



Brick masonry is a traditional building type that relies on the structural integrity of each brick and mortar layer. (www.loc.gov)

# R5

## RESILIENCE GUIDANCE: EXTERIOR MASONRY

### EXTERIOR MASONRY IMPROVEMENT GOALS

Masonry is often part of the structural system of older buildings and maintenance is critical to prevent significant problems. Severe storms will find weak points allowing wind and water to cause more damage. Brick and other unreinforced masonry is vulnerable to earthquakes and potential collapse.

### MAINTENANCE AND PERMITTING

A building permit may be required for any of these suggested work items. (Refer to Resilience Guidance: Permit Review, page R1.5.) Also, if the property is subject to review by the Board of Architectural Review or Design Review Board, additional reviews may be required. For any questions or concerns, contact the Permit Center. Additional resources and codes can be found on the last page of this topic section.

Masonry includes any type of stone, brick, or concrete-formed material. **Functionally, the primary role of masonry is to transfer building loads to the ground, either through masonry walls acting as the principal load-bearing system or through masonry piers supporting wood-framed structures. Masonry also protects a building from fire; acts as a building's skin shedding water, deflecting sunlight and wind; and provides thermal mass that can regulate interior temperatures.** Masonry and stucco can also be an important design feature, complementing the building's style.

As a critical structural component, masonry must address several forces listed below to be resilient.

- **Gravity:** Transferring the weight of the building and its contents to the ground.
- **Lateral pressure:** Horizontal forces that press into the side of walls, foundations, or piers. Lateral forces can be caused by severe winds or the weight of floodwater or saturated soil.
- **Lateral impacts or forces:** Significant horizontal forces such as shaking from an earthquake, storm surge, or impacts from waterborne debris like a floating tree trunk can knock a building or an appendage, such as a porch or piazza, off its foundation.
- **Buoyancy:** Water pressure below a building or a foundation that can lift and crack a floor slab or a dislodge a porch from its foundation.

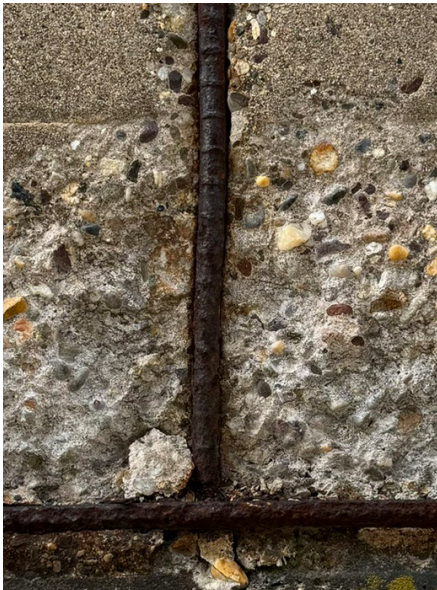
**Resilience can be improved by maintaining masonry or working with a design professional to supplement a masonry system.**



## MASONRY AS BUILDING COMPONENTS

There are a variety of masonry types used in building construction with different properties, which, when combined with the condition, impact resiliency.

- **Unit Masonry:** Stone, brick, and stacked concrete block rely on mortar between the units to form a solid structure. If the mortar bonds are damaged or missing, the wall or pier is weakened and more likely to fail in a flood, severe winds, or an earthquake.
- **Monolithic Masonry:** Poured concrete or concrete block filled with poured concrete tends to act as a single, solid unit, and when supplemented by steel reinforcing bars, can resist lateral loads from floodwaters, severe winds, and earthquakes. However, voids or cracks in the concrete can expose the metal reinforcing to water, leading to rust and further deterioration of the concrete. Additionally, concrete can be a very porous material, which if uncoated, absorbs water (like standing floodwater) very easily.
- **Impacts on Resiliency:** The strength and water absorption rate can vary dramatically between different types of stone, brick, and concrete. Older, handmade brick usually is softer and is likely to absorb more water than newer, machine-made brick, and requires special care when installing mortar, stucco, or masonry coatings. Similarly, limestone is relatively soft, making it easier to carve than granite, but its open pores are more likely to absorb water.
- **Installation:** The way materials were installed, masonry thicknesses, bonding pattern, foundation depths, and connections to other materials like wood framing will impact resiliency. Thinner masonry walls are more vulnerable to lateral forces than thicker walls.

