
MICHIGAN HISTORIC
PRESERVATION NETWORK


NO "HEADLESS" CRAFTSMEN
BUILDING RENOVATION LLC.


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BUILDING RENOVATION LLC.
Teaching the art of lasting restoration


CITY OF
GRAND
RAPIDS


MIDTOWN
CRAFTSMEN

A General Guide For:
Appropriate Materials and Methods for Re-pointing Historic Masonry Buildings.

Grand Rapids Historic District Commission

October 18th, 2025

Presented By: Blair E. Bates, Building Renovation, LLC

Who is Building Renovation LLC

- Instructors background.
  - NCCC
  - Buffalo State Univ.
  - Restoration Engineering.
  - Restoration Construction.
  - Book worm.
  - Teaching.
- What's this headless craftsman meaning?

What is the meaning of “no headless craftsman”

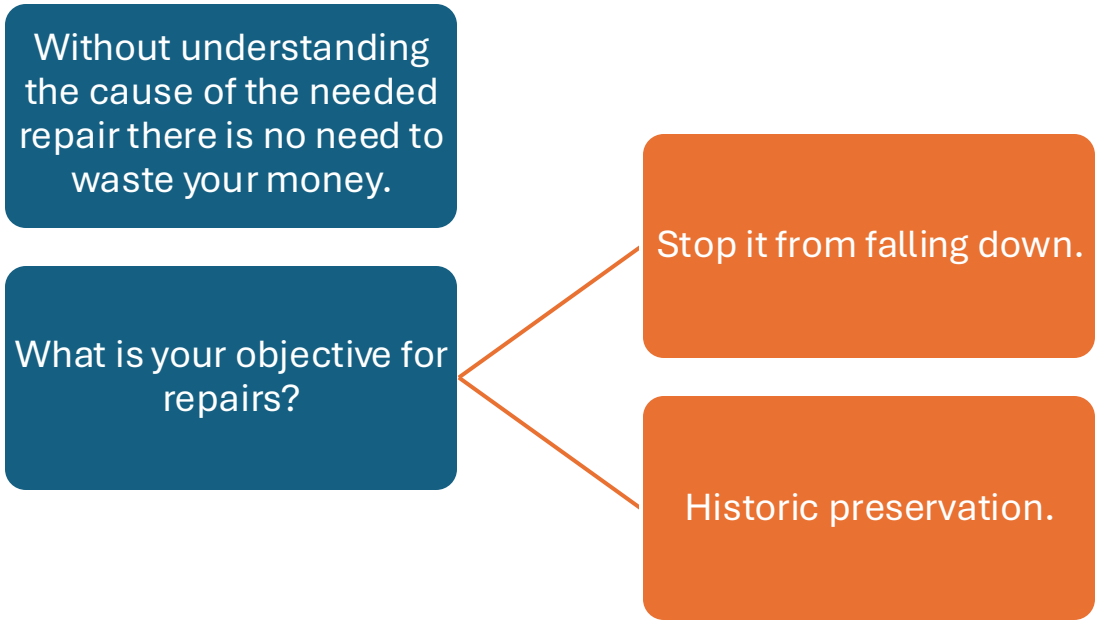
- Audell's 4 year
- Apprentice program
- Restoration training

Let’s Mix some mud

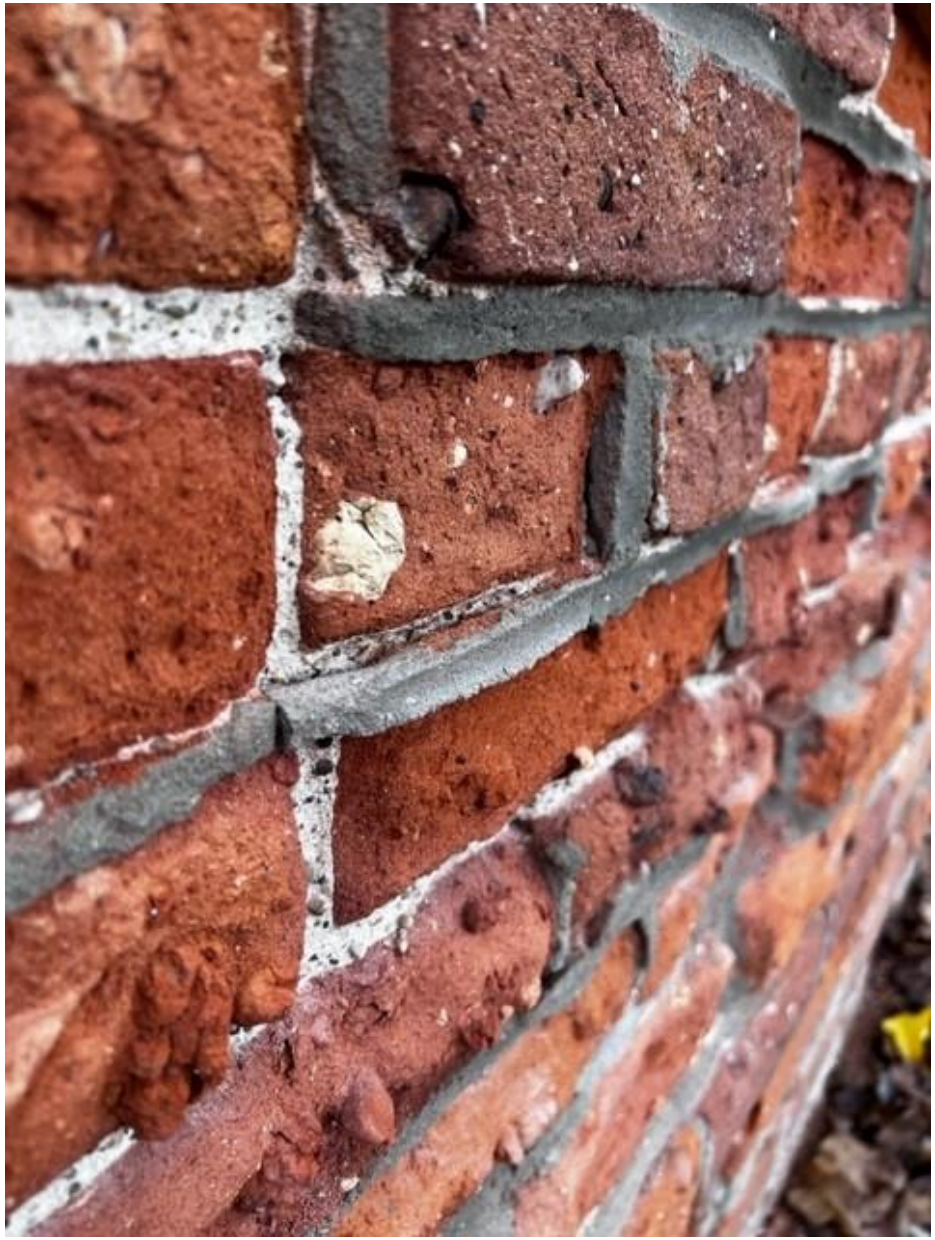
Examples of Poor work Regional

- Coldwater

A study of cause and effect focusing on what has caused the need for repairs.



Kalamazoo



Kalamazoo

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Grand Rapids

Marshall

Learning objectives

1

Learn the true definition of repointing.

2

Understand the difference between historic mortars and new mortars.

