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Guide to specifying the quality of building mortars

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Foreword

Committees of the British Standards Institution have recently been preparing standards for mortar plasticizers, masonry cement, ready-mixed lime:sand for mortar, and for methods of testing mortar. The Code of Practice for brickwork and blockwork (CP 121 'Walling', Part 1 'Brick and block masonry') has also been revised. This interest in mortar has led to a detailed appraisal of the methods of specifying the quality of mortar by a panel set up to consider long-term developments in the improved use of mortar.

Traditionally, mortar has been specified by simple volumetric proportions of the solid constituents, the water content being controlled by a craftsman by choice of consistence. This method has been adequate for most work in the past and will continue to be so where the properties of the mortar are not critical. However, new developments in building make greater control of the quality of mortar technically and economically worthwhile, and a more refined specification is necessary.

This document records the panel's recommendations for specifying the quality of conventional mortar for present-day applications, such as bedding bricks or blocks, rendering or plastering, and thus to assist specifying authorities in the drafting of specifications for mortar for building purposes.

The document is not itself a specification for the supply of mortar and it cannot be used as such because it requires the specifier to provide information essential to the function of a specification.

Section one outlines the factors to be considered in deciding the form of the specification and the quality to be specified for a particular job; the specification may be either of the 'prescription' or 'performance' types. Section two deals with general clauses for all specifications; section three gives details for the prescription type of specification and section four for the performance type.

BS 4551, 'Methods of testing mortars and specification for mortar testing sand', BS 4721, 'Ready-mixed lime:sand for mortar' and BS 4887, 'Mortar plasticizers' have already been published, and this document also refers to a British Standard for masonry cement which is in course of preparation.

NOTE. The titles of the British Standards referred to in this document are listed on the inside back cover.

Guide to specifying the quality of building mortars

0. Introduction

Mortar is a relatively simple material but may have to fulfil many functions during its service. The requirements of both the fresh and the hardened mortar are complex and interacting so that it is often necessary to adopt some compromise. Insufficient knowledge is yet available to be able to advise in detail on how all these characteristics can be adequately specified by requirements either for composition or performance.

Some characteristics of the mortar are sensitive to its working properties while still fresh and traditionally the craftsman has been left to adjust the proportions to produce a mortar which he could handle easily and which, in his experience, would be adequate. However, requirements for strength or other important properties may not be satisfied by this approach. While it is necessary for a mortar to be of a suitable consistence for the craftsman, this requirement should be consistent with the production of mortar which will behave adequately in other essential respects.

On the other hand, it is fortunate that some properties of mortar are relatively insensitive to normal prescription or performance requirements. For example, the thermal properties of a mortar are not greatly affected by the relative proportions of the materials or by the strength, but are affected significantly by the choice of dense or lightweight aggregate and, to a limited extent, by any air entrained.

Strength of mortar, in a general sense (whether expressed in terms of measured values of compressive or bending strength or in terms of richness of cement in compositional requirements), is an important characteristic. For some purposes, bedding mortars need to be strong in order to achieve the required loadbearing capacity of the wall; for other purposes, too strong a bedding mortar can be an important factor in encouraging cracking of the construction. Similarly, the strength of mortars for rendering and plastering in relation to the substrate to which they are applied affects the adhesion and the likelihood of cracking in the hardened mortar.

This document gives detailed advice on the writing of a specification for the quality of mortar to be handled by a craftsman using a trowel when bedding units for brickwork or blockwork or when rendering or plastering. It is not intended to apply to the use of slurries, grouts or dry mortar for packed joints, nor to mortar for floor screeds or for the bedding of paving flags. It does not necessarily apply to mortars containing gypsum.

It is not intended that all, or even most, of the outline requirements referred to in this document are necessary or desirable in a specification for any one particular job.

Section one. General considerations

1. Forms of specification

The specifier should accept responsibility for the adequacy of the requirements to cover all aspects of the quality of the mortar provided it is made in accordance with these requirements.

