional lead coating. Lead coated copper is often used in restoration work.

Terne is a less desirable flashing material since it must be painted periodically. Terne coated stainless steel (TCS) is a modern-day substitute for terne. Although more difficult to work than terne, TCS will not corrode if left unpainted; a great advantage, especially in areas that are difficult to access.

Once a metal is chosen, it is important to use it throughout for all flashings, gutters, downspouts, and metal roofs. Mixing of dissimilar metals can lead to rapid corrosion of the more electronegative metal by galvanic action. Where flashings turn up a vertical surface, they should be covered with a cap flashing. Slates which overlap metal flashings should be nailed in such a manner as to avoid puncturing the metal. This may be accomplished by punching a second hole about 2" (5cm) above the existing hole on the side of the slate not overlapping the metal flashing. It is important that holes be punched from the back side of the slate. In this way, a shallow countersink is created on the face of the slate in which the head of the nail may sit.

◄ *Continuation of the roof repair sequence of Arlington House from page 13.*

Figure 23. Slate roofs should not be walked on if at all possible. For large projects, lifts can be used to inspect roofs periodically to assess maintenance needs. Photograph courtesy of the National Park Service.

The use of artificial, mineral fiber slate is not recommended for restoration work since its rigid appearance is that of a man-made material and not one of nature. Artificial slates may also have a tendency to fade over time. And, although artificial slate costs less than natural slate, the total initial cost of an artificial slate roof is only marginally less than a natural slate roof. This is because all the other costs associated with replacing a slate roof, such as the cost of labor, flashings, and tearing-off the old roof, are equal in both cases. Over the long term, natural slate tends to be a better investment because several artificial slate roofs will have to be installed during the life span of one natural slate roof.

Clear roof expanses can be covered by an experienced slater and one helper at the rate of about two to three squares per day. More complex roofs and the presence of chimneys, dormers, and valleys can bring this rate down to below one square per day. One square per day is a good average rate to use in figuring how long a job will take to complete. This takes into account the installation of flashings and gutters and the set-up and break-down of scaffolding. Tear-off of the existing roof will require additional time.

Maintenance

Given the relatively high initial cost of installing a new slate roof, it pays to inspect its overall condition annually and after severe storms. For safety reasons, it is recommended that building owners and maintenance personnel carry out roof surveys from the ground using binoculars or from a cherry picker (Figure 23). Cracked, broken, misaligned, and missing slates and the degree to which delamination has occurred should be noted, along with failed flashings (pin holes, open seams, loose and misaligned elements, etc.) and broken or clogged downspouts. A roof plan or sketch and a camera can aid in recording problems and discussing them with contractors. In the attic, wood rafters and sheathing should be checked for water stains and rot. Critical areas are typically near the roof plate and at the intersection of roof planes, such as at valleys and hips. Regular maintenance should include cleaning gutters at least twice during the fall and once in early spring, and replacing damaged slates promptly. Every five to seven years inspections should be conducted by professionals experienced in working with slate and steep slopes. Good record keeping, in the form of a log book and the systematic filing of all bills and samples, can help in piecing together a roof's repair history and is an important part of maintenance.

As part of regular maintenance, an attempt should be made to keep foot traffic off the roof. If maintenance personnel, chimney sweeps, painters, or others must walk on the roof, it is recommended that ladders be hooked over the ridge and that the workmen walk on the ladders to better distribute their weight. If slates are to be walked on, it is best to wear soft soled shoes and to step on the lower-middle of the exposed portion of the slate unit.

Conclusion

Slate roofs are a critical design feature of many historic buildings that cannot be duplicated using substitute materials (Figure 24). Slate roofs can, and should be, maintained and repaired to effectively extend their serviceable lives. When replacement is necessary, details contributing to the appearance of the roof should be retained. High quality slate is still available from reputable quarries and, while a significant investment, can be a cost effective solution over the long term.

Further Reading

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Repair/Replacement Guideline

The following guideline is provided to assist in the repair/replace decision making process:

1. Consider the age and condition of the roof versus its expected serviceable life given the type of slate employed.

2. Calculate the number of damaged and missing slates. Is the number less than about 20%? Is the roof generally in good condition? If so, the roof should be evaluated for repair rather than replacement. Also, keep in mind that the older a roof becomes, the more maintenance it will likely require.

3. Determine if there are active leaks and what their source may be. Do not assume the slates are leaking. Gutters, valleys and flashings are more likely candidates. "False leaks" can be caused by moisture condensation in the attic due to improper ventilation.

4. Check the roof rafters and sheathing for moisture stains. Poke an awl into the wood to determine if it is rotted. Remember that very old, delaminating slates will hold moisture and cause adjacent wood members to deteriorate even if there are no apparent leaks.

5. Are many slates sliding out of position? If so, it may be that ferrous metal fasteners were used and that these are corroding, while the slates are still in good condition. Salvage the slates and re-lay them on the roof. If the slates have worn around the nails holes, it may be necessary to punch new holes before re-laying them.

6. Consider the condition of the roof's flashings. Because slate is so durable, metal flashings often wear out before the slate does. Examine the flashings carefully. Even the smallest pinhole can permit large quantities of water to enter the building.

7. Is the deterioration of the slate uniform? Often this is not the case. It may be that only one slope needs replacement and the other slopes can be repaired. In this way, the cost of replacement can be spread over many years.

8. Press down hard on the slates with your hand. Sound slates will be unaffected by the pressure. Deteriorated slates will feel brittle and will crack. Tap on slates that have fallen out or been removed. A full, deep sound indicates a slate in good condition, while a dull thud suggests a slate in poor condition.

9. Are new slates readily available? Even if replacement is determined to be necessary, the existing roof may have to be repaired to allow time for documentation and the ordering of appropriate replacement slates.

Figure 24. Although slate replacement roofs are expensive, the superiority of materials and craftsmanship will give years of continued service. If amortized over the life of the roof, the replacement cost can be very reasonable. Photograph courtesy of the National Park Service.

Note: measurements in this publication are given in both U.S. Customary System and International (Metric) System for comparative purposes. Metric conversions are in some cases approximate and should not be relied upon in preparing technical specifications.

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Cover Photograph: A portion of an advertisement for Slatington-Bangor Slate Syndicate (Slatington, PA) which appeared in the July 1910 issue of Building Age *(Vol.32 No.7).*

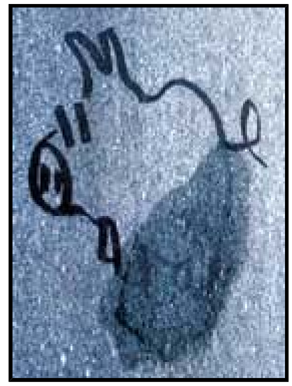
EXHIBIT 7

Preservation Brief 38:
Removing Graffiti from Historic
Masonry

38 Preservation Briefs

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

Removing Graffiti from Historic Masonry



Martin E. Weaver

A NOTE TO OUR USERS: The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

Removing graffiti as soon as it appears is the key to its elimination--*and* recurrence. Thus, the intent of this Preservation Brief is to help owners and managers of historic masonry structures find the best way to remove exterior, surface-applied graffiti* quickly, effectively, and safely. The Brief will discuss the variety of materials used to apply graffiti, and offer guidance on how to remove graffiti from all types of historic masonry without harming either the surface or the substrate. Suggestions will also be given regarding the use of physical barriers to protect masonry surfaces from graffiti, and the application of barrier coatings to facilitate graffiti removal. Building managers and owners of historic properties will be advised on the importance of being prepared for rapid graffiti removal by testing different cleaning techniques in advance in order to select the most appropriate and sensitive cleaning technique. Health and safety and environmental concerns are addressed, as well as regulatory matters. Removing graffiti without causing damage to historic masonry is a job for trained maintenance crews, and in some cases, professional conservators, and generally should not be attempted by untrained workers, property owners or building managers. Although the focus of this Preservation Brief is on *historic* masonry, the same guidance may be applied equally to removing graffiti from non-historic masonry.

Identifying the Graffiti and the Masonry

Successful graffiti removal from historic masonry depends on achieving a balance between breaking the bond between the graffiti and the masonry surface without damaging the masonry.

This generally requires knowledge both of the materials used to make the graffiti and the masonry on which the graffiti has been executed, as well as knowledge of cleaning methods and materials. Without this, masonry surfaces can be badly disfigured or damaged during graffiti removal.

*The word *graffito* (*graffiti*, plural) -- is derived from the old Italian diminutive of *graffio*-to scratch, and the Latin *graphire*-to write. *Graffiti* in contemporary usage has come to mean an inscription, drawings, or markings. Except in very formal or technical applications, *graffiti* is generally considered a "mass" noun and paired with a singular verb.

Inappropriate abrasive blasting to remove the graffiti has permanently etched the graffiti into the stone. Photo: NPS files.

Graffiti. Most graffiti is made with spray paints. Although a number of solvents and paint strippers are capable of dissolving or breaking down these paints, some may permanently discolor or stain the masonry surface if not used correctly. As a result, the remaining paint may become more difficult, or even impossible, to remove. Poorly thought-out and generally hasty attempts to remove graffiti using harsh chemicals or abrasives can also cause permanent damage to the masonry that may be worse than the graffiti.

The ability to identify the graffiti material is an important step in successful removal. Numerous kinds of spray paint (polyurethanes, lacquers, and enamels), and brush-applied paints (oils and synthetic resins such as vinyls, acrylics, acetates, methacrylates, or alkyds), as well as permanent felt markers are the materials most often used to make graffiti. But other materials are also used for graffiti, including water-soluble felt markers, ballpoint pens, chalk, graphite and colored pencils, pastels, wax and oil crayons, liquid shoe polish, and lipstick. The range of materials adopted by graffitists continues to expand.

Paints are composed of pigments that provide color and hiding power; binder that holds the pigments together and to the substrate; and a solvent that allows the pigment/binder mixture to flow. Some spray paints and markers may contain dyes instead of pigments. Paints are applied wet. Generally, as the solvent evaporates, the binder solidifies. The greater the solvent content of the paint, the greater the flow rate, and thus, the greater the ability of the paint to penetrate into masonry pores.

The two primary components contained in most graffiti materials--pigment or dye, and binder--may simply remain on the masonry surface, or penetrate into the masonry to varying depths depending on a number of factors, including the surface tension of the substrate and viscosity of the solvent or vehicle. Thus, even the total removal of the pigment or the binder may leave residues of the other component actually in, or below, the surface of the stone. Residual stains, or graffiti "ghosts," such as those from any kind of red paint or the fine black pigments used in spray paints, may be particularly difficult to remove.

