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Canadian Building Digest

Division of Building Research, National Research Council Canada

CBD 138

On Using Old Bricks in New Buildings

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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This publication is a part of a discontinued series and is archived here as an historical reference.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.

The use of bricks recovered from old buildings has become a popular fashion in recent years in Canada. The bricks may be taken from a particular building of historical significance; or they may appeal to builders simply because of their appearance, whether this involves, alone or in combination, a warm, orange-red colour, a sandy surface texture, or the irregular shape and size usually attributed to "hand-moulded" manufacture. In other instances the laws of economics may apply, the selection of reclaimed bricks over new ones merely reflecting the fact that they may be cheaper to buy.

Although any one of these features may provide a valid reason for their use, few who propose to build with salvaged bricks realize that the success of their use depends much more on their conditions of use than is the case with new bricks. Salvaged bricks employed for their decorative effect in interior walls and fireplaces rarely give trouble because the normal agents of their decay do not operate under these conditions of service. In outside walls and chimneys, where they are exposed to weathering however, there is a much greater risk of unsatisfactory performance.

For all the aesthetic enrichment and "atmosphere" that old bricks may add to a new building, and in this regard their effect may be considerable, their exposure to the weather creates special conditions that should be considered by the builder. Many problems that have developed in walls built of reclaimed bricks have been brought to the attention of the Division of Building Research, notably that of decay and spalling which may occur within a short time following completion of the building (Figure 1). Efflorescence and rain penetration, too, are commonly experienced. It is the purpose of this Digest to discuss the properties of salvaged bricks and their influence on the performance of buildings, and to offer suggestions for their use when the builder considers it necessary and desirable that they should be employed.



Figure 1. A wall built of bricks recovered from the demolition of old buildings damaged after one year of service by the spalling of many bricks and marked by efflorescence.

Properties of Old Bricks

Bricks that can be reclaimed from demolished buildings are those that were laid in lime mortar. Mortar containing portland cement is usually too strong and too difficult to remove without damaging the bricks to justify attempts at their salvage. Because use of lime mortar, at least in large buildings, was discontinued in the 1920's, reclaimed bricks that become available are generally those manufactured over 50 years ago.

Bricks made half a century ago differ in several important respects from those now being manufactured, not only as a result of differences in the methods of forming the clay into bricks but also in their burning. The soft-mud method, by which clay and sand were mixed with sufficient water to produce a plastic mass easily formed into the shape of a brick, produced bricks of a generally more porous structure than those formed today by the extrusion process that accounts for most modern production of Canadian brick. In addition, the burning of bricks in earlier times was carried out in kilns in which there were wide temperature variations so that many were underburned. Such bricks, termed "salmons," were much weaker, more porous, and less durable than the hard-burned bricks from the same kiln.* Even though the bricks removed from the kiln were sorted into grades considered to represent well-burnt and under-burnt products (the separation being made on the basis of colour, the deeper the colour the harder-burnt the brick), there was considerably greater variation in the properties of the bricks delivered to the building site than is the case today when more precise conditions of forming and burning can be employed.

Durability

The output of early kilns, comprising bricks covering a wide range of porosity, strength and durability, and roughly sorted into those considered adequately durable for the facing of a building and the remainder, was sold by the brickmaker as "facing" brick and as "backing" brick, the latter intended for the construction of the inner part of the wall. Fortunately for the brickmakers there was a substantial market for backing bricks, since by modern standards walls were very thick; they were frequently 12, 16, 20 or even more inches in thickness, made up of three, four, five or more wythes of bricks. It can be appreciated that when such a wall is torn down the rubble, consisting of the original facing bricks and the backing bricks, cannot easily be sorted into the two types so that each load of reclaimed bricks is almost certain to contain a great many non-durable backing bricks.

Even if it is possible to carry out demolition in such a way as to keep separate the facing and backing bricks (Figure 2), or to sort salvaged bricks carefully enough to ensure recovery of the original facing bricks, they may not possess a high degree of durability. Like any other material exposed to the weather, bricks undergo a gradual degradation, their resistance to decay decreasing as a result of their long exposure to the natural weathering agents of dampness and frost. Although in some instances this decay may be so gradual that their service life is

reckoned in centuries, it may well be shorter. Thus after fifty years or more of service a considerable proportion of the useful life of the brick may have been used up by the time it is reclaimed from a demolished building and put back into service in a new structure. There is, unfortunately, no way of knowing how much service life is left in a used brick.

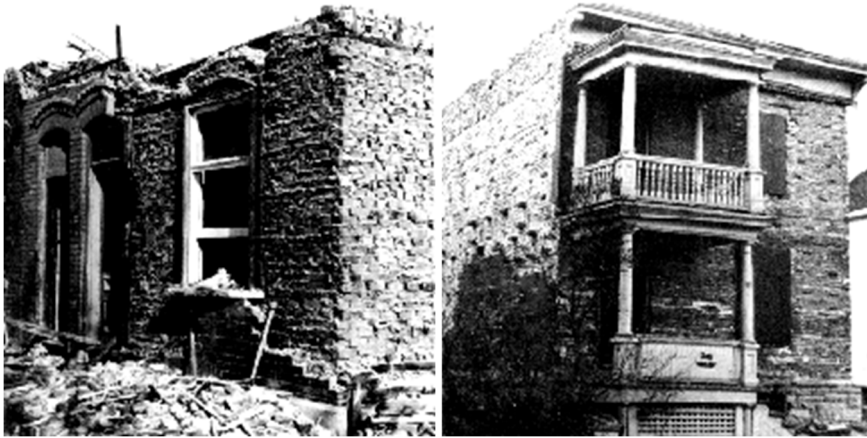


Figure 2. Even when facing bricks are carefully removed from the backing, as was done in the demolition of these old buildings, their durability is not assured.

