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by J.I. Davison

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SOMMAIRE

On a effectué une brève étude de l'effet de la température sur l'absorption des briques et notamment sur le taux initial d'absorption, facteur qui sert à déterminer la quantité d'eau du mortier absorbée par les briques adjacentes. Cette considération est importante pour la construction par temps froids lorsque la quantité d'eau extraite du mortier permet de déterminer l'espace restant pour les forces d'expansion qui agissent si l'eau résiduelle gèle à un stade avancé.

L'étude porte sur les briques extrudées en argile et en schiste, en argile séchée et compressée, silico-calcaires, et en béton choisies spécialement pour leurs différentes valeurs du taux initial d'absorption. Les valeurs ont été déterminées à 20, 10, -1.5, et -10°C avec de l'eau à 20°C, et à 20°C avec de l'eau à 10°C.

Les résultats indiquent une légère diminution du taux avec les températures décroissantes pour les briques à faible absorption et une diminution plus nette pour les briques à forte absorption (briques extrudées et briques en argile séchée et compressée) à des températures inférieures à 0°C. On en conclut que les briques devaient être à des températures supérieures à 0°C pour obtenir une réduction maximale de l'humidité du mortier pendant la construction en hiver.

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Effect of Temperature on Brick Suction

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ABSTRACT: A brief study has been carried out on the effect of temperature on brick suction or initial rate of absorption (IRA), which is a factor in determining the amount of water extracted from mortar placed between bricks. This is important during cold weather construction when the amount of water extracted determines the pore space available for expansive forces if the remaining water freezes at an early age.

The study included extruded clay and shale, dry-press clay, sand-lime, and concrete bricks selected to include a range of control IRA (suction) values. Values were determined at 20, 10, −1.5, and −10°C with water at 20°C and at 20°C with water at 10°C.

Results indicate a small reduction in suction with dropping temperature for low absorption bricks and a substantial drop for high absorption extruded and dry-press clay bricks at temperatures below 0°C. It is concluded that bricks should be at temperatures above 0°C to ensure maximum potential for reducing the moisture content of mortar during winter construction.

KEYWORDS: bricks, clays, shales, concretes, sand-lime, extruding, dry pressing, initial rate of absorption, suction, cold weather masonry construction

One of the conditions, identified in Scandinavian studies [*1,2*], that enables plastic masonry mortars to survive early freezing is that "the moisture content should be reduced to 6 percent by the suction of the masonry units" before freezing occurs. This is based on data by Sneck et al [*1*] showing the virtual elimination of freezing expansions in plastic mortar in which the moisture content has been reduced to the 6% level. These findings have been substantiated by the author [*3*] under ideal ambient laboratory conditions in which mortar moisture content levels were reduced under the influence of the suction of dry masonry units (bricks). Problems in reaching the low 6% level have prompted questions regarding the probability of achieving similar reductions under the less than ideal conditions of winter construction, where bricks may contain some moisture and may be laid up in freezing temperatures. The moisture problem has been addressed by one of the cardinal rules for traditional cold weather masonry construction, the requirement that bricks must be dry. This paper reports the results of a brief study of the effect of temperature on brick suction.

Suction was determined by initial rate of absorption (IRA), defined as the amount of water absorbed in 1 min by 193.55 cm^2 (30 $in.^2$) of bedding surface when a dry brick is immersed to a depth of 3.175 mm (⅛ in.) in water. This is considered to be a good indication of the ability of the brick to extract water from mortar when there is contact between the two in a masonry wall. IRA was determined, using procedures contained in Canadian Standards Association Methods of Sampling and Testing Brick (CSA A82.2), on a sampling of 33 bricks, including shale and clay extruded, clay dry-press, concrete, and sand-lime units, successively at temperature levels of 20, 10, −1.5, and −10°C with water at 20°C and at a temperature of 20°C with water at 10°C. Between tests the bricks were redried for 72 h at 110°C, then cooled, sealed in polyethylene, and left in the cooling chamber overnight.