With painted graffiti, it is helpful to establish how long it has been on the surface. For most paints that have been on the surface for several weeks or months, hardening processes are likely to be complete or well-advanced; the solubility of the paint is proportionately reduced and it will be more difficult to remove.

Removing this densely painted graffiti will require several applications of paint remover. Photo: NPS files.

Masonry. The historic masonry substrate must also be identified. As used here, the term *masonry* encompasses all types of natural stones; manufactured clay materials, including brick and terra cotta; and cementitious materials, such as cast stone, concrete and mortar. The common factor among masonry materials is that they are porous, to a greater or lesser extent, and sensitive to abrasion. After identifying the masonry, its condition, including fragility, porosity and permeability, must also be assessed prior to beginning graffiti removal. For example, a smooth, newly-polished granite surface is comparatively easy to clean because it is relatively impermeable and paint vehicles tend to stay on the surface rather than penetrate into microscopic pores. A very smooth, polished surface also has no pits or crevices that will retain particles of pigment or binder. In contrast, weathered marble or limestone may be extremely porous and permeable, with a rough surface on which particles of pigment can easily lodge. The fragility of such a surface can make it impossible to clean the surface even with a bristle brush without risking severe surface loss. A difference in surface texture or finish may also be the reason that a particular cleaning agent will work in one situation but not another.

Spray painted graffiti defaces this historic brick building. Photo: NPS files.

Some types of masonry may react adversely to contact with the various cleaning agents required to break or dissolve the bond between the graffiti and the masonry surface. Thus, for purposes of cleaning, masonry types are often categorized according to whether they are acid-sensitive, non-acid sensitive, or alkali-sensitive. *Acid-sensitive* stones consisting of carbonate materials may be damaged or even destroyed by contact with acids. Although, in many instances, acidic cleaning compounds are not effective for graffiti removal and generally should not be used for this purpose, it is useful to know that some acid-sensitive materials include: stones such as limestone, marble, travertine, calcareous sandstones and shales; most polished stones; and glazed architectural terra cotta and glazed brick. *Non-acid sensitive* masonry materials include slate, granite, unglazed architectural terra cotta and unglazed brick. *Alkali-sensitive* stones may contain silicates, or ferrous, soluble iron compounds that can react with alkalis or water to form severe staining. *Alkali-sensitive* stones include some granites, Indiana limestone, and many types of sandstone, especially those that are green or grey in color. Glazed and polished surfaces tend to be damaged by both strong acids and strong alkalis.

Graffiti Removal Methods and Materials

A variety of treatments are available from which to choose the most appropriate method of graffiti removal that will not damage the surface of historic masonry. Removal techniques, which are chosen according to the type of graffiti and the masonry, range from simply erasing pencilled graffiti with soft erasers, or removing chalked graffiti with soft brushes, to poulticing with water (with or without detergents), poulticing with organic solvents or alkali-based paint removers, or applying bleach to remove painted graffiti. In very limited situations, it may mean using very delicate and controlled abrasive means. Successful graffiti removal often requires a combination of cleaning materials and methods.

A poultice is ofen the preferred method of graffiti removal. Photo: NPS files.

Poulticing

The most effective method of removing graffiti from masonry usually involves the use of a poultice. A poultice consists of an absorbent material or powder-inert clays such as kaolin or sepiolite, diatomaceous earth (fuller's earth); or cellulose products such as fluff pulp cellulose or shredded paper-mixed with a cleaning solution (a liquid reagent such as water, organic solvent, paint stripper or bleach) to form a paste or slurry. The purpose of a poultice is twofold: it enables a cleaning solution to be kept in contact with the stained area as long as possible, while allowing the cleaning solution to pull the staining material out of the substrate via the poultice without redepositing it in, or restaining, the masonry. A poultice is often covered with a plastic sheet to retard evaporation. With some extremely porous types of stone, such as marble, although a poultice may remove a stain from one side of the stone, stains can pass completely through the stone and be redeposited on the other side of the masonry slab. Thus, caution should always be exercised in stain and graffiti removal.

Painting over graffiti on stone is not a recommended maintenance treatment. Photo: NPS files.

Water and Detergent. Graffiti removal from historic masonry should always begin with the gentlest means possible. In some instances, this means low-pressure water washing. Fresh graffiti-one or two days old-made with water-soluble markers may sometimes be removed with water, possibly aided by a neutral or non-ionic detergent. (Non-ionic detergents which do not ionize in solution, do not deposit a solid, visible residue.) Ammonia can also be effective in removing fresh graffiti. Any detergent should be approached with caution and tested before using because most commercial laundry detergents are not neutral and contain substances which may leave undesirable residues on masonry materials. Usually, the water and detergent should be mixed with an absorbent material and applied in the form of a poultice. Although water washing is often likely to be the gentlest cleaning method for historic masonry, it may not be as effective for removing graffiti because many graffiti materials are not soluble in water.

Organic Solvents and Paint Removers. Most graffiti can be removed without damaging the masonry with proprietary graffiti-removal products and commercial paint strippers containing organic solvents. But, these products should always be tested and used in accordance with manufacturer's instructions included in the product literature. Normally, solvents should be used in a poultice form to prevent them from penetrating into the substrate, and permanently discoloring or staining the masonry. A number of paint-removers are manufactured as thick gels or pastes that cling to the surface, and some commercial paint-removal products include a tough fiber-reinforced paper or cloth backing that retards evaporation and also facilitates neat and clean removal of the used stripper. The advantage of using organic solvents is that they evaporate completely, leaving no residual material in the masonry. However, organic solvents may present a severe health hazard, and workers using them must wear adequate protection. "Off-the-shelf" aerosol graffiti removers generally should not be used because the dissolved paint being removed may run down the wall "staining" a previously clean area; or pigments may also be redistributed by the rinsing and scrubbing recommended by the product manufacturer.

Alkaline Compounds. Alkaline compounds may be used to remove some oils and greases, and waxes from *non-alkali sensitive* masonry. Like organic solvents, alkaline compounds should generally be used in conjunction with a poultice when removing graffiti. The use of alkaline compounds should always be followed by a weak acid wash and a water rinse in order to neutralize-or remove-all the alkaline residues from the masonry. Strong alkalies (pH13-14), such as sodium hydroxide-based paint removers (caustic soda or lye), generally should not be used as they can cause efflorescence and staining on masonry surfaces, if not properly neutralized. Potassium and other hydroxide paint removers may react with iron compounds in some masonry, particularly Indiana limestone, to form dark brown (rust-colored), or black ferric hydroxide stains, which are very difficult to remove.

Bleaches. Alkali-based bleaches such as calcium hypochlorite can sometimes be used very successfully in a poultice to bleach or decolorize certain dyes contained in some paints and inks that cannot readily be removed by other means.

Damaging graffiti removal methods have scarred the marble. Photo: NPS files.

Mechanical or Abrasive Methods. Mechanical treatments include dry or wet blasting, using abrasive grits, such as sand, dolomite powder, aluminum oxide, ground-walnut shells, sodium bicarbonate (baking soda), and others; high-pressure water washing; and mechanical sanding or grinding. All of these abrasive methods will cause damage to masonry and, in most instances, should never be considered as a method of removing graffiti from historic masonry. Abrasive methods used mistakenly by untrained workers to remove graffiti usually result in etching the outline of the graffiti permanently into the masonry. Some historic masonry materials can be easily damaged by pressure washing even at low or moderate pressures (100-400 psi). Occasionally, however, under very controlled circumstances, a *micro-abrasive* technique may be appropriate for removing graffiti from delicate masonry surfaces, if used at low pressures of 35-40 psi with fine abrasives.

This treatment, which must be done very slowly and carefully to avoid damaging the masonry, should be tested first, and undertaken only by a professional conservator. Another exception, even though it is not strictly an abrasive treatment, is using a razor blade as a first step to remove spray paint or felt-tip marker from polished granite. However, this too, should be undertaken only by a *professional conservator*, and only on *polished granite*, which is very hard and generally impervious to scratches.

Laser Cleaning. Although not in general use as a cleaning technique, laser technology offers great promise in the future as a non-damaging method of graffiti removal.

Testing

Before selecting a removal method, all cleaning materials and techniques for removing graffiti from a historic masonry building should be tested on mock-ups or areas of the resource that are not highly visible, but which are representative of typical conditions. Visual observation should be supplemented by the use of a magnifying glass, and spot tests should be carried out with various solvents to help identify the specific graffiti medium, which will aid in its removal. More complex testing using laboratory equipment and more scientific analytical processes may sometimes be necessary in complex situations. Sample areas that represent the desired degree of "cleanliness" should be approved in writing by client, architect, conservator or other appropriate authority. The materials and all the other data necessary to reproduce the desired cleaning results should be meticulously recorded and the accepted sample area preserved for reference until the end of the job. The existence of a "clean" sample for comparison and a signed agreement can avoid unpleasant surprises, misunderstandings, and perhaps legal actions.

When a type of graffiti appears for the first time that was executed with a material not immediately recognizable and for which no countermeasures have been developed, tests may need to be carried out by an architectural conservator to identify the material and to determine effective removal treatments. Agencies with large inventories of graffiti-prone buildings and structures should watch for graffiti made with new materials and experiment with different cleaning methods in order to be prepared when it appears. Such early action can save large sums of money in the long term. (See "Development of a Treatment Plan.")

Health and Safety Considerations

Most of the chemicals used for graffiti removal are dangerous to workers, as well as to others who may be in the vicinity. Organic solvents are toxic by ingestion, inhalation, and skin contact. Material Safety Data Sheets (MSDS), available from the product manufacturer for all paint-removal products, should always be consulted and followed. Identification of hazardous components and checking with chemical reference works will help assure that the least hazardous, but most effective, products are selected.

Generally speaking, it is a sensible policy to carry out all graffiti removal in well-ventilated conditions. Some solvents can be used only outdoors, and sometimes forced ventilation may be necessary even there, requiring workers to use air-fed respiratory equipment to avoid wind-blown fumes. Smoking, eating or drinking must not be allowed when cleaning is in progress.

Some materials used for graffiti removal are so corrosive that accidental contact can cause serious, permanent scarring and painful injuries. Wearing appropriate protective clothing must be strictly enforced. Mandatory personal protective equipment (PPE) normally includes face shields or safety glasses; long, chemical-resistant gloves; face masks with respirators for organic solvents; and possibly, full protective clothing with an independent air supply.

All smoking and open flames should be rigorously excluded from work areas; many solvents are flammable or highly explosive in vapor or liquid form when mixed with air. Solvent residue, used swabs, cloths, overalls and all other solvent-contaminated items should be safely and legally disposed of, or properly stored-even overnight-away from potential sources of fire. Electrical equipment may require explosion-proof fittings when used with certain solvents.

