PLANNING BOARD

Wednesday, October 2, 2024 at 5:00 PM
Room 24 (Ground Level of City Hall) and Zoom

MEMBERS
Robert O'Brien, Chair
Brad Miller, Vice Chair
Hilary Bassett
Michael Hutchins
Valerie Paquin-Gould
Brian Sosebee
Rob Whitten

REMOTE ACCESS INFORMATION:
The Historic Preservation Board invites the public to attend the meeting **in person or Zoom** pursuant to the Remote Meeting Policy adopted by the Historic Preservation Board. Prior to the meeting, please check the Agenda Center https://www.portlandmaine.gov/602/Agendas-Minutes to view memos and reports which will be posted by the end of the day on the Friday before the Historic Preservation Board meeting.

REMOTE PARTICIPATION
Allow your computer to install the free Zoom app to get the best meeting experience. If you are not able to attend either in person or via Zoom, a recording will be available in the Agenda Center following the meeting.

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Dial(for higher quality, dial a number based on your current location):
+1 305 224 1968 US
+1 309 205 3325 US
+1 312 626 6799 US (Chicago)
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+1 929 205 6099 US (New York)
+1 301 715 8592 US (Washington DC)
+1 669 444 9171 US
+1 669 900 6833 US (San Jose)
+1 689 278 1000 US
+1 719 359 4580 US
+1 253 205 0468 US
+1 253 215 8782 US (Tacoma)
+1 346 248 7799 US (Houston)
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PUBLIC COMMENT INFORMATION:
To submit written public comment on an agenda item, email hp@portlandmaine.gov. Submissions must be received by 12:00 pm **the day before** the Historic Preservation Board meeting to guarantee their inclusion in

the agenda packet. All submissions must include the commenter's name and legal address. To help ensure your comment is submitted for the correct item, please include the name of the agenda item (see below).

AGENDA:

PUBLIC HEARING - 5:00 PM

1. **ROLL CALL AND DECLARATION OF QUORUM**
2. **COMMUNICATION AND REPORTS**
3. **REPORT OF ATTENDANCE AT THE MEETING HELD ON SEPTEMBER 18, 2024**

   Public Hearings
   489 Cumberland Avenue: Bassett, Miller, O'Brien, Paquin-Gould, Sosebee, and Whitten present.
4. **REPORTS OF DECISIONS AT THE MEETING HELD ON SEPTEMBER 18, 2024**
   - i. Certificate of Appropriateness for Roof Replacement; 489 Cumberland Avenue; Denny Fuller, Applicant. Plan Number: HPBR-002667-2023. The Board voted 6-0 to approve the application with conditions.
5. **NEW BUSINESS**
   - i. Certificate of Appropriateness for Revisions to New Construction; 1168 Westbrook Street; Richard B. Harding, Applicant. Plan Number: HPBR-002649-2023.
   - ii. Certificate of Appropriateness for Roof Replacement; 184 State Street; Geoffrey Rice, Applicant. Plan Number: HPBR-003017-2024.

STAFF MEMORANDUM
HISTORIC PRESERVATION PROGRAM
PLANNING AND URBAN DEVELOPMENT

TO: Chair O'Brien and Members of the Historic Preservation Board
FROM: Evan R. Schueckler, Historic Preservation Program Manager
DATE: September 27, 2024
RE: 1168 Westbrook Street – PUBLIC HEARING – New Construction, Revisions
PROJECT ID: HPBR-002649-2023
MEETING: October 2, 2024

Owner: Brewster Harding
Designer: Anthony Taylor

A sign announcing the Historic Preservation Board's meeting on October 2, 2024 was posted at the property on September 24, 2024. A legal ad was published in the Portland Press Herald on September 20, 2024 and September 21, 2024, and 44 notices were sent to neighboring property owners within 100 feet of the subject property.

PROJECT SCOPE

Construct new two-and-a-half story single-family residence on undeveloped portion of lot associated with contributing single-family home at 1168 Westbrook Street. New structure to be of frame construction, clad in clapboards. Structure to have entrances on south elevations (facing the proposed driveway), and a two-car garage at the rear. Windows to be single or paired double-hung.

SUMMARY OF HISTORIC CONTEXT

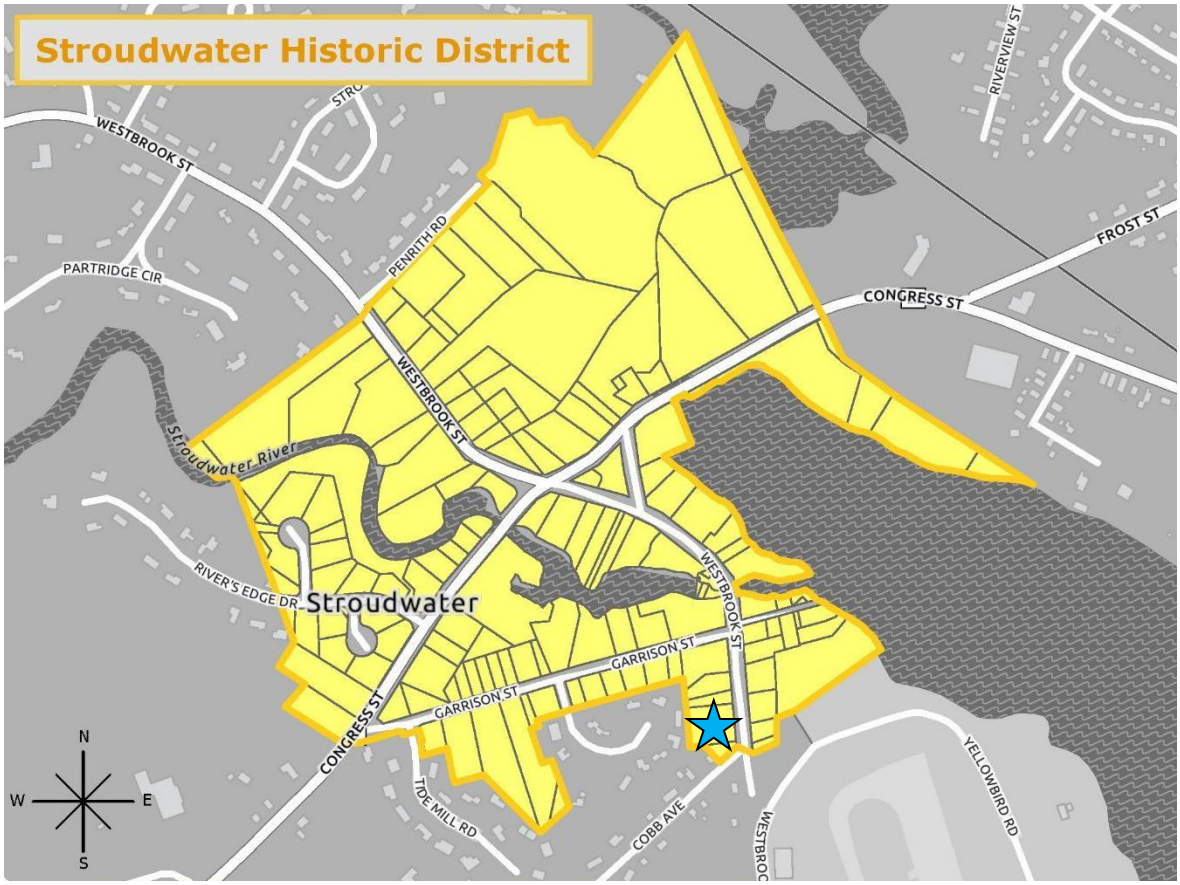

Figure 1: Map of the Stroudwater Historic District showing location of 1168 Westbrook with a blue star.

The Stroudwater Historic District is significant as an early village which still conveys a coherent sense of a place, as well as its distinctive history. The fact that Stroudwater is now part of the City of Portland, where comparable eighteenth and early nineteenth century settlement has been considerably obliterated by fires and later development, makes this historic district especially important to the city. Moreover, Stroudwater is a good example of the planning of a New England village, not according to rigid plans and typical central commons, but in terms of the natural topography that both respected the landscape and exploited it for economic advantage. For instance, the streets on which the historic structures now stand follow the high ground and were originally the roads used to haul masts to the Fore River.

The village occupies the western bank of the tidal Fore River where it is joined by the Stroudwater River. The historic district contains about thirty residences, dating from the Colonial, Federal, and Greek Revival periods and standing on the gentle hills that slope down to the Fore River. In addition, the district includes the village burying ground, sites associated with collecting and exporting of masts, mills, tanneries, and shipyards which supported the inhabitants, and the section of the Cumberland and Oxford Canal which runs along the eastern bank of the Fore River opposite the village.

The district contains many outstanding examples of Georgian/Colonial, Federal, and Greek revival architecture. Preeminent among these houses are The George Tate House (Figure 3, left), the Captain James Means House (Figure 2, right), and the Francis Waldo House (Figure 3, right). Several other fine examples of the grander homes in the district are pictured below; however, the district also contains a number of other more modest houses in these same styles and more vernacular forms such as simple capes and center hall colonials.

Figure 1: Left - Dr. Jeremiah Barker House, 1799 (1168 Westbrook Street) and right - Elias Jacobs House, 1854 (1181 Westbrook Street).

Figure 2: Left – Richard Forder House, 1730 (1235 Westbrook Street) and right - Captain James Means House, 1797 (2 Waldo/1267 Westbrook Streets).

Figure 3: Left - George Tate House, 1755 (1270 Westbrook Street) and right – Francis Waldo/Captain Daniel Dole House, 1765 (1365 Westbrook Street.

While the contributing structures in the district range in grandeur and age, there are a number of shared characteristics. Structures are usually situated set back from and at a right angle to the street with lawns and informal plantings between. Heights range from one-and-a-half to two-and-a-half stories with gabled, hipped, or gambrel roofs. Buildings are most commonly centrally planned, with the front doors facing towards the street, though some are oriented to the side. A few buildings even feature central entrances to the front and side. Openings are typically arranged in symmetrical and regular intervals across the facades, aligning vertically and horizontally, though the pattern is often broken at the uppermost half-story. The ratio of solid to void typically favors solid. Windows are vertically oriented, double-hung, and with divided lights. Doors are usually a single leaf, sometimes with sidelights, all set within a pronounced architrave. Garage additions, typically set back at the side or hidden in the rear.

Additional information on the Stroudwater Historic District can be found on the city website: https://www.portlandmaine.gov/665/Historic-Districts

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PREVIOUS REVIEW BY HISTORIC PRESERVATION BOARD

November 1, 2023, Public Hearing:

At a public hearing held on November 1, 2023, the Board voted unanimously to approve the proposed new construction with the condition that exterior light fixtures be reviewed and approved by Historic Preservation Staff.

Figure 4: Perspective drawings of the structure as approved at the November 1, 2023 Public Hearing.

STAFF COMMENTS

The application is being brought before the Historic Preservation Board again as the applicant is proposing a several substantial modifications to the previously approved design. Staff have generally found that the proposed revisions are still consistent with the historic context, and are therefore bringing this application directly to a public hearing with the Board.

The applicant is proposing the following revisions:
- Elimination of the street-facing entrance,
- Modifications to the side (primary) entrance,
- Elimination of the projecting bays from the North façade,
- The use of single windows on the sides and rear,
- The use of multi-light windows at the front façade, and
- Small changes to proposed trim configurations.

Staff found that while street-facing entrances are common in Stroudwater, there are also many examples of historic houses with street-facing gables and prominent side entrances. As part of this adjustment, the primary side entrance on the south façade has been redesigned to have some of the same detail as the previous street-facing entrance, giving it prominence on the side façade. Eliminating the street-facing entrance has also had the advantage of allowing a more balanced arrangement of windows on the street-facing façade.

The applicant is also proposing to eliminate the three projecting square bays that had been proposed for the north façade. While there are some examples of bays in the district, they are less common the majority of the contributing buildings which tend to date from the 18th or early 19th

centuries. Generally, staff found that this change was still consistent with the proposed context.

The applicant is now proposing to use single windows on the side and rear elevations. Previously the Board had found that the paired windows helped to differentiate the building as a modern construction. The applicant is still proposing to use single-light windows at the sides which the Board had previously also found helped to differentiate the building as non-historic. However, the applicant is now proposing to use a combinate of six-over-six and four-over-four windows at the front façade. Staff have some concern that this might create some small amount of confusion about whether the building is historic, but also is inconsistent with the rest of the building. Staff are including a suggested condition that all windows be single-light to address this concern. Certainly the Board could discuss this with the applicant and may be able to come to another solution/condition.

Finally, the applicant is proposing some changes to the trim details. Staff had requested that new exterior trim details be provided in advance of this review; however, the applicant has not provided those. They have included a description which indicated that the trim will generally still consistent with the prior in being simplified interpretations of molding arrangements found on contributing buildings in the district. Staff have included a suggested condition that final trim details be submitted to staff for review prior to construction so that the appropriateness of the details can be confirmed.

The prior condition for staff review of lighting I also still suggested.

ANALYSIS OF APPLICABLE REVIEW STANDARDS

Standards for Review of New Construction, 17.8.3:

Standard A. Scale and Form	
1. Height The proposed height shall be visually compatible with surrounding structures when viewed from any street or open space and in compliance with any design guidelines.	
Standard Met?	**Staff Comments**
Yes	The proposed two-and-a-half story height is in keeping with typical heights found throughout the Historic District.
2. Width The width of a building shall be visually compatible with surrounding structures when viewed from any street or open space and in compliance with any design guidelines.	
Standard Met?	**Staff Comments**
Yes	The proposed width of the front façade is in keeping with the range of widths found throughout the district.

3. Proportion of principal facades The relationship of the width to the height of the principal elevations shall be visually compatible with structures, public ways, and open spaces to which it is visually related.	
Standard Met?	**Staff Comments**
Yes	The proposed structure has a somewhat vertically oriented front façade, and more horizontal sides. Many of the gable-fronted structures in the district have similarly vertical street-facing facades.
4. Roof shapes The roof shape of a structure shall be visually compatible with the structures to which it is visually related.	
Standard Met?	**Staff Comments**
Yes	The proposed gabled roof is typical of the district.
5. Scale of a structure The size and mass of structures in relation to open spaces, windows, door openings, porches, and balconies shall be visually compatible with the structures, public ways, and places to which they are visually related.	
Standard Met?	**Staff Comments**
Yes	The scale of the structure is generally in-keeping with the scale of other structures in the district.

Standard B. Composition of Principle Facades	
1. Proportion of openings The relationship of the width to height of windows and doors shall be visually compatible with structures, public ways, and places to which the building is visually related.	
Standard Met?	**Staff Comments**
Yes	The proposed windows are vertically oriented, as is typical of the district. At the front of the house, the applicant is proposing paired windows, which present a squarer proportion. Paired windows are less common in the district but help differentiate the structure from nearby historic structures.
2. Rhythm of solids to voids in facades The relationship of solids to voids in the façade of a structure shall be visually compatible with structures, public ways, and places to which it is visually related.	
Standard Met?	**Staff Comments**
Yes	The proposed structure favors solid to void, as is typical of the district. Windows are fairly regular, in particular at the front façade where they are arranged symmetrically. Windows are slightly less regular on the sides and towards the rear, though still generally aligned vertically.

3. Rhythm of entrance porch and other projections The relationship of entrances and other projections to sidewalks shall be visually compatible with the structures, public ways, and places to which they are visually related.	
Standard Met?	Staff Comments
Yes	The applicant is proposing a roughly central entrance at the south (side) elevation. The entrance will have a simple, but substantial surround and be accessed by a small landing and set of steps. The applicant is also proposing that the garage entrance be located towards the rear with a step back, meaning that it will have minimal visibility from Westbrook Street.
4. Relationship of materials The relationship of the color and texture of materials (other than paint color) of the facade shall be visually compatible with the predominant materials used in the structures to which they are visually related.	
Standard Met?	Staff Comments
Yes	The applicant is proposing to use clapboard siding with corner boards and other trim, as is typical of the district.

Standard C. Relationship to Street	
1. Walls of continuity Facades and site structures, such as masonry walls, fences, and landscape masses, shall, when it is a characteristic of the area, form cohesive walls of enclosure along a street to ensure visual compatibility with the structures, public ways, and places to which such elements are visually related.	
Standard Met?	Staff Comments
Yes	The Stroudwater district is characterized by a broken street wall, with large side yards and gaps between structures. The proposed structure will retain this pattern.
2. Rhythm of spacing and structures on streets The relationship of a structure or object to the open space between it and adjoining structures or objects shall be visually compatible with the structures, objects, public ways, and places to which it is visually related	
Standard Met?	Staff Comments
Yes	The applicant is proposing to locate the structure with an ample side yard to the north, and a driveway and small side yard to the south. These will allow the structure to retain the large gaps between houses associated with the district.

3. Directional expression of principal elevation A structure shall be visually compatible with the structures, public ways, and places to which it is visually related in its directional character, whether this be vertical character, horizontal character, or nondirectional character.	
Standard Met?	**Staff Comments**
Yes	The proposed structure has a somewhat vertically oriented façade, though this is layered with horizontal elements in the clapboards. Structures in the district vary in their expression, though many feature a layered composition with vertical massing and windows, contrasted with horizontal siding and details.

Standard D. Other Standards	
1. Compatible use Every reasonable effort shall be made to provide a compatible use for a property which requires minimal alteration to the character defining features of the structure, object, or site and its environment or to use a property for its originally intended purpose.	
Standard Met?	**Staff Comments**
Yes	The proposed structure will have a residential use which is typical of the district.
2. Distinguishing original character The distinguishing original qualities or character of a structure, object, or site and its environment shall not be destroyed. The alteration of any historic material or distinctive architectural features should be avoided when possible.	
Standard Met?	**Staff Comments**
Yes	The proposed structure will not require destruction of or alteration to any historic materials or features.
4. Contemporary design Contemporary design for additions to existing properties shall not be discouraged when such alterations and additions do not destroy significant cultural, historical, architectural, or archaeological materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the size, scale, material, and character of the property, neighborhood and environment.	
Standard Met?	**Staff Comments**
Yes	The proposed structure will have a fairly traditional design; however, the applicant has proposed several design elements to differentiate the structure including paired rather than single windows, and simplified trim.

MOTION FOR CONSIDERATION

I move to CONDITIONALLY APPROVE revisions to application HPBR-002649-2023 for New Construction at 1168 Westbrook Street on the basis of submitted documentation, plans, and specifications; information provided in the staff memo; and findings by the Historic Preservation Board that the project meets Standards for Review of New Construction 17.8.3-A.1-5, B.1-4, C.1-3, D.1-2, and D.4 with the following conditions:

1) That exterior light fixtures be reviewed and approved by Historic Preservation staff as being appropriate based on the Standards for Review;
2) That all windows be single-light windows without muntins to differentiate the building from nearby contributing buildings; and
3) That final details or shop drawings for exterior trim be provided to Historic Preservation Staff for review and approval as being sufficiently differentiated from historic trim profiles and configurations.

ATTACHMENTS

1. Summary of Changes
2. Revised Drawings
3. Certificate of Appropriateness, December 7, 2023
4. Approved Drawings, December 7, 2023

September 10, 2024

Hi Evan,

Thanks for explaining in detail your criteria and the reasons for them. In response, here are revised elevations (see atttachments) along with explanations of window placement and style and other features:

Double windows have been placed on the street front and single windows on the sides and rear; divided lights on the street front and single pane sash on the sides and rear. Our reasoning for so doing is as follows: Windows on the street front are grouped in pairs and are intended to have 4/4 sash with divided lights expressed in realistic simulated putty bevels on the exterior. The windows on the street front are doubled to achieve a grouping of four such windows on the gable end, as the two other houses on Westbrook Street with side entrances and gable ends facing the street have gable end windows grouped to form a rectangular arrangement of four windows. Windows on the side and rear elevations are single and consist of single pane double hung sash. The window directly above the entrance is in a narrow stair hall and space is lacking for a double window there. All windows on the sides and rear are single to achieve a uniform rather than lumpy or inconsistent fenestration on the sides and rear, and to avoid excessively wide windows on the sunny side and particularly in the kitchen, laundry room and bathroom. 4/4 divided lights were omitted on the sides and rear because window sash proportions are wider horizontally there, and the effect of 4/4 divided lights on the sides and rear look fussy and don't match the pleasing proportions of the double ones on the street front. Likewise, door sidelights are changed from multi-pane to single light to correspond to adjacent single light sash. Doing so also expresses the idea of "dissipation" explained in the book "Big House, Little House, Back House, Barn" by Hubka by means of making the window trim level and sash sizes of the sides and rear smaller and simpler than those of the more formal street front. In contrast to Tracie's elevations, though in keeping with the essence of Tracie's floor plan, the revised plan strives for consistent window proportions wherever feasible rather than differentiating window sizes on the same side of the house to vary with interior room uses such as higher windowsill heights over the kitchen sink and in bathrooms. One exception to this in the revised plan is the small stair window placed there in part to relieve the plainness of the large gap between adjacent full-size windows to either side, something Brewster suggested to relieve the blankness of the wall to the right of the side entrance.

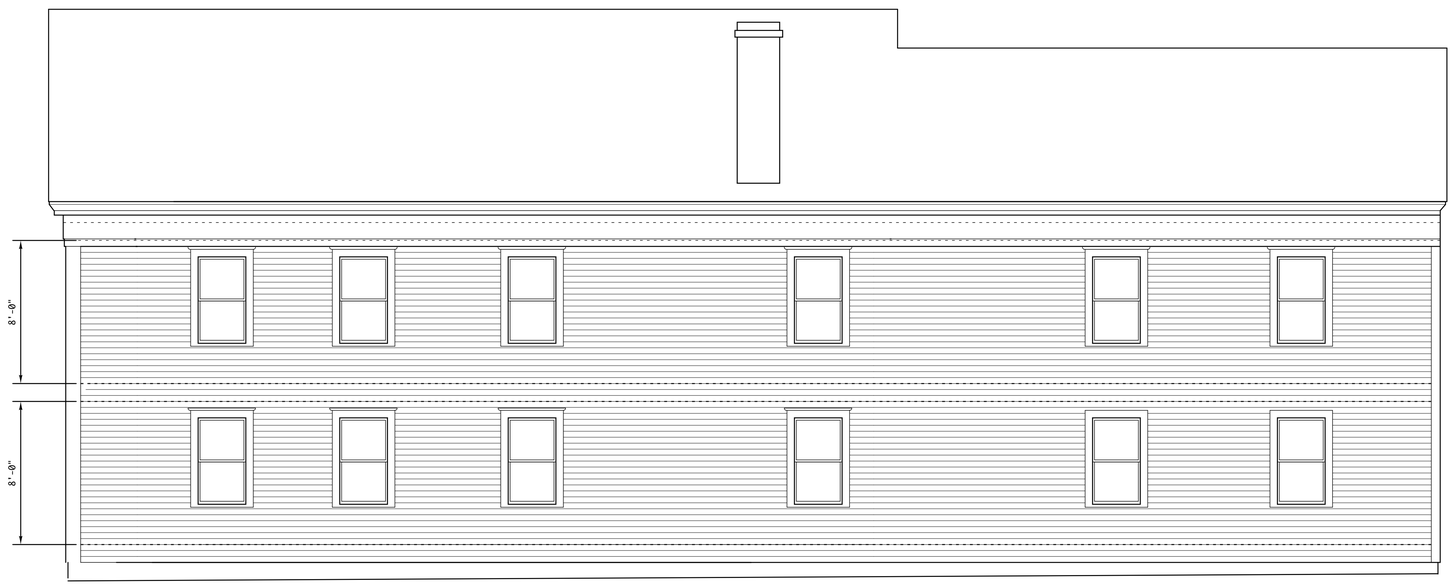
Second floor windows have window cap moldings of simple quarter round shape that serve to visually join their flat face frames to the frieze board above, while such moldings are omitted on all first floor windows for simplicity and practicality's sake.

