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How To Spot Distress In Masonry Structures

Masonry is a broadly defined term, covering a variety of exterior building materials, including but not limited to brick, limestone, stone, clay tile, concrete block, precast concrete and terra cotta.Each of these building materials has individual features like form, color, composition, strength and utility, while sharing some basic traits in construction and destruction.

The ability of any masonry wall to withstand deterioration is a function of the interaction of the original design, the quality of construction, and continuing maintenance, especially for water entry problems. Quick remedies, the band-aid approach, seldom solve water problems, and in fact, frequently aggravate them by sealing moisture within the wall system. The *cause* of the problem must be found and resolved.

What follows is a two part checklist to help you evaluate the extent of distress in masonry buildings. First, you must gain an overall impression of the building, from the type of building materials used to obvious weak points or glaring problems that are easily discernible, even to the untrained eye. The second section of our checklist suggests ways to spot common problems before they become critical.

GAINING AN OVERALL IMPRESSION

1. Review any existing construction documents
2. Determine the building's age
3. Note the condition and extent of previous repairs that are indicative of previous or possibly, existing conditions
4. Determine, whenever possible the construction method
   - A. Solid brick masonry wall , generally found in older structures
   - B. Brick masonry veneer over, and in contact with, concrete masonry units (CMU) , or structural clay tile
   - C. Brick masonry with a gap or cavity between it and the back-up construction
   - D. Reinforced brick masonry, with rebar cast into a grout-filled cavity
   - E. Masonry bonded wall, with bricks at intermittent spacing which are turned 90 degrees to the normal coursing, used to tie two wythes of brick together
   - F. Brick masonry facing over metal stud and gypsum wall

With this information in hand,consider the following compendium of common masonry problems and possible causes. Causes will vary with the type of construction. The following information is necessarily "broad brush" and is not intended to replace, but rather to supplement , professional diagnosis of your building's condition.

INSPECTION POINTS FOR MASONRY BUILDINGS

INTERIOR OF PERIMETER WALLS Water stains around windows, peeling or flaking paint on perimeter walls
PARAPET WALLS AND PARAPET CAP Openings in parapet cap joints, cracks or holes in the parapet walls
ROOF FLASHING Holes or cracks in the flashing
WINDOW SEALANT Cracked or open perimeter sealant; broken window putty or loose glazing gaskets
WINDOW LINTELS Rusting or sagging metal lintels (These are the main support for the masonry units above the window)
WINDOW MULLIONS AND SILLS Cracked or spalled masonry units
BUILDING CORNERS Vertical cracks close to each side
MASONRY WALLS Cracks near window openings and/or walls
MASONRY FACES Surface spalling; Efflorescence; Air pollution (check for stained, dirty surfaces, which tend to collect and hold deteriorating chemicals such as salt and acid rain.)
MORTAR JOINTS Deterioration, or shrinkage-cracking
EXPANSION JOINTS Dryness or deterioration (these joints allow wall movement and prevent moisture infiltration)
SHELF ANGLES Rusting angles

WATER INTRUSION

APPEARANCE

Efflorescence, a white, dusty appearance on the brick surface;
Areas of abnormal wetness that can be observed after precipitation;
Moss growing on masonry surfaces.

CAUSES

Look for water intrusion at a point above the surface condition

- Bond failure at mortar joints
- Adhesive failure of sealants
- Improperly struck mortar
- Loose or missing mortar
- Lack of, or plugged, weep holes
- Lack of, or improperly installed, flashing

BULGING OR OUT-OF-PLUMB WALLS

APPEARANCE

Perceptible bowing of the masonry veneer in either horizontal or vertical planes

CAUSES

Vertical Bowing

- Failing relieving angles
- Lack of soft joints below relieving angles
- Wall tie failure
- Use of open cell insulation
- Settlement of walls - growth of masonry

Horizontal Bowing

- Insufficient vertical expansion joints
- Failure of wall ties
- Use of open cell insulation that absorbed water, dislodging masonry through freeze/thaw cycles

CRACKS IN MASONRY AT BUILDING CORNERS

APPEARANCE

- Vertical cracks or dislocation of brick at building corners
- Cracks at a regular spacing along building facades

CAUSES

- Discontinuity of relieving angles at all columns and spacing and deteriorated condition of wall ties in these locations
- Insufficient vertical soft joints

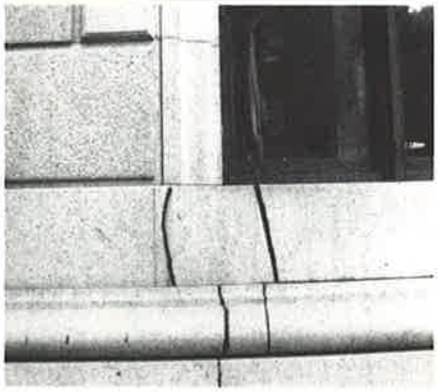
SEEMINGLY RANDOM CRACKS

APPEARANCE

- Cracks traveling in a combination of vertical and horizontal directions, but always following the mortar joint
- Cracks running uninterrupted through the mortar and the masonry

CAUSES

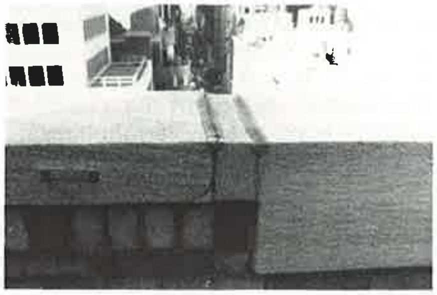
- Uneven settlement
- Failure of relieving angles
- Horizontal displacement of walls



Cracks in window sill

Surface spalling of concrete in parking garage

Cracked window sealant



Cracks in parapet cap

Of Time and Motion

By Walter E. Damuck, AIA

Forget about an airplane flying into your building, or earthquakes, or fire, bombs, tornadoes or war damage. There's very little that can be done to preclude these extrinsic destructive forces.

