TECHNICAL GUIDANCE - EFFLORESCENCE IN CONCRETE

Efflorescence is often used to describe white deposits or staining on concrete materials. It is often used as a general term to describe what is basically a range of deposits that vary significantly in chemical composition and method of formation.

Efflorescence in the true sense can only ever manifest on clay masonry such as clay brick. The most common form of deposit on concrete masonry is **"Lime Bloom"** or **"Lime Weeping"**. This can be seen as a white deposit, which is apparent, either as white patches or streaks from the mortar joints, or merely as an overall lightening in colour. The latter effect is sometimes mistakenly interpreted as colour fading or bleaching of concrete.

The effects of Lime Bloom are triggered by allowing masonry and mortar to become saturated before and during construction and therefore adequate protection of the material once on site should be considered.

The cause of lime-bloom lies in the chemical composition of **Portland Cement**. When water is added to cement a series of chemical reactions take place that result in setting and hardening. This then allows Calcium hydroxide (a product of the cement) to migrate to the surface due to the fact that sufficient hydration of the cement has not taken place. Calcium hydroxide is slightly soluble in water and under certain conditions it can migrate through damp concrete or mortar to the surface and react with Carbon-dioxide from the atmosphere to produce a surface deposit of Calcium-carbonate crystals. This surface deposit is generally seen as "white crystals" or "powder" leaching out of mortar joints, but in severe cases, can also be similar to a very thin coat of white wash if the blockwork is saturated and allowed to remain so before and during construction.

This natural effect can also be attributed to the presence of "free lime" in Lime Sand mortars, which acts in the same way to produce surface deposits on the face of concrete masonry. This same problem can also occur in the mortar joints used with clay brickwork.

Limestone aggregate, which is the most commonly used material in the production of all concrete, be it insitu or precast, **is not** a significant contributor to the onset of Lime Bloom, and has never been proven to be so. Carboniferous Limestone does not present soluble lime into the product, on the contrary, the presence of limestone in the mix acts, in chemical terms, as a catalyst to aid the hydration of the cement, and if anything, should reduce the risk of lime bloom.

The occurrence of lime-bloom on concrete tends to be spasmodic and unpredictable. Nevertheless, an important factor is the weather. "Lime-bloom" forms most readily when concrete becomes wet and remains damp for several days and this is reflected in the fact that it occurs most frequently in the winter months. In particular, extended periods of rain and snow, which may be present for some time and damp foggy days.

Also, drying winds are often suggested as causing "Lime Bloom" but they are not a major factor.
This is because "Lime-bloom" is not visible on wet concrete and so only becomes apparent during and after the onset of drying weather. The drying weather does not necessarily produce the "lime bloom", it may only make visible a deposit that had already formed but could not be seen because the concrete was damp.

Concrete is normally only susceptible to "lime-bloom" early in its life. "Lime-bloom" is a **temporary** effect and given time, left to the elements, usually disappears of its own accord. It is purely superficial and does not affect the durability or strength of the concrete.

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Also, it has been suggested that the use of other aggregates in concrete blocks such as fine sands and gravel will reduce the risk of lime bloom efflorescence. To reiterate the statement above, the cause of lime bloom is quite simply attributable to the cement content of the masonry and mortar, and also the free lime in Lime Sand mortars. Therefore, the chance of this occurrence happening **on any masonry product** is equal. Furthermore, lime bloom, as previously mentioned, is reduced by the presence of carboniferous limestone, which has hardened during its natural evolution and exposure to carbon dioxide in the atmosphere.

The major advantages such as strength, low permeability, acoustic performance, thermal resistance, and durability for long life are not questionable in view of the excellent long-term performance limestone aggregate has provided. This is why the vast majority of precast concrete manufacturers and insitu concrete suppliers use limestone aggregate.

With regards to cleaning lime bloom from an affected area, it is advisable to allow the area to dry out for as long as possible prior to any type of cleaning action. This will facilitate the cleaning process as it will reduce the risk of the lime bloom “re-appearing” once a wet cleaning process has been utilised.