The attic window on the street front, the only example of 6/6 sash on the house, was chosen for its compatibility with the shape of the gable and should be thought of as a “novelty window” comparable to the circular or octagonal novelty windows popular with home builders but less cliched, and the same applies to the small four light stair window to right of the side entrance.

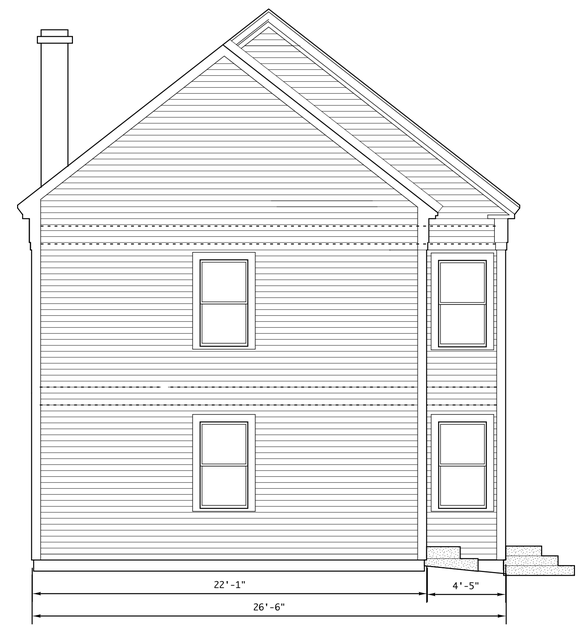
You expressed a desire to see a simplification of roof edge trim to differentiate Brewster’s new house from older ones nearby. To do so, we’ve omitted the fillet or molding of rectangular section between the fascia and crown molding of the main cornice, resulting in a smoother and wider Modernist appearance. Cornice returns are of simple rectangular section without the stepped appearance of a traditional fillet. Pedimented gable trims are popular with contemporary builders, albeit achieved with simplified detail. Many contemporary buildings are seen with simple, unadorned and wide beveled roof edge trims corresponding to traditional crown moldings – one example of this being the detailing of the roof edge on Hannaford grocery stores. The plain wide frieze boards and corner boards reflect both traditional and Modernist practices, hinting at the massiveness and austerity of simplified farmhouse Doric or stripped classic as well as partaking somewhat of the character of Modernist Brutalism.

Please feel free to comment and reply concerning the revised elevations and accompanying descriptions and explanations.

Tony Taylor
Designer

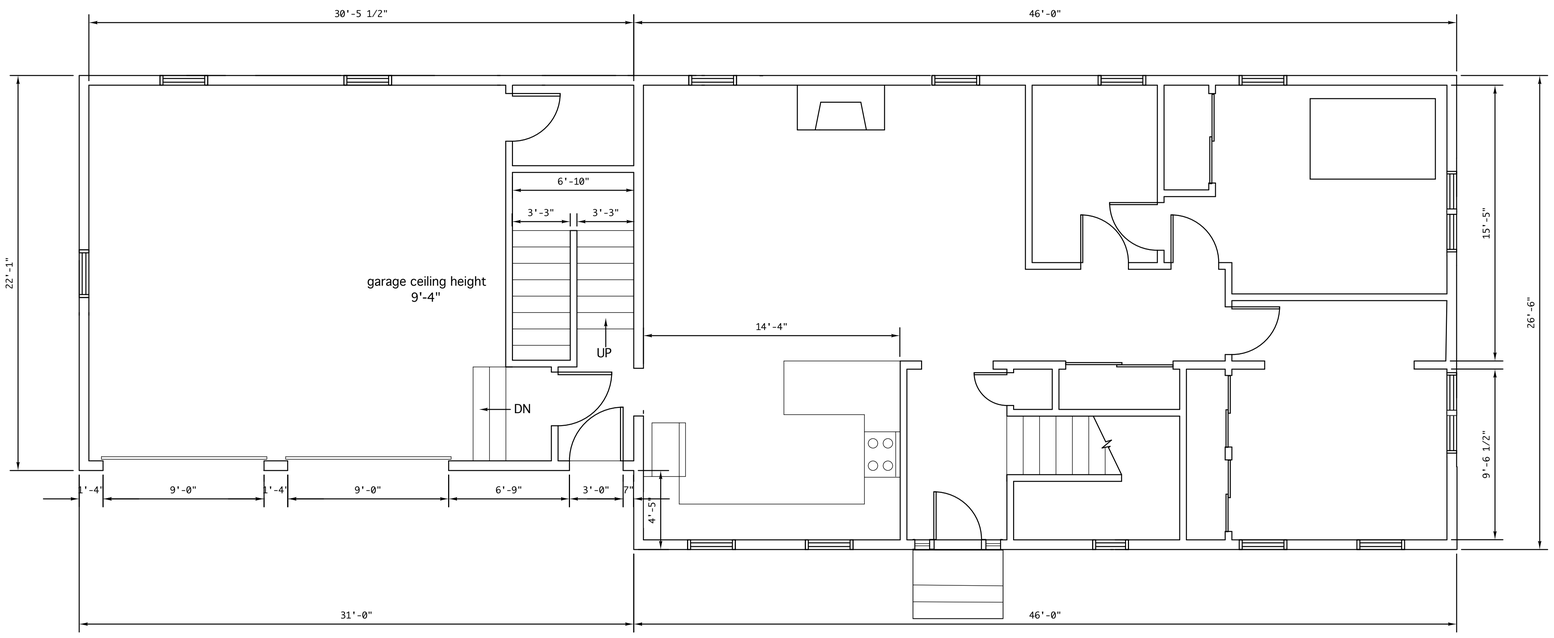


NORTH ELEVATION



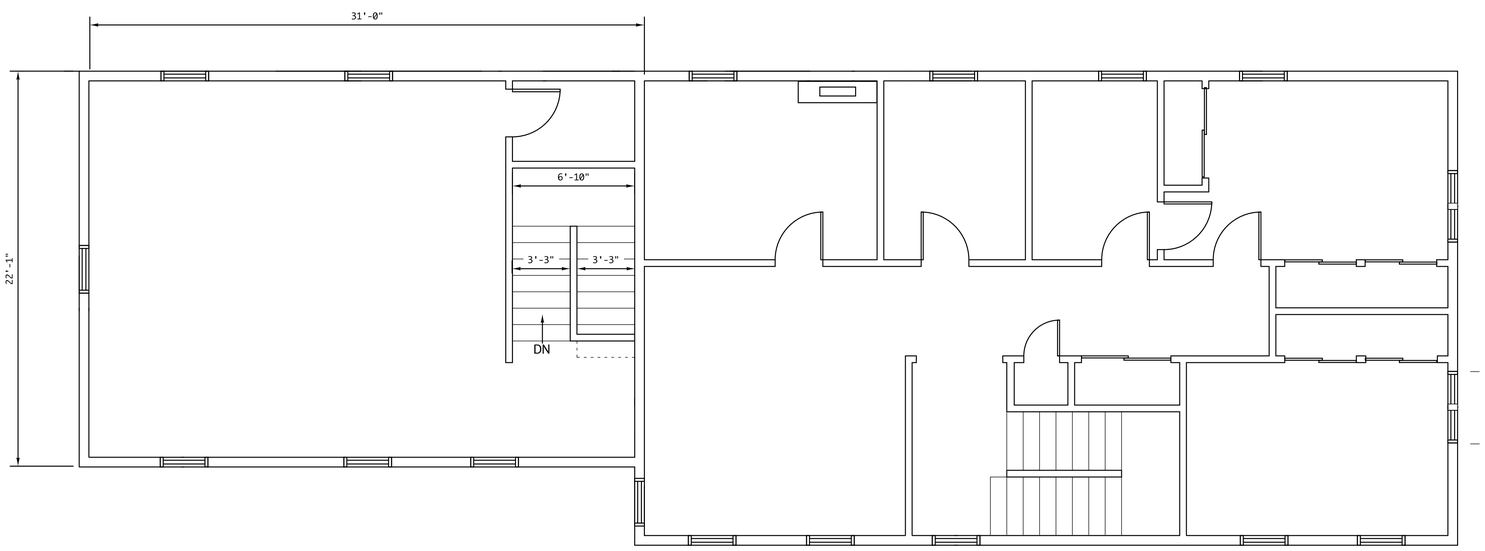
REAR ELEVATION

PROPOSED HOUSE AT 1162 WESTBROOK STREET
PORTLAND, MAINE
SCALE 1/4" = 1'-0" MAY 21, 2023



FIRST FLOOR PLAN

6,230.7892 Sq ft



SECOND FLOOR PLAN

PROPOSED HOUSE AT 1172 WESTBROOK STREET
PORTLAND, MAINE
SCALE 1/4" = 1'-0" AUG 24, 2024

December 7, 2023

Owner: Brewster Harding
1168 Westbrook Street
Portland, ME 04102

Applicant: Tracie Reed
Dextrous Creative, LLC
77 Newbury Street, Unit 1
Portland, ME 04101

Re: 1168 Westbrook Street – New Construction HPBR-002649-2023

Brewster Harding and Tracie Reed,

The Historic Preservation Board has approved your application for a Certificate of Appropriateness for new construction at 1186 Westbrook Street. Approval was based on the application materials submitted for the public hearing held on November 1, 2023, and stamped for approval on December 7, 2023, except as modified by the following conditions:

1) Exterior light fixtures be reviewed and approved by Historic Preservation staff as being appropriate based on the Standards for Review.

All improvements shall be carried out as shown on the materials submitted for the hearing on November 1, 2023, and stamped for approval on December 7, 2023, except as to comply with the conditions above. Changes to the approved plans or specifications, and any additional work that may be undertaken must be reviewed and approved by the Historic Preservation program prior to construction, alteration, or demolition. If, during the course of completing the approved work, conditions are encountered which prevent completing the approved work, or which require additional or alternative work, you must apply for and receive a Certificate of Appropriateness or Non-Applicability PRIOR to undertaking additional or alternative work.

This Certificate is granted upon condition that the work authorized herein is commenced within twelve (12) months after the original date of issuance. If the work authorized by this Certificate is not commenced within twelve (12) months after the original date of issuance or if such work is suspended in significant part for a period of one year after the time the work is commenced, such Certificate shall expire and be of no further effect; provided that, for cause, one or more extensions of time for periods not exceeding ninety (90) days each may be allowed in writing by the Department.

Sincerely,

Evan R. Schueckler
Historic Preservation Program Manager

October 19, 2023

PLANNING & URBAN DEVELOPMENT
HISTORIC PRESERVATION
CERTIFICATE OF APPROPRIATENESS
Project No:
HPBR-002649-2023
Public Hearing Date:
11/1/2023
Approved Drawings Date:
12/7/2023
Preservation Staff: Evan Schueckler

Evan Schueckler,
Historic Preservation Program Manager
389 Congress Street, Fourth Floor
Portland, ME 04101

Mr. Schueckler,

On behalf of our client, Brewster Harding, please find revisions to our previous submission reflecting feedback from the September workshop for the new single-family residence at 1168 Westbrook Street in the Stroudwater Historic Preservation District. In response to Committee feedback, we have modified the following elements on the project:

South Elevation (C6/A-2.1)
-Simplified windows on the South elevation. Removed window at top of interior steps.
-Shown two garage doors in lieu of a single larger door (added notation on J1/A-1.0 illustrating visible distance from street – 105'-6" at minimum to 122'-0" at farthest edge of door).

North Elevation (G6/A-2.1)
-Bay windows are symmetrically oriented

West Elevation
-No changes (not visible from street)

East Elevation – Street Facing (C1/A-2.1)
-Enlarged the entrance trim detail to emphasize its import. Trim detail shown on J8/A-2.1
-Provided trim detail for window and boxed eave (J4/A-2.1 and H1/A-2.1)
-Added illustrative perspective of trim, modeled in 3D (J12/A-2.1)
-Wrapped fascia trim at gable wall return to create corner board cap
-Included exterior wall sconce placeholders in model – selection TBD. Request submittal deferral until permit.

On the East Elevation the window sizes are largely dictated by programmatic elements. The kitchen windows are raised above the countertop and are vertically aligned with the windows above. The hall window in circulation corridor is a single window aligned over the side door. The bedroom window at the front corner of the building are mulled matching other bedroom windows in the project. We have retained the entrance at garage level which reduces the chance that a garage door will be left open for traveling in and out. This door is located at the level of the garage, adjacent to the interior steps which lead up and into the house. During winter months this at-grade entrance will allow safe snow removal, eliminating the need to traverse exterior steps which may be icy.

Our perspectives include the massing of adjacent structures to provide neighbors, particularly those on Cobb Avenue, a better sense of the new building's massing relative to their homes. Perspectives on sheet A-5.1 include the survey as an underlay to notate property boundaries and the client's existing driveway.

We look forward to reviewing these changes with the Board next month.

Respectfully,

Tracie J. Reed, Dextrous Creative (she/her)
Licensed to Practice Architecture in Maine, MA and NH, NCARB, AIA, NOMA, LEED AP

Enclosures: Architectural documentation

17
GARRISON
1187
WESTBROOK
1178
1169
1168
1
9
COBB
PORTLAND
JETPORT
PLANNING & URBAN DEVELOPMENT
HISTORIC
PRESERVATION
CERTIFICATE OF APPROPRIATENESS
Project No:
HPBR-002649-2023
Public Hearing Date:
11/1/2023
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12/7/2023
Preservation Staff: Evan Schueckler

1168 Westbrook Street (adjacent)

9 & 1 Cobb Street (adjacent)

1178 Westbrook Street

1169 Westbrook Street

1187 Westbrook Street

17 Garrison Street

PLANNING & URBAN DEVELOPMENT
HISTORIC PRESERVATION
CERTIFICATE OF APPROPRIATENESS
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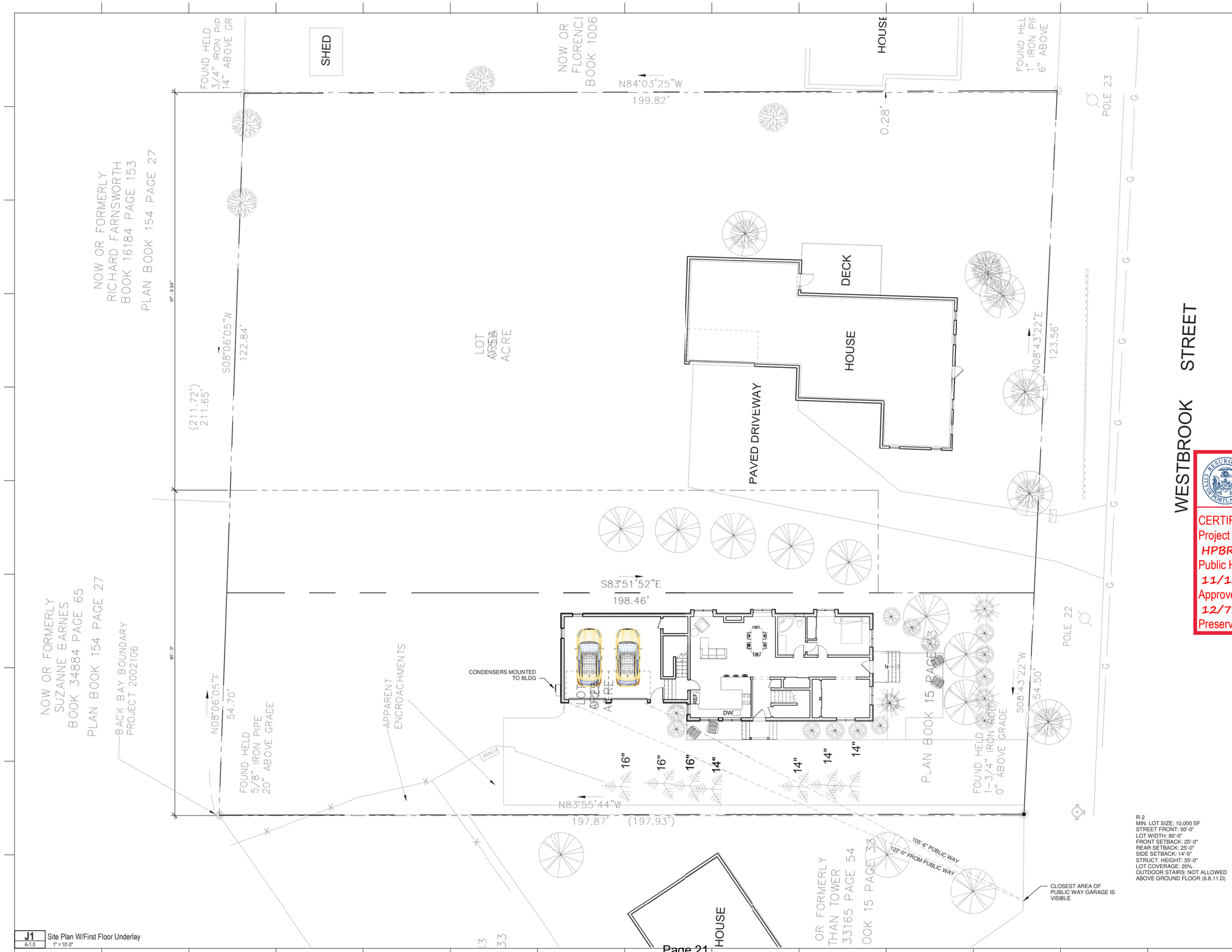


R-2
MIN. LOT SIZE: 10,000 SF
STREET FRONT: 50'-0"
LOT WIDTH: 80'-0"
FRONT SETBACK: 25'-0"
REAR SETBACK: 25'-0"
SIDE SETBACK: 14'-0"
STRUCT. HEIGHT: 35'-0"
LOT COVERAGE: 20%
OUTDOOR STAIRS: NOT ALLOWED ABOVE GROUND FLOOR (6.8.11.D)

J1 A-1.0 Site Plan W/First Floor Underlay
1" = 10'-0"

STROUDWATER HOUSE

DEXTROUS CREATIVE
PORTLAND, ME 04102
TRACIE REED, ARCHITECT
NCARB, AIA, LEED AP BD+C
traciereed@dextrouscreative.com
207.409.0459 (cell)

PROJECT TEAM

PLANNING & URBAN DEVELOPMENT
HISTORIC PRESERVATION

CERTIFICATE OF APPROPRIATENESS
Project No:
HPBR-002649-2023
Public Hearing Date:
11/1/2023
Approved Drawings Date:
12/7/2023
Preservation Staff: Evan Schueckler

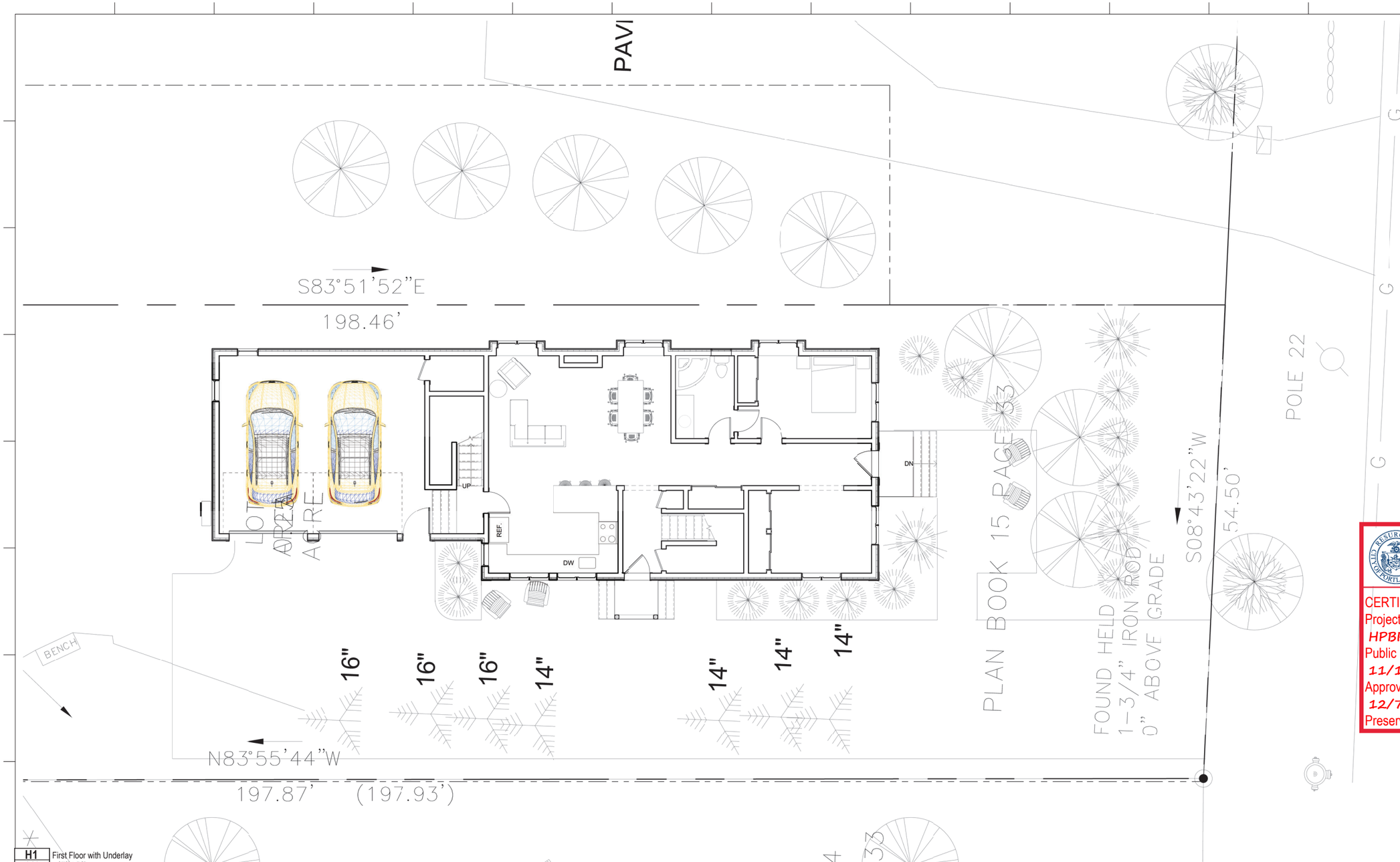
No.	Description	Date

SITE PLAN W/FIRST FLOOR UNDERLAY

Project number	23-30_1168 Westbrook Street
Date	10.19.23
Drawn by	Author
Project Status	Concept

A-1.0

Scale 1" = 10'-0"



H1 A-1.1 First Floor with Underlay 3/16" = 1'-0"

R-2
MIN. LOT SIZE: 10,000 SF
STREET FRONT: 50'-0"
LOT WIDTH: 80'-0"
FRONT SETBACK: 25'-0"
REAR SETBACK: 25'-0"
SIDE SETBACK: 14'-0"
STRUCT. HEIGHT: 35'-0"
LOT COVERAGE: 20%
OUTDOOR STAIRS: NOT ALLOWED ABOVE GROUND FLOOR (6.8.11.D)

STROUDWATER HOUSE

DEXTROUS CREATIVE
PORTLAND, ME 04102
TRACIE REED, ARCHITECT
NCARB, AIA, LEED AP BD+C
traciereed@dextrouscreative.com
207.409.0459 (cell)

