HISTORIC DISTRICT REVIEW COMMISSION

November 7, 2017

5:30 p.m.

City Council Chambers
101 E. Kansas

Liberty
missouri

HISTORIC DISTRICT REVIEW COMMISSION
Regular Meeting Agenda

November 7, 2017
5:30 p.m.
City Hall Council Chambers

I. Call to Order

II. Roll Call
John Carr, Vern Drottz, Mike Gilmore, Matt Grundy, Dail Hobbs, Clay Lozier, Kelley Wrenn Pozel, Brett Rinker, Doug Wilson

III. Approval of Regular Meeting Summary: September 19, 2017

IV. Approval of Design Sub Committee Meeting Summary: October 10, 2017

V. HDRC Case # 17-014PH Consideration of a Certificate of Appropriateness at 20 S. Terrace repairs and alterations to deck

VI. HDRC Case #17-019LS Consideration of a Certificate of Appropriateness at 117b N. Main Street façade improvement

VII. Other Business
Administrative Approvals since the September 19, 2017 meeting:
421 N. Lightburne Roof
38 S. Terrace Stairs
2 N. Main Brick Wall Rebuild
22 N. Main Sidewalk Café Fence

Miscellaneous matters from the Commission

Miscellaneous matters from staff
Preservation Month Activities May 2018
Preservation Briefs Article Discussion

VIII. Adjournment

LIBERTY HISTORIC DISTRICT REVIEW COMMISSION
Regular Session Summary
City Council Chambers, City Hall
September 19, 2017
5:30 p.m.

I. Call to Order

Chairman Grundy called the meeting to order at 5:30 p.m.

II. Roll Call

John Carr, Vern Drottz, Matt Grundy, Dail Hobbs, Clay Lozier, Kelley Wrenn Pozel and Doug Wilson answered roll call. Mike Gilmore and Brett Rinker were absent. Jeanine Thill, Community Development Manager represented staff. There were five members of the public in attendance applicants; Paemon & Ashley Aramjoo, Sarah Rohaus & Michelle Russo and Don Altis.

III. Approval of Meeting Summary

Vice Chairman Carr made a motion to approve the Meeting Summary of September 5, 2017 Commissioner Drottz seconded the motion. Motion passed with unanimous approval. 7-0-0

IV. **HDRC Case # 17-010PH** Consideration of a Certificate of Appropriateness at 119 S. Terrace, Prospect Heights District, for replacement of retaining walls and driveway and replace the cellar door with a garage door. Vice Chairman Carr commented this is a great improvement to the property. The commission was pleased to see the progress on the garage. Motion by Vice Chaiman Carr to accept the application as submitted because it meets the UDO and Design Guidelines. Motion seconded by Commissioner Hobbs. Motion passed with unanimous approval. 7-0-0.

V. **HDRC Case #17-011PH** Consideration of a Certificate of Appropriateness at 246 & 248 Mill Street, Prospect Heights District, to paint the front brick façade, replace front door, light and awning as well as in-kind repairs to the roof and existing parking pad. Staff reported the Historic Survey on the property was missing but verified is in the Prospect Heights district, by the legal description mapped out by GIS. Vice Chairman Carr reported that the Design Sub Committee met with the applicants and there may have been some miscommunication regarding painting the brick. The design guidelines do not allow painting brick, but given this is a non-contributing building it may be acceptable. Drottz asked the applicants for the reason they wanted to paint or stain the brick, the applicant stated it was more for aesthetics, as the front is the only part of the building that is brick and they would like a cohesive look. The applicant handed out information to the commission titled "Benefits of Brick Staining". Chairman Grundy said that he thinks because it is a non-contributing building that painting it may be appropriate. Commissioner Lozier agreed. Commissioner Pozel said she is fine with it as long as it is not setting a precedent, allowing for other masonry or stone that has never been painted to be painted in the future. Motion by Commissioner Lozier to

approve the application with the stipulation that stain, not paint be used on the masonry, this is acceptable because this building is not a contributing building to the Prospect Heights District. The motion was seconded by Vice Chairman Carr. Motion passed unanimously. 7-0-0. Commissioner Drottz advised the applicants to seal the brick with Professional Products, a breathable sealant.

VI. **HDRC Case #17-018LS** Consideration of an After the Fact Certificate of Appropriateness at 2 N. Main, Liberty Square Historic District to rebuild the west wall and replace windows. Commissioner Wilson asked for clarification on how much work has been done. The applicant, Mr. Altis, said the West Wall was rebuilt and they put in new wood aluminum clad windows. Vice Chairman Carr asked if the applicant was going to overlay the new back wall with brick. The applicant confirmed that has already been done. Vice Chairman Carr asked if the brick mould would be traditional or contemporary. Mr. Altis said it will be 2 ¼" wide brick mould around to frame the windows. There are several different styles. Vice Chairman Carr asked what profile. The applicant replied it would be approx. 2.5 inches. Vice Chairman Carr commented that the building is severely compromised as it is and use of appropriate materials is important moving forward. Commissioner Wilson asked if the original brick is gone. The applicate said he thought part of it could be repointed but as they worked down he realized there was nothing holding it together. The original bricks were used to determine what type of new bricks to use. Commissioner Drottz agrees with Vice Chairman Carr on the brick profile. The Commission would like to see a sample of the brick mould. Commissioner Drottz asked if there was guttering on the back and if a cap was removed and replaced. Mr. Altis said they did not replace any of it. The corrugated gutter and down spout will be put back. Commissioner Wilson asked if the windows were replaced. The applicant confirmed they had been but they were not original windows. They put in Pella wood aluminum clad windows. Vice Chairman Carr said they come without trim then you install the trim. As opposed to a window where the casings are part of the unit. The applicant shared that there are plans to remove the plywood and put in more new windows. The wall that faces Kansas has already been painted, and the applicant indicated he will paint it soon. Commissioner Lozier commented in the future, approval needs to happen first. Commissioner Hobbs said there are products available that will act as a barrier to moisture for stone and brick. Commissioner Wilson asked if the commission was pleased with the bricks that were chosen. Vice Chairman Carr said in his opinion it was a good choice of brick. Motion by Commissioner Lozier to approve this application submitted with the stipulation that the applicant submit a sample of the brick mould for final approval. Motion seconded by Vice Chairman Carr. Motion passed unanimously. 7-0-0.

VII. **HDRC Case #17-012PH** Consideration of a Certificate of Appropriateness at 343 W. Liberty Drive, Prospect Heights District for in-kind repairs to the roof and soffits in conjunction with a Chapter 353 application. Commissioner Lozier made a motion to approve the application as submitted. Motion seconded by Commissioner Hobbs. Motion passed unanimously. 7-0-0.

Other Business
Administrative Approvals since the September 5, 2017 meeting

- 19 N. Water Window Repair In-Kind
- 315 W. Kansas Fence

Miscellaneous matters from the Commission
Vice Chairman Carr said the porch rebuild on Lightburne is still in progress. The applicant has changed to wood flooring on the front porch. He will ask for an amended COA.
Commissioner Lozier said he ran into the owner of Windbrick. He is looking for local landmark status for his property and hopes to be able to take advantage of the 353 Tax Abatement. Staff will do some checking to find out if that status is to originate with the property owner or the Commission.
Staff will check to see if there a City match is required for the matching grant to update the historic district survey, create a new survey or do a landmark survey.
Commissioner Pozel asked for clarification on the process for establishing another local district. Commissioner Hobbs said the first step should be to see if there is an interested among the home owners to establish a new local district. Commissioner Hobbs said for the Arthur District we need to see if we want the district to boundaries to match the National Boundaries or connect it to the Jewell District. Community outreach is the most important piece as it takes the majority of the home owners to agree to a district. Commissioner Hobbs said there are significant homes on Jewell Street, that are significant because of who owned them.

Miscellaneous matters from staff
CLG Training: Those going to St Joe for the CLG Training on ethics will depart at 9 a.m. Thursday from City Hall.
Follow Up from last meeting: Staff asked if there was evidence that people were living in the home at Kansas and Jewell Street. Vice Chairman Carr said he believes a father and two young children are living there. Staff said if the home is deemed dangerous it will have to be demolished, with no input from HDRC. It is an 1840's home and has been neglected for a long time. Staff will follow up.

Preservation Briefs – Staff reported that after our CLG training with the state it was suggested that each month an article on preservation be provided to the commission and added as a discussion item to the agenda. Commissioner Carr commented that the "Preservation Briefs" article provided was very good. It was about making historic properties ADA Compliant; he added it brought to light that there are creative ways to make this possible. Commissioner Pozel commented she found the article to be interesting and helpful. Chairman Grundy commented the old Post office came to mind as not accessible and staff added that the Archives building is another one. There are some simple changes that can be made to make historic buildings accessible.

The meeting adjourned at 6:50 p.m.

HDRC Design Sub Committee Meeting Summary

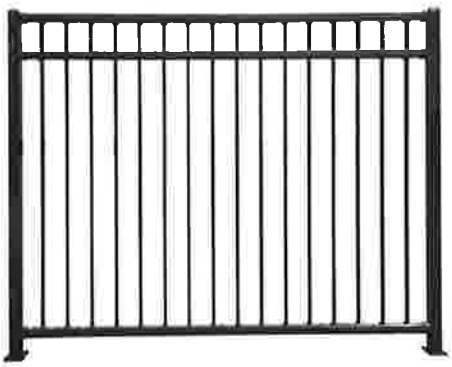
October 10, 2017

9:00 AM

Attendees: John Carr, Vern Drottz, Dail Hobbs. Applicants: Don Altis and Alex Merrell. City Staff: Jeanine Thill

I. 2 N. Main - Don Altis, Owner. It was approved for Mr. Altis use a snap in window frame for all the windows. A resource to consider- call Pella Windows sales rep, Jim Cindrick at 816-985-8140 to get information. It may be available at PMD (Pacific Mutual Door & Window Co.) or Schulte. For the bricks they are an acceptable color and are appropriately laid, with the smooth side out. They replicate the 100 year old brick very well. For the South elevation Mr. Altis said he would like to do the same improvements as the West wall and asked for the committee's suggestions on the crawl space door and the opening where there was a door on the second floor. The committee said it would be acceptable to brick in the door opening with the same brick. For the stone he should strip it and use Peel Away 1. Professional brand sealant should be used for the brick and stone. At the roofline he should consider a U shaped masonry cap coping. For the front façade the shake shingles should be examined and dismantled with care.

II. 22 N. Main - Alex Merrell, owner of Hammerhand Coffee showed a sample of the aluminum fence he is proposing to use as a barrier around his sidewalk café. The committee approved of the design (see below) and asked that it not be attached to the building in any fashion. Mr. Merrell indicated it would not and would only be anchored into the sidewalk. He will work with building and engineering divisions on the height. The committee preferred the 36 inch height over the 48 inch. Staff will have City Staff follow up with Mr. Merrell on the height.



The City of Liberty missouri

Historic District Review Commission

HDRC Case No. 17-014PH

Staff: Jeanine Thill, Community Development Manager

Meeting Date: November 7, 2017

GENERAL INFORMATION

Application:	Certificate of Appropriateness for side deck with porch elements
Applicant:	Cathy Teague
Location:	20 S. Terrace Ave.
District:	Prospect Heights Historic District
NRHP Status/category:	Contributing
File Date:	October 30, 2017

SPECIFIC INFORMATION

SITE HISTORY

A typical Prairie 4-square with wide, overhanging hip roof eaves. The hipped roof dormers also have overhanging eaves. The full length, hip roof front porch does have round, classical columns rather than the typical square porch supports. The clapboards are quite narrow and the foundation is high, in response to the sloping land. The home is believed to have been part of a dairy operation in Liberty – the concrete patio on the side of the house was park of the cooling room for milk.

PROPOSAL DESCRIPTION

The applicant proposes to replace the decking, railing, gate and steps and add porch style elements.

Details

The new deck will retain the footprint of the existing deck. The structure will be constructed of wood. In kind repairs will be done to the wood floor of the porch. The railing will be 42" high, with 2x4" top and bottom rails. North handrail and West handrail: To be built to match the existing east facing handrail. Gate on the west elevation will match east gate. Skirt on east elevation: White 4X8 vinyl lattice from under rim to grade to match existing. Skirt North and West elevation: Treated lattice from rim to grade. Paint will be applied to the east elevation facing the street to include the post, top and bottom rail, balusters, face of rim, trim around lattice and stairs.

ANALYSIS

Unified Development Ordinance ("UDO") - The Unified Development Ordinance outlines design principles that have been adopted for all historic districts and landmarks in the City of Liberty.

Design Guidelines ("DG") - Design Guidelines were established to give the HDRC general guidance in making subjective preservation choices in accordance with accepted best practices and the Secretary of the Interior standards for historic preservation.

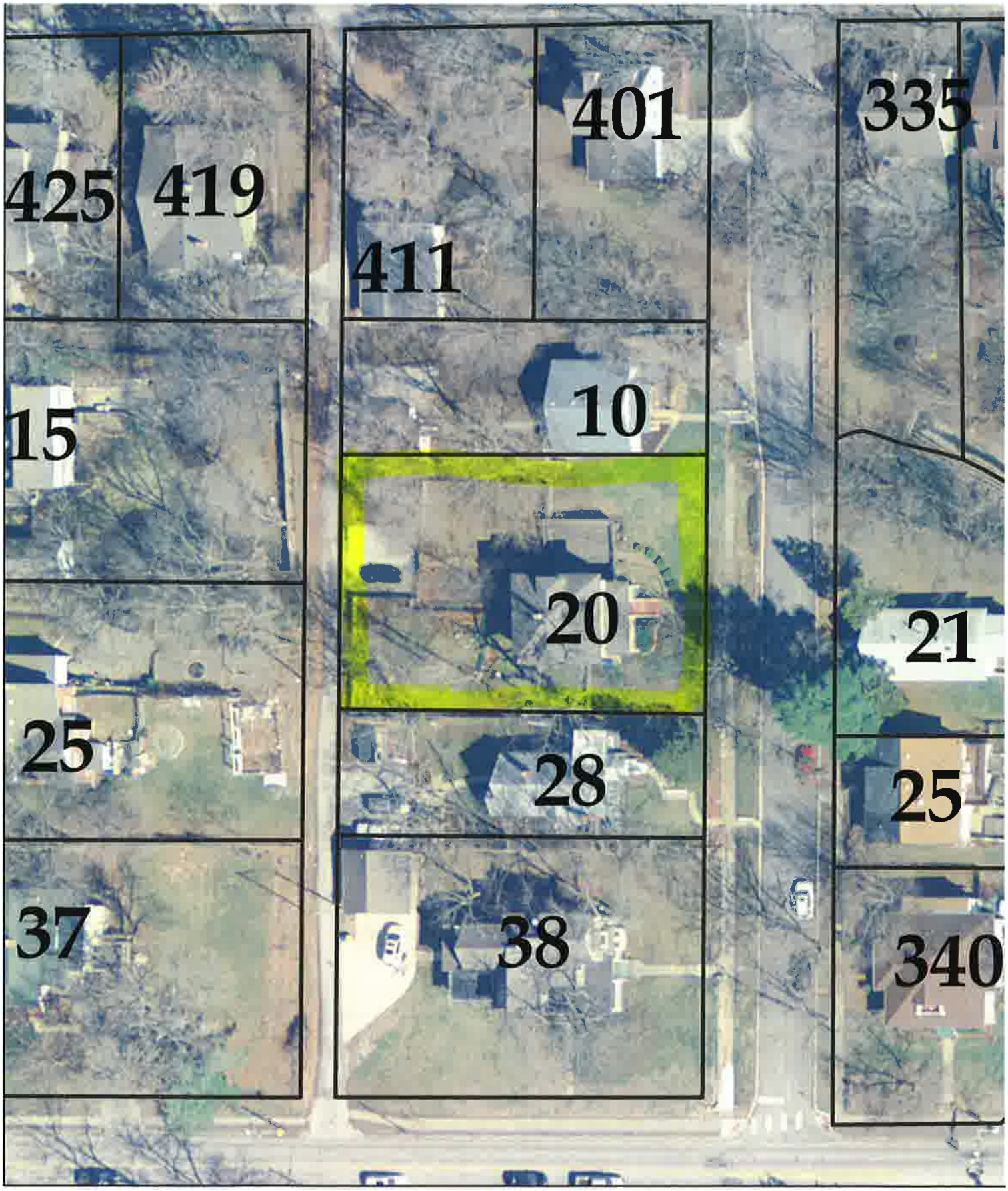
DG: Sec. 30-72. District HP, design principles.	Staff Analysis
8. Porches: Porches, porticos, stoops, entryways, loading docks, decks, and exterior stairways shall be of a scale, design, material, and color that complement the existing façade and its individual elements.	The proposed deck with porch elements will complement the design and materials of the house.
UDO: Sec. 30-81.2. Accessory structures, residential districts. 5. A deck, patio, or gazebo shall be allowed only in the rear yard and located at least 5 feet from any lot line.	The proposed deck is a reduction in non-conformity and meets the required setbacks.