When electric pumps and pressure-spraying equipment are used, it is especially important that all necessary precautions be taken to avoid electric shock. Water sprays and puddles on the ground present a potentially dangerous situation, if they come into contact with temporary wiring at worksites where graffiti is being removed. Such hazards must be carefully monitored and controlled.

As with any construction project, attention should always be directed toward the general safety of the workers and passers-by, but also toward possible damage to the resource itself that might result from careless placement of ladders, or scaffolding. Chemicals used for masonry cleaning can also damage adjacent metals, glass, and painted surfaces, as well as vegetation. Product manufacturers' instructions should always be closely followed to avoid such inadvertent "collateral" damage.

Environmental Considerations

To protect against environmental contamination, including the formation of unwanted ozone at ground level and damage to the ozone layer in the earth's outer atmosphere, legislation has been enacted in some states making it illegal to use even moderate quantities of some solvents--*volatile organic compounds (VOCs)* contained in paint removers. In response to this legislation, many new products are being developed that do not contain VOCs.

After completing graffiti removal, the disposal of chemical products and rinsing effluent must be taken into account. Arrangement for disposal of the cleaning waste should be made *prior* to beginning graffiti removal, especially if it is a project of considerable size. In many places it is illegal to discharge solvents and/or paint residues into sewers or storm drains. The owner or manager of a historic property, or in some cases the individual or firm doing the cleaning or graffiti removal, is responsible for being informed of, and complying with, relevant laws and regulations. Under provisions of the National Historic Preservation Act of 1966, as amended, approval may be required from a state or federal preservation agency before any work can be undertaken on buildings or structures listed in or eligible for listing in the National Register of Historic Places, if such a project involves federal funding or licensing. Many state and local historic district commissions and review boards have their own regulations that require approval for cleaning or graffiti removal work that is undertaken on landmarks or properties in locally designated historic districts.

Barrier Coatings

Anti-graffiti or barrier coatings are intended to facilitate the removal of graffiti from porous as well as non-porous surfaces. These coatings are most commonly transparent, but may also be pigmented. They are available in a variety of formulations designed to serve different needs. The use of barrier coatings to protect graffiti-prone historic masonry surfaces may seem to be an easy preventive solution to a persistent graffiti problem. However, for the most part, these coatings are not the panacea that some advertising might suggest. Some of them simply do not work, and others may cause physical or aesthetic changes or damage to the masonry.

Transparent Coatings. Transparent coatings serve as a barrier between the masonry surface and graffiti, preventing graffiti from penetrating into the masonry. They are also intended to make graffiti removal easier since most graffiti does not adhere well to them. Generally, graffiti applied over transparent barrier coatings can be removed with low-pressure water and a detergent, or with a solvent.

There are basically two kinds of transparent barrier coatings: temporary and permanent. Temporary, or "sacrificial" coatings are removed when graffiti is removed and then must be reapplied. Permanent transparent barrier coatings are more resistant to the water or solvents used to remove graffiti, and remain on the masonry surface when graffiti is removed (although this type of coating also must usually be reapplied after several cleanings). A third type of transparent barrier coating combines temporary and permanent coatings, based on a two-part system.

The difference in color between the bottom and the top of the stone spandrel is the only clue to the presence of a clear barrier coating. Photo: NPS files.

A water-based acrylic sealer is first applied to the masonry surface, after which a sacrificial layer consisting of a polyethylene wax emulsion or dispersion coat is applied over the sealer. When graffiti is removed, the sealer coat remains on the masonry, but the sacrificial coat dissolves and is removed with the graffiti, and thus must be reapplied. (With this two-part system, even the first coat will eventually wear off after multiple cleanings, and must also be reapplied.)

Unfortunately, in application, there are a number of negative aspects of transparent barrier coatings that generally prevent their being recommended for use on historic masonry. First, clear coatings may alter the color of the masonry surface and add a gloss that may be highly visible, or apparent only in certain lighting conditions or when it rains. Second, clear coatings may reduce the water-vapor permeability of the masonry, thereby contributing to possible water-related deterioration. Third, the coating may discolor and change over time. Exposure to ultra-violet light can cause a coating to yellow; dirt build-up may darken the treated surface; and some coatings acquire a sheen when rubbed or brushed against. Such changes are especially noticeable when only a portion of the building has been coated. Furthermore, if coatings are not maintained on a regular basis, usually through periodic removal and reapplication, many coatings tend to fail. What often results is an uneven, "patchy" look to the masonry that can have a very negative impact on the character of the historic building.

Despite these potential drawbacks, there may be some instances in which the graffiti problem or frequency of occurrence is so severe that application of a transparent barrier coating on historic masonry may be worth considering. Some water-base polysaccharide coatings, and silicone and silicone-base coatings have been used with success on masonry structures. They are essentially invisible, and do not change the natural appearance of the masonry. Although less durable than solvent-borne coatings, they are water-vapor permeable (breathable), and may be reapplied to the masonry surface immediately after removing graffiti, while the surface is still damp.

However, extreme caution must be exercised before applying a transparent barrier coating. Experimental test applications should always be tried first on discrete areas that are not highly visible, and the treated areas evaluated over a period of time. Laboratory test results on the performance of coatings applied to samples of like masonry types may be useful to some extent. But because the tests are carried out in a controlled environment, they may not be as accurate or reliable as tests actually carried out on-site where the factors of weather and pollution are the same as those at the location where the coating will be used. If circumstances warrant, and the use of a barrier coating is determined necessary, an architectural conservator should evaluate the test performance of a variety of coatings before selecting one to be applied to historic masonry. Because of the potential for disfigurement, owners of landmark-designated buildings are required by some preservation review boards and landmark commissions to obtain approval before they apply a barrier coating.

Pigmented Coatings. A pigmented barrier coating may be used on masonry as a *permanent*, preventive barrier coating, or as a *temporary* means of concealing graffiti until it can be removed.

This formerly clear barrier coating is very shiny and has discolored as it has aged. Photo: NPS files.

Like a transparent barrier coating, a pigmented barrier coating facilitates the removal of graffiti because graffiti does not adhere well to it. Pigmented barrier coatings that are water-vapor permeable may sometimes be used as a *permanent* barrier coating on non-historic masonry where there is frequent recurrence of graffiti, and when constant surveillance is not possible. Although there are some instances in which pigmented barrier coatings may be appropriate on painted historic masonry, they are **not** recommended for unpainted historic masonry because they will change the appearance of the masonry. There is also another kind of pigmented coating that is specially formulated to be used as a *temporary* measure to conceal graffiti that cannot be removed right away. This temporary, vapor-permeable paint is removed when the graffiti is removed.

Pigmented coatings are also not generally recommended as a permanent measure to cover up graffiti. Some graffiti materials, particularly felt markers, bleed through the coating; and repeated applications of the coating or paint can result in a heavy paint build-up on a masonry surface. Another disadvantage of using paint or a pigmented coating to hide graffiti is that it usually appears as an obvious patch on unpainted masonry and tends to attract more graffiti unless the paint can be applied in a discrete, and well-defined area. If incompatible with either the masonry or the graffiti, such a coating may peel off the masonry surface in an unsightly manner. Like transparent coatings, pigmented coatings may be difficult or impossible to remove completely once their performance or appearance is no longer satisfactory.

Preventing and Controlling Graffiti

Experience shows that prompt removal of graffiti is one of the most effective measures against its recurrence. Graffiti that is not removed quickly tends to attract more graffiti. Often motivated by a need to have their work seen, graffitists tend to be discouraged from repeating their efforts in a location where their work is quickly removed.

Apart from removal, effective graffiti-prevention measures can be considered under two headings. The first consists of physical measures involving maintenance, lighting, security and the erection of barriers on or around the property itself. The second focuses on community awareness programs that include neighborhood patrols, community service programs and educational programs in the schools.

Maintenance and Security. Neglect invites vandalism, whereas a well-maintained property encourages civic pride. Thus, careful attention should be given to establishing regular maintenance programs which do not allow properties to reach a point of obvious deterioration or abandonment. Cyclical maintenance also makes good sense economically.

Graffiti is less likely to occur if graffitists can be clearly seen. It is often recommended that accessible, graffiti-prone areas be illuminated with floodlighting or spotlights. Graffiti may also be reduced or prevented by the presence of security guards, park rangers or police officers, or by the visible presence of surveillance cameras. Publicity about arrests and punitive measures against the graffitists, and the general vigilance of the security system may also reduce graffiti.

If they are historically appropriate and compatible with the historic property, soft barriers in the form of low, possibly thorny, shrubs and bushes or other forms of landscaping and planting may be effective deterrents. Such plantings can make it difficult to reach the property by any route other than the approved secure one. Hard barriers provided by fences and transparent screens or shields, such as clear acrylic or other polycarbonate sheets, may also afford some degree of protection. But these can have a negative aesthetic impact on the property's appearance, particularly if the barriers themselves become disfigured by graffiti.

Community Awareness. Community action and education often play an important role in a successful anti-graffiti program. Neighborhood watches can effectively deter graffitists, and can help police and other security agencies in the detection and prevention of graffiti. Intensive public campaigns against graffiti, including presentations in schools, developing programs to foster community pride, and sentencing offenders to remove graffiti in their own community can also be useful. Publicity concerning arrests of graffitists can be a useful preventive tool. (But, on the other hand, frequent newspaper coverage of graffiti outbreaks or even of new community efforts at deterring graffiti can sometimes have the opposite effect by challenging the "creativity" of graffitists.) Community groups trained in proper cleaning techniques can also assist property owners in prompt and non-damaging graffiti removal.

Summary

Although rapid graffiti removal is the most effective weapon in eliminating graffiti and preventing its recurrence in the same location, hasty, untested removal attempts can disfigure and cause harm to historic masonry. Thus, it is important that the owner or manager of a historic masonry building or structure be prepared with a plan to ensure the prompt removal of graffiti when it occurs. Regularly scheduled maintenance and cleaning programs to eliminate graffiti from historic masonry properties may be assisted by the installation of physical barriers, security systems and lighting, as well as increased community involvement. Successful graffiti removal from historic masonry requires knowledge of a variety of cleaning methods and materials, and an awareness that what works to remove graffiti from one kind of masonry surface may not remove it from another. By testing different cleaning methods in advance, treatment plans will be available, when needed, to provide guidance for safe and sensitive graffiti removal from historic masonry.

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Development of a Treatment Plan.