3

Understand specification requirements for;

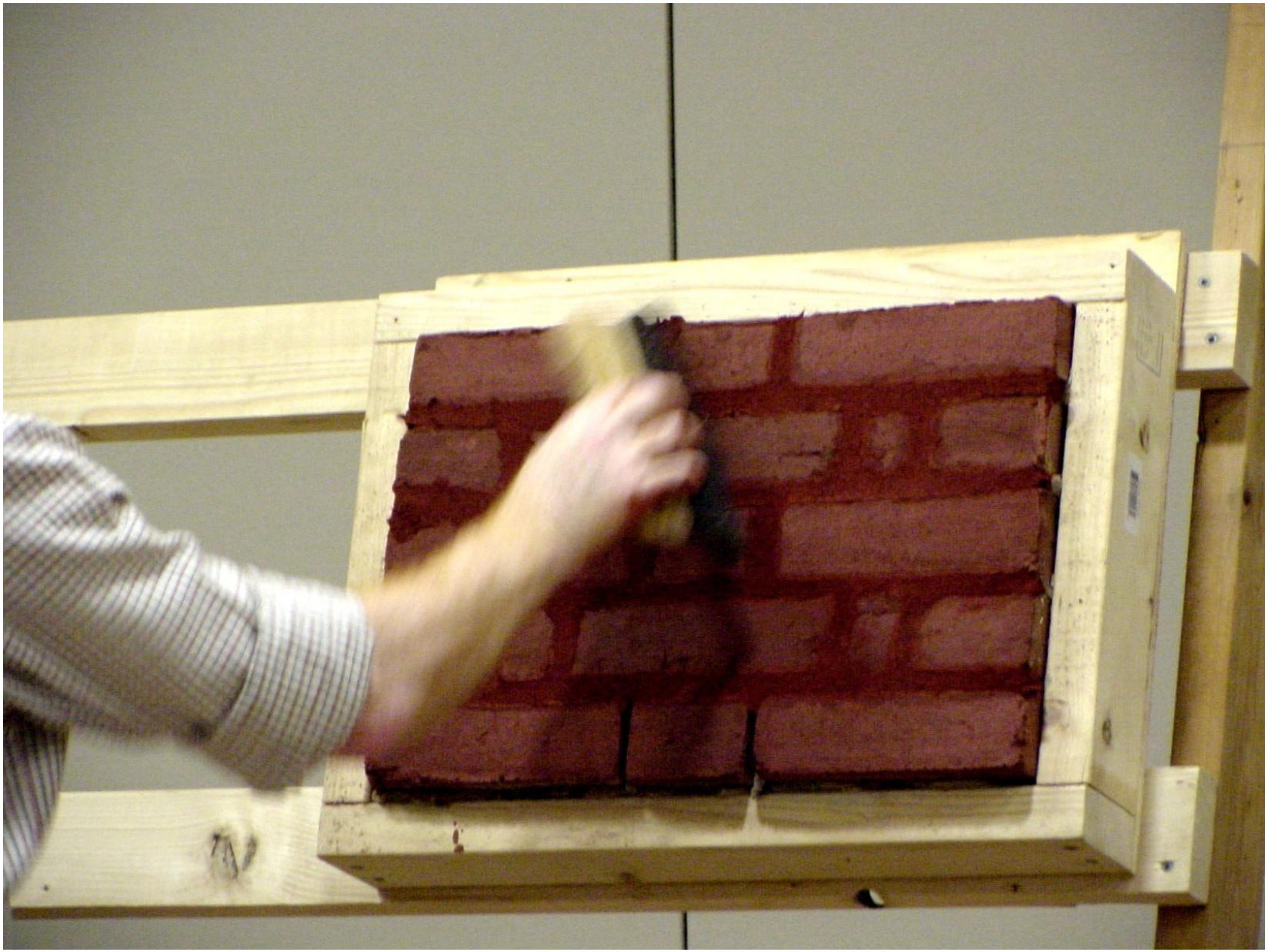
- Durability
- Visual acceptance

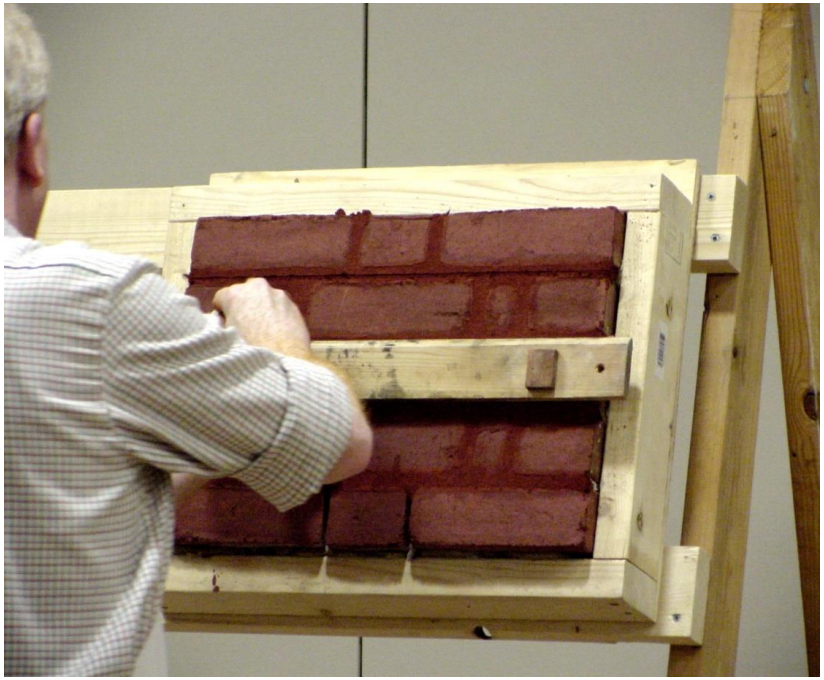
So, why fix it?

So, what is this actually called? Is it Kleenex or tissue paper

- Pointing
- Flushing out
- Fixin da holes
- Re-mortaring
- Re-pointing
- Tuck Pointing

