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BUILDING DIGEST

CENTRAL BUILDING RESEARCH INSTITUTE, INDIA

LIME BURSTING IN BRICKS

Bricks in India are made from alluvial, black cotton and red soils. In some parts of the country these soils contain lime nodules of various sizes and composition. When bricks are made and fired from such soils, calcium oxide is formed within the brick mass. The oxide so formed expands after taking moisture from the air and causes blowing of bricks. This phenomena is known as 'Lime Bursting' and 'Lime Blowing' in bricks.

Factors Affecting Lime Bursting:

Composition, size and the amount of lime nodules, nature of clay and firing temperature are some of the factors which affect the bursting of bricks.

Composition of lime nodule present in clay varies widely. The main impurities are silica, alumina, and iron oxide. In general, kankar containing high percentage of calcium carbonate show greater bursting. The greater the impurities present in limestone, the greater is the possibility of reaction to form compounds which do not expand on contact with water and hence lesser bursting in bricks containing impure limestones. No lime bursting is observed with kankar containing less than 50 per cent calcium carbonate. Kankar containing between 50-60 per cent calcium carbonate may not be harmful provided its size is reduced below 2 mm and bricks are fired at a minimum temperature of 900° C.

The amount of kankar or lime nodules present in a soil affects the bursting of bricks to a great extent. The higher the nodule content the greater are the chances of bursting of bricks.

Varied opinions have been expressed regarding the effect of fineness of kankar, but in general, reduction in particle size helps in the prevention of lime bursting. However, when kankar of high carbonate content are present in sandy soils, grinding upto 0.63 mm is not effective unless the firing temperature is raised to 1000° C. On the other hand, with low carbonate kankar, reduction in size below 2 mm prevents the bursting of bricks to a great extent. Cracking is also more in bricks from sandy soil than from clayey soils, probably due to poor strength of bricks from sandy soils. Cracking is more in black cotton soil bricks than those made from alluvial soils.

Harder firing has also been recommended as one of the remedies of lime bursting. Thus bricks may be fired at as high a temperature (more than 1000°C) when the carbonate content of kankar is high (more than 70 per cent). Wide variation of temperature in different parts of the kiln creates difficulties. Firing of bricks at high temperature alone cannot, therefore, be relied upon unless bricks are fired within a narrow temperature range in different parts of the kiln.

Methods of Preventing Lime Bursting

In addition to the methods described so far, two other methods can be recommended for the prevention of lime bursting in bricks. (i) Docking, and (ii) Addition of sodium chloride.

Docking

The process of dipping freshly fired bricks in water is known as 'docking'. Soaking the bricks in water for ten minutes has the desired effect. In some kilns water is sprayed on a stack of bricks to be docked, but the effect of docking is varied. It does not prevent disintegration in all cases. In some of them bursting is accelerated, while in others it delays the period of cracking.

Addition of Common Salt

Sodium chloride is effective in preventing lime bursting upto a limited extent. Generally, 15 kg of common salt is sufficient for one thousand bricks. The mechanism by which sodium chloride renders the lime particles harmless is still not very clear. A probable reason could be a reaction between chloride salts and carbonate in kankar. Other chlorides such as that of NH_4, Ca, Mg, Fe and Al can also be used for the prevention of lime blowing.

Field Procedure to be adopted

The kankar separated from soil should first be tested by putting few drops of dilute hydrochloric acid. If

effervescence takes place it is likely to give trouble. Washing of soil is necessary when it contains substantial amount of kankar in size bigger than 4 mm. Soils can be washed by the 'ghol' method, which is practised on a large scale in Indore and other areas of Madhya Pradesh. In this method, the soil is first mixed with water in tanks called 'ghol tanks' and screened through baskets called 'jhirnis'. Coarse particles of kankar are allowed to settle at the bottom of the tank. The clay water mix is then allowed to pass in the other tanks by gravity and allowed to settle. The excess supernatent water is removed and sediment is brought to a consistency suitable for moulding bricks.

Sometimes when kankar size is small separation of kankar from clay becomes difficult. In such cases other methods as described before are to be used either singly or in conjunction with others. In the field trials carried out by the Institute, sodium chloride method has been used in conjunction with docking to get the best results.

If hydrochloric acid test shows effervescence the following field test can be performed.

Sufficient soil is collected to make about one thousand bricks. Soil is divided into two parts. To one part, 7.5 kg of common salt is added. About five hundred bricks from each part of the soil are moulded and fired in a Bulls kiln or a clamp kiln in the usual manner. Two hundred and fifty bricks from each of the treated and untreated bricks are docked in water for a period of ten minutes. The entire lot of bricks is then exposed to atmosphere for a period of two to four weeks. The results obtained will show the treatment necessary to avoid bursting. If any treatment given above is not able to avoid bursting, then the soil should be washed in 'ghol tanks' to reduce kankar content and the above process repeated.

Accelerated Test for Lime Bursting

For quick assessment, the accelerated tests developed in the Institute can be performed. The test is carried out in an electric oven. Two dishes full of water are placed in two lower compartments of the oven to ensure presence of sufficient quantity of water in it during the test. Brick samples to be tested are placed in the third compartment. The temperature of the oven is raised to 120° C. The specimens are taken out of the oven after 12 hours, and examined for cracking. It may be pointed out that water in the liquid phase should not be allowed to come in contact with the test specimens during the test.

Economics of the Addition of Common Salt

The cost of the addition of sodium chloride depends upon the rate at which it is available at a particular place. At Surat, the rate is Rs. 8.00 per 100 kg. The cost of 15 kg of salt required for 1000 bricks is Rs. 1.20. Thus, this additional cost for the prevention of lime blowing in bricks could be considered nominal.

There is a demand for short notes summarising available information on selected building topics for the use of Engineers and Architects in India. To meet the need this Institute is bringing out a series of Building Digests from time to time and the present one is the 113th in the series. Readers are requested to send to the Institute their experience of adopting the suggestions given in this Digest.

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