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Bricks

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Canadian Building Digest

Division of Building Research, National Research Council Canada

CBD 169

Bricks

Originally published 1974.

T. Ritchie

Please note

This publication is a part of a discontinued series and is archived here as an historical reference. Readers should consult design and regulatory experts for guidance on the applicability of the information to current construction practice.

In this age of mechanization, automation and prefabrication, it is surprising (and probably, to certain individuals, refreshing) to find that one material at least makes an important contribution to Canadian building through the efforts of craftsmen. This material is brick. It has been employed for at least 5,000 years in building throughout the world, including the entire period of the history of Canadian building. Bricks, indeed, were made at the first settlement established in Canada, the Port Royal Habitation founded early in the 17th century.

Although bricks are used in modern building in essentially the same way they have been used throughout the ages - made into walls by bricklayers who spread a mortar bed then place and position each brick in relation to those previously laid - the process of manufacture has undergone vast changes since the brickmaker at Port Royal tempered his clay. Then, he took plastic clay, dropped it into a wooden mould, and dumped the brick from the mould on the ground of the drying yard; when it was sufficiently dried by the sun, he placed it in a small, primitive kiln for burning. Such was the method of manufacturing bricks in Canada until the middle years of the nineteenth century when machines for grinding clay and forming bricks were introduced, later augmented by artificial dryers and kilns with exact temperature control and continuous operation.

By the end of the nineteenth century the clay brick had been joined in Canadian building by two other kinds, one made from concrete, the other from lime and sand and known as the sand-lime or calcium silicate brick. Whereas clay bricks develop their strength and durability by high-temperature firing, which sinters and partially fuses the minerals of the clay to produce a hard, stable body, other bricks develop hardness and durability in different ways. Concrete bricks are made from a mixture of portland cement, sand, stone and water and are formed in steel moulds to brick shape; calcium silicate bricks are a mixture of lime and sand pressed into brick shape. In contrast with concrete brick, which is self-hardening, sand-lime brick must be subjected to steam pressure for hardening, so that steaming in an autoclave is an important step in its manufacture.

Most of the clay bricks now manufactured in Canada are actually made from shale, the rock-like form of clay. The shale is finely ground, tempered with water into a mass of very stiff consistency then forced through a rectangular die by means of pressure exerted by an auger. This extrusion process produces a continuous "ribbon" of clay that is cut up into bricks; these are stacked on small railway cars, passed through a drying chamber, and finally through a kiln

for burning. Other methods of forming bricks have been used in the Canadian industry but they are now employed at only a few plants.

Statistics

Although the first properly-conducted population census in the world, undertaken in New France in 1666, showed that at least one of the colony's inhabitants was a brickmaker, detailed statistics and information concerning Canada's brick industry were not recorded until the late 1880's. Surveys indicated that at that time there were about 350 brickyards operating in Canada. In contrast, a survey in 1972 showed that clay bricks were being made at only 34 plants in Canada, half of them in Ontario. Their total production capacity, however, now exceeds that of the hundreds of small yards formerly making up the Canadian industry. In addition to those plants producing clay bricks there are over 70 factories making concrete bricks, but only a few operate for the production of sand-lime bricks.

In recent years the total number of bricks produced annually in Canada has been in excess of 800 million, valued at over 48 million dollars, with clay bricks accounting for about 64 per cent of the total, concrete bricks about 29 per cent, and the remainder sand-lime bricks. By way of indicating the market for bricks in Canada it can be calculated that the industry's production would provide sufficient bricks in a year for the construction (should such a structure ever be required) of a wall over 6 feet high stretching from Halifax to Vancouver, a distance of 3475 miles.

Sizes

The dimensions of bricks used in traditional building appear to have been set by the span of the hand (about 8 inches), this dimension providing the brick's length, half of it the width, and a quarter of it the height. Although "standard" bricks of such dimensions account for a large proportion of the bricks used in Canadian building, several other sizes are also manufactured.

By increasing the length of the standard brick to 12 inches but not changing its other dimensions, the brickmaker produces the "Norman" brick. A slight reduction in the height of the Norman brick gives the "Roman" brick. Increasing the width of the Norman brick to 6 or 8 inches produces TTW (through-the-wall) bricks which are intended to provide, by themselves, the thickness of the wall. Other bricks are usually used in composite walls having a facing of bricks backed by wood frame stud walls or masonry formed of other bricks or blocks. An even larger unit than the TTW brick is the hollow brick, with dimensions nominally 16 in. long, 8 in. wide and 4 in. high, approaching the size of a concrete block.

