The pointing hardness tester – an instrument to meet a need

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The quality of the pointing in recent brickwork is, at least in The Netherlands, often unsatisfactory. In the author's view an important cause may be that architects seem to be only interested in the aesthetic aspects of the pointing. Another significant reason may be, however, that until recently there was no effective method of measuring the quality of the work done. TNO Building and Construction Research (TNO-IBBC up to 1991) modified the Schmidt pendulum hammer P for plaster and aerated concrete. It can now be used by anyone in the building trade to measure the hardness of pointing in masonry - simply, quickly and reproducibly. The results are so good that the new measuring methodology deserves to be standardized. In anticipation of this a provisional classification is proposed based on several years' experience. The results of both laboratory investigations and practical work are presented.

1. INTRODUCTION

Facade masonry in The Netherlands is generally not rendered. On the contrary, clay-brick masonry often plays a major part in The Netherlands' architecture. Apart from the colour and structure of the exposed surfaces of the bricks (stretcher face or head) the visual aspect of masonry is also largely determined by the colour, type and structure of the pointing. The final finishing of the joints, the pointing, is therefore usually determined on the basis of one or more test walls or sections. In this case the specifications state 'pointing to be approved by the supervisor'.

Unfortunately all too often only the visual aspects are considered. It is only when complaints are made and the high cost of repair or replacement has to be faced that it is realized that there are also quality considerations attached to pointing. For example, pointing work which at the building stage cost Dfl10 m⁻² could easily cost Dfl50 m⁻² to replace, in addition to which repointing can be very awkward as scaffolding has to be set up again, which is particularly inconvenient for gardeners. Removing the old pointing produces a great deal of dust and noise, and the edges of the bricks are frequently damaged. Moreover, removing pointing is considered rather unhealthy work.

Until recently the quality of pointing was judged by little more than just looking at it, scratching and prodding it with a hard object (Fig. 1). Many car keys, pocket knives, screwdrivers and other unsuitable types of 'measuring equipment' have been worn out in this way. The assessment barely goes further than 'not very good', 'not too bad' or 'fair'. Needless to say, it is very difficult to set a quality standard to be met when such methods are used.

As TNO were regularly faced with this issue a study was undertaken to find a convenient instrument for measuring pointing quality, or at least a major quality factor, objectively, reproducibly, reasonably accurately, and preferably easily and quickly as well. The search was successful and for some four years the instrument and its measurement and assessment methodology have been used with full confidence in investigations and commissioned work on a fairly large scale. In the author's view there is definitely a solid foundation for a standard on 'measuring the quality of pointing in masonry'. Those concerned will readily admit that there is a tremendous need for such a standard.
2. HAZARDS TO POINTING

Pointing in masonry is exposed to various influences:

1. At ground-floor level the pointing needs to have some mechanical resistance, for example to scraping caused by bicycles leaned against the façade or children who like to mess about with the pointing, particularly when they are successful.

2. Rain-water dissolves the binding agent of the pointing mortar. This mostly affects horizontal pointing, e.g. unprotected tops of walls. Similarly affected are chimneys without overhang, corners and the lowest brickwork courses (by splashing water). The dissolving action of rain-water on the binding agent of the mortar is mainly due to the fact that rain-water is almost completely saturated with carbon dioxide. Water containing carbon dioxide will transform carbonate into bicarbonate, which is much more soluble than the original calcium carbonate. Pure rain-water saturated with carbon dioxide has a pH value of 5.6. However, due to air pollution the average pH value in The Netherlands is 4.3. That makes the rain-water over ten times as aggressive towards cement- and/or lime-bonded mortars. In coastal areas the chloride in windborne salt can contribute to the dissolving of calcium compounds.

3. When wet masonry dries, salts may be deposited on or just below the surface. When these salts crystallize in the pores of the pointing mortar, pressures can develop of such magnitude that the walls of the pores give way and the mortar becomes powdery or flakes off. This can also happen when the crystals are transformed due to changes in the temperature or dampness of the surroundings.

4. Algae, and at a later stage mosses, may grow on masonry which is wet for a prolonged period. Algal growth usually has no more effect than changing the colour. The effect of mosses, however, can be damaging because their roots penetrate the pores in the mortar and release acids which dissolve the mortar binding. After a while some wet sand may be all that is left of moss-covered pointing.

5. Pointing which appears to be in good condition may not be able to withstand the effects of chemicals or the force of high-pressure water or grit blasting used when masonry is cleaned. This often leads to serious conflicts between the customer and cleaning contractor.

Naturally resistance to dissolving or crystallization effects is not the same as resistance to mechanical load. At first sight assessing the quality of pointing would appear to be quite complicated and expensive. However, it is not quite that bad. The destruction of the mortar is always associated with the breakdown of the bonding, which means that the binder is attacked. Resistance to these forms of attack can generally be improved by increasing the amount of binder. Its effectiveness can also be increased by improving the grain-size distribution of the sand, by compacting the mortar on application, and by controlling the curing conditions. Poor-quality pointing mortar can usually be traced back to one of these factors. Improving any of these factors will also improve the compressive strength. Therefore a measuring methodology which gives information about the compressive strength of the mortar should be sought.

3. MEASURING METHODOLOGIES

When looking for a practical measuring instrument and methodology we naturally wanted to ensure the greatest possible compatibility with existing instruments and methodologies. A non-destructive measuring method was preferred. Some non-destructive testing methods for measuring the quality of concrete depend on the speed of sound in concrete. To measure the quality of mortar pointing in masonry the speed of sound along the length of the pointing would have to be measured. It was clear that the bricks and mortar used to build the wall could have an unknown influence on the measurements. This measuring method did not therefore offer any great prospects for a practical measuring method and was not studied extensively.

Plasters used for exterior insulation systems are tested with a Perfotester. A die with a defined surface area is driven into the plaster by a spring. The depth of penetration is then measured. On mortar pointing even a