What really is Tuck-pointing



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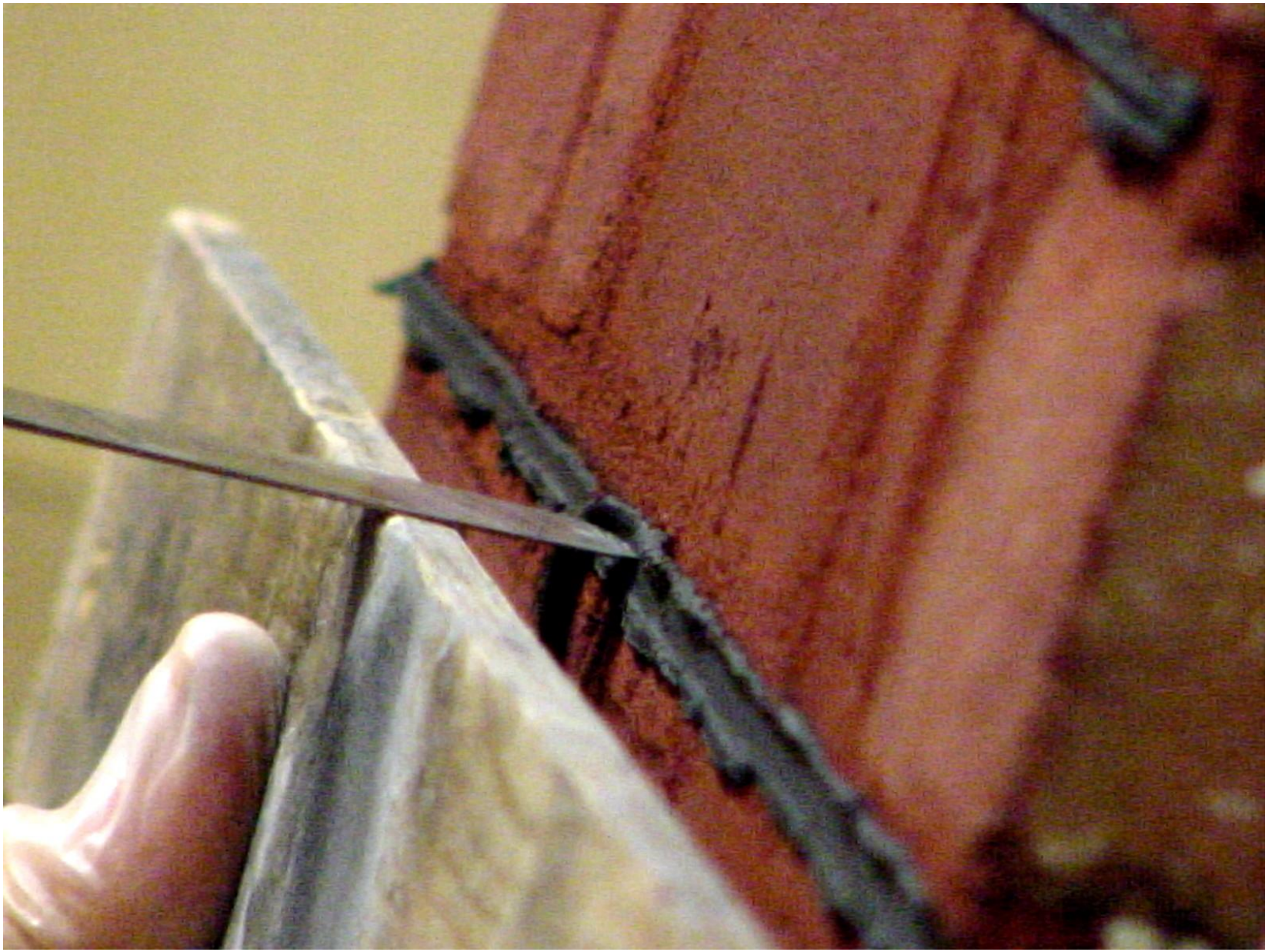
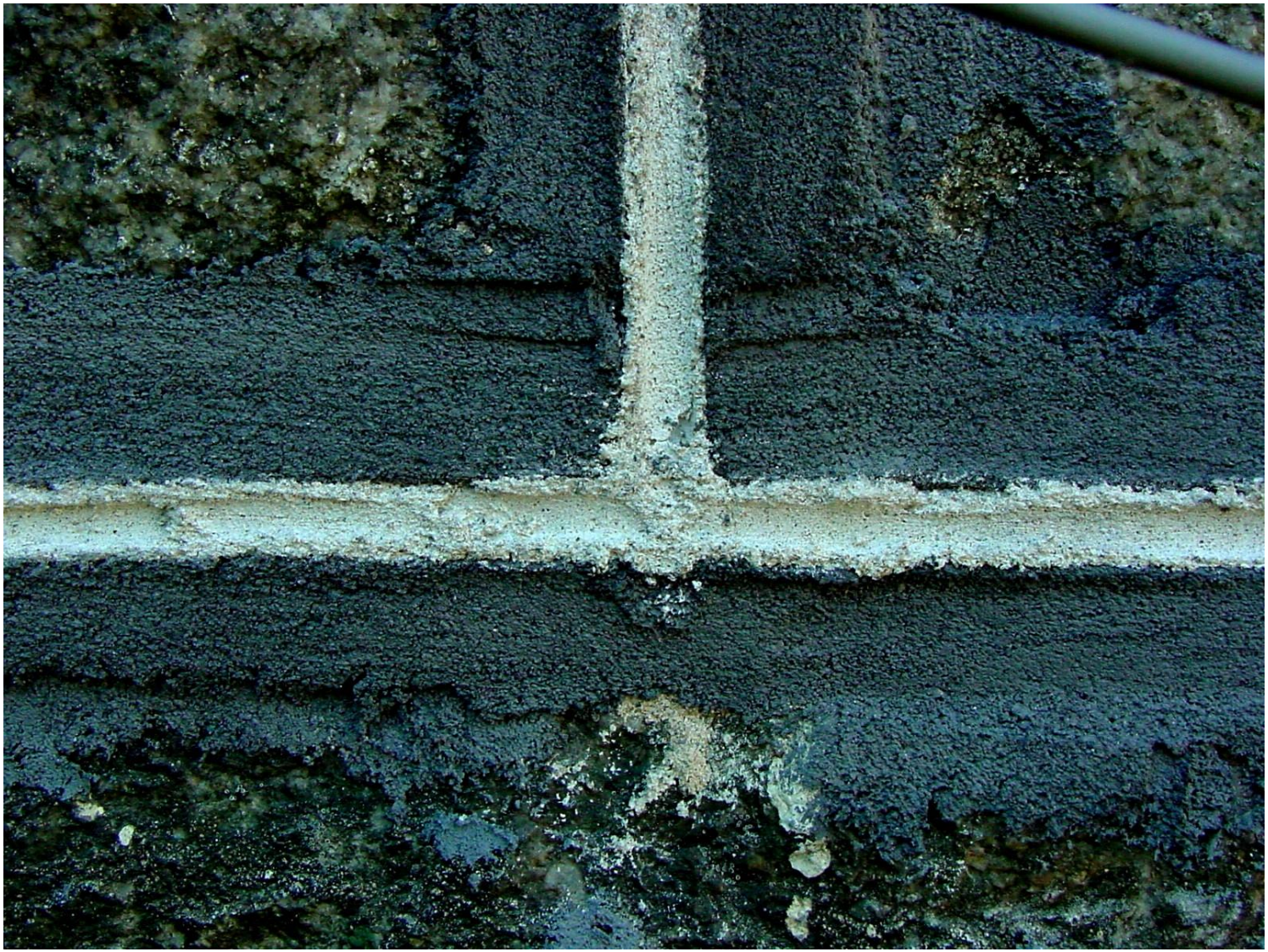