PROJECT TEAM

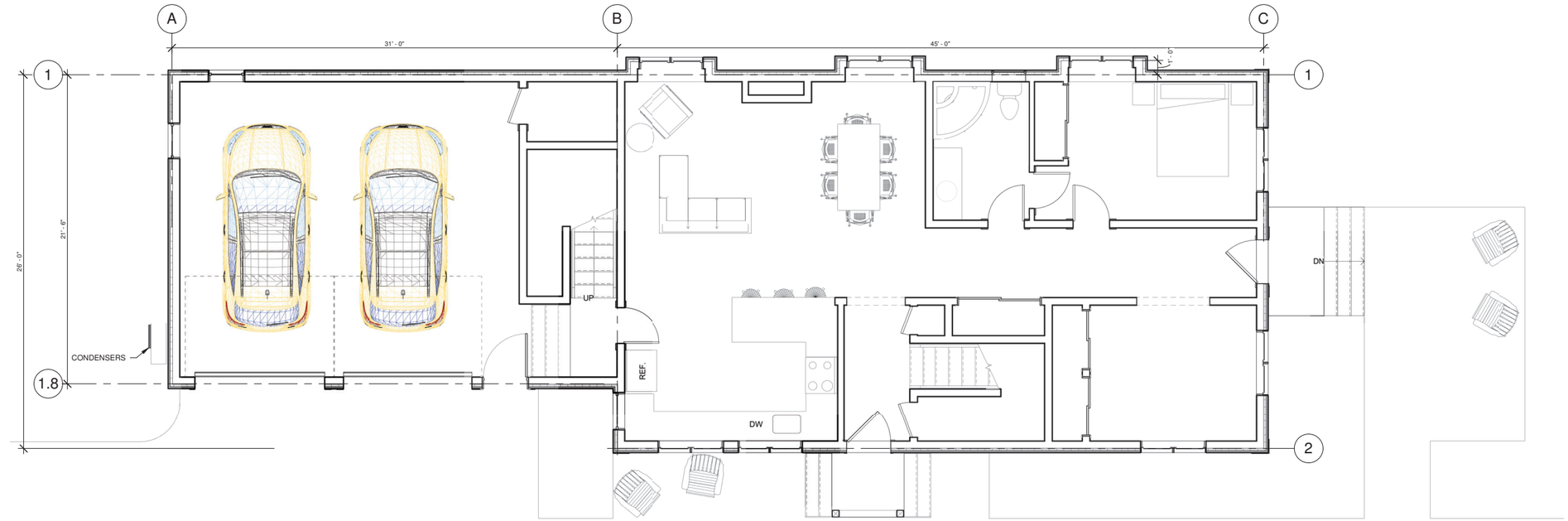
PLANNING & URBAN DEVELOPMENT
HISTORIC PRESERVATION

CERTIFICATE OF APPROPRIATENESS
Project No:
HPBR-002649-2023
Public Hearing Date:
11/1/2023
Approved Drawings Date:
12/7/2023
Preservation Staff: Evan Schueckler

No.	Description	Date

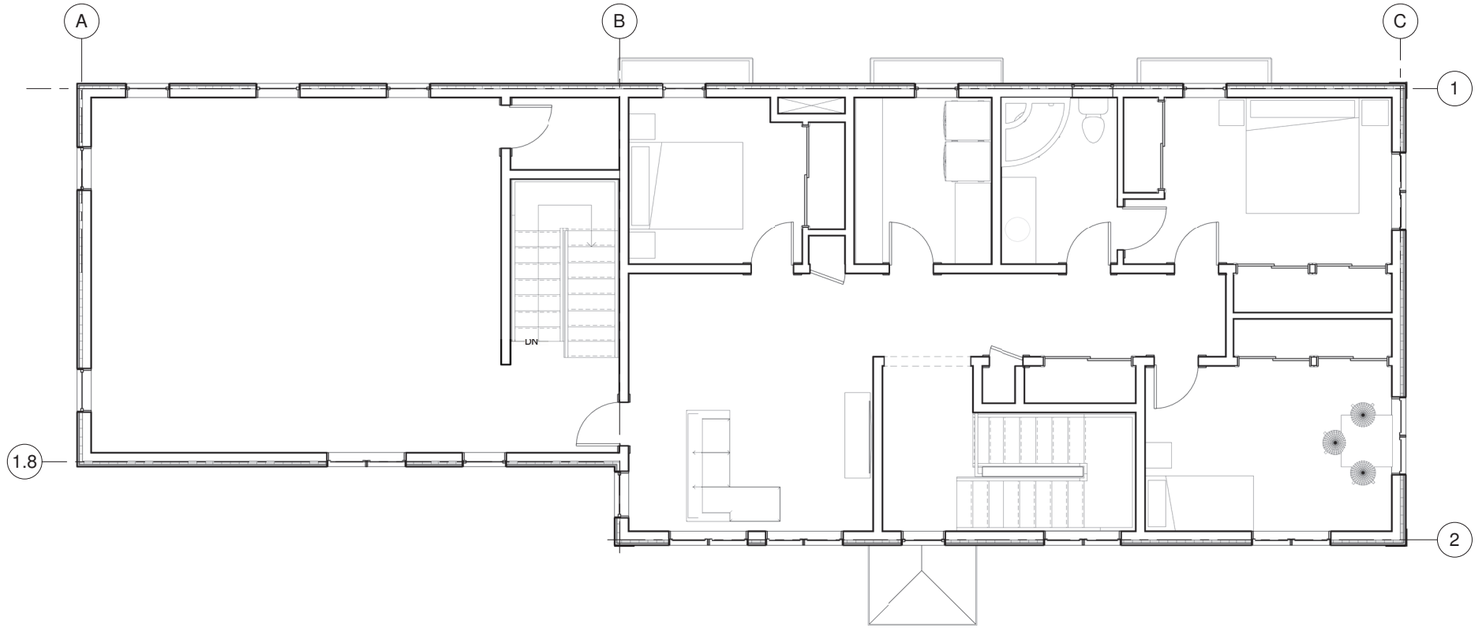
FIRST FLOOR PLAN

Project number	23-30_1168 Westbrook Street
Date	10.19.23
Drawn by	
Project Status	Concept
	A-1.1
Scale	3/16" = 1'-0"



D1 A-1.2 First Floor Plan
1/4" = 1'-0"

R-2
MIN. LOT SIZE: 10,000 SF
STREET FRONT: 50'-0"
LOT WIDTH: 80'-0"
FRONT SETBACK: 25'-0"
REAR SETBACK: 25'-0"
SIDE SETBACK: 14'-0"
STRUCT. HEIGHT: 35'-0"
LOT COVERAGE: 20%
OUTDOOR STAIRS: NOT ALLOWED ABOVE GROUND FLOOR (6.8.11.D)



H1 A-1.2 Second Floor
1/4" = 1'-0"

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HISTORIC PRESERVATION

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Project No:
HPBR-002649-2023
Public Hearing Date:
11/1/2023
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12/7/2023
Preservation Staff: Evan Schueckler

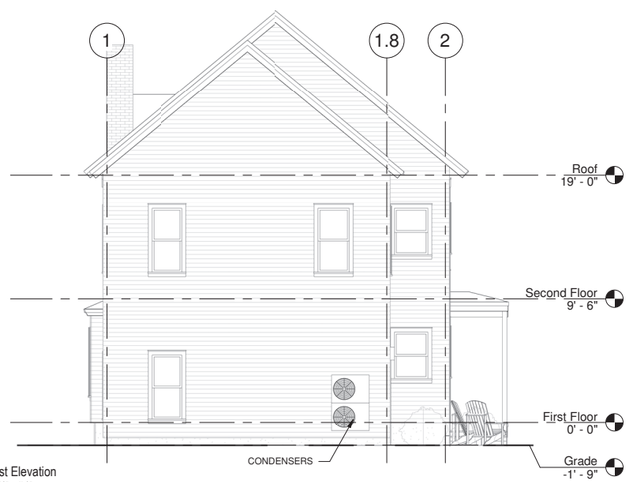
No.	Description	Date

FLOOR PLANS

Project number	23-30_1168 Westbrook Street
Date	10.19.23
Drawn by	
Project Status	Concept
	A-1.2
Scale	1/4" = 1'-0"

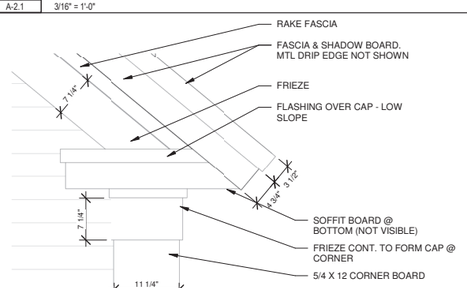
C1 A-2.1 East Elevation 3/16" = 1'-0"

C6 A-2.1 South Elevation 3/16" = 1'-0"

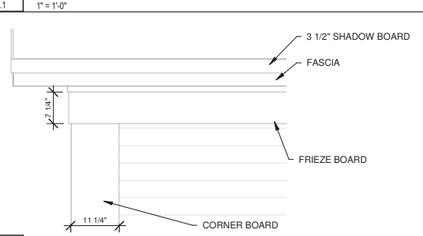


G1 A-2.1 West Elevation 3/16" = 1'-0"

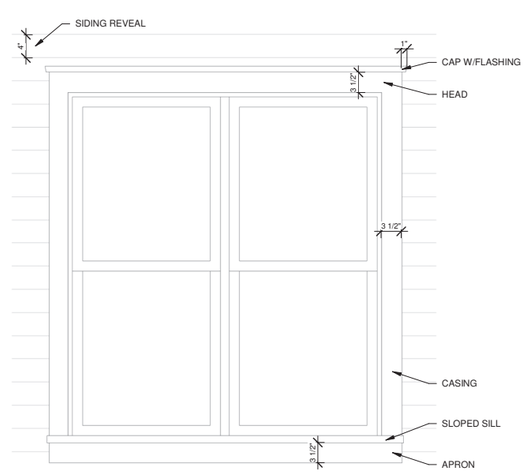
G6 A-2.1 North Elevation 3/16" = 1'-0"



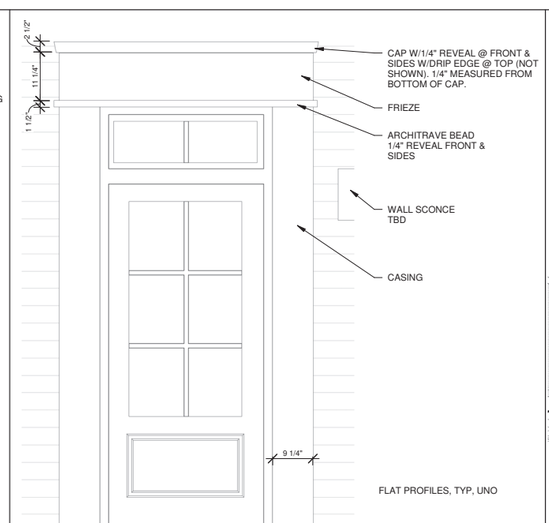
H1 A-2.1 EAVE - GABLE WALL RETURN 1" = 1'-0"



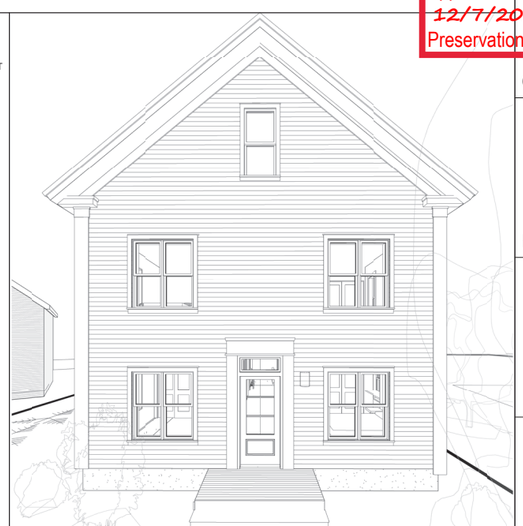
J1 A-2.1 EAVE & FRIEZE 3/4" = 1'-0"



J4 A-2.1 TYPICAL WINDOW TRIM 1" = 1'-0"



J8 A-2.1 FRONT ENTRANCE TRIM DETAIL 3/4" = 1'-0"



J12 A-2.1 RAISED PERSPECTIVE (12'-0" ABOVE GRADE)

STROUDWATER HOUSE

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PROJECT TEAM

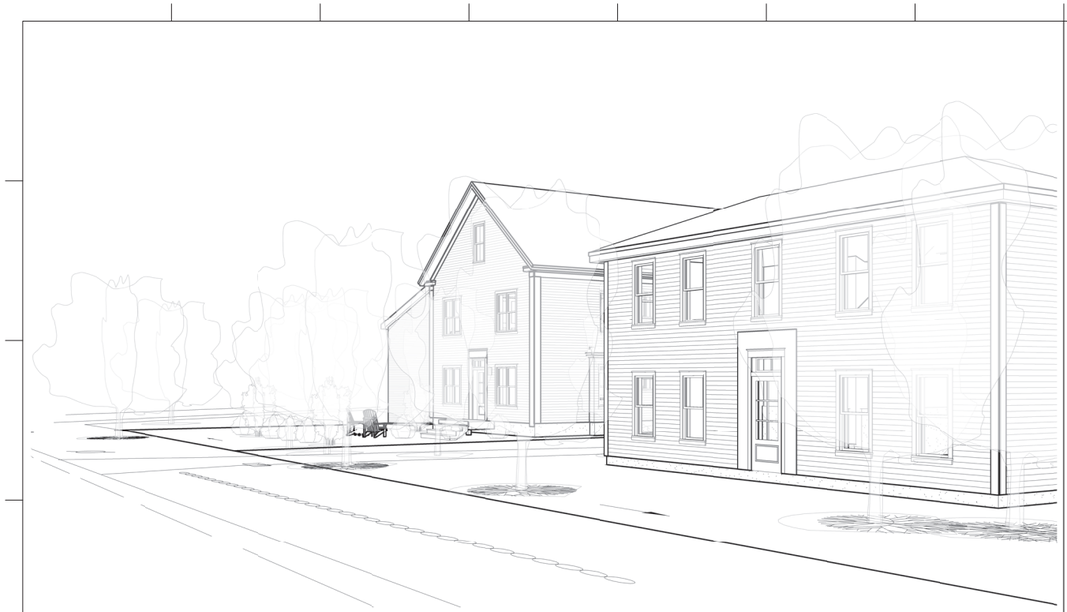
PLANNING & URBAN DEVELOPMENT
HISTORIC PRESERVATION

CERTIFICATE OF APPROPRIATENESS
Project No: HPBR-002649-2023
Public Hearing Date: 11/1/2023
Approved Drawings Date: 12/7/2023
Preservation Staff: Evan Schueckler

No.	Description	Date

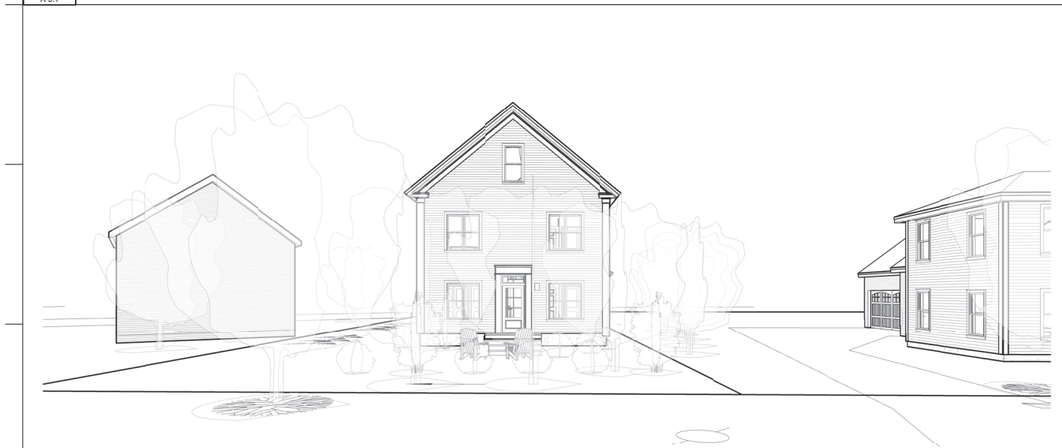
BUILDING ELEVATIONS

Project number	23-30_1168 Westbrook Street
Date	10.19.23
Drawn by	TJR
Project Status	Concept
	A-2.1
Scale	As indicated



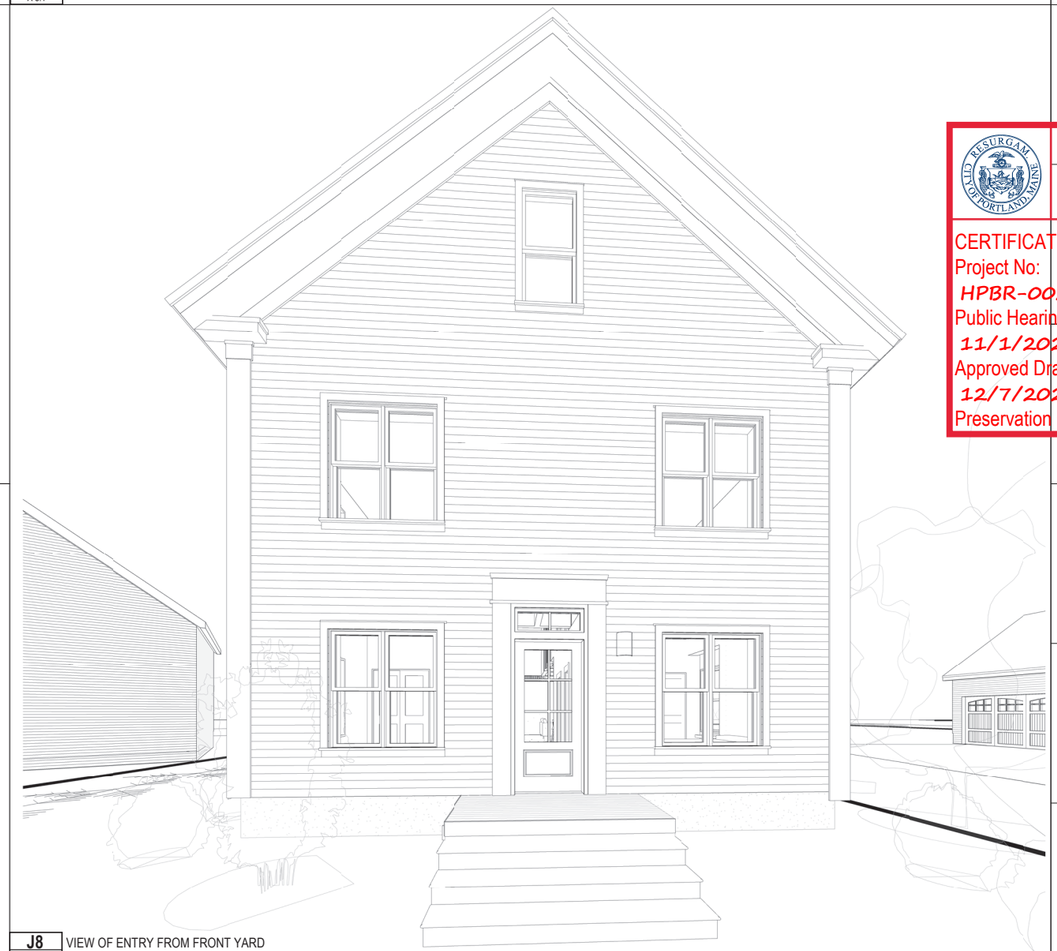
D1 A-5.1 At 1168 Looking Towards Cobb Ave

D8 A-5.1 From 1168 Facing New Building



G1 A-5.1 Street View

G8 A-5.1 Facing Existing House from Cobb Ave



J8 A-5.1 VIEW OF ENTRY FROM FRONT YARD

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No.	Description	Date

PERSPECTIVES

Project number	23-30_1168 Westbrook Street
Date	10.19.23
Drawn by	TJR
Project Status	Concept
	A-5.1
Scale	

STAFF MEMORANDUM
HISTORIC PRESERVATION PROGRAM
PLANNING AND URBAN DEVELOPMENT

TO: Chair O'Brien and Members of the Historic Preservation Board
FROM: Rob Wiener, Associate Preservation Planner
DATE: September 27, 2024
RE: 182-184 State Street – PUBLIC HEARING – Slate Roof Replacement
PROJECT ID: HPBR-003017-2024
MEETING: October 2, 2024

Owner: Geoffrey Rice
Owner's Representative: Greg Shinberg

A sign announcing the Historic Preservation Board's meeting on 10/2/2024 was posted at the property on 9/17/2024. A legal ad was published in the Portland Press Herald on 9/20/2024 and 9/21/2024, and 31 notices were sent to neighboring property owners within 100 feet of the subject property.

PROJECT SCOPE

Applicants propose to replace the front section of slate roof of 182 State Street, facing State Street, with DaVinci artificial slate tiles, because of ongoing maintenance and leakage issues. On November 15, 2023 the Board approved a Certificate of Appropriateness on a proposal to replace two other adjacent sections of roof, closer to Pine Street, with the same type of artificial slate. As of September 27, the DaVinci roofing has now been installed on those sections of roof.

Material Specifications:

Siding	Brick
Trim	Painted wood
Roofing	Roof section that is the subject of this review: slate with copper valleys, ridge caps, and drip edge (Two adjacent roofs mentioned above are temporarily covered with asphalt shingles and ice and water shield, pending replacement with DaVinci.

SUMMARY OF HISTORIC CONTEXT

Originally an 1847 Greek Revival duplex, 180-182 State Street has been heavily altered. At the northern end, 182 State was renovated and added to in 1871-1872 in the Italianate Style, including raising the roof, adding bays and porches, and altering the window openings. The storefronts

facing the corner and Pine Street (also referred to as 184 State Street,) were added after 1924. At the south end, 180 State Street contains several apartments, and the Upper floors of 182 contain multiple apartments as well.

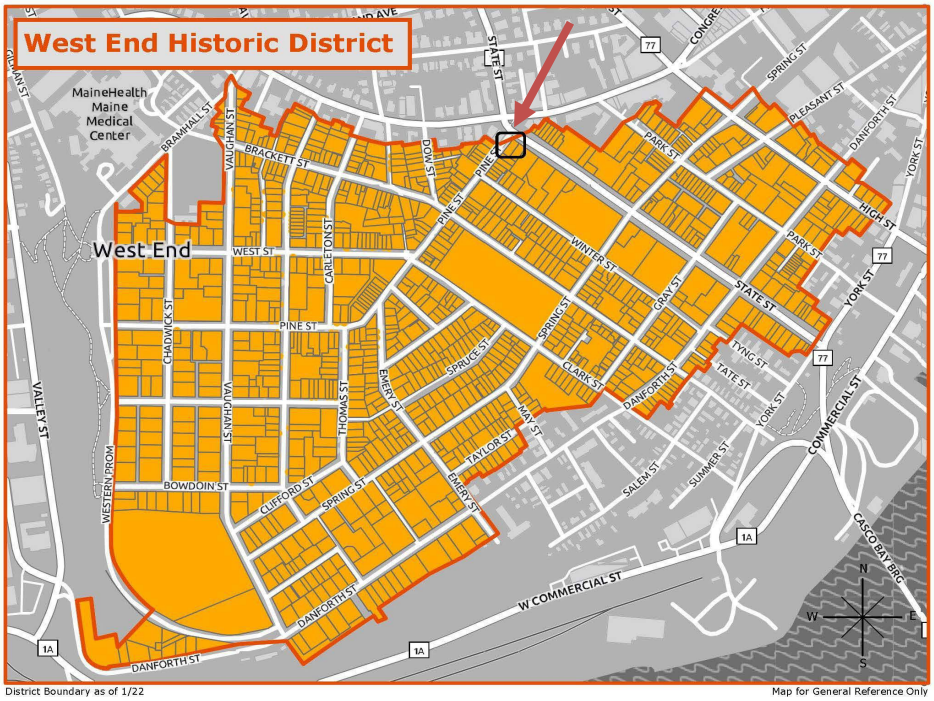

Figure 1: Map of the West End Historic District/Partial map of Portland showing location of 182-184 State

Figure 2: 1924 Tax Photo of 182 State Street

Additional information on the West End Historic District can be found on the city website: https://www.portlandmaine.gov/665/Historic-Districts

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PREVIOUS REVIEW BY HISTORIC PRESERVATION BOARD

November 15, 2023 - Public Hearing:

By a vote of 4-2, the Board approved a Certificate of Appropriateness to install artificial slate on two roof planes that had been stripped to repair leaks. The roofs in question are visible at a distance from Longfellow Square and State Street, but the Board found that with height and distance it would be difficult to distinguish artificial slate from natural slate. Board members agreed that only the two roof sections in question were approved for the alternate material, and removed slate that was salvageable should be retained on site in case it could be used to repair other more visible parts of the roof. As a condition of approval, the Board delegated to staff review and approval of the final roofing material selection. The approved material is Inspire Classic by DaVinci, with slate gray color, a width of 12", and an exposure of 7".