For managers or owners of historic masonry buildings, or agencies responsible for large inventories of graffiti-prone properties, including parks, highway and railroad bridges and viaducts, bus, train and subway stations, and cemeteries, the development of a treatment plan may be the first step toward an effective graffiti-removal program. It is becoming increasingly common for large or important historic properties to have regular maintenance and disaster plans that include graffiti removal.

When feasible, a separate treatment plan should be prepared for each structure. However, if this is not possible, it is advisable to prepare a variety of treatment plans for specific masonry types. Plans should be prepared to cover all types of masonry that fall under one jurisdiction, management or ownership that are potential targets for graffiti.

Guidance contained in treatment plans should be based on the results of carefully controlled testing to remove a wide variety of common graffiti materials safely, and without damaging the various types of masonry. Individual treatment plans should address all parts of the building or structure that could be disfigured by graffiti, and any features too fragile to be cleaned by anyone other than a conservator should be noted on the plan.

A treatment plan is essentially a cleaning specification, but it should also include information on the following:

- the types and conditions of masonry likely to be targeted by graffiti;
- methods, materials and techniques known to work most successfully in the removal of specific types of graffiti from the surface of each type of masonry;
- sources for materials;
- a list of contractors with expertise in graffiti removal, including names, telephone numbers, information on emergency access to the property, and storage location of materials;
- graffiti-removal methods which may be harmful to the masonry surface;
- contractors or consultants who are **not acceptable** and should not be considered for graffiti removal;
- scaffolding, pumps, or safety equipment that might be required, where it is available, and costs involved; and
- health and safety concerns regarding specific removal treatments, product literature and Material Safety Data Sheets (MSDS).

Criteria to Consider Before Selecting a Barrier Coating as the Primary Protective Means of Combating Graffiti

What to look for in a Barrier Coating:

- Water-vapor permeable, or "breathable".
- "Invisible" without gloss or sheen, when applied to masonry.
- No change in appearance from uncoated areas when masonry is wet.
- Does not discolor or attract dirt.
- Weathers evenly.

Questions to Ask:

- Will the coating last long enough to offset its cost?
- Will the application and reapplication of the coating be cost effective?
- Will the coating be effective against more than one type of graffiti?
- Can the coating be completely and thoroughly removed, so that, if necessary, paint, or another coating will adhere to the masonry surface?
- Will the building ever need to be repointed or patched? A barrier coating may make this difficult or even impossible.

Before Application:

- Seek advice of an architectural conservator.
- Test coating on an inconspicuous area of masonry, or study the success/failure of the coating in other locations where it has been used.

Tips for Successful Graffiti Removal

- It is important to pre-wet the masonry surface when using an alkaline paint remover; it is also advisable to pre-wet the masonry surrounding a graffitied area to dilute the effect of any cleaning agents that might be inadvertently splashed or spilled on the unsoiled surface. **Do not wet the area to be cleaned if the cleaning agent is solvent-based or incompatible with water.**

- Always rinse the cleaning agent off the masonry surface starting at the bottom and moving up. This prevents the cleaning agent from running down and staining a lower surface.

- Air temperature can be a factor in graffiti removal. Most paint removers do not work when the air temperature is either very cold or very hot. This may sometimes explain why a method that worked in one instance may not be effective again in another, similar situation.

- Variations within the same type of stone, such as bedding planes, density, finish, or degree of weathering, may explain why some areas of the same stone sometimes clean better that others.

- Even if advance testing has been done and a treatment plan exists, at least some on-the-spot testing will probably be necessary.

- Mortar joints react differently from masonry units, and may require a different cleaning material and/or method to be cleaned effectively.
- Graffiti removal may result in an obviously "clean" spot. Always clean the entire masonry unit that is bounded by mortar joints (but not the joints themselves, unless necessary). The prominence of the clean spot may be minimized by fanning the cleaning out from the spot, and "feathering" it by gradually reducing the strength or thoroughness of the cleaning.
- If it is not possible to completely remove all traces of graffiti without removing some of the masonry surface, it may be preferable to leave the masonry alone. Some graffiti ghosts become less noticeable with time due to fading of the dyes used in paints and markers. Sometimes it may be possible to conceal more obvious graffiti ghosts with carefully-matched paint.
- After graffiti removal, the masonry surface should always be tested with Ph strips to make sure all the cleaning materials have been completely removed. Non-staining Ph strips, available from chemical supply companies, will indicate whether acids or alkalis remain on the masonry surface.
- Although alkaline paint removers are sometimes ineffective on modern formulations of aerosol paints, they can work well in removing multi-layered graffiti because they last longer.
- What removes graffiti in one instance may not always work again even in what appears to be an identical situation.
- More than one cleaning material and technique may be required to clean a heavily graffitied area if different materials were used to make the graffiti. For example, shapes are often outlined with broad-tipped felt markers and then filled in with spray paint.
- Effective graffiti removal often depends on trial-and-error testing, as well as a knowledge of masonry materials, graffiti materials and cleaning techniques.

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Home page logo: Poultice to remove pig graffiti. Photo: NPS files.

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. Technical Preservation Services (TPS), Heritage Preservation Services Division, National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments for a broad public.

Questions

EXHIBIT 8

Preservation Brief 40:
Preserving Historic Ceramic Tile
Floors

Some of the web versions of the Preservation Briefs differ somewhat from the printed versions. Many illustrations are new and in color; Captions are simplified and some complex charts are omitted. To order hard copies of the Briefs, see Printed Publications.

PRESERVATION BRIEFS

40

Preserving Historic Ceramic Tile Floors

Anne E. Grimmer and Kimberly A. Konrad

This Minton encaustic floor tile was installed in the U.S. Capitol in the 1850s. Photo: NPS files.

With a tradition that dates to ancient civilizations, *ceramic tile flooring can be found in a variety of settings in diverse cultures and structures, including residential buildings ranging from large apartment buildings to small private houses, institutional buildings such as government offices and schools, and religious buildings such as cathedrals and mosques. Historically, its widespread use may be attributed to the fact that a readily available natural material—clay—could be converted by a relatively simple manufacturing process—baking or firing—into a very durable, long-lasting and attractive floor tile that is easy to maintain. Ceramic floor tiles exhibit a versatility of colored glazes and decoration, and they range from the plainest terra cotta tiles to highly decorated individual ceramic tiles and elaborately patterned tile floors. Their modularity, as standardized units, make them easy to fit into different sized spaces which also explains much of the popularity of ceramic floor tiles throughout history.

**Ceramic: Any product manufactured from a nonmetallic mineral (such as clay), by firing at high temperatures.*

This Brief begins with an overview of ceramic tiles as a traditional flooring material. It includes an explanation of the various kinds of historic floor tiles used in the United States and how they were made. General guidance is given on preservation treatments, focusing on maintenance, and, when necessary, selective replacement of damaged floor tiles. The Brief is intended to provide owners and managers of historic properties with an understanding of the significance and historical background of ceramic floor tiles, and a basic awareness of maintenance techniques and various deterioration problems to which tile floors are especially prone. In the case of significant historic ceramic tile floors, a professional conservator of ceramics should be consulted to advise in matters of repair, restoration or conservation. Historically, ceramic tiles were used on walls as wainscotting, on fireplace hearths and fireplace surrounds, and even on furniture, as well as for flooring. However, because floor tiles are subject to greater damage and deterioration, they are the primary emphasis of this Brief. Highlights include: a short history of ceramic floor tiles; a description of ceramic tile types; a summary of traditional installation methods; maintenance techniques; and guidance on repair and replacement.

The Tile-Making Process

Clay is an earthen material, moldable or plastic when wet, non-plastic when dry, and permanently hard when baked or fired. It is widely distributed geographically, and often found mixed with sand in soils of a loam type-a mixture of clay, silt and sand. Relatively pure clay is not usually a surface deposit, although, in some cases, it may be exposed by erosion. Clay types vary throughout the world, and even within a region. Each type of clay possesses a unique combination of special properties such as plasticity, hardness and lightness, as well as color and texture, which makes some clays better suited for one kind of ceramic than another. The correct clay mixture needed for a particular purpose can be created by blending clays and adding other materials, but using the wrong type of clay can result in expensive production problems such as crazing (the formation of tiny cracks in a tile glaze) or warping of the tile itself. Traditionally, chalky clays have been preferred for many kinds of ceramic tiles, in part because they produce, when fired, a white body which is desirable for decorating. Other materials can be added, including grog (or ground-up fired clay) that helps aerate the clay and prevents warping, speeds firing and reduces shrinking, or calcined flint, to harden it.

There are several methods used for making ceramic tiles: extrusion; compaction or dust-pressing; cutting from a sheet of clay; or molded in a wooden or metal frame. Quarry tiles are extruded, but most ceramic floor tiles, including traditional encaustic, geometric and ceramic "mosaic" tiles are made from refined and blended ceramic powders using the compaction method, known as dust-pressing. Encaustic tiles, which were made by dust-pressing, are unique in that their designs are literally "inlaid"into the tile body, rather than surface-applied. Once formed, tiles are dried slowly and evenly to avoid warpage, then fired in a special kiln that controls high, even heat at temperatures up to 1200°C (or approximately 2500°F) for 30-40 hours. Higher temperatures produce denser tiles with harder glazes. Most ceramic tiles require only one firing to achieve low porosity and become vitrified or grass-like, but some, especially highly decorated tiles, are fired more than once. Non-vitreous and semi-vitreous tiles are fired at lower temperatures and are much more porous.

Colored slip, or liquid clay, is being poured into the indented portion of a reproduction encaustic tile, to create the pattern. Photo: H & R Johnson Tiles.

Historical Background

Historically, the use of ceramic floor tiles goes back to the fourth millennium B.C. in the Near and Far East. The Romans introduced tile-making in Western Europe as they occupied territories. However, that art was eventually forgotten in Europe for centuries until the 12th century when Cistercian monks developed a method of making encaustic floor tiles with inlaid patterns for cathedral and church floors. But, this skill was again lost in the 16th century following the Reformation. Except for finely decorated wall tiles made in Turkey and the Middle East, and Delft tiles made in Holland in the 17th century, ceramic floor tiles were not made again in Europe until almost the mid-19th century.

In the 19th century, Minton tiles were sold from this catalogue to American clients. Photo: NPS files.

The modern tile industry was advanced by Herbert Minton in 1843 when he revived the lost art of encaustic tile-making in England. The industry was further revolutionized in the 1840s by the "dust-pressing" method which consisted of compressing nearly dry clay between two metal dies. Dust-pressing replaced tile-making by hand with wet clay, and facilitated mechanization of the tile-making industry.