STAFF RECOMMENDATION

With the stipulation that wood lattice being used rather than vinyl, and all elevations of the lattice, balusters and rails are painted, the application meets the standards for review and the design guidelines; therefore staff recommends approval of HDRC case #17-014PH.

ATTACHMENTS

1. Exhibit A: Vicinity Map
2. Exhibit B: Inventory Data Sheet
3. Exhibit C: Photos of existing conditions
4. Exhibit D: Photo of proposed railing and materials list



HDRC Case #17-014PH
20 S Terrace Ave.

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EXHIBIT A:
VICINITY MAP

MISSOURI OFFICE OF HISTORIC PRESERVATION

ARCHITECTURAL/HISTORIC INVENTORY SURVEY FORM

1. NO. H-11a

2. COUNTY Clay

3. LOCATION OF NEGATIVES Liberty Community Development

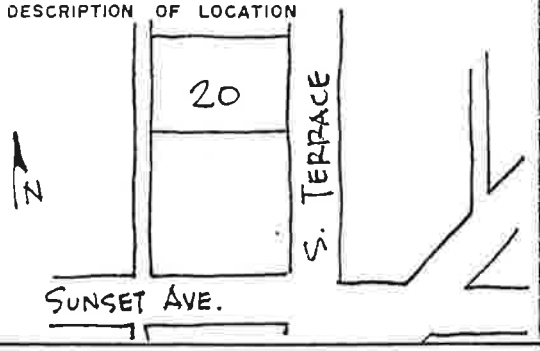
4. PRESENT LOCAL NAME(S) OR DESIGNATION(S) 20 S. Terrace Av.

5. OTHER NAME(S)

6. SPECIFIC LEGAL LOCATION TOWNSHIP 51N RANGE 31W SECTION 7
IF CITY OR TOWN, STREET ADDRESS

7. CITY OR TOWN Liberty IF RURAL, VICINITY

8. DESCRIPTION OF LOCATION



9. COORDINATES UTM
LAT N121,000
LONG E521,000

10. SITE ( ) STRUCTURE ( )
BUILDING (X) OBJECT ( )

11. ON NATIONAL REGISTER? YES ( ) NO (X)

12. IS IT ELIGIBLE? YES ( ) NO (X)

13. PART OF ESTAB. HIST. DISTRICT? YES ( ) NO (X)

14. DISTRICT POTENTIAL? YES (X) NO ( )

15. NAME OF ESTABLISHED DISTRICT

16. THEMATIC CATEGORY

17. DATE(S) OR PERIOD ca. 1909

18. STYLE OR DESIGN Prairie 4-square

19. ARCHITECT OR ENGINEER

20. CONTRACTOR OR BUILDER

21. ORIGINAL USE, IF APPARENT residence

22. PRESENT USE residence

23. OWNERSHIP PUBLIC ( ) PRIVATE (X)

24. OWNER'S NAME AND ADDRESS IF KNOWN May

25. OPEN TO PUBLIC? YES ( ) NO (X)

26. LOCAL CONTACT PERSON OR ORGANIZATION Community Development Director

27. OTHER SURVEYS IN WHICH INCLUDED

28. NO. OF STORIES 2

29. BASEMENT? YES (X) NO ( )

30. FOUNDATION MATERIAL stone

31. WALL CONSTRUCTION frame

32. ROOF TYPE AND MATERIAL hip; composition shingle

33. NO. OF BAYS FRONT 2 SIDE 2

34. WALL TREATMENT clapboard

35. PLAN SHAPE square

36. CHANGES (EXPLAIN IN NO. 42) ADDITION ( ) ALTERED ( ) MOVED ( )

37. CONDITION INTERIOR _____ EXTERIOR good

38. PRESERVATION UNDERWAY? YES (X) NO ( )

39. ENDANGERED? BY WHAT? YES ( ) NO (X)

40. VISIBLE FROM PUBLIC ROAD? YES (X) NO ( )

41. DISTANCE FROM AND FRONTAGE ON ROAD 100'

42. FURTHER DESCRIPTION OF IMPORTANT FEATURES A typical Prairie 4-square with wide, overhanging hip roof eaves. The hipped roof dormers also have overhanging eaves. The full length, hipp roof front porch does have round, classical columns rather than the typical square porch supports. The clapboards are quite narrow, and the foundation is high, in response to the sloping land. There is an interior fireplace.

PHOTO MUST BE PROVIDED

43. HISTORY AND SIGNIFICANCE The house is a good example of the Prairie 4-square, a vernacular housing type popular at the first part of this century. It serves as a transition between the larger, more detailed Queen Anne on the left, and the smaller, more modest bungalow on the right. It is believed to have been part of a dairy operation in Liberty - the concrete patio on the side of the house was part of the cooling room for the milk. A ca. 1905-1912 photgraph reveals a barn at the rear of the property.

44. DESCRIPTION OF ENVIRONMENT AND OUTBUILDINGS A large, wooded lot which sits fairly high on a ridge. The house sits quite high off of S. Terrace. Parking is in the rear, reached from the back alley.

45. SOURCES OF INFORMATION City water permits. Owner survey. The Heritage of Liberty, 1976.

46. PREPARED BY Deon Wolfenbarger

47. ORGANIZATION Community Development

48. DATE 4/87

49. REVISION DATE(S) Exhibit B

RETURN THIS FORM WHEN COMPLETED TO: OFFICE OF HISTORIC PRESERVATION
P.O. BOX 176
JEFFERSON CITY, MISSOURI 65102
PH. 314-751-4096

IF ADDITIONAL SPACE IS NEEDED, ATTACH SEPARATE SHEET(S) TO THIS FORM

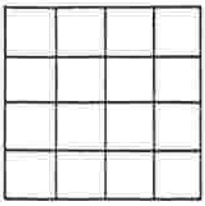
1. NO. 2. COUNTY 3. LOCATION OF NEGATIVES 4. PRESENT LOCAL NAME(S) OR DESIGNATION(S) 5. OTHER NAME(S) 6. TOWNSHIP RANGE SECTION

Sketch map of location Site No. _____

Section 7 Township 51N Range 31W

Indicate the chief topographical features, such as streams and elevations. Also indicate houses and roads. Indicate the site location by enclosing the site area with dotted line. Note scale of map and portion of section included in sketch map. Include drawings, photographs, etc. on additional pages.

Indicate part of section included in sketch map.



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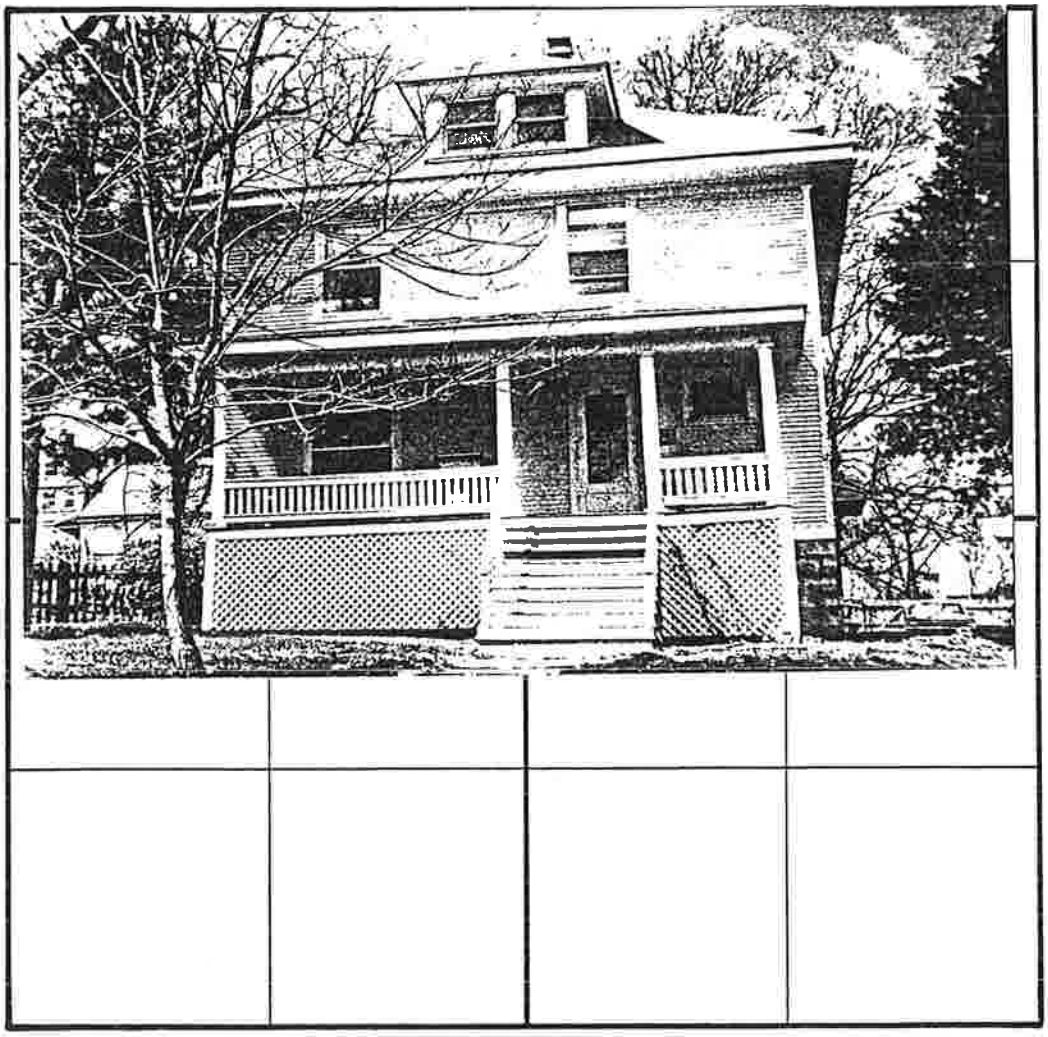

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Notes:

THIS IS PROBABLY THE ONE MOST IMPORTANT PART OF THIS DATA FORM!

Please Attach a copy of a topographic map with the site marked on it.

Front Porch, Existing Conditions

Deck, Existing Conditions

Exhibit C
Existing Conditions

Exhibit C
Existing Conditions

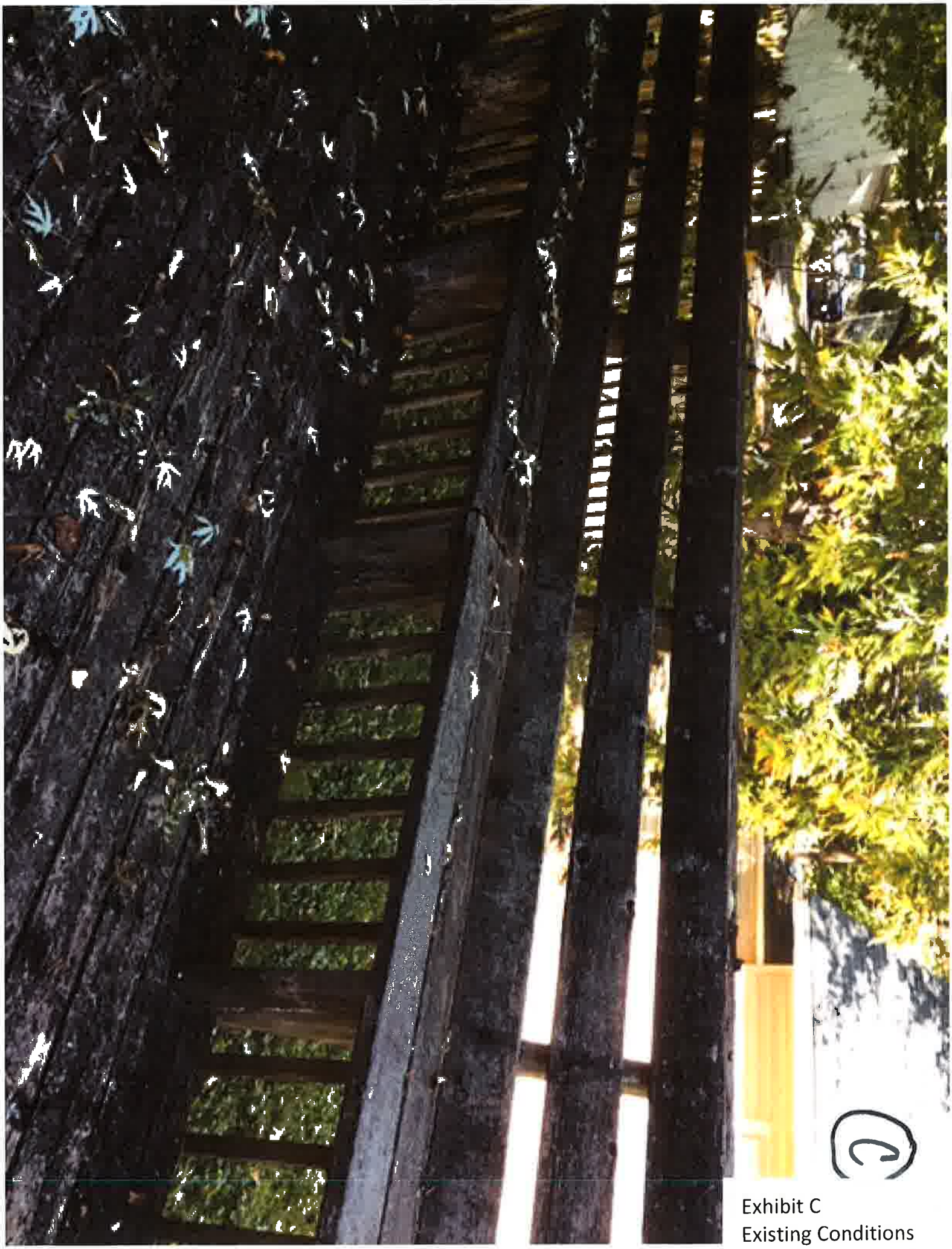


Exhibit C
Existing Conditions

East side of deck (facing street) -6"x6" post 42" tall with 3/4" 45 degree taper around top.
-2"x4" top rail horizontal centered on adjacent face of post from rim (38" finish height).
-2"x4" bottom rail horizontal centered on adjacent face of post from rim.
-2"x2" balusters centered on top and bottom rail evenly spaced at 3-1/2" o.c..
-Gate will be built to match existing with the arch.
North handrail and West handrail -These handrails will be built to match the existing east facing handrail. -Gate on west elevation will match east gate.
Skirt East elevation -White 4'x8' vinyl lattice from under rim to grade to match existing (vinyl for longevity and ease of maintenance)
Skirt North and West elevation -Treated lattice from rim to grade.
Paint -Treated lumber will need to dry over the winter. -Paint will only be applied to the east elevation facing the street (post, top and bottom rail, balusters, face of rim, trim around lattice, stairs)

Exhibit D
Photos of proposed railing,balusters and materials. No roof or columns proposed.