PROPOSED PROJECT:

Figure 3: Satellite image showing 180-184 State Street, with blue x's marking the roofs approved last fall, and the red arrow indicating the roof under review on September 4, 2024.

The photo above shows that the front section of roof (red arrow,) facing State Street, is now

under review to receive the same roofing approved for the nearby sections facing Pine Street. The low remnant of a chimney on the lower roof that had been partially removed and capped years ago is proposed to be completely removed and roofed over. As in the case of the proposal reviewed last November, copper valleys, ridges, drip edges, and flashings are to be replaced in kind. Project Manager Greg Shinberg also stated that the existing snow guards are to be saved and reinstalled.

STAFF COMMENTS

As with the review last November, staff suggest that Board members carefully consider the visibility of the roof in question from a variety of locations in and near Longfellow Square. Staff notes that while this roof faces directly toward State Street, because of the height of the building it is difficult to see except at some distance. It is also possible to see the DaVinci roofing recently installed on the two roof sections previously approved. (Please see Attachments for photos provided by the applicant and staff.) As the staff report for November 15 stated:

> The Board is asked to decide whether given the degree of visibility of the roofs in question, it is acceptable to replace the original, aged slate with a substitute that is a reasonably convincing mimic. Certainly Standard 2 requires the original historic materials be retained "*where possible*." And Standard 6 states that when original material must be removed, "...the new feature should match the feature being replaced in composition, design, texture, and other visual qualities and, *where possible*, materials." (Emphasis by staff)

The standard is therefore written to allow the Board latitude in considering the use of alternative materials when replacing deteriorated historic material and a reasonable visual match can be achieved. A sample of the natural slate from the building will be available during the meeting to allow the Board to compare it with a sample of the DaVinci roofing.

When the Board approved the use of the substitute last year, it was clear that the approval was limited to two sections of roof, and no broad precedent was being established. Staff noted in the report:

> ...the only precedent that might be established by this case would be that artificial slate can be considered *under some circumstances*, provided the proposed material is difficult to distinguish from natural slate, in the proposed location... With advancements in artificial roofing materials over the last twenty years, the Board is asked to judge the circumstances under which a pragmatic compromise might be judged to meet the Standards for Review of Alterations.

While the use of matching materials is considered the preferred approach for historic buildings, the Board should consider the ability of these matching materials to be distinguished from alternatives, especially when there are cost or logistical considerations for property owners. If it is difficult to distinguish the substitute from the original material at a distance, the use of an alternate material may be appropriate under Standard 6. This is not to say that alternative materials will be acceptable in every instance, but instead, that under the specific circumstances of a particular case, and where a reasonable match is available the Board should allow applicants some flexibility in the use of alternative materials.

Staff has included as an attachment the recently updated National Park Service Preservation Brief # 16, which provides guidance on examining the use of alternate materials.

ANALYSIS OF APPLICABLE REVIEW STANDARDS

Standards for Review of Alterations, 17.8.2:

Standard 1	
Every reasonable effort shall be made to provide a compatible use for a property which requires minimal alteration to the character defining features of the structure, object, or site and its environment or to use a property for its originally intended purpose.	
Standard Met?	Staff Comments
Not Applicable	

Standard 2	
The distinguishing original qualities or character of a structure, object, or site and its environment shall not be destroyed. The removal or alteration of any historic material or distinctive architectural features should be avoided when possible.	
Standard Met?	Staff Comments
For Board discussion	The applicant is proposing to remove historic slate. However, they are proposing to replace it with a synthetic slate that is a close visual match. The use of an alternative material is proposed based on the cost and extensive lead times associated with using natural slate. The Board should consider whether the proposed synthetic slate sufficiently preserves the character of the structure's historic slate roof.

Standard 5	
Distinctive features, finishes, and construction techniques or examples of skilled craftsmanship which characterize a structure, object, or site shall be treated with sensitivity.	
Standard Met?	Staff Comments
For Board discussion	The applicant is proposing to remove the historic slate from the building. Slate can be a distinctive feature of a building. This building features a basic installation of rectangular slates on low-slope roofs with minimal prominence and visibility. The applicant is proposing to replace it with a synthetic slate that is a close visual match. The Board should consider whether the existing slate roof is highly distinctive and character-defining for this building.

Standard 6	
Deteriorated historic features shall be repaired rather than replaced wherever feasible. Where the severity of deterioration requires replacement of a distinctive feature, the new feature should match the feature being replaced in composition, design, texture, and other visual qualities and, where possible, materials. Repair or replacement of missing historic features should be based on accurate duplications of features, substantiated by documentary, physical, or pictorial evidence rather than on conjectural designs or the availability of different architectural elements from other structures or objects.	
Standard Met?	Staff Comments
For Board discussion	The applicant has argued that the existing slate roof has deteriorated, and has had active leaks in recent years. Given cost and logistical consideration for the use of natural slate, the applicant is proposing to use a simulated slate. While the difference between natural and synthetic slate is distinguishable from up close; from a distance, the pattern, color, and texture can be convincing. The Board should discuss whether in this application, the use of a synthetic slate is an acceptable alternative material.

Standard 10	
Wherever possible, new additions or alterations to structures and objects shall be undertaken in such a manner that, if such additions or alterations were to be removed in the future, the essential form and integrity of the historic property would be unimpaired.	
Standard Met?	Staff Comments
For Board discussion	The proposed synthetic slate is reversible in that it could be removed and replaced with natural slate at some time in the future if desired by a property owner.

MOTION FOR CONSIDERATION

I move to APPROVE application HPBR-003017-2024 for replacement of slate roofing with simulated slate at 182-184 State Street on the basis of submitted documentation, plans, and specifications; information provided in the staff memo; and findings by the Historic Preservation Board that the project meets Standards for Review of Alterations 17.8.2-# 1, 2, 5, 6, and 10.

ATTACHMENTS

1. Cover letter
2. Applicant photos
3. Staff photos
4. Examples of proposed materials
5. NPS Preservation Brief #16

shinberg
CONSULTING, LLC

July 22, 2024

The slate roof is leaking and in disrepair. We are asking to replace approximately 300 square feet of slate roofing with the same simulated slate that was approved by the Historic Preservation Board at the November 15, 2023 meeting and stamped for approval on November 22, 2023.

You can view the product (Gray/Black Blend 718) on the attached DaVinci Roofscapes product sheet.

The roof's existing drip edge, valley and cap are copper. Any metal that is replaced will also be copper. In addition, any gutters that need to be repaired or replaced will match the existing gutters in materials, size and shape.

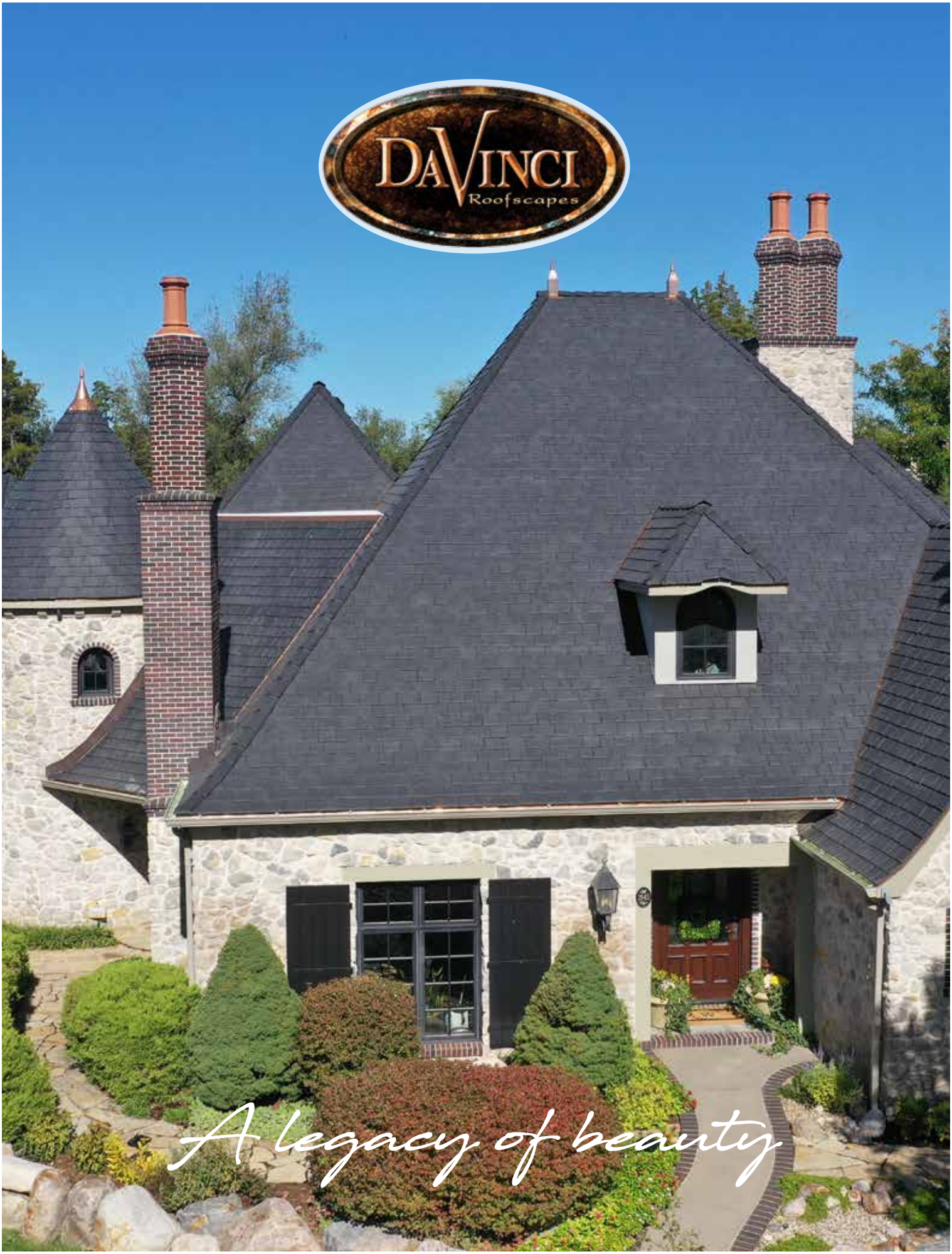
Sincerely,

Greg Shinberg,

Owner, Shinberg Consulting, LLC

shinberg
WEEKEND VINTAGE

Recently Installed DaVinci Roofing - 184 State Street


DaVinci
Roofscapes
A legacy of beauty

PERFECTLY AT HOME

in every corner of the continent

WILMINGTON, DELAWARE

Hot and steamy defines this Delaware town. The subtropical setting has 60% humidity consistently throughout the year and gets an average of 9 days of precipitation each month.

WE FIT YOUR STYLE

WE STAND UP TO YOUR WEATHER

From the mountains to the coasts… Wherever you call home, a DaVinci roof lives up to your vision of beauty and stands up to the challenges of your weather.

DaVinci has been the leader in composite roofing for nearly two decades. Our commitment to creating durable, beautiful roofing tiles is unparalleled. You won't find a more realistic or better-performing roofing product anywhere.

With DaVinci, you can retain all the character your home was intended to have without worrying about time-consuming and costly maintenance. Whether you're replacing an existing roof or looking for the crowning touch on a new construction project… just leave it to DaVinci.

DaVinci Roofscapes

Engineered to look better, longer.

Thick construction, deep grooves and realistic grain patterns combine to create dramatic shadows and visual richness.

Due to DaVinci's performance features, many insurance companies now offer reduced rates when switching from cedar or slate, especially in high wind-, fire- or hail-prone areas.

DaVinci tiles are made of pure virgin resins fortified with state-of-the-art UV stabilizers. The color you pick is the color you keep.

DaVinci products are modeled from actual slate and hand-split shake for natural, non-repeating beauty.

Realistic chisel marks add a hand-crafted finishing touch.

WHAT'S BEHIND THE BEAUTY IS *Genius*

Every region of North America presents challenges to the exterior of your home. Mother Nature's fury is universal.

With the damaging effects of sun, hail, gale-force winds and freeze and thaw cycles, roofing materials are at odds with the weather year-round. DaVinci's unique composite construction outperforms both natural slate and cedar shake with a Class A Fire Rating, Class 4 Impact Rating and a 110 MPH Wind Rating. But the real genius of a DaVinci roof lies in its ability to provide lasting beauty and a constant source of pride.

DaVinci roof tiles are constructed of a composite material made of pure virgin resins, UV and thermal stabilizers as well as a highly-specialized fire retardant. The result is a state-of-the-art tile that gives us the greatest degree of color control and consistency in the manufacturing process and an end product that endures beautifully in any climate.

VS. NATURAL SHAKE

Unfortunately, the long-hailed performance attributes of cedar shake have disappeared along with old-growth trees. Rotting, cracking and curling is inevitable. In most climates, cedar shake has a lifespan comparable to (or even less than) asphalt. DaVinci composite tiles give you the look you love with superior durability for a lifetime.

MADE IN THE USA

DaVinci roofing tiles are proudly manufactured in Lenexa, Kansas.

VS. NATURAL SLATE

Like a rock? Slate tiles are not immune to the ravages of time…or hail. Its tiny fissures make natural slate susceptible to damage caused by freeze and thaw cycles. DaVinci slate products defy the elements for decades of enduring and worry-free beauty.

Our commitment TO COLOR

Nobody offers you more color options than DaVinci—your only limitation is your imagination. Our industry-leading standard color palette is just the beginning. As our name implies, our ability to blend colors and create drama is unparalleled. So whether you're selecting a single color or opting for one of our expertly-crafted VariBlends,™ we've got you covered. When it comes to bringing out the best in your home…leave it to DaVinci.

JUST LIKE NATURE

DaVinci's proprietary VariBlend™ manufacturing process creates subtle color variations from one tile to the next. The nuanced shifts result in the most natural-looking composite roof you can buy.

Our color blend options consist of as few as one to as many as eight individual colors to create a dynamic range of results.

THE DAVINCI NATURE CRAFTED COLLECTION™

The DaVinci Nature Crafted Collection is our most ambitious foray into color development to date. Our advanced technology has simulated the warmth and softness of a patina previously only created by time and exposure to the elements. Our Nature Crafted Collection captures the look of a moment and retains it for decades.

Look for the Nature Crafted Collection symbol and experience the industry's most advanced color technology yet. NC

Cool roofs BUILT TO BE COOL AND STAY THAT WAY

DaVinci Cool Roof tiles reflect sunlight and heat away from the home. Higher emissivity and reflectivity rates lead to greater reductions in the cooling load and in return increase energy efficiency.

CR *Look for the Cool Roof symbol for options that can increase energy efficiency in your home.*

COLORMYROOF.COM

THE TOP DOWN COLOR™ VISUALIZER

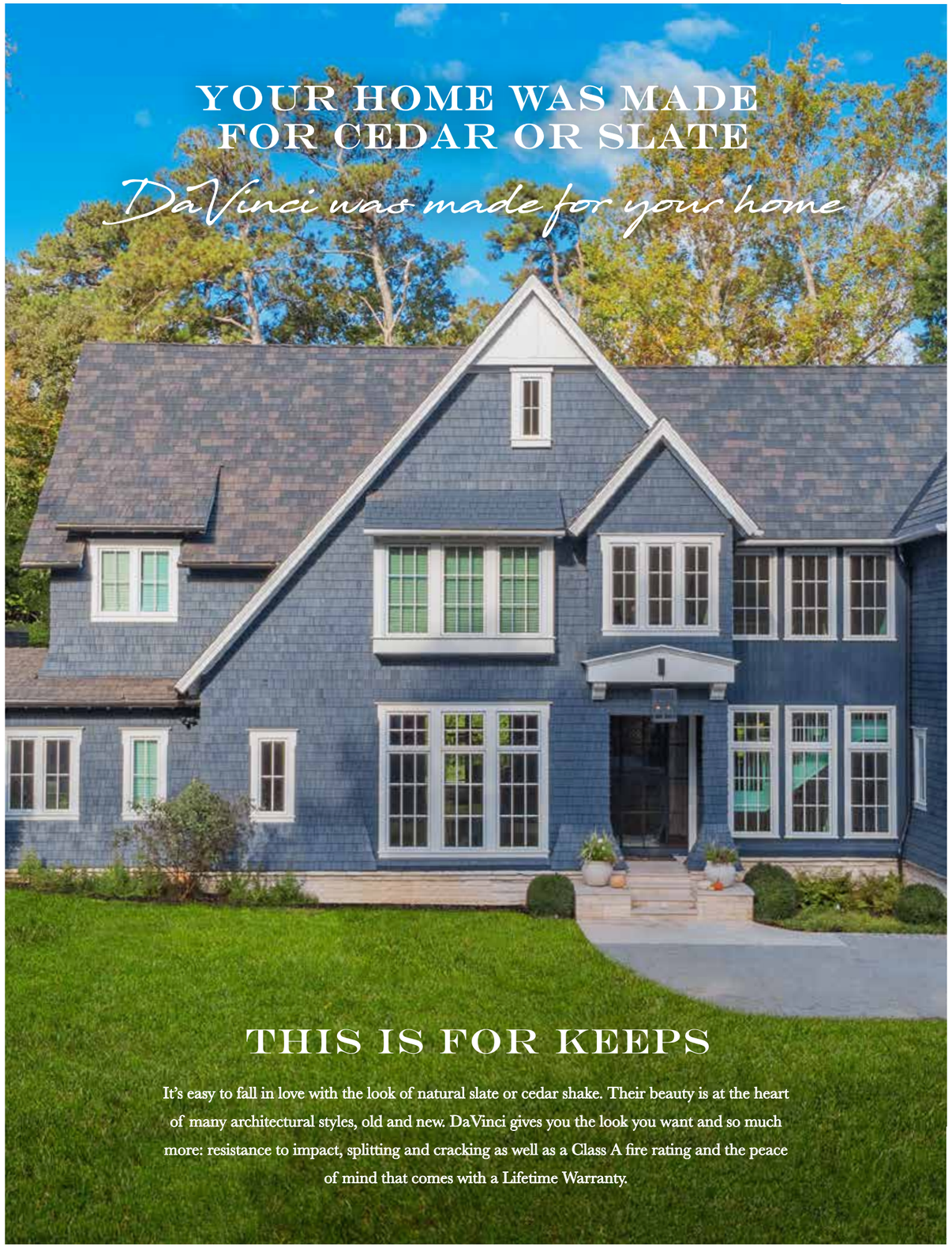
See for yourself how your color options enhance your home's curb appeal. This powerful tool lets you upload an image and experiment with color combinations of roofing, trim and more.

TALK TO A COLOR EXPERT

We want to help you be absolutely sure that your DaVinci roof is exactly what you envisioned.

Our color consultant will answer your color questions and offer advice to guide you through the process of choosing a color blend to complement your home beautifully.

Email our color expert at
coloradvice@davinciroofscapes.com



YOUR HOME WAS MADE FOR CEDAR OR SLATE

DaVinci was made for your home

THIS IS FOR KEEPS

It's easy to fall in love with the look of natural slate or cedar shake. Their beauty is at the heart of many architectural styles, old and new. DaVinci gives you the look you want and so much more: resistance to impact, splitting and cracking as well as a Class A fire rating and the peace of mind that comes with a Lifetime Warranty.

Visual VERSATILITY

DaVinci offers the beauty of natural slate and cedar shake in different tile options, giving you the ability to meet your aesthetic vision as well as respect your budget.

MULTI-WIDTH

Our most authentic-looking and versatile option, DaVinci's Multi-Width tiles set the high mark for luxury. Laying tiles of multiple widths in a straight or staggered pattern creates the most natural, non-repeating appearance possible.

MULTI-WIDTH SLATE ..... Page 12
MULTI-WIDTH SHAKE..... Page 22

SELECT SHAKE

Created from real cedar profiles, Select Shake gives your home the beauty of authentic wood while remaining maintenance-free. The versatile design provides a worry-free, best-in-class roof that speeds up installation with the look of multi-width shake.

SELECT SHAKE ..... Page 24

SINGLE-WIDTH

Single-width tiles add a budget-friendly touch of tradition to your home in either a straight or staggered pattern. The uniform tile size and impact-resistant composite construction work to reduce waste and speed up installation.

SINGLE-WIDTH SLATE..... Page 14
SINGLE-WIDTH SHAKE..... Page 26

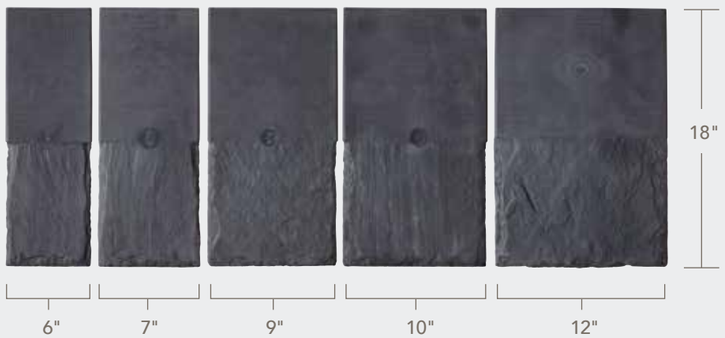
PROVINCE

The inspired engineering of Province makes uncommon beauty considerably more attainable. Its innovative design requires less overlap (reducing waste and cost), making it a stylish upgrade that won't bust the budget.

PROVINCE SLATE ..... Page 16

DaVinci SLATE

Historically, attaining the luxurious look of natural slate hasn't been easy. The cost, the weight and the required army of skilled tradesmen made the installation process complicated and costly. Thanks to the genius of DaVinci, the look of slate is more viable than ever.



MULTI-WIDTH

Multi-width tiles provide the greatest degree of authenticity and flexibility.

SINGLE-WIDTH

Single-width tiles reduce material and speed up installation time without compromising style.