Flushing out vs. Tuck pointing

Tuck Pointing on stone



Or Stencil Pointing

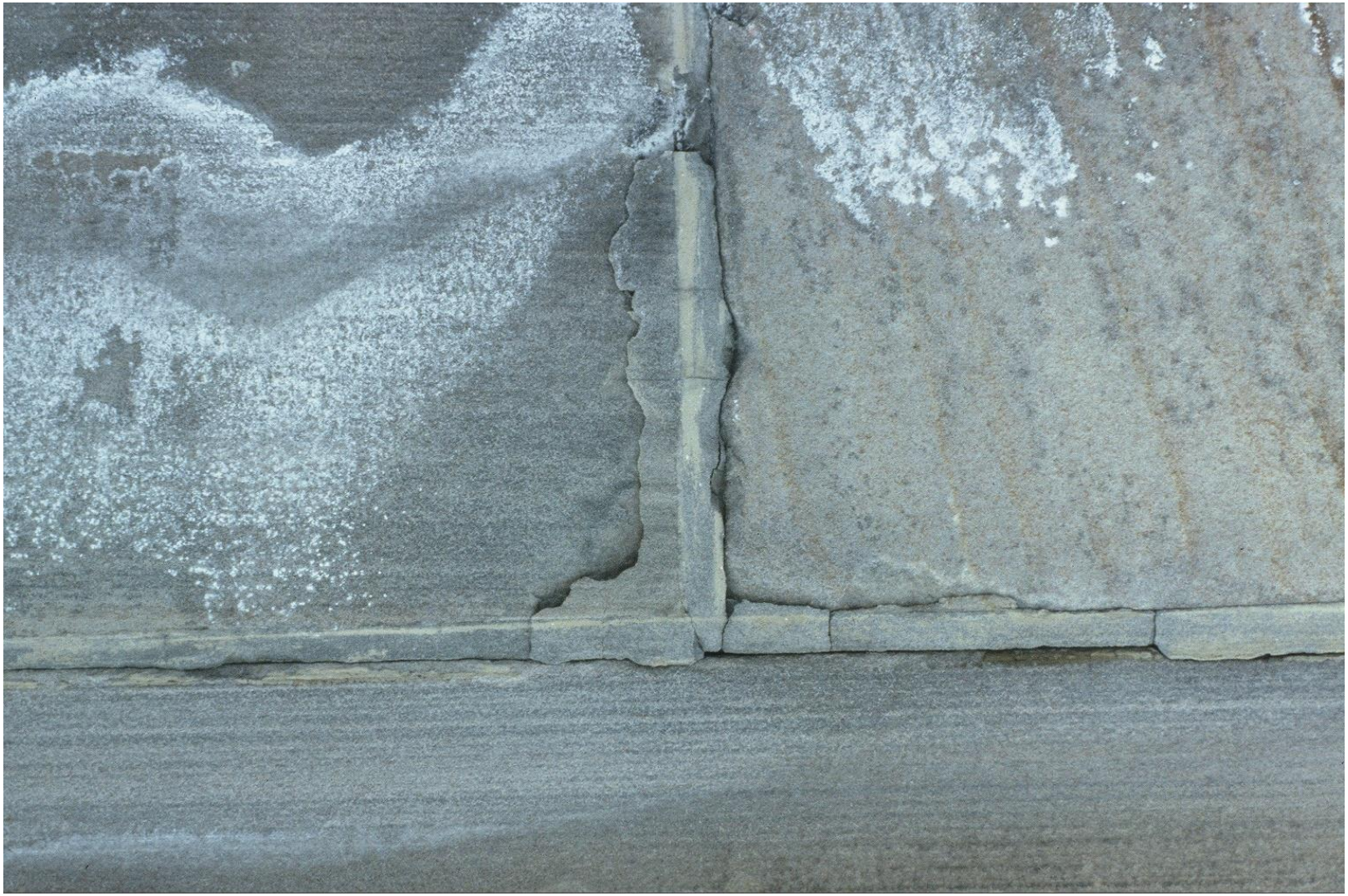
Durable Masonry Mortar Restoration

Selecting a I thru IV grade repair

Durable Masonry Mortar Restoration

Mortar Destroys Brick Masonry

THE WRONG Mortar Destroys Stone Masonry



The wrong Mortar Destroys History

Repair mortar destroys late 1700's hydraulic mortar

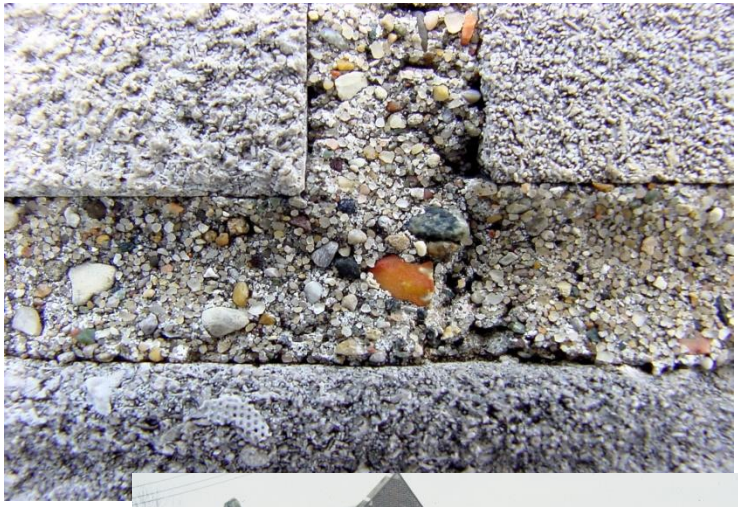
Why are we doing this mortar repair in the first place?

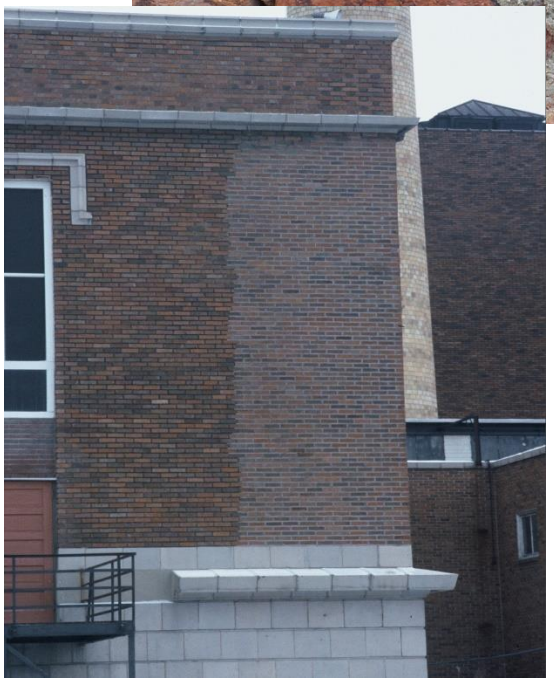
- Looks
- Leaks
- Deterioration
- Preservation
- Preventative maintenance
  - Are you addressing the cause or just the effect?

The Owners Questionnaire:

- Cost effective VS durability
  - Be proactive or reactive to the buildings needed repairs.
  - A number of bids can easily be prepared by the same contractor for a grade I,II,III or IV performance.

Visual Acceptance;





Visual Acceptance:

- At what minimum distance from the repair do you want to see that it has not blended in?
  - I. Not at any distance.
  - II. 2 feet.
  - III. 5 feet.
  - IV. 25 feet.
  - IV+ 100 yards.