The City of Liberty missouri

Historic District Review Commission

HDRC Case No. 17-019LS

Staff: Jeanine Thill, Community Development Manager

HDRC Meeting Date: November 7, 2017

GENERAL INFORMATION

Application:	Certificate of Appropriateness for storefront alterations
Applicant:	Historic Downtown Liberty Inc. – Aimee Gray
Location:	117b N. Main Street
District:	Liberty Square Historic District
NRHP Status/category:	Contributing
File Date:	October 27, 2017

SPECIFIC INFORMATION

SITE HISTORY

This building faces west and consists of a one story section which contains an office at the southernmost end, and a section which is taller as it serves as a garage. The building is constructed of rusticated concrete block. John Fischer was one of Liberty's first auto mechanics and his garage was probably one of the earliest to be located in the town.

PROPOSAL DESCRIPTION

The applicant proposes façade improvements

Details

Remove concrete block back to original opening, header to remain. New wood storefront entry with double doors in existing masonry opening (see West Elevation Option 2). Powerwash and paint façade. Repair and repaint wood windows, each side. A dog watering fountain is proposed on the SW corner, use existing plumbing.

ANALYSIS

Unified Development Ordinance ("UDO") - The Unified Development Ordinance outlines design principles that have been adopted for all historic districts and landmarks in the City of Liberty.

Design Guidelines ("DG") - Design Guidelines were established to give the HDRC general guidance in making subjective preservation choices in accordance with accepted best practices and the Secretary of the Interior standards for historic preservation.

DG: Sec. 30-72. District HP, design principles.	Staff Analysis
2. Alterations: Alterations shall restore a structure's original elements, materials, and appearance, if economically or physically	Based on historic photo evidence, it appears the

feasible. Alterations affecting the exterior of a structure shall preserve all significant original exterior elements, including building materials, doors, windows, and decorative elements. Elements that are not original, but which may have acquired significance by virtue of age or craftsmanship, shall also be preserved. Alterations that disguise or sheath original elements and materials will not be permitted. Storefronts and commercial building facades shall be treated as a whole, and alterations to the first floor should be compatible with the upper floor(s).	concrete block in the storefront is not original. Reconstruction of the storefront is encouraged and appropriate. The proposed dog water fountain will not disguise or sheath original elements.
7. Doors and windows: Original doors and windows shall not be replaced unless there is substantial evidence that they are no longer serviceable or cannot be restored. Restoration of original entryways that may have been covered, altered, or removed over time is encouraged. Replacement doors and windows that imitate an earlier inappropriate style are discouraged.	The existing door is not original. The style of the proposed double doors is more appropriate for commercial use than the existing doors, and their replacement is encouraged. Appropriate in-kind repairs will be made to the existing wood windows.
13. Signs and awnings: Signs that disguise, obstruct, or detract from significant façade elements shall not be allowed. Signs and awnings shall be designed to complement the style, materials, and color of the building.	The proposed signs will complement the style of the building.
UDO: Sec. 30-87.4. CBD and MU districts. 1. Each freestanding commercial building shall be allowed a total of 2 signs, each of which shall be designed in a manner that is suitable and complementary to adjacent development, from the following: b. A projecting sign in accordance with the following provisions: i. the sign shall not exceed 6 square feet in area; ii. the sign shall have an 8 foot minimum vertical clearance; iii. the sign shall not project more than 5 feet from the face of the building; and iv. the sign shall not be lit.	The proposed signs will meet the standards for projecting signs.

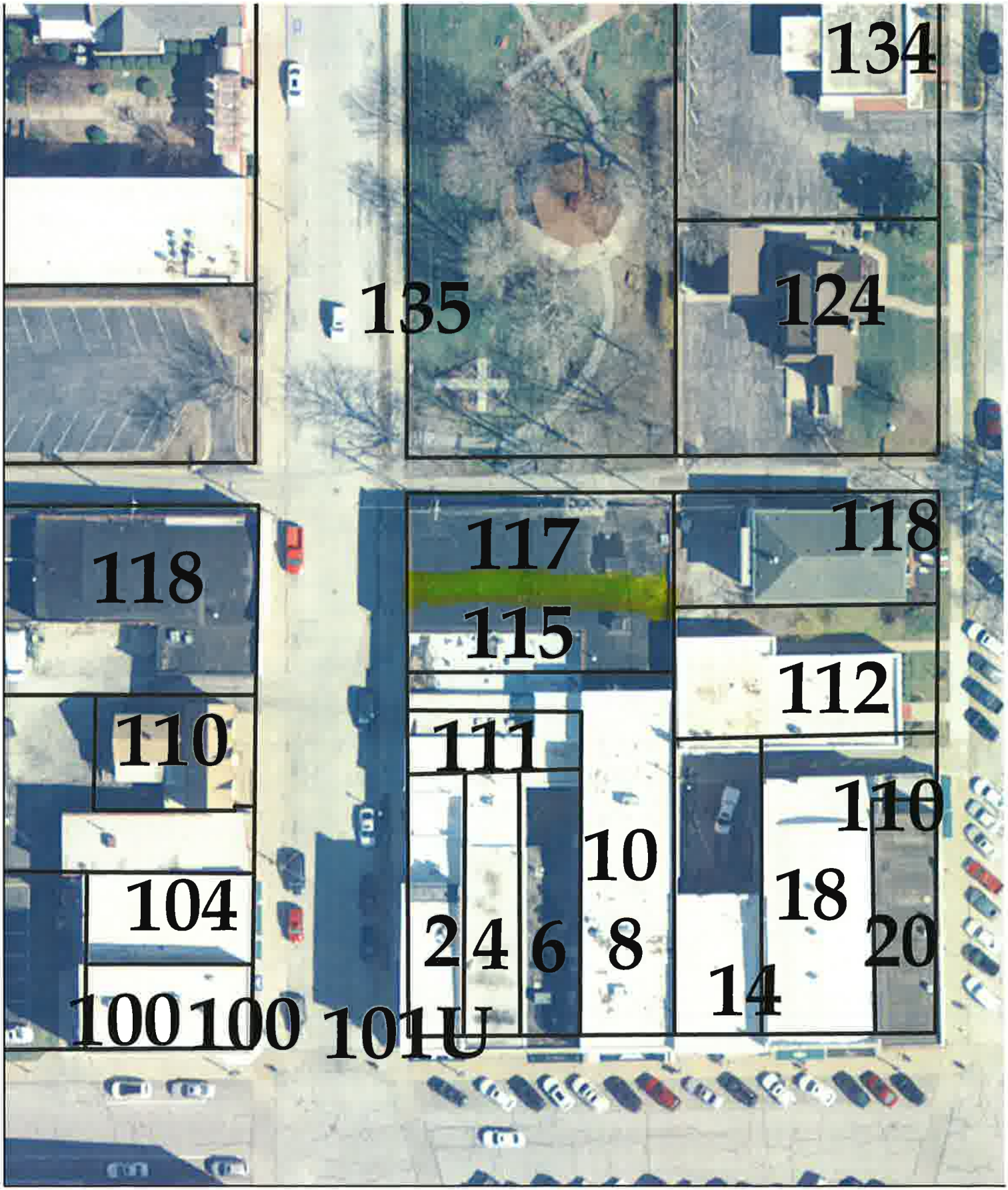
STAFF RECOMMENDATION

The application meets the standards for review and guidelines; therefore staff recommends approval of HDRC case #17-019LS.

ATTACHMENTS

1. Exhibit A: Vicinity Map
2. Exhibit B: Inventory Data Sheet
3. Exhibit C: Proposed storefront designs
4. Exhibit D: Proposed Pet Fountain

117b N. Main Existing Conditions



HDRC Case #17-019LS
117b N Main Street

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EXHIBIT A:
VICINITY MAP

HISTORIC INVENTORY

1. No. 4-D

2 County: Clay

Location of Negatives: Liberty Community Development

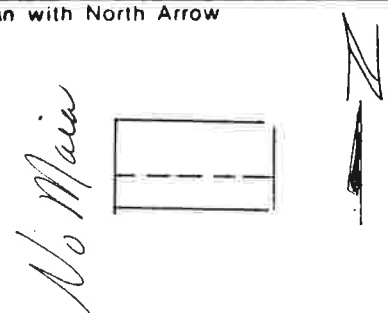
4. Present Name(s): 117 North Main Street

5. Other Name(s): J.F. Fischer Garage

6 Specific Location: 117 North Main

7 City or Town / If Rural, Township & Vicinity: Liberty, Missouri

8. Site Plan with North Arrow



9. Negative No.: 4-14 & 4-13

10. Site / Building XX / Structure / Object

On National Register? Yes / No XX

12 Is It Eligible? Yes XX / No

13. Part of Estab. Hist. Dist.? Yes / No XX

14. District Potent'l? Yes XX / No

15. Name of Established District

16. Thematic Category

17 Date(s) or Period: c.1910

18 Style or Design

19. Architect or Engineer

20. Contractor or Builder

21. Original Use, if apparent: garage

22. Present Use: garage

23 Ownership: Public / Private X

24. Owner's Name & Address, if known

25. Open to Public? Yes / No XX

26. Local Contact Person or Organization: Liberty Mo, Community Devel.

27. Other Surveys in Which Included

28. No of Stories: 1

29. Basement? Yes / No

30. Foundation Material

31. Wall Construction: concrete block

32. Roof Type & Material: flat; tar & gravel

33. No. of Bays: Front / Side

34. Wall Treatment: concrete block

35. Plan Shape: rectangular

36. Changes (Explain in #42): Addition / Altered / Moved

37. Condition: Interior / Exterior: good

38. Preservation Underway? Yes / No X

39. Endangered? By What? Yes / No X

40. Visible from Public Road? Yes X / No

41. Distance from and Frontage on Road: approx 35' on N. Main

42. Further Description of Important Features: This building faces west and consists of a one story section which contains an office at the southern most end, and a section which is taller as it serves as a garage. The building is constructed of rusticated concrete block.

43. History and Significance: John Fischer was one of Liberty's first auto mechanics and his garage was probably one of the earliest to be located in the town.

44. Description of Environment and Outbuildings: A small park is north of this building. To the east is a residence. Commercial buildings are to the south and west.

45. Sources of Information: erty Tribune, December 19,1948; Oct. 31,1940 ~~Liberty City Directories~~

46. Prepared by: PILAND/UGUCCIONI

47. Organization: Liberty, Comm. Dev.

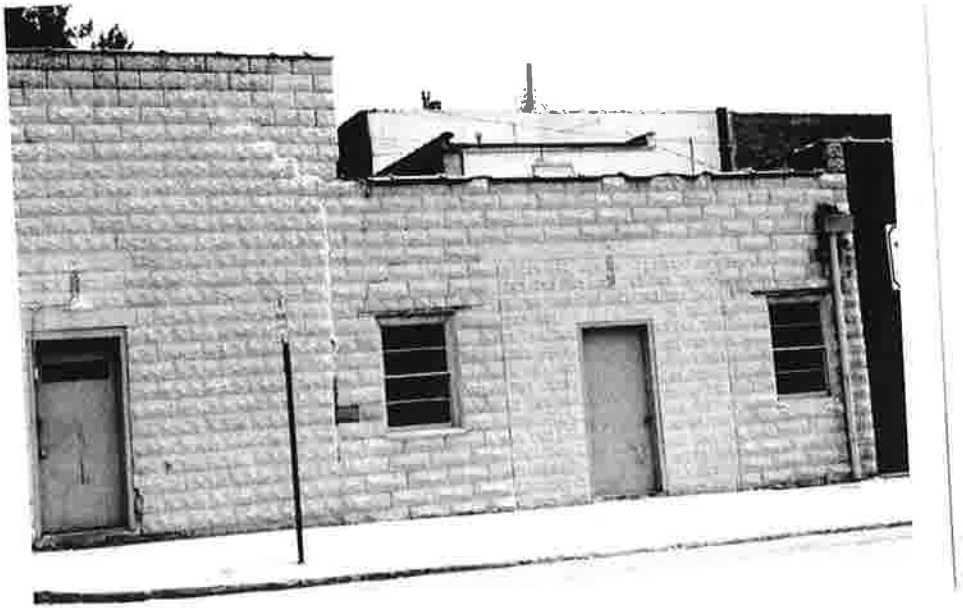
48. Date: 4/85

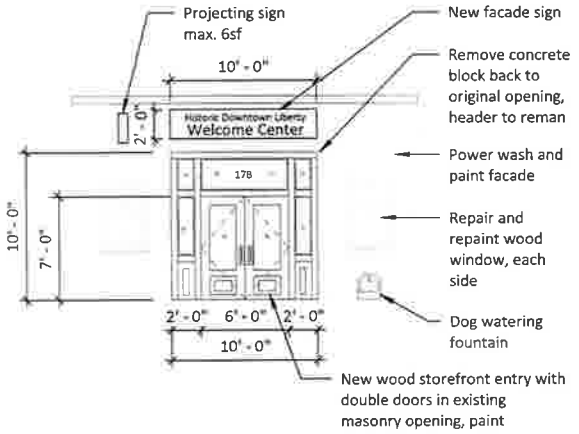
49. Exhibit B

Continuation

HISTORIC INVENTORY

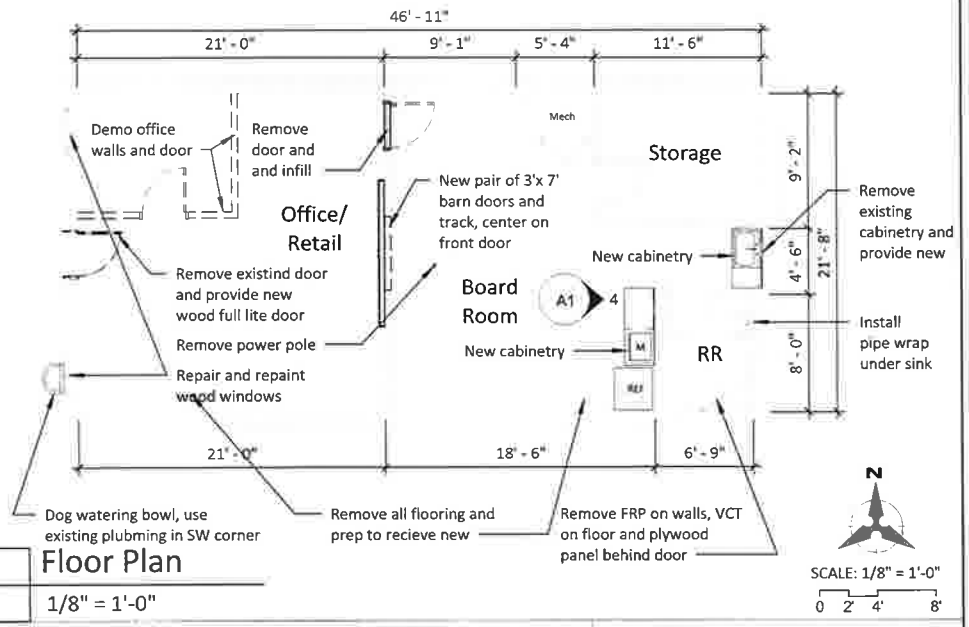
ADDRESS: 117 North Main Street
Liberty, MO





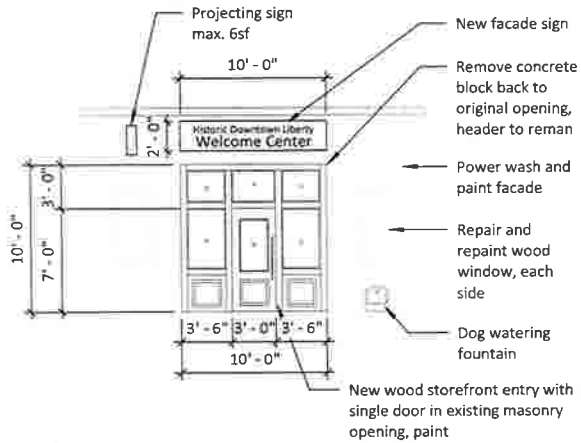
3 West Elevation Option 2

1/8" = 1'-0"



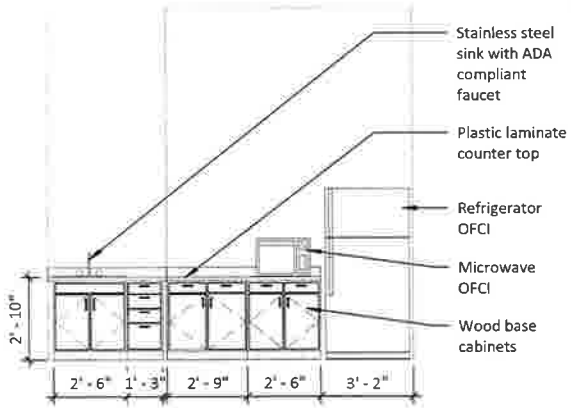
1 Floor Plan

1/8" = 1'-0"



2 West Elevation Option 3

1/8" = 1'-0"



4 Cabinetry Elevation

A1 1/4" = 1'-0"

Flooring

Option 1
- Office/Board: Kinetex, Umbra (1819) 1762 Opaque
- Base: 4" rubber base, Roppe Black Brown
- Bathroom: Ceramic tile on walls and floor

Option 2
- Office/Board: Roll good tile
- Bathroom: Ceramic tile on floor, paint walls
- Base: Repair and paint existing

Walls

Option 1 - Kilz and paint throughout, eggshell
Option 2 - Paint throughout, eggshell
Provide epoxy paint in bathroom

Ceilings

Option 1 - New ceiling tile and grid throughout
Option 2 - Paint grid and install new tile
Option 3 - Paint ceiling tile and grid
Option 4 - Remove and paint all components

Lighting (refer to ceiling options)

Option 1-3 - Replace all with 2x4 LED troffer
Option 4 - Provide suspended 1x4 fixtures

a3G architects
15 South Main Street
Liberty, Missouri 64068
816.476.2531
Missouri Certificate of Authority: #A-2014000783

Historic Downtown Liberty Inc.