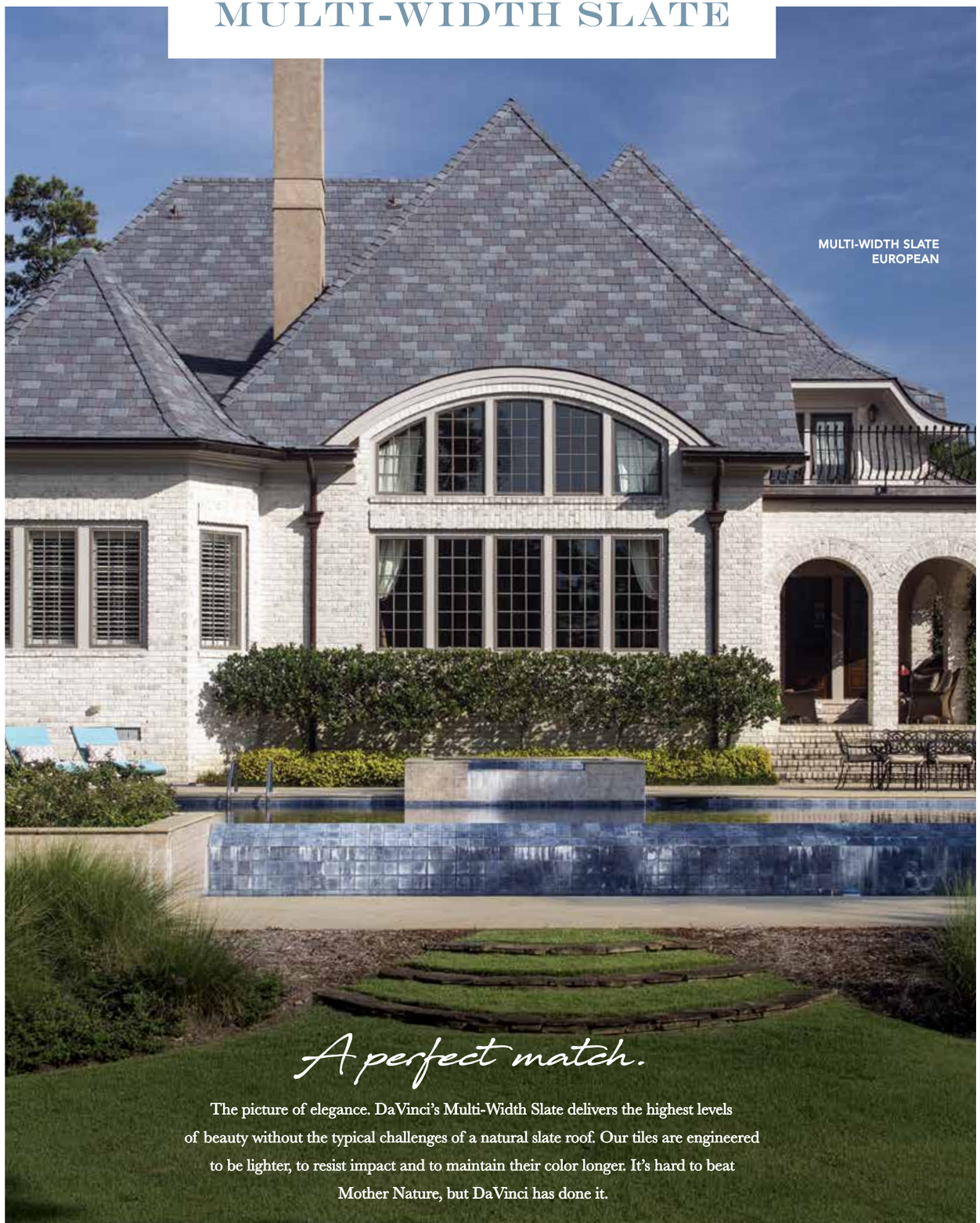
PROVINCE

The look of slate at a fraction of the cost and weight.

CHARLESTON, SOUTH CAROLINA

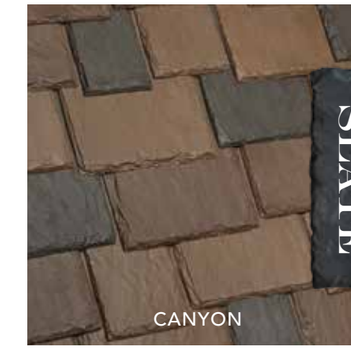
Picturesque Charleston is no stranger to hurricanes and heat. In addition to some nasty storms and high winds, its hot muggy summers can produce thick rafts of moss.

MULTI-WIDTH SLATE



A perfect match.

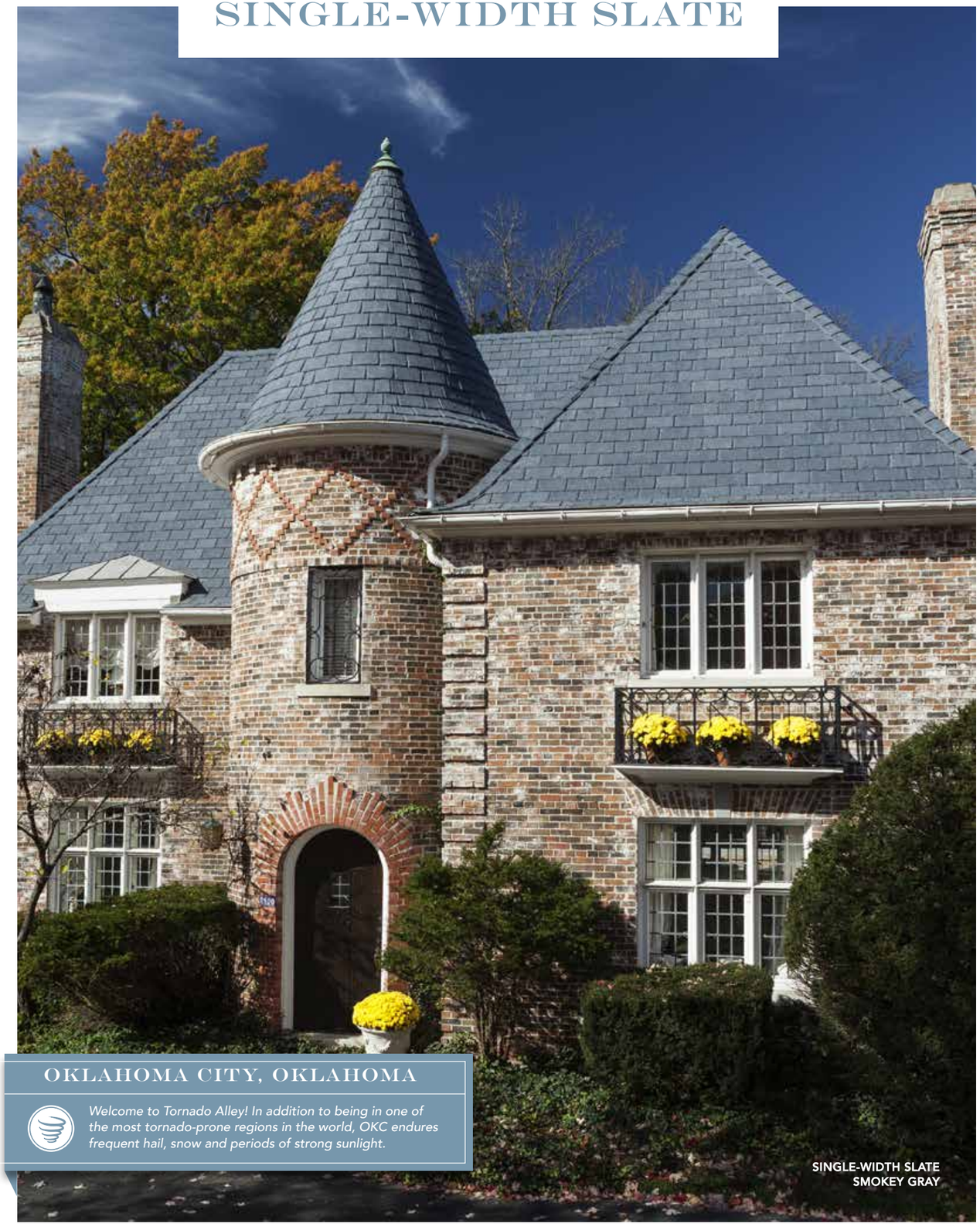
The picture of elegance. DaVinci's Multi-Width Slate delivers the highest levels of beauty without the typical challenges of a natural slate roof. Our tiles are engineered to be lighter, to resist impact and to maintain their color longer. It's hard to beat Mother Nature, but DaVinci has done it.



MULTI-WIDTH SLATE

CR ALSO AVAILABLE IN COOL ROOF COLOR

SINGLE-WIDTH SLATE



SINGLE-WIDTH SLATE
SMOKEY GRAY

OKLAHOMA CITY, OKLAHOMA

Welcome to Tornado Alley! In addition to being in one of the most tornado-prone regions in the world, OKC endures frequent hail, snow and periods of strong sunlight.

It feels right.

Some homes were created with the promise of a slate roof in mind. DaVinci's Single-Width Slate delivers on that promise with its astonishing versatility. Our single-width tile construction streamlines installation but still enables the flexibility of straight or staggered appearances.

BROWNSTONE

SONORA

EUROPEAN

CANYON

SLATE BLACK

SLATE GRAY

EVERGREEN

CASTLE GRAY

SMOKEY GRAY

CR ALSO AVAILABLE IN COOL ROOF COLOR

PROVINCE SLATE

PROVINCE SLATE
SLATE BLACK

MELBOURNE, FLORIDA

Particularly vulnerable to hurricanes, coastal Melbourne also faces the challenges of high winds leading to potential inland wildfire spread.

PROVINCE SLATE

We've gone back to the past to ensure a beautiful future for your home.

Province Slate tiles add the classic look of authentic slate to any residence. Just as important, low maintenance makes life easier for homeowners and fade-resistant color stability assures long-lasting beauty.

SLATE GRAY

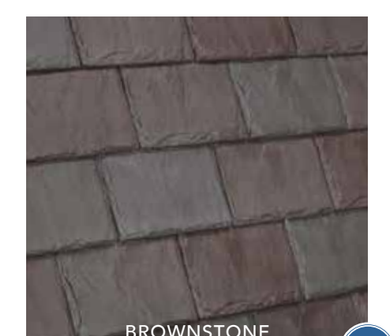
SLATE BLACK

SMOKEY GRAY

> THIS COMPOSITE PRODUCT COMES IN AT A VERY COMPETITIVE PRICE POINT WITHOUT ANY SACRIFICE IN QUALITY OR PERFORMANCE. HOMEOWNERS LIKE THAT IT MATCHES THE LOOK OF A SINGLE-WIDTH SLATE OPTION WHILE ADDING VALUE TO THEIR HOME.
>
> RYAN, ROOFING CONTRACTOR

CASTLE GRAY

EUROPEAN



BROWNSTONE

CR ALSO AVAILABLE IN COOL ROOF COLOR

SLATE GALLERY

PROVINCE SLATE
SLATE GRAY

"DaVinci SLATE FITS WELL WITH MY TRADITIONALLY-BASED AND FRENCH PROVINCIAL DESIGNS. HOMEOWNERS REALLY LIKE THE DETAILED LOOK AND APPRECIATE THE LOW-MAINTENANCE APPEAL.

CHRISTOPHER, RESIDENTIAL ARCHITECT

SINGLE-WIDTH SLATE
CUSTOM COLOR BLEND

MULTI-WIDTH SLATE
SLATE GRAY

MULTI-WIDTH SLATE
EUROPEAN

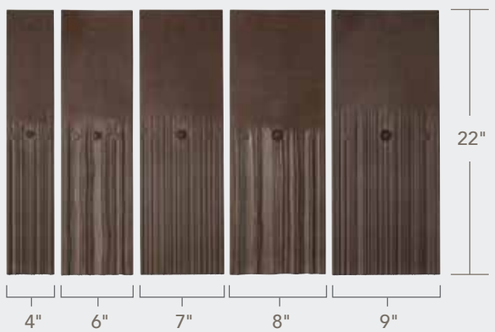
SINGLE-WIDTH SLATE
SLATE BLACK

"AFTER TERRIBLE HAIL STORMS DEVASTATED HUNDREDS OF HOMES IN OUR AREA, WE BEGAN SEEING MANY IMPACT-RESISTANT DaVinci COMPOSITE ROOFS INSTALLED. WE WANTED A WORRY-FREE, BEAUTIFUL, BEST-IN-CLASS ROOF THAT COULD WITHSTAND FUTURE STORMS, AND WE GOT IT WITH OUR NEW DaVinci ROOF.

JULIE, HOMEOWNER

DaVinci SHAKE

If you love the look of cedar shake, there's no reason to shy away from it. Whether you're building a new home or replacing an existing shake roof, DaVinci eliminates the pesky concerns of ongoing maintenance and lets your heart get exactly what it wants.



MULTI-WIDTH

Achieve the authentic look of rough-hewn, hand-split cedar shake with subtle color shifts and randomly-staggered overlaps.

SELECT SHAKE

Our versatile design replicates the look of authentic cedar on 8" and 10" tiles for a best-in-class roof.

SINGLE-WIDTH

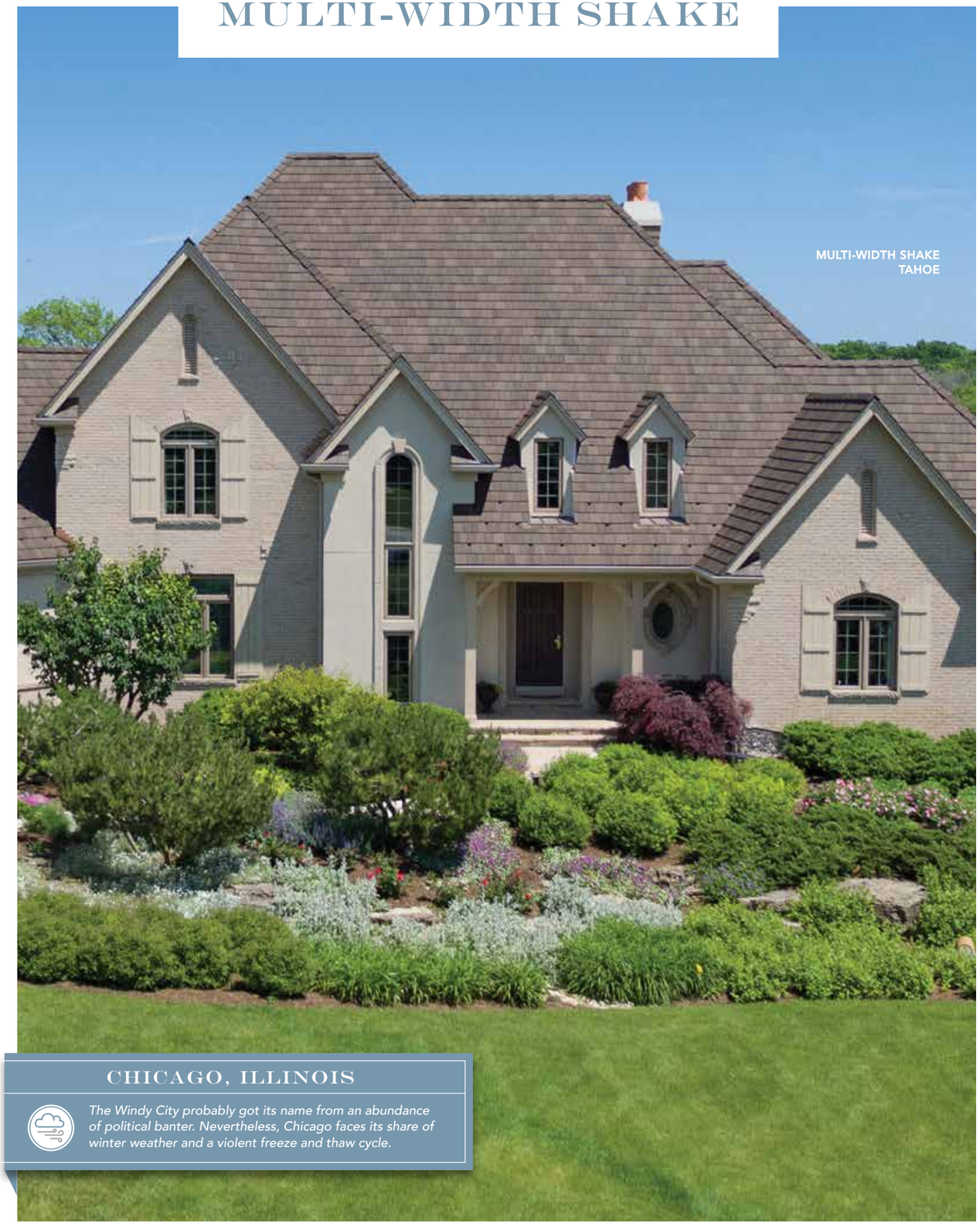
The tidy and uniform appearance is a popular choice for a wide range of architectural styles.

THE FINISHING *touch*

ATLANTA, GEORGIA

Atlanta's hot and humid summers and frequent rainstorms set the stage for wood rot.

MULTI-WIDTH SHAKE



MULTI-WIDTH SHAKE
TAHOE

CHICAGO, ILLINOIS

The Windy City probably got its name from an abundance of political banter. Nevertheless, Chicago faces its share of winter weather and a violent freeze and thaw cycle.

Everything you love about shake... without the headaches or the heartaches.

DaVinci Multi-Width Shake recalls the craftsmanship and authenticity of natural, hand-split cedar shake with the advantages of color stability and a lifetime warranty. These deep-grained, multiple-width tiles are available in nine standard color blends.

AGED CEDAR — NC

BLACK OAK — NC

MOSSY CEDAR — NC

AUTUMN

CHESAPEAKE

TAHOE — CR

MOUNTAIN — CR

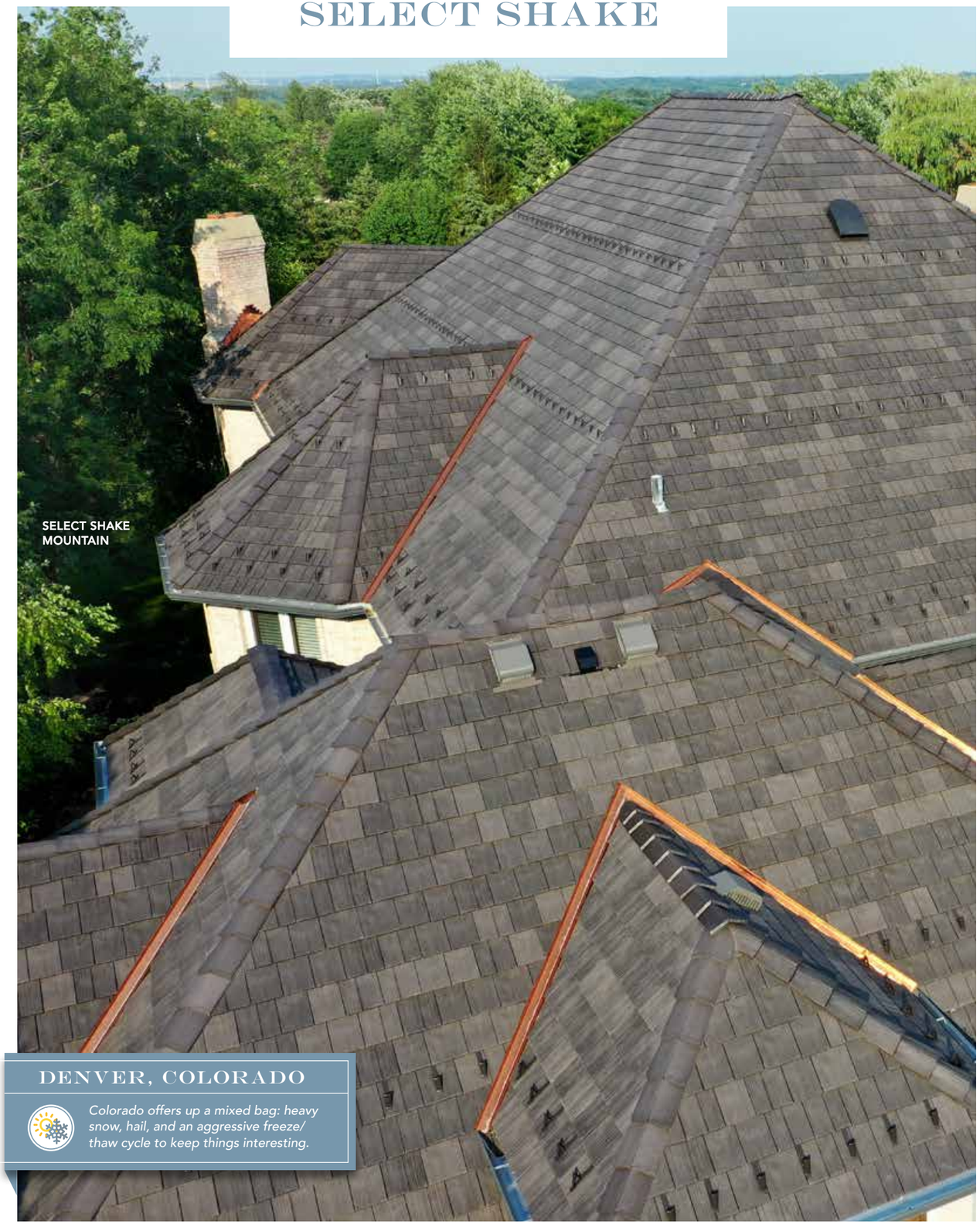
NEW CEDAR

WEATHERED GRAY — CR

CR ALSO AVAILABLE IN COOL ROOF COLOR

NC NATURE CRAFTED COLLECTION™

SELECT SHAKE



SELECT SHAKE
MOUNTAIN

DENVER, COLORADO

Colorado offers up a mixed bag: heavy snow, hail, and an aggressive freeze/ thaw cycle to keep things interesting.

The beauty of natural shake... but ours is for keeps.

DaVinci's Select Shake provides the craftsmanship and authenticity of natural, hand-split cedar shake with the advantages of color stability and a lifetime warranty. Meet your vision and make your dream home a reality with our versatile design.

AGED CEDAR — NC

BLACK OAK — NC

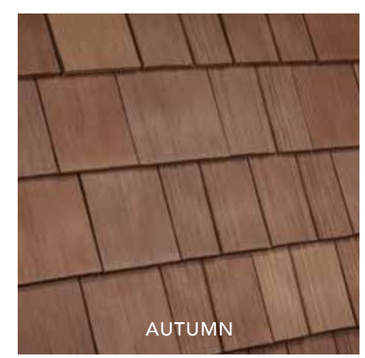
MOSSY CEDAR — NC

MOUNTAIN — CR

IF YOU'RE LOOKING FOR A WORRY-FREE, BEAUTIFUL, BEST-IN-CLASS ROOF THAT CAN WITHSTAND STORMS, LOOK TO DAVINCI.

TAHOE — CR

CHESAPEAKE



AUTUMN

WEATHERED GRAY — CR

CR ALSO AVAILABLE IN COOL ROOF COLOR

NC NATURE CRAFTED COLLECTION™

SINGLE-WIDTH SHAKE

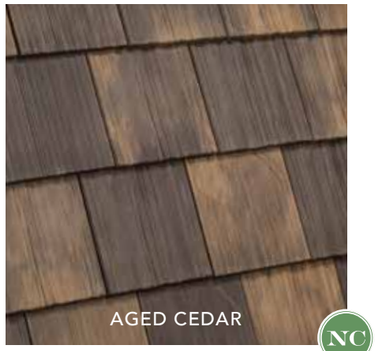
SINGLE-WIDTH SHAKE
BLACK OAK

LOCH LLOYD, MO

From cool winters to long, hot summers, Missouri's interior location causes extremes in weather.

The look of cedar shake has never been easier.

Single-width shake delivers the varied textures and natural visual shifts in color and shading that occur with real hand-split cedar.



AGED CEDAR NC

BLACK OAK NC

MOSSY CEDAR NC

"IT IS ONE OF THE MOST FLAWLESSLY REPLICATING PRODUCTS OUT THERE, AND WE'VE LOOKED AT ALL OF THEM, BELIEVE ME."

DANIEL, RESIDENTIAL ARCHITECT

MOUNTAIN CR

TAHOE CR

CHESAPEAKE

AUTUMN

WEATHERED GRAY CR

CR ALSO AVAILABLE IN COOL ROOF COLOR

NC NATURE CRAFTED COLLECTION™

SHAKE GALLERY

SELECT SHAKE
TAHOE

"THE ROOF IS LIKE A CANVAS. THE DESIGN, COLORS, PRODUCTS AND ACCESSORIES WE USE HELP US CREATE A CUSTOMIZED PIECE OF ART FOR EVERY HOMEOWNER.

