STAFF REPORT 2-10-2021 REGULAR MEETING **PREPARED BY:** A. PHILLIPS
APPLICATION NUMBERS: 21-7071, 21-7072, 21-7073, 21-7074
21-7075, 21-7076, 21-7077, 21-7078, 21-7079, 21-7080, 21-7081
ADDRESSES: 3664, 3690, 3700, 3708 TRUMBULL
3689, 3697, 3701, 3707, 3713, 3907, 3915 LINCOLN STREET
HISTORIC DISTRICT: WOODBRIDGE FARM
APPLICANT: JASON JONES, 3701 LINCOLN LLC
PROPERTY OWNER: JASON JONES, 3701 LINCOLN LLC
DATE OF PROVISIONALLY COMPLETE APPLICATION: 1-29-2021
DATE OF STAFF SITE VISIT: 2-2-2021

SCOPE: ERECT NEW BUILDINGS, REHABILITATE EXISTING POWER HOUSE

EXISTING CONDITIONS

The noncontiguous project site encompasses parcels addressed at 3664, 3690, 3700, 3708 Trumbull and 3689, 3697, 3701, 3707, 3713, 3907, 3915 Lincoln Street. The portion of the site located along Trumbull is situated at the northeast corner of Trumbull and Brainard and runs west of the public alley from Brainard north to the existing property located at the corner of Trumbull and Selden. It currently includes a collection of open, grassy lots with the exception of one building, the Scripps Mansion Power House, which is located at 3664 Trumbull. Specifically, the ca.1900 red brick power house is located mid-block along the alley and boasts cast stone details including quoining around the window and door openings. A recent fire has destroyed its roof and windows. The windows are currently boarded up. Landscape features of the site include four stone columns – two flanking the entrance to the site at Trumbull and Brainard and two flanking the original entrance to the Scripps Mansion located on Trumbull mid-block – and the remains of an ornate wrought iron and stone perimeter wall which once enclosed the Scripps estate. The wrought iron pickets of the wall no longer exist but portions of the stone base remain along Brainard and Trumbull. The portion of the site containing 3689-3713 Lincoln is situated at the southwest corner of Selden and Lincoln, east of the alley, and runs south along Lincoln stopping mid-block between Selden and Brainard. It is currently a grassy lot with trees at the perimeter. The portion of the site containing 3907 and 3915 Lincoln is situated at the northwest corner of Selden and Lincoln, east of the alley and currently a grassy lot with a row of trees along the north property line.

3664-3708 Trumbull. View from Brainard Street looking northeast. Photo taken by HDC staff, February 2, 2021

3664 Trumbull - Existing Masonry Power House. View from Trumbull looking southeast. Photo taken by HDC staff, February 2, 2021

3689-3713 Lincoln. View from Selden Street looking southwest. Photo taken by HDC staff, February 2, 2021

PROPOSAL

With the current proposal, the applicant is seeking the Commission's approval **to erect new buildings and rehabilitate the existing power house per the attached drawings and application**. Included in the proposal are the following scope items:

- **Sitework**
  - **Demolition**
    - Demolish existing concrete barrier wall along north side of alley.
    - Demolish existing decorative stone wall at corner of Trumbull and Brainard in its entirety, including the lengths running along Trumbull and Brainard.
    - Demolish (2) two existing stone columns located along Trumbull mid-way through the site in their entirety.
    - Remove and salvage (2) existing decorative stone columns near corner of Trumbull and Brainard (to be relocated as part of development outdoor space).
    - Remove all existing trees on the site.

  - **New Sitework**
    - Renovate and repave alley with new stamped concrete
    - New paved drive aisles and parking areas
    - New concrete pedestrian paths along front of buildings and entries
    - Creation of new community lawn space in front of existing power house including two "outdoor rooms" consisting of crushed stone surfaces edged with brick pavers
    - Planting areas with ornamental grasses and small shrubs at front porch areas of each unit
    - New trees as shown on site plan

- **Rehabilitation of Existing Power House**

  Rehabilitate and convert existing 2-story brick Power House building into a detached residential condominium unit
  - **Demolition**
    - Demolish remaining portions of existing brick wall along alley adjacent to building. Salvage brick to be used as required for repair of building.
    - Demolish existing wood roof structure (destroyed in fire)

  - **Rehabilitation Scope**
    - Repair/repoint brick as required. Mortar mix to match existing color, composition, and texture.
    - Clean brick to remove soot stands and graffiti. Contractor to test least invasive (1) to more invasive (3) cleaning methods. 1 = power washing, 2 = acid/chemical cleaners, 3 = abbrasives/media-blasting
    - Remove existing wood porch railing at north end of west facade of building and reconstruct wood porch rail in-kind and painted Yellowish White (C4).
    - Install new wood entry door centered on the west elevation. The replacement door is proposed to be a Craftsman 3 Panel 3 Light Premium Wood Pella Entry Door (stain color: Bordeaux)
    - Reconstruct damaged brick wall at northeast corner of building with salvaged brick from the demolition of the existing brick wall along the alley.

- Reopen the upper portion of the existing brick-infilled window opening at second floor of rear (east) elevation.
- Repair and replace existing wood header detail on front (west) façade above entry door.
- Install new glass access hatch at roof.
- Construct new roof deck (Trex Decking – Color: Saddle/Dark Brown) with painted aluminum (color: black) guard rail.
- Install continuous aluminum gutter and downspout (color: black).
- Install new aluminum-clad wood windows at all window openings. Replacement windows are proposed to be the Pella Architect Series aluminum-clad wood windows with a black exterior finish, simulated divided light with 2/1 custom grille patterns based on historic photos and photos of the property prior to the most recent fire which destroyed the windows. The arched-top window located at the front elevation is proposed to be a custom window manufactured by Pella using the same construction methods as the Architect Series. The design of the arched-top window is based on the historic wood door that was destroyed by fire.
- Raise sill of window at rear south elevation of building, coordinate with interior configuration. Use salvaged brick to infill opening as required below new windows.

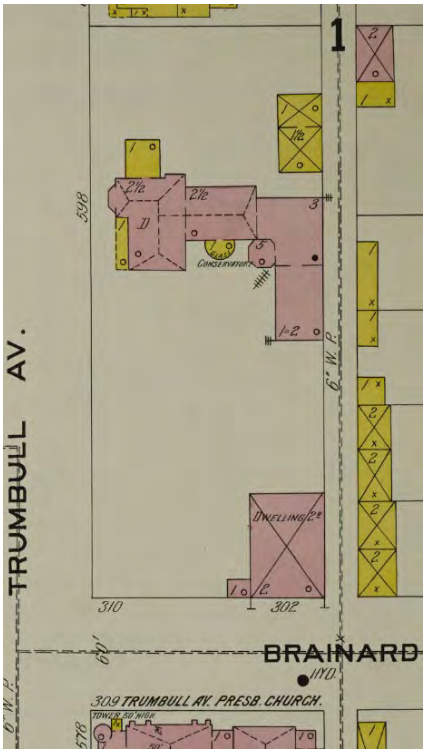
- **New Construction**
  Construct 15 new buildings (64 units) consisting of two to seven 3-story town-home units placed throughout the project site (see attached drawings for locations).
  - Individual garages are included in the first floor of the building footprints with vehicle access from the interior of the site, not from the street. Additional uncovered surface parking for guests is located at various locations within the site.
  - (6) of the buildings will incorporate a "red" color scheme which includes the following exterior building materials:
    - Reddish-brown brick
    - Painted James Hardie Lap siding, smooth finish, iron gray in color
    - Woodtone Composite Wood siding – color: summer wheat
    - Asphalt singles at the roof – color: dark gray/black
  - (9) of the buildings will incorporate a "gray" color scheme which includes the following exterior building materials:
    - Warm gray brick
    - Painted James Hardie Lap siding, smooth finish, dark brownish gray in color
    - Woodtone Composite Wood siding – color: summer wheat
    - Asphalt shingles at the roof – color: dark gray/black
  - Windows in all new buildings are proposed to be the Anderson 100 Series Fibrex (composite material) windows of varying size and operation including:
    - Low-E Glass
    - No grilles
    - Exterior finish color: Black
  - Patio doors in all new buildings are proposed to be the Anderson 100 Series (composite material) doors of vary size and operation including:
    - Low-E Glass
    - No grilles
    - Exterior finish color: Black
  - Exterior entry doors are proposed to be Thermatru Smooth-Star Pluse Echo 4-Lite Centered fiberglass doors (color: black).
  - Railings of the second floor balconies are to be 3'-6" high "ultra-picket"-style aluminum railings.

STAFF OBSERVATIONS & RESEARCH

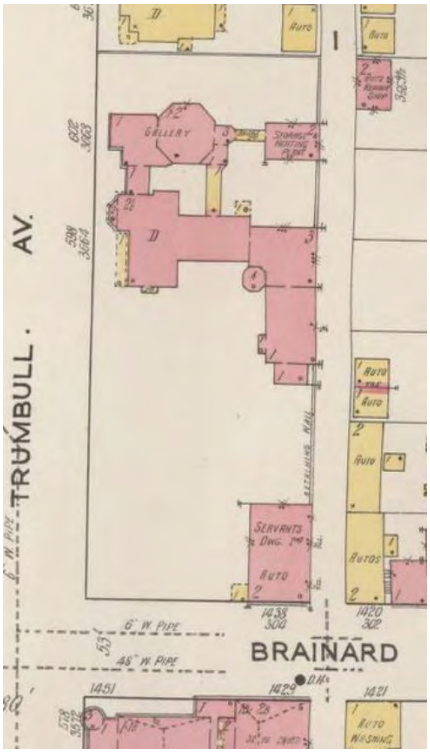
- Woodbridge Farm Historic District was designated in 1991.
- This site is also known collectively as 3700 Trumbull.
- The portion of the project site located along Trumbull was historically the site of the Scripps Mansion. The designation report for Woodbridge Farm states, "Building on Trumbull began in 1879 when James Scripps, founder

and publisher of the Detroit News, built his home near the corner of Grand River. His fine home, with art gallery and chapel designed by Mason and Rice in 1891 and library by Albert Kahn in 1898, set the tone for the erection of other spacious houses on the avenue. Unfortunately, the Scripps House fell victim to arson in the 1980's…"

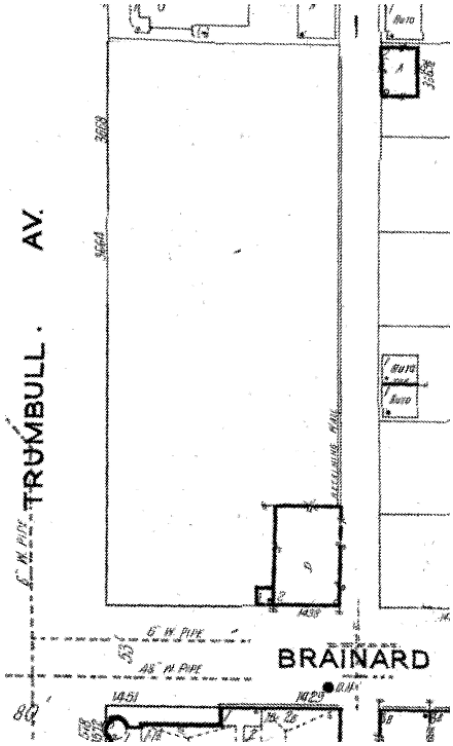
- See Sanborn Maps and historic photos below of the property below for a history of the site development:



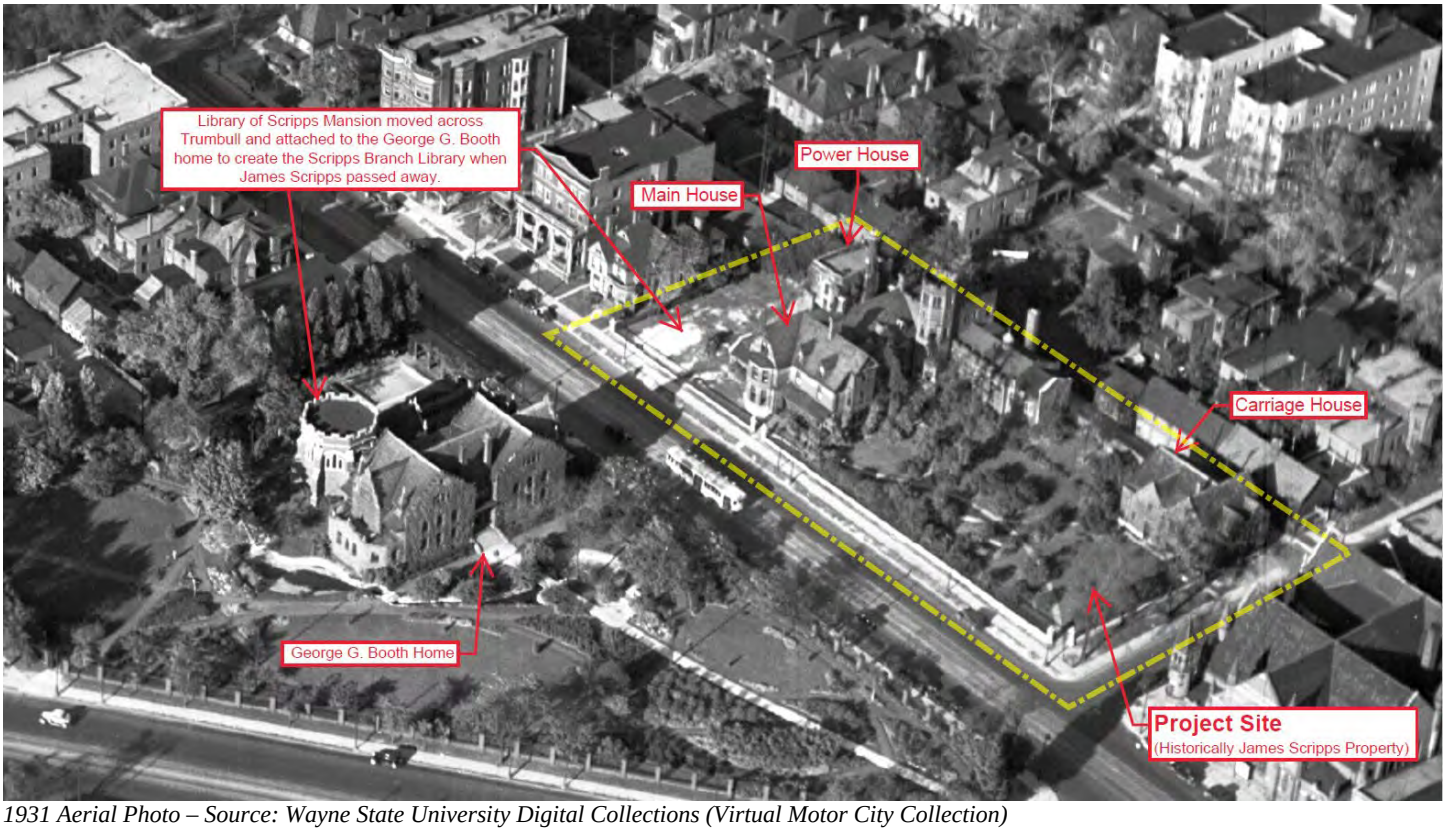
1897 Sanborn Map



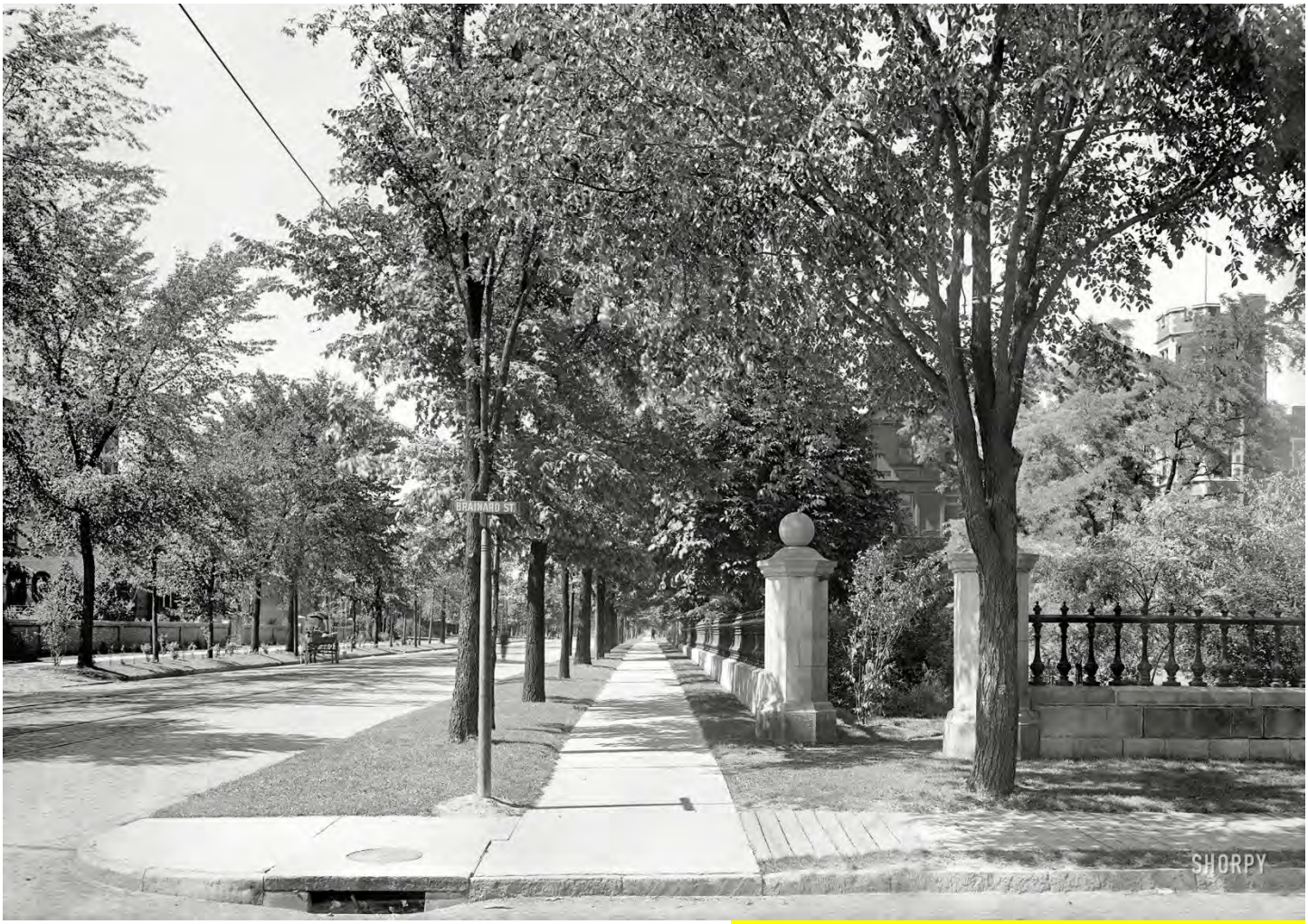
1921 Sanborn Map



Post-1950 Sanborn Map



1931 Aerial Photo – Source: Wayne State University Digital Collections (Virtual Motor City Collection)



1910 Photo of Scripps Property taken from the corner of Brainard and Trumbull. Note the perimeter garden wall base (cast iron pickets no longer intact) and stone columns at the corner. – Source: https://www.shorpy.com/files/images/SHORPY-4a20022a.jpg

Photo of Scripps mansion (date unknown) taken from Trumbull looking northeast. Note the perimeter garden wall base (cast iron pickets no longer intact) and stone columns at the central entrance to the site. – Source: Wayne State University Digital Collections (Virtual Motor City Collection)

1940 Photo of Scripps mansion (date unknown) taken from Trumbull looking northeast. Note the perimeter garden wall base (wrought iron pickets no longer intact) and stone columns at the central entrance to the site.
Source: Wayne State University Digital Collections (Virtual Motor City Collection)

Photo of stone columns and perimeter garden wall (wrought iron pickets no longer intact) at the corner entrance to the property taken from the corner of Brainard and Trumbull.

ISSUES

- **Sitework**
  - **Stone garden wall and columns** - As shown in the photographs, the stone base of the perimeter fence and two sets of stone columns (4 total stone columns – 2 at the corner of Brainard and Trumbull and 2 along Trumbull at the center of the site) date back to the Scripps estate. It is staff's opinion that these are distinctive character-defining features, and the applicant's proposal to demolish the remaining stone wall, demolish the two stone columns at the center of the site, and remove/relocate the two stone columns at the corner of Trumbull and Brainard not only removes historic material but also erases the physical history of development of the City. At the time the Scripps mansion was constructed, it was considered a suburb of Detroit. The perimeter garden wall and columns are the last remaining indications that at one point in Detroit's history, a grand estate existed at that site. Staff suggests the applicant endeavor to incorporate all of the existing stone elements as they exist into the design (not relocated or re-used in an alternate location) to honor and retain the physical history of the development of the city. Additionally, the Elements of Design (#13 – Relationship of significant landscape features and surface treatments) for the Woodbridge Farm Historic District mention the fencing and hedges around the Scripps Estate specifically.
  - **Trees** - Staff is concerned about the removal of all of the trees on the site, however, the proposed landscape plan seems appropriate and adequate. Staff suggests the applicant consider street tree planting in an effort to re-establish the tree canopy along Trumbull.

- **Rehabilitation of Existing Power House**
  - **Masonry** - The proposed masonry cleaning tests are of concern to staff. The contractor should start with the gentlest means possible (See attached National Park Service's Preservation Briefs and excerpts from the Secretary of the Interior's Standards Illustrated Recommendations for Rehabilitation). Starting with power-washing, especially if the pressure is too high, can result in the unintended removal of the exterior glaze of the brick, exposing the porous interior. Once the exterior glaze has been compromised, moisture infiltration will occur, causing the brick to spall and ultimately fail. Staff suggests the applicant select a qualified contractor familiar with historic brick to perform any cleaning of the brick (including soot) or removal of graffiti.
  - **Roof Deck** – Staff is concerned about the visibility of the railing at the roof deck. Due to the short stature and small footprint of the existing power house, as well as the open space surrounding the building, the railing will be highly visible from all sides. It is staff's opinion that the high visibility of the railing alters the character of the historic building and is not consistent with the National Park Service guidelines concerning rooftop additions. Staff suggests the applicant consider pulling the railing location back from the edges as well as utilizing a lighter, more transparent railing design to minimize the impact to the historic building.
  - **Windows (Muntin Pattern)** – On page 43 of the application packet is a photograph labeled "Scripps Mansion Main House" in which the applicant is calling out a series of 2/1 windows on which they are basing the light configuration for their new windows. While staff greatly appreciates this effort, during the research associated with this report, staff realized that the photograph included in the application is not the Scripps Mansion but is

actually the George G. Booth (James Scripps' son-in-law) residence which was located across Trumbull from the Scripps Mansion. See side-by-side comparison below. It is staff's opinion that for the windows which were originally proposed to be 2/1 (based on the historic photograph) should actually be 1/1 without divided lights.

- **Windows (Aluminum-Clad Wood)** – Staff has recently learned of the potential failure of aluminum-clad wood windows due to moisture infiltration and is concerned about the harm that may be caused to historic buildings with aluminum-clad wood window replacements should such failure occur. Staff has started researching the issue and will keep the Commission informed of relevant facts related to this issue.

1891 photo of the Scripps family in front of the George G. Booth Residence.
Source: Wayne State University Digital Collections (Virtual Motor City Collection)

Historic photo series included in the application package (pg. 43).

- **New Construction**
  - It is staff's opinion that, in general, the proposed new construction is compatible with the Woodbridge Farm historic district, however, staff is concerned about the longevity of the following materials and their appearance within the historic district:
    - Woodtone Composite Wood Siding – According to the cut sheet, this product is not true wood siding, it is a composite product comprised of a coating applied to a fiber-cement substrate that makes it look like wood. Some of the images included in the brochure demonstrate a noticeable pattern repeat in the "wood" coating. In general, it is staff's opinion that it is inappropriate within this historic district to replicate wood with a composite material.
    - Anderson 100 Series Fibrex (composite material) windows – Windows made of Fibrex are somewhat new to the market and although they boast efficiency and sustainability, staff is concerned about the appearance of this product within the historic district. It is staff's opinion the windows should not be Fibrex.

RECOMMENDATION

Section 21-2-73, Certificate of Appropriateness

It is staff's opinion that the proposal should qualify for a Certificate of Appropriateness. Staff recommends that the Commission approve a COA for the proposed application, as it meets the Secretary of the Interior's Standards and the Woodbridge Farm Historic District's Elements of Design, with the conditions that:

- The existing stone base of the perimeter fencing and all four (4) columns remain in place.
- The masonry at the existing power house, stone perimeter wall, and stone columns is to be cleaned and graffiti removed using the gentlest means possible.
- The railing at the roof deck is be pulled back at least 3' from proposed location on all sides and modify the railing design to a more transparent or "lighter" impact system which staff finds appropriate.
- The windows at the existing power house which were originally proposed to be 2/1 (based on the historic

photograph) are to be 1/1 without divided lights.

- The “wood” cladding at the new buildings is to be real wood siding or smooth/plain-faced cementitious siding (Hardiboard).
- The windows at the new construction are to be a material other than Fibrex.
- Applicant to submit revised cut sheets for the items listed above to HDC staff for review and approval prior to pulling the permit.

3689-3713 LINCOLN

3664-3708 TRUMBULL

1897 SANBORN MAP

CALUMET 86 30' W. P. AV.

71

DETROIT VOL. 2

WILLIS AV.

COMMONWEALTH AV.

TRUMBULL AV.

LINCOLN AV.

8TH

ALEXANDRINE AV. W.

ALEXANDRINE AV. W.

70

SELDEN AV.

68

3907-3915 LINCOLN

Scale of Map
50 Feet to one inch

1897 SANBORN MAP

3689-3713 LINCOLN

3664-3708 TRUMBULL

1921 SANBORN MAP

(3975) A'K.P.
DETROIT, MICH., VOL. 2.

86
(71)

91 CALUMET AV.

W. WILLIS AV.

W. ALEXANDRINE AV.

COMMONWEALTH AV.

TRUMBULL AV.

LINCOLN AV.

GIBSON AV.

W. ALEXANDRINE AV.

EDINBURGH SELDEN AV.

THE HARPER

THE RICHARDSON THE RICHARDSON NO 2. NO 1.

CONSERVATORY BRICK & GLASS ROOF

3907-3915 LINCOLN

Scale of Feet.

1921 SANBORN MAP

3689-3713 LINCOLN

3664-3708 TRUMBULL

1921-1950 SANBORN MAP

(3975) 4"W.P.
DETROIT, MICH., VOL. 2.
86
(71)
MICH..007

91 CALUMET AV.

W. WILLIS AV.

W. ALEXANDRINE AV.

COMMONWEALTH AV.

TRUMBULL AV.

LINCOLN AV.

GIBSON AV.

EDINBURGH

SELDEN AV.

W. ALEXANDRINE AV.

85

87

65

67

1 2 3 4 5 6 7 8 9

HOPE GOSPEL CHURCH

THE HARPER

THE RICHARDSON THE RICHARDSON No 2. No 1.

SETTLEMENT HOUSE

PRIVATE HOSPITAL

FACT'Y.

FILL'G STA.

3907-3915 LINCOLN

Scale of Feet.

1920-1950 SANBORN MAP

3689-3713 LINCOLN

3664-3708 TRUMBULL

POST-1950 SANBORN MAP

DETROIT, MICH., VOL. 2.

86

87

CALUMET AV.

W. WILLIS

W. ALEXANDRINE

TRUMBULL AV.

COMMONWEALTH AV.

LINCOLN AV.

GIBSON AV.

EDINBURGH

SELDEN

8" W. PIPE

30" W. PIPE

6" W. PIPE

CHURCH

MEMORIAL FAITH LUTH. CHURCH

PRIVATE HOSPITAL

PARK'G P.

PRIV. DRIVE

SCALE OF FEET

0 50 100

COPYRIGHT SANBORN MAP COMPANY, INC.

3907-3915 LINCOLN

1920-1950 SANBORN MAP


Trumbull
STAFF SITE VISIT 2/2/2021


STAFF SITE VISIT 2/2/2021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BUS STOP
29
STAFF SITE VISIT 2/2/2021


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STOP
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Brainard
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THIS IS A 3-PAGE FORM - ALL INFORMATION IS REQUIRED FOR PROJECT REVIEW

HISTORIC DISTRICT COMMISSION
PROJECT REVIEW REQUEST

City of Detroit - Planning & Development Department
2 Woodward Avenue, Suite 808
Detroit, Michigan 48226

Date: January 25, 2021

PROPERTY INFORMATION

ADDRESS: See attached legal description **AKA:** 3700 Trumbull

HISTORIC DISTRICT: Woodbridge Farm

SCOPE OF WORK: (Check ALL that apply)

- ☐ Windows/ Doors
- ☐ Roof/Gutters/ Chimney
- ☐ Porch/ Deck
- ☐ Landscape/Fence/ Tree/Park
- ☑ General Rehab
- ☑ New Construction
- ☐ Demolition
- ☐ Addition
- ☑ Other: New & General Rehab

APPLICANT IDENTIFICATION

- ☑ Property Owner/ Homeowner
- ☐ Contractor
- ☐ Tenant or Business Occupant
- ☑ Architect/Engineer/ Consultant

NAME: Jason Jones **COMPANY NAME:** 3701 Lincoln, LLC

ADDRESS: See attached legal description **CITY:** Detroit **STATE:** MI **ZIP:** 48202

PHONE: _____ **MOBILE:** 313-575-6835 **EMAIL:** jason@TektonDevCo.com

PROJECT REVIEW REQUEST CHECKLIST

Please attach the following documentation to your request:

PLEASE KEEP FILE SIZE OF ENTIRE SUBMISSION UNDER 30MB

- ☒ **Completed Building Permit Application** (highlighted portions only)
- ☐ **ePLANS Permit Number** (only applicable if you've already applied for permits through ePLANS)
- ☒ **Photographs** of ALL sides of existing building or site
- ☒ **Detailed photographs** of location of proposed work (photographs to show existing condition(s), design, color, & material)
- ☒ **Description of existing conditions** (including materials and design)
- ☒ **Description of project** (if replacing any existing material(s), include an explanation as to why replacement--rather than repair--of existing and/or construction of new is required)
- ☒ **Detailed scope of work** (formatted as bulleted list)
- ☒ **Brochure/cut sheets** for proposed replacement material(s) and/or product(s), as applicable

NOTE:
Based on the scope of work, additional documentation may be required.
See www.detroitmi.gov/hdc for scope-specific requirements.

Upon receipt of this documentation, staff will review and inform you of the next steps toward obtaining your building permit from the Buildings, Safety Engineering and Environmental Department (BSEED) to perform the work.

SUBMIT COMPLETED REQUESTS TO HDC@DETROITMI.GOV

First American	ISSUED BY **First American Title Insurance Company**
Schedule C	File No:897505

Commitment No.: 897505

Land in the City of Detroit, Wayne County, MI, described as follows:

PARCEL 1:
Lot 45 and the North 20 feet of Lot 46, of HODGES BROS SUBDIVISION OF OUTLOTS 98, 99, 102 & 103 WOODBRIDGE FARM, according to the plat thereof as recorded in Liber 1 of Plats, Page 308, Wayne County Records.

PARCEL 2:
South 30 feet of Lot 46, of HODGES BROS SUBDIVISION OF OUTLOTS 98, 99, 102 & 103 WOODBRIDGE FARM, according to the plat thereof as recorded in Liber 1 of Plats, Page 308, Wayne County Records.

PARCEL 3:
Lot 47, of HODGES BROS SUBDIVISION OF OUTLOTS 98, 99, 102 & 103 WOODBRIDGE FARM, according to the plat thereof as recorded in Liber 1 of Plats, Page 308, Wayne County Records.

PARCEL 4:
Lot 48, of HODGES BROS SUBDIVISION OF OUTLOTS 98, 99, 102 & 103 WOODBRIDGE FARM, according to the plat thereof as recorded in Liber 1 of Plats, Page 308, Wayne County Records.

PARCEL 5:
Lot 49, of HODGES BROS SUBDIVISION OF OUTLOTS 98, 99, 102 & 103 WOODBRIDGE FARM, according to the plat thereof as recorded in Liber 1 of Plats, Page 308, Wayne County Records.

PARCEL 6:
Lot 85, of HODGES BROS SUBDIVISION OF OUTLOTS 98, 99, 102 & 103 WOODBRIDGE FARM, according to the plat thereof as recorded in Liber 1 of Plats, Page 308, Wayne County Records.

PARCEL 7:
Lot 86, of HODGES BROS SUBDIVISION OF OUTLOTS 98, 99, 102 & 103 WOODBRIDGE FARM, according to the plat thereof as recorded in Liber 1 of Plats, Page 308, Wayne County Records.

PARCEL 8:
Lots 33 through 43, both inclusive, including the Northerly 8.00 feet of vacated Brainard Street adjacent thereto, of HODGES BROS SUBDIVISION OF OUTLOTS 98, 99, 102 & 103 WOODBRIDGE FARM, according to the plat thereof as recorded in Liber 1 of Plats, Page 308, Wayne County Records.

THE TOWNS @ SCRIPPS PARK

MULTI-BUILDING TOWNHOUSE DEVELOPMENT IN THE WOODBRIDGE FARMS HISTORIC DISTRICT

TEKTON DEVELOPMENT

CIVIC

RB ROBERTSON BROTHERS HOMES

4545 architecture

PROJECT NARRATIVE

The T
new-construction townhomes on the existing Scripps Mansion site in the Woodbridge Farms Historic District. The project site consists of parcels on the east side of Trumbull Avenue between Selden St. to the north, and Brainard St. to the south. Parcels on the west side of Lincoln directly north and south of Selden St. are also included.

Each townhome consists of internal parking and a bonus room on the , and bedrooms and . There are two unit types, one 20’ wide 1,624 sqft, two to three bedroom units(with two parking spaces), and one 16’ wide, 1,349 sqft two bedroom (with one parking space).

The overall design strategy is for the buildings to complement the historic district. Simple massing creates a rhythm along Trumbull and Lincoln that speaks to - rary detailing allows the buildings to visually recede and act as a back- elements of the district.

Quality exterior materials including brick, James Hardie composite siding, and WoodTone composite siding are durable and long lasting, and complement the brick and wood-sided homes throughout the district.

In addition to the new structures, new public open spaces are also created as part of the development. At the center of the development along Trumbull, a new community lawn is created in front of the Existing Scripps Mansion Power House. This area is directly across the street from one of the entrances to Scripps Park, and is seen as an extension of the park. The existing alley between Trumbull and Lincoln will be redeveloped with new paving to make it more accessible to vehicle and

The existing Power House will be renovated and developed into a detached residential condomiunium unit

Overall, The T
Historic District’s unused space in a way that allows the existing historic

Woodbridge Farms.

PROJECT SCOPE

DEMOLITION

- Demolish existing concrete barrier wall along north side of alley
- Demolish existing decorative stone wall at corner of Trumbull and Brainard
- Remove and salvage (2) existing decorative stone columns near corner of Trumbull and Brainard (to be relocated as part of development outdoor space)

SITEWORK

- Renovate and repave alley with new stamped concrete
- New paved drive aisles and parking areas
- New concrete pedestrian paths along front of buildings and entries
- Creation of new community lawn space in front of existing power house including two “outdoor rooms” consisting of crushed stone surfaces with brick paver edging.
- Planting areas with ornamental grasses and small shrubs at front porch areas of each unit.
- New trees as shown on site plan

NEW CONSTRUCTION

- Construct 15 new buildings consisting of two to seven 3-story
- townhome units.

RENOVATION WORK

- Renovate and convert existing 2-story brick Power House building int a detached residential condomiunium unit.

EXISTING SITE PLAN

KEY

A. 2-STORY BRICK POWERHOUSE

B. STONE WALL AND DECORATIVE COLUMNS

3907 - 3915 LINCOLN (2 LOTS)

PARCEL 6 — 3915 LINCOLN — ITEM 005777/WARD 06

PARCEL 7 — 3907 LINCOLN — ITEM 005778/WARD 06

3921 LINCOLN — 2660 — ITEM 005776/WARD 06

OWNER: 2657 ROBERT L. EVANS

2659 — 2658 — 2661 — 2656 — 2655 — 2654 — 2653 — 2652 — 2651 — 2650

BRUSH/ WOODED AREA

TREE LINE

S22°47'00"E 100.00' (R&M)

S67°13'00"W 124.00' (R&M)

N67°13'00"E 124.00' (R&M)

3689 - 3713 LINCOLN (5 LOTS)

PARCEL 1 — 3713 LINCOLN — ITEM 005779/WARD 06

PARCEL 2 — 3707 LINCOLN — ITEM 005780/WARD 06

PARCEL 3 — 3701 LINCOLN — ITEM 005781/WARD 06

PARCEL 4 — 3697 LINCOLN — ITEM 005782/WARD 06

PARCEL 5 — 3689 LINCOLN — ITEM 005783/WARD 06

3691 LINCOLN — ITEM 005784-001/WARD 06

OWNER: ANTONIN & JAN PAVLICEK

2525 — 2526 — 2527

TREE LINE

BRUSH/ WOODED AREA

S22°47'00"E 244.40' (R&M)

S67°13'00"W 124.00' (R&M)

N22°47'00"W 244.40' (R&M)

26.32'

EX. HOUSE — 3669 LINCOLN — ITEM 005785/WARD 06

3677 LINCOLN — ITEM 005786-002/WARD 06

3651 LINCOLN — ITEM 005786/WARD 06

3643 LINCOLN — ITEM 005787/WARD 06

3627 LINCOLN — ITEM 005788/WARD 06

3617 LINCOLN — ITEM 005789/WARD 06

3605 LINCOLN — ITEM 005790/WARD 06

3507 LINCOLN — ITEM 005791/WARD 06

LOT 83 — LOT 84 — LOT 85 — LOT 86 — LOT 45 — N. 20' OF LOT 46 — S. 30' OF LOT 46 — LOT 47 — LOT 48 — LOT 49 — S. 25' OF LOT 50 — LOT 51 — LOT 52 — LOT 53 — LOT 54 — LOT 55 — LOT 56

HODGES BROS. SUBDIVISION (L.1, P.308)

Selden St. (60' R.O.W.)

Lincoln St. (70' R.O.W.)

Brainard St. (44' R.O.W.)

8' VACATED BRAINARD ST.

18' VACATED PUBLIC ALLEY

18' PUBLIC ALLEY

PUBLICLY DEDICATED

BENCHMARK — ARROW ON HYDRANT — ELEVATION 135.84 — DETROIT DATUM

BENCHMARK — ARROW ON HYDRANT — ELEVATION 132.97 — DETROIT DATUM

BENCHMARK — ARROW ON HYDRANT — ELEVATION 134.84 — DETROIT DATUM

BENCHMARK — ARROW ON HYDRANT — ELEVATION 132.16 — DETROIT DATUM

CAUTION!! 2" GAS MAIN

CAUTION!! 4" GAS MAIN

CAUTION!! 6" GAS MAIN

CAUTION!! 6" GAS MAIN

3664 - 3708 TRUMBULL (11 LOTS)

PARCEL 8 — 3664 TRUMBULL — ITEM 005913-5/WARD 06

3708 TRUMBULL — ITEM 005918/WARD 06

3700 TRUMBULL — ITEM 005917/WARD 06

3690 TRUMBULL — ITEM 005916/WARD 06

3704 TRUMBULL — ITEM 005919/WARD 06 — ONE-STORY BLOCK BLDG. "TRUMBULL MARKET" — BLDG. COR. 0.40' N. OF P/L

3904 TRUMBULL — ITEM 005920/WARD 06

3914 TRUMBULL — ITEM 005921/WARD 06

3920 TRUMBULL — ITEM 005922/WARD 06

3556 TRUMBULL — ITEM 005902-12/WARD 06

LOT 90 — N. 20' OF LOT 89 — S. 30' OF LOT 89 — LOT 88 — LOT 87 — LOT 44 — LOT 43 — LOT 42 — LOT 41 — LOT 40 — LOT 39 — LOT 38 — LOT 37 — LOT 36 — LOT 35 — LOT 34 — LOT 33

HODGES BROS. SUBDIVISION (L.1, P.308)

Trumbull St. (80' R.O.W.)

N22°47'00"W 558.00' (R&M)

S22°47'00"E 558.00' (R&M)

S67°13'00"W 124.00' (R&M)

N67°13'00"E 124.00' (R&M)

A. — 20.82' BLDG. COR. — 20.49' — 2.40' — 2.44' — 43' HIGH

TWO-STORY BRICK BLDG. 22.4' HIGH 652 SQ. FT.