2 Feet

- Re-pointing mortar on the right side of the bed joint has utilized no coarse aggregate to help match in “color, texture, porosity and compressive strength”

25 Feet to 100 Yards

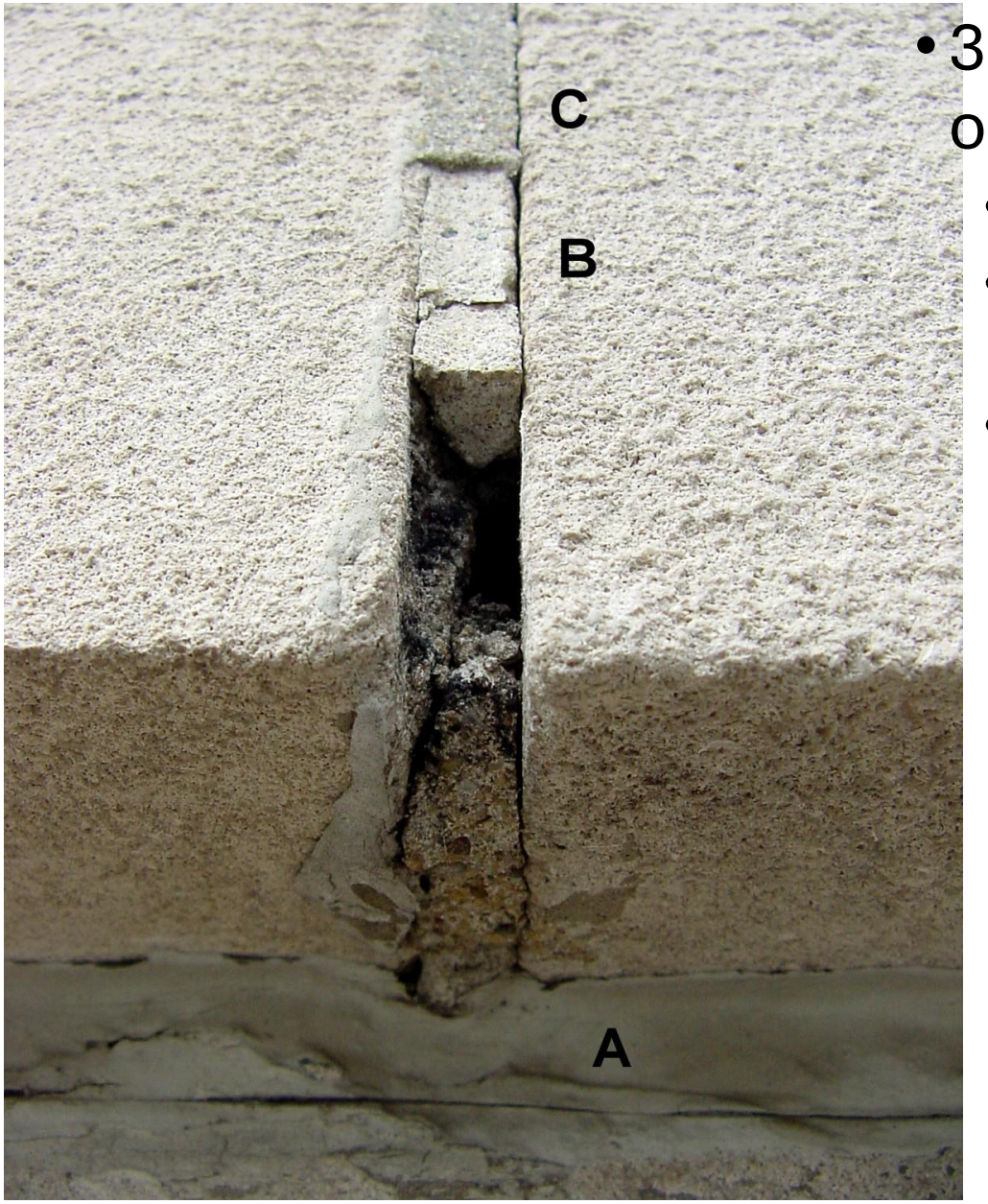
- Mortar was placed at a ½” wide finished joint surface. Original was at a 3/8” to ¼” width.
- Minimal coarse aggregate.
- Grey cement.

100 Yards

100 Yards

1910 Construction

- Mortar extruded out beyond the brick face.
- No coarse aggregate in the mix.
- Light amount of grey Portland cement used.



- 3 pointing methods in one joint:
  - A. Caulk
  - B. White silica sand w/ white Portland cement
  - C. Painted on sand cement Latex slurry

Installation, Compaction & Dry Brush

Acid Wash to Weather In ?

The Original

The Replica

The Replica

What are we trying to match?

- Color of the mortar prior to cleaning.
- Color of the mortar after cleaning.

Durability Acceptance:

- What is the life expectancy of the repair mortar
  - IV+. One year?
  - IV. Two year?
  - III. Five year?
  - II. Twenty-five year?
  - I. As long as the original mortar has lasted? Yes like 100 or more years…

Durability Acceptance:

- **System requirements**
  - **Mortar requirements**
  - **Brick requirements**

Durability Acceptance:

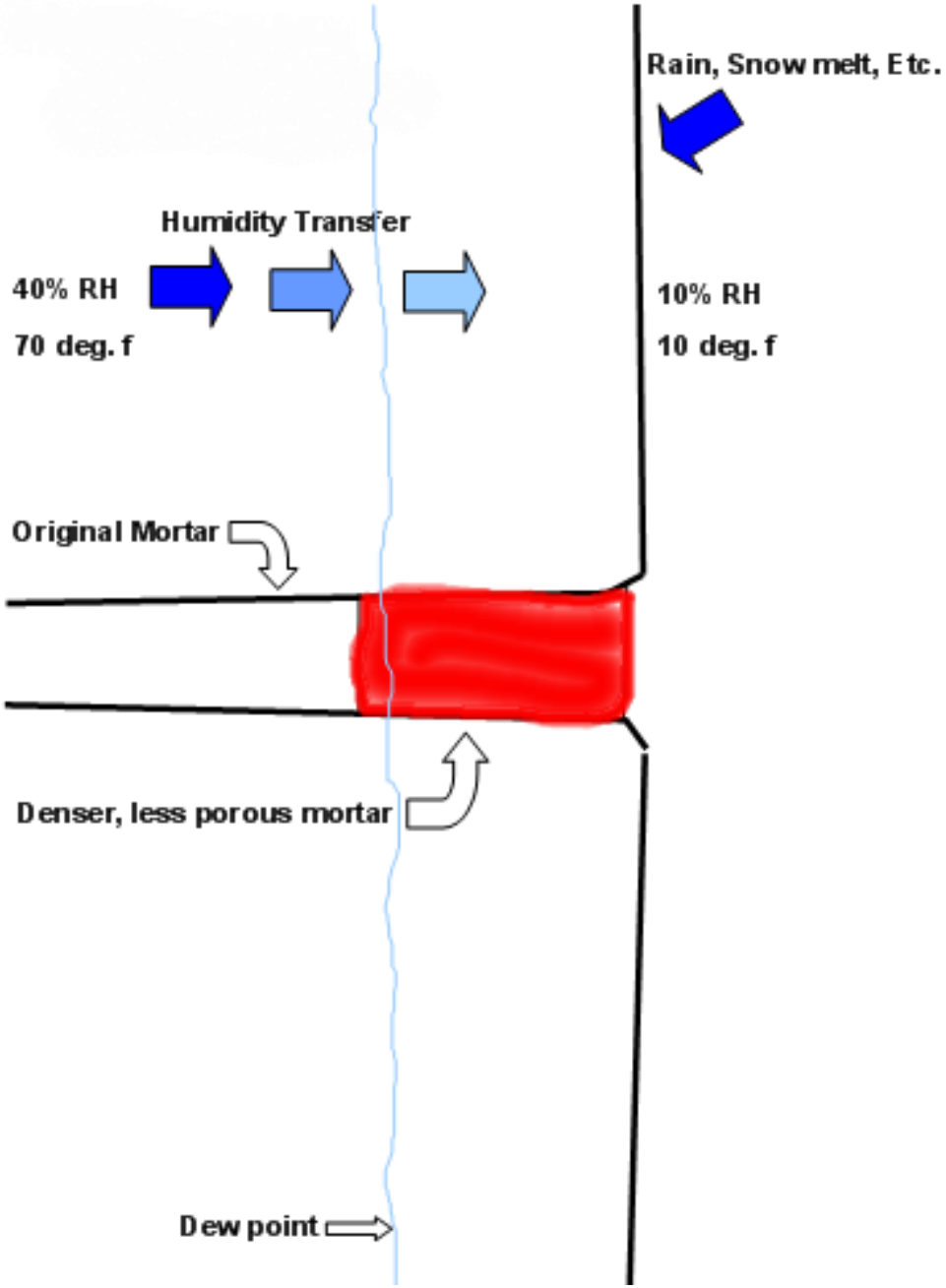
- **System requirements;**
  - Compressive strength less than or equal to surrounding mortar.
  - Porosity greater than or equal to surrounding brick and mortar.
  - Compressive strength less than or equal to surrounding brick.