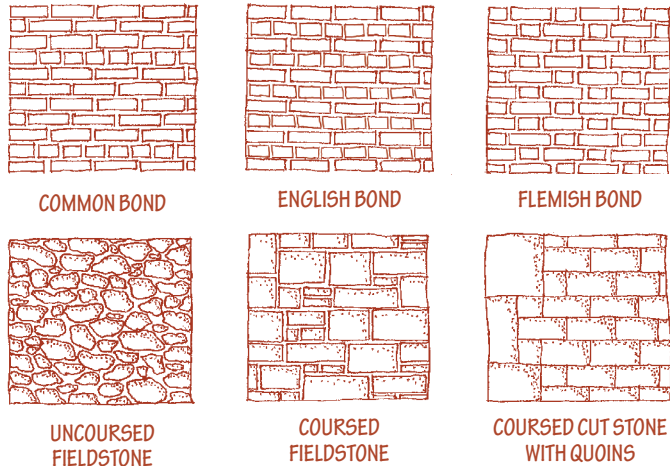


The metal reinforcing bars were installed very close to the outside face of the concrete. Water exposure through small cracks has caused the bars to rust and expand, spalling the concrete surface.

**Due to the critical structural role of masonry, the forces it must withstand, and the factors that can impact its ability to perform sufficiently, the types of resiliency repairs that can be performed by property owners are limited. Property owners should consult with an architect, engineer, or a building inspector if there are any concerns, or conditions that suggest a structure may be compromised.**

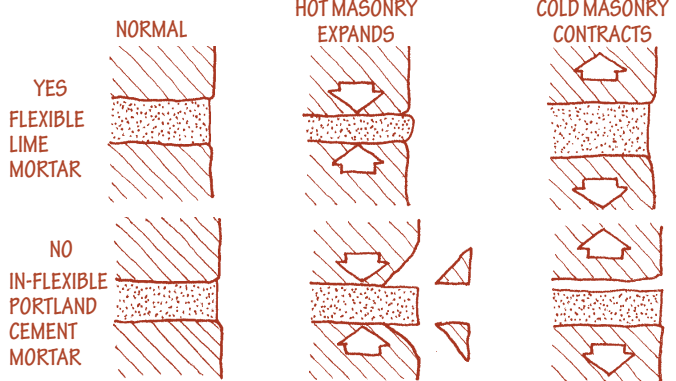
**CHIMNEYS**  
Chimneys should be maintained to minimize moisture absorption. They can also be braced to protect against severe winds and earthquakes. (Refer to Chimneys, page R3.5.)

### TYPICAL COURSING PATTERNS



Unit masonry is made up of stacked material joined by mortar. The size, arrangement, and bonding pattern of the bricks or stones can impact the strength of masonry walls and piers and its ability to withstand severe impacts.

### MORTAR DO'S AND DON'T'S



Maintaining the mortar in unit masonry is critical to bonding the individual bricks, stones, or concrete blocks together. Portland cement-based mortar, typically sold in pre-mixed bags in big-box hardware stores, is too hard for older bricks and some types of stones. Using it can damage the masonry and cause the bonds to break, reducing the structural stability and providing a pathway for floodwater. (Refer to Mortar, page R5.4.)



Avoid locating downspout discharges near masonry walls and foundations.



Buildings should be stabilized and secured while awaiting rehabilitation.

## MANAGING MOISTURE



The algae along the foundation suggests significant moisture in the wall. Possible sources can be pooling adjacent to the wall, rising damp, or rainwater splashing from the sidewalk.