Tenant Finish

117 B N. Main Street
Liberty, Missouri
64068

Aimee D Gray
Missouri License #A-2007019924

ISSUE

HDRC Review	25 Oct 17

Renovation Plans

A1

Project Number: 16.000

Exhibit C

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Outdoor pet drinking fountains/ Pet Fountains are designed for parks, pet parks, pet clinics, home owners and associations or anywhere there is a thirsty pet. Made in the U.S.A.

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- Specifications
- Operation Manual/ Submittal

WATCH THE VIDEO

DESCRIPTION:

- Push button requires less than 5 lbs of pressure to operate.
- Vacuum breaker included for pet fountain.
- Solid engineering and intuitive design.
- Maintenance friendly and built "tank tough".
- Available in one piece welded construction with standard 3/16" wall or standard 304 schedule 10 stainless steel.
- Exterior anchoring system.
- Simple winterization if applicable.
- Supply connection stops above grade behind the access door.
- All products including 'SS' are powder coated for extra protection.
- Weight: 90 lbs.

Exhibit D

Celebrate Preservation Month!

Thanks to a grant received from Missouri State Historic Preservation Office (SHPO), Missouri Main Street Connection (MMSC) plans to celebrate Preservation Month during May 2018, and we hope you and your organization will join us in a brand-new event that joins historic sites, special events, and fun!

We are urging all Missouri Main Street Programs to partner with other local organizations (Historical Societies, Museums, Special Events, Tourism groups, Chambers of Commerce, etc.) and come up with tours of preservation properties and other preservation special events to feature in your community. These preservation events do not have to be "stand alone" events; link them to other activities in your community if you prefer. If possible, join with surrounding communities to form a regional destination in May to celebrate Preservation Month.

We have divided the state into three Regions—St. Louis/SE Region, Kansas City/SW Region, and Northern Missouri Region. We would like to group events in each region to make it easier for visitors to pick up two or three events in one trip or perhaps make an overnight visit. We have allowed for some overlap in dates and each group has two full weekends. Please plan your events according to the following:

Northern Missouri Region—May 1-13
St. Louis/SE Region—May 7-20
KC/SE Region—May 19-31

Please think about what your community can do. We are sure you will come up with many good ideas. Let us know what you are doing and we will help promote it. We encourage you to be creative!

MMSC will develop a "Calendar of Events" for May, 2018 showing community events and state historic sites. We will advertise the Calendar in Missouri Life magazine (print and digital) and it will be on the MMSC website. Each selected community is entitled to ONE entry on the Calendar—so make yours a good one!

In addition to local preservation events, we will include on the Calendar of Events a number of statewide historic sites to invite folks to visit. We have surveyed our communities and others to tell us what they think is the Top Ten Historic Sites in Missouri. We will include the top four sites in our calendar of events.

We will sponsor a poster promoting the Calendar of Events that will be distributed throughout Missouri to encourage folks to visit Missouri Historic Sites. We will do a Media Blitz to include social media and press releases for your local media. We will also sponsor a road show to bring MMSC staff, Board members, SHPO and Missouri Preservation folks to visit selected sites.

Each community that contributes to the Calendar of Events will receive 24 buttons and 12 tee shirts that proclaim, "This Place Matters/Missouri." Extra tee shirts can be purchased in advance at cost. Each community will also receive posters.

So, call your neighbors, see how many historic sites and other activities you can package together for a visit in your community/region. Be creative, teach and learn about preservation, but most of all, have FUN!

Let's all celebrate preservation and invite visitors to our communities to see what wonderful history we have in Missouri!

This project is partially funded by a grant from the Missouri Department of Natural Resources, State Historic Preservation Office and U.S. Department of the Interior, National Park Service. Grant awards do not imply an endorsement of contents by the grantor. Federal laws prohibit discrimination on the basis of race, religion, sex, age, handicap, or ethnicity. For more information, write to the Office of Equal Opportunity, U.S. Department of the Interior, Washington, D.C. 20240.

2 PRESERVATION BRIEFS

Repointing Mortar Joints in Historic Masonry Buildings

Robert C. Mack, FAIA
John P. Speweik

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

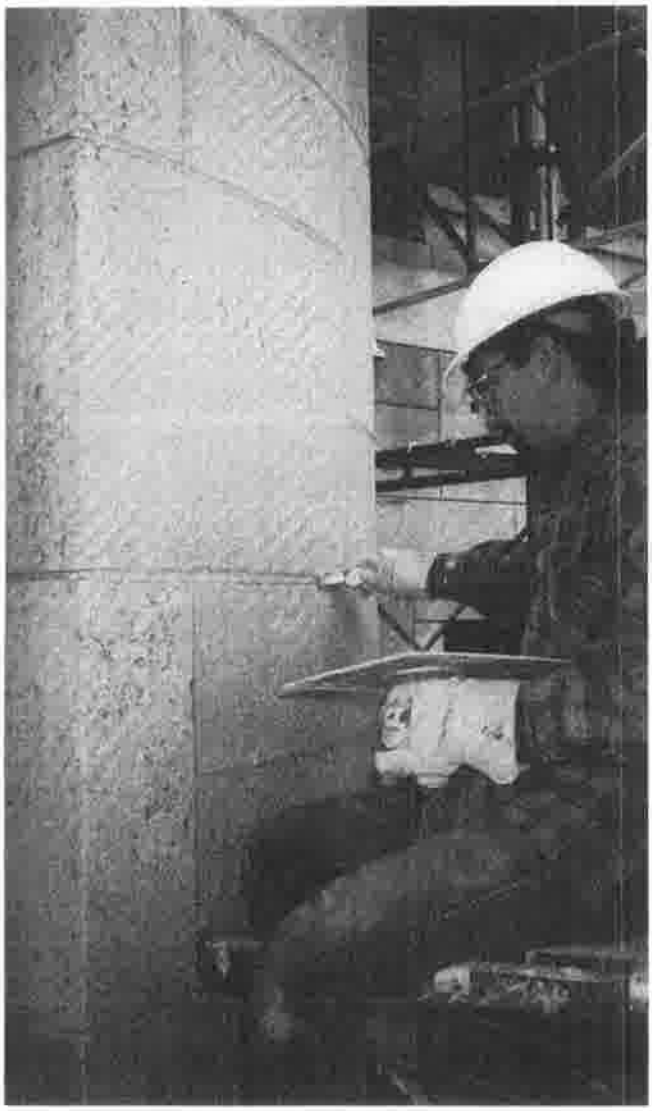


Figure 1. After removing deteriorated mortar, an experienced mason repoints a portion of this early-20th century limestone building. Photo: Robert C. Mack, FAIA.

Masonry — brick, stone, terra-cotta, and concrete block — is found on nearly every historic building. Structures with all-masonry exteriors come to mind immediately, but most other buildings at least have masonry foundations or chimneys. Although generally considered "permanent," masonry is subject to deterioration, especially at the mortar joints. Repointing, also known simply as "pointing"or—somewhat inaccurately—"tuck pointing"*, is the process of removing deteriorated mortar from the joints of a masonry wall and replacing it with new mortar (Fig. 1). Properly done, repointing restores the visual and physical integrity of the masonry. Improperly done, repointing not only detracts from the appearance of the building, but may also cause physical damage to the masonry units themselves.

The purpose of this Brief is to provide general guidance on appropriate materials and methods for repointing historic masonry buildings and it is intended to benefit building owners, architects, and contractors. The Brief should serve as a guide to prepare specifications for repointing historic masonry buildings. It should also help develop sensitivity to the particular needs of historic masonry, and to assist historic building owners in working cooperatively with architects, architectural conservators and historic preservation consultants, and contractors. Although specifically intended for historic buildings, the guidance is appropriate for other masonry buildings as well. This publication updates *Preservation Briefs 2: Repointing Mortar Joints in Historic Brick Buildings* to include all types of historic unit masonry. The scope of the earlier Brief has also been expanded to acknowledge that the many buildings constructed in the first half of the 20th century are now historic and eligible for listing in the National Register of Historic Places, and that they may have been originally constructed with portland cement mortar.

*Tuckpointing technically describes a primarily decorative application of a raised mortar joint or lime putty joint on top of flush mortar joints.

Historical Background

Mortar consisting primarily of lime and sand has been used as an integral part of masonry structures for thousands of years. Up until about the mid-19th century, lime or quicklime (sometimes called lump lime) was delivered to construction sites, where it had to be slaked, or combined with water. Mixing with water caused it to boil and resulted in a wet lime putty that was left to mature in a pit or wooden box for several weeks, up to a year. Traditional mortar was made from lime putty, or slaked lime, combined with local sand, generally in a ratio of 1 part lime putty to 3 parts sand by volume. Often other ingredients, such as crushed marine shells (another source of lime), brick dust, clay, natural cements, pigments, and even animal hair were also added to mortar, but the basic formulation for lime putty and sand mortar remained unchanged for centuries until the advent of portland cement or its forerunner, Roman cement, a natural, hydraulic cement.

Portland cement was patented in Great Britain in 1824. It was named after the stone from Portland in Dorset which it resembled when hard. This is a fast-curing, hydraulic cement which hardens under water. Portland cement was first manufactured in the United States in 1872, although it was imported before this date. But it was not in common use throughout the country until the early 20th century. Up until the turn of the century portland cement was considered primarily an additive, or "minor ingredient" to help accelerate mortar set time. By the 1930s, however, most masons used a mix of equal parts portland cement and lime putty. Thus, the mortar found in masonry structures built between 1873 and 1930 can range from pure lime and sand mixes to a wide variety of lime, portland cement, and sand combinations.

In the 1930s more new mortar products intended to hasten and simplify masons' work were introduced in the U S. These included **masonry cement**, a premixed, bagged mortar which is a combination of portland cement and ground limestone, and **hydrated lime**, machine-slaked lime that eliminated the necessity of slaking quicklime into putty at the site.

Identifying the Problem Before Repointing

The decision to repoint is most often related to some obvious sign of deterioration, such as disintegrating mortar, cracks in mortar joints, loose bricks or stones, damp walls, or damaged plasterwork. It is, however, erroneous to assume that repointing alone will solve deficiencies that result from other problems (Fig. 2). The root cause of the deterioration—leaking roofs or gutters, differential settlement of the building, capillary action causing rising damp, or extreme weather exposure—should always be dealt with prior to beginning work. Without appropriate repairs to eliminate the source of the problem, mortar deterioration will continue and any repointing will have been a waste of time and money.

Use of Consultants. Because there are so many possible causes for deterioration in historic buildings, it may be desirable to retain a consultant, such as a historic architect or architectural conservator, to analyze the building. In addition to determining the most appropriate solutions to the problems, a consultant can prepare specifications which reflect the particular requirements of each job and can provide oversight of the work in progress. Referrals to preservation consultants frequently can be obtained from State Historic Preservation Offices, the American Institute for Conservation of Historic and Artistic Works (AIC), the Association for Preservation Technology (APT), and local chapters of the American Institute of Architects (AIA).

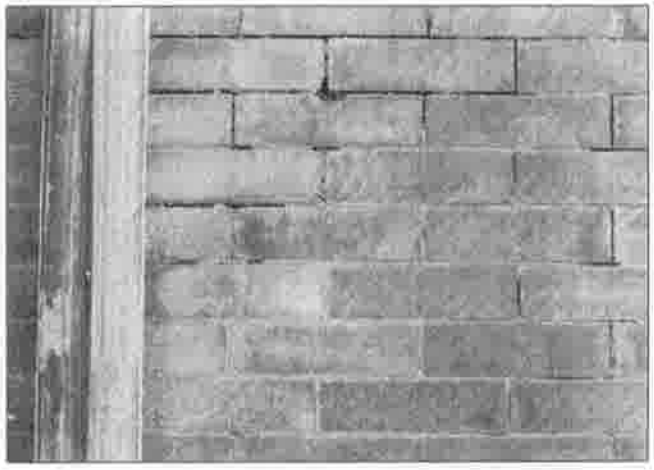


Figure 2. Much of the mortar on this building has been leached away by water from a leaking downspout. The downspout must be replaced and any other drainage problems repaired before repointing. Photo: Robert C. Mack, FAIA.

Finding an Appropriate Mortar Match

Preliminary research is necessary to ensure that the proposed repointing work is both physically and visually appropriate to the building. Analysis of unweathered portions of the historic mortar to which the new mortar will be matched can suggest appropriate mixes for the repointing mortar so that it will not damage the building because it is excessively strong or vapor impermeable. Examination and analysis of the masonry units—brick, stone or terra cotta—and the techniques used in the original construction will assist in maintaining the building's historic appearance (Figs. 3-4). A simple, non-technical, evaluation of the masonry units and mortar can provide information concerning the relative strength and permeability of each–critical factors in selecting the repointing mortar—while a visual analysis of the historic mortar can provide the information necessary for developing the new mortar mix and application techniques.

