# NATSPEC Working Note

# SAND FOR MORTAR

*Prepared for NATSPEC//Construction Information.*
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*NATSPEC wishes to acknowledge the support of Rocla Quarry Products*

## 1 INTRODUCTION

This note discusses and recommends improvements in NATSPEC's specification of sand for mortar[1]. The note draws upon the work of others, with the main innovations being the way in which information is arranged and the insights that are drawn from that exercise. Being a 'working note', it focuses on explanation at least as much as on requirements, with the intent of facilitating peer review. To make the note self-contained, clauses from acknowledged standards/specifications such as AS 2758.1 are imported or referred to:

The aim is to promote the use of sand for mortar which:

- Enables mortar to be made without recourse to "doping" – the on-site (i.e. uncontrolled) addition of inappropriate quantities or combinations of cement, water or mineral or chemical plasticisers, all of which are deleterious if used to excess.
- Facilitates the making of mortar that is reasonably tolerant of variations in materials, preparation and environment – thus minimising the need for on-site manipulation of composition.
- Facilitates the making of mortar that can be placed, compacted and finished easily and quickly.
- Enables long term in-situ durability criteria to be met.(or ensures satisfactory long term in situ performance).

The subject of this note is sand for cement-based mortar, principally for bedding masonry and tiles, for plastering and for monolithic toppings to concrete. It does not include sand for sand/lime mortars. It is hoped that it will facilitate the development of similar recommendations for sand for concrete. The performance of mortar, in both fresh and hardened states, is particularly dependent on sand quality, more so than is that of concrete. Also, sand which is functionally optimal for mortar may not be so for concrete.

The term mortar is used to describe a class of cement-based materials of which the primary components are sand, cement and water. Hydrated lime is a near – primary component. Mortar can also be defined as a sub-class of concrete, differing only in that it has no coarse aggregate. Mortar for bedding masonry and tiles, and for plastering, is normally placed and finished by hand.

This note covers sand alone but refers to materials that are used to improve mortar, or to compensate for deficient sand, such as mineral and chemical plasticisers. It is proposed that these materials be covered in companion specifications.

## 2 DEFINITIONS

### Suitability/Acceptability

A sand that is suitable is one that can be used to make mortar that does not require "doping" – the on-site (i.e. uncontrolled) addition of inappropriate quantities or combinations of cement, water or mineral or chemical plasticisers.

A mortar that is acceptable is one that will satisfy specified performance requirements in both fresh and hardened states. This means that the fresh mortar can be easily placed and finished yet will not sag or deform unacceptably after placing and/or finishing and before hardening, and will harden quickly enough to not materially delay construction. This implies that the fresh mortar will have enough water

[1] Here defined as Mortar: A plastic mix of fine aggregates and binders applied by trowel for bedding masonry units, plastering walls and topping floors and stairs, which dries and sets hard.

retentivity to not impair the specified requirements for hardened mortar. This further means that the hardened mortar will have sufficiently low shrinkage and permeability and sufficient strength (e.g. bond, tensile and compressive), and sufficient durability to satisfy the specified structural and functional requirements of masonry structures or of plaster and render that the mortar is used to make.

**Plaster**

Cement/sand-based mortar applied to principally vertical faces of masonry, commonly known as render.

**Microfines**

That fraction of sand passing a 75 µm nominal sieve.

**Paste**

A composition of hydraulic cement and other powdered materials of a similar or finer size, including those in the aggregates (sand), together with water, and any admixtures. The powdered materials include cementitious (e.g. Portland cement and hydrated lime), supplementary cementitious (e.g. pozzolans such as fly ash, slag, silica fume, natural pozzolans and processed natural materials such as metakaolin), beneficially reactive (e.g. milled limestone) or non-reactive (e.g. microfines derived from sand, and pigments).

All solid materials other than cementitious ones are defined as additives.

**Additive**

A particulate material incorporated into the paste to influence all or any of the rheological properties of the paste, the hydration reaction, the pozzolanic reaction or the properties of the hardened mortar. Additives are typically powders with a particle size similar to or less than that of cement.

**Admixture**

A material incorporated into the paste to influence all or any of the rheological properties of the fresh paste, the hydration reaction, the pozzolanic reaction or the properties of the hardened mortar. Admixtures are conventionally (but not necessarily) formulated as aqueous mixtures.

**Voids content**

The volume of voids in a unit total volume of compacted sand.

**Packing density**

The volume of solids in a unit total volume of compacted sand.