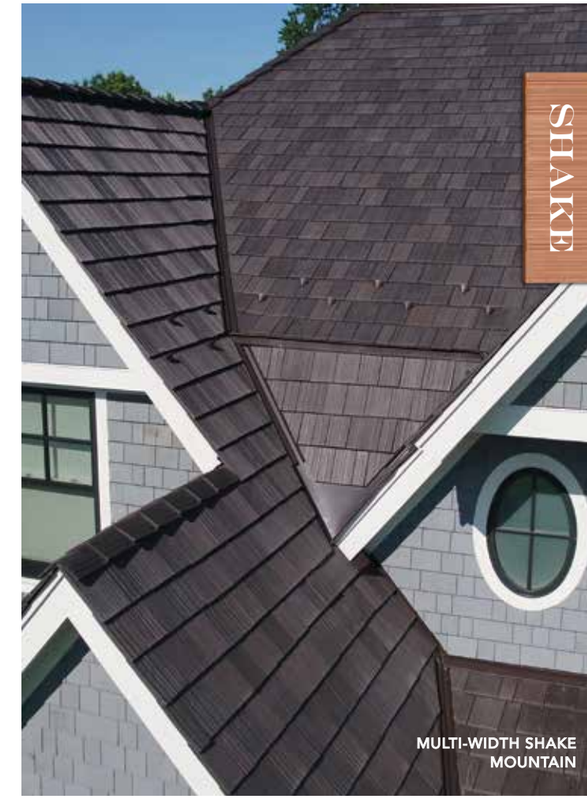
JEFF, ROOFING CONTRACTOR

MULTI-WIDTH SHAKE
BLACK OAK

MULTI-WIDTH SHAKE
AUTUMN

"MY DAVINCI ROOF WAS DEFINITELY THE SMART CHOICE.

DAVID, HOMEOWNER



SHAKE

MULTI-WIDTH SHAKE
MOUNTAIN

SELECT SHAKE
AGED CEDAR

A ROOF DOESN'T GET ANY BETTER THAN *DaVinci*

	DaVinci	ASPHALT	NATURAL SLATE	NATURAL SHAKE
WIND RESISTANT	●	●	●	●
FIRE RESISTANT	●	●	●	●
IMPACT RESISTANT	●	●	●	●
FREEZE/THAW RESISTANT	●	●	●	●
MAINTENANCE-FREE	●	●	●	●
COLOR-FADE RESISTANT	●	●	●	●
LIGHTWEIGHT	●	●	●	●

When it comes to roofing materials, you've got plenty of options...and none better than a DaVinci composite roof. DaVinci composite roofing tiles blend state-of-the-art materials with an artist's touch. You won't find a better looking or better performing roof at any price.

● STRENGTH
● AVERAGE
● WEAKNESS

Building Code & Testing Approvals: *ICC-ES ESR-2119; Miami-Dade County, FL; CA Title 24; Texas Dept. of Insurance; LEED contribution; Class A Fire; Class 4 Impact; WUI; and CCMC 14094-R*

TECHNICAL SPECIFICATIONS

DaVinci Slate

	WIDTHS	THICKNESS AT BUTT	WEIGHT/SQUARE
MULTI-WIDTH	12", 10", 9", 7", 6"	1/2"	8" (266 lbs), 7.5" (283 lbs) 7" (304 lbs), 6" (354 lbs)
SINGLE-WIDTH	12"	1/2"	8" (275 lbs), 7.5" (294 lbs) 7" (315 lbs), 6" (367 lbs)
PROVINCE	12"	5/8"	8" (193 lbs)

DaVinci Shake

	WIDTHS	THICKNESS AT BUTT	WEIGHT/SQUARE
MULTI-WIDTH	9", 8", 7", 6", 4"	5/8"	10" (300 lbs), 9" (333 lbs)
SINGLE-WIDTH	9"	5/8"	10" (297 lbs), 9" (330 lbs)
SELECT SHAKE	8", 10"	5/8"	10" (284 lbs), 9" (316 lbs)

Testing Summary

See DaVinciRoofscapes.com for the most up-to-date testing and certifications.

	STANDARD	RESULTS
FIRE TEST	ASTM E 108	Class A
IMPACT TEST	UL 2218	Class 4
WIND TEST	ASTM D 3161	Certified to 110 mph
HIGH VELOCITY HURRICANE ZONE	TAS 125	Up to 180 mph

THE *Complete* PACKAGE

For a finished look and a lifetime of enhanced performance, DaVinci makes a full offering of specialized accessory pieces in every standard color we offer.

HIP & RIDGE TILES ONE-PIECE

HIP & RIDGE TILES TWO-PIECE

RAKE TILES

TURRET KITS

CREATING EXPOSURE

Straight or staggered tile coursing is a personal choice. Although budget and architectural style will enter into the equation, personal preference is typically the final determining factor. With DaVinci Multi-Width and Single-Width tiles, you have the greatest ability to vary tile placement. Province Slate tiles must be installed at an 8" exposure.

Multi-Width and Single-Width Slate can be installed at 6", 7", 7½" and 8" exposure.

Multi-Width, Single-Width, and Select Shake can be installed at 9" and 10" exposure.

WE KEPT EVERYTHING YOU LOVE...

and made it better.

It's no wonder people are drawn to the timeless good looks of slate tile and cedar shake. The allure is unmistakable. A DaVinci composite roof lives up to the look of nature, but does so without the ongoing maintenance, repairs and replacement.

At DaVinci, we made a good thing better:

Resistant to fading, rotting, cracking and pests

—

Stands up to wind, hail and fire as well as or better than natural materials

—

Enjoy the peace of mind that comes with a Lifetime Limited Material Warranty

—

Every tile reflects the artistry and the genius of DaVinci himself

MADE IN THE USA

LOOKING FOR ASSISTANCE?

We're ready to help.

If you have questions, feel free to contact us directly.

A DaVinci Project Specialist will answer any questions you have concerning product differences, color selection, project timing and contractor selection.

800-328-4624

110 MPH WIND RATING | CLASS A FIRE RATING | CLASS 4 IMPACT RATING | 180 MPH HIGH VELOCITY HURRICANE ZONE

DaVinci Roofscapes

13890 West 101st Street | Lenexa, Kansas 66215 | 800-328-4624

DAVINCIROOFSCAPES.COM

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Printing reproduction of colors shown in this brochure may vary from actual product. For product warranty details, please visit DVroof.com/warranty. The warranty found there is the sole warranty applicable to DaVinci products.

Westlake Royal Building Products™

MLDVBRO2018 - 05/2023

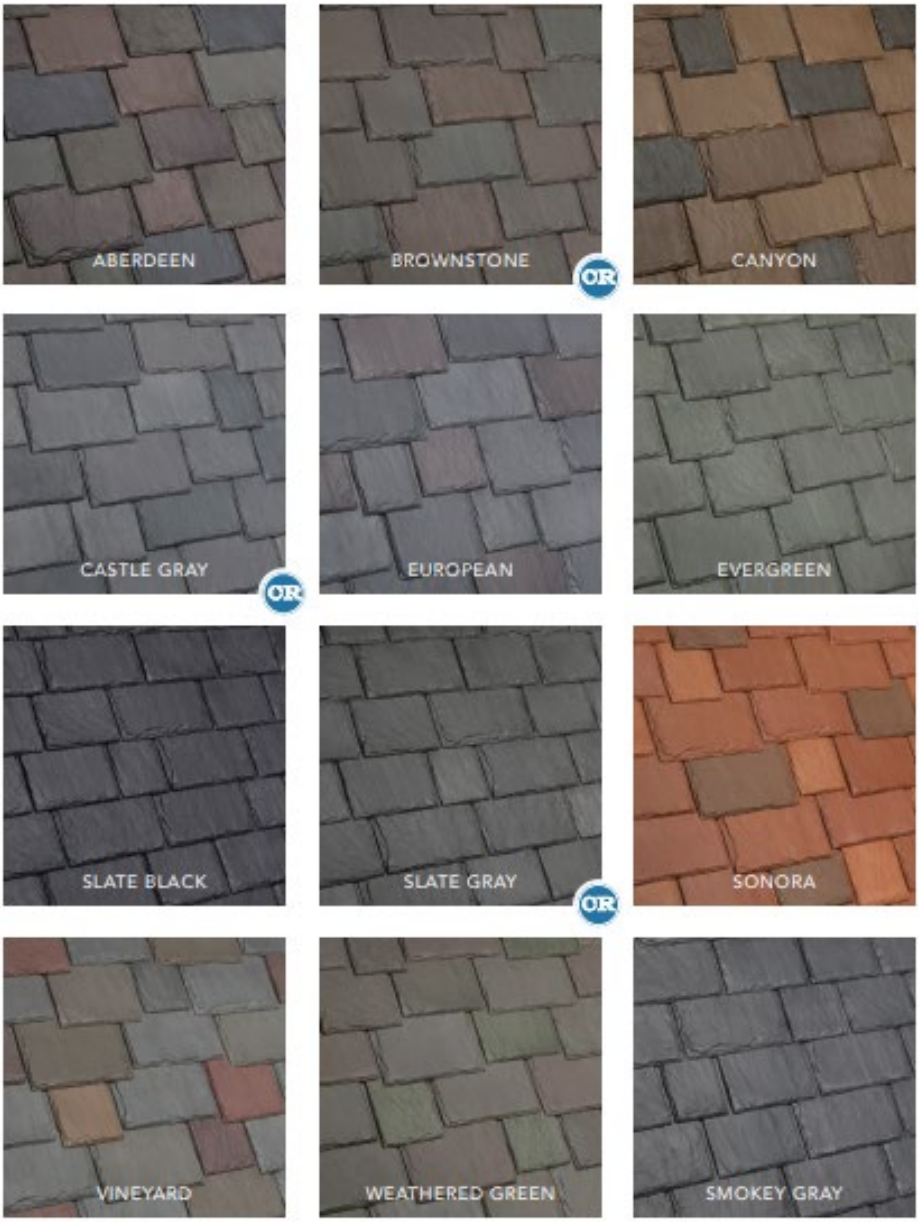
SINGLE-WIDTH SLATE

DaVinci's Single-Width Slate delivers astonishing versatility.
Our single-width tile construction streamlines installation but still enables the flexibility of straight or staggered appearances.

CR ALSO AVAILABLE IN COOL ROOF COLOR

MULTI-WIDTH SLATE

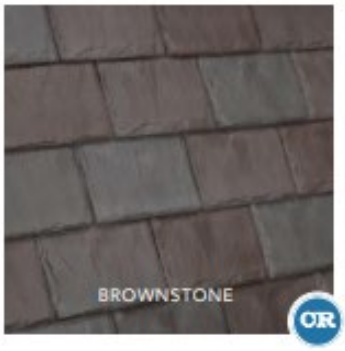
DaVinci's Multi-Width Slate delivers the highest levelsof beauty without the typical challenges of a natural slate roof. Our tiles are engineered to be lighter, to resist impact and to maintain their color longer.

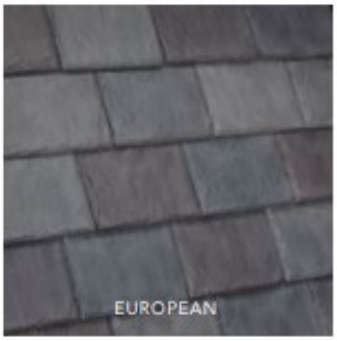


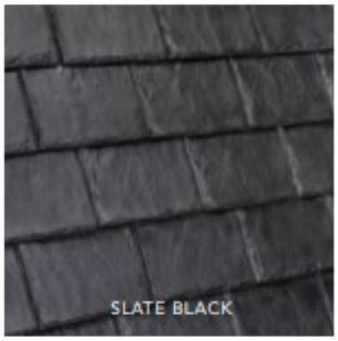
OR ALSO AVAILABLE IN COOL ROOF COLOR

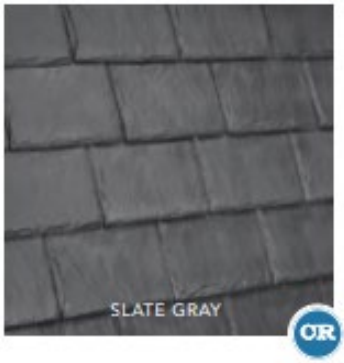
PROVINCE SLATE

DaVinci's Province Slate is a new line of stunning single-width tile that replicates traditional slate with extraordinary accuracy.









CR ALSO AVAILABLE IN COOL ROOF COLOR

16 PRESERVATION BRIEFS

The Use of Substitute Materials on Historic Building Exteriors

John Sandor, David Trayte, and Amy Elizabeth Uebel

National Park Service
U.S. Department of the Interior

Technical Preservation Services

The *Secretary of the Interior's Standards for Rehabilitation* generally require that deteriorated distinctive architectural features of a historic property be repaired rather than replaced. Standard 6 of the *Standards for Rehabilitation* further states that when replacement of a distinctive feature is necessary, the new feature must "match the old in composition, design, color, texture, and other visual properties, and, *where possible*, materials" (emphasis added). While the use of matching materials to replace historic ones is always preferred under the *Standards for Rehabilitation*, the Standards also purposely recognize that flexibility may sometimes be needed when it comes to new and replacement materials as part of a historic rehabilitation project. Substitute materials that closely match the visual and physical properties of historic materials can be successfully used on many rehabilitation projects in ways that are consistent with the Standards.

The flexibility inherent in the *Standards for Rehabilitation* must always be balanced with the preservation of the historic character and the historic integrity of a building, of which historic materials are an important aspect. Any replacement work reduces the historic integrity of a building to some degree, which can undermine the historic character of the property over time. With limited exceptions, replacement should only be considered when damage or deterioration is too severe to make repair feasible. When needed replacement is made with a material that matches the historic material, the impact on integrity can be minimal, especially when only a small amount of new material is needed. When a substitute material is used for the replacement, the loss in integrity can sometimes, although not always, be greater than that of a matching material. Also, whether historic or substitute material, there is a point where the amount of replacement can become excessive and the building's historic integrity is diminished to an unacceptable degree, regardless of the material used—that is, a loss of authenticity and the physical features and characteristics closely associated with the property's historic significance.

The term *substitute materials* is used to describe building materials that have the potential to match the appearance, physical properties, and related attributes of historic materials well enough to make them alternatives for use in current preservation practice when historic materials require replacement.

Compelling reasons to use a substitute material instead of the historic material include the unavailability or poor performance of the historic material, or environmental pressures or code-driven requirements that necessitate a change in material. When using a substitute material for replacement it is critical that it match the historic material in all of its visual and physical properties to preserve the historic character of the building and minimize the impact on its integrity.

Substitute materials can be cost-effective, permit the accurate visual duplication of historic materials, and provide improved durability. While the behavior of traditional, historic materials is generally well understood, the behavior of newer materials can be less established and sometimes less predictable. Substitute materials are most successful when the properties of both the original material and the substitute are thoroughly understood by all those involved in the design and construction process. The architect must be adept at the selection of substitute materials and their incorporation into architectural plans and specifications. The contractor or tradesperson in the field must also be experienced with their use.

This Preservation Brief provides general guidance on the use of substitute materials as replacement materials for distinctive features on the exterior of historic buildings. Due to the ever-evolving product market for construction materials, this Brief does not provide specifications for substitute materials. This guidance should be used in conjunction with qualified professionals who are knowledgeable in current construction and historic preservation practices.

This Brief includes a discussion of the appropriate use of substitute materials and provides a path for decision-making in their use. In considering the use of substitute materials, such issues as the deterioration or failure of the historic building component and material must be understood. The existing component's physical and visual properties, profile, surface texture, dimensions, and performance should be identified to establish the basis for evaluating a possible replacement material. The physical and visual properties of the various substitute materials available should also be assessed and compared to the original material for their physical and visual compatibility. Lastly, the suitability of a given substitute replacement material should be determined based on how well the material matches both the physical and visual properties of the existing material as well as any specific performance or application needs. The Brief's descriptions of common substitute materials are not meant to be comprehensive, and, as the performance history of newer materials continues to grow and new materials are developed, available options will change, and our understanding of current material performance will continue to evolve.

Historical Use of Substitute Materials

The tradition of using affordable and common materials in imitation of more expensive and less available materials is a long one. At Mount Vernon, for example, George Washington used wood painted with sand-impregnated paint to imitate rusticated stone. This technique, along with scoring stucco into block patterns, was common in Colonial America to imitate stone.

Nineteenth-century technology made a variety of materials readily available and widely used that were not only able to imitate traditional materials but were also cheaper to fabricate and easier to use. Traditionally, carved stone units were individually worked. Molded or cast materials greatly increased efficiency in creating repetitive elements. Cement-based products such as cast stone could provide convincing imitations of natural stone with carefully chosen aggregates and cements and was typically a commercially manufactured product. It could be tooled like natural stone, though that could reduce much of the cost advantage. These carefully-crafted cementitious products were widely used as trim elements for masonry structures or as the face material for an entire building. At the other end of the spectrum, mail-order catalogs provided a wide variety of forms for molding concrete that were merely evocative of natural stone and did little to match its appearance. Concrete masonry units could be fabricated locally and on site, avoiding expensive quarrying and shipping costs.

Offering similar efficiencies as cast stone for reproducing repetitive and even complex decorative shapes, terra cotta could mimic the surface characteristics of stone with various textures and glazes. It was popular in the late nineteenth and early twentieth centuries for details on stone or brick buildings as well as for the entire skin of large and elaborately detailed buildings.

Cast iron was also used to imitate stone, often with very decorative profiles, for a variety of architectural features ranging from window hoods to columns, piers, balustrades, and even whole façades. Cast iron offered its own set of efficiencies including cost, fabrication time, and weight, but required a painted finish.

While cast stone, terra cotta, and cast iron offered efficiencies over quarried and, particularly, carved stone, they were not cheap or impermanent materials. Less costly, but also less durable, stamped or brake-formed sheet metal, typically galvanized, could also be used instead of masonry for cornices, window hoods, roofing tiles, and even entire building façades.

Substitute Materials and Applying the Standards for Rehabilitation

The *Standards for Rehabilitation* are focused on preserving the important and distinctive character-defining features of a historic property (Standards 2 and 6), and they are to be applied in a reasonable manner, taking into account economic and technical feasibility (36 CFR 67.7 and 36 CFR 68). The Standards have an inherent flexibility that facilitates their application to diverse projects, historic properties, and conditions. They are to be applied on a "cumulative-effect" basis, when the overall effect of all work in the context of the specific conditions of the property and the project is consistent with the property's historic character.

The *Standards for Rehabilitation* require that the replacement of a distinctive feature match the old in physical and visual properties. While the use of matching materials is always preferred, the Standards purposely allow for the use of substitute materials when the use of original materials is not reasonably possible, such as in consideration of economic and technical feasibility or in new construction. They also provide additional flexibility in the treatment of secondary, less distinctive features that are less important in defining the historic character of the property. The *Standards for Rehabilitation* recognize that flexibility is appropriate to facilitate "a compatible use for a property … while preserving those portions or features which convey its historical, cultural, or architectural values" (definition of "Rehabilitation," 36 CFR 67.2(b)).

Examples of Historical Use of Substitute Materials

Figure 2a. Casting concrete blocks to mimic quarried stone was a popular late 19th- to mid 20th-century technique. Concrete masonry units could be completed by local craftsman, saving time and shipping costs. Photo: John Sandor, NPS.

Figure 2b: The 19th century also produced a variety of metal products used to imitate other materials. Across the country, cast iron was used in storefronts to imitate stone. Photo: John Sandor, NPS.

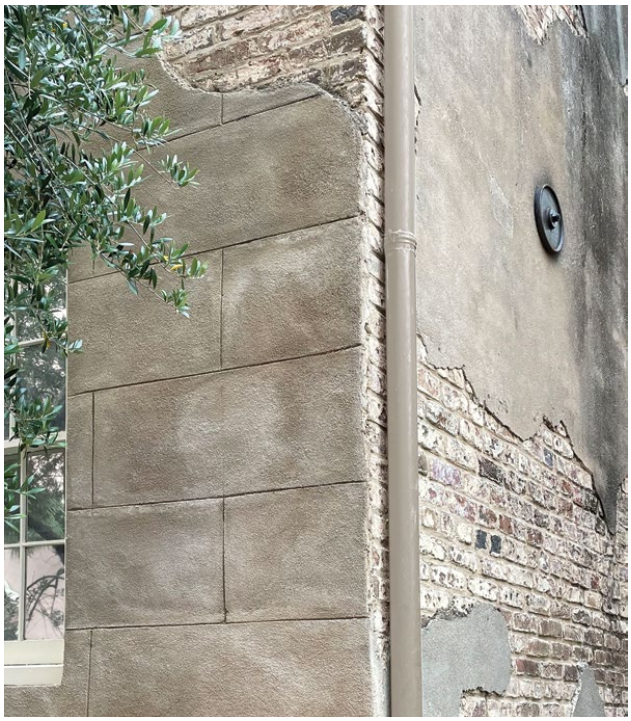


Figure 2c: Stucco has been used to imitate a number of building materials for many centuries. Seen here, stucco was applied to a brick structure and scored to represent a stone façade. Photo: John Sandor, NPS.

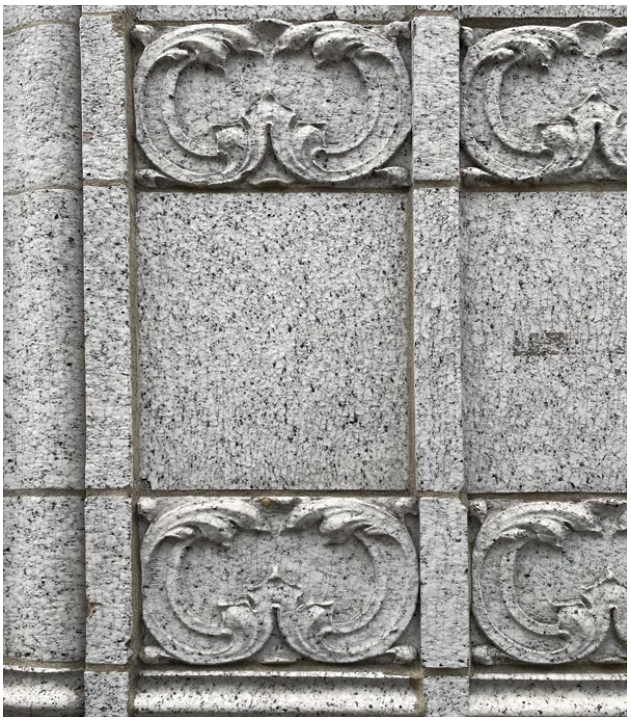


Figure 2d: Terra cotta gained popularity in the late 19th century as a cheap and lightweight alternative to stone. Glazing techniques allowed the blocks to imitate a variety of natural stone materials. Photo: John Sandor, NPS.

These examples of one material used to imitate another, more often in initial construction than for later repair and replacement purposes, are referred to as *imitative materials* in the *Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings*, updated in 2017, that accompany the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. These imitative materials, while evoking other materials, usually had distinctive qualities of their own and were not always a very close match in appearance to the historic material they were meant to imitate.

Many of the traditional materials discussed above are still available and used to replace damaged or missing original features, both to replace matching historic materials and sometimes as substitute materials. Because of their extensive use over time and their known physical and chemical properties, cast stone, cast iron, and terra cotta are well understood substitute materials. This continued usage and familiarity means their installation requirements and service life are well established, which in turn makes it easier to determine when and how to use these traditional materials as substitutes for a deteriorated material. However, innovation in replacement materials continues, and new products (many of them consisting of synthetic materials) are continually introduced. These non-traditional products are an increasing part of both the new construction and rehabilitation industries. Some materials, like glass fiber reinforced polymers, glass fiber reinforced concrete, or fiber cement, have been in use long enough for an accurate prediction of their service life and performance. Other newer, non-traditional materials may be too new to have established performance records, thus, understanding their material properties is critical, and their use should be approached with more caution.