Although not crucial to a successful repointing project, for projects involving properties of special historic significance, a mortar analysis by a qualified laboratory can be useful by providing information on the original ingredients. However, there are limitations with such an analysis, and replacement mortar specifications should not be based solely on laboratory analysis. Analysis requires interpretation, and there are important factors which affect the condition and performance of the mortar that cannot be established through laboratory analysis. These may include: the original water content, rate of curing, weather conditions during original construction, the method of mixing and placing the mortar, and the cleanliness and condition of the sand. *The most useful information that can come out of laboratory analysis is the identification of sand by*

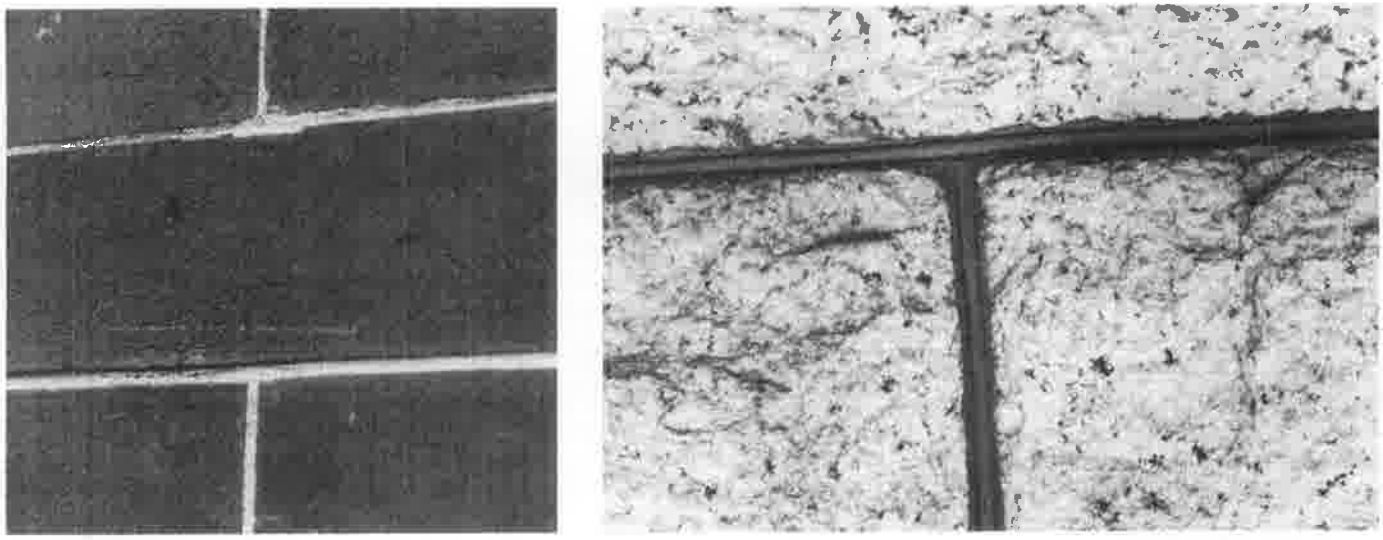


Figure 3. Good-quality repointing closely replicates the original in composition, texture, joint type and profile on this 19th century brick building (left), and on this late-19th century granite on H.H. Richardson's Glessner House in Chicago (right). Photos: Charles E. Fisher; Sharon C. Park, FAIA.

gradation and color. This allows the color and the texture of the mortar to be matched with some accuracy because sand is the largest ingredient by volume.

In creating a repointing mortar that is compatible with the masonry units, the objective is to achieve one that matches the historic mortar as closely as possible, so that the new material can coexist with the old in a sympathetic, supportive and, if necessary, sacrificial capacity. The exact physical and chemical properties of the historic mortar are not of major significance as long as the new mortar conforms to the following criteria:

- The new mortar must match the historic mortar in color, texture and tooling. (If a laboratory analysis is undertaken, it may be possible to match the binder components and their proportions with the historic mortar, if those materials are available.)
- The sand must match the sand in the historic mortar. (The color and texture of the new mortar will usually fall into place if the sand is matched successfully.)
- The new mortar must have **greater vapor permeability** and be **softer** (measured in compressive strength) than the masonry units.
- The new mortar must be **as vapor permeable** and **as soft or softer** (measured in compressive strength) than the historic mortar. (Softness or hardness is not necessarily an indication of permeability; old, hard lime mortars can still retain high permeability.)

Properties of Mortar

Mortars for repointing should be softer or more permeable than the masonry units and no harder or more impermeable than the historic mortar to prevent damage to the masonry units. It is a common error to assume that hardness or high strength is a measure of appropriateness, particularly for lime-based historic mortars. Stresses within a wall caused by expansion, contraction, moisture migration, or settlement must be accommodated in some manner; in a masonry wall these

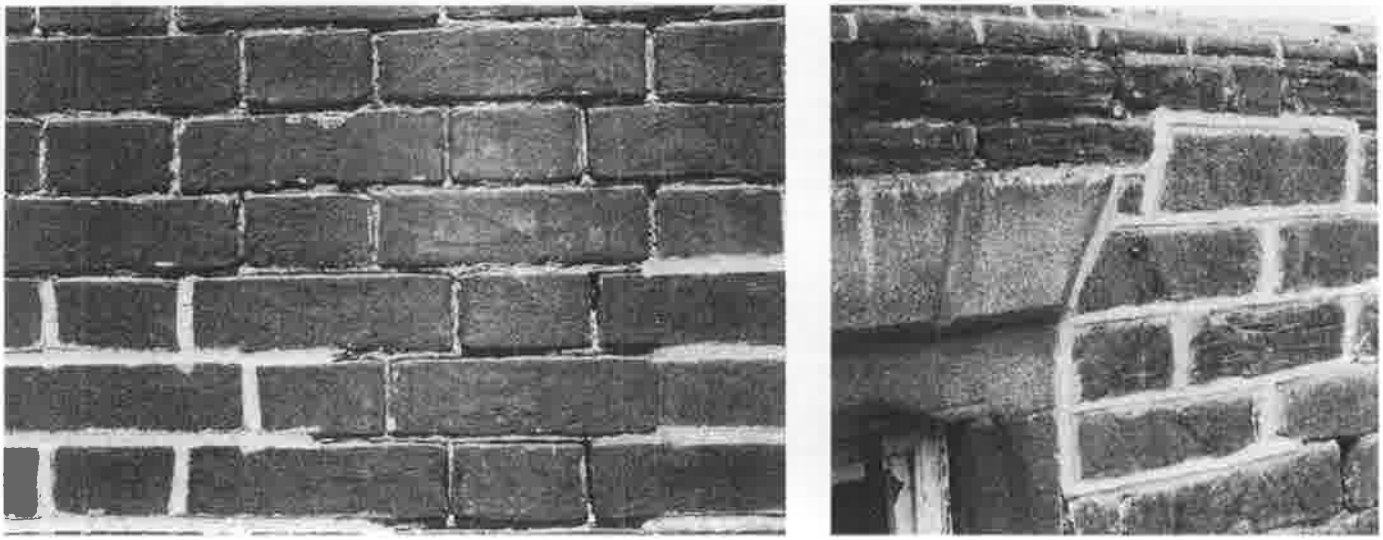


Figure 4. (left) The poor quality of this repointing–it appears to have been "tooled" with the mason's finger–does not match the delicacy of the original beaded joint on this 19th-century brick wall. (right) It is obvious that the repointing on this "test patch" is not an appropriate replacement mortar joint for this early-19th century stone foundation. Photos: Lee H. Nelson, FAIA.

stresses should be relieved by the mortar rather than by the masonry units. A mortar that is stronger in compressive strength than the masonry units, will not "give," thus causing the stresses to be relieved through the masonry units—resulting in permanent damage to the masonry, such as cracking and spalling, that cannot be repaired easily (Fig. 5). While stresses can also break the bond between the mortar and the masonry units, permitting water to penetrate the resulting hairline cracks, this is easier to correct in the joint through repointing than if the break occurs in the masonry units.

Permeability, or rate of vapor transmission, is also critical. High lime mortars are more permeable than denser cement mortars. Historically, mortar acted as a bedding material–not unlike an expansion joint–rather than a "glue" for the masonry units, and moisture was able to migrate through the mortar joints rather than the masonry units. When moisture evaporates from the masonry it deposits any soluble salts either on the surface as *efflorescence* or below the surface as *subflorescence*. While salts deposited on the surface of masonry units are usually relatively harmless, salt crystallization within a masonry unit creates pressure that can cause parts of the outer surface to spall off or delaminate. If the mortar does not permit moisture or moisture vapor to migrate out of the wall and evaporate, the result will be damage to the masonry units.

Components of Mortar

Sand. Sand is the largest component of mortar and the material that gives mortar its distinctive color, texture and cohesiveness. Sand must be free of impurities, such as salts or clay. The three key characteristics of sand are: particle shape, gradation and void ratios.

Figure 5. The use of hard, portland-cement mortar that is less permeable than the soft bricks has resulted in severe damage to this brick wall. Moisture trapped in the wall was unable to evaporate through the mortar which is intended to be sacrificial, and thus protect the bricks. As a result the moisture remained in the walls until water pressure eventually popped the surface off the bricks. Photo: National Park Service Files.

When viewed under a magnifying glass or low-power microscope, particles of sand generally have either rounded edges, such as found in beach and river sand, or sharp, angular edges, found in crushed or manufactured sand. For repointing mortar, rounded or natural sand is preferred for two reasons. It is usually similar to the sand in the historic mortar and provides a better visual match. It also has better working qualities or plasticity and can thus be forced into the joint more easily, forming a good contact with the remaining historic mortar and the surface of the adjacent masonry units. Although manufactured sand is frequently more readily available, it is usually possible to locate a supply of rounded sand.

The gradation of the sand (particle size distribution) plays a very important role in the durability and cohesive properties of a mortar. Mortar must have a certain percentage of large to small particle sizes in order to deliver the optimum performance. Acceptable guidelines on particle size distribution may be found in ASTM C 144 (American Society for Testing and Materials). However, in actuality, since neither historic nor modern sands are always in compliance with ASTM C 144, matching the same particle appearance and gradation usually requires sieving the sand.

A scoop of sand contains many small voids between the individual grains. A mortar that performs well fills all these small voids with binder (cement/lime combination or mix) in a balanced manner. Well-graded sand generally has a 30 per cent void ratio by volume. Thus, 30 per cent binder by volume generally should be used, unless the historic mortar had a different binder: aggregate ratio. This represents the 1:3 binder to sand ratios often seen in mortar specifications.

For repointing, sand generally should conform to ASTM C 144 to assure proper gradation and freedom from impurities; some variation may be necessary to match the original size and gradation. Sand color and texture also should match the original as closely as possible to provide the proper color match without other additives.

Lime. Mortar formulations prior to the late-19th century used lime as the primary binding material. Lime is derived from heating limestone at high temperatures which burns off the carbon dioxide, and turns the limestone into quicklime. There are three types of limestone—calcium, magnesium, and dolomitic—differentiated by the different levels of magnesium carbonate they contain which impart specific qualities to mortar. Historically, calcium lime was used for mortar rather than the dolomitic lime (calcium magnesium carbonate) most often used today. But it is also important to keep in mind the fact that the historic limes, and other components of mortar, varied a great deal because they were natural, as opposed to modern lime which is manufactured and, therefore, standardized. Because some of the kinds of lime, as well as other components of mortar, that were used historically are no longer readily available, even when a conscious effort is made to replicate a "historic" mix, this may not be achievable due to the differences between modern and historic materials.

Lime, itself, when mixed with water into a paste is very plastic and creamy. It will remain workable and soft indefinitely, if stored in a sealed container. Lime (calcium hydroxide) hardens by carbonation absorbing carbon dioxide primarily from the air, converting itself to calcium carbonate. Once a lime and sand mortar is mixed and placed in a wall, it begins the process of carbonation. If lime mortar is left to dry too rapidly, carbonation of the mortar will be reduced, resulting in poor adhesion and poor durability. In addition, lime mortar is slightly water soluble and thus is able to re-seal any hairline cracks that may develop during the life of the mortar. Lime mortar is soft, porous, and changes little in volume during temperature fluctuations, thus making it a good choice for historic buildings. *Because of these qualities, high calcium lime mortar may be considered for many repointing projects, not just those involving historic buildings.*

For repointing, lime should conform to ASTM C 207, Type S, or Type SA, Hydrated Lime for Masonry Purposes. This machine-slaked lime is designed to assure high plasticity and water retention. The use of quicklime which must be slaked and soaked by hand may have advantages over hydrated lime in some restoration projects if time and money allow.

Lime putty. Lime putty is slaked lime that has a putty or paste-like consistency. It should conform to ASTM C 5. Mortar can be mixed using lime putty according to ASTM C 270 property or proportion specification.

Portland cement. More recent, 20th-century mortar has used portland cement as a primary binding material. A straight portland cement and sand mortar is extremely hard, resists the movement of water, shrinks upon setting, and undergoes relatively large thermal movements. When mixed with water, portland cement forms a harsh, stiff paste that is quite unworkable, becoming hard very quickly. (Unlike lime, portland cement will harden regardless of weather conditions and does not require wetting and drying cycles.) Some portland cement assists the workability and plasticity of the mortar without adversely affecting the finished project; it also provides early strength to the mortar and speeds setting. Thus, it may be appropriate to add some portland cement to an essentially lime-based mortar even when repointing relatively soft 18th or 19th century brick under some circumstances when a slightly harder mortar is required. The more portland cement that is added to a mortar formulation the harder it becomes—and the faster the initial set.

For repointing, portland cement should conform to ASTM C 150. White, non-staining portland cement may provide a better color match for some historic mortars than the more commonly available grey portland cement. But, it should not be assumed, however, that white portland cement is always appropriate for all historic buildings, since the original mortar may have been mixed with grey cement. The cement should not have more than 0.60 per cent alkali to help avoid efflorescence.

Masonry cement. Masonry cement is a preblended mortar mix commonly found at hardware and home repair stores. It is designed to produce mortars with a compressive strength of 750 psi or higher when mixed

MORTAR ANALYSIS

Methods for analyzing mortars can be divided into two broad categories: **wet chemical** and **instrumental.** Many laboratories that analyze historic mortars use a simple **wet-chemical** method called *acid digestion*, whereby a sample of the mortar is crushed and then mixed with a dilute acid. The acid dissolves all the carbonate-containing minerals not only in the binder, but also in the aggregate (such as oyster shells, coral sands, or other carbonate-based materials), as well as any other acid-soluble materials. The sand and fine-grained acid-insoluble material is left behind. There are several variations on the simple acid digestion test. One involves collecting the carbon dioxide gas given off as the carbonate is digested by the acid; based on the gas volume the carbonate content of the mortar can be accurately determined (Jedrzejewska, 1960). Simple acid digestion methods are rapid, inexpensive, and easy to perform, but the information they provide about the original composition of a mortar is limited to the color and texture of the sand. The gas collection method provides more information about the binder than a simple acid digestion test.

Instrumental analysis methods that have been used to evaluate mortars include polarized light or thin-section microscopy, scanning electron microscopy, atomic absorption spectroscopy, X-ray diffraction, and differential thermal analysis. All instrumental methods require not only expensive, specialized equipment, but also highly-trained experienced analysts. However, instrumental methods can provide much more information about a mortar. Thin-section microscopy is probably the most commonly used instrumental method. Examination of thin slices of a mortar in transmitted light is often used to supplement acid digestion methods, particularly to look for carbonate-based aggregate. For example, the new ASTM test method, ASTM C 1324-96 "Test Method for Examination and Analysis of Hardened Mortars" which was designed specifically for the analysis of modern lime-cement and masonry cement mortars, combines a complex series of wet chemical analyses with thin-section microscopy.

The drawback of most mortar analysis methods is that mortar samples of known composition have not been analyzed in order to evaluate the method. Historic mortars were not prepared to narrowly defined specifications from materials of uniform quality; they contain a wide array of locally derived materials combined at the discretion of the mason. While a particular method might be able to accurately determine the original proportions of a lime-cement-sand mortar prepared from modern materials, the usefulness of that method for evaluating historic mortars is questionable unless it has been tested against mortars prepared from materials more commonly used in the past.

Lorraine Schnabel.