Regular moisture saturation of masonry can eventually result in structural issues that can compromise its resiliency. Water saturation can cause mortar to lose its bond or wash out of the joints in unit masonry, and it can cause concrete reinforcing to rust and expand, cracking off chunks of the surface. **While professional assistance from an architect or engineer is likely needed to address structural issues related to masonry, property owners can minimize damage to masonry by reducing moisture infiltration and the resulting deterioration.**

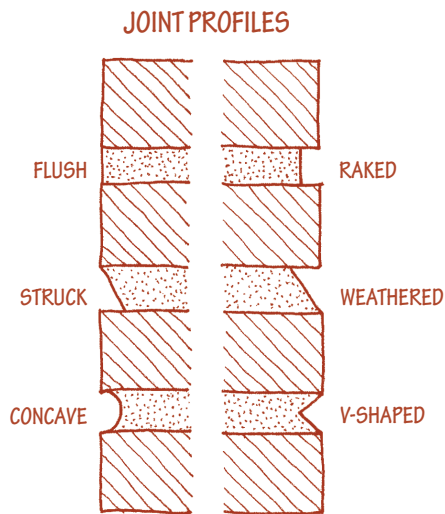
One of the keys in successfully managing masonry moisture damage is understanding the source. While rainwater entering an open joint is an obvious source, it is more likely that greater damage will be caused from an overflowing gutter or downspout, or stormwater pooling next to a building foundation and then sucked up into the masonry like a straw. Other sources of moisture include rising damp, water wicking up through masonry foundations from underground, or rainwater splashing up onto masonry from adjacent hard surfaces.

### KEY TIPS:

- Review areas for sources of potential moisture intrusion, particularly during or immediately after a storm
- Verify that gutters and downspouts are clear and directing water away from the building (*refer to Gutters and Downspouts, page R3.4*)
- Install splash blocks or downspout extensions to direct water away from building walls or foundations
- Remove or thin vegetation close to a building and conduct regular inspections for algae and/or mold behind vegetation
- Re-grade area adjacent to foundation to direct groundwater away from building if there are noticeable puddles or ponding during a rain storm (*refer to Site Grading, page R2.5*)
- Remove any vines and scrub surface with a stiff natural-bristle brush to remove dried roots, allowing air to circulate and the sun to dry the wall
- Clean moss, or algae, and efflorescence from masonry surfaces with low pressure water, gentle detergent, and natural bristle brushing; a non-toxic biocide can be used for more significant discoloration as needed



The loss of a stucco coating from a masonry wall can allow water to be absorbed by the underlying masonry, advancing deterioration of the brick and mortar joints.



When repointing, joint profiles, in addition to color and texture, should match the existing for a blended appearance.



Deteriorated surfaces and mortar are more likely to absorb moisture.



There is a wide range of stone types, colors, and coursing patterns. Regular maintenance of mortar joints is critical.



Many older buildings use unreinforced masonry construction, which is more vulnerable to seismic events.

## MORTAR

Historically, mortar was generally composed of a few ingredients: sand, lime, and water, and possibly additives such as animal hair or oyster shells. The mortar mix was selected to be softer than the adjacent masonry, allowing movement in the wall to damage the mortar rather than crack the brick or stone. Repointing is needed as the mortar wears over time. Eventually, a small amount of Portland cement was added into the mix to improve the workability and setting time. **Over time, the amount of Portland cement in mortar was increased, and it became more available in bagged mixes sold at hardware stores. However, modern Portland cement mixes tend to be too hard for most historic bricks and softer stone, causing damage when used for repairs or repointing.** (Refer to *Mortar Do's and Don't's*, page R5.2.) Soft and crumbling mortar or open joints/broken joint bonds are indications that the mortar is failing, and, if untreated, may cause building damage.

### KEY TIPS:

- Selectively repoint with compatible mortar (lime-based mortar for older brick) using joint profiles and mortar mixture to match the existing to minimize recurrences
- Consider full repointing with compatible mortar if deterioration is substantial
- Carefully remove deteriorated mortar to minimize adjacent masonry damage

## WALLS AND PIERS

Traditionally constructed of brick or stone and bonded by mortar, these elements carry the weight of interior walls, floors, and roofs. With structural masonry, they carry the weight of walls, floors, and roofs.

Signs of potential masonry problems include spalling, chipping, flaking, cracking, or crumbling of surfaces; loose or missing stones or bricks; pitted surface from sandblasting or pressure washing; or stucco removal.