Out of the baker's dozen of primary factors contributing to premature building decay, only 31% are products of nature: 1) Air, especially the oxygen in it; 2) Temperature, in extremes and fluctuation; 3) Wind, with its pressures and suctions; and, 4) Water. The three most important of these are water, water and water.

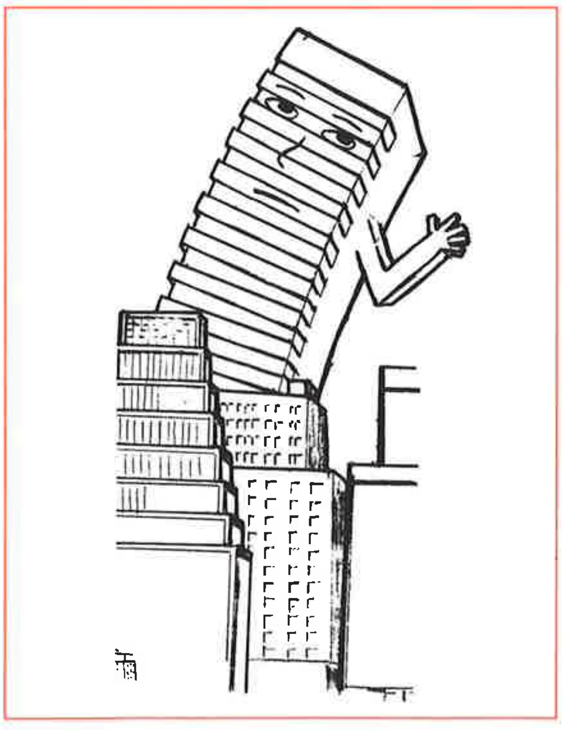
The other 69% of destructive factors originate with homo sapiens (man, woman and child, maybe even teenagers). Sad but true. Sad, because the exercise of only a little more judgement and care can prevent the more than one billion dollars a year that property owners are paying for human fallibility. The human contributions are: 1) Design deficiencies; 2) Poor materials selection; 3) Improper construction; 4) Deferred maintenance (be honest, say neglect); 5) Applied forces; 6) Weight; 7) Vibrations; 8) Pollution; and, 9) Vandalism.

BRICK

Let's first consider brick, one of the basic masonry materials that includes clay tile, adobe and terra cotta. In modern manufacturing, brick ware shrinks about 8% in size in the kiln. As soon as it is put into use, the brick is trying very hard, by absorbing moisture, to regain some of the volume it lost. Brick continues to grow in size after being laid into a wall. This growth is irreversible! A 30 foot long brick wall is expected to grow about 0.02% (0.0002), or about 5/64 of an inch (2mm) over a period of time. Thermal growth, on the other hand, is reversible and can amount to as much as 1/8 inch (3mm) over a 100 degree Fahrenheit (38C) temperature differential. Consideration must be given in design and material selection to take care of this growth and movement.

Lime-rich mortars, which are softer than cement-rich mortars, will absorb some of the growth; but this is not to say that building control joints and horizontal relieving angles are not required if lime-rich mortars are used, they are. High lime mortars are slow hardening and remain elastic or flexible and are, therefore, able to accommodate stresses caused by building movement and cyclical volume changes without excessive cracking. They possess greater adhesive (bond) strength than cohesive (internal) strength, thus, if cracks develop, they will most likely occur within the mortar joint itself rather than at the interface where leakage is more of a problem.

Understanding the behavior of brick, we should also consider the material most commonly used to back it up — concrete block. Concrete block behaves the same as cast-in-place concrete and precast concrete when made with the cements currently in use. Today's concrete products do not grow in use...they shrink.



"The building waved everytime I passed."
Graphic by Richard Kadlubowski

The cement in use today is natural, portland or pozzolanic, with or without flyash; it is characteristically a mixture of alumina and silica, possibly lime, iron-oxide, or magnesia; it is burned together in a rotary kiln and finely pulverized. When mixed with water it calcifies at a rapid rate. It will never be drier than it is just before water is added to it. Right then, its affinity to water is so great that the chemical reaction of assimilating the water raises its temperature, causing what is known as the heat of calcification. The cement powder has become so hungry, once united with water it takes years to give it all up.

What this means is that concrete and concrete products are continually growing smaller in use. This is not conjecture, it is fact. The shrinkage is as irreversible as the growth of the brick. How much does it shrink? About 4-1/2 times as much as brick grows, or, ulti-

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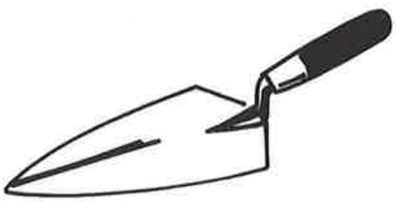
mately, somewhere around 11/32-inch (9mm) over a 30-foot length. Thermal movement, on the other hand, is nearly static... just a shade greater than 1/1,000 that of brick, or 0.165 mil (o.000165 inch) (0.004mm) in 30-feet. Recent concrete-framed projects have been stalled during curtain wall installation because hundreds of prefabricated panels did not fit. Detailed connections did not line up with the corre-



sponding slab connections because the slabs had lowered as a result of concrete shrinkage.