- Mortar is still in good shape. However, it has severely accelerated the deterioration of the stone.

Original mortar condition

- Re-pointing mortar is still in good shape. However, it has severely accelerated the deterioration of the brick.

120 Yr. Old Brick 2 Years after Re-pointing


Rain, Snow melt, Etc.
Humidity Transfer
40% RH
70 deg. f
10% RH
10 deg. f
Original Mortar
Denser, less porous mortar
Dew point

What makes a mortar different if the sample mix design is approved as compatible.

- Different field mixing
- Placed in too wet or dry of a void prior to compaction
- Initial compaction
- Final compaction

Procedure % Time Required

1) Remove deteriorated mortar to required depth (Saw & chisel)	• 30%	30%
2) Air blast	• 2%	
3) Determination of extent	• 10%	
4) Re-work if required	• 15%	
5) Air blast or extract	• 2%	
6) Water soak	• 4%	4%
7) Pre-wet	• 2%	
8) Deliver mortar to the void	• 5%	5%
9) Strike back	• 5%	5%
10)Cut back	• 6%	
11)Wait for set	• 5%	
12)Dry brush compact	• 2%	
13)Pre-wet	• 6%	
14)Weathering wash	• 3%	
	• 100%	45%

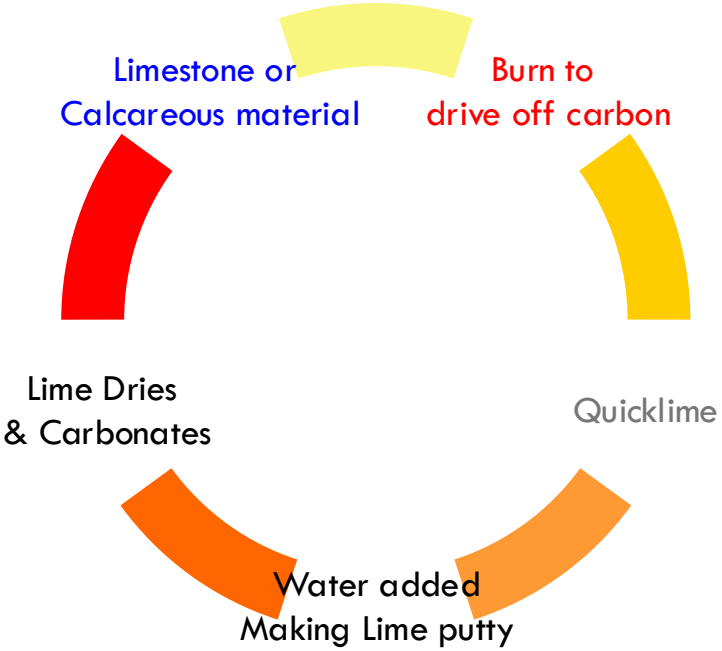
1700’s and still standing strong

Easy to Acquire pre-blended mortar

Lime: what do we mean?

- Quicklime
- Slaked lime
- Hydrated lime
- Lime putty
- Masons lime
- Autoclaved lime
- Agricultural lime

The Lime Cycle



Burning off to make Quicklime 1800 deg. f

Traditional lime production

Limestone was burned with wood or charcoal

- Fuel and stones were layered, then slowly heated and held at temperature for a period
- The end result was lump lime or quicklime
- $CaCO_3 + H_2O + heat = CaO$

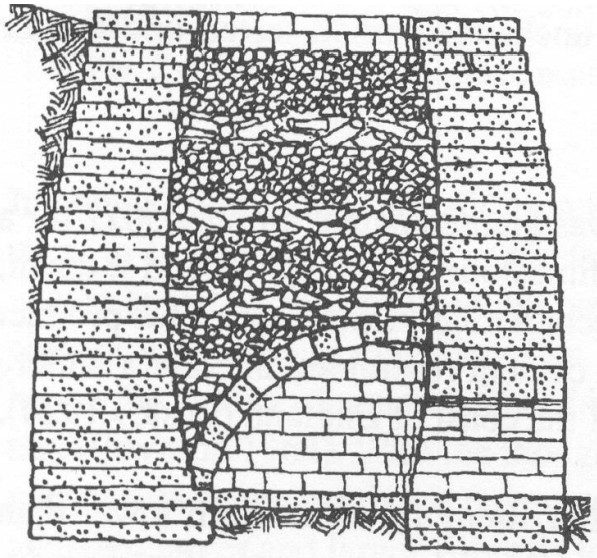


Fig. 3 Lime Kilns 1825.
Common type, built into a hillside. Often lined with firebrick in the 19th century. Sometimes wood or coal and lumps of limestone were placed in alternate layers, as shown here; other times fuel was burned only at the bottom (McKee 1973).

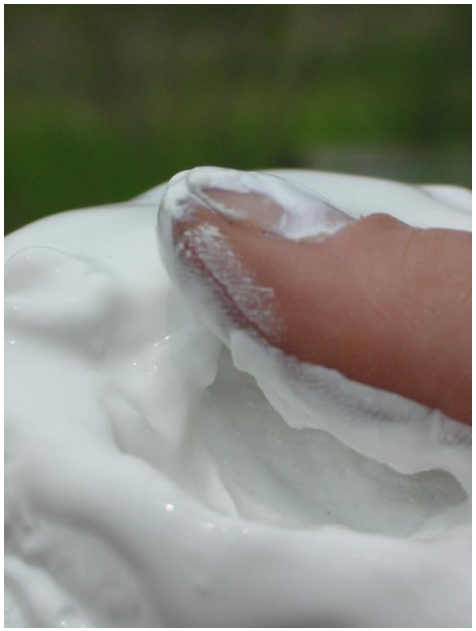
Slaked lime

- To slake lime we add water to quicklime, start the process of returning the quicklime to limestone
- $CaO + H2O = Ca(OH)$
- All the heat that was pumped into the quicklime when it was burned starts to come out, sometimes violently

Slaking “hydrates” the lime

- If we add just enough water, we can break the lump lime down into a dry powder
- This is what we get with “masons lime”
- The release of heat actually makes the water boil to 350 deg. f

Adding More Water Creates Lime Putty



- The older it is the smoother it is.
- Romans preferred to use only three year aged putty when using putty in fresco work.