Throughout the rest of the 19th century, dust-pressing enabled faster and cheaper production of better quality floor tiles in a greater range of colors and designs. In the 1850s encaustic tiles were selected for such important structures as the new Palace at Westminster in London, and Queen Victoria's Royal Residence on the Isle of Wight. By the latter part of the 19th century, despite the fact that encaustic tiles were still quite expensive, they had become a common flooring material in many kinds of buildings.

Development of the Tile Industry in America

Although plain, undecorated ceramic tiles were traditionally a common flooring material in many parts of the Americas, especially in Latin and South America, ceramic floor and roof tiles were probably not made in the North American Colonies until the late-16th or early-17th century. It was, however, in the Victorian era that ceramic tile flooring first became so prevalent in the United States. The production of decorative tiles in America began about 1870 and flourished until about 1930.

Like so many architectural fashions of the day, the popularity of ceramic tile floors in America was greatly influenced by the noted architect and critic, Andrew Jackson Downing. In his book *The Architecture of Country Houses*, published in 1850, Downing recommended encaustic floor tiles for residential use because of their practicality, especially in vestibules and entrance halls.

The 1876 Philadelphia Centennial Exposition, with its European and even a few American exhibits of decorative floor tile, was a major factor in popularizing ceramic tile floors in the U.S. Initially, most ceramic tiles-other than purely utilitarian floor tiles-were imported from England, and their relatively high cost meant that only wealthy Americans could afford them. However, when English tile companies realized the potential for profitable export, they soon established agents in major U.S. cities to handle their American business. The English near monopoly actually stimulated the growth of the U.S. tile industry in the 1870s resulting in sharply decreased English imports by 1890.

The location of potteries and ceramic tile factories is dependent upon the ready availability of suitable ball clay (clay that balled or held together), kaolin (a white clay used as a filler or extender), and feldspar (a crystalline mineral), and an accessible market. Since the cost of shipping the manufactured products tended to restrict profitable sales to limited areas, this usually determined whether a factory would succeed. Although the United States Pottery in Bennington, Vermont, is known to have made encaustic tiles as early as 1853, the Pittsburgh Encaustic Tile Company (later the Star Encaustic Tiling Company), was the first successful American tile company, and is generally considered the first to manufacture ceramic tile in the U.S. on a commercial basis beginning in 1876.

At least 25 ceramic tile companies were founded in the United States between 1876 and 1894. In the East, several notable tile firms that were established in this period flourished in the Boston area, such as the Chelsea Keramic Art Works, the Low Art Tile Works, and the Grueby Faience Company. Other East Coast companies organized in the late-19th and early-20th century included the International Tile & Trim Company, in Brooklyn, New York; the Trent Tile Company, Providential Tile Company, Mueller Mosaic Tile Company, and the Maywood Tile Company, all in New Jersey; and the Moravian Pottery and Tile Works in Doylestown, Pennsylvania.

Many factories were also established in the Midwest-in Indiana, Michigan, and, especially, in Ohio. In the last quarter of the 19th century, the town of Zanesville, Ohio, was the largest center for pottery and tile-making in the world. Some of the factories in Zanesville included: Ohio Encaustic Tile Company; Mosaic Tile Company; Zanesville Majolica Company; and J.B. Owens Pottery, later to become the Empire Floor and Wall Tile Company. The American Encaustic Tiling Company, established in 1876, was one of the first, and most successful manufacturers in Zanesville. In the early 1930s it was the largest tile company in the world, producing large quantities of floor tile, plain and ornamental wall tile, and art tile until it closed about 1935, as a result of the Depression. The United States Encaustic Tile Company, Indianapolis, Indiana; Rookwood Pottery, Cincinnati, Ohio; Cambridge Art Tile Works, Covington, Kentucky; and Pewabic Pottery, Detroit, Michigan, were some of the other well-known potteries in the Midwest.

Around the turn of the century, the industry began to expand as tilemakers moved West and established potteries there. Joseph Kirkham started the ceramic tile industry on the West Coast in 1900 when he set up the Pacific Art Tile Company in Tropico, California, after his company in Ohio was destroyed by fire. In 1904 the company became the Western Art Tile Company, surviving for five years until it went out of business in 1909. During the early-20th century, other companies were founded in Southern California, in and around Los Angeles. Batchelder & Brown, in particular, of Pasadena (later Batchelder-Wilson in Los Angeles), was well-known for its Arts and Crafts-style tiles in the teens and 1920s. By the early 1940s California had become one of the leading producers of tile, especially faience, in the U.S.

Ceramic engineers, potters and artists not only moved frequently from one pottery to another, but often struck out on their own and established new factories when dissatisfied with a former employer. Also, it was not uncommon for one company to reuse a defunct factory or purchase another pottery business, change the name and increase the product line. As a result, many of the companies in existence today are descendants of the early pioneering firms.

Changes in the Tile Industry

The majority of ceramic floor tile made in the U.S. before 1890 was encaustic, but various factories gradually began to develop and produce other kinds of tiles. The Trent Tile Company, among others, started to manufacture both white and colored ceramic mosaic tiles by the mid-1890s. White vitreous wall tile became available, as well as more decorative tiles with colored glazes, such as the variegated faience glazes intended to give a more hand-crafted appearance that were originated by the Grueby Faience and Tile Company in 1894, and soon adopted by other potteries.

In the 19th and early-20th century, many ceramic tile firms had their own engraving departments, while some used commercial designs supplied by professional printers. Well-known designers were often commissioned to work on specific product lines for a particular firm. These designers worked for one firm after another which resulted in similar designs being produced by different companies. (Historic ceramic floor tiles were usually identified by a manufacturer's or designer's mark on the back, if they were marked at all.) By the latter part of the 19th century ready-mixed glazes and colors were also available.

This was a great advantage for potters who, prior to this, had to mix their own colors and glazes.

Ceramic mosaic tiles are a practical floor covering in the entryway of this early 20th century school building. Photo: NPS files.

During the 20th century, the floor tile industry continued to evolve as much as it had in the previous century. Modern methods of production employed sophisticated machinery, new materials and decorating techniques. In the years following World War II, there were many advances in the industry. Commercially manufactured dust-pressed tiles, which had previously required more than 70 hours just in the kiln, could be made in less than two hours from the raw material stage to finished tiles, boxed and ready to ship. Dried, unglazed tiles were sprayed with colored glaze evenly and automatically as conveyors carried the tiles into the tunnel kilns, and the extrusion process ensured that the tiles were cut to a uniform thickness and size. The changes and developments in the production of floor tile brought forth a wide range of shapes and sizes, along with new colors, glazes and decorating techniques.

After the turn of the century, fewer encaustic floor tiles were used, particularly in residential architecture. The introduction of ceramic mosaic floor tiles was a factor in their decline. The development of rubber interlocking floor tiles in 1894, along with other, more resilient, flooring materials, was instrumental in the decreased popularity not only of encaustic tiles, but also other ceramic tile flooring. These new materials were not only cheaper, they were not as fragile; they were also lighter and thinner, and easier to install.

Ceramic mosaic tiles remained in common use through the 1930s in part because an innovative development had made laying such small tiles easier. The tiles were pre-mounted in decorative patterns on 12" x 12" sheets of paper, and sold ready to lay in cement. This greatly simplified the tile setter's work, and no doubt was a significant factor in the increased popularity of ceramic mosaic tiles. Sophisticated mosaic floor designs became common in entrance foyers of public and private buildings. Small, white, unglazed tiles in round, square, octagonal or hexagonal shapes were promoted for their sanitary qualities, particularly for bathroom floors, while larger, rectangular, white, glazed tiles were used for bathroom walls or wainscotting. Colored tiles were also popular, especially for bathrooms, and even kitchens. Quarry tile, which was larger and thicker than other ceramic floor tile of this period, was often used in public buildings, as well as for entrance halls, small studies, libraries, dining rooms and even living rooms in private homes. But, by the 1930s, the fashion for art tile had diminished to the point where floor tiles were, for the most part, generally regarded as primarily utilitarian, as opposed to important decorative elements.

Ceramic Floor Tile Types

The **thickness** of historic ceramic floor tiles varied considerably according to their intended use and when they were made. Floor tiles were thicker and harder than wall or ceiling tiles. Stove tiles, meant to retain the heat of the stove, were sometimes as much as several inches thick. Medieval floor tiles were usually one inch thick; encaustic tiles of the Victorian era tended to be slightly thinner. Modern, 20th-century tiles, with the exception of some art pottery tiles, are the thinnest, as a result of modern manufacturing methods. The backs of most, but not all, ceramic floor tiles are covered with raised (or sometimes recessed) ridges, circles or squares which help to increase the bonding capability of the tile.

Unglazed and Glazed Tiles

Ceramic floor tiles can generally be divided into two types: **unglazed** and **glazed**. Unglazed tiles include: quarry tiles; encaustic and geometric tiles; and ceramic mosaic tiles, which can be either glazed or unglazed. Most other ceramic floor tiles are glazed.

Unglazed Tiles

Quarry tiles are the most basic type of historic ceramic floor tile. Originally made from quarried stone, they are machine-made using the extrusion process. Quarry tiles are unglazed, semi-vitreous or vitreous, and essentially are square or rectangular slabs of clay baked in a kiln. The colors of quarry tiles are natural earthen shades of gray, red and brown determined by the clay and, to some extent, the temperature and duration of firing. Quarry tiles, which range from ¼" to ½" in thickness, are available in square and rectangular shapes in sizes that include 3", 4-1/4", 6" (one of the most common sizes), 9" and 12" squares; 6" x 12", 6" x 9", 4-1/4" x 9", 3" x 6", and 3" x 9" rectangles; and 4" x 8" hexagon shapes. (Pavers or paver tiles are a simpler, and tend to be somewhat cruder, version of quarry tiles. Like quarry tiles, they are usually unglazed, but slightly thicker. Machine-made pavers are either semi-vitreous or vitreous, and generally formed by dust-pressing, although sometimes are extruded. Hand-made pavers which are common in Mexico and southern Europe are non-vitreous.)

Encaustic tiles are a type of traditional unglazed-yet decorative-floor tile, manufactured by the dust-pressed method.