### KEY TIPS:

- Replace incompatible mortar and match original mortar (refer to *Mortar*, at left)
- Patch missing or deteriorated stone and brick with compatible materials if area is isolated
- Consider substantial repairs or replacement with in-kind materials when deterioration is substantial
- Address damaged masonry surfaces to reduce moisture absorption
- Install diagonal bracing inside parapet walls
- Install tension anchors from masonry walls to roof and floor framing
- Periodically review adjacent materials and interior finishes for signs of moisture damage



Concrete blocks are structural masonry units typically covered in stucco or a masonry veneer, or painted. Reinforced blocks have poured concrete and steel rods connecting the individual units and is an approved foundation material for building elevations.

## CONCRETE MASONRY UNITS

Like bricks, concrete masonry units (CMUs), also known as concrete blocks, and cast stone units are formed structural elements. While concrete blocks are plain, cast stone units will often have specialty textures, shapes, or colors to mimic stones. Similar to stone and brick, cracks or pitted surfaces are signs of potential problems.

### KEY TIPS:

- Repair surface cracks, which can absorb moisture and increase exposure of reinforcing bars to moisture and corrosion
- Maintain stucco coating, if present, as a barrier to moisture entry



These cast stone blocks are made of concrete and formed to appear like stone.



Stucco-clad concrete retaining walls may serve as planting areas and/or stormwater barriers. (Refer to Walls and Fences, page R2.11.)



Surface cracking in concrete or masonry can provide an pathway for water to enter a wall.

## CONCRETE

Poured concrete walls and slabs may appear to be waterproof but concrete is a very porous material that can absorb water, particularly when exposed to water for extended periods, like during a flood. In addition, concrete may be vulnerable to seepage at transitions between structural members or between installation “pours.” The structural capacity of concrete to resist lateral and buoyancy forces is influenced by the thickness of the concrete, the size and condition of the reinforcing, the manner in which the building was constructed, and its condition.

### KEY TIPS:

- Repair surface cracks quickly to reduce the exposure of reinforcing bars to moisture and corrosion
- Apply an exterior wall sealer that will not discolor concrete to flood-vulnerable surfaces; apply a small test area and view after drying prior to applying to entire surface; and consult a professional as needed
- Install an under-slab sealer prior to installing a new slab on grade

## TERRA COTTA

Exterior terra cotta is typically a decorative element on a building. Similar to brick, terra cotta is made from clay that can be molded into a variety of shapes with different colors of glaze applied. The glaze acts as a protective layer to prevent moisture absorption. Terra cotta is usually attached to the wall with either mortar or metal anchors. When located along a building cornice, as is common, terra cotta is more exposed to the elements. Because it can be highly decorative, the formed, profiled shapes can hold water. Open joints, cracks in the glaze, or damaged sections of terra cotta material provide an opportunity for moisture absorption. The loss of mortar or the rusting of anchors could allow individual units to become airborne in high winds or detach in an earthquake.

### KEY TIPS:

- Verify terra cotta units are well anchored to building
- Clean surfaces with gentle detergents and water pressure
- Maintain mortar joints (*refer to Mortar, page R5.4*)
- Repair or renew deteriorated glazes
- Address small cracks and spalls with masonry coating and, if more severe, consider a replacement unit



Terra cotta is made of clay, cast in molds similar to brick, in a variety of decorative shapes and colors. Decorative terra cotta is usually non-structural.

## BRICK OR STONE VENEERS

Decorative masonry finishes can be applied as an outer layer over structural walls and can also imitate traditional materials. These include brick and stone veneers that are either a single layer of a material, or thin slices of the solid materials attached to the backup structure with mortar or metal anchors. Veneers were applied over an original exterior material that was deteriorating, or used to cover a design that was out of favor. Problem areas can be recognized from cracks in the surfaces, bulges, or peeling away from the wall.

### KEY TIPS:

- Verify brick and stone veneer is well-attached to wall to prevent it from becoming airborne, waterborne, or detaching during an earthquake
- Install anchors or grout to reattach veneer separating from backup structure
- Maintain mortar joints to prevent water entry and detachment of units
- Patch missing or deteriorated stone and brick with compatible materials if area is isolated
- Consider substantial repairs or replacement with in-kind materials when deterioration is substantial after completing necessary substrate repairs



Terra cotta can flake or spall allowing water and wind to penetrate into structural components.