THE HAND OF MAN

Time has an aging influence, our buildings are in continuous motion, the materials we use have their weaknesses, and Mother Nature keeps working against us. All of these factors must be applied in developing an etiology for building skin problems, being always mindful that some of them are imputable to the building skeleton.

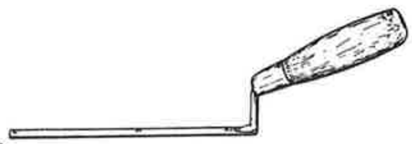
Design deficiencies usually show up early in a building's life, normally within the first decade. Determining what they are, without destructive testing, represents the kind of challenge that makes remedial architecture so interesting. A couple of cases in point: One building over 40-stories high, and another only seven stories — both representing expensive remedial procedures.

Slender and rectangular in shape, the high rise was demonstrating glass failures, thirty mile an hour winds encumbered elevator operation, and, aluminum curtain wall fasteners were failing. The steel frame had moment connections and wind bracing was incorporated in two floors below grade and one floor above grade. Acceleration was experienced on the uppermost floors, masonry in the elevator hoistways and stair towers was spalling, and joints were opening up.

"Deferred maintenance produces...leaks, rust and dry rot."

No shear walls had been incorporated into the construction, and the displacement at the top of the tower was more than 50% of what it should have been. The building waved at me every time I passed.

The seven-story building was concrete-framed on bearing block walls and brick veneered, actions in diametric opposition. The block design was adequate for the imposed loads, but, no relieving angles had been provided to support the brick and its growth and to compensate for the concrete block shrinkage.



Two other areas where human actions are of great concern are in concrete and masonry. Rebar chairs and cement finishing are cost items. It is not uncommon to pour the first few inches of a slab, screed it off, and let it set up overnight. Then the next morning, lay the top steel onto the base slab and pour the topping over it: no overtime for the cement finishers. Most of the time the screeding is not accurate enough to give the top steel the proper concrete coverage, invariably a bonding agent is not used, and a couple of years later, the slab begins to ring hollow, spalling begins, and the rebars are exposed. This is most often seen in parking garages. Today, brick is seldom properly moistened before erection to reduce suction in hot weather, and, the mortar is invariably retempered, even after initial set of the cement has started. Ergo, unfonded, friable, and leaky joints result.

DEFERRED MAINTENANCE

If you care to have the very best, deferred maintenance should not be in your vocabulary. Deferred maintenance produces three building scourges: leaks, rust and dry rot.

Very often, a tradesman is called in to stop leaks. The tradesman has very little concern (and probably very little knowledge) of what may be happening to the structural frame as a result of a leak in a wall system or a roof. Indeed, the underlying problem is undetected until rusting is so great that masonry is displaced. It's too late for any economical approach to repair.

Probably the greatest harm ever done to a building is the method frequently used to stop leaks in parapet walls. Contractors in the roofing business will cover it with impervious waterproofing goo, making matters worse than if they had called in an expert to properly repoint the parapet. Both sides of masonry parapet walls must be permitted to breathe!

Remedial recommendations for any building require extensive research, thorough knowledge of past and present building products and construction methods, and a well-

drawn set of clear, concise and tight specifications.The problems created by time and motion (and humans) can be corrected, or they can be exacerbated.

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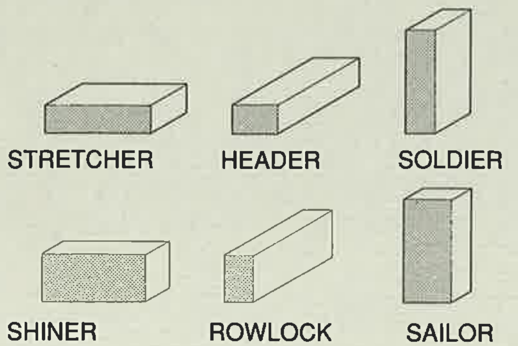
Glossary of Masonry Terms

Ashlar: Masonry composed of squared stones; one pattern of masonry construction. A catchall term, variously applied, for squared stone masonry units, or for walling constructed of them.
Back Plastering: Plaster applied to one face of a lath system following application and subsequent hardening of plaster applied to the opposite face.
Back, Filling: (1) Rough masonry built behind a facing or between two faces. (2) Filling over the extrados of an arch. (3) Brickwork in spaces between structural timbers, sometimes called "brick nogging."
Back-up (also spelled Backup) : Masonry material or masonry construction used in a wall behind stone or brick facing.
Bat: A piece of brick.
Bed Joint: A horizontal joint between stones, usually filled with mortar, lead or sealant.
Belt Course: A continuous horizontal course, marking a division in the wall plane. A narrow horizontal course of masonry, sometimes slightly projected such as window sills which are made continuous. Sometimes called "string course" or "sill course".
Bevel: The angle that one surface or line makes with another, when they are not at right angles. When the angle between two sides is greater or less than a right angle.
Block Beam: A flexural member composed of individual blocks which are joined together by prestressing.
Bond: (1) Tying various parts of a masonry wall by lapping units one over another or by connecting with metal ties. (2) Patterns formed by exposed faces of units. (3) Adhesion between mortar or grout and masonry units or reinforcement.
Brick and Brick: a method of laying brick so that units touch each other with only enough mortar to fill surface irregularities.
Brick Grade: Designation for durability of the unit expressed as SW for severe weathering, MW for moderate weathering, or NW for negligible weathering.
Brick Seat: Ledge on wall or footing to support a course of masonry.



