Table I.—Strength of Mortars.

Composition of mortar.	Age when tested.	Strength in lbs. per sq. in.
1 lime : 2 sand	1 month	94.
1 lime : 2 sand	3 months	136.
1 lime : 2 sand	6 months	245.
1 cement : 3 sand	2½ months	1352.
1 cement : 3 sand	8 days	655.
1 cement : 3 sand	13 days	1320.
1 cement : 3 sand	28 days	2155.
1 cement : 2 sand	8 days	895.
1 cement : 2 sand	13 days	2325.
1 cement : 2 sand	28 days	2690.

The table shows that cement mortar is much stronger and gains strength much more quickly than the lime mortar. In factory and tall building construction, both of these points of superiority of cement mortar are of importance. By the use of a mortar such as 1 part cement to 2 parts sand a much higher allowable strength could very safely be allowed than is allowed at the present time, which would mean an additional economy in material.

Another difficulty with mortar, and especially lime mortar, is the variation in quality due to carelessness in proportioning and mixing. The proportions are usually left to the experience and guessing ability of the mortar mixer, and seldom, if ever, is the material accurately measured. The only tests required of the fitness of the resulting mixtures are their spreading and working qualities, which are in many cases very different from strength qualities. More care in measuring and mixing the materials of a mortar would improve its strength and reliability.

The purpose of this article is to point out where improvements might be made. What has been termed carelessness is as much the fault of the architect and engineer as it is the fault of the brickmaker or bricklayer. If specifications were drawn up more carefully and precisely a great many of the inaccuracies in using building materials would be eliminated; for instance, if architects, by agreement, were to issue specifications for bricks without frogs it would be but a short time until the manufacturers would be making only that kind of brick. To the brickmaker the frog is more or less of a nuisance anyway, and its elimination would, in most cases, mean but slight changes in his moulding machinery. The writer knows of four firms of architects doing business in Toronto and Montreal whose specifications are of the type described. Most of the other difficulties pointed out could be gotten rid of by a similar process.

In Canada at present the ceramic industries are booming. The development has improved the quality as well as increased the quantity and ultimately the improvement in quality must be recognized by increasing the allowable safe loads and thus cutting down the waste in building operations.

The following points are suggested as improvements over the present practices:—

1. The elimination of the frog in bricks.
2. The use of cement mortars, not exceeding 1 part cement to 3 of sand, in all but residential buildings.
3. A definite minimum and maximum height for all bricks.
4. Better and more precise specifications for proportioning and mixing mortars.
5. Increased bearing values.
6. That the following be the specification for bricks, which is the specification proposed by the American Society for Testing Materials:—

Selection of Samples.—For the purpose of tests, brick should be selected by some disinterested and experienced person to represent the commercial products. All brick shall be carefully examined, and their condition noted before being subjected to any test.

Transverse Test.—At least five brick to be tested, laid flat-wise with a span of seven inches, and with the load applied at mid span. The knife edges shall be slightly curved in the direction of their length. Steel bearing plates, about ¼-inch thick and 1½-inches wide, may be placed between the knife edges and the brick. The use of a wooden base-block, slightly rounded transversely across its top, upon which to rest the lower knife edges, is recommended. The modulus of rupture shall be obtained by the following formula.

$$R = \frac{3\ W\ L}{2\ b\ d^2}$$

in which:—

L. is the distance between supports in inches.
b. is the breadth of the bricks in inches.
d. is the depth of the brick in inches.
W. is the load in pounds at which the brick failed.

The half brick resulting from the transverse test shall be used for the compression and absorption tests. One half to be crushed in its dry condition. The other half to be used for the absorption test and crushed while in this wet condition. No specimen shall be used if any part of the line of fracture is more than one inch from the centre line.

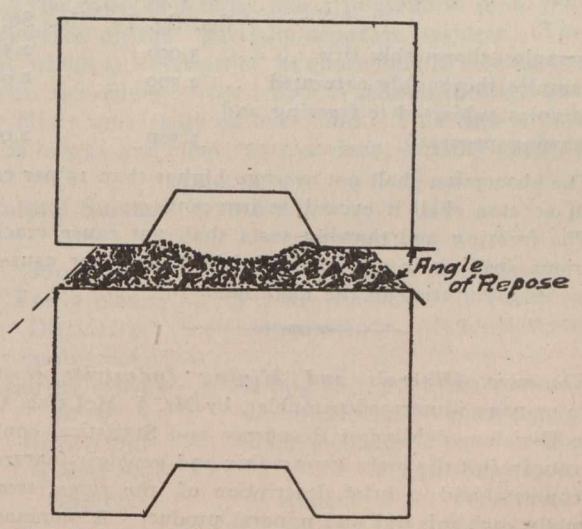

Fig. 3.—Showing Effect of Crushing on the Mortar.

Compression Test.—Compression test shall be made on half brick, resulting from the transverse test. The brick shall be bedded flat-wise on blotting paper, heavy fibrous building paper, or heavy felt, to secure a uniform bearing in the testing machine. In case the brick have uneven bearing surfaces, they shall be bedded in a thin coat of plaster of Paris. For dry test, before applying the plaster of Paris, the bearing surfaces of the brick shall receive a coat of shellac. The machine used for compression tests shall be equipped with spherical bearing block. The breaking load shall be divided by the area in compression, and the results reported in pounds per square inch.

Absorption Test.—At least five half brick shall be first thoroughly dried to constant weight, at a temperature of from 200 to 250 degrees F., weighed, then placed on their face in