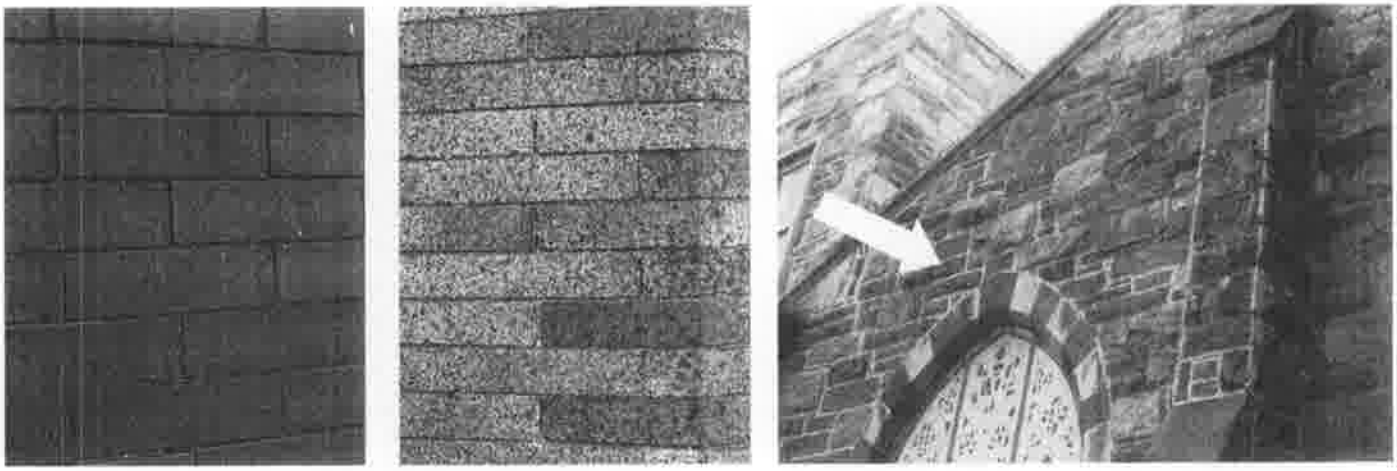


Figure 6. Tinted mortar. (left)Black mortar with a beaded joint was used here on this late-19th century hard pressed red brick and, (center) a dark brown tinted mortar with an almost flush joint was used on this early-20th century Roman brick. (right) When constructed at the turn-of-the-century, this building was pointed with a dark gray mortar to blend with the color of the stone, but the light-colored mortar used in spot repointing has destroyed this harmony and adversely impacts the building's historic character. Photos: Anne Grimmer.

with sand and water at the job site. It may contain hydrated lime, but it always contains a large amount of portland cement, as well as ground limestone and other workability agents, including air-entraining agents. Because masonry cements are not required to contain hydrated lime, and generally do not contain lime, they produce high strength mortars that can damage historic masonry. *For this reason, they generally are not recommended for use on historic masonry buildings.*

Lime mortar (pre-blended). Hydrated lime mortars, and pre-blended lime putty mortars with or without a matched sand are commercially available. Custom mortars are also available with color. In most instances, pre-blended lime mortars containing sand may not provide an exact match; however, if the project calls for total repointing, a pre-blended lime mortar may be worth considering as long as the mortar is compatible in strength with the masonry. If the project involves only selected, "spot" repointing, then it may be better to carry out a mortar analysis which can provide a custom pre-blended lime mortar with a matching sand. In either case, if a preblended lime mortar is to be used, it should contain Type S or SA hydrated lime conforming to ASTM C 207.

Water. Water should be potable—clean and free from acids, alkalis, or other dissolved organic materials.

Other Components

Historic components. In addition to the color of the sand, the texture of the mortar is of critical importance in duplicating historic mortar. Most mortars dating from the mid-19th century on—with some exceptions—have a fairly homogeneous texture and color. Some earlier mortars are not as uniformly textured and may contain lumps of partially burned lime or "dirty lime", shell (which often provided a source of lime, particularly in coastal areas), natural cements, pieces of clay, lampblack or other pigments, or even animal hair. The visual characteristics of these mortars can be duplicated through the use of similar materials in the repointing mortar.

Replicating such unique or individual mortars will require writing new specifications for each project. If possible, suggested sources for special materials should be included. For example, crushed oyster shells can be obtained in a variety of sizes from poultry supply dealers.

Pigments. Some historic mortars, particularly in the late 19th century, were tinted to match or contrast with the brick or stone (Fig. 6). Red pigments, sometimes in the form of brick dust, as well as brown, and black pigments were commonly used. Modern pigments are available which can be added to the mortar at the job site, but they should not exceed 10 per cent by weight of the portland cement in the mix, and carbon black should be limited to 2 per cent. Only synthetic mineral oxides, which are alkali-proof and sun-fast, should be used to prevent bleaching and fading.

Modern components. Admixtures are used to create specific characteristics in mortar, and whether they should be used will depend upon the individual project. *Air-entraining agents*, for example, help the mortar to resist freeze-thaw damage in northern climates. *Accelerators* are used to reduce mortar freezing prior to setting while *retarders* help to extend the mortar life in hot climates. Selection of admixtures should be made by the architect or architectural conservator as part of the specifications, not something routinely added by the masons.

Generally, modern chemical additives are unnecessary and may, in fact, have detrimental effects in historic masonry projects. The use of antifreeze compounds is not recommended. They are not very effective with high lime mortars and may introduce salts, which may cause efflorescence later. A better practice is to warm the sand and water, and to protect the completed work from freezing. No definitive study has determined whether air-entraining additives should be used to resist frost action and enhance plasticity, but in areas of extreme exposure requiring high-strength mortars with lower permeability, air-entrainment of 10-16 percent may be desirable (see formula for "severe weather exposure" in **Mortar Type and Mix**). Bonding agents are not a substitute for proper joint preparation, and they should generally be avoided. If the joint is properly prepared, there will be a good bond between the new mortar and the adjacent surfaces. In addition, a bonding agent is difficult to remove if smeared on a masonry surface (Fig. 7).

Mortar Type and Mix

Mortars for repointing projects, especially those involving historic buildings, typically are custom mixed in order to ensure the proper physical and visual qualities. These materials can be combined in varying proportions to create a mortar with the desired performance and durability. The actual specification of a particular mortar type should take into consideration all of the factors affecting the life of the building including: current site conditions, present condition of the masonry, function of the new mortar, degree of weather exposure, and skill of the mason. Thus, no two repointing projects are exactly the same. Modern materials specified for use in repointing mortar should conform to specifications of the American Society for Testing and Materials (ASTM) or comparable federal specifications, and the resulting mortar should conform to ASTM C 270, Mortar for Unit Masonry.

Specifying the proportions for the repointing mortar for a specific job is not as difficult as it might seem. Five mortar types, each with a corresponding recommended mix, have been established by ASTM to distinguish high strength mortar from soft flexible mortars. The ASTM designated them in decreasing order of approximate general strength as Type M (2,500 psi), Type S (1,800 psi), Type N (750 psi), Type O (350 psi) and Type K (75 psi). (The letters identifying the types are from the words MASON WORK using every other letter.) Type K has the highest lime content of the mixes that contain portland cement, although it is seldom used today, except for some historic preservation projects. The designation "L" in the accompanying chart identifies a straight lime and sand mix. Specifying the appropriate ASTM mortar by proportion of ingredients, will ensure the desired physical properties. Unless specified otherwise, measurements or proportions for mortar mixes are always given in the following order: cement-lime-sand. Thus, a Type K mix, for example, would be referred to as 1-3-10, or 1 part cement to 3 parts lime to 10 parts sand. Other requirements to create the desired visual qualities should be included in the specifications.

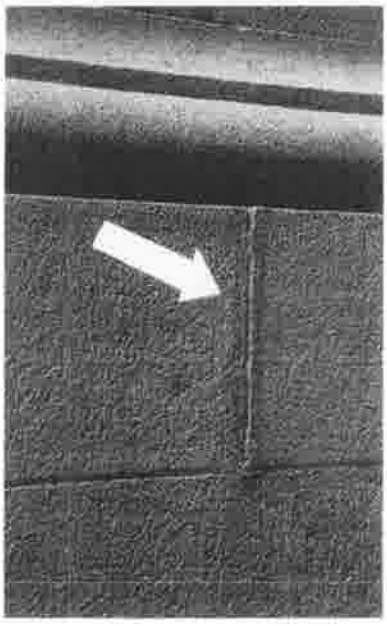


Figure 7. The dark stain on either side of the vertical joint on this sandstone watertable probably resulted from the use of a bonding agent that was not properly cleaned off the masonry after repointing. Photo: Anne Grimmer.

Figure 8. Due to inadequate joint preparation, the repointing mortar has not adhered properly and is falling out of the joint. Photo: Robert C. Mack, FAIA.

The strength of a mortar can vary. If mixed with higher amounts of portland cement, a harder mortar is obtained. The more lime that is added, the softer and more plastic the mortar becomes, increasing its workability. A mortar strong in compressive strength might be desirable for a hard stone (such as granite) pier holding up a bridge deck, whereas a softer, more permeable lime mortar would be preferable for a historic wall of soft brick. Masonry deterioration caused by salt deposition results when the mortar is less permeable that the masonry unit. A strong mortar is still more permeable than hard dense stone. However, in a wall constructed of soft bricks where the masonry unit itself has a relatively high permeability or vapor transmission rate, a soft, high lime mortar is necessary to retain sufficient permeability.

Budgeting and Scheduling

Repointing is both expensive and time consuming due to the extent of handwork and special materials required. It is preferable to repoint only those areas that require work rather than an entire wall, as is often specified. But, if 25 to 50 per cent or more of a wall needs to be repointed, repointing the entire wall may be more cost effective than spot repointing. Total repointing may also be more sensible when access is difficult, requiring the erection of expensive scaffolding (unless the majority of the mortar is sound and unlikely to require replacement in the foreseeable future). Each project requires judgement based on a variety of factors. Recognizing this at the outset will help to prevent many jobs from becoming prohibitively expensive.

In scheduling, seasonal aspects need to be considered first. Generally speaking, wall temperatures between 40 and 95 degrees F (8 and 38 degrees C) will prevent freezing or excessive evaporation of the water in the mortar. Ideally, repointing should be done in shade, away from strong sunlight in order to slow the drying process, especially during hot weather. If necessary, shade can be provided for large-scale projects with appropriate modifications to scaffolding.

The relationship of repointing to other work proposed on the building must also be recognized. For example, if paint removal or cleaning is anticipated, and if the mortar joints are basically sound and need only selective repointing, it is generally better to postpone repointing

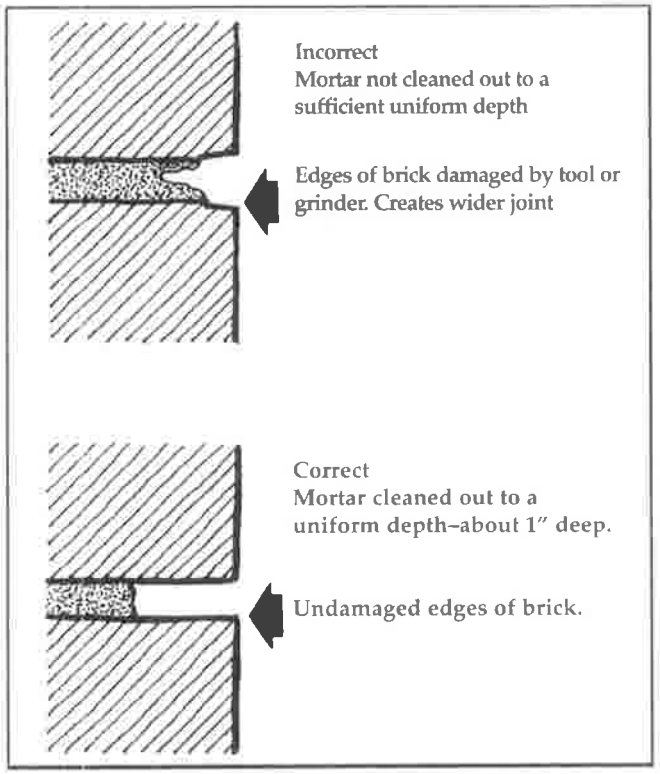


Figure 9. Comparison of incorrect and correct preparation of mortar joints for repointing. Drawing: Robert C. Mack, FAIA, and David W. Look, AIA.

until after completion of these activities. However, if the mortar has eroded badly, allowing moisture to penetrate deeply into the wall, repointing should be accomplished before cleaning. Related work, such as structural or roof repairs, should be scheduled so that they do not interfere with repointing and so that all work can take maximum advantage of erected scaffolding.

Building managers also must recognize the difficulties that a repointing project can create. The process is time consuming, and scaffolding may need to remain in place for an extended period of time. The joint preparation process can be quite noisy and can generate large quantities of dust which must be controlled, especially at air intakes to protect human health, and also where it might damage operating machinery. Entrances may be blocked from time to time making access difficult for both building tenants and visitors. Clearly, building managers will need to coordinate the repointing work with other events at the site.

Contractor Selection

The ideal way to select a contractor is to ask knowledgeable owners of recently repointed historic buildings for recommendations. Qualified contractors then can provide lists of other repointing projects for inspection. More commonly, however, the contractor for a repointing project is selected through a competitive bidding process over which the client or consultant has only limited control. In this situation it is important to ensure that the specifications stipulate that masons must have a minimum of five years' experience with repointing historic masonry buildings to be eligible to bid on the project. Contracts are awarded to the lowest *responsible* bidder, and bidders who have performed poorly on other projects usually can be eliminated from consideration on this basis, even if they have the lowest prices.

The contract documents should call for unit prices as well as a base bid. Unit pricing forces the contractor to determine in advance what the cost addition or reduction will be for work which varies from the scope of the base bid. If, for example, the contractor has fifty linear feet less of stone repointing than indicated on the contract documents but thirty linear feet more of brick repointing, it will be easy to determine the final price for the work. Note that each type of work—brick repointing, stone repointing, or similar items—will have its own unit price. The unit price also should reflect quantities; one linear foot of pointing in five different spots will be more expensive than five contiguous linear feet.

Execution of the Work

Test Panels. These panels are prepared by the contractor using the same techniques that will be used on the remainder of the project. Several panel locations—preferably not on the front or other highly visible location of the building—may be necessary to include all types of masonry, joint styles, mortar colors, and other problems likely to be encountered on the job. If cleaning tests, for

Figure 10. Using a hammer and masonry chisel is the least damaging and, thus, generally the preferred method of removing old mortar in preparation for repointing historic masonry. Photo: John P. Speweik.

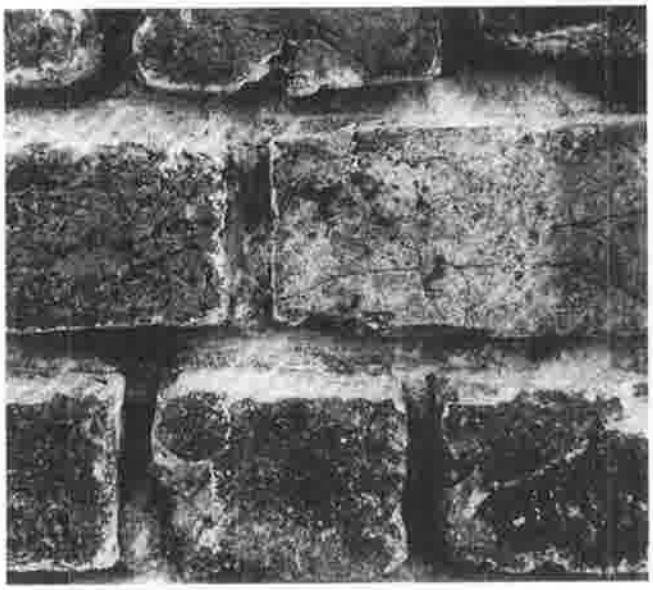


Figure 11. The damage to the edges and corners of these historic bricks was caused by using a mechanical grinder to rake out the joints. Note the overcutting of the head joint and the damage to the arises (corners) of the bricks. Photo: Lee H. Nelson, FAIA.

example, are also to be undertaken, they should be carried out in the same location. Usually a 3 foot by 3 foot area is sufficient for brickwork, while a somewhat larger area may be required for stonework. These panels establish an acceptable standard of work and serve as a benchmark for evaluating and accepting subsequent work on the building.