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Brick: A solid masonry unit of clay or shale, formed into a rectangular prism while plastic and burned or fired in a kiln.
Buttering: Placing mortar on a masonry unit with a trowel. Process of spreading mortars on a brick or other masonry unit with a trowel; also the process by which the interior of a concrete mixer, transportation unit, or other item coming in contact with fresh concrete is provided with a mortar coating so that the fresh concrete coming in contact with it will not be depleted of mortar.
Buttress: A bonded column of masonry built as an integral part of the wall, projecting from either or both surfaces, and decreasing in area from base to top. A projecting structure to support a wall or building.
Camber: A deflection that is intentionally built into a structural element or form to improve appearance or to nullify the deflection of the element under the effects of loads, shrinkage and creep.
Centering: Temporary framework for the support of masonry arches or lintels during construction. Also called center (s).
Chamfer: To bevel the junction of an exterior angle.
Clay: A natural, mineral aggregate consisting essentially of hydrous aluminum silicate; it is plastic when sufficiently wetted, rigid when dried and vitrified to a sufficiently high temperature.
Clip: A portion of a brick cut to length.
Concrete Brick: A solid masonry unit having a shape approximately a rectangular prism and composed of inert aggregate particles embedded in a hardened cementitious matrix.
Concrete masonry unit: A masonry unit composed principally of inert aggregate particles embedded in a hardened cementitious matrix.
Coping: The material or units used to form a cap or finish on top of a wall, pier, pilaster or chimney.
Corbel: A shelf or ledge formed by projecting successive courses of masonry out from the face of the wall.
Course: One of the continuous horizontal layers of units, bonded with mortar in masonry.
Damp Course: A course or layer of impervious material which prevents capillary entrance of moisture from the ground or lower course. Often called "damp check".
Dampproofing: Prevention of moisture penetration by capillary action.
Dentil Course: A narrow molding ornamented by small rectangular blocks (that is, dentils) projecting at regular intervals.
Dentil: Block projections on an entablature.
Drip: A projecting piece of material, shaped to throw off water and prevent its running down the face of wall or other surface.
Efflorescence: A powder or stain sometimes found on the surface of masonry, resulting from deposition of water-soluble salts.
Fascia: A flat horizontal band, appearing as a vertical face, used decoratively, alone or in combination with other moldings.
Feather-Edged Coping: Coping that slopes in only one direction (not ridged or gabled). In some usage implies slope toward rear of wall. Also called (Brit.) "wedge coping"
Fire Clay: A clay which is highly resistant to heat without deforming, and used for making brick.
Fire Resistance: The property of a material or assembly to withstand fire or give protection from it; as applied to elements of buildings, it is characterized by the ability to confine a fire or to continue to perform a given structural function, or both.
FireProofing: Any material or combination protecting structural members to increase their fire resistance.

Footing: That portion of the foundation of a structure which spreads and transmits load directly to the piles, or to the soil or supporting grillage.

Foundation: The material or materials through which the load of a structure is transmitted to the earth.

Frieze: A belt course— sometimes decorated with sculpture relief, occurring just under a cornice.

Furring: A method of finishing the interior face of a masonry wall to provide space for insulation, prevent moisture transmittance, or to provide a level surface for finishing.

Grouted Masonry: Concrete masonry construction composed of hollow units where hollow cells are filled with grout, or multi-wythe construction in which space between wythes is solidly filled with grout.

Efflorescence

Hard-Burned: Nearly vitrified clay products which have been fired at high temperatures. They have relatively low absorptions and high compressive strengths.

Haunch: The deepened portion of a beam that increases in depth toward the support.

Head Joint: The vertical mortar joint between ends of masonry units. Often called "cross joint".

Header: A brick laid across a wall with the end surface exposed. Headers are usually used as bonders.

Heading Course: A continuous bonding course of header brick. Also called "header course."

Hollow Concrete Masonry Units: A masonry unit whose net cross sectional area in any plane parallel to the bearing surface is less than 75 percent of its gross cross-sectional area measured in the same plane.

Honed Finish: Honed is a super fine smooth finish.

Initial Rate of Absorption: The weight of water absorbed expressed in grams per 30 sq. in. of contact surface when a brick is partially immersed for one minute. Also called suction.

Joint: (1) The end or side surface of a piece, which is covered when the piece is set in place. (2) A filled or open space extending vertically between adjacent pieces set in place.

Kerf: Kerf is to wire-cut a soft clay unit during extrusion, permitting easier breaking or cutting of the units on the job for specific and varied applications.

Kiln: A furnace oven or heated enclosure used for burning or firing brick or other clay material.

Lateral Support: Members such as cross walls, columns, pilasters, buttresses, floors, roofs or spandrel beams which have sufficient strength and stability to resist the horizontal forces transmitted to them may be considered as lateral support.

Lead: The section of a wall built up and racked back on successive courses. A line is attached to leads as a guide for constructing a wall between them.

Lintel: A beam located over an opening in a wall to carry superimposed load.