8' HIGH BRICK WALL

2' HIGH BRICK RET. WALL

2'x6'x2' HI. CONC. BLOCKS

6' CHAIN LINK FENCE

6' WOOD FENCE

BRICK WALL

5' HIGH CHAIN LINK FENCE

6' HIGH CHAIN LINK FENCE

2' HIGH CONC. RET. WALL

CONC. COLUMN

6' TO 7'

15' BUILDING SETBACK (L.357, P.282)

15' BUILDING SETBACK (L.308, P.78)

3" DIA. x 3' HIGH REFLECTOR POST (TYP)

5" DIA. VERTICAL PVC PIPE

SCRIPPS PARK

18' VACATED PUBLIC ALLEY EASEMENT RETAINED (L.35232, P.714)

OWNERSHIP OF THE EASTERLY 1/2 VACATED PUBLIC ALLEY ADJACENT TO LOT 85 & 86 TO BE ADDRESSED BY THE TITLE COMPANY AND/OR CLIENT

OWNER: SHAFO PROPERTIES LLC

R.O.W. LINE — CONC. — ASPHALT — 15" SEWER — 8" WATER — 2" GAS (PLX) — CB — MH — GV — HH — 6" GAS (G) — 3" GAS (PLA) — 4" GAS (PLA) — 4'-0" CYL. SEWER — 3'-6"x4'-8" SEWER — 6" WATER — AT&T CONDUIT — 2'-9"x4'-0" RELIEF SEWER — 48" W.M. — UG. PL. — OH. ELEC. — BRUSH LINE — WOOD FENCE — CHAIN LINK FENCE — BRICK — STEP

TEKTON DEVELOPMENT — CIVIC — ROBERTSON BROTHERS HOMES — 4545 architecture

EXISTING SITE PHOTOS

3689 - 3713 LINCOLN (LOOKING WEST)

3907 - 3915 LINCOLN (LOOKING WEST)

3664 - 3708 TRUMBULL (LOOKING EAST)

TRUMBULL LIQUOR (CORNER OF SELDEN AND TRUMBULL)

EXISTING POWERHOUSE

EXISTING STONE WALL AND DECORATIVE COLUMNS

TEKTON DEVELOPMENT

CIVIC

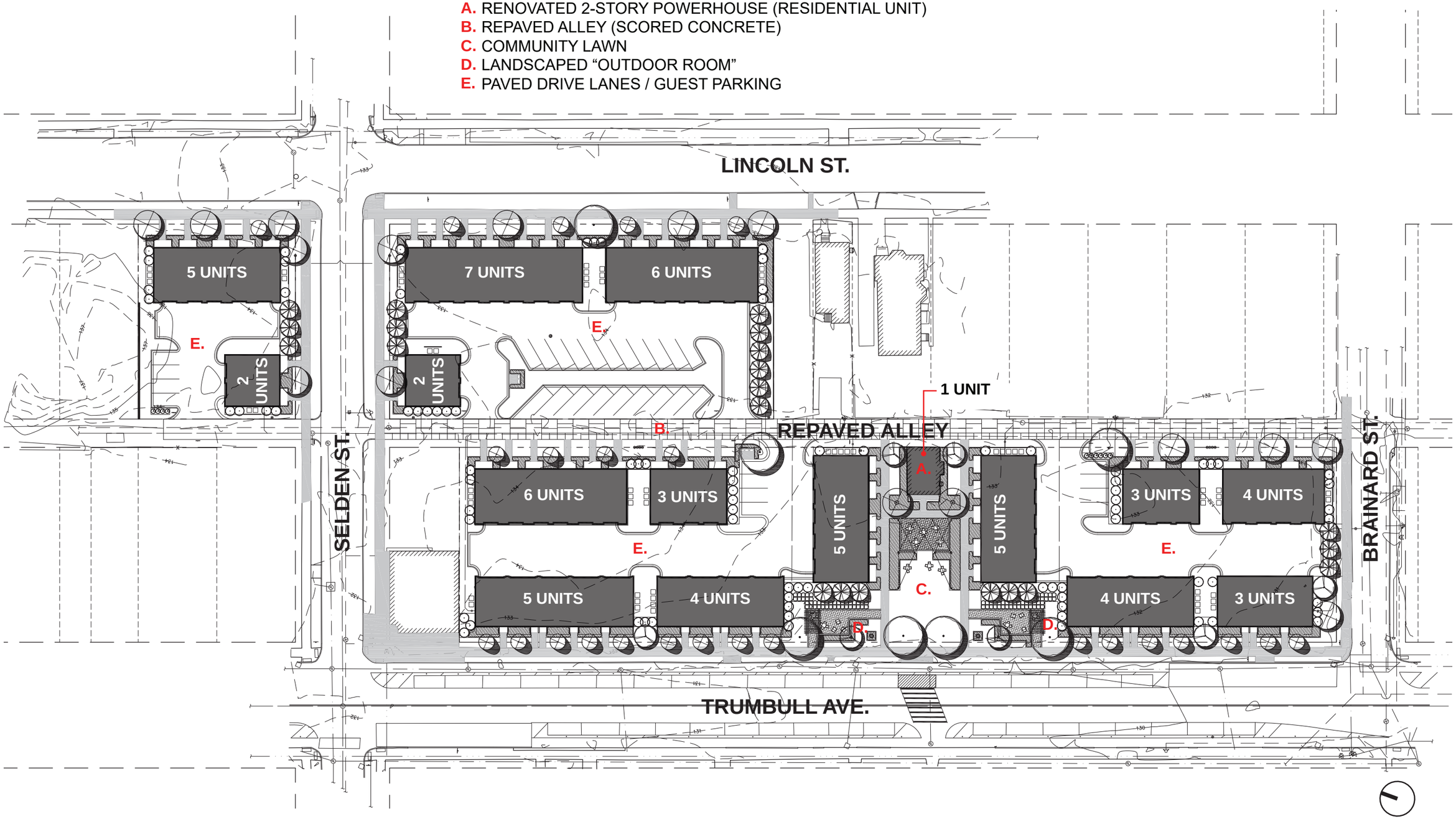
RB ROBERTSON BROTHERS HOMES

4545 architecture

PROPOSED SITE PLAN

KEY

A. RENOVATED 2-STORY POWERHOUSE (RESIDENTIAL UNIT)
B. REPAVED ALLEY (SCORED CONCRETE)
C. COMMUNITY LAWN
D. LANDSCAPED “OUTDOOR ROOM”
E. PAVED DRIVE LANES / GUEST PARKING



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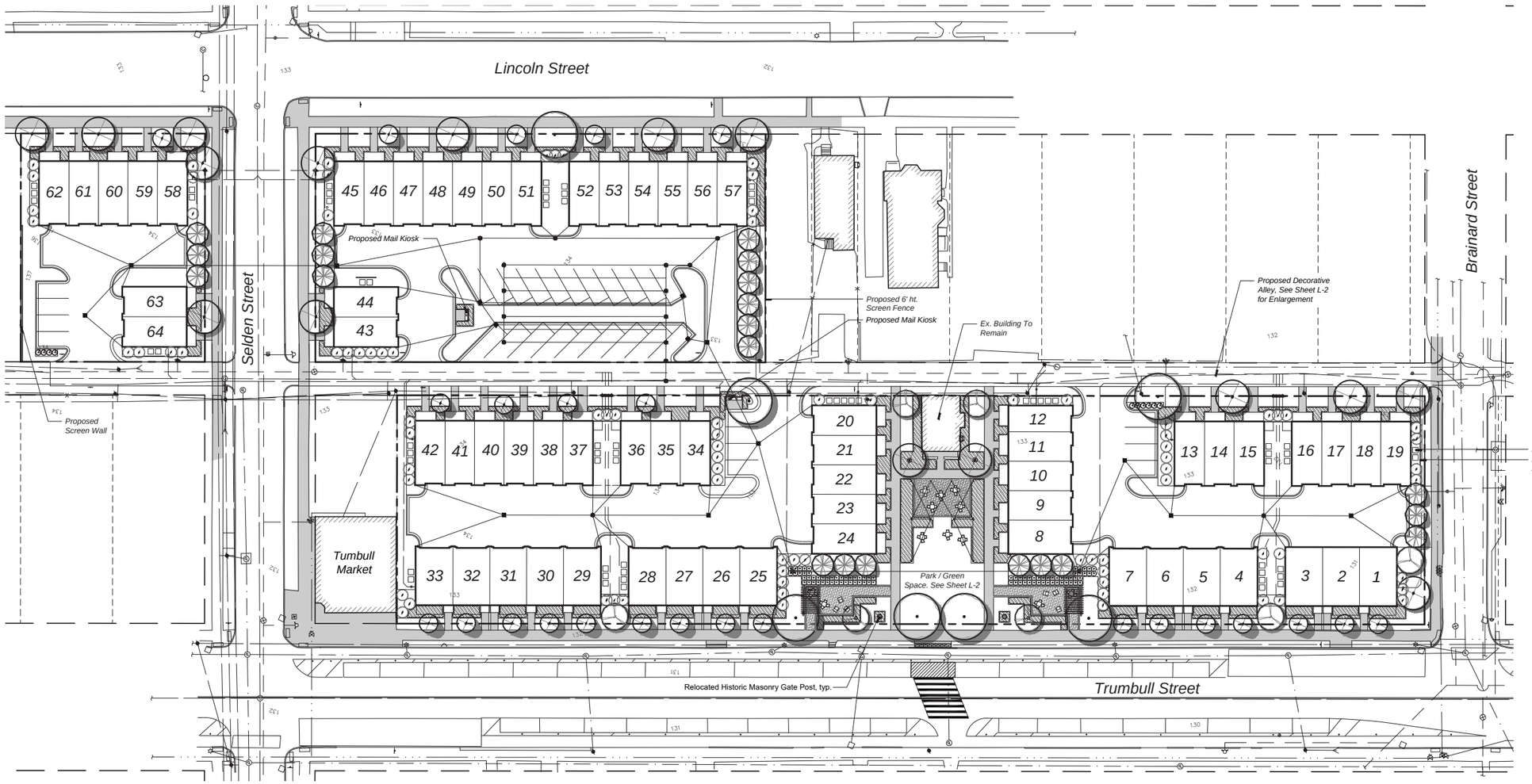
LANDSCAPE PLAN



Landscape Summary

Trumbull Street
- Required: 1 Tree / 30 LF frontage
- Length of Frontage: 558 LF
- Required: 19 Trees
- Provided: 20 Trees

Brainard Street
- Required: 1 Tree / 30 LF frontage
- Length of Frontage: 124 LF
- Required: 5 Trees
- Provided: 5 Trees

Lincoln Street South
- Required: 1 Tree / 30 LF frontage
- Length of Frontage: 224.40 LF
- Required: 8 Trees
- Provided: 8 Trees

Lincoln Street North
- Required: 1 Tree / 30 LF frontage
- Length of Frontage: 100 LF
- Required: 4 Trees
- Provided: 4 Trees

Selden Street South
- Required: 1 Tree / 30 LF frontage
- Length of Frontage: 124 LF
- Required: 5 Trees
- Provided: 5 Trees

Selden Street North
- Required: 1 Tree / 30 LF frontage
- Length of Frontage: 124 LF
- Required: 5 Trees
- Provided: 5 Trees

Landscape Legend

= Proposed Shade Tree

= Proposed Columnar Tree

= Proposed Evergreen Tree

= Proposed Ornamental Tree

= Proposed Large Deciduous Shrub

= Proposed Ornamental Grass

= Proposed Perennial Planting Bed

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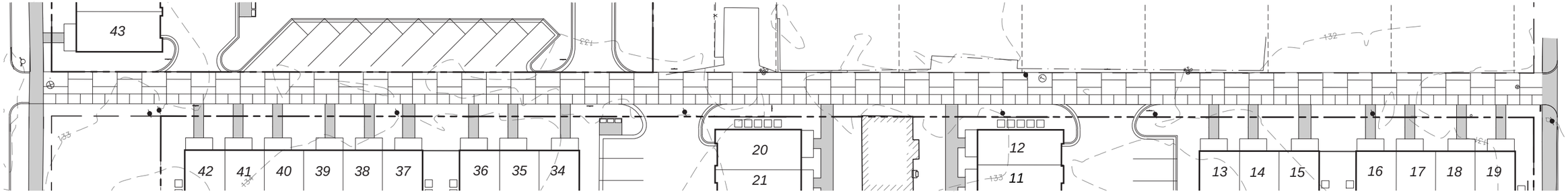
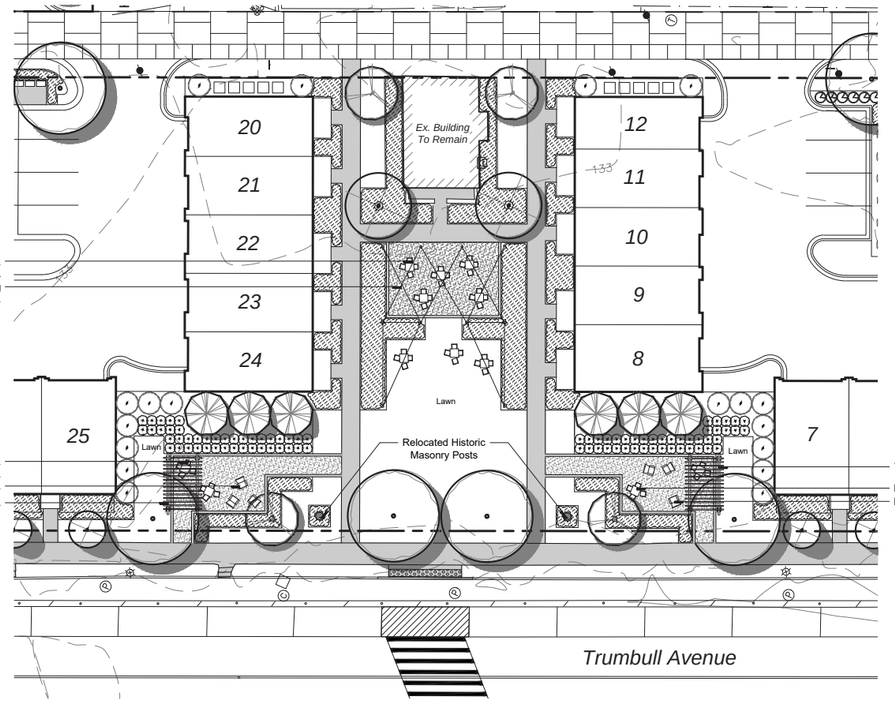
LANDSCAPE PLAN



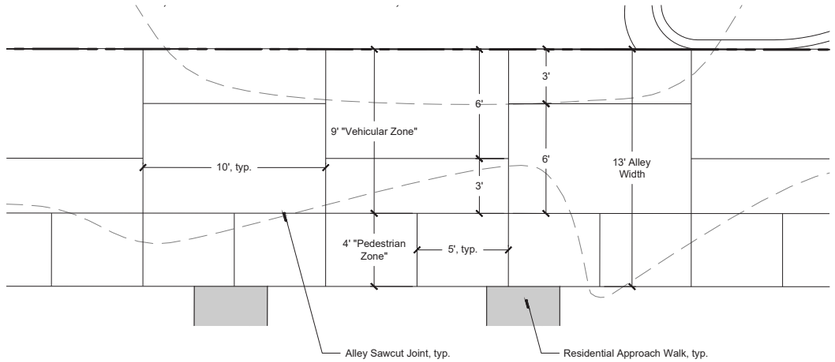
Decorative Alleyway Overall Enlargement Plan

Scale: 1" = 20'



Concept Amenity Enlargement Plan

Scale: 1" = 20'



Decorative Alleyway Typical Jointing Detail

Scale: $\frac{1}{4}$" = 1'

Walk Material Legend

= Broom Finished Concrete Walk

= Compacted Gravel / Fines Walk with 6"x6" Concrete Edging

Landscape Legend

= Proposed Shade Tree

= Proposed Columnar Tree

= Proposed Evergreen Tree

= Proposed Ornamental Tree

= Proposed Large Deciduous Shrub

= Proposed Ornamental Grass

= Proposed Perennial Planting Bed

TEKTON DEVELOPMENT

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LANDSCAPE PLAN

Hardscape Precedent Imagery

Decorative Trellis Structure
(Potentially matching Scripps Park, or similar)

4' ht. Screen Fence - Color to match Architcture
(For use between select buildings and as AC Unit screens)

4' ht. Screen Fence - Alternate Natural Finish
(For use between select buildings and as AC Unit screens)

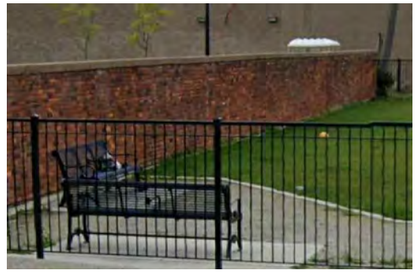
Mail Cluster Box Unit

Overhead String Lights on Posts

Movable Chairs
(Adirondack or Similar)

Movable Bistro Table & Chairs

Movable Bistro Table & Chairs



6' ht. Screen Wall - Brick to match Architecture

Note: The hardscape elements displayed here are to be considered conceptual and are subject to change as details are developed.

Plant Material Precedent Imagery

Tulip Tree
(Shade Tree)

Exclamation London Planetree
(Shade Tree)

Armstrong Red Maple
(Columnar Tree)

Slender Silhouette Sweetgum
(Columnar Tree)

White Fir
(Evergreen Tree)

Note: The plant material displayed here is to be considered conceptual and are subject to change as detailed planting plans are developed

Autumn Brilliance Serviceberry
(Ornamental Tree)

Kousa Dogwood Tree
(Ornamental Tree)

Diabolo Ninebark
(Large Shrub)

Arctic Fire Red Twig Dogwood
(Medium Shrub)

Dense Yew
(Evergreen Shrub)

Karl Foerster Feather Reed Grass
(Ornamental Grass)

Shenandoah Switchgrass
(Ornamental Grass)

Purple Palace Coralbells
(Perennial - Shade Application)

Big Blue Liriope
(Perennial)

Dark Towers Penstemon
(Perennial)

Little Business Daylily
(Perennial)

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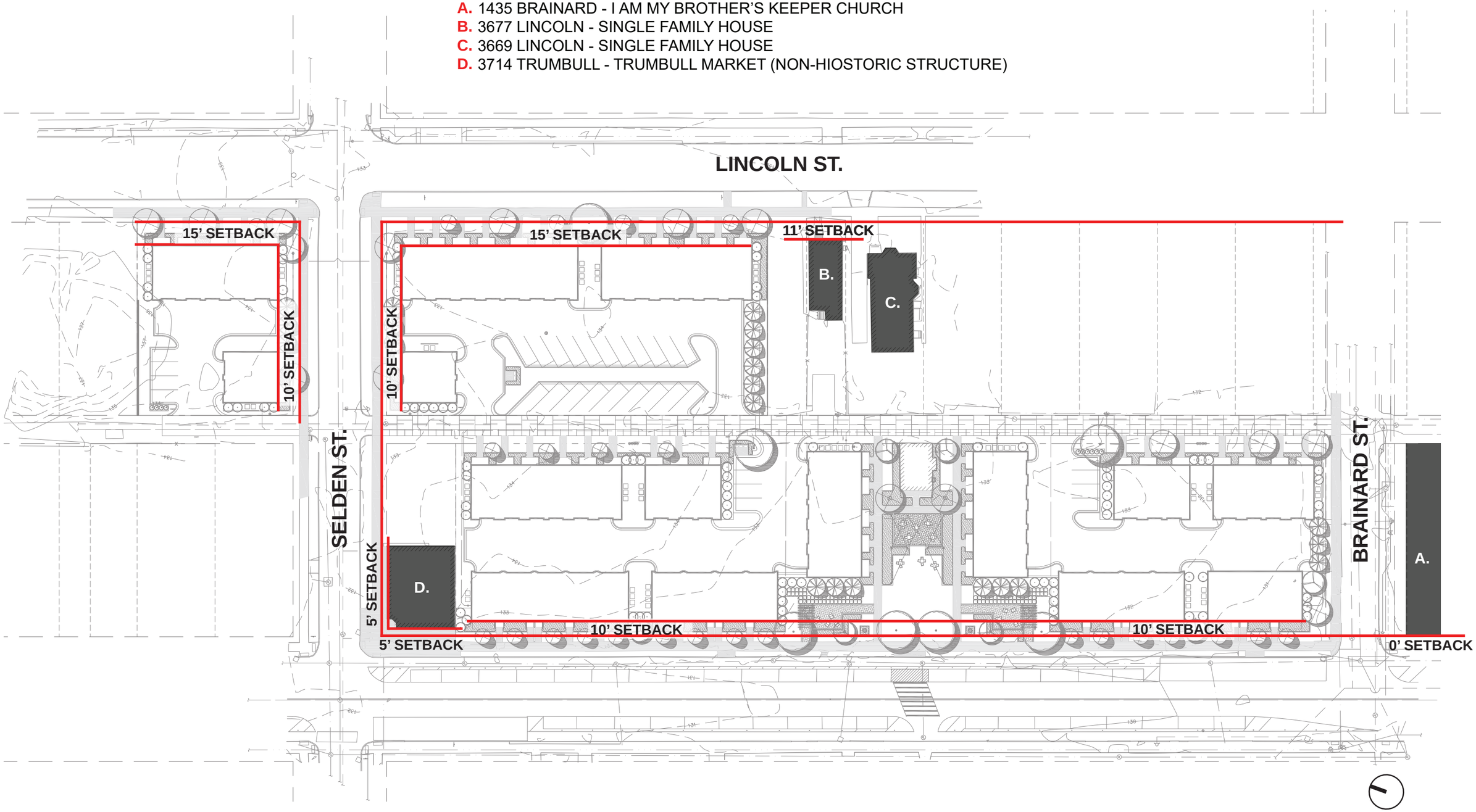
ADJACENT HISTORIC STRUCTURES / SETBACKS

KEY

A. 1435 BRAINARD - I AM MY BROTHER'S KEEPER CHURCH
B. 3677 LINCOLN - SINGLE FAMILY HOUSE
C. 3669 LINCOLN - SINGLE FAMILY HOUSE
D. 3714 TRUMBULL - TRUMBULL MARKET (NON-HIOSTORIC STRUCTURE)



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HVAC UNIT LOCATIONS

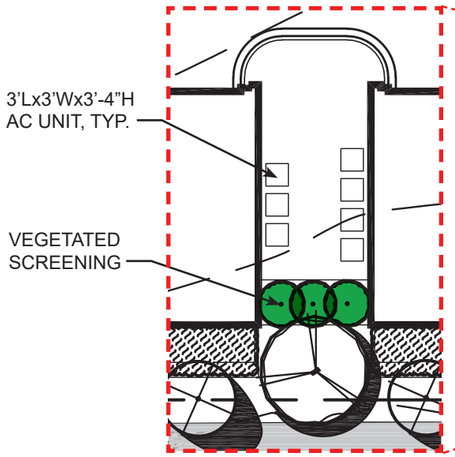
KEY
HVAC UNIT LOCATIONS

LINCOLN ST.

SELDEN ST.

BRAINARD ST.

TRUMBULL AVE.



TYP. AC UNIT LOCATION

TEKTON DEVELOPMENT
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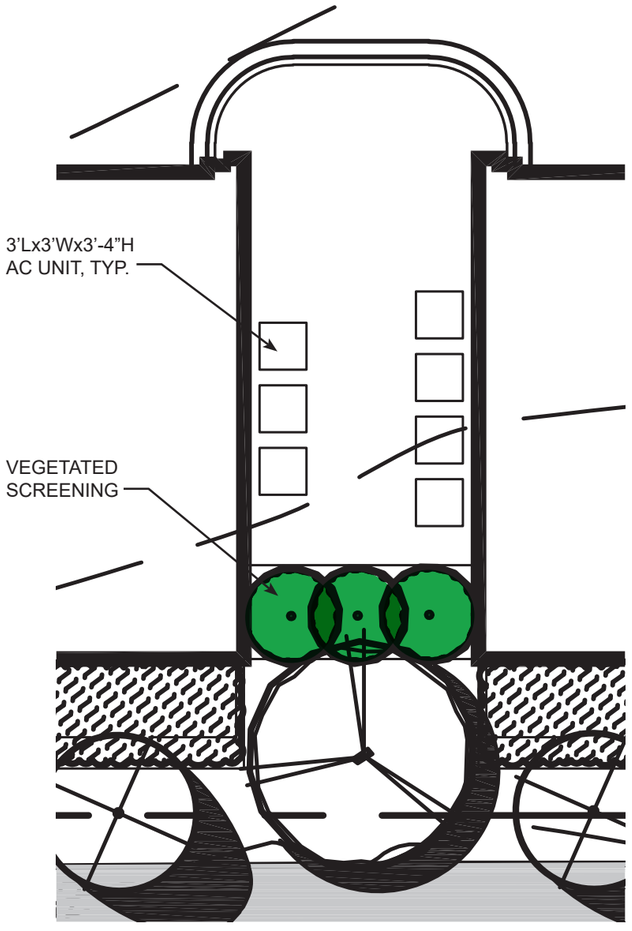
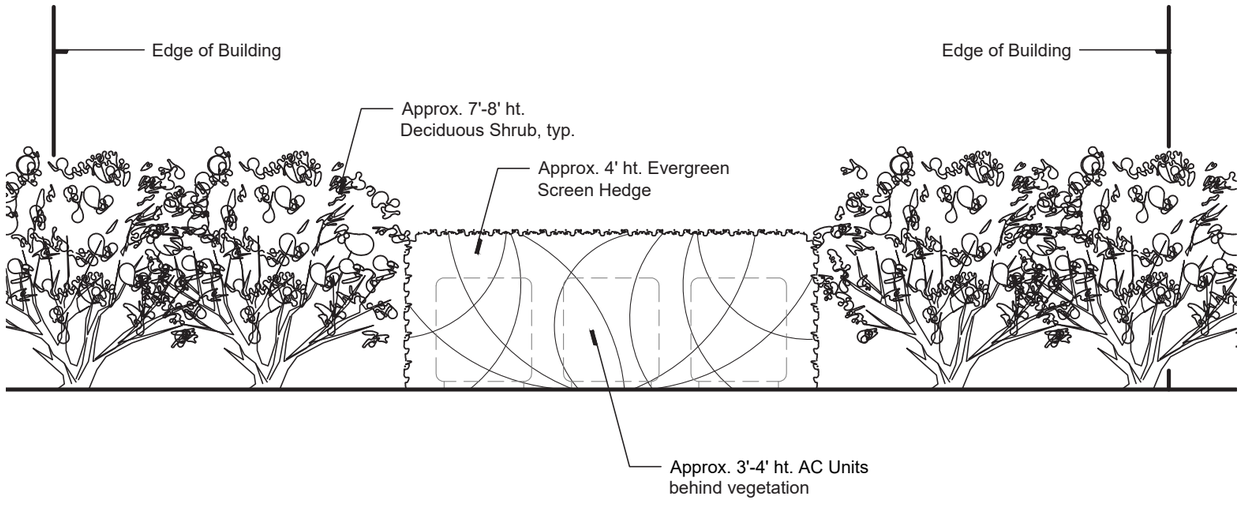
HVAC UNIT SCREENING



TYP. AC UNIT LANSCAPE SCREEN PLAN
NOT TO SCALE



TYP. AC UNIT LANSCAPE SCREEN ELEVATION
NOT TO SCALE

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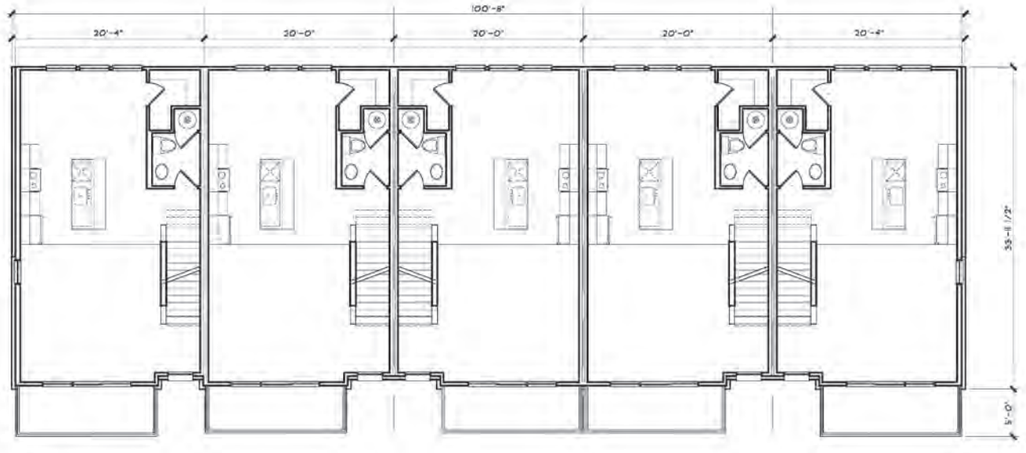
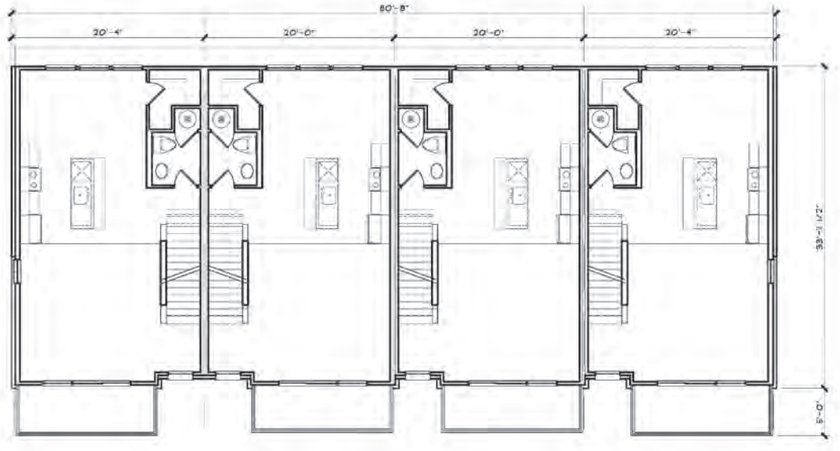
TYPICAL BUILDING FLOOR PLANS

20’ WIDE UNITS



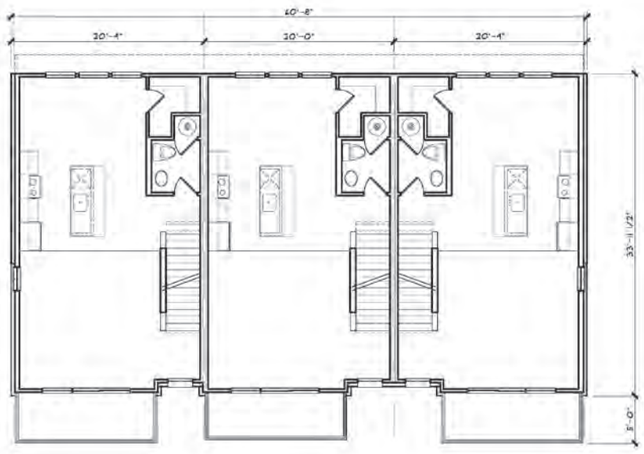
FIRST FLOOR PLAN
5 UNIT BUILDING

SCALE: 1/8" = 1'-0"



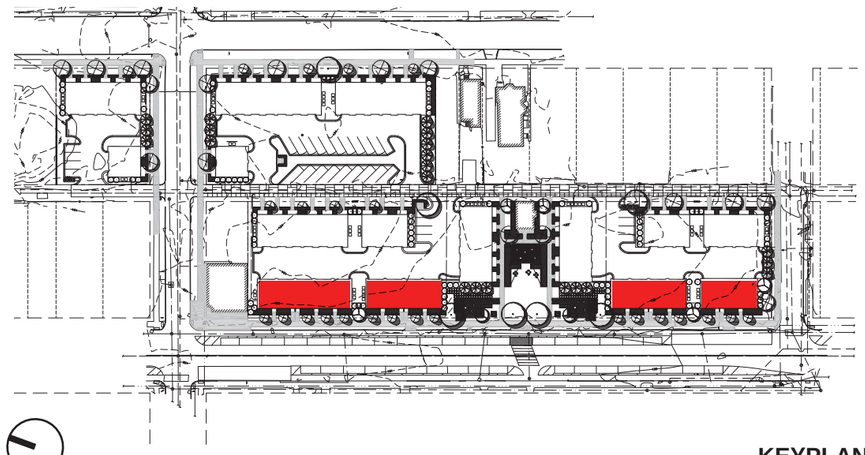
FIRST FLOOR PLAN
4 UNIT BUILDING

SCALE: 1/8" = 1'-0"



FIRST FLOOR PLAN
3 UNIT BUILDING

SCALE: 1/8" = 1'-0"



KEYPLAN

TEKTON DEVELOPMENT

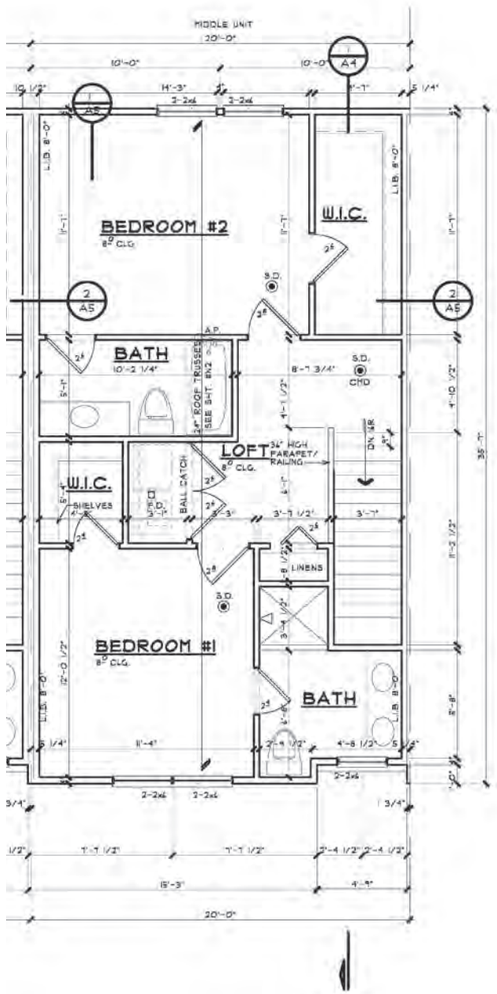
CIVIC

RB ROBERTSON BROTHERS HOMES

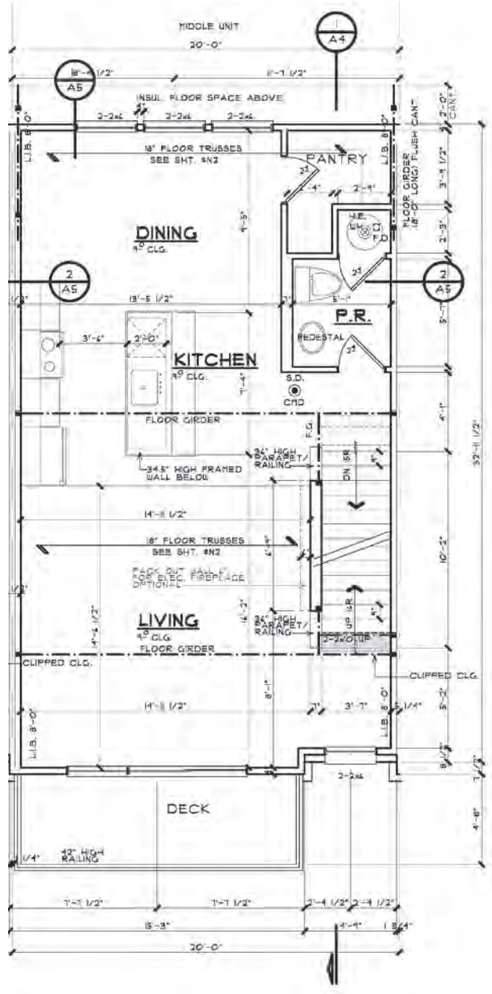
4545 architecture

TYPICAL UNIT FLOOR PLANS

20’ WIDE UNIT

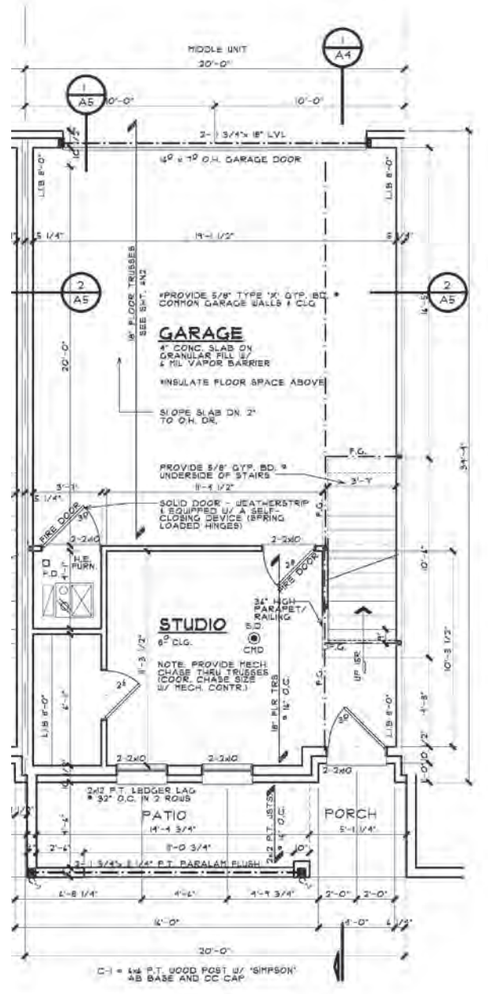


SECOND FLOOR PLAN



FIRST FLOOR PLAN

STANDARD INTERIOR LAYOUT



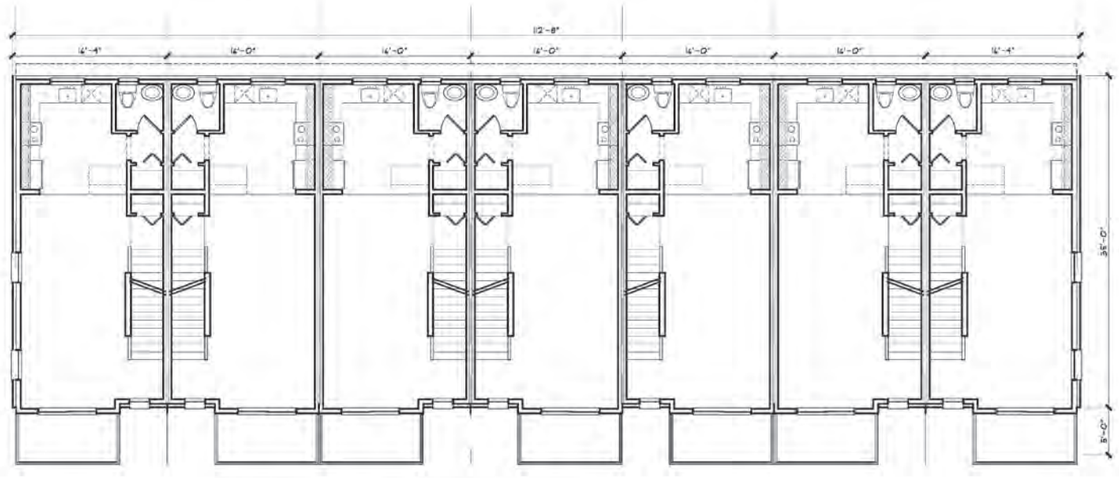
GROUND FLOOR PLAN

STANDARD INTERIOR LAYOUT

TEKTON DEVELOPMENT · CIVIC · ROBERTSON BROTHERS HOMES · 4545 architecture

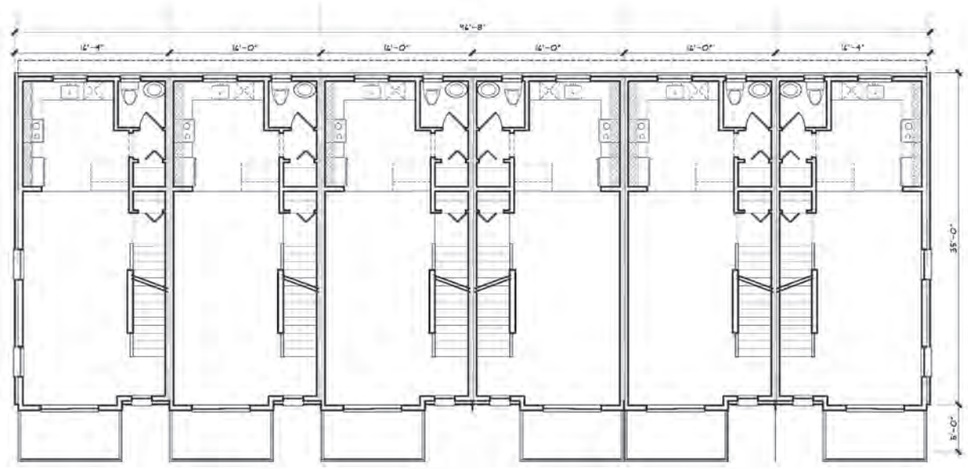
TYPICAL BUILDING FLOOR PLANS

16’ WIDE UNITS



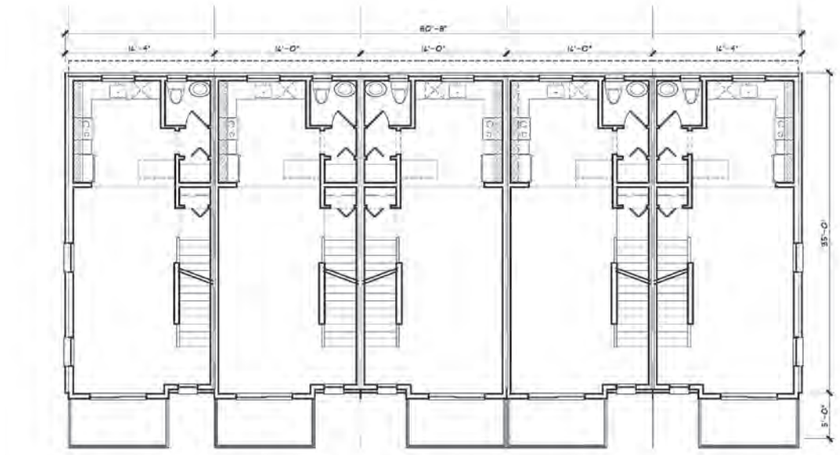
FIRST FLOOR PLAN
7 UNIT BUILDING

SCALE: 1/8" = 1'-0"



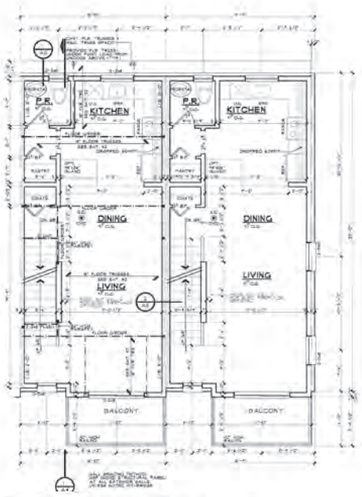
FIRST FLOOR PLAN
6 UNIT BUILDING

SCALE: 1/8" = 1'-0"

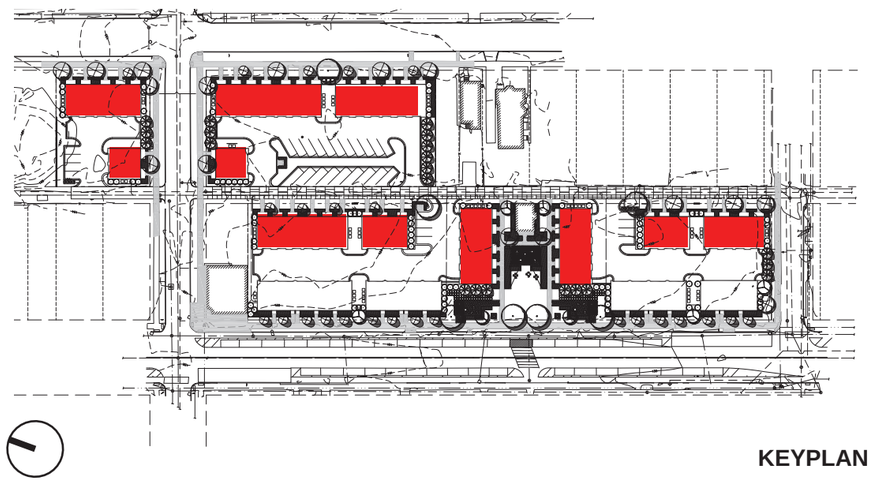


FIRST FLOOR PLAN
5 UNIT BUILDING

SCALE: 1/8" = 1'-0"



FIRST FLOOR PLAN
STANDARD INTERIOR LAYOUT

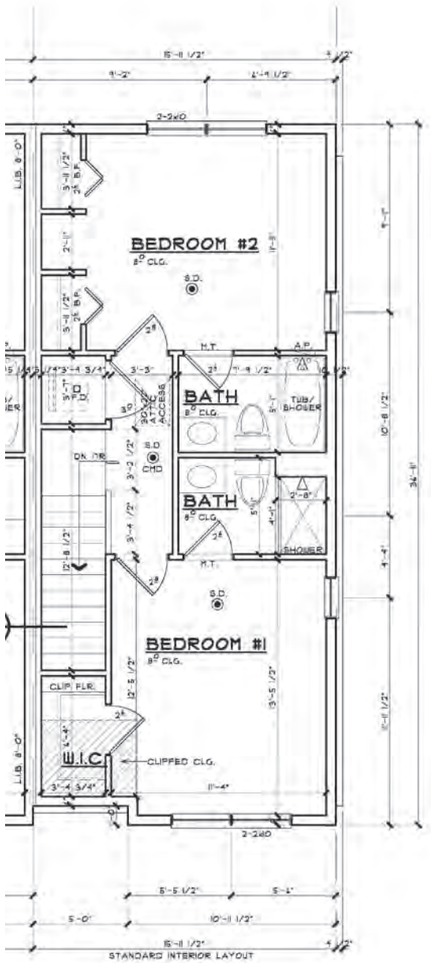


KEYPLAN

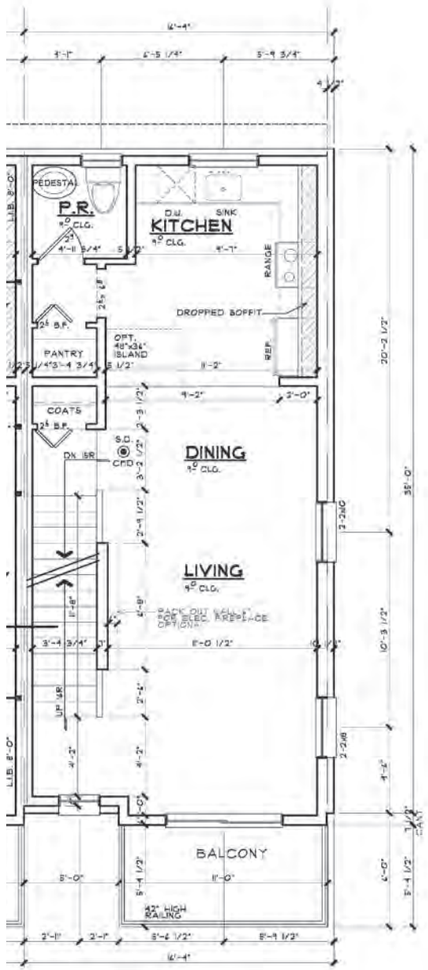
TEKTON DEVELOPMENT · CIVIC · RB ROBERTSON BROTHERS HOMES · 4545 architecture

TYPICAL UNIT FLOOR PLANS

16’ WIDE UNIT

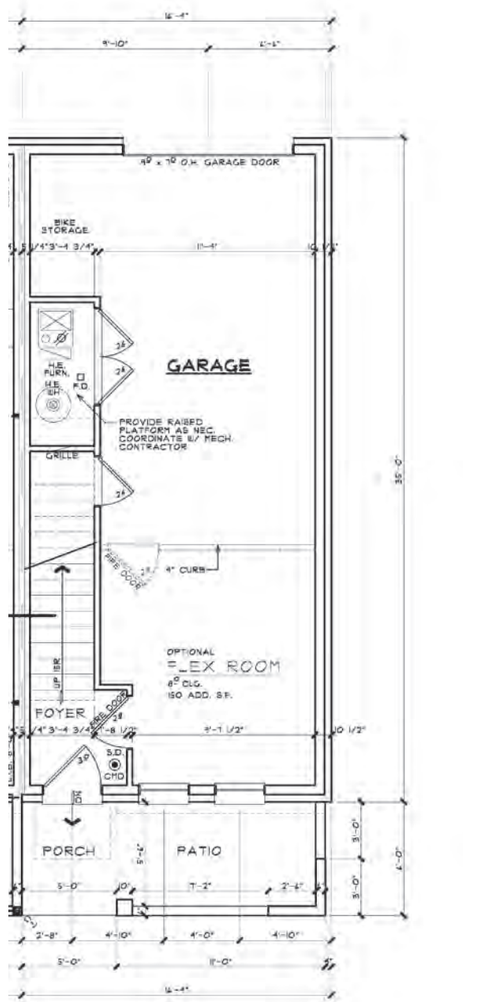


SECOND FLOOR PLAN



FIRST FLOOR PLAN

STANDARD INTERIOR LAYOUT



GROUND FLOOR PLAN

STANDARD INTERIOR LAYOUT

TEKTON DEVELOPMENT · CIVIC · ROBERTSON BROTHERS HOMES · 4545 architecture

EXTERIOR ELEVATIONS

20’ WIDE UNIT

FRONT ELEVATION
(20’ WIDE UNIT - 5 UNIT BUILDING)

FRONT ELEVATION
(20’ WIDE UNIT - 4 UNIT BUILDING)

FRONT ELEVATION
(20’ WIDE UNIT - 3 UNIT BUILDING)

TEKTON DEVELOPMENT
CIVIC
RB ROBERTSON BROTHERS HOMES
4545 architecture

EXTERIOR ELEVATIONS

20’ WIDE UNIT

TYP. SIDE ELEVATION
(20’ WIDE UNIT)

TYP. REAR ELEVATION
(20’ WIDE UNIT - 4 UNIT BUILDING SHOWN)

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20’ WIDE UNITS ON TRUMBULL AVE.