Results

Brick Temperature

Suction values for bricks at temperatures of +20 and −10°C with a water temperature of 20°C, are shown graphically in Figs. 1 to 3. Average values ($g/193.55$ cm^2 [$g/30$ $in.^2$] per minute) are given in Table 1. Increased suction at the low temperature is indicated for the extruded shale and concrete bricks. Their low suction values coupled with possible experimental error suggest that the increase is not significant. There was a definite reduction in suction at the low temperature for the other three groups, the

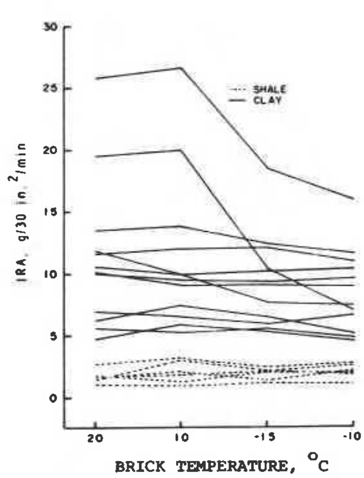

FIG. 1—*Extruded clay and shale bricks. g/30 in.*^{2} *per min = g/193.55 cm*^{2} *per min.*

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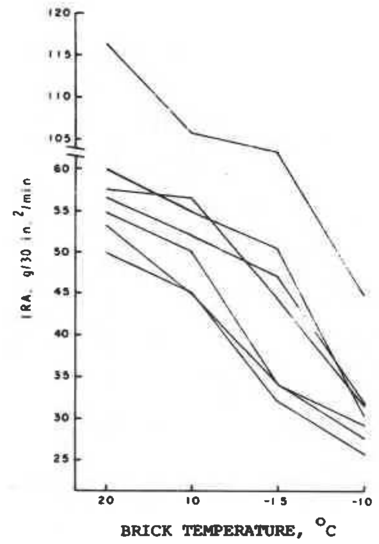

FIG. 2—*Dry-press clay bricks, g/30 in.^{2} per min = g/193.55 cm^2 per min.*

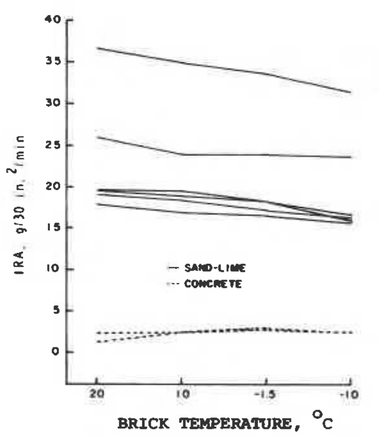

FIG. 3—*Sand-lime and concrete bricks, g/30 in.^{2} per min = g/193.55 cm^2 per min.*

TABLE 1—*Average suction values (g/193.55 cm^2 [g/30 in.^{2}] per minute) for bricks at temperatures of +20 and −10°C with a water temperature of 20°C.*

Brick[a]	+20°C	−10°C
Shale, extruded (6)	1.6	2.1
Clay, extruded (12)	11.3	8.6
Clay, dry-press (7)	64.0	31.5
Concrete (2)	2.0	2.2
Sand-lime (6)	23.0	19.9

[a]Number of specimens in parentheses.

TABLE 2—*Average suction values (g/193.55 cm^2 [g/30 in.^{2}] per minute) for bricks (+20°C) at two water temperatures.*

Brick[a]	+20°C	+10°C
Shale, extruded (6)	1.6	2.1
Clay, extruded (12)	11.3	8.6
Clay, dry-press (7)	64.0	61.7
Concrete (2)	2.0	2.2
Sand-lime (6)	23.0	19.9

[a]Number of specimens in parentheses.

largest in the high absorption clay dry-press bricks (Fig. 2) where the average loss was more than 50% of the control value. Suction loss in the clay extruded bricks was greatest in samples with the highest control values (Fig. 1). Losses for the sand-lime bricks (Fig. 3) were not as substantial as those for comparable clay bricks.

Water Temperature

Average suction values (g/193.55 cm^2 [g/30 in.^{2}] per minute) for bricks (+20°C) at two water temperatures are given in Table 2. There was a minor increase in suction values for low absorption shale and concrete bricks at the low water temperature, with small decreases in clay extruded, dry-press, and sand-lime bricks. Although the trend towards lower suction values with dropping water temperature appears to be similar to that for dropping brick temperature, no determinations were made at lower temperatures because it was unlikely that there would be serious reductions when water temperature dropped from +10 to 0°C and because water below 0°C would not, in any case, be used in cold weather masonry construction.

It is possible that IRA values may vary when individual units are successively tested under the same temperature conditions. Although the results at each data point were not checked against values for a control unit at 20°C, in water at 20°C, the results are considered significant.

Conclusion

Suction values for clay and sand-lime bricks decline as the temperature of the bricks drops. The decline is significant in extruded and dry-press clay bricks with high suction values and is most substantial when brick temperatures drop below 0°C. This suggests that bricks should be at temperatures above 0°C to ensure maximum potential for reducing the moisture content in plastic mortars during cold weather masonry construction.

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