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# MASONRY IN BUILDING CODES

BY L. H. HART, C. E., 1910

Our study of text books usually holds up for consideration, the "best practice," without conveying much idea of "usual" or "allowable" practice: Hence our young engineer is due for a great shock upon discovering what lax work actually goes into buildings every day, and almost as much surprised to discover not only the variations that exist in our building codes, but the deviation from good practice, and even in many cases, the utter lack of law on important phases.



L. H. HART

The writer has studied the masonry sections of one hundred city codes and abstracted the following birdseye view of the situation for the guidance of others who cannot spend the time themselves.

**Factor of Safety.** Almost without exception, city codes require that actual breaking stresses in masonry shall be **ten** times as great as the safe working loads. The exceptions are, Wichita and Waterbury 5, Youngstown 4.

**Sand.** There exists no definition of sand which fits more than a few cities. Each locality tries to define it so as to exclude local sands known to be undesirable, but many cities have no sand (commercially available) which would be tolerated in other cities, and hence must do the best they can with local materials. Common and dangerous faults are salt, extreme fineness, or organic matter. Most of the codes, therefore, specify sand shall be "clean, sharp, free from loam, clay, salt and organic matter." Shorter phrases are found in these:

- Wilkes Barre "Free from all impurities"
- Dayton "Hard, moderately sharp"
- Omaha "Not dirty or loamy"
- Seattle "Coarse, sharp"
- St. Louis "Equal to Mississippi River Sand"
- Roanoke "Clean, sharp"

A few refer to sieve analysis:

- Pasadena "Not over 65% through 50 sieve"
- Portland, Me. "Not over 6% through 100 sieve"
- Chicago "Not over 55% through 20 sieve"
- Cleveland } "Not over 70% through 30 sieve"
- } "Not over 30% through 60 sieve"
- Columbus } "Not over 5% through 200 sieve"
- } "All through No. 10 sieve"

However, a third of all the cities make no attempt at the difficult question "what is sand?"

**Cement.** Most cities now refer to the specifications of the American Society for Testing materials, as all the brands can pass it and it has been well tried out. Nowadays, Portland Cement is quite as uniform and dependable as rails, wire or thread, and is ground so fine that the bulk of it will pass through a water-tight sieve.

**Quicklime.** Here the problem is more difficult, for the specifications of the American Society for Testing Materials (with directions for slaking and ageing lime), are not so well established. The Nashville code refers to them and they deserve general adoption, as they are far in advance of the old phrase "fresh burnt lime of commerce," which is the only restriction in Birmingham, Cincinnati, Detroit, Duluth, Macon, Norfolk, Philadelphia, Pittsfield, Richmond and Wilkes Barre.

**Hydrated Lime,** the powdered form, is modern and convenient, but many cities seem not to know of it at all. Dayton, Kansas City (Mo.), Nashville, New York and the Underwriters' codes refer to the excellent A. S. T. M. Specifications.

- Birmingham says "Standard quality"
- Boston "Pine Cone or equal"
- Detroit "First quality"
- Duluth "First quality"
- Minneapolis "Approved Brands"
- Rochester "Approved Brands"
- St. Paul "Approved Brands"
- Richmond, Va. "Original packages, first quality"
- South Bend "Standard Brand"
- Wilkes Barre "Pulverized"

**Lime Mortar.** Wide differences of opinion occur as to proportions—and even after the officials have determined what they **want**, what they **get** will be determined by the man with the hoe, who will gauge the mix by "feeling it with his tool," since he thinks it cannot be expressed in words. The Underwriters, and many cities, prescribe **four** parts of sand (by volume) to one part lime putty, but **five** are permitted in Boston, Spokane, Portland, Ore., Tacoma, San Francisco, Waterbury

Only **three** parts of sand are allowed in

- Birmingham Louisville Pawtucket
- Chattanooga Macon Seattle
- Columbus Manchester South Bend
- Dayton Memphis St. Louis

**Safe Loads on Brick.** This depends chiefly on the mortar, but we find many grades of brick,

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and thus encourage more building and secure more service and income for a given expenditure.