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EXTERIOR ELEVATIONS

16’ WIDE UNIT

FRONT ELEVATION
(16’ WIDE UNIT - 7 UNIT BUILDING)

FRONT ELEVATION
(16’ WIDE UNIT - 4 UNIT BUILDING)

FRONT ELEVATION
(16’ WIDE UNIT - 6 UNIT BUILDING)

FRONT ELEVATION
(16’ WIDE UNIT - 5 UNIT BUILDING)

TEKTON DEVELOPMENT
CIVIC
RB ROBERTSON BROTHERS HOMES
4545 architecture

EXTERIOR ELEVATIONS

16’ WIDE UNIT

TYP. SIDE ELEVATION
(16’ WIDE UNIT)

TYP. REAR ELEVATION
(16’ WIDE UNIT - 4 UNIT BUILDING SHOWN)

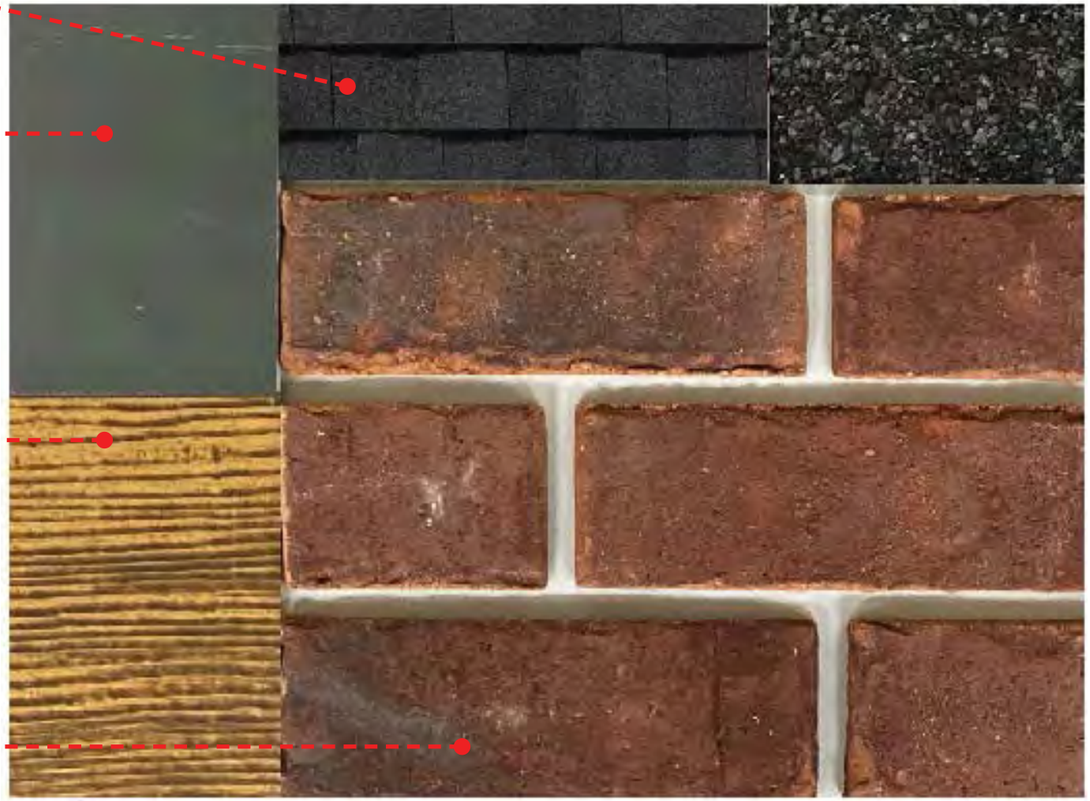
TEKTON DEVELOPMENT · CIVIC · ROBERTSON BROTHERS HOMES · 4545 architecture

16’ WIDE UNITS ON LINCOLN ST.

TEKTON DEVELOPMENT | CIVIC | ROBERTSON BROTHERS HOMES | 4545 architecture

EXTERIOR FINISHES

“RED” SCHEME

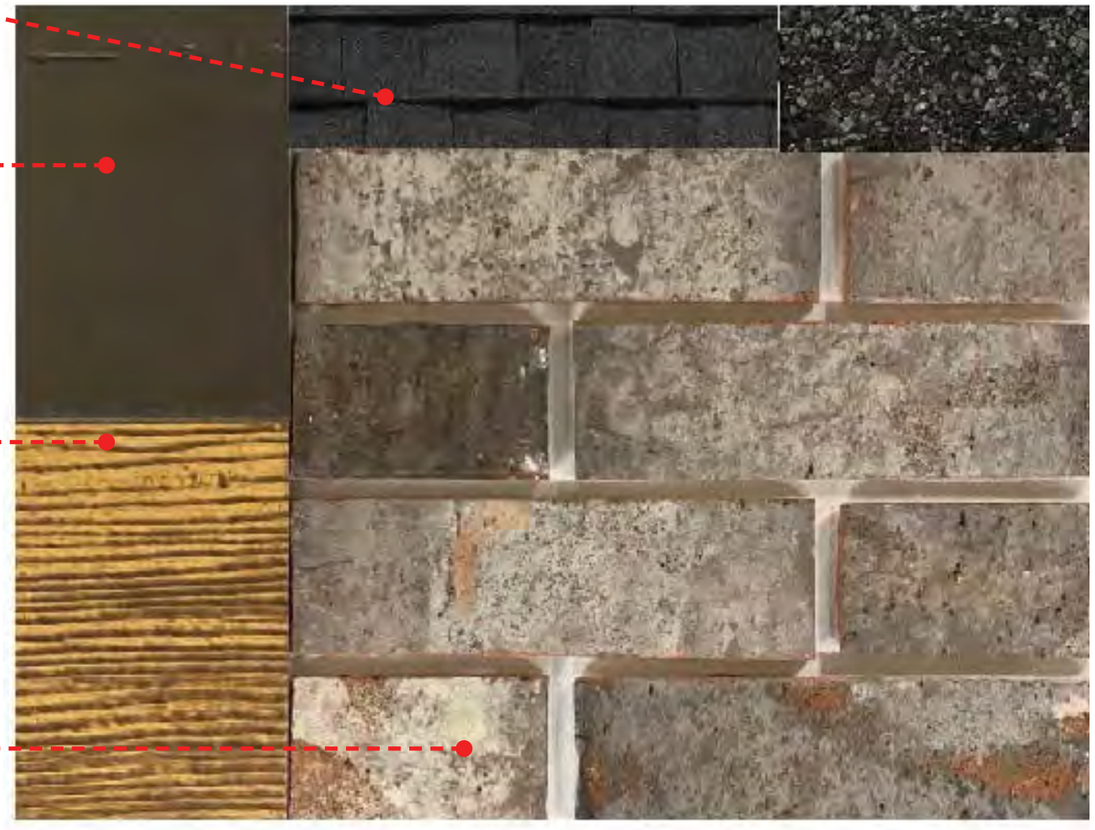


BRICK: MERIDIAN - GRAND RIVER QUEEN
PAINTED SIDING: JAMES HARDIE LAP SIDING, IRON GRAY, SMOOTH
WOOD SIDING: WOODTONE STAINED - SUMMER WHEAT
ROOF SHINGLES: CERTAINTEED - MOIRE BLACK

TEKTON DEVELOPMENT
CIVIC
ROBERTSON BROTHERS HOMES
4545 architecture

EXTERIOR FINISHES

“GRAY” SCHEME



BRICK: BRICK CRAFT - CORAL BLEND QUEEN
PAINTED SIDING: JAMES HARDIE LAP SIDING, RICH ESPRESSO, SMOOTH
WOOD SIDING: WOODTONE STAINED - SUMMER WHEAT
ROOF SHINGLES: CERTAINTEED - MOIRE BLACK

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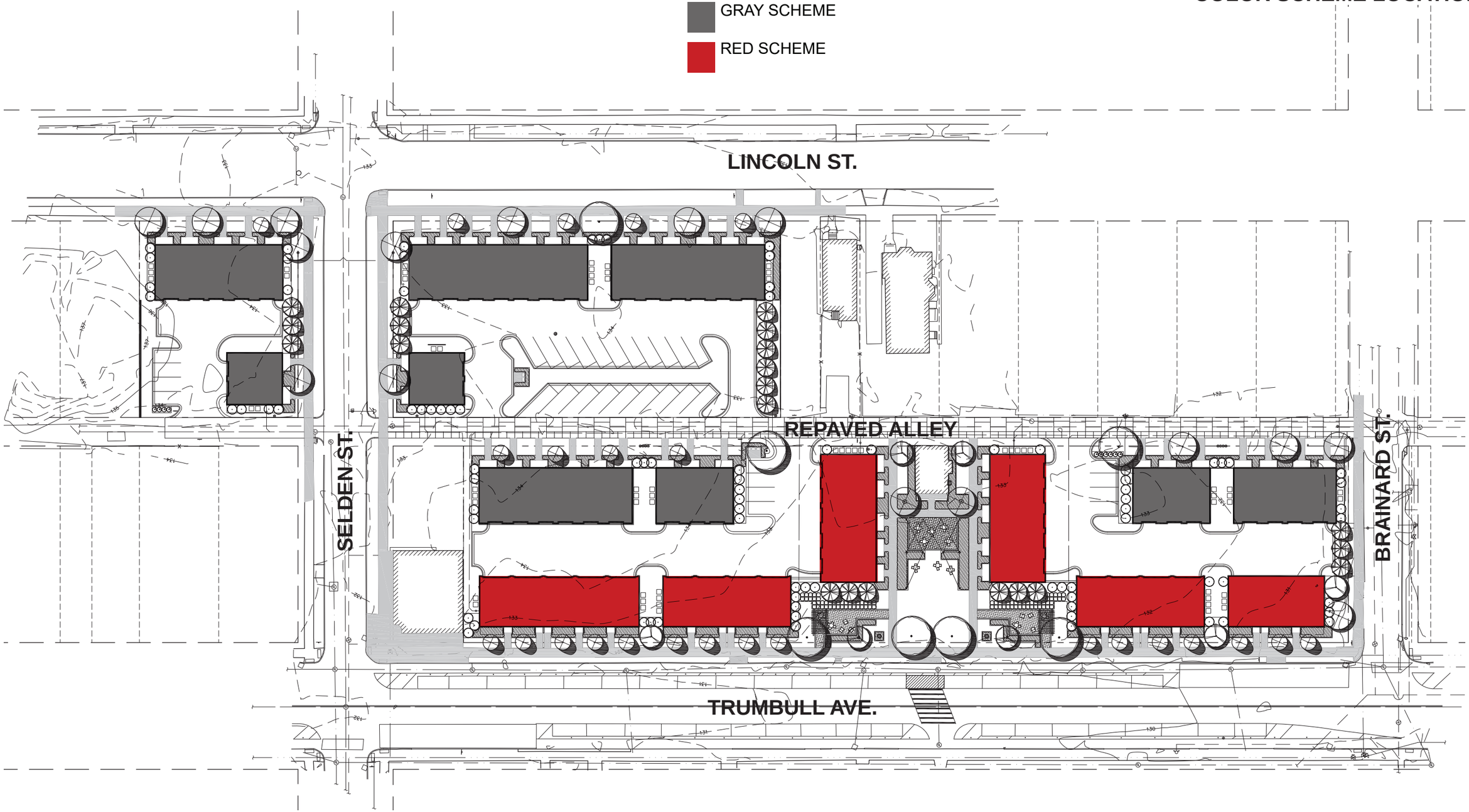
EXTERIOR FINISHES

COLOR SCHEME LOCATIONS

KEY

GRAY SCHEME

RED SCHEME



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DESIGN CONTEXT OBSERVATIONS

VARIATION IN BUILDING WIDTH / RHYTHM IN STREET WALL

THERE IS A MIX OF BUILDING TYPES THROUGHOUT THE DISTRICT, FROM SINGLE-FAMILY HOMES TO DUPLEXES AND MULTI-FAMILY BUILDINGS. THIS CREATES VARIATION IN BUILDING WIDTH, WITH NARROW HOUSES SITUATED NEXT TO WIDER MULTI-UNIT BUILDINGS

16’ WIDE UNIT
(PARTIAL ELEVATION ALONG LINCOLN ST.)

20’ WIDE UNIT
(PARTIAL ELEVATION ALONG TRUMBULL AVE.)

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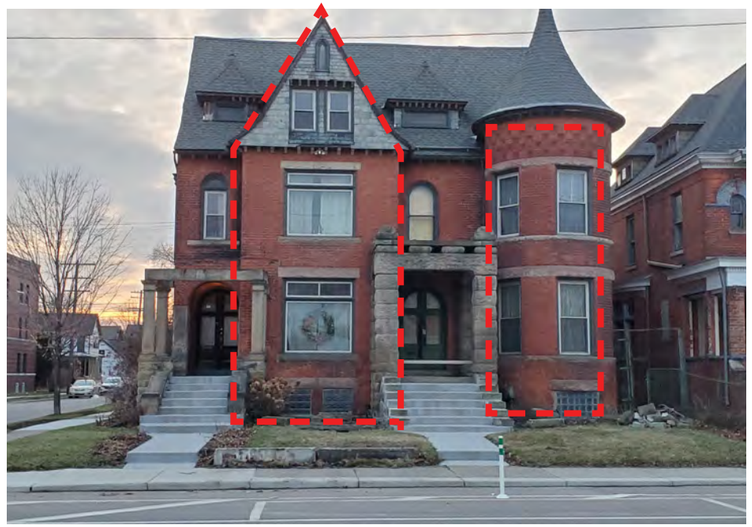
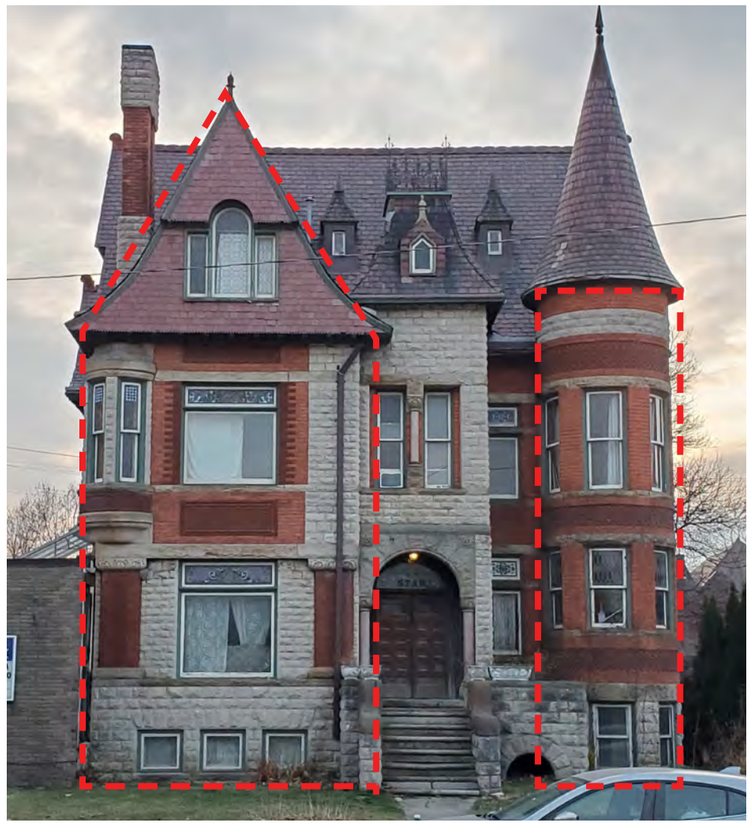
DESIGN CONTEXT OBSERVATIONS

ARCHITECTURAL PROJECTIONS / CHANGE IN FACADE PLANE

MANY OF THE LARGER HOMES IN THE DISTRICT FEATURE FACADES ELEMENTS THAT PROJECT FORWARD, BREAKING DOWN THE SCALE OF THE BUILDING AND MAINTAINING A VERTICAL EXPRESSION.





20’ WIDE UNIT
(TYPICAL FRONT ELEVATION)

16’ WIDE UNIT
(TYPICAL FRONT ELEVATION)

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DESIGN CONTEXT OBSERVATIONS

2-STORY FRONT PORCH ELEMENTS

20’ WIDE UNIT
(TYPICAL FRONT ELEVATION)

16’ WIDE UNIT
(TYPICAL FRONT ELEVATION)

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DESIGN CONTEXT OBSERVATIONS

MIX OF BRICK AND HORIZONTAL SIDING

THROUGHOUT THE DISTRICT, THERE ARE MANY EXAMPLES OF BUILDINGS UTILIZING MULTIPLE SIDING TYPES. A COMMON COMBINATION IS BRICK FOR THE FIRST STORY, AND HORIZONTAL SIDING ABOVE .

20’ WIDE UNIT
(TYPICAL FRONT ELEVATION)

16’ WIDE UNIT
(TYPICAL FRONT ELEVATION)

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HISTORIC CONTEXT

TRUMBULL HISTORIC CONTEXT
SCALE: 1” = 10’-0”

LINCOLN HISTORIC CONTEXT
SCALE: 1” = 10’-0”

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ELEMENTS OF DESIGN

CITY OF DETROIT CODE OF ORDINANCES
SECTION 21-2-155 WOODBRIDGE FARMS HISTORIC DISTRICT

1. HEIGHT

stories tall. The proposed project features buildings that are 3 stories tall, which is within the range of existing building heights.

2. PROPORTION OF BUILDING FACADES

There are a variety of building types in the district, creating a variety of facade proportions. The proposed project features buildings comprised of two to seven townhouses. While the proposed buildings are wider than they are tall, each unit is designed with an asymmetrical 3-story projection at the front facade, which emphasizes verticality. Individual units are mirrored within each building in a way that created variation and rhythm along each facade.

3. PROPORTION OF OPENINGS

The varied housing styles within the district create a variety of opening organization strategies. Most windows are taller than they are wide, but are sometimes grouped together The proposed buildings feature windows that are generally taller than they are wide. On the front and rear facades, windows are usually grouped together to create a horizontal expression, similar to many houses in the district

4. RHYTHM OF SOLIDS AND VOIDS

The proposed buildings use a high degree of organization in the relationships between the position of openings on each facade. This is similar to many of the Italianate and apartment-style buildings in the district.

5. RHYTHM OF SPACING BUILDINGS ON STREETS

Since many homes in the district have been lost to demolition, there is no overall rhythm to spacing of buildings. The proposed development features a relatively consistent spacing between buildings of 15’-0”, however, a larger space is left in the center of the development along Trumbull to create a community lawn space and to frame views to the existing power house structure.

6. RHYTHM OF ENTRANCE/PORCH PROJECTIONS

Steps and porches exist on all of the residential buildings in the district. Front porches are

or in the centers of the front facades on duplexes. The proposed development features two-story porch projections that are aligned to one side of the unit, which is consistent with the district.

7. RELATIONSHIP OF MATERIALS

The district exhibits a wide variety of building materials characteristic of Victorian architecture. Some Queen

elevations, the brick extends up to either the top of the second story, or up to the eave. The rest of the buildings are clad in a painted horizontal siding and wood-look accent siding. The mix of materials is consistent with the district.

8. RELATIONSHIP OF TEXTURES

The development’s mix of brick, smooth lap siding, and wood-look siding create a variety of texture similar to many of the Victorian and Queen Anne style buildings in the district that also use a mix of brick and various siding types to create textural contrast.

9. RELATIONSHIP OF COLORS

Many buildings in the district feature brick with contrasting trim and siding colors. The proposed buildings feature two color schemes, one with red brick, one with gray brick. Both color schemes include darker siding and trim to contrast with each brick color. In addition, the lighter wood-look accent siding contrasts with the dark siding.

10. RELATIONSHIP OF ARCHITECTURAL DETAILS

The majority of buildings in the district are highly ornate Victorian homes with articulated wood detailing. In order to set this development apart, and allow it to express its own time, more stream-lined contemporary detailing is used throughout. The overall proportions and material palate complements the district, and the use of less-ornate detailing allows the development to recede visually and act as a backdrop for the ornate historic buildings.

11. RELATIONSHIP OF ROOF SHAPES

The predominant roof shapes in the district are gables, hips, and mansards. The proposed buildings feature a large side-facing gable across the entire building, and multiple front facing shed-style roofs over projections along the front facade. The use of shed-style roofs is another way to simplify the detailing of the buildings in order for them to speak more to their time of construction instead of try to match their historic counterparts. However, the use of multiple roof types within each building is consistent with the character of the district

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ELEMENTS OF DESIGN

CITY OF DETROIT CODE OF ORDINANCES
SECTION 21-2-155 WOODBRIDGE FARMS HISTORIC DISTRICT

12. WALLS OF CONTINUITY
The proposed project is designed with total alignment of the structure building to front setback of the adjacent buildings. This direct alignment will reinforce the primary wall of continuity on this block of Trumbull.

13. RELATIONSHIP OF LANDSCAPE FEATURES AND TREATMENTS
The proposed project is designed to be in keeping with the landscape and surface treatments that exist along Trumbull Avenue. These elements will consist concrete walks up to the front entrances, two “outdoor rooms” along Trumbull with crushed stone surfaces edged with brick pavers, and the resurfaced alley consisting of stamped concrete. The majority of the site area at the front of buildings is lawn with planted areas featuring ornamental grasses and small shrubs directly in front of the at-grade porch areas. Parking areas at the rear of buildings will be paved with asphalt.

14. RELATIONSHIP OF OPEN SPACE TO STRUCTURES
The proposed development seeks to revitalize a large portion of open land at the south end of the district. The existing Scripps power house currently stands along in the middle of the vacant land, but the project proposes to make it a focal point within a pocket of open space in the center of the development. The resulting relationship of proposed open space to structures is appropriate relative a pre-demolition version of the district.

15. SCALE OF FACADES AND FACADE ELEMENTS
Buildings in the district range from small to large. For example, some duplexes are twice as wide as the single family homes they are next too. Some larger single family homes are broken up into multiple masses to break down their scale. The proposed buildings are each made up of a series of townhouse units. Each unit features an asymmetrical front projection to break up its mass and express verticality. These asymmetrical units are mir-

facade elements, keeping with the character of the development.

16. DIRECTIONAL EXPRESSION OF FRONT ELEVATIONS
Each individual townhouse unit has an asymmetrical vertical expression. Sometimes, two units are mirrored within a building so that their large forward projection are joined, creating a more neutral directional expression. The variety created by this is consistent with the variety of building types found in the district.

17. RHYTHM OF BUILDING SETBACKS
The proposed buildings along Trumbull are inline with the adjacent Trumbull Market building, as well as the church to the south. The buildings on Lincoln are inline with the existing home to the south.

18. RELATIONSHIP OF LOT COVERAGE
Buildings in the district typically occupy approximately between 40 percent to 95 percent of their, sites. This development occupies approximately 30 percent of the overall site, which is similar to the overall district. This slightly lower lot coverage is due to providing a public outdoor space at the center of the development.

19. DEGREE OF COMPLEXITY WITHIN THE FACADE
The district features buildings with a range of complexity in massing, textures, and materials based on individual styles. The proposed buildings feature relatively contemporary styling, with minimal detailing, but an overall complexity of massing that is complimentary to the district.

20. ORIENTATION, VISTAS, OVERVIEWS
Most buildings in the district are oriented toward the major north-south streets. An exception is on Selden, where some buildings are oriented toward Selden. The majority of the proposed buildings are oriented toward the north-south streets, including buildings that front the redeveloped alley. Two small buildings face Selden. This orientation strategy is in line with the district.

21. SYMMETRIC OR ASYMMETRIC APPEARANCE
The proposed buildings are made up of townhouse units that feature an asymmetrical appearance, similar to the majority of existing buildings in the district.

22. GENERAL ENVIRONMENTAL CHARACTER

the district. It reconnects large stretches of the streetscape along Trumbull and Lincoln. The contemporary character of the development features massing that is complementary to the existing historic buildings, but the more modest streamlined detailing allows the development to act as backdrop for the more expressive historic structures to remain the focal points of this unique district.

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POWER HOUSE AND COMMUNITY LAWN

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GUEST PARKING

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RECLAIMED ALLEY

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POWER HOUSE RENOVATION

PROJECT NARRATIVE

The existing Power House building is a 2-story brick structure on the Scripps Mansion site. It is the only remaining structure from the original development. The goal of the project is to renovate the structure to become a detached residential condominum unit as part of the Towns@ Scripps Park development. Visually, it will become the focal point of the newly created community lawn space across from one of the entrances to Scripps Park.

The roof

beyond repair. In addition to this damage, all of the original windows and doors have been removed, with openings being boarded or blocked in with CMU.

The proposed project completely renovates the interior including recon-

two-story space at the front of the building. New stairs will be constructed connecting the basement (utility space), ground , mezzanine, and roof. The roof structure will also be reconstructed with wood framing, a new membrane roof, and a roof deck with glass railing. A glass access hatch will be installed to provide access to the roof while remaining low enough to be visually concealed by the existing parapet when viewed from the ground.

New aluminum-clad wood windows will be installed in all window openings. A new wood entry door will be installed at the front entrance.

Windows on the south elevation toward the rear of the building will have These windows do not have the ornate stone detailing featured at windows closer to the front of the building, and are partially concealed from view by the chimney structure in front of them.

Additional work includes the reconstruction of the collapsing mason-

from brick and stone, and reconstruction in-kind of the wood railing and header detail on the west facade of the building as well as typical brick repairs and tuckpointing as required.

PROJECT SCOPE

DEMOLITION

- Demolish remaining portions of existing brick wall along alley adjacent to building. Salvage brick to be used as required for repair of building.
-
-
- Demolish existing interior stair
-

INTERIOR WORK

-
-
- , and roof
- Install new kitchen and bathrooms, refer to plans.

EXTERIOR WORK

- Install new glass access hatch at roof
- Construct new roof deck with guard rail
- Install new aluminum-clad wood windows at all window openings
- Raise sill of window at rear south elevation of building, coordinate with in-

new windows.

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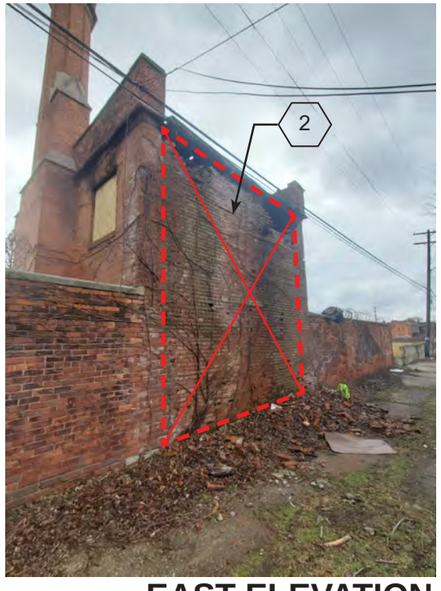
POWER HOUSE RENOVATION

EXTERIOR DEMOLITION WORK

WINGWALL ELEVATION



EAST ELEVATION

WINGWALL ELEVATION

SOUTH ELEVATION

NORTH ELEVATION

WEST ELEVATION

DEMOLITION KEYNOTES

1. DEMOLISH REMAINING BRICK FENCE/WALL. SALVAGE BRICK
2. DEMOLISH COLLAPSING REAR BRICK WALL. SALVAGE BRICK
3. REMOVE DAMAGED/ ROTTED WOOD DETAILING. DOCUMENT PROFILES FOR IN-KIND REPLACEMENT

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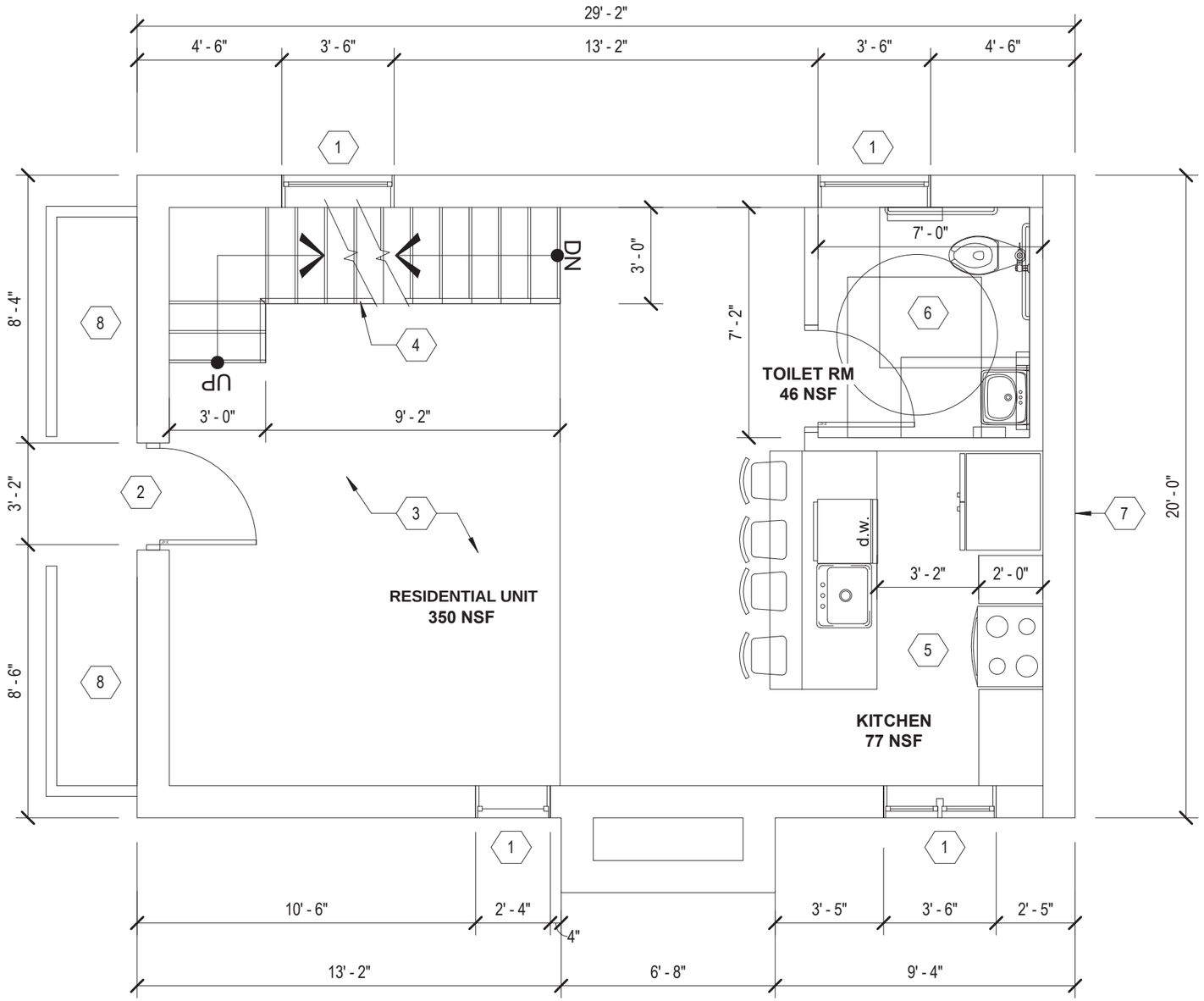
POWER HOUSE RENOVATION

NEW WORK PLANS



GROUND FLOOR PLAN

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

PLAN KEYNOTES

1. NEW ALUM CLAD WOOD WINDOWS. BASIS OF DESIGN: PELLA ARCHITECTURAL SERIES TRADITIONAL. EXTERIOR COLOR: BLACK
2. NEW WOOD ENTRY DOOR. SEE CUTSHEET FOR SELECTION
3. NEW FLOOR FINISH ON WOOD SUBFLOOR AND FRAMING. REPAIR, REPLACE, AND INFILL EXISTING FLOOR FRAMING AS REQUIRED.
4. NEW STAIR
5. INSTALL KITCHEN CABINETS, COUNTERTOPS, AND APPLIANCES. SELECTIONS TBD.
6. NEW TOILET ROOM INCLUDING TILE FLOOR FINISH, FIXTURES, AND ADA ACCESSORIES. SELECTIONS TBD.
7. RECONSTRUCT MASONRY WALL WITH SALVAGED BRICK
8. RECONSTRUCT WOOD PORCH RAIL DETAILING IN KIND. INTACT PORTION TO BE USED AS BASIS OF DESIGN

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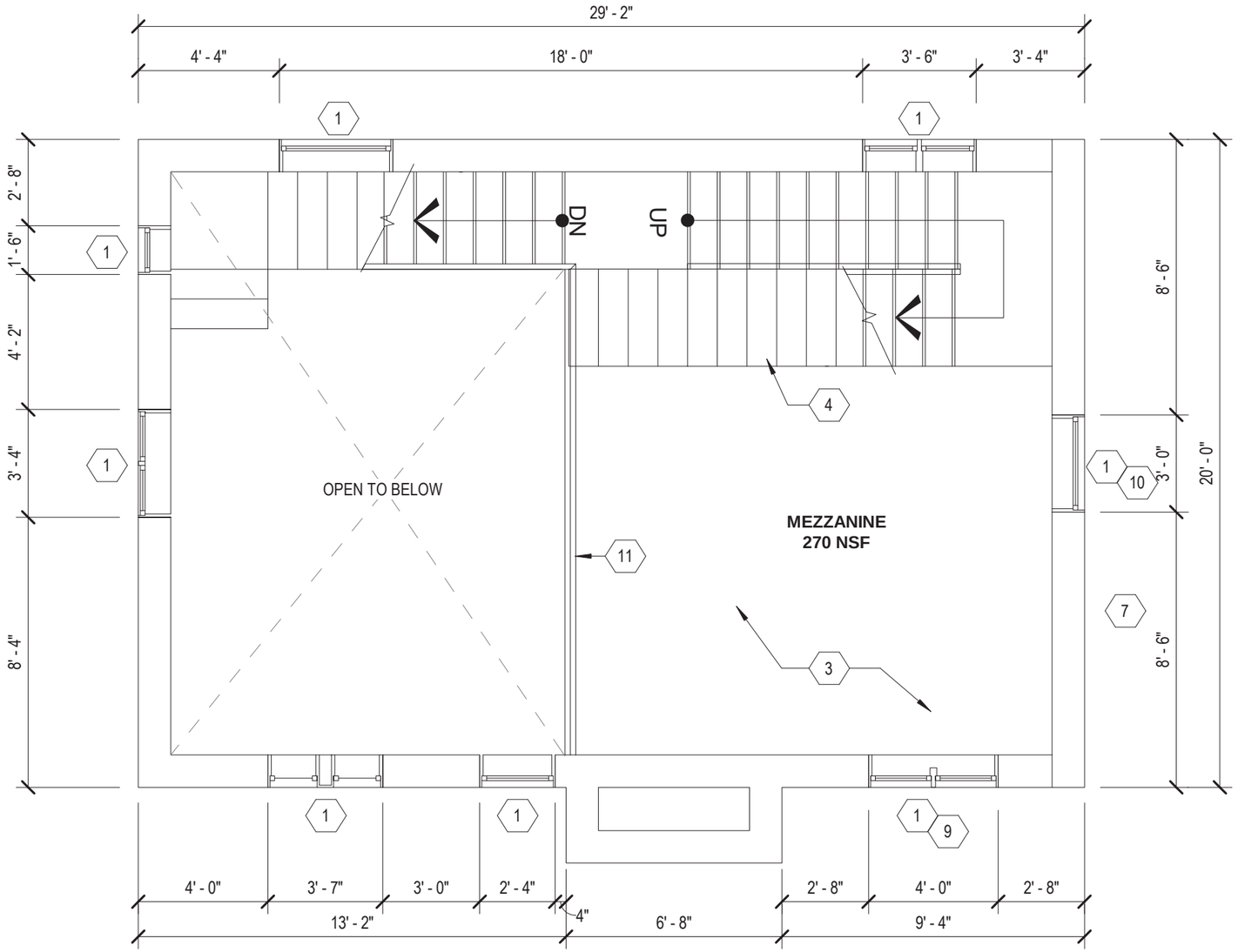
POWER HOUSE RENOVATION

NEW WORK PLANS



PLAN KEYNOTES

1. NEW ALUM CLAD WOOD WINDOWS. BASIS OF DESIGN: PELLA ARCHITECTURAL SERIES TRADITIONAL. EXTERIOR COLOR: BLACK
3. NEW FLOOR FINISH ON WOOD SUBFLOOR AND FRAMING. REPAIR, REPLACE, AND INFILL EXISTING FLOOR FRAMING AS REQUIRED.
4. NEW STAIR
7. RECONSTRUCT MASONRY WALL WITH SALVAGED BRICK
9. RAISE EXISTING SILL HEIGHT AS REQUIRED. INFILL OPENING BELOW NEW SILL WITH SALVAGED BRICK
10. NEW WINDOW IN EXISTING FRAMED OPENING (CURRENTLY BRICKED -IN)
11. NEW RAILING

MEZZANINE FLOOR PLAN
SCALE: 1/4" = 1'-0"

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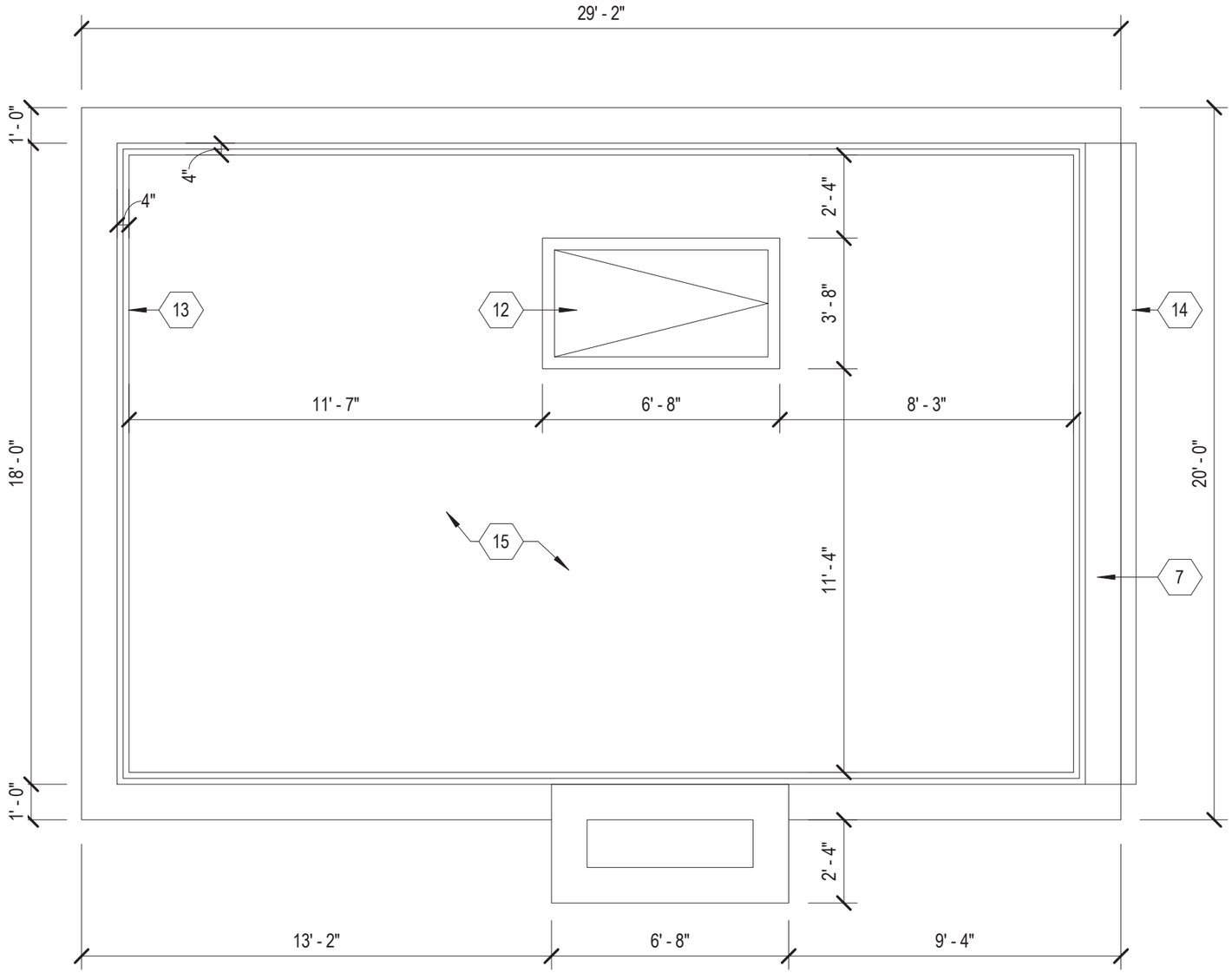
POWER HOUSE RENOVATION

NEW WORK PLANS



PLAN KEYNOTES

7 RECONSTRUCT MASONRY WALL WITH SALVAGED BRICK

12 GLASS ROOF ACCESS HATCH

13 PAINTED ALUM RAIL. SEE CUTSHEET FOR SELECTION. COLOR: BLACK

14 CONTINUOUS ALUM GUTTER AND DOWNSPOUT

15 TREX DECKING ON WOOD SLEEPERS ON EPDM ROOFING MEMBRANE AND 5/8" COVERBOARD OVER NEW WOOD ROOF JOISTS. SEE CUTSHEETS FOR SELECTIONS.