Whereas most ceramic tiles are surface-decorated or decorated with impressed or embossed designs created by a mold, encaustic tiles are unique in that their decorative designs are not on the surface, but are inlaid patterns created as part of the manufacturing process. First, a thin, approximately ¼" layer of fine, almost powder-dry, clay was pressed into a mold with a relief design at the bottom which formed a depression in the face of the tile. A second, thicker layer of coarser clay was laid over the first layer, then covered with another layer of fine clay. This "sandwich" helped prevent warping and ensured that the body of the tile was strong and had a fine, smooth surface. The layers of clay "dust" were compacted by presses, after which the mold was inverted and the die removed, thus producing a tile with an indented or intaglio pattern on top. After the tile dried, colored slip (liquid white clay colored with dyes), was poured to fill in the intaglio pattern. Each color had to dry before another color of slip was added. The recessed area was overfilled to allow for shrinkage, and after drying for several days, and before firing, the excess slip was scraped off the surface by a rotating cutter that created a flat, although not completely smooth, face. Problems might arise during the firing. Due to the dissimilar rates of contraction of the different clays, the inlaid clay could shrink too much and fall out of the tile recesses; or, the tile could be stained by the different pigments used for the design if impure or unstable.

Encaustic floor tiles were decorated with traditional as well as original designs. Over time, the decorations can be worn thin by heavy traffic. Photo: NPS files.

By the 1840s, encaustic tiles were made entirely with almost-dry clay using the dust-pressed method. This served to eliminate the possibility of staining the body of the tile with other colors and permitted the use of more colors on a single tile. Thus, an encaustic tile can sometimes be dated according to the complexity and the number of colors in its pattern. Red tiles with white figurative patterns were generally the earliest, followed by brown and buff colored tiles. In the 1860s, blue tiles with yellow or buff patterns were popular, succeeded by more subtle color schemes featuring a "chocolate" red with a soft grey. By 1860, up to six colors were used in a single tile to form a pattern. Toward the end of the century, white encaustic tiles with a black or gold design were common, as well as tiles with complicated color patterns of white, black, gold, pink, green and blue. Encaustic tiles were decorated with traditional as well as original designs. Some, particularly intricate, designs were painted on the surface of the tile with opaque colored glazes, instead of being inlaid. Most major tile manufacturers sold many of the same pre-formed encaustic floor tile patterns through catalogues. Encaustic tiles were produced in a variety of sizes, mostly square or octagonal in shape, and almost any design could be custom-made for a special purpose or to fit a particular space. Historic, 19th-century encaustic tiles were generally slightly less than 1" thick, about 15/16." Cheaper tiles of lesser quality were also made of clay or cement. These designs resembled those commonly found on encaustic tiles but applied as a transfer printed pattern, or using a multi-color lithographic or silkscreen process. These are still manufactured and popular in many parts of the world.

Smaller, single-colored versions of encaustic tiles that, when assembled together form a geometric pattern, are called **geometric tiles** in England. However, in the United States they are generally not differentiated from encaustic tiles. Based on the geometric segments of a six-inch square, they were typically rectangular, square, triangular or hexagonal in shape, and about the same thickness as patterned encaustic tiles. Geometric tiles were especially well suited for decorative borders, and a wide variety of floor designs could be created with their many shapes, sizes and colors—either alone or combined with patterned encaustic tiles. The cost of producing geometric tiles was much less than of encaustic tiles because each tile involved only one type of clay and one color. By the end of the 19th century, over 60 different shapes and sizes of geometric tiles were available in up to ten colors, including buff, beige or tan, salmon, light grey, dark grey, red, chocolate, blue, white and black.

Ceramic mosaic tiles are essentially smaller versions of geometric tiles (usually no larger than 2-1/4", and no thicker than ¼") ranging in size from ½" to 2 3/16", in square, rectangular or oblong, hexagonal, pentagonal and trapezoidal shapes. Both vitreous and semi-vitreous mosaic tiles were available, unglazed in solid or variegated colors with a matte finish, or glazed in unlimited colors. Single, one-piece tiles were also fabricated to give the appearance of multiple mosaic pieces. This was achieved with a mold, which gave the appearance of recessed mortar joints separating individual "mosaics".

Ceramic mosaic tiles were practical for structures like this Bath House, Hot Springs, Arkansas (1914-1915).

Glazed Tiles

With the exception of quarry tiles, encaustic tiles, and some mosaic tiles, most ceramic floor tiles are decorated with a glaze. While unglazed tiles derive their color solely from the clay, or from oxides, dyes or pigments added to the clay, the color of glazed tiles is provided by the glaze, either shiny or matte. Some potteries specialized in certain kinds of glazes and were famous for them. The earliest and most common method of clay tile decoration made use of tin-glazes which were essentially transparent lead glazes. Tiles were either dipped into the glaze or the glaze was brushed on the tile surface. Glazes were generally made with white lead, flint, or china clays ground up and mixed with finely ground metallic oxides that provided the color. Colored glazes were commonly known as "enamels". Colors included blue derived from cobalt, green from copper, purple from manganese, yellow from antimony and lead, and reds and browns from iron. An opaque glaze was created by adding tin oxide.

Photo: Jack E. Boucher, HABS Collection, NPS.

Laying Historic Ceramic Tile Floors

19th Century Techniques

Aside from the use of improved tools and modern materials, installation methods have changed little since the mid-19th century. M. Digby Wyatt, an architect for one of the major 19th century encaustic tile manufacturers in Britain, Maw & Co., described this procedure for laying encaustic and geometric tiles in 1857:

First, either an even layer of bricks, a 2-1/2" bed of concrete of quicklime and gravel, or a mixture of Portland cement and clean sharp sand was laid to prepare a solid foundation for the tiles. If the tiles were to be laid over an existing wooden floor, the floor boards had to be pulled up, sawn into short lengths and fitted between the joists. Concrete filled in the spaces and made the base flush with the upper face of the joists, and created a level surface finished within 1" of the finished floor line. A layer of cement mortar was then laid on top. This allowed the tiles to fit in the same amount of space as the floorboards they replaced.*Before laying the tiles, skirting boards or shoe moldings were to be removed, and replaced after the tiles were laid. This eliminated having to cut the outer tiles to fit exactly, and resulted in a neater appearance.

Next, the floor design was marked off with mason's string or chalk lines which divided the space into equal quadrants. The first section to be laid out was defined by two parallel strips of wood, or guide pieces, about 4" wide. A level thickness of cement was spread between these strips. The tiles, thoroughly soaked in water, were laid in the cement and leveled with a straight-edge. The foundation had to be kept wet while the tiles were being laid. Small strips of wood temporarily placed at right angles to the guide pieces helped keep elaborate patterns straight.

When the bed was hard, the joints were filled with pure cement mortar-sometimes colored with lamp black, red ochre or other natural pigments-mixed to the consistency of cream. Excess mortar was wiped off the tiles with a piece of flannel or sponge.

A newly-laid tile floor could not be walked on for 4-6 days until the cement hardened properly. Occasional washing would remove the saline scum that often appeared on the surface right after the tiles were laid.

20th Century Techniques

Almost 50 years later, in 1904, the Tile Manufacturers of the United States of America published *Suggestions for Setting Tile* with the intent of bringing tile-laying up to a uniform standard. This guidance was very similar to that given by Wyatt. But, there were some differences, such as using hollow clay tile as a foundation material and heavy tar paper when laying tile over a wooden floor to protect the floor boards from the moisture of the mortar mix. Emphasis was placed on using the best quality cement, sand, and purest water to obtain a durable tile floor. Soaking the tiles before setting was no longer necessary, but using stiffer mortar was suggested to prevent it from rising up between the tiles.

Tile-laying methods changed somewhat more later in the 20th century, mostly due to the availability of new materials and techniques. By the 1920s small ceramic mosaic tiles were manufactured as 12" square sheets held together by a face-mounted paper "skin." This made it possible to lay the 12" square of tiles as a unit rather than each of the small tiles individually. Mounting the tiles directly in the cement resulted in a very strong bond. But the face-mounted paper obscured the tiles from view making it difficult for the tile-setter to see if the tiles were being laid straight. The fact that the paper was not removed until after the tiles were firmly set in the cement bond coat further complicated realignment of crooked tiles. This paper "skin" was eventually replaced with a fabric mesh backing. This permitted the tiles to be aligned as soon as the moisture from the bond coat loosened the mesh from the back of the tile; it also allowed a single tile to be cut away from the mesh and repositioned immediately. Although the fabric mesh made tile setting faster, sometimes it also resulted in a weaker bond by reducing the contact area between the backs of the tiles and the bond coat.

Following World War II, different methods of preparing a foundation for a ceramic tile floor were developed to be more compatible with new materials, such as reinforced concrete, expanded wire mesh, polyethylene and waterproof plywood. New adhesives and grouts also facilitated tile installation, and an increased variety of epoxy and cement mortars allowed for different setting bed thicknesses. But today, after half a century of practical application, some of these "new" materials, such as plywood, particle board, oriented strand boards and other wood panels, are no longer recommended for use with ceramic tile.

Mortar beds are lighter, more flexible, and much thinner than they were previously, having shrunk from several inches to as thin as 3/32". A greater variety of materials are used for setting ceramic floor tiles, including bonding agents and waterproof membranes. Basic installation methods have not changed significantly, but they vary according to the type of subfloor on which the tile is to be laid. While the same concerns for level underlayment and strong adhesion exist, advancement has occurred mostly in the increased speed and ease of laying the tiles.

**The traditional practice of sawing the original floor boards and fitting them between the joists, still used today to maintain a low finished floor profile, has resulted in numerous cracked tiles and other failures. Instead, a better approach is to leave the existing floor boards, if they are in good shape, and install a cementitious backer board (CBU) available in thicknesses ranging from ¼" to 5/8" as the setting bed for the tiles.*

Historic Ceramic Floor Tile: Preservation and Maintenance

Before undertaking any work more complicated than regular maintenance or a very simple repair on a significant historic ceramic tile floor, or on any historic tile floor where serious damage has occurred, it is recommended that a professional conservator of ceramics, an historical architect, an architectural historian, or a chemist with particular knowledge and experience in this field be consulted. This will ensure that all future work, whether it be regularly-scheduled maintenance or more technical and specialized repair and restoration, is done in accordance with *The Secretary of the Interior's Standards for the Treatment of Historic Properties*.

This tiled Presidential seal was laid in the floor of the Pension Building in 1901 at President McKinley's 2nd inaugeration. Photo: NPS files.

Cleaning Methods

Ceramic tiles are essentially a practical, low-maintenance flooring material. Yet, even glazed tiles are somewhat porous, and can get dirty and stained, especially in heavy traffic areas or where oil, fat, and grass stains are likely to occur. Although heavily soiled areas may be difficult or impossible to clean completely, in most instances, cleaning ceramic tile floors is relatively easy. Cleaning should always begin with the gentlest means possible, which may be as simple as warm water. Regular maintenance should include sweeping, or preferably dry or damp mopping or vacuuming to reduce grit. Tiles can usually be cleaned with a non-soap-based household floor cleaner, such as one of the commercial products intended for cleaning ceramic tile floors available on the market.

