History and use of roman cement stuccos

Roman Cement was first discovered by the Rev. James Parker in 1796 during an era when scientists and industrialists first started experimenting with new types of cements and limes. Parker had collected marlstone from the Thames estuary and following some experiments he discovered a strong, durable and valuable binder. The word 'cement' was used to differentiate the new product from lime and the name 'Roman' as a marketing point at a time when classical architecture was much admired.

Parker filed a patent in 1796 for the burning of marl to form a cement which was highly hydraulic compared to the limes and lime/pozzolan mixtures of those times. The resulting cement had many advantages; it was fast setting, low shrinkage and durable. Although harder than traditional lime, it was much softer and more breathable than modern Portland cement.

The "noddles of clay", as Parker called them, were septarian calcareous concretions, and are common in the London Clay which forms cliffs along the north coast of the Isle of Sheppey, on the south side of the Thames estuary. After the use of Parker's cement became popular, other sources of septaria or "cement stones" were sought, and concretions of a very similar character were found elsewhere.

Geology was in its infancy, but it became apparent that the London Clay outcropped at other coastal locations also contained septaria. Most important was the area around Harwich. Various other soft clays outcropping on the coast were found to contain septaria. Notable among these were Tertiary clays around the Solent and the Jurassic Kimmeridge Clay appearing on the coasts of Dorset and North Yorkshire. At some coastal and inland locations, similar concretions were found in harder shales, notably the Blue Lias shale and the Coal Measures shales. These were also calcareous, but not always of the same chemistry, and cements made from these were not generally regarded as "true" Roman Cements. In the early 19th century, this process spread throughout continental Europe and North America.

Roman Cement is easy to produce. The raw material is burnt at a low temperature, below the melting point of stone, at around 1000^{o}C; as a result, clayey limestone with a proportion of clay varying approximately from 22 % to 35 % can be used from deposits found almost everywhere. Although Louis Vicat proved in 1817 that it was possible to make cement from an artificial mixture of clay and limestone, grinding tools and energy costs at that time made this an expensive and unpredictable option. This is why the natural mixture of limestone and clay in marls was preferred. Simple and existing technology traditionally used for lime kilns could be easily adapted to make Roman Cement. The chief production difference was that unlike lime, Roman cement does not slake due to the almost total lack of quick lime; it was simply ground, often using tidal mills.

Strength and durability in Roman Cements are built up in two phases, over a very long period; during hydration, the aluminates formed in the kiln at low temperature are responsible for the quick set (in the order of 2 to 3 minutes without retarder) and the initial strength build-up phase during the first hours. After this the belite (also the principal component of hydraulic lime) is formed over many months giving great durability.

Application

Lime Green's Roman Stucco is applied using traditional techniques. The inclusion of a small amount of lime to control strength and suction removes the need to work "green on green" and coats can be keyed and left to set if desired. As with all Stuccos, successive coats in must be thinner than the preceding coat, finishing coats in particular should be substantially thinner.

The products available are:

Roman Stucco Primer

Roman Stucco Undercoat

Roman Stucco Finish in 3 textures (TF, FF or VF)

Priming and preparation

Remove any loose or friable material, and brush down old masonry to remove dust. Cleaning with dilute brick acid or biocide may be necessary if organic growth is present. Masonry may require priming if it is highly absorbent or completely non-porous or waterproofed. Ensure masonry is free from dust and dirt, if necessary clean old masonry using brick acid.

- On highly absorbent masonry brush on a slurry of Roman Stucco Primer no more than 1 hour before applying further coats.
- On non-porous masonry (for example engineering bricks) or waterproofed concrete apply Lime Green Grippa and leave for 24 hours.
- On good quality masonry of average suction, simply pre-wet with a light mist of water.

Running Cornices and mouldings in situ

Where necessary prime the background as above. Core-out the feature with coats of Roman Stucco Undercoat running the mould "green on green" between each application. As it contains fibres it is also suitable for application onto wooden and metal lathing. Each coat of Roman Stucco Undercoat should be allowed to firm up and harden before further coats are applied, typically between 1 hour and 24 hours after the last.

The final 3 to 5mm is run with Roman Stucco Finish FF, in 1 or more passes which will leave a fine sand face texture. Optionally the very final pass may be done in Roman Stucco Finish VF for a crisper, smoother finish. Cornices of significant depth (typically greater then 40mm) should have additional support from wooden or a stainless steel metal armature.

Plain Flat Work

Build out the background in coats of 10 to 20mm of Roman Stucco Undercoat, levelling with a straight edge. Scratch a key between each coat and allow it to set before applying another. The background should be brought level with no more than ±3mm deviation under a 2metre straight edge.

Apply a final coat of Roman Stucco Finish TF at 3 to 5mm thick and finish with a sponge or a wood float. Never attempt to level up using this coat.

Ashlar lined work

Initially applied as above. Once firm, work methodically to mark out the ashlar lining using a plumb-bob and chalk line to the specified plan and ensuring the marking does not align with windows and doors etc. Use a jointing tool to mark the stucco once it has hardened to the necessary degree.

Quoins

Build out and level the background in coats of 10 to 20mm of Roman Stucco Undercoat. Scratch a key between each layer, and allow each coat to set before applying another. The background should be brought level with no more than ±3mm deviation under a 2 metre straight edge.

Joints should be cut into the fresh stucco, after it has set but before it gains considerable strength, typically within hours.

Apply a coat of either Roman Stucco Finish FF or VF (depending on the texture desired), at no more than 3 to 5mm thick. Never attempt to level up using this coat.

Vermiculation

Build out using Roman Stucco Undercoat to the approximate shape desired and lightly roughen before allowing it to set for at least 24 hours. A network of features / bands is formed using Roman Stucco Finish (TF, FF or VF texture as desired), which are then sculpted or picked out using a small tool. Alternatively, a thicker layer of Roman Stucco Finish is applied flat, and then carved back as the initial set occurs using a small tool.

Repairs

Historic Roman cement renders can often be well bonded but cracked. They were often also given a “cement wash” just after completion to unify the surface; this can be reproduced by using Roman Stucco VF mixed to a slurry. Trials should be carried out to check on the exact technique to achieve a good match.

- *Crack repair*

  Fine Cracks <1mm use Roman Stucco VF mixed to a putty consistency.
  Cracks >1mm use Roman Stucco FF

- *Patch repairs*

  To help achieve a good bond between retained render and the new render we recommend using Lime Green Roman Stucco Primer, painting it on as a slurry worked well in to the background. Once the primer has “picked up” apply an undercoat which can used to build up in relatively thick layers. There are two grades of finish coat (TF or FF) depending on the desired texture.

Curing

- Prevent all coats from drying out too rapidly.
- Lightly spray each coat with water to prevent the product from drying too quickly.
- Protect from adverse conditions such as frost, rain, direct sun and strong wind.
- Apply in temperatures between 3°C and 25°C
- Do not re-work the material once it has started to set.