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

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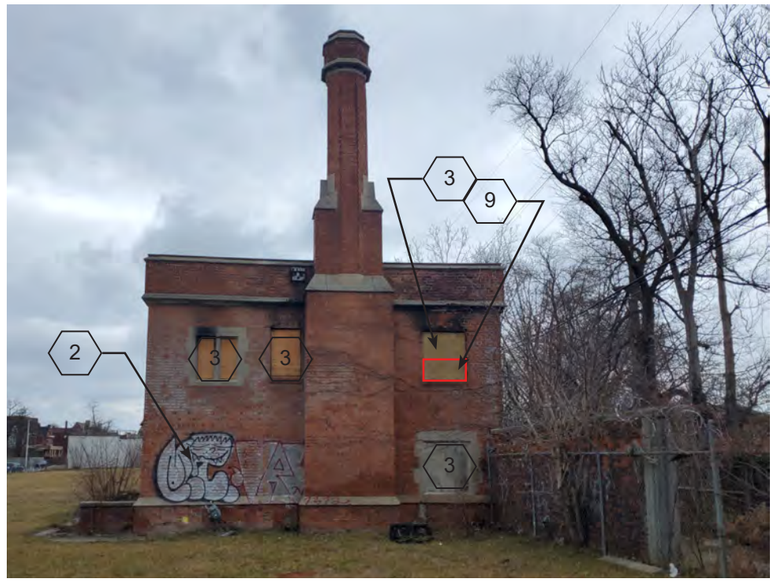
POWER HOUSE RENOVATION

EXTERIOR WORK

EAST ELEVATION

FRONT PORCH DETAIL

WEST ELEVATION



SOUTH ELEVATION

NORTH ELEVATION

EXTERIOR KEYNOTES

1. REPAIR/TUCKPOINT BRICK AS REQUIRED. MORTAR MIX TO MEET HDC STANDARDS
2. CLEAN BRICK TO REMOVE SOOT STAINS AND GRAFFITI. CONTRACTOR TO TEST LEAST INVASIVE METHODS
3. NEW ALUM. CLAD WOOD WINDOWS. REFER TO PLANS FOR BASIS OF DESIGN
4. NEW WOOD ENTRY DOOR. REFER TO CUT-SHEET FOR SELECTIONS
5. RECONSTRUCT DAMAGED BRICK WALL WITH SALVAGED BRICK
6. ADD NEW WINDOW OPENING WHERE EVIDENCE OF BRICKED-IN WINDOW OPENING EXISTS
7. RECONSTRUCT WOOD PORCH RAIL DETAIL IN-KIND
8. REPAIR/REPLACE WOOD HEADER DETAIL AS REQUIRED.
9. BRICK-IN OPENING AS REQUIRED TO RAISE SILL. USE SALVAGED BRICK

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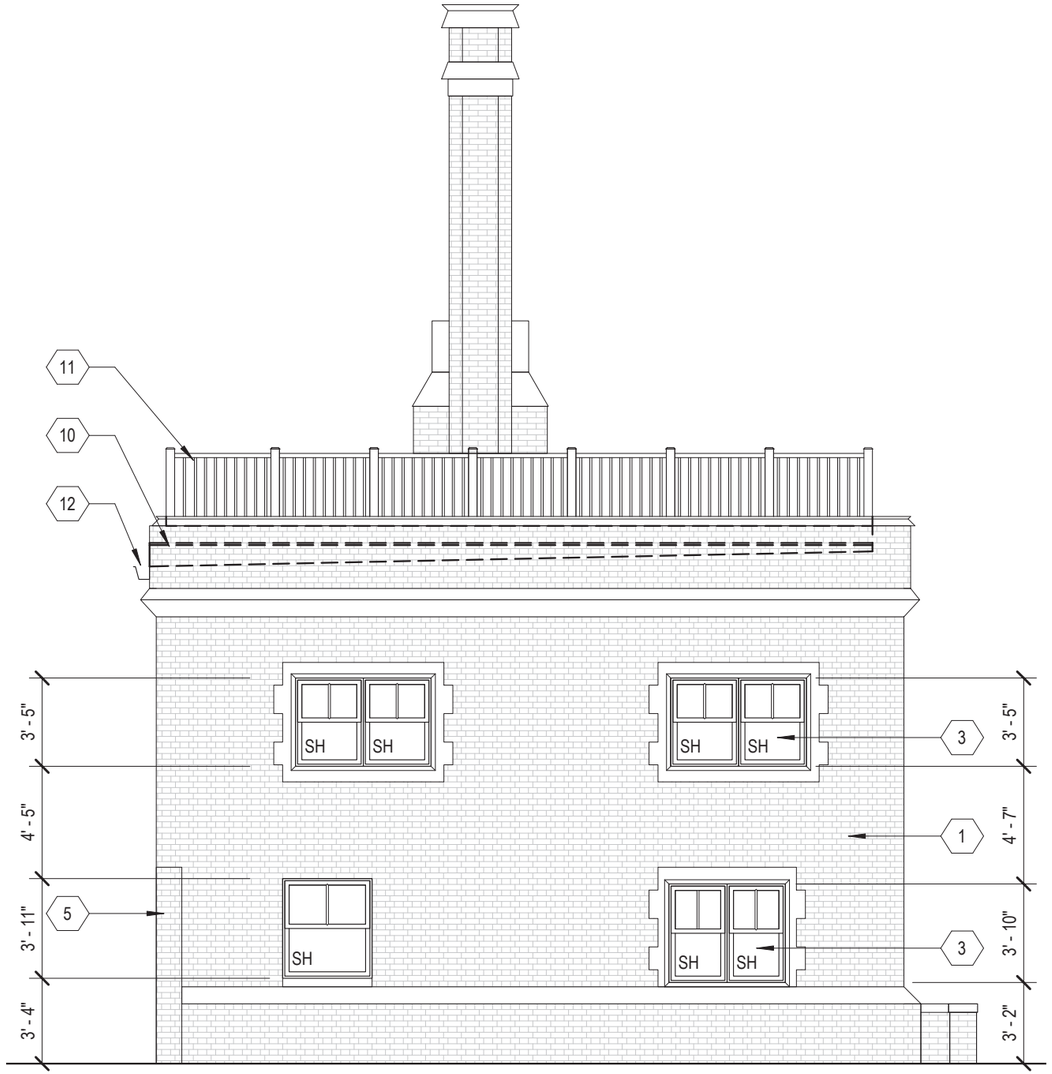
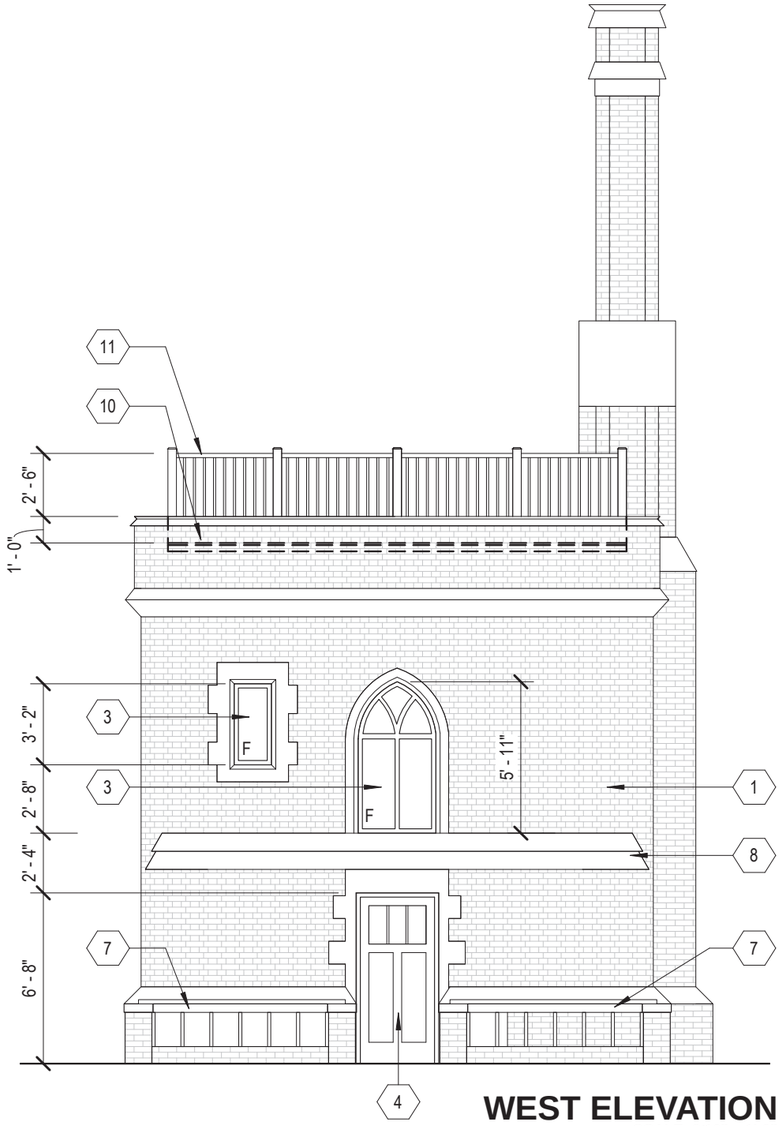
POWER HOUSE RENOVATION

EXTERIOR WORK



NORTH ELEVATION
SCALE: 3/16" = 1'-0"



WEST ELEVATION
SCALE: 3/16" = 1'-0"

EXTERIOR KEYNOTES

1. REPAIR/TUCKPOINT BRICK AS REQUIRED. MORTAR MIX TO MEET HDC STANDARDS
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8. REPAIR/REPLACE WOOD HEADER DETAIL AS REQUIRED.
9. BRICK-IN OPENING AS REQUIRED TO RAISE SILL. USE SALVAGED BRICK
10. TREX DECKING ON WOOD SLEEPERS ON EPDM ROOFING MEMBRANE AND 5/8" COVER-BOARD OVER NEW WOOD ROOF JOISTS. SEE CUTSHEETS FOR SELECTIONS.
11. PAINTED ALUM RAIL. SEE CUTSHEET FOR SELECTION. COLOR: BLACK
12. CONTINUOUS ALUM GUTTER AND DOWN-SPOUT

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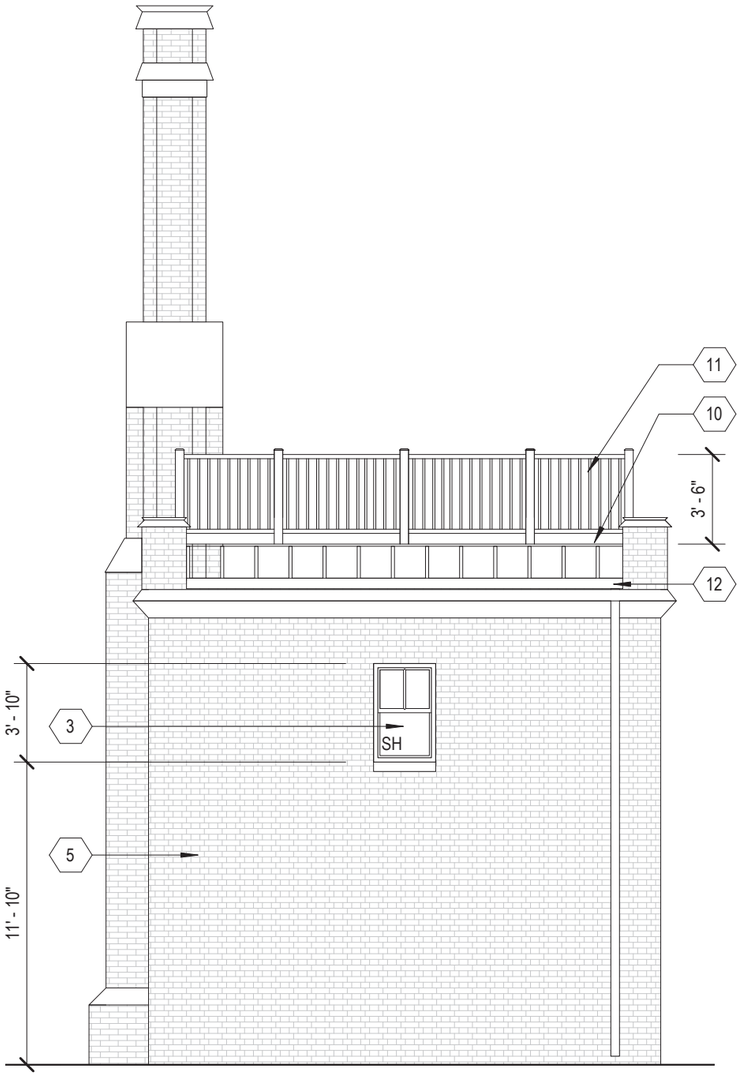
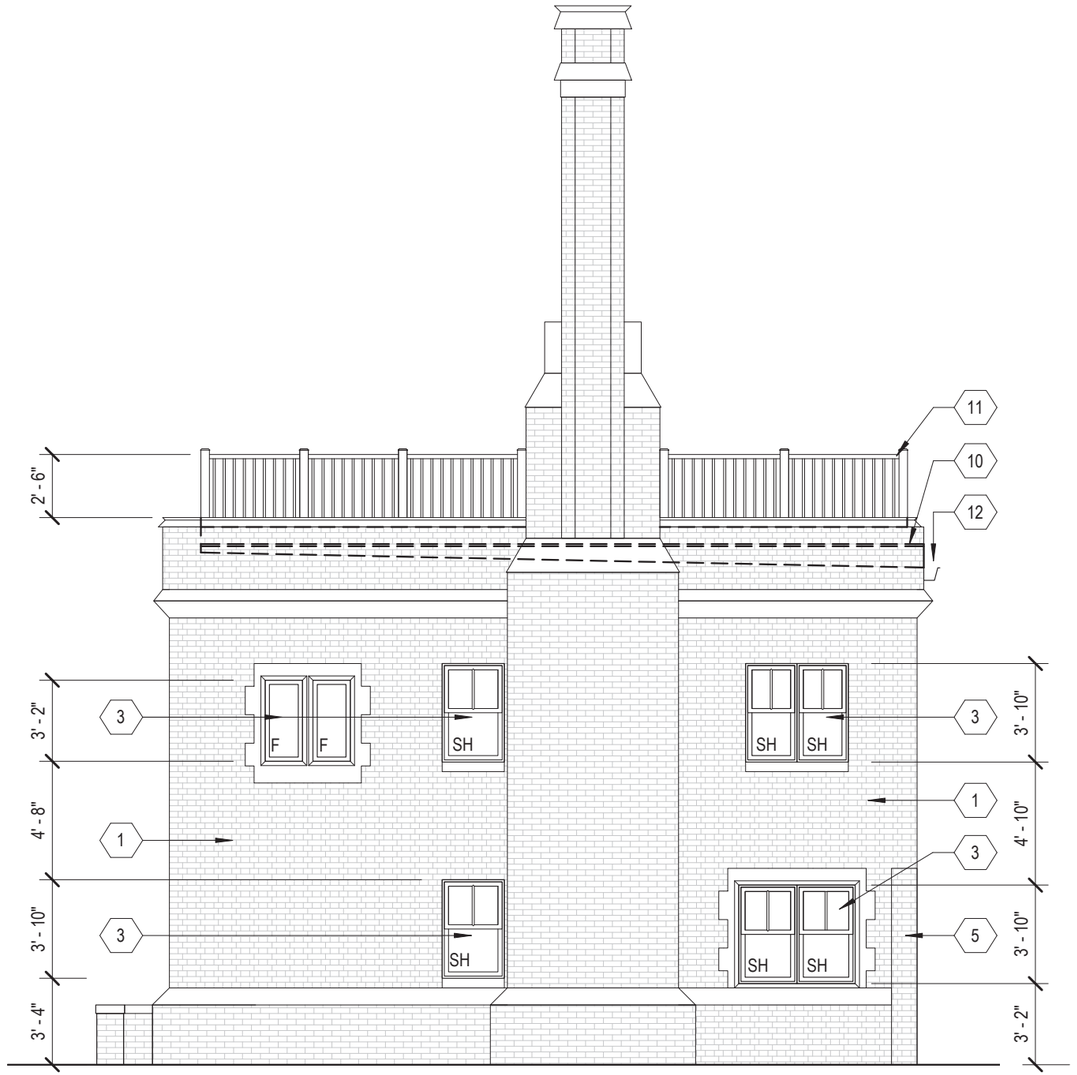
POWER HOUSE RENOVATION

EXTERIOR WORK



EAST ELEVATION
SCALE: 3/16" = 1'-0"



SOUTH ELEVATION
SCALE: 3/16" = 1'-0"

EXTERIOR KEYNOTES

1. REPAIR/TUCKPOINT BRICK AS REQUIRED. MORTAR MIX TO MEET HDC STANDARDS
2. CLEAN BRICK TO REMOVE SOOT STAINS AND GRAFFITI. CONTRACTOR TO TEST LEAST INVASIVE METHODS
3. NEW ALUM. CLAD WOOD WINDOWS. REFER TO PLANS FOR BASIS OF DESIGN
4. NEW WOOD ENTRY DOOR. REFER TO CUT-SHEET FOR SELECTIONS
5. RECONSTRUCT DAMAGED BRICK WALL WITH SALVAGED BRICK
6. ADD NEW WINDOW OPENING WHERE EVIDENCE OF BRICKED-IN WINDOW OPENING EXISTS
7. RECONSTRUCT WOOD PORCH RAIL DETAIL IN-KIND
8. REPAIR/REPLACE WOOD HEADER DETAIL AS REQUIRED.
9. BRICK-IN OPENING AS REQUIRED TO RAISE SILL. USE SALVAGED BRICK
10. TREX DECKING ON WOOD SLEEPERS ON EPDM ROOFING MEMBRANE AND 5/8" COVERBOARD OVER NEW WOOD ROOF JOISTS. SEE CUTSHEETS FOR SELECTIONS.
11. PAINTED ALUM RAIL. SEE CUTSHEET FOR SELECTION. COLOR: BLACK
12. CONTINUOUS ALUM GUTTER AND DOWNSPOUT

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POWER HOUSE RENOVATION

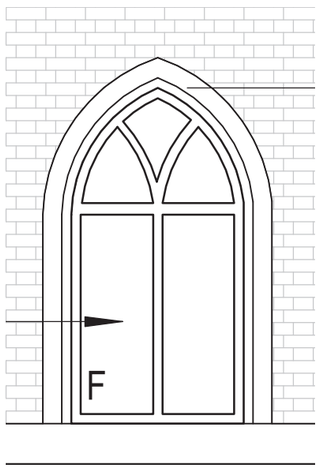
WINDOW PRECEDENTS

SCRIPPS MANSION
MAIN HOUSE

POWER HOUSE
PRE-FIRE

2/1 WINDOWS

ORNATE ARCHED DOOR



PROPOSED WINDOW

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Alexander Lamb Ph.D., P.E.

January 22, 2021

Mr. Tim Flintoff
Principal
4545 Architecture and Design, PLLC.
4545 Commonwealth St., Detroit, MI 48208

RE: 3700 Trumbull Powerhouse: Structural Condition Evaluation of East Elevation and Masonry Wing Walls

Project No. 21-1004
The Towns at Scripps Park

Dear Mr. Flintoff,

In accordance with your request, we have completed our evaluation process of the above captioned project on January 22, 2021.

An evaluation of the east elevation masonry wall and the masonry wing walls was performed on 01/19/2021. The walls were evaluated for deterioration, and compliance with the minimum loading criteria identified in ASCE 7-10 as referenced by the 2015 Michigan Building Code.

East Elevation Masonry Wall:

The east elevation masonry wall is shown in Photograph 1. The wall is constructed of brick masonry units set in hydraulic sand-lime mortar. Both the masonry units and the mortar joints are in an advanced state of deterioration. A significant number of masonry units have begun to spall and the mortar joints have softened such that a masonry rubble pile has formed at the base of the wall. Further, the wall has been exposed to a fire at the second level, and numerous unabated freeze thaw cycles as a result of water penetrating the damaged building envelope. Aside from those sources of deterioration, calcification and efflorescence was observed covering more than 50% of the surface area of the east elevation, indicating that the masonry material itself has reached its serviceable life and will no longer meet the durability requirements specified in ACI 318.

East Masonry Wing Walls:

The east masonry wing walls are shown in Photograph 2 and Photograph 3. The walls are constructed of brick masonry units set in hydraulic sand-lime mortar and are approximately 11ft tall by 12in thick. The masonry units and mortar joints are experiencing similar spall, softening, calcification, and efflorescence as the east elevation masonry wall identified in Photograph 1. The level of deterioration is not as advanced as the east elevation masonry wall, however, it has progressed to the point where the masonry materials will no longer meet the durability requirements specified in ACI 318.

Further, the change in use of the building from a powerhouse to a community clubhouse changes the risk category of the building according to Section 1604.5 of the Michigan Building Code. This change in risk category mandates that the building and its structural

elements be evaluated for the current code required minimum design loads associated with the risk category related to the new use. The resulting wind speed of 115mph applied to the approximately 11ft tall freestanding masonry wall structure results in the existing east masonry wing walls to be overstressed and in an otherwise unsafe condition structurally.

Accordingly, it is our recommendation that the east elevation masonry wall be removed and replaced, and the east masonry wing walls be demolished.

If you have any questions regarding the contents of this report, please do not hesitate to contact our office.

Sincerely,

Alexander Lamb, Ph.D., P.E.
Registered Professional Engineer (Michigan)
248-561-2035
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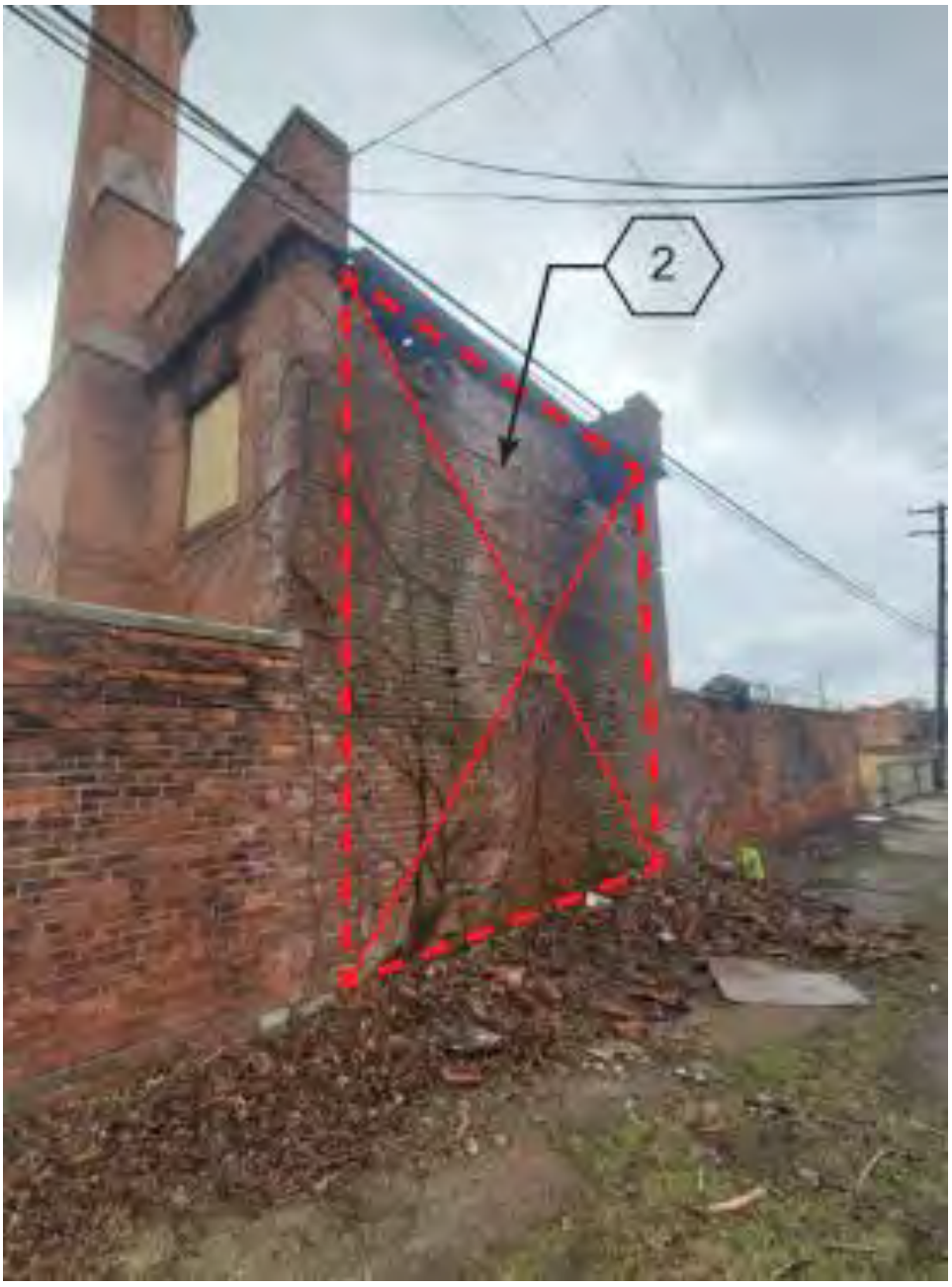
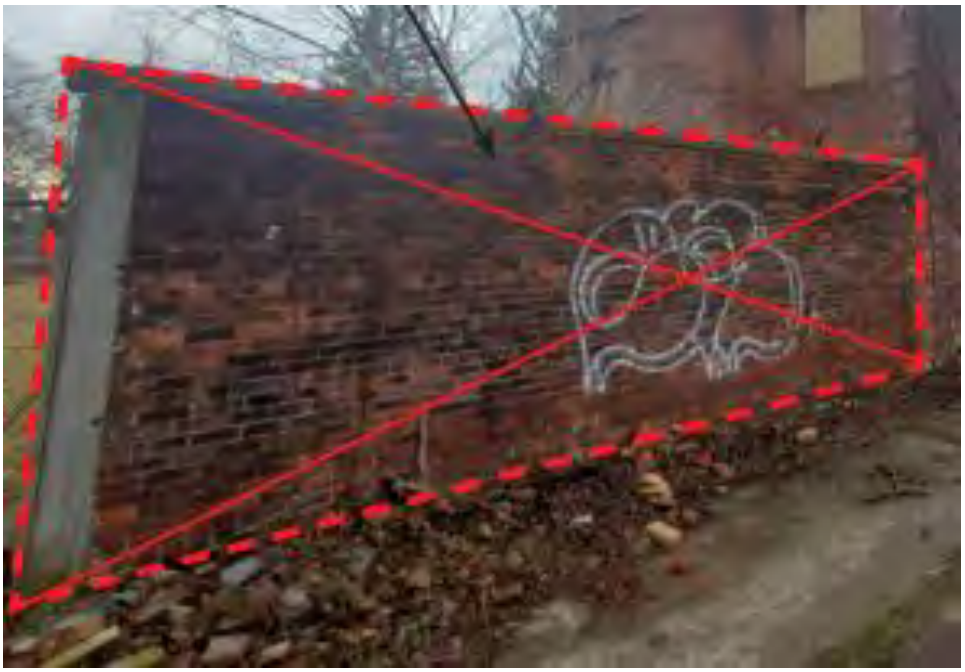


Photograph 1: East Elevation Masonry Wall



Photograph 2: East Masonry Wing Wall – South

Photograph 3: East Masonry Wing Wall - North

STANDARDS FOR REHABILITATION & GUIDELINES FOR REHABILITATING HISTORIC BUILDINGS

Rehabilitation

Rehabilitation is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.

Standards for Rehabilitation

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

GUIDELINES FOR REHABILITATING HISTORIC BUILDINGS

INTRODUCTION

In **Rehabilitation,** historic building materials and character-defining features are protected and maintained as they are in the treatment Preservation. However, greater latitude is given in the **Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings** to replace extensively deteriorated, damaged, or missing features using either the same material or compatible substitute materials. Of the four treatments, only **Rehabilitation** allows alterations and the construction of a new addition, if necessary for a continuing or new use for the historic building.

Identify, Retain, and Preserve Historic Materials and Features

The guidance for the treatment **Rehabilitation** begins with recommendations to identify the form and detailing of those architectural materials and features that are important in defining the building's historic character and which must be retained to preserve that character. Therefore, guidance on ***identifying, retaining, and preserving*** character-defining features is always given first.

Protect and Maintain Historic Materials and Features

After identifying those materials and features that are important and must be retained in the process of **Rehabilitation** work, then ***protecting and maintaining*** them are addressed. Protection generally involves the least degree of intervention and is preparatory to other work. Protection includes the maintenance of historic materials and features as well as ensuring that the property is protected before and during rehabilitation work. A historic building undergoing rehabilitation will often require more extensive work. Thus, an overall evaluation of its physical condition should always begin at this level.

Repair Historic Materials and Features

Next, when the physical condition of character-defining materials and features warrants additional work, ***repairing*** is recommended. **Rehabilitation** guidance for the repair of historic materials, such as masonry, again begins with the least degree of intervention possible. In rehabilitation, repairing also includes the limited replacement in kind or with a compatible substitute material of extensively deteriorated or missing components of features when there are surviving prototypes features that can be substantiated by documentary and physical evidence. Although using the same kind of material is always the preferred option, a substitute material may be an acceptable alternative if the form, design, and scale, as well as the substitute material itself, can effectively replicate the appearance of the remaining features.

Replace Deteriorated Historic Materials and Features

Following repair in the hierarchy, **Rehabilitation** guidance is provided for ***replacing*** an entire character-defining feature with new material because the level of deterioration or damage of materials precludes repair. If the missing feature is character defining or if it is critical to the survival of the building (e.g., a roof), it should be replaced to match the historic feature based on physical or his-

toric documentation of its form and detailing. As with repair, the preferred option is always replacement of the entire feature in kind (i.e., with the same material, such as wood for wood). However, when this is not feasible, a compatible substitute material that can reproduce the overall appearance of the historic material may be considered.

It should be noted that, while the National Park Service guidelines recommend the replacement of an entire character-defining feature that is extensively deteriorated, the guidelines never recommend removal and replacement with new material of a feature that could reasonably be repaired and, thus, preserved.

Design for the Replacement of Missing Historic Features

When an entire interior or exterior feature is missing, such as a porch, it no longer plays a role in physically defining the historic character of the building unless it can be accurately recovered in form and detailing through the process of carefully documenting the historic appearance. If the feature is not critical to the survival of the building, allowing the building to remain without the feature is one option. But if the missing feature is important to the historic character of the building, its replacement is always recommended in the **Rehabilitation** guidelines as the first, or preferred, course of action. If adequate documentary and physical evidence exists, the feature may be accurately reproduced. A second option in a rehabilitation treatment for replacing a missing feature, particularly when the available information about the feature is inadequate to permit an accurate reconstruction, is to ***design*** a new feature that is compatible with the overall historic character of the building. The new design should always take into account the size, scale, and material of the building itself and should be clearly differentiated from the authentic historic features. For properties that have changed over time, and where those changes have acquired significance, reestablishing missing historic features generally should not be undertaken if the missing features did not coexist with the features currently on the building. Juxtaposing historic features that did not exist concurrently will result in a false sense of the building's history.

Alterations

Some exterior and interior alterations to a historic building are generally needed as part of a **Rehabilitation** project to ensure its continued use, but it is most important that such alterations do not radically change, obscure, or destroy character-defining spaces, materials, features, or finishes. Alterations may include changes to the site or setting, such as the selective removal of buildings or other features of the building site or setting that are intrusive, not character defining, or outside the building's period of significance.

Code-Required Work: Accessibility and Life Safety

Sensitive solutions to meeting code requirements in a **Rehabilitation** project are an important part of protecting the historic character of the building. Work that must be done to meet accessibility and life-safety requirements must also be assessed for its potential impact on the historic building, its site, and setting.

Resilience to Natural Hazards

Resilience to natural hazards should be addressed as part of a **Rehabilitation** project. A historic building may have existing characteristics or features that help to address or minimize the impacts of natural hazards. These should always be used to best advantage when considering new adaptive treatments so as to have the least impact on the historic character of the building, its site, and setting.

Sustainability

Sustainability should be addressed as part of a **Rehabilitation** project. Good preservation practice is often synonymous with sustainability. Existing energy-efficient features should be retained and repaired. Only sustainability treatments should be considered that will have the least impact on the historic character of the building.

The topic of sustainability is addressed in detail in *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings.*

New Exterior Additions and Related New Construction

Rehabilitation is the only treatment that allows expanding a historic building by enlarging it with an addition. However, the **Rehabilitation** guidelines emphasize that new additions should be considered only after it is determined that meeting specific new needs cannot be achieved by altering non-character-defining interior spaces. If the use cannot be accommodated in this way, then an attached exterior addition may be considered. New additions should be designed and constructed so that the character-defining features of the historic building, its site, and setting are not negatively impacted. Generally, a new addition should be subordinate to the historic building. A new addition should be compatible, but differentiated enough so that it is not confused as historic or original to the building. The same guidance applies to new construction so that it does not negatively impact the historic character of the building or its site.

Rehabilitation as a Treatment. *When repair and replacement of deteriorated features are necessary; when alterations or additions to the property are planned for a new or continued use; and when its depiction at a particular time is not appropriate, Rehabilitation may be considered as a treatment. Prior to undertaking work, a documentation plan for Rehabilitation should be developed.*

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining and preserving masonry features that are important in defining the overall historic character of the building (such as walls, brackets, railings, cornices, window and door surrounds, steps, and columns) and decorative ornament and other details, such as tooling and bonding patterns, coatings, and color.	Removing or substantially changing masonry features which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Replacing or rebuilding a major portion of exterior masonry walls that could be repaired, thereby destroying the historic integrity of the building. Applying paint or other coatings (such as stucco) to masonry that has been historically unpainted or uncoated to create a new appearance. Removing paint from historically-painted masonry.
Protecting and maintaining masonry by ensuring that historic drainage features and systems that divert rainwater from masonry surfaces (such as roof overhangs, gutters, and downspouts) are intact and functioning properly.	Failing to identify and treat the causes of masonry deterioration, such as leaking roofs and gutters or rising damp.
Cleaning masonry only when necessary to halt deterioration or remove heavy soiling.	Cleaning masonry surfaces when they are not heavily soiled to create a "like-new" appearance, thereby needlessly introducing chemicals or moisture into historic materials.
Carrying out masonry cleaning tests when it has been determined that cleaning is appropriate. Test areas should be examined to ensure that no damage has resulted and, ideally, monitored over a sufficient period of time to allow long-range effects to be predicted.	Cleaning masonry surfaces without testing or without sufficient time for the testing results to be evaluated.

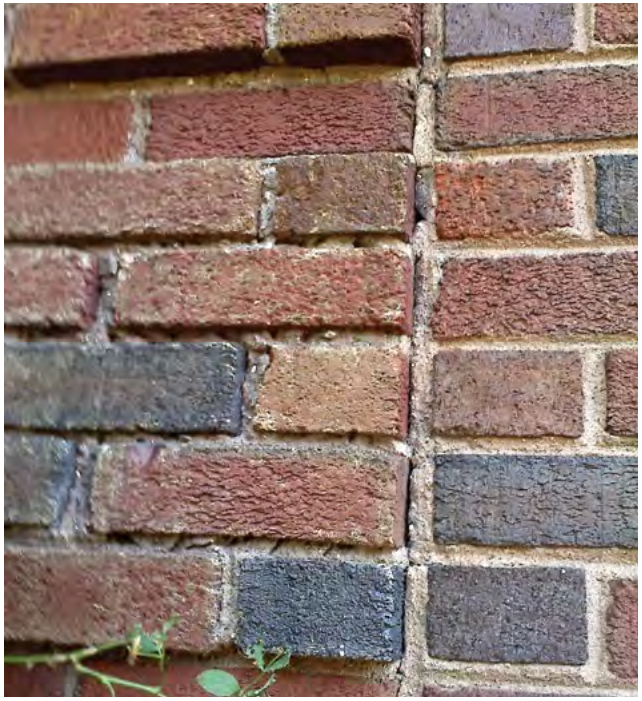
[1] An alkaline-based product is appropriate to use to clean historic marble because it will not damage the marble, which is acid sensitive.

[2] Mid-century modern building technology made possible the form of this parabola-shaped structure and its thin concrete shell construction. Built in 1961 as the lobby of the La Concha Motel in Las Vegas, it was designed by Paul Revere Williams, one of the first prominent African-American architects. It was moved to a new location and rehabilitated to serve as the Neon Museum, and is often cited as an example of Googie architecture. *Credit: Photographed with permission at The Neon Museum, Las Vegas, Nevada.*

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Cleaning soiled masonry surfaces with the gentlest method possible, such as using low-pressure water and detergent and natural bristle or other soft-bristle brushes.	Cleaning or removing paint from masonry surfaces using most abrasive methods (including sandblasting, other media blasting, or high-pressure water) which can damage the surface of the masonry and mortar joints. Using a cleaning or paint-removal method that involves water or liquid chemical solutions when there is any possibility of freezing temperatures. Cleaning with chemical products that will damage some types of masonry (such as using acid on limestone or marble), or failing to neutralize or rinse off chemical cleaners from masonry surfaces.

[3] **Not Recommended:** The white film on the upper corner of this historic brick row house is the result of using a scrub or slurry coating, rather than traditional repointing by hand, which is the recommended method.



[4] **Not Recommended:** The quoins on the left side of the photo show that high-pressure abrasive blasting used to remove paint can damage even early 20th-century, hard-baked, textured brick and erode the mortar, whereas the same brick on the right, which was not abrasively cleaned, is undamaged.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Using biodegradable or environmentally-safe cleaning or paint-removal products.	
Using paint-removal methods that employ a poultice to which paint adheres, when possible, to neatly and safely remove old lead paint.	
Using coatings that encapsulate lead paint, when possible, where the paint is not required to be removed to meet environmental regulations.	
Allowing only trained conservators to use abrasive or laser-cleaning methods, when necessary, to clean hard-to-reach, highly-carved, or detailed decorative stone features.	
Removing damaged or deteriorated paint only to the next sound layer using the gentlest method possible (e.g., hand scraping) prior to repainting.	Removing paint that is firmly adhered to masonry surfaces, unless the building was unpainted historically and the paint can be removed without damaging the surface.
Applying compatible paint coating systems to historically-painted masonry following proper surface preparation.	Failing to follow manufacturers' product and application instructions when repainting masonry features.
Repainting historically-painted masonry features with colors that are appropriate to the historic character of the building and district.	Using paint colors on historically-painted masonry features that are not appropriate to the historic character of the building and district.
Protecting adjacent materials when cleaning or removing paint from masonry features.	Failing to protect adjacent materials when cleaning or removing paint from masonry features.
Evaluating the overall condition of the masonry to determine whether more than protection and maintenance, such as repairs to masonry features, will be necessary.	Failing to undertake adequate measures to ensure the protection of masonry features.
Repairing masonry by patching, splicing, consolidating, or otherwise reinforcing the masonry using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing parts of masonry features when there are surviving prototypes, such as terra-cotta brackets or stone balusters.	Removing masonry that could be stabilized, repaired, and conserved, or using untested consolidants and unskilled personnel, potentially causing further damage to historic materials. Replacing an entire masonry feature, such as a cornice or balustrade, when repair of the masonry and limited replacement of deteriorated or missing components are feasible.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

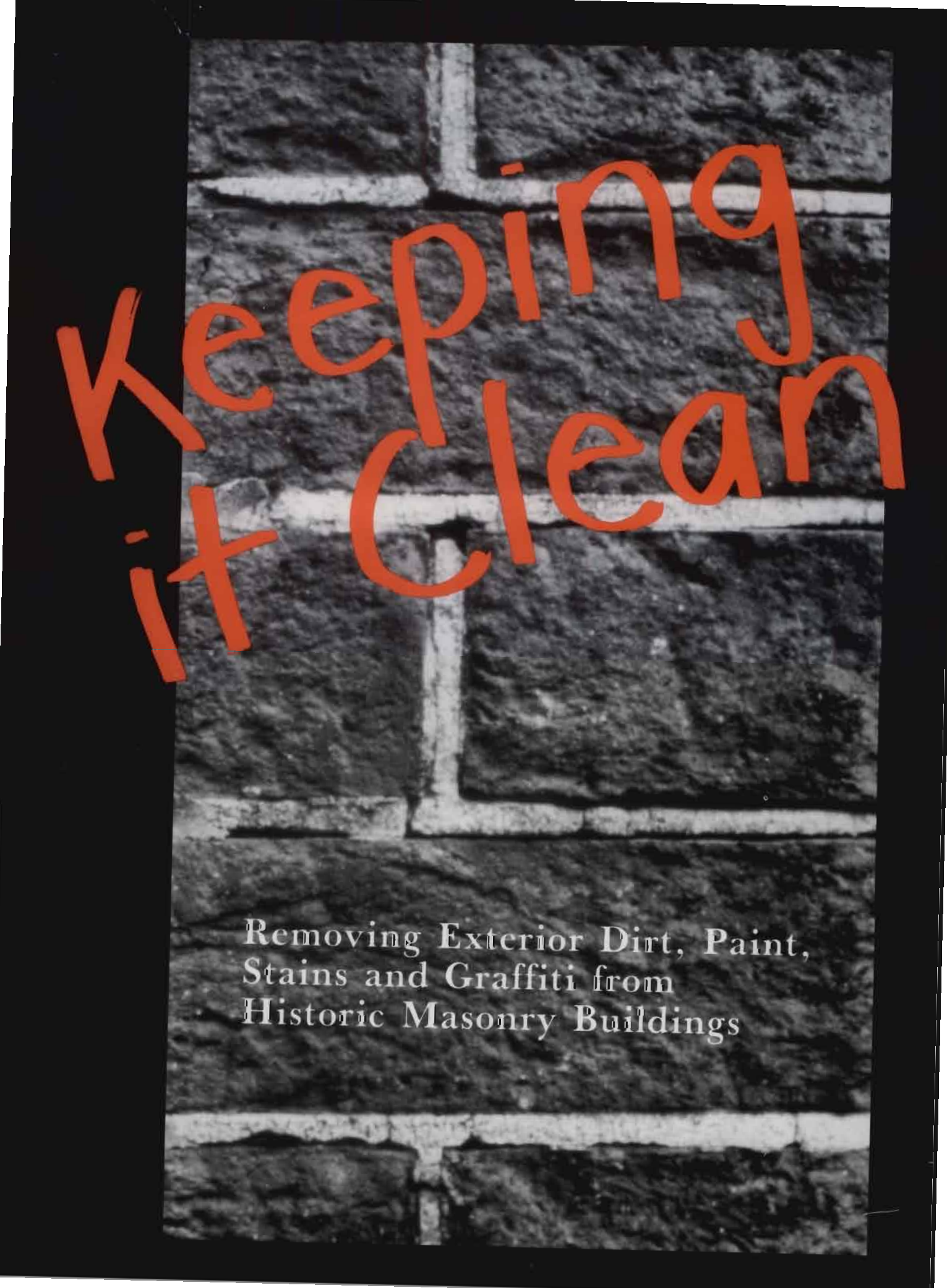
RECOMMENDED	NOT RECOMMENDED
Repairing masonry walls and other masonry features by repointing the mortar joints where there is evidence of deterioration, such as disintegrating mortar, cracks in mortar joints, loose bricks, or damaged plaster on the interior.	Removing non-deteriorated mortar from sound joints and then repointing the entire building to achieve a more uniform appearance.
Removing deteriorated lime mortar carefully by hand raking the joints to avoid damaging the masonry.	
Using power tools only on horizontal joints on brick masonry in conjunction with hand chiseling to remove hard mortar that is deteriorated or that is a non-historic material which is causing damage to the masonry units. Mechanical tools should be used only by skilled masons in limited circumstances and generally not on short, vertical joints in brick masonry.	Allowing unskilled workers to use masonry saws or mechanical tools to remove deteriorated mortar from joints prior to repointing.
Duplicating historic mortar joints in strength, composition, color, and texture when repointing is necessary. In some cases, a lime-based mortar may also be considered when repointing Portland cement mortar because it is more flexible.	Repointing masonry units with mortar of high Portland cement content (unless it is the content of the historic mortar). Using "surface grouting" or a "scrub" coating technique, such as a "sack rub" or "mortar washing," to repoint exterior masonry units instead of traditional repointing methods. Repointing masonry units (other than concrete) with a synthetic caulking compound instead of mortar.
Duplicating historic mortar joints in width and joint profile when repointing is necessary.	Changing the width or joint profile when repointing.
Repairing stucco by removing the damaged material and patching with new stucco that duplicates the old in strength, composition, color, and texture.	Removing sound stucco or repairing with new stucco that is different in composition from the historic stucco. Patching stucco or concrete without removing the source of deterioration. Replacing deteriorated stucco with synthetic stucco, an exterior finish and insulation system (EFIS), or other non-traditional materials.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

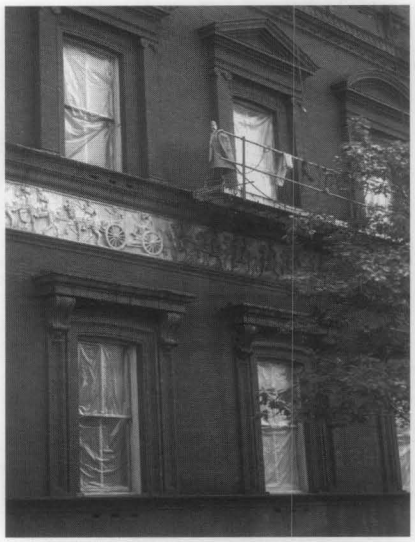
RECOMMENDED	NOT RECOMMENDED
Using mud plaster or a compatible lime-plaster adobe render, when appropriate, to repair adobe.	Applying cement stucco, unless it already exists, to adobe.
Sealing joints in concrete with appropriate flexible sealants and backer rods, when necessary.	
Cutting damaged concrete back to remove the source of deterioration, such as corrosion on metal reinforcement bars. The new patch must be applied carefully so that it will bond satisfactorily with and match the historic concrete.	Patching damaged concrete without removing the source of deterioration.

