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Limes, Mortars and Cements.

Testing Qualities of Lime

The quality would be tested, in the case of fat lime, by making it up into plaster and observing whether it remained free from blisters, 'blows' or bulges; in hydraulic lime, by testing the setting power in still water; and in the case of cement by making briquettes and testing the tensile strength after seven days. Also, in all cases, by observing the colour, weight and general appearance…chalk lime would give off considerable heat when slaking and would set very slowly; the lias lime would give off no appreciable heat and would set quickly. A mixture of the limes would show intermediate results…

Slaking Lime

When water is added to pure lime…, the slaking action commences immediately…and the lime falls to a fine powder…With hydraulic limes the slaking is much slower; the heat less, the increase of bulk less, and the lumps may crack all over, but do not fall to powder…The ydraulicity of lime depends mainly upon the presence of silicate of alumina, or clay. Up to 10 per cent clay, the limes are feebly hydraulic. Up to 20%... ordinary hydraulic…up to 30 %...eminently hydraulic

Varieties of Lime

Fat lime or rich lime is made from nearly pure carbonate of lime, calcined from the upper chalk, marble or other beds containing 98 to 100 % carbonate of lime. Slakes fiercely, swelling to two or three times original bulk, with great disengagement of heat and steam, and falls into a bulky powder which, made into mortar, **has very little setting power (??). Is very soluble (before it carbonates and not especially when a hot mix)** and used chiefly for plastering and whitewashing. Rich lime will carry the most sand, because it is nearly pure carbonate of lime…it is necessary to use a larger quantity of sand with the rich lime to prevent excessive shrinkage. **The setting is very protracted, and only superficial…**

Chalk lime, otherwise known as rich, fat or pure lime, is used for plastering for the following reasons: It slakes easily and thoroughly. It is economical, the slaking process causing it to swell to two or three times its original bulk. It works easily. It is deficient in strength, but strength is not required (is it in building?). It is porous and therefore temporarily absorbs the moisture, which condenseson a wall upon a sudden rise in temperature. It is cheap in the first

instance. It does not spoil but rather improves by being mixed a considerable time before it is required for use; this is called cooling it.
Hydarulic limes are those made from carbonate of lime containing a mixture of clay, which gives it the power of setting under water…Hydraulic limes slake almost without heat, and do not fall into powder…

Lias lime varies according to the locality it comes from, generally with 20 to 30 % of clay in its composition; it is **very difficult to slake, commences after long and uncertain periods, very slight development of heat sensible only to touch, very often no cracking or powder produced. Sets firm under water in 20 hours, is hard in 2 to 4 days, very hard in a month; in 6 months can be worked like a hard limestone…The lias lime is used for retaining walls or for foundations in damp walls, is unsuited for plastering, and seldom if ever used for that purpose. The grey (chalk) lime slakes freely, but is not so economical as chalk lime, and forms a less absorbent surface. Lias lime is very liable to blow when used for plastering, and gives a non-absorbent surface.**

Poor lime contains 60 – 90% of carbonate of lime, together with useless inert impurities, slakes sluggishly and imperfectly, with little increase of bulk; it sets rather firmer than rich limes…but has no strength.

…Stone lime, or grey chalk lime, slakes very freely; after being wetted, it pauses a few minutes, then slakes with decrepitation, development of heat, cracking and ebullition of vapour. It will set in still water, owing to it containing 5 – 12 % of clay, is firm in 15 to 20 days and in 12 months is as hard as soap. Stone lime is suitable for building ordinary walls of brick or stone…and when made with 2 parts of sand will sensibly resist the finger nail at a month old….

Mortar.

Lime mortar in London is usually composed of 1 part of best grey stone lime (Mertsham, Halling or Dorking) and two parts of clean sharp sand. Blue lias lime…may be used in wet ground; those named above being suitable only for dry situations. Chalk lime is unsuitable for use in brickwork owing to its solubility and want of setting power (really??)…For brick-on-edge coping, the mortar should be composed of 1 Portland cement to 2 or 3 of sand, to hold the bricks firmly and prevent moisture from soaking through to the lower courses. For a tall chimney shaft, cement mortar is generally considered **too rigid** and a mortar is preferred composed of 1 blue lias lime to 3 sand. For outer wall of warehouse basement, the mortar may be composed either of blue lias lime or Portland cement, as **either will be suitable for resisting moisture, and will be of considerable strength. Mortar for flat pointing, 1 of lime or cement to 2 of sand.** A struck joint with the upper edge pressed in, and done as the work proceeds, is more durable than flat pointing. Cement pointing is **not usually applied to a new wall built with lime mortar, although it is often used in repairs…**

The common proportion for London mixture is 3 to 1, instead of 2 to 1 as given above, but most architects specify the 2 to 1 proportion. A rod of London stock brickwork, laid to the standard of four courses to the foot, requires 71 to 75 cubic ft of mortar.