Live Load: Any load that is not permanently applied to a structure.

Masonry Unit: Natural or manufactured building units of burned clay, concrete, stone, glass, gypsum etc.

Masonry: Construction composed of shaped or molded units, usually small enough to be handled by one man and composed of stone, ceramic brick or tile concrete, glass, adobe, or the like.

Moisture Migration: (1) The movement of moisture through a porous medium. (2) The effects of such movement on efflorescence and volume change in hardened cement paste, mortar, concrete, or rock.

Mosaic: A pattern or design formed by inlaying fragments or small pieces of stone, tile, glass or enamel into a cement, mortar or plastic matrix.

Nominal Dimension: A dimension greater than a specified masonry dimension by the thickness of a mortar joint, but not more then 1/2".

Overhand Work: Laying brick from inside a wall by men standing on a floor or on a scaffold.

Parapet: That part of a wall that extends above the roof level.

Parge: To coat with plaster, particularly foundation walls and rough masonry.

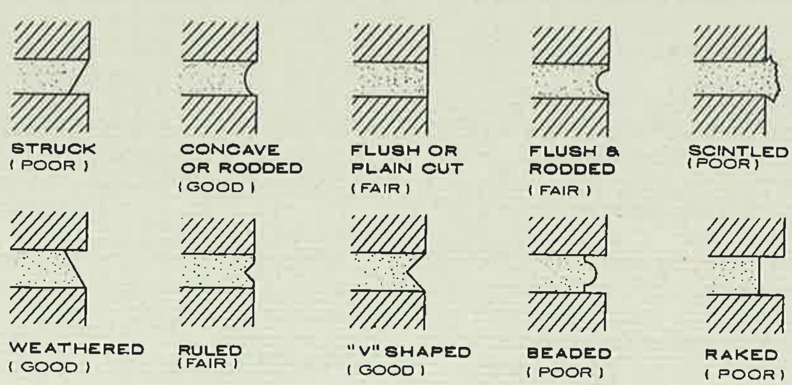
Patched Coping

Parging: Dampproofing by placing a coat of 1/2" of setting mortar to the back of stones, or, the face of backup material.

Pediment: The triangular face of a gable, if separated by entablature or molding from the lower wall and treated as a decorative unit. By extension, a triangular surface used ornamentally over doors or windows.

Pick and Dip: A method of laying brick whereby the bricklayer simultaneously picks up a brick with one hand and, with the other hand, enough mortar on a trowel to lay the brick. Sometimes called the "Eastern" or "New England" method.

Pier: An isolated column of masonry.
Pilaster: A wall portion projecting from either or both wall faces and serving as a vertical column and/or beam.
Plumb: Vertical or to make vertical.
Pointing: Troweling mortar into a joint after masonry units are laid.
Porosity: The ratio, usually expressed a percentage, of the volume of voids in a material to the total volume of the material, including the voids.
Prefabricated Brick Masonry: Masonry construction fabricated in a location other than its final in-service location in the structure. Also known as preassembled, panelized and sectionalized brick masonry.
Pressure-Relieving Joint: An open horizontal joint below the supporting angle or hanger located at approximately every floor line and not over 15 ft. apart, horizontally, and every 20-30 ft. vertically, to prevent the weight from being transmitted to the masonry below. These joints are to be caulked with a resilient material to prevent moisture penetration.
Prism: A small masonry assemblage made with masonry units and mortar. Primarily used to predict the strength of full scale masonry members.
Quirk: A groove separating a bead or other molding from the adjoining members.
Quoin: A projecting right angle masonry corner.
Racking: A method entailing stepping back successive courses of masonry.
Raked Joint: A joint in a masonry wall which has the mortar raked out to the specified depth while it is only slightly hardened.
Rebate: A rectangular groove or slot, as to receive a frame insert in a door or window opening.
Recess: A sinkage in a wall plane.
Reglet: A recess to receive and secure metal flashing.
Reinforced Masonry: Masonry containing metal mesh or rods in the joints to resist shearing and tensile stresses.
Relief or Relieve: Ornament in relief. The ornament or figure can be slightly, half or greatly projected.
Repointing: Replacing mortar in masonry.
Return: Any surface turned back from the face of a principal surface.
Reveal: That portion of a jamb or recess which is visible from the face of a wall.
Rowlock: A brick laid on its face edge so that the normal bedding area is visible in the wall face. Frequently spelled "rolok".
Rubbed Finish: Mechanically rubbed for smoother finish.
Rustication: A groove in a concrete or masonry surface.
Sawed Edge: A clean cut edge generally achieved by cutting with diamond blade, gang saw or wire saw.
Scotia: A concave molding.
Shear: A type of stress; a body is in shear when it is subjected to a pair of equal forces which are opposite in direction and which act along parallel planes.
Shoved Joints: Vertical joints filled by shoving a brick against the next brick when it is being laid in a bed of mortar.
Sill: In masonry, a flat or slightly beveled stone set horizontally at the base of an opening in a wall.
Slushed Joints: Vertical joints filled, after units are laid, by "throwing" mortar in with the edge of a trowel. (Generally, not recommended).
Soap: A masonry unit of normal face dimensions, having a nominal 2" thickness.
Soffit: The underside of a beam, lintel or arch.
Soft-Burned: Clay products which have been fired at low temperature ranges, producing relatively high absorptions and low compressive strengths.
Soldier: A stretcher set on end with face showing on the wall surface.
Spall: A fragment, usually in the shape of a flake, detached from a larger mass by a blow, by the action of weather, by pressure, or by expansion within the larger mass.
Spandrel: On buildings supported by skeleton structure, the facing of the area between the sill of one window and the top (or lintel) of the window next below.
Splay: A beveled or slanted surface.
Split-Face Block: Concrete masonry unit with one or more faces produced by purposeful fracturing of the unit, to provide



TYPES OF JOINTS (WEATHERABILITY)

Reprinted with permission from Architectectural Graphic Standards, 7th Edition architectural effects in masonry wall construction.