[5] Rebars in the reinforced concrete ceiling have rusted, causing the concrete to spall. The rebars must be cleaned of rust before the concrete can be patched.

[6] Some areas of the concrete brise soleil screen on this building constructed in 1967 are badly deteriorated. If the screen cannot be repaired, it may be replaced in kind or with a composite substitute material with the same appearance as the concrete.


Keeping it Clean
Removing Exterior Dirt, Paint, Stains and Graffiti from Historic Masonry Buildings

1 PRESERVATION BRIEFS



Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings

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National Park Service
Cultural Resources

Heritage Preservation Services

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

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

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

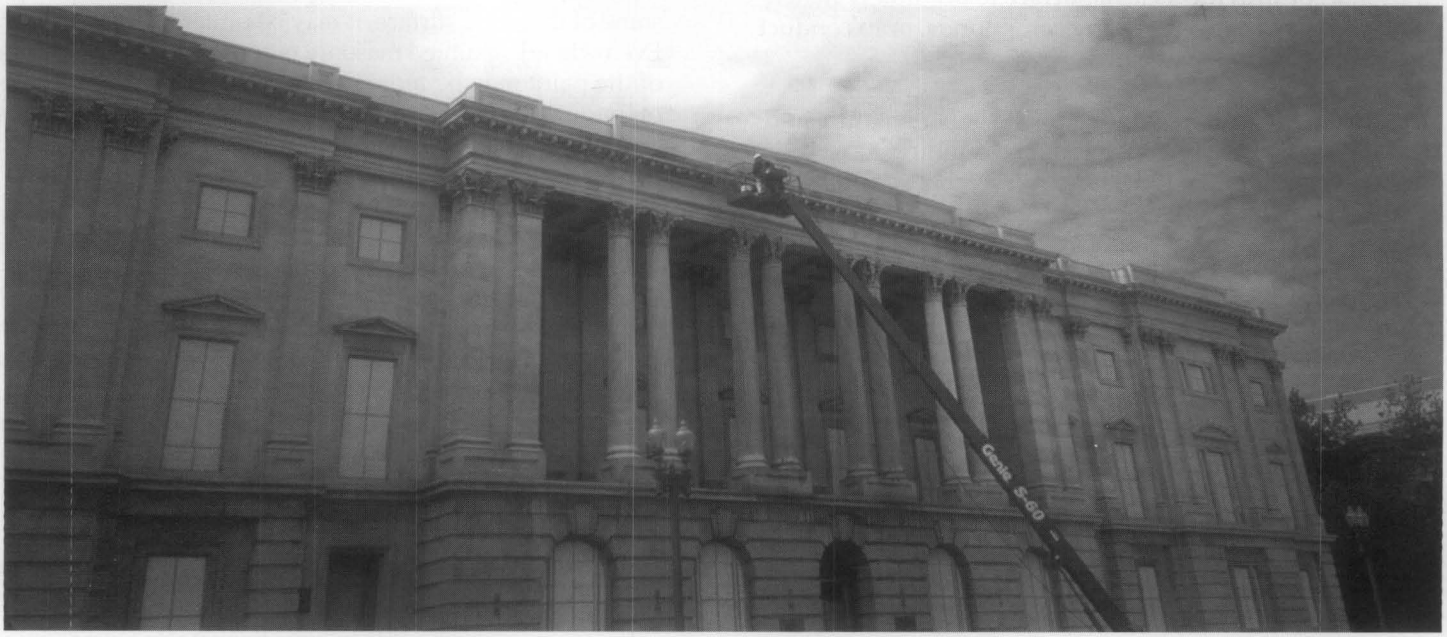


Figure 1. Low-to medium-pressure steam (hot-pressurized water washing), is being used to clean the exterior of the U.S. Tariff Commission Building, the first marble building constructed in Washington, D.C., in 1839. This method was selected by an architecural conservator as the "gentlest means possible"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

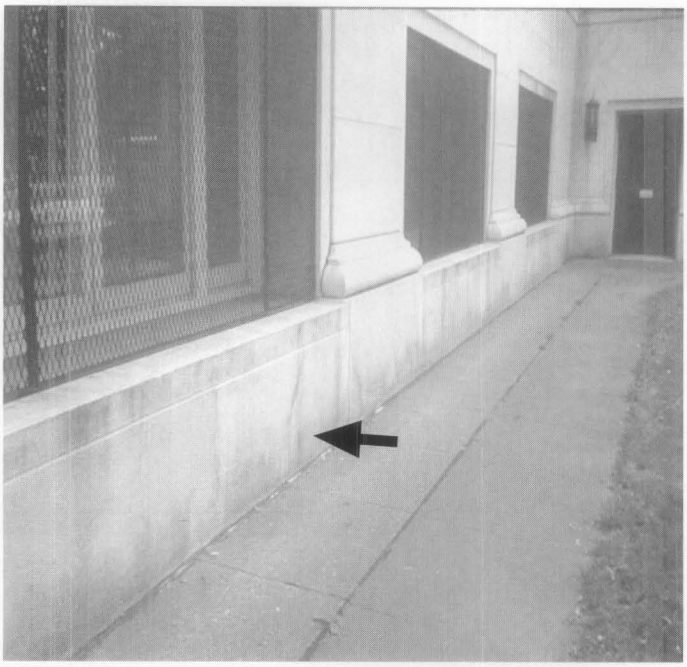


Figure 2. Biological growth as shown on this marble foundation can usually be removed using a low-pressure water wash, possibly with a non-ionic detergent added to it, and scrubbing with a natural or synthetic bristle brush.

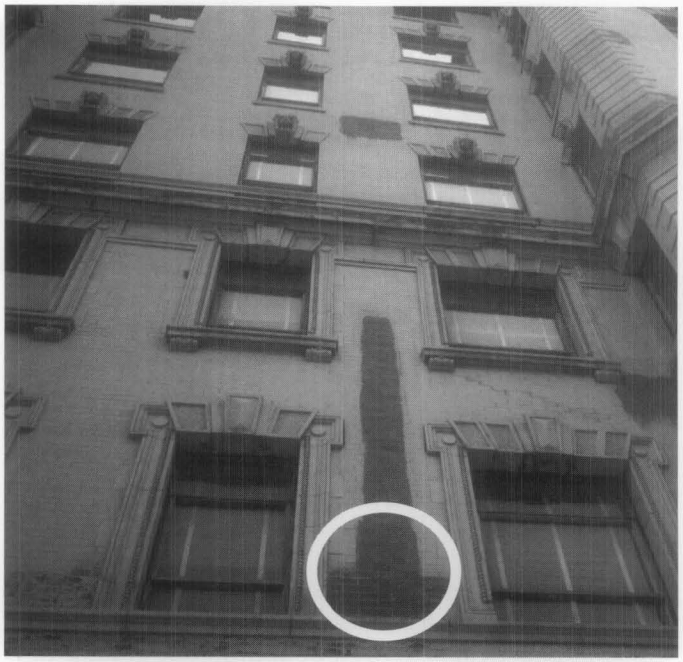


Figure 3. This small test area has revealed a red brick patch that does not match the original beige brick. This may explain why the building was painted, and may suggest to the owner that it may be preferable to keep it painted.

Preparing for a Cleaning Project

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

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

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

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

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

Understanding the Building Materials

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

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

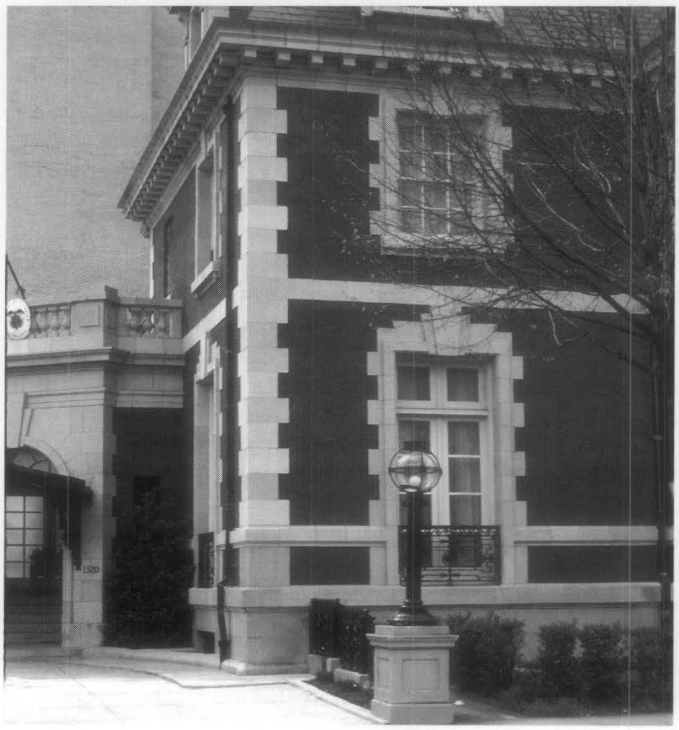


Figure 4. The foundation of this brick building is limestone, but the decorative trim above is architectural terra cotta intended to simulate stone.

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

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

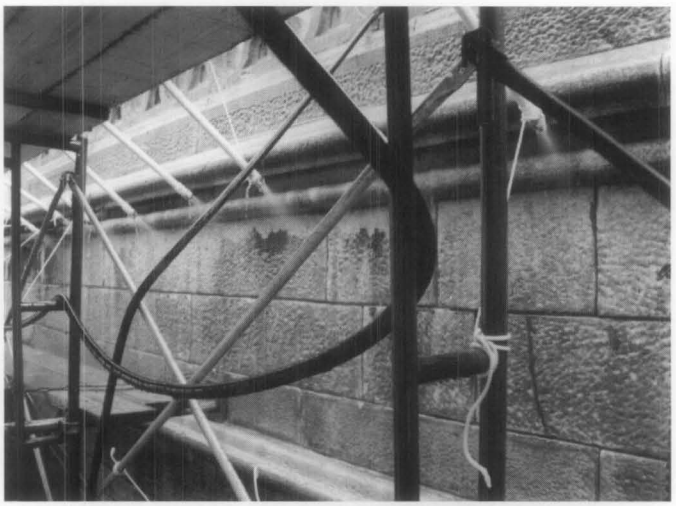


Figure 6. Timed water soaking can be very effective for cleaning limestone and marble as shown here at the Marble Collegiate Church in New York City. In this case, a twelve-hour water soak using a multi-nozzle manifold was followed by a final water rinse. Photo: Diane S. Kaese, Wiss, Janney, Elstner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

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

Cleaning Methods and Materials

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

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

Water Cleaning

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

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

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

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

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

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

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

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

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

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

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

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

Chemical Cleaning

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

Chemical Cleaners to Remove Dirt

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

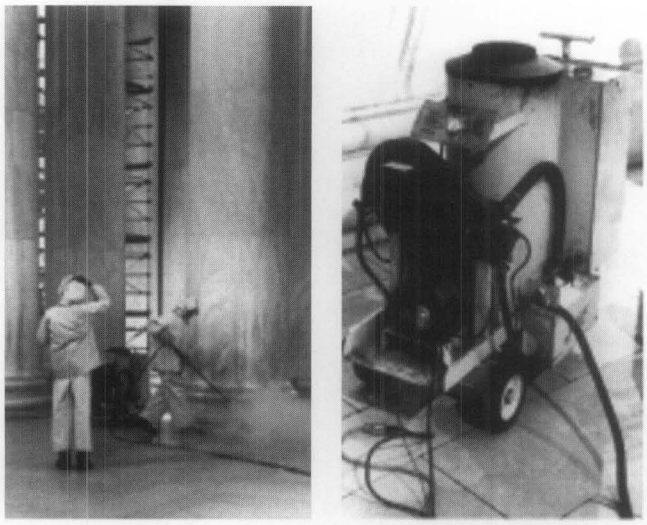


Figure 8. (Left) Low-pressure (under 100 psi) steam cleaning (hot-pressurized water washing), is part of the regular maintenance program at the Jefferson Memorial, Washington, D.C. The white marble interior of this open structure is subject to constant soiling by birds, insects and visitors. (Right)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

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

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

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

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

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

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

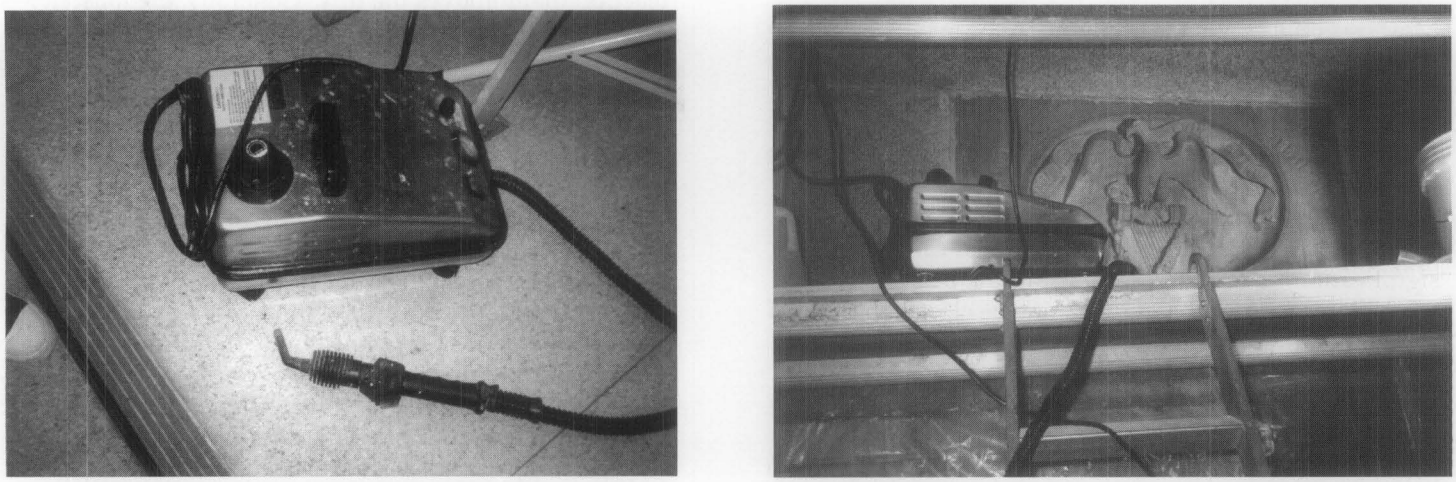


Figure 9. (Left) This small steam cleaner—the size of a vacuum cleaner—offers a very controlled and gentle means of cleaning limited, or hard-to-reach areas or carved stone details. (Right) It is particularly useful for interiors where it is important to keep moisture to a minumum, such as inside the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

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

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

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

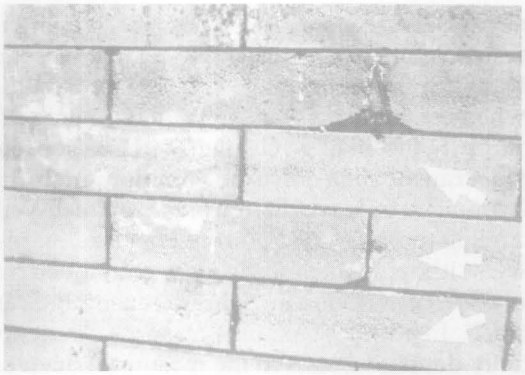


Figure 11. Rinsing with high-pressure water following chemical cleaning has left a horizontal line of abrasion across the bricks on this late-19th century row house.

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

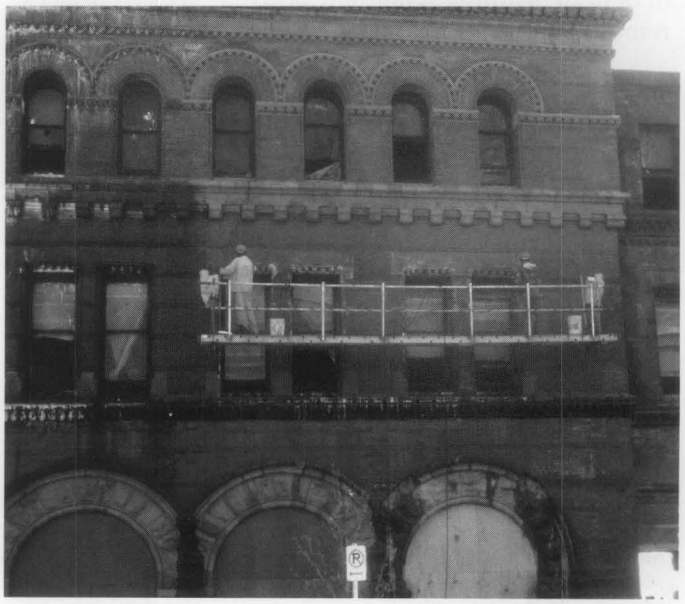


Figure 12. A mild acidic cleaning agent is being used to clean this heavily soiled brick and granite building. Additional applications of the cleaner and hand-scrubbing, and even poulticing, may be necessary to remove the dark stains on the granite arches below. Photo: Sharon C. Park, FAIA.

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

Abrasive and Mechanical Cleaning

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

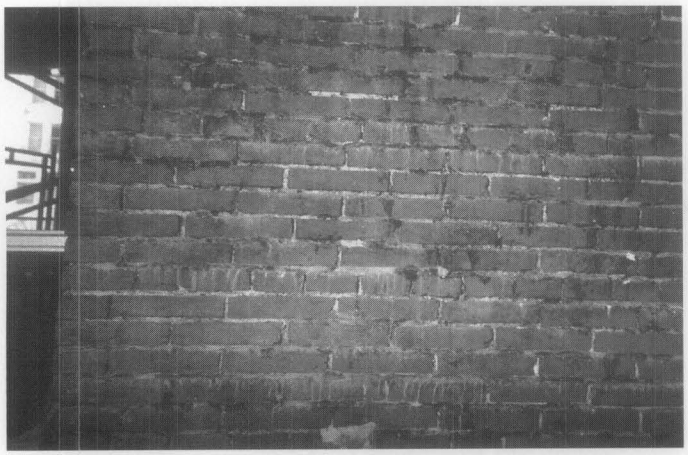


Figure 13. Sometimes it may be preferable to paint over a thick asphaltic coating rather than try to remove it, because it can be difficult to remove completely. However, in this case, many layers of asphaltic coating were removed through multiple applications of a heavy duty chemical cleaner. Each application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

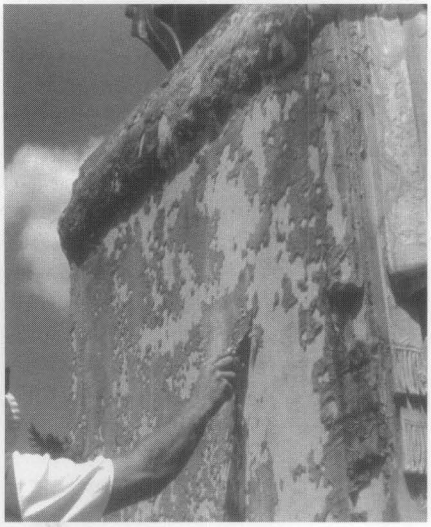
Figure 14. Chemical removal of paint from this brick building has revealed that the cornice and window hoods are metal rather than masonry.

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

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

Poulticing to Remove Stains and Graffiti

a



c

d

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

b

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

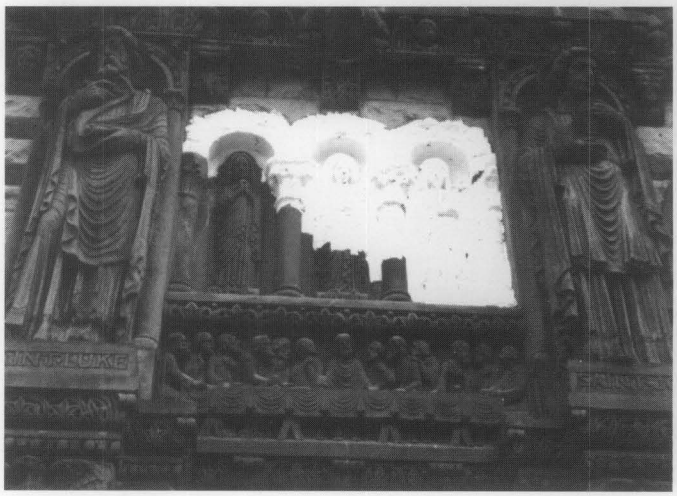


Figure 17. A poultice is being used to remove salts from the brownstone statuary on the facade of this late-19th century stone church. Photo: National Park Service Files.

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

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

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

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

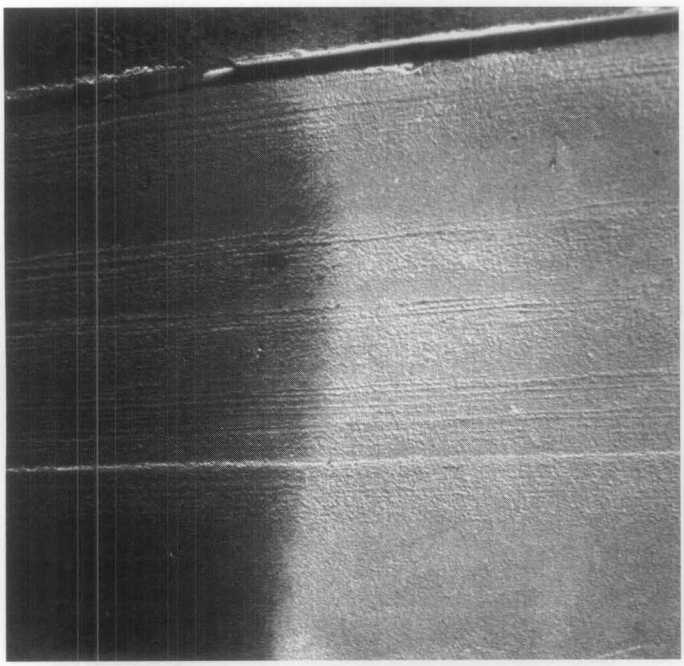


Figure 20. (Left) A comparison of the limestone surface of a 1920s office building before and after "cleaning" with a proprietary abrasive process using fine glass powder clearly shows the effectiveness of this method. But this is an abrasive technique and it has "cleaned" by removing part of the masonry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

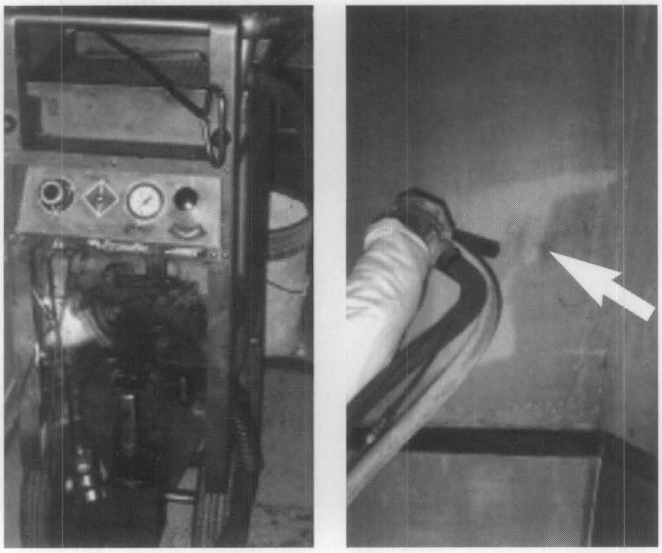


Figure 21. Low-pressure blasting with ice pellets or ice crystals (left) is an abrasive cleaning method that is sometimes recommended for use on interior masonry because it does not involve large amounts of water. However, like other abrasive materials, ice crystals "clean" by removing a portion of the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

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

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

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

Planning A Cleaning Project

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

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

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

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

When feasible, test areas should be allowed to weather for an extended period of time prior to final evaluation. A waiting period of a full year would be ideal in order to expose the test patch to a full range of seasons. If this is not possible, the test patch should weather for at least a month or two. For any building which is considered historically important, the delay is insignificant compared to the potential damage and disfigurement which may result from using an incompletely tested method. *The successfully cleaned test patch should be protected as it will serve as a standard against which the entire cleaning project will be measured.*

Environmental considerations. The potential effect of any method proposed for cleaning historic masonry should be evaluated carefully. Chemical cleaners and paint removers may damage trees, shrubs, grass, and plants. A plan must be provided for environmentally safe removal and disposal of the cleaning materials and the rinsing effluent before beginning the cleaning project. Authorities from the local regulatory agency—usually under the jurisdiction of the federal or state Environmental Protection Agency (EPA) should be consulted prior to beginning a cleaning project, especially if it involves anything more than plain water washing. This advance planning will ensure that the cleaning effluent or run-off, which is the combination of the cleaning agent and the substance removed from the masonry, is handled and disposed of in an environmentally sound and legal manner. Some alkaline and acidic cleaners can be neutralized so that they can be safely discharged into storm sewers. However, most solvent-based cleaners cannot be neutralized and are categorized as pollutants, and must be disposed of by a licensed transport, storage and disposal facility. Thus, it is always advisable to consult with the appropriate agencies before starting to clean to ensure that the project progresses smoothly and is not interrupted by a stop-work order because a required permit was not obtained in advance.

Vinyl guttering or polyethylene-lined troughs placed around the perimeter of the base of the building can serve to catch chemical cleaning waste as it is rinsed off the building. This will reduce the amount of chemicals entering and polluting the soil, and also will keep the cleaning waste contained until it can be removed safely. Some patented cleaning systems have developed special equipment to facilitate the containment and later disposal of cleaning waste.

Concern over the release of volatile organic compounds (VOCs) into the air has resulted in the manufacture of new, more environmentally responsible cleaners and paint removers, while some materials traditionally used in cleaning may no longer be available for these same reasons. Other health and safety concerns have created additional cleaning challenges, such as lead paint removal, which is likely to require special removal and disposal techniques.

Cleaning can also cause damage to non-masonry materials on a building, including glass, metal and wood. Thus, it is usually necessary to cover windows and doors, and other features that may be vulnerable to chemical cleaners. They should be covered with plastic or polyethylene, or a masking agent that is applied as a liquid which dries to form a thin protective film on glass, and is easily peeled off after the cleaning is finished. Wind drift, for example, can also damage other property by carrying cleaning chemicals onto nearby automobiles, resulting in etching of the glass or spotting of the paint finish. Similarly, airborne dust can enter surrounding buildings, and excess water can collect in nearby yards and basements.

Safety considerations. Possible health dangers of each method selected for the cleaning project must be considered before selecting a cleaning method to avoid harm to the

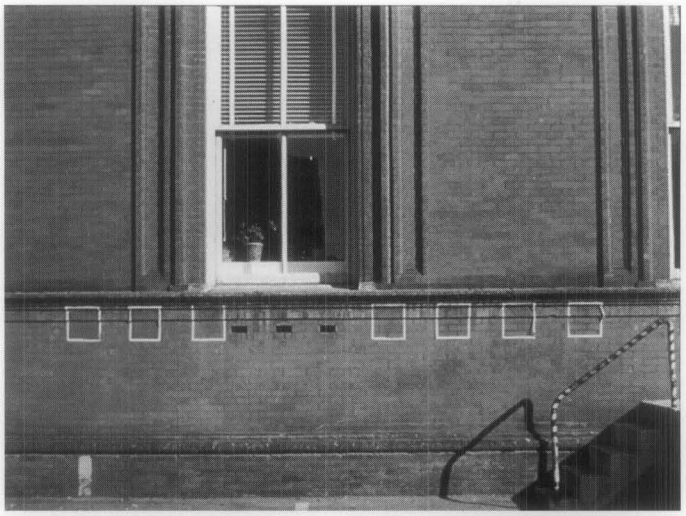


Figure 22. Cleaning test areas may be quite small at first and gradually increase in size as testing determines the "gentlest means possible". Photo: Frances Gale.

cleaning applicators, and the necessary precautions must be taken. The precautions listed in Material Safety Data Sheets (MSDS) that are provided with chemical products should always be followed. Protective clothing, respirators, hearing and face shields, and gloves must be provided to workers to be worn at all times. Acidic and alkaline chemical cleaners in both liquid and vapor forms can also cause serious injury to passers-by (Fig. 23). It may be necessary to schedule cleaning at night or weekends if the building is located in a busy urban area to reduce the potential danger of chemical overspray to pedestrians. Cleaning during non-business hours will allow HVAC systems to be turned off and vents to be covered to prevent dangerous chemical fumes from entering the building which will also ensure the safety of the building's occupants. Abrasive and mechanical methods produce dust which can pose a serious health hazard, particularly if the abrasive or the masonry contains silica.

Water-Repellent Coatings and Waterproof Coatings

To begin with, it is important to understand that waterproof coatings and water-repellent coatings are not the same. Although these terms are frequently interchanged and commonly confused with one another, they are completely different materials. **Water-repellent coatings** —often referred to incorrectly as "sealers", but which do not or should not seal— are intended to keep liquid water from penetrating the surface but to allow water vapor to enter and leave, or pass through, the surface of the masonry (Fig. 24). Water-repellent coatings are generally *transparent*, or clear, although once applied some may darken or discolor certain types of masonry while others may give it a glossy or shiny appearance. **Waterproof coatings** seal the surface from liquid water and from water vapor. They are usually *opaque*, or pigmented, and include bituminous coatings and some elastomeric paints and coatings.

Water-Repellent Coatings

Water-repellent coatings are formulated to be vapor permeable, or "breathable". They do not seal the surface completely to water vapor so it can enter the masonry wall as well as leave the wall. While the first water-repellent coatings to be developed were primarily acrylic or silicone resins in organic solvents, now most water-repellent coatings are water-based and formulated from modified siloxanes, silanes and other alkoxysilanes, or metallic stearates. While some of these products are shipped from the factory ready to use, other waterborne water repellents must be diluted at the job site. Unlike earlier water-repellent coatings which tended to form a "film" on the masonry surface, modern water-repellent coatings actually penetrate into the masonry substrate slightly and, generally, are almost invisible if properly applied to the masonry. They are also more vapor permeable than the old coatings, yet they still reduce the vapor permeability of the masonry. Once inside the wall, water vapor can condense at cold spots producing liquid water which, unlike water vapor, cannot escape through a water-repellent coating. The liquid water within the wall, whether from condensation, leaking gutters, or other sources, can cause considerable damage.

Water-repellent coatings are not consolidants. Although modern water repellents may penetrate slightly beneath the masonry surface, instead of just "sitting" on top of it, they do not perform the same function as a consolidant which is to "consolidate" and replace lost binder to strengthen deteriorating masonry. Even after many years of laboratory study and testing few consolidants have proven very effective. The composition of fired products such as brick and architectural terra cotta, as well as many types of building stone, does not lend itself to consolidation.

Some modern water-repellent coatings which contain a binder intended to replace the natural binders in stone that have been lost through weathering and natural erosion are described in product literature as both a water repellent and a consolidant. The fact that newer water-repellent coatings penetrate beneath the masonry surface instead of just forming a layer on top of the surface may indeed convey at least some consolidating properties to certain stones. However, a water-repellent coating cannot be considered a consolidant. In some instances, a water-repellent or "preservative" coating, if applied to already damaged or spalling stone, may form a surface crust which, if it fails, may exacerbate the deterioration by pulling off even more of the stone (Fig. 25).

Is a Water-Repellent Treatment Necessary?

Water-repellent coatings are frequently applied to historic masonry buildings for the wrong reason. They also are often applied without an understanding of what they are and what they are intended to do. And these coatings can be very difficult, if not impossible, to remove from the masonry if they fail or become discolored. Most importantly, the application of water-repellent coatings to historic masonry is usually unnecessary.

Figure 23. A tarpaulin protects and shields pedestrians from potentially harmful spray while chemical cleaning is underway on the granite exterior of the U.S. Treasury Building, Washington, D.C.

Most historic masonry buildings, unless they are painted, have survived for decades without a water-repellent coating and, thus, probably do not need one now. Water penetration to the interior of a masonry building is seldom due to porous masonry, but results from poor or deferred maintenance. Leaking roofs, clogged or deteriorated gutters and downspouts, missing mortar, or cracks and open joints around door and window openings are almost always the cause of moisture-related problems in a historic masonry building. **If historic masonry buildings are kept watertight and in good repair, water-repellent coatings should not be necessary.**

Rising damp (capillary moisture pulled up from the ground), or condensation can also be a source of excess moisture in masonry buildings. A water-repellent coating will not solve this problem either and, in fact, may be likely to exacerbate it. Furthermore, a water-repellent coating should never be applied to a damp wall. Moisture in the wall would reduce the ability of a coating to adhere to the masonry and to penetrate below the surface. But, if it did adhere, it would hold the moisture inside the masonry because, although a water-repellent coating is permeable to water vapor, liquid water cannot pass through it. In the case of rising damp, a coating may force the moisture to go even higher in the wall because it can slow down evaporation, and thereby retain the moisture in the wall.

Excessive moisture in masonry walls may carry waterborne soluble salts from the masonry units themselves or from the mortar through the walls. If the water is permitted to come to the surface, the salts may appear on the masonry surface as efflorescence (a whitish powder) upon evaporation. However, the salts can be potentially dangerous if they remain in the masonry and crystallize

Figure 24. Although the application of a water-repellent coating was probably not needed on either of these buildings, the coating on the brick building (above), is not visible and has not changed the character of the brick. But the coating on the brick column (below), has a high gloss that is incompatible with the historic character of the masonry.

beneath the surface as subflorescence. Subflorescence eventually may cause the surface of the masonry to spall, particularly if a water-repellent coating has been applied which tends to reduce the flow of moisture out from the subsurface of the masonry. Although many of the newer water-repellent products are more breathable than their predecessors, they can be especially damaging if applied to masonry that contains salts, because they limit the flow of moisture through masonry.

When a Water-Repellent Coating May be Appropriate

There are some instances when a water-repellent coating may be considered appropriate to use on a historic masonry building. Soft, incompletely fired brick from the 18th- and early-19th centuries may have become so porous that paint or some type of coating is needed to protect it from further deterioration or dissolution. When a masonry building has been neglected for a long period of time, necessary repairs may be required in order to make it watertight. If, following a reasonable period of time after the building has been made watertight and has dried out completely, moisture appears actually to be penetrating through the repointed and repaired masonry walls, then the application of a water-repellent coating may be considered *in selected areas only*. This decision should be made in consultation with an architectural conservator. And, if such a treatment is undertaken, it should not be applied to the entire exterior of the building.

Anti-graffiti or barrier coatings are another type of clear coating—although barrier coatings can also be pigmented—that may be applied to exterior masonry, but they are not formulated primarily as water repellents. The purpose of these coatings is to make it harder for graffiti to stick to a masonry surface and, thus, easier to clean. But, like water-repellent coatings, in most cases the application of anti-graffiti coatings is generally not recommended for historic masonry buildings. These coatings are often quite shiny which can greatly alter the appearance of a historic masonry surface, and they are not always effective (Fig. 26). Generally, other ways of discouraging graffiti, such as improved lighting, can be more effective than a coating. However, the application of anti-graffiti coatings may be appropriate in some instances on vulnerable areas of historic masonry buildings which are frequent targets of graffiti that are located in out-of-the-way places where constant surveillance is not possible.

Some water-repellent coatings are recommended by product manufacturers as a means of keeping dirt and pollutants or biological growth from collecting on the surface of masonry buildings and, thus, reducing the need for frequent cleaning. While this at times may be true, in some cases a coating may actually retain dirt more than uncoated masonry. Generally, the application of a water-repellent coating is not recommended on a historic masonry building as a means of preventing biological growth. Some water-repellent coatings may actually encourage biological growth on a masonry wall. Biological growth on masonry buildings has traditionally been kept at bay through regularly-scheduled cleaning as part of a maintenance plan. Simple cleaning of the masonry with low-pressure water using a natural- or synthetic-bristled scrub brush can be very effective if done on a regular basis. Commercial products are also available which can be sprayed on masonry to remove biological growth.

In most instances, a water-repellent coating is not necessary if a building is watertight. The application of a water-repellent coating is not a recommended treatment for historic masonry buildings unless there is a specific

Figure 25. The clear coating applied to this limestone molding has failed and is taking off some of the stone surface as it peels. Photo: Frances Gale.

problem which it may help solve. If the problem occurs on only part of the building, it is best to treat only that area rather than an entire building. Extreme exposures such as parapets, for example, or portions of the building subject to driving rain can be treated more effectively and less expensively than the entire building. Water-repellent coatings are not permanent and must be reapplied periodically although, if they are truly invisible, it can be difficult to know when they are no longer providing the intended protection.

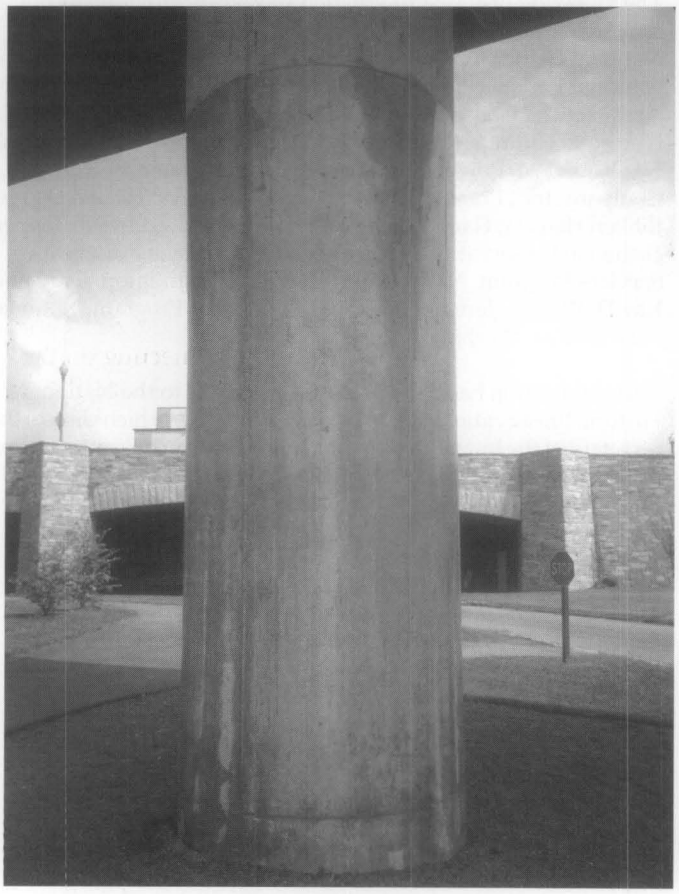


Figure 26. The anti-graffiti or barrier coating on this column is very shiny and would not be appropriate to use on a historic masonry building. The coating has discolored as it has aged and whitish streaks reveal areas of bare concrete where the coating was incompletely applied.

Testing a water-repellent coating by applying it in one small area may not be helpful in determining its suitability for the building because a limited test area does not allow an adequate evaluation of such a treatment. Since water may enter and leave through the surrounding untreated areas, there is no way to tell if the coated test area is "breathable." But trying a coating in a small area may help to determine whether the coating is visible on the surface or if it will otherwise change the appearance of the masonry.

Waterproof Coatings

In theory, waterproof coatings usually do not cause problems as long as they exclude all water from the masonry. If water does enter the wall from the ground or from the inside of a building, the coating can intensify the damage because the water will not be able to escape. During cold weather this water in the wall can freeze causing serious mechanical disruption, such as spalling.

In addition, the water eventually will get out by the path of least resistance. If this path is toward the interior, damage to interior finishes can result; if it is toward the exterior, it can lead to damage to the masonry caused by built-up water pressure (Fig. 27).

In most instances, waterproof coatings should not be applied to historic masonry. The possible exception to this might be the application of a waterproof coating to below-grade exterior foundation walls as a last resort to stop water infiltration on interior basement walls. **Generally, however, waterproof coatings, which include *elastomeric paints*, should almost never be applied above grade to historic masonry buildings.**

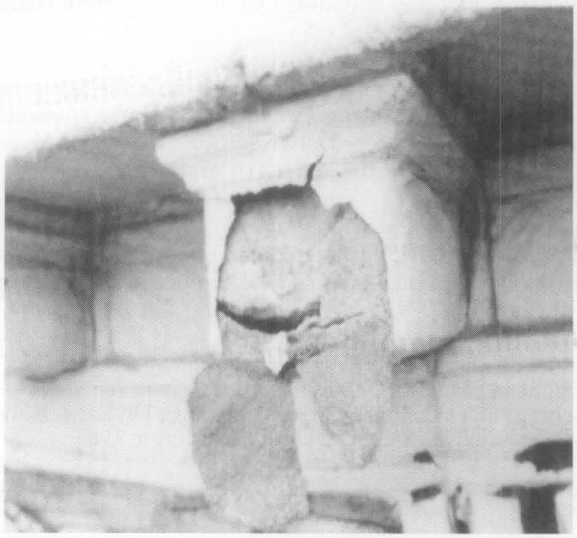


Figure 27. Instead of correcting the roof drainage problems, an elastomeric coating was applied to the already saturated limestone cornice. An elastomeric coating holds moisture in the masonry because it does not "breathe" and does not allow liquid moisture to escape. If the water pressure builds up sufficiently it can cause the coating to break and pop off as shown in this example, often pulling pieces of the masonry with it. Photo: National Park Service Files.

Summary

A well-planned cleaning project is an essential step in preserving, rehabilitating or restoring a historic masonry building. Proper cleaning methods and coating treatments, when determined necessary for the preservation of the masonry, can enhance the aesthetic character as well as the structural stability of a historic building. Removing years of accumulated dirt, pollutant crusts, stains, graffiti or paint, if done with appropriate caution, can extend the life and longevity of the historic resource. Cleaning that is carelessly or insensitively prescribed or carried out by inexperienced workers can have the opposite of the intended effect. It may scar the masonry permanently, and may actually result in hastening deterioration by introducing harmful residual chemicals and salts into the masonry or causing surface loss. Using the wrong cleaning method or using the right method incorrectly, applying the wrong kind of coating or applying a coating that is not needed can result in serious damage, both physically and aesthetically, to a historic masonry building. Cleaning a historic masonry building should always be done using the *gentlest means possible* that will clean, but not damage the building. It should always be taken into consideration before applying a water-repellent coating or a waterproof coating to a historic masonry building whether it is really necessary and whether it is in the best interest of preserving the building.

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Acknowledgments

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This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Comments on the usefulness of this publication may be directed to: Sharon C. Park, FAIA, Chief, Technical Preservation Services Branch, Heritage Preservation Services Program, National Park Service, 1849 C Street, N.W., Suite NC200, Washington, D.C. 20240 (www2.cr.nps.gov/tps).

Front Cover: Chemical cleaning of the brick and architectural terra cotta frieze on the 1880s Pension Building, Washington, D.C. (now the National Building Museum), is shown here in progress. Photo: Christina Henry.

Photographs used to illustrate this Brief were taken by Anne Grimmer unless otherwise credited.

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Keeping it Clean

Removing Exterior Dirt, Paint, Stains and Graffiti from Historic Masonry Buildings

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Heritage Preservation Services

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Preface

Despite the inherent hazards, cleaning historic masonry,which includes stone, brick, architectural terra cotta, and cast stone, stucco and concrete, is one of the most common—and most visible—undertakings when rehabilitating or restoring historic masonry structures. Yet basic information and good technical advice may be hard to find. As a result, those responsible for the care of historic buildings frequently must rely upon the recommendations of a cleaning contractor or a cleaning product manufacturer who may not be completely objective, or familiar with all the cleaning options currently available. The cleaning of historic masonry should thus always be carried out under the supervision and guidance of a preservation or conservation specialist.