**Maximum particle size**

The nominal aperture of the smallest sieve through which all of the sand passes. Normally expressed as $d_{max}$.

**Pozzolanic**

Pertaining to material that possesses little or no cementitious value, but which is capable of reacting chemically with calcium hydroxide at ordinary temperatures to form compounds with cementitious properties.

**Rheology**

The study of the viscous properties of a fluid as a function of shear strain rate. The aim of this science is to establish relationships between shear stress and shear strain rate. The minimum shear stress that is needed to produce a finite shear strain rate is called the yield stress. The ratio of shear stress to shear strain rate is called the viscosity (or plastic viscosity). Fluids such as water and honey have no finite yield stress but have finite viscosity and are called Newtonian fluids. Fluids such as whipped cream and fresh paste, mortar and concrete have finite yield strength and finite viscosity and are called Bingham fluids.

In fresh paste, mortar and concrete, yield stress is the macroscopic result of friction between particles, not of the liquid phase, the only function of which is to control the distance between the particles. Plastic viscosity is the macroscopic result of the flow of water in the voids structure of the granular system[2] also during shear.

## 3 CONTEXT

Current Australian standards describe sand primarily via its physical attributes (e.g. particle size distribution) but not compositional attributes (e.g. mineralogy).

Within AS CA27 and AS 2758.1, sand is specified by reference to a "desirable" particle size distribution. This is insufficient to define voids content – a primary, if not the primary determinant of performance – or to ensure performance per se.

AS 2758.1 uses blanket limits – based on origin – to specify the microfines content (herein defined as the • 75 µm fraction) of fine aggregate (sand). This approach – the "particle size" method of classification- appears to assume that mineralogy can be inferred from particle size. For example, AS 1289.0 defines particles between 60 and 2 µm as silt; those less than 2 µm as clay. This assumption is an oversimplification and needs to be balanced by a "mineralogical" method of classification. For example:

- One mineralogical definition of silt is "predominantly rock flour or quartz mineral particles that are between sand and clay size."
- A basic mineralogical definition of clay is "a hydrous aluminosilicate with layered crystal structure." Clay minerals are divided into four major groups; kaolinite, smectite/montmorillonite, illite and chlorite. Each affects mortar differently, the smectite/montmorillonite group being considered the most deleterious.

Microfines corresponding to the particle size classification of silt will not necessarily be deleterious to mortar; while those corresponding to the mineralogical classification of silt will be beneficial (up to a certain proportion). For example, milled limestone corresponding to the particle size classification of silt is widely used to improve mortar and concrete.

Microfines corresponding to the particle size classification of clay will not necessarily be deleterious in mortar (up to a certain proportion); while those corresponding to the mineralogical classification of clay will be deleterious. For example, amorphous silica corresponding to the particle size classification of clay is widely used to improve mortar and concrete.

*Admixtures for Cement*[3] describes the mechanisms by which clay minerals affect mortar and concrete. *Standardization and Qualification of Fines in Aggregates in France*[4] assesses the effect of microfines composition on the strength of concrete. *An experimental study on the guidelines for using higher contents of aggregate microfines in Portland cement concrete*[5] assesses the effect of microfines content on the properties of mortar and concrete.

The "particle size" method of classification has been influential – leading to the frequent removal of microfines from sand, regardless of its physical or compositional attributes, or end-use. In itself, this practice is frequently both wasteful and environmentally undesirable. It has an important functional consequence; microfines overlap the particle size range of cement, and by definition, form part of the paste. In a

[2] de Larrard, F and Sedran, T**.** Mixture proportioning of high-performance concrete. **Cement and Concrete Research,** Vol 32 (2002), pp 1699-1704.

[3] Joisel, A. **Admixtures for Cement** 1973, published by the author. Out of print. Available from C&CA library, Sydney.

[4] Maldano et al. **Standardization and Qualification of Fines in Aggregates in France.** [Paper presented at the 4th Annual Symposium of the International Center for Aggregates Research, Atlanta, Georgia, 1996.