Joint Preparation. Old mortar should be removed to a minimum depth of 2 to 2- $^1/_2$ times the width of the joint to ensure an adequate bond and to prevent mortar "popouts" (Fig. 8). For most brick joints, this will require removal of the mortar to a depth of approximately $^1/_2$ to 1 inch; for stone masonry with wide joints, mortar may need to be removed to a depth of several inches. Any loose or disintegrated mortar beyond this minimum depth also should be removed (Fig. 9).

Although some damage may be inevitable, careful joint preparation can help limit damage to masonry units. The traditional manner of removing old mortar is through the use of hand chisels and mash hammers (Fig. 10). Though labor-intensive, in most instances this method poses the least threat for damage to historic masonry units and produces the best final product.

The most common method of removing mortar, however, is through the use of power saws or grinders. The use of power tools by unskilled masons can be disastrous for historic masonry, particularly soft brick. Using power saws on walls with thin joints, such as most brick walls, almost always will result in damage to the masonry units by breaking the edges and by overcutting on the head, or vertical joints (Fig. 11).

However, small pneumatically-powered chisels generally can be used safely and effectively to remove mortar on historic buildings as long as the masons maintain appropriate control over the equipment.

Figure 12. A power grinder, operated correctly by a skilled mason may be used in preparation for repointing to cut wide, horizontal mortar joints, typical of many early-20th century brick structures without causing damage to the brick. Note the use of protective safety equipment. Photo: Robert C. Mack, FAIA.

Under certain circumstances, thin diamond-bladed grinders may be used to cut out *horizontal* joints only on hard portland cement mortar common to most early-20th century masonry buildings (Fig. 12). Usually, automatic tools most successfully remove old mortar without damaging the masonry units when they are used in combination with hand tools in preparation for repointing. Where horizontal joints are uniform and fairly wide, it may be possible to use a power masonry saw to assist the removal of mortar, such as by cutting along the middle of the joint; final mortar removal from the sides of the joints still should be done with a hand chisel and hammer. Caulking cutters with diamond blades can sometimes be used successfully to cut out joints without damaging the masonry. Caulking cutters are slow; they do not rotate, but vibrate at very high speeds, thus minimizing the possibility of damage to masonry units (Fig. 13). Although mechanical tools may be used safely in limited circumstances to cut out horizontal joints in preparation for repointing, they should never be used on vertical joints because of the danger of slipping and cutting into the brick above or below the vertical joint. Using power tools to remove mortar without damaging the surrounding masonry units also necessitates highly skilled masons experienced in working on historic masonry buildings. Contractors

Figure 13. (left) In preparation for repointing, the mortar joints on these granite steps are first cut out mechanically (note the vacuum attached to the cutting tool in foreground to cut down on dust). (right) Final removal of the old mortar is done by hand to avoid damage to the edges of the joints. Mechanical preparation of horizontal joints by an experienced mason may sometimes be acceptable, especially where the joints are quite wide and the masonry is a very hard stone. Photos: Anne Grimmer.

should demonstrate proficiency with power tools before their use is approved.

Using any of these power tools may also be more acceptable on hard stone, such as quartzite or granite, than on terra cotta with its glass-like glaze, or on soft brick or stone. The test panel should determine the acceptability of power tools. If power tools are to be permitted, the contractor should establish a quality control program to account for worker fatigue and similar variables.

Mortar should be removed cleanly from the masonry units, leaving square corners at the back of the cut. Before filling, the joints should be rinsed with a jet of water to remove all loose particles and dust. At the time of filling, the joints should be damp, but with no standing water present. For masonry walls—limestone, sandstone and common brick—that are extremely absorbent, it is recommended that a continual mist of water be applied for a few hours before repointing begins.

Mortar Preparation. Mortar components should be measured and mixed carefully to assure the uniformity of visual and physical characteristics. Dry ingredients are measured by volume and thoroughly mixed before the addition of any water. Sand must be added in a damp, loose condition to avoid over sanding. Repointing mortar is typically pre-hydrated by adding water so it will just hold together, thus allowing it to stand for a period of time before the final water is added. Half the water should be added, followed by mixing for approximately 5 minutes. The remaining water should then be added in small portions until a mortar of the desired consistency is reached. The total volume of water necessary may vary from batch to batch, depending on weather conditions. It is important to keep the water to a minimum for two reasons: first, a drier mortar is cleaner to work with, and it can be compacted tightly into the joints; second, with no excess water to evaporate, the mortar cures without shrinkage cracks. Mortar should be used within approximately 30 minutes of final mixing, and "retempering," or adding more water, should not be permitted.

Using Lime Putty to Make Mortar. Mortar made with lime putty and sand, sometimes referred to as roughage or course stuff, should be measured by volume, and may require slightly different proportions from those used with hydrated lime (Fig. 14). No additional water is usually needed to achieve a workable consistency because enough water is already contained in the putty. Sand is proportioned first, followed by the lime putty, then mixed for five minutes or until all the sand is thoroughly coated with the lime putty. But mixing, in the familiar sense of turning over with a hoe, sometimes may not be sufficient if the best possible performance is to be obtained from a lime putty mortar. Although the old practice of chopping, beating and ramming the mortar has largely been forgotten, recent field work has confirmed that lime putty and sand rammed and beaten with a wooden mallet or ax handle, interspersed by chopping with a hoe, can significantly improve workability and performance. The intensity of this action increases the overall lime/sand contact and removes any surplus water by compacting the other ingredients. It may also be advantageous for larger projects to use a mortar pan mill for mixing. Mortar pan mills which have a long tradition in Europe produce a superior lime putty mortar not attainable with today's modern paddle and drum type mixers.

For larger repointing projects the lime putty and sand can be mixed together ahead of time and stored indefinitely, on or off site, which eliminates the need for piles of sand on the job site. This mixture, which resembles damp brown sugar, must be protected from the air in sealed containers with a wet piece of burlap over the top or sealed in a large plastic bag to prevent evaporation and premature carbonation. The lime putty and sand mixture can be recombined into a workable plastic state months later with no additional water.

If portland cement is specified in a lime putty and sand mortar—Type O (1:2:9) or Type K (1:3:11)—the portland cement should first be mixed into a slurry paste before adding it to the lime putty and sand. Not only will this ensure that the portland cement is evenly distributed throughout the mixture, but if dry portland cement is added to wet ingredients it tends to "ball up," jeopardizing dispersion. (Usually water must be added to the lime putty and sand anyway once the portland cement is introduced.) Any color pigments should be added at this stage and mixed for a full five minutes. The mortar should be used within 30 minutes to 1 ½ hours and it should not be retempered. Once portland cement has been added the mortar can no longer be stored.

Filling the Joint. Where existing mortar has been removed to a depth of greater than 1 inch, these deeper areas should be filled first, compacting the new mortar in several layers. The back of the entire joint should be filled successively by applying approximately ¼ inch of mortar, packing it well into the back corners. This

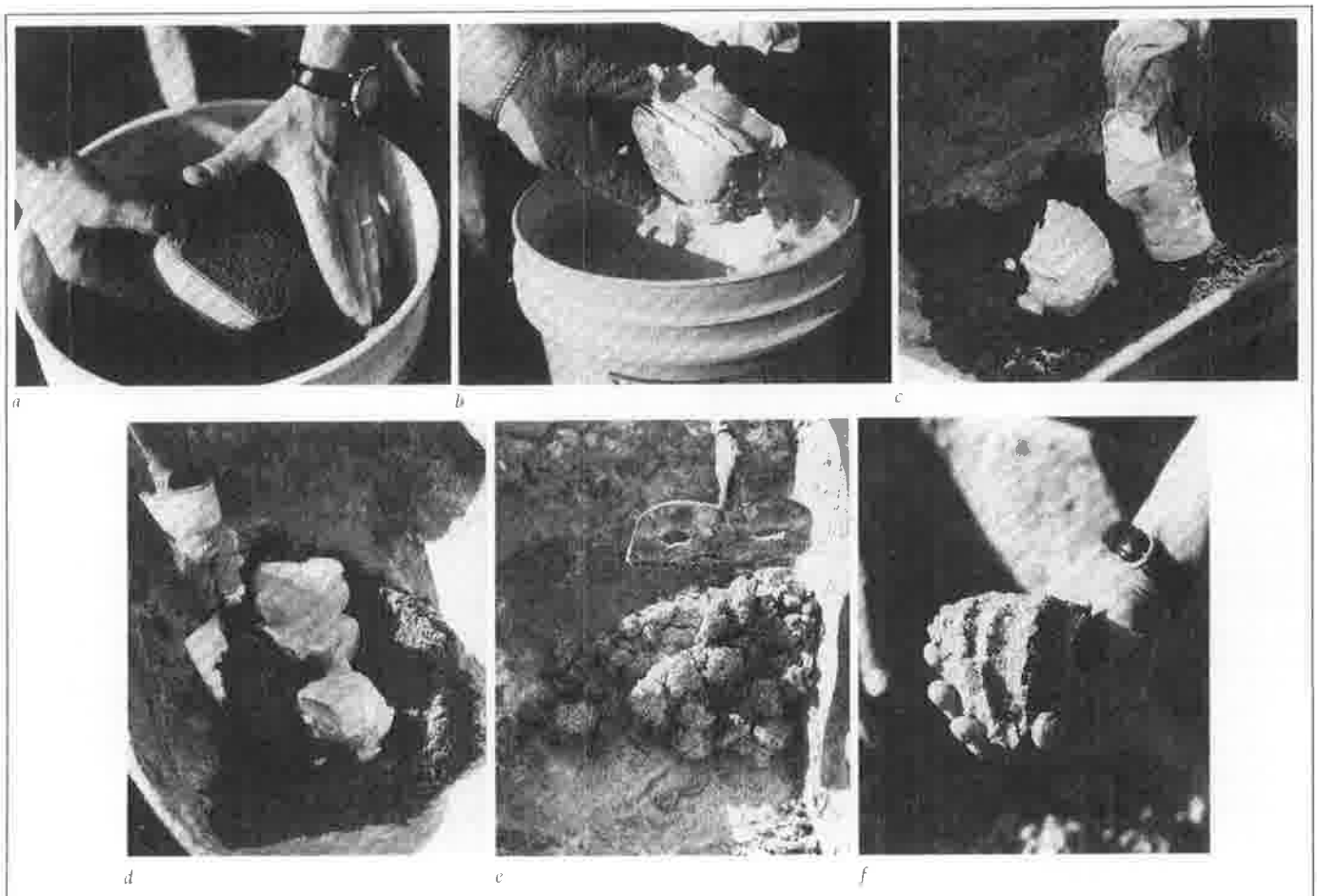


Figure 14. Mixing mortar using lime putty: (a) proportioning sand; (b) proportioning lime putty; (c) placing lime putty on top of sand; (d) mixing sand over lime putty; (e) hand mixing mortar; and, (f) sample of mortar after mixing. Photos: John P. Speweik.

application may extend along the wall for several feet. As soon as the mortar has reached thumb-print hardness, another ¼ inch layer of mortar—approximately the same thickness—may be applied. Several layers will be needed to fill the joint flush with the outer surface of the masonry. It is important to allow each layer time to harden before the next layer is applied; most of the mortar shrinkage occurs during the hardening process and layering thus minimizes overall shrinkage.

When the final layer of mortar is thumb-print hard, the joint should be tooled to match the historic joint (Fig. 15). Proper timing of the tooling is important for uniform color and appearance. If tooled when too soft, the color will be lighter than expected, and hairline cracks may occur; if tooled when too hard, there may be dark streaks called "tool burning," and good closure of the mortar against the masonry units will not be achieved.

If the old bricks or stones have worn, rounded edges, it is best to recess the final mortar slightly from the face of the masonry. This treatment will help avoid a joint which is visually wider than the actual joint; it also will avoid creation of a large, thin featheredge which is easily damaged, thus admitting water (Fig. 16). After tooling, excess mortar can be removed from the edge of the joint by brushing with a natural bristle or nylon brush. Metal bristle brushes should never be used on historic masonry.

Curing Conditions. The preliminary hardening of high-lime content mortars—those mortars that contain more lime by volume than portland cement, i.e., Type O (1:2:9), Type K (1:3:11), and straight lime/sand, Type "L"(0:1:3) —takes place fairly rapidly as water in the mix is lost to the porous surface of the masonry and through evaporation. A high lime mortar (especially Type "L") left to dry out too rapidly can result in chalking, poor adhesion, and poor durability. Periodic wetting of the repointed area after the mortar joints are thumb-print hard and have been finish tooled may significantly accelerate the carbonation process. When feasible, misting using a hand sprayer with a fine nozzle can be simple to do for a day or two after repointing. Local conditions will dictate the frequency of wetting, but initially it may be as often as every hour and gradually reduced to every three or four hours. Walls should be covered with burlap for the first three days after repointing. (Plastic may be used, but it should be tented out and not placed directly against the wall.) This helps keep the walls damp and protects them from direct sunlight. Once carbonation of the lime has begun, it will continue for many years and the lime will gain strength as it reverts back to calcium carbonate within the wall.

***Aging* the Mortar.** Even with the best efforts at matching the existing mortar color, texture, and materials, there will usually be a visible difference between the old and

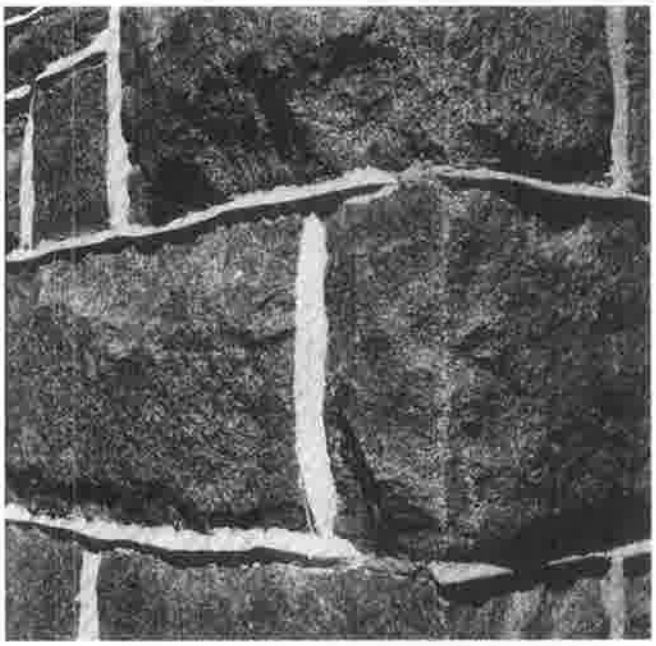


Figure 15. The profile of the repointed joints on the left replicate the historic joints around the corner to the right on the front of this stone building in Leesburg, VA. The contractor's pride in the repointing work is evident by the signature in the vertical joint. Photo: Anne Grimmer.

new work, partly because the new mortar has been matched to the unweathered portions of the historic mortar. Another reason for a slight mismatch may be that the sand is more exposed in old mortar due to the slight erosion of the lime or cement. Although spot repointing is generally preferable and some color difference should be acceptable, if the difference between old and new mortar is too extreme, it may be advisable in some instances to repoint an entire area of a wall, or an entire feature such as a bay, to minimize the difference between the old and the new mortar. If the mortars have been properly matched, usually the best way to deal with surface color differences is to let the mortars age naturally. Other treatments to overcome these differences, including cleaning the non-repointed areas or staining the new mortar, should be carefully tested prior to implementation.