**Rubble Masonry.** In the case of ordinary stone rubble there is almost as much difference of opinion. Buffalo again is the lowest, with 42 pounds per square inch, thirteen cities 56 to 60 pounds, twenty-two cities 70 to 75, nine cities 80 to 85, three at 100 to 111, and two at 120 pounds. With cement mortar, Buffalo stands at 70, five cities permit 100, thirty-one allow 140, eleven agree on 153 to 173, and four go as high as 200.

**Plaster.** A city code should give specifications for sand, cement, lime hard plaster, hair, wood lath, metal lath, fastening and spacing of lath, proportions, number and thickness of coats, time between coats, etc. Most of these materials are now described by specifications of the American Society for Testing Materials, and it is safe to follow their lead, for they comprise both manufacturers, engineers, architects and large consumers. The "Plaster Conference," organized by the Bureau of Standards, and representing all interested parties, is preparing a report covering every phase from preparation of the backing, to decoration of plastered walls. The various trade associations also furnish valuable data for city officers who have codes to write.

Proportions for plaster are touched upon only by the codes of Manchester, Minneapolis, Pawtucket, Rochester, South Bend, St. Louis and St. Paul. They agree (practically) on 2½ parts of sand to one of lime putty for the first coat and 4 or 5 parts of sand in the second. Two to 5 pounds of hair is called for per barrel of lime in the first coat, and none to 3 pounds in the second, but the finish coat is largely left to imagination. Putty must age for 3 to 7 days in different codes. Eleven cities agree that three-coat plaster should be 7/8" thick. In the case of hard plaster, or metal lath in place of wood, it is usual to allow less thickness. Three-eighths inch is the accepted "key" or space between wood lath for lime plaster, and ¼" for hard or "patent" plaster.

**Stucco.** St. Paul and Richmond, Va., suggest three coats on 5/8" grounds, at 24-hour intervals, in respective proportions of cement to sand, 1:2, 1:2½, 1:2½. The first coat contains hair, and ten pounds of lime putty per bag of cement.

The Cement Association and Lime Association issue successful stucco specifications, that should be printed (or referred to) in every city code.

It is plain to see that there is a very wide gap in these trades, between practice and perfection. The idea of the writer is to assist young engineers in getting some perspective as to what is actually being done in the field, so that he will not make himself ridiculous by insisting on perfection the first day he is sent out as inspector. Let him **know** what perfection is, and strive toward it without antagonizing those who have been doing acceptable work for many years.

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also—so many as to induce a headache. Fortunately the manufacturers are now reducing the number of grades and sizes, but in the current codes we find the following qualities:

Merchantable	Ordinary	Hard Pavers
	Red	
Red	Hard	No. 1 Pavers
Salmon	Standard	Hard Pressed-
	Common	
Kiln Run	Common Kiln	Hydraulic
	Run	
Selected	Common	Paving
Grade A (Compression)	No. 1 Common	Strictly Hard-
" B "	First Common	Pressed
" C "	Hard Common	Pressed
" D "	Hard Common	Shale
	Select	Vitrified

Even with the same brick, the range of allowable loads is astonishing. Using No. 1 Common or its equivalent, and **lime mortar**, Buffalo allows 42 pounds per square inch, Dayton 75, Denver 70, South Bend 80, Manchester, Milwaukee, Pasadena, Utica, Providence and Roanoke 83, Rockford 90, San Francisco, Spokane and Youngstown 97. All the others allow between 100 and 111 pounds, except Columbus 139 and New Orleans 150.

If **cement mortar** is used, the safe loads are increased, but Buffalo allows only 70 pounds and Roanoke 139. Twenty cities permit 166 to 180, twenty cities 200 to 222, twenty-two cities 250 pounds, Boston and Cambridge 280 and New Orleans 300. With paving brick, eight cities permit loads of 350 pounds and the State code of Illinois allows 400.

Here is an opportunity to benefit the public by raising the absurdly low limits in some cities,