[5] **An experimental study on the guidelines for using higher contents of aggregate microfines in Portland cement concrete** Research Report ICAR 102-F. Austin, Texas: International Center for Aggregates Research, University of Texas, December 2001. Available at www.engr.utexas.edu/icar

traditional 1:3 mortar, the volume of microfines contributed by the sand may be as much as half that of the cement. It follows that microfines affect, to a similar or even greater degree than cement, the rheological behaviour of fresh mortar – a vital attribute of a material that is placed and finished by hand. When they are removed, the tradesperson has little option but to replace them. Typically this is done by increasing the volume of the paste and/or by improving the rheological behaviour of the paste. The former is normally done by adding cement and water. If this is done to excess, it leads to unacceptable shrinkage cracking. The latter was traditionally done by adding hydrated lime, a time-proven mineral plasticiser, but is often now more conveniently achieved by "doping" – adding quantities of potentially deleterious mineral plasticisers such as "brickies clay" and/or chemical plasticisers, such as air entrainers, on-site. Properly used, the purpose of plasticisers is to make good mortar better. When used to compensate for deficient sand, the required dosages can be such that the performance of the hardened mortar is impaired. This is well known to practitioners.

In AS 3700, sand is specified by a single, qualitative statement. If the supplier responds by providing sand from which it does not remove the microfines, it is vulnerable to the widespread uninformed view amongst specifiers that microfines are "bad" per se. If however the supplier removes the microfines, the tradesperson is left in the position outlined above. Ultimately, AS 3700 puts the designer in the hands of the tradesperson. There appears to be justifiable discomfort with this situation, which seems to be getting worse.

This note attempts to address some of these issues, by distinguishing between, and describing, both the physical and compositional attributes of sand. The primary descriptors that are proposed are:

- Maximum particle size: Relative to mortar thickness and/or function.
- Voids content (compacted) of the • 75 µm fraction of the sand.
- Microfines content of the total sand: Relative to microfines composition.

It is considered that these descriptors will enable specifiers to better set out their requirements for sands. They will not ensure that sands will be ideal; sands of different particle size distribution and particle shape, but equal voids content will confer different rheological behaviour upon mortar. It is anticipated that in practice, however, a tradesperson will be able to choose (and will choose) between sands that conform to these descriptors but differ in suitability (and will do so by trying them or by checking their performance record) and suppliers will be able to respond (and will respond) by producing sands that satisfy both specifier and user. It is predicted that this will tend to drive sand quality in a desirable direction.

The maximum recommended voids content derives from Appendix B of *Good Practice Guide: Stucco*[6]. This study shows that if the uncompacted voids content of the total sand including microfines is • 45%, and if the particle size distribution fits within a defined envelope, the sand will be adequate (suitable?) for plaster. An uncompacted voids content of 45% translates approximately to a compacted voids content of 40%. Sands with microfines contents ranging from 0 – 11% were investigated. Plaster is generally considered to be more sensitive to sand quality than mortar for bedding masonry units.

Particle size distribution is not used as a primary descriptor. It is used only as a reference point for specifying uniformity. Particle shape is not used as a descriptor, it being assumed that this will be taken care of by the voids content criterion. It is

[6] T. Pringle, **Good practice guide: Stucco**. Porirua: BRANZ, 1996 (since revised).

assumed that the above descriptors will be sufficient, in practice, to ensure that sands will meet the specifier's requirements.

The rationale for these – perhaps counter-intuitive – "omissions" is derived from the models used in *Concrete Mixture Proportioning*[7], *Mixture proportioning of high-performance concrete*[2] and *Modeling and measuring the structure and properties of cement-based materials*[8] to predict the packing density of granular materials, and the properties of both fresh and hardened mortar and concrete, from their composition.

The essence of the rationale is that the net effect of the combinations of variation in particle size distribution and shape that can be made within the suggested voids and microfines content limits cannot be of sufficient magnitude to render sand unsuitable.

Reference 6 shows that the plastic viscosity of fresh mortar is determined partly by the viscosity of the paste and partly by the relative concentration of the • 75 µm fraction in the paste. The relative concentration is the ratio of the actual concentration to the packing density of the sand (see 2 – definitions). If the voids content of the sand (which derives from a combination of particle size distribution and shape) is excessive, the paste volume has to be increased and/or the paste viscosity decreased to reduce the viscosity of the mortar to an acceptable level. If one, other or both methods are used to excess, this can lead to deficient mortar. It is considered that the recommended limit on voids content will ensure that this cannot happen.

Reference 6 shows that the yield stress of fresh mortar is a function of the number and nature of inter-particle contacts and not of the liquid phase, which has the sole function of influencing the average distance between particles. The same reference shows that yield stress is a decreasing function of particle size. It follows that the yield stress of mortar is primarily determined by the contribution of the cement and other particles in the paste (which includes microfines) rather than by that of the • 75 µm fraction. It follows equally that the yield stress of the mortar will be sensitive to variations in content and particle size distribution of the microfines, and particularly of the finest fractions. It is considered that the recommended limits on the microfines content and variability will control this effect sufficiently. Further support is taken from the knowledge that Australian sands having microfines contents significantly higher than the proposed levels, have performed and do perform satisfactorily.