The purpose of this technical report is to provide information on removing dirt, stains, paint and related coatings, graffiti, and other disfiguring or potentially harmful substances from exterior masonry. First, however, there is a general discussion on all aspects of planning and carrying out a cleaning project, including anticipating potential problems; correctly identifying what is to be removed; identifying all building materials to be cleaned as well as other materials that might be affected by cleaning; and testing cleaning procedures to ensure the most successful project. The report also includes warnings about using certain techniques on specific building materials, as well as possible dangers to project personnel and the building's environment.

Unless otherwise credited, photographs were taken by the author.

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Part II Choosing the "Gentlest Means Possible"

Part I
What to Consider Before Cleaning

Reasons for Cleaning

There are two primary reasons for cleaning a historic masonry building: 1) to improve the appearance of the structure; and 2) to remove dirt, stains, coatings, efflorescence (salts) and pollutants that may be causing deterioration of the masonry. Generally, the two are intertwined, but the most common motivation for cleaning masonry is the desire for cosmetic improvement. It is easy to understand this rationale, especially considering the positive visual impact of a clean building.

Cosmetic Improvement

A most important factor to consider before cleaning a historic masonry building is its patina—the color and surface texture, or the appearance which only time can impart. Patina usually includes a combination of surface stains, deposits, discoloration, and changes to the surface texture that may result from atmospheric dissolution and erosion. Naturally, patina includes a certain amount of dirt. As long as it does not contribute to, or conceal deterioration, patina is indeed part of the character of a historic building, and careful consideration should be given to its preservation. Determining when patina may be harmful or disfiguring must be done on a building-by-building basis, and will depend on the *type of masonry, the type and degree of soiling, and how much it might be obscuring damage to the masonry units themselves or to the mortar joints.* Careful removal of dirt and pollutant crusts can restore many aspects of the original appearance of the masonry—the color, texture and carved detailing that might have been hidden for years.

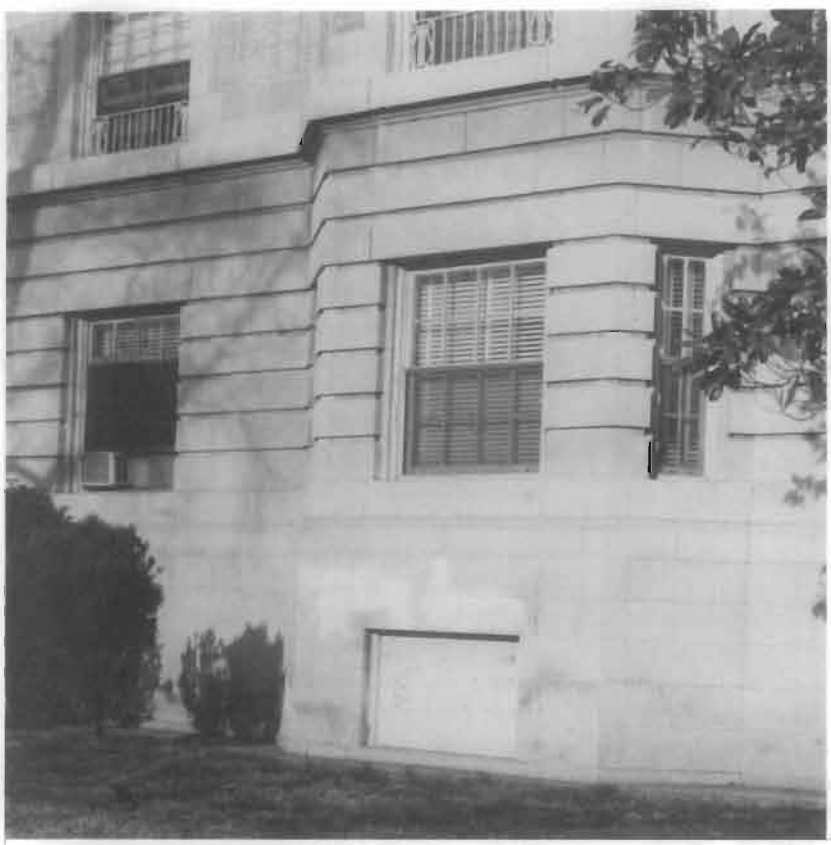


Figure 1. When an inappropriate chemical cleaner was used to remove graffiti, it resulted in permanently bleaching the limestone foundation, and left a mark as unsightly as the graffiti.

The unwelcome presence of graffiti usually triggers an urgent need for cosmetic improvement. An owner or building manager would likely want to remove graffiti as quickly as possible after it appears. Prompt removal is, in itself, a logical approach to the problem because it tends to discourage the incidence of more graffiti. On the other hand, if cleaning is undertaken too hastily, the results may be less than satisfactory (figure 1).

Removing paint from masonry, particularly from brick, is another common "cleaning" treatment, although it may not always be an appropriate or successful treatment for the building. Often, it may be preferable to retain the paint. Painted brick buildings were very popular throughout several historic periods. Many, in fact, were painted immediately after construction. Decorative treatments, such as the penciling of mortar joints, should be carefully examined; they may be original or may have acquired significance over the years. Paint may also have been applied as a protective coating, usually on

some of the more porous types of brick and sandstone; or applied to camouflage alterations or incompatible masonry repairs. All of these factors should be taken into consideration before paint removal is begun. If all nondamaging methods of paint removal have been tried and proven ineffective, it may be best to leave the masonry painted. Or, if the paint is in poor condition, the best approach may be to remove only the loose and peeling paint to a sound surface, and then repaint.

Slowing the Processes of Deterioration

The strongest practical argument in support of masonry cleaning is that it may slow the processes of deterioration and decay. Heavy layers of dirt not only interfere with natural weathering and washing patterns, but also obscure deterioration (figure 2). Cleaning is often necessary to help the architect or building conservator detect problems, and correctly interpret them, in order to take corrective measures, and to prepare a regular maintenance schedule for the building. The cleaning process itself, as well as the close-range view of historic masonry afforded by the scaffolding or other access equipment, also provides an important opportunity to evaluate the condition of the building. Once rid of dirt and pollutant crusts, the conditon of the masonry will be more clearly revealed.

One of the best reasons for a regular cleaning program is that it may remove efflorescent salts from the masonry, thereby reducing potentially harmful salt buildup within the masonry,which can cause spalling or delamination. Regular cleaning or washing can help control plant or other biological growth on a building; it is a safer and gentler approach than applying herbicides that are potentially harmful to the masonry.

Generally, regular cleaning or washing is good preservation and maintenance practice for calcareous stones such as limestone and marble. But it is not as necessary for the less soluble siliceous stones, such as granite and some sandstones, nor for some brick and some glazed architectural terra cotta, all of which have a harder, more impervious outer layer, and are thus better protected from dirt penetration than calcareous stones.

Figure 2. The building on the left is an obvious candidate for cleaning, as the heavy black crust may be concealing or contributing to deterioration of the stone. Despite its more recent cleaning, the stone facade of the house on the right exhibits the same distinctive, and hard-to-eliminate rainwater wash patterns under the eaves and window sills, as its unwashed neighbor.

Identifying the Masonry Substrate

Avoiding Damage

The first and most important step to be taken before beginning any masonry cleaning project is to identify the masonry. When dealing with stone, it is important to select a cleaning method or chemical solution best suited for the kind of stone—that is, one that will not dissolve or etch it. It is also useful to have information about the chemical and geological characteristics of the stone. (For example, although most sandstones may be safely cleaned using acidic cleaners, some sandstones are calcareous, and thus may be damaged by acid.) Gathering detailed geological data is not always possible if the factors of time and cost are prohibitive. However, it *is* essential that the generic stone be identified (i.e., whether it is limestone, marble, sandstone, or granite) because of the differing properties of porosity, solubility and hardness, and mineralogical composition. It is these properties that determine which cleaning methods can be used without adversely affecting the stone.

Tricks of the Eye

Another potential problem is that what might appear to be one type of masonry may actually be another. For example, architectural terra cotta, artificial cast stone, or pre-cast concrete were often manufactured to imitate natural stone. Pre-cast concrete or "cast stone" was being used imitatively as early as the late eighteenth century and still is to this day. Architectural terra cotta was used with this intent in the mid-to-late nineteenth century, and through the early twentieth century. Both materials were popular for decorative features such as window and door moldings. Terra cotta, in particular, was applied on upper floors of tall buildings where distance enhanced the illusion of stone.

Clearly, it is important to identify the material, since the best cleaning method for one type of masonry may not be as effective on another type, and may even cause damage. Many buildings feature a combination of materials. It is not unusual for a building or even a single facade to be composed of more than one type of masonry (brick with stone trim is particularly common), which may mean that more than one cleaning method will be necessary. If, after careful examination, there is any doubt about the type of masonry, a 3 percent solution of hydrochloric (muriatic) acid dropped from an eyedropper on an inconspicuous spot will quickly clarify the situation. This solution will bubble on calcareous stone, and on other acid-sensitive masonry, but will have no reaction on siliceous stone and acid-resistant masonry.

Indeed, some parts of a building, particularly decorative features, may not be masonry at all (figure 3). Frequently, such features as window hoods, cornices and balustrades may be metal, such as cast iron, galvanized sheet iron or zinc. When painted, they give an intentional appearance of masonry. Some features may have been fabricated of wood, then coated with a sanded paint to give the illusion of sandstone. Thus, the need to correctly identify the type of masonry, or other non-masonry materials on a building cannot be over-emphasized when planning a cleaning project.

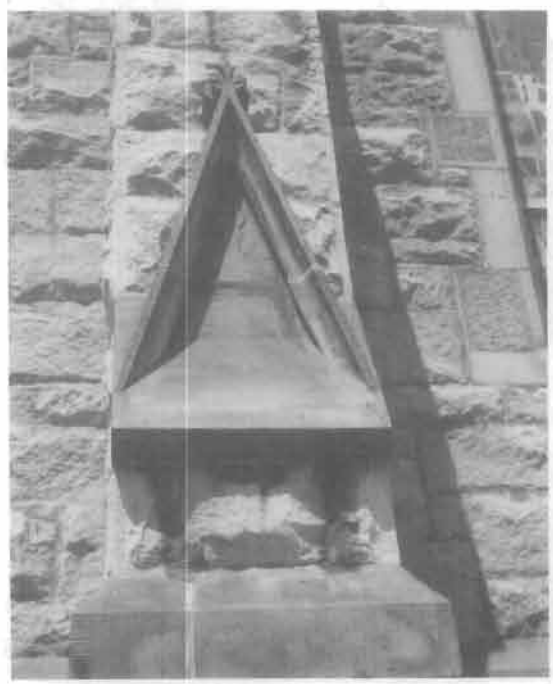
Figure 3. Know what you are cleaning. If the painted surfaces of the projecting bay window on this once elegant Second Empire brick mansion were still intact, it would not be easy to identify the beltcourse as sandstone, the windows and window frames as wood, and the cornice and all of the window hoods as pressed metal. Cleaning so many different building materials may require a variety of techniques and treatments.

Identifying the Substance to be Removed

After the masonry substrate has been identified, the next step is to identify the substance or substances to be removed. The more information available about the substance to be removed, the more successful the cleaning effort will be. For example, the cleaning project can be greatly facilitated by knowing the composition of each paint layer, the cause or source of the stains, the primary components of the dirt, or the probable source of the efflorescence. And it is not uncommon to discover that all or part of a building has been treated with water-repellent coating. Unless the coating has caused discoloration or streaking, the fact that such a coating exists at all may be known only if cleaning test patches fail to react as they would on uncoated masonry.

Dirt and Pollutant Crusts

Dirt or "soiling" on masonry buildings may consist of particles of dust, sand or grit, or tarry soot (resulting from incomplete combustion of fuels). The exact composition of the dirt will vary according to the geographic location of the building, as well as its use. A building in an urban, or heavily industrial area, is likely to exhibit a completely different type of soiling from a building in a rural or agricultural area—or a building near the seacoast or in the desert. While dirt and dust on one building may result from heavy vehicular traffic in the area, soiling on another building may result from human traffic.



Figures 4a-4b. Decorative architectural features that project from a wall surface, such as this granite belt course above an intricately-tooled limestone lintel, and this sandstone pinnacle topping a limestone buttress, may shield or protect masonry surfaces beneath them. But they are also responsible for creating unusual "wash" patterns and black crusts that form underneath them, further complicating cleaning projects.

Dirt or soiling may include disfiguring pollutant or sulfate crusts, which usually build up in sheltered or protected areas not regularly washed by the natural action of rain. It is particularly common under cornices, window sills, or other projecting decorative features (figures 4a - 4b). Some pollutant crusts resulting from a chemical reaction of stone to airborne particulate matter, or particules in which cementing material of the stone has actually incorporated itself, indicate the beginning of dissolution of the stone and incipient decay. Removing these crusts will necessarily involve a loss of a small amount of stone (figure 5). While removal is generally recommended because pollutant crusts hasten stone dissolution, extreme care must nonetheless be exercised to ensure that loss of the stone is minimized.

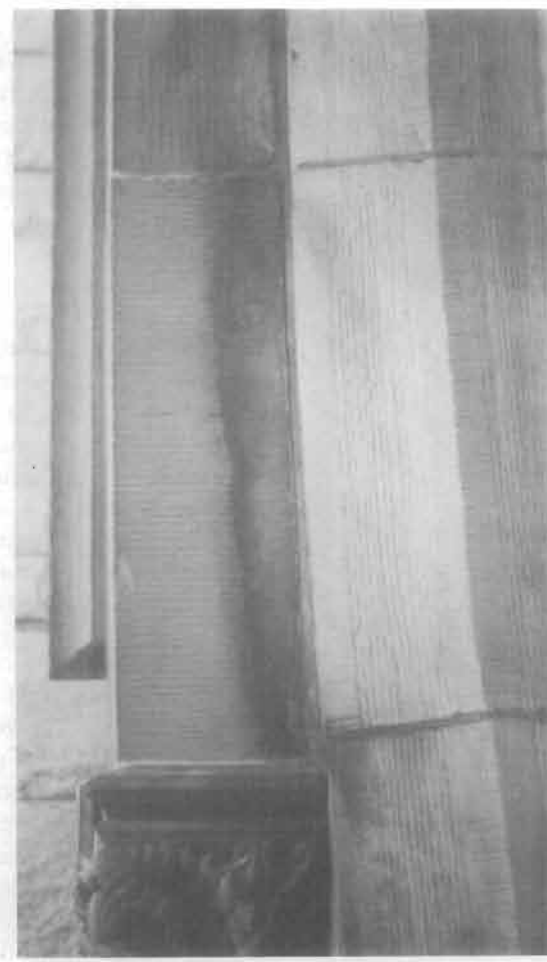


Figure 5. It is unlikely that this blackened crust can be removed without some loss of the tooled sandstone surface, because the sulfate crust has become integral with the stone.

Stains

Unlike particulate dirt, which tends to lie on the surface, stains in masonry are discolorations produced by foreign matter that has penetrated into—or permeated—the masonry. Stains can also result from a chemical reaction between the masonry and the foreign matter, or from impurities in the masonry itself. Common masonry stains include metallic stains caused by iron (rust) or copper, industrial stains of grease, oil, and tar, and biological and plant stains caused by lichens, mosses, algae, and fungal growth such as mildew. Even after removal of the vines themselves, ivy and Virginia Creeper can leave their "marks" on the masonry, which may also have to be removed by cleaning. Discloration can also occur when mineral inclusions or impurities which occur naturally in some stones, or in the clay of some bricks, react to water or chemical cleaners.

Graffiti

Graffiti created with paint or another medium may also be considered a stain. If graffiti is sprayed-on, it is generally likely to permeate the masonry (unless glazed or polished) in the same manner as most other stains. Thus, its removal must usually be carried out in the same manner as other stain removal.

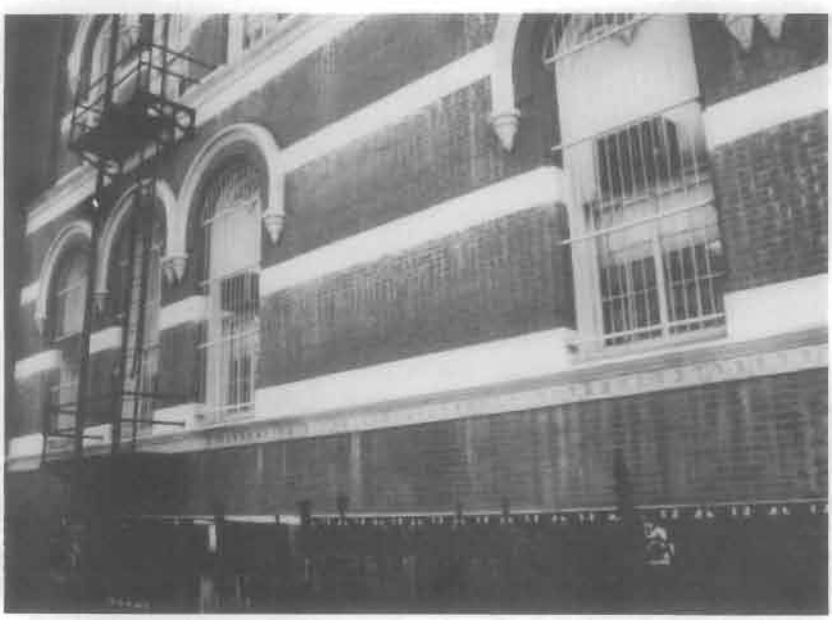


Figure 6. Chalking white paint from decorative metal and stone stringcourses has "bled" and run down the unpainted brick walls. Unlike efflorescence, for which it might be mistaken, chalking generally cannot be washed off, and paint remover will be required.

Paint and Other Coatings

Removal of paint or other coatings will, of course, be facilitated by knowledge about the kind or kinds of paint, and the number of layers to be removed. For example, it is useful, if at all possible, to know whether the paint is oil-based, water-based, or, as is often the case, whether it consists of a variety of paints and coatings, which might include layers of cementitious masonry paint, whitewash or limewash. In some cases, the pigment might be incorporated into the substrate, as is often typical of stucco and traditional limewashes.

Questions may arise about each layer or coating, further complicating the overriding need to remove the offending substance while not damaging the historic masonry. For example, if there is more than one layer of paint, is it consistent over all of the building surface? Or is there an "invisible" water-repellent coating or a wax coating, or perhaps even worse (from the standpoint of removal), an asphalt or bituminous waterproof coating on some areas? If so, will it come off successfully, or might it be better to camouflage it by repainting?

Efflorescence

Efflorescence, the result of capillary action pulling soluble salts up from the ground into the masonry, usually appears as a whitish haze on the exterior surface of masonry. Sulfate deposits may result from carbonates in lime mortar and airborne or water-deposited pollutants in the atmosphere. Another common source of efflorescence in brick is the firing process itself.

Efflorescence may also appear on a masonry surface after chemical cleaning. Some efflorescence is temporary, and will be removed by rain. Other types may disappear for awhile, but return periodically, and some require considerable and repeated efforts to eliminate. It is therefore always necessary to ascertain the source or sources of efflorescence, and it may even be useful to identify the salts that comprise the efflorescence. Further complicating the identification process, white paint from a painted surface above that has "bled" onto a

masonry surface below (particularly common under window sills) might be mistaken for efflorescence (figure 6). In short, it is very easy to misinterpret what is on the surface.

Combination Problems

Often, a cleaning project will involve removal of more than one substance. What first appears to be a straightforward task of paint removal may be complicated by the discovery of multiple layers of different types of paints and coatings on another elevation of the same building, or perhaps on only the first floor of the building. Moreover, what may initially appear to be one substance may, upon closer examination, turn out to be another, or often a combination of substances.

Project Personnel

Once the masonry and the substance to be removed have been identified, the next step is to match potentially appropriate cleaning methods with the particular project at hand.

Role of the Preservation Consultant

To ensure the best possible job, a professional preservation consultant should be retained, preferably someone with a technical or scientific background (an architectural conservator, a restoration architect, or a chemist or geologist). The advice of cleaning contractors or product representatives may be prejudiced by familiarity with only one or two cleaning techniques, or a desire to sell a particular product. Generally, their recommendations should not be substituted for the experience and impartiality of a technical preservation specialist or scientific consultant.

Basically, the consultant should supervise all aspects of the cleaning project—planning, identifying the masonry, identifying what is to be removed, selecting the cleaning methods and materials, selecting the contractor, and supervising the actual cleaning to ensure consistent quality and to minimize any possible damage to the surface.

Role of the Preservation Consultant

- Identify the building's materials.
- Evaluate condition of the masonry materials.
- Identify what is to be removed.
- Supervise the testing of the cleaning methods.
- Analyze the test patches.
- Based on the test patches, select the cleaning methods that most effectively clean the masonry without causing damage.
- Prepare specifications based on these test results (if they have not been prepared already prior to testing).
- Select cleaning contractor (if not already chosen).
- If possible, have cleaning test repeated by cleaning personnel who will do cleaning.
- Supervise actual cleaning process to ensure consistent quality.

Selecting a Cleaning Contractor

A carefully executed cleaning job requires the experience of a reputable cleaning contractor who specializes in cleaning and restoring historic masonry buildings. Negotiating a fair price with one qualified contractor may be preferable to asking several contractors to bid on the cleaning job. The bids and final contract should be based on specifications prepared by the independent preservation consultant. A good contractor should be willing to provide information on the cleaning process, and on the product ingredients, and also provide references in the form of completed cleaning projects.

It is important that a consultant, who is experienced in such evaluations, visit at least one or two projects in order to inspect the quality of the work. A well-executed cleaning project should not show any signs of mechanical or chemical abrasion, nor should it exhibit areas or patches of efflorescence, which might indicate the use of too strong a chemical or improper or inadequate rinsing. (Sometimes efflorescence on a very recently cleaned building is only temporary, and will gradually wash away. It may be the result of salt-laden moisture *within* the masonry

suddenly being released when surface dirt or a coating is cleaned off.)

A responsibly and sensitively cleaned historic masonry building should retain some of its before-cleaning patina, perhaps appearing slightly "dirty," as if it had not been overcleaned. Clearly, however, there may be some aspects of a recently cleaned surface that are not so easy to explain. Sometimes an abraded or eroded surface is the result of natural weathering or a "flaw" in the original materials, or damage from an earlier, harsh cleaning treatment. Or what appears to be a stain may, in fact, be the result of an unexpected reaction of a natural impurity in the stone to a chemical cleaner. In short, as will be repeated again and again, it is not always possible to predict the exact outcome of a cleaning project because of the many variables associated with historic masonry. But despite some unavoidable uncertainty, a cautious, conscientious approach by the consultant, building owner or manager, and the contractor will always result in a better cleaning project—one that does not damage the historic masonry.

Although cost is often a factor in a cleaning project, the contractor should not be selected solely on the basis of a low bid, but rather on the quality of previous work, as well as *on* the basis of test patch results. Local historic district commissions and review boards, State Historic Preservation Offices, regional offices of the National Trust for Historic Preservation, local chapters of the American Institute of Architects (AIA) and the Association for Preservation Technology (APT), may be able to suggest reliable consultants and cleaning contractors experienced in cleaning historic buildings.

What to Require in a Contract and Specifications

Because cleaning a historic masonry building involves so many unexpected and unknown factors, each project is unique. It would be impractical to try to provide a standard set of specifications to cover *all* of the potential situations that might be encountered. But, while the actual specifications will vary from project to project, there are certain principles that should govern any cleaning project to ensure the best possible outcome.

1. The specifications should be very precise. The more specific they are, the less chance there is for mistakes.
2. Qualifications of project personnel should be included in the specifications.
3. If specifications are prepared before testing, they should clearly state that mock-up test areas will serve as quality-control for the project.
4. If testing has already been carried out, the specifications should state the exact cleaning method (technique and materials) to be used based on the testing.
5. If a specific product is to be used, it should be clearly stated so that the contractor is aware that *no* other product may be substituted, unless it is with the prior approval of the preservation consultant or supervising architect—and of course, only after it has been tested on the building. A building may often require more than one cleaning method or cleaning product. If so, each method to be applied to a different material and in a different location on the building should be identified.
6. The cleaning process should take place only under the careful supervision of a qualified professional preservation consultant or preservation architect. The cleaning method outlined in the specifications will have been prescribed only after careful testing on the building with time allowed for weathering. Any unforeseen problems that might arise during the course of the cleaning should be brought to the attention of the consultant (and the owner), and the cleaning halted until the problem is solved.
7. Finally, even a well-written specification is of no use if it is not read and followed.

Testing

Because of the wide variety of unforeseeable factors, the cleaning method or methods should always be tested on an inconspicuous area of the building and preferably in more than one location (figure 7). Such tests must be carried out before attempting any large-scale masonry cleaning project. Failure to do so may have disastrous consequences for the outcome of the cleaning as well as the long-term preservation of the historic building material. Testing should be carried out by the consultant or conservation specialist, or by the contractor, under the consul-

Figure 7. A contractor prepares equipment before testing a low-pressure water wash on a Roman brick and terra cotta building. Photograph: Sharon C. Park, AIA

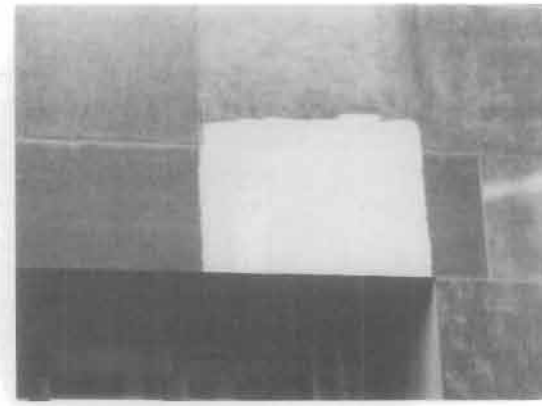


Figure 8. A test cleaning patch (unfortunately in a rather prominent location) on limestone discolored by urban grime and pollution reveals a marked color difference between the cleaned and the uncleaned stone as well as an unexpected discoloration (probably caused by a substance splashed on the wall at an earlier time). Removal of this spot may require a special cleaning treatment. Photograph: Sharon C. Park, AIA

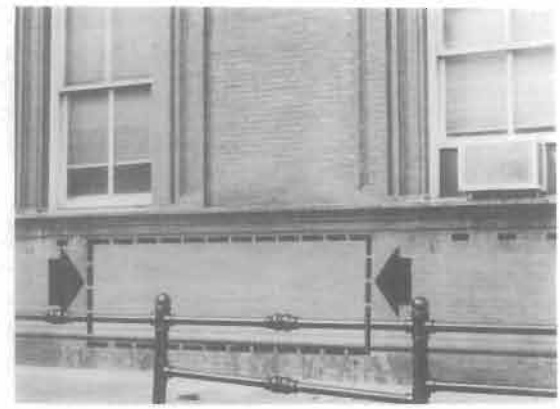


Figure 9. A test patch on brick to remove a century of dirt reveals only a slight difference in appearance between the cleaned and the uncleaned brick. The hard-baked outer skin of the brick provides a surface that is not only impervious to dirt penetration, but resists dirt accumulation. Photograph: Christina Henry

tant's careful supervision. Carefully controlled testing is probably the only reliable way to determine the best or most appropriate cleaning techniques and pressures to be used in a particular project (figures 8-9).

Selecting an "Appropriate" Water Pressure

The process of selecting the most appropriate water pressure should always begin with the lowest pressure, or the "gentlest means possible," proceeding gradually to a higher pressure, as needed. Although that philosophy is certainly sound, its application in a practical sense is very much more difficult. The difficulty lies in the fact that, although the terms "low," "medium" and "high" pressure have traditionally been used in cleaning specifications, they are general terms and subject to wide interpretation. Because of incalculable or unpredictable factors associated with pressure equipment—combined with different types of historic masonry itself—it is virtually impossible to define the categories of low, medium and high in a manner that would apply equally to all cleaning projects.

Precise definition of these pressures is further complicated by the fact that pressure measurement, or psi (pounds per square inch) varies according to the following: pressure as measured by a gauge at the pump; the volume of water (or other liquid cleaning agents) delivered per minute; the size of the nozzle or spray head opening; and the distance between the spray head and the masonry surface. But since most psi measurements are taken at only one location, these seemingly precise measurements may bear little or no relationship to the actual pressure reaching the building. As the variables multiply, it becomes more and more obvious that psi numbers do not really mean very much, or at least do not mean the same thing to all who employ them in cleaning. Thus, although exact pressures may sound precise, the fact that they are not must be kept in mind.

For this reason, until a system can be perfected that will allow greater certainty or precision, selecting a cleaning method and pressure should be done only after careful testing has produced a satisfactorily cleaned test patch to serve as a standard by which the rest of the project can be measured. *Thus, references here to specific pressures are provided only for comparative purposes, and should be considered only as general guidance.*

Choosing Representative Types of Masonry

Finding the appropriate cleaning method can be further complicated when dealing with especially fragile, damaged or deteriorated masonry. These are factors that must be taken into consideration when planning to clean historic masonry.

Areas of the building chosen as test spots should accurately represent the types of masonry material to be cleaned. As noted earlier, another masonry material may have been used to simulate stone. Also, a harder, higher quality brick or "face brick" was often used on the facade, while the less visible side and rear elevations were often covered with a cheaper, usually softer "common brick" as an economy measure. Results from a cleaning test performed on common brick, or a heavily textured brick, would probably not be applicable to smooth, face brick. Likewise, tests on upper parts of a building may not accurately reflect conditions on other areas, such as the foundation or horizontal surfaces that may have been treated with a waterproof or water-repellent coating.

Choosing Representative Soiling

The area or areas selected for testing should represent both the amount and type of the dirt deposits, surface pollutant crusts, stains, efflorescence, or paint on the majority of the building surface. For example, a prominent area of the facade may be stained, disfigured with a heavy coating of soot, or covered by heavy paint buildup. Another area of the building may be only lightly soiled or have only one coat of paint. These might require very different cleaning procedures. A project that proceeds after testing a limited area only might produce very unsatisfactory results.

To ensure the most accurate test results, as much as possible of the dirt, bird droppings, or problem substances should be removed from the surface by hand-scraping or brushing with non-metallic brushes *before* test cleaning. (This same practice should, of course, be followed when the actual cleaning is undertaken.)

Evaluating the Test Patches

Althought a somewhat larger area is preferable, an area approximately one square meter or approximately one square yard will generally serve as an adequate test patch. If there are different types of masonry, or widely dissimilar substances to be removed, several test patches may be necessary. Representative, but inconspicuous areas should be chosen in case any of the tests are not successful, or in case the project does not progress beyond the testing stage.

One building, regardless of size, may require a variety or combinations of cleaning methods. If the type of scaffolding allows, it is advisable to clean the entire building using the gentlest technique to remove the prevailing substance. Then, localized stains on decorative features can be addressed individually. Too strong a cleaner for overall cleaning may harm the masonry. Instead, a milder cleaning solution should be used and augmented, if necessary, by additional applications on hard-to-clean areas or difficult stains. *Always underclean, rather than overclean.*

Test patches can be evaluated accurately only after they are dry. If chemical cleaning is being tested, non-staining pH papers should be held on the surface of the test patch area before and after cleaning to determine if any acidic or alkaline residues remain on the surface. If residues are detected, additional water rinsing or application of a neutralizing solution should be carried out until pH tests indicate that all residues have been removed.

A test patch should be allowed to weather as long as possible before the cleaning project is begun to give ample opportunity for an accurate evaluation of the results. One year is the preferred amount of time; this allows the patch to be exposed to a complete weathering cycle (figures 10a-10b). If this is not feasible, it is a good idea to

Figures 10a-10b. This test cleaning patch on brick and sandstone was allowed to weather over a full year, while other aspects of the rehabilitation were carried out. Finally the entire building was cleaned with a proprietary paint remover sprayed-on under low-pressure and then rinsed by workmen from a truck-mounted hydraulic platform lift.

wait as long as possible, and at least one month at a minimum. Once a cleaning project is begun, the work should proceed in clearly defined areas (preferably delineated by structural or architectural features), since it is difficult to match cleaned areas, especially if the project is halted for several days or more.

Reasonable Expectations

Tests are usually carried out under optimum conditions, and may therefore show better results than the actual cleaning project. For example, a cleaning contractor bidding on the job will naturally try to achieve the best possible result in a sample cleaning area in order to obtain the contract. It is also easier to clean a small area at ground level within a specified amount of time than to achieve the same results several stories above ground by workers who are tired after a long day's work. Overly optimistic estimates of time and costs supplied by a contractor based on the results of a test patch can be misleading.

But an experienced and reputable contractor will be aware of these inherent problems and should be able to provide a reasonable estimate based on the testing.

The test patches serve as a "standard of clean" and will provide guidance regarding the best cleaning method for the job; for example, how many applications of the cleaning material will be necessary if a chemical product is used, the dwell time (the length of time an application should remain on the surface), and what pressures should be used for the cleaning and the final rinse.

Scheduling the Cleaning Project

One of the most important considerations in a cleaning project is scheduling. Since the cleaning method cannot be selected until several techniques have been tested, it follows that the test patches should be done at the start of a rehabilitation or restoration project. And, because of the need for adequate time for the cleaning tests to weather before selecting one, the actual cleaning itself should be the last, or one of the last things to be done in the project.

Never begin cleaning when there is any likelihood of frost or freezing, as most cleaning operations involve the use of water. When the water penetrates the masonry pores during cleaning, the interior of the masonry retains moisture for

some time before it evaporates, even though the exterior surface may appear dry. If a frost occurs, the moisture inside the masonry units will freeze, which could eventually cause the masonry surface to spall. The presence of salts within the masonry wall may exacerbate the process.

The best times to clean a historic masonry building (other than in tropical or arid climates) are late spring, early summer and early fall when there is no danger of freezing. While warmer temperatures contribute to a faster chemical reaction, too much sun and too high temperatures do not result in a good cleaning project either. If cleaning is done in very hot weather, the masonry should be shielded from excessive heat by hanging protective netting or tarpulins around it.

Repointing, if necessary, should generally be carried out before cleaning to prevent damage to interior surfaces caused by liquid cleaning materials penetrating through open joints in the masonry.

Minimizing Hazards of Cleaning

Although most large-scale cleaning projects should be carried out by qualified cleaning professionals accustomed to working with historic buildings, it is still important to keep in mind all of the precautionary guidelines associated with masonry cleaning. Potential harm to the historic masonry and other building materials often used in conjunction with stone and brick, as well as potential harm to the environment and cleaning personnel must be carefully evaluated before initiating a cleaning project.

Protecting the Historic Building

Mortars, especially those of the traditional lime-based formulations, are among the most vulnerable substances to be considered when preparing to clean a historic masonry building. Deteriorated mortar joints can lead to major problems with water washing and other aqueous techniques. The entry of large amounts of water through spraying or prolonged misting may result in damage to interior plaster and other finishes, and in exterior staining as well. Water pressures for cleaning and rinsing operations should be monitored carefully to minimize physical damage to the masonry. Loose mortar can be dislodged by rinsing at too high a pressure, permitting deep penetration of water within the building.

The acidity or alkalinity of cleaning chemicals must be controlled to suit the chemistry of the individual masonry materials. Because chemical cleaning with acidic products is always potentially dangerous to acid-sensitive masonry and lime mortars, acidic cleaners must therefore be diluted carefully, in keeping with the sensitivity of the masonry. To accomplish this successfully, accurate identification of the masonry is essential. This may not be easy. Limestone and some cast stone, or other types of artificial stone, can look very similar.

Many other historic building materials can be damaged by chemical cleaning agents. Glass, glazed brick, and architectural terra cotta will be etched by strong solutions of hydrofluoric acid if not covered adequately. Metal, wood and paint can all be damaged by chemical cleaners, and must be shielded. Such materials can be temporarily protected by plastic sheeting or peelable coatings specifically made for this purpose (figure 11).

Figure 11. Removal of 100 years of grime from the brick and terra cotta facade of the Pension Building (now the National Building Museum), Washington, D.C., was accomplished by workmen on a swing stage using a chemical cleaning product. Note the polyethylene covering the windows to prevent damage. Also note the protective clothing for the workmen which hangs on the platform while not in use. Photograph: Christina Henry

Protecting the Environment

Damage to property, shrubs, trees and ground vegetation in the immediate vicinity can be avoided by using proper controls to avoid overspraying and by covering or shielding plants and property. Site drainage must always be considered when using an acqueous cleaning method, and disposal of toxic chemical runoff and dissolved paint may pose an even greater problen. Lead paint sludge should be placed in suitable containers and disposed of in accordance with enviromental regulations. In the case of organic solvents, a well-designed storage location is necessary to prevent explosion and fire. Use of many of these cleaning materials may require special permits or approval from local authorities, especially if run-off is to be channeled into city storm sewers.

Protecting Cleaning Personnel

Cleaning compounds pose many safety and health hazards, and working personnel must be equipped with protective clothing, gloves and toxic vapor masks. Strong cleaning agents can cause skin burns and irritation, and adequate eye protection is essential at all times. Hydrofluoric acid can cause severe burns and can also penetrate the skin, resulting in bone damage. Organic chemicals are equally health-threatening, because they are absorbed systemically through the skin and are carcinogenic. When using spray equipment containing acid cleaners, extreme caution must be taken to release the pressure slowly so that the contents do not spray or splash the operator.

Part II
Choosing the "Gentlest Means Possible"

Most cleaning techniques suitable for use on historic masonry buildings rely on aqueous or water-based systems, and chemicals. Water-based solutions (which can include detergents) and chemical solutions can be successfully applied separately or in combination, aided by a variety of hand-scraping methods. Properly used, these techniques can safely remove dirt, stains, graffiti, paint or other surface coatings, efflorescences (salts), and plant and fungal growth and stains from historic masonry buildings.

Water Cleaning to Remove Dirt

all types of masonry

Water-based cleaning can be the gentlest and simplest operation, causing the least amount of damage, if certain precautions are followed. It may also be the least expensive cleaning procedure. It is probably the most versatile technique available for sensitive cleaning and removal of dirt and pollutant crusts from *all* types of historic masonry materials, and it is generally the *simplest* method for cleaning limestone and marble. While there are several cleaning methods in which water is the sole ingredient, water is also the principle cleaning agent in other methods which utilize detergents and chemicals.

There are four principal types of water washing: soaking (misting and spraying); low-pressure and medium-pressure water washing; low-pressure and medium-pressure water washing supplemented with non-ionic detergents; and steam cleaning, by itself, or supplemented with non-ionic detergents.

Soaking (Misting or Spraying)

Prolonged spraying with a fine mist is a relatively simple washing method. This technique provides maxium wetting using a minimal amount of water. A mist is produced by inserting fine mesh filters over hose nozzles. Continuous soaking of the surface is then accomplished by running lengths of punctured hose (or a moveable pipe, or one supported on scaffolding) hung under the eaves or along the cornice line of the building. Water pumped up through a compressor at ground level slowly trickles down or sprays the building facade.

Low-pressure, low-volume misting devices with a wide angle of coverage may be the most efficient of the soaking techniques. They can also be set up to handle selected areas of heavy dirt or soot encrustation such as black sulphate or gypsum crusts that form in protected areas (especially under moldings and eaves not washed by rainwater) on limestone, marble and other calcareous stones. The effectiveness of this method relies on the fact that the sulfate crust, in which the dirt is incorporated, is several times more water soluble than the stone. Thus, water loosens the gypsum crust by partial dissolution, along with the material trapped within the network. As the description implies, this is a slow process and may take from four to six hours up to a week or more to soften heavy crusts or dirt deposits. After the dirt has softened, its removal can be facilitated by hand-scrubbing with non-metallic brushes or by using a moderate-pressure water wash; a wooden scraper may help in removing heavy sulfate crusts. A variation of this method is a timed schedule, or pulsed spray, which alternates periods of soaking (misting or spraying) with dry cycles, using a timer to regulate the intervals so the masonry does not dry out. This approach is also good for loosening dirt and pollutant crusts, although its use has been fairly limited in the United States. Before deciding to use any aqueous system, stone should be tested for free iron (iron not completely bound) to avoid the possibility of iron staining.

Low-Pressure and Medium-Pressure Water Washing

Another water-based cleaning method is low and medium-pressure "power" washing. It is always best to start with the lowest pressure possible, and to increase

the pressure only as much as necessary to loosen the dirt and adequately clean the building. Low-pressure water washing can be carried out with a common garden hose in a small-scale cleaning project, that is, one limited to a two-story structure that can be reached conveniently with a ladder. Again, removal of heavy grime can be facilitated by hand-brushing and scraping prior to washing. This is a very effective, gentle, and easily controlled method, unlikely to cause any harm to the building.

Low-pressure washing may also be successfully used for some large-scale cleaning projects, requiring scaffolding, or perhaps a "man lift" to provide access. Deteriorated areas will need specialized treatment, possibly by hand. After cleaning a building with heavy dirt encrustation, a final rinsing or a second cleaning using chemicals may be necessary in order to remove dirt already loosened by the initial washing.

Low-Pressure and Medium-Pressure Water Washing with Detergent Supplement

The best combination of prolonged spraying or dripping, low-to-medium-pressure washing, and brushing and hand-scraping, must be determined experimentally and on a case-by-case basis. While polished surfaces such as polished granite or glazed architectural terra cotta may sometimes be cleaned effectively of dirt simply with a low-to-medium-pressure wash, adding a non-ionic detergent that does not deposit a solid, visible residue, may often hasten cleaning. (Examples of non-ionic detergents include Tergitol by Union Carbide, Triton by Rohm & Haas and Igepal by GAF). Non-ionic detergents will also be needed to clean most textured masonry such as rusticated stonework, rough-surfaced brick, and intricately carved ornamental details; textured surfaces that hold dirt will require additional cleaning effort by hand-brushing with non-metallic brushes. After cleaning, it is important that the surface be carefully rinsed because, while not visible, a "gummy" detergent film tends to attract dirt.

With the exception of steam cleaning, which utilizes heated water, most water-based cleaning methods discussed here can be carried out successfully with cold water. Under certain circumstances however, warm or hot water may facilitate the cleaning process when removing greasy or oily dirt or stains, and sometimes in paint removal.

Steam

Steam cleaning is another water-based cleaning method. Although once used extensively, it is no longer as popular, possibly due to the increased sophistication of chemical methods. In this procedure, steam is generated in a flash boiler and directed against the masonry surface with the use of a very low-pressure (10-30 psi) nozzle, generally with a ½ inch diameter aperture. The heat of the steam swells and softens dirt deposits enough so that the low pressure of the steam is generally sufficient to remove the loosened dirt from the masonry surface. However, the density of the steam makes it difficult for the operator to see or monitor the cleaning process, and because the steam is heated to such a high temperature, it is not only a potential hazard to the operator, but may damage the stone as well.

Steam cleaning is most useful today as a method of removing vine disks and other vegetation clinging to masonry surfaces, and for cleaning small, hard-to-reach or highly carved or ornamented areas without causing mechanical damage. In such instances, it may be necessary to precede the steam cleaning with manual scrubbing using a non-ionic detergent or a low concentrate chemical-based cleaner, or to follow steam cleaning with a low-pressure water rinse. Steam cleaning may also be a suitably gentle method for cleaning damaged or friable stone. Steam cleaning is a technique that, under careful supervision, may occasionally be used for specialized interior cleaning because it does not produce large quantities of water, and therefore reduces the possibility of damaging fine finishes.

Cautions and Precautions. Despite the fact that water washing methods may be the gentlest of all cleaning methods they are not without hazards. Even these methods can be abrasive. Water pressure should always be kept at the lowest level that will clean the masonry without damage. Too highly pressurized water can etch or otherwise scar masonry, and may penetrate through the masonry walls (figure 12).

Figure 12. Water at too high a pressure from a pinpoint nozzle has etched this white Vermont granite. Photograph: David A. Look, AIA

With any aqueous cleaning system it is generally recommended that a masonry building be repointed, if necessary, before cleaning (allowing ample time for the pointing to cure adequately before cleaning, as the water may dislodge green mortar). Another possibility is to use caulking compound to fill in some of the larger gaps in the mortar joints temporarily to prevent water infiltration during cleaning. Before embarking on an aqueous cleaning project, it is important to make sure that the flashing around chimneys is tight, and that there are no open joints around doors and windows where water may enter.

Long periods of soaking or spraying may result in excessive moisture penetration of masonry walls, possibly leading to corrosion of metal anchors, and consequent exterior staining, or damage to interior plaster and paint finishes. To avoid these problems, cleaning personnel should inspect the interior periodically to check for moisture penetration. Prolonged soaking or spraying may also irreversibly weaken the masonry itself, since masonry, like other porous materials, tends to decrease significantly in mechanical strength when saturated.