Marble or granite veneers are often applied at the apron under storefront windows on commercial buildings.



A full-width brick veneer has been installed on this new poured concrete pier at a building elevation to mimic the original appearance.



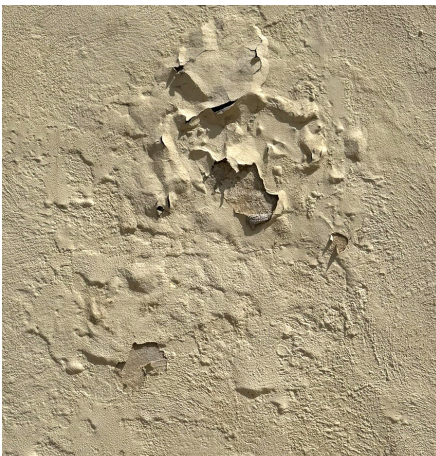
Stucco is a versatile material that can be coated with a color or have a scored finish coat to resemble masonry. It also serves as a protective coating for the underlying masonry or wood structure.

## STUCCO

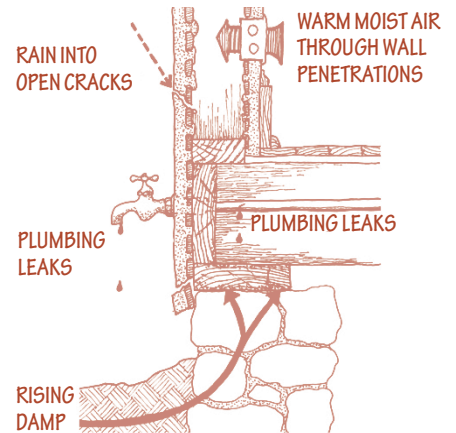
Stucco is made of similar materials to mortar and was traditionally applied in three coats: scratch, brown, and finish coats. This relatively inexpensive material can provide a more finished appearance to brick, stone, or wood-framed buildings. Stucco acts as a weather repellent coating, protecting the building from the elements including rain, sunlight, and wind; and can moderately increase fire resistance. Stucco can also provide an insulating layer to a wall by reducing the passage of air through small gaps.

### KEY TIPS:

- Consider patching with compatible stucco if the area of deterioration is isolated, typically a lime-based stucco for older buildings
- Consider replacement if deterioration is substantial
- Verify keying of stucco to mortar joints, lath or underlying substrate: if wall area moves when pushed, stucco is not bonded and should be secured or replaced with compatible material to avoid potential surface collapse
- Check adjacent materials for moisture trapped behind stucco surface



Moisture trapped in the wall is causing the acrylic paint to fail. Complete paint removal and application of a breathable coating may be required.



Stucco can be applied to masonry and wood-framed buildings. Moisture from a variety of sources can impact the condition of stucco as well as the underlying wood structure.



Some newer applications of stucco are intended to look like stone veneer. They are smeared on masonry and not keyed to joints or lath. Un-keyed stucco cracks easily and can peel away from the wall.

## MASONRY COATINGS

When a masonry surface is located in a vulnerable location or has been damaged by sandblasting or other means, it may not be able to withstand water exposure. In these cases, a breathable masonry coating or stucco may need to be applied to the surface. Lime wash is an example of a traditional masonry coating. Similar types of coatings are available today in a variety of colors. There are a number of newer coatings available, but many can trap moisture in a wall, causing deterioration.

### KEY TIPS:

- Consult the coating manufacturer’s information to complete required repairs and preparation prior to installing a coating
- Apply a “breathable” coating that will prevent moisture from entering, preferably a lime-based coating that allows vapor to escape and avoid coatings that trap moisture like acyclic paint ([Refer to Exterior Masonry Resources, page R5.12, Preservation Brief 1](#))
- Verify coating will not have a shiny appearance or discolor over time



Flood vents may be installed new, or in existing openings in a foundation if they meet design and spacing requirements.

## FLOOD OPENINGS

Floodwater can become trapped in crawlspaces and basements, placing lateral pressure on walls. Flood vents provide a way for floodwater to enter and exit interior spaces in a way that reduces lateral pressure. In existing buildings, crawlspace openings may also function as flood vents or manufactured flood vents can be installed. **Flood vents must be of sufficient size, number, and location to be able to quickly equalize interior and exterior water levels.** Any modification to, or covering of, flood openings such as louvers, screens, netting, or shrubs adjacent to foundations should be installed in a manner that does not impede the free flow of floodwater.