Cleanliness was a concept introduced by earlier specifiers to refer to sands with a low microfines content (e.g. • 5%). As has been discussed, this concept is wasteful, environmentally inappropriate, and leads to poor practice in the "on site" preparation of mortars. The concept is replaced in this note, by the specification of microfines content combined with mineralogical composition.

This approach obviates the need to describe sands by origin. No distinction is made between natural (e.g. river or beach), manufactured (e.g. made from sandstone or rock), or blended (e.g. natural plus manufactured) sand. It is sufficient to describe the physical and compositional attributes of the sand itself.

It is expected that this approach will enable changes to be made in related specifications, particularly the prohibition or more strict regulation of the use of additives and admixtures that are commonly added to mortar to compensate for deficient sand. The most notable (and potentially deleterious) of these are: clay minerals ("brickies clay"), air entraining agents and water thickening agents.

The term sand is taken to mean the total sand used in mortar. The tradesperson may elect to blend sands but must satisfy the specifier that the blend conforms to the recommendations set out in this note.

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[7] de Larrard, F. **Concrete Mixture Proportioning.** London: Spon, 1999.

[8] Garboczi, Edward J et al. **Modeling and measuring the structure and properties of cement-based materials**. Electronic monograph. Available at http://ciks.cbt.nist.gov/monograph.

# 4 RECOMMENDATIONS

## 4.1 PARTICLES and VOIDS

**Particle size range**

The nominal particle size range of sand should be expressed as $d_{min}/d_{max}$ e.g. 0/2.36 or 600/2.36. It is expected that in practice, suppliers will round these off, as is done in Europe e.g. 0/3.

**Maximum particle size**

The maximum particle size of sand should be:

- • 1/3 the layer or bed thickness in mortars for laying or bedding.
- • 1/3 the coat thickness in base coats of plaster.
- • 600 µm for finishing coats of plaster or as specified for the level of finish that is desired.

**Voids content**

The compacted voids content of the • 75 µm fraction of the sand shall be:

- • 40% by volume for mortar for any purpose except finishing coats for plaster. This limit may be increased subject to the specifier being satisfied that the increase in paste volume and/or modification to paste composition that this is likely to require, will not lead to unacceptable shrinkage or other deficiency in the mortar.
- No restriction for finishing coats of plaster.

**Microfines content**

- The microfines content of the total sand should be:
  - • 5% by mass if the mineralogical composition of the microfines is unknown.
  - • 15% by mass if the total clay minerals content of the total sand is • 6% by mass and if the smectite/ montmorillonite, illite or chlorite content of the total sand are each • 2% by mass and if the silt fraction of the total sand is • 95% composed of sound rock or quartz.

Sand having a microfines and/or clay minerals contents exceeding the above limits may be used at the discretion of the specifier, based on evidence of suitability.

Inert or beneficially reactive materials that are finer than 75 µm, such as milled limestone (i.e. calcium carbonate) or rock dust may be added to sand to reduce voids content or increase microfines content, provided that the above limits are respected.

## 4.2 DURABILITY

For durability, it is recommended that all sands comply with the requirements for limiting alkali reactivity given in the relevant clauses of AS 2758.1, Section 9, from which most of the following is drawn.

**Alkali – reactive materials**

Sand intended for use in mortar that will be subjected to frequent wetting, extended exposure to humid atmosphere, or contact with moist ground, should not react with alkalis in the mortar to an extent that may result in unacceptable expansion.

The supplier should provide appropriate documentation to allow assessment of the potential reactivity of the sand. The specifier should define the method of assessment and the test methods to be used.

**Particle strength**

Sand particles of silt size and larger should be as sound and strong as quartz. Evidence of the performance of mortars made using the sand in question, petrographic analysis, or testing to AS 1141.24 – Aggregate Soundness – Evaluation by exposure to sodium sulphate solution, are suggested as evaluation methods. In the latter case, a weighted average weight loss • 6% is suggested.

## 4.3 IMPURITIES

Limits to impurities may be specified by reference to the relevant clauses of AS 2758.1, Section 9, from which most of the following is drawn.