Water cleaning of a moderate size building can require several million gallons of water. When such large amounts of water are involved, it is important to have a good drainage system available for the run off. Additionally, many city water systems may be heavily chlorinated or have a high mineral content. If this is the case, the water used for cleaning should be purified or distilled to avoid introducing chloride salts into the masonry or mineral deposits onto the masonry surface. In addition, water should be pumped through plastic, rather than copper, pipes to avoid possible staining of the masonry. Water cleaning may be rather time-consuming and expensive, particularly if the removal of heavy crusts requires much hand-scrubbing.

It is important to realize that although some types of masonry may benefit from frequent water washing, others do not. While useful as a method of revealing sources of potential deterioration covered by dirt, frequent washing of some of the harder siliceous stones including granite and some sandstones, as well as brick, probably does not aid in their preservation. But the opposite is generally true of calcareous stones such as limestone and marble, whose long-term preservation may be enhanced by regularly scheduled water washing. Regular cleaning of calcareous stones (perhaps every seven to ten years in heavily polluted urban areas) can remove potentially harmful absorbed salts. On the other hand, calcareous stones also tend to be highly soluble and *too* frequent washing may result in accelerated dissolution and loss of surface caused by the slightly acidic water of some city water systems. In general, washing procedures for these stones should not be overly long to avoid excessive exposure of the stone to the dissolving nature of the water. The use of distilled water may further minimize dissolution.

To prevent possible staining of light-colored limestone or marble in areas where the local water supply has a high iron content, it may be useful to add a chelating or complexing agent such as EDTA (ethylene diamine tetra-acetic acid), to the wash water; this will combine with any metal ions present in the water and keep them in solution to avoid metal stains on light-colored stone.

Chemical Cleaning to Remove Dirt

If water-based cleaning is the gentlest and least damaging method of removing dirt from historic masonry, chemical cleaners represent the next level of intervention. Chemical cleaners may be required to remove heavy dirt buildup or layers of paint. Chemical-based cleaners for

masonry are generally one of three types: acidic cleaners, alkaline cleaners, or organic solvents. Acidic or alkaline cleaners are used for regular cleaning or dirt removal; alkaline cleaners or organic solvents are used for paint removal. All of these cleaners rely on water and most contain surfactants ("surface active" agents)—organic compounds that concentrate at oil-water interfaces, and exert emulsifying actions, and thus aid in removing soiling. (Sometimes the term "surfactant" is used interchangeably with "detergent.")

Pre-wetting masonry surfaces is generally recommended for both acidic and alkaline products. In addition to loosening the dirt, this reduces the amount of the cleaning agent and the dirt-laden rinse water that can soak into the masonry and the contiguous mortar joints. Chemicals are then brushed or sprayed on under low pressure—brushing the chemicals on may actually help loosen surface dirt. When surfactant products are used, spraying or brushing generates suds that boost cleaning efficiency by lengthening contact time of the active chemicals with the masonry. Manual scrubbing with a non-metallic brush can have the same effect, and also assists in loosening dirt. After a few minutes (as indicated in the product literature or determined by testing), the cleaner is washed off by flooding the surface with a moderate-to-high (400-600 psi) water spray at a rate of three to four gallons per minute, rinsing from top to bottom. Extremely heavy dirt accumulations or many layers of paint may require repeated applications of the chemical cleaner. A hot water rinse may also facilitate paint removal.

Acidic Cleaners

most granites, most sandstones, slate, unglazed brick, unglazed architectural terra cotta, concrete

Acidic products can be used on unglazed brick and terra cotta, and most granites, sandstones, slate and other non-calcareous or siliceous stones. But acid-based cleaners generally should never be used on acid-sensitive materials that might be etched or abraded by acid. This includes masonry with a glazed or polished surface (glazed architectural terra cotta, glazed brick, polished stone or glass) as well as acid-sensitive stone such as limestone, marble, or calcareous sandstone.

Acidic cleaning is a two-part process: first, the acid cleansing solution is applied to the pre-wet masonry surface. After completing its action, the acid solution is then removed from the masonry by a thorough water rinse. Hydrofluoric acid is the most commonly used acid cleaner for historic masonry, usually with some phosphoric acid added to prevent development of rust-like stains that may appear after cleaning. Hydrofluoric acid specifically dissolves carbonaceous pollutant products, or dirt, and in most cases does not leave water-soluble salts in the masonry if the cleaning is properly carried out. It should preferably be used at a concentration 0.5 percent, but may be used at concentrations as high as 5 percent.

Hydrofluoric acid works on granite, slate, sandstone and brick by dissolving a minute amount of their surface, thus releasing the dirt. In this way, the introduction of potentially harmful residual salts into the masonry is kept to a minimum. The masonry should be kept moist throughout the cleaning operation to avoid silica deposition (efflorescence or the formation of a whitish powder). As most chemical cleaners (both acidic and alkaline) must remain on the surface for several minutes, keeping the masonry moist will also maximize cleaning efficiency. A second or third application of the cleaning agent may be necessary to remove particularly heavy dirt deposits.

Most commercially available products contain thickening agents to form gels or pastes that improve the cleaning agent's ability to cling to vertical surfaces. They also contain secondary solvents of a lower evaporation rate than water, such as glycerine to enable the cleaner to remain moist longer on the masonry surface. However, care must be taken to avoid exposing the masonry to cleaners containing hydrofluoric or other acids for more than five to seven minutes.

A variety of commercially prepared acid-based cleaners for masonry is available: products for granite, brick and sandstone, afterwash products, concrete cleaners and mortar removal products. The principal ingredient in granite products (restoration cleaners) is hydrofluoric acid. The afterwash products contain weak organic acids such as acetic acid. The mortar removers and concrete cleaners are based on

hydrochloric acid. Many of these commercial products are very effective on historic masonry buildings if used according to the manufacturer's directions and under the supervision of a preservation consultant.

It may be difficult to obtain a list of all the ingredients or their exact proportions for most of these products, since they are usually of a proprietary nature, and not patented. However, the Occupational Safety and Health Administration (OSHA), requires that Material Safety Data Sheets be supplied by manufacturers to distributors upon request; the provide information about all hazardous contents in commercially available cleaning products.

Cautions and Precautions. Hydrofluoric acid-based cleaners can sometimes leave whitish deposits of silica, or calcium fluoride salts (efflorescence). These deposits are generally not harmful to the masonry but may be disfiguring, especially on darker masonry. Since this efflorescence is soluble in hydrofluoric acid, it can usually be removed by a second chemical treatment, followed immediately by a thorough cold water rinse. It should be noted that hydrofluoric-based cleaners left too long on the masonry may result in a colloidal silica deposit that may be almost impossible to remove (figure 13).

Figure 13. While hydrofluoric acid-based cleaners are often appropriate for cleaning unglazed brick, they may form hard-to-remove whitish silica deposits if left too long on the surface.

Although cleaning non acid-sensitive masonry with hydrofluoric acid-based products is generally a relative safe undertaking—using proper precautions—hydrofluoric acid may lighten the color of some sandstones containing iron. This is another reason why it is always important to test the product on the masonry before beginning a full-scale cleaning project. Hydrofluoric acid can also severely etch aluminum and glass; therefore, these materials must be covered with acid-resistant coatings for protection during cleaning.

Hydrochloric (muriatic) acid is a very strong acid and thus should generally not be used as a cleaning agent on historic masonry (even when diluted). Rather than cleaning or dissolving dirt, it dissolves lime-based mortars and even some stones, and leaves chloride deposits on the masonry surface. *The fact that it dissolves lime-based mortar as well as lime contained in some stones clearly illustrates that its use on historic masonry is generally inappropriate, since many historic mortars have a high lime content.*

When used as a cleaning agent, hydrochloric acid also tends to result in the formation of water soluble salts in the masonry itself, which even thorough surface rinsing is unable to remove. Some of these salts deposited within the masonry will probably appear on the exterior surface of the masonry as efflorescence, which may be washed off or brushed off by hand. However, not all of these chloride sales will migrate to the exterior surface. Salts remaining within the masonry may eventually cause spalling of the masonry units themselves. Furthermore, the use of hydrochloric acid may also result in the formation of yellow ferrous chloride stains on some types of masonry.

Commercially available acid-based cleaners usually contain varying combinations of hydrofluoric, phosphoric, hydrochloric (muriatic), sufuric, acetic, and oxalic acid. As a final caution, it should be noted that despite the manufacturer's recommendations, commercially available "all purpose" cleaners that contain hydrochloric acid should not be used on limestone.

Generally, the only appropriate application of diluted hydrochloric acid to historic masonry is to remove excess mortar that

may have been splashed over the stone or brick while repointing, to remove whitewash or other lime or cement-based coating, or sometimes to clean concrete.

Alkaline Cleaners

limestone, marble, calcareous sandstone, glazed brick, glazed architectural terra cotta, polished marble, polished granite

Alkaline cleaners should be used on acid-sensitive masonry materials that would be damaged by acidic cleaners: limestone and marble, calcareous sandstone, glazed brick and glazed architectural terra cotta, and polished marble and polished granite.

Alkaline cleaners consist of two major ingredients: 1) a detergent (or surfactant), and 2) some type of alkali, usually potassium hydroxide. Following their application to the pre-wet masonry, alkaline cleaners are rinsed off with water; then the masonry is given a slightly acidic wash (for example, acetic acid) to neutralize the alkaline solution. The final step is to rinse the masonry with water a second time. Both potassium hydroxide and ammonium hydroxide (ammonia) are suitable alkaline cleaners for historic masonry. (Ammonia cleaners are especially effective in removing soil of a slightly greasy nature.) For lighter-colored calcareous masonry, a more uniform final appearance may require the addition of complexing agents (such as EDTA) and organic bleaches, but only under careful professional supervision. The effectiveness of alkaline cleaners, particularly for removing paint, wax coatings, grease and oil stains, may be increased by a hot water rinse (not over 160°F). Alkaline paint removers as well as alkaline cleaners for dirt removal from calcareous stones are used undiluted.

Cautions and Precautions. Sodium hydroxide (caustic soda or lye) generally should not be used on older or historic masonry. It is extremely harsh and can cause efflorescence and subflorescence, and may also cause physical abrasion and loss of small amounts of a brick surface (figure 14). Ammonium bifluoride is another alkaline cleaner that is commonly recommended as an "all-purpose" cleaner, but in general, ammonium bifluoride solutions are also not suitable for use on limestones, marbles, calcareous sandstones, or unglazed brick because of the likelihood of leaving ammonium salts on the surface or within the masonry.

Figure 14. Although the sodium hydroxide-based test cleaning patch on the right side of this wall of common brick appears to have been successfully cleaned, closer inspection reveals that a minute portion of the brick surface has been dissolved and removed by the cleaner. As a result, considerable brick dust can be seen in the cracks of the pavement beneath the wall.

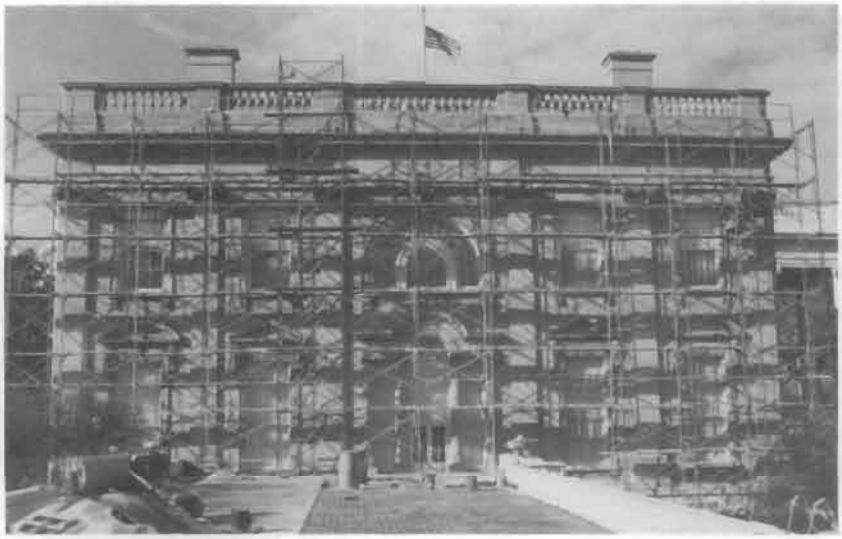
Surfactants and Detergents

polished granite, glazed brick, architectural terra cotta

Surfactants (without acids or alkalies) can be used on polished granite, glazed brick, and architectural terra cotta without risk of etching. Scrubbing with non-metallic brushes (or sometimes even hand-sponging) with a detergent is another effective method of cleaning these smooth surfaces. (However, it may not be possible to remove discoloration caused by dirt that has penetrated a crazed terra cotta glaze.) Non-ionic surfactants can be especially effective in removing oily or greasy dirt.

Chemical Cleaning to Remove Paint and Other Coatings

Large-scale paint removal from historic masonry buildings can best be accomplished with chemical paint removers, based either on organic solvents or alkaline solutions. Commercial paint removers are



Figures 15a-15b. If a highly articulated facade is being cleaned it may be necessary to scaffold the building, one elevation at a time. When the monumental task of chemically removing all the paint from the White House was begun, each side was scaffolded in preparation for repainting. Removal of the many layers of paint that had obscured the stone tooling marks for almost a century, without damaging the historic sandstone, required much painstaking hand work. Photograph: National Park Service

generally formulated to remove most types of paint (except cementitious or lime-based paints such as whitewash) from all types of masonry. But it is always preferable to use an alkaline paint remover on acid-sensitive masonry (figures 15a-15b).

Alkaline Paint Removers

limestone, marble, calcareous sandstone, glazed brick, glazed architectural terra cotta, polished marble, polished granite

One type of paint remover is based on ammonium hydroxide (ammonia), potassium hydroxide, or trisodium phosphate. This alkaline-based paint remover is best used on calcareous and other acid-sensitive masonry, and is particularly useful for removing oil, latex and acrylic paint. (Many paint removers are composed primarily of sodium hydroxide—caustic soda or lye—which, as explained earlier, should not be used on historic masonry because of the likelihood of depositing harmful salts.)

Organic Solvent Paint Removers

A second type of paint remover is composed of a combination of organic solvents, which almost always includes methylene chloride, and others such as methanol (wood alcohol), acetone, xylene, and toluene. Organic solvent-based cleaners are particularly effective in removing more recently developed coatings, including epoxy and urethane-type coatings. However, methylene chloride-based cleaners may also tend to spread some stains deeper into the masonry, so they must be applied with caution, and of course, only after testing. Both types of paint removers are applied either with a brush or sprayed on the masonry surface. The addition of gels, thickeners and waxes prevents paint removers, which evaporate rapidly, from drying out so that they may remain active on the surface for several hours.

The softened paint is then washed off using a water rinse that may range from as low as 200 psi to possibly as high as 800 psi. Efficiency of the paint removal differs from project to project. Multiple layers of paint may require two or more applications of paint remover, or the use of several types. An intricately carved, rough or damaged masonry surface will also take more time and may not result in a surface completely free of paint. If the paint has penetrated into the masonry, total paint removal may be impossible to achieve without damaging the surface.

Removing Other Coatings

Traditional lime-based whitewash or color washes that have deteriorated and no longer bond to the substrate, may be removed with hydrochloric (muriatic) acid—which will dissolve the lime *(and also the masonry substrate if it is not applied with caution)*—or sometimes with acetic acid, and hand-scrubbing with non-metallic

brushes. Sometimes prolonged wet poulticing may also be necessary. Twentieth-century cement-based, or textured coatings, may be very difficult to remove without damaging the masonry. They are not likely to be soluble in paint remover, although occasionally hydrochloric acid may be effective, and sometimes they can be removed by hand-scraping. Removal of acrylic water-repellent coatings may usually be accomplished with an alkaline, possibly potasium hydroxide, solution.

Cautions and Precautions. In particular, those paint removers based on organic solvents should be handled with extra caution. Most organic solvents are flammable. Their vapors, easily absorbed through the skin and the lungs, are carcinogenic, and some are irritating to the skin.

It should be noted that the use of heat (applied with a propane torch or similar device) is *never* an acceptable method of paint removal from historic masonry. Not only is heat ineffective, it may actually damage the masonry, and cause softened paint to permeate porous masonry. Furthermore, use of a propane torch also introduces the hazard of fire to historic materials. Finally, the use of high-pressure water in itself is also not an effective or acceptable method of paint removal from historic masonry.

Poulticing to Remove Stains

The first step in stain removal is to identify the stain; the next step is to try to prevent recurrence of the problem by getting at its source. This source may be integral to the configuration of building materials in a historic structure, and as such, may not be feasible to eliminate. For example, copper flashing will often stain light-colored stone or brick. And the more porous the masonry, the greater the tendency for the masonry to become stained. Thus, while glazed brick and architectural terra cotta are generally resistant to penetrating stains, limestone and marble are considerably more likely to stain because of their porous nature. The fact that acids should not be used on acid-sensitive materials frequently means that, while an acid might indeed be capable of removing a certain stain from brick or a siliceous stone, an alternative, non-acidic cleaner must be substituted when dealing with a calcareous or otherwise acid-sensitive masonry type. There are many premixed poultices commercially available that are based on much the same composition as those described here.

Frequently stains will be removed during a general cleaning of the masonry. But the removal of disfiguring stains, graffiti, and efflorescent salt deposits from masonry is often a complex and challenging undertaking. It is complicated by the fact that, unlike particulate dirt which tends to sit on the surface, stains generally penetrate into and permeate the masonry.

For this reason, poulticing is generally the most effective means of removing stains from historic masonry. Efficient stain removal requires that a cleaning solution (selected according to the type of stain) be kept in contact with the stained area for as long as possible, and that the cleaning solution pull out the staining material without redepositing or spreading it on the masonry itself (figure 16). Poulticing methods meet all these requirements.

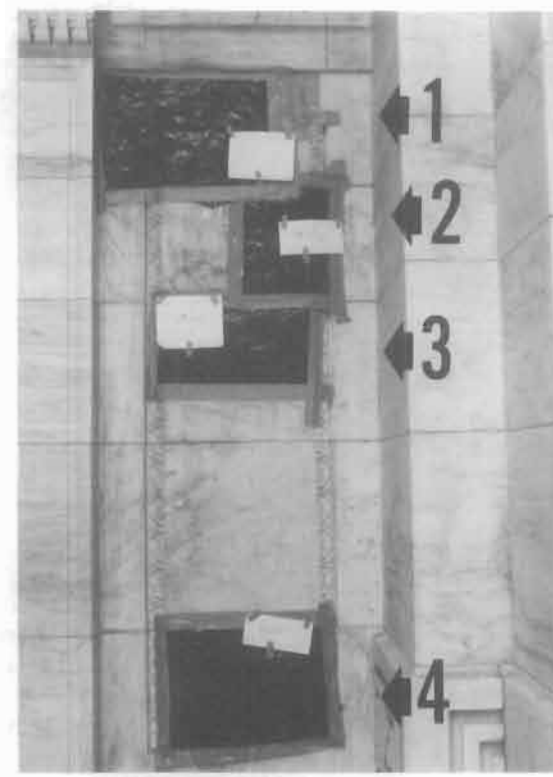


Figure 16. Four different poultice mixtures were tested to remove metal stains from this marble wall. From top to bottom, they included a commercial poultice, as well as formulations of peroxide and hydrated lime, ammonia and hydrated lime, and sodium citrate and glycerine with hydrated lime. Photograph: The Ehrenkrantz Group

Simply stated, a poultice is composed of an absorbent material or powder, mixed with a liquid to form a paste or slurry. The absorbent powders or chemically inert fillers used to make up the poultice not only slow the rate of evaporation or reaction, allowing adequate time for the solvent to dissolve the stain, but also provide a vehicle to accept the staining material after it has been pulled from the masonry. Among the powders commonly used for poulticing are clays (such as attapulgite, kaolin and fuller's earth), talc, chalk (whiting), sepiolite (hydrous magnesium silicate), diatomaceous earth (kieselguhr) and methyl cellulose. While absorbent clays and diatomaceous earth are the most efficient, whiting and kaolin are the cheapest. It should be noted that the absorbent material for a poultice does not always have to be powdered, but can consist of shredded acid-free paper or absorbent cotton or cotton pads. (Generally, whiting, or iron-containing clay such as fuller's earth, should not be used as the absorbent ingredient if an acid is used as the solvent; they will react with, and thus, negate the effectiveness of the acid.)

Next, the type of solvent (liquid) is chosen to match the requirements of the stain to be removed. It will either be water for a chemical poultice or an organic solvent for stains that are soluble only in solvents. A heavy or thick poultice may require additional support on vertical surfaces in the form of a non-ferrous, or plastic mesh which can be held against the wall with non-staining fasteners. The poultice will clean more effectively if kept wet throughout the dwell period. It can be covered with plastic to prevent it from drying out too rapidly, and can also be rewetted if it dries too quickly without having removed the stain. If a single poulticing operation is not effective, a second application can be made. After removing and discarding the poultice material, the area should be thoroughly rinsed with clean water to cleanse the masonry of any chemical residue (figure 17a - 17d).

The poultice is applied as follows: a ¼-¾ inch layer of the paste is applied to the masonry surface, and the liquid is absorbed into the masonry to act upon the stain. As the poultice dries out, the liquid is re-absorbed back into it, drawing out the stain. The poultice is allowed to dry completely, and is removed gently by

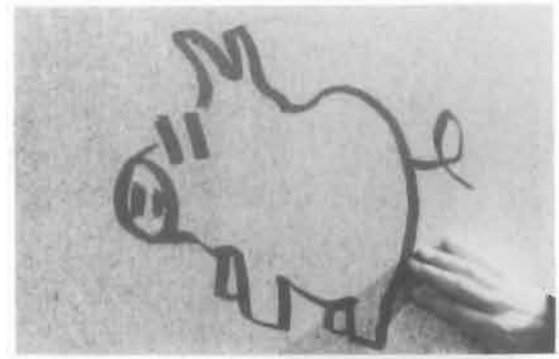


Figure 17(a). This graffiti was applied with a wide felt-tipped marker to a polished granite wall. To facilitate removal and to prevent the image from penetrating further into the stone, the masonry surface was first wetted with denatured alcohol.

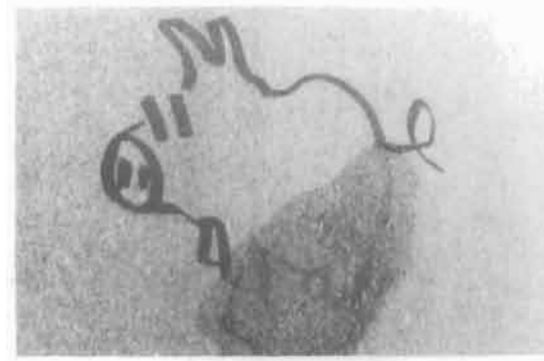


Figure (b) Most of the image was removed using a rag saturated with a mixture of solvents, including acetone, lacquer thinner and N-methy-2-pyrrolidone.

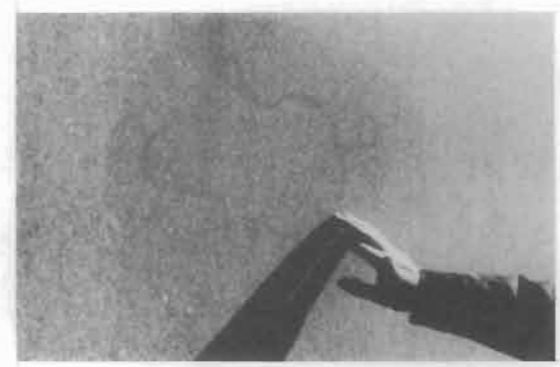


Figure (c-d) The slight ghost outline remaining was easily removed with the solvent mixture in a poultice composed of attapulgite and Kaolin clays and whiting, and followed by a thorough detergent and water wash. Photographs: Nicholas F. Veloz

hand with a wooden scraper or non-metallic brush.

Metallic Stains

In general, metallic stains on siliceous or acid-resistant surfaces can be removed effectively with a weak acid solution. Metallic stains on acid-sensitive masonry should be removed using an alkaline salt of the appropriate acid (for example, ammonium oxalate to remove rust stains). Metal compounds are responsible for a great number of stains on historic masonry structures. Of these, rust stains from *iron* are probably the most common. The orange color is caused by small particles of hydrous iron oxide. Most rust stains are directly related to the corrosion of exterior ironwork such as porch railings and grillwork, or concealed interior support mechanisms such as iron anchors and tie rods. Corrosion is usually initiated by water penetration into the building, primarily via cracks and open mortar joints, and the stains will continue to reappear if these leaks are not repaired. However, some rust stains are due to certain iron-containing minerals, such as pyrite, that may occur naturally in the stone and, as such, cannot be removed.

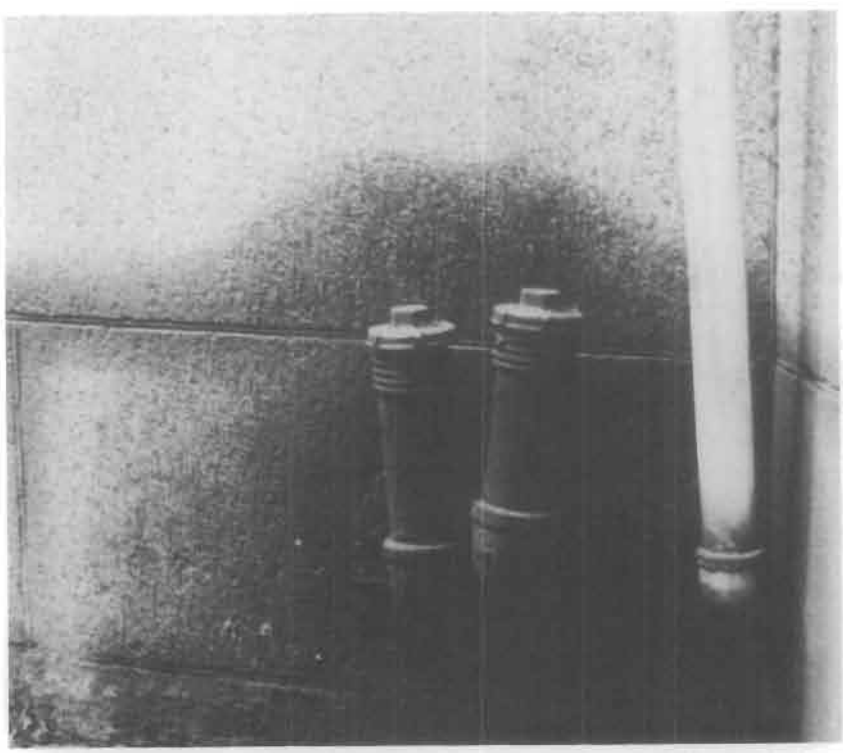


Figure 18. Removal of this oil stain which has penetrated deep into the granite will necessitate poulticing with an organic solvent.

Green stains are usually associated with the presence of a number of *copper* compounds. Copper roofing, brass ornaments and bronze hardware and sculpture are among the obvious scources of green staining. Copper and bronze stains are usually not difficult to eliminate successfully. Generally, they are soluble in an ammonia solution (aqueous ammonium hydroxide).

Industrial Stains

Industrial stains result from contact with such materials as *fuel oil, asphalt* and *tar*. Some superficial (or surface) industrial stains, like smoke and soot and oil, may be removed by gently scrubbing with a scouring powder containing bleach (but not household bleaches which are sodium-based) or water-based household detergents that are acid and alkali-free. However, scouring powders sometimes contain abrasives which may damage delicate masonry surfaces. Ammonia also dissolves some superficial oily stains; thus, a solution of ammonia and water applied in a poultice is useful for removing oil and grease stains from marble. But most procedures for the removal of these oily stains require the use of organic solvents. Because flooding the surface with solvents is both inefficient and costly, brushing with an emulsion of organic solvents such as mineral spirits may be more effective. A water rinse afterward is necessary.

Industrial stains that have penetrated more deeply into the masonry should not be rubbed in, but should always be removed with a poultice (figure 18). An appropriate solvent (or solvent mixture) must be selected. This will probably involve some testing to find a solvent best suited to the type of stain. Among the common organic solvents that may be effective in removing industrial stains are the following: naptha, mineral spirits, chlorinated hydrocarbons (such as methylene chloride and perchloroethylene), ethyl alcohol, acetone, ethyl acetate, amyl acetate, toluene, xylene, and trichlorethylene. (A slight variation of the poultice method consists of thoroughly soaking the stained area with the solvent, and immediately covering it with absorbent powder.)

It may not always be possible to remove all traces of asphaltic stains, but their visual impact will be substantially reduced

by using these methods. Additional washing and scrubbing with detergent or scouring powder following application of the poultice may further reduce staining.

Removal of larger chunks of asphalt or tar accumulations may be facilitated by applying dry ice or spraying with carbon dioxide. The asphalt or tar will be embrittled by the dry ice or carbon dioxide, and after tapping with a small hammer, can usually be removed from the masonry surface by prying it up with a putty knife, (figure 19). This same technique can be use for removing gum, adhesives or other sticky substances, Such techniques, however, should not be used on wet masonry, as they may freeze the moisture in the masonry, and cause cracking or spalling. Organic solvents or bleaches are also effective, sometimes in a poultice, on sticky substances.

Figure 19. Efficient removal of tar splatters from limestone and sandstone may be facilitated initially by applying dry ice or carbon dioxide, but complete removal will probably require poulticing with an inorganic solvent.

Biological Stains

Heavy growths of *lichens, algae, moss and fungi* should be removed from masonry surfaces. Lichens in particular, and mosses, tend to encourage stone or masonry deterioration, because they produce oxalic acid, and, because like other plant growth, they attract—or are attracted to—moisture, one of the major enemies of masonry. Thus, in most cases, it is best to eliminate all plant, lichen and algae growth on historic masonry.

Lichens and algae can usually be removed with water and a stiff natural bristle brush, after soaking, if necessary (figure 20). Stains caused by plant growth such as mildew (which is a fungus) can sometimes be removed with organic solvents, but are generally best treated with diluted ammonia or bleaches. Hydrogen peroxide can also be effective. Calcium hypochlorite solutions and pastes (the basic of swimming pool chlorine) and Chloramine-T may also be useful in many cases. Chemical removal of the growth itself may sometimes be accomplished with zinc or magnesium fluorosilicate, copper naphthenate, or with a variety of quartenary ammonium salts. Low-to-medium-pressure (100-400 psi) water rinsing can be used to eliminate much of the plant material prior to treatment and stain removal. However, these compounds should be used with caution, as some copper compounds may stain light-colored masonry, and the use of zinc or magnesium fluorosilicate may result in formation of a surface crust on some masonry.

Figure 20. Plant growth such as lichens growing on a protected side of this limestone and granite parapet wall, can be damaging even to a relatively hard stone like granite because lichens secrete oxalic acid. Lichens can usually be removed, after soaking with water by scrubbing with a stiff natural bristle brush.

Other growing vines such as ivy and Virginia Creeper should be cut at the roots, and allowed to dry before removal to prevent the disk-tipped tendrils

characteristic of these plants from dislodging parts of the masonry. Once the plants have dried up they can be carefully pulled off; the roots should be killed (ammonium sulfamate may be applied to the roots if necessary, taking care not to get it on the masonry). Any remaining dried plant material on the walls can be removed by scrubbing with a non-metallic brush, and then washed off (figure 21). Except in extreme cases, herbicides should not be used to remove algae, moss or lichens because of the danger of introducing addtional salts or acids into the masonry, as well as the potential for creating environmental problems.

Most of these forms of plant growth on masonry buildings—algae, moss, lichens and fungi—are a direct result of moisture in the masonry and lack of sunshine. Thus, unless the specific conditions change, i.e., the moisture problem is eliminated, or the masonry is given more exposure to the sun, they will recur continually (figure 22). A leaking downspout or gutter can be repaired, a tree or bush too close to the building can be trimmed or pruned to introduce more sunlight, and even lawn sprinklers can be redirected so they do not repeatedly deposit excessive amounts of water on the same area of a building surface (figure 23).

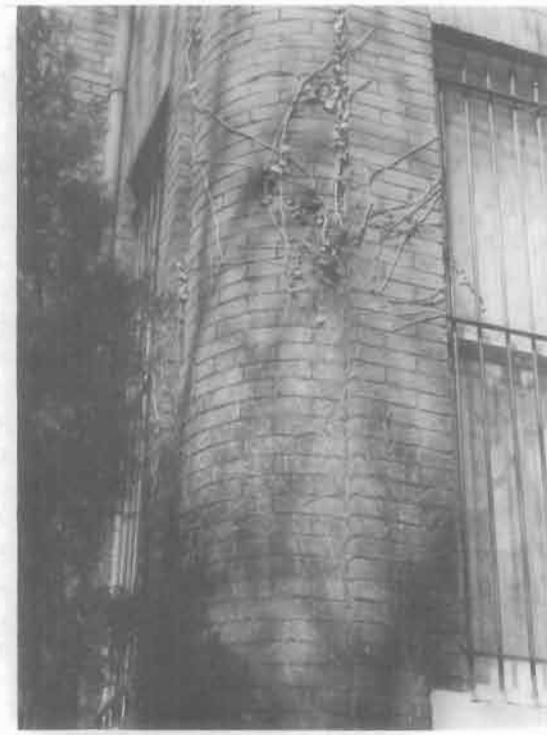


Figure 21. After the ivy was cut at the roots, it has been allowed to wither and die before being pulled off the wall. Most of the ivy has been removed, but a few tendrils still cling higher on the wall. After these have completely dried and have been pulled off, the remaining dried plant material can then be removed from the brick by scrubbing with water and a bristle brush.

Figure 22. The discoloration on this white marble is a green-colored algae growth on a shady side of the building and caused by water dripping from the air-conditioner above it.

Figure 23. The moss growing around the downspout and along the base of this stucco building clearly indicates the presence of excess moisture—here due to rising damp as well as a leaky downspout. Photograph: Lee H. Nelson, FAIA

Graffiti

As with other types of cleaning problems, it is always preferable to identify the substance used to create the graffiti before selecting what is likely to be the best remover. If there is any possibility of discovering how the graffiti was applied (such as discarded spray paint cans in the immediate area), it is worthwhile to investigate, since the manufacturer of a particular product may be able to provide specific information concerning the ingredients of the paint, and thereby simplify the task of removal. It is also important to be aware that it may be extremely difficult, if not impossible, to completely remove all traces of some types of graffiti. Successful and total removal of graffiti may depend on the type and surface texture of the masonry, as well as the particular substance applied. After its removal, which is essentially a spot cleaning operation, the masonry surface may appear spotty. If too unsightly, cleaning the entire surface or wall may be necessary. Sometimes it may be easier to "redirty" slightly the cleaned area to blend in with the uncleaned wall.

Like most other cleaning projects, successful graffiti removal will probably involve a "trial and error" approach, unless the material used to apply it can be readily identified before cleaning is begun. And, as with any type of cleaning of historic masonry, the gentlest method possible should always be tried first; otherwise, one may run the risk of permanently etching the graffiti into the masonry surface.

Painted graffiti applied from a spray can or by a felt-tipped marker or lipstick may generally be removed from masonry by a commercial paint remover—either a solvent type of remover such as lacquer thinner or acetone, or a methylene chloride-based remover (figure 24). In some instances, poulticing may not be necessary. If the graffiti has not permeated deeply into the masonry, it may be removed by the paint remover or a solution of trisodium phosphate brushed on with a non-metallic brush. After the paint has softened, as much as possible should be scraped off with a wooden scraper. Then the area should be washed again using a detergent and soapy water, and rinsed thoroughly with water.

A variety of commercial solvents are available on the market, which may contain aromatic non-chlorinated solvents such as xylol, toluene with methanol or ketone, or chlorinated hydrocarbon solvents such as methylene chloride. But before trying these solvents which, as noted, are effective but are also very toxic and dangerous to handle, it is always best to try something milder, such as a detergent solution and water combined with hand-scrubbing with a non-metallic brush.

Although many cleaning contractors may advise application of a coating to protect masonry surfaces that are particularly vulnerable to defacement by graffiti, a coating is generally not recommended. Historic masonry may be discolored or damaged more by such coatings, which may inhibit moisture evaporation, than by the graffiti. Furthermore, the coating itself is likely to be removed by subsequent graffiti removals.

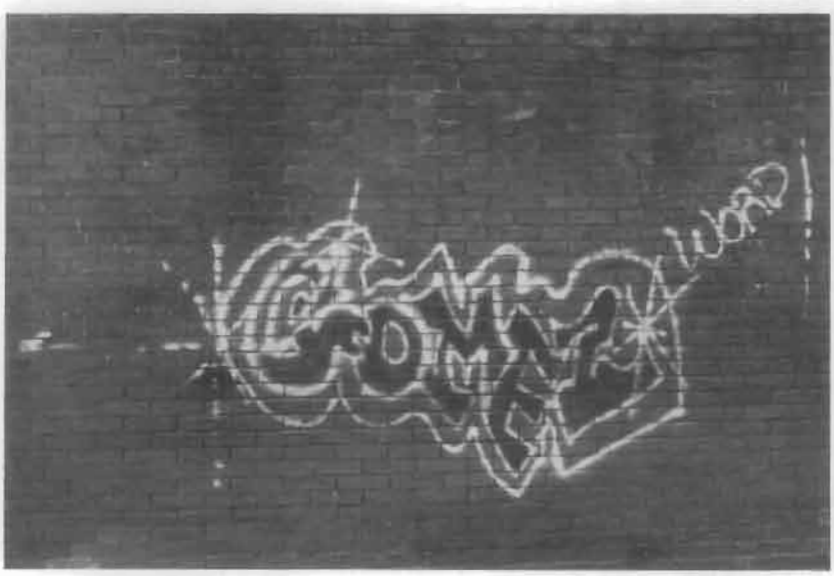


Figure 24. Spray-painted graffiti on this brick wall can be removed with paint remover, and in this case, probably will not require poulticing.

Salt/Efflorescence

Efflorescence is a whitish powder made up of excess salts that have crystalized on the masonry surface. Because efflorescence may have many causes, it is important to identify the source of the problem. For example, although efflorescence is usually a sign of excessive amounts of moisture in the masonry, it may also result from

chemical cleaning or repointing if the masonry is not thoroughly rinsed. It may also come from heavy use of de-icing salts, or rain penetrating masonry through deteriorated mortar joints may result in efflorescent patches on an entire facade. Finally, air pollution often results in the formation of thick sulfate (salt) crusts on the underside of moldings and eaves—areas not regularly washed by rainfall (figure 25).

Efflorescence can usually be brushed or washed off with water since it is formed of water soluble salts. Some efflorescence that results from cleaning may eventually disappear through normal rain washing; however, some chemical residue left from the cleaning process can form damaging insoluble salts. Efflorescence resulting from water penetration into the masonry structure will continue to reappear unless the source of the water entry is removed; thus, the first task is to identify the point of entry and stop the water penetration (figure 26).

Figure 25. Excess moisture leaching out through the walls has resulted in the formation of white efflorescent salts on the brick and blackish sulfate salts on the limestone water table.

Figure 26. Efflorescent salts appearing on many of the brick piers of this turn-of-the-century building may indicate the existence of clogged interior gutters that, because they no longer function have been supplemented by an exterior rain removal system. Photograph: National Park Service

Sulfate encrustations often may be removed with a heavy wooden scraper. But removal of particularly heavy salt buildup may also require a poultice of one of the following: diatomaceous earth, cotton, crushed dolomite, crushed limestone, or shredded polyester fiber soaked in distilled water. The area of the masonry that displays efflorescence should also be soaked in distilled water before applying the poultice to avoid redistributing the salts back into the masonry.

Cautions and Precautions. Several points need to be made regarding the use of chemicals in poultices. First, copper stains should never be removed from limestone with potassium cyanide or sodium cyanide as is sometimes recommended. Both of these cyanide compounds can be lethal to cleaning personnel. Second, most organic solvents are flammable. Their vapors, easily absorbed through the skin and the lungs, are carcinogenic, and some are irritating to the skin. Third, bleach should never be used in conjunction with ammonia in a poultice; this simple-sounding household combination produces toxic chlorine gas that may cause lung tissue damage or death. Finally, spraying liquid nitrogen or asphalt or tar will make it brittle and thus removable, but it is highly flammable and so dangerous to work with that a user must be specially licensed.

Other Methods of Stain Removal

While it is usually necessary to employ a poultice to remove most stains on masonry, other, sometimes simpler, procedures may also be effective. If a stain is superficial, it may often be eliminated by applying a chemical remover or solvent with brushes, or by "washing" the solvent over the surface using a low pressure (under 100 psi) spraying apparatus. It may also help to coat the surface with talc

or similar material to help absorb the stain in a sort of simplified poultice. To prevent outward migration of the staining agent, which would increase the size of the stained area, the masonry immediately adjacent to the stain on all sides should be thoroughly prewetted. Following application of the cleaning solution, the masonry must be rinsed off, and the entire procedure repeated, as necessary. Rinsing need not be done with pressure; in fact, it is normally sufficient to gently flood the treated surface for several minutes.

Cautions and Precautions. Mechanical or abrasive procedures such as sandblasting, grinding or chiseling to remove dirt, paint, stains or graffiti are not acceptable methods of cleaning historic masonry. Such abrasive methods may—with varying degrees of success—remove the offending substance from the masonry, but may also damage the masonry by removing or abrading the outer surface layer (figure 27). Very loose or flaking paint or a similar coating on smooth surfaces, such as brick, may sometimes be successsfully removed by careful hand-scraping in preparation for repainting, but the physical irregularities of most rough-cut or carved surfaces make this impractical. Furthermore, abrasive cleaning techniques may also be harmful to the applicator, passersby and public property.

Cleaning to Remove Bird Droppings

Removal of small amounts of bird droppings may be accomplished as part of a regular cleaning project with cold water washing, possibly supplemented with detergents and chelating agents such as EDTA (ethylene diamine tetra-acetic acid), or on non-acid sensitive masonry with acidic cleaners, where appropriate. Removal may also be facilitated by brushing with a non-metallic brush and scraping with a wood scraper (figure 28).

In some instances where particularly porous types of stone may have been stained by heavy accumulations of droppings that have permeated into the stone over the years, they can be removed by using a combination of the above materials.

Cautions and Precautions. Histoplasmosis and cryptococcosis, both potentially fatal

Figure 27. Heavily pitted by sandblasting, this window recess provides a vivid contrast to adjacent undamaged brick protected from abrasion by a metal signboard.

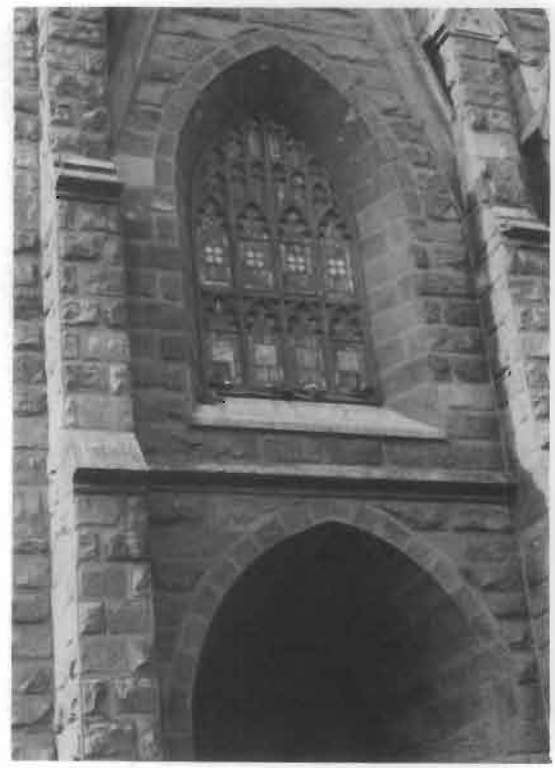


Figure 28. If water, or water and detergent wash, does not remove the pigeon droppings from this sandstone sill and stringcourse below, it may be necessary to use a dilute acidic cleaner containing hydrofluoric acid, providing the sandstone is not calcareous and thus, acid-sensitive.

diseases of the lungs and central nervous system, can result from exposure to accumulations of pigeon excrement. Because of this disease potential, it may be better to apply water pressure from a safe distance to remove excessive amounts of droppings and better not to attempt total removal, particularly if droppings are not highly visible or do not appear to be damaging the masonry. Bleach should not be used as a component of any removal process; bird droppings contain ammonia, which forms toxic gases when mixed with some bleaches. When removing bird droppings, cleaning personnel should guard against exposure to the attendant health hazards by wearing protective masks and clothing.