Canadian brickmakers manufacture most of their products to modular dimensions, which means that when bricks are laid up in mortar the centreline of a mortar joint falls on the grid-line of a standard 4-inch module. Thus, bricks nominally 8 in. long but actually $7 \frac{5}{8}$ in. long and $2 \frac{1}{4}$ in. high, laid in mortar joints $\frac{3}{8}$ -in. wide, provide modular brickwork in that the distances between the centrelines of the mortar joints correspond with the grid-lines of the standard modular grid. This is illustrated in Figure 1 in relation to the format of some of the bricks manufactured in Canada.

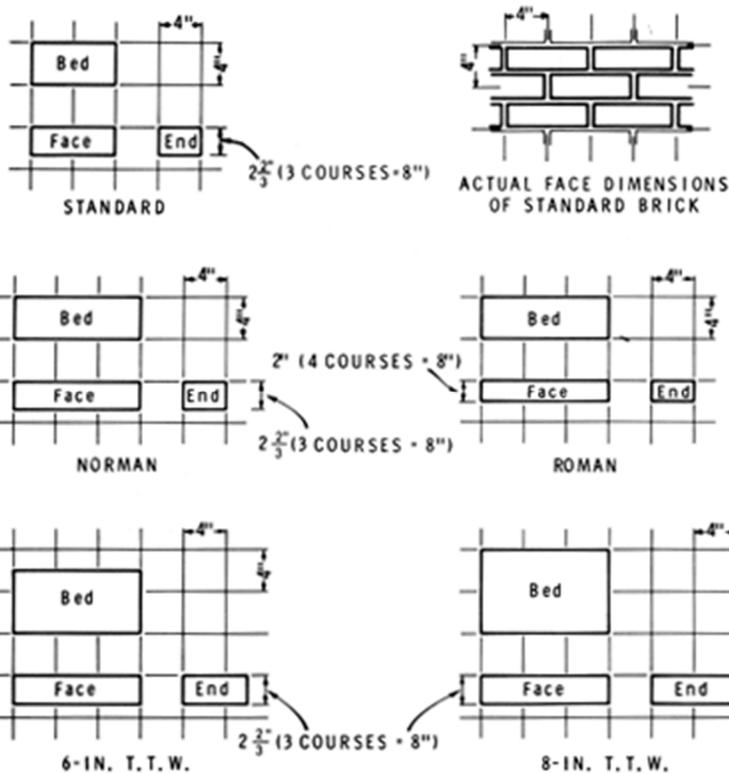


Figure 1. Nominal dimensions of modular-size bricks (mortar joint thickness included - actual brick dimensions less than nominal by the thickness of the mortar joint).

Colour and Texture

Many of the clays and shales used in brickmaking burn to a red colour, although some provide buff bricks. The brickmaker can influence colour by changing the atmosphere of the kiln; for example, certain kiln conditions produce dark, almost black shades in a brick that normally burns red. Colour may also be changed by adding suitable materials to the shale or by the application of a colouring material such as glaze to the brick surfaces. Similarly, the manufacturer of concrete and sand-lime bricks may colour them by adding pigments to the mix or by applying surface colouring materials. The Canadian brick manufacturer, therefore, is able to provide a wide range of colours in his product.

Surface texture, particularly of clay bricks, is now another important factor in their marketing. The forming of bricks by extrusion makes it easy to apply texture; as the ribbon of clay is extruded from the machine it can be scratched, scored, indented, or otherwise marked to produce a particular texture on the brick faces. The scratching of the clay column by stiff wires, for example, produces fine striations sometimes called "brush" texture, whereas much deeper scratches provide the heavier "rug" texture. These and other popular textures are shown in Figure 2. The fact that the extrusion method of forming bricks lends itself so readily to the application of texture is, indeed, an important reason why this method of manufacture has come into extensive use in Canada. Another popular surface texture, independent of the method of forming and used by manufacturers of all types of bricks, is that obtained by breaking or chipping away the brick's surface to produce a rough "rock-face" texture.