The specification may take either of two principal forms, 'prescription' or 'performance', or be an appropriate combination of each, provided conflicting requirements are not thereby included. Normally a prescription type of specification will be satisfactory for rendering and plastering mortars and for bedding mortars for traditional brickwork and blockwork; a performance type of specification may be preferable for bedding mortars to be used for calculated loadbearing brickwork or blockwork.

The supervision, inspection and testing required for the enforcement of the requirements should be appropriate to the particular type. Each should include requirements for quality of materials and for workmanship, which may be the same irrespective of the form, but each should have an appropriate preamble outlining the basis on which the specification will be operated.

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1.1 Prescription specification. The prescription type of specification should be drafted so that the quality of mortar is controlled by stated requirements for the composition of the material only and is enforced by regular inspection that these requirements are being complied with. If the specifier requires confirmation that the requirements are adequate for his purpose he may arrange for preliminary tests to be made (see Clause 4).

1.2 Performance specification. The performance type of specification should be drafted so that the quality of mortar is controlled by stated requirements for the properties of the mortar as determined by specified tests on samples taken during the course of the work. The procedure for checking performance requirements should be specified to relate (a) to simple visual inspection with the testing of a sample of any suspect quantity or consignment of mortar, or (b) to visual inspection with infrequent but regular testing of samples or (c) to the statistical analysis of the results of tests on random samples taken over a period of production.

Method (c) involves a greater amount of testing than methods (a) or (b); hence it is only likely to be appropriate for controlling the quality of mortar produced in considerable quantities where strict control is economically or technically desirable. However, statistical procedures can give warning of adverse trends before the results are too serious, and an adjustment of the composition may be the only action required if mortar is found not to comply.

2. Assessment of the job

The choice of type of specification, the detailed requirements and the methods of enforcement should be based on an assessment of the work to be covered by the specification in which the following circumstances are taken into consideration.

2.1 Essential characteristics of the mortar. The specification should include only those requirements which are of significance to the quality of the work and which are the responsibility of the contractor or supplier of materials.

2.2 Relation between properties of mortars and characteristics required. Table 1 gives the main properties of mortar and Table 2 the main properties which affect each characteristic. Where test methods have been standardized the property may be specified in relation to the procedure given in the stated clause of BS 4551; where test methods have not yet been standardized it may be possible to select compositional requirements on the basis of a qualitative assessment of the relevant properties.

2.3 Relevance of performance requirements to essential characteristics. Strength has been found to be a convenient property to specify in performance specifications because limiting values can be chosen as a means of controlling the quality of mortar relevant to more than one essential characteristic when there is some degree of correlation between them. For example, it may be appropriate to specify a minimum compressive strength for a bedding mortar to ensure adequate strength of the wall or to ensure that the mortar of a particular type, such as a non-plasticized as opposed to a plasticized mortar, will be durable – either might be the limiting criterion. Furthermore, it may even be desirable to specify a maximum strength to reduce the danger of cracking.

2.4 Characteristics not easily specified. If certain features are difficult to specify precisely in words, e.g. characteristics affecting finish, it may be necessary to require that preliminary tests or trials are made to establish criteria for acceptable ranges of these features.

2.5 Action to be taken in case of non-compliance. If there is serious danger that structural collapse could occur in the immediate future or, because of inadequate durability, in years to come, the faulty work may have to be removed and replaced; in other situations, the likely consequence may be less serious and some immediate repair, such as raking out bedding joints and repointing, may be adequate; in others still, the faults may be difficult to correct, in which case financial penalties may be imposed. With the performance type of specification based on regular random sampling, the action may simply be to demand a change of composition of the mortar which would be expected to raise the quality sufficiently to ensure that future material will comply with the requirements.

2.6 Systems of inspection and/or testing. If the importance or size of the work does not warrant much inspection, it is pointless to draft other than the simplest type of specification with requirements which imply a high probability against the work being unsatisfactory in any of all the essential characteristics.