All cleaning and stain-removal products should always be tested on a small, inconspicuous area before using. Abrasive cleaners (including powdered cleansers and even "mildly" abrasive creams) and mechanical equipment can damage and wear away the protective surface, as well as the decorative design on the tiles, and should not be used on ceramic tile floors. Generally, acid-based cleaning solutions should also not be used on ceramic tile floors because they can damage the complex silicates in a glaze. However, there are some acid-based cleaners specially formulated for cleaning and removing coatings from ceramic tile floors that may be acceptable, but even these must be used with caution. Sometimes an acid-based cleaner may, in fact, be needed to remove discoloration or staining caused by lime or cement mortar. But, it should be tested first, used with caution, and applied only to a thoroughly wetted tile floor from which excess water has been removed. Pre-wetting a ceramic tile floor before cleaning is a good policy to observe with all cleaners. The water saturates the porous tile and prevents chemicals or other cleaning agents from penetrating into the tile body. Floor tiles should be always rinsed thoroughly after cleaning.

Plastic pot-scrubbers may be effective in loosening and removing superficial dirt without abrading the glazed or vitrified surface of the tiles. Stubborn asphalt or oil stains, scuff marks, or soiling can sometimes be removed with ammonia or one of the household spray products intended for cleaning kitchen or bathroom tiles. If necessary, a solvent may be applied carefully to pre-wetted tiles, but it should not be left on the surface for an extended amount of time as it may cause discoloration. If possible, a stain should always be identified first in order to select the material best-suited to remove it.

Organic growth, such as mold or mildew, can be eliminated with a dilute solution of household bleach and a neutral household detergent, or a dilute (5-10%) solution of tri-sodium phosphate (TSP). After applying either of these solutions, it may be necessary to scrub the floor with a natural bristle or nylon brush, and then rinse with clear water. Even a dilute bleach solution should not be left on a ceramic tile floor for more than a few minutes, since the alkali in the bleach can lead to the formation of a white efflorescent deposit. Efflorescence (a whitish haze of water-soluble salts) may stain and streak the tile, or may even cause minor spalling around the joints.

Regular maintenance of a ceramic tile floor should always begin with vacuuming to remove loose dirt and grit. Then, a mild cleaning solution may be applied and left on the floor for 10-15 minutes, without letting it dry on the tiles. Heavily soiled areas may be scrubbed with a natural bristle or nylon brush to loosen dirt from the tile surface. Finally, the floor should be thoroughly rinsed with clean, clear water, preferably twice, and dried with terry cloth towels, if necessary. Any proprietary cleaning product should always be used in accordance with the manufacturer's directions.

Protective Coatings

In most instances, traditional ceramic tile floors probably would not have been treated or given a protective coating other than wax. In the 19th century, some encaustic tile floors were treated with linseed oil, but this is not a practice recommended today because linseed oil tends to attract dirt and discolors as it ages. Most historic ceramic tile floors simply acquired a natural "polish" or sheen through use. Because the surface of ceramic tiles is already protected with a fired skin or a glaze, an additional protective coating should generally not be needed.

Opinions differ concerning the use of protective coatings, penetrating sealers, or waxes on ceramic tile floors, and, especially, on historic ceramic tile floors. If properly applied and regularly cleaned, a coating can sometimes be an effective maintenance treatment, but only on interior floors. However, if not adequately or properly maintained, rather than facilitating maintenance of ceramic tile floors in high traffic areas, such coatings may tend to emphasize traffic patterns as they wear away or become scratched. Some coatings may also peel in spots, or cause tile to appear hazy or cloudy if the coating is not applied in accordance with the manufacturer's specifications, or if the tiles are not perfectly clean when the coating is applied. Furthermore, applying such a coating may actually increase maintenance costs, since a coating requires periodic removal and renewal. The frequent removal of a coating can also damage a ceramic tile floor if it is carried out with harsh chemicals or abrasive mechanical equipment. If any coating is considered, a traditional coating, such as floor wax, may be the most suitable. Wax is easy to remove when it becomes worn, and does not impart a high, potentially inappropriate, gloss to the surface.

On the other hand, a penetrating sealer, or *impregnator*, may be worth considering to protect patterned encaustic tiles, or painted or printed tiles featuring a design that might be worn off, particularly in public buildings with a high volume of foot traffic. For example, some manufacturers of new, reproduction encaustic tiles recommend applying a penetrating sealer to the replacement tiles, as well as to the historic tiles. Impregnators do not change the color of the tile surface and, unlike some penetrating sealers, are completely invisible after they have been applied. They can reduce the porosity or water absorption of the tile surface, and provide some protection for the tile (and the grout) against staining. This may be particularly useful on light-colored floors. Whether to apply an impregnator to an historic ceramic tile floor, and what type or product to use, are decisions that should generally made in consultation with a conservator or ceramic tile specialist. *It may also be necessary to comply with certain safety standards and friction requirements of the ADA (Americans with Disabilities Act). The ADA Guidelines recommend "a static coefficient of friction" of 0.6 for level surfaces and 0.8 for ramps. This may require the application of a non-slip sealer or wax to historic ceramic tile floors in some public buildings.*

Despite the non-traditional shiny finish they may impart to a floor surface, two-part, acrylic-based coating systems are commonly used today on historic ceramic tile floors in many public buildings, primarily because they facilitate easy maintenance. If it is decided that a sealer is to be used, a product with a matte or dull finish may be preferable, or more appropriate, for a historic ceramic tile floor than one with a high-gloss.

In some cases, temporary protection may be the best approach until a better solution is found. Non-permanent protection for an historic ceramic tile floor may be as simple as using floor mats at doors or in heavy traffic areas.

Historic Ceramic Floor Tile:
Damage and Deterioration Problems

Worn encaustic tiles are still serviceable, but once the design has been lost, the tiles cannot be repaired. They must be replaced in kind, to match. Photo: NPS files.

Loss of Tile Surface and Pattern

Ceramic tiles are among the most durable of historic flooring materials, but natural wear and a certain amount of deterioration or damage is inevitable. Some tiles, such as dense, close-textured quarry tiles and ceramic mosaic tiles, resist abrasion and stain absorption very well. But many others, especially patterned encaustic and geometric tiles, are extremely susceptible to abrasion. Heavy traffic can also result in uneven wear, or even cupping, in certain areas of tile floors that get more use than others, such as doorway entrances. The particular clay mix, or the dye or pigment used to color the clay, can also affect the hardness and durability of individual tiles or an entire ceramic tile floor.

Tile Glaze Failure

Occasionally some glazes can become pitted or powdery as they age. Lead glazes used in the 19th century, which were fired at low temperatures, deteriorated relatively quickly. Glazes have different physical properties from the fired clay tile body itself, and as a result may sometimes crack or craze. Unless the crazing visibly extends into the porous clay of the tile body beneath, this is not generally a serious material failure; however, dirt entering these cracks cannot be removed, and will discolor the tile. If the crazing penetrates through the glaze, it may increase the water absorption of the tile.

Tile Breakage

Ceramic floor tiles are very susceptible to damage and breakage caused when something heavy is dropped. Repeated passage of heavy objects, or carts, over a floor can also crack and break ceramic tiles, as well as heavy vibration from outside traffic.

Moisture Damage to Tile

Ceramic tile floors have been traditionally viewed as highly waterproof systems that do not require protection from moisture. In reality, however, this is not true. Water-related problems are one of the most common causes for the deterioration and failure of historic tile floors, particularly in bathrooms and other rooms where there is a lot of moisture. Water that is allowed to sit in areas around shower stalls and bathtubs can eventually damage grout and mortar, and loosen tiles. Some of the more porous kinds of tiles that are not as hard-fired may actually begin to powder or spall if subjected to constant moisture.

Loose, Cracked, Broken or Unbonded Tile Due to Mortar Failure

The durability of ceramic tile floors depends to a great extent on a sound mortar bed and sound mortar joints. The wrong mortar type or mortar that is inadequately mixed can also spell trouble for a ceramic tile floor. Failure of a tile floor system laid over a subfloor is often the result of weakened or deteriorated grout or mortar which allows the tiles to become loose. Mortar may also be weakened or loosened by cleaning solutions that are too strong.

Proper tile-laying technique includes the use of a material that will allow for some movement of the tiles. Traditionally, a layer of asphalt (replaced by a layer of plastic or building paper in more modern construction) was inserted to separate the base and the bedding underneath. This prevents bonding between the base and the bed, and allows for some "relative" movement. It is intended to prevent the ceramic tile floor from arching or ridging, a condition in which single or entire rows of tiles can pop up to relieve tension and separate completely from the bed. When this happens, the condition will probably require taking up and relaying many or all of the tiles.

Tile Damage or Loss Caused by Systems Update

The installation of new plumbing, electrical and HVAC systems, or the attachment of new fixtures and furnishings, may be one of the most common sources of damage to an historic ceramic tile floor. Earlier remodeling projects to remove old pipes or to replace "out-dated" bathroom fixtures may have resulted in the loss of floor tiles. Different shapes and sizes of new fixtures, equipment or pipes may have exposed previously untiled areas that have been inappropriately patched with cement. Careless workers and insensitive installations can also result in damage, breakage or removal of historic floor tiles. All of these conditions will require matching replacement tile.

Historic Ceramic Floor Tile: Repair and Replacement

The Secretary of the Interior's Standards for the Treatment of Historic Properties emphasize the retention and preservation of historic building material. Preservation and repair treatments are always preferable to replacement.

Mortar Joint Repair

Deteriorated mortar joints and loose mortar or grout can generally be repaired. First, the entire floor should be checked for loose tiles that need to be regrouted. Damaged mortar should be carefully removed by hand and the joints wetted or a bonding agent applied in preparation for regrouting. When making mortar repairs, it is important to use grout that matches the old in color and consistency as closely as possible.

Tile Repair

Trying to remove one tile can endanger surrounding tiles. Thus, it may be better to preserve and retain an original historic tile that is only slightly damaged, rather than replace it. Sometimes cracks may be repaired, or a corner or piece of tile that has broken off may be re-attached, using an epoxy glue, or grout. If a tile is chipped or a small corner or edge is missing, a carefully executed patch of epoxy-mixed with colored enamel, or mortar tinted to blend with the tile, may be less conspicuous than trying to replace every tile that has even the slightest damage. And, it is a better preservation treatment.

In limited instances, glaze failure or surface powdering of ceramic floor tiles may sometimes be treated successfully by a conservator with a specially formulated, solvent-based, mineral densifying agent (such as silicic acid), followed by a siloxane sub-surface repellent, applied 24 hours later. Under the right circumstances, such a treatment can harden and bind the surface, and lower the absorbency of the tile, and still maintain the vapor transmission. But this is a highly complex undertaking and should only be attempted by a conservator after appropriate testing. Not only are these chemicals highly toxic and dangerous to handle, but if used improperly, they can cause greater damage to the tile!