Bond and Efflorescence

Other properties of salvaged bricks, in addition to that of durability, have important effects on the performance of the wall, particularly the ability of the brick to develop a close bond to new mortar. The thin layer of old mortar still adhering to the brick as well as the dust that has settled on its surfaces during demolition of the wall interferes with the bonding of the new mortar to the brick. The resulting incomplete extent of bond between mortar and brick provides channels for the passage of rain into the wall.

Bricks that have had 50 years of service, with the exposure to rain and dust that this involves, may have become contaminated with salts not found in new bricks. When reclaimed bricks are used, therefore, the risk that efflorescence will form on the wall is much greater than normal, not only because of the salts originally in the bricks but also from those they absorb from the new mortar. The problem is not simply one of aesthetics. A high concentration of salts in a relatively weak and porous brick may favour the formation of efflorescence and cause disruption of the brick from the pressure of their crystallization in the wetting and drying of the brickwork.

The Use of Salvaged Brick

The serious questions of durability, weather resistance, and efflorescence that arise with the proposed use of salvaged bricks must result in a recommendation to avoid them for outside use. When they are to be employed solely for aesthetic reasons in an attempt to reproduce early brickwork it is better to obtain the good imitations that most Canadian brick manufacturers now supply. They are much less subject to problems. If, in spite of the disadvantages and dangers inherent in the use of old bricks, there is a compelling reason for their employment, they should be used in such a way that the harmful effects that may result from their inherent weaknesses are minimized.

Builders of the past, aware of the limitations of the bricks available to them, arranged to use them under conditions that favoured durability. Accordingly, they attempted to keep the bricks in service as dry as possible since excessive dampness was known to lead to their decay from frost action. Builders usually provided a roof that extended well beyond the walls, the wide overhang acting as an umbrella to minimize wetting of the wall by rain. In modern building this degree of wall protection is frequently lacking, requiring more reliance on the durability of the

bricks themselves. In using old bricks, therefore, the builder should revert if possible to the old design feature of a wide overhanging roof.

Just as it is wise to protect brickwork of salvaged brick as much as possible from wetting by rain, so also is it wise to take precautions to protect it from other sources of dampness. Brickwork near grade must be kept out of contact with the soil and should be erected on a foundation wall from which it is separated by an impervious flashing material. The wall should be provided with an adequate vapour barrier so that moisture cannot migrate from within the building into the brickwork. The severe exposure conditions to which chimneys, patios and planters subject bricks rule out the use of salvaged bricks for these purposes.

Attempts to improve the durability and weather resistance of brickwork made of reclaimed brick and exposed to severe wetting conditions by treatment of the wall with a water-repellent such as silicone are generally not successful. The cracks and large pores characteristic of such bricks as well as those between brick and mortar cannot be effectively treated by the water-repellent material.

Mortar

In the laying of reclaimed brick, mortar composed of lime and sand (Type K, CSA Specification A179-1967) is recommended for several reasons. Lime mortar is generally low in content of the salts that cause efflorescence on the brickwork, a problem to which reclaimed brick is particularly susceptible. Such mortar is also, as a rule, highly plastic and is thus more likely to achieve good bond with porous bricks. Mortar made of lime and sand has a third useful property for this application in that it is relatively weak; its shrinkage, therefore, will not impose a high stress on the bricks.

Conclusions

Salvaged bricks should not give rise to any particular problems when used inside buildings. Their use under conditions that require exposure to weather, however, should be avoided because many of their properties have an adverse effect on the quality and performance of the brickwork. The need for "old-fashioned" bricks for this application can be met from current Canadian brick production which includes bricks imitating the colour, texture, shape and dimensions of the bricks made in earlier times but not possessing their inherent weaknesses.

When it is considered necessary to use reclaimed bricks externally, careful attention must be paid to the design of the wall to afford it as much protection as possible from wetting, including that from rain, soil moisture, or the migration of water vapour from within the building. A mortar composed of lime and sand is desirable for laying salvaged bricks.

* The problem of temperature control in kilns, which has remained with brickmakers until fairly recent times was well described in *The Art of Building* written by Thomas Wilsford in 1659; ". . . in Brick-kels, or Clamps those next the fire are best burnt, and such as have naturally much Niter, or Salt-peter in them, with the violence of heat will run, as if glaz'd over for perpetuity: these some call Clinckers, the next to them are best for generall uses, the outermost in the Clamp are worst, where the Salt-peter is not digested, for want of heat they will moulder away: these are by many called Samel or Sandal bricks; besides observe, while the bricks are burning, that side of the Clamp next the wind are the worst of all, the heat being driven from thence." Wilsford's contemporary, Gerbier, wrote that, "of Bricks burnt in a Clam (being burnt with Sea-coales) there are at the least in twenty thousand, five thousand unfit for work, and though some Bricklayers pretend that Sammell Bricks are good enough to fill the Choare of a wall, it is not so . . . most Sammell Bricks are no better than dust . . ."]