When to Consider Using Substitute Materials in Preservation Projects

According to the *Standards for Rehabilitation*, deterioration should generally be addressed through repair if in repairable condition. Repair can entail a variety of treatments that retain the unit of building material and remove and patch or replace only the damaged portion. This approach can be done with traditional methods and materials such as a dutchman, where like-kind material is precisely inserted into wood or stone, or it may employ other materials such as epoxies for wood repair or cementitious compounds for masonry. As long as the repair methods are sound and do not damage or accelerate the deterioration of the historic material, repairs are generally preferable to replacement of an entire element. More complex manufactured products, typical of more recent historic materials (as well as a lot of modern building materials generally), may be more difficult to repair, if they can be repaired at all.

There are situations, however, when the level of deterioration makes localized repairs infeasible and entire features or units of historic material must be replaced. While achieving an effective match of all of the visual qualities of a material can be challenging, even when replacement is in kind, it can be even more challenging when the replacement is a substitute material. A good visual match is not the only consideration when a substitute material is to be used for incremental replacement within a larger assembly of historic material. When an individual siding board or a single block of ashlar is being replaced, it is usually best achieved with the original material. Introduction of a different material into an intact assembly requires that its inherent properties, such as expansion and contraction, moisture resistance, or permeability, be thoroughly considered relative to those of the surrounding historic materials to avoid causing damage.

Figure 3: Incremental repair is best done using in-kind material to minimize differences in the performance characteristics that could negatively affect the overall assembly. Photo: NPS.

Figure 4. While occasionally used to imitate other materials such as wood or slate shingle, many asbestos shingles and siding materials had their own distinct shape and profile. No longer manufactured today, alternative materials must be found to replace these materials when they are distinctive features on a historic structure. Drawing: Association for Preservation Technology, Building Technology Heritage Library.

Figure 5. (Left) Asbestos shingles were often used as a substitute for traditional slate roof shingles. The historic asbestos roof on this rehabilitation project had reached the end of its lifespan and required complete replacement. (Right) Given the limited replacement materials available to match the historic asbestos shingles, utilizing natural slate was determined to be the best visual match for the original shingles and design intent in this instance. Photos: Crosskey Architects.

Circumstances in which the use of substitute materials may generally be considered appropriate, taking into consideration technical and economic feasibility reasons, include: the unavailability of historic materials; the unavailability of skilled artisans or historic craft techniques; inadequate durability of the original materials; the replacement of a secondary feature; construction of a new addition; the reconstruction of a missing feature; code-required performance; and for enhanced resilience and sustainability:

- **Unavailability of historic material.** A common reason for using substitute materials is the difficulty in finding a good match using the historic material (particularly a problem for masonry materials where the color and texture are derived from the material itself). This may be due to the actual unavailability of the material or to protracted delivery dates, particularly if the material cannot be sourced domestically. It is not uncommon for a local quarry that is no longer in operation to have been the source of an original stone. If another quarry cannot supply a satisfactory match, a substitute material such as dry-tamp cast stone or textured precast concrete may be an appropriate alternative, if care is taken to ensure that the detail, color, and texture of the original stone are matched. Even when the color is successfully matched, the appearance of a cementitious product may diverge from that of the historic stone as the substitute material ages.

  Many manufactured materials that were used historically on buildings are no longer made. Terne-plated steel, which was the material most typically used for painted standing-seam or flat-seam roofing, is no longer made. However, because it was always painted, other metals including galvanized steel or copper can generally be substituted if painted. When the historic material needing to be replaced is a manufactured product developed as an imitation of a natural material, which was the case with asbestos shingles meant to imitate slate, the natural material may now be an appropriate substitute material to consider for the manufactured one that is no longer produced.

- **Unavailability of skilled artisans or historic craft techniques**. These two issues can complicate any preservation or rehabilitation project. This is particularly true for intricate ornamental work, such as carved wood, carved stone, wrought iron, or cast iron. While skilled craftsmen may not be as difficult to find as they once were, there can still be limitations geographically, even in finding less specialized skills, and particularly if a project is small. Technical advances have allowed some stone or wood carvers to take advantage of computerized equipment, but complex designs will likely still require hand work. It may also be possible to mimic a carved element using a material that can be cast in a mold, adding significant efficiency where an historic element survives from which a mold can be made. Options for casting include aluminum, cast stone, fiberglass, glass fiber reinforced concretes, and terra cotta, but not all carved elements can be duplicated by a casting, and mold-making and casting still require skilled craftsmen.

- **Inadequate durability of the original material.** Some historic building materials were of inherently poor quality or were not durable. In other cases, one material was naturally incompatible with other materials on the building, causing staining or galvanic corrosion. Examples of poor-quality materials are very soft sandstones, which eroded quickly, and brownstone, which is vulnerable to delamination. In some cases, more durable natural stones may be visually similar enough to stand in for these soft stones but cast stone or another material may be needed to achieve an appropriate match.

The ready availability of manufactured ornamental wood features fed a nineteenth-century taste for decorative architectural details that were often used on the exterior of buildings with little concern for how they would be affected by moisture or maintained. Even old-growth wood from decay-resistant species often could not prevent features with severe exposure from eventually needing to be replaced. Today's available commercial supplies of lumber no longer provide the denser, more decay-resistant wood of old-growth forests, so even careful matching to species, which is not always possible, will not yield a replacement equal in performance to the historic material. Old-growth wood is likely to be very expensive, if it can be found, and may not be available from a sustainable, environmentally responsible source. When features with severe exposure need to be replaced or reproduced, substitute materials that are less susceptible to decay can have a longer life, and when the feature is painted, as exterior wood features generally are, the visual effect of a substitute material can be minimal.

- **Replacement of a secondary feature.** When it is necessary to replace a less distinctive, secondary feature that is less important in defining the historic character of the property, there is more flexibility in how it can be replaced. While it may be less important to find an exact match in materials when replacing such a feature, the retention of the overall historic character should still guide selection of an appropriate replacement material. For example, replacing secondary features such as those with limited visibility (e.g., siding materials on a rear elevation) may permit replacement materials that are similar in appearance or character without having to be a perfect match.

Figure 6. The dramatic difference in the number of growth rings between old-growth wood and wood that was recently harvested from second- or third-growth forests is indicative of the diminished dimensional stability and durability of most lumber currently available. Photo: Zachary Dettmore.

- **Construction of a new addition.** The *Standards* require that new additions to historic buildings and related new construction be differentiated from the old as well as be compatible with the historic character of the property and its site and environment. Using materials that evoke, without matching, the historic material can be an effective means of achieving the needed balance between compatibility and

Figure 7. A new addition replaced non-historic construction on the rear elevation of this building. Fiber cement gives the addition a compatible appearance without replicating the exposure for thickness of the historic siding. Photo: Ward Architecture + Preservation.

differentiation for new additions and new construction. Even if differentiation is achieved through design rather than materials, there generally is no basis for requiring the use of matching historic materials for new additions and new construction as part of a rehabilitation project.

- **Reconstruction of a missing feature.** Many buildings lose significant features over the course of their lives for reasons such as those previously discussed. When a missing feature is to be reconstructed, the importance of matching the original material may be less important to the effect replacing the missing feature may have on the overall historic character and appearance of the building. Though replacement of missing features must be substantiated by documentary, physical, or pictorial evidence, in many cases the authenticity of the material may be secondary to the overall visual qualities. The use of a more cost-effective substitute material for the construction of a missing feature can often be an important factor in the feasibility of undertaking such work.

- **Code-required performance.** Modern building codes are regularly amended to require higher performance levels for new and existing buildings in such areas as life safety, seismic retrofits, and accessibility. Rehabilitation projects often trigger compliance with code requirements that were not in place when a building was constructed. Although building codes may often allow for the retention of historic materials and assemblies, substitute materials can offer an alternative in situations when the historic materials are non-compliant and cannot otherwise be reasonably retained. In these instances, a change in material may be appropriate to meet code requirements, while in other instances selecting the optimal code compliance method for the project may achieve code-compliant solutions that also allow for the preservation of a building's historic materials and finishes.

  For example, fire codes may require increased resistance to flame spread for buildings within dense urban environments where building proximity and separation between buildings is a concern. Some substitute materials are non-combustible, have good ratings for flame spread, and can provide an alternative to help meet

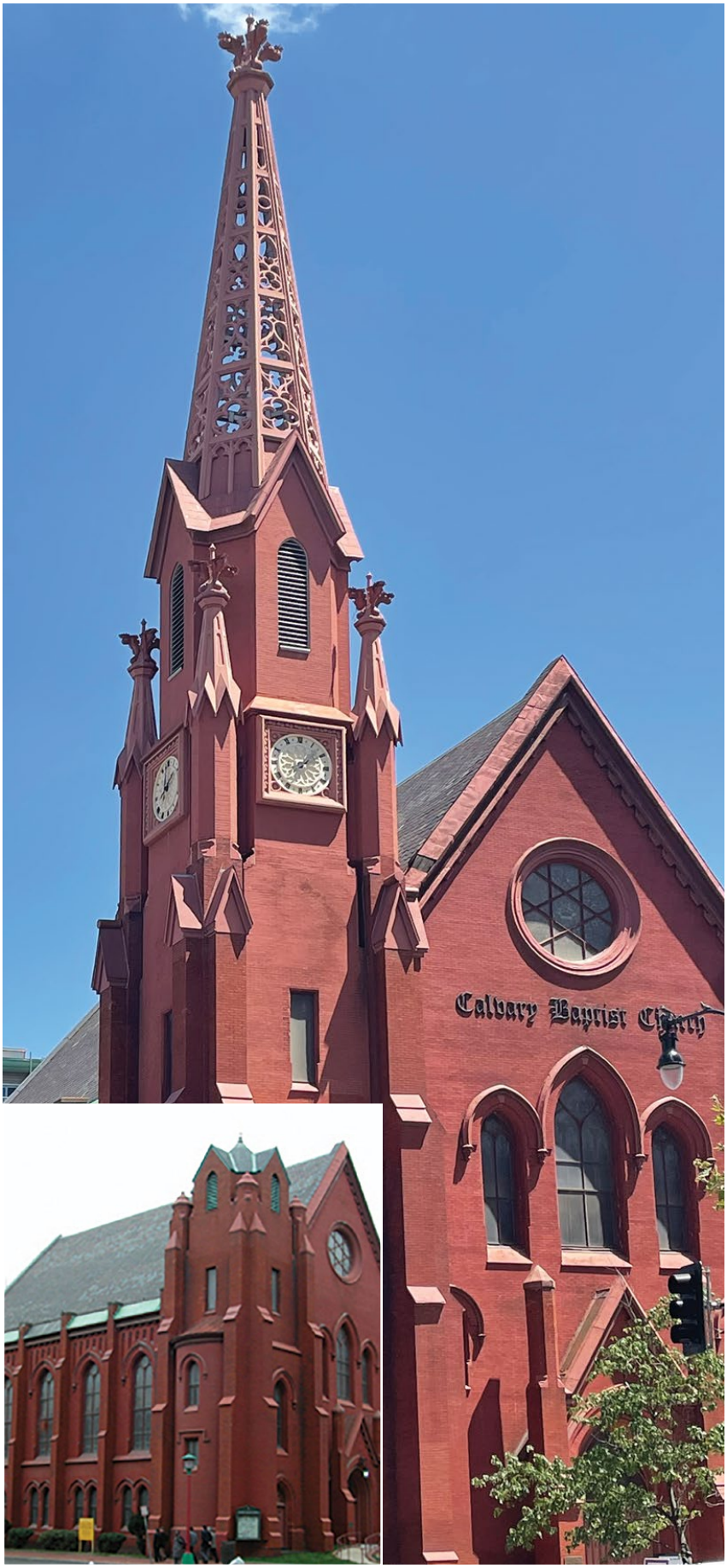


Figure 8. A long-missing cast-iron steeple was reconstructed in aluminum and fiber-reinforced polymer (FRP). Photo: John Sandor, NPS, Inset: Quinn Evans.

fire code requirements. Depending on the building component and the material, however, a substitute material may not resist fire any better than the historic material. In addressing code issues, all feasible alternatives should be considered to minimize the impact on the historic character of the building while still meeting code requirements.

With specific provisions in building code related to issues such as seismic hazards, the choice of materials for features inherently unstable in a seismic event can be a key part of a code-compliant retrofit solution. Elements at risk of falling such as parapets, finials, and overhanging cornices may be made safe by anchoring them to new structural frames. However, for some heavy masonry features, especially where there is deterioration or the feature is difficult to effectively brace, adequately anchoring the existing feature may not prove feasible. In such cases removing and replacing these features with lighter-weight replicas that incorporate a resilient structural framework can help preserve the historic character of the building while improving life safety performance.

- **Enhanced resilience and sustainability.** Wildfires, earthquakes, floods, hurricanes, and other extreme weather events put historic buildings and their occupants at risk and may require adaptive treatments that are more invasive than might be accepted in other circumstances, including related to the use of substitute materials. In these contexts, it is still necessary to try to minimize impacts on a building's historic character as much as possible while still adapting it to be more resilient. Widespread wildfires, for example, have increased demand for fire resistant materials for the exterior building envelope. Flood events may necessitate the replacement of historic materials that have been damaged or inundated with hazardous substances in contaminated floodwaters. When undertaking repairs in such circumstances, substitute materials may offer greater resilience to anticipated future exposure to natural hazard risks.

  Similarly, efforts to improve energy efficiency and performance may include the use of substitute materials as replacement components when modifications to building assemblies are required and the historic materials cannot be preserved. When evaluating substitute materials in the context of sustainability objectives, factors such as the environmental impact of production, the full life cycle of products, and the embodied carbon of the materials already in place should be carefully analyzed. There may be more sustainable choices for a replacement material, including the use of more traditional materials in place of manufactured products that may consist of non-renewable resources or hazardous materials. While some synthetic substitute materials are made from recycled materials or are otherwise sustainably produced, many are not repairable, salvageable, or recyclable themselves, and they may have shorter lifespans to their historic material counterparts. When either greater resilience or sustainability is a factor, all feasible alternatives should be considered in finding a balanced approach that maintains historic character while meeting resilience and sustainability goals.

Substitute Materials and Economic Feasibility

Economic feasibility is inevitably a concern when choosing a material for any part of a project, whether a historic or substitute material, but it should not be the sole determinant factor at the expense of maintaining the historic character and historic integrity of a building. Other factors may prompt the consideration of a substitute material, such as the cost of maintaining the historic material, because it is comparatively difficult or costly to reach or access, or the frequency of required maintenance the historic material needs. Additionally, where in-kind replacement material is found to be prohibitively expensive, it may be reasonable to consider a substitute that offers an alternative and is a good physical and visual match. Not all substitute materials are, however, cost-effective replacements. Long-term durability and maintainability are other factors that should be considered in conjunction with initial cost.

Figure 9. Previously bricked-in openings below the flood line were reopened and new aluminum windows installed with cellular PVC trim detailed to hold back moderate flood waters and survive exposure to water. Photo: John Sandor, NPS.

Maintenance of a material, particularly where accessibility is difficult or expensive, can be an important part of a

cost evaluation. Maintenance costs should not be considered without also considering life-cycle expenses. While some substitute materials may offer reduced initial costs, they may be as or more costly than traditional materials to maintain over time. For example, many substitute materials are not readily repairable, necessitating full replacement when damaged. The cost to replace a material or assembly at the end of its lifespan may also be greater than the accumulated incremental expense to maintain the historic material, particularly if it is a more traditional, repairable material. Maintenance cost should never be the sole reason for replacing a historic material that is not deteriorated.

Criteria for the Appropriate Use of Substitute Materials

Substitute materials must meet three basic criteria to be considered: they must be compatible with the historic materials in appearance; their physical properties must be similar to those of the historic materials, or the materials must be installed in a manner that tolerates differences; and they must meet certain basic performance expectations over an extended period of time.

- **Matching the Appearance of the Historic Material**
  Any material's appearance varies depending on the nature of the material and how it is used. Some historic materials, such as wood and ferrous metals, were typically painted, making the color of the substitute unimportant, though the texture of the surface, which telegraphs through a paint layer, is still an important consideration. Texture can be a large part of distinguishing a material formed by hand from one that is machine-made. Many historic materials, such as most building stones, are used without any coating, making the color, pattern, and reflectivity, as well as surface texture, dependent on the material itself. Matching the color and surface characteristics of a historic natural material with a man-made substitute can often be quite difficult.

When the color and surface characteristics of an existing material are important, cleaning the material should be the starting point for evaluating a potential matching material. In situations where there are subtle variations in color and texture within the original material, the substitute material should be similarly varied so that it is not conspicuous by its uniformity. If a material is custom fabricated, a sufficient number of samples should be supplied to permit on-site comparison of color, texture, detailing, and other critical visual qualities. For a manufactured product with preset choices of color or texture, it may be necessary to look at samples from more than one manufacturer to find the best match. Similarly, prefabricated products, such as roofing slate, may offer limited, if any, choice of unit size, which can be a critical factor for achieving a good match. A substitute material should not be used to replace distinctive, character-defining materials and features if an adequate match in design and appearance is not possible.

As all exposed materials are subject to ultraviolet degradation, samples of a new material, particularly when custom formulated, should be prepared during the early planning phases to allow for evaluation of the effects of weathering on color stability. When that is not possible, or if a prefabricated product is used, the fabricator or manufacturer may be able to identify regional locations where equivalent products have been installed long enough ago to get a better sense of how the material weathers and performs.

While a perfect match is the desired goal for replacing distinctive features, it is not always possible, even when the same matching material is chosen for the replacement. When any compromise

Figure 10. Polymer slates offer a choice of shapes but not sizes, limiting their ability to achieve a good visual match for some historic slate. With the size of the polymer slates (right) being nearly twice that of the historic slates (left), the scale of the entire feature is incompatibly altered. The molded edges of this material, which contribute to its ability to replicate slate, would be lost if each shingle was resized by cutting. Photo: John Sandor, NPS.

Figure 11. The thickness of the wood siding on the front (left) creates a deeper shadow line than is achieved with the fiber cement siding used on the side (right) elevation. While the exposure can be adjusted, fiber cement siding is not available in a matching thickness. Photo: John Sandor, NPS.

must be made in the precision of the match, it is wise to consider the vantage point from which the material will be seen. Sometimes what seems important at close range, such as variations in the texture of a surface, may be secondary to other aspects of the material when viewed from some distance. The closer a feature is to the viewer, the more closely the material and craftsmanship should match the original. An on-site mock-up using a sample of the proposed material can help evaluate whether it is an adequate visual match.

- **Matching the Physical Properties of the Historic Material**
  Carefully chosen substitute materials can often closely match the appearance of historic materials, but their physical properties may differ greatly. These differences are most critical when incrementally replacing components of a larger assembly that retains significant historic material. The chemical composition of the material (e.g., the presence of acids, alkalis, salts, or metals) should be evaluated to ensure that the replacement materials will be compatible with the adjacent historic materials. Materials that will cause galvanic corrosion or other chemical reactions must be isolated from one another.

  The thermal- and moisture-driven expansion and contraction coefficients of each adjacent material must be within narrow limits or be accommodated

Figure 12. Cellulose composite materials, like wood, expand and contract with moisture. Here it was used to reconstruct a missing storefront. Unlike solid wood that is dimensionally stable parallel to the grain, this composite moves equally in all dimensions, resulting in gaps that were not adequately anticipated in the design. Photo: John Sandor, NPS.

by carefully designed joints and fasteners. Joints can play a role both in accommodating movement of materials as well as in managing moisture, either to keep it from entering the enclosure assembly or to let it escape from the building envelope, or both. Because some synthetic materials are less permeable to moisture than more traditional materials, installations must take into account the potential to trap moisture and cause deterioration of historic and new materials. An assembly incorporating new and historic materials should be designed so that if material failures occur, the failures occur within the new material rather than the historic one.

During installation, surface preparation is critical to ensure proper attachment. Deteriorated underlying material must be removed or stabilized. Non-corrosive anchoring devices or fasteners that are designed to carry the new material and to withstand wind, rain, snow, and other destructive elements should be used. Since physical failures often result from poor anchorage or improper installation techniques, a structural engineer should be included in planning any major project. For readily available, off-the-shelf materials, manufacturers' recommendations for attachment and spacing should be followed.

Nearly all substitute materials have some properties that are different from the historic materials they may replace. Even when substitute materials are isolated from historic materials and features, it is important to understand the substitute materials' properties in order to use them successfully.

- **Performance of the Material Over Time**
  When more traditional materials are used to replace damaged historic materials and features, their performance is predictable in most cases. An exception may be modern wood that has durability and other prop-

erties different than those of historic wood from old-growth forests. Many of the materials used as substitutes have been in use long enough to provide some idea of how they perform over time. Other material may only have test results from accelerated weathering. The length of manufacturer warranties may be an indicator of expected durability and lifespan. Warranties only predict a manufacturer's expectation of a product's performance and are no guarantee that the manufacturers will still be in business at the time needed to stand behind them. Just as new manufacturers emerge with new materials, others disappear. Where possible, projects involving substitute materials in similar installations and exposures should be examined before selecting a new, less-tested material. It is unrealistic to expect a substitute material, which can be quite different in composition than the historic material, not to age differently.

Even traditional materials will not perform well if not used or detailed appropriately, and experienced architects, engineers, fabricators, and installers rely on their professional knowledge and experience to ensure proper installation and techniques when working with familiar materials. This is just one of many reasons that using the original materials for needed replacement is usually the best choice. Some of the materials now available as substitutes have properties that differ greatly from the traditional materials they may be used to replace. It is critical to the successful performance of substitute materials that everyone involved in the selection, design, and installation fully understands the material's properties, especially how it is different than the material it is replacing, and how that will affect the surrounding materials and building systems.

Many traditional building materials can be repaired either with traditional methods and materials or with more modern conservation techniques using substances like epoxies. However, many modern substitute materials (particularly synthetic ones) are not as easily repaired, if repairable at all, as their more traditional counterparts. Confirming that a material is repairable may be important for those used, e.g., where impact or significant wear or abrasion is likely.

Finally, it is critical that the substitute materials be documented as part of the historical record of the building so that proper care and maintenance of all of the building materials continue, ensuring the continued life of the historic building.

Choosing an Appropriate Substitute Material

Once all reasonable options for repair and replacement in kind have been considered and sufficient justification for substitute materials has been established, the choice among the variety of substitute materials currently available must be made. Rapidly developing technologies allow a wide variety of materials to choose from that are intended to mimic historic materials. Many of the materials that were historically used as substitutes for more traditional historic materials have themselves become historic, and some of these early substitutes continue to be reasonable options as substitute materials today. No substitute material will exactly match the historic material in all aspects, but many are able to adequately match the appearance and relevant physical attributes to make for a potential substitute. If a substitute material is not

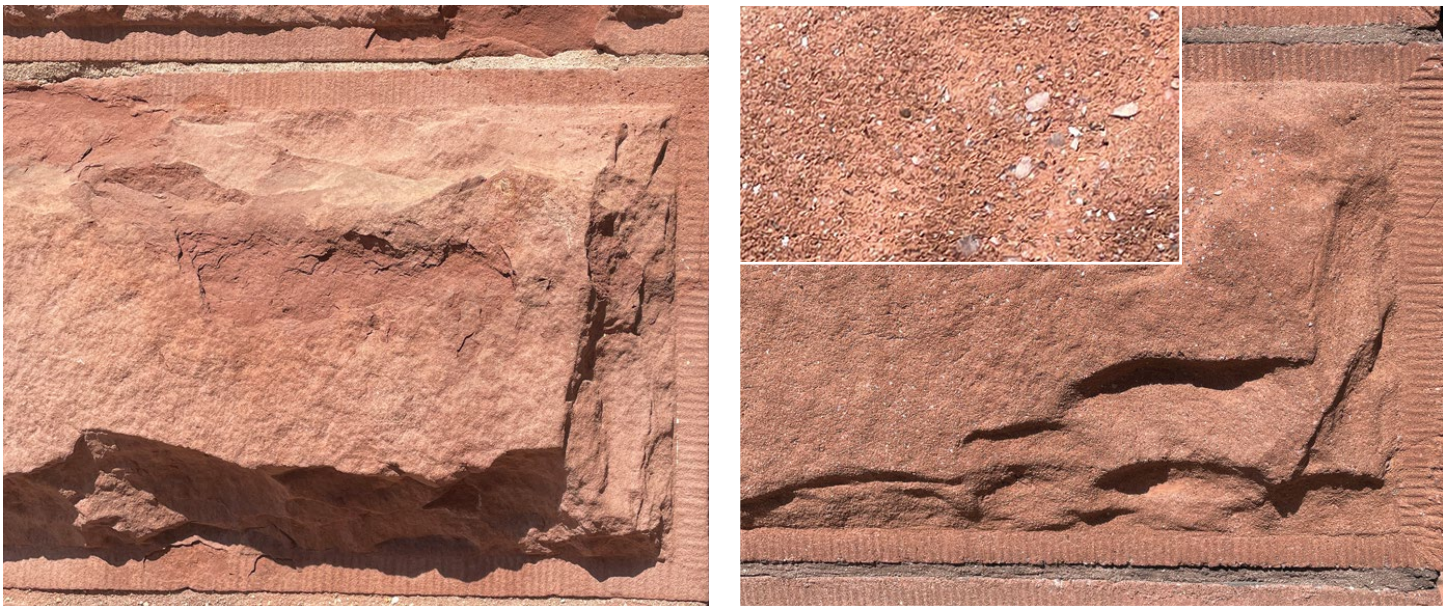


Figure 13. Cast stone was used to effectively replace individual blocks of sandstone. Both the original (left) and the substitute material (right) retain similar physical and visible properties. Having weathered for over 30 years, some erosion of the binder has revealed quartz grains of the aggregate (inset), but it is only noticeable upon close inspection. Photo: John Sandor, NPS.

an adequate physical and visual match given the specific conditions of the building and the project, then it should not be used to replace distinctive, character-defining materials and features.