**Organic impurities**

If sand is tested to AS 1141.34, the colour obtained should not be darker than the standard colour of the reference solution. The performance of any suspect sand may be evaluated by comparing its performance in mortar to that of a similar mortar manufactured using sand that is known to be satisfactory.

**Sugar**

If sand is tested in accordance to AS 1141.35, it should not be positive to the presence of sugar.

**Soluble salts**

Some soluble salts may cause efflorescence in mortar or adjacent concrete or masonry, corrosion of reinforcing steel or embedded metallic items (if such are used) or disintegration of the mass of the mortar. Permissible levels of soluble salts are generally expressed as the proportion of the relevant ion present in the mortar by mass of mortar or by mass of Portland cement.

*Chlorides*: The chloride ion content of sand determined quantitatively in accordance with AS 1012.20 should be reported if in excess of 0.01 %. A combination of sands where the total chloride salt content (expressed as $Cl^-$) exceeds 0.04 % should not be used in reinforced mortar or mortar in contact with embedded metallic fittings. A combination of sands where the total chloride salt content exceeds 0.15 % should not be used in plain mortar.

*Sulphates*: The sulphate ion content of sand determined quantitatively in accordance with AS 1012.20 should be reported if in excess of 0.01 %. Sand should not be used which, when tested in accordance with AS 1012.20, contain sulphates (expressed as $SO_3$) in proportions which result in the sulphate content of the mortar exceeding 5.0% by mass of Portland cement.

*Other salts*: Sand which contains other strongly ionized salts, such as nitrates, shall not be used unless it can be shown that they do not adversely affect mortar durability.

## 4.4 UNIFORMITY/TOLERANCES

The mass of sand passing any sieve other than those corresponding to the maximum particle size, and the • 75 µm fraction, should not vary by more than 10% from a reference particle size distribution provided by the supplier. The mass of sand passing the sieve corresponding to the maximum particle size should not increase, and the • 75 µm fraction should not increase, by more than 1% from the reference distribution without an investigation of the continuing acceptability of the sand.

The voids content of the • 75 µm fraction of the sand should not vary by more than 5% from a reference content provided by the supplier without an investigation of the continuing acceptability of the sand. For example, if the reference content is 40%, the actual content may vary between 38 and 42%.

## 4.5 SAMPLING and TESTING

Sampling should be carried out using the methods described in AS 1141.3.1.

When required by the purchaser, samples shall be provided as evidence of the quality of the materials proposed to be supplied. The specifier may alternatively require the supplier to provide test data to indicate the quality of the sand proposed for supply.

Testing should be carried out in accordance with the methods described in the relevant parts of AS 1141 and AS 1012, in AS 4489.7.1 and as below.

**Compacted voids content**

AS 1141.4 is to be used to determine voids content. The voids content is calculated from; (container volume – mass of compacted sand/particle density)/container volume x 100%. It should be noted that compaction is achieved by manual dry rodding and is operator dependent. The voids content of a blend of sands should be determined upon sand taken from a sample of not less than 10kg that has been mixed for at least 3 minutes at slow speed in a Hobart or equivalent planetary mixer. For the purposes of this specification, the test is conducted on samples modified by the removal of the • 75 µm fraction. The container which is to be used for voids content determination should be filled by successive scoopfuls of sand so as to avoid segregation. Blends in which there is a large difference in particle size are more susceptible to segregation.

**Microfines content**

Determined by AS 1141.11 – Particle size distribution by sieving or AS 1141.12 – Material finer than 75 µm.

**Mineralogical content of microfines**

The sand equivalent (SE) test AS 1289.3.7.1 may be used to provide a preliminary indication of the total clay mineral content of sand. It should not be considered to be a reference technique.

The Methylene Blue Absorption Value (MBV) test, Technical Bulletin no 145, International Slurry Surfacing Association www.slurry.org may be used to provide an indication of the smectite/ montmorillonite content of sand. It should not be considered to be a reference technique.

Techniques such as X-ray diffraction (XRD), X-ray fluorescence spectroscopy (XRF), and petrographic analysis should be used for quantitative determination of the composition of microfines. These are to be considered to be reference techniques.