Stack Bond: Stack bond is an installation joint pattern where the joints, both horizontal and vertical, are aligned throughout the installation. Units are stacked one over the other, either in a horizontal or vertical position.

Stool: (1) Interior window sill, shelf or ledge. (2) (Brit.) Flat member against which the lower sash of a doublehung window seats, and thus both interior and exterior feature.

String Course (Belt Course, Bond Course): A horizontal band of masonry, generally narrower than other courses, extending across the facade of a structure and in some structures encircling such decorative features as pillars or engaged columns. May be flush or projecting, and flatsurfaced or decorated.

Struck Joint: Any mortar joint which has been finished with a trowel.

Suction: See "initial rate of absorption".

Surround: An enframement.

Temper: To moisten and mix clay, plaster or mortar to a proper consistency.

Tooling: Compressing and shaping the face of a mortar joint with a special tool other than a trowel.

Toothing: Constructing the temporary end of a wall with the end stretcher of every alternate course projecting. Projecting units are "toothers."

Tuck Pointing: The filling in with fresh mortar of cut-out or defective mortar joints in masonry.

Veneer: In stone masonry, facing material used decoratively and as protection, but not loadbearing.

Vitrification: The condition resulting when kiln temperatures are sufficient to fuse grains and close pores of a clay product, making the mass impervious.

Wall Plate: A horizontal member anchored to a masonry wall to which other structural elements may be attached. Also called head plate.

Wall, Bearing: A wall supporting a vertical load in addition to its own weight.

Wall, Cavity: A wall in which the inner and outer wythes are separated by an air space but tied together with metal ties.

Wall, Composite: A wall in which the facing and backing materials are bonded together.

Water Retentivity: That property of a mortar which prevents the rapid loss of water to masonry units of high suction. It prevents bleeding or water gain when mortar is in contact with relatively impervious units.

Water Table: A projection of lower masonry on the outside of the wall slightly above the ground. Often a damp course is placed at the level of the water table to prevent upward penetration of ground water.

Waterproofing: Prevention of moisture flow through masonry due to water pressure.

Weep Hole: A drainage opening usually inserted at the base of a stone unit to release moisture accumulating between the stone and backup.

Wythe: Each continuous vertical section of a wall one masonry unit in thickness.

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A MORTAR SAMPLER

GENERAL MORTARS

M (2500 psi)*	Very high compressive strength, durable loads, foundations,retaining walls, manholes, reinforced masonry, pavements
S (1800 psi)	High compressive and tensile strength, heavy loads, high wind areas, chimneys
N (750 psi)	Moderate compressive strength: partitions (load and non-load bearing), severe exposure areas, cavity walls, interior w/glass block, terra cotta, parapet walls
O (350 psi)	Not resistant to freezing, low strength,interior non-load bearing partitions, exterior areas faced and backed w/solid units
K (75psi)	Low strength: not allowed by some Building Codes, high lime content, interior nonload-bearing partitions

SPECIAL MORTARS

Non-Staining	Portland cement mortar used for limestone, marble, terra cotta, glazed brick,cut stone Non-staining
Waterproof	For installation of caps, coping, sills, etc.
Gypsum	Decking, gypsum block, etc.
Chemical	Industrial applications, types vary with different additives:silica, resin, and sulfur
Refractory	Chimneys, incinerators, monolithic walls,types vary with different additives and heat requirements
Epoxy	Structural & facing tile, glazed brick, stone veneers, bath-rooms, kitchens
Surface Bond	Portland cement with glass fibers, eliminates mortar between masonry units
Tuck-Pointing	Pre-hydrated mix for stone and brick facing, should match flexibility and strength of existing mortar
High-Bond	Additives used to strengthen mortar, for panel and wall construction
Dirt Resistant	Additives used to increase stain-resistance

**average compressive strength at 28 days*

"Do It Right"

by Dick Bonin

When a project crosses your desk that involves work on the exterior of a masonry building, you should realize that if the work is done correctly, the building can provide many years of use. If the work is done incorrectly,

however, the exterior and even the structural integrity of the building could be in serious jeopardy.

What that means, of course, is that you-the building owner or manager - have to pay particular attention to the building professionals you select to do your job.

By following a few simple guidelines, you can practically ensure yourself that your restoration job will be completed to your satisfaction!

To successfully correct any masonry problem, you first have to make an accurate determination of the damage to the building, and then decide what needs to be done. Here are three preliminary steps that work:

1) Commission a structural analysis;
2) Objectively assess the present condition, type of construction, and the building's past maintenance;
3) Negotiate required restoration with a qualified specialty contractor.

Then, it is essential that you prequalify the contractor and architectural (structural) firm - before any work is started.