### KEY TIPS:

- Clear both sides of flood vents to ensure free flow of water in and out
- Install the recommended quantity of flood vents with the bottom within 12” of the ground to meet FEMA size and location requirements
- Consult an architect or engineer to verify flood vents function as required

### FEMA FLOOD OPENING REQUIREMENTS

There are specific criteria for flood vents for improvements that require local regulatory compliance. Per FEMA, every enclosed area is required to have at least two flood openings on exterior walls and additional openings based on the area that is enclosed. Flood openings should be installed in at least two sides of each enclosed area to decrease the chance that all openings will be blocked by floating debris and to allow for more even transfer of floodwater and decreased pressure.

## ARCHITECT OR ENGINEER CONSULTATION

Architects and structural engineers can provide specific guidance on how to address severe problems with masonry that impact its structural capacity. They can also make recommendations regarding the best way to retrofit a building for flood, wind, and earthquake resilience based upon its unique characteristics and conditions. During a consultation, they can make recommendations for projects that can be completed by a property owner as well as identify projects that might reduce hazards and insurance premium costs.

Some of the structural issues that would benefit from a consultation include:

- Multiple vertical and/or diagonal cracks
- Wide vertical and/or diagonal cracks
- Cracks that split individual bricks or stones
- Bows or bulges in wall plane or partial collapse of a wall
- Leaning walls or chimneys that may indicate differential or uneven foundation settlement or significant structural problems
- Concrete structure missing large chunks or reinforcing bars exposed and/or rusting

### KEY TIPS:

- Consult with a design professional for severe structural issues
- Consult with a design professional to identify building resiliency improvements



Consult with an architect or engineer for severe cracks or partial collapse of masonry walls.



## BAR

Refer to the BAR Jurisdiction Chart and Map or speak with City staff to determine if a property has additional permit or review requirements.

BAR Policy Statements:

- *Use of Mechanical Tools*
- *Piazza Enclosures*
- *Historic Materials Demolition*
- *Elevation Design Guidelines*

## HISTORIC PRESERVATION CONSIDERATIONS

Properties located in a historic district or design review district may require additional City review whether a permit is required or not. Contact the Permit Center, or the BAR or DRB staff, to speak with someone directly. Information provided below are best practices toward maintaining the historic character when making resiliency upgrades to masonry buildings.

### GENERAL MASONRY MAINTENANCE

- Remove algae, moss, vines and other vegetation from masonry and stucco with the gentlest means possible
- Remove or trim adjacent shrubs

- Avoid removing historic stucco from masonry surfaces, creating or maintaining the appearance of delaminated stucco, or exposing brick or unpainted concrete masonry units for decorative or aesthetic purposes

### MORTAR AND STUCCO

- Complete masonry and stucco work in fair weather
- Repoint mortar or stucco of the same hardness or softer than the original mortar or stucco; do not use premixed mortar or stucco
- Match the appearance, color, texture, pattern, joint size, and tooling of the historic mortar and stucco
- Repoint mortar in a single layer no greater than 3/8" deep at a time to minimize the potential for cracking
- Avoid widening or extending the existing mortar joints or overlapping the new mortar over the masonry surface
- Avoid destructive power tools and modern chemical additives
- Avoid installing stucco over brick, stone, or wood-framed buildings that were not intended to be stuccoed

### REPLACEMENT MASONRY

- Replace masonry that matches the historic in type, color, texture, size, shape, bonding pattern, and compressive strength; do not use modern masonry made to look old
- Replace masonry toothed into the existing to continue adjacent pattern

## EXTERIOR MASONRY IMPROVEMENT CHECKLIST

The Exterior Masonry Improvement Checklist on the following pages identifies maintenance information and related potential resilience improvements. Information on the relative costs, expertise, and vulnerabilities addressed are keyed with icons described at right.