Sand + lime putty = mortar

- That's it! Traditional mortar. Simple.

The final step in the cycle

- As the mortar dries, carbon dioxide is drawn in (slow process)
- $Ca(OH) + CO2 = CaCO3$
- The lime binds the sand in the mortar into an artificial sandstone with calcite binder.
- In dry condition this process takes an inch per year.

Evolution of modern mortar

- Portland cement became widely available end of the 1800's
- Increased strength and weathering resistance of mortar
- Lead to a sometimes unhealthy emphasis on strength to detriment of other desirable properties
- Modern masonry cements and mortars usually contain no lime

Portland Cement Mortars

- Portland cement Type I,IA,II,lll,lV,V
- Since 2023 it is now 1L
- Color makes a difference: **GRAY** or **WHITE** By varying the ratio of Portland cement and lime, we can modify the mortar properties, create different types
- Masonry cement Type M,S,N,O,K,L

  MASONS WORK L

Building Code vs Historic Preservation Requirements

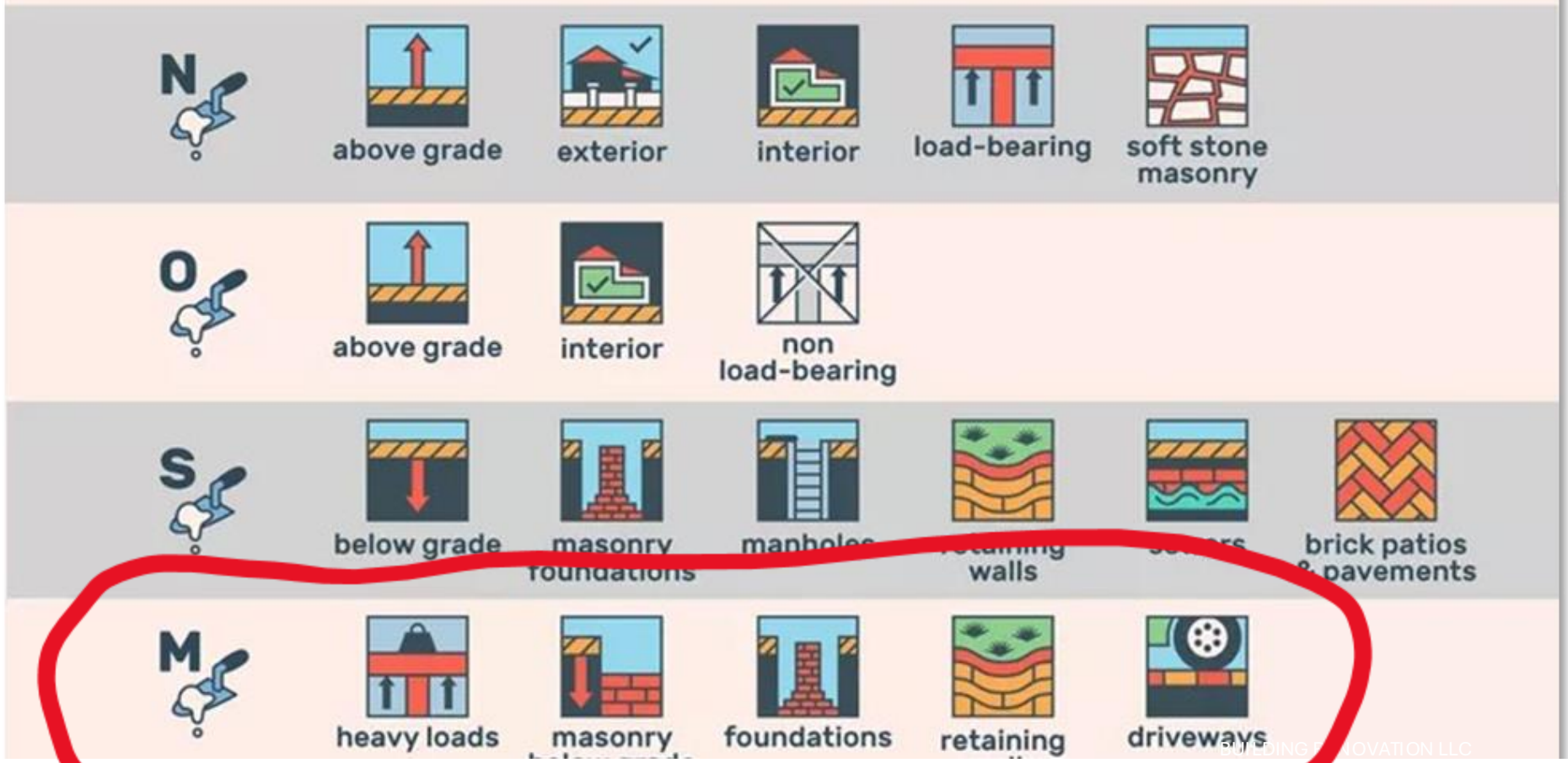
- Building codes generally specify mortar types as referenced in **ASTM C 270**, Standard Specification for Mortar for Unit Masonry (ref. 4f). Four mortar types, M, S, N and O are included in this standard. However, Types M, S, and N are typically required by building codes.

Mortar mix Designs Not a Recipe!

1900	A		B		C		D		E	

1930’s	M	A	S	O	N	W	O	R	K	L

How to Choose the Right Mortar Mix Type



a letter. The most common are Type S, N, M, O & K.

Mortar	 TYPE S	 TYPE N	 TYPE S	 TYPE M	 TYPE O	TYPE K
	STRUCTURAL	NON-LOAD BEARING	VENEER	MMERCIAL	INDOORS	RESTORATION
Attributes	• Structural block, brick and stone • High workability • Above or below grade	• Non-structural veneer • Workability • Above grade only	• Better for scratch coats, bond coats and joints • Above grade only	• Extremely strong • Too hard for most repair work • Below grade	• Non structural • Used indoors • Great for repointing and repair work	• Used for historical restoration • Soft enough to use on old brick and stone
Strengths	• 1800 psi at 28 days	• 750 psi at 28 days	• 1800 psi at 28 days	• 2500 psi at 28 days	• 350 psi at 28 days	• 75 psi at 28 days
ASTM	Type S	Type N	Type S	Type M	Type O	Type K
Application						
Structural Block Walls	•			•		
Brick Veneer	•	•	•			
Tuck Point Mortar Joints	•	•	•		•	•
Manufactured Veneer Stone	•					
Dry Stack Veneer Stone					•	•
Natural Stone	•					
Barbeques / Planters		•	•	•		
Parge Coats	•					
Columns / Pillars	•			•		
Block Foundations	•			•		

The above chart shows some the most common mortar mixes along with their attributes, strengths and applications

Mortar Mixes

Portland Cement Rigid/Quick Cure

	M	A	S	O	N	W	O	R	K	L
Ratio PC:L	3:1		2:1		1:1		1:2		1:3	100% Lime
Total Parts BONDING AGENT	3+1=4		2+1=3		1+1=2		1+2=3		1+3=4	1
Total Parts Sand- AGGREGATE	4x3=12		3x3=9		2x3=6		3x3=9		4x3=12	1x3=3