This inappropriate ceramic tile repair is easy to spot. Photo: NPS files.

Tile Replacement

When an individual tile or a larger portion of an historic ceramic tile floor is missing or so severely damaged that it cannot be repaired, or if it has become a safety hazard, then it should be replaced. When a ceramic tile floor has deteriorated as a result of long term wear and abrasion, or from settlement or vibration damage to the setting bed, there are a number of factors that need to be considered before choosing a preservation treatment. If damage to tiles is the result of more than normal wear and tear, the source of the problem needs to be identified, and the problem corrected before replacing the damaged tiles.

Successful replacement not only depends on the availability of matching tiles, but on the condition of the substrate on which the tiles are laid. Before installing the replacement tiles, any problems, such as settlement or vibration, will have to be addressed, and the height of the new setting bed may have to be adjusted for the thickness of the new tiles.

Selective Replacement of Individual Tiles

This cautious approach, typically an attempt to replace only the most seriously damaged tiles, is often taken or considered when only a small number of tiles are involved. Unless old, matching tiles can be found and reused, replacement often requires specially fabricated reproduction tiles. In some instances, individual historic tiles that are damaged may be replaced with matching tiles salvaged from other, less prominent areas of the floor or from other buildings. This is most feasible if the tiles to be replaced are either plain, and easy to match, or decorated with a common historic floor tile pattern.

In order to replace damaged tiles, it can be helpful to identify the manufacturer and the approximate date of the tiles, if possible. However, many mass-produced tiles are not marked and give little or no information as to their origin, although stylistic similarities with other marked tiles may sometimes provide a clue as to the manufacturer. Some decorating firms seldom signed their work, while many firms made bisque tiles (plain, unglazed, once-fired tiles) for other companies, as well as their own use. Identifying marks will generally be found on the back of the tile. A mark impressed or molded into the back of the tile may give the name or initials of the company which made the tile or the bisque; sometimes a printed or painted mark indicates if it was decorated by a different company, or artist. Historic building records and construction documents may provide information about the tile company or supplier. Catalogues of the period may also be useful in identifying the tile manufacturer of unmarked tiles.

Replacing a single damaged tile is based on the ability to remove only the deteriorated tile without harming surrounding tiles. Attempts to remove one or several damaged tiles often fail because a hammer and chisel are used. The shock of the blows to the tile being removed travels through the grout into surrounding tiles and cracks them. To avoid damaging good tiles, all the grout around the tile must be removed. This is best accomplished by an experienced tile installer using a hand tool called a grout saw or, for grout joints wider than 3/8", a dry-cutting diamond blade, mounted in an angle grinder or circular saw.

Other difficulties may be encountered when selectively replacing damaged tiles with reproduction tiles. New tiles, especially encaustic tiles, may be different in thickness and, sometimes, despite the attention to detail of the reproduction process, slightly different in color and design from historic tiles. This can cause both visual and physical problems, especially if the replacements are being laid in a piecemeal fashion.

If the setting bed does not have enough mortar to grip and hold the tile, one new tile laid among the originals will eventually come loose. If the new and old tiles are different thicknesses, the setting bed in which the new tiles are laid must be at a different height to create a level finished surface. In addition, the two levels of setting beds may be of different composition; one may be harder, stronger and less flexible than the other. This may also lead to problems, since the setting bed foundation should act and respond as a unit to the load and stresses placed upon it.

Sectional Replacement of Tiles

In some instances, the best approach may be to remove a complete section of damaged original tiles and replace that section of floor in its entirety with new reproduction tiles. Advantages of this method include the ability to lay a level setting bed, as well as achieving a finished product that is uniform in color and pattern match. Although this approach may involve replacing more original tiles with reproduction tiles than may be absolutely necessary, original tiles that remain in good condition can be saved to be reused in other sections where only a few tiles are damaged. This technique is generally most appropriate either when the section being replaced is the most damaged portion of the floor, or is in a relatively inconspicuous location and the tiles that are removed will supply enough salvaged pieces to permit in-kind repair of a more visually prominent area.

When laying a section of reproduction tiles, it may be a good idea to use contemporary materials and installation methods such as expansion joints or flexible expansion material. One of the major causes of ceramic floor tile installation failure and cracked, broken or disbonded tiles is the lack of expansion joints. Expansion joints were sometimes used in laying historic ceramic tile floors, and these are frequently the ones that have survived in the best condition. Many preservation contractors hesitate to use conventional expansion joint filler materials because of their limited range of colors. However, there are new flexible sealants in a wide range of colors that are available in either sanded or unsanded textures to match the surrounding grout joints. As a result, the expansion joints are almost invisible. A bonding agent may also be considered-if recommended by the tile manufacturer-and any drawings provided by the manufacturer should be used to guide the installation.

Each preservation technique has advantages and disadvantages that the historic property owner or manger should take into consideration before deciding which one is best suited to the particular flooring problem. For example, slight differences in the shape, size, color and the pattern between the old and the new tiles are frequently encountered. If replacing an entire section, the slightest difference in size and dimension between the original tiles and the reproduction tiles, even if it is as small as 1/8" or 1/16", can mean that the new section of tile will not fit inside an existing border. Even though drawings and photos are provided to the manufacturer, there may be some variation in the design and pattern size on the new tiles. Thus, they may not align perfectly with the original tiles, and as a result the section of the floor that has been replaced may be quite conspicuous.

Summary and References

Historic ceramic tiles are a common flooring material in many different kinds of small, as well as large, private and public, structures throughout the United States. Whether plain, or decoratively patterned, traditional ceramic floor tiles are important in defining the character of historic buildings. Although ceramic floor tiles are a practical material, they are also fragile, and can be easily damaged by improper installation techniques, insensitive remodeling, harsh cleaning methods, and even regular daily use. Preserving them requires careful day-to-day maintenance. This should begin with using gentle, non-abrasive methods and materials to clean them, and, in some instances, using an appropriate coating or impregnator to protect them.

Some historic ceramic tile floors, due to their manufacturer, their unique design, or their location in a certain room or within a particular building, may have greater significance than those that are purely utilitarian. Such floors should be accorded special care, and a ceramics conservator or preservation specialist should always be consulted to prepare responsible maintenance plans and to provide guidance concerning repair treatments and replacement techniques for them.

Unless an historic ceramic tile floor is extensively damaged with many missing and broken tiles and, therefore, potentially hazardous, it may be preferable to leave it alone. An unevenly worn floor surface, worn colors or patterns on the tiles, or slight cracks, chips, or scratches in the tiles themselves does not necessarily mean that the tiles should be replaced. Such relatively minor imperfections seldom detract from the character of an historic ceramic tile floor. They may, in fact, impart character, and be less noticeable or obtrusive than replacement of a single tile or a larger section with new tiles that do not match the originals exactly. Each situation should be evaluated on its own basis before selecting the preservation approach best suited to the project.

Some Sources for Replacement Tiles

There are a number of companies that offer standard lines of reproduction tiles, while others focus on custom work. Some new lines of reproduction tile attempt to be exact replicas of original tiles from the late-19th and early-20th century, while others are modern interpretations or adaptations of traditional designs, and may not be appropriate as replacement tiles in a preservation or restoration project. For additional sources see: "Traditional Building's Ceramic Tile SourceList," Traditional Building, Vol. 9, No. 4 (July/August 1996), pp. 92-93.

Designs in Tile

P.O. Box 358

Mt. Shasta, CA 96067

Custom-made reproduction art tile.

Fulper Tile

P.O. Box 373

Yardley, PA 19067

Reopened factory reproduces historic tiles using original Arts and Crafts-period glazes.

HandR Johnson Tiles Ltd.

Head Office: Highgate Tile Works

Tunstall, Stoke-on-Trent

England ST6 4JX

U.S. Office: Johnson USA Inc.

P.O. Box 2335

Farmingdale, NJ 07727

Stock and custom reproductions of Minton Hollins encaustic and geometric tiles.

L'Esperance Tile Works

237 Sheridan Avenue

Albany, NY 12210

Custom-made encaustic, geometric, mosaic and other traditional ceramic tiles.

Moravian Pottery and Tile Works

Swamp Road

Doylestown, PA 18901

Reproduction tiles based on Henry Chapman Mercer's original designs.

Motawi Tileworks

33 North Staebler Road, Suite 2

Ann Arbor, MI 48103

Reproduction tiles in Arts and Crafts, Art Nouveau and other styles.

Native Tile and Ceramics

4230 Glencoe Avenue

Marina Del Rey, CA 90292

Reproduction decorative tiles in Southern California tradition of Craftsman, Mission, Art Deco and other styles.

Original Style

Stovax Ltd.

Falcon Road

Sowton Industrial Estate

Exeter, Devon

England EX2 7LF

Reproduction ceramic tiles from 1750-1902.

Pewabic Pottery, Inc.

10125 East Jefferson Avenue

Detroit, MI 48214

Reopened factory reproduces original tile designs and glazes.

Terra Designs Tileworks

241 East Blackwell Street

Dover, NJ 07801

Mosaic tessarae experts, and reproduction of historic ceramic tiles.

Tile Guild

2840 East 11th Street

Los Angeles, CA 90023

Reproduction of traditional Spanish, Portuguese, Dutch, Italian and English tiles.

Tile Restoration Center, Inc.

3511 Interlake N.

Seattle, WA 98103

Reproduction of Arts and Crafts-period tiles.

Helpful Organizations

The American Institute for Conservation of Historic and Artistic Works (AIC)

1717 K Street, N.W., Suite 301

Washington, DC 20006

Ceramic Tile Institute of America, Inc.

12061 Jefferson Boulevard

Culver City, CA 90030-6212

Friends of Terra Cotta, Inc.

771 West End Avenue, 10E

New York, NY 10025

Tile Council of America

P.O. Box 1787

Clemson, SC 29633

Tile Heritage Foundation

P. O. Box 1850

Healdsburg, CA 95448

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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. Technical Preservation Services (TPS), National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments for a broad public.

October 1996

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Real Estate Department

To whom it may concern 9/6/2023

I am writing this letter on behalf of Hartford Hospital/HHMOB Corporation as owner of 94-110 Jefferson St., providing authorization for the restorative work to be done at 94-110 Jefferson St., Hartford

Hartford Healthcare is the parent corporation of Hartford Hospital and oversees all real estate transactions for this entity

Thank, you in advance for any consideration you give this request

St Alexandre

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