Listed below are various building components or features and the substitute materials which may, in some circumstances, be considered for use as possible replacement materials in a historic rehabilitation project consistent with the *Standards for Rehabilitation*. This list includes different substitute material options available today for these building features and poses questions that should be asked and considered when choosing between the original material and various types of substitute materials. This is followed by a list of some of the more commonly used, currently available materials that may have some applications as substitute materials and the properties of each that affect their suitability for use as substitutes. This list should not be read as an endorsement of any of these materials, generally, or their appropriateness for use as a substitute material, but it serves as a reminder that the successful use of any building material requires a careful consideration of its properties relative to where and how it will be used.

Considering Substitute Materials

Considering the use of a substitute material should begin with the following questions about the conditions and location where it will be used:

- Will the significance or visibility of the historic feature require a very precise match?
- Is the entire feature being replaced or just a component of it?
- Are pre-existing conditions contributing to the failure of the existing material, and, if so, how will they be addressed/corrected?
- Is the need for replacement due to inherent deficiencies of the original material?
- Will the material need to resist any environmental hazards such as flooding or fire?

Historic Features and Substitute Materials

Historic Building Features

Potential Substitute Materials	**Masonry** Stone, terra cotta	**Architectural Metals** Cast & wrought iron, steel, pressed metal	**Siding** Wood, asbestos	**Roofing** Wood shingle, slate, tile	**Decking** Tongue and groove & square edge wood	**Molding / Trim** Wood
Aluminum	●	●	●			●
Cast Stone & Precast Concrete	●			●		
Fiber Reinforced Concretes	●					
Glass Fiber Reinforced Polymers	●	●				
Fiber Cement			●	●		●
Mineral / Polymer Composite			●	●	●	●
Cellulose Fiber / Polymer Composite			●	●	●	●
Non-composite Polymers		●			●	●
Cellular PVC			●		●	●

The above chart lists materials that are sometimes used as substitutes for replacement of historic building features. Even within a given category, all materials may not be equally suitable as a substitute replacement material for the actual historic material or feature. Any substitute material should be selected based on its specific physical and visual characteristics, conditions, and intended application consistent with the Secretary of the Interior's Standards for Rehabilitation.

Historic Building Features: Criteria for selecting an appropriate replacement material

Masonry

FEATURES: corbels, brackets, balusters, cornices, window and door surrounds, friezes, wall surfaces, horizontal surfaces, incidental ornament, columns

HISTORIC MATERIALS: terra cotta, cast stone, stone, concrete

POTENTIAL SUBSTITUTES: cast stone, pre-cast concrete, GFRC, GFRP, non-composite polymers (polyurethane), cast or stamped metal

Questions to ask about the replacement material:

- Can it serve a structural function?
- How is the material affected by moisture?
- Can the material survive flooding and be reused?
- Can it reproduce the surface texture of the original?
- Is its shrinkage in curing low enough to allow it to be molded from existing stones?
- Can matching color be achieved without a coating and with UV stability?
- Can an adequate match of the surface (color and texture) be achieved with a coating?
- Is a coating required?
- If it is not self-supporting, is it lightweight enough to be supported by an underlying framework?
- Can multiple original units be replicated with a single replacement piece?
- Where thermal movement is different from the original material, how will joints accommodate?
- Is the material combustible?

Architectural Metals

FEATURES: pilasters, door and window surrounds, cornices, incidental ornament, columns, spandrels, ceilings, sheathing, roofing

HISTORIC MATERIALS: cast and wrought iron, steel, bronze, lead, aluminum, and stamped steel (usually galvanized or terne-coated)

POTENTIAL SUBSTITUTES: GFRP, aluminum, non-composite polymer (polyurethane), GFRC, metallic/polymer composite

Questions to ask about the replacement material:

- Will the replacement material serve a structural or cosmetic role?
- Will it expand and contract with temperature change enough to require special accommodation in its installation?
- If part of an assembly of mixed materials, how will any expansion and contraction of the dissimilar materials be accommodated?
- Will the replacement material increase deterioration of the historic or surrounding elements, for instance due to galvanic corrosion, moisture entrapment, jacking of original material, off-gassing creating a corrosive environment, or poor original design of the historic material?
- How will the replacement material mimic the surface color/patination of the original material?
- If a coating is needed, what preparation is needed, and what is its durability or service life of the finish?
- What attachment and support systems are necessary?
- If the original element is structural, but the new material is not, how can supplemental structure be introduced to support the new?

Figure 14. Surface texture is an important aspect in matching the appearance of a historic material, especially when a material is viewed at close range. As seen in these two images, many of the substitute materials produced for siding and trim have an embossed wood grain, making them incompatible for replacing historic wood that was typically planed to a smooth surface. Some substitute products are available with a smooth surface as well. Photos: John Sandor, NPS.

Siding

FEATURES: clapboard, tongue-and-groove or shiplap siding, board and batten, shingles

HISTORIC MATERIALS: wood and asbestos

POTENTIAL SUBSTITUTES: cellular PVC, wood fiber/polymer composite, fiber cement, mineral/polymer composite

Questions to ask about the replacement material:

- What are the widths, lengths, profiles, thicknesses, and textures available?
- What, if any, are the finishing requirements, and/or is it available factory-finished?
- How well does it hold paint, and can prefinished surfaces be renewed?
- What tools are needed to cut it, and can it be machined?
- Does it absorb moisture and, if so, to what effect?
- Can the material survive flooding and be reused?
- Will it expand and contract with temperature change enough to require special accommodation in its installation?
- What characteristics can affect its handling (e.g., weight, flexibility, brittleness)?
- Does it have specific fastening requirements?
- Is it susceptible to insect damage?
- What is its impact resistance?
- Does it have a flame spread rating?
- What is the expected lifespan and/or warranty?

Roofing

HISTORIC MATERIALS: wood shingle, slate shingle, asbestos shingle, clay tile, concrete tile, metal

POTENTIAL SUBSTITUTES: fiber cement, mineral/polymer composite, wood fiber/polymer composite, pre-cast concrete, metal

Questions to ask about the replacement material:

- What sizes and shapes are available?
- What are color choices?
- What is the color stability of the new material, and how will it age/weather?
- What is the impact resistance?
- What is its flame spread rating?
- What are the installation requirements of the new material?
- Can the feature being replaced be custom-produced if ready-made ones of the new material are not an accurate match?
- What is the expected lifespan and/or warranty?

Decking

FEATURES: tongue-and-groove, square-edge flooring

HISTORIC MATERIALS: wood

POTENTIAL SUBSTITUTES: cellular PVC, wood fiber/polymer composite, mineral/polymer composite, non-composite polymers (solid PVC)

Questions to ask about the replacement material:

- What are the widths, lengths, and textures available?
- Is it site painted or prefinished?
- How well does it hold paint, and can prefinished surfaces we renewed?
- What tools are needed to cut it, and can it be machined?
- What dimensional span does its strength allow?
- Does it absorb water, and if so, to what effect?
- Can the material survive flooding and be reused?
- Does it require a drainage plane, or can it be installed atop a membrane?
- Will it expand and contract with temperature change enough to require special accommodation in its installation?
- Is it susceptible to insect damage?
- Is it impact resistant?
- Does it have a flame spread rating?
- What is the expected lifespan and/or warranty?

Molding / Trim

FEATURES: run moldings, flat boards, casings, cornice, frieze, railings, balustrade, columns

HISTORIC MATERIALS: wood, metal

POTENTIAL SUBSTITUTES: cellular PVC, wood fiber/polymer composite, mineral/polymer composite, non-composite polymer (polyurethane), GFRP, sheet metal

Questions to ask about the replacement material:

- What are the widths, lengths, and textures available?
- What, if any, are the finishing requirements and/or is it available factory-finished?
- How well does it hold paint, and can prefinished surfaces be renewed?
- What tools are needed to cut it, and can it be machined?
- Does it absorb moisture, and if so, to what effect?
- Can the material survive flooding and be reused?
- Will it expand and contract with temperature change enough to require special accommodation in its installation?
- What characteristics can affect its handling (e.g., weight, flexibility, brittleness)?
- Does it have specific fastening requirements?
- Is it susceptible to insect damage?
- What is its impact resistance?
- Does it have a flame spread rating?
- What is the expected lifespan and/or warranty?

Figure 15. Tongue-and-groove porch flooring is manufactured in several different substitute materials. Each type has different properties, though most are more moisture-resistant than wood. The prefinished product shown can be painted when worn, but repainting is not recommended for some product choices. Photo: Oak Alley Foundation.

Potential Substitute Materials: Matching properties and performance needs

Physical Composition and Properties

After assessing different material options based on the intended application, the appropriateness of a substitute material should also be considered in context of the material's physical composition, associated properties, and necessary visual match.

Aluminum

MATERIAL: Aluminum is a highly corrosion-resistant alloy that can be cast, wrought, or extruded. Molten aluminum is cast into permanent (metal) molds or one-time sand molds forming cast aluminum. Extruded aluminum is formed by passing heated aluminum through a die which produces the desired form. Wrought aluminum is worked using the heated metal and then bending, stamping, and otherwise shaping the metal. If not self-supporting, aluminum elements are generally screwed or bolted to a structural frame. Aluminum can be welded, but more often sections, particularly extruded ones, are mechanically connected.

PROPERTIES:

- Isotropic
- Lightweight
- Thermal movement greater than cast iron or wood
- Corrosion-resistant, but direct contact with other metals may trigger galvanic corrosion
- Lower structural strength that iron or steel
- Ductile - less brittle than cast iron
- Non-combustible
- Retains high definition through molding process and produces crisp profiles through extrusion
- Can be given a durable metallic finish through anodization. Surface etching required for paint adhesion
- Can be machined into a large variety of shapes/ dimensions

Figure 16. Aluminum is a highly corrosion-resistant metal that is commonly used as a substitute material for cast iron. Aluminum can be a more affordable and lightweight alternative to cast iron that retains a similar texture, shape, and maintenance cycle. Photo: NPS.

Figure 17. The balustrade consists of multiple prior campaigns of using cast stone to replace the natural stone. The effective match for the surface texture and color of the original stone allowed individual elements to be incrementally replaced only when they had failed, thus retaining the maximum amount of original material as long as possible. Photo: EverGreene Architectural Arts.

Cast Stone & Precast Concrete

MATERIAL: A cement lime and aggregate mixture that is dry-tamped into a mold is generally referred to as cast stone. Cast stone is one of the original substitute materials. Its longevity has proved that the material ages compatibly with stone. A wet mix of cement and aggregate poured into molds also has a long history of being used to produce concrete masonry units mimicking stone and roofing tiles mimicking clay tile. Both methods have minimal shrinkage during curing, though they employ different curing and finishing techniques. Both can include reinforcing bars and anchorage devices installed during fabrication. The dry-tamp fabrication method is especially effective at producing an outer surface with the appearance of stone.

PROPERTIES:

- Isotropic
- Weight equivalent to stone
- Expansion/contraction similar to stone
- Water absorption may differ from that of any particular stone
- Can be structural
- Non-combustible
- Vapor-permeable
- May achieve a wide range of color and surface textures by varying mix, but use of pigments may reduce UV stability
- Can be coated
- May be tooled to match the appearance of tooled stone
- Repairs similarly to stone

Figure 18. Missing historic terra cotta spandrel panels on all floor levels were recreated utilizing glass fiber reinforced concrete (GFRC) replacements. New spandrels were fabricated as individual components and attached with metal clips between historic terra cotta piers. Photo: Kris Frail, Dewberry.

Fiber Reinforced Concretes (GFRC, CFRC)

MATERIAL: Fiber reinforced concretes are lightweight concrete compounds modified with additives and reinforced with alkaline resistant glass fibers (GFRC), or less frequently carbon fibers (CFRC). They are generally fabricated as thin-shelled panels and applied to a separate structural frame or anchorage system. GFRC is typically sprayed into forms, although it can be poured, and anchoring devices are included in the fabrication. The color is derived from the natural aggregates and, if necessary, a small percentage of added pigments. Because of its low shrinkage in curing, it can be produced using molds taken directly from the building.

PROPERTIES:

- Isotropic
- Lighter weight than solid masonry
- Expansion/contraction similar to stone
- No load bearing capacity, so underlying framework must be used to accommodate any loads
- Material can be fire-rated
- Vapor-permeable
- Can be produced in larger sections efficiently reproducing repetitive elements or features that were originally made up of small individual units
- Large range of colors achievable by varying aggregates, but when pigments are needed UV stability may be reduced
- May be left uncoated or may be painted

Figure 19. A new, lightweight fiber reinforced polymer is attached to a new metal armature to replicate damaged and missing elements of a terra cotta cornice. Photo: Quinn Evans.

Glass Fiber Reinforced Polymers (FRP, Fiberglass)

MATERIAL: Fiberglass is the most well-known of the FRP products generally produced as a thin, rigid, laminate shell formed by pouring a polyester or epoxy resin gelcoat into a mold. When tack-free, layers of chopped glass or glass fabric are added along with additional resins. The surface gel coat can be pigmented or painted. Reinforcing rods and attachment devices can be added when necessary. Because of is low shrinkage in curing, it can be produced using molds taken directly from the building. Rather than being produced as standard components, FRP is custom fabricated for individual applications.

PROPERTIES

- Isotropic
- Lighter weight than masonry, similar to sheet metal
- More thermally driven expansion than masonry or metals
- No load bearing capacity, so underlying framework must be used to accommodate any loads
- High strength to weight ratio
- Flammable
- Not vapor-permeable
- Can be produced in larger sections efficiently reproducing repetitive elements or features that were originally made up of small individual units
- May be difficult to match false joints in multi-unit assemblies to actual joints that need to accommodate movement
- Color can be incorporated into the surface gel-coat, or the surface may be coated

Figure 20. Cement board was used to replace a non-historic infill and mimics the configuration of a typical vehicular door of the period. Photos: Historic Augusta.

Fiber Cement

MATERIAL: Fiber cement products are made from fiber, sand that is ground to a powder, cement, and proprietary additives to reduce moisture absorption. The fiber used in roof products is glass fiber alone, whereas siding and trim board products are primarily wood fiber. The material is formed with a smooth or textured surface, cut to standard sizes of panels, boards, or shingles, and cured in an autoclave. Roofing material has integral color, but board and siding products are produced with a primer, if not fully factory finished. Most siding and trim boards are embossed with a wood grain on one surface and are smooth on the other, the smooth side being the appropriate surface to imitate planed wood.

PROPERTIES:

- Products are minimally orthotropic
- Heavier and more brittle than wood, limiting available lengths
- Very little thermal- and no moisture-driven movement
- Low water absorption, but not recommended for ground or roof contact
- Class A flame spread
- Resists insect damage
- Available in limited thicknesses and widths
- Not machinable, but may be cut with special carbide blades; cutting requires dust collection and personal protective equipment
- Cut edges require sealing
- Available unfinished, primed, or prefinished, and must be painted (with latex paint)
- 15-year limited warranty typical

Figure 21. A mineral polymer composite siding was available in the profile very similar to the historic siding. The replacement siding was used where the original material was almost completely missing beneath a more modern covering. Areas where the original wood was largely intact were replaced with matching wood to sustain more of the material integrity of the building. Photo: Belk Architecture.

Mineral / Polymer Composite

MATERIAL: Calcium carbonate or fly ash are mineral ingredients held in a matrix of various polymers to produce materials formed or molded into a number of building products. Additives found in some of the roofing products include pigments and UV stabilizers. Some use a substantial portion of recycled material. Different combinations yield products with different properties, each formulated for a specific building component. When the material is fly ash with some glass fibers bound in a matrix of polyurethane, it is identified as polyash. Siding, trim, bead board, and deck products are primed or prefinished, whereas roof products have integral color.

PROPERTIES:

Fly ash (siding and trim)

- Isotropic
- Heavier and more brittle than wood, and lacking structural capacity
- Little thermal or moisture-driven movement
- Sufficiently low water absorption to permit ground contact
- Class C flame spread
- Resists insect damage
- Available in limited thicknesses and widths
- Machinable with carbide tools blades; requires dust collection
- Cut edges do not require sealing
- Must be painted
- 30-year limited warranty typical

Calcium carbonate or recycled rubber (roofing)

- Isotropic
- More thermally-driven movement than slate or wood
- Little to no moisture absorption
- As shingles: lighter and more flexible than slate
- As tongue-and-groove decking: heavier and harder than wood
- Not vulnerable to insect damage
- Available in limited dimensions
- As shingles: Class 4 impact resistance, and flame spread ratings ranging from Class A to Class C depending on the specific product
- As shingles: integral color, that may be subject to fading
- As tongue-and-groove decking: prefinished with non-renewable finish, and can be cut with woodworking tools
- 50-year limited warranties on roofing products typical

Cellulose Fiber / Polymer Composite

MATERIAL: Wood strands or fibers are coated with resin for moisture resistance and zinc-borate for insect and fungal-decay resistance, then consolidated under heated pressure. Solid composite core boards are cut from sheets of material, then factory-primed or finished. Resulting siding and trim board products can be referred to as engineered wood, fiber board, or hardboard. Products may be embossed with a wood grain or have a smooth finish, the smooth side being the appropriate surface to imitate planed wood. Siding, trim, and tongue-and-grove decking with a slightly different properties are produced by extruding polyvinyl chloride (PVC) combined with non-wood cellulose. Roofing shingles are molded from fine wood fibers, color additives, and UV stabilizers bound with polypropylene or polyethylene (thermoplastics).

Figure 22. A porch was reconstructed using posts fabricated on site from a smooth-surface cellulose/polymer composite material. Though the face of the posts are painted, the lack of paint on the bottom at the cut ends is not consistent with manufacturers' recommendations. This treatment will allow moisture to be absorbed, shortening the life of the new replacement feature. Photo: John Sandor, NPS.

PROPERTIES:

Predominantly Cellulose (siding, trim and decking)

- Minimal thermal movement
- Resistant to moisture-driven movement
- Lighter and more flexible than solid wood, but lacks structural capacity
- Rice hull cellulose: can span typical floor-framing spacing as decking
- Low water absorption (for wood, no ground or roof contact)
- Class A or Class C flame spread
- Resists insect damage
- Available in limited dimensions
- Machinable with woodworking tools
- Wood cellulose: Cut edges must be sealed and may need additional surface prep for finish; must be painted if unfinished or primed, also available prefinished
- Rice hull cellulose: Accepts stain/paint, but no finish required
- 30–50 year limited warranty, depending on manufacturer

Predominantly Polymer (roofing)

- Minimal thermal movement
- Little to no moisture absorption
- Lighter and more flexible than slate
- Class 4 impact-resistance
- Class A flame spread
- Available in limited shingle size
- 50-year limited warranty typical

Figure 23. 3-D printing using various polymers is occasionally used to replicate missing metal or wood features. This new application is continually being refined, but the application can be successful when a painted, lightweight feature needs to be replicated. Photo: NPS.

Non-composite Polymers

MATERIALS: The main two polymer materials used without significant other components are polyurethane and polyvinyl chloride (PVC). Polyurethane millwork is constructed of urethane foam created by mixing isocyanate and resin. The polyurethane mixture is kept under pressure in a mold as it expands to any desired shape. These molded products have a closed-cell, foamed core with a denser surface skin. Polyurethane products can have exterior applications but are more often used for interior features. Polyvinyl chloride (PVC) in a solid extruded form is another polymer that can have architectural application as tongue-and-groove decking. Various polymers formed using 3-D printing are also being explored as replacements for painted metal or wood ornamental features.

PROPERTIES: Each of the two groupings has distinct physical properties

Urethane Foam (moldings and decorative elements)

- Lightweight and flexible, but lacking structural capacity
- More thermally-driven movement than wood or stone, but less than cellular PVC
- Does not absorb water
- Flammable
- Resists insect damage
- Can be cut with standard woodworking tools
- Adhesive and mechanical fasteners both recommended for installation
- Supplied primed and must be painted (latex paint)
- Lifetime limited warranty typical

Solid PVC (flooring)

- Isotropic
- Heavier and less flexible that wood
- Minimal thermal movement
- Does not absorb water
- Strength to span typical floor-framing spacing
- Impact-resistance greater than wood
- Class A flame spread
- No insect susceptibility
- Good paint adhesion, but also available prefinished
- 20-year warranty typical

Cellular Polyvinyl Chloride (PVC)

MATERIAL: Varying amounts of calcium carbonate and a foaming agent are added to melted PVC before passing through an injection die and then a calibrator to produce the shape and size of the finished product. Cellular PVC is produced as sheets, boards, and moldings. Differences in the specifics of the equipment and the rate of cooling create two varieties of product, with distinct properties. One is known as free-foam, having a fairly consistent structure throughout its section, and the other is identified as Celuka, having a skin that is denser than its core. This primarily affects the ease with which the product can be milled and shaped. The material is white and needs no applied finish. When produced for decking the material has a colored and textured wear layer over the PVC core.

PROPERTIES

- Isotropic
- Lighter and more flexible than wood
- Less strong than wood (in tension and shear), but can span typical floor- framing spacing as decking
- More impact-resistance than wood
- Negligible water absorption; no moisture-driven movement, unlike wood
- Subject to thermal expansion and contraction significantly greater than wood, though the thermal movement is less for the same dimension than the cross-grain moisture-driven movement of wood
- For longer pieces, thermal movement requires manufacturer's specifications to be followed for attachment, and inclusion of expansion joints when installed at low temperature (joints should be glued)
- Class A flame spread
- Resists insect damage
- Machinable with woodworking tools, though cut edges may need additional surface prep for finish
- Good paint adhesion; if painted, high light reflectance (HLV) is recommended to minimize heat driven expansion
- 25–30-year limited warranty, depending on manufacturer

Figure 24. Cellular PVC when painted can be used to replace deteriorated wood features. This beadboard set in a wood frame was not historically designed to shed water effectively and had deteriorated. Cellular PVC was able to match the appearance of the wood details, while its properties were well matched to the shady location, painted finish, and limited size and configuration within the overall assembly; thus, it should provide a long-lasting solution for this application. Photo: Jennifer Balson Alvarez, NPS.

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