The architects and engineers you choose should have the following qualifications:

1) A minimum of five year's restoration experience:
2) Restoration experience in the specific type of structure involved in your project; i.e., terra cotta, cast - in- place concrete, precast concrete, or historical;
3) Restoration experience in a geographic region similar to the one in which the proposed project is located. (some repair systems are not suited for certain climates of the country.)

The contractor you select to work with should have the following qualifications:

1) A minimum of five years' restoration experience in projects similar to that involved in the proposed project;
2) Knowledge of restoration of the specific type of structure involved in your project;
3) Financial stability;
4) Strong guarantee and proven "stand-behind" reputation;

> ***"Make sure there are prices for over/under amounts."***

5) Good insurance and bonding programs;
6) Good safety program and record.

When architects, engineers, and contractors submit their qualifications, don't just accept them as true — check them out!

Contact their references and ask about the projects. Find out if there were any problems; if so, ask if they were handled professionally. Ask if the work exceeded the standards or if it was just "so-so."

Then, get to know the people you might be working with because you will be living with them through the construction period.

If possible, visit one or two of their other projects in progress. Look closely at their field supervision. You want a professional team on your building. Also, look at their housekeeping; make sure the work place is as clean as possible. A clean work place means the contractor is concerned with the safety of its workers, and it's usually a good indicator of quality workmanship.

It is also good, whenever possible, to have an architectural/contractor team that has worked together previosly. Many times this will insure good interaction between them.

Once the team has been chosen, it's time to turn the attention back to the specific problems of your building, to write a set of specifications, and to have the contractor prepare the proposal.

If the project must be bid, a good set of specifications and/or plans should be worked up prior to bid so that all prequalified bidders will be quoting on the same work. Using this method, you'll end up with more competitive bids, a smoother project and quality end-results!

If there are items of work which have unknown quantities, such as replacements for terra cotta and concrete repair, make sure there are unit prices for over/under amounts. There may be 100 pieces of terra cotta estimated to be replaced when the project begins, but only 25 pieces actually may be needed. Or there may be 2,500 square feet of concrete repair estimated; but, after demolition, it may be determined that 3,000 square feet of repair are actually needed. Over/under unit prices for materials

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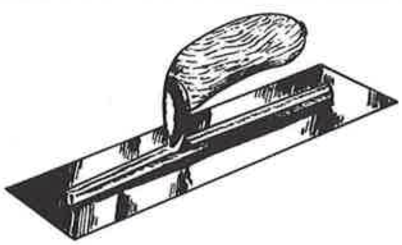
and labor will protect all parties.

Prior to beginning any work, have an in-depth, pre-construction meeting. Make sure everyone is clear on all aspects of the project. This meeting should include critical suppliers and contractors and a review of all schedules, specific responsibilities, etc.

After work has begun, schedule weekly or bi-monthly meetings to go over the progress, the schedule, and any problems that may have surfaced.



Have all parties present at these meetings. Again, if there are critical suppliers and subcontractors, include them in the meetings. Good communications during a project are essential!

During construction, all changes should be in writing and in agreement of all parties concerned. This not only keeps everyone informed on the project but provides good records for the future.

After completion, hold one more meeting to make sure all invoices and payments are correct, guarantees forwarded to the owner or manager, as-builts (when necessary) are complete, final clean-up is done, and attend to other last minute details.

"Doing it right" takes planning, but you'll get the results you want—a building you'll be able to use safely and with pride for years to come!

Dick Bonin is a Masonry Restoration Specialist for The Western Group, St. Louis.

Epoxy Mortars:

The Jury Is Still Out

The standard of the industry is a lime-rich blend, when it comes to mortars for use in repointing masonry buildings, especially limestone, that are five stories or more in height. For many years, experts have been aware of epoxy mortars for the repointing of limestone facades, but, for the most part, epoxy has been avoided.

Lime-rich mortar is noted for its plasticity, accommodating the natural movements and stresses masonry is heir to. Properly mixed and applied, lime-rich mortar is a highly satisfactory material. It can be problematic, however, to mix the lime-rich mortar so that it is the correct consistency. Some masons find it too "buttery" and unable to hold its shape.

Epoxy mortar, on the other hand, is not noted for its pliability. It generally firms up harder than the limestone and creates a bond that is difficult to break the next time the building requires repointing.

Experience with both of these mortar materials shows that common wisdom may not be so wise as it is common. Even after many years of overseeing repointing projects, we are still concerned as we watch the masons mix lime-rich mortars on precarious staging far above busy metropolitan sidewalks. There is no question that the ability to apply epoxy mix with a caulking gun is a distinct advantage. The question remains, however, does epoxy do the job?

We are not aware of any scientific research that would once and for all close the book on this subject. Indeed, it is difficult to find examples of projects where epoxy has been tried.

One client's experience with epoxy mortars would appear to contradict the general thinking on the subject. He notes that after more than fifteen years of service, the epoxy mortared joints on his limestone skyscraper remain in fine condition. The epoxy was specifically mixed for pliability, and to have less tensile strength than the limestone blocks. Thus far there has been no discernable spalling or cracking of the limestone, but then again, the age of a limestone building is counted in scores of years and centuries, not a decade and a half.

The positive aspects of epoxy, including portability and ease of application, make it an attractive joint material. But until more empiric data is accumulated to make its case, the jury is still out.

Journal is a publication of Hoffmann Architects, specialists in investigative and rehabilitative architecture/engineering, including the analysis and solution of roofing, masonry, glazed curtain wall and structural problems. Our office is located at 3074 Whitney Avenue, Hamden, CT 06518 Phone (203) 281-4440.