Plaster of Paris

…..When mixed with lime for plastering, in the proportion of 1 to 4 or 5, it forms 'gauged stuff', and causes the coat to set quicker and harder; but it cannot be used for external work, owing to its solubility and rapid destruction when exposed to the weather.

Cements

Cement is an artificial mixture of lime and clay burnt and ground together (except Roman cement, which is a natural product), possessing the properties of hydraulic limes to an eminent degree, and **suitable for building in wet situations**. Parian and Keene's cement are used for internal plastering and surfaces intended to be painted. Parian cement would be used in preference to Keene's when it is desired to paint the surface as soon as possible, also when the surface to be plastered is large. Keene's cement would be selected for use **where hardness was desirable, such as for floors, skirtings, columns, pilasters etc.** Plaster of Paris forms the basis of **Keene's cement, which is plaster of Paris and alum**; **Parian cement, which is plaster of paris and borax.** …It is the essential element in 'selenitic' mortar or **Scott's cement, where the addition of 5 or 6 % of plaster of paris to a feebly hydraulic lime checks the slaking and expedites the setting, permitting also a larger quantity of sand to be used without weakening the mortar (it failed, generally).**

Selenitic Cement. Invented by General Scott RE, contains a small proportion of sulphate of lime, added in the form of plaster of Paris to the carbonate of lime and ground with it. **The best lime for the purpose is lias lime,** but limes from the magnesian limestone formation and grey chalk are much used. The proportion of sulphate varies from 4 to 7%, according to the nature of the limes…Records of experiments show that it makes a **stronger mortar than Portland cement,** at less cost. It is also used for plastering, **but plasterers say it requires much more time and labour to work up to a good face than common plaster, whilst fire-cracks are liable to develop on the surface…**

Roman Cement

….Does not attain any great strength, and is much weakened by admixture of sand. At the end of 7 days the tensile strength of neat cement is about 150 lb on 1 ½ inch square (compared to 1000 lb on 1 ½ inch square for Portland cement at the time), but with equal parts of sand and cement the strength would be only about 1/3 of that amount.

Plasterers Materials

…carbonate of lime generally pure or fat lime from the upper chalk, calcined and thoroughly slaked…

Coarse stuff is a rough mortar containing **1 to 1 ½ parts of sand to 1 of slaked lime by measure and 1 lb ox-hair to every cubic ft to 3 cubic foot of stuff…. The lime, previously slaked and mixed with water in a large wooden tub to a creamy consistency, is then poured into the middle.** The hair – long, sound ox-hair from the tanner's yard, free from grease or dirt, and previously well-switched with a lath or immersed in water to separate the hairs – is then added and well-worked in throughout the mass with a three-pronged rake. **The mixture is then left for several weeks to cool, that is, to become thoroughly slaked to prevent blowing after being laid.**

Fine stuff is pure lime slaked to paste and afterwards diluted to the consistence of cream. It is then allowed to settle, the water rising to the top is run off, and the stuff is left till it is thick enough for use. A little white hair is added for some purposes.

Plasterer's Putty is pure lime slaked with water, brought to a creamy consistence, starined through a hair sieve, and allowed to evaporate until stiff enough for use. It is the last coat applied to internal walls that are to be coloured, and always is used without hair.

Gauged Stuff is plaster's putty with a portion of of plaster-of-Paris mixed with it, the proportions being 3 parts putty to 1 part plaster-of-Paris **when required to set quickly,** and gauged in small quantities.

….Blistering of Plaster…is a defect to which internal plastering is subject…and is due to the slaking of particles of the lime after the plaster has been applied. To prevent it, the stuff should be made a long time before it is required **and left for some weeks to cool.** In a very bad case of blistering, the lime used probably contained large hard overburnt particles, which, slaking afterwards, expanded and caused bulges. **Sifting the lime before using would have removed these particles.**