Staining the new mortar to achieve a better color match is generally not recommended, but it may be appropriate in some instances. Although staining may provide an initial match, the old and new mortars may weather at different rates, leading to visual differences after a few seasons. In addition, the mixtures used to stain the mortar may be harmful to the masonry; for example, they may introduce salts into the masonry which can lead to efflorescence.

Cleaning the Repointed Masonry. If repointing work is carefully executed, there will be little need for cleaning other than to remove the small amount of mortar from the edge of the joint following tooling. This can be done with a stiff natural bristle or nylon brush after the mortar has dried, but before it is initially set (1-2 hours). Mortar that has hardened can usually be removed with a wooden paddle or, if necessary, a chisel.

Further cleaning is best accomplished with plain water and natural bristle or nylon brushes. If chemicals must

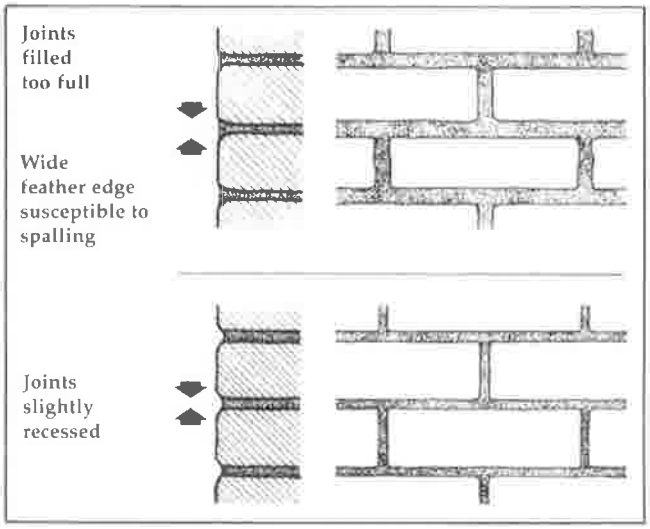


Figure 16. Comparison of visual effect of full mortar joints vs. slightly recessed joints. Filling joints too full hides the actual joint thickness and changes the character of the original brickwork. Drawing: Robert C. Mack, FAIA.

be used, they should be selected with extreme caution. Improper cleaning can lead to deterioration of the masonry units, deterioration of the mortar, mortar smear, and efflorescence. New mortar joints are especially susceptible to damage because they do not become fully cured for several months. Chemical cleaners, particularly acids, should never be used on dry masonry. The masonry should always be completely soaked once with water before chemicals are applied. After cleaning, the walls should be flushed again with plain water to remove all traces of the chemicals.

Several precautions should be taken if a freshly repointed masonry wall is to be cleaned. First, the mortar should be fully hardened before cleaning. Thirty days is usually sufficient, depending on weather and exposure; as mentioned previously, the mortar will continue to cure even after it has hardened. Test panels should be prepared to evaluate the effects of different cleaning

Figure 17. This photograph shows the significant visual change to the character of this historic brick building that has resulted from improper repointing procedures and a noticeably increased thickness of the mortar joints. Photo: Lee H. Nelson, FAIA.

Mortar Types			
(Measured by volume)			
Designation	Cement	Hydrated Lime or Lime Putty	Sand
M	1	1/4	3 - 3 1/4
S	1	1/2	4 - 4 1/2
N	1	1	5 - 6
O	1	2	8 - 9
K	1	3	10 - 12
"L"	0	1	2 1/4 - 3

Suggested Mortar Types for Different Exposures			
	Exposure		
Masonry Material	Sheltered	Moderate	Severe
Very Durable: granite, hard-cored brick, etc.	O	N	S
Moderately Durable: limestone, durable stone, molded brick	K	O	N
Minimally Durable: soft hand-made brick	"L"	K	O

methods. Generally, on newly repointed masonry walls, only very low pressure (100 psi) water washing supplemented by stiff natural bristle or nylon brushes should be used, except on glazed or polished surfaces, where only soft cloths should be used.**

New construction "bloom" or efflorescence occasionally appears within the first few months of repointing and usually disappears through the normal process of weathering. If the efflorescence is not removed by natural processes, the safest way to remove it is by dry brushing with stiff natural or nylon bristle brushes followed by wet brushing. Hydrochloric (muriatic) acid, is generally ineffective, and it should not be used to remove efflorescence. It may liberate additional salts, which, in turn, can lead to more efflorescence.

Surface Grouting is sometimes suggested as an alternative to repointing brick buildings, in particular. This process involves the application of a thin coat of cement-based grout to the mortar joints and the mortar/brick interface. To be effective the grout must extend slightly onto the face of the masonry units, thus widening the joint visually. The change in the joint appearance can alter the historic character of the structure to an unacceptable degree. In addition, although masking of the bricks is intended to keep the grout off the remainder of the face of the bricks, some level of residue, called "veiling," will inevitably remain. Surface grouting cannot substitute for the more extensive work of repointing, and it is not a recommended treatment for historic masonry.

**Additional information on masonry cleaning is presented in *Preservation Briefs 1: The Cleaning and Waterproof Coating of Masonry Buildings*, Robert C. Mack, AIA, Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior, 1975; and *Keeping it Clean: Removing Exterior Dirt, Paint, Stains & Graffiti from Historic Masonry Buildings*, Anne E. Grimmer, Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior, 1988.

Summary

For the Owner/Administrator. The owner or administrator of a historic building should remember that repointing is likely to be a lengthy and expensive process. First, there must be adequate time for evaluation of the building and investigation into the cause of problems. Then, there will be time needed for preparation of the contract documents. The work itself is precise, time-consuming and noisy, and scaffolding may cover the face of the building for some time. Therefore, the owner must carefully plan the work to avoid problems. Schedules for both repointing and other activities will thus require careful coordination to avoid unanticipated conflicts. The owner must avoid the tendency to rush the work or cut corners if the historic building is to retain its visual integrity and the job is to be durable.

For the Architect/Consultant. Because the primary role of the consultant is to ensure the life of the building, a knowledge of historic construction techniques and the special problems found in older buildings is essential. The consultant must assist the owner in planning for logistical problems relating to research and construction. It is the consultant's responsibility to determine the *cause* of the mortar deterioration and ensure that it is corrected before the masonry is repointed. The consultant must also be prepared to spend more time in project inspections than is customary in modern construction.

For the Masons. Successful repointing depends on the masons themselves. Experienced masons understand the special requirements for work on historic buildings and the added time and expense they require. The entire masonry crew must be willing and able to perform the work in conformance with the specifications, even when the specifications may not be in conformance with standard practice. At the same time, the masons should not hesitate to question the specifications if it appears that the work specified would damage the building.

Visually Examining the Mortar and the Masonry Units

A simple in-situ comparison will help determine the hardness and condition of the mortar and the masonry units. Begin by scraping the mortar with a screwdriver, and gradually tapping harder with a cold chisel and mason's hammer. Masonry units can be tested in the same way beginning, even more gently, by scraping with a fingernail. This relative analysis which is derived from the 10-point hardness scale used to describe minerals, provides a good starting point for selection of an appropriate mortar. It is described more fully in "The Russack System for Brick & Mortar Description" referenced in **Selected Reading** at the end of this Brief.

Mortar samples should be chosen carefully, and picked from a variety of locations on the building to find unweathered mortar, if possible. Portions of the building may have been repointed in the past while other areas may be subject to conditions causing unusual deterioration. There may be several colors of mortar dating from different construction periods or sand used from different sources during the initial construction. Any of these situations can give false readings to the visual or physical characteristics required for the new mortar. Variations should be noted which may require developing more than one mix.

1) Remove with a chisel and hammer three or four unweathered samples of the mortar to be matched from several locations on the building. (Set the largest sample aside—this will be used later for comparison with the repointing mortar). Removing a full representation of samples will allow selection of a "mean" or average mortar sample.

2) Mash the remaining samples with a wooden mallet, or hammer if necessary, until they are separated into their constituent parts. There should be a good handful of the material.

3) Examine the powdered portion—the lime and/or cement matrix of the mortar. Most particularly, note the color. There is a tendency to think of historic mortars as having white binders, but grey portland cement was available by the last quarter of the 19th century, and traditional limes were also sometimes grey. Thus, in some instances, the natural color of the historic binder may be grey, rather than white. The mortar may also have been tinted to create a colored mortar, and this color should be identified at this point.

4) Carefully blow away the powdery material (the lime and/or cement matrix which bound the mortar together).

5) With a low power (10 power) magnifying glass, examine the remaining sand and other materials such as lumps of lime or shell.

6) Note and record the wide range of color as well as the varying sizes of the individual grains of sand, impurities, or other materials.

Other Factors to Consider

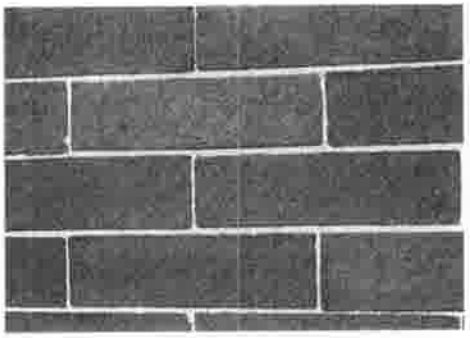
Color. Regardless of the color of the binder or colored additives, the sand is the primary material that gives mortar its color. A surprising variety of colors of sand may be found in a single sample of historic mortar, and the different sizes of the grains of sand or other materials, such as incompletely ground lime or cement, play an important role in the texture of the repointing mortar. Therefore, when specifying sand for repointing mortar, it may be necessary to obtain sand from several sources and to combine or screen them in order to approximate the range of sand colors and grain sizes in the historic mortar sample.

Figure 19. Mortar joints of 18th century brick buildings were often as much as 1/2 inch wide, cut flush and struck with a grapevine joint, but for window and door surrounds where a finer quality rubbed brick was used, mortar joints were very thin. Photo: National Park Service Files.

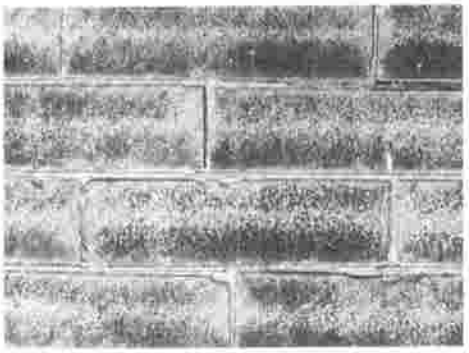
Pointing Style. Close examination of the historic masonry wall and the techniques used in the original construction will assist in maintaining the visual qualities of the building (Fig. 18). Pointing styles and the methods of producing them should be examined. It is important to look at both the horizontal and the vertical joints to determine the order in which they were tooled and whether they were the same style. Some late-19th and early-20th century buildings, for example, have horizontal joints that were raked back while the vertical joints were finished flush and stained to match the bricks, thus creating the illusion of horizontal bands. Pointing styles may also differ from one facade to another; front walls often received greater attention to mortar detailing than side and rear walls (Fig. 19). **Tuckpointing** is not true repointing but the

Figure 20. This stone garden wall was tuckpointed to match the tuckpointing on the c. 1920s house on the property. Photo: Anne Grimmer.

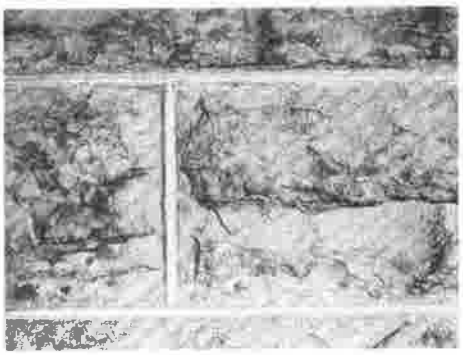
a



b



c



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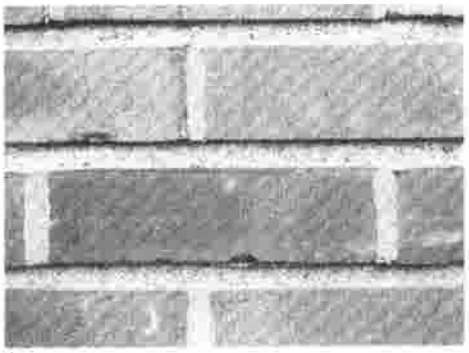
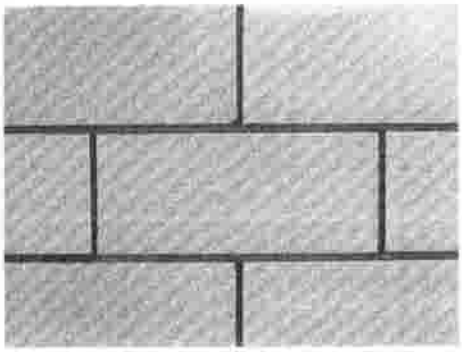


f



g

Figure 18. A cross-section of mortar joint types. (a) Grapevine joints on a mid-18th century brick building; (b) flush joints on a mid-to-late 19th century brick building; (c) beaded joints on a late-19th century brick building; (d) early-20th century beaded joints on rough-cut limestone where the vertical joints were struck prior to the horizontal joints; (e) raked joints on 1920s wire brick; (f) horizontal joints on a 1934 building designed by Frank Lloyd Wright were raked back from the face of the bricks, and the vertical joints were filled with a red-tinted mortar to emphasize the horizontality of the narrow bricks, and struck flush with the face of the bricks; (g) the joints on this 20th century glazed terra-cotta tile building are raked slightly, emphasizing the glazed block face. Photos: National Park Service Files (a,b,e); Robert C. Mack, FAIA (c,d,f,g).

application of a raised joint or lime putty joint on top of flush mortar joints (Fig. 20). **Penciling** is a purely decorative, painted surface treatment over a mortar joint, often in a contrasting color.

Masonry Units. The masonry units should also be examined so that any replacement units will match the historic masonry. Within a wall there may be a wide range of colors, textures, and sizes, particularly with hand-made brick or rough-cut, locally-quarried stone. Replacement units should blend in with the full range of masonry units rather than a single brick or stone.

Matching Color and Texture of the Repointing Mortar

New mortar should match the unweathered interior portions of the historic mortar. The simplest way to check the match is to make a small sample of the proposed mix and allow it to cure at a temperature of approximately 70 degrees F for about a week, or it can be baked in an oven to speed up the curing; this sample is then broken open and the surface is compared with the surface of the largest "saved" sample of historic mortar.

If a proper color match cannot be achieved through the use of natural sand or colored aggregates like crushed marble or brick dust, it may be necessary to use a modern mortar pigment.

During the early stages of the project, it should be determined how closely the new mortar should match the historic mortar. Will "quite close" be sufficient, or is "exactly" expected? The specifications should state this clearly so that the contractor has a reasonable idea how much time and expense will be required to develop an acceptable match.

The same judgment will be necessary in matching replacement terra cotta, stone or brick. If there is a known source for replacements, this should be included in the specifications. If a source cannot be determined prior to the bidding process, the specifications should include an estimated price for the replacement materials with the final price based on the actual cost to the contractor.

Conclusion

A good repointing job is meant to last, at least 30 years, and preferably 50-100 years. Shortcuts and poor craftsmanship result not only in diminishing the historic character of a building, but also in a job that looks bad, and will require future repointing sooner than if the work had been done correctly (Fig. 17). The mortar joint in a historic masonry building has often been called a wall's "first line of defense." Good repointing practices guarantee the long life of the mortar joint, the wall, and the historic structure. Although careful maintenance will help preserve the freshly repointed mortar joints, it is important to remember that mortar joints are intended to be sacrificial and will probably require repointing some time in the future. Nevertheless, if the historic mortar joints proved durable for many years, then careful repointing should have an equally long life, ultimately contributing to the preservation of the entire building.

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Useful Addresses

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Front Cover: Repointing a historic brick building using a lime-based mortar. Traditional lime mortars have a consistency that enables the mortar to cling to a repointing tool while in a vertical position. Photo: John P. Speweik.

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