Part III
Summary of Guidance

The "Gentlest Means Possible"

Although masonry may be one of the most durable of historic building materials, it is nonetheless susceptible to damage by improper maintenance or repair techniques and by harsh and abrasive cleaning methods. Thus, cleaning historic masonry is recommended only when necessary to halt deterioration or to remove heavy soiling, and *only* after careful testing. Observing the "gentlest means possible" rule always means beginning with a low-pressure water wash, supplemented, if necessary, with non-ionic detergents and scrubbing with non-metallic brushes. If this very gentle method does not clean the masonry, or if paint or stains must be removed, the next step is to use a chemical cleaning process. Abrasive cleaning methods are damaging and are not suitable cleaning techniques for historic masonry buildings.

Summary of Cleaning Techniques*

Substance to be Removed	Acid-Sensitive Masonry **Limestone, Marble, Calcareous Sandstone, Glazed Brick, Architectural Terra Cotta, Polished Granite**	Non-Acid-Sensitive Masonry **Sandstone, Slate, Granite, Unglazed Brick, and Unglazed Terra Cotta, Concrete**
Dirt and/or Pollutant Crusts	Water wash Water + non-ionic detergent Alkaline cleaner (ammonia or potassium hydroxide)	Water wash Water + non-ionic detergent Acidic cleaner (hydrofluoric acid)
Paint (oil, latex, acrylic coating, vinyl, epoxy, urethane-type coatings)	Alkaline paint remover (ammonia or potassium hydroxide or trisodium phosphate) Organic solvent paint remover (methylene chloride)	Alkaline paint remover (ammonia or potassium hydroxide or trisodium phosphate) Organic solvent paint remover (methylene chloride)
Whitewash and Cementitious Paints	Acetic acid *or* very weak solution of hydrochloric acid	Acetic acid Hydrochloric acid
Stains - Iron (Rust)	*Poultice with:* Sodium citrate in water + glycerine *or* Ammonium oxalate	*Poultice with:* Oxalic acid or orthophosphoric acid + sodium salt of EDTA in water *or* Dilute hydrofluoric acid
Stains - Copper	*Poultice with:* Ammonium chloride *or* Aluminum hydroxide + ammonia	*Poultice with:* Ammonia (+ EDTA) *or* Dilute hydrofluoric acid
Stains - Industrial (smoke, soot, grease, oil, tar, asphalt, waxes)	Scouring powder with bleach Water-based household detergent Ammonia Mineral spirits Alkaline cleaner *Poultice with one of the following:* Sodium bicarbonate (baking soda) Naptha Mineral spirits Methylene chloride Perchloroethylene Ethyl alcohol Acetone Ethyl acetate Amyl acetate Toluene Xylene Trichloroethylene Dry ice/carbon dioxide (Tar, Asphalt, Gum)	Scouring powder with bleach Water-based household detergent Ammonia Mineral spirits Alkaline cleaner *Poultice with one of the following:* Sodium bicarbonate (baking soda) Naptha Mineral spirits Methylene chloride Perchloroethylene Ethyl alcohol Acetone Ethyl acetate Amyl acetate Toluene Xylene Trichloroethylene Dry ice/carbon dioxide (Tar, Asphalt, Gum)
Stains - Plant and Fungal (lichens, algae, moss, fungi)	Dilute ammonia Bleaches Hydrogen peroxide Sodium hypochlorite Chloramine-T	Dilute ammonia Bleaches Hydrogen peroxide Sodium hypochlorite Chloramine-T
Stains - Graffiti (paint, spray-paint, felt-tipped marker)	Organic solvent or alkaline paint remover Lacquer thinner or acetone Organic solvent (methylene chloride) See also **Paint,** above	Organic solvent paint remover Lacquer thinner or acetone Organic solvent (methylene chloride) See also **Paint,** above
Salt/Efflorescence	Water wash Water (poultice)	Water wash Water (poultice)
Bird Droppings	Water wash Water + detergent + chelating agent such as EDTA	Water wash Water + detergent + chelating agent such as EDTA Acidic cleaners (hydrofluoric acid)

*Cleaning techniques are listed in order starting with the "gentlest means possible."

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14 PRESERVATION BRIEFS

New Exterior Additions to Historic Buildings: Preservation Concerns

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A new exterior addition to a historic building should be considered in a rehabilitation project only after determining that requirements for the new or adaptive use cannot be successfully met by altering non-significant interior spaces. If the new use cannot be accommodated in this way, then an exterior addition may be an acceptable alternative. Rehabilitation as a treatment "is defined as the act or process of making possible a compatible use for a property through repair, alterations, and *additions* while preserving those portions or features which convey its historical, cultural, or architectural values."

The topic of new additions, including rooftop additions, to historic buildings comes up frequently, especially as it relates to rehabilitation projects. It is often discussed and it is the subject of concern, consternation, considerable disagreement and confusion. Can, in certain instances, a historic building be enlarged for a new use without destroying its historic character? And, just what is significant about each particular historic building that should be preserved? Finally, what kind of new construction is appropriate to the historic building?

The vast amount of literature on the subject of additions to historic buildings reflects widespread interest as well as divergence of opinion. New additions have been discussed by historians within a social and political framework; by architects and architectural historians in terms of construction technology and style; and by urban planners as successful or unsuccessful contextual design. However, within the historic preservation and rehabilitation programs of the National Park Service, the focus on new additions is to ensure that they preserve the character of historic buildings.

Figure 1. The addition to the right with its connecting hyphen is compatible with the Collegiate Gothic-style library. The addition is set back from the front of the library and uses the same materials and a simplified design that references, but does not copy, the historic building. Photo: David Wakely Photography.

Most historic districts or neighborhoods are listed in the National Register of Historic Places for their significance within a particular time frame. This period of significance of historic districts as well as individually-listed properties may sometimes lead to a misunderstanding that inclusion in the National Register may prohibit any physical change outside of a certain historical period—particularly in the form of exterior additions. National Register listing does not mean that a building or district is frozen in time and that no change can be made without compromising the historical significance. It does mean, however, that a new addition to a historic building should preserve its historic character.

Figure 2. The new section on the right is appropriately scaled and reflects the design of the historic Art Deco-style hotel. The apparent separation created by the recessed connector also enables the addition to be viewed as an individual building.

Guidance on New Additions

To meet Standard 1 of the *Secretary of the Interior's Standards for Rehabilitation*, which states that "a property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment," it must be determined whether a historic building can accommodate a new addition. Before expanding the building's footprint, consideration should first be given to incorporating changes—such as code upgrades or spatial needs for a new use—within secondary areas of the historic building. However, this is not always possible and, after such an evaluation, the conclusion may be that an addition is required, particularly if it is needed to avoid modifications to character-defining interior spaces. An addition should be designed to be compatible with the historic character of the building and, thus, meet the *Standards for Rehabilitation*. Standards 9 and 10 apply specifically to new additions:

> (9) "New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment."
>
> (10) "New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired."

The subject of new additions is important because a new addition to a historic building has the potential to change its historic character as well as to damage and destroy significant historic materials and features. A new addition also has the potential to confuse the public and to make it difficult or impossible to differentiate the old from the new or to recognize what part of the historic building is genuinely historic.

The intent of this Preservation Brief is to provide guidance to owners, architects and developers on how to design a compatible new addition, including a rooftop addition, to a historic building. A new addition to a historic building should preserve the building's *historic character.* To accomplish this and meet the *Secretary of the Interior's Standards for Rehabilitation*, a new addition should:

- Preserve significant historic materials, features and form;
- Be compatible; and
- Be differentiated from the historic building.

Every historic building is different and each rehabilitation project is unique. Therefore, the guidance offered here is not specific, but general, so that it can be applied to a wide variety of building types and situations. To assist in interpreting this guidance, illustrations of a variety of new additions are provided. Good examples, as well as some that do not meet the Standards, are included to further help explain and clarify what is a compatible new addition that preserves the character of the historic building.

Figure 3. The red and buff-colored parking addition with a rooftop playground is compatible with the early-20th century school as well as with the neighborhood in which it also serves as infill in the urban setting.

Preserve Significant Historic Materials, Features and Form

Attaching a new exterior addition usually involves some degree of material loss to an external wall of a historic building, but it should be minimized. Damaging or destroying significant materials and craftsmanship should be avoided, as much as possible.

Generally speaking, preservation of historic buildings inherently implies minimal change to primary or "public" elevations and, of course, interior features as well. Exterior features that distinguish one historic building or a row of buildings and which can be seen from a public right of way, such as a street or sidewalk, are most likely to be the most significant. These can include many different elements, such as: window patterns, window hoods or shutters; porticoes, entrances and doorways; roof shapes, cornices and decorative moldings; or commercial storefronts with their special detailing, signs and glazing patterns. Beyond a single building, entire blocks of urban or residential structures are often closely related architecturally by their materials, detailing, form and alignment. Because significant materials and features should be preserved, not damaged or hidden, the first place to consider placing a new addition is in a location where the least amount of historic material and character-defining features will be lost. In most cases, this will be on a secondary side or rear elevation.

Figure 4. This glass and brick structure is a harmonious addition set back and connected to the rear of the Colonial Revival-style brick house. Cunningham/Quill Architects. Photos: © Maxwell MacKenzie.

One way to reduce overall material loss when constructing a new addition is simply to keep the addition smaller in proportion to the size of the historic building. Limiting the size and number of openings between old and new by utilizing existing doors or enlarging windows also helps to minimize loss. An often successful way to accomplish this is to link the addition to the historic building by means of a hyphen or connector. A connector provides a physical link while visually separating the old and new, and the connecting passageway penetrates and removes only a small portion of the historic wall. A new addition that will abut the historic building along an entire elevation or wrap around a side and rear elevation, will likely integrate the historic and the new interiors, and thus result in a high degree of loss of form and exterior walls, as well as significant alteration of interior spaces and features, and will not meet the Standards.

Compatible but Differentiated Design

In accordance with the Standards, a new addition must preserve the building's historic character and, in order to do that, it must be differentiated, but compatible, with the historic building. A new addition must retain the essential form and integrity of the historic property. Keeping the addition smaller, limiting the removal of historic materials by linking the addition with a hyphen, and locating the new addition at the rear or on an inconspicuous side elevation of a historic building are techniques discussed previously that can help to accomplish this.

Rather than differentiating between old and new, it might seem more in keeping with the historic character

simply to repeat the historic form, material, features and detailing in a new addition. However, when the new work is highly replicative and indistinguishable from the old in appearance, it may no longer be possible to identify the "real" historic building. Conversely, the treatment of the addition should not be so different that it becomes the primary focus. The difference may be subtle, but it must be clear. A new addition to a historic building should protect those visual qualities that make the building eligible for listing in the National Register of Historic Places.

The National Park Service policy concerning new additions to historic buildings, which was adopted in 1967, is not unique. It is an outgrowth and continuation of a general philosophical approach to change first expressed by John Ruskin in England in the 1850s, formalized by William Morris in the founding of the Society for the Protection of Ancient Buildings in 1877, expanded by the Society in 1924 and, finally, reiterated in the 1964 Venice Charter—a document that continues to be followed by the national committees of the International Council on Monuments and Sites (ICOMOS). The 1967 *Administrative Policies for Historical Areas of the National Park System* direct that "...a modern addition should be readily distinguishable from the older work; however, the new work should be harmonious with the old in scale, proportion, materials, and color. Such additions should be as inconspicuous as possible from the public view." As a logical evolution from these Policies specifically for National Park Service-owned historic structures, the 1977 *Secretary of the Interior's Standards for Rehabilitation*, which may be applied to **all** historic buildings listed in, or eligible for listing in the National Register, also state that "the new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment."

Preserve Historic Character

The goal, of course, is a new addition that preserves the building's historic character. The historic character of each building may be different, but the methodology of establishing it remains the same. Knowing the uses and functions a building has served over time will assist in making what is essentially a physical evaluation. But, while written and pictorial documentation can provide a framework for establishing the building's history, to a large extent the historic character is embodied in the physical aspects of the historic building itself—shape, materials, features, craftsmanship, window arrangements, colors, setting and interiors. Thus, it is important to identify the historic character before making decisions about the extent—or limitations—of change that can be made.

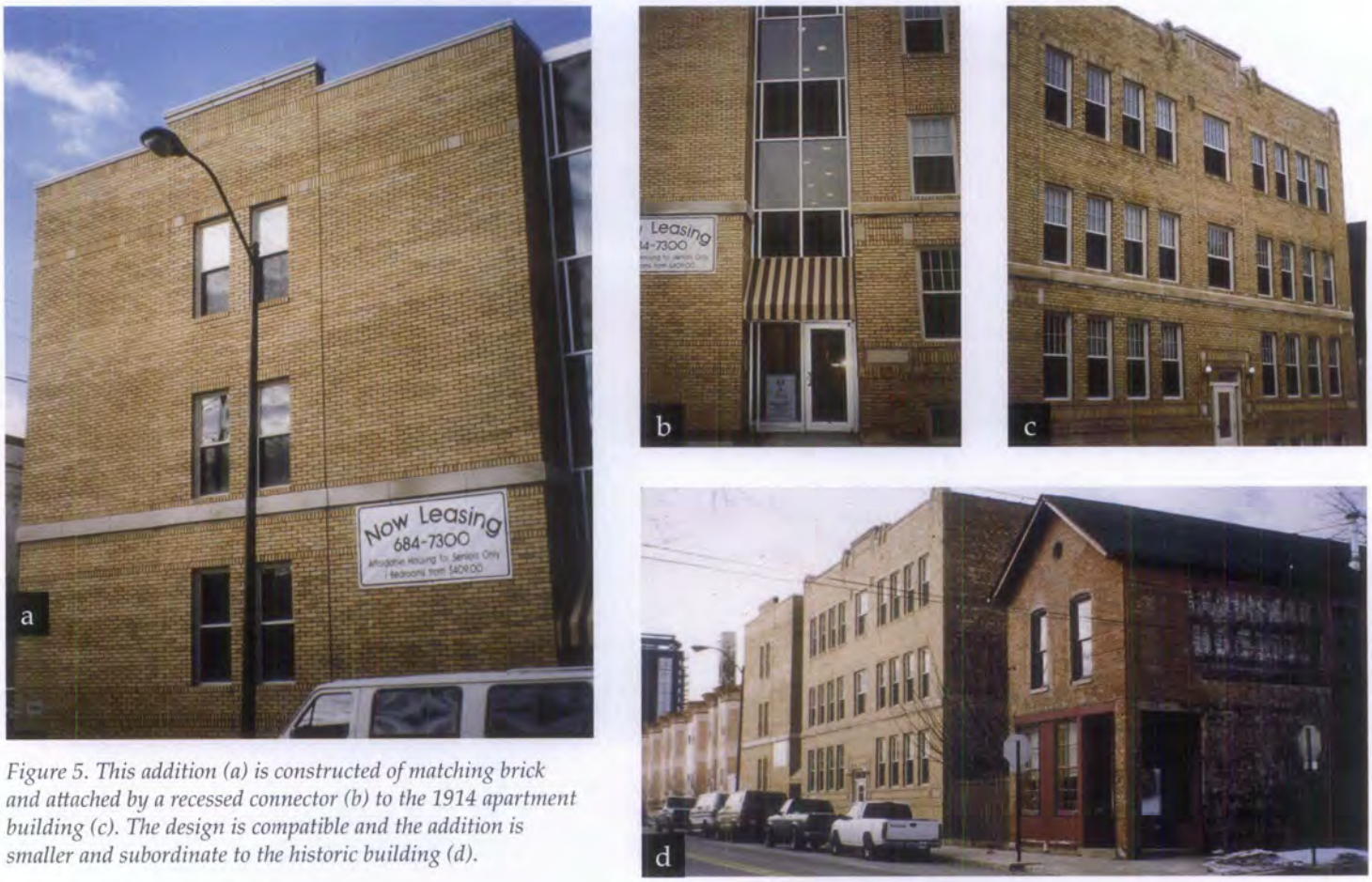

Figure 5. This addition (a) is constructed of matching brick and attached by a recessed connector (b) to the 1914 apartment building (c). The design is compatible and the addition is smaller and subordinate to the historic building (d).

Figure 6. A new addition (left) is connected to the garage which separates it from the main block of the c. 1910 former florist shop (right). The addition is traditional in style, yet sufficiently restrained in design to distinguish it from the historic building.

A new addition should always be subordinate to the historic building; it should not compete in size, scale or design with the historic building. An addition that bears no relationship to the proportions and massing of the historic building—in other words, one that overpowers the historic form and changes the scale—will usually compromise the historic character as well. The appropriate size for a new addition varies from building to building; it could never be stated in a square or cubic footage ratio, but the historic building's existing proportions, site and setting can help set some general parameters for enlargement. Although even a small addition that is poorly designed can have an adverse impact, to some extent, there is a predictable relationship between the size of the historic resource and what is an appropriate size for a compatible new addition.

Generally, constructing the new addition on a secondary side or rear elevation—in addition to material preservation—will also preserve the historic character. Not only will the addition be less visible, but because a secondary elevation is usually simpler and less distinctive, the addition will have less of a physical and visual impact on the historic building. Such placement will help to preserve the building's historic form and relationship to its site and setting.

Historic landscape features, including distinctive grade variations, also need to be respected. Any new landscape features, including plants and trees, should be kept at a scale and density that will not interfere with understanding of the historic resource itself. A traditionally landscaped property should not be covered with large paved areas for parking which would drastically change the character of the site.

Despite the fact that in most cases it is recommended that the new addition be attached to a secondary elevation, sometimes this is not possible. There simply may not be a secondary elevation—some important freestanding buildings have significant materials and features on all sides. A structure or group of structures together with its setting (for example, a college campus) may be of such significance that any new addition would not only damage materials, but alter the buildings' relationship to each other and the setting. An addition attached to a highly-visible elevation of a historic building can radically alter the historic form or obscure features such as a decorative cornice or window ornamentation. Similarly, an addition that fills

Figure 7. A vacant side lot was the only place a new stair tower could be built when this 1903 theater was rehabilitated as a performing arts center. Constructed with matching materials, the stair tower is set back with a recessed connector and, despite its prominent location, it is clearly subordinate and differentiated from the historic theater.

Figure 8. The rehabilitation of this large, early-20th century warehouse (left) into affordable artists' lofts included the addition of a compatible glass and brick elevator/stair tower at the back (right).

Figure 9. A simple, brick stair tower replaced two non-historic additions at the rear of this 1879 school building when it was rehabilitated as a women's and children's shelter. The addition is set back and it is not visible from the front of the school.

Figure 10. The small size and the use of matching materials ensures that the new addition on the left is compatible with the historic Romanesque Revival-style building.

in a planned void on a highly-visible elevation (such as a U-shaped plan or a feature such as a porch) will also alter the historic form and, as a result, change the historic character. Under these circumstances, an addition would have too much of a negative impact on the historic building and it would not meet the Standards. Such situations may best be handled by constructing a separate building in a location where it will not adversely affect the historic structure and its setting.

In other instances, particularly in urban areas, there may be no other place but adjacent to the primary façade to locate an addition needed for the new use. It may be possible to design a lateral addition attached on the side that is compatible with the historic building, even though it is a highly-visible new element. Certain types of historic structures, such as government buildings, metropolitan museums, churches or libraries, may be so massive in size that a relatively large-scale addition may not compromise the historic character, provided, of course, the addition is smaller than the historic building. Occasionally, the visible size of an addition can be reduced by placing some of the spaces or support systems in a part of the structure that is underground. Large new additions may sometimes be successful if they read as a separate volume, rather than as an extension of the historic structure, although the scale, massing and proportions of the addition still need to be compatible with the historic building. However, similar expansion of smaller buildings would be dramatically out of scale. In summary, where any new addition is proposed, correctly assessing the relationship between actual size and relative scale will be a key to preserving the character of the historic building.

Figure 11. The addition to this early-20th century Gothic Revival-style church provides space for offices, a great hall for gatherings and an accessible entrance (left). The stucco finish, metal roof, narrow gables and the Gothic-arched entrance complement the architecture of the historic church. Placing the addition in back where the ground slopes away ensures that it is subordinate and minimizes its impact on the church (below).

Design Guidance for Compatible New Additions to Historic Buildings

There is no formula or prescription for designing a new addition that meets the Standards. A new addition to a historic building that meets the Standards can be any architectural style—traditional, contemporary or a simplified version of the historic building. However, there must be a balance between differentiation and compatibility in order to maintain the historic character and the identity of the building being enlarged. New additions that too closely resemble the historic building or are in extreme contrast to it fall short of this balance. *Inherent in all of the guidance is the concept that an addition needs to be subordinate to the historic building.*

A new addition **must preserve significant historic materials, features and form**, and **it must be compatible but differentiated from the historic building**. To achieve this, it is necessary to carefully consider the **placement or location** of the new addition, and its **size, scale and massing** when planning a new addition. To preserve a property's historic character, a new addition must be visually distinguishable from the historic building. This does not mean that the addition and the historic building should be glaringly different in terms of design, materials and other visual qualities. Instead, the new addition should take its design cues from, but not copy, the historic building.

A variety of design techniques can be effective ways to differentiate the new construction from the old, while respecting the architectural qualities and vocabulary of the historic building, including the following:

- Incorporate a simple, recessed, small-scale hyphen to physically separate the old and the new volumes or set the addition back from the wall plane(s) of the historic building.
- Avoid designs that unify the two volumes into a single architectural whole. The new addition may include simplified architectural features that reflect, but do not duplicate, similar features on the historic building. This approach will not impair the existing building's historic character as long as the new structure is subordinate in size and clearly differentiated and distinguishable so that the identity of the historic structure is not lost in a new and larger composition. The historic building must be clearly identifiable and its physical integrity must not be compromised by the new addition.

Figure 12. This 1954 synagogue (left) is accessed through a monumental entrance to the right. The new education wing (far right) added to it features the same vertical elements and color and, even though it is quite large, its smaller scale and height ensure that it is secondary to the historic resource.

Figure 13. A glass and metal structure was constructed in the courtyard as a restaurant when this 1839 building was converted to a hotel. Although such an addition might not be appropriate in a more public location, it is compatible here in the courtyard of this historic building.

Figure 14. This glass addition was erected at the back of an 1895 former brewery during rehabilitation to provide another entrance. The addition is compatible with the plain character of this secondary elevation.

- Use building materials in the same color range or value as those of the historic building. The materials need not be the same as those on the historic building, but they should be harmonious; they should not be so different that they stand out or distract from the historic building. (Even clear glass can be as prominent as a less transparent material. Generally, glass may be most appropriate for small-scale additions, such as an entrance on a secondary elevation or a connector between an addition and the historic building.)
- Base the size, rhythm and alignment of the new addition's window and door openings on those of the historic building.
- Respect the architectural expression of the historic building type. For example, an addition to an institutional building should maintain the architectural character associated with this building type rather than using details and elements typical of residential or other building types.

These techniques are merely examples of ways to differentiate a new addition from the historic building while ensuring that the addition is compatible with it. Other ways of differentiating a new addition from the historic building may be used as long as they maintain the primacy of the historic building. Working within these basic principles still allows for a broad range of architectural expression that can range from stylistic similarity to contemporary distinction. The recommended design approach for an addition is one that neither copies the historic building exactly nor stands in stark contrast to it.

Revising an Incompatible Design for a New Addition to Meet the Standards

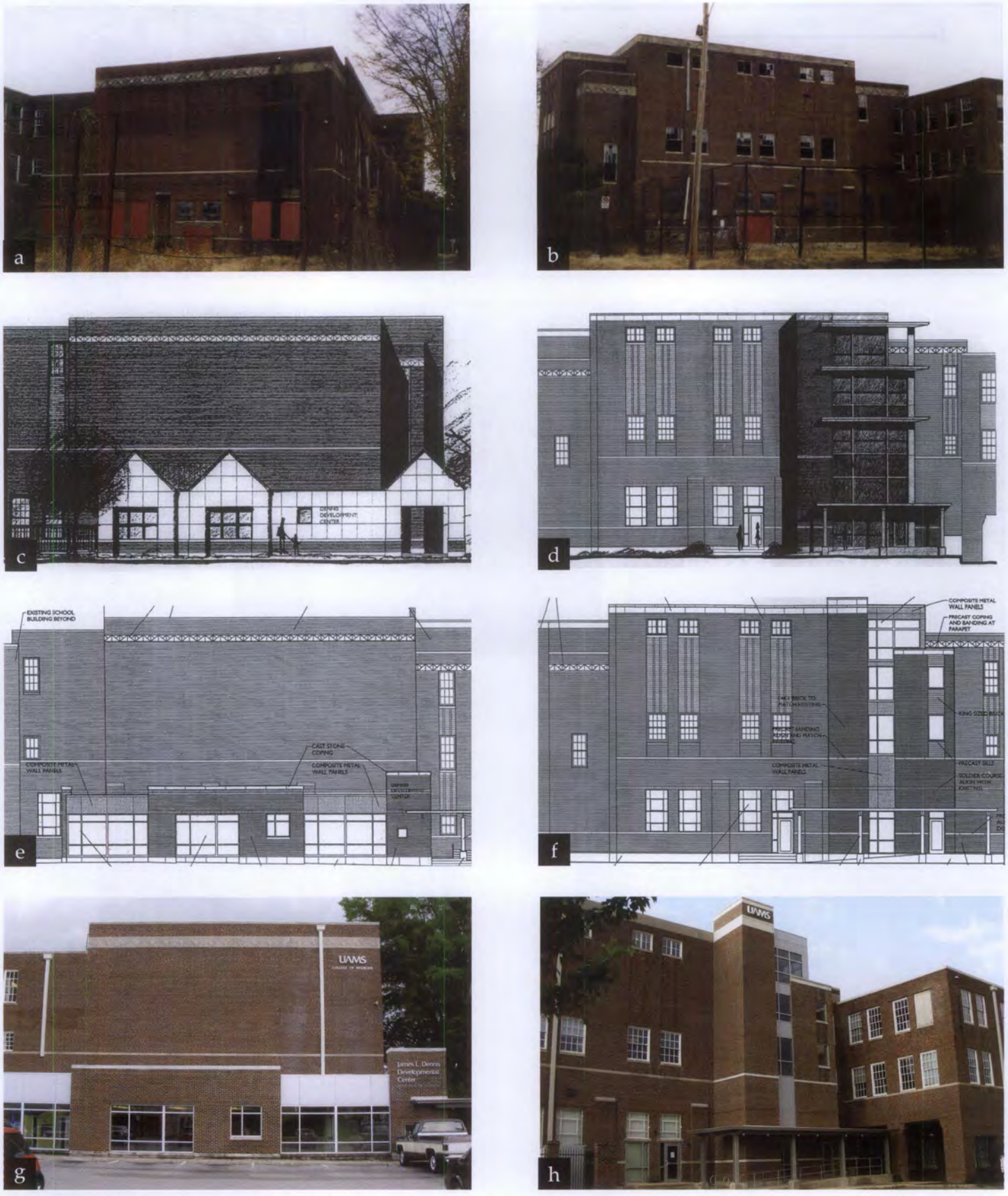

Figure 15. The rehabilitation of a c. 1930 high school auditorium for a clinic and offices proposed two additions: a one-story entrance and reception area on this elevation (a); and a four-story elevator and stair tower on another side (b). The gabled entrance (c) first proposed was not compatible with the flat-roofed auditorium and the design of the proposed stair tower (d) was also incompatible and overwhelmed the historic building. The designs were revised (e-f) resulting in new additions that meet the Standards (g-h).

Incompatible New Additions to Historic Buildings

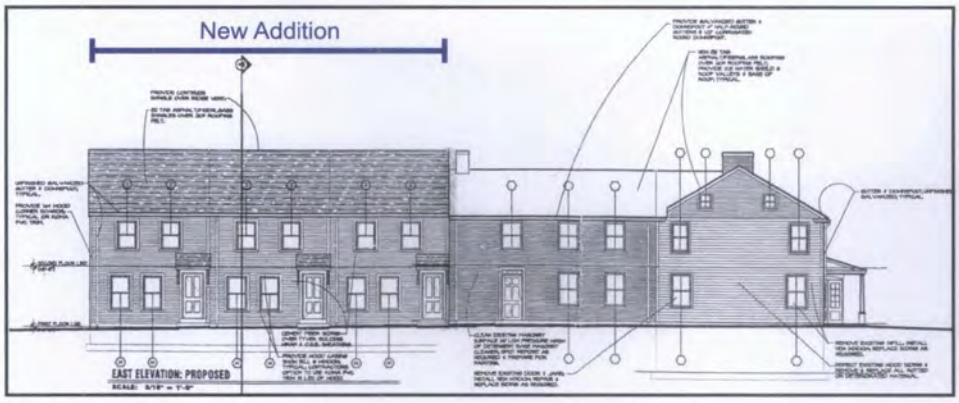

Figure 16. The proposal to add three row houses to the rear ell of this early-19th century residential property doubles its size and does not meet the Standards..

Figure 17. The small addition on the left is starkly different and it is not compatible with the eclectic, late-19th century house.

Figure 18. The expansion of a one- and one-half story historic bungalow (left) with a large two-story rear addition (right) has greatly altered and obscured its distinctive shape and form.

Figure 19. The upper two floors of this early-20th century office building were part of the original design, but were not built. During rehabilitation, the two stories were finally constructed. This treatment does not meet the Standards because the addition has given the building an appearance it never had historically.

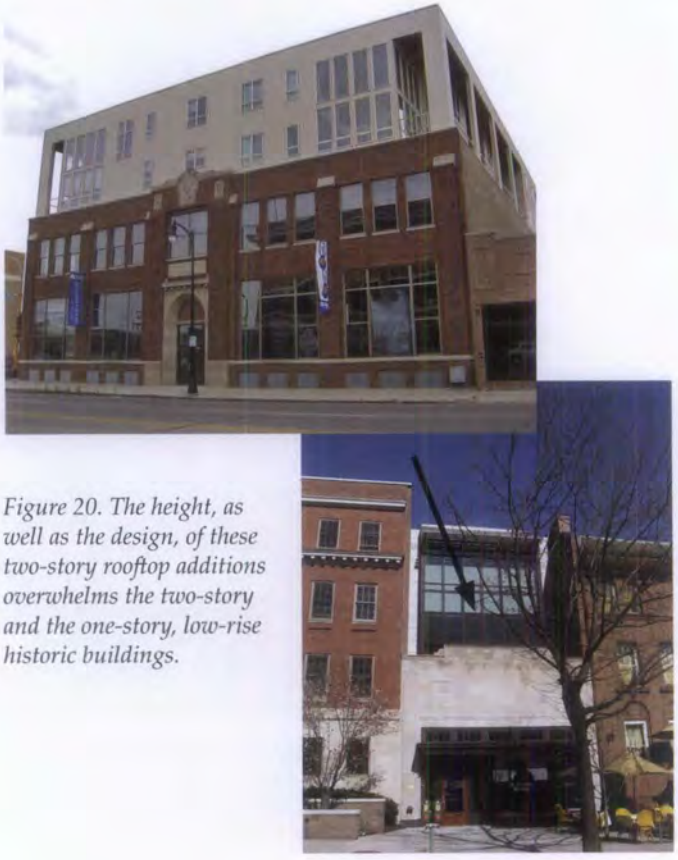

Figure 20. The height, as well as the design, of these two-story rooftop additions overwhelms the two-story and the one-story, low-rise historic buildings.

New Additions in Densely-Built Environments

In built-up urban areas, locating a new addition on a less visible side or rear elevation may not be possible simply because there is no available space. In this instance, there may be alternative ways to help preserve the historic character. One approach when connecting a new addition to a historic building on a primary elevation is to use a hyphen to separate them. A subtle variation in material, detailing and color may also provide the degree of differentiation necessary to avoid changing the essential proportions and character of the historic building.

A densely-built neighborhood such as a downtown commercial core offers a particular opportunity to design an addition that will have a minimal impact on the historic building. Often the site for such an addition is a vacant lot where another building formerly stood. Treating the addition as a separate or infill building may be the best approach when designing an addition that will have the least impact on the historic building and the district. In these instances there may be no need for a direct visual link to the historic building. Height and setback from the street should generally be consistent with those of the historic building and other surrounding buildings in the district. Thus, in most urban commercial areas the addition should not be set back from the façade of the historic building. A tight urban setting may sometimes even accommodate a larger addition if the primary elevation is designed to give the appearance of being several buildings by breaking up the facade into elements that are consistent with the scale of the historic building and adjacent buildings.

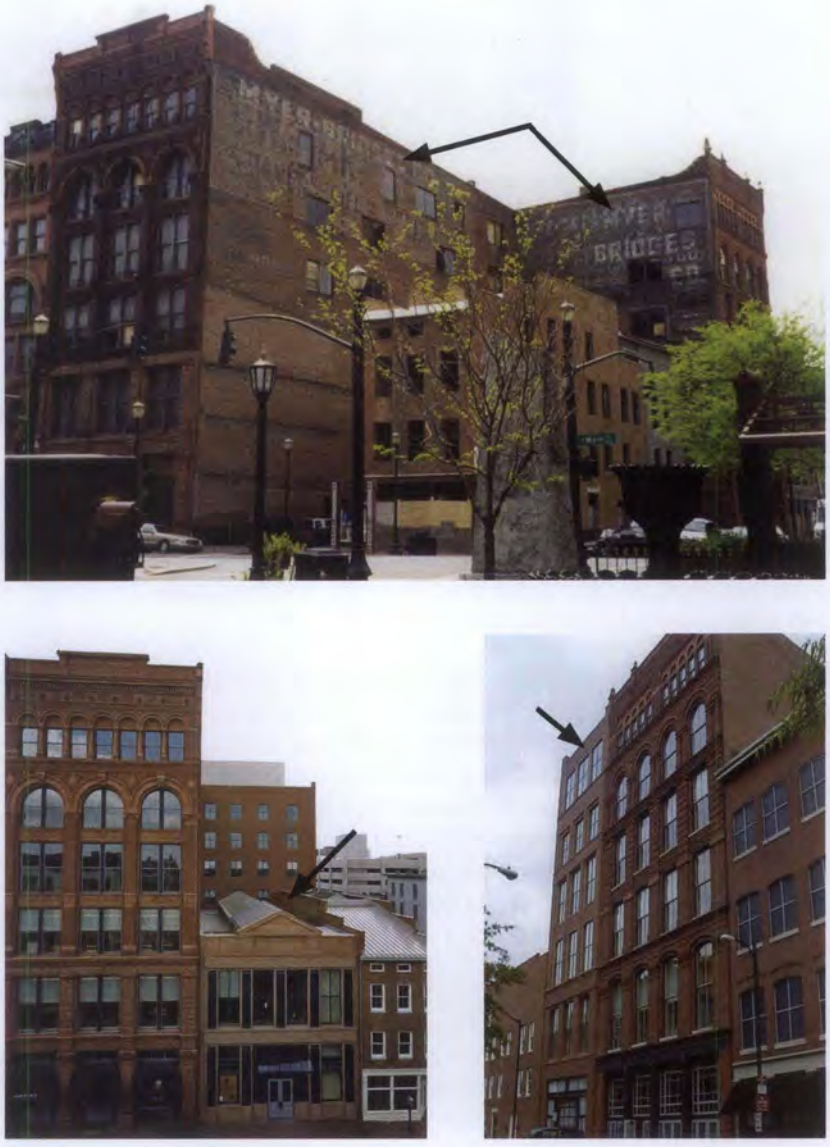

Figure 21. Both wings of this historic L-shaped building (top), which fronts on two city streets, adjoined vacant lots. A two-story addition was constructed on one lot (above, left) and a six-story addition was built on the other (above, right). Like the historic building, which has two different facades, the compatible new additions are also different and appear to be separate structures rather than part of the historic building.

Figure 22. The proposed new addition is compatible with the historic buildings that remain on the block. Its design with multiple storefronts helps break up the mass.

Figure 23. Colored flags marking the location of a proposed penthouse addition (a) were placed on the roof to help evaluate the impact and visibility of an addition planned for this historic furniture store (b). Based on this evaluation, the addition was constructed as proposed. It is minimally visible and compatible with the 1912 structure (c). The tall parapet wall conceals the addition from the street below (d).

Rooftop Additions

The guidance provided on designing a compatible new addition to a historic building applies equally to new rooftop additions. A rooftop addition should preserve the character of a historic building by preserving historic materials, features and form; and it should be compatible but differentiated from the historic building.

However, there are several other design principles that apply specifically to rooftop additions. Generally, a rooftop addition should not be more than one story in height to minimize its visibility and its impact on the proportion and profile of the historic building. A rooftop addition should almost always be set back at least one full bay from the primary elevation of the building, as well as from the other elevations if the building is free-standing or highly visible.

It is difficult, if not impossible, to minimize the impact of adding an entire new floor to relatively low buildings, such as small-scale residential or commercial structures, even if the new addition is set back from the plane of the façade. Constructing another floor on top of a small, one, two or three-story building is seldom appropriate for buildings of this size as it would measurably alter the building's proportions and profile, and negatively impact its historic character. On the other hand, a rooftop addition on an eight-story building, for example, in a historic district consisting primarily of tall buildings might not affect the historic character because the new construction may blend in with the surrounding buildings and be only minimally visible within the district. A rooftop addition in a densely-built urban area is more likely to be compatible on a building that is adjacent to similarly-sized or taller buildings.

A number of methods may be used to help evaluate the effect of a proposed rooftop addition on a historic building and district, including pedestrian sight lines, three-dimensional schematics and computer-generated design. However, drawings generally do not provide a true "picture" of the appearance and visibility of a proposed rooftop addition. For this reason, it is often necessary to construct a rough, temporary, full-size or skeletal mock up of a portion of the proposed addition, which can then be photographed and evaluated from critical vantage points on surrounding streets.

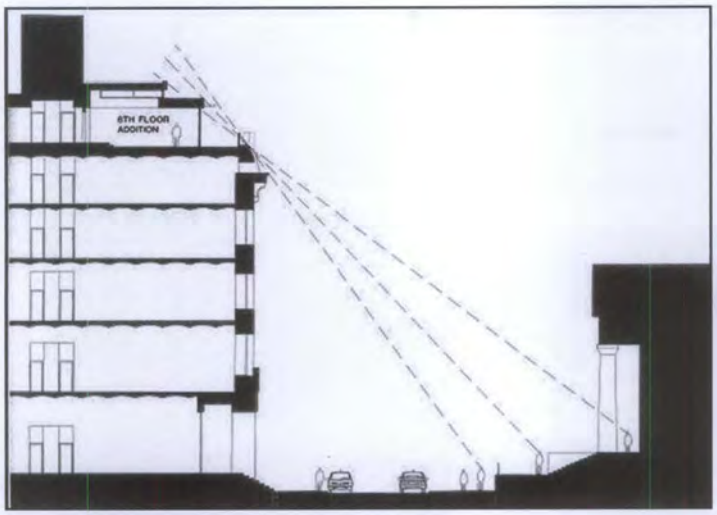

Figure 24. ***How to Evaluate a Proposed Rooftop Addition.*** *A sight-line study (above) only factors in views from directly across the street, which can be very restrictive and does not illustrate the full effect of an addition from other public rights of way. A mock up (above, right) or a mock up enhanced by a computer-generated rendering (below, right) is essential to evaluate the impact of a proposed rooftop addition on the historic building.*

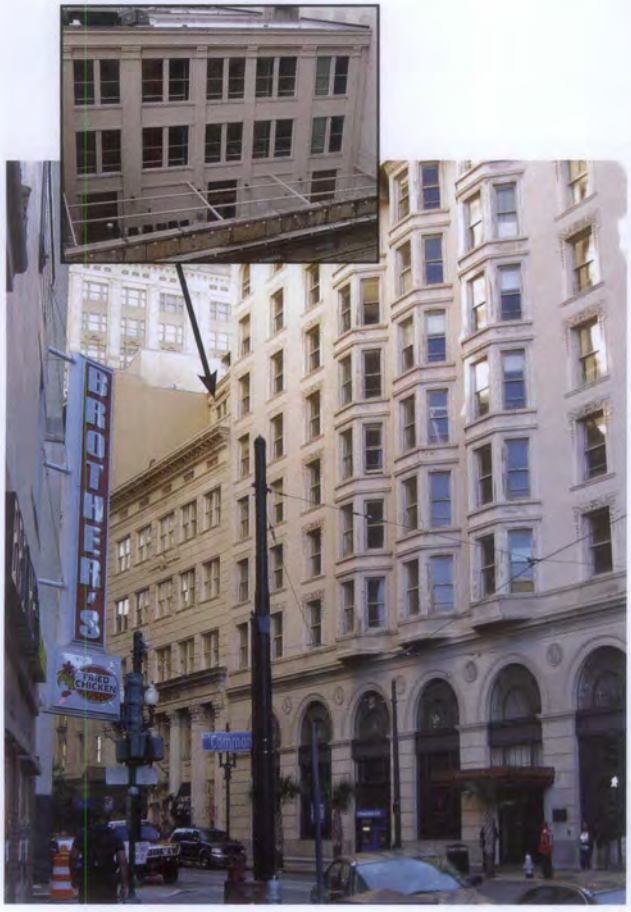

Figure 25. It was possible to add a compatible, three-story, penthouse addition to the roof of this five-story, historic bank building because the addition is set far back, it is surrounded by taller buildings and a deep parapet conceals almost all of the addition from below.

Figure 26. A rooftop addition would have negatively impacted the character of the primary facade (right) of this mid-19th century, four-story structure and the low-rise historic district. However, a third floor was successfully added on the two-story rear portion (below) of the same building with little impact to the building or the district because it blends in with the height of the adjacent building.

Figure 27. Although the new brick stair/elevator tower (left) is not visible from the front (right), it is on a prominent side elevation of this 1890 stone bank. The compatible addition is set back and does not compete with the historic building. Photos: Chadd Gossmann, Aurora Photography, LLC.

Designing a New Exterior Addition to a Historic Building

This guidance should be applied to help in designing a compatible new addition that that will meet the *Secretary of the Interior's Standards for Rehabilitation*:

- A new addition should be simple and unobtrusive in design, and should be distinguished from the historic building—a recessed connector can help to differentiate the new from the old.
- A new addition should not be highly visible from the public right of way; a rear or other secondary elevation is usually the best location for a new addition.
- The construction materials and the color of the new addition should be harmonious with the historic building materials.
- The new addition should be smaller than the historic building—it should be subordinate in both size and design to the historic building.

The same guidance should be applied when designing a compatible **rooftop** addition, plus the following:

- A rooftop addition is generally not appropriate for a one, two or three-story building—and often is not appropriate for taller buildings.
- A rooftop addition should be minimally visible.
- Generally, a rooftop addition must be set back at least one full bay from the primary elevation of the building, as well as from the other elevations if the building is freestanding or highly visible.
- Generally, a rooftop addition should not be more than one story in height.
- Generally, a rooftop addition is more likely to be compatible on a building that is adjacent to similarly-sized or taller buildings.

Figure 28. A small addition (left) was constructed when this 1880s train station was converted for office use. The paired doors with transoms and arched windows on the compatible addition reflect, but do not replicate, the historic building (right).

Figure 29. This simple glass and brick entrance (left) added to a secondary elevation of a 1920s school building (right) is compatible with the original structure.

Summary

Because a new exterior addition to a historic building can damage or destroy significant materials and can change the building's character, an addition should be considered only after it has been determined that the new use cannot be met by altering non-significant, or secondary, interior spaces. If the new use cannot be met in this way, then an attached addition may be an acceptable alternative if carefully planned and designed. A new addition to a historic building should be constructed in a manner that preserves significant materials, features and form, and preserves the building's historic character. Finally, an addition should be differentiated from the historic building so that the new work is compatible with—and does not detract from—the historic building, and cannot itself be confused as historic.

Additional Reading

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Figure 30. The small addition on the right of this late-19th century commercial structure is clearly secondary and compatible in size, materials and design with the historic building.

Figure 31. An elevator/stair tower was added at the back of this Richardsonian Romanesque-style theater when it was rehabilitated. Rough-cut stone and simple cut-out openings ensure that the addition is compatible and subordinate to the historic building. Photo: Chuck Liddy, AIA.

Acknowledgements

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