Lime Flexible/Long Cure Time

Examples: 3parts Portland Cement + 1part Lime + 12parts Sand = **M** mortar

1part Portland Cement + 2parts Lime + 9cparts Sand = **O** mortar

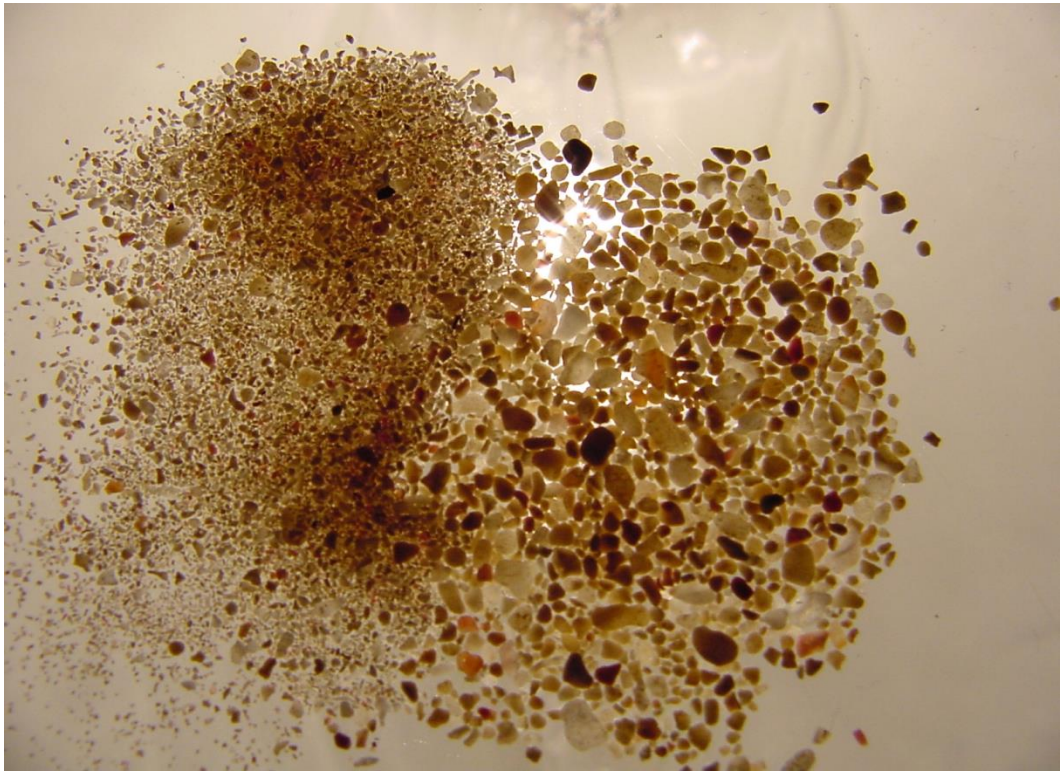
How much binder do I need?

Void Ratio

Let’s mix more mud.

Sand is 75% of the volume, has a big effect on character and color

- Masons
- Coarse
- Dirty
- Silica
- Gradation
- Sizing

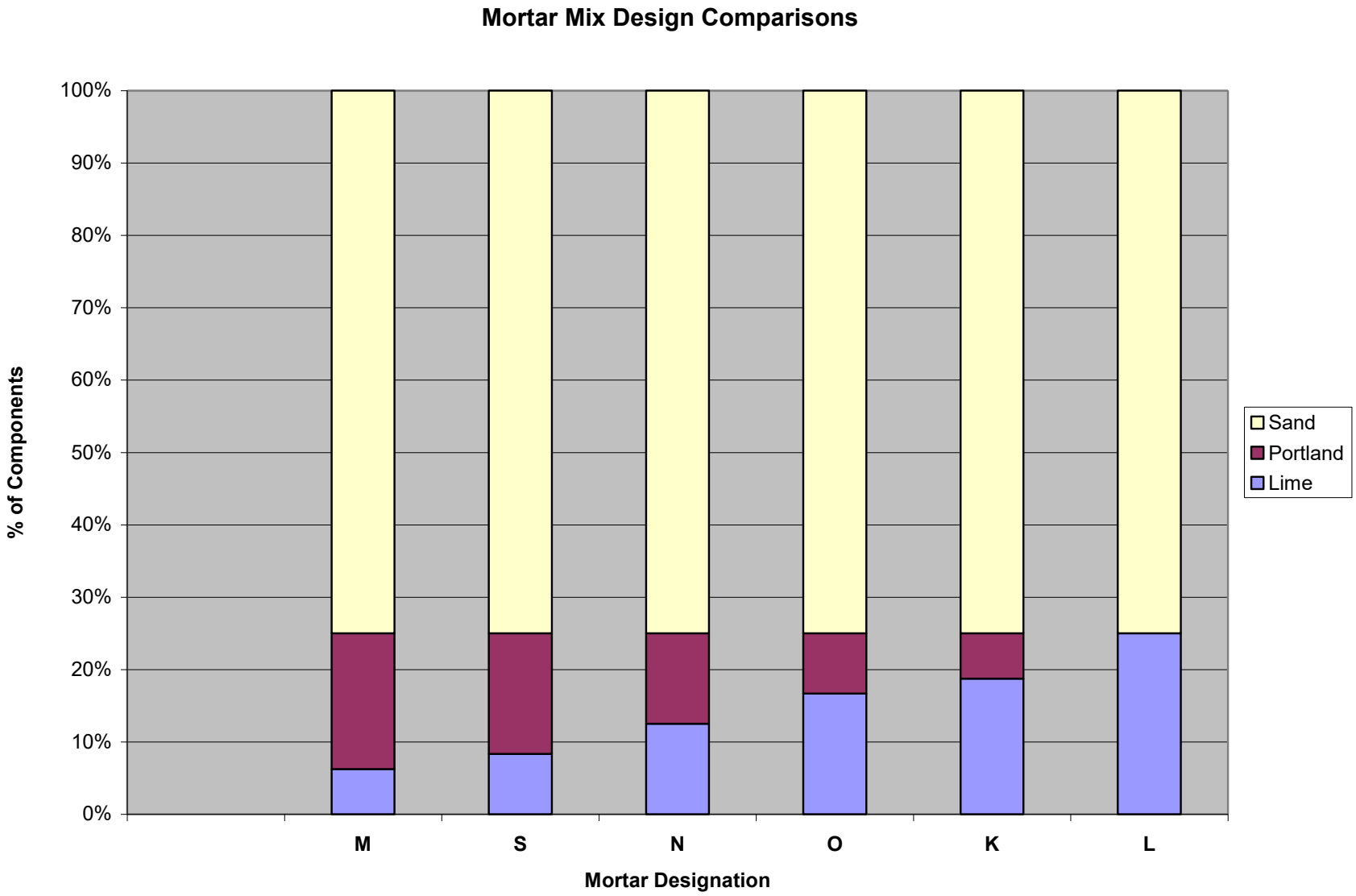


Exposing sand adds depth to mortar appearance

- Removing paste from the surface of joints allows sand grains to show through

Finish cleaning or weathering

- Water wash and scrub
- Acid mist
- Rinse
- Dry


Mortar Mix Design Comparisons
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% of Components
M
S
N
O
K
L
Mortar Designation
Sand
Portland
Lime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Confused Yet?

Your Concerns