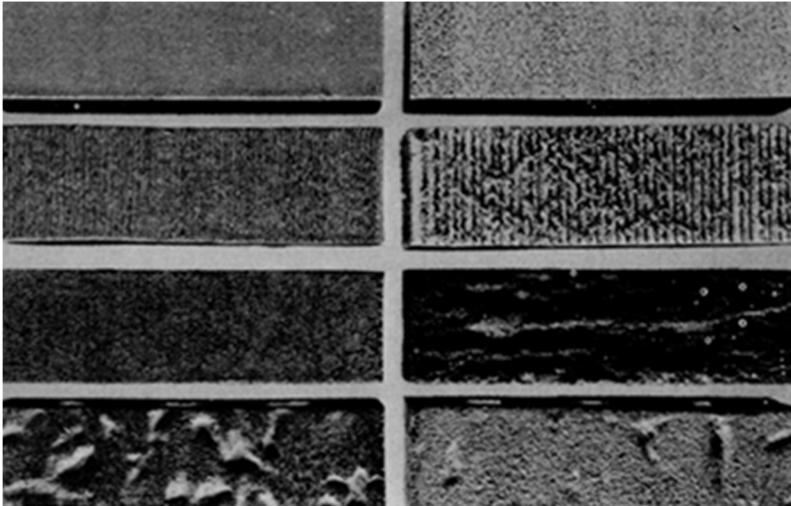


Figure 2. Brick textures; smooth-faced and stippled(top), "brush" and "rug" (second row), "matte" and "bark" (third row), indented "matte" and the same with sanded surface (bottom).

Colour and surface texture cannot be defined in such a way that requirements for these attributes can be included in standards for bricks, nor indeed is there a common terminology within the brick industry with reference to colour and surface texture.

Standards for Bricks

The Canadian Standards Association (CSA) has issued the following standards for bricks manufactured in Canada:

| CSA Designation | Subject |
|-----------------|---|
| A82.1 | Burned clay brick |
| A165.2 | Concrete brick masonry units |
| A82.3 | Calcium silicate (sand-lime) building brick |

The standards set forth requirements for certain properties of bricks considered important to their performance, particularly compressive strength. This property not only governs the strength and stability of a wall but also, indirectly, provides a measure of the brick's durability. Another requirement of the standards concerns dimensional variation, i.e. the difference allowed between actual dimensions of the manufactured brick and intended dimensions. References are given in the standards to the methods by which bricks are sampled and tested for compliance with the provisions of the standards.

Selection of Bricks

When brickwork is to be employed as engineered masonry, designed on the basis of an engineering analysis of the structural effects of the loads and forces acting on it, the compressive strength of the bricks (and mortar) is obviously a major concern of the designer in his selection of bricks. For brickwork that is to be used in the traditional way, however, for example, for forming the veneer on a wood-frame house, the selection is made mainly on the basis of relative cost and appearance. In the latter case, choice clearly depends on a person's taste in colour and texture.

As the appearance of an individual brick imperfectly conveys the appearance of a wall (because of the effects of mortar colour and the shape of the joints, brick bond pattern and surface

finish). it is useful to examine actual walls built of bricks whose colour and texture are of interest. The manufacturer or distributor can usually supply the addresses of buildings providing such examples. When the selection has been made, assurance should be obtained from the manufacturer that the chosen bricks meet the requirements of the CSA standard.

The selection and use of bricks reclaimed from demolished buildings raises special problems that have been discussed in **CBD 138**.

Brick Panels

In certain countries bricks are used not only on the job site, laid into walls by the bricklayer. but also for the construction of prefabricated wall panels that are transported from the factory to the building site for the same application as panels and wall sections of concrete or other materials. Brick panels have been used in a few buildings in Canada, demonstrating the feasibility of manufacturing this type of brickwork and applying it to Canadian conditions, but no significant market for such panels has yet developed in this country.

Conclusions

Bricks, which have been employed in Canadian building practically since the start of building in this country, continue to provide the construction industry with an important building material. The Canadian brick industry is a large one, supplying clay, concrete and sand-lime units in a wide variety of colours, textures and sizes, and finding use in all types of buildings, from small houses to high-rise apartments.

The extensive use of bricks throughout the history of Canadian building indicates that brickwork provides technical as well as aesthetic qualities much valued by builders and building owners. Brickwork also provides satisfaction to the craftsman who fashions it, expressed by one writer as "...the real feeling of satisfaction that comes to a building tradesman with the completion of a project built with his skill and labour."