We welcome contributions to HA/J from our clients and friends. Please send news and technical information to Peter Borgemeister, Editor, Hoffmann Architects/Journal at the Hamden address. Address changes and additions to the mailing list should be sent to the Hamden office.

Representative Projects

A number of nationally known institutions and corporations have been added to the Hoffmann Architects client list in the past several months. We welcome our new clients, large and small, and we feel gratified by our old clients asking us to do additional work for them.

ROOFING

The METROPOLITAN OPERA ASSOCIATION has engaged Hoffmann Architects to prepare plans and specifications for the re-roofing of the Metropolitan Opera House in New York City.

The Metropolitan Opera House at Lincoln Center

This firm will provide the full range of architectural services to re-roof two buildings on the Busch Campus of RUTGERS UNIVERSITY in New Jersey.

Hoffmann Architects surveyed the roofs of two buildings owned by IBM in Kentucky and Alabama.

FAIRFIELD UNIVERSITY in Fairfield, Connecticut has hired Hoffmann Architects to survey the condition of the roofs of five buildings on the campus.

The roof of the headquarters building of GENERAL ELECTRIC, also in Fairfield, will be replaced with this firm furnishing the architectural services.

Hoffmann Architects has been hired to design new roofs for the Mendenhall Center for the Performing Arts at SMITH COLLEGE in Northhampton, Mass. We will also assist Smith College in the bidding process and administer the ensuing contracts for construction.

RICHARD BERGMANN, FAIA, an architect in New Canaan,Conn., has asked our firm to consult with him concerning re-roofing and waterproofing matters on renovations of the Noroton Presbyterian Church in Noroton, Conn.

We have been asked to prepare plans and specifications for re-roofing Frampton Hall, part of the NEW YORK INSTITUTE FOR SPECIAL EDUCATION (formerly the New York Institute for the Blind).

PARKING GARAGES

Hoffmann Architects has been a consultant to TOR AND PARTNERS, a structural engineering firm located in New Haven, Conn., on waterproofing and deck coatings of the Temple Street Parking Garage in New Haven.

Hoffmann Architects recently completed consulting to THEODORE NELSON, structural engineer of Madison, Conn. on cracks in a precast concrete parking garage in Albany, New York.

CODE COMPLIANCE

We provided consulting services to the COMMONS, a condominium complex in Stamford, Conn., on fire code corrections as well as correcting air and water infiltration in six buildings.

FACADE REHABILITATION

The brick and terra cotta front facade of the headquarters building of the GILLETTE COMPANY in Boston, Mass. will be surveyed by Hoffmann Architects.

The firm will also survey the four exterior walls of the Research and Engineering Building of the TORRINGTON COMPANY in Torrington, Conn.

Frampton Hall

staff news

NEW STAFF

Hoffmann Architects is pleased to introduce three new members to the staff:

Jane B. Beaudry is a graduate of the State University of New York at Buffalo, and intern architect;

Muoi Le a graduate of the University of Houston Texas, and intern architect;

Frank Scherr, is a graduate of the University of Colorado, and intern architect.

PROFESSIONAL ACCOMPLISHMENTS

Peter Borgemeister, Hon. A IA, has been appointed by the First Selectman of Branford, Ct. to serve on the Branford Inland Wetland Commission for a third three-year term.

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Richard Kadlubowski has been appointed to the CSA Associates Commission. He has also been elevated to project manager for Hoffmann Architects.

Kadlubowski recently attended the BURSI (Better Understanding of Roofing Systems Institute) Seminar on the latest technology in roofing applications in Denver, Colorado.

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John J. Hoffmann, AIA, was a delegate to the Middle Atlantic Regional Conference of BOMA (Building Owners and Managers Association) in Boston, where he was elected to the Board of Directors.

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Susan Hauser has been elected to the Board of Directors of the Auxiliary to the Hospital of St. Raphael in New Haven. She is also membership chairperson of that organization.

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Walter E. Damuck, AIA, was just named to the Executive Committee of the New England Building Code Association. Walter's article, entitled "The Fine Points of Repointing Older Masonry Buildings", appeared in the annual Weathervane Update issue, put out by The Western Group. Western, which publishes 14,000 copies of this magazine, is one of the largest Waterproofing and Restoration Companies in the U.S. Damuck also wrote an article, "Masonry Deterioration and Rehabilitation" that was published in the first issue of the Connecticut Architect & Specifier magazine.

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Harwood W. Loomis, AIA, was recently elected acting secretary of a proposed Connecticut Professional Chapter of Building Officials and Code Administrators International (BOCA), publishers of the Basic/National Building Code used in Connecticut and most Northeast states. He also recently testified before the Public Safety Committee of the Connecticut General Assembly regarding proposed legislation affecting building and fire codes and enforcement in Connecticut. Loomis is also participating in the formation of a Computers in Architecture Committee within the Connecticut Society of Architects/AIA.

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A contingent from Hoffmann Architects visited the recent AIA Convention in New York City. Richard Kadlubowski, Jane Beaudry, Wayne Bonin, Muoi Le and Frank Scherr attended a seminar session on Artist/Architect Collaborations.

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SPORTS NOTE:

The Architectural Summer Softball league now has teams representing 11 firms in the Hamden -New Haven Area. The season runs through July. This is the third year of play for the league. Wayne Bonin and Jane Beaudry are co-captains of the Hoffmann team.

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