## 5 REFERENCED STANDARDS

AS 1012.20 (1992) Methods of testing concrete - Determination of chloride and sulfate in hardened concrete and concrete aggregates
*Sets out a separate solution method which can be used in aggregate or concrete laboratories to indicate whether chlorides or sulfates are present over a threshold detectable quantity.*
AS 1141.3.1 (1996) Methods for sampling and testing aggregates - Sampling – Aggregates
*Specifies methods and defines principles for sampling aggregates and sands, for subdividing samples and for packing and forwarding samples for testing. A number of photographs assist in describing the taking of samples and increments.*
AS 1141.4 (2000) Methods for sampling and testing aggregates – Bulk density of aggregate
*This Standard sets out the method for determining the bulk density of fine, coarse, or mixed aggregates. The bulk density is determined in the uncompacted, compacted, or uncompacted and compacted states. The test is normally performed on material dried to constant mass, but may be performed at other moisture conditions if specifically required. The values obtained for bulk density of fine aggregates at different moisture conditions will differ significantly. This method is only applicable to samples with a maximum nominal size of 63 mm.*
AS 1141.11 (1996) Methods for sampling and testing aggregates - Particle size distribution by sieving
*Determines the sizes of coarse and fine aggregates and fillers for asphalt by sieving.*
AS 1141.12 (1996) Methods for sampling and testing aggregates - Materials finer than 75 µm in aggregates (by washing)
*Specifies the method for determining the amount of material finer than 75 micrometre by drying then washing with water. Particles such as clay which are dispersed by the water and water soluble materials will be included in the result as materials finer than 76 micrometre.*
AS 1141.24 (1997) Methods for sampling and testing aggregates - Aggregate soundness - Evaluation by exposure to sodium sulfate solution
*Determines the loss of mass when subjected to repeated wetting and drying with saturated sodium sulfate solution to approximate weathering of aggregate.*
AS 1141.34 (1997) Methods for sampling and testing aggregates - Organic impurities other than sugar
*This Standard sets out a qualitative method of detection of sugar in aggregates. A positive reaction is given by one part of sugar in one thousand parts of aggregates. No visible reaction is given by one part of sugar in ten thousand parts of aggregates.*
AS 1141.35 (1995) Methods for sampling and testing aggregates – Sugar
*Sets out a qualitative method of detection of sugar in aggregates. A positive reaction is given by one part of sugar in one thousand parts of aggregates. No visible reaction is given by one part of sugar in ten thousand parts of aggregates. NOTE: The basis of the test is that, although FehlingÆs solution does not react directly with cane sugar (sucrose), it does react with glucose (grape sugar). Therefore cane sugar, if present, is first converted into invert sugar (glucose plus fructose) by boiling with hydrochloric acid. The glucose so formed reacts with FehlingÆs solution, giving a positive test. Although cane sugar is perhaps the most likely sugar source if concrete aggregate is accidentally contaminated, the test also detects contamination from honey, wine, fruit juices or other sources of glucose*

AS 1289.0 (2000) Methods of testing soils for engineering purposes – General requirements and list of methods
*This Standard is fundamental to all of the methods in the AS 1289 series. It provides the following information: (a) A list of methods in the AS 1289 series. (b) Related documents. (c) Definitions. (d) Apparatus used in a number of methods in the series and the Standards with which that apparatus have to comply. (e) Soil groups for use in a number of methods.*
AS 1289.3.7.1 (2002) Methods of testing soils for engineering purposes - Soil classification tests - Determination of the sand equivalent of a soil using a power-operated shaker
*This Standard sets out a procedure for the measurement of the sand equivalent of road-making aggregates for quality control purposes. It provides an empirical measure of the quantity and type of the fines in the aggregate tested*
AS 2758.1 (1998) Aggregates and rock for engineering purposes – Concrete aggregates
*Provides a basis for specifying requirements for aggregates for use in concrete. This Standard is for use in conjunction with a works specification, and it is expected that requirements may be varied on the basis of local experience. The requirements relate to quality of rock, grading, durability and other properties of aggregates including lightweight aggregates.*
AS 3700 (2001) Masonry structures
*Provides designers, engineers and specifiers with the minimum requirements for the design and construction of unreinforced, reinforced and prestressed masonry, including built-in components, for use in masonry applications.*
AS 4489.7.1 (1997) Test methods for limes and limestones - Loss on ignition - Quicklime, hydrated lime and limestone
*This Standard describes the method for determining loss on ignition in limestone, quicklime and hydrated lime.*
AS CA27 (1959) Code of recommended practice for internal plastering on solid backgrounds
*Lays down recommendations for proportioning of normal types of plaster and its application to internal brickwork, blockwork, cast-in-situ concrete or other masonry. It deals with materials, choice of plastering system (including one, two and three coat work), preparatory work, proportioning and mixing.*