**Level of Risk and Professional Help:** The Checklist identifies work that can be completed by property owners or tenants who are able to safely and comfortably use hand tools or power equipment, as needed. Any lifting, bending, or exertion beyond a person's abilities should be undertaken by professionals.

**Vulnerabilities:** The icons below are used throughout this guide. Completion of the proposed improvements can increase a building's resilience from the following vulnerabilities:

-  Flood
-  Wind
-  Earthquake
-  Heat
-  Good maintenance

**Cost:** The relative cost of the proposed improvement is denoted by symbols below. The cost will vary based on the conditions and extent of the impacted area.

- ¢ Minimal supplies under \$100
- \$ \$100-\$1,000
- \$\$ \$1,000-\$5,000
- \$\$\$ \$5,000 and above

**"Off-the-Shelf" Solution Available:** An item that is relatively available for purchase and easy to install by a property owner or contractor.



EXTERIOR MASONRY IMPROVEMENT CHECKLIST

<b>ACTION / PROJECT</b> <i>PERMITS: A building permit may be required for any of these suggested work items. Additionally, if the property is subject to review by the Board of Architectural Review or Design Review Board, additional reviews may be required. For any questions or concerns, contact the Permit Center.</i>	RESILIENCE BENEFIT	COST	DO-IT-YOURSELF	CONTRACTOR MAY BE REQUIRED	ARCHITECT OR ENGINEER MAY BE REQUIRED	"OFF-THE-SHELF" SOLUTION AVAILABLE
<b>MANAGING MOISTURE</b> <span style="float: right;">Page R5.3</span>						
<input type="checkbox"/> Verify that gutters and downspouts are clear and directing water away from the building, install splash blocks or downspout extensions if needed		¢-\$	●			●
<input type="checkbox"/> Manage vegetation close to a building and inspect for algae and/or mold behind vegetation		¢	●			
<input type="checkbox"/> Re-grade area adjacent to foundation		\$-\$-\$	●	●		
<input type="checkbox"/> Clean with low pressure water, gentle detergent, and natural bristle brushing; apply a non-toxic biocide as needed		¢-\$	●			●
<b>MORTAR</b> <span style="float: right;">Page R5.4</span>						
<input type="checkbox"/> Selectively repoint using compatible mortar		\$-\$-\$	●	●	●	
<input type="checkbox"/> Consider replacement if deterioration is substantial		\$-\$-\$-\$		●	●	
<b>WALLS AND PIERS</b> <span style="float: right;">Page R5.4</span>						
<input type="checkbox"/> Patch missing stone and brick with compatible materials		\$-\$-\$-\$	●	●		
<input type="checkbox"/> Consider replacement if deterioration is substantial		\$-\$-\$-\$		●	●	
<input type="checkbox"/> Install diagonal bracing inside parapet walls		\$-\$		●	●	
<input type="checkbox"/> Install tension anchors from masonry walls to roof and floor framing		\$-\$-\$-\$		●	●	
<b>CONCRETE MASONRY UNITS</b> <span style="float: right;">Page R5.5</span>						
<input type="checkbox"/> Repair surface cracks		\$-\$-\$	●	●		●
<input type="checkbox"/> Maintain stucco coating, if present, as a barrier to moisture entry		\$-\$-\$	●	●		●
<b>CONCRETE</b> <span style="float: right;">Page R5.5</span>						
<input type="checkbox"/> Repair surface cracks quickly		\$-\$-\$	●	●	●	●
<input type="checkbox"/> Apply wall sealer that will not discolor		\$-\$-\$	●	●	●	●
<input type="checkbox"/> Install an under-slab sealer at new slab-on-grade		\$-\$-\$-\$	●	●	●	

<b>ACTION / PROJECT</b> <i>PERMITS: A building permit may be required for any of these suggested work items. Additionally, if the property is subject to review by the Board of Architectural Review or Design Review Board, additional reviews may be required. For any questions or concerns, contact the Permit Center.</i>	RESILIENCE BENEFIT	COST	DO-IT-YOURSELF	CONTRACTOR MAY BE REQUIRED	ARCHITECT OR ENGINEER MAY BE REQUIRED	"OFF-THE-SHELF" SOLUTION AVAILABLE
<b>TERRA COTTA</b> <span style="float: right;">Page R5.6</span>						
<input type="checkbox"/> Clean surfaces		¢-\$\$	●	●		
<input type="checkbox"/> Maintain mortar joints and repair or renew deteriorated glazes		\$-\$\$		●	●	
<input type="checkbox"/> Address small cracks and spalls with masonry coating; if more severe consider a replacement unit		\$\$-\$\$\$		●	●	
<b>BRICK OR STONE VENEERS</b> <span style="float: right;">Page R5.6</span>						
<input type="checkbox"/> Verify veneer is well-attached to wall		¢-\$	●	●		
<input type="checkbox"/> Repair or reattach veneer		\$-\$\$\$		●		
<b>STUCCO</b> <span style="float: right;">Page R5.7</span>						
<input type="checkbox"/> Patch or replace with compatible stucco		\$-\$\$\$		●	●	
<input type="checkbox"/> Consider replacement for significant damage		\$-\$\$\$		●	●	
<input type="checkbox"/> Verify keying of stucco to substrate		\$-\$\$\$		●	●	
<input type="checkbox"/> Check for moisture trapped behind stucco		¢-\$		●		
<b>MASONRY COATINGS</b> <span style="float: right;">Page R5.7</span>						
<input type="checkbox"/> Complete required repairs and preparation prior to installing coating		¢-\$\$\$	●	●		
<input type="checkbox"/> Apply a "breathable" coating		\$-\$\$\$	●	●		●
<input type="checkbox"/> Select flat-finish coating that won't discolor		\$- \$\$	●	●	●	
<b>FLOOD OPENINGS</b> <span style="float: right;">Page R5.8</span>						
<input type="checkbox"/> Clear both sides of flood vents		¢	●			
<input type="checkbox"/> Install number and size of flood vents to meet FEMA requirements		\$-\$\$\$		●	●	
<input type="checkbox"/> Consult architect or engineer to verify flood vents function as required		\$			●	
<b>ARCHITECT OR ENGINEER CONSULTATION</b> <span style="float: right;">Page R5.8</span>						
<input type="checkbox"/> Consult architect or engineer for severe structural issues		\$			●	
<input type="checkbox"/> Consult architect or engineer to identify building resiliency improvements		\$			●	

## EXTERIOR MASONRY RESOURCES

### City of Seattle Emergency Management

Unreinforced Masonry Buildings

[seattle.gov](http://seattle.gov)

### Federal Emergency Management Administration

Requirements for Openings in Foundation Walls and Walls of Enclosures

[fema.gov](http://fema.gov)

### Historic England

Repairing Walls of an Older Home

Repointing Brick and Stone Walls

[historicengland.org.uk](http://historicengland.org.uk)

### National Park Service

A Glossary of Historic Masonry Deterioration Problems and Preservation Treatments

Preservation Brief 1: Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings

Preservation Brief 2: Repointing Mortar Joints in Historic Masonry Buildings

Preservation Brief 22: The Preservation and Repair of Historic Stucco

Preservation Brief 41: The Seismic Rehabilitation of Historic Buildings

[nps.gov](http://nps.gov)

### Old House Journal

Repairing Stucco by Steve Jordan

Repairing Structural Brickwork by Elizabeth Wheeler

[oldhouseonline.com/repairs-and-how-to](http://oldhouseonline.com/repairs-and-how-to)

### Old House Web

General Masonry Inspection

[oldhouseweb.com/how-to-advice](http://oldhouseweb.com/how-to-advice)

### U.S. Department of Housing and Urban Development

Residential Rehabilitation Inspection Guideline

[huduser.gov](http://huduser.gov)



### REGULATIONS TO REVIEW

- International Existing Building Code
- ASCE 24-14 Flood Resistant Design and Construction
- South Carolina Building Code
- South Carolina Residential Code
- City of Charleston Code of Ordinances
- City of Charleston Flood Hazard Prevention and Control Ordinance

*This is not a comprehensive list and is intended only to provide additional resources to consider when planning a project. Contact the Permit Center for detailed information.*

#### City of Charleston Permit Center

2 George Street, Ground Floor

Charleston, SC 29401

843.577.5550

[permits@charleston-sc.gov](mailto:permits@charleston-sc.gov)